TOWN OF TECUMSEH

Functional Servicing Report

Tecumseh Hamlet Secondary Plan Area

June 2025 – 23-5735

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1.0 Introduction

1.1 General

The Tecumseh Hamlet Secondary Plan Area (THSPA) is a part of the Tecumseh Hamlet Settlement Area (the Hamlet) located in the Town of Tecumseh (the Town), as shown in **Figure 1.1**. This area is planned for redevelopment, in accordance with the Tecumseh Hamlet Secondary Plan (2025) and Tecumseh Official Plan (2021). This report outlines the functional servicing for the following proposed municipal infrastructure required for redevelopment of the THSPA:

- The sanitary sewer collection system
- The storm sewer collection system
- Major event overland drainage scheme and site grading
- Stormwater management facilities
- Watermain network
- Collector Road network

This report is intended to serve as a guideline for the Town, regulatory agencies, and landowners/developers to facilitate the orderly servicing of this area. Beyond the servicing recommendations herein, factors affecting the servicing criteria of these lands include:

- Market conditions and housing needs
- Development phasing
- Identify the extent of lands required to accommodate proposed servicing infrastructure
- Variable servicing costs including supply chain and labour shortages
- Proximity to existing sanitary and storm sewer outlets
- Implementation of sanitary sewer system improvements capacity limitations of the downstream system
- Proximity to a suitable potable water supply system
- Feasibility and approval of any interim servicing measures based on initial build-out demand, sanitary servicing, and stormwater management
- Implementation of external traffic system modifications

Based on the functional servicing strategy developed in this report, estimates of probable construction costs were identified for planning and budgeting purposes.

This functional design study shall be reviewed in conjunction with the Tecumseh Hamlet Environmental Study Report (ESR).

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1.2 Background

The Hamlet community is situated south of County Road 22 (CR22) and is bounded by County Road 19 (CR19) (also known as Manning Road) to the east, County Road 42 (CR42) to the south, and Banwell Road / County Road 43 (CR43) to the west. The Hamlet is nestled between two municipalities: City of Windsor to the west and the Municipality of Lakeshore to the east. The Hamlet has a current population of approximately 5,300 - housed within neighbourhoods east and west of Lesperance Road, the current major transportation spine of the Hamlet. There are two secondary plan areas within the Hamlet:

- Manning Road Secondary Plan Area (MRSPA) consisting of the undeveloped lands east of Lesperance Road, west of Manning Road and north of the CPR Railway.
- Tecumseh Hamlet Secondary Plan Area (THSPA) consisting of undeveloped lands west of Lesperance Road, between CR 22 and CR 42.

Functional design and servicing requirements for the MRSPA were determined and described in the MRSPA Functional Servicing Report (Dillon, 2023). The regional servicing strategies developed herein considers the servicing needs of the MRSPA and make up part of the overall servicing strategy for the THSPA.

In 2022, the Town retained Dialog and Dillon Consulting Limited (Dillon) to complete the Hamlet Secondary Plan as part of the Town's Official Plan. This Plan establishes proposed land uses, zoning requirements, and develops a proposed roadway layout for the area. All proposed conditions herein, are based on the final THPSA report (2025) which as been approved by Town Council on January 28, 2025. Over the duration for the secondary plan process, Dillon has undertaken the Schedule C Class Environmental Study Report (ESR) following the Municipal Class Environment Assessment framework. This Functional Servicing Report (FSR) will be appended to this ESR to supplement the municipal servicing recommendations developed through that study.

The following studies/reports were referenced during the completion of this updated FSR:

- CR19/CR22 Improvements, Environmental Assessment (Dillon, 2008)
- CR42/CR43 Improvements, Environmental Assessment (AECOM, 2009)
- Tecumseh Hamlet Sanitary Sewer Flow Monitoring and Modelling Updates- Summary of Work Completed (Dillon, 2010)
- Town of Tecumseh East Townline Drain Hydrology and Hydraulics Study Report (Dillon, 2012)
- Tecumseh Sanitary Modelling Update and Gouin Development Memo (Dillon, 2013)
- Lauzon Road Environmental Assessment and Addendum (MRC, 2015)
- Banwell Road Improvements, Environmental Assessment (IBI, 2016)
- Transportation Master Plan (Dillon, 2017) and Complete Streets Guideline (Dillon, 2017)
- Windsor/Essex Region Stormwater Management Standards Manual (Regional Guidelines) (December 2018, updated June 2024)
- Town of Tecumseh Storm Drainage Master Plan Report (Dillon, 2019)

- 2018 Water and Wastewater Master Plan Update (CIMA, 2019)
- Little River Floodplain Hydrologic and Hydraulic Studies and ERCA Floodplain Mapping (Dillon, 2021)
- Design Guidelines for Sewage Works (MECP, 2023)
- Design Criteria for Sanitary, Storm Sewers and Forcemains for Alterations Authorized under an Environmental Compliance Approval (MECP, 2023)
- Upper Little River Watershed Master Drainage and Stormwater Management Plan (Stantec, 2023)
- ERCA Regulatory Floodplain Mapping (2023)
- Manning Road Secondary Plan Area Functional Servicing Report (Dillon, 2023)
- County Road 43 Improvements North of Shields Avenue Stormwater Management Brief (Dillon, 2023)
- Sanitary Recalibration Analysis and Basement Flood Risk Mitigation Report (Dillon, 2024)
- Hydraulic Analysis of the Planned Watermains in the THSPA (AECOM, Nov 2024)
- East Townline Drain Stormwater Management Report, (Landmark, June 2024)
- Tecumseh Hamlet Secondary Plan (Dialog, 2025)
- East Townline Drain Stormwater Management Report (Landmark, 2024)
- Various Municipal Drainage Projects:
  - Drainage Report for the East Towline Drain (St. Clair Outlet) (Dillon, February 2019)
  - Drainage Report for the Lachance Drain (Dillon, May 2019)
  - Repair and Improvement of the Antaya Drain (Dillon, November 2021)
  - Drainage Report for the Desjardins Drain (Draft) (Dillon, January 2025)

1.3 Tecumseh Hamlet Municipal Class Environmental Assessment

This FRS is an appendix to a larger Municipal Class Environmental Assessment - Schedule C Environmental Study Report (ESR) that has been initiated by the Town of Tecumseh and provides recommendations for infrastructure projects required to service the THSPA. The ESR recommended sanitary sewer, stormwater management, storm sewer, water distribution and roadway projects that have been evaluated based on a number of social, economic, and environmental factors. The MCEA process provided several opportunities for the public, indigenous, agencies, and stakeholders to be involved in the development of the servicing solutions. The functional design presented has considered the results of consultation and feedback received (details of the consultation and corresponding study recommendations are included in the covering ESR report).

1.4 Objectives of the Functional Servicing Report

The objectives of this Functional Servicing Report are to:

1. Determine the servicing requirements for the development of the THSPA, including confirmation of the design criteria for the municipal services (stormwater management pond, storm sewers, sanitary sewers, watermains, and roadways) that are to be used to complete the detailed design of this infrastructure.
2. Undertake a functional design of these facilities to satisfy both servicing needs of the planning district and provide a framework to facilitate the servicing of the THSPA.

1.5 Land Ownership

As part of this study, it is anticipated that development of the subject lands will require cooperation and coordination amongst the local landowners. Municipal servicing will provide shared benefit to various landowners and implement the regional municipal servicing projects recommended herein.

Every effort has been made to ensure that the functional design of the municipal infrastructure provides flexibility to accommodate the staged development of these lands. As a result of future market conditions, changes in land ownership, and other issues that may arise, temporary servicing measures may be deemed appropriate. The acceptability of any temporary servicing measures will be determined by the Town and regulatory agencies, while ensuring that the overall functional design of these services is not compromised.

2.0 Study Area

2.1 Tecumseh Hamlet Secondary Plan Area (THSPA)

The THSPA is made up of two distinct areas which are located within the Tecumseh Hamlet neighborhood of the Town of Tecumseh. The west area is approximately 260 hectares in size and is bounded by CR22 to the north, existing residential developments to the east, County Road 42 (CR42) to the south, and the Town/City of Windsor Municipal boundary to the west (as shown in **Figure 1.1**). The east area, referred to as the Southeast Hamlet (SE Hamlet) herein, is approximately 23 hectares in size and bounded by the Canadian Pacific Railway (CPR) rail corridor to the north, the Hydro One Networks' hydro corridor to the east and south, and County Road 19 (CR19) to the west. The THSPA is located within the Tecumseh Hamlet Settlement Area which is approximately 760 hectares in size.

2.2 Existing Land Uses

The undeveloped lands within this study area are comprised of agricultural uses and vacant property. The existing land uses surrounding this undeveloped land include:

- Banwell Road /County Road 43 (CR43) and CR42 right of way
- Stellantis Electric Vehicle (EV) Battery Plant to the west
- Agricultural lands
- Ministry of Transportation – Former Landfill Site
- Residential lands centred along Lesperance Road
- Canadian Pacific Railway corridor and hydro corridor
- County of Essex right-of-way to the north (CR22) and south (CR42)
- An existing school and parklands

2.3 Official Plans and Secondary Plan

This Functional Servicing Report generally conforms to the Town of Tecumseh Official Plan (2021) and the Tecumseh Hamlet Secondary Plan (THSP) which was adopted by Town Council on January 28, 2025.

This FSR was originally initiated in 2013 as part of the first draft development of the THSPA however this study was paused to allow for the completion of necessary planning and engineering studies, such as the Upper Little River Watershed Master Drainage and Stormwater Management Plan (ULRMP) (Stantec, 2023). The functional design and technical analyses were reinitiated in 2022 to assist with the development of the initial draft of the Secondary Plan. The final design included herein is based on the final THSPA (2025) and has been adopted to be part of the Town's Official Plan and the Tecumseh Hamlet Secondary Plan Environmental Assessment Process that has been underway since early 2023.

The THSP is a planning and urban design policy framework required to implement the Town's vision, establish land use, and guide physical development of the Future Development lands. The functional design analysis is based on the confirmed land use type, development layout, built-form policies, and population densities defined in the THSP.

If through future planning studies or official plan amendments, the proposed land use plan is modified, targeted engineering assessments shall be completed to ensure that changes were reflected in the proposed servicing strategy and that the municipal systems will have capacity to support proposed changes.

2.4 Proposed Land Use Plan

The lands situated within the THSPA are proposed for development in accordance with the land use plan provided in the THSPA. The THSPA ESR and FSR recommendations and findings are based on the established land use plan and is not evaluating alternative land use types, areas or population criteria. The THSP details the zoning requirements and proposed land use plan within the THSPA, as illustrated in **Figure 2.1**. A breakdown of the proposed land use areas within the THPSA is provided in **Table 1** below.

Table 1: Proposed Land Use Areas

Land Use Type	Net Area (Ha)	% Total Area
Residential	108.08	57.37%
Mixed-Use	3.25	1.73%
Commercial	10.21	5.42%
Business Park	1.03	0.55%
Parkland	19.11	10.15%
NH/Woodlot	7.87	4.18%
Stormwater Management Facility	22.24	11.81%
Institutional	14.64	7.77%
Cemetery	1.95	1.04%
Total	**188.39**	**100%**

Note: The net area excludes the proposed municipal right-of-way boundaries.

Along with the proposed land use areas, the THSP details the allowable densities and coverage for each land use. The densities are defined by the number of units per net hectare area for residential developments and percent Gross Floor Area (GFA) coverage for commercial and mixed-use developments as per **Table 2**.

Table 2: Proposed Land Use Densities

Proposed Land Use		Proposed Density
Anchor Commercial (Banwell/Gouin) and Business Park		30% GFA Coverage, 1 story
Plaza Commercial (CR43/Shields)		30% Coverage, 1-2 stories
Main Street Mixed-Use (Maisonneuve) (Retail at-grade with an average of 2 residential stories above)	Commercial	55% Coverage, 1 story
	Residential	55% Coverage, 2 stories GFA*0.80 efficiency / 85m^2 average unit size
High Density Residential		100 units/net ha
Medium Density Residential		35 units/net ha
Low Density Residential		20 units/net ha

Note: For the purpose of sanitary servicing assessment, an allowance of up to 30 units/net hectare was used for low density residential to account for variations in density that may be implemented overtime such as Additional Residential Units (ARU). In addition, a 20% flexibility factor was applied to proposed densities for all future development areas to account for future variability in design criteria. .

2.5 Soil Conditions/Characteristics

Using the Essex Region Conservation Authority (ERCA) Interactive Mapping tool as best available information, the soil conditions found within the THSPA consists mainly of Brookston Clay. These soils are generally characterized as dark clay over mottled clay then blue-grey compact gritty clay with few stones. Brookston Clay Sand – Spot Phase is also present within the northern and southern portions of the THSPA, which may consist of mixed areas of shallow sand knolls less than 1 metre in thickness, over clay, intermixed with Brookston Clay and Clay Loam.

Detailed soil investigations were not completed as part of this FSR, and all cost estimates were based on the soils expected in this area. The developers/landowners will be responsible for soil investigations as part of the detailed design process for each phase of this development in order to determine the detailed design and construction requirements for servicing, buildings, and pavement designs.

2.6 Existing Topography

As part of the Town's Stormwater Drainage Master Plan (2019), a ground digital elevation map (DEM) of the study area was prepared using data obtained from an aerial remote sensing method, known as Light Detection and Ranging (LiDAR). LiDAR mapping was completed in 2017 and is assumed to be consistent with existing conditions and adequate for the purposes of this study. This data was used for the development of the proposed design as well as to develop estimated quantities of cut/fill for this area.

In general, the existing topography within the THSPA is relatively flat with the elevations slightly increasing from north to south. The Gouin, Lachance and Desjardins municipal drains all flow from east to west, through the THSPA providing channelized drainage outlets to direct the overland flows.

As shown in **Figure 2.2,** the existing land topography within the northwest Hamlet area (north of CP Railway, east of Banwell Road) ranges between 179.5m to 182.5m. **Figure 2.3** shows the existing topography south of the CP Railway ranges from 182.0m to 185.0m. Lastly, in **Figure 2.4**, the SE Hamlet area, which is located east of Lesperance Road, has elevations ranging from 182.0m to 185.0m with lands generally draining towards the existing Antaya and East Townline municipal drains. Localized grading and drain contour mapping are not reflected in **Figures 2.2 to 2.4** which shall be used for reference only.

3.0 Sanitary Drainage

3.1 General

Existing lands within the Tecumseh Hamlet are serviced by an existing sanitary sewer system that conveys domestic sewage from residential, commercial, industrial and institutional lands to the Little River Pollution Control Plant (LRPCP) in the City of Windsor, where it is treated and discharged to the Little River Drain and ultimately to the Detroit River. The existing sanitary system discharges into the downstream City of Windsor sanitary sewer system via a 1200 mm dia. gravity sewer outlet at the intersection of County Road 22 and Banwell Road.

The Town's Water and Wastewater Master Plan (WWMP) (2018) provides the basis for the alignment and sizing of future trunk sanitary sewers required to serve existing and proposed development within the THSPA. Those recommendations were used to complete more detailed analysis of the system capacity as it relates to new development and assessing basement flood risk within existing development areas. Historically, sanitary sewer design focused on providing servicing for population generated sewage with allowances for infiltration caused by sewer deficiencies and groundwater infiltration. Based on more accurate sewer monitoring system analysis and basement flood reporting, it is understood that during wet weather events, inflow of rainwater in the sanitary system can result in widespread basement flooding in existing development areas. Through previous analysis the Town established new wet weather design criteria that has been considered in the preparation of this sanitary sewer functional design.

A Sanitary Model Recalibration and Basement Flood Risk Mitigation Study (BFM) (January 2024) (Dillon) was completed to analyze the existing sanitary sewer infrastructure in the Town and recommended solutions for reducing risk of basement flooding due to sanitary sewer back-up. A Town-wide Infoworks-ICM computational model of the sanitary system was refined and recalibrated as part of this study. This model was used to analyze the capacity of the existing Tecumseh Hamlet sanitary system to receive flows from the proposed development.

Section 3.3 provides details on the overall sanitary sewer analysis and reallocation of flows within the Tecumseh Hamlet area. The calculations completed throughout the design of the overall sanitary sewer analysis are provided in **Appendix A.**

Using the Town's calibrated sanitary sewer model, interim and ultimate conditions modelling scenarios were evaluated with varying levels of infrastructure improvements. Details of this analysis have been summarized in a memo entitled Functional Sanitary Servicing Modelling Technical Report included as **Appendix B**. This analysis confirmed that the proposed trunk sanitary sewers recommended in the Town's WWMP (2018) would provide adequate capacity for new development. This assumes that infiltration monitoring and control is in place to ensure that capacity is not impacted by inflow and infiltration.

3.2 Sanitary Sewer Design Criteria

To establish the proposed sanitary sewer functional design, the design criteria in **Table 3** and **Table 4** were established. This design criteria are in accordance with sound engineering practices, design criteria from the WWMP (2018), the Ministry of the Environment, Conservation and Parks' (MECP) guidelines (May 31, 2023) and the Town's Environmental Compliance Approval - Comprehensive Linear Infrastructure (ECA-CLI). Designers will be required to meet all other MECP and CLI-ECA guidelines not specifically identified in this FSR.

Table 3: Sanitary Sewer Design Criteria

Criteria	WWMP 2018 & MECP Guidelines
Minimum Sewer Size	200 mm diameter
Minimum cover of sanitary private drain connections at property line (Note 1)	1.5 meters
Minimum pipe slopes	Selected to obtain minimum MECP flow velocities
Full Flow Velocity: • Minimum • Maximum	 0.6 m/s 3.0 m/s
Hydraulic Losses Across Manholes: • Straight Through • 90 Degree Bend	 30 mm 60 mm
Hydraulic Sizing	Manning's Equation
Manning's Roughness Coefficient 'n'	0.013
Infiltration Allowance / Peak Extraneous Flow	0.28 L/s/Ha
Peaking Factor	Based on Harmon Formula
Average Daily Domestic Sewage Flow • Residential (Note 2) • Commercial (Note 3)	 300 L/Cap/Day 28 m^3/ha/day
Population Densities	See **Table 4**

Note 1: This minimum cover elevation assumes that the Town enforces a requirement for mandatory sewage ejector pump installation for basement plumbing in all new development areas.

Note 2: Average Daily Domestic Sewage Flow rates for commercial land use is based the MECP's design criteria. A minimum allowance of 28 m3/gross ha/day shall be used for sanitary sewer design.

The population density criteria and number of units used for the sanitary sewer design is summarized in **Table 4**. To normalize equivalent unit rate estimates across land uses for volumetric flows, commercial land use has been converted into population density equivalent. The sewage generation rates for commercial lands are based on the MECP Guidelines (2023) minimum allowance of 28 m^3/ha/day for commercial flows, divided by the average daily domestic sewage flow of 300 L/cap/day, resulting in 93.3 cap/ha. The institutional populations are provided by the Town and are site specific, allowing for 2300 persons for the Tecumseh Vista High School, and 500 persons for a future elementary school. The residential population densities were derived from the Development Charges Background Study for the Town of Tecumseh completed by Watson & Associates Economists Ltd. in May 2022. The residential unit quantities based on ranges stipulated within the THSPA (2025).

Table 4: Wastewater Design Population Densities by Land Use

Land Use Type	Population Density
High Density	100 units per Ha, 1.594 persons/unit
Mixed-Use Residential	94.12 units per Ha, 1.594 persons/unit
Medium Density Residential	35 units per Ha, 1.947 persons/unit
Low Density Residential	30 units per Ha, 3.054 persons/unit
Commercial	93.3 persons/Ha
Institutional: • Tecumseh Vista High School • Future Elementary School • Cemetery	 2300 500 0
Park/Open Space	0 persons/Ha

In October 2022, the Town of Tecumseh established By-Law Number 2022 – 078, which specifies that Residential Type One, Two and Three (Zoned R1, R2, R3) properties are permitted to have one additional residential unit (ARU) on their property. This means that the properties which choose to participate in the By-Law can accommodate additional residential units within an established lot boundary. In order to design the sanitary sewer system for ultimate conditions, it was assumed that fifty percent (50%) of the low-density residential units will utilize this By-Law, resulting in a unit quantity of 30 units per hectare, instead of the previously mentioned 20 units per hectare. This assumption was used for sanitary sewer design purposes.

In addition to the allowance noted above, a 20% flexibility factor has been applied to the proposed population estimates to account for future flexibility and to accommodate any future changes to the proposed sewage servicing needs. The factor is meant to test the sensitivity of the sewer system sizing and any changes to the inflow assumptions. A breakdown of the calculated populations, areas for each sanitary drainage area, and the sanitary sewer design sheets are provided in **Appendix A**.

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In addition to the sewer design sheet, the proposed trunk sewer hydraulic design and sewer sizing was evaluated using the Town's sanitary sewer model to confirm that the proposed hydraulic gradeline is situated at an acceptable depth based on a 1:25 year return period (refer to Functional Sanitary Servicing Modelling Technical Report (2024) in **Appendix B**). Through the completion of a Town Wide basement flood mitigation study completed in early 2024, the level of service established for sanitary sewers is based on a 1:25 year storm event. Under this event, the hydraulic gradeline of the sewer shall be lower than typical basement depths which is assumed to be 1.5 m below grade.

For the functional design, the sanitary sewer infiltration and extraneous flows was determined by applying an Infiltration Allowance of 0.28 L/s/Ha. This was applied to all sewers within the proposed development area. During wet weather events, in existing areas, the total inflow and infiltration (I&I) of rainwater is found to exceed this allowance. The Town's calibrated sewer model more accurately estimates the I&I of existing areas. This model is based on sewer monitoring and the hydraulic gradeline within the sewer. This assessment ensures that during wet weather events, impacts of sewer surcharge are minimal. If significant change is made during detailed design from the assumptions, analysis and population densities outlined in this report, the incremental assessment of the sanitary system's wet weather performance should be assessed, using the Town-wide model, to confirm that impacts to upstream and downstream areas are not present.

3.3 Sanitary Servicing Strategy

The sanitary sewer servicing strategy in the WWMP (2018) recommends that the THSPA be serviced by a proposed West Tecumseh Trunk Sewer, as illustrated in **Figure 3.1**. The trunk sewer will provide an outlet for the new development lands within the THSPA and provide relief for existing flows within the surrounding area. This trunk sewer will allow for an additional area of approximately 254 ha to be serviced within the THSPA.

The proposed sanitary trunk sewer alignment corresponds with the THSP (2025) road network and land use plan and includes crossings under the existing CP Railway and through the hydro corridor. The 1200 mm dia. trunk sewer will extend from the existing stub provided south of CR22 and run south along an established road right-of way, through the CP Railway and hydro corridor to Shields St. At Shields St. the 1200 mm diameter sewer will extend westerly, west of CR43 and then extend south to the intersection of CR42 and 11th Concession Road. The horizontal and vertical alignment of the sewer is proposed be to be kept as flat and deep as possible to maximize the gravity service area of the pipeline as recommended in the WWMP (2018). The proposed development within the THSPA will be serviced through sub trunks which are directed toward the West Tecumseh Trunk Sewer to allow for phasing of development.

3.3.1 Outlet Constraints

The existing sanitary sewer outlet for the west THSPA is located at the intersection of CR22 and Banwell Road, where the 1200 mm dia. sanitary trunk sewer discharges into the City of Windsor's sanitary system through a connection to a 2100 mm dia. trunk sewer on Banwell Road. A 1200 mm dia. sanitary trunk sewer extends easterly along CR22 with a 1200 mm dia. stub provided for the connection of the THSPA. Currently, the Town has a Wastewater Agreement (2004) with the City of Windsor that mandates a maximum instantaneous inlet flow rate at this location of 983L/s. In order to comply with this agreement, a flow measurement facility is required on the proposed 1200 mm dia. trunk sewer prior to discharging to the outlet sewer on CR22. The sanitary sewer assessment completed (**Appendix B**) was used to assess the total sewage flow from the Tecumseh Hamlet under both 'dry' and 'wet 'weather conditions and this maximum allowable rate was used to assess the outlet conditions for this assessment.

The Southeast (SE) Hamlet THSPA is proposed to outlet to the existing sanitary sewer on Lesperance Road. This area is adjacent to the existing Lesperance Road Sewer; however, the original Lesperance Road sewer design did not include capacity for the expansion of this development area. The WWMP (2018) sanitary sewer strategy recommends the reallocation of flows from the St. Anne Street trunk to a new 600 mm dia. sewer along Intersection Road thereby opening sewer capacity and allowing for the development of the SE Hamlet. Due to the elevation of the existing Lesperance Road, servicing the SE Hamlet via gravity outlet is limited, therefore a sanitary lift station that will discharge flows to the Lesperance Road Sewer is required.

3.3.2 Wastewater Servicing Infrastructure

Under ultimate conditions, the West Tecumseh Trunk Sewer will not only serve the THSPA but will also provide relief to the surrounding existing areas. The existing infrastructure has been carefully considered for connectivity with the West Tecumseh Trunk Sewer to confirm that the existing flows will feasibly intercept and flow into the new system by gravity. The following projects are recommended to provide relief for existing areas and to serve new development areas and are depicted in **Figure 3.1**:

- WW1 - West Tecumseh Trunk Sewer, CR22 to Intersection Road
- WW2 - Tecumseh Hamlet Diversion Sewer (Intersection Road)
- WW3 - SE Hamlet System and Pumping Station
- WW5 - Maidstone Hamlet Pumping Station and Forcemain Outlet
- WW6 – West Tecumseh Trunk Sewer, Intersection Road to Shields St
- WW7 - Shields / St. Alphonse Diversion Sewer and St. Alphonse Pumping Station Decommissioning
- WW8 – West Tecumseh Trunk Sewer along Shields St. and Extension to CR42
- Settlement Area Expansion - Commercial development south of CR42 and west of 11th Concession Road

WW1 - West Tecumseh Trunk Sewer - CR22 to Intersection Road

A 1200 mm dia. trunk sewer is proposed to extend from CR22, southernly to Intersection Road. The alignment of the trunk sewer was evaluated and recommended within the THSPA ESR and as been established based on the THSP. This trunk sewer will provide a servicing outlet for the proposed relief sewers and new sanitary sewer sub-trunks required to serve the THSPA. Private drain connections will not be permitted to connected directly to this trunk sewer. All properties must be served via a separate local sanitary sewer that will discharge to the West Tecumseh Trunk Sewer at allocated manhole structures. The depth and slope of this trunk sewer is critical as it will also provide future outlet for the surrounding areas.

WW2 - Tecumseh Hamlet Diversion Sewer (Intersection Road)

In order to provide relief of the existing Lesperance Road trunk sewer system, a 600 mm dia. diversion sewer is proposed along Intersection Road, from the existing trunk sewer on St. Anne Street and to the proposed West Tecumseh Trunk Sewer. This diversion sewer will also serve the Shawnee Road sanitary sewer drainage area south of Intersection Road. As outlined in the WWMP (2018), flows from the existing St. Anne Street trunk sewer are planned to be intercepted by this diversion sewer which will ultimately provide relief to the downstream Lesperance Road sewer and allow connection of the Manning Road Secondary Plan Area (MRSPA). Additional information on the Lesperance Road Trunk Sewer and the MRPSA development can be referenced in the Draft MRSPA Functional Servicing Report (July 2023).

The diversion sewer is also designed to accommodate the flows from the proposed SE Hamlet area located south of the CP Railway and east of Lesperance Road. This area will ultimately tie into the Lesperance Road trunk sewer and connect to the new diversion sewer on Intersection Road via the existing St. Anne Street trunk sewer.

WW3 - Southeast (SE) Hamlet and Pumping Station

The SE Hamlet shall accommodate a mixture of low and medium density residential development. The future land use plan for this area is shown in the Proposed Land Use Plan, **Figure 2.1.** Flow from this area shall discharge into the Lesperance Road trunk sewer via a pumping station located at the west side of the SE Hamlet area. The flow will then be directed from the Lesperance Road trunk sewer to the Tecumseh Hamlet Diversion Sewer on Intersection Road via the existing St. Anne Street trunk sewer. Details regarding the proposed pumping station functional design is included in **Section 3.6.**

WW5 - Maidstone Hamlet Pumping Station and Forcemain

Per the WWMP (2018), the Maidstone Hamlet area will be serviced by a pumping station which will direct sewage flows via a 300 mm dia. forcemain to the uppermost end of the 1200 mm dia. West Tecumseh Trunk sewer at CR42 and 11th Concession Road (shown as Future Project Area 3 (FP3) on **Figure 3.1**). For the purposes of the functional servicing report, it was assumed that this pumping station will have an outflow into the West Tecumseh Trunk Sewer at a rate of 169 L/s into the most southern maintenance hole, located on CR42 at 11th Concession Road.

The flow rate for this area was provided in the WWMP (2018). The alignment and depth of the proposed trunk sanitary sewer at CR 42 and 11th Concession Road was designed (refer to design sheet MH FP4 to MH TA) such that future development to the west of 11th Concession could connect in the future.

WW6- West Tecumseh Trunk Sewer - Intersection Road to Shields Street

A 1200 mm dia. trunk sewer is proposed to extend from Intersection Road, southernly to Shields St including crossing the CP Rail corridor and Hydro easement. The alignment of the trunk sewer was evaluated and recommended within the THSPA ESR and as been established based on the THSP. This trunk sewer will provide a servicing outlet for the proposed relief sewers and new sanitary sewer sub-trunks required to serve the THSPA. Private drain connections will not be permitted to connected directly to this trunk sewer. All properties must be served via a separate local sanitary sewer that will discharge to the West Tecumseh Trunk Sewer at allocated manhole structures. The depth and slope of this trunk sewer is critical as it will also provide future outlet for the surrounding areas.

WW7 - Shields Street and St. Alphonse Street Diversion Sewer

The WWMP (2018) outlined the construction of a new diversion sewer on CR42 from Lesperance Road to the new West Tecumseh Trunk. The sanitary sewer along CR 42 was reviewed in detail as part of the BFM (2024) study, in a memo entitled, "County Road 42 Sanitary Sewer Improvement Assessment" (Dillon) (April 2021).

This memo recommended that the St. Alphonse PS discharge be redirected northernly along St Alphonse St. to Shields St. and connect to the West Tecumseh Hamlet Trunk sewer. This 600 mm dia. diversion sewer will permit the Town to decommission the St. Alphonse Street pumping station (shown as Future Project Area 2 (FP2) on **Figure 3.1**), and thereby eliminate the ongoing operation and maintenance costs for this facility. The existing development along Shields Street and St. Alphonse Street that currently outlet into the St. Alphonse pumping station will be redirected to the West Tecumseh Trunk at two locations, Shields St. and St. Alphonse St. at CR42.

WW8 - West Tecumseh Trunk Sewer – Shields St to CR 43

A 1200 mm dia. trunk sewer is proposed to extend along Shields Street, southernly to CR43. The alignment of the trunk sewer was evaluated and recommended within the THSPA ESR and as been established based on the THSP. This trunk sewer will provide a servicing outlet for the proposed relief sewers and new sanitary sewer sub-trunks required to serve the THSPA. Private drain connections will not be permitted to connected directly to this trunk sewer. All properties must be served via a separate local sanitary sewer that will discharge to the West Tecumseh Trunk Sewer at allocated manhole structures. The depth and slope of this trunk sewer is critical as it will also provide future outlet for the surrounding areas.

Settlement Area Expansion - Commercial Development South of CR42 and West of 11th Concession Road

The area southwest of the THSPA, south of CR42 (shown as Future Project Area 4 (FP4) on **Figure 3.1**), is planned to be developed as commercial area in the future. To account for the future flows, it was assumed that the total area of 22.42 ha will develop as commercial lands. It is envisioned that this area would be serviced via a sanitary sewer within the CR42 right-of-way and connect to the proposed West Tecumseh Trunk Sewer.

Expectant Flow Summary

As introduced in Section 3.2 all future development flows, including the SE Hamlet and CR42 Commercial area, a 20% flexibility factor has been added to the expected flows entering the West Tecumseh Trunk Sewer. This factor was incorporated into the design to account for added flexibility and to accommodate any future changes to the proposed sewage servicing needs. The areas which are existing have been assumed to maintain their existing build out therefore no additional flexibility factor has been incorporated into the design. The expected flows, drainage areas, and tie-in locations for each of the future project (FP) areas that have been used to design the West Tecumseh Trunk Sewer is summarized in **Table 5**. An overview of these areas is shown in **Figure 3.1**.

Table 5: Summary of Future Development Flows

FP#	Future Project Area	Tie-In Street	Tie-In MH	Area (ha)	Population	Peak Flow (L/s)
FP1	Intersection Road Diversion	Intersection Road	MH TAO	40.95	789	43.5
	SE Hamlet	Lesperance Road	MH TAI	20.83	1378[1]	23
FP2	CR42	St. Alphonse Street	MH TP	119.05	3815	80.1
		Shields Street	MH TT	4.75	101	
FP3	Maidstone Area	Maidstone PS	MH TA	PS Outflow = 169 L/s		
FP4	CR42 Commercial	CR42	MH TA	24.33	817[1]	17..8

Note 1: Proposed peak sanitary flows shall not exceed these flows included in this table.

3.4 Sanitary Drainage Functional Design

The functional design of the Tecumseh Hamlet sanitary sewer system is illustrated in **Appendix A**. The detailed sewer design calculation sheets, sewer layout, assessed drainage areas and corresponding populations have also been included in **Appendix A.**

As previously determined, the proposed West Tecumseh trunk sanitary sewer will be 1200 mm in diameter. The proposed sanitary sub trunks range in size from 250 mm to 600 mm dia. Sewer invert elevations and gradients were designed to ensure proper drainage of the entire THSPA within the design constraints listed above.

It should be noted that main conflicts between the sanitary and storm trunk sewers were assessed, however, it is critical that any changes to these proposed sewer alignments and/or invert elevations (detailed in **Appendix A and E**) be re-evaluated for conflicts during detailed design.

3.5 Sanitary Private Drain Connections

The profile of the proposed sanitary sewer system is dictated by the available sanitary sewer outlet elevations, conflicts with other municipal infrastructure and the proposed site grading. The Town of Tecumseh is moving towards the implementation of a Town-wide standard for the installation of sewage ejector pumps for the drainage of basement plumbing in all new developments, including the THSPA. This standard has been implemented as a best practice in other Town developments as part of its continued effort to reduce the risk of basement flooding due to sanitary sewer surcharging that is known to occur during more extreme wet weather conditions.

The trunk sanitary sewer system functional design was based on a minimum cover of 2.4 metres to provide sufficient cover. Private drain connections at the municipal property line will flow by gravity into a local sewer, which will subsequently discharge into the trunk sewer. Direct connections of private drains to the trunk mainline sewer are not permitted. Private drain connections must be a minimum of 1.5 m deep at the property line. All PDCs shall be equipped with sealed cleanouts and constructed in accordance with the Town's standards.

3.6 SE Hamlet Sanitary Pumping Station

In order to achieve appropriate sanitary sewer depths based on the available sanitary sewer outlet elevations and the proposed SE Hamlet lands, it was determined that a sanitary pumping station (PS) would be required. The proposed location of the sanitary PS is within the future right of way where the SE Hamlet area ties into Lesperance Road, as shown in **Figure 3.1**. The PS shall be based on 30 L/s outflow capacity for the upstream drainage area which assumes the area will be a mix of low and medium density. The breakdown of population for the SE Hamlet area is detailed in **Appendix A.**

The proposed sanitary PS will consist of 3800 mm dia. precast concrete wet-well, installed to a depth of approximately 6.5 m below grade (Finished Grade = 182.1 m, Inlet Invert = 176.15 m). The gravity inlet to the PS will include an internal drop pipe structure for inlet of the sewage at the PS elevation, preventing air entrainment and reducing stringy solids entanglement on the pumps.

The proposed sanitary PS will include two submersible pumps, each rated for a minimum 30 L/s with a power draw of approximately 10 kW. One pump will operate as duty and one pump as standby. One pump will include an internal recirculation nozzle to reduce solids build-up within the wet well. Heavy duty sewage rated, or chopper pumps, would be recommended. The submersible pumps are to be removable without entering the PS, using a rail and break-away elbow system. The check valves and pump isolation valves will be located within the station and will require confined space entry to service. A service platform and access ladder should be considered.

The proposed sanitary PS will have a stand-alone NEMA 4X control panel that will be located within 3.5 m of the station. The PS shall be equipped with a gravity overflow along with emergency back-up power supply. Provisions for a SCADA interconnection and a high-water level alarm shall also be included. All monitoring and remote communication, including SCADA and Programmable Logic Controller (PLC), shall be in conformance with prevalent Town and OCWA standards.

4.0 Stormwater Drainage

4.1 General

Stormwater collection and management systems generally consist of a network of open drains, storm sewers, pump stations, overland flood routes and stormwater management facilities (SWMF). This functional design of the stormwater drainage for the THSPA consists of several upstream trunk storm sewers, draining both existing and proposed development lands to an assigned SWMF that consists of ponds, quality control infrastructure and pumping station outlets.

The stormwater management (SWM) strategy for this development was established through the completion of the Upper Little River Watershed Master Drainage and Stormwater Management Plan (ULRMP) (Stantec, 2023), and Tecumseh Storm Drainage Master Plan (TDMP). The SE Hamlet falls within study area of the ULRMP as its boundaries are within East Townline Drain watershed however, the SWM strategy for this area was not included in these plans. The SWM strategy is essential to manage runoff from the THSPA development areas prior to entering the downstream municipal drains. This approach aims to prevent impacts to the downstream watershed area, which is historically susceptible to flooding during periods of intense rainfall when combined with high lake levels.

It is anticipated that future detailed design of each SWMF, as well as the upstream storm sewer system, will be refined upon detailed design and will adhere to the appropriate design guidelines listed herein and any updates to the respective guidelines at the time of design. This functional design of the SWMF considers the overall surface water runoff in the study area to provide SWMF water quality and water quantity control volume sizing, water level recommendations, outlet release rates, as well as guidance for layouts and elevations.

This section shall be reviewed in conjunction with the THSPA ESR. The ESR details the development of stormwater servicing solutions and the selection of preferred servicing solutions including the type and location of these facilities.

4.2 Existing Drainage and Municipal Drains

The THSPA is currently serviced by the following drainage outlets, with corresponding existing stormwater drainage areas, as shown in **Figure 4.1** and below in **Table 6.**

The drainage patterns for the THSPA into the municipal drains noted above are generally flat with slopes of less than 1%. Sub-watershed boundaries for the municipal drains were confirmed through the review of historical drainage reports, and studies completed previously, as well as drainage area mapping provided by the Town and ERCA.

Table 6: Existing Drainage Areas of Corresponding Outlet

Drainage Outlet	Existing Drainage Area (ha)
West Hamlet	
Gouin Drain	107.7
Lachance Drain	58.3
Desjardins Drain	119.7
Southeast Hamlet	
East Townline Drain (ETLD) (Antaya Drain)	35.1

For the West THSPA areas (Gouin, Lachance and Desjardins Drainage Areas), the municipal drains primarily serve agriculture lands and rural housing areas. The existing drainage areas for each municipal drain also serve existing lands upstream of the THSPA development boundary that mainly consists of residential development and open space. The upstream residential areas in the West Hamlet, including areas fronting or in the vicinity of Shawnee Road, Corbi Lane, and Kavanagh Drive, are currently serviced through a series of roadside swales and local storm sewers that were constructed prior to the development of the current SWM requirements for the region. The THSPA functional design has accounted for existing upstream drainage to be redirected to the proposed SWMFs at a rate that is consistent with current guidelines (1:5-year event). The functional design of the proposed THSPA storm trunk sewers and SWMFs have considered that these upstream improvements are in place. The Town has identified the need to improve the existing development drainage system as a priority and therefore will subsequently develop a local servicing plan that considers the improved outlet condition and SWMF.

For the SE Hamlet area (Antaya and East Townline drainage dreas), similarly to the West Hamlet area, the municipal drains primarily serve agriculture lands and rural housing areas. The Antaya municipal drain services agriculture areas and rural lands within the watershed boundaries and routes the storm water along the western boundary of the site and along the southern border of the CPR corridor. It should be noted that the upstream areas of the Antaya drain watershed will continue to drain directly to the East Townline Drain (bypassing the SE Hamlet SWMF).

4.3 Design Criteria

The stormwater design for the THSPA is governed by guidelines and historical studies completed to date and listed in **Section 1.2** above:

The following storm events were used to design each SWMF:

- Single Event Chicago Distribution 1:100 year – 24-hour design storm.
- Urban Stress Test (UST) (Chicago 1:100 year – 24-hour (108 mm) + additional 42 mm).

The 1:100 year – 24-hour design storm is used to determine the high-water level in each SWMF; whereas the UST event is used as a climate change stress test on the proposed SWM system to confirm that runoff from the THSPA is contained within the SWMF, prior to discharging downstream into the respective municipal drainage outlets (The Chicago 4-hour and SCS Type II 24-hour were both explored during the development of the Functional Servicing Report. However, between the two design events and the Chicago-24 hour design storm event the Chicago 24-hour event produced the maximum water surface level (MWSL) elevation in the ponds).

4.4 Outlet Capacity Analysis (Gouin, Lachance and Desjardins Drainage Areas)

Under a full development condition, the western portion of the THSPA is proposed to have a controlled discharge into three existing municipal drains: Gouin Drain, Lachance Drain and Desjardins Drain. This SWM strategy was recommended through the completion of the Upper Little River Watershed Master Drainage and Stormwater Management Plan (Stantec, 2023) (ULRMP). The ULRMP identified a 100-year allowable post-development release rate of 6 L/s/ha which has been established to control runoff within the upper reaches of the Little River watershed to mitigate impacts that could arise as vacant lands are developed.

As a part of the Little River Floodplain Hydraulics and Hydrology Study (LRFPS)(2023), a dynamic hydrologic and hydraulic model was developed to assess what impact the full buildout within the THSPA lands would have on the downstream municipal drains. The model was developed using the 2-dimensional (2D) modelling capabilities of PCSWMM to create a watershed-scale model. This model was used to update the regulatory floodplain mapping of the Little River watershed and assess outlet capacity constraints within the municipal drainage system for development intensification in the future.

The Town, partnering with ERCA and the City on Windsor, also completed the LRFPS along with the City's Sandwich South Master Servicing Plan (SSMSP), completed in 2023. As part of those studies, two development buildout scenarios were considered: initial, and ultimate conditions. The initial buildout condition considered full buildout of the East Pelton and CR42 Secondary Planning areas within the City of Windsor, and the West THSPA (Gouin, LaChance and Desjardins Drainage Areas). These initial development areas were considered in the analysis to fully understand the impact on the Little River watershed municipal drainage system over an anticipated 10-year buildout horizon. The ultimate buildout condition considered full buildout of the SSMSP area and West THSPA with their respective SWM controls. The findings of the outlet capacity analysis during both development conditions, with their respective SWM controls, showed an overall reduction in hydraulic grade line (HGL) within the lower reaches of the Little River Drain.

In 2021, in conjunction with the development of the LRFPS and SSMSP, an outlet capacity assessment for the THSPA was completed to assist with the internal THSPA road network and SWMF design.

A memo was completed entitled, "Tecumseh Hamlet SPA SWM Analysis – Outlet Capacity Assessment and Recommended Allowable Release Rate Summary", dated March 22, 2021. This memo, as provided in **Appendix C**, further assessed the allowable release rates for the THSPA and recommended alternative allowable release rates into the downstream watercourses.

This memo was completed to determine the most cost effective and feasible SWM servicing solution for the development lands, while ensuring no adverse impacts on the downstream system. As part of this memo, the project team coordinated with the ERCA, which confirmed that they were in acceptance of the revised allowable release rates (ERCA email of acceptance provided in **Appendix C**). The findings of the outlet capacity assessment were used as the basis of the functional SWMF design and acceptable allowable release rates for the THSPA. In July 2023, the findings of this assessment were refined based on the updated THSPA development plan, provided in **Appendix C**. Provided below are the alternative SWMF conditions considered for the THSPA as part of the July 26, 2023, meeting presentation.

Three alternatives as described below were considered for the appropriate release rate during this assessment:

1. **Alternative 1:** Controlling post-development THSPA flows based on the maximum 6 L/s/ha from the SWMF's and assessing downstream hydraulic conditions.
2. **Alternative 2A:** Controlling post-development THSPA flows to the pre-development 2-year 24-hour SCS Type II storm event from the SWMF's and assessing downstream hydraulic conditions.
3. **Alternative 2B:** Building on Alternative 2A, an outlet capacity assessment was completed under a condition where the municipal drains have matured over time (10-15 years), where sediment buildout and vegetation have grown within the open drainage channels. This alternative considered a change to the Manning's 'n' roughness coefficient for the Gouin, Lachance and Desjardins Drain from 0.045 to 0.060. The impacts on the HGL were then assessed to confirm where drain conveyance capacity may be restricted.

Based on the above noted conditions, the results shown in **Table 7** identify the allowable release rates for each alternative.

Table 7: THSPA - Alternative Release Rates Options

Municipal Drain	Existing Drainage Area (ha)	SPA Alternative 1 6 L/s/ha (L/s)	SPA Alternative 2A (L/s)	SPA Alternative 2A (L/s/ha)	SPA Alternative 2B (L/s)	SPA Alternative 2B (L/s/ha)
Gouin	121.0[1]	725	4,110[2]	34.0	1,750[1,3]	14.1
Lachance	47.4[1]	285	1,205[2]	25.4	1,205[1,]	25.4
Desjardins	125.2[1]	752	660	5.2	600[3]	4.8

Note 1: Drainage Area from July 2023 memo slightly changed based on refinements to existing and proposed drainage boundaries

Note 2: 1:2-year Existing Condition flows take into consideration the existing Tecumseh development, east of the study area, currently entering the respective municipal drains which are proposed to be abandoned with contributing drainage brought into the THSPA storm sewer system and SWMF system.

Note 3: The SPA Alternative 2B values were updated from the August 2021 memo in the scenario where each Municipal Drain was poorly maintained as described above

As shown in **Table 7**, the 1:2-year release rates identified from the existing condition modelling assessment (Alternative 2A) are significantly higher than the 6 L/s/ha rate for Gouin and Lachance drains, with only the Desjardins drain remaining somewhat consistent. This can be attributed to the Gouin and Lachance drain currently receiving flows from existing developed areas east of the THSPA which are currently allocated to the respective watersheds. These flows are proposed to be brought into the THSPA storm sewer system and SWMF under a developed condition. Based on the analysis performed to increase the Manning's 'n' roughness coefficient in Alternative 2B, each pond will require a further reduction in release rate to not adversely impact the HGL downstream.

Based on the analysis completed, the allowable release rates noted for Alternative 2B are recommended. Under this recommendation, the HGL downstream of the THSPA development lands within each municipal drain is at or below existing conditions.

4.5 Outlet Capacity Analysis (Southeast (SE) Hamlet Outlet)

Under existing conditions, the Southeast (SE) Hamlet development area currently drains directly to the East Townline Drain (ETLD) and Antaya Municipal Drain. The ETLD is located along the west side of County Road 19 (CR19) and conveys flows northernly though a box culvert at the CPR Railway crossing. The Antaya drain runs along the western and northern boundary of the SE Hamlet area and eventually discharges into the ETLD, south of the CP Rail at-grade crossing.

To assess existing conditions for this area, the Town's, "Tecumseh Storm Drainage Master Plan" (Dillon, 2019) (DMP) computational PCSWMM model was reviewed. This report assessed existing conditions to identify surface flooding issues in the developed settlement areas of the Town, north of CR42.

The model included catchments and drainage areas for both the ETLD and Antaya Drain. Based on the model analysis completed for this study, a 1:100-year, 4 hour modelled peak flow of 277 L/s was identified for the Antaya Drain into the ETLD.

In addition to that study, the Town of Tecumseh's, County of Essex's County Road 19 and County Road Environmental Study Report and Preliminary Design Report (2006) (CR19/CR22 ESR), ETLD Hydrology and Hydraulics Study Report (2012) and East Townline Drain Stormwater Management Report (2024) (ETLD SWM) were referenced to develop the ultimate stormwater solution for this area.

The recommended CR19/CR22 ESR (2006) servicing solution established that the section of the ETLD, south of the CP Rail, will ultimately be rerouted to Pike Creek. The recommendations included the re-routing of the ETLD south and turning easternly, crossing Manning Road (CR19), and continuing through the hydro corridor and eventually connecting to the Pike Creek Drain. Due to the constraints associated with staging and constructability and the recent ETLD SWM report, under ultimate conditions the ETLD will continue to route north. The expected outlet rate from this area was not determined during the 2006 assessment. Therefore, it is assumed that controlling the outlet flow to less than the existing 2-year pre-development flow would be permitted.

Under a developed condition, the SWM facility will discharge to the existing ETLD at a controlled rate to minimize impacts on downstream drainage. Analysis of the Antaya Drain and ETLD, under future conditions indicates that a release rate of 200 L/s from the proposed SWM facility will not elevate the hydraulic grade line (HGL) of the ETLD downstream of the SE Hamlet Area. This rate is intentionally lower than the SWM facility's estimated outflow as found in the Town's DMP, to allow flexibility in the design of the ETLD storm sewer system. A reduced release rate is necessary due to existing capacity limitations within the ETLD, which experiences flooding and backups during significant wet weather, particularly early spring rain events when ice jamming and snow accumulation reduce drain capacity.

It is recommended that upon detailed design of the SE Hamlet area, that the developer engage the Town of Tecumseh and County of Essex to clarify outlet conditions at the time. Collaboration with the Essex Region Conservation Authority (ERCA) will be required to establish necessary interim outlet conditions.

4.6 Stormwater Management Strategy

Future development within the THSPA as indicated above includes a mixture of low, medium and high density residential, commercial, institutional, parks and environmental reserve lands. The land use plan and location of the proposed SWMFs (Gouin, Lachance, Desjardins East, Desjardins West and SE Hamlet) are presented in **Figure 2.1**. Due to the flat topography of the THSPA, each SWMF will outlet into the corresponding municipal drain through a pumped outlet. An overview of the proposed SWM strategy is provided in **Figures 4.2, 4.3 and 4.4**.

The modelling completed for functional design was developed using a lumped modelling approach to size each SWMF, with consideration of each facilities allowable release rate into the downstream drainage system.

For functional design considerations, SWMF refers to all elements of the end-of-pipe SWM strategy, including sewer inlets, pumping station outlet and pond water quality and quantity control features.

4.6.1 Catchment Areas

Catchment areas draining to each proposed SWMF were divided into several subcatchments, as shown in **Figures 4.2, 4.3 and 4.4**. The catchment imperviousness values were derived from recommended values listed in the Regional Guidelines (Table 3.7.5.1) as shown in **Table 8** below.

Table 8: Land Use with Assumed Imperviousness (%)

Land Use	Imperviousness (%)
Residential Single Family	60
Residential Semi-Detached (Medium) Family	70
Residential Townhouse/Row Housing (High)	80
Commercial	90
SWMF – Wet Pond	50
SWMF – Dry Pond	0
Institutional	70
Open Space – Parks/Woodlot	5
Right of Way (Road and Boulevard)	80

Below in **Table 9** lists the modelling subcatchment parameters for the THSPA. A weighted impervious value was used for each subcatchment based on the values presented in **Table 8** and proposed land use.

Table 9: Subcatchment Parameters

Drainage Area Name	Drainage Area (ha)	Weighted Imperviousness (%)	Remarks
GOUIN SWMF DRAINAGE AREAS			
P-1_G	54.9	65	THSPA lands
P-2_G	12.4	73	THSPA lands
EXT-3_G	39.5	60	Existing Development
EXT-6_LA	14.2	60	Existing Development
LACHANCE SWMF DRAINAGE AREAS			
P-4_LA	30.3	61	THSPA lands
EXT-5_LA	11.0	60	Existing Development
HYDRO_DA3_DESJ	6.1	5	Hydro Corridor
DESJARDINS EAST SWMF DRAINAGE AREAS			
P-7_DJ	66.0	51	THSPA lands
HYDRO_DA_DESJ	6.5	0	Hydro Corridor
HYDRO_DA2_DESJ	1.1	0	Hydro Corridor
HYDRO_DA3_DESJ	6.1	5	Hydro Corridor
P-7_DJ_2	4.5	70	Tecumseh Vista High School
P-7_DJ_4	7.6	18	Tecumseh Vista High School
DESJARDINS WEST SWMF DRAINAGE AREAS			
P-8_DJ	31.4	57	THSPA lands
S45	0.38	80	Banwell Road
S46	0.29	80	Banwell Road
S47	0.30	80	Banwell Road
S48	0.23	80	Banwell Road
S56	0.43	80	Banwell Road
S61	0.21	80	Banwell Road
S65	0.15	80	Banwell Road
ETLD SWMF DRAINAGE AREAS			
W341	12.38	60	THSPA lands
ETLD_SA	9.06	60	THSPA lands
W340	10.20	60	THSPA lands
W655	3.47	60	THSPA lands

It should be noted that the proposed drainage areas assigned to each pond slightly differ from the existing municipal drainage boundaries. During the future design of each SWMF, anticipated upstream contributing drainage areas to each municipal drain are expected to be adjusted. At this time, the Town or Developer will be required to complete all necessary municipal drainage reports, in accordance with the Municipal Drainage Act process.

It should also be noted that to be conservative, the hydro corridor drainage area (HYDRO_DA3_DESJ) was included in the drainage areas for both the Desjardins and Lachance SWMF drainage areas. As shown in **Figure 4.3,** the overland flow from the hydro corridor is presently assessed to the Lachance Drain. Surface drains capture the overland drainage, under ultimate conditions, and the flow will be directed to the Lachance SWM pond via a number of culvert crossings under the CPR tracks.

This conservative approach provides flexibility for changes within the hydro corridor to occur over time. Also, the size and condition of culverts conveying the flows to the Lachance Pond are unknown and therefore for major rain events, it is critical to provide an alternative route for drainage of the corridor to the East Desjardins Pond. To manage water flow, drainage swales will be incorporated within the hydro corridor, following the land's topography and existing drainage. These swales will channel water away from the developable areas and future road right of ways towards designated outlets. Swales collecting water solely from Hydro One land will be maintained within their boundaries, while grading and drainage from private properties will be redirected accordingly. Instances such as the SE Hamlet where future road right of ways cross the hydro corridor necessary drainage culvert crossing shall be utilized to maintain drainage. Developers shall coordinate with Hydro One networks early in the design process to coordinate and obtain necessary approvals.

4.6.2 Stormwater Management Facility Design

Following the background reports and regional guidelines listed in **Section 4.3**, a total of four (4) SWMF's are required to serve the THSPA. SWMF functional design completed as part of this study includes:

- Determination of the necessary land use footprint for each SWMF.
- Determination of total permanent pool and active storage volumes needed for their respective contributing drainage areas and respective land uses.
- Cross-sectional design elements for each SWMF.
- Critical water level criteria.

The following criteria was taken from the 2018 Windsor/Essex Region Stormwater Manual and MECP guidelines and used as a basis for the functional design of each pond, unless noted otherwise.

- Side slopes:
  - 5:1 – Above the (Normal Water Level) NWL to top of bank
  - 5:1 – Below the NWL
  - 6:1 – Depth 0.5 m above and below the normal water level (NWL)
- Minimum Permanent Pool Depth: 1.0 m
- Minimum High-Water Level (HWL) Freeboard: 0.30 m to top of bank

- 8.0 to 10.0 m buffer around the pond for maintenance access, temporary sedimentation dry-out areas, pedestrian pathways and landscaping.

The HWL represents the maximum water surface elevation achievable during the 100-year design storm. Conversely, for the Urban Stress Test (UST) design storm, the water surface elevation must be contained within the pond banks with no freeboard requirements.

SWMF elements such as inlet and outlet erosion control, maintenance access, footprint and fine grading shall be implemented in accordance with the MECP and Ontario Provincial Standard Specifications (OPSS) guidelines. During detail design, pond contours and geometric design shall be in keeping with this study. A detailed landscape plan shall be prepared using recommended plants species and seed mixes described in the supporting waterfowl habitat mitigation measures listed in **Section 4.5.6.**

Recommended pond design elements for wet ponds and dry ponds are shown in **Figures 4.5A and 4.5B** with detailed cross section grading included in **Figures 4.6A to 4.6E**. The location and layout of the proposed ponds is provided in **Figures 4.2, 4.3 and 4.4**.

Common for the Essex County region, the study area has constraints that require SWM ponds to be relatively deep and therefore, preferred MECP pond depth is difficult to meet. Per Table 4.6 Wet Ponds – Summary of Design Guidance and Table 4.8 Dry Ponds - – Summary of Design Guidance (MECP Stormwater Management Planning and Design Manual) the proposed ponds meet the maximum permanent pool and active storage depths listed. Prior to detailed design, a pond specific stormwater management report must be completed to confirm the design is in keeping with this functional design. This report shall be submitted to the Town, ERCA for review and approval as part of the ERCA Permit and MECP-CLI application processes.

Pond designs shall also consider long term operation and maintenance requirements per the MECP's Operation, Maintenance and Monitoring provisions within the Stormwater Management Planning and Design Manual. Coordination with the Town of Tecumseh is required to develop a plan that is practical and cost effective. During pond maintenance operations, exterior buffer lands surrounding the ponds provide sufficient area to temporarily store the wet sediment in order for it to decant (prior to being trucked offsite). Temporary storage piles shall not exceed 1.0 m in height and shall be placed in areas that naturally drain toward the pond. Piles shall not block recreational corridors or impede on access around the perimeter meter of the pond. Methods for material removals, storage, and export shall be defined during the detailed design stage for municipal approval. The existing vegetation along the pond banks is necessary to mitigate waterfowl (as per **Section 4.6.6**) however, during the sediment removal maintenance period, access through the vegetation will be required. The use of mowers and other brush removal equipment shall be permitted at specified increments (to allow excavation equipment access to the pond sediment forebays). The use of silt fencing is required along the perimeter of the dry out area while sediment is decanting (to ensure minimal sediment re-enters the pond while the material is drying).

The outlet pumping station for each pond is equipped with an additional standby pump to provide resiliency in the pump station should maintenance be required. In addition, each station will be equipped with an emergency generator. In most cases, due to the depth (freeboard) at each pond, the pond will store flows for events greater than the Urban Stress Test event. An additional emergency bypass will not be required at each outlet.

4.6.2.1 Gouin 'DRY' Pond

The Gouin Pond is proposed to be constructed along the north boundary of THSPA lands, just south of the CR22 right-of-way, ultimately discharging to the Gouin Municipal Drain at Banwell Road. Based on the environmental assessment of design concepts, it was recommended that the Gouin Pond be a 'Dry Pond'. This SWMF location overlaps with the Windsor Airport's flight path which poses the safety risks associated with waterfowl habitat. Dry ponds generally are less attractive to waterfowl however the designs and landscape treatments of the ponds shall still follow waterfowl habitat mitigation principles (see **Section 4.6.6**).

The top of pond bank shall be a minimum of 10.0 metres from the existing Ministry of Transportation (MTO) former landfill site (see **Figure 1.0**). Based on an environment site assessment of the MTO site (provided in **Appendix G**), soil conditions were analyzed to confirm the suitability of the proposed pond location. This study concluded where segments of the pond are within 30 m of the landfill site that an engineered liner is required. A liner would be placed along the east pond wall with the liner keyed into the natural clay soils below the base of the pond to prevent migration of the contaminants into the runoff. The 30 m setback is based on the D-4 Land Use On or Near Landfills and Dumps, Section 5.2.1 Operating sites. During detailed design, the pond shall be placed outside of the 30 m buffer area. Based on this functional design and the achieved setback, a liner is not required along the east pond wall.

A summary of the anticipated Gouin Pond design characteristics is provided in **Table 10** and **Table 11**.

Table 10: Gouin Pond Conceptual Stage-Storage Curve

Elevation (m)	Depth (m)	Notes	Area (ha)	Storage (m^3)
177.50	0.0	Bottom/Normal Water Level (NWL)	1.05	-
178.00	0.5		1.77	7,000
178.50	1.0		2.52	17,800
179.00	1.5		2.84	31,200
179.50	2.0		3.16	46,200
180.00	2.5		3.49	62,800
180.50	3.0	High Water Level (HWL)	3.81	81,100
181.00	3.5		4.15	101,000
181.40	3.9	Freeboard Elevation (Minimum Top of Pond)	4.42	118,100

Table 11: Gouin Pond Conceptual Design Data

Parameter	Value
Total Catchment Area	120.9 ha
1:5 Year Water Level	179.37 m
High Water Level (HWL)	180.50 m
Pond Depth below NWL	N/A
Active Storage Depth (Bottom to HWL)	3.00 m
Release Rate	1,750 L/s
Freeboard Elevation (Minimum Top of Pond)	181.40 m
Pond Storage Volume at NWL	N/A
Pond Storage Volume at HWL	81,300 m^3
Active Storage Volume at HWL	81,300 m^3
UST Active Volume Required	98,100 m^3
UST Elevation	180.93 m

4.6.2.2 Lachance 'WET' Pond

The Lachance Pond is situated north of the CPR Right-of-Way and discharges to the west into the Lachance Municipal Drain. Exact setback requirements from CPR Right-of-Way the shall be confirmed during detailed design based on geotechnical information, CPR consultation and the requirement to accommodate security/noise barrier fencing (as referenced in "Guidelines for New Development in Proximity to Railway Operations- May 2013").

A summary of the anticipated Lachance Pond design characteristics is provided in **Table 12** and **Table 13**.

Table 12: Lachance Pond Conceptual Stage-Storage Curve

Elevation (m)	Depth (m)	Notes	Area (ha)	Total Storage (m^3)	Active Storage (m^3)
177.20	0.0	Bottom	0.31	-	-
177.70	0.5		0.45	1,900	-
178.20	1.0		0.63	4,500	-
178.60	1.4	NWL	0.86	7,500	0
179.10	1.9		1.17	12,600	5,100
179.60	2.4		1.42	19,100	11,600
180.10	2.9		1.68	26,800	19,300
180.60	3.4	HWL	1.94	35,900	28,400

Elevation (m)	Depth (m)	Notes	Area (ha)	Total Storage (m^3)	Active Storage (m^3)
181.10	3.9		2.21	46,200	38,700
181.60	4.4		2.47	57,900	50,400
182.10	4.9	Freeboard Elevation (Minimum Top of Pond)	2.75	71,000	63,500

Table 13: Lachance Pond Conceptual Design Data

Parameter	Value
Total Catchment Area	47.5 ha
Normal Water Level (NWL)	178.60 m
1:5 Year Water Level	179.75 m
High Water Level (HWL)	180.60 m
Pond Depth below NWL	1.40 m
Active Storage Depth (NWL to HWL)	2.00 m
Release Rate	1,200 L/s
Freeboard Elevation (Minimum Top of Pond)	182.10 m
Pond Storage Volume at NWL	7,500 m^3
Pond Storage Volume at HWL	35,900 m^3
Active Storage Volume at HWL	28,400 m^3
UST Active Volume Required	29,300 m^3
UST Elevation	180.65 m

4.6.2.3 Desjardins 'WET' Ponds

The Desjardins Municipal Drain bisects the THSPA lands and crosses CR43, heading west beyond the Town's municipal boundary, ultimately discharging into the Little River Drain. The Desjardins SWMF is separated by CR43, therefore, two ponds, Desjardins East and Desjardins West, have been proposed to provide an outlet for the east and west THSPA. The ponds will be interconnected by a 900 mm dia. pipe, set at the pond's NWL, to provide conveyance of storage flow from the east pond to the west pond. The elevation of the Desjardins Pond 900 mm interconnection sewer crossing CR43, should be approximately 179.10 m at the centre of the ROW. This proposed elevation is recommended to avoid vertical conflicts with the existing 750 mm storm sewer and 600mm watermain along CR43 (running north - south).

The elevation noted above is proposed to provide adequate separation between the 900 mm pipe and this watermain at the proposed crossing location however this will need to be confirmed prior to construction. Horizontally, the proposed interconnection shall route within the proposed SWM corridor that is proposed north of the right of way corridor to the south of the East Desjardins Pond.

It shall be noted that the implementation of both the East and West ponds will be developer driven and therefore may be constructed in phases. This FSR provides functional servicing design for the ultimate Desjardin Stormwater Management Facilities; design for phased stormwater management solutions will be subject to detailed engineering analysis and design by the developer. Notwithstanding the above, any phased solution must not impede or otherwise prevent the implementation of the ultimate Desjardin Stormwater Management Facilities.

In keeping with the ULRMP (2023), a 30 m wide SWM corridor is proposed to interconnect the McAuliffe Park, East Desjardins Pond and West Desjardins Pond. This right of way is proposed to accommodate storm sewers, local drainage, overland drainage corridors and the Natural Heritage Corridor.

Table 14 and **Table 15** are the anticipated Desjardins East Pond design characteristics.

Table 14: Desjardins East Pond Conceptual Stage-Storage Curve

Elevation (m)	Depth (m)	Notes	Area (ha)	Total Storage (m^3)	Active Storage (m^3)
177.30	0.0	Bottom	1.35	-	-
177.80	0.5		1.56	7,300	-
178.30	1.0		1.78	15,600	-
178.80	1.5		2.01	25,100	-
179.30	2.0	NWL	2.28	35,800	0
179.80	2.5		2.56	48,000	12,200
180.30	3.0		2.80	61,400	25,600
180.80	3.5		3.04	76,000	40,200
181.30	4.0	HWL	3.29	91,800	56,000
181.80	4.5		3.54	108,900	73,100
182.26	4.96	Freeboard Elevation (Minimum Top of Pond)	3.77	126,000	90,200

Table 15: Desjardins East Pond Conceptual Design Data

Parameter	Value
Total Catchment Area	92.0 ha
Normal Water Level (NWL)	179.30 m
1:5 Year Water Level	180.31 m
High Water Level (HWL)	181.30 m
Pond Depth below NWL	2.00 m
Active Storage Depth (NWL to HWL)	2.00 m
Release Rate	Refer to Desjardins West (Table 17)
Freeboard Elevation (Minimum Top of Pond)	182.26 m
Pond Storage Volume at NWL	35,800 m^3
Pond Storage Volume at HWL	91,800 m^3
Active Storage Volume at HWL	56,000 m^3
UST Active Volume Required	70,100 m^3
UST Elevation	181.71 m

Table 16 and **Table 17** are the anticipated Desjardins West Pond design characteristics.

Table 16: Desjardins West Pond Conceptual Stage-Storage Curve

Elevation (m)	Depth (m)	Notes	Area (ha)	Total Storage (m^3)	Active Storage (m^3)
177.70	0.0	Bottom	0.92	-	-
178.20	0.5		1.09	5,000	-
178.70	1.0		1.29	11,000	-
179.00	1.3	NWL	1.42	15,000	0
179.50	1.8		1.65	22,700	7,700
180.00	2.3		1.84	31,400	16,400
180.50	2.8		2.03	41,100	26,100
181.00	3.3	HWL	2.24	51,800	36,800
181.80	4.1	Freeboard Elevation (Minimum Top of Pond)	2.56	71,000	56,000

Table 17: Desjardins West Pond Conceptual Design Data

Parameter	Value
Total Catchment Area	33.4 ha
Normal Water Level (NWL)	179.00 m
1:5 Year Water Level	180.03 m
High Water Level (HWL)	181.00 m
Pond Depth below NWL	1.30 m
Active Storage Depth (NWL to HWL)	2.00 m
Release Rate	600 L/s
Freeboard Elevation (Minimum Top of Pond)	181.80 m
Pond Storage Volume at NWL	15,000 m^3
Pond Storage Volume at HWL	51,800 m^3
Active Storage Volume at HWL	36,800 m^3
UST Active Volume Required	48,700 m^3
UST Elevation	181.51 m

4.6.2.4 SE Hamlet 'WET' Pond

As referenced in **Section 4.5**, the outlet of this pond is intended to be pumped to the ETLD, however this may not be required in the future if the ETLD is improved, and the drain becomes enclosed (the release rate provided herein shall be maintained regardless of the improvements to the drain). The functional design of the pond has assumed a pond location based on the EA evaluation of alternative design concepts. Refer to the Tecumseh Hamlet ESR for further details.

Hydro corridor lands abutting the SE Hamlet shall have overland flow routes maintained during construction and under ultimate development conditions. During detailed design, modifications to the hydro corridor will be required, including implementation of directional drainage swales including culverts at road crossings sized to maintain existing overland flow routes as well as maintaining the Antaya drain. Consultation with Hydro One is required to ensure that any approvals between hydro one and the developer are adequately addressed to the satisfaction of Hydro One prior of the implementation of SWMF. This includes but is not limited to the stormwater pond and for the accommodation of overland drainage within the hydro corridor. Future road right of way drainage interconnections to Lesperance Road and Strawberry Drive have been included in the pond sizing however the remaining portions of the hydro corridor shall be directed to the existing outlet.

A summary of the anticipated SE Hamlet SWMF design characteristics are provided in **Table 18** and **Table 19**.

Table 18: SE Hamlet Pond Conceptual Stage-Storage Curve

Elevation (m)	Depth (m)	Notes	Area (ha)	Total Storage (m^3)	Active Storage (m^3)
178.00	0.0	Bottom	0.50	-	-
179.50	1.5	NWL	1.00	11,250	-
181.50	3.5	HWL	1.60	37,250	26,000
181.80	3.8	Freeboard Elevation (Minimum Top of Pond)	1.80	21,000	31,100

Table 19: SE Hamlet Pond Characteristics

Parameter	Value
Total Catchment Area	35.1 ha
Normal Water Level (NWL)	179.50 m
1:5 Year Water Level	180.36 m
High Water Level (HWL)	181.50 m
Pond Depth below NWL	1.50 m
Active Storage Depth (NWL to HWL)	2.00 m
Release Rate	200 L/s
Freeboard Elevation (Minimum Top of Pond)	181.80 m
Pond Storage Volume at NWL	11,250 m^3
Pond Storage Volume at HWL	37,250 m^3
Active Storage Volume at HWL	26,000 m^3
UST Active Volume Required	30,000 m^3
UST Elevation	181.74 m

4.6.3 Stormwater Management Facility - Pumping Station Design

In order to direct water from each SWMF to the downstream existing drains, a pumping station (PS) outlet is required. The proposed location of each SWMF PS will be within the anticipated SWM corridor at the outlet to the respective municipal drain. **Table 16** below details the PS conceptual design parameters required to facilitate the connection of each PS to the respective drains. The discharge rate for each PS is dependent on the maximum allowable release rates noted in **Section 4.4**.

4.6.3.1 Pumping Station Site Layout

The Gouin, Lachance and Desjardins PS's will require the implementation of a cast-in-place rectangular wet well structure. Sizes of each pumping station wet well have been included in the PS design summary **Table 20** below. Wet wells are to accommodate 2 duty axial flow pumps with 1 standby pump, the exception of the SE Hamlet PS which will only need to accommodate 1 duty axial flow pump with 1 standby pump. For the SE Hamlet PS, a standard cylindrical wet well structure is sufficient to accommodate the pumps. The dimensions and configuration of the PS's were determined by the ANSI Standard Pump Intake Design Guidelines developed by the Hydraulic Institute.

The PS site layouts in **Figures 4.7 and 4.8** show the size and location of the proposed wet wells, standby power generator, and required control panel equipment. A site area of approximately 30 m by 30 m will be required to accommodate the larger pumping stations, including space for regular maintenance access. The drain/pond maintenance corridors are to provide linkages to the PS sites from the municipal right-of-way for vehicles needing access.

In addition to the typical PS controls and power supply, the Town of Tecumseh requires that monitoring equipment be implemented to record outflow data as well as a power generator to provide emergency backup capabilities.

Each PS shall be equipped with an outlet which will discharge to the adjacent municipal drain. The sewer outlet elevations have been based on the existing drain depths per each drain's municipal drainage report. Permanent sediment and erosion control shall also be implemented at each sewer outlet. It is recommended that each PS outlet be routed as follows and shown in **Figures 4.1-4.4.**

Gouin SWMF Outlet: The 750mm dia. pumped forcemain outlet shall discharge to a 1050 mm dia. sewer routed south, crossing the proposed Gouin Road extension and discharging just upstream of the Gouin Drain culvert crossing Banwell Road. The elevations noted below are based on the draft Gouin Drain culvert design being developed through the City of Windsor's Banwell Road/E.C Row Interchange project.

Lachance SWMF Outlet: The 600mm dia. pumped forcemain outlet shall discharge to a 900 mm dia. sewer that shall cross Banwell Road and outlet to the existing Lachance Drain. The elevation and location of the 900mm forcemain crossing at Banwell Road is identified in the 'Banwell Road/ E.C. Row Interchange and Corridor Improvements- U-02 Drawing set' (Dillon, 2025) and shall be followed upon the detail design of this outlet.

Desjardins SWMF Outlet: The 500mm dia. pumped forcemain outlet shall discharge directly into the Desjardins Drain.

SE Hamlet SWMF Outlet: A 350mm dia. forcemain outlet will discharge to the ETLD. The depth and location shall be confirmed as part of the ETLD Enclosure design to be done by others.

Table 20: Storm Pumping Station Design Summary

<table>
<tr><th colspan="2">Parameter</th><th>Gouin PS</th><th>Lachance PS</th><th>Desjardins PS (West)</th><th>SE Hamlet PS</th></tr>
<tr><td colspan="2">Receiver Location (Municipal Drain)</td><td>Gouin Drain</td><td>Lachance Drain</td><td>Desjardins Drain</td><td>East Townline Drain</td></tr>
<tr><td colspan="2">Reference Layout Figure</td><td>Figure 4.7</td><td>Figure 4.7</td><td>Figure 4.7</td><td>Figure 4.8</td></tr>
<tr><td colspan="2">PS Required Capacity (m3/s)</td><td>1.75</td><td>1.21</td><td>0.6</td><td>0.2</td></tr>
<tr><td colspan="2">Wet Well Size (m)</td><td>9.0 x 15.0</td><td>9.0 x 15.0</td><td>6.0 x 10.0</td><td>3.6 (diameter)</td></tr>
<tr><td colspan="2">Pond Normal Water Level (Elevation m)</td><td>Not Applicable</td><td>178.60</td><td>179.00</td><td>179.50</td></tr>
<tr><td colspan="2">Pond Bottom (Elevation m)</td><td>177.50</td><td>177.20</td><td>177.70</td><td>178.00</td></tr>
<tr><td colspan="2">PS Depth - Bottom of Wet Well (m)</td><td>6.20</td><td>7.90</td><td>6.80</td><td>5.70</td></tr>
<tr><td colspan="2">Total Dynamic Head – Estimate (m)</td><td>5.00</td><td>5.00</td><td>5.00</td><td>6.00</td></tr>
<tr><td colspan="2">Pump Configuration</td><td>2 duty + 1 standby</td><td>2 duty + 1 standby</td><td>2 duty + 1 standby</td><td>1 duty + 1 standby</td></tr>
<tr><td colspan="2">Individual Pump Motors (kW each)</td><td>80</td><td>70</td><td>25</td><td>20</td></tr>
<tr><td colspan="2">Individual Pump Discharge Forcemain Diameter (mm)</td><td>750</td><td>600</td><td>500</td><td>350</td></tr>
<tr><td rowspan="5">PS Outlet Sewer to Receiver</td><td>Receiver Invert at the Municipal Drain (Elevation m)</td><td>179.86</td><td>180.14</td><td>180.66</td><td>180.78</td></tr>
<tr><td>Pipe Diameter – PS Outlet Sewer to Receiver (mm)</td><td>1050</td><td>900</td><td>500</td><td>300</td></tr>
<tr><td>Outlet Sewer Length of Receiver (m)</td><td>110.0</td><td>75</td><td>113.0</td><td>164.0</td></tr>
<tr><td>Minimum Pipe Slope (%)</td><td>0.07</td><td>0.07</td><td>0.09</td><td>0.50</td></tr>
<tr><td>Minimum Outlet Invert at PS (Elevation m)</td><td>179.94</td><td>180.80[1]</td><td>180.76</td><td>181.60</td></tr>
</table>

Parameter		Gouin PS	Lachance PS	Desjardins PS (West)	SE Hamlet PS
	Finished Grade at PS (Elevation m)	181.90	182.80	182.20	181.90
	Cover at PS (m)	0.91	1.72	0.69	N/A
	Inlet Sewer to PS	1200mm	1050mm	750mm	450mm

Note 1: To avoid future conflicts with sewers and roadwork proposed within the Banwell Road corridor, the 900 mm gravity storm sewer crossing for the Lachance pumped SWM pond outlet shall be constructed south of the Banwell Road storm sewer. The proposed sewer depth at the eastern Banwell Road right of way boundary is 180.748 m with a 0.5% slope for 48 m.

The proposed depth at the western right of way boundary shall be 180.508 m. The developer shall reference the Banwell Road/ E.C. ROW Interchange and Corridor improvements as built drawings (U- 02) for the exact location of the proposed crossing.

Note 2: The size of the Desjardin Pump Station Site (capacity 0.6cms with a 6m by 10m wet well) shall be a minimum of 20m by 20m (as shown in **Figure 4.3**). The power supply and communication routing shall be outside of the PS site and shall follow along the 10m access buffer area along the perimeter of the pond.

4.6.4 Water Quality

The proposed THSPA wet ponds shall provide a minimum 'Normal' (70% TSS removal) Protection Level for water quality treatment in accordance with the CLI-ECA for a municipal SWM System and the Windsor/Essex Region Stormwater Manual. The Gouin Pond is proposed to be a dry pond and therefore for this facility, quality treatment infrastructure will be required upstream of the ponds in accordance with the Town's CLI-ECA and MECP requirements.

The design permanent pool and extended detention storage volumes for each pond were calculated based on the design service area, the proposed impervious coverage, and the criteria presented in the Design Criteria for Environmental Compliance Approval (MECP, 2023), as summarized in **Table 21**.

Table 21: Water Quality Storage Summary of each Pond

Facility	Drainage Area (ha)	Imperviousness (%)	Total Required Water Quality Control Unit Volume (m^3/ha)	Active Required Extended Detention Unit Volume (m^3/ha)	Active Required Extended Detention Volume (m^3)	Active Provided Extended Detention Volume (m^3)	Required Permanent Pool (m^3)	Provided Permanent Pool (m^3)	Required Minimum Forebay Bottom Width (m)	Provided Minimum Forebay Bottom Width (m)
Lachance	47.5	54	109	40	1,900	28,400	3,250	7,500	6	6
Desjardins East	92.0	42	97	40	3,680	56,000	5,225	35,800	10	20
Desjardins West	33.4	58	114	40	1,336	36,800	2,460	15,000	11	11
SE Hamlet	35.1	60	118	40	1,404	26,050	2,755	11,250	7	10

For wet ponds, sediment forebays for each pond are recommended to be positioned within the pond to maximize the flow path distance under normal operating conditions to promote sediment removal. Forebay berms are to be designed to lengthen the effective flow path and reduce the possibility of short circuiting under low flow conditions.

The settling distance, dispersion length and minimum forebay bottom width calculations are presented in **Appendix D** to provide the minimum allowable forebay lengths for each pond. It should be noted, that within the calculations presented in **Appendix D** the peak outflow rate for the "*Forebay Settling Length, Dist 1*" calculation is what the pumps should be set at during most design storm events for the Lachance, Desjardins West and SE Hamlet ponds. This should be considered during detailed design of the lift stations.

As identified, the Gouin Pond is proposed to be a dry pond and will require water quality treatment upstream of the facility. All pond inlet pipes into the Gouin Pond will require upstream Mechanical Treatment Devices (MTD) to provide treatment of runoff prior to discharge into the pond. MTDs shall be sized to provide Normal Protection and to meet the requirements of the Town's CLI-ECA and MECP design criteria. A combination of Oil and Grit Separators (OGS) and/or underground water quality facilities (Ex. *Stormceptor* underground detection chambers or approved equivalent) shall be used. MTDs shall be placed within the allocated SWMF lands at each pond inlet.

4.6.5 Little River Floodplain

The upper reaches of the Little River Floodplain regulatory floodplain mapping and critical floodplain elevations are established for the West THSPA area and shall be followed when preparing the proposed site grading. The required floodproofing standards will include:

- Minimum road grade to be 0.30 m below the identified 1:100-year flood fringe level
- Minimum building opening to be 0.30 m above the higher of either:
  - The 1:100-year flood fringe level of the watershed, or
  - The dynamic 1:100-year local road ponding level.

The boundaries of the SWM ponds shall be higher than the regulatory floodplain elevations such that SWM ponds are protected from flooding during events.

4.6.6 Waterfowl Mitigation

It was identified through the ULRMP and Windsor International Airport Master Plan (2010) that the use of SWMF's in the vicinity of the Windsor Airport poses safety risks associated with typical airport operations. In order to address the potential for waterfowl safety risks, a comprehensive mitigation plan that provides guidance for the design and implementation of the SWMF was developed as part of the City of Windsor's SSMSP. A memo entitled "Supplementary Waterfowl Adaptive Mitigation Plan and Stormwater Management Facilities – Sandwich South Master Servicing Plan" dated May 2023 was developed and is available on the City of Windsor's website as well as **Appendix M**. Due to the THSPA's proximity to the Windsor Airport, reference to this guidance and findings of this memo were considered in the preparation of this functional design.

The ULRMP has recommended that all SWMF within the THPSA be wet ponds to provide the necessary quantity and quality control treatment required to meet Regional Guidelines. Where ponds are directly within the airport flight path zones, dry ponds shall be used.

To confirm the appropriate type of facility is selected, an evaluation of alternatives SWMFs were undertaken in the covering Environmental Study Report. To assess the risks associated with the two main types of SWMFs (dry vs wet ponds) an overlay of the Airports Obstacle Limitation Surface (OLS) was placed over the THPSA, as shown in **Figure 4.9.** The OLS is a *"surface that establishes the limit to which objects may project into the airspace associated with an aerodrome consisting of the following: a takeoff surface, an approach surface, a transitional surface, and an outer surface"* (Transport Canada – TP1247E). For waterflow mitigation, wet ponds are not permitted within the OLS boundary and as a best practice, where wet ponds are near the OLS zones, actions to mitigate waterfowl habitat will be implemented to reduce migration of waterfowl from facility to facility. The Gouin SWMF was designed to be a dry pond with no permanent standing water pool in order to mitigate waterfowl habitation due to its direct positioning in relation to the take off and landing routes for the Windsor Airport.

Specifically, the landing routes are areas where aircrafts may be less than 1500 feet (547 m) above ground surface and therefore pose greater risk for in-air collisions. Other ponds are all permitted to be wet ponds however mitigation measures shall be considered in the design and implementation of these facilities. During the design, construction and operation of the SWMF, mitigation practices shall be used to discourage waterfowl habitat. The memo referenced above provides a detailed assessment of various mitigation measures and their respective effectiveness. In summary, the following provisions shall be undertaken during the implementation of these facilities:

Detailed Design

- Follow the most current Transport Canada, airport and regional guidelines (Wildlife Control Procedures Manual-Transport Canada Aerodromes Standards Branch, Wildlife Hazard Mitigation, Federal Aviation Administration, United States Department of Transportation and Airport Wildlife Management. Bulletin No. 38. Transport Canada).
- Minimizing permanent open water space (i.e. permanent pool) width, wherever possible, by using narrow wetted areas with a non-straight (meandering) alignment.
- Provide raised berms, benching or other landscape features within the permanent pool area to provide visual deterrent and restrict flight paths for birds landing and taking off.
- Landscape design shall include a plan for densely planted vegetation along the sloped banks with designed maintenance corridors.
- Vegetation selection including tree plantings, shrubs and grasses shall be consistent with those recommended in the Supplementary Waterfowl Adaptive Mitigation Plan or approved equivalent.
- Design storm sewer outlets and pumping stations have the functionality to drain permanent pools for maintenance to provide the ability to remove attractive vegetation and remove sediment build up.
- Fast draw-down period (48 hours) in active storage areas limit open water available during storm periods.
- Provide screening along the top of banks such as short fencing, trees and rocks.

Construction

Contractors shall be directed to provide mitigation measures throughout construction to deter waterfowl habitat during pond excavation and landscaping works. This includes provisions for mitigating waterfowl during each project’s maintenance period. Due to the anticipated timeline of two to fives years for the required vegetation identified for planting to mature in height, interim measures shall be taken to prevent waterfowl habitat. Interim measures such as netting and cabling are recommended for mitigation before sufficient canopy cover to the permanent pool can be achieved.

<u>Operation</u>

SWM ponds shall be monitored and maintained over the life of the facility. Monitoring and maintenance practices including the parties who will be responsible for these works shall be determined upon implementation of the SWMF. Monitoring of the new (less then 3 years old) ponds shall be conducted regularly to observe and document the presence of waterfowl.

Similarly, regular monitoring should also be conducted within the SWMF to ensure that landscaping and engineering designs working effectively. Monitoring will consist of single site visits to each feature/SWMF to visibly assess if waterfowl are present (species and number), evidence of woody vegetation dieback, or damage to the SWMF is present.

4.7 Trunk Storm Sewer Design

Stormwater conveyance will be provided by a series of local and trunk storm sewers, generally located within the proposed right-of-way corridors within the THSPA. The storm sewers shall drain the proposed road right of way through catchbasins along curbs. Private property drainage shall be captured via private drain connections. The proposed trunk storm sewer routing is shown in **Figures 4.2, 4.3 and 4.4**.

4.7.1 Existing Development Areas and Improved Level of Service

As part of this functional design, it is recommended that areas upstream of the THSPA be improved to meet current provincial and regional guidelines; however, they are not necessarily required prior to the development of the THSPA. Many of the existing storm sewers or roadside ditches within the existing development areas do not provide an adequate level of service that is consistent with the Regional Guidelines. The new storm network and pond arrangements will provide an overall improvement to the level of service for the entire watershed, as identified in **Section 4.7.3.**

Upstream portions of the existing drainage catchments for the Gouin and Lachance Drains consist of existing residential development. These existing developments will be intercepted by the proposed storm trunk sewers and ultimately routed to the proposed THSPA SWMF's. The existing storm trunk sewer system for the Gouin drainage area has been sized to provide a 1:5-year level of service to all upstream areas contributing to the proposed THPSA ponds. The expected flows from these areas and sewer sizes for a 1:5-year level of service from the existing Gouin development area is provided in **Appendix E.** Potential conflicts with the existing sanitary and storm private drain connections were reviewed to ensure feasibility of this design.

The detailed design of the Intersection Road storm sewer system which will provide an outlet for the Lachance drainage area was completed by Stantec in 2024. Coordination with Stantec's design team took place to incorporate the storm design flows and detailed design parameters entering the THSPA. In addition, the connectivity of the anticipated local improvements with the proposed THSPA trunk storm sewer design was reviewed to ensure positive drainage to the Gouin and Lachance SWMF's.

The upstream reach of the Desjardins Drain runs along the west boundary of the McAuliffe Park woodlot (350 m). Approximately 180m south of the hydro Corridor boundary, the drain changes course and flows westerly continuing to its outlet into the Little River Drain (2115 m, 1100 m of which is in the THPSA). Based on the existing topographical information, the Desjardins Drain currently provides drainage for the McAuliffe Park. It is proposed that these existing flows continue to be intercepted at the westerly limit of McAuliffe Park by a surface drain within the identified 30m-wide SWM Corridor which is ultimately captured via a ditch inlet catch basin (CBMH #425- as shown in the Storm Sewer Design sheets provided under **Appendix E**) where the internal storm sewer network will direct these flows to the Desjardins SWMF.

The storm sewer system at the Tecumseh Vista High School is currently restricted to the pre-developed 2-year storm event, as per the original SWM design for the high school, flow from the school must continue to be stored on-site. Details on the original design from the Shields Avenue Town of Tecumseh SWM Report can be found in **Appendix H.** For the purposes of the THSPA storm sewer and SWMF design, it was assumed that this restriction in flow will be maintained.

A breakdown of the existing areas that are being directed into the proposed storm sewer network and their corresponding outflows are shown in **Table 22**. Existing overland flow paths, where there is currently existing development, has been accommodated in the conceptual grading plan shown in **Figures 4.10, 4.11 and 4.12**.

Table 22: Existing Storm Drainage Flows

Drainage Area	Tie-In Location	Area (ha)	Time of Concentration (min)	Expected Flow (L/s)
Gouin	Gouin Street – East	44.99	32.20	4205.66
	Gouin Street – North	4.56	20.47	565.32
	Maisonneuve Street	4.23	19.75	534.86
Lachance	Intersection Road	13.62	26.48	1244.26
Desjardins East	Shields Street at Tecumseh Vista High School	13.08	20.00	195.00 [1]
	McAuliffe Park	7.87	20.00	329.81

1: This is the maximum allowable flow to leave the Tecumseh Vista High School site.
2: SE Hamlet drainage area does not have any existing flows upstream.

The trunk storm sewers system design excludes the hydro one corridor drainage area. It is proposed that the hydro corridor will continue to maintain flows to its currently designated Desjardins municipal drainage outlet through overland flow routes and swales along the hydro corridor property.

4.7.2 Design Criteria

The proposed storm sewers were designed based on the requirements set out within the Regional Guidelines and keeping with sound engineering principles and represents current Town and Provincial standards, as shown in **Table 23**.

Table 23: Storm Sewer Design Criteria

Criteria	Windsor/Essex Region Stormwater Manual (Regional Guidelines)
Local and Collector Roads	1:5 Year Return Period
Storm Sewer Design	Rational Method/Modelling
Hydraulic Storm Sewer Sizing	Manning's Equation
Manning's Roughness Coefficient 'n'	0.013
IDF Rainfall Data	Windsor AES
Initial Time of Concentration (T_c)	20 Minutes
Minimum Cover (2)	1.5 m
Manning's Roughness Coefficient 'n'	0.013
IDF Rainfall Data	Windsor AES
Initial Time of Concentration (T_c)	20 Minutes
Velocity: • Minimum • Maximum	 0.60 m/s 3.00 m/s
Runoff Coefficients (1): • Low Density Residential • Medium Density Residential • High Density Residential • Commercial • Institutional • Park/Open Space • ROW (20% grass, 80% asphalt and concrete)	 0.70 0.80 0.90 0.90 0.70 0.20 0.80

1. *Where drainage areas contain multiple land uses, a weighted average was used to determine the runoff coefficient.*
2. *As per MECP guidelines, the minimum cover must be below frost penetration depth*

The storm sewers have been designed based on the criteria that the HGL during the 1:5-year storm event is to be no higher than 0.30 m from the proposed road elevation and no surface ponding in the roadway.

The runoff coefficients detailed in **Table 23** above are derived from the Regional Guidelines and correspond with the land use plan for the THSPA as shown in **Figure 2.1**.

It was assumed based on the proposed general cross section that the future road rights-of-way within the THSPA will consist of 20% grass and 80% combination of asphalt, sidewalk and pathway areas. Where drainage areas between manholes contain multiple land uses, a weighted average was used to determine the runoff coefficient. A breakdown of the runoff coefficients has been included in **Appendix E**.

Upon future design of the proposed residential storm sewer and SWMF, any additional runoff that is generated due to higher development density shall be stored locally, either in oversized sewers, underground storage chambers or local depressions. As each developer proceeds to detailed design, they will be required to analyze and confirm that the proposed SWM design for the site is being met to the requirements laid out within this report, including the respective allowable release rate to the storm sewer to the designed 1:5-year level of service.

The downstream storm sewers have been designed to accommodate the allowable post-development runoff rates based on the SWM criteria outlined. The detailed storm sewer design calculation sheets have been included in Appendix E.

4.7.3 Hydraulic Grade Line Analysis

A hydraulic grade line (HGL) analysis was performed for the proposed storm trunk sewer designed to service the existing developed areas of Tecumseh to ensure that the HGL from the SWMF during an extreme event does not cause adverse impacts on the existing drainage system and flooding conditions. The analysis compared the HGL conditions under both existing and proposed conditions.

This analysis was completed by inputting the existing infrastructure into the PCSWMM model described in **Section 4.4** based on information provided by Tecumseh. The PCSWMM model was then updated to incorporate the proposed storm trunk sewer and SWMF's for comparison purposes. The comparison profiles, provided in **Appendix F**, identify that the proposed SWM conveyance and management strategy for the THSPA will not have any adverse impacts on the existing upstream drainage system during the 100-year design event.

4.8 Major System Storm Drainage

The storm sewer system has been designed to convey surface runoff for the minor event based on the regional Chicago 1:5-year 4-hour storm event. For storm events beyond the 1:5-year, sufficient surface depression storage is to be incorporated along roadways, within parklands and through site grading to temporarily retain this runoff volume until it can drain through the storm sewer system to the proposed SWMF. During detailed design, a major system overland flow route will be required through sufficient road grading where overland flow runoff during larger storm events are directed to the development areas SWMF. An analysis of the major system drainage from existing areas of Tecumseh Hamlet were incorporated into the conceptual grading plan. See **Figures 4.10, 4.11 and 4.12** for a depression analysis for the location and elevation of these critical overland flow routes. Surface depression along roadways for storms up to the 1:100-year event is to be limited to depths of no more than 300 mm.

Lower depths may be required for high traffic roadways where emergency vehicular routes are identified. For private property grading and building elevations the lowest Finished Floor Elevations (FFE) is to be designed to the greater of a minimum of 300 mm above the Regulatory Flood Level or the locally calculated 1:100-year water storage elevation. Developers will be required to provide grading plans and surface storage calculations that support these requirements.

4.9 Guidance on Detailed Design and Implementation

The functional design of the SWM system for the THSPA has been developed in accordance with the relevant design guidelines as described in the above report. During detailed design, quality and quantity control measures will need to be refined.

4.9.1 Abandonment of Existing Drains

The proposed infrastructure within the THSPA will require the abandonment of the existing municipal drains that run through the site in accordance with the provisions of the Drainage Act, R.S.O 1990, c.D.17. The municipal drains which will require portions to be abandoned as part of this functional servicing report include the following:

- Gouin Drain
- Lachance Drain
- Desjardins Drain

Abandonment of the drains will be developer driven and will be completed in phasing as infrastructure allows. Coordination with the Town of Tecumseh Drainage Superintendent will be required. The Robinet Drain, located in the north-east quadrant of the west Hamlet, is not recognized as a Municipal Drain and is considered to be a private drain. It will no longer be useful as a drainage feature under ‘developed conditions’ and will therefore be removed to accommodate the proposed land uses shown on **Figure 2.1**."

4.9.2 Requirements for Maintaining Drainage

Based on the staging of development, developers must maintain, by means of temporary or permanent measures, all existing surface and sub-surface drainage systems to ensure that runoff from any adjacent lands is directed toward appropriate stormwater outlets. Developers will also be required to mitigate any possible flooding impacts on adjacent properties. Sediment and erosion control measures must also be designed, implemented and maintained to address potential impacts during all stages of site development. Each developer will be responsible to fully assess existing farm tile drainage systems and implement measures to abandon and remove all existing tile drains within their proposed development to eliminate the risk of flooding from these sub-surface drainage systems.

This will also include all measures necessary to maintain drainage tile flows from the balance of the remaining adjacent lands by effectively intercepting and redirecting these sub-surface drainage systems to a suitable outlet.

In order to address the potential for interim drainage requirements as development proceeds, temporary measures may be required to maintain flows within the Gouin, Lachance and Desjardins Drains. These requirements are to be identified during the detailed design stage. The property owner/developer shall ensure that the final design and the construction of drainage works will be coordinated and approved by ERCA and other regulatory agencies, as required.

4.9.3 Proposed Site Grading for Overland Flow Routes

Developers will be required to establish the proposed minimum road grades, as shown in **Figures 4.10, 4.11 and 4.12**, to ensure that overland flow is routed along roads or designated corridors to appropriate outlets. Proposed overland flow routes have been directed towards the proposed SWMFs where overland flow will be directed through spillways into the ponds. The grades provided represent lowest road grades and it shall be anticipated the fine grading of the roadways will include high points (greater than the noted grades) to achieve local road grading and allow drainage to roadside catchbasins.

Overland flow will be provided through road grading towards the proposed SWMFs. The overland flow will “cascade” over the “saw-tooth” road grading to the ponds. There will be temporary ponding of runoff on the road surfaces until it can be captured by the catchbasins and/or conveyed to the ponds. The roadway ponding depth shall not exceed 0.30 m for rain events up to and including a 1:100-year storm.

Each Developer will have to assess their developable lands and provide detailed roadway grading that conforms to the designated overland flow patterns outlined herein. Based on the staging of development. Developers must provide temporary flow routes and address temporary drainage of any adjacent vacant lands and or occupied lands to ensure runoff is directed towards appropriate stormwater outlets. Sediment and erosion control must also be implemented during construction and for any temporary SWM measures.

Developers will also be required to mitigate any possible flooding in adjacent undeveloped properties. The proposed ground elevations should be developed to allow for sufficient cover on the proposed sanitary and storm sewers, while also adhering to the minimum flood-proofing elevations, as described above. All required costs associated with maintaining the overland flow routes and modifying the site grades will be the direct responsibility of the Developer, as required.

Furthermore, with respect to the SWMFs the 1:100 Natural Hazard water level described in the Little River Floodplain mapping requires two of the four ponds (Gouin and Desjardins West) top of banks to be above the reported water surface elevation. The other two (Lachance and Desjardins East) are hydraulically disconnected from the drains due to the proposed development in the THSPA; thus, no additional floodproofing is required.

Proposed minimum road grades within the Hamlet were established to match into the existing road grades along the adjacent THSPA existing development boundary. Presently, the existing developments are serviced via municipal drains, and under these existing conditions overland flow is directed into the downstream municipal drain.

The proposed minimum road grades within the Hamlet ensures that positive drainage downstream, toward the proposed SWMFs is maintained. It is the responsibility of the Developers to provide any necessary drains, grading or local sewers to ensure that rear lot drainage from existing development areas, as well as any existing drainage easements, are maintained.

For surface runoff conditions up to the 1:100-year event, each development must provide for sufficient surface depression storage to retain the maximum allowable runoff volumes while also providing roadway grading that generally conforms to the designated overland flow patterns outlined herein.

The proposed road grades and design of the SWMFs were modelled as a 3D surface in AutoCAD Civil 3D. The surface was comprised of specified lowest grade points along the centreline of the roads at intersections (as shown in **Figures 4.10, 4.11 and 4.12**). The proposed grading plan does not include variations in detailed road grading such as high points and lower points (saw toothing) along roadways, road base structure, boulevard grading, nor does it include any fine lot grading. It is expected that the fill materials required to achieve the proposed site grading may be largely obtained from the excavation of the proposed SWMFs and other excess excavated materials associated with site servicing and home building. However, to fully achieve the desired grades for providing sufficient overland flows and servicing there is a net fill quantity required. The proposed grades allow for minimum cover on storm and sanitary servicing, restricting them from being lowered.

A Geotechnical Report was completed by WSP in March 2024 for portions of the proposed THSPA area, specifically the alignment of the proposed West Tecumseh Trunk Sanitary sewer and Watermain north of the Hydro Corridor. This report identified an average topsoil thickness of the existing ground to be 0.20m. The cut/fill volume estimates exclude the topsoil required to be stripped from the site prior to completing earthworks. Each SWMF was also modelled, and a cut volume was determined using the AutoCAD Civil 3D surface. The total volumes are provided in **Table 24**.

Table 24: Cut-Fill Analysis

Area	Estimated Pond Excavation Volume (m^3)	Development Grading[1] Volume (m^3)	Net Volume (m^3)[2]	Cut / Fill Overall
Gouin Pond Drainage Area	144,825	247,875	103,050	Fill
Lachance Pond Drainage Area	81,178	74,520	6,660	Cut
Desjardins East Drainage Area	130,720	142,500	11,775	Fill
Desjardins West Drainage Area	79,798	170,200	90,400	Fill
SE Hamlet Drainage Area	41,890	51,960	10,070	Fill

Notes:

1. This quantity reflects the existing surface excluding 0.2m of topsoil and the fill required to attain the proposed surface modelled in AutoCAD Civil 3D.
2. These quantities assume the SWMF excavation materials can be used as fill throughout the site..
3. 5% contaminated materials needs to be cut from the overall volume of the pond and trucked away…

The net total volumes in **Table 24** represents the balance of fill material required across each THSPA drainage are to achieve the proposed road grades compared to the cut anticipated for each SWMF. This assumes that all material excavated from the SWMFs may be used within the THSPA.

Private property grading, building foundation or parking lot excavation was not included in the above cut-fill analysis and it was assumed that any excavation from underground utilities will be used as backfill with no excess materials leaving the site. It is anticipated that there will be excess excavation from larger commercial and institutional sites that can be used as fill throughout the THSPA however this was not factored into the analysis in **Table 24**.

All costs associated with temporary stockpiling, placement, compaction of fill materials to achieve the proposed site grading and requirements for Excess Soil (as per the On-Site and Excess Soil Regulation under the Environmental Protection Act (EPA)) will be the direct responsibility of the individual developers.

5.0 Water Distribution

5.1 General

The Town of Tecumseh's potable water supply system is served by ENWIN Utilities Ltd. (WUC). The WUC system supplies the Town of Tecumseh with potable water that meets peak hourly domestic demands and fire protection, which is further supplemented by an elevated water storage tower within the Town of Tecumseh.

5.2 Background

Originally, as part of the WWMP (2018), a West Tecumseh trunk watermain was proposed to connect the feeder main on CR22 to the feeder main on CR42, to provide looping for the main potable water feed lines from the Windsor system into the Town of Tecumseh. The proposed trunk watermain will provide direct servicing for the new development lands within the THSPA and improve the fire flows in the surrounding existing developments. Subsequently, in 2023, the opportunity to integrate the trunk watermain improvements, proposed along Banwell Road by ENWIN, with the proposed West Tecumseh watermain projects was identified. In the Council Report PWES-2013-42 and Hydraulic Analysis of the Planned Watermains in the THSPA (AECOM, Nov 2024) technical memo, provided in **Appendix I**, AECOM confirmed that the revised trunk watermain configuration will improve efficiencies within the watermain distribution system for both the Town and ENWIN.

For the West Hamlet, the alignment and configuration of the trunk watermain was evaluated within the covering Environment Study Report. The following WWMP (2018) projects are recommended as part of the THSPA servicing strategy:

- W-1 - West Tecumseh Trunk Watermain from CR 22 to CP Railway
- W-4 - West Tecumseh Trunk Watermain from CP Railway to CR 42

For the SE Hamlet, the WWMP (2018) proposed two trunk watermain projects to serve the eastern portion of the Tecumseh Hamlet (both MRSPA and SE Hamlet). The following projects are recommended as part of the THSPA servicing strategy:

- W-2A - East Tecumseh Hamlet Watermain Connection
- W-2B - Trunk Watermain on Manning Road from CR 22 to CP Railway
- W-5A - Trunk Watermain on Manning Road south of CP Railway

W-1 West Tecumseh Trunk Watermain from CR 22 to CP Railway

A 400 mm dia. watermain shall be extended from the existing stub located just south of the CR22 right-of-way (ROW) to the north limits of the CP Railway corridor. At Intersection Road, a 400 mm dia. interconnection shall be installed along the Intersection Road ROW, easterly from the new West Tecumseh trunk to the existing watermain at Shawnee Road and westerly from the West Tecumseh trunk to an interconnection on Banwell Road. The 400 mm dia. trunk sewer shall continue from Intersection Road to the CP Railway corridor, generally along the same north-south alignment.

W-4 West Tecumseh Trunk Watermain from CP Railway to CR 42

The 400 mm dia. watermain from the north THSPA area will continue south, through the CP Rail and hydro corridor, extending to the proposed east-west road, just south of the east Desjardins SWMF. At the east-west road, a 600 mm dia. trunk watermain would route easterly to interconnect with the proposed 600 dia. trunk watermain located along the CR43 ROW. South of the east-west road a 300 mm dia. watermain will continue south, where at Shields Street the watermain will route easterly to connect to the existing watermain on St. Alphonse St. A constructed 600 mm dia. stub, watermain connection from County Road 43 easterly along the proposed East- West Collector Road right of way alignment has been provided for future connection of this feeder main.

Trunk Watermain on CR19 (Manning Road) from CR22 to CR42 and East Tecumseh Hamlet Watermain Connection (Project W-2A, 2B and 5A)

It is anticipated that the need to implement these watermain projects will be prompted by the proposed MRSPA and SE Hamlet development. The level of development that can be accommodated prior to these improvements will need to be assessed by the developer through future water model assessments of the Town's water system.

5.3 Design

Trunk watermains shall be designed to accommodate the water demand criteria detailed in the WWMP (2018) and adhere to the most current version of the Town of Tecumseh's Water Distribution System Standards and Material Specifications and MECP requirements.

The alignment of the proposed trunk watermain shall follow the proposed ROW and is shown in **Figure 5.1**. The trunk watermain shall be placed with a minimum cover of 1.5 m.

For local servicing, to establish the required watermain sizes, the following design criteria shall be used. The demands shall be allocated based on the proposed population and number of units to be serviced.

The watermain shall follow the unit rate parameters identified in the WWMP (2018), Table 6-1: Water Demand Criteria, namely:

- Residential: 347 L/capita/day
- Institutional/Commercial/Industrial (ICI): 21,430 L/ha/day
- Maximum Day Demand Peak Factor: 2.0 x Average Day Demand
- Peak Hour Demand Peak Factor: 3.0 x Average Day Demand

Watermain shall also be designed per the Town of Tecumseh's most current Water Distribution System Standards and Material Specifications and shall generally follow the alignments shown in the provided Typical Cross Sections (**Figures 6.6 to 6.11**).

6.0 Transportation

The following sections summarize the findings of the transportation network assessment completed for the THSPA and will provide design guidance for the proposed road network and right-of-way configuration.

6.1 Transportation Study Addendum

The Tecumseh Hamlet Secondary Plan Transportation Study (the Hamlet TIS) was prepared by Dillon in 2015 based on the draft land use plan. As part of this Functional Servicing Report, an addendum has been completed, entitled Tecumseh Hamlet Secondary Plan, Transportation Study Addendum, dated June 2024 (**Appendix K**). This updated assessment presents traffic projections and intersection analyses to reflect changes to the development concept that have been made since the original analyses were undertaken in 2015, along with changes to background conditions associated with adjacent developments and transportation improvement projects in the area. Projections were based on population projection estimates based on the THSPA land use plan at the time of the study and did not include additional safety factors or elevated population assumptions. Based on the Hamlet TIS addendum (June 2024), various road network configuration alternatives were evaluated, resulting in the recommended solutions to support the proposed development, including:

- Modifications to the Banwell Road/CR 43 corridor intersection design (that was underway during the duration of this study) including:
  - Gouin Street/South E.C Row Terminal Ramp: Providing two westbound lanes and having a shared left turn / through lane on the eastbound off-ramp leg.
  - Maisonneuve Street: Confirm need for dual eastbound left turn lands from the Nextstar Battery Plant driveway.
  - Intersection Road: Confirm need for dual eastbound left turn lands from the NextStar Battery Plant driveway.
  - Shields Street: Provide dedicated northbound left turn lane.
- Confirmed two-lane configurations for all internal collector roads that connect the internal development to the surrounding arterial road network.
- Highlighted the need for interim capacity improvement modifications at the CR 22 intersections with Manning Road (additional lanes on the north and south approaches) and at Lesperance Road (longer turning lanes).

Subsequently, a supplemental traffic analysis was completed on December 5, 2024, entitled Tecumseh Hamlet Secondary Plan Transportation Study Addendum — Supplemental Analysis Effect of NextStar Shift Change Adjustments and is included in **Appendix K**.

This memo updated traffic projections and intersection analyses as a result of updated staffing levels and shift change times associated with the NextStar battery plant, now that the plant is closer to opening. This analysis confirmed that the proposed corridor modifications to the Banwell Road Corridor listed above will be able to support the development of the THSPA.

6.2 Arterial Roads

Arterial roads that surround the THSPA provide access and egress to and from the THSPA. The Arterial roads are owned and operated by the County of Essex and the City of Windsor as noted in the list below. The capacity and configuration of the existing and proposed improvements to these corridors are described in the various environmental assessments and traffic master plans that have been referenced in **Section 1.2**.

- County Road 22
- E.C Row Expressway
- County Road 43
- County Road 42
- County Road 19 (Manning Road)
- Banwell Road

The Hamlet TIS Addendum reviewed the impact of the THSPA on the external arterial network to confirm if the proposed corridor improvements would require modification or other provisions to accommodate the THSPA development. At most locations within the study area, the proposed changes to the Hamlet development concept are not anticipated to significantly affect the analysis results. The primary change from a volume perspective is in the northwest portion of the study area, due in part to the increased residential density in the northern Tecumseh Hamlet and in the MRSPA, higher trip generation rates for the commercial blocks, and changes to the originally proposed "anchor commercial" block.

Based on this change, modifications to the intersections of Gouin Street, Maisonneuve Street and Intersection Road were recommend.

6.3 Collector Road Design

The proposed road network for the THSPA is shown in **Figure 2.1.** The following streets are proposed to be classified as collector roads:

- Gouin Street
- Maisonneuve Street
- Intersection Road
- Shields Street
- The North-South Collector Road

These classifications are in keeping with the TMP (2017) and Complete Streets Design Handbook which includes a section on road classification policy. Amongst the proposed characteristics of different road functions, it suggests a daily traffic volume of 1,000 vehicles/day or less for local streets in the urban area.

The streets listed above are all anticipated to exceed this threshold. It is likely that some north-south street sections in the commercial section will also exceed this threshold despite their local function, as a result of traffic accessing commercial blocks; this will depend on specific development details (size and nature of commercial development; access locations, etc.). Those streets continue to be designated as local streets but with consideration for additional right-of-way may be required to support intersections access points and auxiliary lanes.

Collector roadways shall be designed as two-lane roadways that generally should not permit on-street parking. Road lane widths are proposed to be 3.35 m with barrier curb and gutters. There are instances were portions of collector roads have non-typical cross sections, that better suit the proposed built-form development layout or usage. Typical Cross Sections can be found on **Figures 6.6 to 6.11**. Details of the cross sections are summarized below:

- Gouin Street:
  - Three lanes (two eastbound and one westbound) separated by a median is proposed to support the eastbound inflow of traffic from the intersection with Banwell Road. A 4.0 m wide westbound lane is provided to provide access/egress for channelized traffic.
- Maisonneuve Street:
  - Within the mainstreet portion of this roadway, two travel lanes (one westbound and one eastbound), two parking lanes and cycling tracks shall be accommodated with paved boulevard areas.
- Shields Street:
  - Where the proposed roadway bi-sects McAuliffe Park the roadway will have two lanes (one westbound and one eastbound) separated by a median. To promote safety, enhanced paving, streetscape, and walled boulevards will direct pedestrians to assigned crossing locations that will be controlled by pedestrian crossovers signals.
  - Throughout this zone, the roadway will be integrated within the park context, this will reduce the amount of asphalt.
  - The above noted design will help with the speed of vehicular traffic through the park.

The need for auxiliary turn lanes to accommodate intersection movement will need to be confirmed prior to detailed design. This verification will be achieved by completing a local Traffic Impact Plan, which will be based on the proposed development layout, the most current road network configuration, and traffic counts.

All other right of ways within the THSPA will be classified as local roads. Collector roads shall have two-way traffic with necessary auxiliary lanes to be included at intersections and roundabouts as required to facilitate traffic movements.

6.4 Active Transportation

The current conceptual active transportation network within the THSPA includes off-road cycling facilities on all collector roads, connecting to potential regional facilities on the surrounding arterial network. The proposed active transportation network is outlined in Hamlet TIS (**Appendix K**). Consideration is also being given to the potential for trails to be incorporated within stormwater blocks.

6.5 Roadway Cross-Sections and Right-of-Way Widths

The proposed Collector Road alignments for Gouin Street, Maisonneuve Road, Intersection Road, Shields Street and the N-S Collector Roads are provided in **Figures 6.1 to 6.5**, respectively. These alignments include proposed areas for planting, utility infrastructure, streetlighting, sidewalks and multi-use paths as well as the proposed right-of-way limits. **Table 25** provides guidance on the critical ROW design elements.

Urban Collector Roadway cross-sections have been developed based on recommendations within the Hamlet TIS, Ontario Traffic Manual and the Town's Complete Streets Design Handbook. The proposed roadway cross-sections for most collector roadways shall be 23m wide (shown in **Figure 6.7**) and include off-street multi-use pathways and no on-street parking as recommended through the Tecumseh Hamlet ESR.

Shields Street will be integrated into the enhanced McAuliffe Park Improvements and shall include off-street multi-use pathways, no street parking and a bio-swale median as determined through the Tecumseh Hamlet ESR. This cross-section is shown in **Figure 6.11** Designated pedestrian crossover signals, wayfinding signage and raised planters shall also be incorporated into the Shields Street ROW design to assist movement of pedestrians and cyclists.

To accommodate the land use plan, which establishes the implementation of a Main Street along the new section of Maisonneuve Street, a cross section that suits the proposed ROW use is recommended. This cross section will accommodate on-street parking, and a two-way cycle track that is separate from the pedestrian sidewalk zones located on both sides of the street. This recommended cross section can be accommodated within the proposed 23.0 m ROW and is illustrated by **Figure 6.10.**

The ROW width along segments of existing roadways, specifically those section along existing developed sections of Gouin, Maisonneuve and Intersection Road, vary between 20 and 23 m. In sections where the existing ROW is less than 23.0 m, the proposed improvements shall be alternated to fit within the existing ROW width. At this time, additional property acquisition along these ROWs have not been identified.

All roadway corridors shall be designed to meet requirements of the Accessibility for Ontarians with Disabilities Act (AODA) to be accessible to all ages and abilities and shall consider future need to facilitate transit routes.

Table 25: Typical Right-of-Way Cross Section Design Criteria – Collector Roads

Cross Section Element	Criteria	Source/Reference
Collector Road R.O.W Width	23.0 m	Tecumseh Transportation Master Plan, Tecumseh Hamlet Secondary Plan - Official Plan
Number of Lanes	2	Hamlet TIS, Appendix K
Lane Width	3.35 m	Hamlet TIS, Appendix K
Grades	Minimum 0.3 m below the Regulatory Floodplain Levels Maintain overland flow routing to the corresponding SWMF.	Little River Regulatory Floodplain Mapping (2023) and Conceptual Grading Plans Figure 4.10 to 4.12
Sidewalk	1.5 m wide sidewalks on one side of the road	Ontario Traffic Manual, Complete Streets Guideline
Bike Facility	3.0 Multi-use Pathway on one side of the road	Ontario Traffic Manual, Complete Streets Guideline
Landscape Zones	>1.2 m	Minimum required to accommodate street tree planting.
Parking Lanes or Transit Lanes	Maisonneuve Street within the mix commercial area.	Tecumseh Hamlet Secondary Plan - Official Plan

7.0 Utilities

In addition to the municipal servicing and road network infrastructure, private utilities which include electrical power, natural gas, and telecommunications are required to support development. Utilities have been involved throughout the course of the study to ensure that the scope of development and demand associated with the first stages of development are communicated. Currently Hydro One, Enbridge, MNSi, Cogeco, Telus and Bell have existing infrastructure along existing municipal rights-of-ways surrounding the study area. Each of these utilities have been involved in project discussion and were provided with the proposed land use and projected populations within the secondary plan area. To support the growth proposed within the THSP area, extension of utility services will be required including routing of necessary trunk/feeder infrastructure to distribute utilities to service increase demand.

As development proceeds and road right of ways are developed, it is recommended that utilities be placed underground. Refer to the typical road cross sections **Figures 6.6 and 6.11** for the proposed joint use utility corridor location within the proposed roadways.

The meeting minutes for all utility meetings are provided in **Appendix J**. The following sections highlight notes from the meeting held on February 14, 2022, with all the utilities. Developers will be required to engage all relevant utility providers during future detailed design stages.

7.1 Hydro One Networks

Hydro One Networks Inc. (HONI) has an existing plant fed from Lesperance Road which consists of a three-phase aerial along the north side of Intersection Road and continues north on the west side of Banwell Road to CR 22. The THSPA north of Intersection Road will be serviced from this three-phase line. The SE Hamlet area can be serviced through a feed on Manning Road.

Servicing the THSPA south of the CP Railway tracks will require a rail crossing. It would be beneficial to utilize a joint rail crossing for all utilities. An additional rail crossing may be requested by Hydro One to account for future infrastructure needs.

HONI has future plans to utilize the high voltage corridor as a feed for the westerly City of Windsor Lands. Coordination and approval from Hydro One will be required for any work planned within the hydro one corridor, including active transportation trails and SE Hamlet Pond. If the Developer of the SE Hamlet lands are unable to procure approval from HONI for their pond (as shown in this FSR and ESR), the pond will have to be relocated outside of the HO corridor (an EA amendment may be required at that time, developer to confirm).

Coordination with the City of Windsor will be required during the detailed design.

7.2 Enbridge

Enbridge will assess future sub station needs within the area, including the existing substation along Manning Road. Enbridge is strategizing on the need for future servicing of this area. Developers shall follow up early in the subdivision planning process to confirm servicing feasibility.

7.3 Telecommunication Utilities

The areas surrounding the Hamlet study area are currently serviced by existing Telus, Bell, Cogeco and MNSi infrastructure. Presently, Telus has no intentions to service the study area with infrastructure. Bell, Cogeco and MNSi do not foresee any potential concerns with servicing the Tecumseh Hamlet area. All utilities were tasked with providing preliminary servicing strategies and potential constraints in order to assist with coordination on the future developments. A joint rail crossing for all utilities including Hydro One would be beneficial for servicing the Tecumseh Hamlet area south of the CP Railway tracks. Prior to the design of each project, existing utilities shall be identified.

8.0 Agency Approvals for Infrastructure

Below summarizes the approvals required prior to the implementation of municipal infrastructure. Environmental or cultural heritage assessments required to refine impact and mitigation plans are detailed in the Hamlet ESR report.

8.1 Town of Tecumseh – Water Department

Approval for modifications to the Town's Drinking Water Works Permit is required from the Town of Tecumseh for the proposed watermains required to service the THSPA. Town approval was not obtained as part of this report.

8.2 Ministry of the Environment, Conservation and Parks

The Town has a Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA) for the Town's sewage collection system and SWM system. Should proposed infrastructure applications meet the pre-authorization criteria of the CLI ECA, property developers will no longer require a separate approval from MECP and will be able to undertake construction under the authority of the Town's CLI ECA. The Town will require that a reviewed submission package be provided with all relevant documents to demonstrate compliance with the pre-authorization criteria.

8.3 Essex Region Conservation Authority

Final ERCA approval is required for the detailed design of the proposed SWMFs, overland flood routes, fill placement, drain enclosures and any temporary stormwater drainage measures. Developers shall prepare and submit necessary ERCA clearance applications directly to ERCA.

8.4 Additional Approvals

Additional approvals for the development of these lands may be required (i.e. Species at Risk, County of Essex, Archaeological, etc.). These approvals will be the responsibility of the individual landowners/developers. A Drainage Report and adherence to all associated bylaws will be required for all Drain improvements, abandonments, apportionments, and any related actions. Consultation and approvals will be addressed during the Draft Plan of Subdivision process to be followed by each developer as part of their development. In addition to standard information required in the Town's application forms, additional information in the form of the studies or assessments listed in the Town of Tecumseh's Official Plan (2021) Section 10.20, may be required in order to consider a planning application complete.

9.0 Implementation

9.1 General

This Functional Servicing Report outlines a framework for the coordinated servicing of the THSPA. The recommended functional design of the site services identified herein should be updated from time to time as development proceeds and as any changes to the servicing requirements are identified.

The design criteria and the overall functional servicing plans provide a basis upon which developers and the Town can evaluate any development proposals. Implementation of the plan will require cooperation between landowners, developers, the Town and regulatory agencies. The timing of implementation will vary depending on development initiatives.

10.0 Cost Estimate Summary

Capital cost estimates for the main components to the municipal infrastructure within the THSPA development have been calculated and summarized in **Table 26** below. During detailed design, detailed cost estimates should be completed to more accurately estimate the construction costs for the proposed improvements. This section includes a summary of the high-level costs related to the proposed roadways, sanitary and storm trunk sewers, pumping stations and ponds.

10.1 Assumptions

The cost assumptions for all recommended improvements for each of the service areas include, but are not limited to, the following:

- Construction cost estimates, including labour, are based on 2024-unit prices and the accuracy of each estimate is +/- 30% and dependent on the timing of implementation.
- Contingency and engineering allowances for each project were added based on a percent of the Capital Construction Cost; the percent varies pending the scope of the work and the scale of the project.
- Trunk infrastructure cost estimates are consistent with the 2024 Development Charge Background Study.

It should be noted that land acquisition costs required to construct recommended solutions are not included in the cost estimates. Land acquisition requirements and the associated costs shall be confirmed during detailed design.

A more detailed summary of key assumptions used to develop project cost estimates can be found in **Appendix L**.

Stormwater Management Facilities

The cost estimates for SWMFs include the installation of the facilities, including excavation of material, allowances for export or movement of material, landscaping, erosion control, restoration, and recreational trails. It was assumed that 5% of the excavated materials from the Gouin SWMF will be removed from the site due to contamination from the neighbouring MTO Landfill site. The remaining excavation volumes from the SWMFs is assumed to remain on site to achieve the proposed site grading.

Pumping Stations

The cost estimate for the recommended pumping stations includes the cost to construct the pumping station, provide generators and outlet pipes to the municipal drains.

Storm and Sanitary Infrastructure

Storm and sanitary construction cost estimates for works within the municipal right-of-way include the pipes, backfill, maintenance holes, private drain connections, and restoration. Sewer costs do not include road restoration costs and assume that road work will be included in the provided transportation network costs.

Road Works

The roadway construction cost estimates for full road construction of proposed roadways (which only includes Shields, Maisonneuve, Gouin, the North South Collector, and Intersection) within the THSPA includes earth excavation, granular road base, pavement, curbs and gutters, sidewalks, bike lanes, restoration, street lighting, traffic signals and other typical surface works. For road re-construction works, cost estimates have been extracted from the 2024 Development Charge Background Study.

10.2 Unit Prices

Approximate unit prices were developed based on 2024 average construction costs for similar projects. The unit prices were utilized to determine the total construction costs for the recommended solutions within the study area. To simplify the costs for the proposed works, the majority of the unit prices were developed on a per metre basis, with a few others developed on a per item basis.

Appendix L details the functional design costs, unit costs, and a summary of total costs for the projects identified for the THSPA.

10.3 Implementation Variances

Due to the scale of the proposed works and the implementation schedule, actual construction costs may vary significantly depending on the year of implementation. Priority projects recommended for implementation in the near future will have a higher degree of cost accuracy than works to be completed many years in the future.

Timing of projects should vary in implementation timing as they are driven by development. Consideration for inflation, material supply and market factor shall be considered in budgeting and planning proposed infrastructure.

10.4 Operation and Maintenance Costs

The costs to operate and maintain the various infrastructure improvements that have been recommended were not included in the cost estimate. As the improvements are constructed, the Town should update their asset inventories and corresponding operational budgets that will be necessary to maintain the new infrastructure. On-going monitoring and maintenance will need to take place to ensure that the infrastructure is not altered in any way that could make the system vulnerable to failure. The costs for maintenance may vary significantly from year to year, so it is important to be conservative when estimating the Town's operation maintenance costs.

10.5 Cost Estimate Summary

All construction estimates have been broken down into projects to provide a more accurate representation of the costs to complete the construction of the proposed infrastructure within the THSPA. The construction costs for the new proposed collector roads, sanitary and storm infrastructure, SWMFs, and pumping stations are separated.

Table 26 below summarizes the total cost for each infrastructure separately. A more detailed breakdown of the cost estimates is provided in **Appendix L**.

Table 26: Estimated Construction Cost

Project		Total Estimated Construction Costs
1	**Gouin Stormwater Management**	
a)	Dry Pond & Pumping Station	$ 20,116,000.00
b)	Storm Sewer System – East Trunk & Outlet	$ 16,466,000.00
c)	Storm Sewer System – West Trunk & Outlet	$ 8,220,000.00
	Total Gouin Stormwater Management	**$ 44,802,000.00**
2	**Lachance Stormwater Management**	
a)	Wet Pond & Pumping Station	$ 10,695,000.00
b)	Storm Sewer System – East Trunk & Outlet	$ 2,510,000.00
c)	Storm Sewer System – West Trunk & Outlet	$ 1,991,000.00
	Total Lachance Stormwater Management	**$ 15,196,000.00**
3	**Desjardins West Stormwater Management**	
a)	Wet Pond & Pumping Station	$ 8,114,000.00
b)	Storm Sewer System Trunk & Outlet	$ 29,740,000.00
	Total Desjardins West Stormwater Management	**$ 37,854,000.00**
4	**Desjardins East Stormwater Management**	
a)	Wet Pond	$ 8,570,000.00
b)	Storm Sewer System – South Trunk & Outlet	$ 16,274,000.00
c)	Storm Sewer System – North Trunk & Outlet	$ 976,000.00
d)	Storm Sewer System – East Trunk & Outlet	$ 1,664,000.00
	Total Desjardins East Stormwater Management	**$ 27,484,000.00**

Project		Total Estimated Construction Costs
5	**Southeast Hamlet Stormwater Management**	
	a) Wet Pond & Pumping Station	$ 4,603,000.00
	b) Storm Sewer System Trunk & Outlet	$ 4,731,000.00
	Total Southeast Hamlet Stormwater Management	**$ 9,334,000.00**
Total Stormwater Management Costs		**$ 134,670,000.00**
6	**Sanitary Sewer from CR 22 To CP Railway**	
	a) TRUNK SEWER – MH TH335 TO MH TAO (WW-1)	$ 11,821,000.00
	b) TRUNK SEWER – MH TAO TO MH TAC (WW-6A)	$ 9,045,000.00
	c) SUBTRUNK 'A' – MH AA TO MH TBA	$ 288,800.00
	d) SUBTRUNK 'A' – MH AC TO MH TAW	$ 356,800.00
	e) SUBTRUNK 'B' – MH BA TO MH TAS	$ 908,640.00
	f) SUBTRUNK 'C' – MH CA TO MH TAO	$ 912,700.00
	g) SUBTRUNK 'D' – MH DA TO MH DQ	$ 1,707,200.00
	Total Sanitary Sewer from CR 22 To CP Railway	**$ 25,040,140.00**
7	**Sanitary Diversion Sewer**	
	a) TRUNK SEWER – MH TAI TO MH TAO (WW-2)	$ 2,438,000.00
	Total Sanitary Diversion Sewer	**$ 2,438,000.00**
8	**Sanitary Sewer from CP Railway to CR 42**	
	a) TRUNK SEWER – MH TAC TO MH TW (WW-6B)	$ 4,498,000.00
	b) TRUNK SEWER – MH TW TO MH TP (WW-7)	$ 3,378,000.00
	c) TRUNK SEWER – MH TW TO MH TA (WW-8A)	$ 11,923,000.00
	d) SUBTRUNK 'E' – MH EA TO MH TZ & MH ET TO MH TZ	$ 2,407,640.00
	e) SUBTRUNK 'F' – MH FA TO MH TAC	$ 302,680.00
	f) SUBTRUNK 'G' – MH GA TO MH TI	$ 677,960.00
	g) SUBTRUNK 'H' – MH HA TO MH TJ	$ 276,080.00
	Total Sanitary Sewer from CP Railway to CR 42	**$ 23,463,360.00**

Project		Total Estimated Construction Costs	
9	**Sanitary Pumping Stations**		
	a) Southeast Hamlet	$	196,000.00
	Total Sanitary Pumping Stations	**$**	**196,000.00**
10	**SANITARY SETTLEMENT AREA EXPANSION**		
	Settlement Area Expansion	$	1,020,000.00
	Total Sanitary Settlement Area Expansion	**$**	**1,020,000.00**
Total Wastewater Costs		**$**	**52,157,500.00**
11	**Trunk Watermain From CR 22 To CP Railway (W-1)**	$	4,563,000.00
	Trunk Watermain From Lesperance to Manning (W-2A)	$	3,094,000.00
	Trunk Watermain on Manning Road from CR22 to CP Railway (Excluding Rail Crossing) (W-2B)	$	3,563,000.00
	Trunk Watermain From CP Railway to CR 42 (W-4)	$	5,468,000.00
	Trunk Watermain on Manning Road from CP Railway to CR 42 (Including Rail Crossing) (W-5A)	$	1,754,000.00
Total Watermain Costs		**$**	**18,442,000.00**
	Proposed Roadways		
	a) Shields Street	$	5,158,525.00
	b) Maisonneuve Street	$	2,130,060.00
	c) Gouin Street	$	2,304,875.00
	Road Reconstruction		
	a) Gouin Street – Lesperance to Hebert	$	1,476,210.28
	b) Gouin Street – Hebert to Corbi	$	1,226,315.15
	c) Maisonneuve Street – Lesperance to Hebert	$	1,499,198.37
	d) Maisonneuve Street – Hebert to Shawnee	$	641,519.31
	e) Maisonneuve Street – Shawnee to Corbi	$	824,889.13
	f) Maisonneuve – Corbi to Tecumseh Hamlet Site	$	294,092.71
	g) Intersection Road – Lesperance to Shawnee	$	2,481,595.49
	h) Intersection Road – Shawnee to Banwell	$	3,237,350.23
Total Roadway Construction and Reconstruction		**$**	**21,274,630.66**

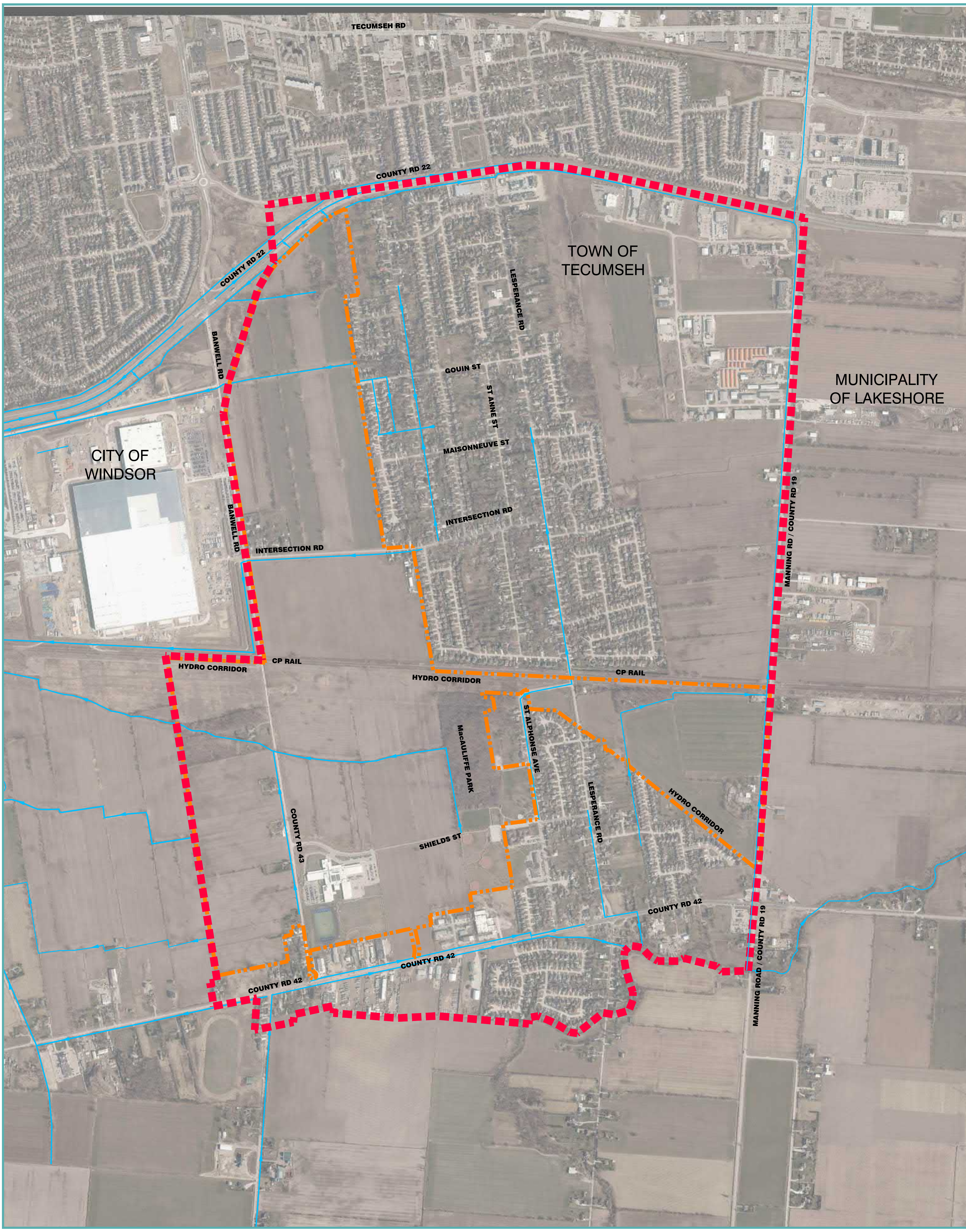
11.0 Conclusions and Recommendations

The functional servicing outlined within this report should be used as a guide for the detailed design of these services as development proceeds in phases.

We recommend the following:

1. That review and approval of the detailed design drawings be conducted by the Town to ensure that all the design parameters noted in this report are met.
2. That any deviation from the Functional Servicing Report be reviewed in depth to ensure conformance to the design parameters outlined in this report, and that changes do not compromise subsequent development phases.

Figures



LEGEND

- TECUMSEH HAMLET SETTLEMENT AREA (THE HAMLET)
- TECUMSEH HAMLET SECONDARY PLAN AREA (THSPA)
- EXISTING MUNICIPAL DRAIN

TECUMSEH HAMLET SECONDARY PLAN AREA ENVIRONMENTAL STUDY REPORT

STUDY AREA

FIGURE 1.1

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:7500
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PROJECT: 23-5735

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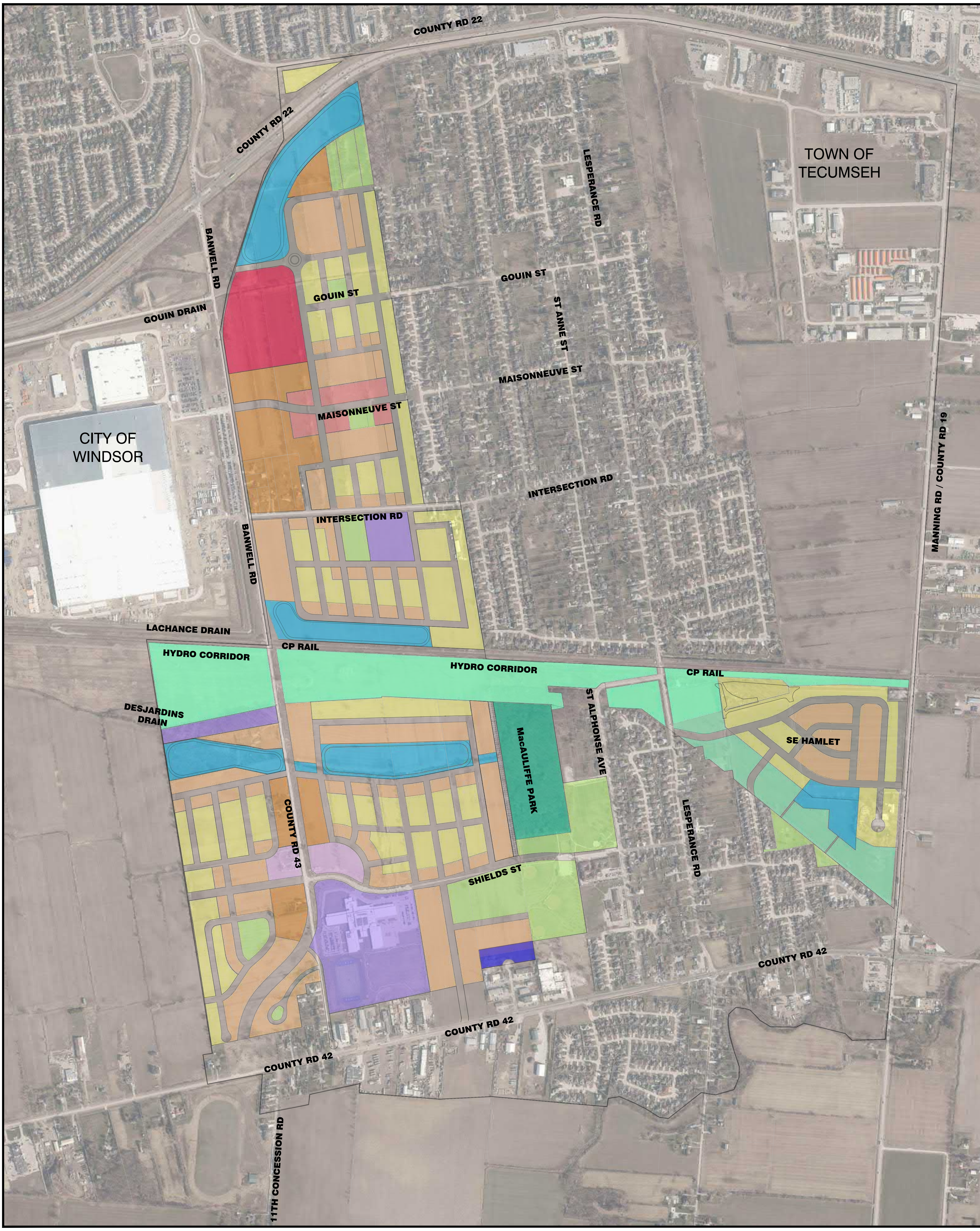

LEGEND

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MAIN STREET MIXED-USE
- ANCHOR COMMERCIAL
- PLAZA COMMERCIAL
- INSTITUTIONAL / CEMETERY
- PARK SPACE
- STORMWATER MANAGEMENT POND
- NATURAL HERITAGE / WOODLOT
- ENVIRONMENTALLY PROTECTED AREA
- MAJOR INFRASTRUCTURE EASEMENT
- HYDRO CORRIDOR
- BUSINESS PARK

TECUMSEH

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

SECONDARY LAND USE PLAN

FIGURE 2.1

DILLON CONSULTING

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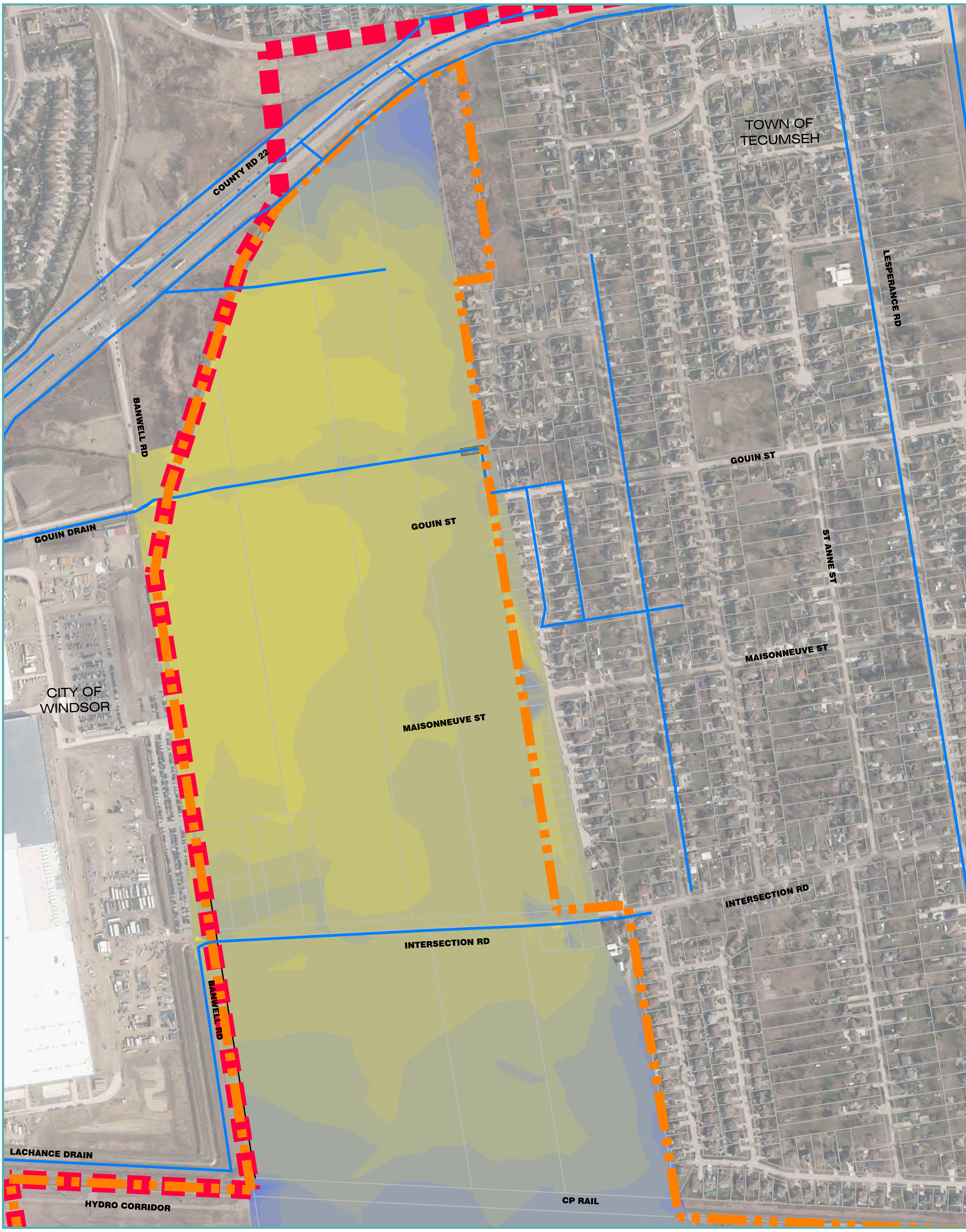

LEGEND

- TECUMSEH HAMLET SETTLEMENT AREA (THE HAMLET)
- TECUMSEH HAMLET SECONDARY PLAN AREA (THSPA)
- EXISTING MUNICIPAL DRAIN

ELEVATION RANGES (m)

180.50	181.50	182.50	183.50
180.75	181.75	182.75	183.75
181.00	182.00	183.00	184.00
181.25	182.25	183.25	184.25
181.50	182.50	183.50	184.50

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

EXISTING LAND TOPOGRAPHY - NORTH OF CP RAILWAY

FIGURE 2.2

DILLON CONSULTING

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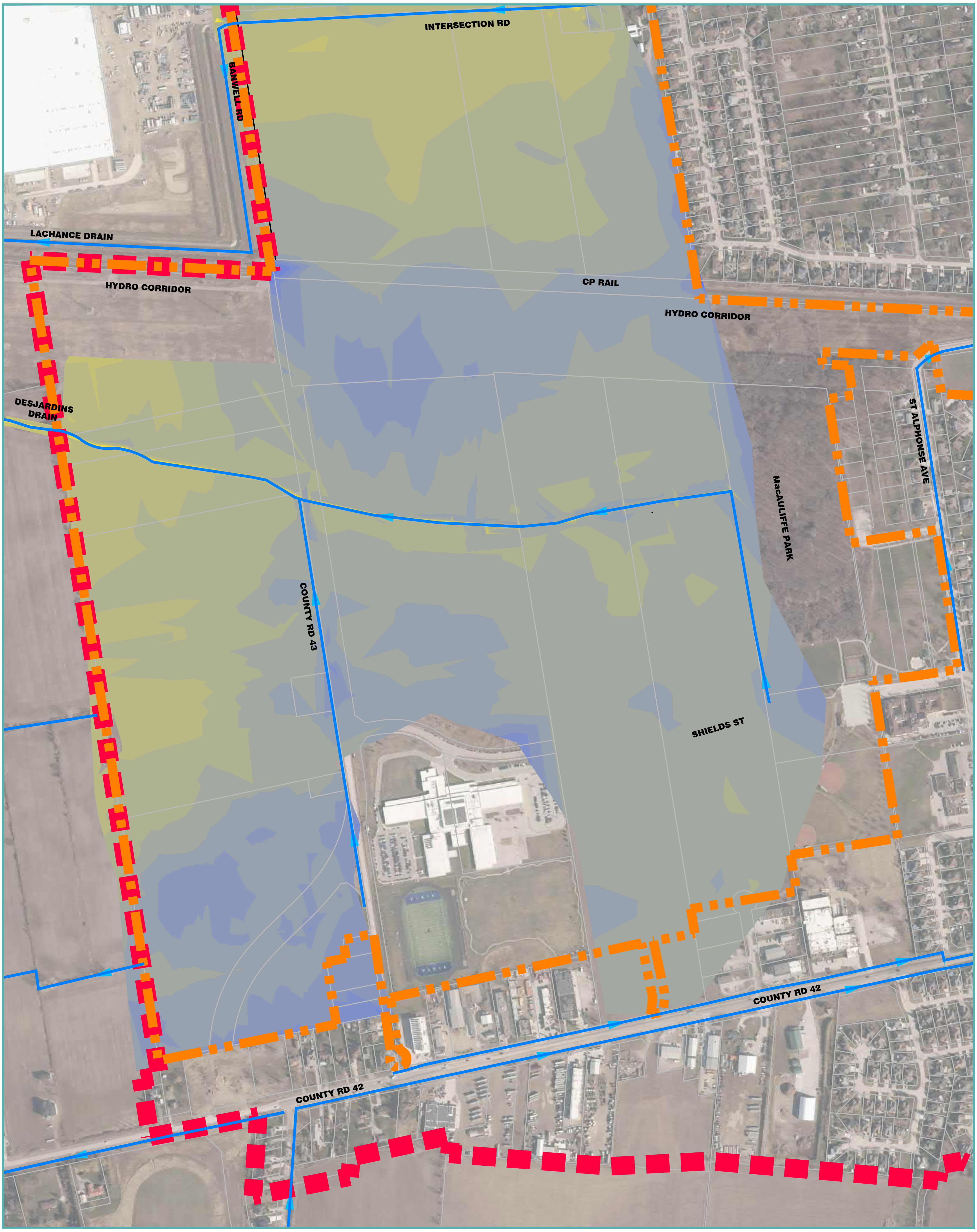

LEGEND

- TECUMSEH HAMLET SETTLEMENT AREA (THE HAMLET)
- TECUMSEH HAMLET SECONDARY PLAN AREA (THSPA)
- EXISTING MUNICIPAL DRAIN

ELEVATION RANGES (m)

180.50 – 180.75 – 181.00 – 181.25 – 181.50

181.50 – 181.75 – 182.00 – 182.25 – 182.50

182.50 – 182.75 – 183.00 – 183.25 – 183.50

183.50 – 183.75 – 184.00 – 184.25 – 184.50

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

EXISTING LAND TOPOGRAPHY - SOUTH OF CP RAILWAY

FIGURE 2.3

DILLON CONSULTING

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MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

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STATUS: DRAFT
PROJECT: 23-5735

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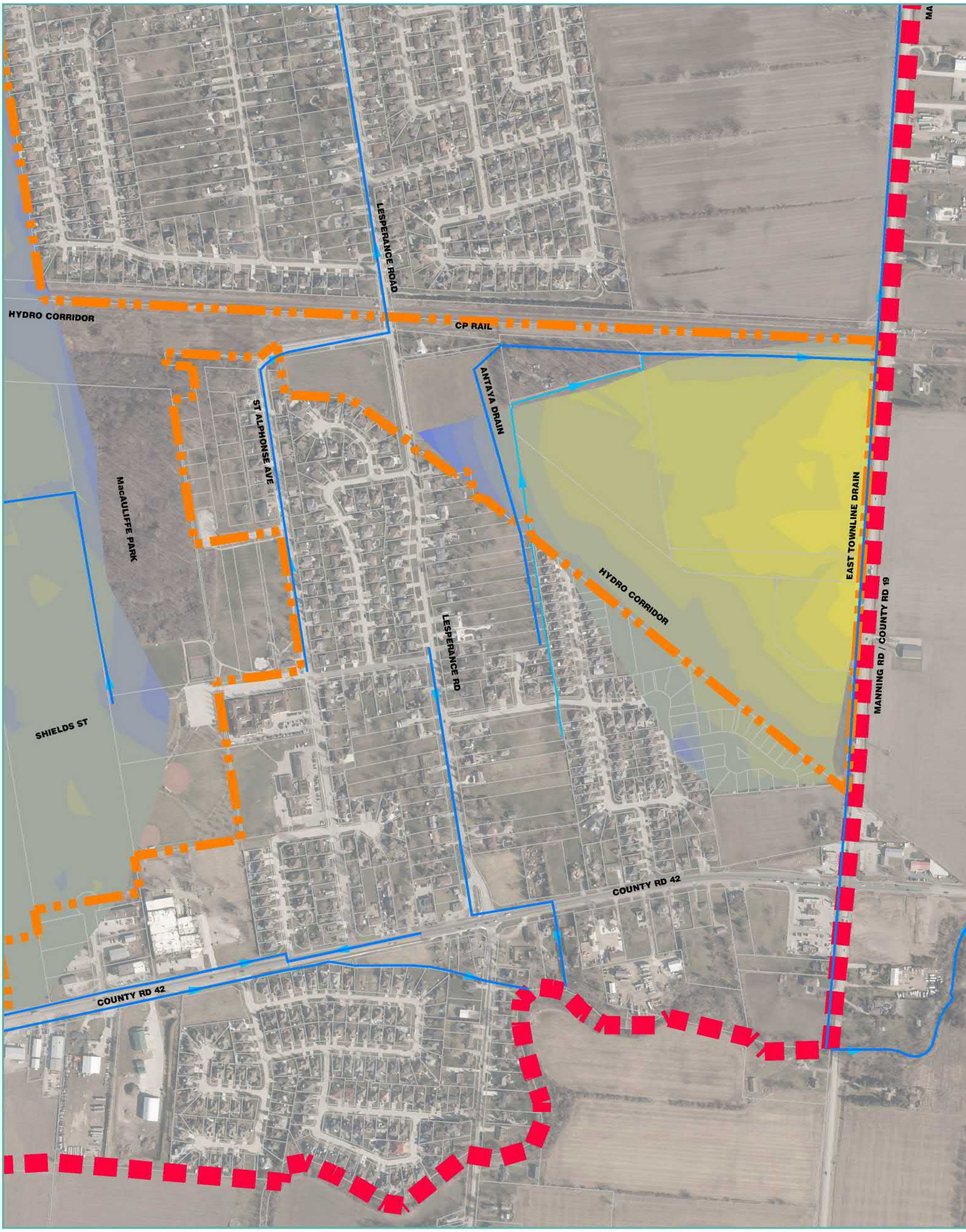

LEGEND

- TECUMSEH HAMLET SETTLEMENT AREA (THE HAMLET)
- TECUMSEH HAMLET SECONDARY PLAN AREA (THSPA)
- EXISTING MUNICIPAL DRAIN

ELEVATION RANGES (m)

180.50	181.50	182.50	183.50
180.75	181.75	182.75	183.75
181.00	182.00	183.00	184.00
181.25	182.25	183.25	184.25
181.50	182.50	183.50	184.50

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

EXISTING LAND TOPOGRAPHY - SOUTHEAST HAMLET

FIGURE 2.4

MAP CREATED BY: LPJ
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MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

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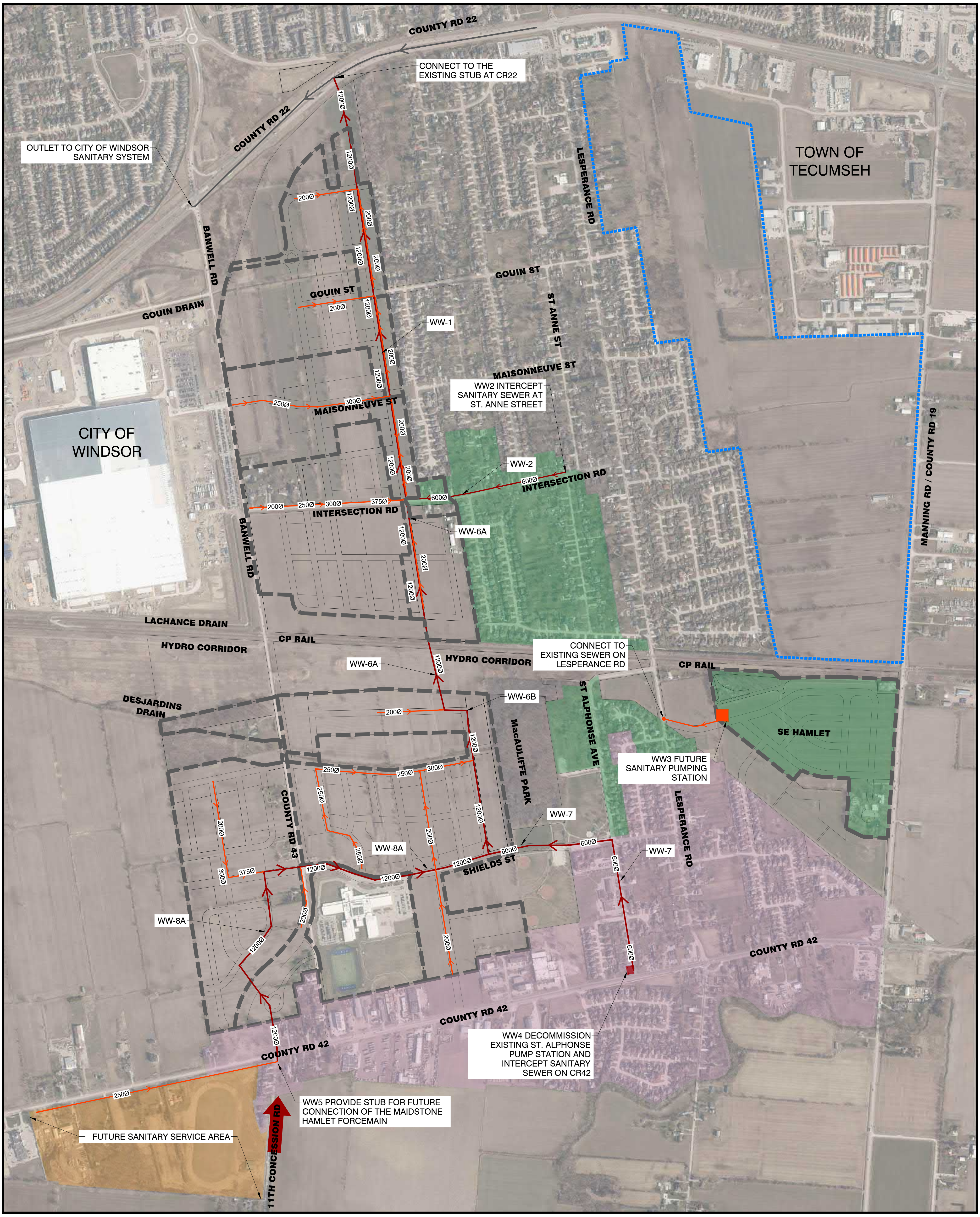

LEGEND

- PROPOSED SANITARY TRUNK
- PROPOSED SANITARY SUBTRUNK
- SUBTRUNK DRAINAGE BOUNDARY
- 1200Ø SEWER DIAMETER
- PROPOSED SANITARY PUMPING STATION
- EXISTING SANITARY PUMPING STATION
- MRSPA STUDY AREA
- FUTURE PROJECT AREA 1 (FP1)
- FUTURE PROJECT AREA 2 (FP2)
- FUTURE PROJECT AREA 3 (FP3)
- FUTURE PROJECT AREA 4 (FP4)

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL DESIGN REPORT

SANITARY SERVICING STRATEGY

FIGURE 3.1

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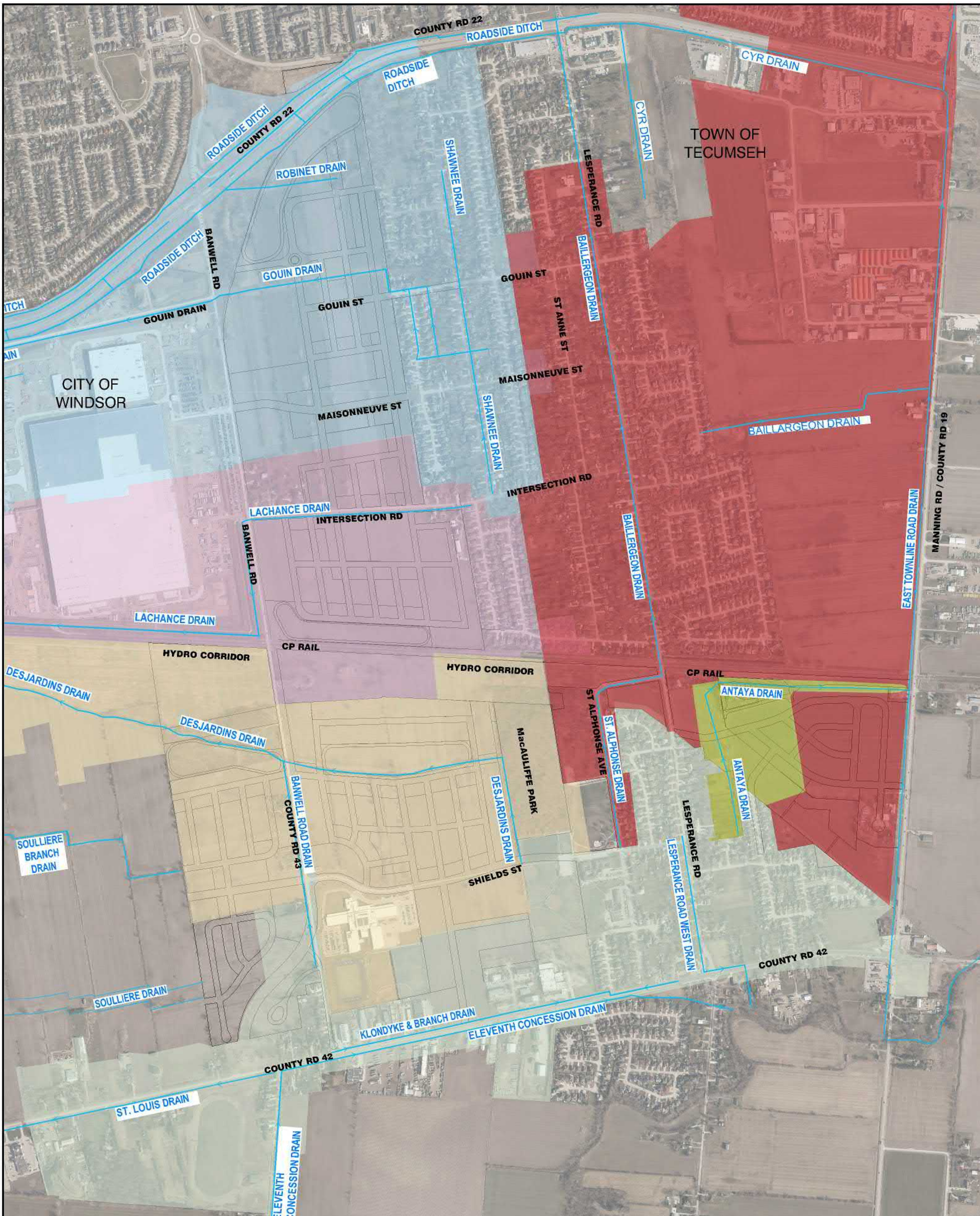

LEGEND

- EXISTING GOUIN DRAINAGE AREA
- EXISTING 11th CONCESSION DRAINAGE AREA
- EXISTING LACHANCE DRAINAGE AREA
- EXISTING DESJARDINS DRAINAGE AREA
- EXISTING ANTAYA DRAINAGE AREA
- EXISTING EAST TOWNLINE DRAINAGE AREA
- EXISTING MUNICIPAL DRAIN

TECUMSEH

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

EXISTING DRAINAGE AND MUNICIPAL DRAINS

FIGURE 4.1

DILLON CONSULTING

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SCALE: 1:6000
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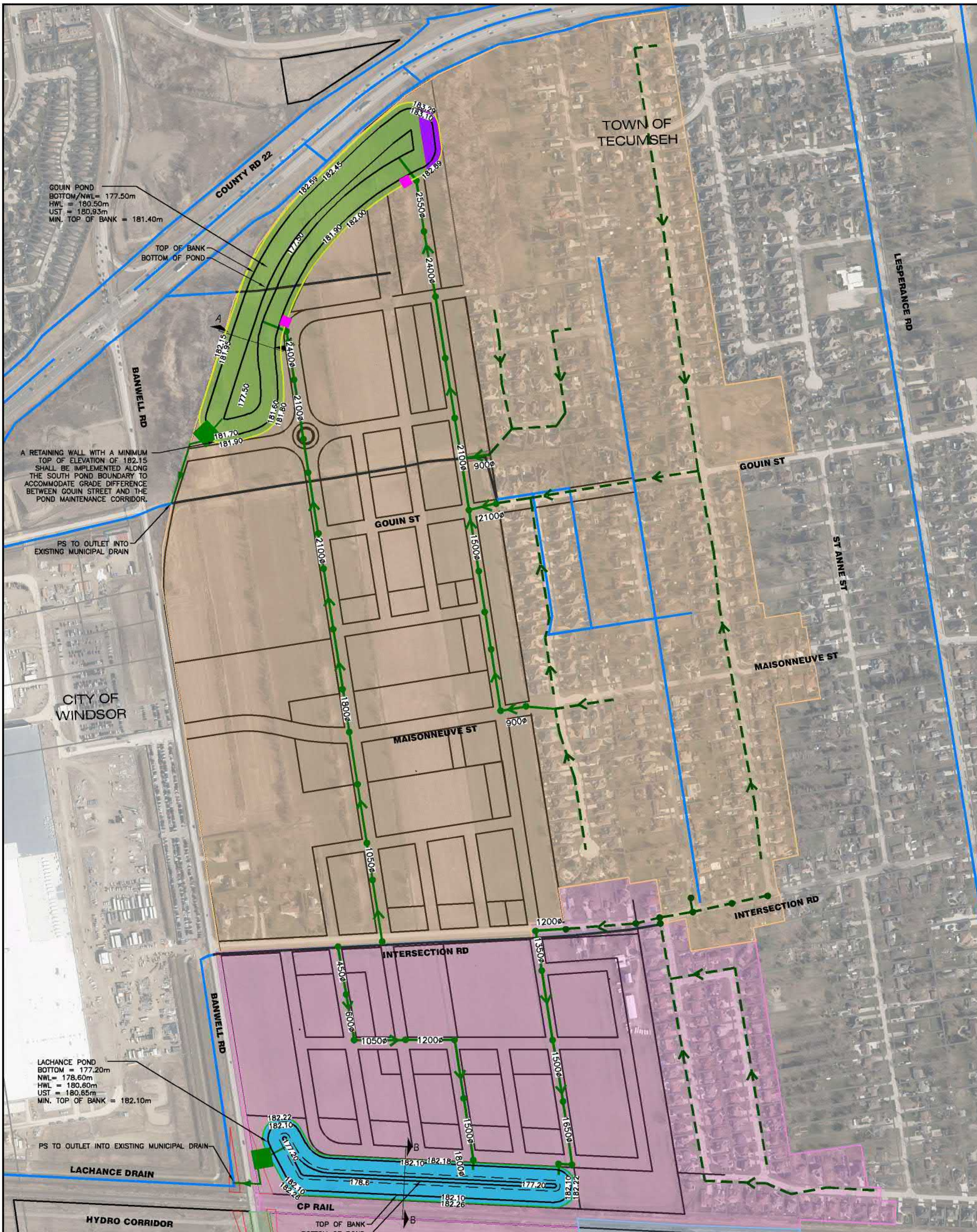

TECUMSEH

PROPOSED WET STORMWATER MANAGEMENT PONDS	DESJARDINS EAST POND DRAINAGE AREA
PROPOSED DRY STORMWATER MANAGEMENT PONDS	DESJARDINS WEST POND DRAINAGE AREA
ENGINEERED LINER	GOUIN POND DRAINAGE AREA
PROPOSED STORM PUMPING STATION (PS)	LACHANCE POND DRAINAGE AREA
1200ø PROPOSED STORM DIAMETER	SOUTH EAST HAMLET DRAINAGE AREA
PROPOSED STORM MANHOLE	182.43 PROPOSED POND GRADES
PROPOSED STORM TRUNK SEWER	PROPOSED POND NORMAL WATER LEVEL
EXISTING STORM TRUNK SEWER	PROPOSED POND BOTTOM / TOP OF BANK
PROPOSED MECHANICAL TREATMENT DEVICE	ABANDONED PORTION OF MUNICIPAL DRAIN
FUTURE ROW FOR RAIL OVERPASS	EXISTING MUNICIPAL DRAIN
	UTILITY EASEMENT

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

STORMWATER MANAGEMENT STRATEGY - NORTH OF CP RAILWAY

FIGURE 4.2

DILLON CONSULTING

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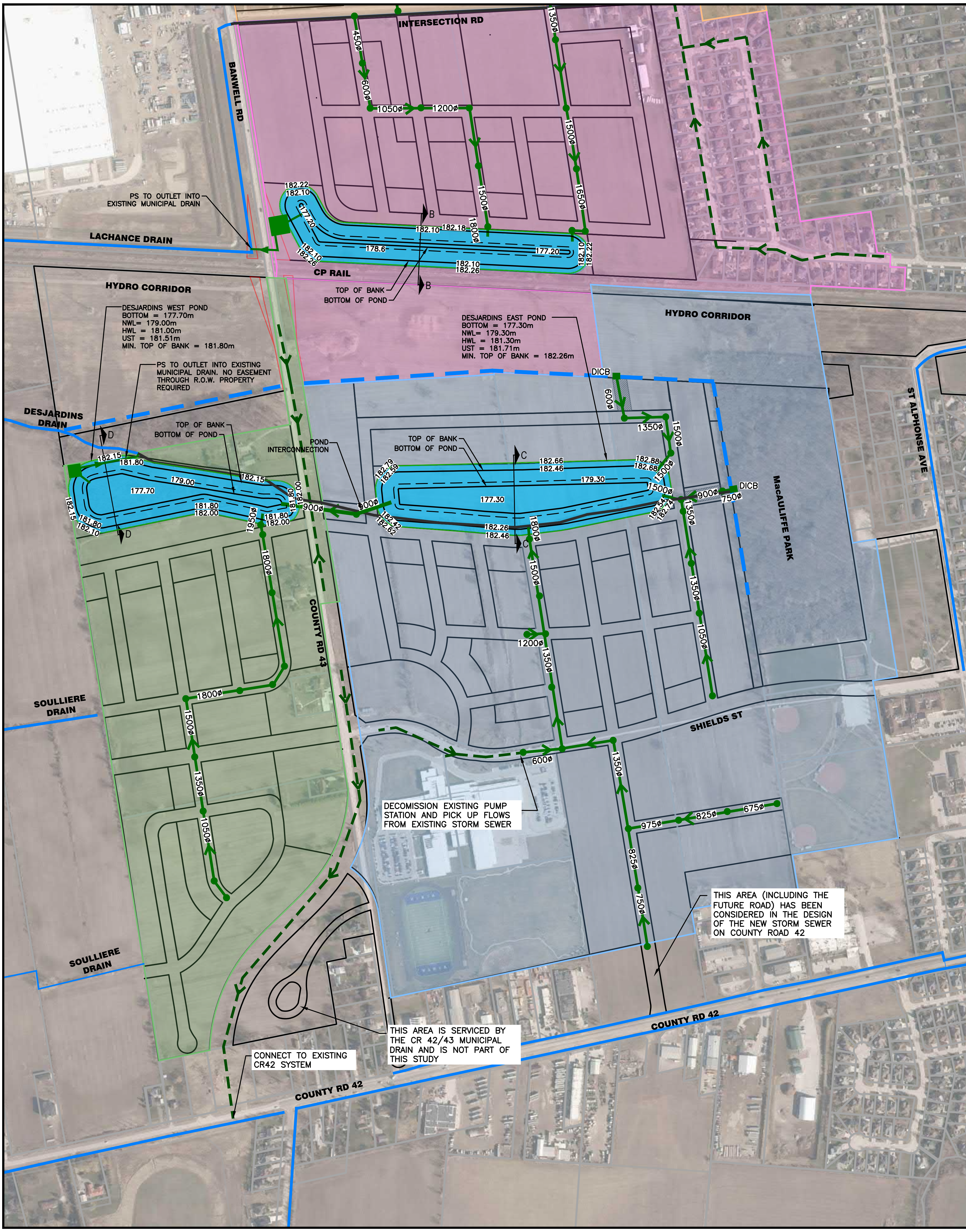

- PROPOSED WET STORMWATER MANAGEMENT PONDS
- PROPOSED DRY STORMWATER MANAGEMENT PONDS
- PROPOSED STORM PUMPING STATION (PS)
- 1200ø PROPOSED STORM DIAMETER
- PROPOSED STORM MANHOLE
- PROPOSED STORM DITCH IN-LET CATCH BASIN
- PROPOSED STORM TRUNK SEWER
- EXISTING STORM TRUNK SEWER
- UTILITY EASEMENT
- FUTURE ROW FOR RAIL OVERPASS
- DESJARDINS EAST POND DRAINAGE AREA
- DESJARDINS WEST POND DRAINAGE AREA
- GOUIN POND DRAINAGE AREA
- LACHANCE POND DRAINAGE AREA
- SOUTH EAST HAMLET DRAINAGE AREA
- 182.43 PROPOSED POND GRADES
- PROPOSED POND NORMAL WATER LEVEL
- PROPOSED POND BOTTOM / TOP OF BANK
- ABANDONED PORTION OF MUNICIPAL DRAIN
- EXISTING MUNICIPAL DRAIN
- PROPOSED SWALE

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

STORMWATER MANAGEMENT STRATEGY - SOUTH OF CP RAILWAY

FIGURE 4.3

DILLON CONSULTING

MAP CREATED BY: LPJ
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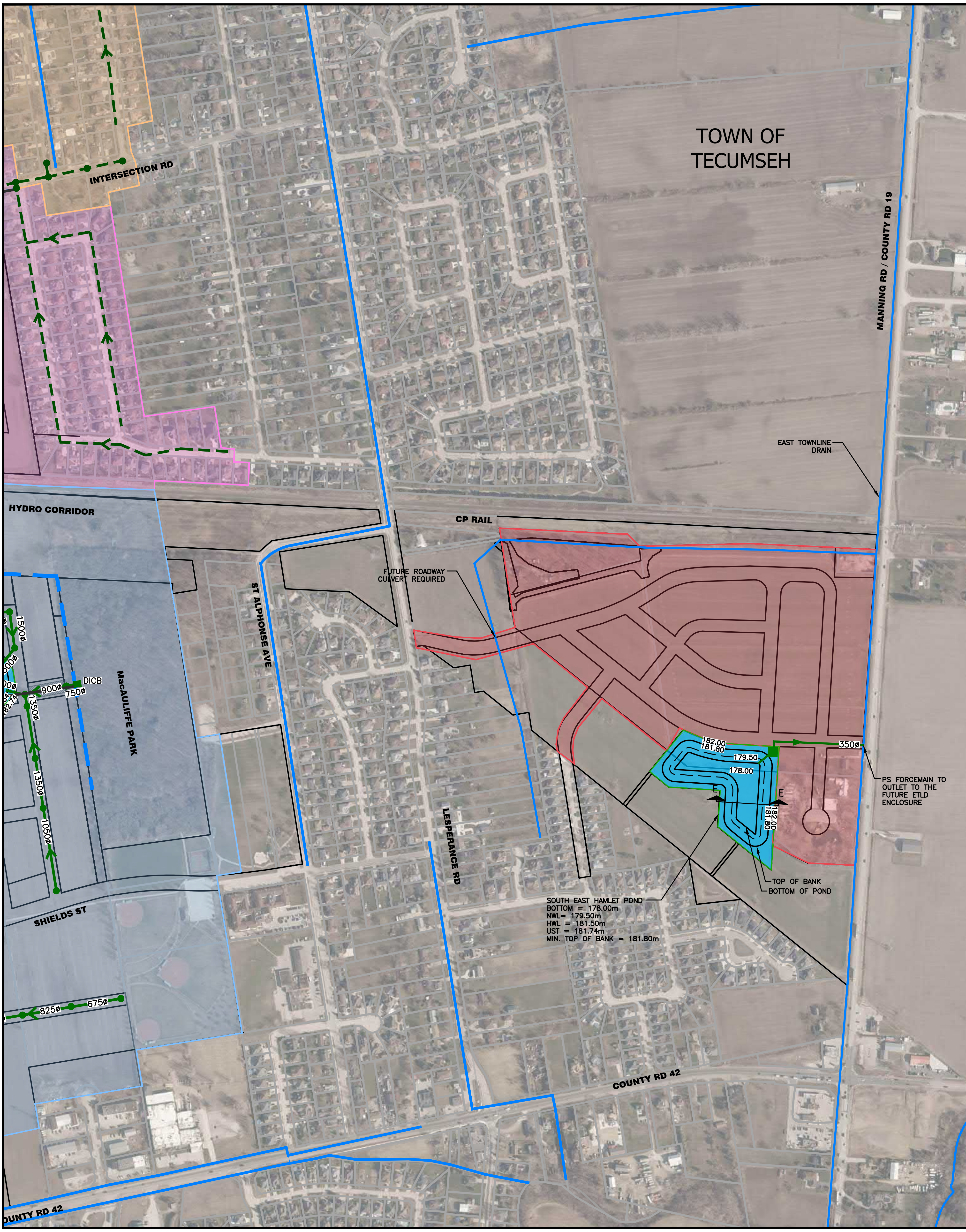

PROPOSED WET STORMWATER MANAGEMENT PONDS
PROPOSED DRY STORMWATER MANAGEMENT PONDS
PROPOSED STORM PUMPING STATION (PS)
1200ø PROPOSED STORM DIAMETER
PROPOSED STORM MANHOLE
PROPOSED STORM TRUNK SEWER
EXISTING STORM TRUNK SEWER
UTILITY EASEMENT

DESJARDINS EAST POND DRAINAGE AREA
DESJARDINS WEST POND DRAINAGE AREA
GOUIN POND DRAINAGE AREA
LACHANCE POND DRAINAGE AREA
SOUTH EAST HAMLET DRAINAGE AREA
182.43 PROPOSED POND GRADES
PROPOSED POND NORMAL WATER LEVEL
PROPOSED POND BOTTOM / TOP OF BANK
ABANDONED PORTION OF MUNICIPAL DRAIN
EXISTING MUNICIPAL DRAIN
PROPOSED SWALE

TECUMSEH

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

STORMWATER MANAGEMENT STRATEGY - SOUTHEAST HAMLET

FIGURE 4.4

DILLON CONSULTING

MAP CREATED BY: LPJ
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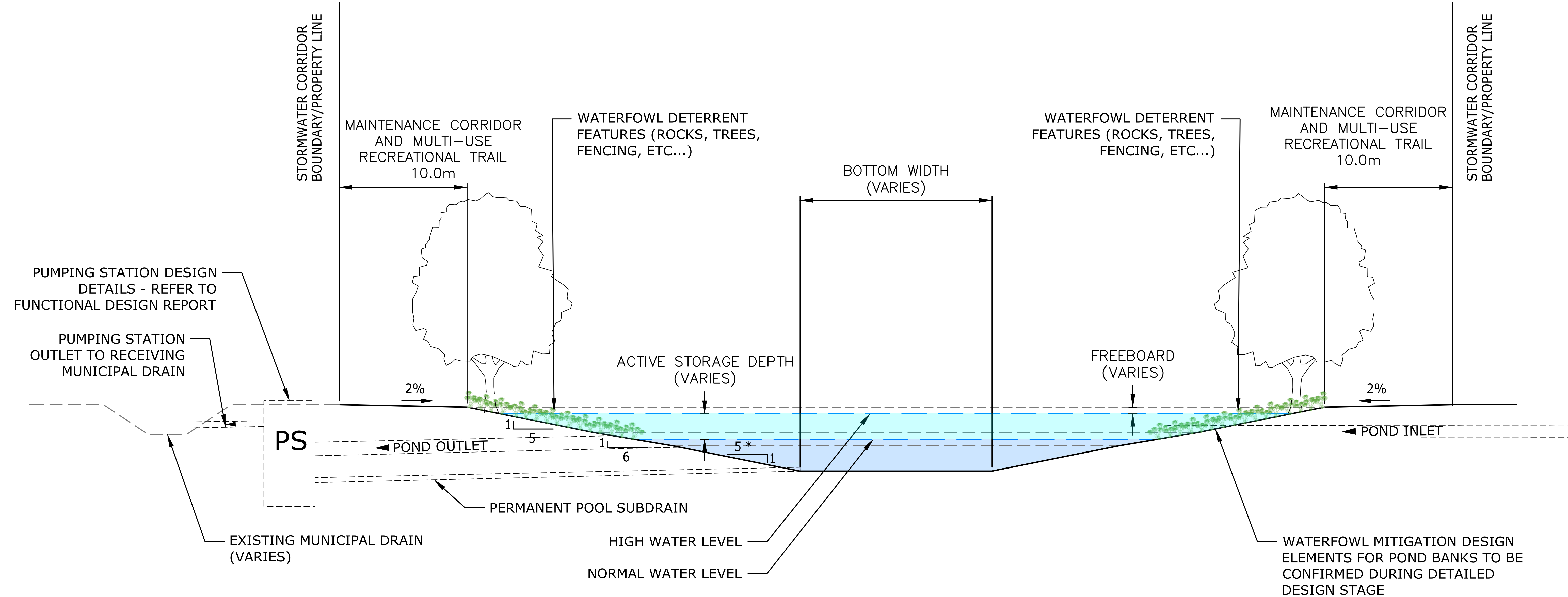

* PERMANENT POOL SLOPES VARY.

STORMWATER MANAGEMENT POND - ACTIVE STORAGE

STORMWATER MANAGEMENT POND - PERMANENT POOL

TOP OF BANK ELEVATION

0.5 ABOVE OR 0.5 BELOW NORMAL WATER LEVEL

NOTE:
A MINIMUM 0.3 m FEEBOARD SHALL BE PROVIDED FROM THE HIGH WATER LEVEL TO THE TOP OF BANK ELEVATION.
THE URBAN STRESS TEST WATER LEVEL SHALL NOT EXCEED THE TOP OF BANK ELEVATION.

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

WET POND DESIGN ELEMENTS

FIGURE 4.5A

DILLON CONSULTING

CREATED BY: LPJ
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 16, 2025

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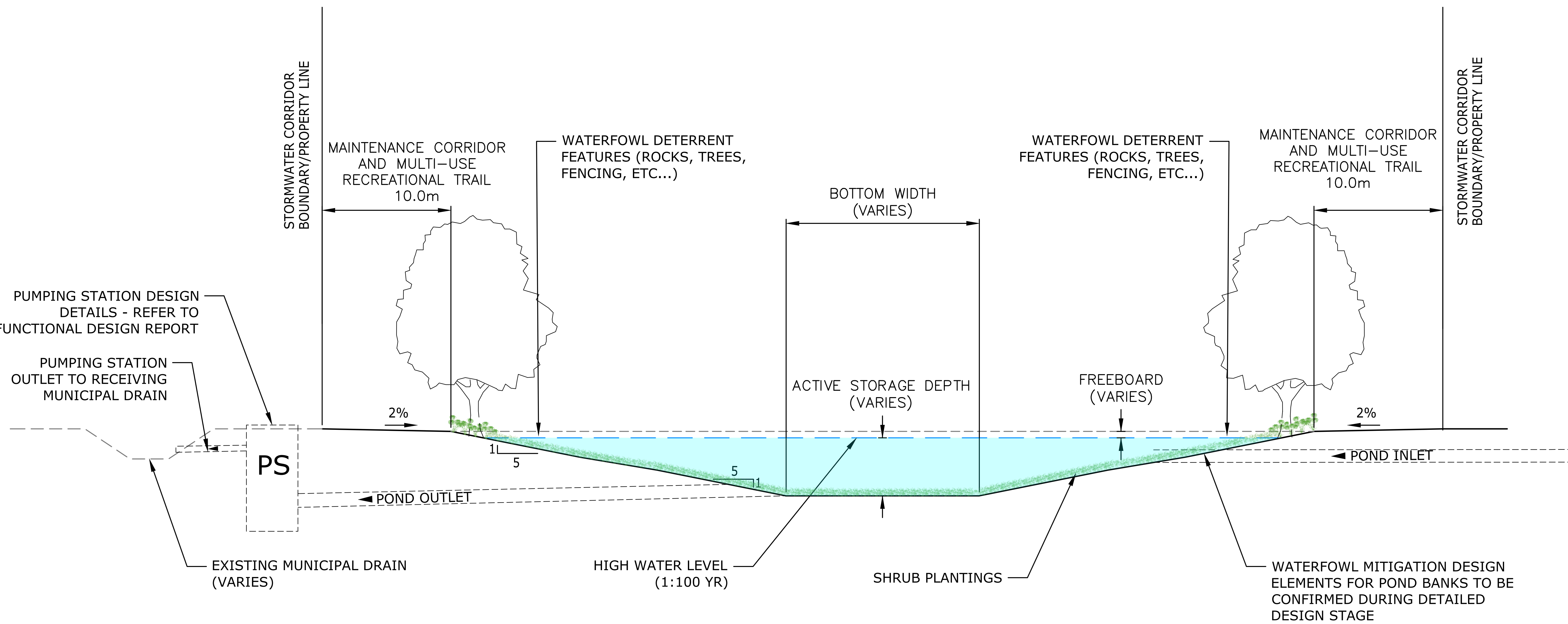

STORMWATER MANAGEMENT POND - ACTIVE STORAGE

NOTE:
A MINIMUM 0.3 m FEEBOARD SHALL BE PROVIDED FROM THE HIGH WATER LEVEL TO THE TOP OF BANK ELEVATION.
THE URBAN STRESS TEST WATER LEVEL SHALL NOT EXCEED THE TOP OF BANK ELEVATION.

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

DRY POND DESIGN ELEMENTS

FIGURE 4.5B

CREATED BY: LPJ
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

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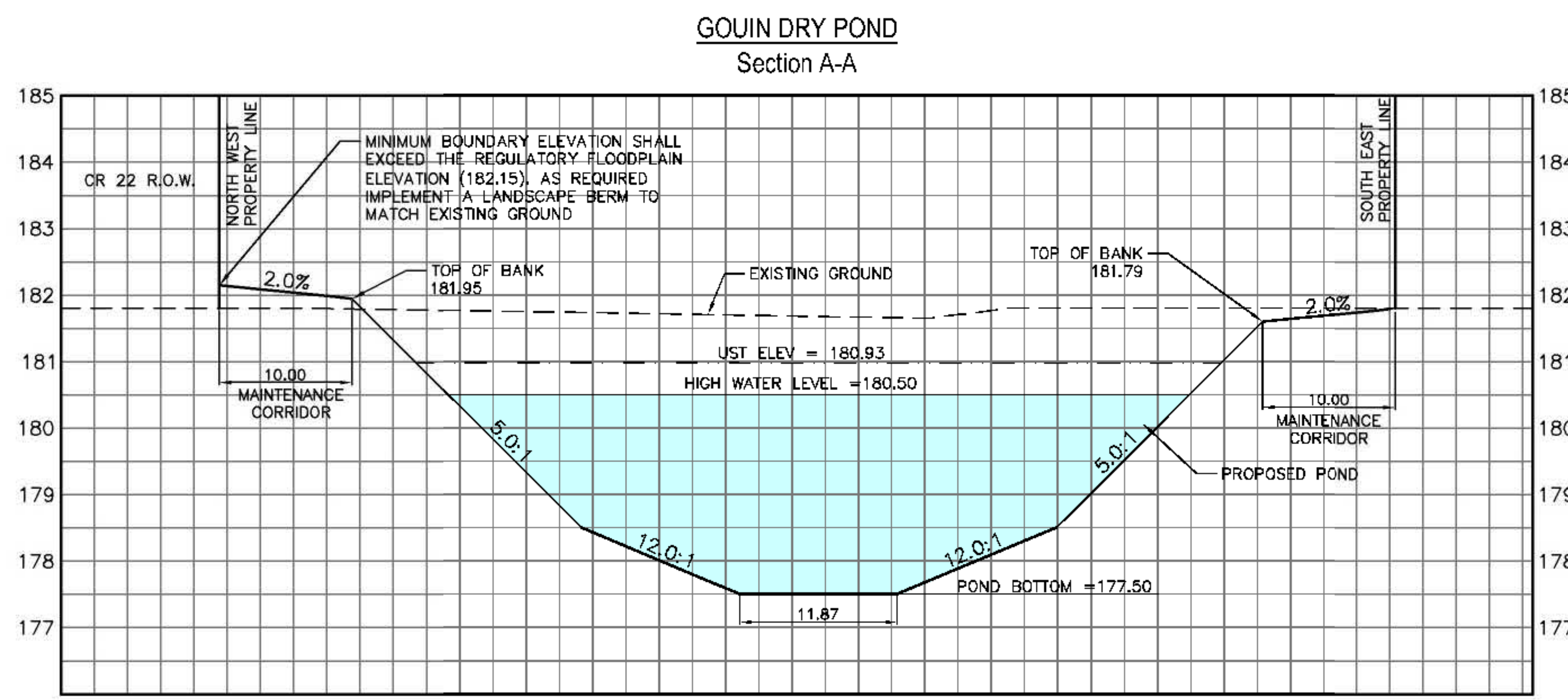

STORMWATER MANAGEMENT POND - ACTIVE STORAGE

STORMWATER MANAGEMENT POND - PERMANENT POOL

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

GOUIN SWMF SECTION

FIGURE 4.6A

DILLON CONSULTING

CREATED BY: MMM
CHECKED BY: LMH

SCALE: 1:500 H, 1:100 V
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 23, 2025

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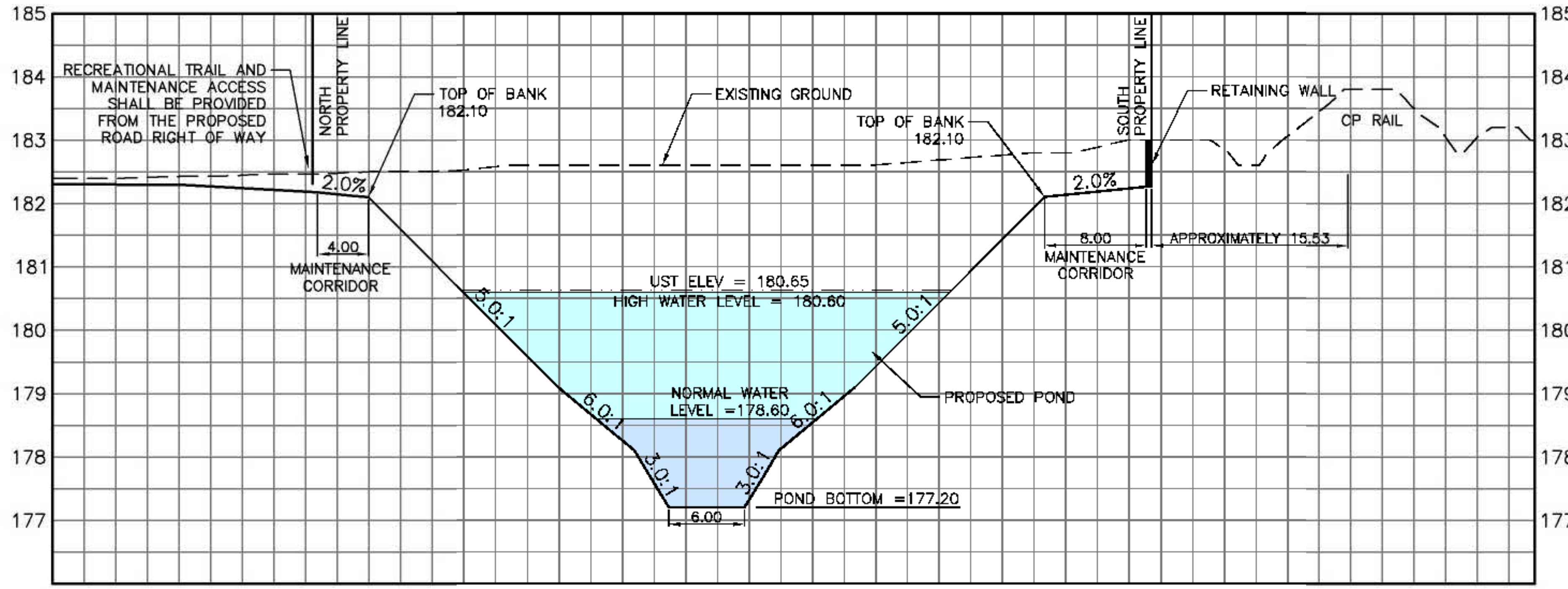
LACHANCE WET POND
Section B-B



STORMWATER MANAGEMENT POND - ACTIVE STORAGE

STORMWATER MANAGEMENT POND - PERMANENT POOL

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

LACHANCE SWMF SECTION

FIGURE 4.6B

DILLON CONSULTING

CREATED BY: MMM
CHECKED BY: LMH

SCALE: 1:500 H, 1:100 V
STATUS: DRAFT
PROJECT: 23-5735

PROJECT: 23-5735 DATE: May 23, 2025

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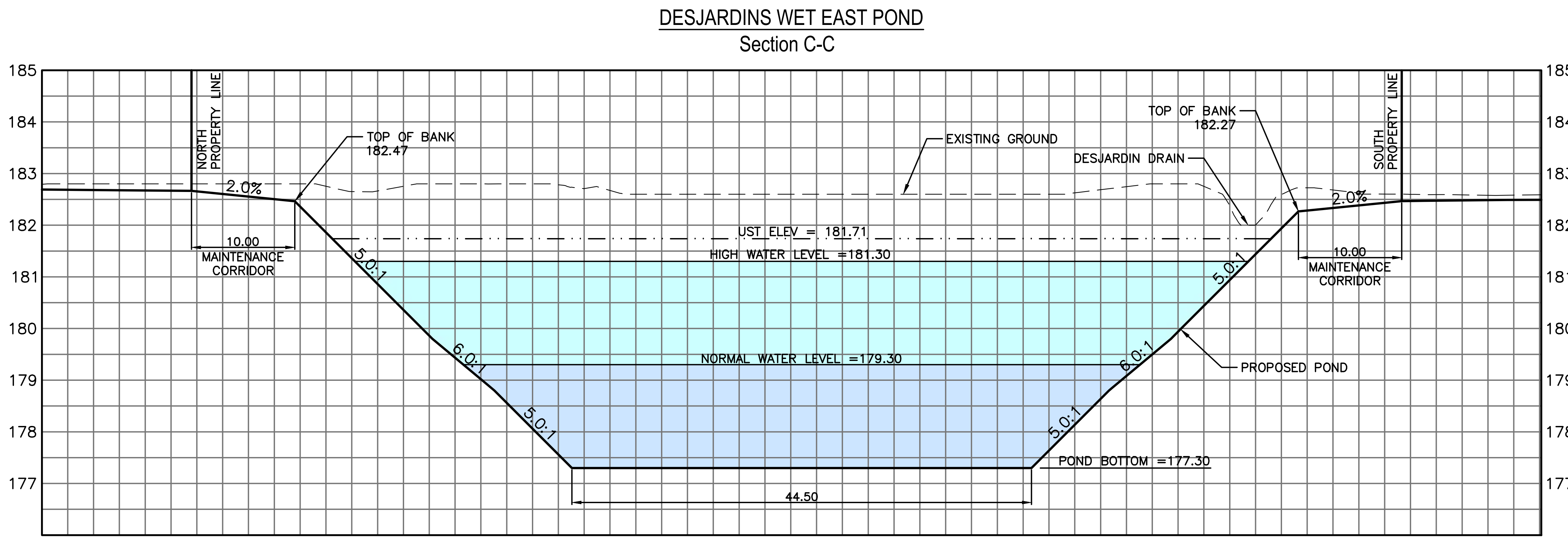

STORMWATER MANAGEMENT POND - ACTIVE STORAGE

STORMWATER MANAGEMENT POND - PERMANENT POOL

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

DESJARDINS EAST SWMF SECTION

FIGURE 4.6C

CREATED BY: MMM
CHECKED BY: LMH

SCALE: 1:500 H, 1:100 V
STATUS: DRAFT
PROJECT: 23-5735

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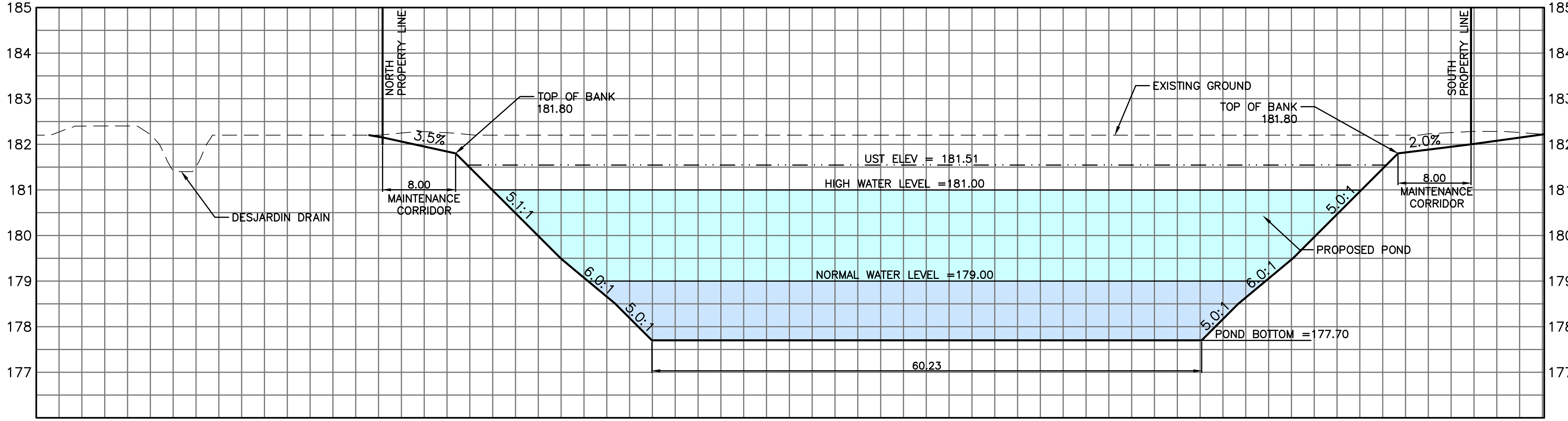
DESJARDINS WET WEST POND

Section D-D



STORMWATER MANAGEMENT POND - ACTIVE STORAGE

STORMWATER MANAGEMENT POND - PERMANENT POOL

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

DESJARDINS WEST SWMF SECTION

FIGURE 4.6D

DILLON CONSULTING

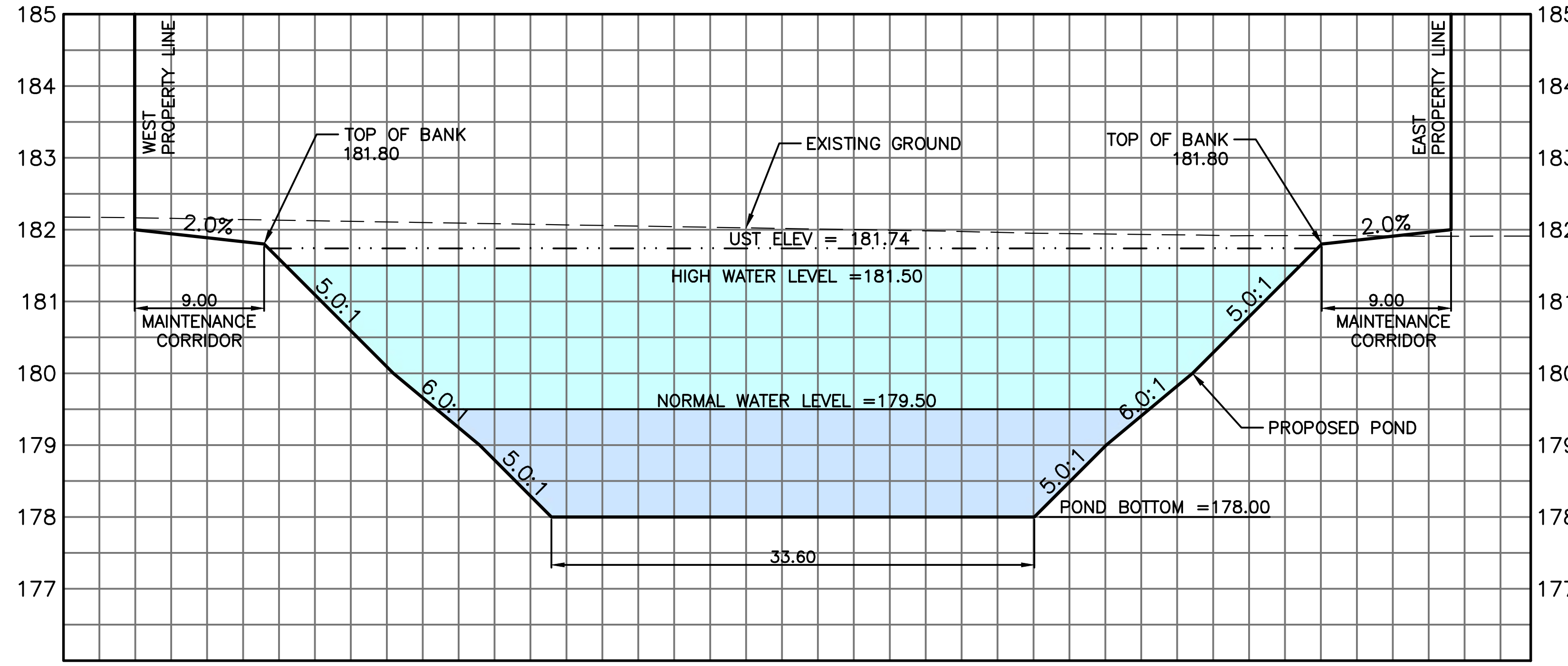
CREATED BY: MMM
CHECKED BY: LMH

SCALE: 1:500 H, 1:100 V
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 16, 2025

SE HAMLET WET POND SECTION

Section E-E



STORMWATER MANAGEMENT POND - ACTIVE STORAGE

STORMWATER MANAGEMENT POND - PERMANENT POOL

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

SE HAMLET SWMF SECTION

FIGURE 4.6E

DILLON CONSULTING

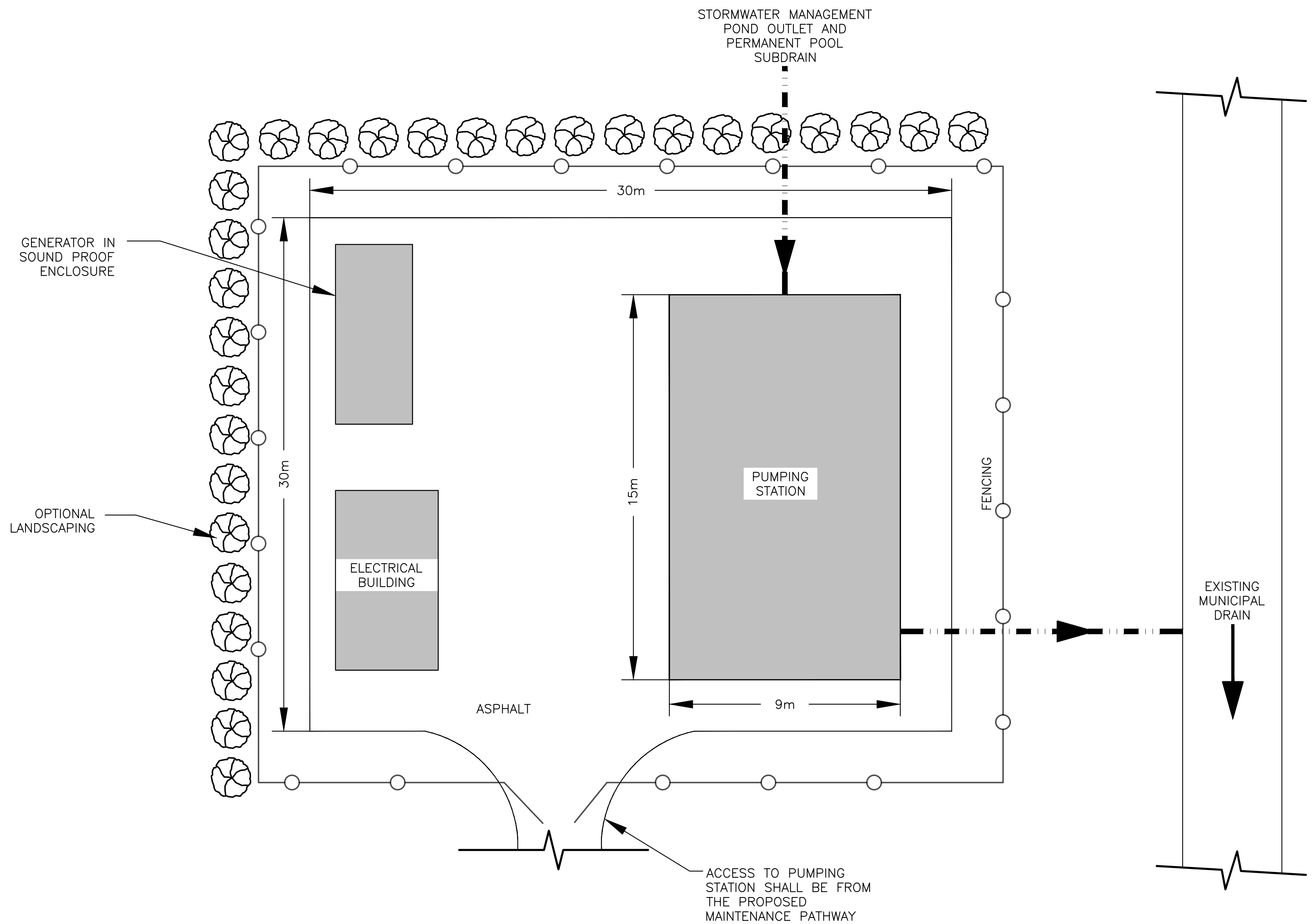
CREATED BY: MMM
CHECKED BY: LMH

SCALE: 1:500 H, 1:100 V
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 16, 2025

NOTES:

1. PUMPING STATION ACCESS, PANEL EQUIPMENT AND GENERATOR SHALL BE PLACED AT ELEVATIONS 0.3 M GREATER THAN THE MINIMUM ERCA FLOOD PROOFING ELEVATIONS.
2. PUMPING STATION FORCEMAIN INLET TO THE MUNICIPAL DRAINS SHALL CONSIDER EROSION CONTROL AND SCOUR PROTECTION.
3. THE PUMPING STATION FOOTPRINT IS DEPENDENT ON THE CAPACITY OF THE PUMP STATION. REFER TO THE FUNCTIONAL DESIGN REPORT FOR SITE SPECIFIC WET WELL DIMENSIONS.
4. THE PERMANENT POOL SUBDRAIN WILL ONLY BE REQUIRED FOR INLETS FOR WET STORMWATER MANAGEMENT PONDS.



TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TYPICAL PUMPING STATION SITE PLAN (GREATER THAN 0.4 CMS CAPACITY)

FIGURE 4.7

DILLON CONSULTING

CREATED BY: LPJ
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

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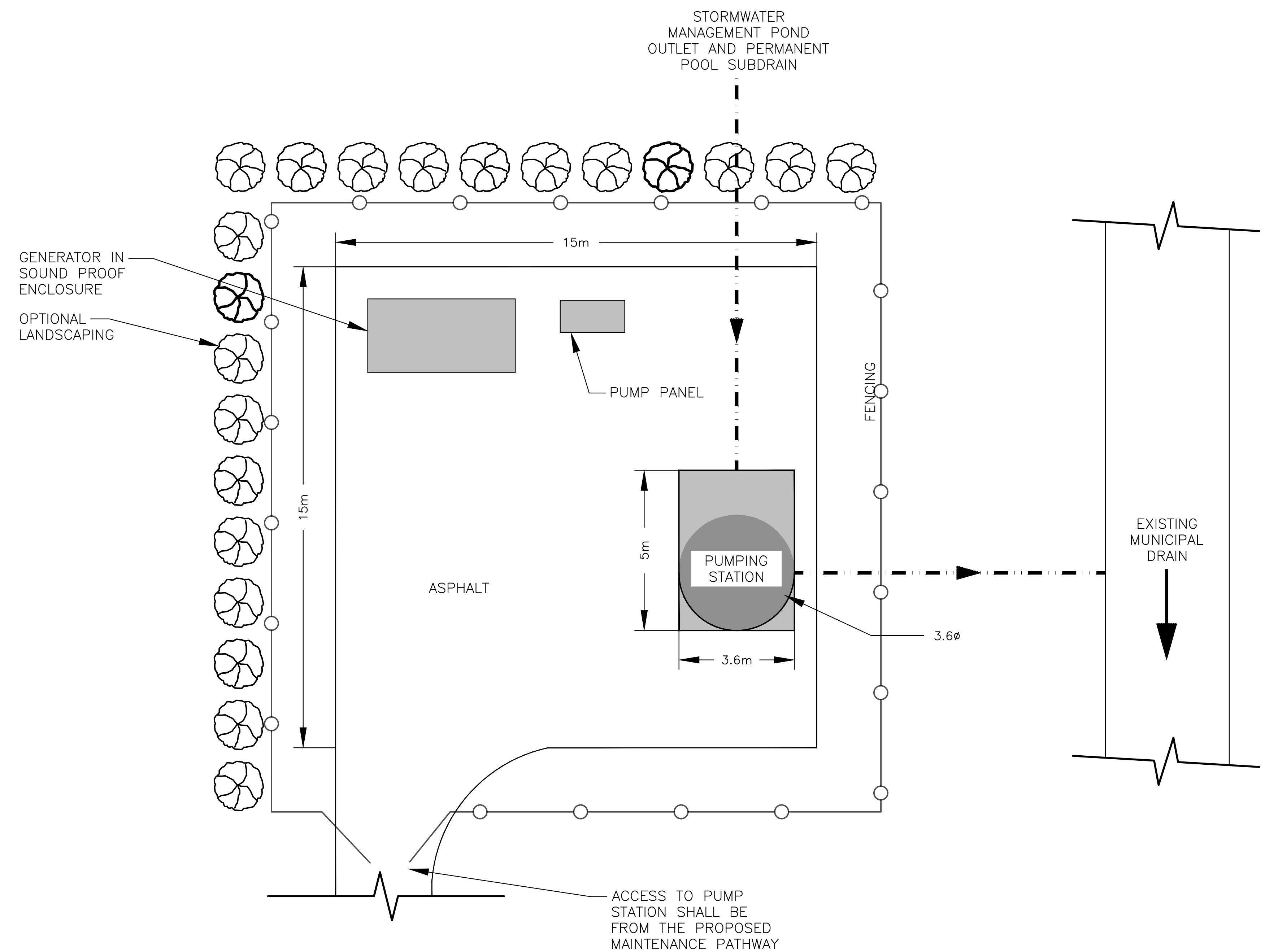
NOTES:

1. PUMPING STATION ACCESS, PANEL EQUIPMENT AND GENERATOR SHALL BE PLACED AT ELEVATIONS 0.3 M GREATER THAN THE MINIMUM ERCA FLOOD PROOFING ELEVATIONS.
2. PUMPING STATION FORCEMAIN INLET TO THE MUNICIPAL DRAINS SHALL CONSIDER EROSION CONTROL AND SCOUR PROTECTION.
3. THE PUMPING STATION FOOTPRINT IS DEPENDENT ON THE CAPACITY OF THE PUMP STATION. REFER TO THE FUNCTIONAL DESIGN REPORT FOR SITE SPECIFIC WET WELL DIMENSIONS.
4. THE PERMANENT POOL SUBDRAIN WILL ONLY BE REQUIRED FOR INLETS FOR WET STORMWATER MANAGEMENT PONDS.



TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TYPICAL PUMPING STATION SITE PLAN (LESS THAN 0.4 CMS CAPACITY)

FIGURE 4.8

DILLON CONSULTING

CREATED BY: LPJ
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 16, 2025

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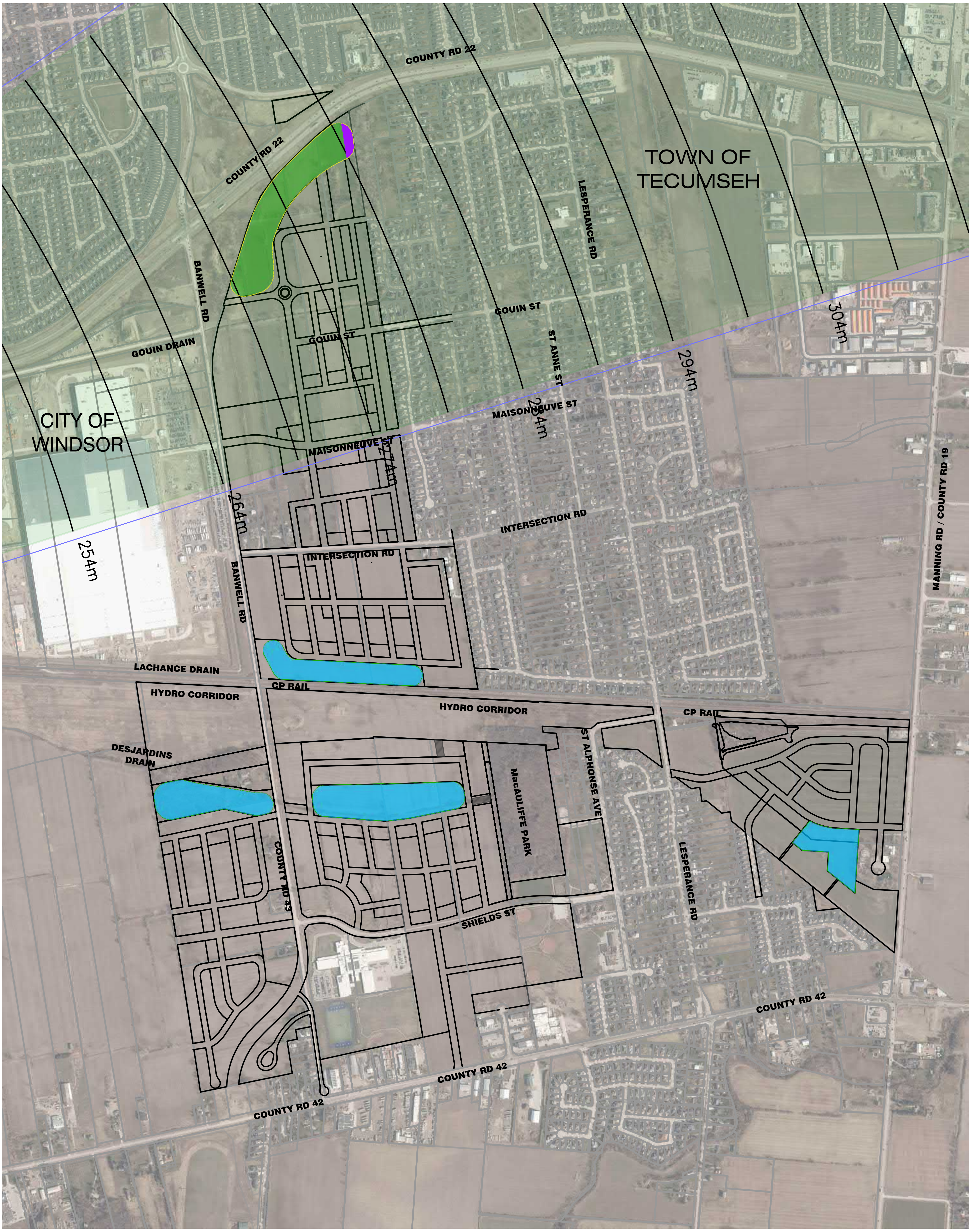

PROPOSED WET STORMWATER MANAGEMENT PONDS	WINDSOR AIRPORT OBSTACLE IDENTIFICATION SURFACE (OLS)
PROPOSED DRY STORMWATER MANAGEMENT PONDS	244m — OLS ELEVATION
ENGINEERED LINER	

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

WINDSOR AIRPORT ZONE

FIGURE 4.9

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:6000
STATUS: DRAFT
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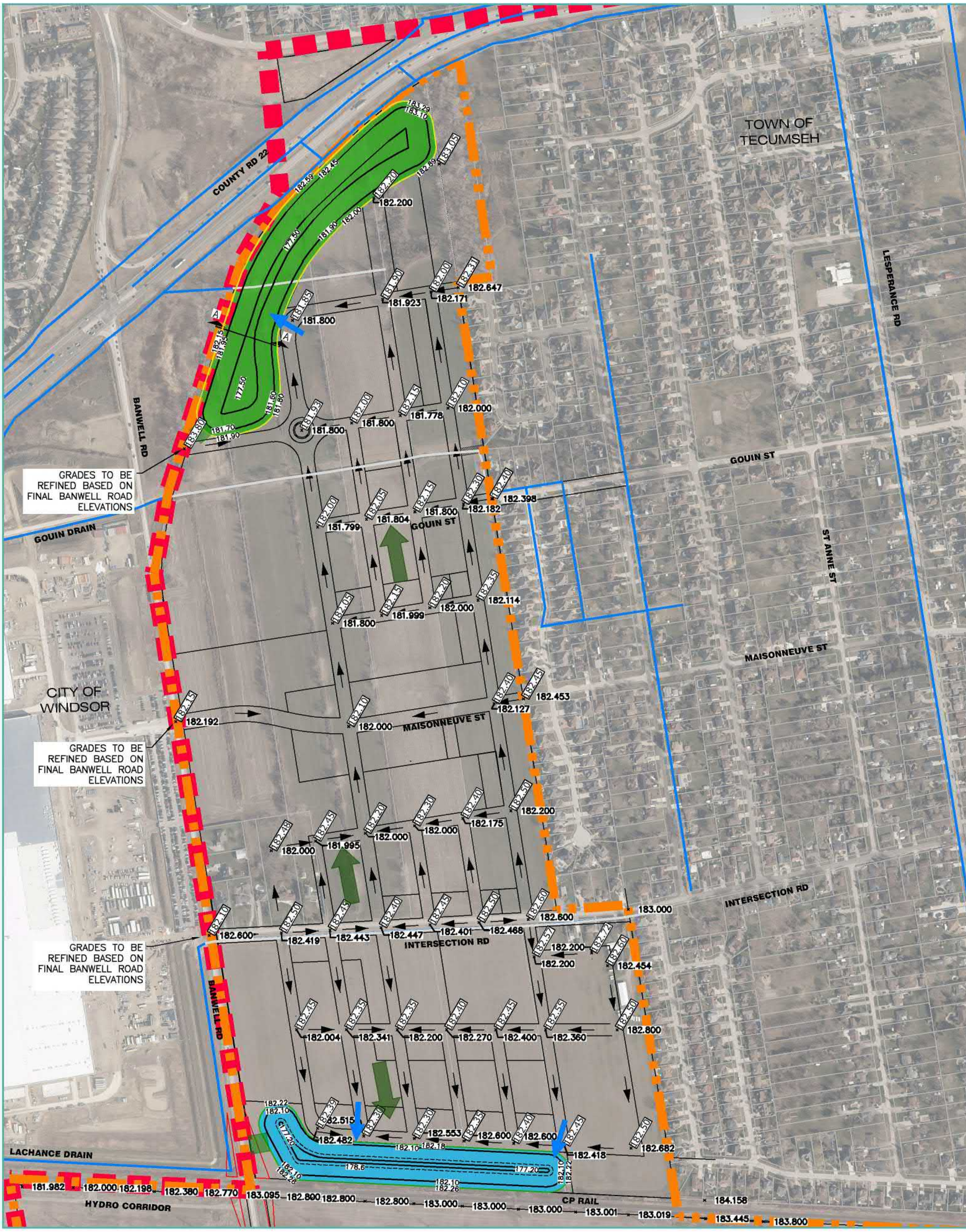

LEGEND

- TECUMSEH HAMLET SETTLEMENT AREA (THE HAMLET)
- TECUMSEH HAMLET SECONDARY PLAN AREA (THSPA)
- MINIMUM ROAD GRADE
- OVERLAND FLOW DIRECTION
- OVERALL FLOW DIRECTION
- SPILLWAY TO POND
- PROPOSED STORM PUMP STATION
- FUTURE ROW FOR RAIL OVERPASS
- PROPOSED SWALE
- EXISTING MUNICIPAL DRAIN
- ABANDONED MUNICIPAL DRAIN
- 181.928 EXISTING GRADE
- PROPOSED WET STORMWATER MANAGEMENT PONDS
- PROPOSED DRY STORMWATER MANAGEMENT PONDS
- PROPOSED POND NORMAL WATER LEVEL
- PROPOSED POND BOTTOM / TOP OF BANK

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

CONCEPTUAL GRADING PLAN - NORTH OF CP RAILWAY

FIGURE 4.10

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

DILLON CONSULTING

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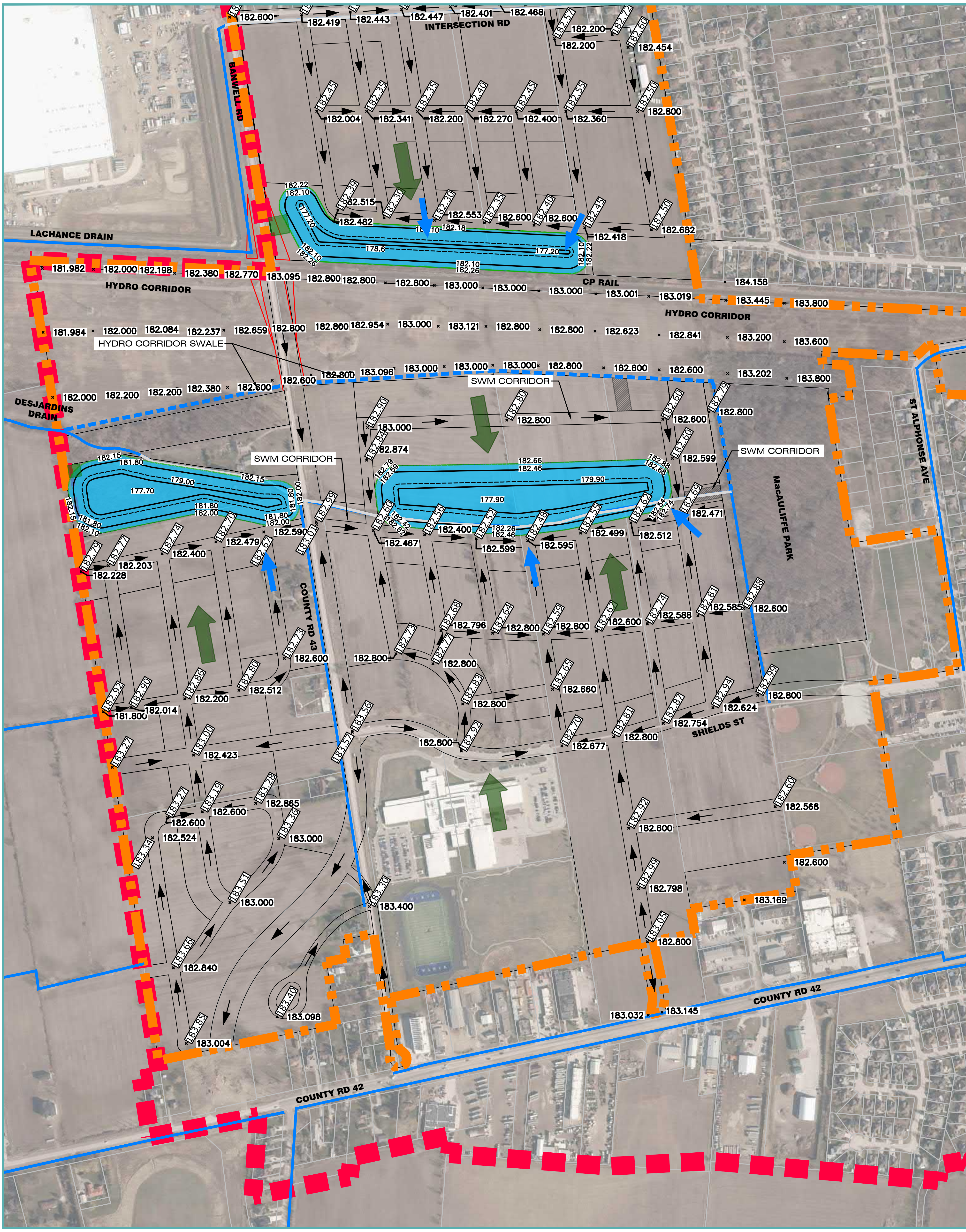

LEGEND

- TECUMSEH HAMLET SETTLEMENT AREA (THE HAMLET)
- TECUMSEH HAMLET SECONDARY PLAN AREA (THSPA)
- MINIMUM ROAD GRADE
- OVERLAND FLOW DIRECTION
- OVERALL FLOW DIRECTION
- SPILLWAY TO POND
- PROPOSED STORM PUMP STATION
- FUTURE ROW FOR RAIL OVERPASS
- PROPOSED SWALE
- EXISTING MUNICIPAL DRAIN
- ABANDONED MUNICIPAL DRAIN
- 181.928 EXISTING GRADE
- PROPOSED WET STORMWATER MANAGEMENT PONDS
- PROPOSED DRY STORMWATER MANAGEMENT PONDS
- PROPOSED POND NORMAL WATER LEVEL
- PROPOSED POND BOTTOM / TOP OF BANK

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

CONCEPTUAL GRADING PLAN - SOUTH OF CP RAILWAY

FIGURE 4.11

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

PROJECT: 23-5735

DATE: June 19, 2025

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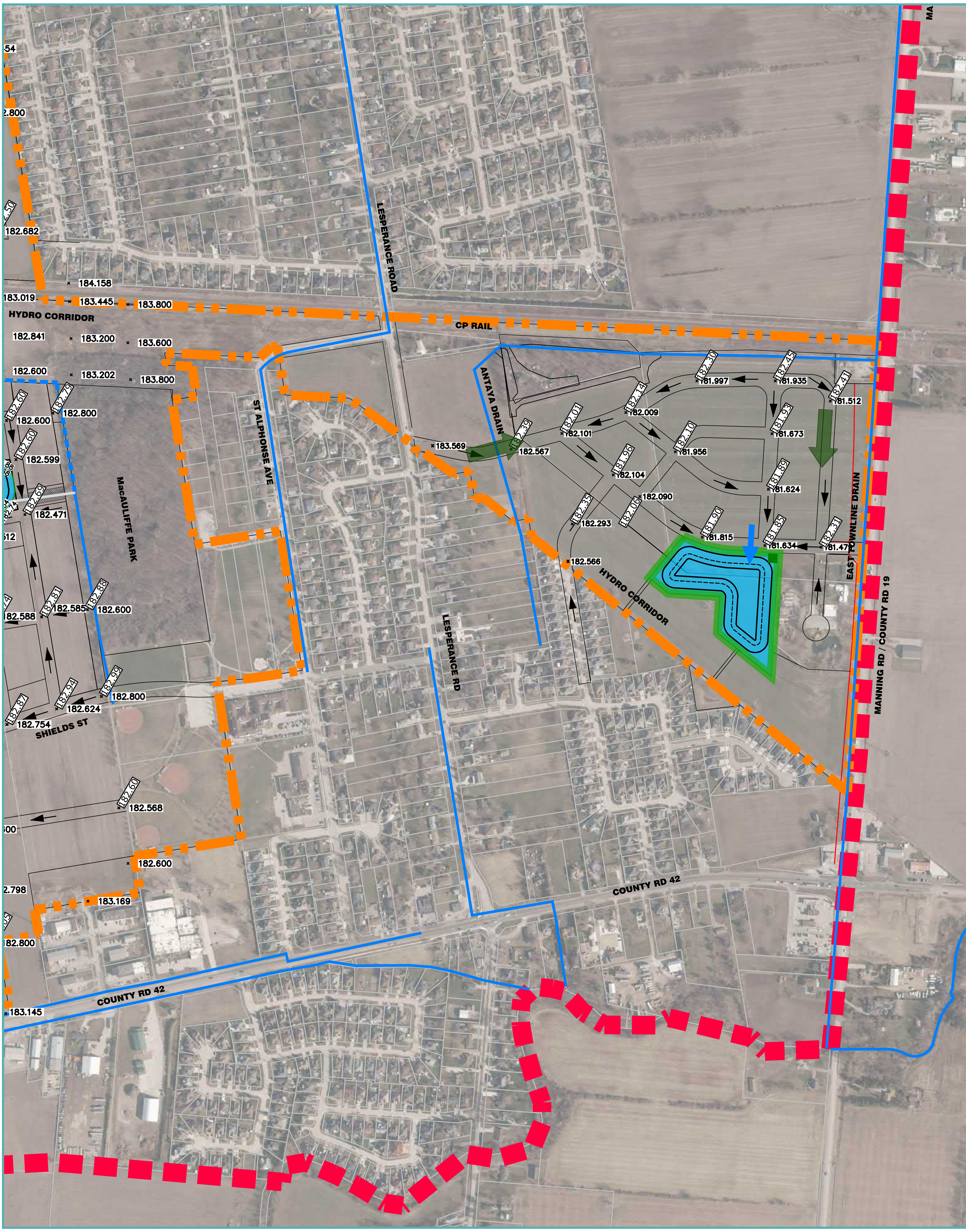

LEGEND

- TECUMSEH HAMLET SETTLEMENT AREA (THE HAMLET)
- TECUMSEH HAMLET SECONDARY PLAN AREA (THSPA)
- MINIMUM ROAD GRADE
- OVERLAND FLOW DIRECTION
- OVERALL FLOW DIRECTION
- SPILLWAY TO POND
- PROPOSED STORM PUMP STATION
- EXISTING MUNICIPAL DRAIN
- ABANDONED MUNICIPAL DRAIN
- 181.928 EXISTING GRADE
- PROPOSED WET STORMWATER MANAGEMENT PONDS
- PROPOSED DRY STORMWATER MANAGEMENT PONDS
- PROPOSED POND NORMAL WATER LEVEL
- PROPOSED POND BOTTOM / TOP OF BANK

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

CONCEPTUAL GRADING PLAN - SOUTHEAST HAMLET

FIGURE 4.12

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 19, 2025

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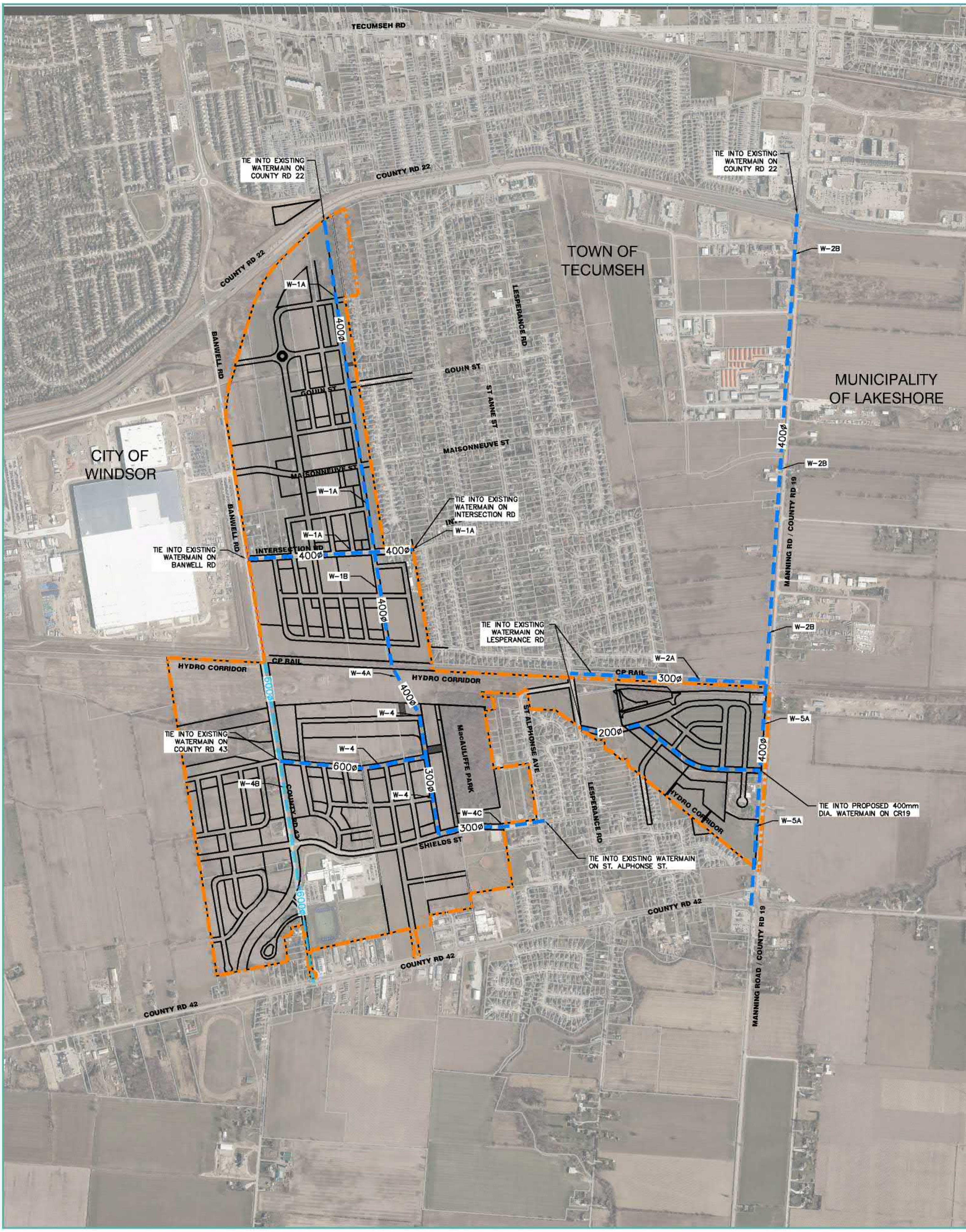

LEGEND

(orange dash-dot line)	TECUMSEH HAMLET AREA BOUNDARY
(blue dashed line)	PROPOSED TRUNK WATERMAIN
600ø	PROPOSED TRUNK WATERMAIN DIAMETER
(light blue dashed line)	EXISTING WATERMAIN
600ø	EXISTING TRUNK WATERMAIN DIAMETER

NOTE: ALL WATER SYSTEM IMPROVEMENTS REQUIRED OUTSIDE OF THE PROJECT STUDY AREA AND WATER METERING CHAMBERS SHALL BE IN ACCORDANCE WITH TOWN'S MOST CURRENT WATER AND WASTEWATER MASTER PLAN

TECUMSEH

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

POTABLE WATER DISTRIBUTION SYSTEM IMPROVEMENTS

FIGURE 5.1

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:7500
STATUS: DRAFT
PROJECT: 23-5735

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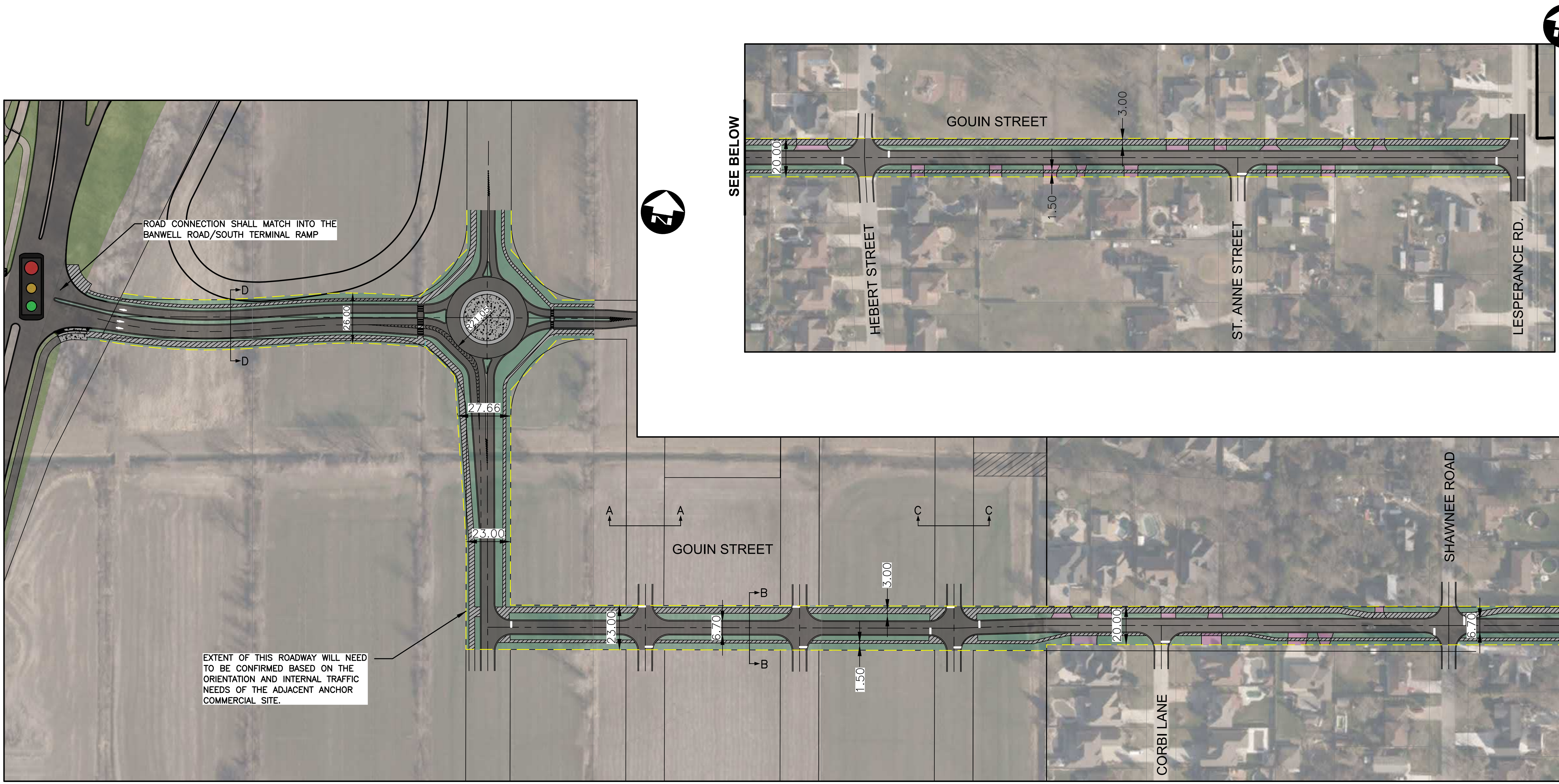

PROPOSED ROADWAY	PROPOSED RIGHT OF WAY LIMITS
PLANTING ZONE	PROPOSED CENTERLINE
PROPOSED SIDEWALK/MULTIUSE PATH	PROPOSED CURB
DRIVEWAYS TO BE REINSTATED	STOP BARS

NOTE:
REFER TO THE ACCOMPANYING ROAD CROSS SECTIONS FOR GUIDANCE ON BOTH ABOVEGROUND AND UNDERGROUND RIGHT–OF–WAY ELEMENTS. THE PROPOSED RIGHT–OF–WAY WIDTH SHOWN HEREIN TAKE PRECEDENCE OVER THE TYPICAL CROSS SECTIONS. ALL WIDTHS SHALL BE CONFIRMED THROUGH LOCAL TRAFFIC ASSESSMENTS PRIOR TO ACQUIRING PROPERTY.

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT GOUIN STREET

FIGURE 6.1

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:1000
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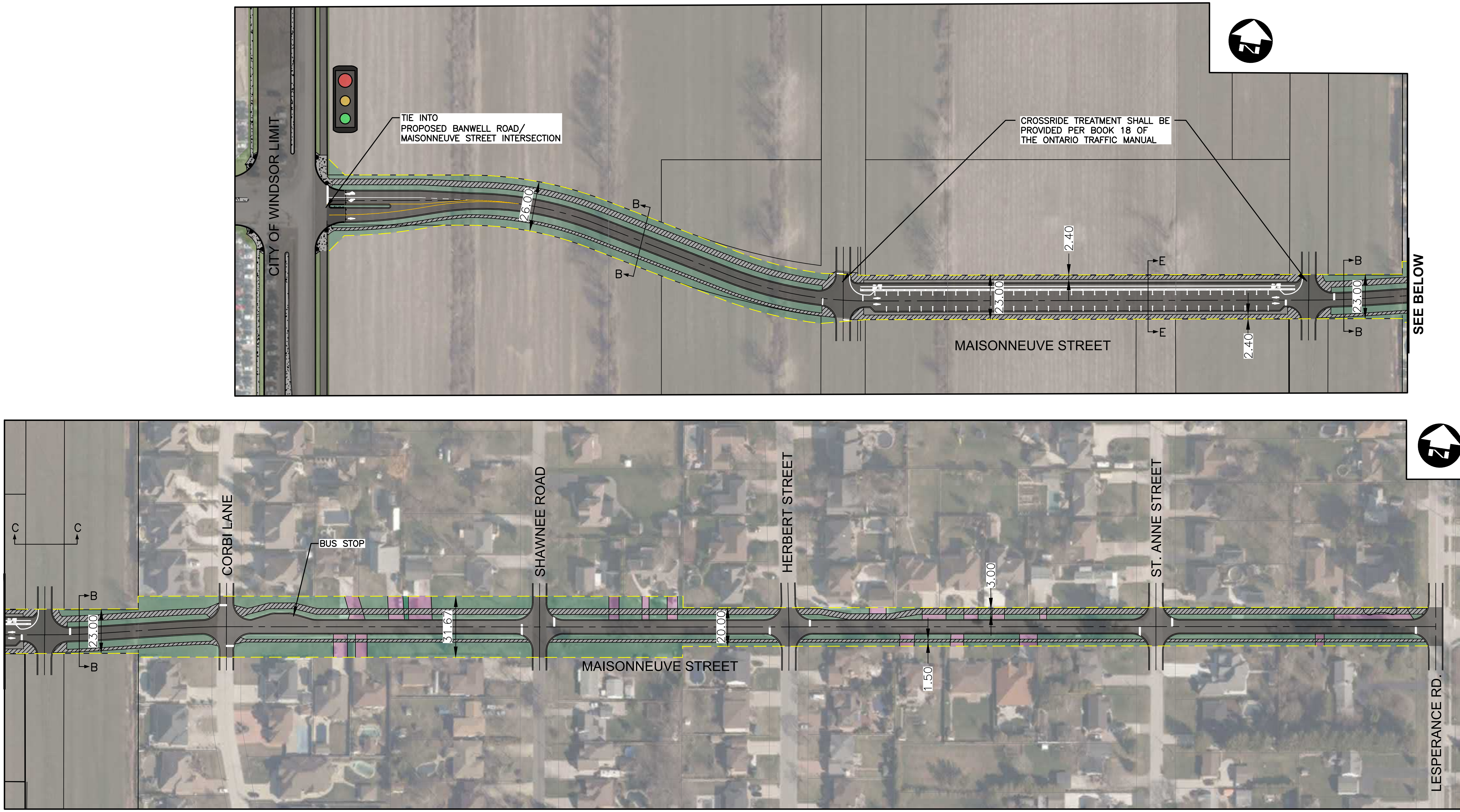


TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

PROPOSED ROADWAY
PLANTING ZONE
PROPOSED SIDEWALK/MULTIUSE PATH
DRIVEWAYS TO BE REINSTATED
PROPOSED RIGHT OF WAY LIMITS
PROPOSED CENTERLINE
PROPOSED CURB
STOP BARS

NOTE:
REFER TO THE ACCOMPANYING ROAD CROSS SECTIONS FOR GUIDANCE ON BOTH ABOVEGROUND AND UNDERGROUND RIGHT-OF-WAY ELEMENTS. THE PROPOSED RIGHT-OF-WAY WIDTH SHOWN HEREIN TAKE PRECEDENCE OVER THE TYPICAL CROSS SECTIONS. ALL WIDTHS SHALL BE CONFIRMED THROUGH LOCAL TRAFFIC ASSESSMENTS PRIOR TO ACQUIRING PROPERTY.

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT MAISONNEUVE STREET

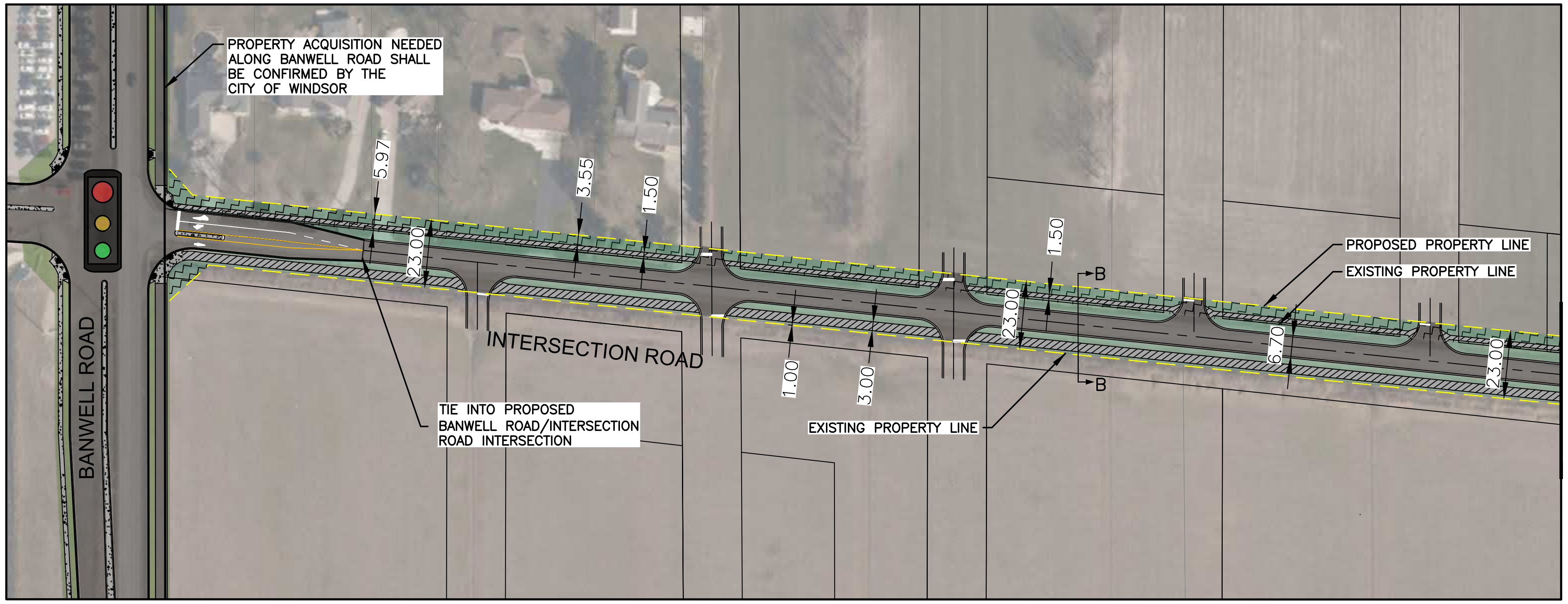
FIGURE 6.2

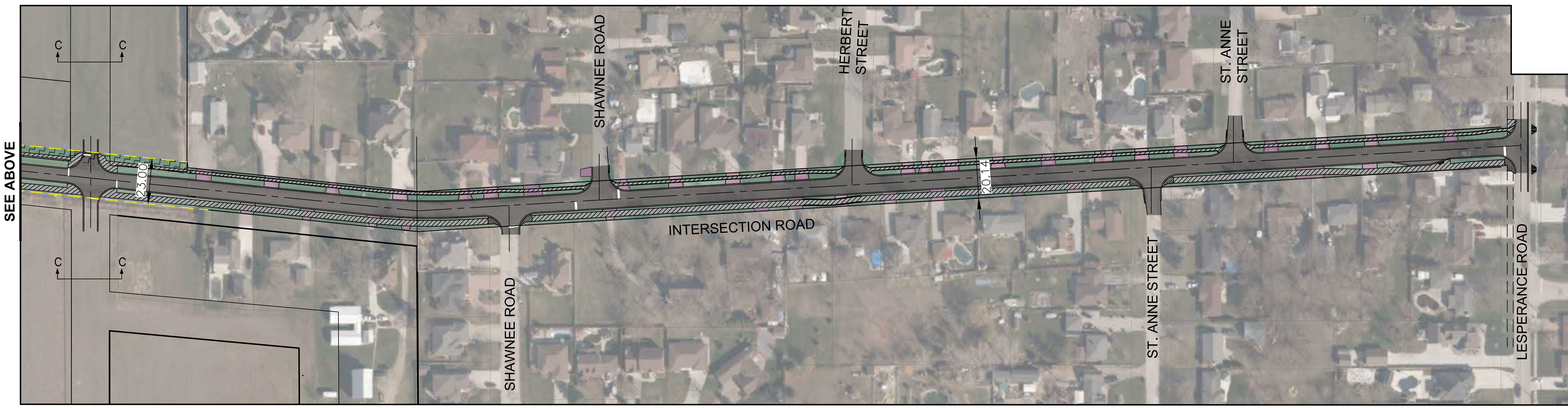
DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:1000
PROJECT: 23-5735

DATE: June 20, 2025





TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

PROPOSED ROADWAY

PLANTING ZONE

PROPOSED SIDEWALK/MULTIUSE PATH

DRIVEWAYS TO BE REINSTATED

PROPOSED RIGHT OF WAY LIMITS

PROPOSED CENTERLINE

PROPOSED CURB

STOP BARS

PROPERTY ACQUISITION

EXISTING RIGHT OF WAY LIMITS

NOTE:
REFER TO THE ACCOMPANYING ROAD CROSS SECTIONS FOR GUIDANCE ON BOTH ABOVEGROUND AND UNDERGROUND RIGHT-OF-WAY ELEMENTS. THE PROPOSED RIGHT-OF-WAY WIDTH SHOWN HEREIN TAKE PRECEDENCE OVER THE TYPICAL CROSS SECTIONS. ALL WIDTHS SHALL BE CONFIRMED THROUGH LOCAL TRAFFIC ASSESSMENTS PRIOR TO ACQUIRING PROPERTY.

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT INTERSECTION ROAD

FIGURE 6.3

TECUMSEH

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:1000
PROJECT: 23-5735

DATE: June 20, 2025

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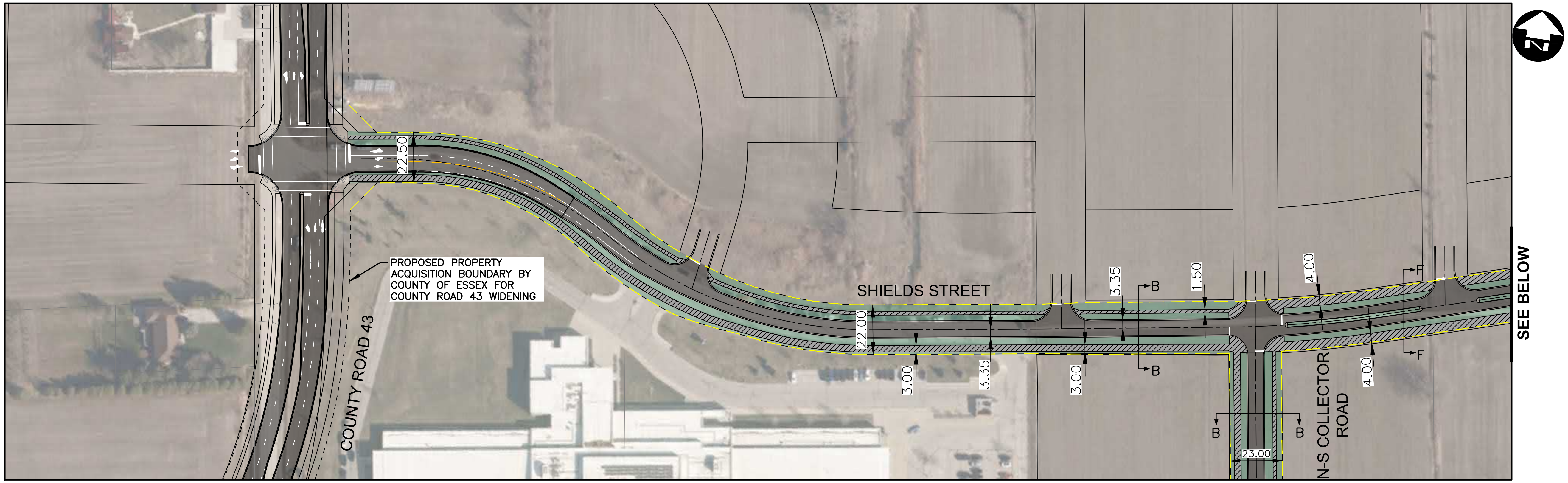

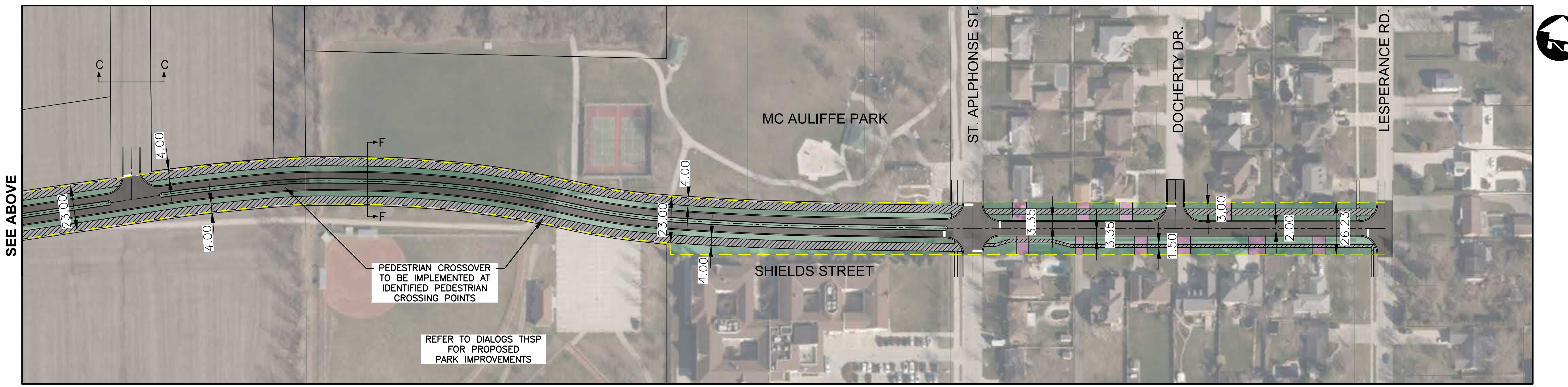

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

PROPOSED ROADWAY	PROPOSED RIGHT OF WAY LIMITS
PLANTING ZONE	PROPOSED CENTERLINE
PROPOSED SIDEWALK/MULTIUSE PATH	PROPOSED CURB
DRIVEWAYS TO BE REINSTATED	STOP BARS

NOTE:
REFER TO THE ACCOMPANYING ROAD CROSS SECTIONS FOR GUIDANCE ON BOTH ABOVEGROUND AND UNDERGROUND RIGHT-OF-WAY ELEMENTS. THE PROPOSED RIGHT-OF-WAY WIDTH SHOWN HEREIN TAKE PRECEDENCE OVER THE TYPICAL CROSS SECTIONS. ALL WIDTHS SHALL BE CONFIRMED THROUGH LOCAL TRAFFIC ASSESSMENTS PRIOR TO ACQUIRING PROPERTY.

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT SHIELDS STREET

FIGURE 6.4

TECUMSEH

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:1000
PROJECT: 23-5735

DATE: June 20, 2025

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TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT N-S COLLECTOR ROAD

FIGURE 6.5

PROPOSED ROADWAY

PLANTING ZONE

PROPOSED SIDEWALK/MULTIUSE PATH

DRIVEWAYS TO BE REINSTATED

PROPOSED RIGHT OF WAY LIMITS

PROPOSED CENTERLINE

PROPOSED CURB

STOP BARS

NOTE:
REFER TO THE ACCOMPANYING ROAD CROSS SECTIONS FOR GUIDANCE ON BOTH ABOVEGROUND AND UNDERGROUND RIGHT-OF-WAY ELEMENTS. THE PROPOSED RIGHT-OF-WAY WIDTH SHOWN HEREIN TAKE PRECEDENCE OVER THE TYPICAL CROSS SECTIONS. ALL WIDTHS SHALL BE CONFIRMED THROUGH LOCAL TRAFFIC ASSESSMENTS PRIOR TO ACQUIRING PROPERTY.

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:1000
PROJECT: 23-5735

DATE: June 20, 2025

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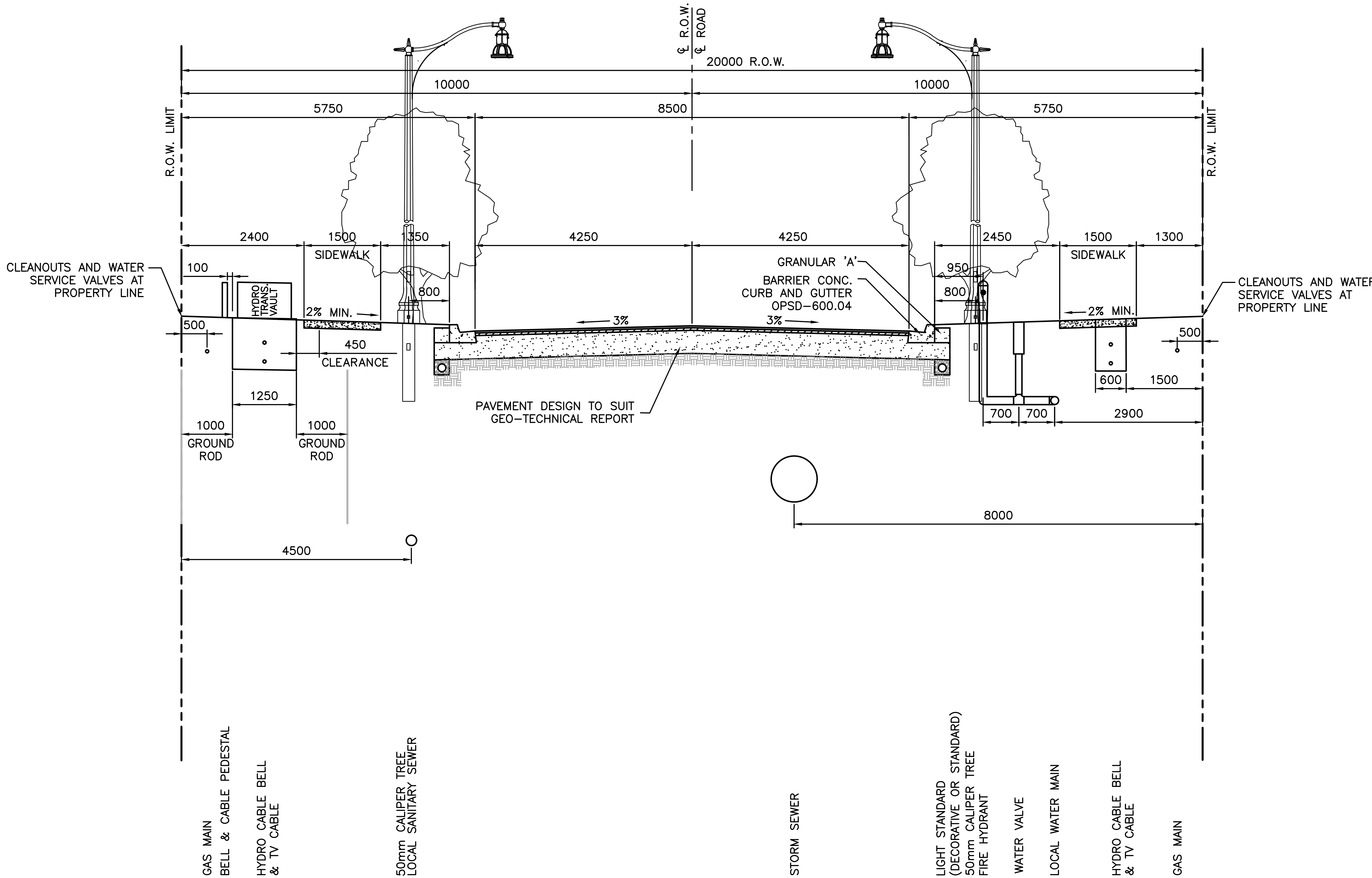

NOTE:

1. CROSS SECTIONAL DIMENSIONS SHALL BE CONFIRMED DURING DETAILED DESIGN.
2. THE EXACT SIZE AND DEPTH OF FACILITIES WILL VARY ALONG THE ALIGNMENT OF THE PROPOSED CORRIDOR.
3. COORDINATION WITH UTILITY SHALL BE UNDERTAKEN TO CONFIRM SHARED UTILITY CORRIDORS.
4. IT IS NOT ANTICIPATED THAT A HYDRO VAULT WILL BE REQUIRED WITHIN THIS CROSS SECTION. HOWEVER IF IT IS NEEDED, THE PATHWAY MUST BE SHIFTED TO ACCOMMODATE THE VAULT. HYDRO VAULT SHALL BE POSITIONED IN SUCH A WAY THAT IT IS NOT IN CONFLICT WITH STREETLIGHT AND OTHER ABOVE GROUND INFRASTRUCTURE.

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TYPICAL LOCAL ROAD CROSS SECTION 20m RIGHT OF WAY

FIGURE 6.6

(SECTION A-A)

CREATED BY: JS
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 19, 2025

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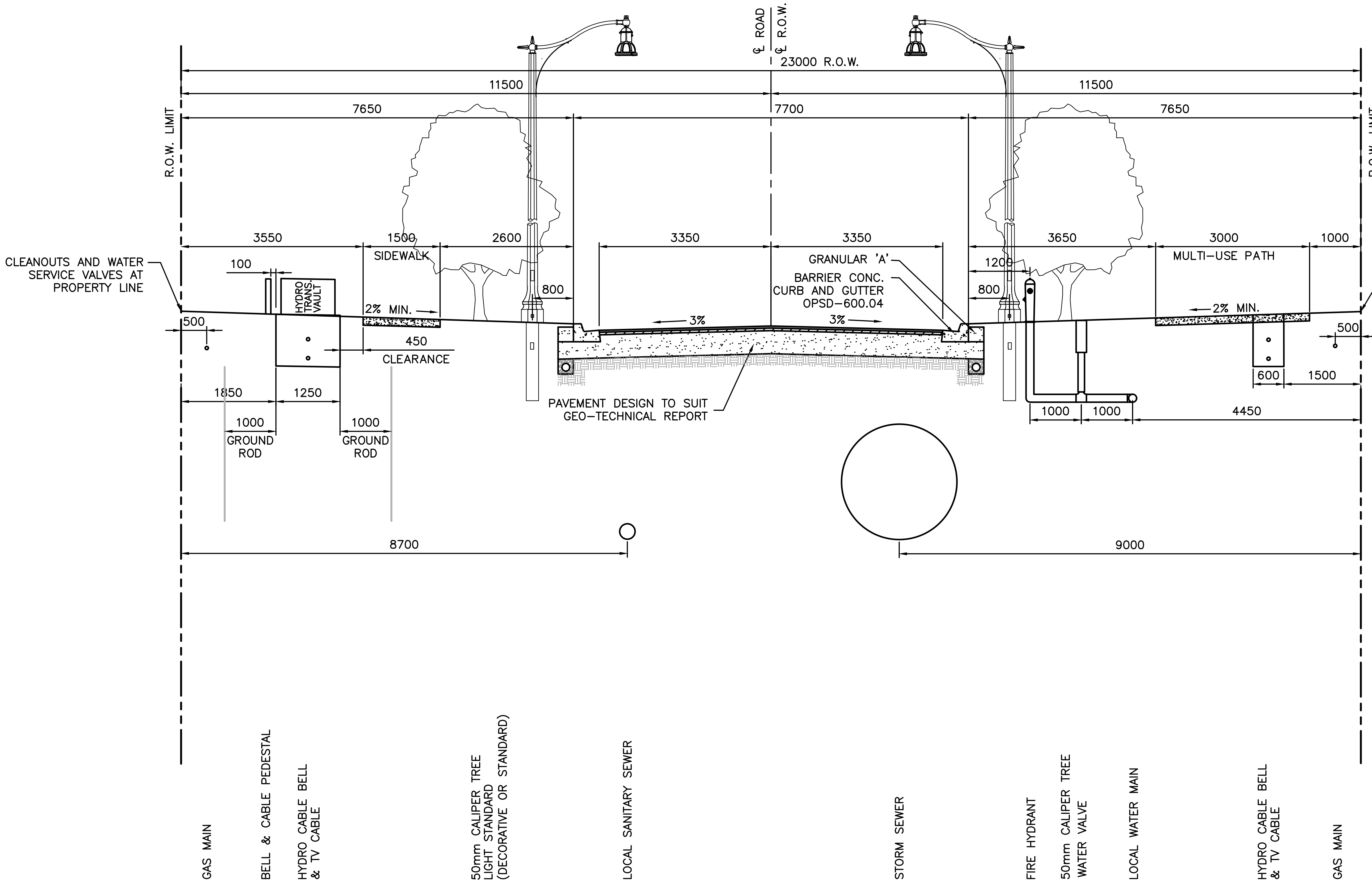

NOTE:

1. CROSS SECTIONAL DIMENSIONS SHALL BE CONFIRMED DURING DETAILED DESIGN.
2. THE EXACT SIZE AND DEPTH OF FACILITIES WILL VARY ALONG THE ALIGNMENT OF THE PROPOSED CORRIDOR.
3. COORDINATION WITH UTILITY SHALL BE UNDERTAKEN TO CONFIRM SHARED UTILITY CORRIDORS.
4. THE ROAD LANE WIDTH AND NUMBER OF LANES SHALL BE CONFIRMED BASED ON LOCAL TRAFFIC NEEDS.
5. PROVISIONS FOR PARKING AND /OR AUXILIARY LANES SHALL BE PROVIDED, AND THE RIGHT OF WAY WIDTH SHALL BE CONFIRMED.

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TYPICAL COLLECTOR ROAD CROSS SECTION 23m RIGHT OF WAY

FIGURE 6.7

(SECTION B-B)

DILLON CONSULTING

CREATED BY: JS
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 01, 2025

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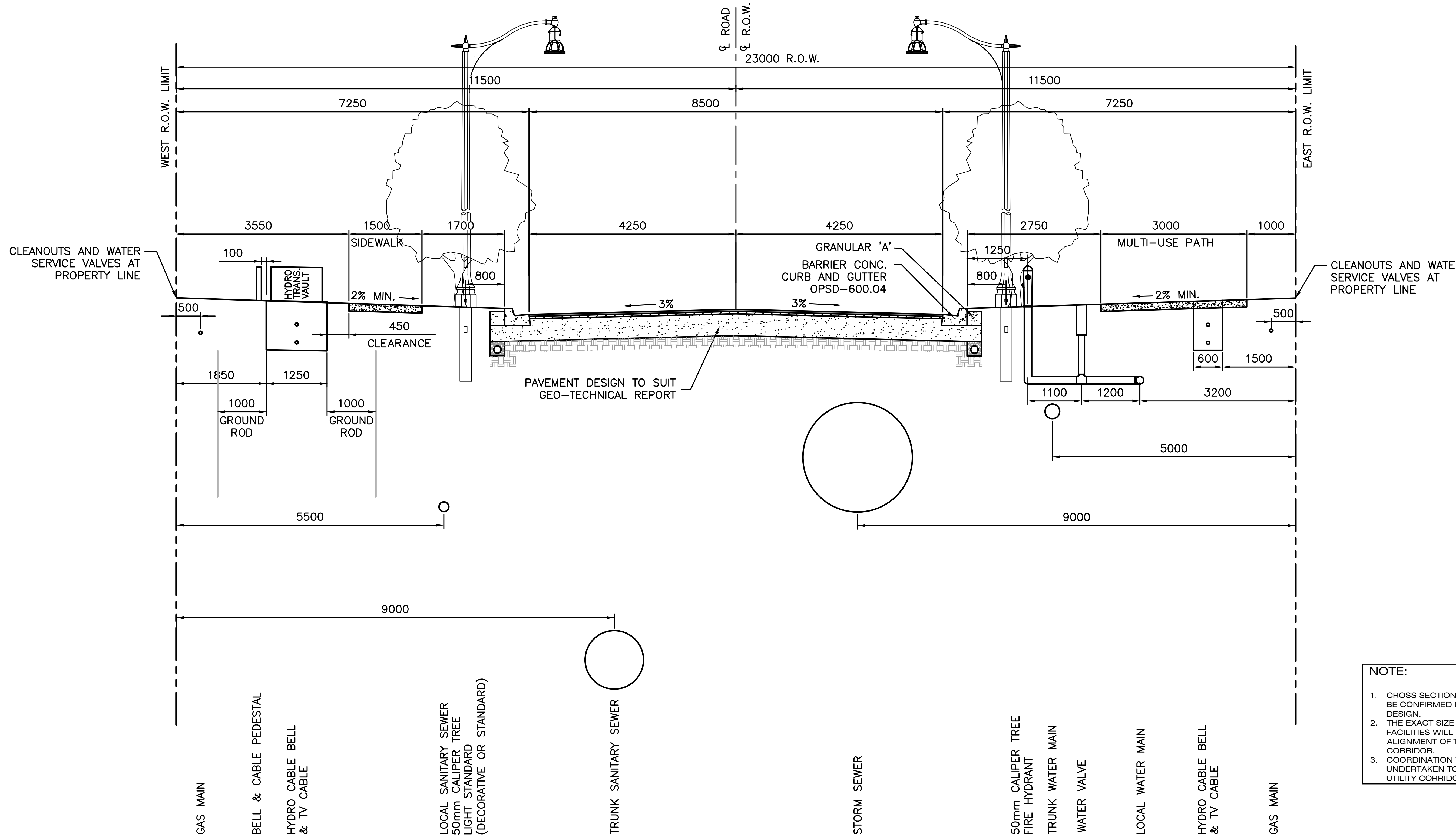

NOTE:

1. CROSS SECTIONAL DIMENSIONS SHALL BE CONFIRMED DURING DETAILED DESIGN.
2. THE EXACT SIZE AND DEPTH OF FACILITIES WILL VARY ALONG THE ALIGNMENT OF THE PROPOSED CORRIDOR.
3. COORDINATION WITH UTILITY SHALL BE UNDERTAKEN TO CONFIRM SHARED UTILITY CORRIDORS.

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TYPICAL TRUNK UTILITY CORRIDOR CROSS SECTION 23m RIGHT OF WAY

FIGURE 6.8

(SECTION C-C)

DILLON CONSULTING

CREATED BY: JS
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 01, 2025

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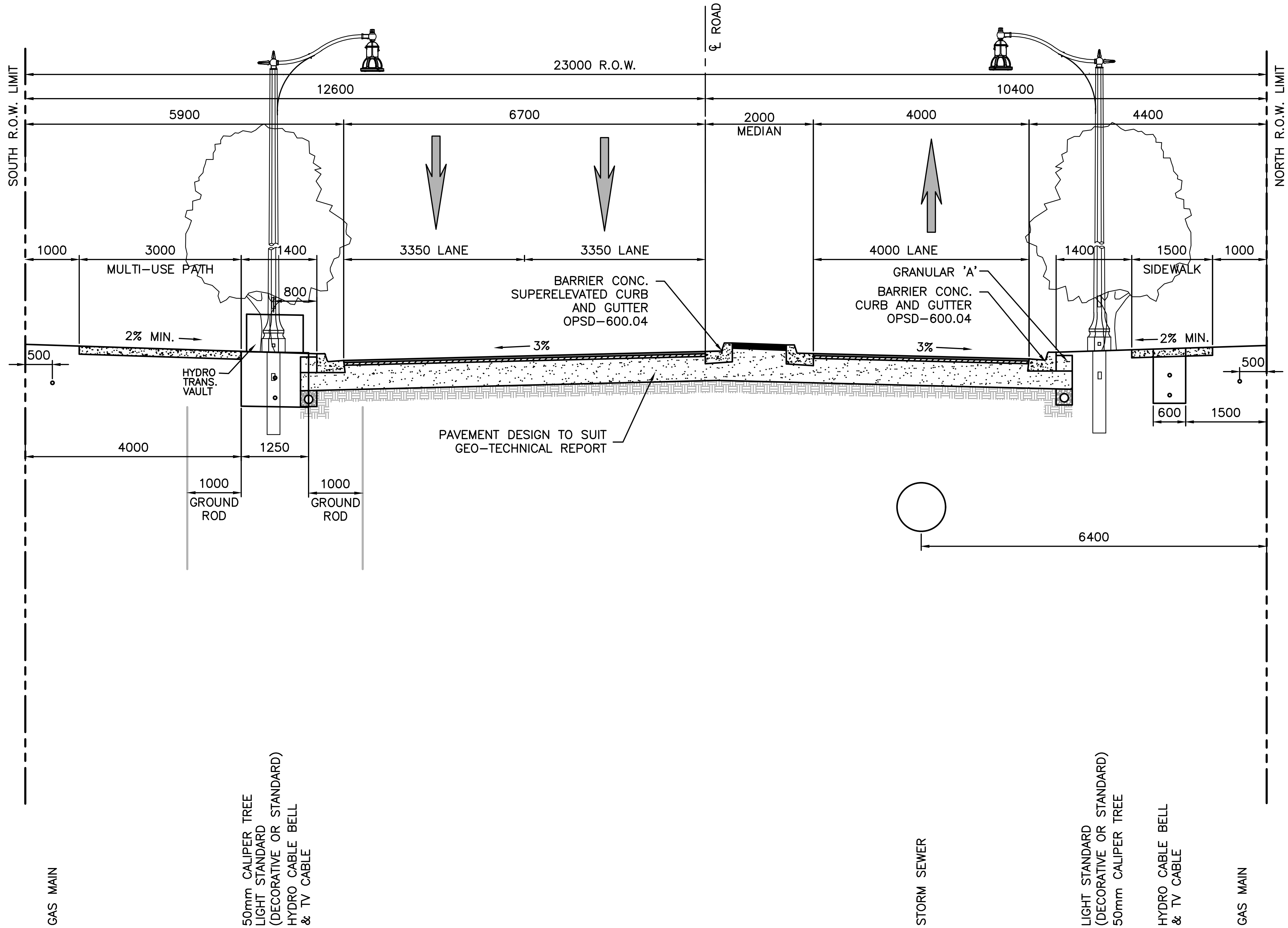

NOTE:

1. CROSS SECTIONAL DIMENSIONS SHALL BE CONFIRMED DURING DETAILED DESIGN.
2. THE EXACT SIZE AND DEPTH OF FACILITIES WILL VARY ALONG THE ALIGNMENT OF THE PROPOSED CORRIDOR.
3. COORDINATION WITH UTILITY SHALL BE UNDERTAKEN TO CONFIRM SHARED UTILITY CORRIDORS.
4. IT IS NOT ANTICIPATED THAT A HYDRO VAULT WILL BE REQUIRED WITHIN THIS CROSS SECTION. HOWEVER, IF IT IS NEEDED, THE PATHWAY MUST BE SHIFTED TO THE SOUTH TO ACCOMMODATE THE VAULT.

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

GOUIN STREET GATEWAY TYPICAL CROSS SECTION 23m RIGHT OF WAY

FIGURE 6.9

(SECTION D-D)

CREATED BY: JS
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 03, 2025

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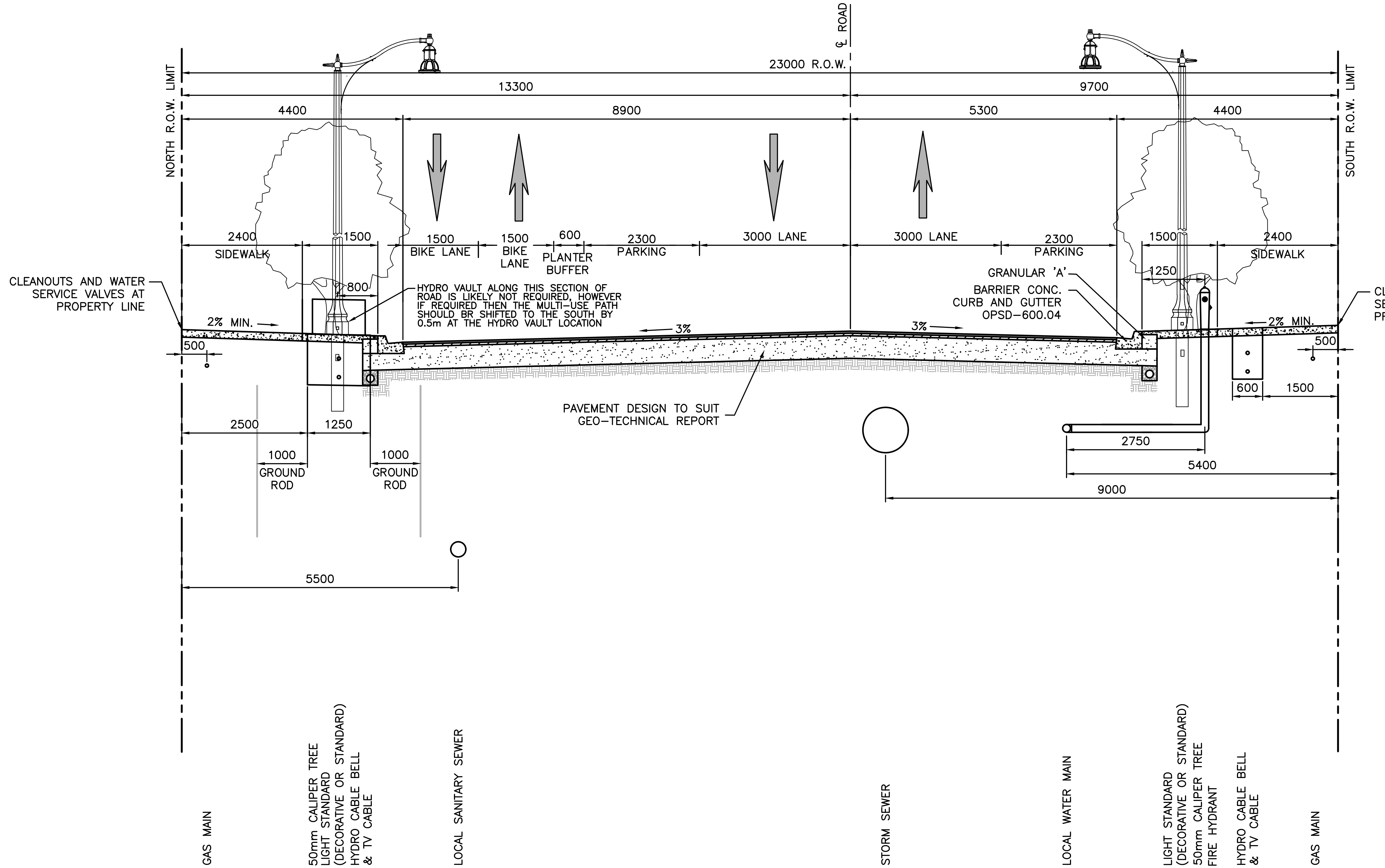

NOTE:

1. CROSS SECTIONAL DIMENSIONS SHALL BE CONFIRMED DURING DETAILED DESIGN.
2. THE EXACT SIZE AND DEPTH OF FACILITIES WILL VARY ALONG THE ALIGNMENT OF THE PROPOSED CORRIDOR.
3. COORDINATION WITH UTILITY SHALL BE UNDERTAKEN TO CONFIRM SHARED UTILITY CORRIDORS.

(SECTION E-E)

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

MAISONNEUVE (MAIN STREET) STREET TYPICAL CROSS SECTION

FIGURE 6.10

DILLON CONSULTING

CREATED BY: JS
CHECKED BY: LMH

SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 01, 2025

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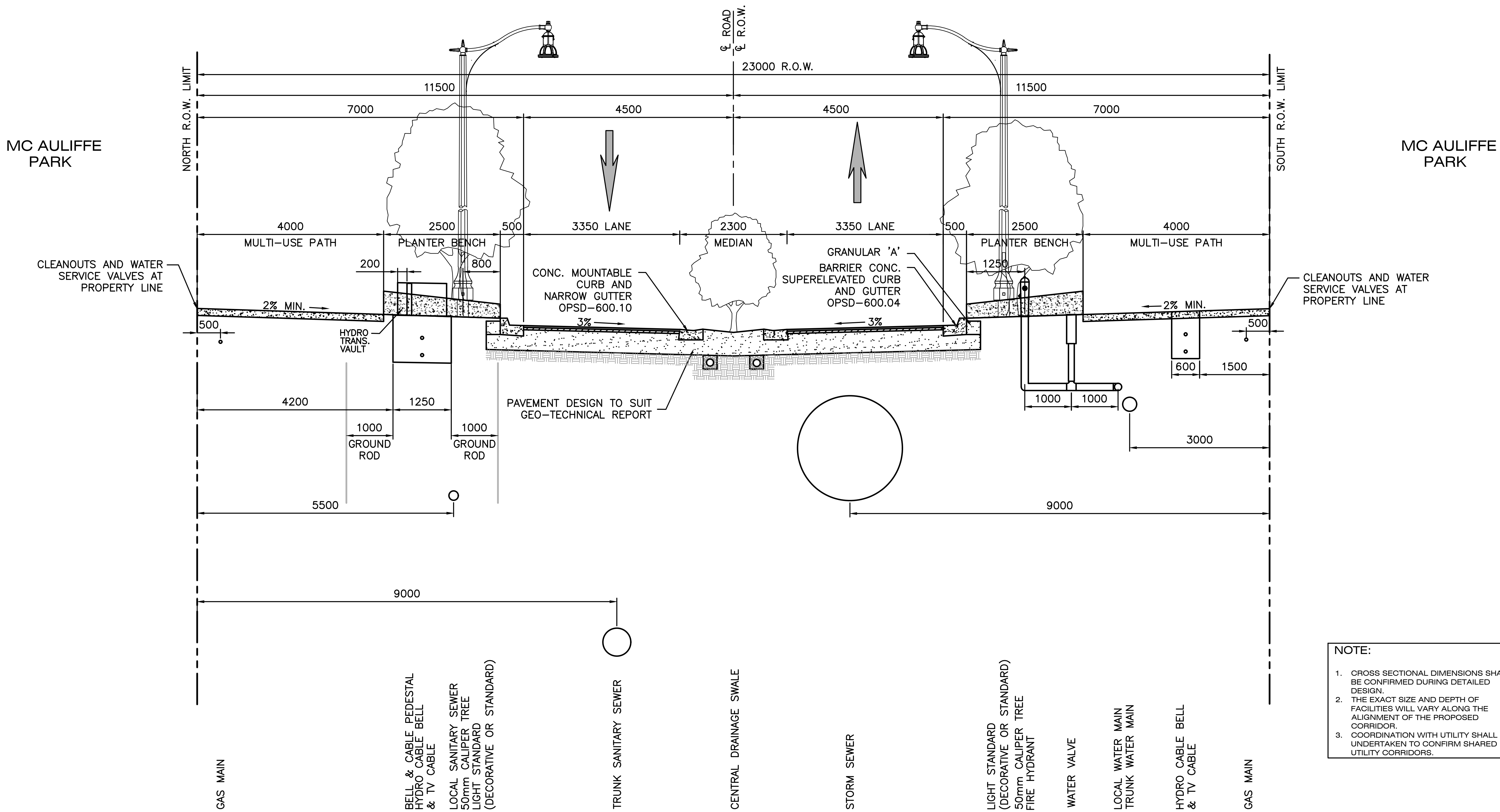


NOTE:

1. CROSS SECTIONAL DIMENSIONS SHALL BE CONFIRMED DURING DETAILED DESIGN.
2. THE EXACT SIZE AND DEPTH OF FACILITIES WILL VARY ALONG THE ALIGNMENT OF THE PROPOSED CORRIDOR.
3. COORDINATION WITH UTILITY SHALL BE UNDERTAKEN TO CONFIRM SHARED UTILITY CORRIDORS.

(SECTION F-F)

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

SHIELDS STREET TYPICAL CROSS SECTION

FIGURE 6.11

CREATED BY: JS
CHECKED BY: LMH

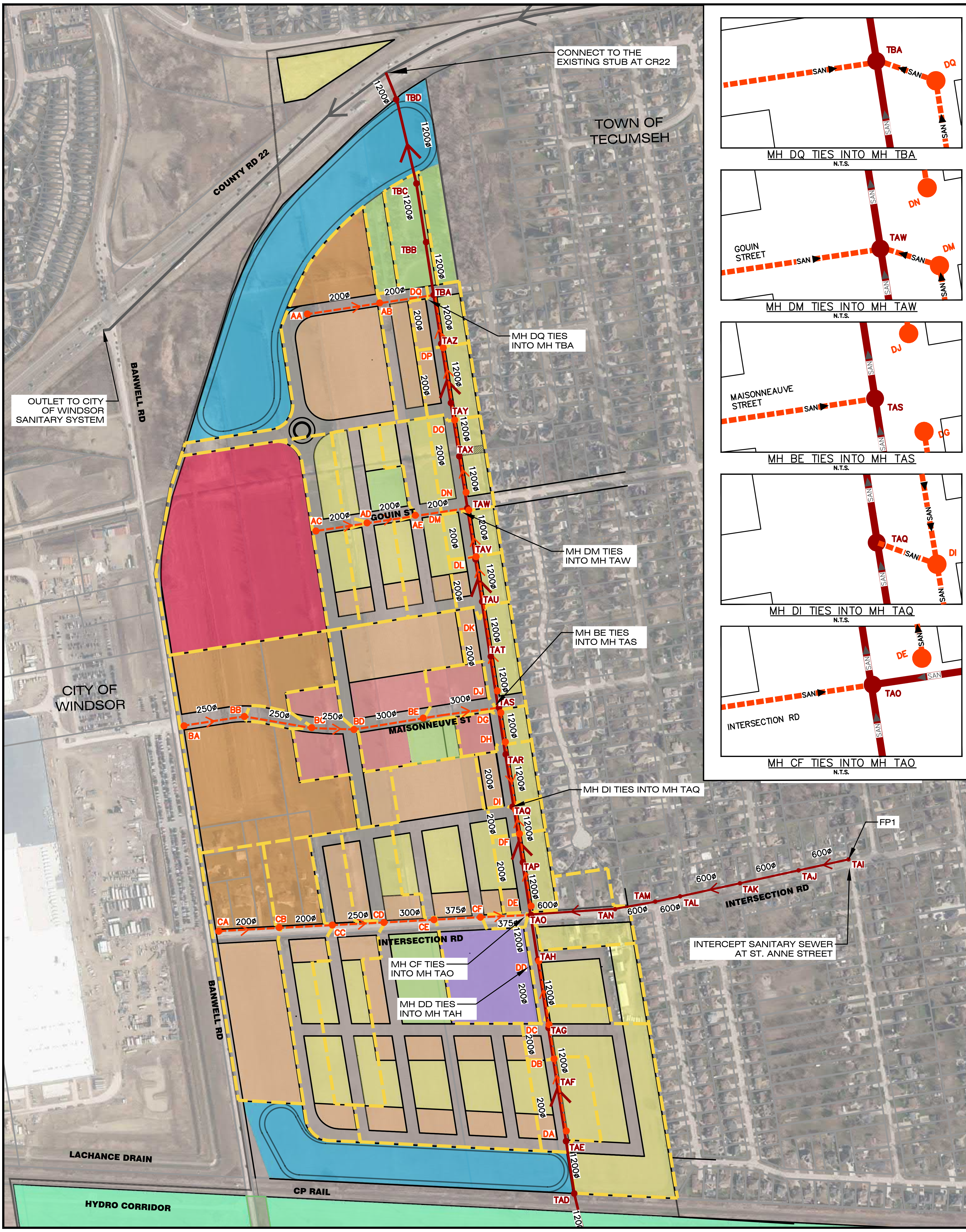
SCALE: N.T.S.
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 01, 2025

File Location: c:\pw working directory\projects 2020\dillon_32js\dms18944\202559-02-typ-fig.dwg May, 01, 2025 3:10 PM

Appendix A

Sanitary Sewer Design Calculations and Layout



LEGEND

LOW DENSITY RESIDENTIAL	BUSINESS PARK
MEDIUM DENSITY RESIDENTIAL	PARK SPACE
HIGH DENSITY RESIDENTIAL	NATURAL HERITAGE / WOODLOT
MAIN STREET MIXED-USE	ENVIRONMENTALLY PROTECTED AREA
ANCHOR COMMERCIAL	MAJOR INFRASTRUCTURE EASEMENT
PLAZA COMMERCIAL	EXISTING SANITARY SEWER
INSTITUTIONAL / CEMETERY	PROPOSED SANITARY TRUNK
HYDRO CORRIDOR	PROPOSED SANITARY SUBTRUNK
	SUBTRUNK DRAINAGE BOUNDARY

1200ø PROPOSED SANITARY DIAMETER
TAF PROPOSED SANITARY TRUNK MANHOLE
DB PROPOSED SANITARY SUBTRUNK MANHOLE
PROPOSED SANITARY TRUNK MANHOLE
PROPOSED SANITARY SUBTRUNK MANHOLE

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

SANITARY SEWER FUNCTIONAL DESIGN - NORTH OF CP RAILWAY

APPENDIX A-1

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 16, 2025

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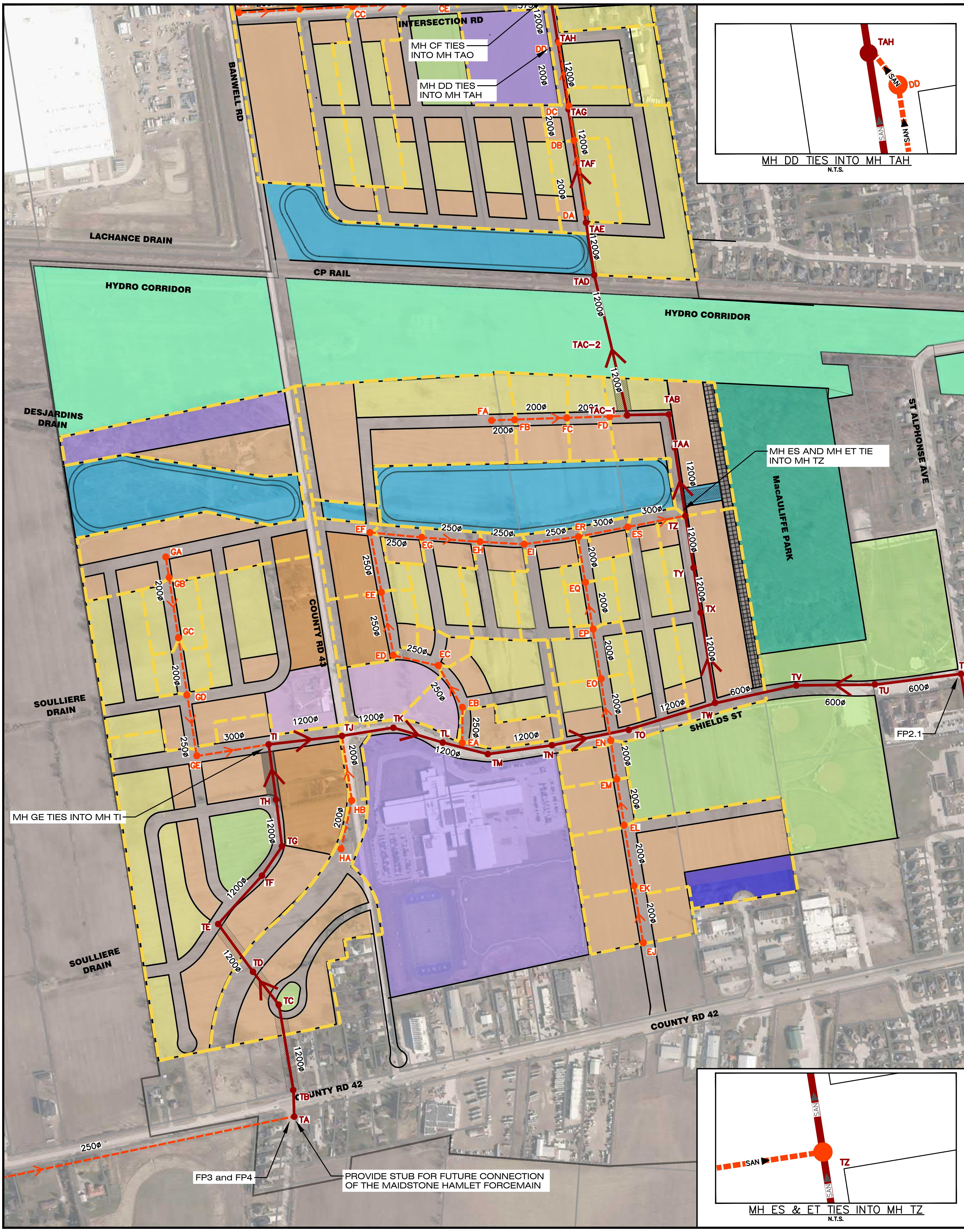

LEGEND

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MAIN STREET MIXED-USE
- ANCHOR COMMERCIAL
- PLAZA COMMERCIAL
- INSTITUTIONAL / CEMETERY
- HYDRO CORRIDOR
- BUSINESS PARK
- PARK SPACE
- NATURAL HERITAGE / WOODLOT
- ENVIRONMENTALLY PROTECTED AREA
- MAJOR INFRASTRUCTURE EASEMENT
- EXISTING SANITARY SEWER
- PROPOSED SANITARY TRUNK
- PROPOSED SANITARY SUBTRUNK
- SUBTRUNK DRAINAGE BOUNDARY
- 1200ø PROPOSED SANITARY DIAMETER
- TAF PROPOSED SANITARY TRUNK MANHOLE
- DB PROPOSED SANITARY SUBTRUNK MANHOLE
- PROPOSED SANITARY TRUNK MANHOLE
- PROPOSED SANITARY SUBTRUNK MANHOLE

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

SANITARY SEWER FUNCTIONAL DESIGN - SOUTH OF CP RAILWAY

APPENDIX A-2

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

DATE: May 16, 2025

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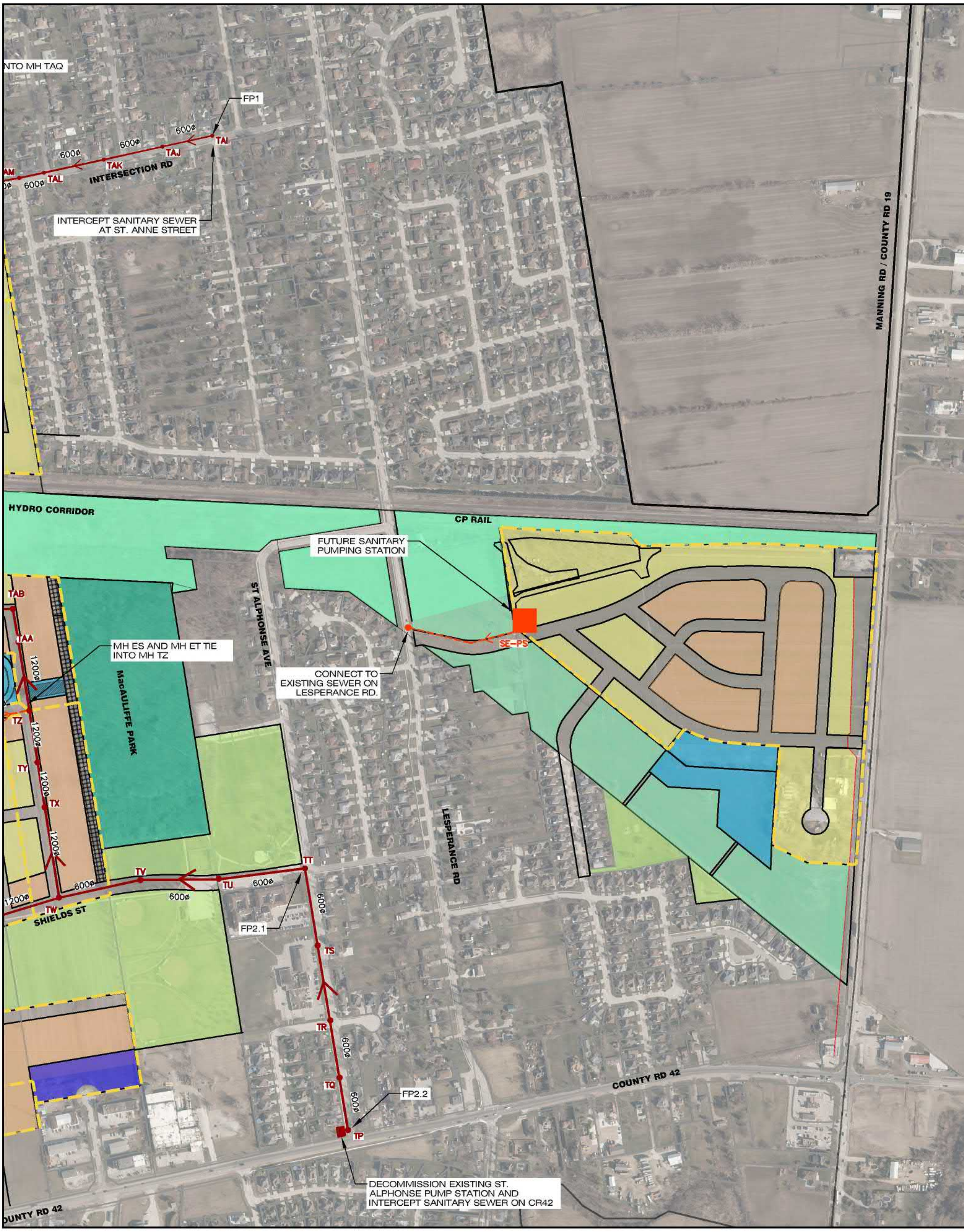

LEGEND

LOW DENSITY RESIDENTIAL	BUSINESS PARK
MEDIUM DENSITY RESIDENTIAL	PARK SPACE
HIGH DENSITY RESIDENTIAL	NATURAL HERITAGE / WOODLOT
MAIN STREET MIXED-USE	ENVIRONMENTALLY PROTECTED AREA
ANCHOR COMMERCIAL	MAJOR INFRASTRUCTURE EASEMENT
PLAZA COMMERCIAL	EXISTING SANITARY SEWER
INSTITUTIONAL / CEMETERY	PROPOSED SANITARY TRUNK
HYDRO CORRIDOR	PROPOSED SANITARY SUBTRUNK
	SUBTRUNK DRAINAGE BOUNDARY

1200ø PROPOSED SANITARY DIAMETER
TAF PROPOSED SANITARY TRUNK MANHOLE
DB PROPOSED SANITARY SUBTRUNK MANHOLE
PROPOSED SANITARY TRUNK MANHOLE
PROPOSED SANITARY SUBTRUNK MANHOLE
PROPOSED SANITARY PUMP STATION

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

SANITARY SEWER FUNCTIONAL DESIGN - SOUTHEAST HAMLET

APPENDIX A-3

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

DILLON CONSULTING

N W E S

DATE: May 23, 2025

File Location: c:\pw working directory\projects 2020\dillon_32js\dms18944\202559-02-swp-des.dwg May, 23, 2025 9:29 AM

Tecumseh Hamlet Secondary Plan Area
Functional Design Report
Sanitary Sewer Design Sheet

Project Name: Tecumseh Hamlet
Project No: 23-5735
Town of Tecumseh

The Peaking Factor was derived:
Using Harmon Formula= Y (Y or N)
From a Table= N
Value from table=

Average Daily Domestic Flow= 300 L/Cap.D
Peak Extraneous Flow= 0.280 L/Ha.S

Outlet Invert Elevation= 171.910
Mannings 'n'= 0.013
Total Area= 253.343

Basement Floor Elevation =
or
Hydraulic Grade Line Cover = 2.40

Ground Elevation at Outlet = 183.210
HGL at Outlet = 173.110

Location: ROAD/STN	LOCATION FROM MH	LOCATION TO MH	INDIVIDUAL POP	INDIVIDUAL AREA (ha.)	CUMULATIVE POP	CUMULATIVE AREA (ha.)	PEAKING FACTOR M	POP FLOW Q(p) (L/s)	PEAK EXTR. FLOW Q(i) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE DIA. (mm)	Wall Thickness (mm)	SLOPE (%)	UPPER INVERT (m)	LOWER INVERT (m)	FALL (m)	VELOCITY (m/s)	DROP IN LOWER MANHOLE (m)	Ground Elevation Upper MH	Cover @ Up MH (m)	Cover @ Low MH (m)	HGL Elev at Upstream MH	HGL Elev vs. Grnd Elev @ Up MH	HGL Elev vs. Obvert @ Up MH
CR42	FP4	MH TA	817	24.33	817	24.33	3.855	10.942	6.812	**17.75**	**31.47**	806.0	250	15	0.28	180.221	177.964	2.257	0.64	1.500	183.550	3.064	5.321	174.114	OKAY	HGL INTERSECTS OBVERT
MAIDSTONE PS	FP3	MH TA		0.00	18044	0.00	2.697	169.001	0.000	**169.00**	**0.00**		FUTURE PROJECT													
TRUNK	MH TA	MH TB	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	42.9	1200	127	0.04	176.464	176.447	0.017	0.69	0.030	183.550	5.759	5.776	173.395	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TB	MH TC	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	141.9	1200	127	0.04	176.417	176.360	0.057	0.69	0.060	183.550	5.806	5.935	173.394	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TC	MH TD	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	68.6	1200	127	0.04	176.300	176.273	0.027	0.69	0.030	183.622	5.995	6.022	173.391	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TD	MH TE	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	97.0	1200	127	0.04	176.243	176.204	0.039	0.69	0.060	183.622	6.052	6.024	173.390	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TE	MH TF	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	107.7	1200	127	0.04	176.144	176.101	0.043	0.69	0.030	183.555	6.084	6.015	173.388	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TF	MH TG	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	58.4	1200	127	0.04	176.071	176.048	0.023	0.69	0.060	183.443	6.045	6.013	173.385	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TG	MH TH	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	77.7	1200	127	0.04	175.988	175.956	0.031	0.69	0.030	183.388	6.073	6.032	173.384	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TH	MH TI	0	0.00	18861	24.33	2.678	175.389	6.812	**182.20**	**779.75**	101.3	1200	127	0.04	175.926	175.886	0.041	0.69	0.060	183.315	6.062	6.011	173.382	OKAY	HGL INTERSECTS OBVERT
SUB_G.1	MH GA	MH GB	324	7.04	324	7.04	4.064	4.577	1.971	**6.55**	**22.00**	39.1	200	12	0.45	178.775	178.599	0.176	0.70	0.030	182.739	3.752	3.944	173.775	OKAY	HGL INTERSECTS OBVERT
SUB_G.2	MH GB	MH GC	85	0.99	409	8.03	4.017	5.710	2.248	**7.96**	**22.00**	102.2	200	12	0.45	178.569	178.109	0.460	0.70	0.030	182.755	3.974	4.486	173.759	OKAY	HGL INTERSECTS OBVERT
SUB_G.3	MH GC	MH GD	53	0.65	462	8.68	3.992	6.406	2.429	**8.84**	**22.00**	98.9	200	12	0.45	178.079	177.634	0.445	0.70	0.030	182.807	4.516	5.011	173.699	OKAY	HGL INTERSECTS OBVERT
SUB_G.4	MH GD	MH GE	693	8.45	1155	17.12	3.759	15.071	4.794	**19.87**	**34.16**	78.4	250	18	0.33	177.604	177.345	0.259	0.70	0.060	182.857	4.985	5.370	173.627	OKAY	HGL INTERSECTS OBVERT
SUB_G.5	MH GE	MH TI	1034	13.63	2189	30.76	3.555	27.016	8.612	**35.63**	**45.36**	117.9	300	18	0.22	177.285	177.026	0.259	0.64	1.200	182.983	5.380	5.880	173.540	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TI	MH TJ	0	0.00	21050	55.09	2.630	192.241	15.424	**207.67**	**779.75**	120.7	1200	127	0.04	175.826	175.778	0.048	0.69	0.030	183.224	6.071	6.376	173.380	OKAY	HGL INTERSECTS OBVERT
SUB_H.1	MH HA	MH HB	188	18.19	188	18.19	4.157	2.720	5.094	**7.81**	**22.00**	80.0	200	12	0.45	179.410	179.050	0.360	0.70	0.060	183.467	3.845	4.213	173.492	OKAY	HGL INTERSECTS OBVERT
SUB_H.2	MH HB	MH TJ	0	0.43	188	18.62	4.157	2.720	5.215	**7.93**	**22.00**	120.4	200	12	0.45	178.990	178.448	0.542	0.70	2.700	183.475	4.273	4.821	173.447	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TJ	MH TK	0	0.00	21238	73.71	2.626	193.675	20.639	**214.31**	**779.75**	87.5	1200	127	0.04	175.748	175.713	0.035	0.69	0.060	183.481	6.406	6.259	173.377	OKAY	HGL INTERSECTS OBVERT
TEC. VISTA	EX.	MH TM	2300	13.39	2300	13.39	3.538	28.253	3.748	**32.00**	**36.15**	21.0	200	12	1.22	180.902	180.647	0.255	1.15	5.150	183.080	1.966	2.000	173.569	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TK	MH TL	0	0.00	21238	73.71	2.626	193.675	20.639	**214.31**	**779.75**	86.8	1200	127	0.04	175.653	175.618	0.035	0.69	0.030	183.299	6.319	6.082	173.374	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TL	MH TM	0	0.00	21238	73.71	2.626	193.675	20.639	**214.31**	**779.75**	76.6	1200	127	0.04	175.588	175.557	0.031	0.69	0.060	183.027	6.112	5.975	173.371	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TM	MH TN	0	0.00	23538	87.10	2.582	210.998	24.387	**235.39**	**779.75**	106.1	1200	127	0.04	175.497	175.455	0.042	0.69	0.030	182.859	6.035	5.936	173.369	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TN	MH TO	0	0.00	23538	87.10	2.582	210.998	24.387	**235.39**	**779.75**	128.1	1200	127	0.04	175.425	175.374	0.051	0.69	0.030	182.718	5.966	6.127	173.365	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TO	MH TW	0	0.00	23538	87.10	2.582	210.998	24.387	**235.39**	**779.75**	148.5	1200	127	0.04	175.344	175.284	0.059	0.69	0.030	182.828	6.157	6.319	173.360	OKAY	HGL INTERSECTS OBVERT
SHIELDS	FP2.1	MH TT	101	4.75	101	4.75	4.243	1.485	1.330	**2.81**	**31.32**	111.8	250	15	0.28	180.450	180.140	0.310	0.64	4.317	183.100	2.385	2.665	173.427	OKAY	HGL INTERSECTS OBVERT
ST. ALPHONSE	FP2.2	MH TP	3815	119.05	3815	119.05	3.352	44.396	33.334	**77.73**	**212.70**	13.8	600	24	0.12	176.495	176.478	0.017	0.75	0.030	183.070	5.951	5.968	173.496	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TP	MH TQ	0	0.00	3815	119.05	3.352	44.396	33.334	**77.73**	**203.64**	87.1	600	25	0.11	176.448	176.352	0.096	0.72	0.030	183.070	5.997	6.093	173.494	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TQ	MH TR	0	0.00	3815	119.05	3.352	44.396	33.334	**77.73**	**203.64**	93.4	600	25	0.11	176.322	176.220	0.103	0.72	0.030	183.070	6.123	6.225	173.480	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TR	MH TS	0	0.00	3815	119.05	3.352	44.396	33.334	**77.73**	**203.64**	124.5	600	25	0.11	176.190	176.053	0.137	0.72	0.030	183.070	6.255	6.392	173.465	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TS	MH TT	0	0.00	3815	119.05	3.352	44.396	33.334	**77.73**	**203.64**	127.3	600	25	0.11	176.023	175.883	0.140	0.72	0.060	183.070	6.422	6.562	173.445	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TT	MH TU	0	0.00	3916	123.80	3.342	45.432	34.664	**80.10**	**203.64**	142.4	600	25	0.11	175.823	175.666	0.157	0.72	0.030	183.070	6.622	6.809	173.424	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TU	MH TV	0	0.00	3916	123.80	3.342	45.432	34.664	**80.10**	**203.64**	129.0	600	25	0.11	175.636	175.494	0.142	0.72	0.030	183.100	6.839	6.931	173.400	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TV	MH TW	0	0.00	3916	123.80	3.342	45.432	34.664	**80.10**	**203.64**	136.4	600	25	0.11	175.464	175.314	0.150	0.72	0.060	183.050	6.961	6.991	173.378	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TW	MH TX	0	0.00	27454	210.90	2.515	239.766	59.051	**298.82**	**779.75**	150.0	1200	127	0.04	175.254	175.194	0.060	0.69	0.030	182.930	6.349	6.291	173.355	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TX	MH TY	0	0.00	27454	210.90	2.515	239.766	59.051	**298.82**	**779.75**	74.5	1200	127	0.04	175.164	175.134	0.030	0.69	0.030	182.812	6.321	6.288	173.346	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TY	MH TZ	0	0.00	27454	210.90	2.515	239.766	59.051	**298.82**	**779.75**	86.0	1200	127	0.04	175.104	175.070	0.034	0.69	0.030	182.749	6.318	6.290	173.342	OKAY	HGL INTERSECTS OBVERT
SUB_E.1	MH EA	MH EB	54	0.82	54	0.82	4.308	0.810	0.229	**1.04**	**22.00**	55.0	200	12	0.45	179.010	178.763	0.247	0.70	0.060	182.906	3.684	3.867	173.864	OKAY	HGL INTERSECTS OBVERT
SUB_E.2	MH EB	MH EC	181	2.50	235	3.32	4.121	3.369	0.929	**4.30**	**22.00**	81.0	200	12	0.45	178.703	178.339	0.365	0.70	0.060	182.842	3.927	5.224	173.863	OKAY	HGL INTERSECTS OBVERT
SUB_E.3	MH EC	MH ED	95	1.78	331	5.09	4.060	4.663	1.426	**6.09**	**22.00**	76.1	200	12	0.45	178.279	177.936	0.343	0.70	0.060	183.775	5.284	5.616	173.849	OKAY	HGL INTERSECTS OBVERT
SUB_E.4	MH ED	MH EE	181	1.49	512	6.58	3.969	7.058	1.843	**8.90**	**22.00**	105.0	200	12	0.45	177.876	177.403	0.473	0.70	0.030	183.764	5.676	5.073	173.823	OKAY	HGL INTERSECTS OBVERT
SUB_E.5	MH EE	MH EF	150	1.42	662	8.00	3.908	8.982	2.240	**11.22**	**34.16**	98.2	250	15	0.33	177.373	177.049	0.324	0.70	0.060	182.688	5.050	5.317	173.746	OKAY	HGL INTERSECTS OBVERT
SUB_E.6	MH EF	MH EG	21	0.41	683	8.41	3.901	9.249	2.355	**11.60**	**34.16**	85.0	250	15	0.33	176.989	176.709	0.281	0.70	0.030	182.631	5.377	5.592	173.711	OKAY	HGL INTERSECTS OBVERT
SUB_E.7	MH EG	MH EH	92	1.47	775	9.88	3.869	10.405	2.767	**13.17**	**34.16**	84.7	250	15	0.33	176.679	176.399	0.280	0.70	0.030	182.566	5.622	5.857	173.678	OKAY	HGL INTERSECTS OBVERT
SUB_E.8	MH EH	MH EI	86	1.43	861	11.32	3.841	11.478	3.169	**14.65**	**34.16**	84.5	250	15	0.33	176.369	176.090	0.279	0.70	0.030	182.521	5.887	6.132	173.637	OKAY	HGL INTERSECTS OBVERT
SUB_E.9	MH EI	MH ER	85	1.49	946	12.81	3.815	12.533	3.585	**16.12**	**34.16**	88.1	250	15	0.33	176.060	175.770	0.291	0.70	0.030	182.487	6.162	6.515	173.585	OKAY	HGL INTERSECTS OBVERT

January 2025

Tecumseh Hamlet Secondary Plan Area
Functional Design Report
Sanitary Sewer Design Sheet

Project Name: Tecumseh Hamlet
Project No: 23-5735
Town of Tecumseh

The Peaking Factor was derived:
Using Harmon Formula= Y (Y or N)
From a Table= N
Value from table=

Average Daily Domestic Flow= 300 L/Cap.D
Peak Extraneous Flow= 0.280 L/Ha.S

Outlet Invert Elevation= 171.910
Mannings 'n'= 0.013
Total Area= 253.343

Basement Floor Elevation =
or
Hydraulic Grade Line Cover = 2.40

Ground Elevation at Outlet = 183.210
HGL at Outlet = 173.110

Location			Flow Characteristics								Sewer Design/Profile										Cover			Hydraulic Grade Line		
ROAD/STN	LOCATION FROM MH	LOCATION TO MH	INDIVIDUAL POP	INDIVIDUAL AREA (ha.)	CUMULATIVE POP	CUMULATIVE AREA (ha.)	PEAKING FACTOR M	POP FLOW Q(p) (L/s)	PEAK EXTR. FLOW Q(i) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE DIA. (mm)	Wall Thickness (mm)	SLOPE (%)	UPPER INVERT (m)	LOWER INVERT (m)	FALL (m)	VELOCITY (m/s)	DROP IN LOWER MANHOLE (m)	Ground Elevation Upper MH	Cover @ Up MH (m)	Cover @ Low MH (m)	HGL Elev at Upstream MH	HGL Elev vs. Grnd Elev @ Up MH	HGL Elev vs. Obvert @ Up MH
SUB_E.10	MH EJ	MH EK	107	1.52	107	1.52	4.235	1.574	0.424	**2.00**	**22.00**	94.5	200	12	0.45	179.040	178.614	0.425	0.70	0.030	183.070	3.818	4.179	174.029	OKAY	HGL INTERSECTS OBVERT
SUB_E.11	MH EK	MH EL	235	4.68	342	6.20	4.053	4.820	1.735	**6.55**	**22.00**	88.0	200	12	0.45	178.584	178.188	0.396	0.70	0.030	183.005	4.209	4.514	174.025	OKAY	HGL INTERSECTS OBVERT
SUB_E.12	MH EL	MH EM	56	0.86	398	7.06	4.023	5.566	1.976	**7.54**	**22.00**	88.3	200	12	0.45	178.158	177.761	0.398	0.70	0.030	182.914	4.544	4.879	173.990	OKAY	HGL INTERSECTS OBVERT
SUB_E.13	MH EM	MH EN	40	0.71	438	7.77	4.003	6.094	2.175	**8.27**	**22.00**	79.8	200	12	0.45	177.731	177.372	0.359	0.70	0.030	182.852	4.909	5.222	173.943	OKAY	HGL INTERSECTS OBVERT
SUB_E.14	MH EN	MH EO	82	1.40	520	9.17	3.965	7.160	2.568	**9.73**	**22.00**	87.4	200	12	0.45	177.342	176.949	0.393	0.70	0.030	182.806	5.252	5.566	173.892	OKAY	HGL INTERSECTS OBVERT
SUB_E.15	MH EO	MH EP	74	1.04	594	10.21	3.935	8.111	2.858	**10.97**	**22.00**	84.6	200	12	0.45	176.919	176.538	0.381	0.70	0.030	182.727	5.596	5.910	173.816	OKAY	HGL INTERSECTS OBVERT
SUB_E.16	MH EP	MH EQ	49	0.60	643	10.80	3.916	8.741	3.025	**11.77**	**22.00**	75.4	200	12	0.45	176.508	176.169	0.339	0.70	0.030	182.660	5.940	6.224	173.721	OKAY	HGL INTERSECTS OBVERT
SUB_E.17	MH EQ	MH ER	22	0.35	665	11.16	3.907	9.024	3.124	**12.15**	**22.00**	75.3	200	12	0.45	176.139	175.800	0.339	0.70	0.060	182.605	6.254	6.538	173.624	OKAY	HGL INTERSECTS OBVERT
SUB_E.18	MH ER	MH ES	21	0.42	1632	24.38	3.653	20.701	6.826	**27.53**	**49.31**	84.1	300	18	0.26	175.740	175.521	0.219	0.70	0.030	182.550	6.492	6.779	173.521	OKAY	HGL INTERSECTS OBVERT
SUB_E.19	MH ES	MH TZ	347	7.06	1979	31.44	3.589	24.666	8.802	**33.47**	**49.31**	96.6	300	18	0.26	175.491	175.240	0.251	0.70	0.200	182.618	6.809	7.129	173.453	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TZ	MH TAA	0	0.00	29433	242.33	2.485	254.002	67.853	**321.86**	**779.75**	113.4	1200	127	0.04	175.040	174.995	0.045	0.69	0.030	182.687	6.320	6.638	173.337	OKAY	HGL INTERSECTS OBVERT
SUB_F.1	MH FA	MH FB	415	5.61	415	5.61	4.014	5.787	1.569	**7.36**	**22.00**	37.5	200	12	0.45	178.408	178.239	0.169	0.70	0.030	182.712	4.092	4.243	173.523	OKAY	HGL INTERSECTS OBVERT
SUB_F.2	MH FB	MH FC	110	1.31	525	6.91	3.963	7.222	1.936	**9.16**	**22.00**	86.5	200	12	0.45	178.209	177.820	0.389	0.70	0.030	182.694	4.273	4.751	173.505	OKAY	HGL INTERSECTS OBVERT
SUB_F.3	MH FC	MH FD	75	0.94	600	7.85	3.932	8.193	2.198	**10.39**	**22.00**	70.0	200	12	0.45	177.790	177.475	0.315	0.70	0.030	182.783	4.781	5.166	173.437	OKAY	HGL INTERSECTS OBVERT
SUB_F.4	MH FD	MH TAC	189	3.16	790	11.01	3.864	10.592	3.083	**13.68**	**22.00**	26.5	200	12	0.45	177.445	177.325	0.119	0.70	2.500	182.853	5.196	5.380	173.367	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAA	MH TAB	0	0.00	29433	242.33	2.485	254.002	67.853	**321.86**	**779.75**	55.5	1200	127	0.04	174.965	174.942	0.022	0.69	0.060	182.960	6.668	6.851	173.329	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAB	MH TAC	0	0.00	29433	242.33	2.485	254.002	67.853	**321.86**	**779.75**	67.9	1200	127	0.04	174.882	174.855	0.027	0.69	0.030	183.120	6.911	6.735	173.325	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAC	MH TAD	0	0.00	30223	253.34	2.474	259.629	70.936	**330.57**	**3019.95**	236.5	1200	127	0.60	174.825	173.406	1.419	2.67	0.120	182.917	6.765	7.804	173.321	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAD	MH TAE	0	0.00	30223	253.34	2.474	259.629	70.936	**330.57**	**779.75**	87.0	1200	127	0.04	173.286	173.251	0.035	0.69	0.030	182.537	7.924	7.775	173.304	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAE	MH TAF	0	0.00	30223	253.34	2.474	259.629	70.936	**330.57**	**779.75**	95.1	1200	127	0.04	173.221	173.183	0.038	0.69	0.030	182.353	7.805	7.869	173.297	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAF	MH TAG	0	0.00	30223	253.34	2.474	259.629	70.936	**330.57**	**779.75**	92.8	1200	127	0.04	173.153	173.116	0.037	0.69	0.030	182.379	7.899	7.960	173.291	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAG	MH TAH	0	0.00	30223	253.34	2.474	259.629	70.936	**330.57**	**779.75**	113.2	1200	127	0.04	173.086	173.041	0.045	0.69	0.030	182.403	7.990	8.068	173.284	OKAY	HGL INTERSECTS OBVERT
SUB_D.1	MH DA	MH DB	116	1.43	116	1.43	4.226	1.699	0.402	**2.10**	**22.00**	120.0	200	12	0.45	178.606	178.066	0.540	0.70	0.030	182.357	3.539	4.112	173.431	OKAY	HGL INTERSECTS OBVERT
SUB_D.2	MH DB	MH DC	374	4.47	490	5.90	3.979	6.768	1.653	**8.42**	**22.00**	56.3	200	12	0.45	178.036	177.783	0.253	0.70	0.030	182.390	4.142	4.411	173.426	OKAY	HGL INTERSECTS OBVERT
SUB_D.3	MH DC	MH DD	137	2.01	627	7.92	3.922	8.540	2.216	**10.76**	**22.00**	105.3	200	12	0.45	177.753	177.279	0.474	0.70	0.060	182.406	4.441	4.944	173.389	OKAY	HGL INTERSECTS OBVERT
TRUNK TIE-IN	MH DD	MH TAH	0	0.00	627	7.92	3.922	8.540	2.216	**10.76**	**78.41**	4.0	375	18	0.20	177.219	177.211	0.008	0.71	4.200	182.435	4.823	4.832	173.276	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAH	MH TAO	0	0.00	30850	261.26	2.465	264.079	73.152	**337.23**	**779.75**	74.5	1200	127	0.04	173.011	172.981	0.030	0.69	0.030	182.436	8.098	8.150	173.276	OKAY	HGL INTERSECTS OBVERT
SUB_C.1	MH CA	MH CB	443	4.43	443	4.43	4.001	6.151	1.240	**7.39**	**22.00**	96.0	200	12	0.45	177.740	177.308	0.432	0.70	0.030	182.645	4.693	5.013	173.615	OKAY	HGL INTERSECTS OBVERT
SUB_C.2	MH CB	MH CC	331	2.85	774	7.28	3.869	10.395	2.037	**12.43**	**22.00**	79.8	200	12	0.45	177.278	176.919	0.359	0.70	0.030	182.533	5.043	5.280	173.567	OKAY	HGL INTERSECTS OBVERT
SUB_C.3	MH CC	MH CD	231	3.65	1005	10.92	3.799	13.250	3.059	**16.31**	**34.16**	96.1	250	15	0.33	176.889	176.572	0.317	0.70	0.030	182.411	5.257	5.567	173.452	OKAY	HGL INTERSECTS OBVERT
SUB_C.4	MH CD	MH CE	409	8.73	1414	19.66	3.698	18.151	5.504	**23.65**	**49.31**	80.4	300	18	0.26	176.542	176.333	0.209	0.70	0.030	182.404	5.544	5.771	173.380	OKAY	HGL INTERSECTS OBVERT
SUB_C.5	MH CE	MH CF	774	6.20	2188	25.86	3.555	27.007	7.239	**34.25**	**78.41**	80.4	375	18	0.20	176.303	176.142	0.161	0.71	0.030	182.422	5.726	5.904	173.332	OKAY	HGL INTERSECTS OBVERT
SUB_C.5	MH CF	MH TAO	0	0.17	2188	26.02	3.555	27.007	7.286	**34.29**	**78.41**	80.4	375	18	0.20	176.112	175.951	0.161	0.71	3.000	182.439	5.934	6.114	173.301	OKAY	HGL INTERSECTS OBVERT
SE Hamlet	PS	MH TAI	1378	18.71	1378	18.71	3.706	17.732	5.239	**22.97**	**0.00**		FUTURE PROJECT													
FP1	MH TAI	MH TAJ	397	25.37	1775	44.08	3.626	22.345	12.341	**34.69**	**194.17**	83.0	600	25	0.10	178.431	178.348	0.083	0.69	0.030	182.400	3.344	3.427	173.291	OKAY	HGL INTERSECTS OBVERT
Intersection	MH TAJ	MH TAK	21	0.93	1796	45.00	3.622	22.590	12.601	**35.19**	**194.17**	100.0	600	25	0.10	178.318	178.218	0.100	0.69	0.030	182.400	3.457	3.557	173.289	OKAY	HGL INTERSECTS OBVERT
Intersection	MH TAK	MH TAL	18	1.15	1815	46.16	3.618	22.799	12.924	**35.72**	**194.17**	100.0	600	25	0.10	178.188	178.088	0.100	0.69	0.030	182.400	3.587	3.687	173.285	OKAY	HGL INTERSECTS OBVERT
Intersection	MH TAL	MH TAM	46	3.01	1861	49.16	3.610	23.321	13.765	**37.09**	**194.17**	42.0	600	25	0.10	178.058	178.016	0.042	0.69	0.030	182.400	3.717	3.759	173.282	OKAY	HGL INTERSECTS OBVERT
Intersection	MH TAM	MH TAN	232	9.01	2093	58.17	3.570	25.943	16.288	**42.23**	**194.17**	67.0	600	25	0.10	177.986	177.919	0.067	0.69	0.030	182.400	3.789	3.856	173.280	OKAY	HGL INTERSECTS OBVERT
Intersection	MH TAN	MH TAO	74	1.49	2167	59.66	3.559	26.769	16.706	**43.48**	**194.17**	137.6	600	25	0.10	177.889	177.751	0.138	0.69	4.800	182.400	3.886	4.082	173.277	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAO	MH TAP	0	0.00	35204	346.95	2.409	294.517	97.145	**391.66**	**779.75**	87.3	1200	127	0.04	172.951	172.916	0.035	0.69	0.030	182.458	8.180	8.199	173.270	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAP	MH TAQ	0	0.00	35204	346.95	2.409	294.517	97.145	**391.66**	**779.75**	78.5	1200	127	0.04	172.886	172.855	0.031	0.69	0.030	182.442	8.229	8.240	173.261	OKAY	HGL INTERSECTS OBVERT

January 2025

Tecumseh Hamlet Secondary Plan Area
Functional Design Report
Sanitary Sewer Design Sheet

Project Name: Tecumseh Hamlet
Project No: 23-5735
Town of Tecumseh

The Peaking Factor was derived:
Using Harmon Formula= Y (Y or N)
From a Table= N
Value from table=

Average Daily Domestic Flow= 300 L/Cap.D
Peak Extraneous Flow= 0.280 L/Ha.S

Outlet Invert Elevation= 171.910
Mannings 'n'= 0.013
Total Area= 253.343

Basement Floor Elevation =
or
Hydraulic Grade Line Cover = 2.40

Ground Elevation at Outlet = 183.210
HGL at Outlet = 173.110

Location			Flow Characteristics								Sewer Design/Profile										Cover			Hydraulic Grade Line		
	LOCATION		INDIVIDUAL		CUMULATIVE		PEAKING	POP FLOW	PEAK EXTR.	PEAK DESIGN				Wall												
ROAD/STN	FROM MH	TO MH	POP	AREA (ha.)	POP	AREA (ha.)	FACTOR M	Q(p) (L/s)	FLOW Q(i) (L/s)	FLOW Q(d) (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE DIA. (mm)	Thickness (mm)	SLOPE (%)	UPPER INVERT (m)	LOWER INVERT (m)	FALL (m)	VELOCITY (m/s)	DROP IN LOWER MANHOLE (m)	Ground Elevation Upper MH	Cover @ Up MH (m)	Cover @ Low MH (m)	HGL Elev at Upstream MH	HGL Elev vs. Grnd Elev @ Up MH	HGL Elev vs. Obvert @ Up MH
SUB_D.4	MH DE	MH DF	96	1.15	96	1.15	4.249	1.411	0.322	**1.73**	**22.00**	120.0	200	12	0.45	179.570	179.030	0.540	0.70	0.030	182.456	2.674	3.190	173.259	OKAY	HGL INTERSECTS OBVERT
SUB_D.5	MH DF	MH DI	31	0.44	127	1.59	4.214	1.860	0.446	**2.31**	**22.00**	28.2	200	12	0.45	179.000	178.873	0.127	0.70	0.030	182.432	3.220	3.336	173.256	OKAY	HGL INTERSECTS OBVERT
SUB_D.6	MH DG	MH DH	125	0.72	125	0.72	4.215	1.835	0.201	**2.04**	**22.00**	48.3	200	12	0.45	179.710	179.492	0.217	0.70	0.030	182.389	2.467	2.696	173.269	OKAY	HGL INTERSECTS OBVERT
SUB_D.7	MH DH	MH DI	68	0.90	193	1.62	4.153	2.788	0.455	**3.24**	**22.00**	124.3	200	12	0.45	179.462	178.903	0.559	0.70	0.060	182.400	2.726	3.306	173.267	OKAY	HGL INTERSECTS OBVERT
TRUNK TIE-IN	MH DI	MH TAQ	0	0.00	320	3.22	4.066	4.524	0.901	**5.42**	**22.00**	4.0	200	12	0.45	178.843	178.825	0.018	0.70	6.000	182.421	3.366	3.385	173.255	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAQ	MH TAR	0	0.00	35525	350.16	2.406	296.728	98.046	**394.77**	**779.75**	100.6	1200	127	0.04	172.825	172.785	0.040	0.69	0.030	182.422	8.270	8.293	173.254	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAR	MH TAS	0	0.00	35525	350.16	2.406	296.728	98.046	**394.77**	**779.75**	77.4	1200	127	0.04	172.755	172.724	0.031	0.69	0.030	182.405	8.323	8.337	173.243	OKAY	HGL INTERSECTS OBVERT
SUB_B.1	MH BA	MH BB	1287	7.27	1287	7.27	3.727	16.658	2.036	**18.69**	**34.16**	100.0	250	15	0.33	178.057	177.727	0.330	0.70	0.060	182.299	3.977	4.286	173.783	OKAY	HGL INTERSECTS OBVERT
SUB_B.2	MH BB	MH BC	0	0.24	1287	7.51	3.727	16.658	2.102	**18.76**	**34.16**	112.0	250	15	0.33	177.667	177.298	0.370	0.70	0.060	182.278	4.346	4.697	173.684	OKAY	HGL INTERSECTS OBVERT
SUB_B.3	MH BC	MH BD	293	1.96	1580	9.47	3.663	20.099	2.650	**22.75**	**34.16**	69.4	250	15	0.33	177.238	177.009	0.229	0.70	0.060	182.260	4.757	5.016	173.573	OKAY	HGL INTERSECTS OBVERT
SUB_B.4	MH BD	MH BE	472	4.15	2052	13.62	3.577	25.485	3.812	**29.30**	**49.31**	115.1	300	18	0.26	176.949	176.649	0.299	0.70	0.030	182.290	5.023	5.371	173.471	OKAY	HGL INTERSECTS OBVERT
SUB_B.5	MH BE	MH TAS	151	0.83	2203	14.44	3.553	27.173	4.044	**31.22**	**49.31**	125.3	300	18	0.26	176.619	176.294	0.326	0.70	3.600	182.338	5.401	5.776	173.366	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAS	MH TAT	0	0.00	37727	364.60	2.380	311.822	102.089	**413.91**	**779.75**	85.1	1200	127	0.04	172.694	172.660	0.034	0.69	0.030	182.388	8.367	8.385	173.235	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAT	MH TAU	0	0.00	37727	364.60	2.380	311.822	102.089	**413.91**	**779.75**	91.0	1200	127	0.04	172.630	172.593	0.036	0.69	0.030	182.372	8.415	8.433	173.226	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAU	MH TAV	0	0.00	37727	364.60	2.380	311.822	102.089	**413.91**	**779.75**	70.2	1200	127	0.04	172.563	172.535	0.028	0.69	0.030	182.353	8.463	8.478	173.215	OKAY	HGL INTERSECTS OBVERT
SUB_D.8	MH DJ	MH DK	85	1.24	85	1.24	4.263	1.254	0.347	**1.60**	**22.00**	120.0	200	12	0.45	178.025	177.485	0.540	0.70	0.030	182.390	4.153	4.673	173.216	OKAY	HGL INTERSECTS OBVERT
SUB_D.9	MH DK	MH DL	51	0.74	135	1.98	4.205	1.978	0.554	**2.53**	**22.00**	102.9	200	12	0.45	177.455	176.992	0.463	0.70	0.030	182.370	4.703	5.116	173.213	OKAY	HGL INTERSECTS OBVERT
SUB_D.10	MH DL	MH DM	57	0.67	192	2.65	4.154	2.772	0.741	**3.51**	**22.00**	77.3	200	12	0.45	176.962	176.614	0.348	0.70	0.060	182.320	5.146	5.514	173.207	OKAY	HGL INTERSECTS OBVERT
TRUNK TIE-IN	MH DM	MH TAW	0	0.00	192	2.65	4.154	2.772	0.741	**3.51**	**34.16**	4.0	250	15	0.33	176.554	176.541	0.013	0.70	4.100	182.340	5.521	5.515	173.198	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAV	MH TAW	0	0.00	37727	364.60	2.380	311.822	102.089	**413.91**	**779.75**	85.1	1200	127	0.04	172.505	172.471	0.034	0.69	0.030	182.340	8.508	8.523	173.207	OKAY	HGL INTERSECTS OBVERT
SUB_A.1	MH AA	MH AB	440	5.19	440	5.19	4.002	6.118	1.452	**7.57**	**22.00**	120.1	200	12	0.45	177.652	177.112	0.540	0.70	0.030	182.162	4.298	4.893	173.284	OKAY	HGL INTERSECTS OBVERT
SUB_A.2	MH AB	MH TBA	43	2.25	483	7.43	3.982	6.676	2.080	**8.76**	**22.00**	89.4	200	12	0.45	177.082	176.680	0.402	0.70	4.500	182.217	4.923	5.357	173.220	OKAY	HGL INTERSECTS OBVERT
SUB_A.3	STUB	MH AC	255	7.85	255	7.85	4.108	3.633	2.198	**5.83**	**22.00**	14.9	200	12	0.45	176.701	176.634	0.067	0.70	0.030	182.224	5.311	5.378	173.462	OKAY	HGL INTERSECTS OBVERT
SUB_A.4	MH AC	MH AD	85	1.78	340	9.64	4.055	4.790	2.698	**7.49**	**22.00**	73.0	200	12	0.45	176.604	176.276	0.328	0.70	0.030	182.224	5.408	5.770	173.457	OKAY	HGL INTERSECTS OBVERT
SUB_A.5	MH AD	MH AE	152	2.77	493	12.40	3.978	6.803	3.473	**10.28**	**22.00**	80.5	200	12	0.45	176.246	175.883	0.362	0.70	0.030	182.258	5.800	6.196	173.419	OKAY	HGL INTERSECTS OBVERT
SUB_A.6	MH AE	MH TAW	156	2.30	648	14.70	3.914	8.810	4.116	**12.93**	**22.00**	91.6	200	12	0.45	175.853	175.441	0.412	0.70	3.000	182.291	6.226	6.668	173.340	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAW	MH TAX	0	0.00	38568	381.95	2.371	317.537	106.946	**424.48**	**779.75**	86.0	1200	127	0.04	172.441	172.407	0.034	0.69	0.030	182.321	8.553	8.570	173.198	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAX	MH TAY	0	0.00	38568	381.95	2.371	317.537	106.946	**424.48**	**779.75**	88.6	1200	127	0.04	172.377	172.341	0.035	0.69	0.030	182.304	8.600	8.619	173.188	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAY	MH TAZ	0	0.00	38568	381.95	2.371	317.537	106.946	**424.48**	**779.75**	98.5	1200	127	0.04	172.311	172.272	0.039	0.69	0.030	182.287	8.649	8.668	173.177	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TAZ	MH TBA	0	0.00	38568	381.95	2.371	317.537	106.946	**424.48**	**779.75**	80.8	1200	127	0.04	172.242	172.210	0.032	0.69	0.030	182.267	8.698	8.712	173.166	OKAY	HGL INTERSECTS OBVERT
SUB_D.11	MH DN	MH DO	97	1.34	97	1.34	4.247	1.427	0.376	**1.80**	**22.00**	120.0	200	12	0.45	177.280	176.740	0.540	0.70	0.030	182.315	4.823	5.338	173.184	OKAY	HGL INTERSECTS OBVERT
SUB_D.12	MH DO	MH DP	73	1.01	169	2.35	4.174	2.453	0.658	**3.11**	**22.00**	120.0	200	12	0.45	176.710	176.170	0.540	0.70	0.030	182.290	5.368	5.868	173.181	OKAY	HGL INTERSECTS OBVERT
SUB_D.13	MH DP	MH DQ	54	0.81	223	3.16	4.130	3.202	0.885	**4.09**	**22.00**	84.9	200	12	0.45	176.140	175.758	0.382	0.70	0.060	182.250	5.898	6.296	173.170	OKAY	HGL INTERSECTS OBVERT
TRUNK TIE-IN	MH DQ	MH TBA	0	0.00	223	3.16	4.130	3.202	0.885	**4.09**	**22.00**	4	200	12	0.45	175.698	175.680	0.018	0.70	3.500	182.266	6.356	6.357	173.157	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TBA	MH TBB	0	0.00	39274	392.54	2.364	322.320	109.911	**432.23**	**779.75**	87.6	1200	127	0.04	172.180	172.145	0.035	0.69	0.030	182.249	8.742	9.012	173.156	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TBB	MH TBC	0	0.00	39274	392.54	2.364	322.320	109.911	**432.23**	**779.75**	97.5	1200	127	0.04	172.115	172.076	0.039	0.69	0.030	182.484	9.042	9.397	173.145	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TBC	MH TBD	0	0.00	39274	392.54	2.364	322.320	109.911	**432.23**	**779.75**	141.6	1200	127	0.04	172.046	171.989	0.057	0.69	0.060	182.800	9.427	9.712	173.133	OKAY	HGL INTERSECTS OBVERT
TRUNK	MH TBD	TH335	0	0.00	39274	392.54	2.364	322.320	109.911	**432.23**	**779.75**	47.3	1200	127	0.04	171.929	171.910	0.019	0.69	0.060	183.028	9.772	9.973	173.116	OKAY	OKAY

FUTURE PROJECT AREAS
UNDER RAILWAY TRACKS

NOTE: REFER TO "Tecumseh Hamlet – Outlet Capacity Analysis Technical Memo" (2024) FOR CONFIRMATION OF THE SANITARY SYSTEM HYDRAULIC DESIGN

Tecumseh Hamlet Secondary Plan Area
Functional Design Report
Design Sheet Calculations

	Design Crietia						
	Unit Quantities		GFA (ha)		Population Density (Note 2)		Flexibility Factor (+20%) (Note 4)
			% Coverage	# of Storeys			
Low Density Residential (Note 3)	30	units / net Ha	n/a		3.054	persons / unit	120%
Medium Density Residential	35	units / net Ha	n/a		1.947	persons / unit	
High Density Residential	100	units / net Ha	n/a		1.594	persons / unit	
Mixed-Use Residential	94.12	units / net Ha	55%	2	1.594	persons / unit	
Commercial: Main Street	n/a		55%	1	93.3	persons / Ha GFA	
Commercial: Anchor	n/a		30%	1			
Commercial: Plaza	n/a		30%	2			
Institutional (Note 6)	n/a		n/a		Tecumseh Vista = 2300 persons Proposed Elementary School = 500 persons Cemetery = 0 persons		

Notes:
1. Net Area, GFA and unit quantity assumptions were provided to us by Dialog
2. The population densities were provided by the Town of Tecumseh based on Development Charges Update Study (May 2022) by Watson & Associates for the Town of Tecumseh
3. Low density residential areas are permitted to develop at a density of 20 units / net Ha, however to provide flexibility and consider future infill such as ARUs, a density of 30 units / net Ha was used.
4. A flexibility factor of 20% was added onto the total populations to account for future variability in design criteria or insitu conditions. This factor was not added onto the existing development areas.
5. Net areas were measured off of the CAD Land Use Plan provided by Dialog and do not include right-of-ways
6. Institutional populations do not include the 20% flexibility factor

Drainage Area	FROM MH	TO MH	Low Density Residential		Medium Density Residential		High Density Residential		Mixed-Use Residential (Above Main Street)			Commercial			Institutional		Open Space - Parks	Open Space - NH/Woodlot
			Net Area (ha)	Population	Net Area (ha)	Population	Net Area (ha)	Population	Net Area (ha)	GFA (ha)	Population	Net Area (ha)	GFA (ha)	Population	Net Area (ha)	Population	Net Area (ha)	Net Area (ha)
SUB_A.1	MH AA	MH AB	0.00	0	2.39	196	1.28	244	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_A.2	MH AB	MH DQ	0.00	0	0.52	43	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	1.12
SUB_A.3	STUB	MH AC	0.00	0	0.00	0	0.00	0	0.00	0.00	0	7.58	2.27	255	0.00	0	0.00	0.00
SUB_A.4	MH AC	MH AD	0.69	76	0.12	10	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_A.5	MH AD	MH AE	1.21	133	0.24	20	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.40	0.00
SUB_A.6	MH AE	MH DM	1.24	136	0.24	20	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
TOTAL SUB_A			3.13	344	3.52	288	1.28	244	0.00	0.00	0	7.58	2.27	255	0.00	0	0.40	1.12
SUB_B.1	MH BA	MH BB	0.00	0	0.00	0	6.73	1287	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_B.2	MH BB	MH BC	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_B.3	MH BC	MH BD	0.00	0	0.38	31	0.00	0	1.01	1.11	199	1.01	0.56	62	0.00	0	0.00	0.00
SUB_B.4	MH BD	MH BE	0.00	0	1.72	140	0.00	0	1.28	1.40	253	1.28	0.70	79	0.00	0	0.53	0.00
SUB_B.5	MH BE	MH TAS	0.00	0	0.00	0	0.00	0	0.58	0.64	115	0.58	0.32	36	0.00	0	0.00	0.00
TOTAL SUB_B			0.00	0	2.10	172	6.73	1287	2.86	3.15	567	2.87	1.58	177	0.00	0	0.53	0.00
SUB_C.1	MH CA	MH CB	0.00	0	2.54	208	1.23	235	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_C.2	MH CB	MH CC	0.65	72	0.46	38	1.16	222	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_C.3	MH CC	MH CD	1.35	149	1.00	82	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_C.4	MH CD	MH CE	1.80	198	2.58	211	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	1.20	0.00
SUB_C.5	MH CE	MH CF	1.28	141	1.63	133	0.00	0	0.00	0.00	0	0.00	0.00	0	2.20	500	0.00	0.00
SUB_C.6	MH CF	MH TAO	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
TOTAL SUB_C			5.09	560	8.22	672	2.39	456	0.00	0.00	0	0.00	0.00	0	2.20	500	1.20	0.00
SUB_D.1	MH DA	MH DB	0.96	105	0.13	10	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.2	MH DB	MH DC	3.31	364	0.12	10	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.3	MH DC	MH DD	1.25	137	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.4	MH DE	MH DF	0.78	86	0.12	10	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.5	MH DF	MH DI	0.29	31	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.6	MH DG	MH DH	0.22	25	0.00	0	0.00	0	0.39	0.43	77	0.39	0.21	24	0.00	0	0.00	0.00
SUB_D.7	MH DH	MH DI	0.37	41	0.33	27	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.8	MH DJ	MH DK	0.58	63	0.26	22	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.9	MH DK	MH DL	0.37	41	0.12	10	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.10	MH DL	MH DM	0.52	57	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.11	MH DN	MH DO	0.88	97	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.12	MH DO	MH DP	0.46	50	0.27	22	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_D.13	MH DP	MH DQ	0.31	34	0.25	20	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
TOTAL SUB_D			10.29	1131	1.60	131	0.00	0	0.39	0.43	77	0.39	0.21	24	0.00	0	0.00	0.00
INTERSECTION	MH TAN	MH TAO	0.59	65	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
TOTAL INTERSECTION ROAD			0.59	65	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00

Drainage Area	FROM MH	TO MH	Low Density Residential		Medium Density Residential		High Density Residential		Mixed-Use Residential (Above Main Street)			Commercial			Institutional		Open Space - Parks	Open Space - NH/Woodlot
			Net Area (ha)	Population	Net Area (ha)	Population	Net Area (ha)	Population	Net Area (ha)	GFA (ha)	Population	Net Area (ha)	GFA (ha)	Population	Net Area (ha)	Population	Net Area (ha)	Net Area (ha)
SUB_E.1	MH EA	MH EB	0.00	0	0.66	54	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.2	MH EB	MH EC	1.11	123	0.27	22	0.00	0	0.00	0.00	0	0.55	0.33	37	0.00	0	0.00	0.00
SUB_E.3	MH EC	MH ED	0.00	0	0.29	24	0.00	0	0.00	0.00	0	1.07	0.64	72	0.00	0	0.00	0.00
SUB_E.4	MH ED	MH EE	0.18	19	0.11	9	0.80	153	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.5	MH EE	MH EF	0.15	16	0.00	0	0.70	133	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.6	MH EF	MH EG	0.00	0	0.26	21	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.7	MH EG	MH EH	0.64	71	0.26	21	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.8	MH EH	MH EI	0.59	65	0.25	21	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.9	MH EI	MH ER	0.58	64	0.27	22	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.10	MH EJ	MH EK	0.00	0	1.31	107	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.11	MH EK	MH EL	0.00	0	2.88	235	0.00	0	0.00	0.00	0	1.03	0.00	0	0.00	0	0.00	0.00
SUB_E.12	MH EL	MH EM	0.00	0	0.68	56	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.13	MH EM	MH EN	0.00	0	0.49	40	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.14	MH EN	MH EO	0.45	50	0.39	32	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.15	MH EO	MH EP	0.67	74	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.16	MH EP	MH EQ	0.45	49	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.17	MH EQ	MH ER	0.20	22	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.18	MH ER	MH ES	0.00	0	0.26	21	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_E.19	MH ES	MH TZ	1.32	146	2.46	202	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
TOTAL SUB_E			6.35	698	10.84	886	1.50	286	0.00	0.00	0	2.65	0.97	109	0.00	0	0.00	0.00
SUB_F.1	MH FA	MH FB	1.59	175	2.94	241	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_F.2	MH FB	MH FC	0.60	65	0.54	44	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_F.3	MH FC	MH FD	0.36	39	0.44	36	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_F.4	MH FD	MH TAA	0.54	59	1.59	130	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
TOTAL SUB_F			3.08	339	5.51	451	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_G.1	MH GA	MH GB	0.00	0	3.39	277	0.25	47	0.00	0.00	0	0.00	0.00	0	1.95	0	0.00	0.00
SUB_G.2	MH GB	MH GC	0.77	85	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_G.3	MH GC	MH GD	0.48	53	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
SUB_G.4	MH GD	MH GE	3.09	340	1.01	82	1.06	202	0.00	0.00	0	1.01	0.61	68	0.00	0	0.00	0.00
SUB_G.5	MH GE	MH TI	3.19	351	4.18	342	1.78	341	0.00	0.00	0	0.00	0.00	0	0.00	0	1.02	0.00
TOTAL SUB_G			7.54	829	8.58	702	3.09	590	0.00	0.00	0	1.01	0.61	68	1.95	0	1.02	0.00
SUB_H.1	MH HA	MH HB	0.00	0	2.30	188	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.14	0.00
SUB_H.2	MH HB	MH TJ	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
TOTAL SUB_H			0.00	0	2.30	188	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.14	0.00
SUB-TOTAL			36.07	3965	42.67	3489	14.98	2865	3.25	3.58	644	14.49	5.64	632	4.15	500	3.28	1.12
TECUMSEH VISTA SCHOOL SITE	MH TK		0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0	12.44	2300	0.00	0.00
SE HAMLET			8.86	974	4.93	403	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0	0.00	0.00
ABSOLUTE TOTAL			44.93	4939.40	47.60	3892.70	14.98	2864.74	3.25	3.58	643.96	14.49	5.64	632	16.59	2800	3.28	1.12

Tecumseh Hamlet Secondary Plan Area
Functional Design Report
Design Sheet Inputs

DESIGN SHEET INPUT

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
SUBCATCHMENT AREA A					
SUB_A.1	MH AA	MH AB	3.67	5.19	440
SUB_A.2	MH AB	MH DQ	1.64	2.25	43
SUB_A.3	STUB	MH AC	7.58	7.85	255
SUB_A.4	MH AC	MH AD	0.81	1.78	85
SUB_A.5	MH AD	MH AE	1.85	2.77	152
SUB_A.6	MH AE	MH DM	1.48	2.30	156
TOTAL SUB_A			17.03	22.13	1131

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population	
SUBCATCHMENT AREA B						
SUB_B.1	MH BA	MH BB	6.73	7.27	1287	
SUB_B.2	MH BB	MH BC	0.00	0.24	0	
SUB_B.3	MH BC	MH BD	2.40	1.96	293	
SUB_B.4	MH BD	MH BE	4.79	4.15	472	
SUB_B.5	MH BE	MH TAS	1.16	0.83	151	
TOTAL SUB_B			15.09	14.44	2203	off by 1 - rounding

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population	
SUBCATCHMENT AREA C						
SUB_C.1	MH CA	MH CB	3.77	4.43	443	
SUB_C.2	MH CB	MH CC	2.27	2.85	331	
SUB_C.3	MH CC	MH CD	2.36	3.65	231	
SUB_C.4	MH CD	MH CE	5.58	8.73	409	
SUB_C.5	MH CE	MH CF	5.11	6.20	774	
SUB_C.6	MH CF	MH TAO	0.00	0.17	0	
TOTAL SUB_C			19.09	26.02	2188	off by 1 - rounding

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
SUBCATCHMENT AREA D					
SUB_D.1	MH DA	MH DB	1.09	1.43	116
SUB_D.2	MH DB	MH DC	3.43	4.47	374
SUB_D.3	MH DC	MH DD	1.25	2.01	137
SUB_D.4	MH DE	MH DF	0.90	1.15	96
SUB_D.5	MH DF	MH DI	0.29	0.44	31
SUB_D.6	MH DG	MH DH	1.00	0.72	125
SUB_D.7	MH DH	MH DI	0.70	0.90	68
SUB_D.8	MH DJ	MH DK	0.84	1.24	85
SUB_D.9	MH DK	MH DL	0.49	0.74	51
SUB_D.10	MH DL	MH DM	0.52	0.67	57
SUB_D.11	MH DN	MH DO	0.88	1.34	97
SUB_D.12	MH DO	MH DP	0.73	1.01	73
SUB_D.13	MH DP	MH DQ	0.55	0.81	54
TOTAL SUB_D			12.67	16.94	1363

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
TECUMSEH VISTA SCHOOL SITE					
TECUMSEH VISTA SCHOOL SITE		MH TK	12.44	13.39	2300
TOTAL TECUMSEH VISTA SCHOOL SITE			12.44	13.39	2300

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
SUBCATCHMENT AREA E					
SUB_E.1	MH EA	MH EB	0.66	0.82	54
SUB_E.2	MH EB	MH EC	1.93	2.50	181
SUB_E.3	MH EC	MH ED	1.36	1.78	95
SUB_E.4	MH ED	MH EE	1.09	1.49	181
SUB_E.5	MH EE	MH EF	0.85	1.42	150
SUB_E.6	MH EF	MH EG	0.26	0.41	21
SUB_E.7	MH EG	MH EH	0.90	1.47	92
SUB_E.8	MH EH	MH EI	0.85	1.43	86
SUB_E.9	MH EI	MH ER	0.85	1.49	85
SUB_E.10	MH EJ	MH EK	1.31	1.52	107
SUB_E.11	MH EK	MH EL	3.91	4.68	235
SUB_E.12	MH EL	MH EM	0.68	0.86	56
SUB_E.13	MH EM	MH EN	0.49	0.71	40
SUB_E.14	MH EN	MH EO	0.84	1.40	82
SUB_E.15	MH EO	MH EP	0.67	1.04	74
SUB_E.16	MH EP	MH EQ	0.45	0.60	49
SUB_E.17	MH EQ	MH ER	0.20	0.35	22
SUB_E.18	MH ER	MH ES	0.26	0.42	21
SUB_E.19	MH ES	MH TZ	3.79	7.06	347
0	0	0	0.00	6.24	0
TOTAL SUB_E			21.33	37.67	1979

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
SUBCATCHMENT AREA F					
SUB_F.1	MH FA	MH FB	4.53	5.61	415
SUB_F.2	MH FB	MH FC	1.14	1.31	110
SUB_F.3	MH FC	MH FD	0.80	0.94	75
SUB_F.4	MH FD	MH TAA	2.13	3.16	189
TOTAL SUB_F			8.59	11.01	790

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
SUBCATCHMENT AREA G					
SUB_G.1	MH GA	MH GB	5.59	7.04	324
SUB_G.2	MH GB	MH GC	0.77	0.99	85
SUB_G.3	MH GC	MH GD	0.48	0.65	53
SUB_G.4	MH GD	MH GE	6.17	8.45	693
SUB_G.5	MH GE	MH TI	10.17	13.63	1034
TOTAL SUB_G			23.18	30.76	2189

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
SUBCATCHMENT AREA H					
SUB_H.1	MH HA	MH HB	2.44	18.19	188
SUB_H.2	MH HB	MH TJ	0.00	0.43	0
TOTAL SUB_H			2.44	18.62	188

Drainage Area	From MH	To MH	Net Area (ha)	Gross Area (ha)	Total Population
SOUTHEAST HAMLET AREA					
SE HAMLET			13.79	18.71	1378
TOTAL SE HAMLET			13.79	18.71	1378

Future Project (FP) Areas				
Drainage Area	From MH	To MH	Gross Area	Total Population (Note 1)
FP1: Tecumseh Hamlet Diversion Sewer (excludes SE Hamlet)				
FP1.1	MH TAI	MH TAJ	25.37	397
FP1.2	MH TAJ	MH TAK	0.93	21
FP1.3	MH TAK	MH TAL	1.15	18
FP1.4	MH TAL	MH TAM	3.01	46
FP1.5	MH TAM	MH TAN	9.01	232
FP1.6	MH TAN	MH TAO	1.49	74
TOTAL FP1			40.95	789
FP2: Shields Street and St. Alphonse Street Diversion Sewer				
FP2.1	SHIELDS	MH TT	4.75	101
FP2.2	ST. ALPHONSE	MH TP	119.05	3815
TOTAL FP2			123.80	3916

Future Project (FP) Areas				
Drainage Area	From MH	To MH	Gross Area	Total Population (Note 1)
FP3: Maidstone Hamlet Pumping Station				
FP3	MAIDSTONE PS	MH TA	0.00	Pumped rate of 169 L/s
FP4: Settlement Area Expansion - Commercial Development South of CR42 and West of Concession 11				
FP4	CR42	MH TA	24.33	817

Notes:
1. A count of the existing properties was used to determine the existing development populations
2. Allowance for 20% population sewage increase is allocated to future project areas where new development will occur for the the purpose of this insitu sanitary design. This includes the SE Hamlet Are as well as the CR42 Commercial Area. No factor was added to any existing development, with the exception of FP2 (which includes a 20% population sewage increase).

Appendix B

Functional Sanitary Servicing Modelling Technical Report (2024), Tecumseh Hamlet Secondary Plan Area

DILLON CONSULTING

TOWN OF TECUMSEH

Functional Sanitary Servicing Modelling Technical Report (2024)

Tecumseh Hamlet Area

September 2024 – 23-5735

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Tables

1.0 Introduction

As part of the Functional Servicing for the proposed Tecumseh Hamlet Secondary Plan Area (SPA) development, the Town of Tecumseh (Town) requested that Dillon Consulting Limited (Dillon) evaluate the impacts of the proposed development on the Town's existing and proposed sanitary infrastructure.

The Tecumseh Hamlet Secondary Plan Area (THSPA) is approximately 280 hectares in size and is made up of two separate development areas:

- West THSPA: Bounded by Essex County Road 22 (CR22) to the north, existing residential developments to the east, Essex County Road 42 (CR42) to the south, and the Town/City Municipal boundary to the west.
- Southeast THSPA (SE THSPA): Bounded by Essex County Road 22 (CR22) to the north, Essex County Road 19 (CR19 or Manning Road) to the east, Lesperance Road to the east, and Hydro One Corridor to the south.

Both areas are located within the Town's Tecumseh Hamlet neighbourhood, which generally includes all lands between CR22 and CR42, as defined by the settlement boundary in the Town's Official Plan. Wastewater servicing for these areas is provided by a 1200 mm dia. sanitary trunk sewer located along CR22, which eventually conveys flow to Banwell Road. From there, the flow continues through the City of Windsor's sanitary system and eventually discharges to the Little River Pollution Control Plant (LRPCP). The land use and ultimate population growth population estimates are based on the Secondary Plan Area land use and proposed unit and commercial usage densities included in the Tecumseh Secondary Plan (Dialog, 2024). The West THSPA area is proposed to be serviced by an extension of sanitary trunk sewers, known as the West Tecumseh Trunk Sewer, which was originally proposed as projects WW-1 and WW-4, in the Water and Wastewater Master Plan, that was updated in 2018 (CIMA, 2018). The SE THSPA will connect to the existing sanitary sewer located on Lesperance Road.

The sanitary sewer assessment is based on ultimate build out conditions where all developable lands with the THSPA as well as other areas in the Tecumseh Hamlet have been developed. This memo shall be reviewed in conjunction with the Town of Tecumseh's Sanitary Model Recalibration and Basement Flood Mitigation Study (Dillon, 2024). Under ultimate conditions, it is proposed that the West Tecumseh Trunk Sewer not only serve the THSPA development but also provide relief to the existing development areas in the Hamlet. Two relief sewers, proposed along Intersection Road and Shields Street, respectively, provide relief to the existing sanitary sewer system by way of interconnections with the existing sanitary system.

In addition, the SE THSPA area has been incorporated into this analysis and is proposed to be low and medium density residential development. Flow from this area shall discharge into the Lesperance Road trunk sanitary sewer via a lift station located at the west side of the SE THSPA area (refer to Figure F-1).

The flow will then be directed to the West Tecumseh Hamlet Trunk Sewer through the Intersection Road diversion sewer.

The Maidstone Hamlet Pumping Station and Forcemain referred to as WW-8B in the WWMP 2018) and infill areas along CR42, are also recommended to be served by this trunk sewer. The Maidstone Hamlet outlet to the West Tecumseh Hamlet Trunk Sewer, via pumping station, has been considered in the sanitary system analysis. The Maidstone Pump Station will direct sewage flows via a 300 mm diameter forcemain to the 1200 mm diameter West Tecumseh Hamlet Trunk Sewer at CR42 and 11th Concession Road (Refer to Figure F-1).

The objective of this report is to provide a summary of the sanitary modelling analysis completed to evaluate the proposed West Hamlet sanitary trunk sewer capacity and its benefit to the existing sanitary sewer system. This study focused on the proposed trunk sewer infrastructure therefore proposed local sanitary sewers servicing the THSPA were not included in the modelling analysis however shall be designed in accordance with the sanitary sewer criteria described herein and the accompanying Tecumseh Hamlet Functional Servicing Study (2024).

Functional design of the sanitary trunk sewer and sub-trunk system included in the Tecumseh Hamlet Secondary Plan Functional Design Report were generally based on the recommendations herein however that design has been revised based on a more detailed subcatchment analysis and in keeping with the parameters of the "Design Criteria for Sanitary Sewers, Storm sewers and Forcemains for Alternations Authorized under an Environmental Compliance Approval", V. 2.0 May 31, 2023.

2.0 Existing Conditions Analysis

The calibrated Infoworks-ICM model for the Town of Tecumseh's sanitary sewer system was used for this study and the proposed future development areas were incorporated into the model to assess the capacity of the Tecumseh Hamlet Trunk Sewer. For detailed information, in regard to the calibration of sanitary sewer flows in the Town of Tecumseh's sanitary model, refer to Sanitary Model Recalibration and Basement Flood Mitigation Study (Dillon, 2024).

3.0 Proposed Condition Model Development

The existing condition (i.e. Baseline) and proposed condition analysis discussed in this document have been evaluated using the 5-year, 24 hour, and 25-year, 4 hour design storm events to be consistent with how the remainder of the municipality was assessed as part of Sanitary Model Recalibration and Basement Flood Mitigation Study (Dillon, 2024) (BFM Study). The 25-year, 4 hour design storm is the level of service (LOS) that was determined to be acceptable for sanitary sewer system design and analysis within the greater Town of Tecumseh as part of the BFM Study and there the following criterial was used evaluate the level of service within this assessment:

Criteria:
During storm events up to and including the 25-year, 4 hour design storm event, Hydraulic Gradelines (HGLs) within the sewer shall remain below assumed basement floor levels which is 1.8 m from ground elevation. This 25-year LOS provides added resiliency to the system under more intense rain events where there is the potential for increased Rainfall Derived Inflow and Infiltration (RDII) into sanitary sewers. Further discussion regarding the establishment of LOS is provided in Sanitary Model Recalibration and Basement Flood Mitigation Study (Dillon, 2024).

Under proposed conditions, two scenarios were assessed based on the population density of the proposed residential development. The scenarios are described in Section 3.1.1 below.

Figure F-1 represents the proposed Tecumseh Hamlet SPA development areas.

3.1 Sanitary Flow Parameters for Tecumseh Hamlet SPA

3.1.1 Dry-Weather Flow (DWF) Parameters

For estimating DWF, the following assumptions regarding population densities (Table 1) were used to update the model to reflect the development of Tecumseh Hamlet SPA.

Table 1: Assumptions for Population Estimation

Land Use	Unit Quantities[1]	Population Densities[3]
Mixed-Use (Residential/Commercial)	94.12 units/net Ha	1.594 persons/unit
High Density Residential	100 units/net Ha	
Medium Density Residential	35 units/net Ha	1.947 persons/unit
Low Density Residential	30 units/net Ha[2]	3.054 persons/unit
Commercial: Main Street	55% Coverage, 3 Storeys (retail at-grade with residential above)	93.3 persons/Ha GFA
Commercial: Anchor	30% Coverage, 1 Storey	
Commercial: Plaza	30% Coverage, 1-2 Storeys	
Institutional	N/A	2300 persons for Tecumseh Vista, 500 persons for proposed elementary school

Notes:

[1] Net Area, GFA and unit quantity assumptions were provided to us by Dialog (Feb. 2024).

[2] This unit quantities assumed only for sanitary analysis. Low density development is expected to yield a 20 units/net Ha density however, an allowance of up to 30 units/net Ha was used to account for variations in density that may occur over the lifetime of the sanitary sewer system.

[3] The population densities were taken from Development Charges Background Study for the Town of Tecumseh (Watson & Asso., 2022) (Table 4-8).

Under proposed conditions, two scenarios were assessed based on the population density of proposed residential development.

- Scenario 1 with projected population based on proposed development density; and
- Scenario 2 with an additional 20% population flexibility factor over the projected populations for the proposed development areas in Scenario-1.

A 20% safety factor was assumed in Scenario-2, to increase the proposed population within the residential and commercial areas to allow for future changes of land use or intensification. The estimated population for new proposed development areas in Hamlet SPA based on the above assumptions for both scenarios are summarized in Table 2.

Table 2: Assumed Population for Proposed Development Areas in Tecumseh Hamlet SPA

Land Use	Net Area (ha)	GFA (ha)	Number of Units	Population	
				Scenario-1	Scenario-2 (Population with Flexibility Factor) [1]
Low Density Residential	45.72	-	1372	4189	5026
Medium Density Residential	46.88	-	1641	3194	3833
High Density Residential	13.87	-	1387	2210	2652
Mixed Use Residential (above Main Street)	3.25	3.58	337	537	644
Commercial	13.47	5.64	-	526	632
Institutional	16.59	-	-	2800	2800
Open Space - Parks	17.28	-	-	0	0
Open Space - SWM	21.84	-	-	0	0
Open Space - NH/Woodlot	11.0	-	-	0	0
Total	186.65	-	4737	13456	15587

[1] 20% flexibility factor was assumed for all residential and commercial developments.

The population in Table 1 includes only the population with the Tecumseh Hamlet Secondary Plan study area limits, population of other developable lands can be found in the BFM Study (2024).

Based on MECP Sewer Design Guidelines (2023) the average daily domestic flow (exclusive of extraneous flows) of 225 to 450 L/capita/day is recommended. However, the 2018 Water and Wastewater Master Plan (WWMP) recommends a per capita flow rate of 300 L/capita/day for new development. The 300 L/capita/day was used as the per capita flow for the future development areas in the Tecumseh Hamlet SPA to be consistent with the other sanitary assessment studies conducted within the Town of Tecumseh.

3.1.2 Wet-Weather Flow (WWF) parameters

To estimate the volume and peak flow of RDII in sanitary sewers for proposed new developments within the Town, the following criteria were considered in the sanitary analysis:

- The infiltration volume allowance of 16,415 L/ha/day (0.19 L/ha/s) for new developments, as recommended within the 2018 WWMP; and
- An allowable peak flow of 0.3 L/ha/s for new developments as recommended in the *CSA W204:19 – Flood Resilient Design of New Residential Communities (2019).*

To prepare the local sanitary sewer design for the Functional Design study, an infiltration allowance of 0.28 L/ha/s was used in sewer design sheets to be consistent with the Design Criteria for Sanitary Sewers, Storm Sewers, and Forcemains for Alterations under and Environmental Compliance Approval (Ministry of Environment, Conservation and Parks (MECP), May 31, 2023). However, in sanitary model the 0.3 L/ha/s allowable peak flow was used to be consistent with the other sanitary studies conducted for the Town recently.

Updates to the sanitary sewer Infoworks ICM model were made to reflect the increased flow generated from the planned Tecumseh Hamlet SPA development area under both DWF and WWF conditions. A physical parameter-based approach was used in the Infoworks ICM model to simulate RDII in the sanitary system. For the existing conditions model, these parameters were calibrated to match the observed flows from the sanitary drainage areas as part of the model calibration process. For the future conditions assessment, the parameters of subcatchments representing RDII during WWF events were also updated to reflect full build out conditions which includes new development within the Tecumseh Hamlet as well as infill in other areas of the Town.

3.2 Model Updates for Proposed Conditions Analysis

To assess the sanitary sewer capacity in the Tecumseh Hamlet SPA, the ultimate condition scenarios with improvements or changes recommended through the Sanitary Model Recalibration and Basement Flood Mitigation Study (Dillon, 2024) were evaluated. Under ultimate conditions, two scenarios were considered as follows:

- Scenario 1 with base population; and
- Scenario 2 with 20% population flexibility factor for residential and commercial lands.

The model setup in the proposed conditions scenarios included full development of the Tecumseh Hamlet SPA, north of County Road 42 and south of CR22, along the proposed sanitary trunk sewer alignment. The proposed development also included commercial development located south of CR42 and west of 11th Concession Road, and the SE-Hamlet SPA.

The Manning Road Secondary Plan Area (MRSPA) was considered to be fully developed. The existing sluice gate along the Lesperance Road sanitary trunk sewer south of CR22 is remained closed under both proposed conditions scenarios.

3.2.1 Downstream Boundary Conditions

For the proposed condition scenarios, an assumed fixed tailwater condition was used at the outlet of the Town's CR22 relief sewer into the existing 1200 mm diameter City of Windsor sanitary sewer system at Banwell Road. This fixed tailwater downstream at the Town limits was set at the obvert of the existing 1200 mm diameter sanitary sewer.

3.2.2 Pumped Flow from Maidstone Hamlet

Pumped outflow from the Maidstone Hamlet area has been accounted in the West Hamlet Trunk sewer. A constant pumped flow of 169 L/s was assumed for the Maidstone Hamlet and incorporated into the model as a timeseries with duration of 7.2 hours. Pump flow rates from the Maidstone Hamlet were sourced from the Town's 2018 WWMP.

3.2.3 Pumped Flow from South-East Hamlet Area

Pumped outflow from the SE Hamlet area has been incorporated into the sanitary model. A 7-hour and 8.7-hour timeseries with a constant flow of 20 L/s and 28 L/s were considered for Scenarios 1 and 2, respectively. These flows were derived from the sanitary sewer design included in the Hamlet SPA Functional Design report based on the population yield expected from this development. The pumping station is required in this instance due to vertical grade constraints that limit the gravity connection of this development area into the existing Lesperance Road sewer.

3.2.4 Improvements to Sanitary Sewer Infrastructure

Improvements to the sanitary conveyance infrastructure assumed to be completed in the proposed conditions model simulations are divided into the following categories:

1. West Hamlet Trunk Sanitary Sewer, including:
    a. 600 mm dia. Intersection Road diversion sewer: This sewer is proposed to divert flows from the existing Hamlet trunk sanitary sewer along St. Anne Street to the new West Hamlet trunk sanitary sewer;
    b. Decommissioning of the existing St. Alphonse Sanitary PS; and
    c. 600 mm dia. Shields Street diversion sewer: This sewer will divert flows from the existing sewer along St. Alphonse Ave., after decommissioning of the St. Alphonse PS, to the West Hamlet trunk sanitary sewer.
2. Sewer improvements proposed to reduce risk of basement flooding in the Tecumseh Hamlet area recommended through the Sanitary Model Recalibration and Analysis Study (Dillon, 2024), including:

   a. Upsizing existing sanitary sewer along Charlene Lane between St Agnes Crescent and Lesperance Road (proposed diameter: 600 mm; existing diameter: 250 mm);
   b. Upsizing existing sanitary sewer along Lesperance Road between Charlene Lane and Intersection Road (proposed diameter: 600 mm; existing diameter: 300 mm);
   c. Upsizing existing sanitary sewer along Intersection Road between Lesperance Road to St Anne Street (proposed diameter: 600 mm; existing diameter: 300 mm); and
   d. Upsizing existing sanitary sewer along Lesperance Road downstream of Gouin Street Road (proposed diameter: 1050 mm; existing diameter: 600 mm).
3. Sewer improvements proposed to reduce downstream impacts of sanitary flows from the MRSPA development. In-line storage along the trunk sewer alignment, downstream of the proposed sanitary PS was proposed to reduce the impacts to the downstream sewer system and help reduce risk of basement flooding during wet-weather events within the MRSPA development.
   a. Upsizing proposed MRSPA sanitary trunk sewer (downstream of proposed sanitary PS); and
   b. Upsizing existing sanitary sewer along Gouin Street between Deslippe Drive and Lesperance Road (proposed diameter: 750 mm; existing diameter: 375 mm).

Details about improvements mentioned above are provided in Sanitary Model Recalibration and Basement Flood Mitigation Study (Dillon, 2024), and the MRSPA Functional Sanitary Servicing Modelling Technical Report (Dillon, 2023).

The West Hamlet Sanitary Trunk Sewer was included in the model updates for proposed conditions analysis. The local sanitary sewers discharging into the trunk sanitary sewer were not included in the model setup.

4.0 Proposed Development Conditions Analysis Results

The Infoworks ICM model was utilized to assess the capacity of the proposed Hamlet sanitary sewer system under WWF conditions during 5-year, 24 hour and 25-year, 4 hour design storm events. From the proposed conditions model simulation results, a significant reduction in the maximum Hydraulic Grade Lines (HGLs) is observed within the Tecumseh Hamlet sanitary sewers. Therefore, a reduction in the risk to basement flooding due to sanitary sewer surcharging in the Tecumseh Hamlet area is demonstrated by the model due to the improvements in infrastructure and construction of West Hamlet Trunk sanitary sewer.

It should be noted that the HGLs and peak flows in the Infoworks-ICM model is based on the observed diurnal flow patterns for the sanitary sewers in the Hamlet area and are not necessarily equal to the design peak flows provided in design sheets. In addition, the model results are based on the assumption that the existing sanitary trunk sewer along CR22 does not surcharge beyond the obvert of the pipe within the City of Windsor, downstream of the Tecumseh system. It is also expected that new development within the Tecumseh Hamlet will meet maximum extraneous flow allowances provided in the 2018 WWMP. An HGL profile of the West Hamlet Trunk sewer, Intersection Road diversion sewer, St. Alphonse Avenue and Shields Street diversion sewer are provided in Figures F-2 to F-7.

The current Wastewater Servicing Agreement between the City of Windsor and Town (2004) stipulates a maximum outflow from the Town's sanitary system that can discharge into the City's system. Based on this agreement, a maximum peak wet weather flow of 1308 L/s is permitted at the outlet at Banwell Road and County Road 22. A portion of this allowance is allocated to the Oldcastle Hamlet, that is serviced via the 8th Concession Road sanitary sewer. Of the total 1308 L/s allowance, 325 L/s is reserved for the Oldcastle Hamlet, and the remaining 983 L/s peak flow allowance is reserved for the Tecumseh Hamlet. Under the 25-year, 4 hour event, the total peak flow expected in CR22 trunk sanitary sewer is 940 L/s and 958 L/s under Scenario 1 and Scenario 2, respectively. This flow includes the future outflows from the Maidstone Hamlet, Manning Road Secondary Plan Area (MRSPA), proposed commercial development located south of CR42 and west of 11th Concession Road, re-directed flows from the Intersection Road and Shields Street relief sewers as well as sanitary flows from existing development in the Hamlet area. The allowable and simulated outflows from Tecumseh Hamlet into the City's system are summarized in Table 3.

Table 3: Maximum Outflow from Tecumseh Hamlet Sanitary System into the City's System

Allowable Outflow (L/s)	Simulated Outflow (L/s)			
	25-Year, 4 hour event		5-Year, 24 hour event	
	Scenario-1	Scenario-2	Scenario-1	Scenario-2
983	940	958	831	847

5.0 Conclusions and Recommendations

The current analysis has been completed to evaluate the capacity of the proposed Tecumseh Hamlet Area sanitary sewer system to convey sanitary flows from proposed developments. Under proposed conditions, two scenarios were assessed based on the population density of proposed developments. Scenario 1, in which, the population for the new developments in residential and commercial areas were estimated based on the proposed development density. While in Scenario 2, a 20% population flexibility factor was applied to the proposed developments' population estimated in Scenario 1. In addition, for simulating RDII in the sanitary sewer model, an infiltration volume allowance of 16,415 L/ha/day and an allowable peak flow of 0.30 L/ha/s for new developments were considered. This is consistent with the modelling methodology used for assessing other developments in the Town of Tecumseh.

An infiltration allowance of 0.28 L/ha/s was used in sanitary sewer design sheets, for designing local sanitary sewers, to be consistent with the Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations under and Environmental Compliance Approval (Ministry of Environment, Conservation and Parks (MECP), May 31, 2023).

The proposed condition scenarios include construction of the entire West Tecumseh Hamlet sanitary trunk sewer including the Intersection Road and Shields Street relief sewers, full development of the MRSPA area and the recommended improvements in the Sanitary Model Recalibration and Basement Flood Mitigation Study (Dillon, 2024). The simulation results indicate that under both proposed conditions scenarios the West Hamlet Trunk sewer has adequate capacity to service the proposed Tecumseh Hamlet SPA development and provide a 25-year LOS for the proposed sanitary infrastructure. The proposed Tecumseh Hamlet SPA development is not expected to cause adverse impacts on the sanitary flow conditions in the northern areas of the Town, as all flows from existing and future development in the Tecumseh Hamlet are routed to the sanitary relief sewer along CR22, provided that the existing sluice gate along the Lesperance Road sanitary sewer remains closed. With the recommended improvements and construction of the West Hamlet Trunk sewer, the HGLs remain below assumed basement floor levels (1.8 below ground elevation) for the Tecumseh Hamlet SPA development, for both 5-year and 25-year return period simulations.

We trust that our findings provide you with the information that you require at this time. We would be pleased to meet with you to review our findings in further detail. Should you have any further questions, we would be pleased to discuss the results of our evaluation in further detail.

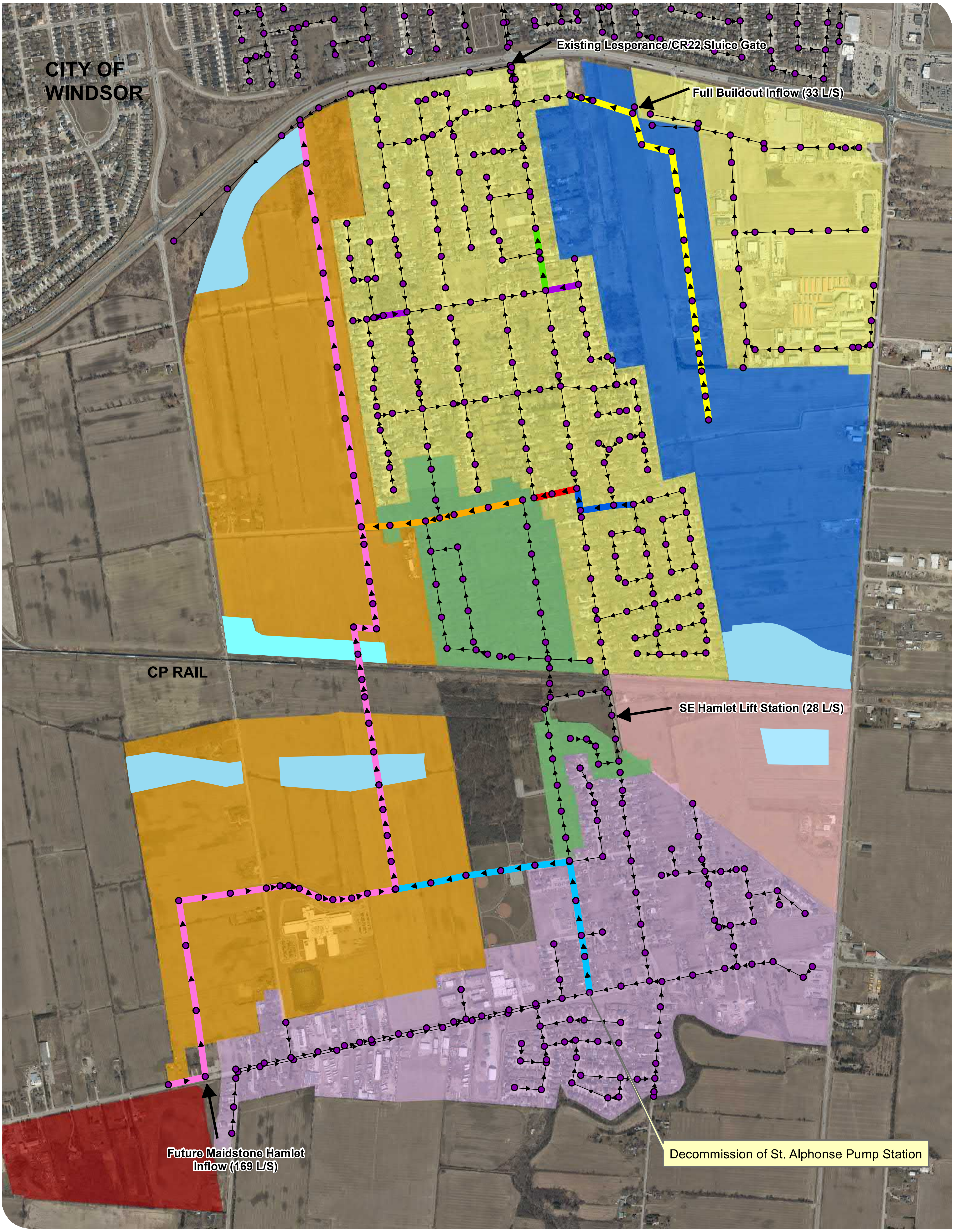
Yours sincerely,

DILLON CONSULTING LIMITED

Aakash Bagchi, P.Eng.
Water Resources Engineer

Samane Lesani, EIT
Water Resources Designer

Figures



CORPORATION OF THE TOWN OF TECUMSEH

TECUMSEH HAMLET MASTER PLAN AND FUNCTIONAL SERVICING REPORT

TECUMSEH HAMLET SANITARY STUDY AREAS

FIGURE F-1

West Hamlet Trunk Sewer
Intersection Road Trunk Sewer Upsizing
Intersection Road Sewer Diversion
MRSPA Trunk sewer
Charlene Lane-Lesperance Road Trunk Sewer Upsizing
Lesperance Road Sewer Upsizing
Gouin Street Sewer Upsizing
St. Alphonse Street-Shields Street Trunk Sewer Diversion
Sanitary Sewers
New Development Area in MRSPA
Existing Development Area Routed to Shields Trunk Sewer
New Commercial Development Area
Stormwater Management Facility
New Development Area in SE Hamlet SPA
Existing Development Area without Change
New Development Area HamletT SPA
Existing Development Area Routed to Intersection Trunk Sewer
Sanitary MHs

MAP DRAWING INFORMATION:
DATA PROVIDED BY TOWN OF TECUMSEH

MAP CREATED BY: SL
MAP CHECKED BY: AB
MAP PROJECTION: NAD 1983 UTM Zone 17N

SCALE 1:12,000

0 0.5 1 km

DILLON CONSULTING

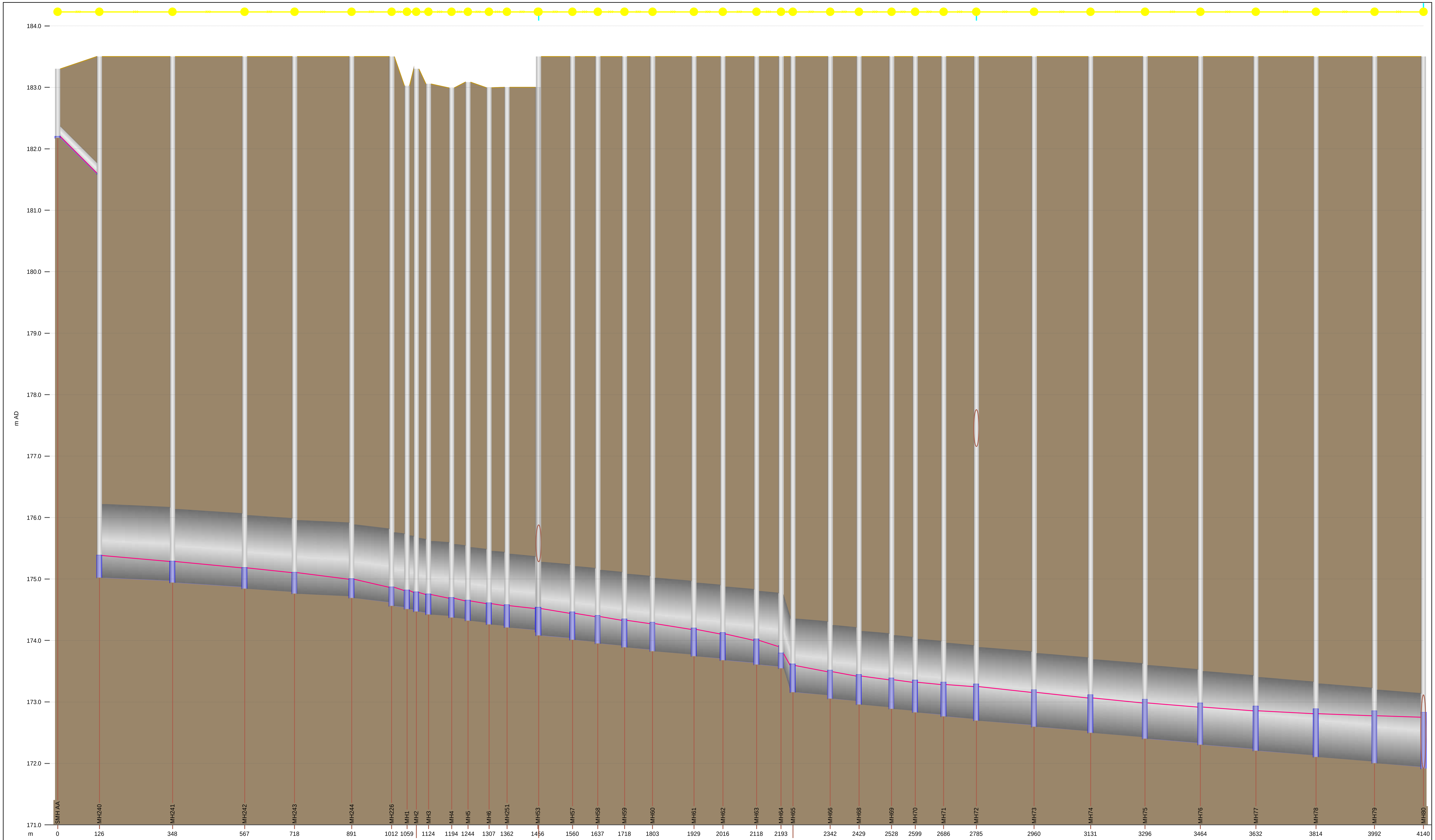
FILE LOCATION: \\DILLON.CA\

PROJECT: 23-5735 STATUS: FINAL DATE: 2024/06/07

FIGURE F-2: West Hamlet Trunk Sanitary Sewer - Peak HGL Profile - Scenario 1

1:25 year, 4 hour design storm simulation

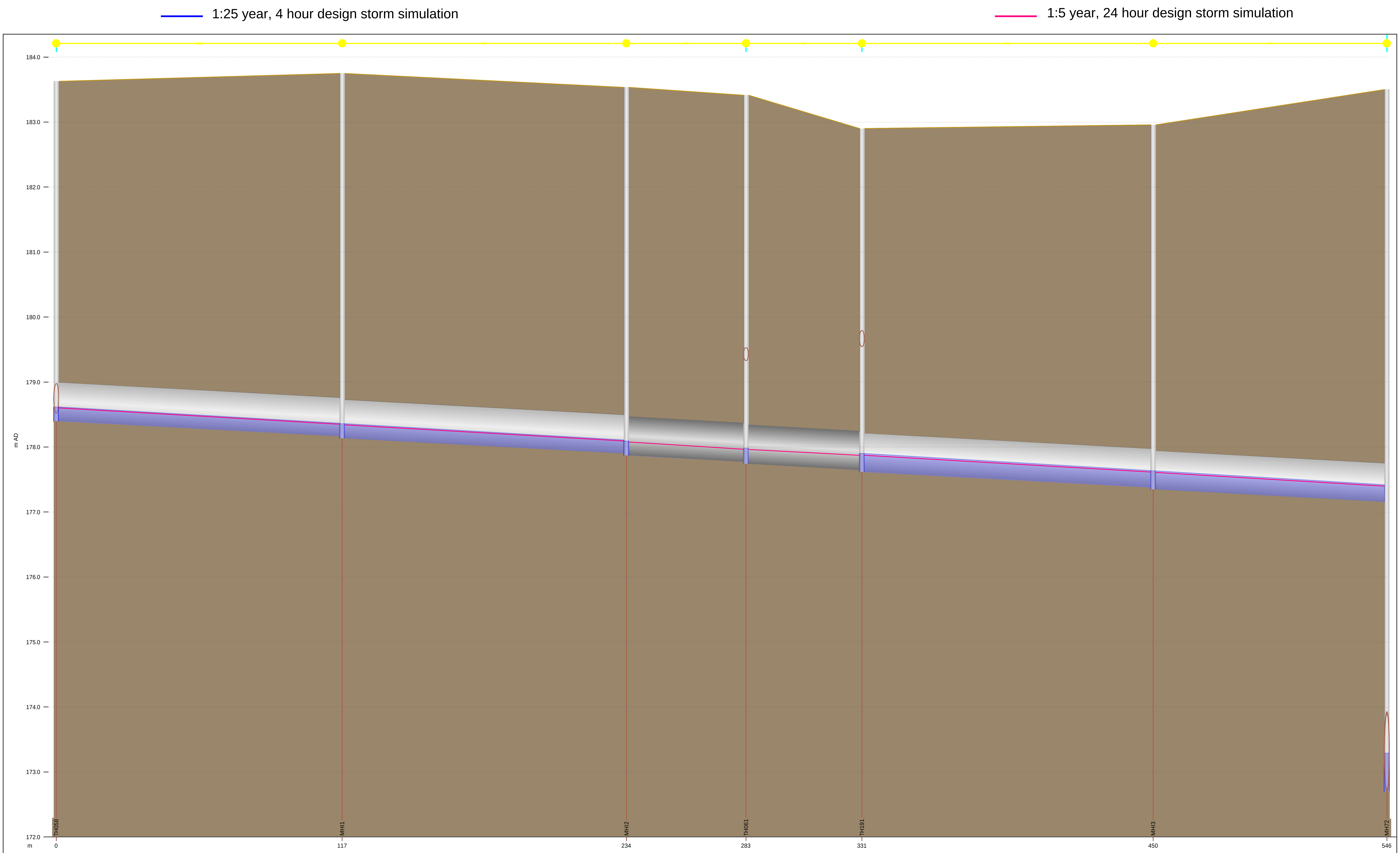
1:5 year, 24 hour design storm simulation



Link	length (m)	height (mm)
SMH AA.1	126.5	200
MH240.2	221.6	1200
MH241.2	218.7	1200
MH242.2	151.2	1200
MH243.2	173.2	1200
MH244.1	121.0	1200
-	46.6	1200
-	-	-
-	-	-
MH3.1	70.1	1200
-	49.6	1200
MH5.1	63.7	1200
-	54.6	1200
MH251.2	93.4	1200
Shields1.1	102.7	1200
MH57.1	76.7	1200
MH58.1	81.2	1200
MH59.1	85.0	1200
MH60.1	125.3	1200
MH61.1	87.8	1200
MH62.1	101.9	1200
MH63.1	74.4	1200
-	-	-
MH65.1	113.1	1200
MH66.1	87.2	1200
MH68.1	98.7	1200
MH69.1	71.5	1200
MH70.1	86.4	1200
MH71.1	99.0	1200
MH72.1	175.2	1200
MH73.1	171.2	1200
MH74.1	165.0	1200
MH75.1	167.8	1200
MH76.1	168.2	1200
MH77.1	182.1	1200
MH78.1	177.6	1200
MH79.1	148.3	1200

Node	level (m AD)	flood dep (m)
-	-	-
MH240	175.386	-8.114
MH241	175.290	-8.210
MH242	175.183	-8.317
MH243	175.107	-8.393
MH244	175.003	-8.497
MH226	174.870	-8.630
-	-	-
-	-	-
-	-	-
MH4	-	-
-	-	-
MH6	-	-
-	-	-8.419
-	-	-
-	-	-
MH57	174.462	-9.038
MH58	-	-9.094
MH59	174.349	-9.151
MH60	174.293	-9.207
MH61	174.200	-9.300
MH62	174.124	-9.376
MH63	174.020	-9.480
-	-	-
MH65	-	-9.885
MH66	173.513	-9.987
MH68	173.445	-10.055
MH69	173.388	-10.112
MH70	-	-
MH71	173.320	-10.180
MH72	173.289	-10.211
MH73	173.196	-10.304
MH74	173.114	-10.386
MH75	173.041	-10.459
MH76	172.980	-10.520
MH77	172.929	-10.571
MH78	172.886	-10.614
MH79	172.852	-10.648
MH80	-	-

FIGURE F-3: Intersection Road Trunk Sanitary Sewer - Peak HGL Profile - Scenario 1



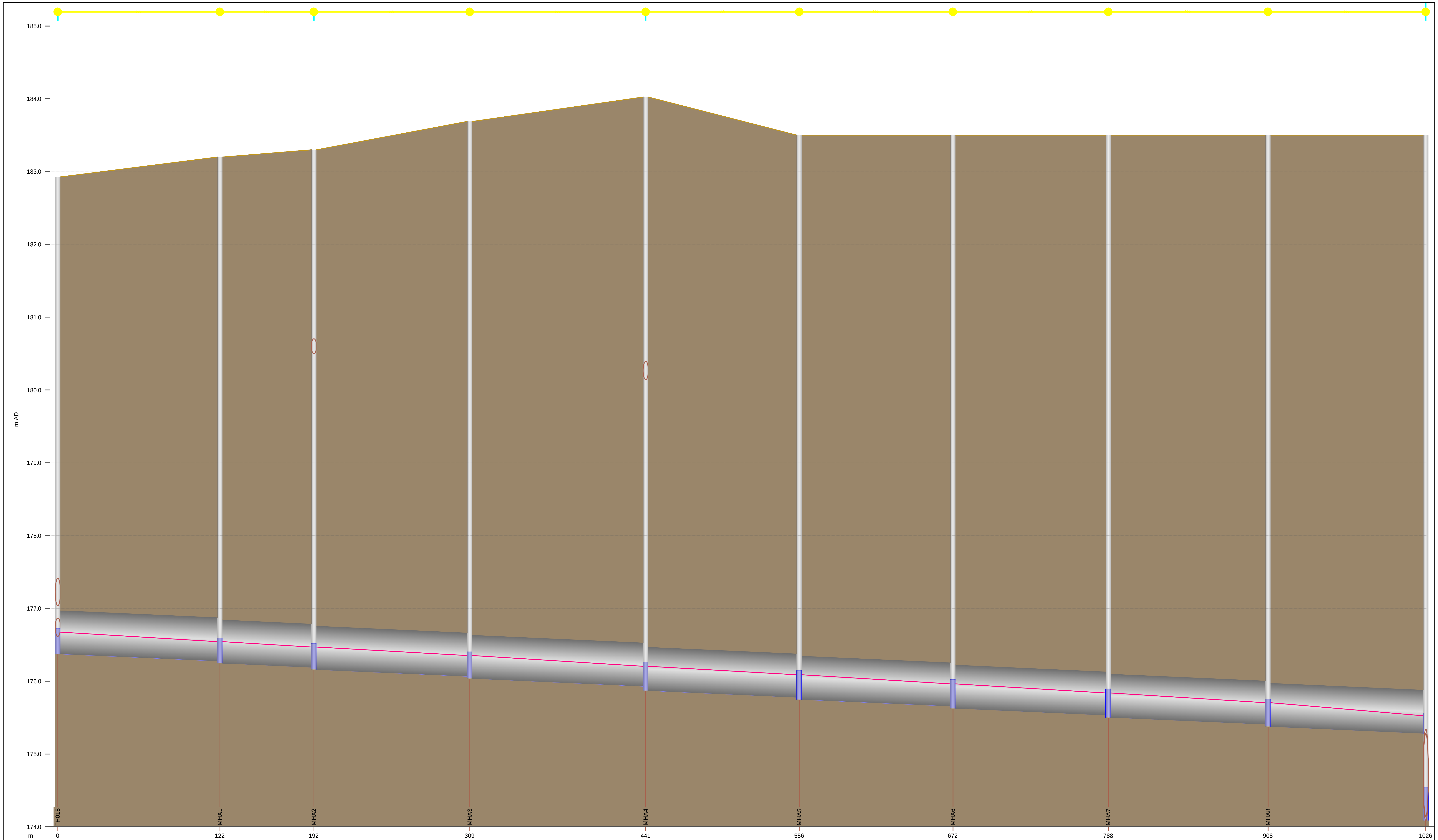
Link	TH058.1	MHI1.1	MHI2.1	TH061.1	TH191.1	MHI3.1
length (m)	117.4	116.7	49.1	47.6	119.6	95.9
height (mm)	600	600	600	600	600	600

Node	TH058	MHI1	MHI2	TH061	TH191	MHI3	MH72
level (m AD)	178.614	178.356	178.090	177.981	177.896	177.632	173.289
flood dep (m)	-5.016	-5.393	-5.445	-5.429	-5.004	-5.325	-10.211

FIGURE F-4: St Alphonse and Shields Street Trunk Sanitary Sewer from Pump Station in CR42 Road toward 1200 mm Hamlet Trunk Sewer - Peak HGL Profile - Scenario 1

1:25 year, 4 hour design storm simulation

1:5 year, 24 hour design storm simulation



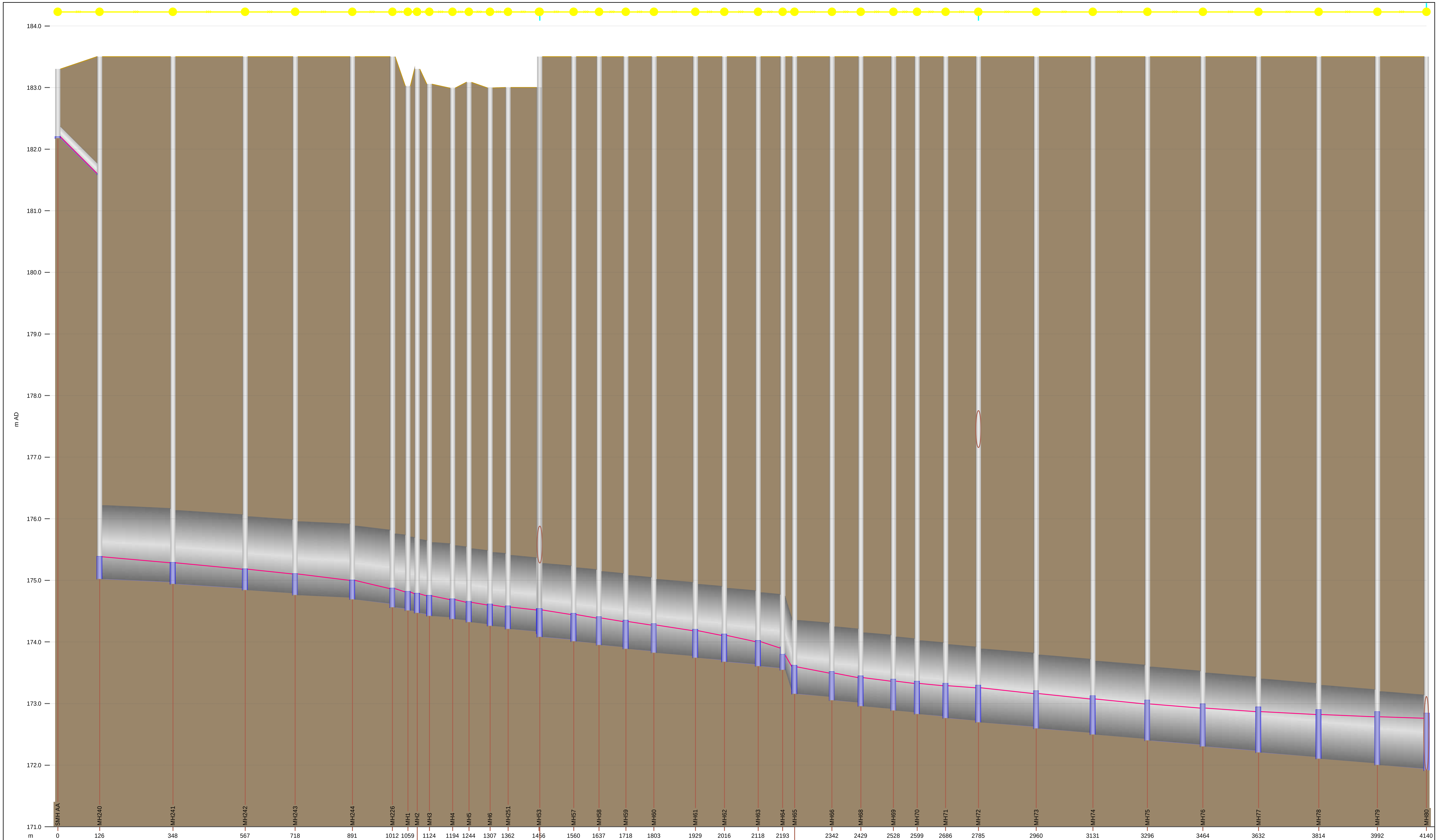
Link	TH015.1	MHA1.1	MHA2.1	MHA3.1	MHA4.1	MHA5.1	MHA6.1	MHA7.1	MHA8.1
length (m)	121.6	70.5	117.0	132.0	115.2	115.3	116.7	119.8	118.3
height (mm)	600	600	600	600	600	600	600	600	600

Node	TH015	MHA1	MHA2	MHA3	MHA4	MHA5	MHA6	MHA7	MHA8	Shields1
level (m AD)	176.718	176.589	176.517	176.401	176.260	176.143	176.018	175.891	175.749	174.537
flood dep (m)	-6.212	-6.611	-6.783	-7.287	-7.760	-7.357	-7.482	-7.609	-7.751	-8.963

FIGURE F-5: West Hamlet Trunk Sanitary Sewer - Peak HGL Profile - Scenario 2

1:25 year, 4 hour design storm simulation

1:5 year, 24 hour design storm simulation



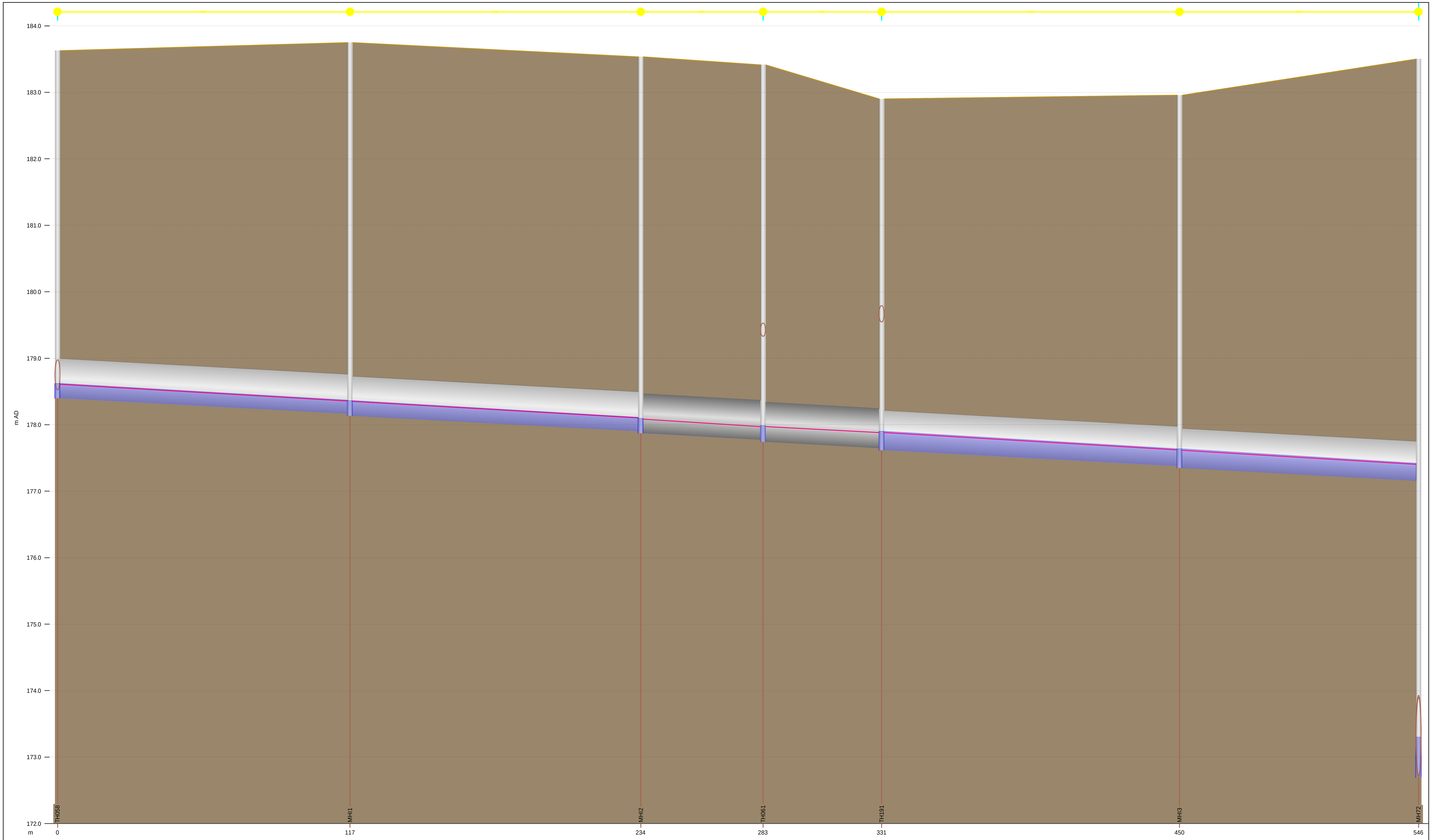
Link	length (m)	height (mm)
SMH AA.1	126.5	200
MH240.2	221.6	1200
MH241.2	218.7	1200
MH242.2	151.2	1200
MH243.2	173.2	1200
MH244.1	121.0	1200
-	46.6	1200
-	-	-
-	-	-
MH3.1	70.1	1200
-	49.6	1200
MH5.1	63.7	1200
-	54.6	1200
MH251.2	93.4	1200
Shields1.1	102.7	1200
MH57.1	76.7	1200
MH58.1	81.2	1200
MH59.1	85.0	1200
MH60.1	125.3	1200
MH61.1	87.8	1200
MH62.1	101.9	1200
MH63.1	74.4	1200
-	-	-
MH65.1	113.1	1200
MH66.1	87.2	1200
MH68.1	98.7	1200
MH69.1	71.5	1200
MH70.1	86.4	1200
MH71.1	99.0	1200
MH72.1	175.2	1200
MH73.1	171.2	1200
MH74.1	165.0	1200
MH75.1	167.8	1200
MH76.1	168.2	1200
MH77.1	182.1	1200
MH78.1	177.6	1200
MH79.1	148.3	1200

Node	level (m AD)	flood dep (m)
-	-	-
MH240	175.386	-8.114
MH241	175.290	-8.210
MH242	175.183	-8.317
MH243	175.107	-8.393
MH244	175.004	-8.496
MH226	174.872	-8.628
-	-	-
-	-	-
-	-	-
MH4	-	-
-	-	-
MH6	-	-
-	-	-8.418
-	-	-
-	-	-
MH57	174.463	-9.037
MH58	-	-9.093
MH59	174.350	-9.150
MH60	174.295	-9.205
MH61	174.202	-9.298
MH62	174.126	-9.374
MH63	174.022	-9.478
-	-	-
MH65	-	-9.883
MH66	173.516	-9.984
MH68	173.448	-10.052
MH69	173.393	-10.107
MH70	-	-
MH71	173.326	-10.174
MH72	173.296	-10.204
MH73	173.205	-10.295
MH74	173.124	-10.376
MH75	173.053	-10.447
MH76	172.993	-10.507
MH77	172.942	-10.558
MH78	172.899	-10.601
MH79	172.866	-10.634
MH80	-	-

FIGURE F-6: Intersection Road Trunk Sanitary Sewer - Peak HGL Profile - Scenario 2

1:25 year, 4 hour design storm simulation

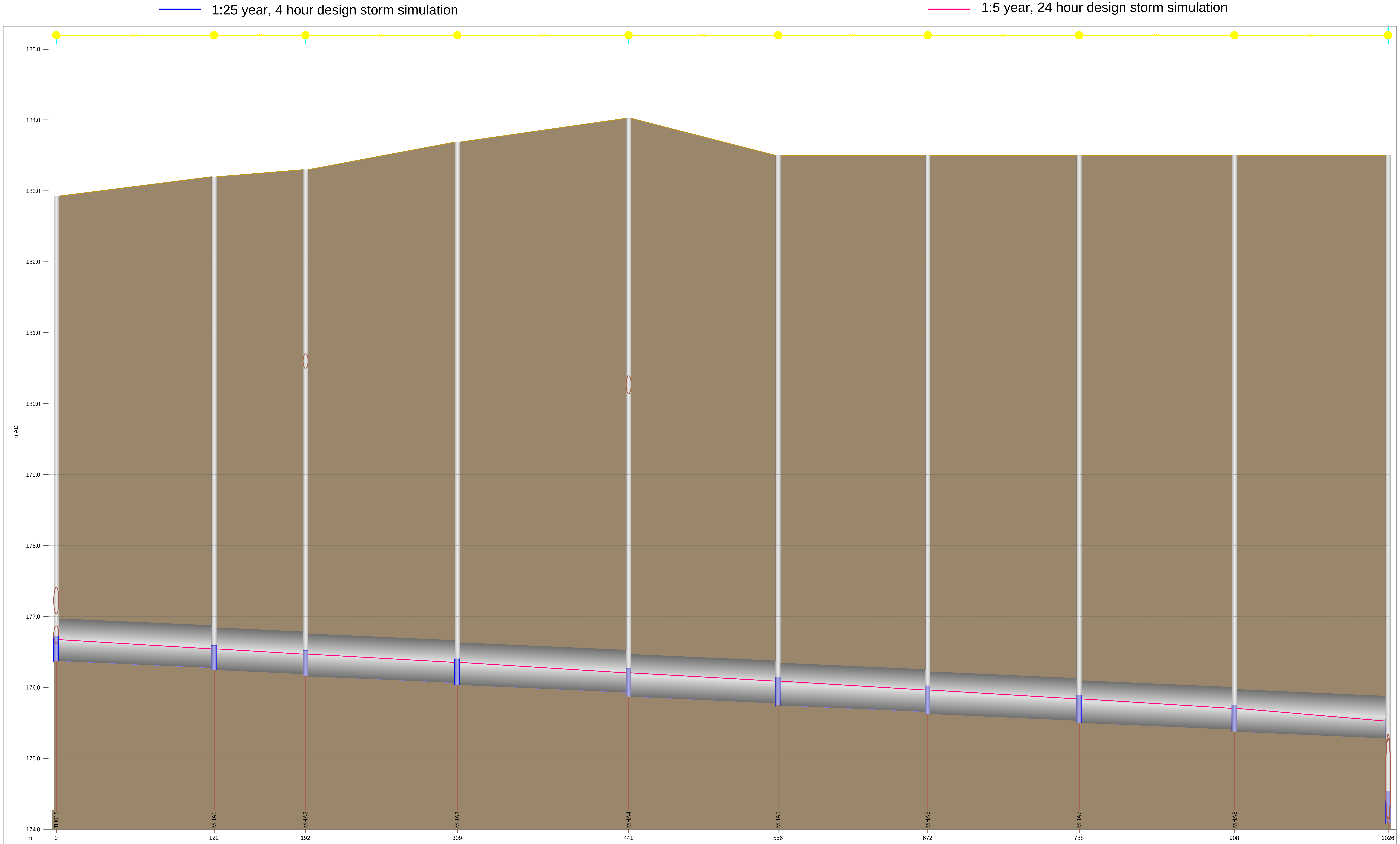
1:5 year, 24 hour design storm simulation



Link	TH058.1	MHI1.1	MHI2.1	TH061.1	TH191.1	MHI3.1
length (m)	117.4	116.7	49.1	47.6	119.6	95.9
height (mm)	600	600	600	600	600	600

Node	TH058	MHI1	MHI2	TH061	TH191	MHI3	MH72
level (m AD)	178.617	178.359	178.093	177.983	177.897	177.632	173.296
flood dep (m)	-5.013	-5.390	-5.442	-5.427	-5.003	-5.324	-10.204

FIGURE F-7: St Alphonse and Shields Street Trunk Sanitary Sewer from Pump Station in CR42 Road toward 1200 mm Hamlet Trunk Sewer - Peak HGL Profile - Scenario 2



Link	TH015.1	MHA1.1	MHA2.1	MHA3.1	MHA4.1	MHA5.1	MHA6.1	MHA7.1	MHA8.1
length (m)	121.6	70.5	117.0	132.0	115.2	115.3	116.7	119.8	118.3
height (mm)	600	600	600	600	600	600	600	600	600

Node	TH015	MHA1	MHA2	MHA3	MHA4	MHA5	MHA6	MHA7	MHA8	Shields1
level (m AD)	176.718	176.589	176.517	176.401	176.260	176.143	176.018	175.891	175.749	174.538
flood dep (m)	-6.212	-6.611	-6.783	-7.287	-7.760	-7.357	-7.482	-7.609	-7.751	-8.962

Appendix C

Outlet Capacity Analysis Technical Memo

Tecumseh Hamlet SPA Outlet Capacity Assessment
ERCA Coordination

Agenda Items

1. Background Tecumseh Hamlet Secondary Plan
   I. Location in Upper Little River
   II. Proposed Servicing Plan

2. Tecumseh Hamlet SPA SWM Analysis – Outlet Capacity Assessment and Recommended Allowable Release Rate Summary

3. Updates:
   I. Pumped Release Rates
   II. East Townline Drain – SE Hamlet Area

4. Discussion

Tecumseh Hamlet SPA Outlet Capacity Assessment

ERCA Coordination

Location in Upper Little River

The Location of the Tecumseh Hamlet SPA in the Upper Little River is highlighted in RED within the screenshot from the 2017 Upper Little River Report.

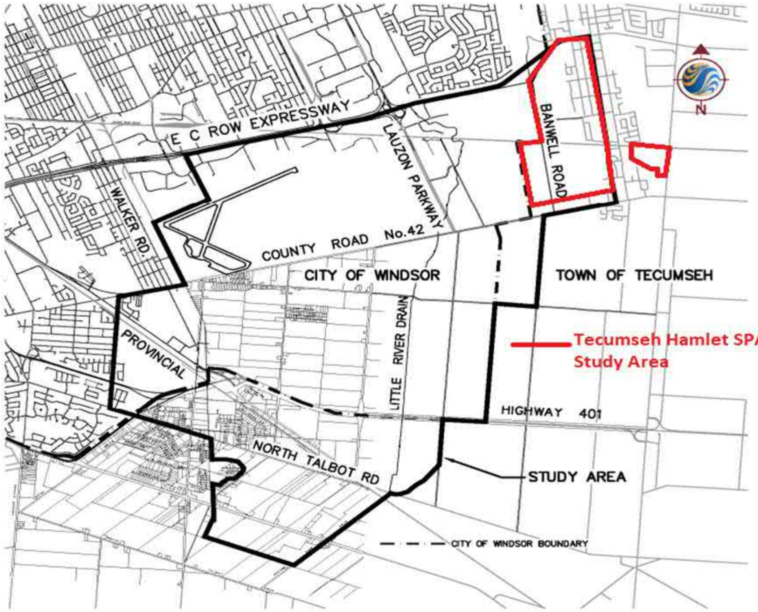
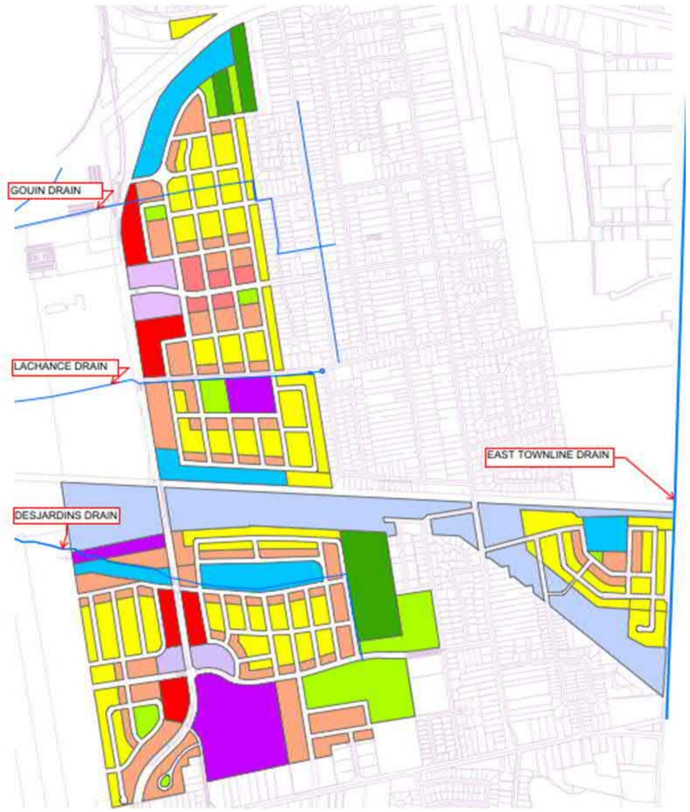


Figure E1: Site Location Plan

Source – Upper Little River Watershed Master Drainage and Stormwater Management Plan Environmental Assessment, Environmental Study Report (Stantec, 2017)

Proposed Servicing Plan

Construct four pond's in the Tecumseh Hamlet SPA Study Area that are pumped into three drains – Gouin, Lachance and Desjardins. For the Desjardins Drain two of the ponds are planned to be interconnected. The SE Hamlet Area (not within the Upper Little River Watershed) discharges into the East Townline Drain.



Tecumseh Hamlet SPA Outlet Capacity Assessment

ERCA Coordination

Allowable Release Rate Summary

ERCA Approved Release Rates on August 11th, 2021

Table 1: Tecumseh Hamlet SPA - Alternative Release Rates Options

Municipal Drain	Drainage Area (ha)	SPA Alternative 1: 6 L/s/ha (L/s)	SPA Alternative 2: 2-year 24-hour SCS Type II (L/s)
Gouin	106.5	638	2,504*
Lachance	62.6	360	2,360*
Desjardins	114.0	660	765

** 1:2 year Existing Condition flows take into consideration the existing Tecumseh development east of the study area currently entering the respective municipal drains which are proposed to be brought into the SPA storm sewer system and SWM facilities.*

Tecumseh Hamlet SPA Outlet Capacity Assessment
ERCA Coordination

Updates

Allowable Release Rates (2021 vs Present)

All three Municipal Drain release rate have changed since August 11th, 2021 ERCA approval. In the fall of 2021 Dillon was requested by The Town of Tecumseh to investigate a scenario wherein each Municipal Drain was poorly maintained; thus having an increased Manning's 'n' roughness coefficient (0.045 to 0.060). The resulting release rate changes are circled in RED.

Municipal Drain	Drainage Area (ha) (2021)	Drainage Area (ha) (Present)	SPA Alternative 1: 6 L/s/ha (L/s) (2021)	SPA Alternative 1: 6 L/s/ha (L/s) (Present)	SPA Alternative 2: 2-year 24-hour SCS Type II (L/s) (2021)	SPA Alternative 2: 2-year 24-hour SCS Type II (L/s) (Present)	Allowable Release Rate (L/s)
Gouin	106.5	120.0 (+13.5)	638	720	2,504	4,110	1,750
Lachance	62.6	45.9 (-16.7)	360	275	2,360	1,205	1,205
Desjardins	114.0	119.7 (+5.7)	660	718	765	660	600

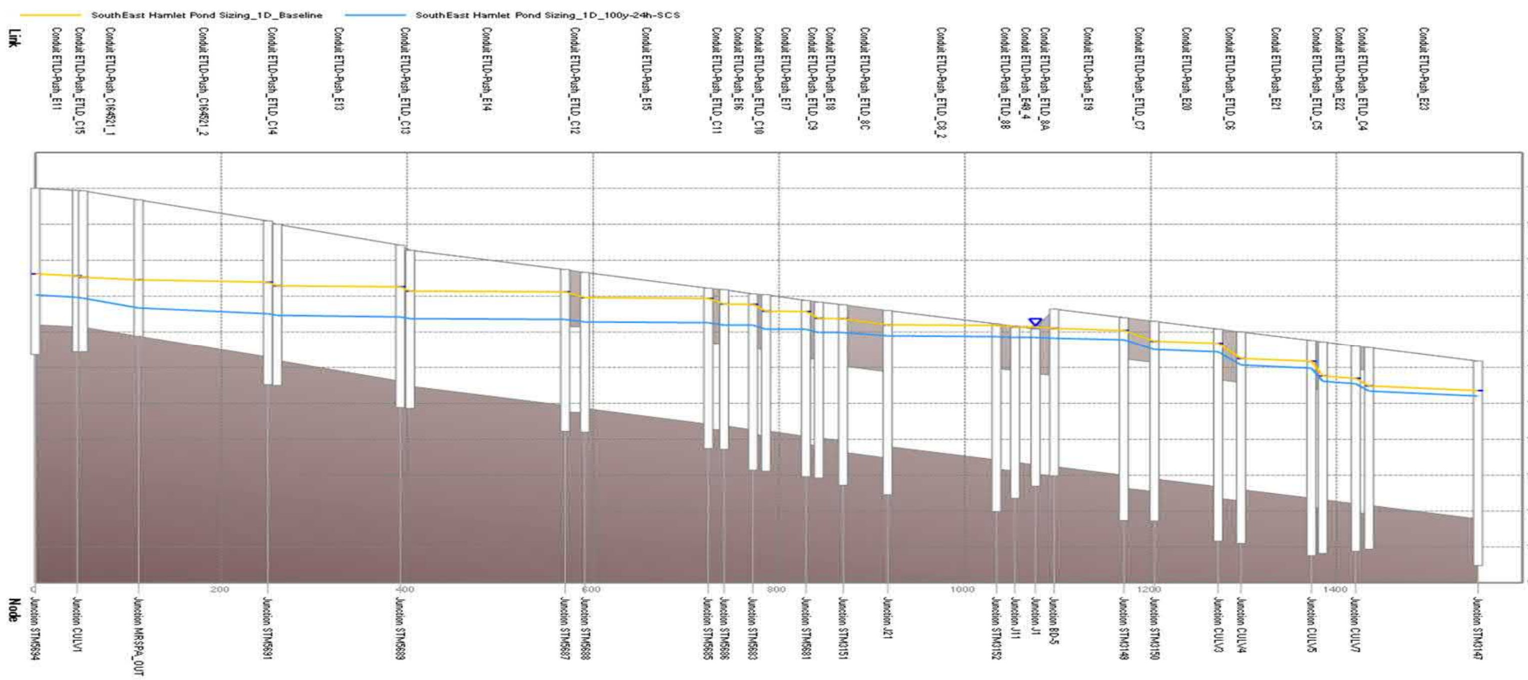
The Gouin and Desjardins Drain pumped release rate from the ponds were required to be reduced to maintain the existing Hydraulic Grade Line based on the Littler River Floodplain Mapping and Sandwich South Master Servicing Plan boundary conditions. The Lachance Drain Hydraulic Grade Line was analyzed for the 2,360 L/s release rate and the existing conditions were not impacted. However, with the change in area the proposed release rate will meet the existing release rate of 1,205 L/s

Tecumseh Hamlet SPA Outlet Capacity Assessment
ERCA Coordination

Updates

East Townline Drain – SE Hamlet Area

A constant pump rate of 200 L/s was not observed to have a negative impact on the HGLs in the East Townline Drain.



Discussion

Memo

To: James Bryant, P.Eng. – Essex Region Conservation Authority

From: Susan St Louis, P.Eng. – Dillon Consulting Limited

cc: John Henderson, P.Eng. – Town of Tecumseh

Ryan Langlois, P,Eng. - Dillon Consulting Limited

Date: March 22, 2021

Subject: Tecumseh Hamlet SPA SWM Analysis – Outlet Capacity Assessment and Recommended Allowable Release Rate Summary

Our File: 20-2559

In 2012 Dillon Consulting (Dillon) was retained to complete an Environmental Assessment and Functional design related to the Tecumseh Hamlet Secondary Plan Area (SPA) within The Town of Tecumseh (see Site Location in **Figure 1**). In 2014, the study was placed on hold for various reasons. In 2020, the study has recommenced to further detail and confirm the recommended stormwater management (SWM) strategy based on updated regional stormwater design standards. Specifically, the updated SWM analysis is aimed at confirming the allowable release rates from the development area and to confirm the SWM facility location and size to provide both water quantity and quality control.

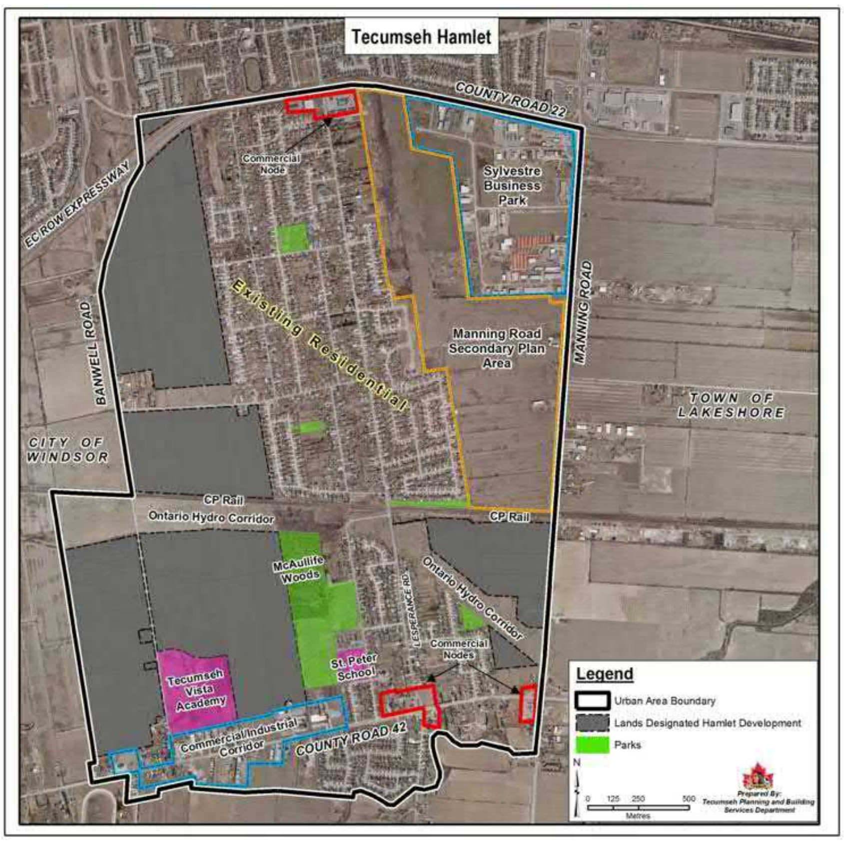


Figure 1: Tecumseh Hamlet Secondary Plan Area

Prior to proceeding with the Environmental Assessment and Functional design component for the SPA, Dillon reviewed the previous background information which were taken into consideration during the SWM analysis. This included a review of initial recommendations for allowable release rates within the Little River watershed based on the 2017 Upper Little River Watershed Drainage Master Plan (ULRMP) which has yet to be approved and adopted by the regional municipalities involved. The SWM design also took into consideration the requirements set forth in the adopted 2018 Windsor/Essex Region Stormwater Management Standards Manual (Regional SWM Manual). Based on this, the initial SWM design criteria for the SPA included:

- Assessing the SWM requirements for the SPA based on initial recommended maximum allowable release rates from the ULRMP:
    - 2-year Allowable = 3 L/s/ha;
    - 5-year Allowable = 4 L/s/ha; and
    - 100-year Allowable = 6 L/s/ha.
- Water Quality Control:
    - Providing for a Normal (70% TSS Removal) level of on-site treatment to meet both the Regional SWM Manual and Ministry of Environment and Parks (MECP) requirements.
- Climate Change Adaptation:
    - Evaluate and design the proposed stormwater infrastructure based on controlling the 150mm "Urban Stress Test Event" within the site to the accepted allowable release rate.

This memo is aimed at specifically discussing the allowable release rates reviewed for the SPA and summarizing the results of the outlet capacity assessment completed for the site based on the alternative allowable release rates into each downstream watercourse.

The SPA team has been in coordination with the Dillon team currently working on the "Little River Floodplain Study and Sandwich South Master Plan (Little River/SSMP Study)" to provide a coordinated and consistent assessment of the impacts of the downstream watershed upon full buildout of the SPA lands and allowable release rates chosen for the development. By having this approach, both teams have had the advantage of analyzing the impacts on the downstream watersheds based on one consolidated SWM model. It was also identified by the Town of Tecumseh during the project start-up meeting for the Little River/SSMP Study that the SPA lands be assessed as part of the initial buildout conditions for the Little River watershed.

Discussions with the Little River Floodplain Team identified that a dynamic 2-dimensional (2D) PCSWMM model was developed for the full Little River watershed. This model was identified to be used for the updated regulatory floodplain mapping component of the study, but also to develop the overall SWM strategy for the Sandwich South Secondary Planning Areas and complete the outlet capacity assessment for the full Little River watershed system based on initial buildout conditions, including for the SPA. This initial buildout assessment was considered the most conservative, as the ultimate buildout condition for the Upper Little River watershed and respective SWM controls for the individual developments are shown to have a reduction in HGL within the lower reaches of the Little River Drain.

Allowable Release Rate Options

Under a full development condition, the SPA is proposed to discharge into three existing municipal drains; the Gouin, Lachance and Desjardins Municipal Drains. This analysis was completed to determine acceptable release rates for the SPA into each downstream watercourse as to not cause any adverse impacts to the overall watershed. The analysis was developed in a joint effort with the Little River/SSMP Study under a number of allowable release rate options. This included:

- **Alternative 1:** Controlling post-development SPA flows based on the maximum 6 L/s/ha identified within the yet to be approved ULRMP; and
- **Alternative 2:** Assessing the SPA under an existing condition based on a 2-year 24-hour SCS Type II storm event and controlling post-development runoff to the existing 1:2 year event flows.

Based on the above noted alternatives for the SPA, the results shown in **Table 1** identify the allowable release rates determined which were further assessed as part of the outlet capacity analysis for the SPA into each municipal drain.

Table 1: Tecumseh Hamlet SPA - Alternative Release Rates Options

Municipal Drain	Drainage Area (ha)	SPA Alternative 1: 6 L/s/ha (L/s)	SPA Alternative 2: 2-year 24-hour SCS Type II (L/s)
Gouin	106.5	638	2,504*
Lachance	62.6	360	2,360*
Desjardins	114.0	660	765

** 1:2 year Existing Condition flows take into consideration the existing Tecumseh development east of the study area currently entering the respective municipal drains which are proposed to be brought into the SPA storm sewer system and SWM facilities.*

As shown in **Table 1**, the 1:2 year release rates identified from the existing condition modelling assessment are significantly higher than the 6 L/s/ha rate for Gouin and Lachance drains, with only the Desjardins drain remaining somewhat consistent. This can be attributed to the Gouin and Lachance drain currently receiving flows from existing Town developed areas east of the SPA which are currently allocated to the respective watersheds. These flows are expected to be brought into the SPA storm sewer system and into the proposed SWM facilities under a developed condition. Therefore, the existing condition development flows under a 1:2 year condition to establish allowable release rates into the downstream watercourse were warranted.

Based on the allowable release rate differences identified for the two alternatives noted above, each alternative has a dramatic impact on the size of the SWM facilities for the SPA, which are planned to be traditional wet ponds controlling both water quantity and quality. Additionally, the size of the active storage area within the facility ultimately dictates the surface area of the permanent pool, which is recommended to be kept to a minimum due to the SPA being within the Windsor Airport Flightpath. Mitigation design measures within each facility will be required to prevent waterfowl.

<u>Outlet Capacity Analysis</u>

With the ULRMP not yet accepted by the MECP under the official Master Planning requirements to satisfy Schedule B projects, the team felt it was necessary to complete an initial outlet capacity assessment under both alternative allowable release rates. The Tecumseh Hamlet SPA team worked in coordination with the Little River/SSMP Study team to complete an outlet capacity analysis for each alternative.

This outlet capacity assessment used the currently developed 2D PCSWMM model to dynamically assess the impacts of both release rates on the downstream watershed and determined any adverse impacts when releasing the post-development condition at the higher rate. The outlet capacity approach was completed as follows:

- Little River/SSMP Study team extracted each proposed 1:100 year SPA SWM facility pump station outflow hydrograph and incorporated the flows into the dynamic Little River/SSMP model for each alternative release rate scenario; and
- Team assumed full buildout of the SPA lands and eliminated the development area from the existing condition 2D mesh, thus removing all local riparian storage under this condition. Existing flows from developed lands east of the SPA were assumed to be contributing to the proposed SWM facility and therefore were not included as conveying uncontrolled into the downstream watercourses. The respective municipal drains running through the SPA lands were assumed to be abandoned under a post-developed condition.

The 1:100 year HGL plan and profiles based on each alternative allowable release rate through the respective municipal drains downstream of the SPA area to the Detroit River are provided in **Attachment A**.

Peak flow rates are shown in comparison to existing condition flows taken from the Little River/SSMP model. Below in **Table 2** are the 1:100 year peak flow results in tabular format at an analysis point taken at the confluence of the respective municipal drains with the Little River Drain.

Table 2: Existing vs Proposed Peak Flow Results – Alternative Allowable Release Rates

Municipal Drain	Existing Condition: 1:100 Year Flow @ Little River Confluence (m^3/s)	SPA Alternative 1: 6 L/s/ha 1:100 Year Flow @ Little River Confluence (m^3/s)	SPA Alternative 2: 2-year 24-hour SCS Type II 1:100 Year Flow @ Little River Confluence (m^3/s)
Gouin	6.8	3.1	5.0
Lachance	3.0	2.7	3.0
Desjardins	4.8	3.1	3.3

Gouin and Desjardins Municipal Drains

Based on the results shown in **Table 2** and the HGL profile comparisons shown in **Attachment A** for the Gouin and Desjardins Municipal Drain, both alternative release rates outlined reduce the HGL through the downstream municipal drainage system from the outlet location of the proposed SWM facilities into the drain to the Detroit River outfall.

Lachance Municipal Drain

Based on the results shown in **Table 2** and the HGL profile comparisons shown in **Attachment A** for the Lachance Municipal Drain, both alternative release rates outlined are shown to reduce the HGL through the downstream municipal drainage system, with one exception at the upper end of the drain from Banwell Road to directly east of the existing industrial area where the drain takes a 90 degree turn. This increase in HGL is occurring only during the Alternative 2 allowable release rate scenario where the HGL is approximately 0.17 m higher than existing conditions from Station 0 until Station 1100, as shown in **Attachment A**.

This increase in HGL during the 1:100 year event, however, has been determined to not cause any adverse impacts on the system, as the municipal drain dynamic flood inundation extents in this area have been determined to be maintained within the respective municipal drainage banks. The HGL impacts throughout the downstream system is therefore considered negligible.

Recommendations

Based on the results detailed throughout this document, the recommended allowable release rate for the SPA development lands is to be **Alternative 2: 2-year 24-hour SCS Type II existing condition flows**. Based on the results shown above, the Gouin, Lachance, Desjardins and Little River drain all have the hydraulic capacity to convey the allowable flows. With the ULRMP not considered to be developed to a functional level of detail to satisfy requirements for Schedule B projects by the MECP, the Tecumseh Hamlet SPA team completed its due diligence to determine the most cost effective and feasible SWM option for the development lands, while ensuring no adverse impacts on the downstream system. This was confirmed through the detailed outlet capacity assessment which was coordinated with the Little River/SSMP Study team.

Next Steps

Prior to moving forward with functional design of the SWM facilities for the SPA under this recommendation, we felt it was necessary to have this pre-consultation discussion with the Essex Region Conservation Authority for approval of this strategy.

At your earliest convenience please advise if you are supportive of our recommendations herein.

Sincerely,

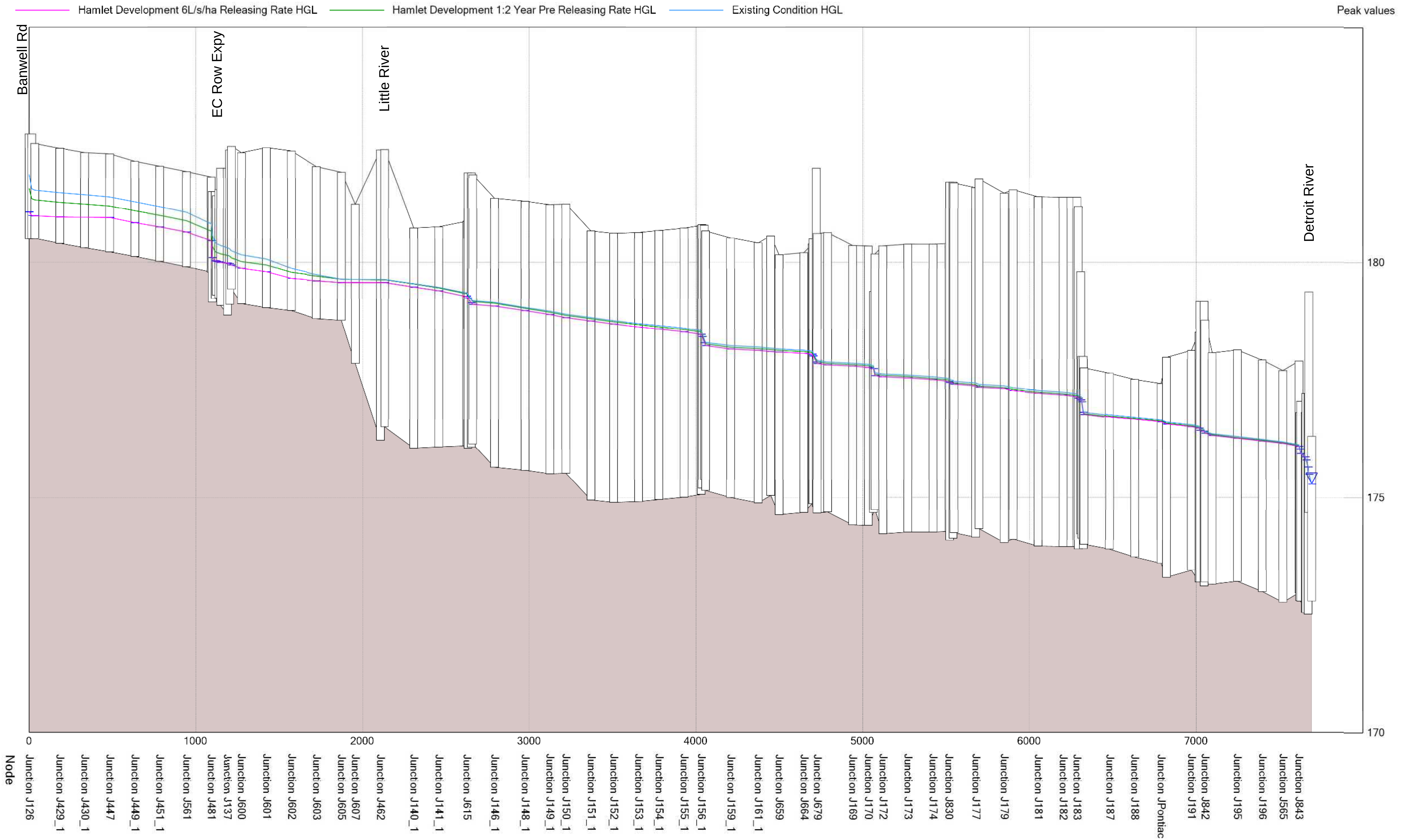
Dillon Consulting Limited

Susan E. St Louis, P.Eng.

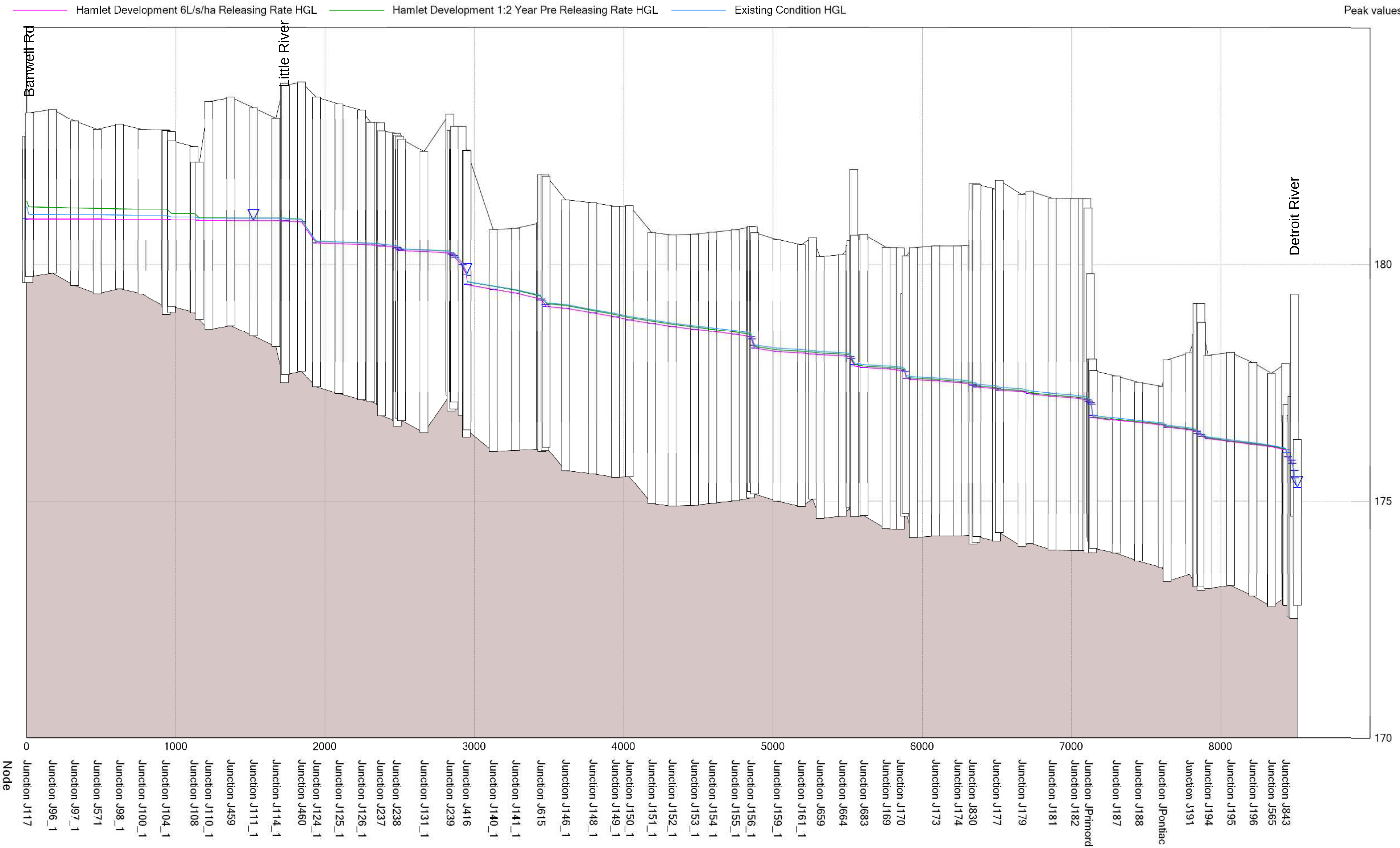
Project Manager

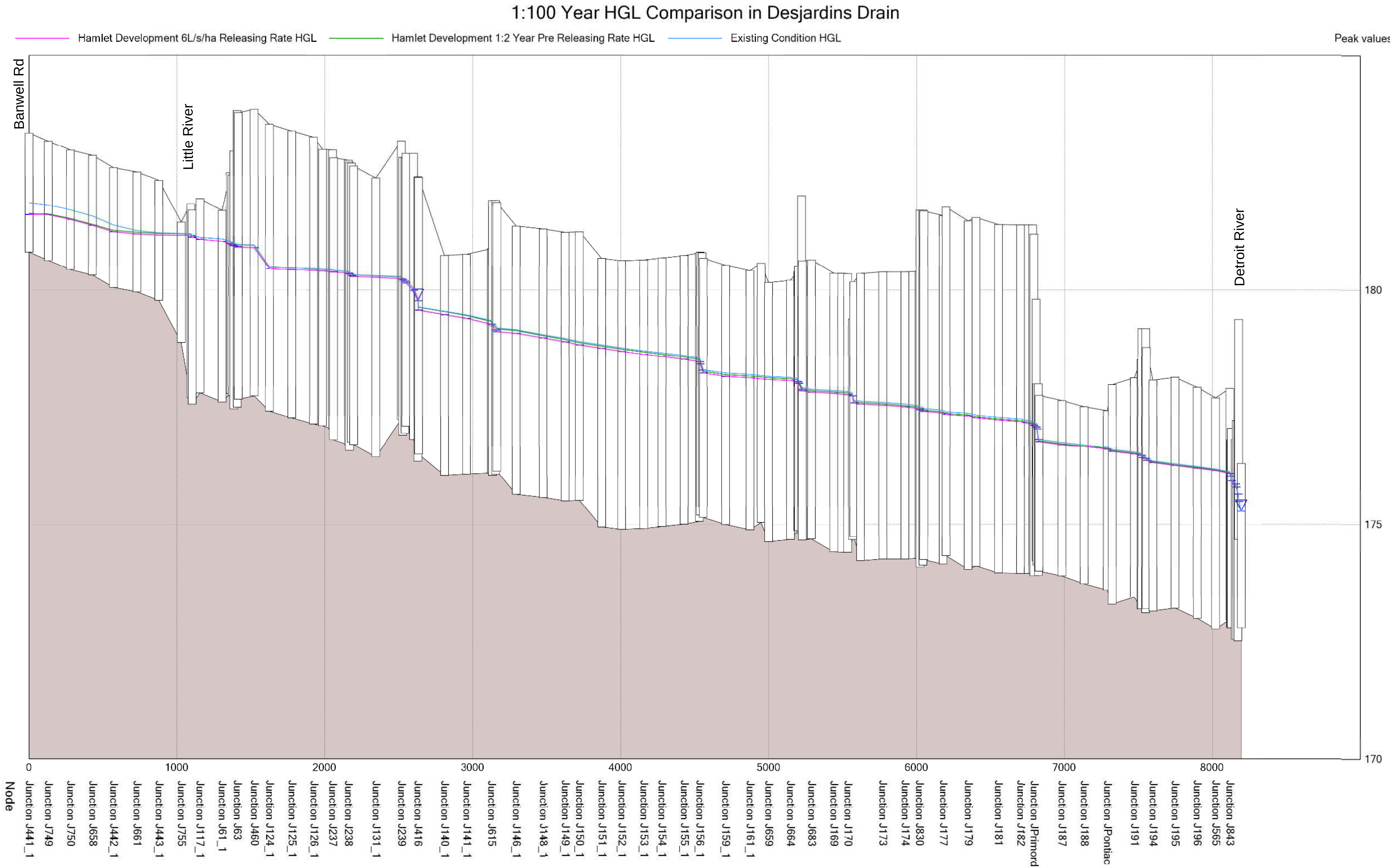
Legend
Gouin Drain
Lachance Drain
Desjardins Drain
Hamlet Inflow Locations
Hamlet Boundary
N
Detroit River
Windsor Airport
Tecumseh
E C Row Expy
County Road 22
County Road 42
Riverside Dr E
Manning Rd
Banwell Rd
Lauzon Pkwy
Lesperance Rd

1:100 Year HGL Comparison in Gouin Drain



1:100 Year HGL Comparison in Lachance Drain




1:100 Year HGL Comparison in Desjardins Drain
Hamlet Development 6L/s/ha Releasing Rate HGL
Hamlet Development 1:2 Year Pre Releasing Rate HGL
Existing Condition HGL
Peak values
Banwell Rd
Little River
Detroit River
180
175
170
0
1000
2000
3000
4000
5000
6000
7000
8000
Node
Junction J441_1
Junction J749
Junction J750
Junction J658
Junction J442_1
Junction J661
Junction J443_1
Junction J755
Junction J117_1
Junction J61_1
Junction J63
Junction J460
Junction J124_1
Junction J125_1
Junction J126_1
Junction J237
Junction J238
Junction J131_1
Junction J239
Junction J416
Junction J140_1
Junction J141_1
Junction J615
Junction J146_1
Junction J148_1
Junction J149_1
Junction J150_1
Junction J151_1
Junction J152_1
Junction J153_1
Junction J154_1
Junction J155_1
Junction J156_1
Junction J159_1
Junction J161_1
Junction J659
Junction J664
Junction J683
Junction J169
Junction J170
Junction J173
Junction J174
Junction J830
Junction J177
Junction J179
Junction J181
Junction J182
Junction JPrimord
Junction J187
Junction J188
Junction JPontiac
Junction J191
Junction J194
Junction J195
Junction J196
Junction J565
Junction J843

DILLON CONSULTING

Herlehy, Laura <lherlehy@dillon.ca>

Fwd: Tec. Hamlet SPA SWM Analysis - Outlet Capacity Assessment

1 message

Langlois, Ryan <rlanglois@dillon.ca> Mon, Jan 9, 2023 at 8:31 PM
To: Laura Herlehy <lherlehy@dillon.ca>

Good evening Laura.

Please see below the response from ERCA in regards to the outlet capacity assessment for the Tecumseh Hamlet Area. The original letter sent to ERCA is also attached.

Thanks

DILLON CONSULTING

BEST MANAGED COMPANIES
Platinum member

Ryan Langlois, P.Eng.
Dillon Consulting Limited
3200 Deziel Drive Suite 608
Windsor, Ontario, N8W 5K8
RLanglois@dillon.ca
www.dillon.ca

---------- Forwarded message ---------
From: **James Bryant** <JBryant@erca.org>
Date: Wed, Aug 11, 2021 at 9:06 AM
Subject: Tec. Hamlet SPA SWM Analysis - Outlet Capacity Assessment
To: John Henderson <jhenderson@tecumseh.ca>
Cc: sstlouis@dillon.ca <sstlouis@dillon.ca>, Phil Bartnik <pbartnik@tecumseh.ca>, Ryan Langlois <rlanglois@dillon.ca>

Good morning John,

Our office has reviewed the memo dated March 22, 2021 prepared by Dillon Consulting with the Subject: Tecumseh Hamlet SPA SWM Analysis – Outlet Capacity Assessment and Recommended Allowable Release Rate Summary. Our office does not have any concerns or objections with proceeding with “Alternative 2: 2-year 24 hour SCS Type II existing flows” for the allowable release rate for the SPA development lands. As part of the complete Hamlet SPA work/report, please document the appropriate information regarding the release rate to be used for the area. It is preferred that this information be also included on a L/s/ha basis to simply development calculations for new development within the SPA. Upon completion, it would also be helpful to receive a shapefile with the associated drainage boundaries that could be uploaded to our system to identify that there is “Watershed Study / Plan’ that governs release rates for the Gouin, Lachance, and Desjardin drains within the Tecumseh Hamlet.

Cheers,

__
James

[cid:image003.jpg@01D44527.9F0E1B90]
James Bryant, P.Eng.
Director, Watershed Management Services
Essex Region Conservation Authority
360 Fairview Avenue West, Suite 311 | Essex, Ontario | N8M 1Y6
P. 519-776-5209 x 246 | F. 519-776-8688
jbryant@erca.org<mailto:jbryant@erca.org> https://urldefense.proofpoint.com/v2/url?u=http-3A__www.essexregionconservation.ca&d=DwIGaQ&c=JnLCALisrKxQZnQdpANaBZUceEgEGD7wjEyj__0JcDA&r=zeYxAkcnd0YG2akC8QtV27te5nW1qjdju_vtvfqfojU&m=ehLJ7Ok0YVP65MoLXgks2qrh6shoxy3uAN_mij9a1gI&s=7j8o6XP-EmsXW59HxFti9Vg3RX2V6siyLaOfwYIOd5w&e= <https://urldefense.proofpoint.com/v2/url?u=http-3A__www.essexregionconservation.ca_&d=DwIGaQ&c=JnLCALisrKxQZnQdpANaBZUceEgEGD7wjEyj__0JcDA&r=zeYxAkcnd0YG2akC8QtV27te5nW1qjdju_vtvfqfojU&m=ehLJ7Ok0YVP65MoLXgks2qrh6shoxy3uAN_mij9a1gI&s=FRMqAcD4vwRGYRm38ReHNI5qqhjnsAqgzaHhxWUoW7M&e= >

3 attachments

image001.jpg
5K

noname
5485K

Tecumseh Hamlet - Outlet Capacity Analysis Technical Memo.pdf
5454K

Appendix D

Water Quality Storage Requirements

SWMF - WATER QUALITY REQUIREMENTS - Lachance Pond

SWMF - Water Quality Requirements

Drainage Area	47.5	ha
% Impervious:	54.00	
Normal Protection (70%TSS):		
Treatment Volume	111.261	m^3/ha
Active Storage:	40	m^3/ha
	1,900	m^3
	23,300	Provided Active Storage
Perm Storage:	71.261	m^3/ha required
	3,385	m^3
	4,400	Provided Perm Storage m^3

SWMF - Required Forebay Length

Length to width ratio of forebay, *r* =	10.1:1	
Peak outflow (25 mm storm), Q_p =	1.070	m^3/s
Target particle size =	150	microns
Settling velocity, V_s =	0.0003	m/s

Forebay Settling Length, Dist 1

$$Dist = \sqrt{\frac{rQ_P}{V_S}}$$

190 m

Forebay Dispersion Length, Dist 2

Desired velocity in forebay, V_f =	0.5	m/s
Peak inlet flowrate , Capacity of Pipe =	2.570	m^3/s
Depth in forebay, *d* =	1.00	m

$$Dist_2 = \frac{8Q}{dV_f}$$

41 m

Therefore, the settling length of 190 m governs the design.

Notes: Input

Output

SWMF - WATER QUALITY REQUIREMENTS - Desjardins East Pond

SWMF - Water Quality Requirements

Drainage Area	92.0	ha
% Impervious:	42.00	
Normal Protection (70%TSS):		
Treatment Volume	96.795	m^3/ha
Active Storage:	40	m^3/ha
	3,680	m^3
	56,000	Provided Active Storage
Perm Storage:	56.795	m^3/ha required
	5,225	m^3
	35,800	Provided Perm Storage m^3

SWMF - Required Forebay Length

Length to width ratio of forebay, r =	5.3:1	
Peak outflow (25 mm storm), Q_p =	0.380	m^3/s
Target particle size =	150	microns
Settling velocity, V_s =	0.0003	m/s

Forebay Settling Length, Dist 1

$$Dist = \sqrt{\frac{rQ_P}{V_S}}$$

82 m

Forebay Dispersion Length, Dist 2

Desired velocity in forebay, V_f =	0.5	m/s
Peak inlet flowrate , Capacity of Pipe =	3.400	m^3/s
Depth in forebay, d =	2.00	m

$$Dist_2 = \frac{8Q}{dV_f}$$

27 m

Therefore, the settling length of 82 m governs the design.

Notes: Input
Output

SWMF - WATER QUALITY REQUIREMENTS - Desjardins West Pond

SWMF - Water Quality Requirements		
Drainage Area	33.4	ha
% Impervious:	58.00	
Normal Protection (70%TSS):		
Treatment Volume	116.083	m^3/ha
Active Storage:	40	m^3/ha
	1,336	m^3
	33,700	Provided Active Storage
Perm Storage:	76.083	m^3/ha required
	2,541	m^3
	14,000	Provided Perm Storage m^3

Notes: Input

Output

SWMF - Required Forebay Length

Length to width ratio of forebay, r =	5.0:1	
Peak outflow (25 mm storm), Q_p =	0.525	m^3/s
Target particle size =	150	microns
Settling velocity, V_s =	0.0003	m/s

Forebay Settling Length, Dist 1

$$Dist = \sqrt{\frac{rQ_p}{V_S}}$$

94 m

Forebay Dispersion Length, Dist 2

Desired velocity in forebay, V_f =	0.5	m/s
Peak inlet flowrate , Capacity of Pipe =	4.300	m^3/s
Depth in forebay, d =	1.30	m

$$Dist_2 = \frac{8Q}{dV_f}$$

53 m

Therefore, the settling length of 94 m governs the design.

SWMF - WATER QUALITY REQUIREMENTS - SE Hamlet Pond

SWMF - Water Quality Requirements

Drainage Area	35.1	ha
% Impervious:	60.00	
Normal Protection (70%TSS):		
Treatment Volume	118.494	m^3/ha
Active Storage:	40	m^3/ha
	1,404	m^3
	26,050	Provided Active Storage
Perm Storage:	78.494	m^3/ha required
	2,755	m^3
	11,250	Provided Perm Storage m^3

Notes:

Input
Output

SWMF - Required Forebay Length

Length to width ratio of forebay, r =	5.0:1	
Peak outflow (25 mm storm), Q_p =	0.200	m^3/s
Target particle size =	150	microns
Settling velocity, V_s =	0.0003	m/s

Forebay Settling Length, Dist 1

$$Dist = \sqrt{\frac{rQ_P}{V_S}}$$

58 m

Forebay Dispersion Length, Dist 2

Desired velocity in forebay, V_f =	0.5	m/s
Peak inlet flowrate , Capacity of Pipe =	4.000	m^3/s
Depth in forebay, d =	1.50	m

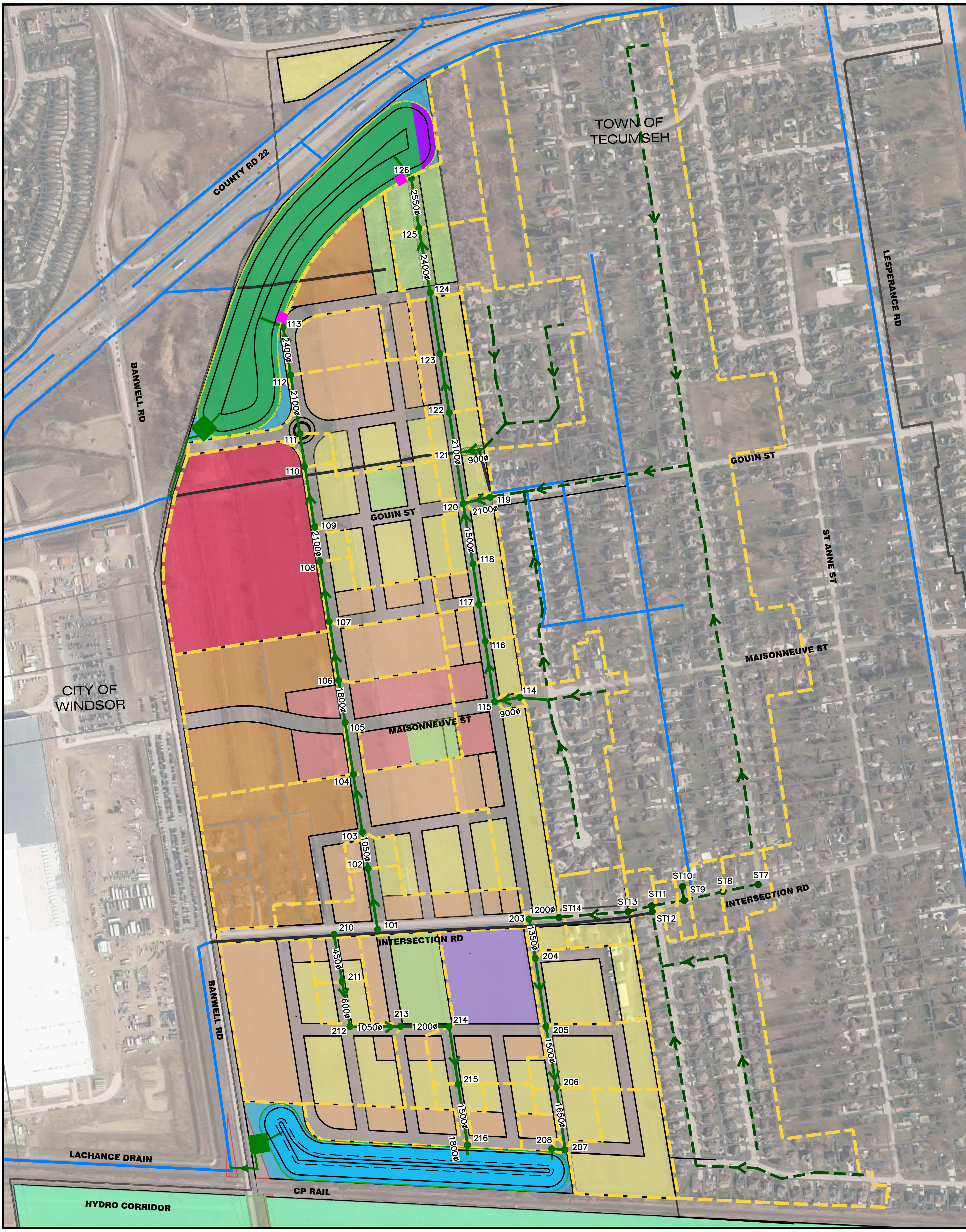
$$Dist_2 = \frac{8Q}{dV_f}$$

43 m

Therefore, the settling length of 58 m governs the design.

Appendix E

Storm Sewer Design Calculations and Layout



TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

STORM SEWER FUNCTIONAL DESIGN - NORTH OF CP RAILWAY

APPENDIX E-1

LEGEND

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MAIN STREET MIXED-USE
- ANCHOR COMMERCIAL
- PLAZA COMMERCIAL
- INSTITUTIONAL / CEMETERY
- HYDRO CORRIDOR
- BUSINESS PARK
- PARK SPACE
- NATURAL HERITAGE / WOODLOT
- ENVIRONMENTALLY PROTECTED AREA
- MAJOR INFRASTRUCTURE EASEMENT
- PROPOSED WET STORMWATER MANAGEMENT PONDS
- PROPOSED DRY STORMWATER MANAGEMENT PONDS
- PROPOSED STORM PUMP STATION
- OGS
- 1200ø PROPOSED STORM DIAMETER
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- EXISTING STORM PIPE
- PROPOSED POND N.W.L.
- PROPOSED POND BOTTOM / TOP OF BANK
- ABANDONED PORTION OF MUNICIPAL DRAIN
- EXISTING MUNICIPAL DRAIN
- PROPOSED SWALE
- 216 PROPOSED MANHOLE NUMBER
- TRUNK DRAINAGE BOUNDARY

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

N S E W

DATE: May 16, 2025

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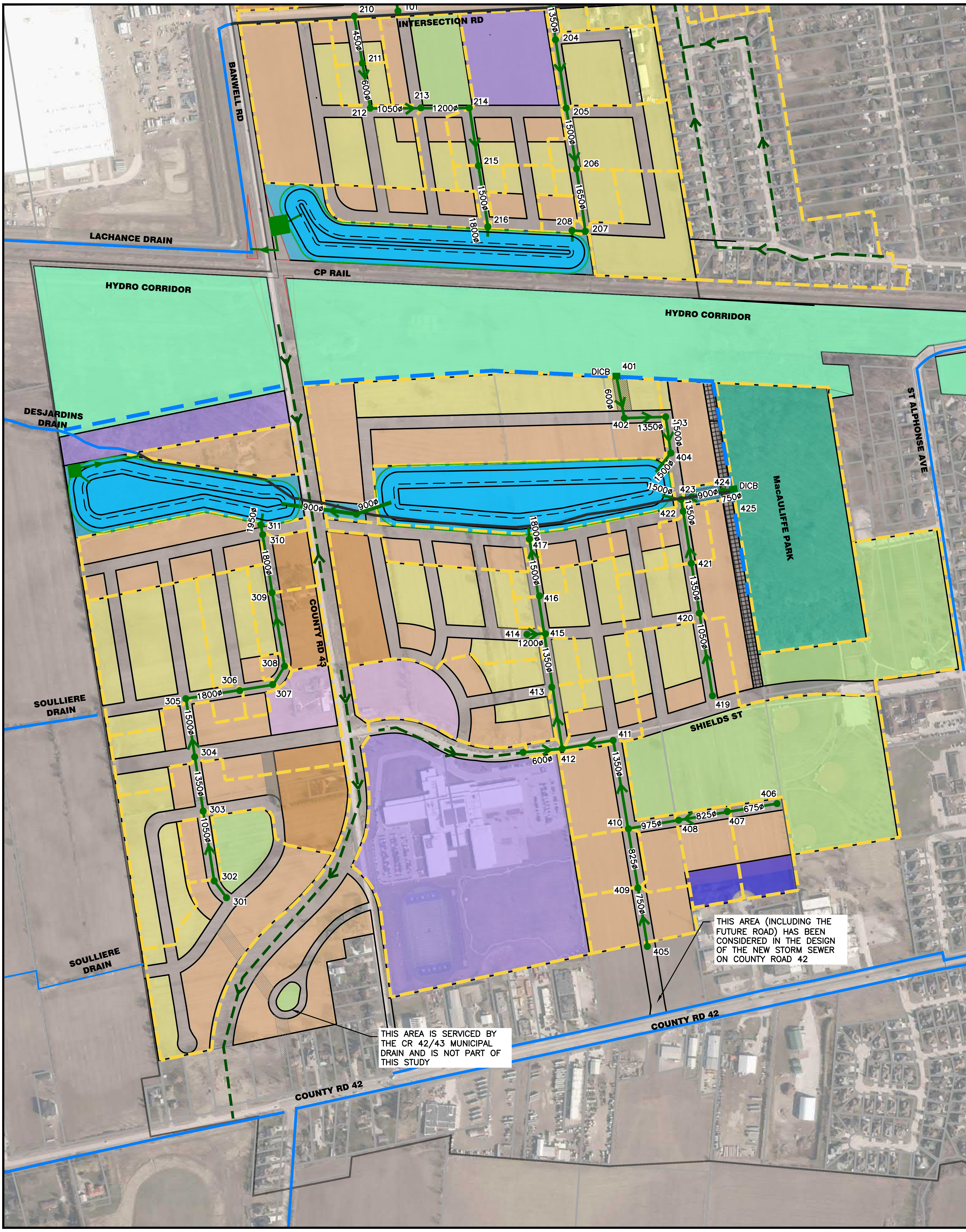

LEGEND

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MAIN STREET MIXED-USE
- ANCHOR COMMERCIAL
- PLAZA COMMERCIAL
- INSTITUTIONAL / CEMETERY
- HYDRO CORRIDOR
- BUSINESS PARK
- PARK SPACE
- NATURAL HERITAGE / WOODLOT
- ENVIRONMENTALLY PROTECTED AREA
- MAJOR INFRASTRUCTURE EASEMENT
- PROPOSED WET STORMWATER MANAGEMENT PONDS
- PROPOSED DRY STORMWATER MANAGEMENT PONDS
- PROPOSED STORM PUMP STATION
- OGS
- 1200ø PROPOSED STORM DIAMETER
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- EXISTING STORM PIPE
- PROPOSED POND N.W.L.
- PROPOSED POND BOTTOM / TOP OF BANK
- ABANDONED PORTION OF MUNICIPAL DRAIN
- EXISTING MUNICIPAL DRAIN
- PROPOSED SWALE
- 216 PROPOSED MANHOLE NUMBER
- TRUNK DRAINAGE BOUNDARY

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

STORM SEWER FUNCTIONAL DESIGN - SOUTH OF CP RAILWAY

APPENDIX E-2

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

N W E S

DATE: June 20, 2025

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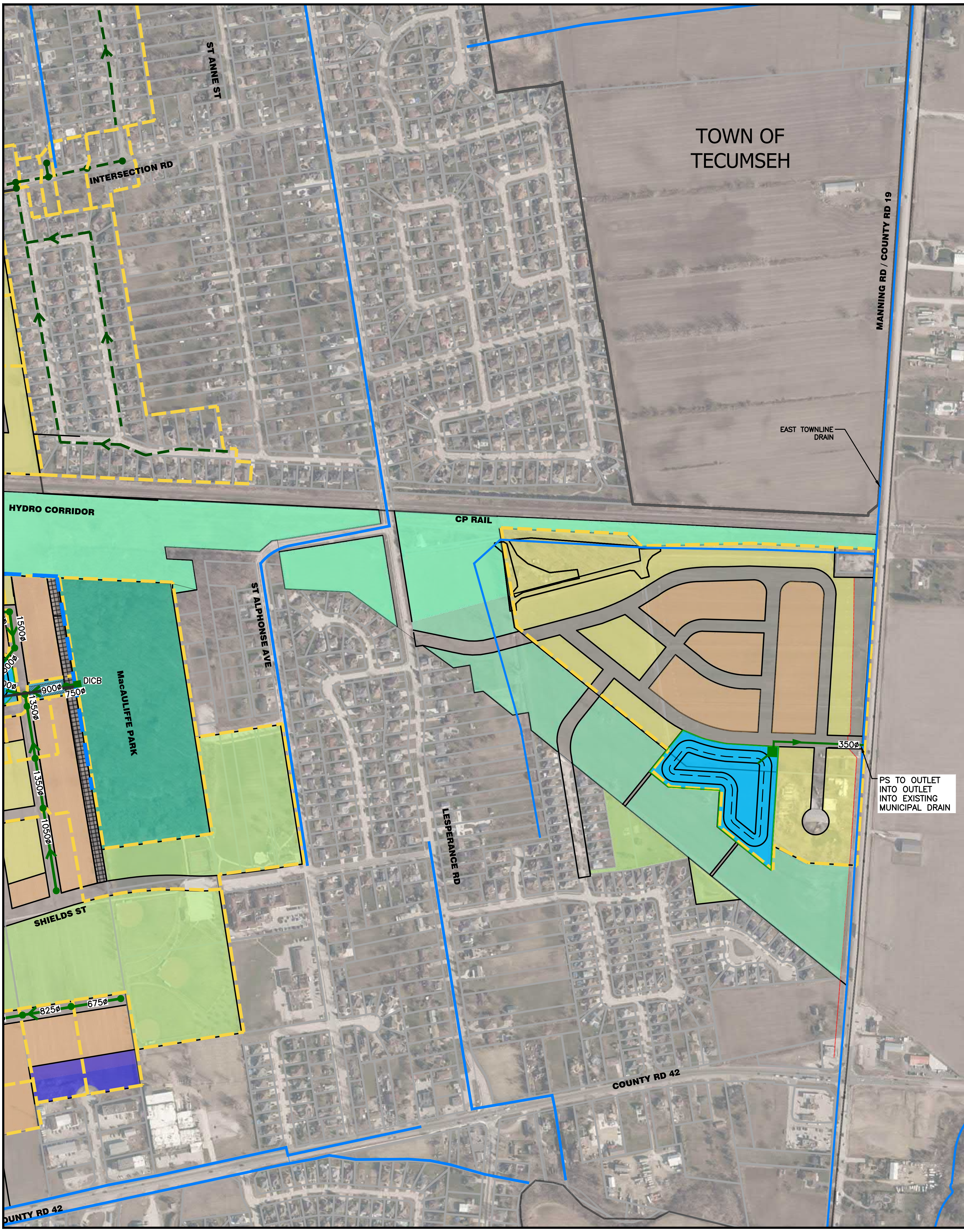


LEGEND

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MAIN STREET MIXED-USE
- ANCHOR COMMERCIAL
- PLAZA COMMERCIAL
- INSTITUTIONAL / CEMETERY
- HYDRO CORRIDOR
- BUSINESS PARK
- PARK SPACE
- NATURAL HERITAGE / WOODLOT
- ENVIRONMENTALLY PROTECTED AREA
- MAJOR INFRASTRUCTURE EASEMENT
- PROPOSED WET STORMWATER MANAGEMENT PONDS
- PROPOSED DRY STORMWATER MANAGEMENT PONDS
- PROPOSED STORM PUMP STATION
- 1200ø PROPOSED STORM DIAMETER
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- EXISTING STORM PIPE
- PROPOSED POND N.W.L.
- PROPOSED POND BOTTOM / TOP OF BANK
- ABANDONED PORTION OF MUNICIPAL DRAIN
- EXISTING MUNICIPAL DRAIN
- PROPOSED SWALE
- 216 PROPOSED MANHOLE NUMBER
- TRUNK DRAINAGE BOUNDARY

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

STORM SEWER FUNCTIONAL DESIGN - SOUTHEAST HAMLET

APPENDIX E-3

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:3000
STATUS: DRAFT
PROJECT: 23-5735

N W E S

DATE: June 20, 2025

File Location: c:\pw working directory\projects 2020\dillon_32js\dms18944\202559-02-swp-des.dwg June, 20, 2025 9:37 AM

Gouin
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: Tecumseh Hamlet
Project Number: 23-5735

1) Intensity (i) = a/(t+b)^c **2) Intensity (i) = a*t^b** **3) Insert Intensity**

Manning's n = 0.013

Based on 1:5 Year Storm Event
Town of Tecumseh

a= 1259.000 a= i=
b= 8.800 b=
c= 0.838

Total Area (ha)= 120.89 Outlet Invert Elevation= 177.500 Ground Elevation @ Outlet = 182.10 High Water Level at Outlet= 179.52

Location												Sewer Design / Profile										Cover			Hydraulic Grade Line	
Road /Stations	**From MH**	**To MH**	**Area (ha)**	**Run. Coef.**	**2.78AC**	**Accum. 2.78AC**	**T of In (min)**	**T of F (min)**	**T of Conc. (min)**	**Intensity (mm/hr)**	**Exp. Flow (L/s)**	**Capacity (L/s)**	**Velocity (m/s)**	**Wall Thickness (mm)**	**Length (m)**	**Pipe Dia. (mm)**	**Slope (%)**	**Invert Up MH**	**Invert Low MH**	**Fall (m)**	**Drop Across Low MH (m)**	**Ground Elev Up MH**	**Cover @ Up MH (m)**	**Cover @ Low MH (m)**	**HGL Elevation at Upstream MH**	**HGL Elev vs. Grnd Elev @ Up MH**
	MH 101	MH 102	3.11	0.80	6.87	6.87	20.0	2.18	20.00	75.35	**517.98**	**668.89**	0.77	133	101.2	1050	0.06	178.641	178.580	0.06	0.025	182.400	2.58	2.52	180.51	Okay
	MH 102	MH 103	0.41	0.76	0.87	7.74		1.31	22.18	70.87	**548.84**	**668.89**	0.77	133	60.5	1050	0.06	178.555	178.519	0.04	0.025	182.280	2.54	2.51	180.48	Okay
	MH 103	MH 104	8.65	0.84	20.12	27.86		1.56	23.49	68.46	**1907.41**	**2570.31**	1.01	178	94.3	1800	0.05	178.494	178.447	0.05	0.025	182.210	1.74	1.73	180.45	Okay
	MH 104	MH 105	0.18	0.80	0.40	28.26		1.61	25.05	65.81	**1859.67**	**2298.95**	0.90	178	87.3	1800	0.04	178.422	178.387	0.03	0.025	182.150	1.75	1.74	180.42	Okay
	MH 105	MH 106	8.69	0.84	20.38	48.63		0.76	26.66	63.30	**3078.37**	**3981.90**	1.56	178	71.5	1800	0.12	178.362	178.276	0.09	0.025	182.100	1.76	1.83	180.40	Okay
	MH 106	MH 107	1.67	0.80	3.71	52.34		1.30	27.42	62.18	**3254.65**	**4247.18**	1.23	203	95.3	2100	0.06	178.251	178.194	0.06	0.025	182.080	1.53	1.55	180.35	Okay
	MH 107	MH 108	1.36	0.79	2.98	55.32		1.40	28.71	60.38	**3339.92**	**4247.18**	1.23	203	102.8	2100	0.06	178.169	178.107	0.06	0.025	182.050	1.58	1.61	180.29	Okay
	MH 108	MH 109	7.84	0.90	19.55	74.87		0.62	30.11	58.56	**4383.99**	**5483.08**	1.58	203	59.1	2100	0.10	178.082	178.023	0.06	0.025	182.020	1.63	1.67	180.25	Okay
	MH 109	MH 110	3.68	0.68	7.00	81.86		0.94	30.73	57.78	**4730.31**	**6006.41**	1.73	203	98.0	2100	0.12	177.998	177.880	0.12	0.025	182.000	1.70	1.78	180.21	Okay
	MH 110	MH 111	0.28	0.76	0.58	82.45		0.61	31.67	56.65	**4670.93**	**5750.70**	1.66	203	60.3	2100	0.11	177.855	177.789	0.07	0.025	181.960	1.80	1.84	180.14	Okay
	MH 111	MH 112	3.74	0.78	8.08	90.53		0.84	32.28	55.95	**5065.46**	**6251.67**	1.80	203	91.4	2100	0.13	177.764	177.645	0.12	0.025	181.930	1.86	1.95	180.10	Okay
	MH 112	MH 113	1.44	0.80	3.21	93.74		0.86	33.12	55.01	**5156.47**	**7001.88**	1.55	229	79.8	2400	0.08	177.620	177.556	0.06	0.025	181.900	1.65	1.81	180.02	Okay
	MH 113	OUTLET	2.70	0.72	5.43	99.17		0.42	33.98	54.08	**5363.03**	**7001.88**	1.55	229	39.1	2400	0.08	177.531	177.500	0.03		182.000	1.84	1.97	179.93	Okay
Maisonneuve	MH 4893	MH 114	4.23	0.60	7.05	7.05	19.8	0.77	19.75	75.89	**534.86**	**677.36**	1.06	121	49.3	900	0.14	178.863	178.794	0.07	0.025	182.400	2.52	2.67	180.79	Okay
	MH 114	MH 115	0.09	0.80	0.20	7.25		0.68	20.53	74.21	**537.71**	**677.36**	1.06	121	43.3	900	0.14	178.769	178.708	0.06	0.025	182.480	2.69	2.67	180.74	Okay
	MH 115	MH 116	4.75	0.77	10.20	17.45		1.21	21.20	72.81	**1270.47**	**1559.49**	1.38	127	100.0	1200	0.16	178.683	178.523	0.16	0.025	182.400	2.39	2.52	180.70	Okay
	MH 116	MH 117	0.68	0.77	1.46	18.91		1.18	22.41	70.44	**1331.66**	**1731.51**	0.98	152	69.3	1500	0.06	178.498	178.457	0.04	0.025	182.370	2.22	2.24	180.60	Okay
	MH 117	MH 118	0.76	0.76	1.62	20.53		1.36	23.59	68.28	**1401.75**	**1731.51**	0.98	152	80.0	1500	0.06	178.432	178.384	0.05	0.025	182.350	2.27	2.28	180.57	Okay
	MH 118	MH 120	0.77	0.72	1.55	22.08		1.28	24.95	65.97	**1456.35**	**1870.25**	1.06	152	81.4	1500	0.07	178.359	178.302	0.06	0.025	182.320	2.31	2.35	180.54	Okay
Gouin	MH 5036	MH 119	44.99	0.60	75.04	75.04	32.2	0.62	32.20	56.04	**4205.66**	**5201.71**	1.50	203	55.6	2100	0.09	178.430	178.380	0.05	0.025	182.300	1.57	1.89	180.57	Okay
Gouin	MH 4883	MH 121	4.56	0.60	7.61	7.61	20.5	0.74	20.47	74.33	**565.32**	**701.13**	1.10	121	48.7	900	0.15	178.479	178.405	0.07	0.300	182.750	3.25	2.76	180.48	Okay
Gouin	MH 119	MH 120	0.10	0.80	0.21	75.26		0.48	32.82	55.34	**4165.17**	**5750.70**	1.66	203	48.0	2100	0.11	178.355	178.302	0.05	0.025	182.570	1.91	1.70	180.54	Okay
	MH 120	MH 121	0.63	0.72	1.28	98.61		0.64	33.30	54.81	**5405.34**	**7356.32**	2.12	203	81.4	2100	0.18	178.277	178.130	0.15	0.025	182.300	1.72	1.76	180.51	Okay
	MH 121	MH 122	0.60	0.72	1.20	107.42		0.60	33.94	54.13	**5814.41**	**7356.32**	2.12	203	76.5	2100	0.18	178.105	177.968	0.14	0.025	182.190	1.78	1.83	180.43	Okay
	MH 122	MH 123	0.85	0.76	1.79	109.21		0.90	34.54	53.50	**5842.51**	**7426.62**	1.64	229	88.5	2400	0.09	177.943	177.863	0.08	0.025	182.100	1.53	1.56	180.34	Okay
	MH 123	MH 124	0.84	0.76	1.77	110.98		1.06	35.44	52.58	**5835.95**	**7426.62**	1.64	229	104.4	2400	0.09	177.838	177.744	0.09	0.025	182.050	1.58	1.63	180.27	Okay
	MH 124	MH 125	1.74	0.28	1.36	112.34		1.05	36.50	51.55	**5791.26**	**7426.62**	1.64	229	103.8	2400	0.09	177.719	177.626	0.09	0.025	182.000	1.65	2.21	180.21	Okay
	MH 125	MH 126	2.32	0.20	1.29	113.63		1.00	37.55	50.57	**5745.97**	**7127.81**	1.40	241	83.3	2550	0.06	177.601	177.551	0.05	0.025	182.460	2.07	2.49	180.15	Okay
	MH 126	OUTLET	0.00	0.20	0.00	113.63		0.51	38.55	49.68	**5644.59**	**7127.81**	1.40	241	42.8	2550	0.06	177.526	177.500	0.03		182.830	2.51	1.81	180.08	Okay

From Existing Gouin Drainage Area Designed to 5YR

Lachance
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: Tecumseh Hamlet
Project Number: 23-5735

1) Intensity (i) = a/(t+b)^c — a= 1259.000, b= 8.800, c= 0.838

2) Intensity (i) = a*t^b — a= , b=

3) Insert Intensity — i=

Based on 1:5 Year Storm Event
Town of Tecumseh

Manning's n = 0.013

Total Area (ha)= 37.671 Outlet Invert Elevation= 178.600 Ground Elevation @ Outlet = 182.30 High Water Level at Outlet= 179.51

Location												Sewer Design / Profile										Cover			Hydraulic Grade Line	
Road /Stations	**From MH**	**To MH**	**Area (ha)**	**Run. Coef.**	**2.78AC**	**Accum. 2.78AC**	**T of In (min)**	**T of F (min)**	**T of Conc. (min)**	**Intensity (mm/hr)**	**Exp. Flow (L/s)**	**Capacity (L/s)**	**Velocity (m/s)**	**Wall Thickness (mm)**	**Length (m)**	**Pipe Dia. (mm)**	**Slope (%)**	**Invert Up MH**	**Invert Low MH**	**Fall (m)**	**Drop Across Low MH (m)**	**Ground Elev Up MH**	**Cover @ Up MH (m)**	**Cover @ Low MH (m)**	**HGL Elevation at Upstream MH**	**HGL Elev vs. Grnd Elev @ Up MH**
	ST14	MH 203 (ST15)	13.62	0.50	18.93	18.93	25.1	0.56	25.10	65.72	**1244.26**	**1509.97**	1.34	127	44.6	1200	0.15	179.496	179.429	0.07	0.164	182.700	1.88	1.94	180.70	Okay
	MH 203	MH 204	0.12	0.80	0.26	19.19		0.92	25.66	64.83	**1244.42**	**1601.22**	1.12	152	61.7	1350	0.09	179.265	179.209	0.06	0.150	182.697	1.93	1.95	180.61	Okay
	MH 204	MH 205	2.18	0.73	4.42	23.62		1.84	26.58	63.42	**1497.72**	**1999.38**	1.13	152	124.7	1500	0.08	179.059	178.959	0.10	0.025	182.660	1.95	1.94	180.56	Okay
	MH 205	MH 206	2.06	0.73	4.18	27.80		1.25	28.41	60.78	**1689.60**	**2235.37**	1.26	152	94.7	1500	0.10	178.934	178.840	0.09	0.100	182.555	1.97	2.01	180.44	Okay
	MH 206	MH 207	0.75	0.72	1.50	29.30		1.57	29.66	59.13	**1732.23**	**2232.57**	1.04	178	98.5	1650	0.06	178.740	178.681	0.06	0.025	182.499	1.93	1.93	180.39	Okay
	MH 207	MH 208	2.48	0.72	4.96	34.26		0.23	31.23	57.17	**1958.71**	**2577.96**	1.21	178	17.0	1650	0.08	178.656	178.642	0.01	0.025	182.438	1.95	1.93	180.31	Okay
	MH 208	OUTLET	0.36	0.80	0.80	35.06		0.29	31.47	56.89	**1994.60**	**2577.96**	1.21	178	21.2	1650	0.08	178.617	178.600	0.02		182.395	1.95	1.87	180.27	Okay
	MH 210	MH 211	0.61	0.76	1.29	1.29	20.0	1.72	20.00	75.35	**97.33**	**127.50**	0.80	64	82.8	450	0.20	179.570	179.404	0.17	0.025	182.613	2.53	2.65	180.87	Okay
	MH 211	MH 212	0.58	0.72	1.16	2.46		1.66	21.72	71.77	**176.23**	**229.74**	0.81	64	80.7	600	0.14	179.379	179.266	0.11	0.025	182.566	2.52	2.59	180.77	Okay
	MH 212	MH 213	5.45	0.77	11.69	14.14		0.88	23.38	68.66	**971.14**	**1365.36**	1.58	133	83.2	1050	0.25	179.241	179.033	0.21	0.025	182.520	2.10	2.27	180.70	Okay
	MH 213	MH 214	2.71	0.52	3.95	18.09		0.95	24.26	67.12	**1214.24**	**1607.49**	1.42	127	81.1	1200	0.17	179.008	178.870	0.14	0.025	182.487	2.15	2.31	180.60	Okay
	MH 214	MH 215	3.93	0.73	8.01	26.10		1.14	25.21	65.55	**1710.68**	**2235.37**	1.26	152	86.5	1500	0.10	178.845	178.758	0.09	0.025	182.510	2.01	2.03	180.52	Okay
	MH 215	MH 216	0.44	0.74	0.91	27.01		1.30	26.35	63.76	**1722.37**	**2235.37**	1.26	152	99.0	1500	0.10	178.733	178.634	0.10	0.025	182.442	2.06	2.07	180.47	Okay
	MH 216	OUTLET	2.38	0.79	5.22	32.23		0.31	27.65	61.84	**1993.45**	**2570.31**	1.01	178	19.0	1800	0.05	178.609	178.600	0.01		182.353	1.77	1.72	180.41	Okay

From Stantec's Detailed Design (December 12, 2024)

Desjardins West
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: Tecumseh Hamlet
Project Number: 23-5735

Based on 1:5 Year Storm Event
Town of Tecumseh

1) Intensity (i) = a/(t+b)^c
a= 1259.000
b= 8.800
c= 0.838

2) Intensity (i) = a*t^b
a=
b=

3) Insert Intensity
i=

Manning's n = 0.013

Total Area (ha)= 27.863301 Outlet Invert Elevation= 179.000 Ground Elevation @ Outlet = 182.65 High Water Level at Outlet= 180.07

Location															**Sewer Design / Profile**								**Cover**		**Hydraulic Grade Line**	
Road /Stations	**From MH**	**To MH**	**Area (ha)**	**Run. Coef.**	**2.78AC**	**Accum. 2.78AC**	**T of In (min)**	**T of F (min)**	**T of Conc. (min)**	**Intensity (mm/hr)**	**Exp. Flow (L/s)**	**Capacity (L/s)**	**Velocity (m/s)**	**Wall Thickness (mm)**	**Length (m)**	**Pipe Dia. (mm)**	**Slope (%)**	**Invert Up MH**	**Invert Low MH**	**Fall (m)**	**Drop Across Low MH (m)**	**Ground Elev Up MH**	**Cover @ Up MH (m)**	**Cover @ Low MH (m)**	**HGL Elevation at Upstream MH**	**HGL Elev vs. Grnd Elev @ Up MH**
	MH 301	MH 302	5.38	0.67	10.02	10.02	20.0	0.55	20.00	75.35	**754.68**	**945.95**	1.09	133	36.3	1050	0.12	180.186	180.143	0.04	0.025	183.510	2.14	2.07	181.71	Okay
	MH 302	MH 303	0.58	0.80	1.29	11.31		1.54	20.55	74.15	**838.41**	**1057.61**	1.22	133	112.5	1050	0.15	180.118	179.949	0.17	0.025	183.400	2.10	2.06	181.68	Okay
	MH 303	MH 304	4.93	0.79	10.88	22.18		1.08	22.09	71.05	**1576.13**	**1997.07**	1.40	159	90.7	1350	0.14	179.924	179.797	0.13	0.025	183.190	1.76	1.69	181.57	Okay
	MH 304	MH 305	4.28	0.82	9.73	31.91		1.08	23.17	69.03	**2202.74**	**2737.76**	1.55	152	100.4	1500	0.15	179.772	179.622	0.15	0.025	183.000	1.58	1.59	181.49	Okay
	MH 305	MH 306	4.12	0.73	8.39	40.30		1.11	24.25	67.13	**2705.79**	**3448.43**	1.36	178	90.0	1800	0.09	179.597	179.516	0.08	0.025	182.860	1.29	1.31	181.40	Okay
	MH 306	MH 307	1.81	0.74	3.73	44.04		0.69	25.36	65.30	**2875.91**	**3634.96**	1.43	178	59.4	1800	0.10	179.491	179.431	0.06	0.025	182.800	1.33	1.36	181.29	Okay
	MH 307	MH 308	0.19	0.80	0.42	44.46		0.41	26.05	64.21	**2854.80**	**3634.96**	1.43	178	34.9	1800	0.10	179.406	179.371	0.03	0.025	182.770	1.39	1.38	181.21	Okay
	MH 308	MH 309	1.32	0.83	3.06	47.52		1.35	26.46	63.59	**3021.90**	**3812.38**	1.50	178	121.0	1800	0.11	179.346	179.213	0.13	0.025	182.730	1.41	1.51	181.16	Okay
	MH 309	MH 310	0.88	0.84	2.06	49.58		1.12	27.81	61.63	**3055.50**	**3812.38**	1.50	178	101.1	1800	0.11	179.188	179.077	0.11	0.025	182.700	1.53	1.62	181.07	Okay
	MH 310	MH 311	3.09	0.80	6.87	56.45		0.13	28.93	60.08	**3391.76**	**4268.94**	1.43	191	10.9	1950	0.09	179.052	179.042	0.01	0.025	182.670	1.48	1.52	181.00	Okay
	MH 311	OUTLET	0.00	0.20	0.00	56.45		0.22	29.06	59.91	**3382.23**	**4268.94**	1.43	191	19.0	1950	0.09	179.017	179.000	0.02		182.700	1.54	1.51	180.97	Okay
DEV. NORTH OF POND			1.29	0.80	2.87	2.87	20.0	0.17	20.00	75.35	**216.16**	**274.59**	0.97	95	10.0	600	0.20	179.020	179.000	0.02		182.650	2.94	2.96	#DIV/0!	#DIV/0!

Desjardins East
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: Tecumseh Hamlet
Project Number: 23-5735

1) Intensity (i) = a/(t+b)^c **2) Intensity (i) = a*t^b** **3) Insert Intensity**

Based on 1:5 Year Storm Event
Town of Tecumseh

a= 1259.000 **a=** **i=**
b= 8.800 **b=**
c= 0.838

Manning's n = 0.013

Total Area (ha)= 72.8006 Outlet Invert Elevation= 179.300 Ground Elevation @ Outlet = 182.46 High Water Level at Outlet= 180.27

Location												**Sewer Design / Profile**										**Cover**			**Hydraulic Grade Line**	
Road /Stations	**From MH**	**To MH**	**Area (ha)**	**Run. Coef.**	**2.78AC**	**Accum. 2.78AC**	**T of In (min)**	**T of F (min)**	**T of Conc. (min)**	**Intensity (mm/hr)**	**Exp. Flow (L/s)**	**Capacity (L/s)**	**Velocity (m/s)**	**Wall Thickness (mm)**	**Length (m)**	**Pipe Dia. (mm)**	**Slope (%)**	**Invert Up MH**	**Invert Low MH**	**Fall (m)**	**Drop Across Low MH (m)**	**Ground Elev Up MH**	**Cover @ Up MH (m)**	**Cover @ Low MH (m)**	**HGL Elevation at Upstream MH**	**HGL Elev vs. Grnd Elev @ Up MH**
	CBMH 401	MH 402	4.96	0.20	2.76	2.76	20.0	1.35	20.00	75.35	**207.78**	**245.60**	0.87	133	70.5	600	0.16	179.652	179.539	0.11	0.025	182.810	2.43	2.54	181.05	Okay
	MH 402	MH 403	8.97	0.75	18.74	21.50	20.0	0.91	21.35	72.50	**1558.81**	**1770.22**	1.24	159	67.7	1350	0.11	179.514	179.439	0.07	0.025	182.810	1.79	1.86	180.97	Okay
	MH 403	MH 404	1.57	0.80	3.49	24.99		0.83	22.27	70.71	**1767.26**	**2120.66**	1.20	159	59.8	1500	0.09	179.414	179.361	0.05	0.025	182.810	1.74	1.66	180.91	Okay
	MH 404	OUTLET	0.01	0.80	0.02	25.01		0.55	23.10	69.17	**1730.16**	**2120.66**	1.20	159	39.5	1500	0.09	179.336	179.300	0.04		182.680	1.69	1.50	180.84	Okay
	MH 405	MH 409	1.54	0.80	3.41	3.41	20.0	1.86	20.00	75.35	**257.22**	**369.23**	0.84	108	93.1	750	0.11	180.448	180.345	0.10	0.025	183.050	1.74	1.79	181.76	Okay
	MH 406	MH 407	1.38	0.84	3.22	3.22	20.0	1.50	20.00	75.35	**242.55**	**314.52**	0.88	102	79.1	675	0.14	180.552	180.441	0.11	0.025	183.220	1.89	2.06	181.83	Okay
	MH 407	MH 408	1.36	0.84	3.16	6.38		1.43	21.50	72.21	**460.69**	**517.55**	0.97	114	83.2	825	0.13	180.416	180.308	0.11	0.025	183.280	1.92	1.75	181.76	Okay
	MH 408	MH 410	0.82	0.80	1.82	8.20		1.36	22.93	69.47	**569.90**	**708.68**	0.95	127	77.5	975	0.10	180.283	180.206	0.08	0.025	183.000	1.61	1.61	181.68	Okay
	MH 409	MH 410	1.04	0.80	2.31	5.73		1.95	21.86	71.50	**409.42**	**476.08**	0.89	114	104.2	825	0.11	180.320	180.206	0.11	0.025	182.990	1.73	1.78	181.71	Okay
	MH 410	MH 411	1.56	0.80	3.47	17.40		2.52	24.29	67.07	**1166.88**	**1412.14**	0.99	159	149.2	1350	0.07	180.181	180.076	0.10	0.025	182.920	1.23	1.22	181.63	Okay
	MH 411	MH 412	1.13	0.78	2.44	19.83		1.37	26.81	63.06	**1250.85**	**1509.65**	1.05	159	86.9	1350	0.08	180.051	179.982	0.07	0.025	182.810	1.25	1.21	181.55	Okay
	MH 7163	MH 412	0.13	0.80	0.29	0.29	20.0	1.14	20.00	75.35	**216.82**	**274.59**	0.97	95	66.5	600	0.20	180.115	179.982	0.13	0.025	182.810	2.00	2.02	181.59	Okay
	MH 412	MH 413	0.34	0.76	0.73	20.85		1.43	28.19	61.10	**1273.85**	**1509.65**	1.05	159	90.4	1350	0.08	179.957	179.884	0.07	0.025	182.700	1.23	1.26	181.51	Okay
	MH 413	MH 415	4.26	0.82	9.65	30.50		1.03	29.61	59.19	**1805.44**	**2134.96**	1.49	159	92.1	1350	0.16	179.859	179.712	0.15	0.025	182.650	1.28	1.37	181.45	Okay
	MH 414	MH 415	5.16	0.79	11.35	11.35	20.0	0.49	20.00	75.35	**854.91**	**1102.73**	0.98	127	28.8	1200	0.08	179.735	179.712	0.02	0.025	182.610	1.55	1.55	181.36	Okay
	MH 415	MH 416	2.18	0.73	4.43	46.28		0.60	30.64	57.89	**2679.28**	**3161.29**	1.79	159	63.9	1500	0.20	179.687	179.559	0.13	0.025	182.590	1.24	1.30	181.35	Okay
	MH 416	MH 417	0.48	0.74	0.98	47.26		0.89	31.24	57.17	**2701.88**	**3161.29**	1.79	159	95.5	1500	0.20	179.534	179.343	0.19	0.025	182.520	1.33	1.48	181.26	Okay
	MH 417	OUTLET	2.33	0.80	5.19	52.45		0.25	32.13	56.12	**2943.69**	**3448.43**	1.36	152	20.2	1800	0.09	179.318	179.300	0.02		182.480	1.21	1.21	181.12	Okay
	MH 419	MH 420	10.68	0.34	10.12	10.12	20.0	2.01	20.00	75.35	**762.24**	**945.95**	1.09	133	131.5	1050	0.12	179.814	179.656	0.16	0.025	182.940	1.94	1.97	181.08	Okay
	MH 420	MH 421	7.92	0.47	10.24	20.36		1.18	22.01	71.21	**1449.66**	**1770.22**	1.24	159	87.7	1350	0.11	179.631	179.535	0.10	0.025	182.810	1.67	1.69	180.98	Okay
	MH 421	MH 422	0.67	0.78	1.46	21.82		1.12	23.19	69.00	**1505.37**	**1848.93**	1.29	159	86.8	1350	0.12	179.510	179.406	0.10	0.025	182.730	1.71	1.78	180.92	Okay
	MH 422	MH 423	0.87	0.78	1.87	23.69		0.29	24.31	67.04	**1588.26**	**1848.93**	1.29	159	22.3	1350	0.12	179.381	179.354	0.03	0.025	182.690	1.80	1.87	180.85	Okay
	MH 423	OUTLET	0.69	0.80	1.54	29.84		0.33	24.60	66.55	**1986.07**	**2344.48**	1.33	152	26.2	1500	0.11	179.329	179.300	0.03		182.730	1.75	1.51	180.83	Okay
	CBMH 425	MH 424	7.87	0.20	4.38	4.38	20.0	0.26	20.00	75.35	**329.81**	**416.55**	0.94	108	14.6	750	0.14	179.497	179.477	0.02	0.025	182.690	2.33	2.36	180.87	Okay
	MH 424	MH 423	0.24	0.35	0.23	4.61		1.22	20.26	74.78	**344.82**	**652.72**	1.03	121	75.4	900	0.13	179.452	179.354	0.10	0.025	182.690	2.22	2.36	180.86	Okay

Street from Decommissioned PS at Vista HS. Flow from street + 195 L/s from Tecumseh Vista HS
Flow from McAuliffe Park
From Hydro Corridor

South East Hamlet
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: Tecumseh Hamlet
Project Number: 23-5735

1) Intensity (i) = a/(t+b)^c — **a=** 1259.000, **b=** 8.800, **c=** 0.838

2) Intensity (i) = a*t^b — **a=** , **b=**

3) Insert Intensity — **i=**

Based on 1:5 Year Storm Event
Town of Tecumseh

Manning's n = 0.013

Total Area (ha)= 23.3043 Outlet Invert Elevation= Ground Elevation @ Outlet = High Water Level at Outlet= 180.36

Location												Sewer Design / Profile										Cover			Hydraulic Grade Line	
Road /Stations	**From MH**	**To MH**	**Area (ha)**	**Run. Coef.**	**2.78AC**	**Accum. 2.78AC**	**T of In (min)**	**T of F (min)**	**T of Conc. (min)**	**Intensity (mm/hr)**	**Exp. Flow (L/s)**	**Capacity (L/s)**	**Velocity (m/s)**	**Wall Thickness (mm)**	**Length (m)**	**Pipe Dia. (mm)**	**Slope (%)**	**Invert Up MH**	**Invert Low MH**	**Fall (m)**	**Drop Across Low MH (m)**	**Ground Elev Up MH**	**Cover @ Up MH (m)**	**Cover @ Low MH (m)**	**HGL Elevation at Upstream MH**	**HGL Elev vs. Grnd Elev @ Up MH**
			22.24	0.70	43.29	43.29	20.0	7.51	20.00	75.35	**3261.49**	**3981.90**	1.56	178	705.0	1800	0.12	0.846		0.85			-2.82			
Future Roads			1.06	0.90	2.65	2.65	20.0		20.00	75.35	**199.82**	**247.05**	1.14	70	TBD	525	0.33						-0.60			

Existing Gouin Watershed - 5YR Design - Gouin Street
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: North Existing Hamlet
Project Number:

1) Intensity (i) = a/(t+b)^c **2) Intensity (i) = a*t^b** **3) Insert Intensity**

Based on 1:5 Year Storm Event
Town of Tecumseh

a= 1259.000 a= i=
b= 8.800 b=
c= 0.838

Manning's n = 0.013
Total Area (ha)= 49.6475
Outlet Invert Elevation (N 178.105
vert Elevation (MH 120)= 178.277
Ground Elevation @ Outlet = 182.39
High Water Level at Outlet= 181.00

Location												Sewer Design / Profile										Cover			Hydraulic Grade Line	
Road /Stations	From MH	To MH	Area (ha)	Run. Coef.	2.78AC	Accum. 2.78AC	T of In (min)	T of F (min)	T of Conc. (min)	Intensity (mm/hr)	Exp. Flow (L/s)	Capacity (L/s)	Velocity (m/s)	Wall Thickness (mm)	Length (m)	Pipe Dia. (mm)	Slope (%)	Invert Up MH	Invert Low MH	Fall (m)	Drop Across Low MH (m)	Ground Elev Up MH	Cover @ Up MH (m)	Cover @ Low MH (m)	HGL Elevation at Upstream MH	HGL Elev vs. Grnd Elev @ Up MH
Hebert (N)	MH 5001	MH 4997	0.51	0.60	0.86	0.86	15.0	0.77	15.00	88.40	**75.64**	**120.96**	0.76	64	35.3	450	0.18	180.831	180.768	0.06	0.150	183.200	1.85	2.22	181.62	Okay
Hebert (N)	MH 4997	MH 4993	1.27	0.60	2.12	2.97		2.68	15.77	86.06	**255.95**	**333.98**	0.76	108	121.6	750	0.09	180.618	180.508	0.11	0.150	183.500	2.02	2.23	181.59	Okay
Hebert (N)	MH 4993	MH 4989	1.20	0.60	2.00	4.97		2.47	18.45	78.91	**392.45**	**512.03**	0.80	121	119.1	900	0.08	180.358	180.263	0.10	0.025	183.600	2.22	2.32	181.53	Okay
Hebert (N)	MH 4989	MH 4985	1.31	0.60	2.18	7.16		1.88	20.92	73.38	**525.18**	**652.72**	1.03	121	115.7	900	0.13	180.238	180.087	0.15	0.150	183.600	2.34	2.49	181.47	Okay
Hebert (N)	MH 4985	MH 4980	1.12	0.60	1.87	9.03		2.08	22.80	69.71	**629.29**	**819.22**	0.95	133	118.2	1050	0.09	179.937	179.831	0.11	0.150	183.600	2.48	2.79	181.38	Okay
Hebert (N)	MH 4980	MH 4981	1.21	0.60	2.01	11.04		2.38	24.88	66.08	**729.55**	**954.99**	0.84	127	120.3	1200	0.06	179.681	179.609	0.07	0.300	183.800	2.79	2.56	181.31	Okay
Hebert (N)	MH 4981	MH 5014	2.34	0.60	3.89	14.94		1.79	27.26	62.41	**932.14**	**1580.65**	0.89	152	96.2	1500	0.05	179.309	179.261	0.05	0.025	183.500	2.54	2.19	181.27	Okay
Hebert (S)	MH 4876	MH 4874	1.93	0.60	3.22	3.22	15.0	2.22	15.00	88.40	**284.97**	**369.23**	0.84	108	111.6	750	0.11	180.674	180.551	0.12	0.150	183.500	1.97	1.99	181.64	Okay
Hebert (S)	MH 4874	MH 4875	1.03	0.60	1.71	4.93		2.04	17.22	82.02	**404.73**	**512.03**	0.80	121	98.5	900	0.08	180.401	180.322	0.08	0.150	183.400	1.98	2.03	181.57	Okay
Hebert (S)	MH 4875	MH 4854	1.75	0.60	2.92	7.86		2.31	19.26	77.00	**605.01**	**772.37**	0.89	133	123.5	1050	0.08	180.172	180.073	0.10	0.025	183.400	2.04	1.74	181.52	Okay
Hebert (S)	MH 4854	MH 4855	1.79	0.60	2.98	10.83		1.47	21.57	72.06	**780.80**	**984.58**	1.14	133	100.5	1050	0.13	180.048	179.918	0.13	0.150	183.000	1.77	1.90	181.46	Okay
Hebert (S)	MH 4855	MH 5013	0.80	0.60	1.34	12.17		1.54	23.05	69.26	**842.93**	**1102.73**	0.98	127	90.2	1200	0.08	179.768	179.696	0.07	0.025	183.000	1.91	1.98	181.38	Okay
Hebert (S)	MH 5013	MH 5014	1.31	0.60	2.19	14.36		2.06	24.59	66.57	**955.83**	**1232.89**	1.09	127	134.9	1200	0.10	179.671	179.536	0.13	0.300	183.000	2.00	2.24	181.33	Okay
Gouin	MH 5138	MH 5014	0.11	0.60	0.19	0.19	15.0	1.41	15.00	88.40	**16.68**	**37.14**	0.76	64	64.0	250	0.39	180.735	180.486	0.25	1.250	183.100	2.05	2.30	181.30	Okay
Gouin	MH 5014	MH 5124	0.23	0.60	0.38	29.86		1.59	29.05	59.92	**1789.56**	**2235.37**	1.26	152	121.0	1500	0.10	179.236	179.115	0.12	0.450	183.100	2.21	2.33	181.25	Okay
Shawnee (N)	MH 1	MH 2	2.13	0.60	3.55	3.55	15.0	2.20	15.00	88.40	**313.90**	**401.40**	0.91	108	120.0	750	0.13	180.402	180.246	0.16	0.150	183.000	1.74	1.90	181.72	Okay
Shawnee (N)	MH 2	MH 3	1.90	0.60	3.17	6.72		1.81	17.20	82.08	**551.90**	**701.13**	1.10	121	120.0	900	0.15	180.096	179.916	0.18	0.150	183.000	1.88	2.06	181.62	Okay
Shawnee (N)	MH 3	MH 4	2.27	0.60	3.79	10.51		1.69	19.02	77.57	**815.61**	**1021.74**	1.18	133	120.0	1050	0.14	179.766	179.598	0.17	0.150	183.000	2.05	2.22	181.51	Okay
Shawnee (N)	MH 4	MH 5	1.33	0.60	2.22	12.74		1.93	20.71	73.82	**940.28**	**1169.62**	1.03	127	120.0	1200	0.09	179.448	179.340	0.11	0.025	183.000	2.22	2.33	181.40	Okay
Shawnee (N)	MH 5	MH 6	1.46	0.60	2.43	15.17		1.67	22.64	70.00	**1061.78**	**1350.56**	1.19	127	120.0	1200	0.12	179.315	179.171	0.14	0.150	183.000	2.36	2.50	181.33	Okay
Shawnee (N)	MH 6	MH 5124	1.59	0.60	2.65	17.82		2.10	24.32	67.02	**1194.51**	**1509.65**	1.05	125	133.0	1350	0.08	179.021	178.915	0.11	0.250	183.000	2.50	2.71	181.24	Okay
Shawnee (S)	MH 7	MH 8	2.62	0.60	4.38	4.38	15.0	1.77	15.00	88.40	**386.96**	**497.87**	1.13	108	120.0	750	0.20	180.366	180.126	0.24	0.300	183.000	1.78	2.02	181.68	Okay
Shawnee (S)	MH 8	MH 9	2.11	0.60	3.51	7.89		2.11	16.77	83.23	**656.59**	**819.22**	0.95	133	120.0	1050	0.09	180.101	179.993	0.11	0.025	183.000	1.72	1.82	181.54	Okay
Shawnee (S)	MH 9	MH 10	1.45	0.60	2.42	10.31		1.69	18.89	77.87	**802.96**	**1021.74**	1.18	133	120.0	1050	0.14	179.968	179.800	0.17	0.150	183.000	1.85	2.02	181.47	Okay
Shawnee (S)	MH 10	MH 11	1.89	0.60	3.16	13.47		1.75	20.58	74.09	**998.13**	**1293.06**	1.14	127	120.0	1200	0.11	179.650	179.518	0.13	0.150	183.000	2.02	2.16	181.36	Okay
Shawnee (S)	MH 11	MH 12	1.91	0.60	3.18	16.65		1.90	22.33	70.58	**1175.35**	**1509.65**	1.05	159	120.0	1350	0.08	179.368	179.272	0.10	0.025	183.000	2.12	2.22	181.28	Okay
Shawnee (S)	MH 12	MH 5124	1.10	0.60	1.83	18.48		1.36	24.23	67.17	**1241.25**	**1601.22**	1.12	159	91.0	1350	0.09	179.247	179.165	0.08	0.500	183.000	2.24	2.43	181.23	Okay
Gouin	MH 5124	MH 5125	0.81	0.60	1.36	67.52		0.91	30.65	57.89	**3908.63**	**4929.35**	1.65	191	90.6	1950	0.12	178.665	178.556	0.11	0.025	183.100	2.29	1.70	181.18	Okay
Gouin	MH 5125	MH 5036	0.58	0.60	0.97	68.49		0.64	31.56	56.79	**3889.22**	**4929.35**	1.65	191	63.5	1950	0.12	178.531	178.455	0.08	0.025	182.400	1.73	1.70	181.11	Okay
Corbi (N)	NEW MH	MH 5044	0.97	0.60	1.62	1.62	15.0	1.55	15.00	88.40	**142.95**	**863.53**	1.00	133	92.7	1050	0.10	179.476	179.384	0.09	0.025	182.400	1.74	1.93	181.10	Okay
Corbi (N)	MH 5044	MH 5040	0.40	0.60	0.67	2.29		0.53	16.55	83.85	**191.87**	**863.53**	1.00	133	31.7	1050	0.10	179.359	179.327	0.03	0.025	182.500	1.96	1.89	181.09	Okay
Corbi (N)	MH 5040	MH 5035	1.25	0.60	2.09	4.38		1.49	17.08	82.41	**360.55**	**1021.74**	1.18	133	105.2	1050	0.14	179.302	179.155	0.15	0.150	182.400	1.92	2.16	181.09	Okay
Corbi (N)	MH 5035	MH 5036	0.88	0.60	1.47	5.85		1.60	18.57	78.64	**459.81**	**1102.73**	0.98	127	93.5	1200	0.08	179.005	178.930	0.07	0.500	182.500	2.17	2.04	181.07	Okay
Gouin	MH 5036	MH 119	0.43	0.60	0.71	75.05		0.62	32.20	56.04	**4205.66**	**5201.71**	1.50	203	55.6	2100	0.09	178.430	178.380	0.05	0.025	182.300	1.57	1.66	181.06	Okay
Kavanagh	MH 7104	MH 5030	0.83	0.60	1.38	1.38	15.0	0.55	15.00	88.40	**122.31**	**148.15**	0.93	64	31.0	450	0.27	179.857	179.773	0.08	0.150	183.000	2.63	2.71	181.43	Okay
Mayrand	MH 5030	MH 4884	0.95	0.60	1.58	2.97		1.97	15.55	86.71	**257.14**	**319.05**	1.13	95	133.3	600	0.27	179.623	179.263	0.36	0.150	183.000	2.68	2.74	181.38	Okay
Mayrand	MH 4884	MH 4885	0.23	0.60	0.38	3.35		0.56	17.52	81.24	**271.96**	**333.98**	0.76	108	25.4	750	0.09	179.113	179.090	0.02	0.150	182.700	2.73	2.75	181.14	Okay
Mayrand	MH 4885	MH 4882	0.57	0.60	0.95	4.30		1.59	18.08	79.82	**343.08**	**478.96**	0.75	121	72.0	900	0.07	178.940	178.890	0.05	0.025	182.700	2.74	2.49	181.13	Okay
Mayrand	MH 4886	MH 4887	0.73	0.60	1.22	1.22	15.0	1.03	15.00	88.40	**107.45**	**133.73**	0.84	64	52.0	450	0.22	179.628	179.513	0.11	0.150	182.700	2.56	2.67	181.30	Okay
Mayrand	MH 4887	MH 4891	0.71	0.60	1.19	2.40		1.21	16.03	85.31	**204.98**	**260.50**	0.92	95	67.0	600	0.18	179.363	179.243	0.12	0.150	182.700	2.64	2.66	181.22	Okay
Mayrand	MH 4891	MH 4882	0.54	0.60	0.91	3.31		1.63	17.24	81.97	**271.16**	**352.05**	0.80	108	78.0	750	0.10	179.093	179.015	0.08	0.150	182.600	2.65	2.53	181.15	Okay
Gouin	MH 4882	MH 4883/7262	0.00	0.60	0.00	7.61		0.79	19.68	76.06	**578.49**	**724.12**	1.14	121	54.2	900	0.16	178.865	178.778	0.09	0.300	182.400	2.51	2.95	181.10	Okay
Gouin	MH 4883	MH 121		0.60		7.61		0.74	20.47	74.33	**565.32**	**701.13**	1.10	121	48.7	900	0.15	178.478	178.405	0.07	0.300	182.750	3.25	2.96	181.05	Okay
Gouin	MH 119	MH 120	0.10	0.80	0.21	75.26		0.48	32.82	55.34	**4165.17**	**5750.70**	1.66	203	48.0	2100	0.11	178.355	178.302	0.05	0.025	182.340	1.68	1.78	181.03	Okay

Input to Tecumseh Hamlet Design

January 2025

Tecumseh Hamlet Storm Sewer Design
Runoff Coefficient Calculations

	Runoff Coefficient	% Imperviousness Used in Model
Low Density Residential	0.7	60%
Medium Density Residential	0.8	70%
High Density Residential	0.9	80%
Commercial	0.9	90%
Institutional	0.7	70%
Open Space - Parks / Woodlot	0.2	5%
ROW (Road and Boulevard)	0.8	80%

FROM MH	TO MH	Area (ha)								Calculated Runoff Coefficient
		Low Density Residential	Medium Density Residential	High Density Residential	Commercial	Institutional	Open Space - Parks / Woodlot	ROW	GROSS AREA	
GOUIN POND										
MH 101	MH 102	0.15	1.28	0.00	0.00	0.00	0.00	1.68	3.11	0.80
MH 102	MH 103	0.15	0.14	0.00	0.00	0.00	0.00	0.12	0.41	0.76
MH 103	MH 104	1.28	1.57	4.41	0.00	0.00	0.00	1.40	8.65	0.84
MH 104	MH 105	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.80
MH 105	MH 106	0.00	0.00	4.43	2.51	0.00	0.53	1.23	8.69	0.84
MH 106	MH 107	0.00	1.45	0.00	0.00	0.00	0.00	0.22	1.67	0.80
MH 107	MH 108	0.16	0.48	0.00	0.00	0.00	0.00	0.72	1.36	0.79
MH 108	MH 109	0.00	0.00	0.00	7.58	0.00	0.00	0.26	7.84	0.90
MH 109	MH 110	1.85	0.00	0.00	0.00	0.00	0.40	1.43	3.68	0.68
MH 110	MH 111	0.11	0.00	0.00	0.00	0.00	0.00	0.17	0.28	0.76
MH 111	MH 112	0.86	1.37	0.00	0.00	0.00	0.00	1.51	3.74	0.78
MH 112	MH 113	0.00	1.25	0.00	0.00	0.00	0.00	0.19	1.44	0.80
MH 113	OUTLET	0.00	0.26	1.28	0.00	0.00	0.56	0.60	2.70	0.72
MH 114	MH 115	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.80
MH 115	MH 116	2.01	0.91	0.00	0.74	0.00	0.00	1.08	4.75	0.77
	MH 117	0.23	0.34	0.00	0.00	0.00	0.00	0.12	0.68	0.77
MH 117	MH 118	0.27	0.24	0.00	0.00	0.00	0.00	0.25	0.76	0.76
MH 118	MH 120	0.62	0.00	0.00	0.00	0.00	0.00	0.16	0.77	0.72
MH 119	MH 120	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.80
MH 120	MH 121	0.48	0.00	0.00	0.00	0.00	0.00	0.15	0.63	0.72
MH 121	MH 122	0.47	0.00	0.00	0.00	0.00	0.00	0.13	0.60	0.72
MH 122	MH 123	0.35	0.26	0.00	0.00	0.00	0.00	0.24	0.85	0.76
MH 123	MH 124	0.36	0.29	0.00	0.00	0.00	0.00	0.18	0.84	0.76
MH 124	MH 125	0.00	0.00	0.00	0.00	0.00	1.51	0.23	1.74	0.28
MH 125	MH 126	0.00	0.00	0.00	0.00	0.00	2.32	0.00	2.32	0.20
LACHANCE POND										
MH 203	MH 204	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.80
MH 204	MH 205	1.51	0.00	0.00	0.00	0.00	0.00	0.67	2.18	0.73
MH 205	MH 206	1.45	0.00	0.00	0.00	0.00	0.00	0.61	2.06	0.73
MH 206	MH 207	0.57	0.00	0.00	0.00	0.00	0.00	0.17	0.75	0.72
MH 207	MH 208	1.99	0.00	0.00	0.00	0.00	0.00	0.49	2.48	0.72
MH 208	OUTLET	0.00	0.25	0.00	0.00	0.00	0.00	0.11	0.36	0.80
MH 210	MH 211	0.22	0.24	0.00	0.00	0.00	0.00	0.15	0.61	0.76
MH 211	MH 212	0.43	0.00	0.00	0.00	0.00	0.00	0.14	0.58	0.72
MH 212	MH 213	1.59	2.78	0.00	0.00	0.00	0.00	1.08	5.45	0.77
MH 213	MH 214	0.25	0.58	0.00	0.00	0.00	1.20	0.67	2.71	0.52
MH 214	MH 215	0.47	0.61	0.00	0.00	2.20	0.00	0.65	3.93	0.73
MH 215	MH 216	0.26	0.00	0.00	0.00	0.00	0.00	0.19	0.44	0.74
MH 216	OUTLET	0.29	0.97	0.00	0.00	0.00	0.00	1.12	2.38	0.79
DESJARDINS WEST POND										
MH 301	MH 302	0.90	2.41	0.00	0.00	0.00	1.02	1.05	5.38	0.67
MH 302	MH 303	0.00	0.36	0.00	0.00	0.00	0.00	0.22	0.58	0.80
MH 303	MH 304	1.68	0.77	1.37	0.00	0.00	0.00	1.10	4.93	0.79
MH 304	MH 305	0.65	1.10	0.41	1.01	0.00	0.00	1.11	4.28	0.82
MH 305	MH 306	2.78	0.18	0.00	0.00	0.00	0.00	1.16	4.12	0.73
MH 306	MH 307	1.06	0.26	0.00	0.00	0.00	0.00	0.49	1.81	0.74
MH 307	MH 308	0.00	0.11	0.00	0.00	0.00	0.00	0.08	0.19	0.80
MH 308	MH 309	0.31	0.00	0.77	0.00	0.00	0.00	0.24	1.32	0.83
MH 309	MH 310	0.15	0.00	0.54	0.00	0.00	0.00	0.19	0.88	0.84
MH 310	MH 311	0.00	2.12	0.00	0.00	0.00	0.00	0.97	3.09	0.80
DESJARDINS EAST POND										
MH 401	MH 402	0.00	0.00	0.00	0.00	0.00	4.96	0.00	4.96	0.20
MH 402	MH 403	3.08	4.42	0.00	0.00	0.00	0.21	1.26	8.97	0.75
MH 403	MH 404	0.00	1.01	0.00	0.00	0.00	0.00	0.56	1.57	0.80
MH 404	OUTLET	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.80
MH 405	MH 409	0.00	1.32	0.00	0.00	0.00	0.00	0.22	1.54	0.80
MH 406	MH 407	0.00	0.70	0.00	0.54	0.00	0.00	0.14	1.38	0.84
MH 407	MH 408	0.00	0.63	0.00	0.49	0.00	0.00	0.24	1.36	0.84
MH 408	MH 410	0.00	0.68	0.00	0.00	0.00	0.00	0.14	0.82	0.80
MH 409	MH 410	0.00	0.82	0.00	0.00	0.00	0.00	0.21	1.04	0.80
MH 410	MH 411	0.00	1.21	0.00	0.00	0.00	0.00	0.35	1.56	0.80
MH 411	MH 412	0.27	0.39	0.00	0.00	0.00	0.00	0.46	1.13	0.78
MH 7163	MH 412	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.80
MH 412	MH 413	0.15	0.00	0.00	0.00	0.00	0.00	0.20	0.34	0.76
MH 413	MH 415	0.96	0.95	0.00	1.62	0.00	0.00	0.73	4.26	0.82
MH 414	MH 415	1.93	0.37	1.50	0.00	0.00	0.00	1.36	5.16	0.79
MH 415	MH 416	1.46	0.00	0.00	0.00	0.00	0.00	0.72	2.18	0.73
MH 416	MH 417	0.28	0.00	0.00	0.00	0.00	0.00	0.19	0.48	0.74
MH 417	OUTLET	0.00	1.16	0.00	0.00	0.00	0.00	1.17	2.33	0.80
MH 419	MH 420	0.95	0.75	0.00	0.00	0.00	8.02	0.96	10.68	0.34
MH 420	MH 421	0.72	1.29	0.00	0.00	0.00	4.30	1.61	7.92	0.47
MH 421	MH 422	0.11	0.39	0.00	0.00	0.00	0.00	0.17	0.67	0.78
CBMH 425	MH 424	0.00	0.00	0.00	0.00	0.00	7.87	0.00	7.87	0.20
MH 424	MH 423	0.00		0.00	0.00	0.00	0.18	0.06	0.24	0.35
MH 422	MH 423	0.21	0.25	0.00	0.00	0.00	0.00	0.41	0.87	0.78
MH 423	OUTLET	0.00	0.38	0.00	0.00	0.00	0.00	0.31	0.69	0.80

Note: These areas were measured off of CAD provided by Dialog

Dillon Consulting Ltd.

Existing Gouin Watershed - 5YR Design - Maisonneuve Street
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: North Existing Hamlet
Project Number:

1) Intensity (i) = a/(t+b)^c | **2) Intensity (i) = a*t^b** | **3) Insert Intensity**

Manning's n = 0.013

Based on 1:5 Year Storm Event
Town of Tecumseh

a= 1259.000 **b=** 8.800 **c=** 0.838 | **a=** **b=** | **i=**

Total Area (ha)= 4.2254 | Outlet Invert Elevation= 178.769 | Ground Elevation @ Outlet = 182.80 | High Water Level at Outlet= 181.00

Location												Sewer Design / Profile										Cover			Hydraulic Grade Line	
Road /Stations	From MH	To MH	Area (ha)	Run. Coef.	2.78AC	Accum. 2.78AC	T of In (min)	T of F (min)	T of Conc. (min)	Intensity (mm/hr)	Exp. Flow (L/s)	Capacity (L/s)	Velocity (m/s)	Wall Thickness (mm)	Length (m)	Pipe Dia. (mm)	Slope (%)	Invert Up MH	Invert Low MH	Fall (m)	Drop Across Low MH (m)	Ground Elev Up MH	Cover @ Up MH (m)	Cover @ Low MH (m)	HGL Elevation at Upstream MH	HGL Elev vs. Grnd Elev @ Up MH
Corbi (S)	MH 4899	MH 4895	1.35	0.60	2.25	2.25	15.0	1.32	15.00	88.40	**198.82**	**245.60**	0.87	95	68.6	600	0.16	179.466	179.356	0.11	0.150	182.400	2.24	2.25	181.20	Okay
Corbi (S)	MH 4895	MH 4894	0.69	0.60	1.15	3.39		1.01	16.32	84.50	**286.86**	**353.80**	0.80	108	48.4	750	0.10	179.206	179.157	0.05	0.150	182.300	2.24	2.29	181.13	Okay
Corbi (S)	MH 4894	MH 4892	0.80	0.60	1.33	4.73		1.63	17.32	81.76	**386.54**	**512.03**	0.80	121	78.8	900	0.08	179.007	178.944	0.06	0.025	182.300	2.27	2.54	181.10	Okay
Corbi (S)	MH 4892	MH 4893	0.35	0.60	0.58	5.31		0.80	18.96	77.71	**412.49**	**512.03**	0.80	121	38.6	900	0.08	178.919	178.888	0.03	0.025	182.500	2.56	2.49	181.06	Okay
Maisonneuve	MH 4905	MH 4893	0.89	0.60	1.48	1.48	15.0	1.55	15.00	88.40	**131.20**	**161.28**	1.01	64	94.3	450	0.32	179.615	179.313	0.30	0.450	182.700	2.57	2.57	181.24	Okay
Maisonneuve	MH 4893	MH 114	0.15	0.60	0.26	7.05		0.77	19.75	75.89	**534.86**	**677.36**	1.06	121	49.3	900	0.14	178.863	178.794	0.07	0.025	182.400	2.52	2.99	181.04	Okay

Input to Tecumseh Hamlet Design

Existing Lachance Watershed - 5YR Design
Storm Sewer Design Sheet

Intensity Option # 1

Project Name: North Exisiting Hamlet
Project Number:

1) Intensity (i) = a/(t+b)^c **2) Intensity (i) = a*t^b** **3) Insert Intensity**

Based on 1:5 Year Storm Event
Town of Tecumseh

a= 1259.000 **a=** **i=**
b= 8.800 **b=**
c= 0.838

Manning's n = 0.013

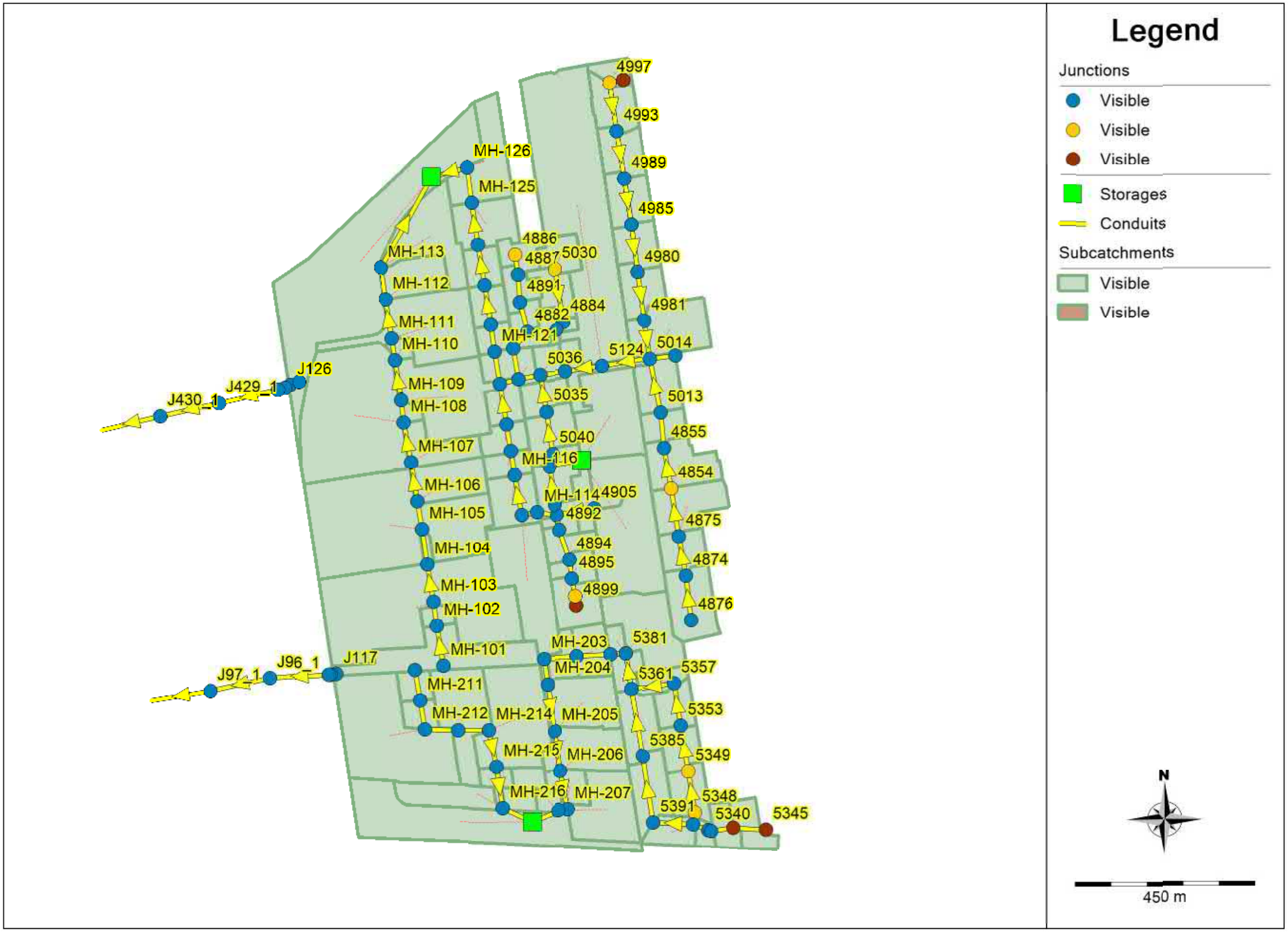
Total Area (ha)= 10.0392 Outlet Invert Elevation= 179.810 Ground Elevation @ Outlet = 182.70 High Water Level at Outlet=

Location												**Sewer Design / Profile**										**Cover**			**Hydraulic Grade Line**	
Road /Stations	**From MH**	**To MH**	**Area (ha)**	**Run. Coef.**	**2.78AC**	**Accum. 2.78AC**	**T of In (min)**	**T of F (min)**	**T of Conc. (min)**	**Intensity (mm/hr)**	**Exp. Flow (L/s)**	**Capacity (L/s)**	**Velocity (m/s)**	**Wall Thickness (mm)**	**Length (m)**	**Pipe Dia. (mm)**	**Slope (%)**	**Invert Up MH**	**Invert Low MH**	**Fall (m)**	**Drop Across Low MH (m)**	**Ground Elev Up MH**	**Cover @ Up MH (m)**	**Cover @ Low MH (m)**	**HGL Elevation at Upstream MH**	**HGL Elev vs. Grnd Elev @ Up MH**
North Pacific	5345	5344	0.92	0.60	1.54	1.54	15.0	1.21	15.00	88.40	**136.22**	**180.32**	1.13	64	82.4	450	0.40	181.353	181.023	0.33	0.150	183.480	1.61	1.95	181.81	Okay
North Pacific	5344	5343	0.65	0.60	1.08	2.62		1.10	16.21	84.80	**222.05**	**369.23**	0.84	108	55.3	750	0.11	180.873	180.812	0.06	0.150	183.490	1.76	1.81	181.62	Okay
North Pacific	5343	5340	0.00	0.60	0.00	2.62		0.17	17.31	81.79	**214.17**	**512.03**	0.80	121	8.0	900	0.08	180.662	180.656	0.01	0.150	183.480	1.80	2.02	181.56	Okay
North Pacific	5340	5399	0.29	0.60	0.49	3.11		0.79	17.48	81.35	**253.04**	**722.48**	0.83	133	39.3	1050	0.07	180.506	180.478	0.03	0.025	183.700	2.01	2.04	181.56	Okay
North Pacific	5399	5391	0.84	0.60	1.40	4.51		1.98	18.26	79.37	**357.83**	**722.48**	0.83	133	99.3	1050	0.07	180.453	180.384	0.07	0.025	183.700	2.06	1.73	181.50	Okay
Shawnee	5391	5385	1.54	0.60	2.57	7.08		3.30	20.25	74.80	**529.36**	**722.48**	0.83	133	165.2	1050	0.07	180.359	180.243	0.12	0.025	183.300	1.76	2.07	181.41	Okay
Shawnee	5385	5361	1.47	0.60	2.45	9.53		2.93	23.55	68.36	**651.37**	**819.22**	0.95	133	166.2	1050	0.09	180.218	180.069	0.15	0.150	183.500	2.10	1.73	181.27	Okay
Murray	5348	5349	1.16	0.60	1.94	1.94	15.0	1.55	15.00	88.40	**171.24**	**313.09**	1.11	95	103.0	600	0.26	181.429	181.161	0.27	0.150	183.800	1.68	1.64	182.03	Okay
Murray	5349	5353	0.95	0.60	1.59	3.53		2.30	16.55	83.85	**295.83**	**369.23**	0.84	108	115.4	750	0.11	181.011	180.885	0.13	0.150	183.500	1.63	1.76	181.76	Okay
Murray	5353	5357	0.93	0.60	1.55	5.08		2.16	18.85	77.96	**395.82**	**512.03**	0.80	121	104.4	900	0.08	180.735	180.651	0.08	0.025	183.500	1.74	1.63	181.63	Okay
Murray	5357	5361	0.65	0.60	1.09	6.17		1.99	21.01	73.19	**451.32**	**572.47**	0.90	121	107.3	900	0.10	180.626	180.519	0.11	0.600	183.300	1.65	1.44	181.53	Okay
Shawnee	5361	5381	0.63	0.60	1.05	16.75		1.26	26.4761	63.57	**1064.47**	**1350.56**	1.19	127	90.6	1200	0.12	179.919	179.810	0.11	0.000	182.980	1.73	1.56	181.12	Okay

Input to Tecumseh Hamlet Design

Appendix F

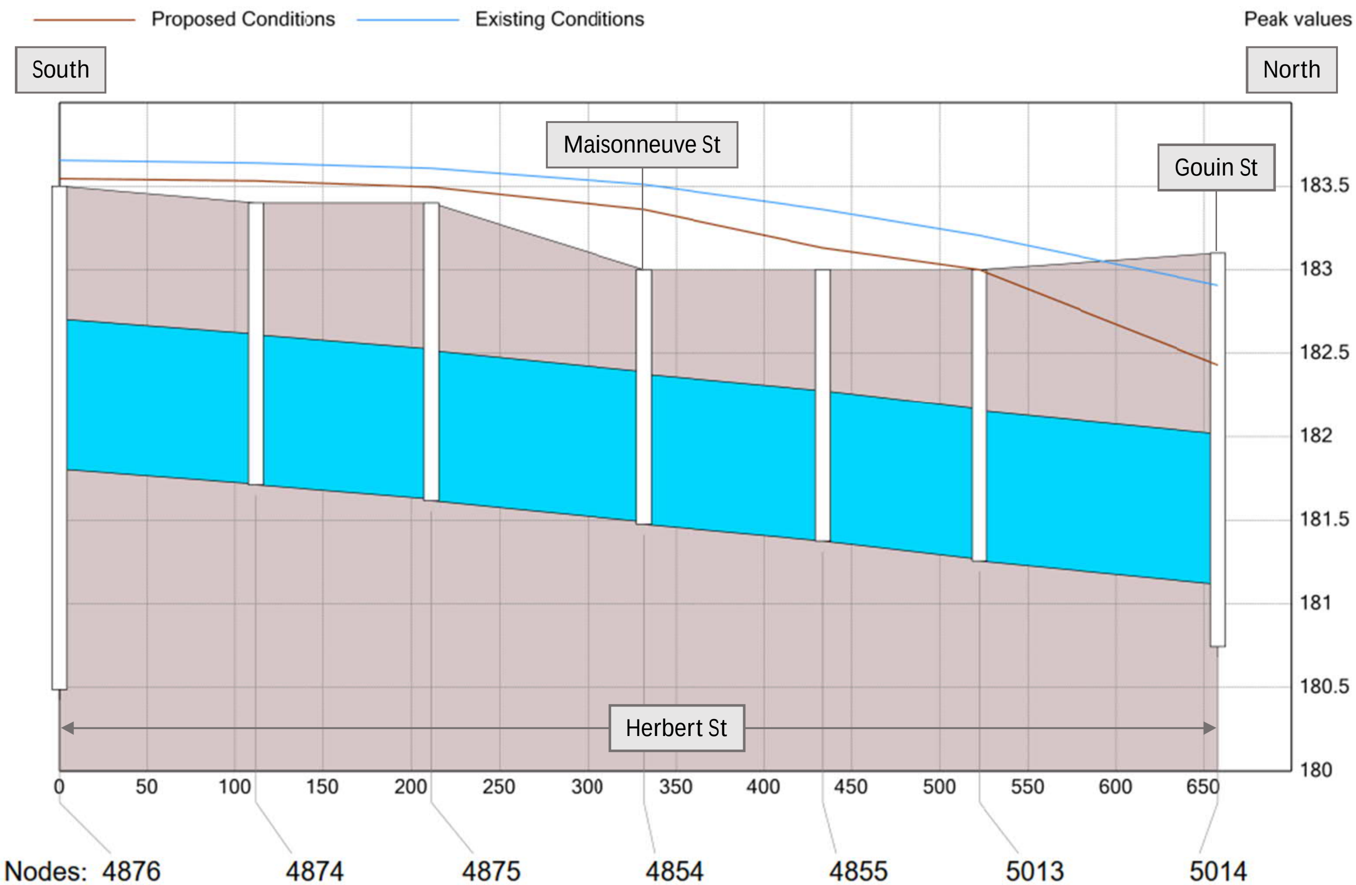
HGL Profiles

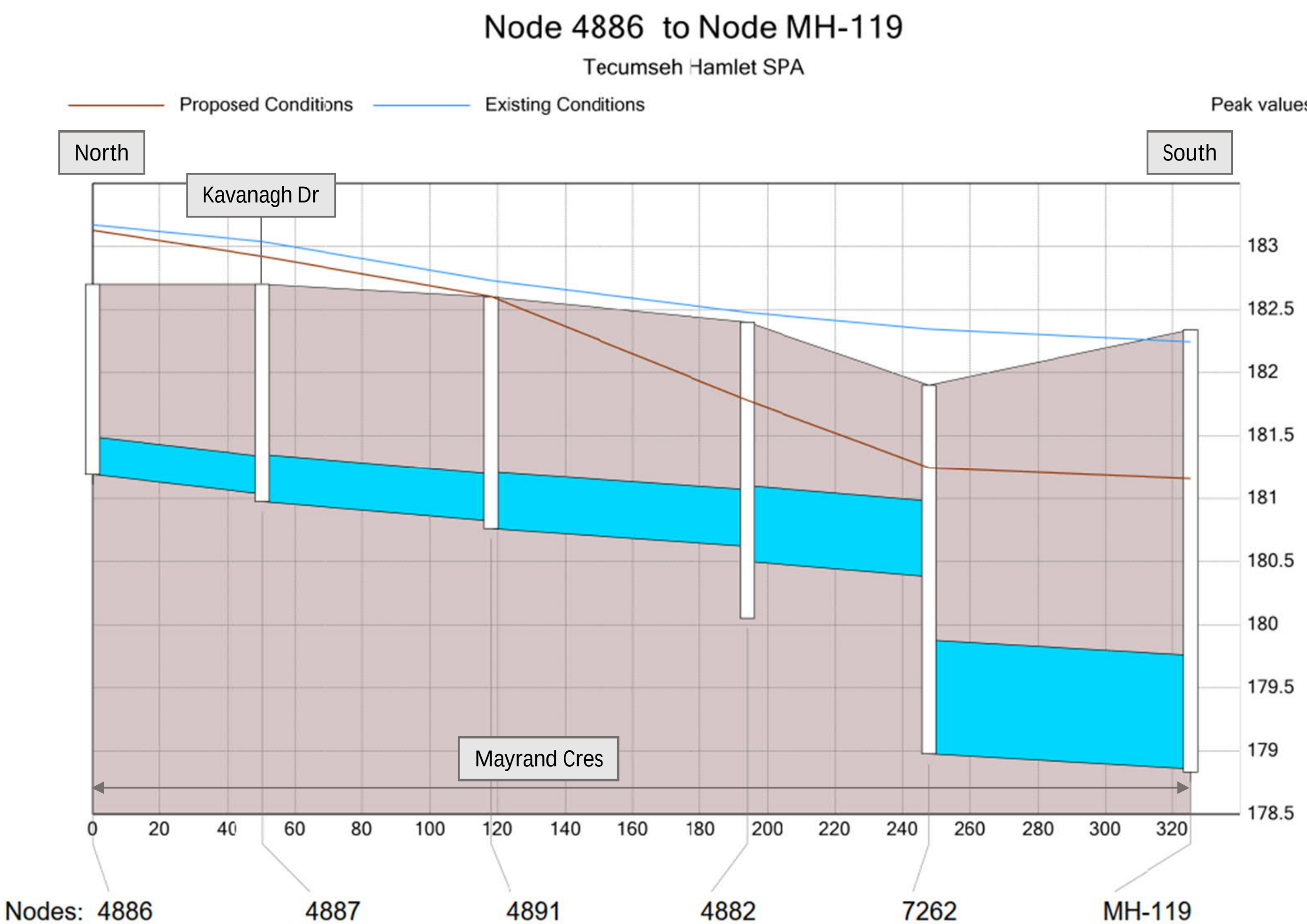


Legend
Junctions
Visible
Visible
Visible
Storages
Conduits
Subcatchments
Visible
Visible
N
450 m
4997
4993
4989
4985
4980
4981
5014
5124
5013
4855
4854
4875
4874
4876
MH-126
MH-125
MH-113
MH-112
MH-111
MH-110
MH-109
MH-108
MH-107
MH-106
MH-105
MH-104
MH-103
MH-102
MH-101
4886
4887
5030
4891
4882
4884
MH-121
5036
5035
5040
MH-116
MH-114
4905
4892
4894
4895
4899
J126
J429_1
J430_1
J117
J96_1
J97_1
MH-203
MH-204
5381
5361
5357
5353
5385
5349
5348
5391
5340
5345
MH-211
MH-212
MH-214
MH-205
MH-215
MH-206
MH-216
MH-207

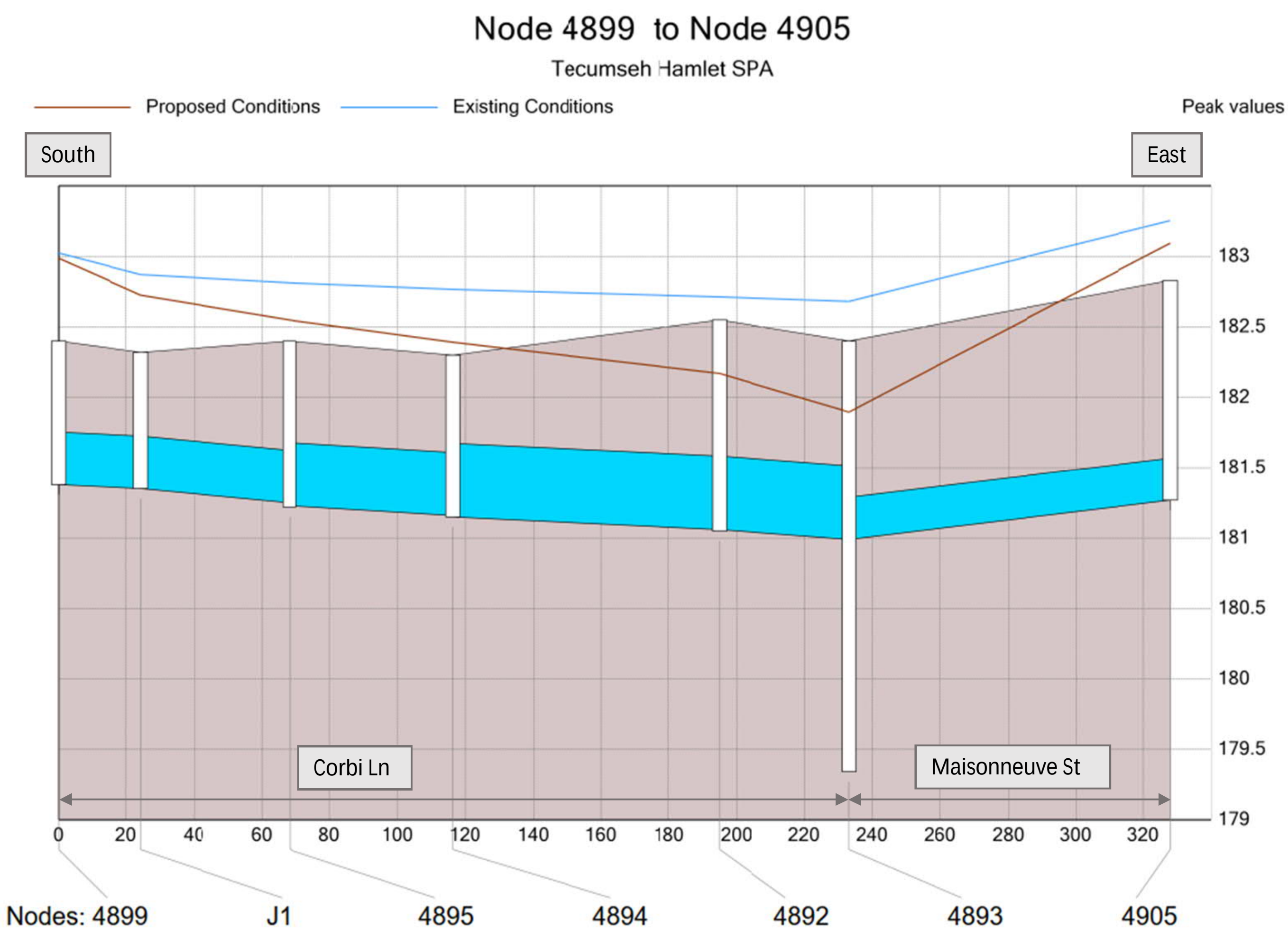
Node 4876 to Node 5014

Tecumseh Hamlet SPA

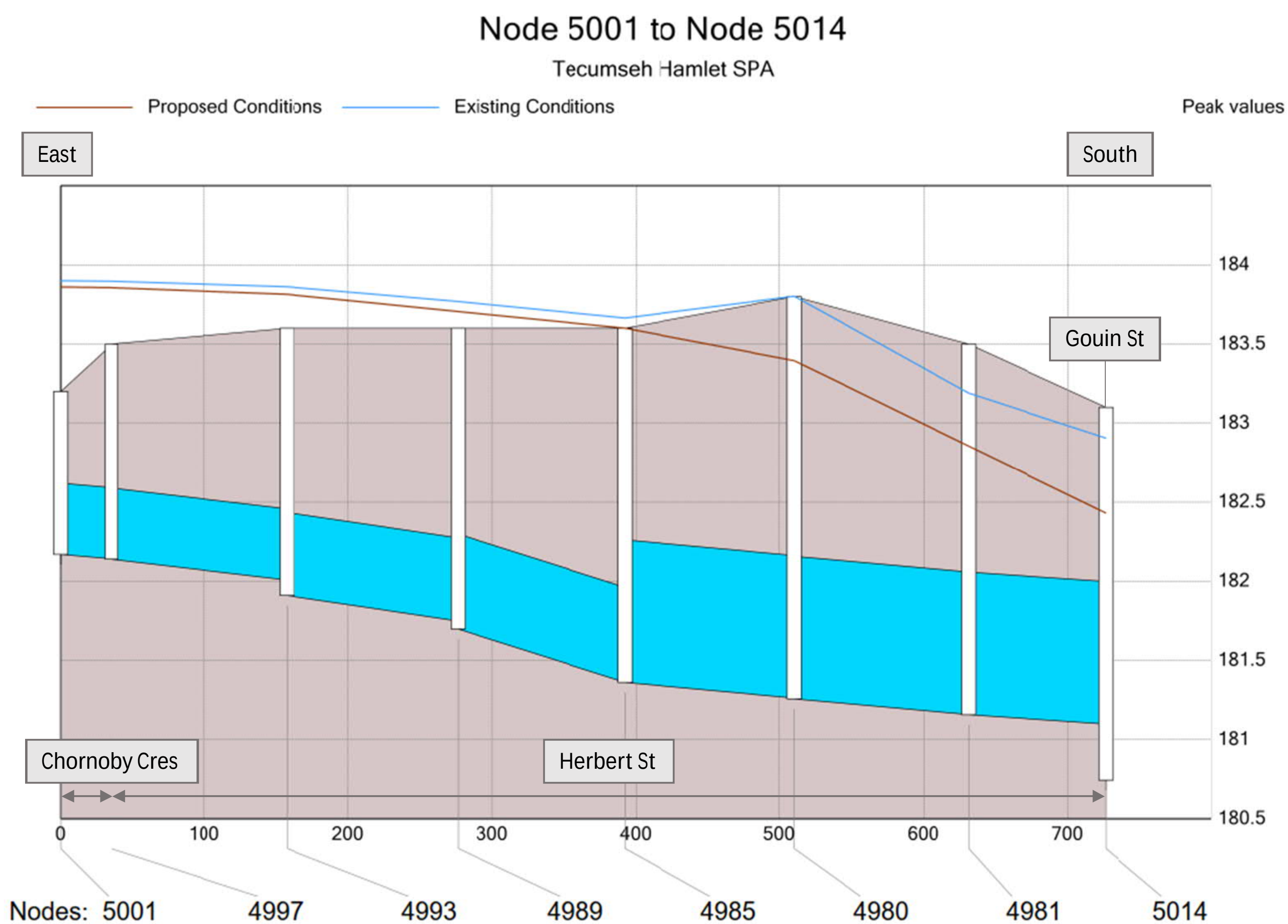




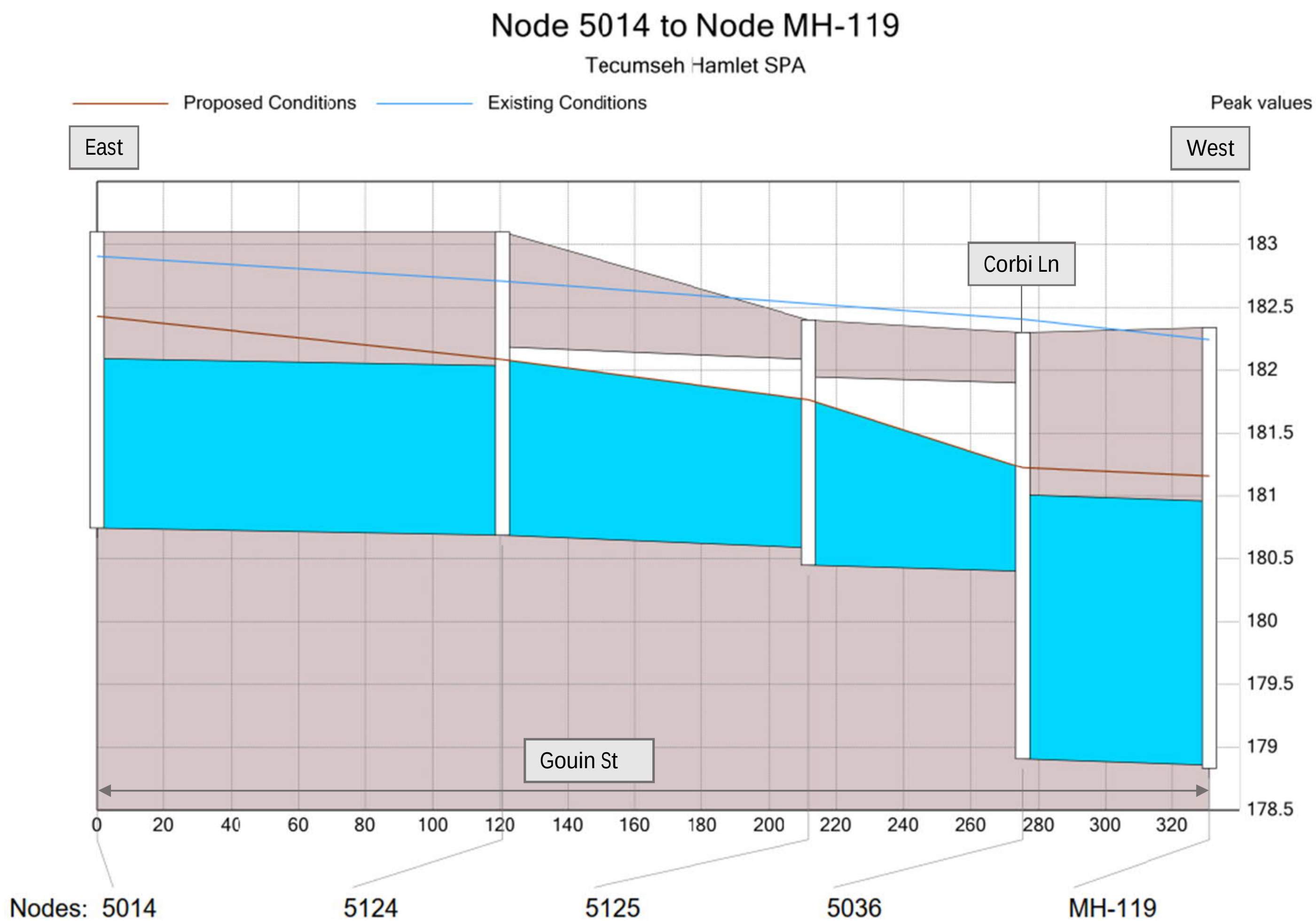
Node 4886 to Node MH-119
Tecumseh Hamlet SPA
Proposed Conditions
Existing Conditions
Peak values
North
South
Kavanagh Dr
Mayrand Cres
183
182.5
182
181.5
181
180.5
180
179.5
179
178.5
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320
Nodes: 4886
4887
4891
4882
7262
MH-119



Node 4899 to Node 4905
Tecumseh Hamlet SPA
Proposed Conditions
Existing Conditions
Peak values
South
East
183
182.5
182
181.5
181
180.5
180
179.5
179
Corbi Ln
Maisonneuve St
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
Nodes: 4899
J1
4895
4894
4892
4893
4905



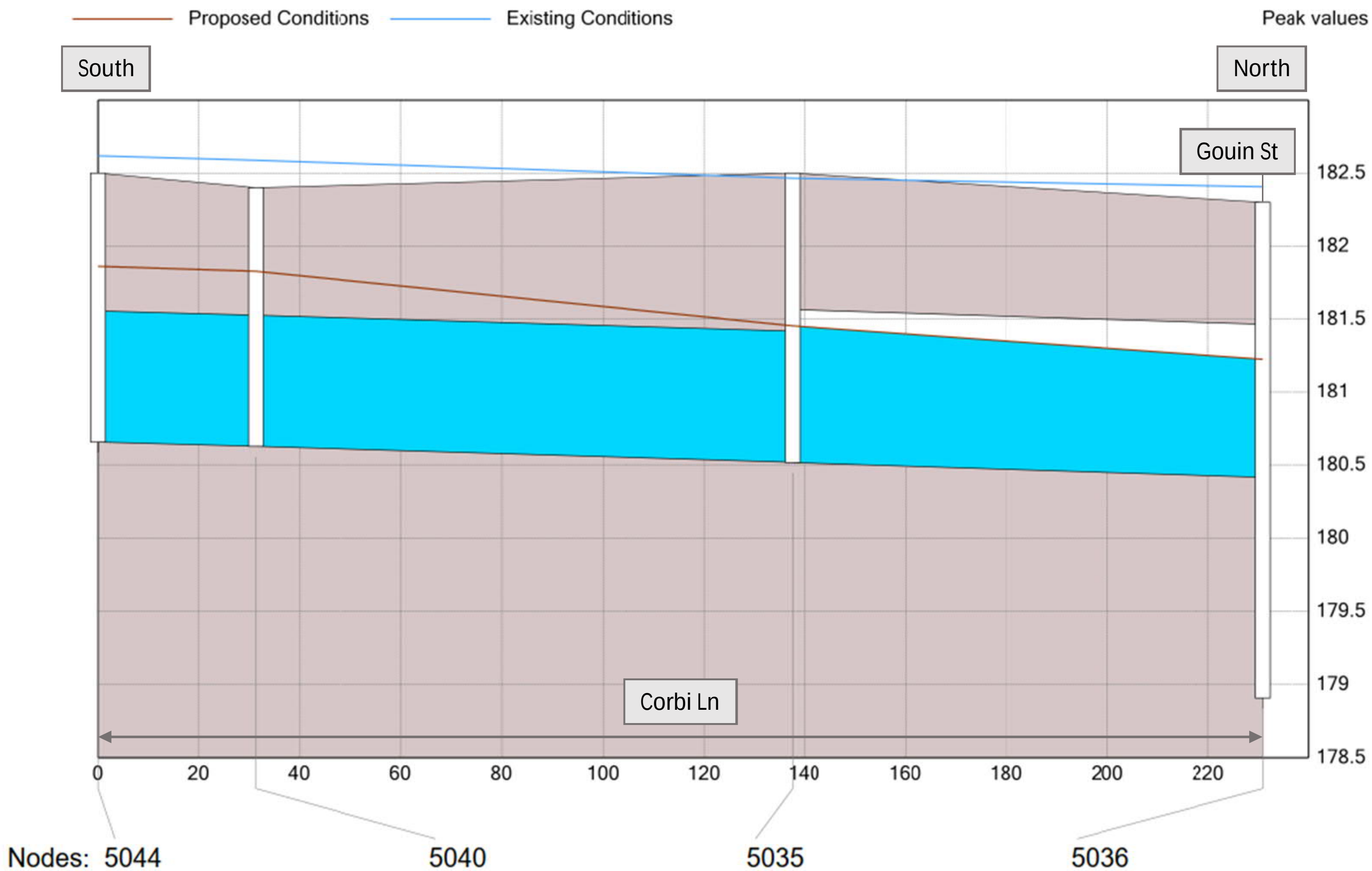
Node 5001 to Node 5014
Tecumseh Hamlet SPA
Proposed Conditions
Existing Conditions
Peak values
East
South
Gouin St
Chornoby Cres
Herbert St
184
183.5
183
182.5
182
181.5
181
180.5
0
100
200
300
400
500
600
700
Nodes: 5001
4997
4993
4989
4985
4980
4981
5014



Node 5014 to Node MH-119
Tecumseh Hamlet SPA
Proposed Conditions
Existing Conditions
Peak values
East
West
Corbi Ln
Gouin St
183
182.5
182
181.5
181
180.5
180
179.5
179
178.5
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
Nodes: 5014
5124
5125
5036
MH-119

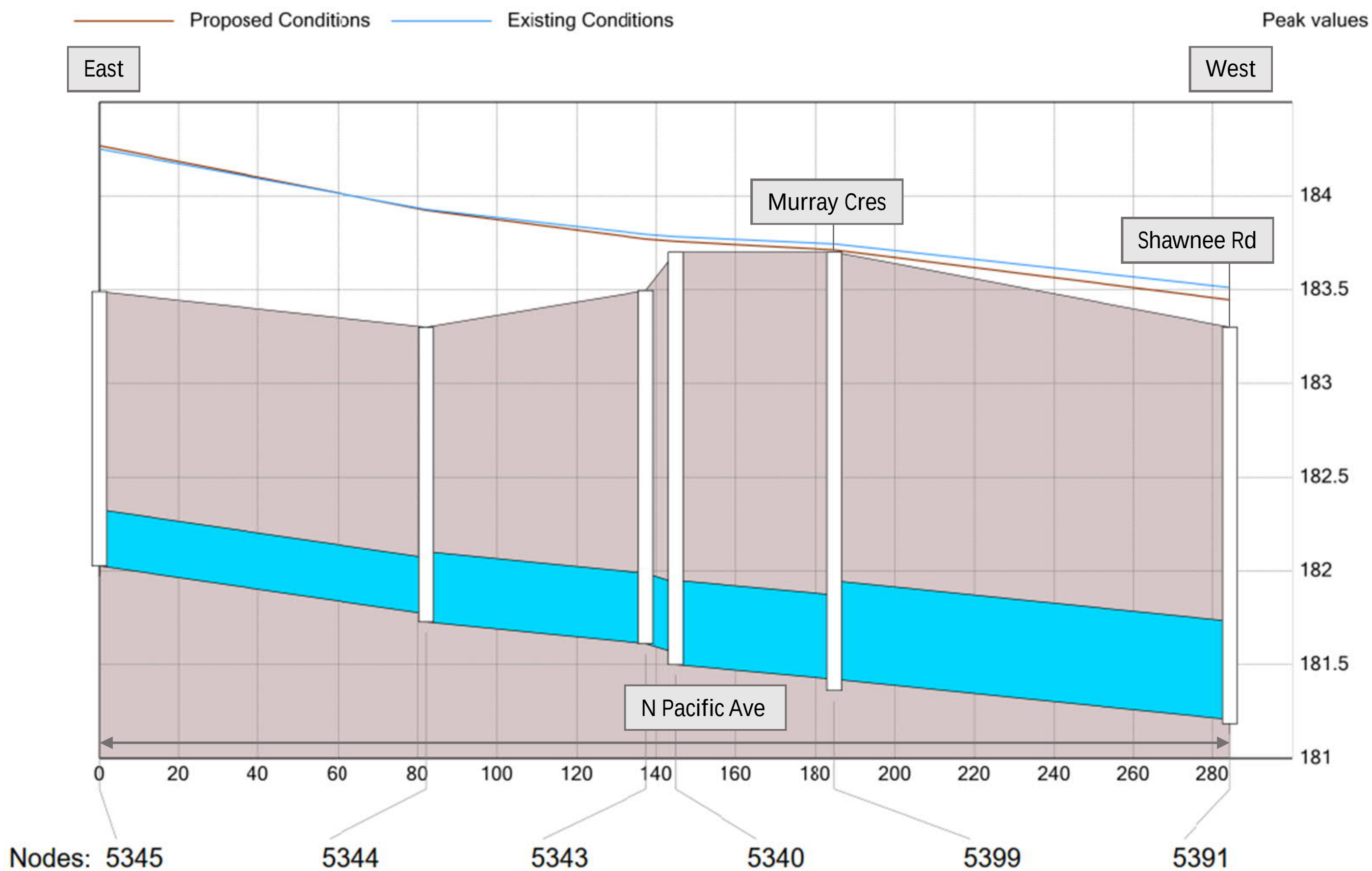
Node 5044 to Node 5036

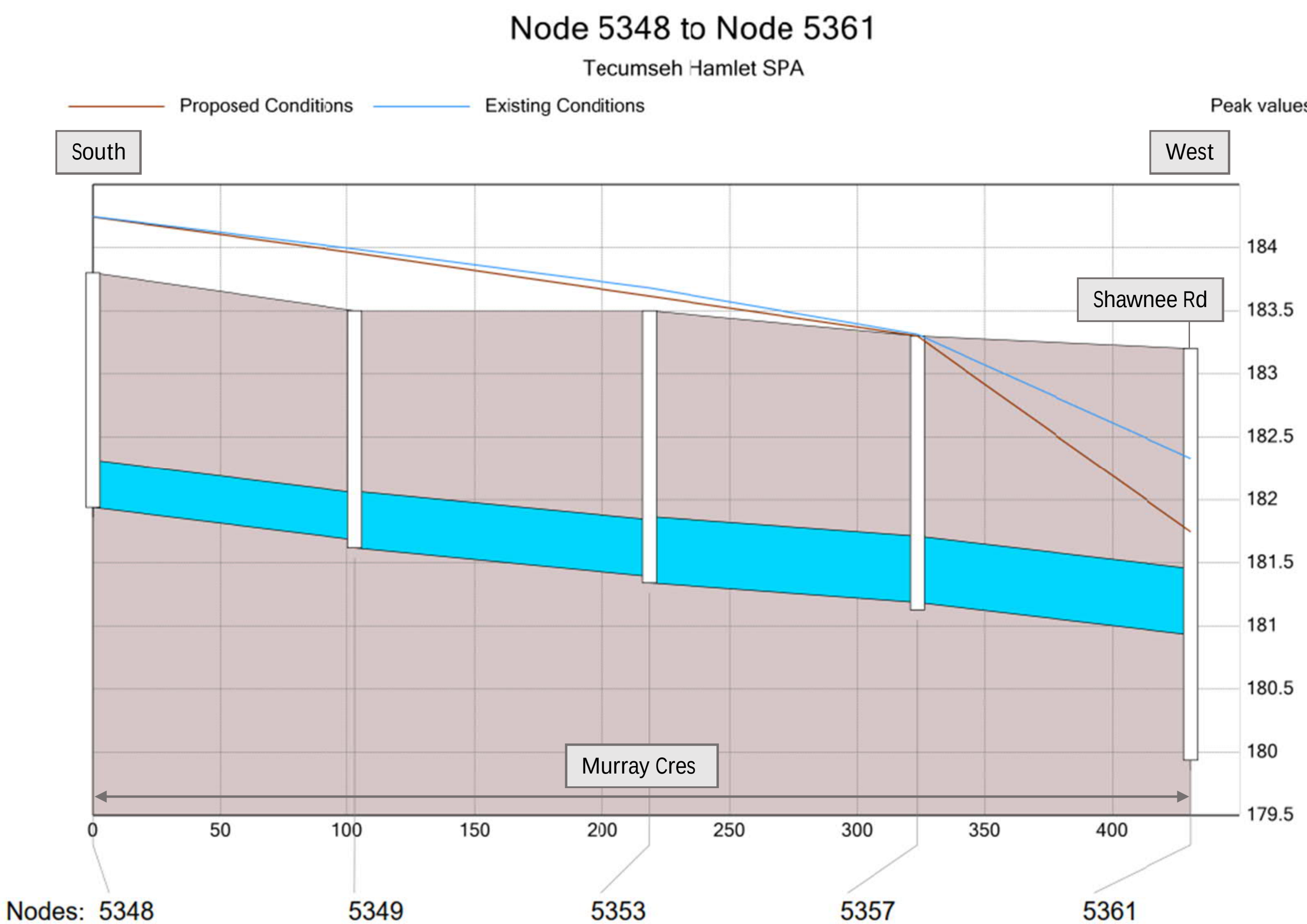
Tecumseh Hamlet SPA



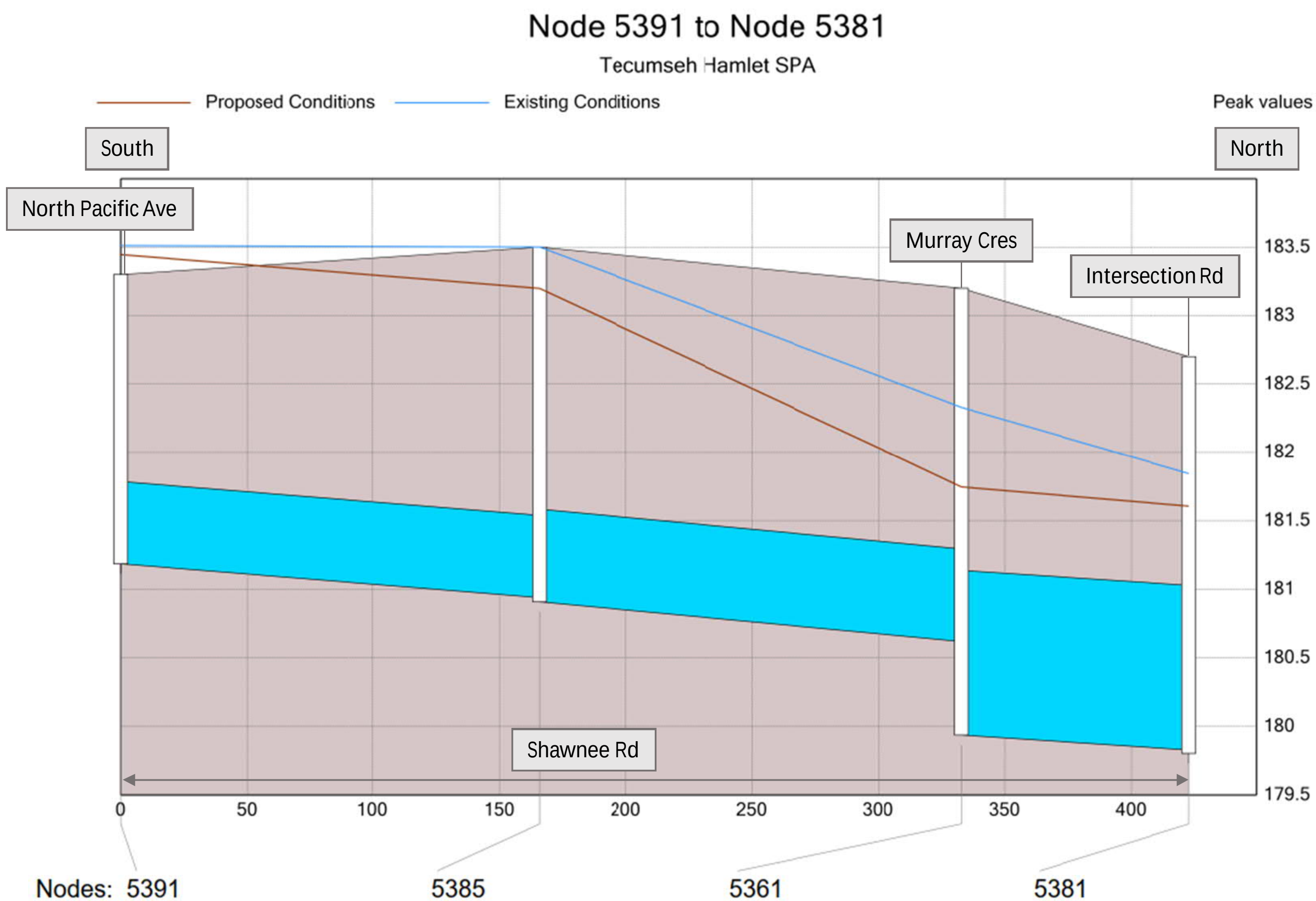
Node 5345 to Node 5391

Tecumseh Hamlet SPA





Node 5348 to Node 5361
Tecumseh Hamlet SPA
Proposed Conditions
Existing Conditions
Peak values
South
West
Shawnee Rd
Murray Cres
184
183.5
183
182.5
182
181.5
181
180.5
180
179.5
0
50
100
150
200
250
300
350
400
Nodes: 5348
5349
5353
5357
5361



Node 5391 to Node 5381
Tecumseh Hamlet SPA
Proposed Conditions
Existing Conditions
Peak values
South
North
North Pacific Ave
Murray Cres
Intersection Rd
Shawnee Rd
183.5
183
182.5
182
181.5
181
180.5
180
179.5
0
50
100
150
200
250
300
350
400
Nodes: 5391
5385
5361
5381

Appendix G

Groundwater and Methane Investigation

DILLON
CONSULTING

TOWN OF TECUMSEH

Groundwater and Methane Investigation

Tecumseh Hamlet Secondary Planning Area

August 2023 – 20-2559

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Tables

Appendices

Executive Summary

Dillon Consulting Limited (Dillon) was retained by the Town of Tecumseh (Town) (the "Client") to conduct a groundwater and methane investigation for lands within the Tecumseh Hamlet Secondary Planning Area (Hamlet SPA) which are adjacent to a former Ministry of Transportation, Ontario (MTO) waste disposal site. The locations of the investigation, Tecumseh Hamlet SPA and MTO waste disposal site are shown on Figure 1.

The objectives of the groundwater and methane investigation were:

- To determine the potential for migration of potentially impacted groundwater and methane gas from the former MTO waste disposal site to the developable lands within the Hamlet SPA, and
- To obtain the information necessary to recommend setback limits from the former MTO waste disposal site to proposed roadways, storm, sanitary and watermain services and residential land use in the Hamlet SPA.

Dillon understands that this groundwater and methane investigation is a preliminary investigation to assist in the planning processes and does not fulfil the requirements of the *D-4 Land Use On or Near Landfill and Dumps* (D-4 Guideline).

The investigation consisted of completing a borehole drilling program, installation of monitoring wells and gas probes, soil grain size analysis, groundwater sampling and analysis, data compilation, interpretation and reporting.

The following is a summary of the findings of this investigation:

- There is no evidence of methane gas migration from the former MTO waste disposal site to the developable lands. Given this finding and that the waste at the MTO property was deposited many years ago, it is concluded that there is negligible potential for landfill gas to migrate onto the development lands.
- The former MTO waste disposal site appears to be influencing groundwater quality in the developable lands directly adjacent to the identified refuse. However, the parameter concentrations in groundwater are not a concern to human health and safety and as such are not considered to be groundwater quality impacts.
- Although no significant impacts were identified from landfill gas or in groundwater quality the following setbacks from the former waste disposal site are recommended:
    - A 10 m setback for the storm water pond. As a best practice it is also recommended that an engineered liner be installed in parts of the storm water pond within 30 m of the former MTO waste disposal site to prevent groundwater from infiltrating the storm water pond;

- A 10 m set back is recommended for trunk sanitary sewer and watermain and other proposed buried utilities. As a best practice, it is recommended that clay cut offs are installed in utility trenches within 30 m of the former MTO waste disposal site to prevent groundwater from infiltrating the utility trenches and acting as a preferential pathway; and
- Residences are a sensitive land use, as such a 30 m setback from the former MTO waste disposal site is recommended.

1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by the Town of Tecumseh (Town) (the "Client") to conduct a groundwater and methane investigation for lands within the Tecumseh Hamlet Secondary Planning Area (Hamlet SPA) which are adjacent to a former Ministry of Transportation, Ontario (MTO) waste disposal site. The locations of the investigation, Tecumseh Hamlet SPA and MTO waste disposal site are shown on Figure 1.

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Dillon understands that this groundwater and methane investigation is a preliminary investigation to assist in the planning processes and does not fulfil the requirements of the *D-4 Land Use On or Near Landfill and Dumps* (D-4 Guideline).

1.1 Background

Dillon was retained by the Town of Tecumseh to complete a preliminary servicing assessment (Phase 1) for the Tecumseh Hamlet Secondary Planning Area (Hamlet SPA) in Southwestern Ontario. The results from Phase 1 are aimed to update the proposed roadway layout for the Hamlet SPA and servicing strategy, including stormwater management (SWM) facility locations prior to resuming the integrated Secondary Planning and Class Environmental Assessment process (Phase 2). Phase 1 will allow for the Town to confirm the overall approach to servicing of the future lands and identify elements that are critical to the development.

Based on the review of the Hamlet SPA, it was identified that a former MTO waste disposal site is located within the Hamlet SPA, south of the EC Row Expressway and west of Shawnee Street in Tecumseh, Ontario (ARN: 374457000046900, PIN: 752420205) (Figure 1).

The report titled *Geotechnical Investigation Hwy #2 Bypass/Shawnee Road Subdivision, Sandwich South Township, Essex County, Gartner Lee Associates Limited, 1979* indicated that the former MTO disposal site includes a former borrow pit which was filled with garbage, foundry sands and fill to a depth of up to approximately 4 m. Refuse was found in the northern area of the waste disposal site, with foundry sands deposited overtop of the refuse and the remainder of the waste disposal site, and fill was used to cap the area. The report also indicated methane gas was detected in qualities greater than the lower explosive limit (5% by volume) in areas of refuse. The approximate area of the refuse as documented in the previous report is displayed on Figure 2.

Based on this information, the potential for migration of potentially impacted groundwater and methane gas which may impact the developable lands to the west of the former MTO waste disposal site in the Hamlet SPA is required to be assessed. This investigation addresses this requirement and recommends setbacks requirements to proposed storm, sanitary and watermain services and residential land use in the Hamlet SPA.

1.2 Initial Disclaimer and Limiting Conditions

This report was prepared by Dillon for the sole benefit of the Town of Tecumseh. The material in the report reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party (i.e., a party other than our Client) makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

2.0 Objectives and Scope

The objectives of the groundwater and methane investigation were:

- To determine the potential for migration of potentially impacted groundwater and methane gas from the former MTO waste disposal site to the developable lands within the Hamlet SPA, and
- To obtain the information necessary to recommend setback limits from the former MTO waste disposal site to proposed roadways, storm, sanitary and watermain services and residential land use in the Hamlet SPA.

Dillon understands that this groundwater and methane investigation is a preliminary investigation to assist in the planning processes and does not fulfil the requirements of the D-4 Guideline.

The groundwater and methane investigation scope of work included:

- Advancement of three boreholes to a depth of 3.0 m and completion as gas probes, and advancement of five boreholes to a depth of 4.6 m and completion as monitoring wells;
- Log soil stratigraphy in the boreholes to identify potential refuse or foundry sand;
- Submission of four soil samples for grain size analysis to the laboratory;
- Development of the five newly installed monitoring wells and collection of groundwater samples for analysis of the parameters listed under the Comprehensive List for Groundwater and Leachate in Schedule 5 of the Landfill standards: A guideline on the regulatory and approval requirements for new or expanding landfilling sites, Ministry of the Environment, Conservation and Parks, January 2012;
- Conduct an elevation survey for groundwater monitoring wells to obtain reference point elevations for calculation of groundwater elevations and flow direction;
- Comparison of groundwater quality data to the Ontario Drinking Water Standards, Objectives and Guidelines, and
- Data compilation, interpretation and reporting.

3.0 Site Description

3.1 General Location

The Hamlet SPA is located between the EC Row Expressway and Country Road 42 in the areas of Lesperance Road and Banwell Road in Tecumseh, Ontario. The focus of this investigation was lands in the northern area of the Hamlet SPA, located adjacent west of the former MTO waste disposal site (ARN: 374457000046900). The location of the investigation, Hamlet SPA and former MTO waste disposal site are presented on Figure 1.

The investigation area is located on the boundary of an agricultural field and a forested area. No buildings or structures were present in the investigation area. The property owner indicated that drainage tiles were present within the investigation area, however no other utilities were identified. The investigation area is owned by 2034053 Ontario Ltd. and is used for agricultural field crops.

3.2 Topography, Physiography, Geology and Hydrogeology

The topography, physiography, geology and hydrogeology for the region are presented in Table 1 below.

Table 1: Summary of Topography, Hydrology and Geology

Topic	Source(s)	Description
Elevation	Elevation survey completed by Dillon Toporama Topographic Map https://atlas.gc.ca/toporama/en/index.html	The investigation area ranges in elevation from approximately 182 to 183 meters above sea level (masl).
Topography	Elevation survey completed by Dillon Site Reconnaissance Observations Toporama Topographic Map https://atlas.gc.ca/toporama/en/index.html	Topography at the investigation area is relatively flat and slopes to the north.
Physiography	Chapman, L.J. and Putnam, D.F., The Physiography of Southern Ontario, Third Edition, Ontario Geological Survey, Special Volume 2, 1984	The region is located within the physiographic region of Southern Ontario known as St. Clair Clay Plains.
Surficial Geology	Soil Map of Essex County, Soil Survey Report No. 11 Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV, 2010	Soils in the region consists of Brookston Clay. Surficial geology in the region is interpreted to consist of fine-textured glaciolacustrine deposits including silt and clay, with minor sand and gravel.
Bedrock Geology	1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1, 2011	Bedrock geology in the region is interpreted to consist of Middle Devonian aged limestone, dolostone and shale of the Dundee Formation. Depth to bedrock is inferred to be approximately 20 to 30 metres below ground surface (mbgs).
Hydrogeology	Toporama Topographic Map https://atlas.gc.ca/toporama/en/index.html	Based on topography of the area, regional groundwater flow is interpreted to be generally towards the north towards Lake St. Clair.

4.0 Methodology

4.1 Utility Locates

Dillon contacted Ontario One Call to arrange buried utility clearances for public sanitary, storm, water, water, telephone, natural gas, cable and electrical services in the investigation area. No buried utilities were identified at the site by Ontario One Call.

Landshark Group was retained to complete private locates in the investigation area. No buried utilities were identified in the investigation area by the private locator.

4.2 Borehole Drilling

Dillon retained Landshark Group to drill the boreholes and install the gas probes and groundwater monitoring wells. The boreholes were drilled on September 8, 2022, using a track-mounted direct push drilling rig (Geoprobe 7822DT). Soil cores were collected using 38 mm outside diameter, 1.5 m long, plastic sample sleeves. No drilling fluids or lubricants were used. Sample sleeves generated during the investigation were taken off-site by the driller for disposal. The gas probe and monitoring well locations are displayed on Figure 2.

Soil stratigraphy was continuously logged and soil cores were classified using ASTM Standard D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) as guidance. Borehole logs were prepared documenting the encountered soil conditions, with descriptions indicating soil type, texture, colour, structure, consistency, plasticity, moisture content and other observations (such as sample recovery, weathering features, staining and odours). Borehole logs are presented in *Appendix A.*

Grain size samples were collected into sample containers supplied by the laboratory for subsequent analysis. The soil samples were labelled and stored in a cooler after collection, and during shipment to the laboratory.

4.3 Gas Probe Installation

Gas probes were installed at three of the borehole locations to monitor for methane gas. The gas probe locations are displayed on Figure 2.

Each newly installed gas probe was constructed of 32 mm diameter, Schedule 40, polyvinyl chloride (PVC) pipe. A 1.5 m long, 0.25 mm slot, PVC screen was placed to target above the water table. The materials were not removed from the protective plastic wrapping until required. The PVC screen and riser piping were flush-threaded and contained O-rings to provide watertight joints. Silica sand was placed around each screen. A bentonite seal was then placed above the silica sand that extended to surface. Each new monitoring well was secured in place with an aboveground monument casing with concrete at ground surface.

4.4 Groundwater Monitoring Well Installation

Monitoring wells were installed at five of the borehole locations to assess groundwater quality and flow direction. The monitoring well locations are displayed on Figure 2.

Each newly installed monitoring well was constructed of 51 mm diameter, Schedule 40, polyvinyl chloride (PVC) pipe. A 3.66 m long, 0.25 mm slot, PVC well screen was placed to intercept the water table. The well materials were not removed from the protective plastic wrapping until required. The PVC screen and riser piping were flush-threaded and contained O-rings to provide watertight joints. Silica sand was placed around each well screen and extended between approximately 0.3 m above each screen. A bentonite seal was then placed above the silica sand that extended surface. Each new monitoring well was secured in place with an aboveground monument casing with concrete at ground surface.

4.5 Elevation Survey

A survey of monitoring well locations and elevations using a Trimble R10 GNSS GPS receiver and a Trimble S7 total station was completed on September 14, 2022. Surveyed elevations of monitoring wells are provided in Table 1.

4.6 Methane Monitoring

The gas probes and monitoring wells were monitored for methane on five occasions throughout the investigation. Methane was measured using a RKI Eagle 2 portable gas meter. To collect the measurements, the gas probes and monitoring wells were opened, the tubing attached to the meter was immediately inserted into the pipe and a seal was created around the tubing and the pipe. The readings on the meter were allowed to stabilize and the highest methane reading was recorded from the meter.

4.7 Groundwater Level Measurement, Development, Purging and Sampling

Depth to groundwater was measured and recorded upon arrival to each monitoring well using an electronic oil-water interphase meter. Readings were measured to the nearest 0.01 m. These measurements were used in conjunction with data collected during an elevation survey to calculate groundwater elevations and interpret flow direction.

The new monitoring wells were developed and purged to remove fine-grained material from the vicinity of the well screen and filter-pack, and to remove stagnant water from the well casing before sampling. Development was conducted using a dedicated inertial foot valve and 16 mm low-density polyethylene (LDPE) tubing. Due to very slow recovery of the monitoring wells, monitoring wells were purged dry one to two times prior to sampling. MW22-102 remained dry throughout the investigation. Observations of the physical appearance of the purge water were noted. Groundwater levels were allowed to recover for several weeks before returning to the site to collect groundwater samples.

Groundwater samples were recovered using a peristaltic pump fitted with 10 mm diameter silicon pump head tubing and dedicated 4 mm ID by 6 mm OD LDPE tubing at each well. Field water quality parameters (i.e., temperature, pH, conductivity, oxidation-reduction potential, dissolved oxygen and turbidity) were observed prior to sampling. Low flow sampling was completed, and groundwater samples were collected after field parameters stabilized, or prior to the well going dry. The groundwater samples were collected into pre-preserved sample containers supplied by the laboratory for subsequent analysis. Groundwater samples for metals analysis were filtered in the field using disposable 0.45 micron filters. The groundwater samples were labelled and stored in a cooler after collection, and during shipment to the laboratory.

4.8 Sample Handling, Custody and Analysis

Samples for laboratory analysis were packed carefully into sample coolers containing ice to prevent damage to the sample containers and to maintain laboratory-suggested temperatures between 4°C and 10°C. A chain-of-custody form was completed and included in each sample cooler. Samples were dropped off at the laboratory depot for shipment to the laboratory for analysis.

Paracel Laboratories Ltd. (Paracel) of Ottawa, Ontario, analyzed the groundwater samples and subcontracted the soil grain size analysis to ALS Canada Ltd. (ALS) of Hamilton, Ontario. Parcel and ALS are accredited by the Canadian Association of Laboratory Accreditation (CALA) for the requested analysis.

4.9 Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) procedures were implemented in the field and laboratory to demonstrate that the data generated were of a level of quality suitable for their intended purposes. Field QA/QC procedures included use of new sampling equipment and/or appropriate equipment cleaning procedures and adherence to published standards for field methodology.

Field instruments (i.e., RKI Eagle 2, water quality meter) were calibrated and checked in accordance with the operating manual.

Soil grain size and groundwater samples were labeled prior to submission for analytical testing with sample identification relevant to the location they were collected and/or by the method of collection. In addition to sample identifications, sample labels also included the date and time of collection, the consultant's name (Dillon) and Dillon's project number. Immediately following collection, samples were stored in coolers on ice and documented on the Chain of Custody forms. Chain of Custody forms completed by Dillon following each individual Certificate of Analysis are included in *Appendix B*.

Field duplicate samples were collected at a minimum rate of 10% (one in ten samples) for groundwater. Each duplicate sample was assigned a 'false' identification which was recorded in the field notes connecting the duplicate with the original sample.

Where concentrations were measured at values 5x the reportable detection limit (RDL) or higher, the field duplicate concentrations were compared to the parent sample concentrations for relative percent difference (RPD) using the following equation:

$$\mathbf{RPD}\ (\%) = \frac{(\mathbf{C1} - \mathbf{C2})}{(\mathbf{C1} + \mathbf{C2})/\mathbf{2}}\mathbf{X\ 100}$$

Where: C1 = sample concentration
C2 = duplicate concentration

Laboratory QA/QC procedures included following internal protocols and analysis of a laboratory blank sample and laboratory reference standards. The data received from the laboratory were compiled and input into spreadsheets. After checking the spreadsheet entries, the compiled data was reviewed to confirm satisfactory quality. Sample chain-of-custody, holding times, dilution factors, surrogate recoveries, replicate analyses, analytical quantitation limits and blank analyses were reviewed, and compared to applicable quality control acceptance criteria. The results of the QA/QC program are detailed in Section 5.6

5.0 Results

5.1 Borehole Drilling

Eight boreholes were drilled to maximum depths ranging from 3.0 to 4.6. Three of the boreholes (GP22-101 through GP22-103) were installed as gas probes. Five of the boreholes were installed as monitoring wells (MW22-101 through MW22-105). The locations of each borehole/monitoring well are presented in Figure 2.

The soil profile observed during the drilling investigation generally consisted of a layer of topsoil underlain by silty clay. Sandy clay was observed between the topsoil and silty clay in select boreholes. Bedrock was not encountered at the maximum drilled depth of 4.6 mbgs.

Gas probes were installed above the inferred water table. Monitoring wells were installed across the inferred water table elevation.

Stratigraphic descriptions and gas probe and monitoring well construction details are presented on the borehole logs in *Appendix A.*

5.2 Methane Monitoring Results

The three gas probes and five monitoring wells were monitored for methane on five occasions throughout the investigation (September 26, 2022, October 18, 2022, March 23, 2023, May 15, 2023 and June 22, 2023). Methane gas was not detected in the three gas probes or the five monitoring wells throughout the course of the investigation. Table 5 summarizes the methane measurements for the gas probes and monitoring wells.

5.3 Groundwater Level Monitoring Results

Groundwater level measurements were made at each monitoring well location prior to sampling. Groundwater level measurements were collected using an oil-water interface probe. Table 2 summarizes the monitoring well elevations, groundwater level measurements, and the calculated groundwater elevations for monitoring wells.

Monitoring wells in the investigation area were observed to have slow recovery. Five weeks after the installation of the monitoring wells, the five monitoring wells were observed dry. In March 2023, six months after installation, two of the monitoring wells were observed dry. Upon sampling in June 2023, nine months after installation, one of the monitoring wells continued to be dry and could not be sampled. Due to slow recovery, static water level conditions may have not been achieved due to time constraints of the investigation. Therefore, actual static groundwater elevations may differ from what was observed during the investigation.

Based on the groundwater elevations at the time of sampling, the gradient appeared higher in the north and lower in the south, suggesting local groundwater flow may have a southward component. However, monitoring wells were not placed in a triangular pattern, but rather in a linear pattern to investigate potential impacts from former MTO waste disposal site, and as such the east-west component to groundwater flow could not be determined.

Drainage tiles are known to be present in the investigation area which may affect local groundwater flow. Additionally, the Robinet Drain and Gouin Drain are located south of the investigation area which may influence local groundwater flow (see Figure 3).

Overall, local groundwater flow direction in the investigation area could not be determined at this time. Regional groundwater flow is inferred to be generally north towards Lake St. Clair.

5.4 Soil Grain Size Results

Grain size sieve and hydrometer testing was completed on four soil samples from boreholes within the investigation area. Soil texture within the investigation area was determined to be medium and fine textured. The results of the sieve and hydrometer testing are presented in Table 3. Particle size distribution curves are presented in *Appendix B*.

Based on the documented properties of silty clay soil, the results of the grain size analysis, and supported by the slow rate of recovery observed in groundwater monitoring wells, the hydraulic conductivity of the native silty clay in the investigation area was estimated to be between $1x10^{-6}$ to $1x10^{-9}$ cm/s.

5.5 Groundwater Comparison Standards

The groundwater samples were analyzed for parameters listed in the under the Comprehensive List for Groundwater and Leachate in Schedule 5 of the *Landfill standards: A guideline on the regulatory and approval requirements for new or expanding landfilling sites, Ministry of the Environment, Conservation and Parks, January 2012* to identify potential impacts from the refuse identified on the former MTO waste disposal site.

The groundwater analytical results were compared against Aesthetic Objectives (AO), Operational Guidelines (OG), Maximum Acceptable Concentrations (MAC) and Interim Maximum Acceptable Concentrations (IMAC) Ontario Drinking Water Standards, Objectives and Guidelines (ODWSOG) in the *Technical Support for Ontario Drinking Water Standards, Objectives and Guidelines, Government of Ontario, Revised June 2006*.

5.6 Groundwater Results

Five groundwater samples and one field duplicate sample were collected from the monitoring wells installed in the investigation area and were submitted for the analysis of the parameters listed under the Comprehensive List for Groundwater and Leachate in Schedule 5 of the *Landfill standards: A guidelines on the regulatory and approval requirements for new or expanding landfilling sites, Ministry of the Environment, Conservation and Parks, January 2012.*

The groundwater samples met the applicable AO, OG, MAC and IMAC ODWSOG for the parameters analyzed with the following exceptions:

- The concentrations of dissolved organic carbon (DOC) at MW22-DUP (field duplicate of MW22-103) (5.1 mg/L) and MW22-104 (5.2 mg/L) exceeded the AO of 5 mg/L.
- The concentrations of total dissolved solids (TDS) MW22-101 (668 mg/L), MW22-103 (658 mg/L), MW22-104 (1,270 mg/L) and MW22-105 (1,140 mg/L) exceeded the AO of 500 mg/L.

Groundwater results and comparison criteria are presented in Table 4. Laboratory certificates of analysis are presented in *Appendix B*.

5.7 QA/QC Results

One field duplicate sample was collected during the groundwater sampling program and submitted for select parameters. The analytical results of the field duplicate sample collected are presented in Table 4. RPD calculations between MW22-103 and its field duplicate MW22-DUP were within the industry accepted value of 30% for groundwater.

The laboratory noted that the laboratory duplicate RPD for calcium slightly exceeded the limit, however the remaining batch QA/QC was acceptable, as such this is not inferred to affect the interpretation of the results. The remaining quality control data provided by the laboratory (laboratory surrogate recoveries, spike, blank and lab duplicate samples) met the applicable quality control acceptance criteria. Information related to laboratory quality control data can be found in the applicable laboratory certificates of analysis presented in *Appendix B*.

Overall, the data collected during the investigations met QA/QC acceptance requirements and are of sufficient quality for their intended use.

6.0 Discussion

6.1 Groundwater

Monitoring wells MW22-104 and MW22-105 are located in the northern part of the investigation area adjacent to the refuse on the former MTO waste disposal site. MW22-103 is located in the mid-northern part of the investigation area slightly southwest of the refuse. MW22-101 is located in the southern part of the investigation area further south of the refuse and is considered representative of background conditions based on its distance from the refuse.

The guidelines for DOC and TDS are aesthetic objectives (AO) established for parameters that may impair the taste, odour or colour of water, however, groundwater in this region is not potable as such these elevated concentrations are not a concern to human health and safety.

Volatile organic compounds analyzed (benzene, toluene, dichloromethane, vinyl chloride and 1, 4-dichlorbenzene) were not detected in groundwater during the investigation, as such volatilization is not concern to human health and safety.

Chloride and sulphate are indicator parameters for leachate. Chloride and sulphate met the applicable ODWSOG, however it is noted that concentrations at monitoring wells adjacent to the refuse were higher compared to wells further south of the refuse. Indicating that the refuse does appear to be influencing groundwater in the developable lands in the Hamlet SPA to an extent, however, the parameter concentrations in groundwater are not a concern to human health and safety.

6.2 Methane Gas

Methane was not detected during the monitoring events. Therefore, there is no evidence of methane gas migration from the former MTO waste disposal site to the developable lands. Given this finding and that the waste at the MTO property was deposited many years ago, it is concluded that there is negligible potential for landfill gas to migrate onto the developable lands.

6.3 Setbacks

The former MTO waste disposal site is a non-operating site. It is unknown exactly when refuse was last brought to the site, however based on the report *Geotechnical Investigation Hwy #2 Bypass/Shawnee Road Subdivision, Sandwich South Township, Essex County, Gartner Lee Associates Limited, 1979*, it was prior to 1979. As such, it has not been operating for greater than 25 years.

Based on the guidance document *D-4 Land Use on or Near Landfills and Dumps,* sensitive land uses for landfills include residences, and compatible land uses for landfills include utilities and above ground transportation routes excepted major highways.

The former MTO waste disposal site is not proposed to be developed at this time. The Town may consider redeveloping this area as parkland in the future, however, additional studies would be required beyond this investigation to support this.

Based on the results of the investigation, there is no evidence of methane gas migration from the former MTO waste disposal site to the developable lands. Based on the results of the investigation, the former MTO waste disposal site appears to be influencing groundwater in the developable lands directly adjacent to the identified refuse to an extent. However, the parameter concentrations in groundwater are not a concern to human health and safety.

A storm water pond is proposed to be located in the northern area of the Hamlet SPA, adjacent west of the former MTO waste disposal site (see Figure 3). A storm water pond is considered a compatible land use. It is recommended that the storm water pond have a 10 m set back from the former MTO waste disposal site. As a best practice it is also recommended that an engineered liner be installed in parts of the storm water pond within 30 m of the former MTO waste disposal site to prevent groundwater from infiltrating the storm water pond.

A trunk sanitary sewer and water main is proposed to traverse the Hamlet SPA north to south adjacent west of the former MTO waste disposal site (see Figure 3). Utilities are considered a compatible land use. It is recommended that the trunk sanitary sewer and watermain and other proposed buried utilities, have a 10 m set back from the former MTO waste disposal site. As a best practice it is recommended that clay cut offs are installed in utility trenches within 30 m of the former MTO waste disposal site to prevent groundwater from infiltrating the utility trenches and acting as a preferential pathway.

Residential development is proposed further west and southwest of the former MTO waste disposal site (see Figure 3). Residences are a sensitive land use, as such a 30 m setback from the former MTO waste disposal site is recommended.

7.0 Summary of Findings

The following is a summary of the findings of this investigation:

- There is no evidence of methane gas migration from the former MTO waste disposal site to the developable lands. Given this finding and that the waste at the MTO property was deposited many years ago, it is concluded that there is negligible potential for landfill gas to migrate onto the development lands.
- The former MTO waste disposal site appears to be influencing groundwater quality in the developable lands directly adjacent to the identified refuse. However, the parameter concentrations in groundwater are not a concern to human health and safety and as such are not considered to be groundwater quality impacts.
- Although no significant impacts were identified from landfill gas or in groundwater quality the following setbacks from the former waste disposal site are recommended:
    - A 10 m set back for the storm water pond. As a best practice it is also recommended that an engineered liner be installed in parts of the storm water pond within 30 m of the former MTO waste disposal site to prevent groundwater from infiltrating the storm water pond;
    - A 10 m set back is recommended for trunk sanitary sewer and watermain and other proposed buried utilities. As a best practice, it is recommended that clay cut offs are installed in utility trenches within 30 m of the former MTO waste disposal site to prevent groundwater from infiltrating the utility trenches and acting as a preferential pathway; and
    - Residences are a sensitive land use, as such a 30 m setback from the former MTO waste disposal site is recommended.

8.0 Disclaimer and Limiting Conditions

This report was prepared exclusively for the purposes, project and site location(s) outlined in the report. The report is based on information provided to or obtained by Dillon Consulting Limited ("Dillon") as indicated in the report and applies solely to site conditions existing at the time of the site investigation(s). Although a reasonable investigation was conducted by Dillon, Dillon's investigation was by no means exhaustive and cannot be construed as a certification of the absence of any contaminants from the site(s). Rather, Dillon's report represents a reasonable review of available information within an agreed work scope, schedule and budget. It is therefore possible that currently unrecognized contamination or potentially hazardous materials may exist at the site(s), and that the levels of contamination or hazardous materials may vary across the site(s). Further review and updating of the report may be required as local and site conditions, and the regulatory and planning frameworks, change over time.

This report was prepared by Dillon for the sole benefit of our Client, the Town of Tecumseh. The material in it reflects Dillon's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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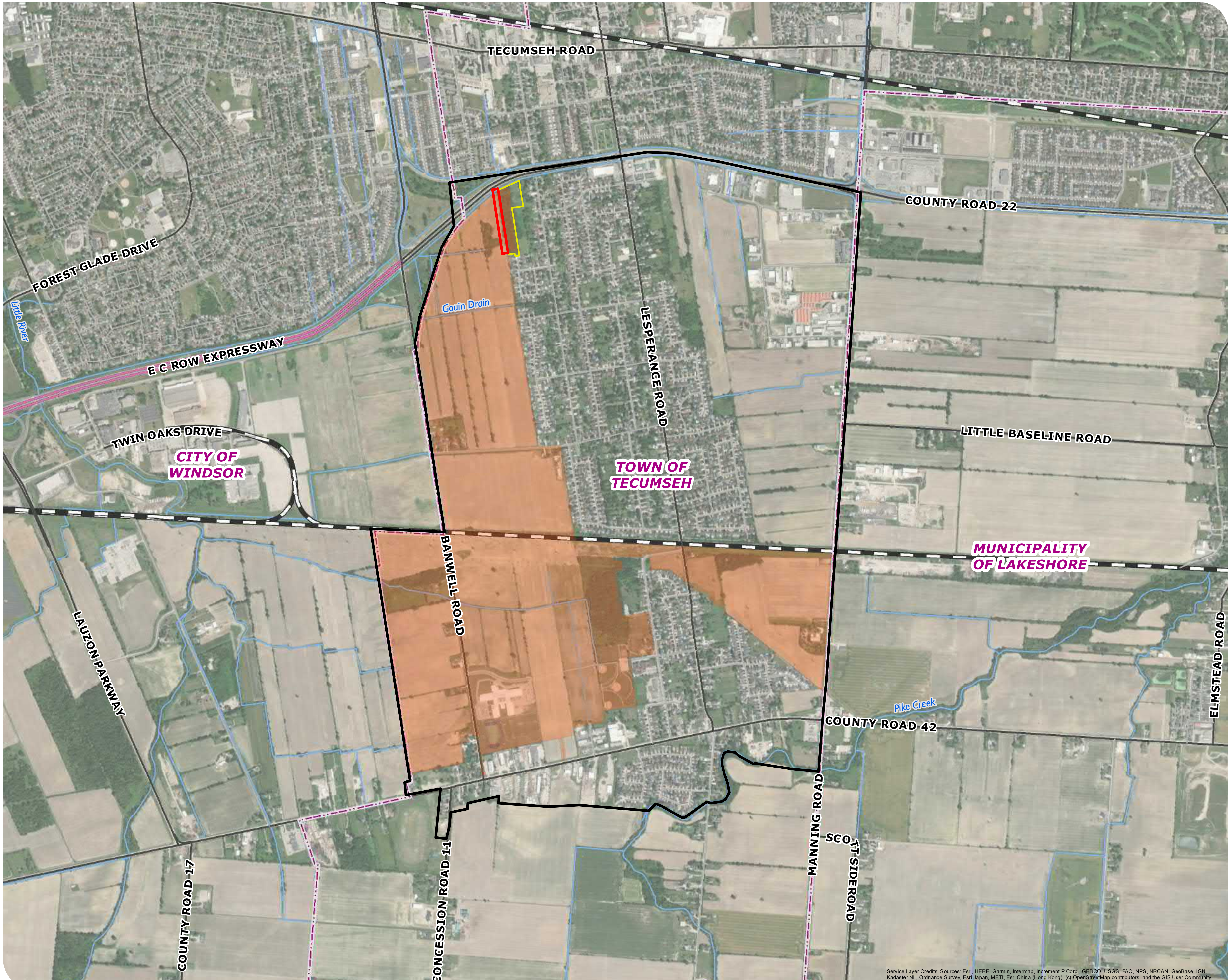
Figures



TOWN OF TECUMSEH

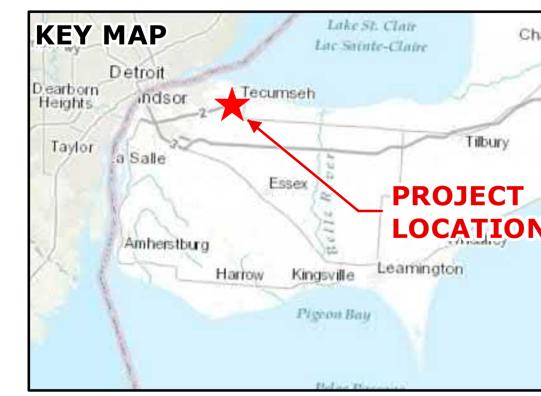
GROUNDWATER AND METHANE INVESTIGATION

PROJECT LOCATION

FIGURE 1

- Settlement Area Boundary (Tecumseh Hamlet)
- Tecumseh Hamlet SPA
- Investigation Area
- Former MTO Waste Disposal Site
- Freeway
- Major Road
- Local Road
- Railway
- Watercourse
- Waterbody
- Municipal Boundary

KEY MAP



SCALE 1:20,000

0 250 500 1,000 m

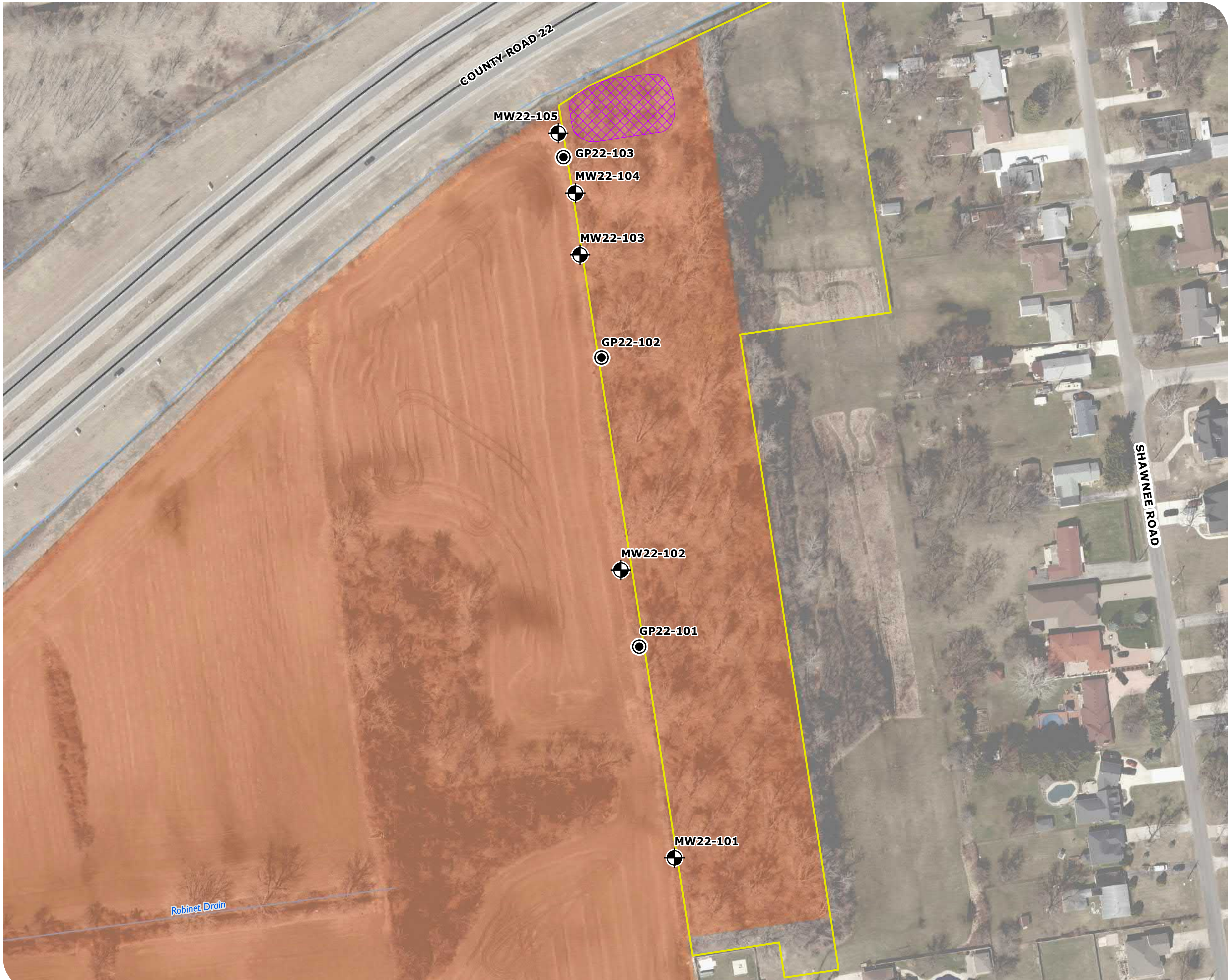
MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: RR
MAP CHECKED BY: MA
MAP PROJECTION: NAD 1983 CSRS UTM Zone 17N

DILLON CONSULTING

PROJECT: 20-2559
STATUS: FINAL
DATE: 2023-08-15

FILE LOCATION: K:\2020\202559\Product\Client\F1_ProjectLocation.mxd



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TOWN OF TECUMSEH

GROUNDWATER AND METHANE INVESTIGATION

MONITORING WELL AND GAS PROBE LOCATIONS

FIGURE 2

- Tecumseh Hamlet SPA
- Major Road
- Watercourse
- Former MTO Waste Disposal Site
- Approximate Refuse Area (Gartner Lee Associates Limited, 1979)
- Monitoring Well Location
- Gas Probe Location

SCALE 1:1,500

0 15 30 60 m

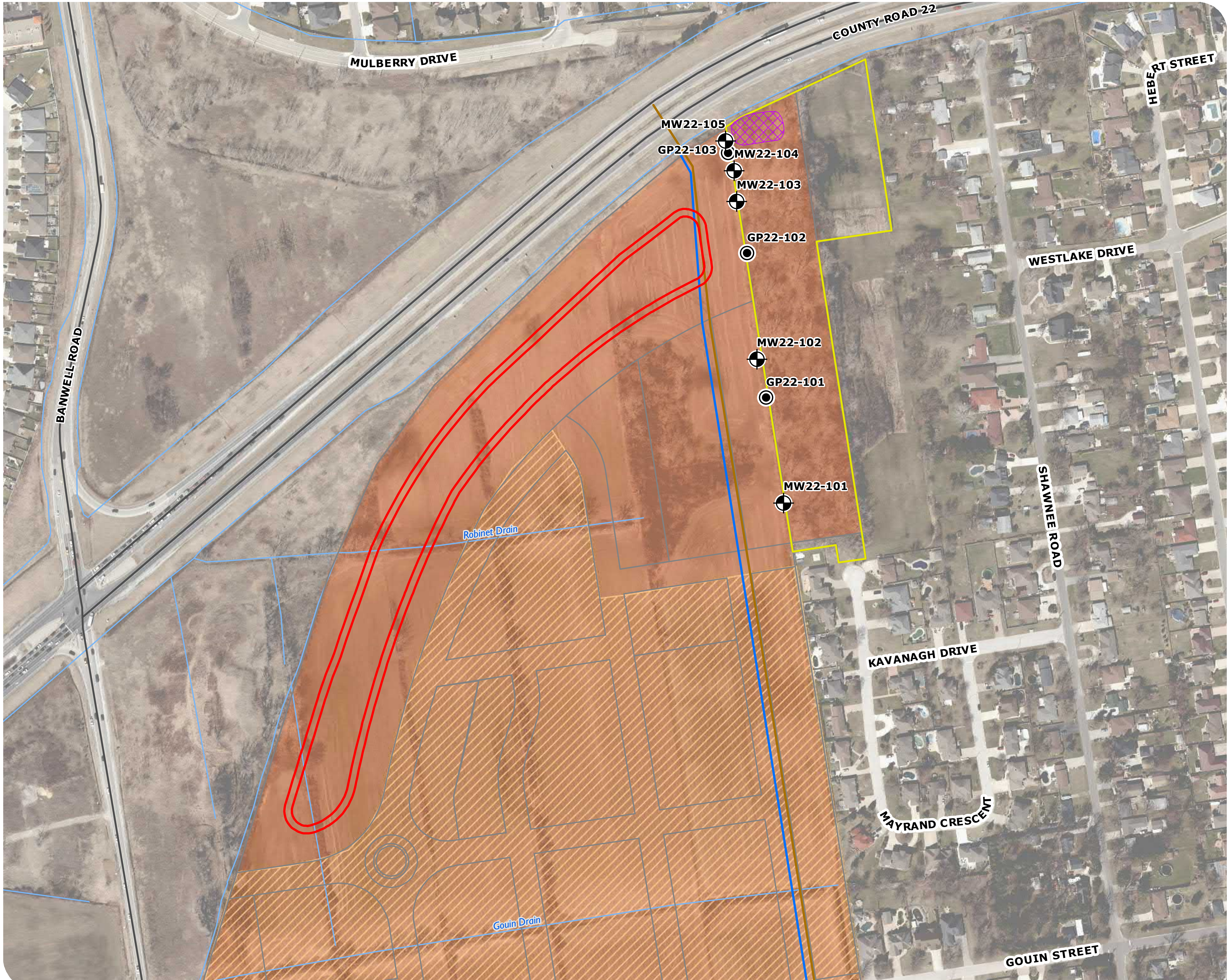
N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, ESSEX COUNTY OPEN DATA

MAP CREATED BY: RR
MAP CHECKED BY: MA
MAP PROJECTION: NAD 1983 CSRS UTM Zone 17N

DILLON CONSULTING

PROJECT: 20-2559
STATUS: FINAL
DATE: 2023-08-15



TOWN OF TECUMSEH

GROUNDWATER AND METHANE INVESTIGATION

PROPOSED DEVELOPMENT

FIGURE 3

- Tecumseh Hamlet SPA
- Proposed Residenital Development Area
- Proposed Storm Water Pond
- Proposed Trunk Watermain
- Proposed Trunk Sewer
- Proposed Roadways
- Major Road
- Watercourse
- Former MTO Waste Disposal Site
- Approximate Refuse Area (Gartner Lee Associates Limited, 1979)
- Monitoring Well Location
- Gas Probe Location

SCALE 1:3,000

0 25 50 100 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, ESSEX COUNTY OPEN DATA

MAP CREATED BY: RR
MAP CHECKED BY: MA
MAP PROJECTION: NAD 1983 CSRS UTM Zone 17N

DILLON CONSULTING

PROJECT: 20-2559
STATUS: FINAL
DATE: 2023-08-24

FILE LOCATION: K:\2020\202559\Product\Client\F3_ProposedDevelopment.mxd

Tables

Table 1: Gas Probe and Monitoring Well Installation Details
Groundwater and Methane Investigation
Tecumseh Hamlet Secondary Planning Area

Monitoring Well	Type	Northing (m)	Easting (m)	Installation Date	Ground Surface Elevation (masl)	Top of Pipe Elevation (masl)	Well Depth (mbgs)	Height of Riser (mags)	Screened Interval		Screen Length (m)	Well Diameter (mm)
									Top (mbgs)	Bottom (mbgs)		
GP22-101	Stick Up	4685152.37	344016.60	08-Sep-22	182.64	183.76	1.82	1.12	0.30	1.82	1.52	32
GP22-102	Stick Up	4685268.30	344001.22	08-Sep-22	183.38	184.53	1.82	1.15	0.30	1.82	1.52	32
GP22-103	Stick Up	4685348.65	343985.94	08-Sep-22	183.39	184.57	1.82	1.18	0.30	1.82	1.52	32
MW22-101	Stick Up	4685067.81	344030.70	08-Sep-22	182.39	183.31	4.57	0.92	0.91	4.57	3.66	51
MW22-102	Stick Up	4685183.07	344009.01	08-Sep-22	182.96	184.24	4.57	1.28	0.91	4.57	3.66	51
MW22-103	Stick Up	4685309.53	343992.71	08-Sep-22	183.53	184.52	4.57	0.99	0.91	4.57	3.66	51
MW22-104	Stick Up	4685333.90	343990.78	08-Sep-22	183.17	184.15	4.57	0.98	0.91	4.57	3.66	51
MW22-105	Stick Up	4685358.41	343983.86	08-Sep-22	183.34	184.49	4.57	1.15	0.91	4.57	3.66	51

Notes:

masl	Metres above sea level
mbgs	Metres below ground surface
mags	Metres above ground surface

Table 2: Groundwater Levels and Product
Groundwater and Methane Investigation
Tecumseh Hamlet Secondary Planning Area

Monitoring Well	Monitoring Date	Top of Pipe Elevation (masl)	Ground Surface Elevation (masl)	Water Depth (mbtop)	Groundwater Elevation (masl)	Water Depth (mbgs)	LNAPL/DNAPL
MW22-101	26-Sep-22	183.31	182.39	DRY	DRY	DRY	nd
	18-Oct-22	183.31	182.39	DRY	DRY	DRY	nd
	23-Mar-23	183.31	182.39	1.6	181.7	0.7	nd
	15-May-23	183.31	182.39	1.2	182.1	0.3	nd
	22-Jun-23	183.31	182.39	2.3	181.0	1.3	nd
MW22-102	26-Sep-22	184.24	182.96	DRY	DRY	DRY	nd
	18-Oct-22	184.24	182.96	DRY	DRY	DRY	nd
	23-Mar-23	184.24	182.96	DRY	DRY	DRY	nd
	15-May-23	184.24	182.96	DRY	DRY	DRY	nd
	22-Jun-23	184.24	182.96	DRY	DRY	DRY	nd
MW22-103	26-Sep-22	184.52	183.53	DRY	DRY	DRY	nd
	18-Oct-22	184.52	183.53	DRY	DRY	DRY	nd
	23-Mar-23	184.52	183.53	1.4	183.2	0.4	nd
	15-May-23	184.52	183.53	1.9	182.6	0.9	nd
	22-Jun-23	184.52	183.53	3.2	181.3	2.2	nd
MW22-104	26-Sep-22	184.15	183.17	DRY	DRY	DRY	nd
	18-Oct-22	184.15	183.17	DRY	DRY	DRY	nd
	23-Mar-23	184.15	183.17	1.9	182.3	0.9	nd
	15-May-23	184.15	183.17	1.5	182.6	0.5	nd
	22-Jun-23	184.15	183.17	2.7	181.5	1.7	nd
MW22-105	26-Sep-22	184.49	183.34	DRY	DRY	DRY	nd
	18-Oct-22	184.49	183.34	DRY	DRY	DRY	nd
	23-Mar-23	184.49	183.34	5.3	179.2	4.2	nd
	15-May-23	184.49	183.34	2.0	182.5	0.8	nd
	22-Jun-23	184.49	183.34	2.8	181.7	1.6	nd

Notes:

masl	Metres above sea level
mbtop	Metres below top of pipe
mbgs	Metres below ground surface
LNAPL	Light non-aqueous phase liquid
DNAPL	Dense non-aqueous phase liquid
nd	No detection

Table 3: Soil Grain Size Results
Groundwater and Methane Investigation
Tecumseh Hamlet Secondary Planning Area

		Borehole ID	MW21-101	MW22-102	MW22-103	GP22-103
		Sample ID	Grain Size 9	Grain Size 3	Grain Size 6	Grain Size 7
		Depth (mbgs)	3.9-4.2	4.1-4.6	1.9-2.2	1.2-2.2
		Date Sampled	08-Sep-2022	08-Sep-2022	08-Sep-2022	08-Sep-2022
Particle Size	Limit of Reporting	Units				
Passing (0.002mm)	1.0	%	35.8	28.0	28.9	25.5
Passing (0.004mm)	1.0	%	43.4	34.6	39.4	33.0
Passing (0.005mm)	1.0	%	45.9	37.0	43.5	35.8
Passing (0.020mm)	1.0	%	61.5	53.3	80.2	54.1
Passing (0.0312mm)	1.0	%	65.4	58.8	86.2	60.0
Passing (0.05mm)	1.0	%	68.4	62.8	88.7	65.3
Passing (0.063mm)	1.0	%	70.6	64.8	90.1	68.0
Passing (0.075mm)	1.0	%	72.6	66.6	91.5	70.5
Passing (0.125mm)	1.0	%	77.3	73.3	93.3	75.3
Passing (0.149mm)	1.0	%	79.5	76.5	94.1	77.6
Passing (0.250mm)	1.0	%	85.8	85.7	96.4	84.3
Passing (0.420mm)	1.0	%	90.1	91.6	97.8	89.1
Passing (0.50mm)	1.0	%	90.8	92.3	98.0	89.8
Passing (0.841mm)	1.0	%	93.4	94.9	98.7	92.4
Passing (1.0mm)	1.0	%	93.8	95.2	98.8	92.9
Passing (4.75mm)	1.0	%	98.7	99.2	100	99.1
Passing (9.5mm)	1.0	%	100	100	100	100
Passing (19mm)	1.0	%	100	100	100	100
Passing (25.4mm)	1.0	%	100	100	100	100
Passing (38.1mm)	1.0	%	100	100	100	100
Passing (50.8mm)	1.0	%	100	100	100	100
Passing (76.2mm)	1.0	%	100	100	100	100
Soil Texture	-	-	Fine/Medium Texture	Fine/Medium Texture	Fine/Medium Texture	Fine/Medium Texture

Table 4: Groundwater Analytical Results
Groundwater and Methane Investigation
Tecumseh Hamlet Secondary Planning Area

					Location Code	MW22-101	MW22-103		RPD (%)	MW22-104	MW22-105	Trip Blank
					Field ID	MW22-101	MW22-103	MW22-DUP		MW22-104	MW22-105	Trip Blank
					Sample Type	Normal	Normal	Field_D		Normal	Normal	Trip_B
					Date	22 Jun 2023	22 Jun 2023	22 Jun 2023		22 Jun 2023	22 Jun 2023	13 Jun 2023
Parameter	Unit	RDL	ODWSOG Aesthetic Objectives	ODWSOG Operational Guidelines	ODWSOG MAC/IMAC							
General Chemistry												
Alkalinity (total)	mg/L	5	-	30-500	-	396	354	358	1	406	436	-
Ammonia as N	mg/L	0.01	-	-	-	<0.01	<0.01	<0.01	NC	0.01	<0.01	-
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	-	-	<0.1	0.3	0.3	NC	0.3	0.2	-
Nitrate (as N)	mg/L	0.1	-	-	10	0.3	1.1	1.1	0	0.3	0.5	-
Nitrite (as N)	mg/L	0.05	-	-	1	<0.05	<0.05	<0.05	NC	<0.05	<0.05	-
Phosphorus, total	mg/L	0.01	-	-	-	0.02	0.07	0.07	NC	0.02	0.02	-
Chemical Oxygen Demand (COD)	mg/L	10	-	-	-	<10	14	12	NC	15	10	-
Electrical Conductivity (Lab)	µS/cm	5	-	-	-	1,160	1,120	1,120	0	1,940	1,720	-
Chloride	mg/L	1	250	-	-	61	66	67	2	166	118	-
Dissolved Organic Carbon (DOC)	mg/L	0.5	5	-	-	2.3	5.0	5.1	2	5.2	4.2	-
pH (Lab)	pH Units	0.1	-	6.5-8.5	-	7.7	7.7	7.7	0	7.6	7.6	-
Sulphate	mg/L	1	500	-	-	162	165	165	0	474	399	-
Total Dissolved Solids (TDS)	mg/L	10	500	-	-	668	658	658	NC	1,270	1,140	-
Metals												
Arsenic	mg/L	0.01	-	-	0.025[I]	<0.01	<0.01	<0.01	NC	<0.01	<0.01	-
Barium	mg/L	0.01	-	-	1	0.051	0.059	0.059	0	0.041	0.041	-
Boron	mg/L	0.05	-	-	5[I]	0.397	0.182	0.18	NC	0.218	0.287	-
Cadmium	mg/L	0.001	-	-	0.005	<0.001	<0.001	<0.001	NC	<0.001	<0.001	-
Calcium	mg/L	0.2	-	-	-	109	118	117	1	206	171	-
Chromium (Total, III+VI)	mg/L	0.05	-	-	0.05	<0.05	<0.05	<0.05	NC	<0.05	<0.05	-
Copper	mg/L	0.005	1	-	-	<0.005	<0.005	<0.005	NC	<0.005	<0.005	-
Iron	mg/L	0.2	0.3	-	-	<0.2	<0.2	<0.2	NC	<0.2	<0.2	-
Lead	mg/L	0.001	-	-	0.01	0.002	<0.001	<0.001	NC	<0.001	<0.001	-
Magnesium	mg/L	0.2	-	-	-	62.9	76.5	77.7	2	125	127	-
Manganese	mg/L	0.05	0.05	-	-	<0.05	<0.05	<0.05	NC	<0.05	<0.05	-
Mercury	mg/L	0.0001	-	-	0.001	<0.0001	<0.0001	<0.0001	NC	<0.0001	<0.0001	-
Potassium	mg/L	0.2	-	-	-	3.99	4.38	4.34	1	5.91	5.7	-
Sodium	mg/L	0.2	200	-	-	56.5	35.1	36.1	3	104	61.2	-
Zinc	mg/L	0.02	5	-	-	<0.02	<0.02	<0.02	NC	<0.02	<0.02	-
Volatile Organic Compounds (VOCs)												
Benzene	mg/L	0.0005	-	-	0.005	<0.0005	<0.0005	<0.0005	NC	<0.0005	<0.0005	<0.0005
Toluene	mg/L	0.0005	0.024	-	-	<0.0005	<0.0005	<0.0005	NC	<0.0005	<0.0005	<0.0005
Dichloromethane	mg/L	0.005	-	-	0.05	<0.0050	<0.0050	<0.0050	NC	<0.0050	<0.0050	<0.0050
Vinyl chloride	mg/L	0.0005	-	-	0.002	<0.0005	<0.0005	<0.0005	NC	<0.0005	<0.0005	<0.0005
1,4-Dichlorobenzene	mg/L	0.0005	0.001	-	0.005	<0.0005	<0.0005	<0.0005	NC	<0.0005	<0.0005	<0.0005
Phenolics												
Phenolics	mg/L	0.001	-	-	-	<0.001	<0.001	<0.001	NC	<0.001	<0.001	-

Notes:

I	Indicates "Interim" Maximum Acceptable Concentration
NC	Not calculable. RPDs not calculated where results are less than 5x the RDL
RDL	Reportable detection limit
RPD	Relative percent difference
mg/L	Milligrams per litre
µS/cm	Micro Siemens per centimetre
ODWSOG Aesthetic Objectives	Aesthetic Objectives in Ontario Drinking Water Standards, Objectives and Guidelines, Revised June 2006
ODWSOG Operational Guidelines	Operational Guidelines in Ontario Drinking Water Standards, Objectives and Guidelines, Revised June 2006
ODWSOG MAC/IMAC	Maximum Acceptable Concentrations/Interim Maximum Acceptable Concentrations in Ontario Drinking Water Standards, Objectives and Guidelines
100	Exceeds ODWSOG Aesthetic Objectives
100	Exceeds ODWSOG Operational Guidelines
100	ODWSOG MAC/IMAC

Table 5: Methane Results
Groundwater and Methane Investigation
Tecumseh Hamlet Secondary Planning Area

MW Location	Type	Date	Methane (% Gas)	Methane (% LEL)
GP22-101	Gas Probe	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0
GP22-102	Gas Probe	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0
GP22-103	Gas Probe	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0
MW22-101	Monitoring Well	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0
MW22-102	Monitoring Well	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0
MW22-103	Monitoring Well	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0
MW22-104	Monitoring Well	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0
MW22-105	Monitoring Well	26-Sep-22	0.0	0.0
		18-Oct-22	0.0	0.0
		23-Mar-23	0.0	0.0
		15-May-23	0.0	0.0
		22-Jun-23	0.0	0.0

Notes:
LEL Lower explosive limit

Appendix A

Borehole Logs

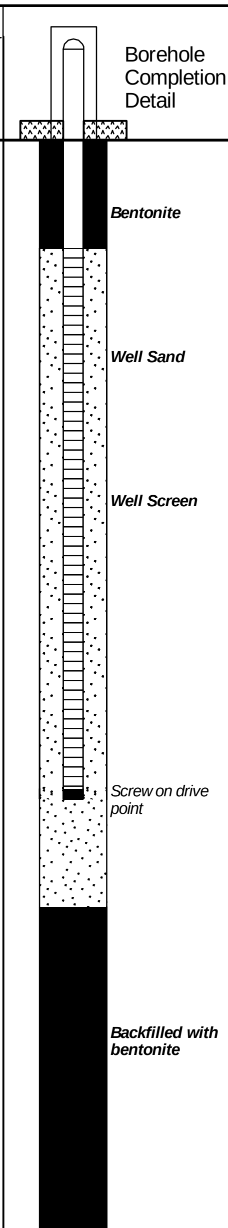
DILLON CONSULTING

Borehole ID: GP22-101

Client: Lakefront Heights Inc
Project No.: 21-2104
Drilling Co.: Landshark Drilling
Observer: M.Antaya

Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Location : 10835 Riverside Drive East, Windsor, ON
Drilling Method: Direct Push (Geoprobe 7822DT) - Dual Tube
Date Started: Sept 8, 2022 Date Completed: Sept 8, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample: Sample Analysis	Sample: Vapour PID/OVM	Sample: Rec %	Sample: Blows/6"	Borehole Completion Detail	Elev. (m asl)
	TOPSOIL Brown, loose, dry, rootlets, some gravel		Organics						Bentonite	
	SILTY CLAY Brown, grey mottling, DPL, brittle, some sandy topsoil (up to 1.52 mbgs), trace gravel		Clay	0.28			83		Well Sand	182
1									Well Screen	181
2	Very stiff with some fine sand at 2.00 to 3.04 mbgs						100		Screw on drive point; Backfilled with bentonite	180
3	End of borehole at 3.04m bgs (10.0 ft)			3.04						179



Notes:
1) mbgs = metres below ground surface
2) DPL = Drier than plastic limit
3) APL = At plastic limit
4) Gas probe installed

LITHOLOGY SYMBOLS
- Organics
- Clay

Casing (m asl): 183.76
Grade Elevation (m asl) : 182.64

DILLON CONSULTING

Borehole ID: GP22-102

Client: Lakefront Heights Inc
Project No.: 21-2104
Drilling Co.: Landshark Drilling
Observer: M.Antaya

Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Location : 10835 Riverside Drive East, Windsor, ON
Drilling Method: Direct Push (Geoprobe 7822DT) - Dual Tube
Date Started: Sept 8, 2022 Date Completed: Sept 8, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample Analysis	Vapour PID/OVM	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	GRAVEL Coarse to fine, dry, loose, rootlets, fine sand									
	TOPSOIL Brown, sandy, rootlets and brances, dry, loose			0.1					Bentonite	
	SANDY CLAY Brown, dry, loose, brittle, few roots			0.36						183
							87		Well Sand	
1	**SILTY CLAY** Brown and grey, brittle, DPL, trace gravel			0.8					Well Screen	182
	SILTY CLAY Dark brown, orange and dark grey mottling, DPL, trace gravel, dusting of light brown sand on sides of core			1.52						
	SAND Light brown/yellow, fine-grained, homogeneous			1.6					Screw on drive point	
2	**SILTY CLAY** Dark brown, orange and dark grey mottling, DPL, trace gravel, dusting of light brown sand on sides of core			1.8			88		Backfilled with bentonite	181
3	End of borehole at 3.04m bgs (10.0 ft)			3.04						180

End of borehole at 3.04m bgs (10.0 ft)
Notes:
1) mbgs = metres below ground surface
2) DPL = Drier than plastic limit
3) APL = At plastic limit
4) Gas probe installed

LITHOLOGY SYMBOLS: Gravel, Organics, Sandy Clay, Clay, Sand

Casing (m asl): 184.53
Grade Elevation (m asl) : 183.38

DILLON CONSULTING

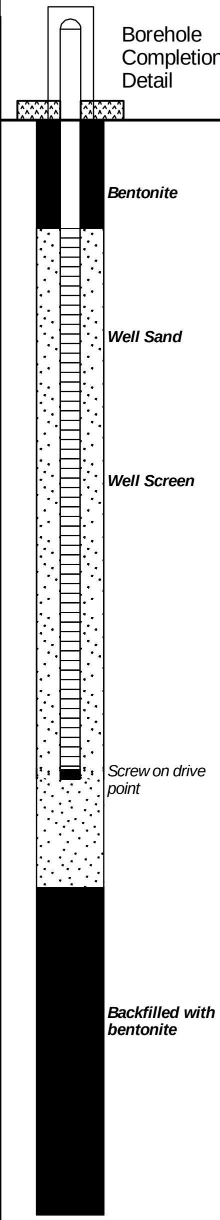
Borehole ID: GP22-103

Client: Lakefront Heights Inc
Project No.: 21-2104
Drilling Co.: Landshark Drilling
Observer: M.Antaya

Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Location : 10835 Riverside Drive East, Windsor, ON
Drilling Method: Direct Push (Geoprobe 7822DT) - Dual Tube
Date Started: Sept 8, 2022 Date Completed: Sept 8, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample Analysis	Vapour PID/OVM	Rec %	Blows/6"	Elev. (m asl)
	TOPSOIL Dark brown, loose, dry, roots		Organics						
	SILTY CLAY/TOPSOIL/SAND Brown, orange mottling, loose, dry, brittle, trace gravel, roots		Clay	0.3					183
1	**SILTY CLAY** Dark grey, orange mottling, DPL, brittle, roots, some cobbles/gravel		Clay	0.7			79		182
2	Brown, trace fine sand, trace grey mottling at 1.52 to 3.04 mbgs		Clay		Grain Size 7 (Grain Size)		100		181
3	End of borehole at 3.04m bgs (10.0 ft) **Notes:** 1) mbgs = metres below ground surface 2) DPL = Drier than plastic limit 3) APL = At plastic limit 3) Gas probe installed			3.04					180

Borehole Completion Detail



DILLON MW MOD 20-2559 - TECUMSEH HAMLET.GPJ 23-8-9

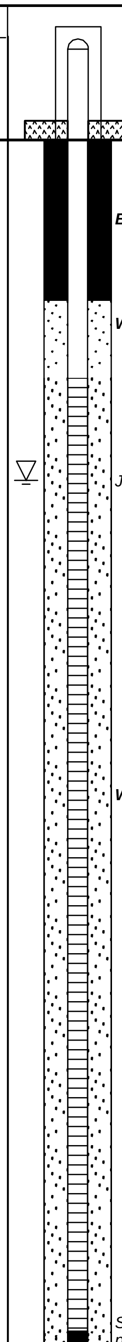
LITHOLOGY SYMBOLS
Organics
Clay

Casing (m asl): 184.57
Grade Elevation (m asl) : 183.39

Borehole ID: MW22-101

Client: Lakefront Heights Inc	Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Project No.: 21-2104	Location : 10835 Riverside Drive East, Windsor, ON
Drilling Co.: Landshark Drilling	Drilling Method: Direct Push (Geoprobe 7822DT)
Observer: M.Antaya	Date Started: Sept 9, 2022 Date Completed: Sept 9, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample Analysis	Vapour PID/OVM	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	SILTY CLAY Brown with orange and grey mottling, brittle, DPL, trace gravel, trace roots (at 0 to 0.35 mbgs)		Clay						Bentonite	182
							61		Well Sand	
1									Jun. 22, 2023	181
	Clay is slightly darker and stiff at 1.52 to 3.04 mbgs; some orange mottling to trace at 2.70 mbgs.									
2							100			180
									Well Screen	
3	Very stiff at 3.04 mbgs									179
	Grey at 3.80 mbgs						100			
4	APL at 3.95 mbgs				Grain Size 9 (Grain Size)					178
									Screw on drive point	
	End of borehole at 4.57m bgs (15.0 ft) **Notes:** 1) mbgs = metres below ground surface 2) DPL = Drier than plastic limit 3) APL = At plastic limit 4) Groundwater well installed			4.6						
5										177



LITHOLOGY SYMBOLS: Clay

Water Level (No Measureable Product)

Casing (m asl): 183.31
Grade Elevation (m asl) : 182.39

DILLON MW MOD 20-2559 - TECUMSEH HAMLET.GPJ 23-8-9

DILLON CONSULTING

Borehole ID: MW22-102

Client: Lakefront Heights Inc
Project No.: 21-2104
Drilling Co.: Landshark Drilling
Observer: M.Antaya

Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Location : 10835 Riverside Drive East, Windsor, ON
Drilling Method: Direct Push (Geoprobe 7822DT)
Date Started: Sept 8, 2022 Date Completed: Sept 8, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample Analysis	Vapour PID/OVM	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	TOPSOIL Brown, sandy, loose, dry, trace rootlets and clay									
	SANDY CLAY Brown, DPL, brittle			0.17					Bentonite	
	SILTY CLAY Brown, DPL, brittle, grey mottling, trace gravel			0.6			61		Well Sand	
1										182
	trace grey mottlin at 1.52 to 1.90 mbgs									
2	Stiff at 1.90 mbgs									181
							100		Well Screen	
3	Some orange mottling at 3.04 to 3.60 mbgs									180
	SILTY CLAY Grey, APL, some gravel and cobbles, firm to stiff			3.6			100			
4										179
					Grain Size 3 (Grain Size)				Screw on drive point	
	End of borehole at 4.57m bgs (15.0 ft) **Notes:** 1) mbgs = metres below ground surface 2) DPL = Drier than plastic limit 3) APL = At plastic limit 4) Groundwater well installed 5) Well dry on June 22, 2023			4.6						
5										178

Borehole Completion Detail: Bentonite; Well Sand; Well Screen; Screw on drive point

LITHOLOGY SYMBOLS: Organics; Sandy Clay; Clay

Casing (m asl): 184.24
Grade Elevation (m asl) : 182.96

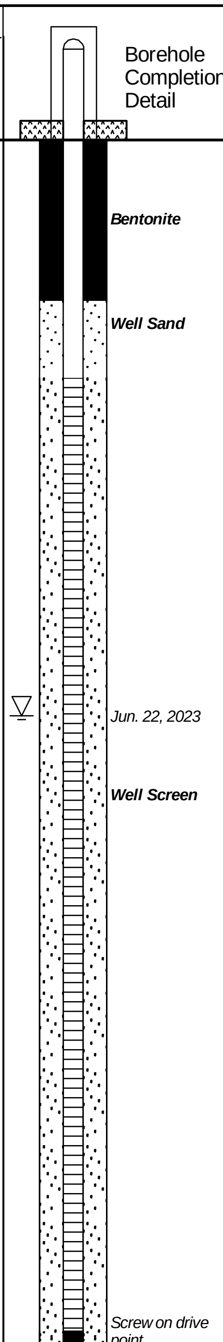
DILLON CONSULTING

Borehole ID: MW22-103

Client: Lakefront Heights Inc
Project No.: 21-2104
Drilling Co.: Landshark Drilling
Observer: M.Antaya

Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Location: 10835 Riverside Drive East, Windsor, ON
Drilling Method: Direct Push (Geoprobe 7822DT)
Date Started: Sept 8, 2022
Date Completed: Sept 8, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample Analysis	Vapour PID/OVM	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	TOPSOIL Dark brown, sandy, dry loose, roots, some cobbles		Organics						Bentonite	
	SILTY CLAY Brown, some brown and orange mottline, DPL, brittle to stiff, trace gravel		Clay	0.39			67		Well Sand	183
1										182
2	Light brown with orange mottling, some fine sand				Grain Size 6 (Grain Size)		100		Jun. 22, 2023 Well Screen	181
3	**SILTY CLAY** Grey, trace orange mottling, APL, stiff, trace gravel		Clay	3.04			100			180
4									Screw on drive point	179
5	End of borehole at 4.57m bgs (15.0 ft) **Notes:** 1) mbgs = metres below ground surface 2) DPL = Drier than plastic limit 3) APL = At plastic limit 4) Groundwater well installed			4.6						



LITHOLOGY SYMBOLS: Organics; Clay

Water Level (No Measureable Product)

Casing (m asl): 184.52
Grade Elevation (m asl) : 183.53

DILLON CONSULTING

Borehole ID: MW22-104

Client: Lakefront Heights Inc
Project No.: 21-2104
Drilling Co.: Landshark Drilling
Observer: M.Antaya

Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Location : 10835 Riverside Drive East, Windsor, ON
Drilling Method: Direct Push (Geoprobe 7822DT)
Date Started: Sept 9, 2022 Date Completed: Sept 9, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample Analysis	Vapour PID/OVM	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	TOPSOIL Dark brown, dry, brittle, roots									183
	SILTY CLAY Brown, grey and orange mottling, DPL, stiff to brittle, trace gravel			0.36			70		Bentonite Well Sand	
1										182
	Brown to light brown with orange and grey mottling at 1.52 to 3.04 mbgs								Jun. 22, 2023	
2							100		Well Screen	181
3	Dark brown with orange mottling (3.04 to 3.20 mbgs) to grey (3.20 to 4.60 mbgs), stiff									180
4							100		Screw on drive point	179
5	End of borehole at 4.57m bgs (15.0 ft) **Notes:** 1) mbgs = metres below ground surface 2) DPL = Drier than plastic limit 3) APL = At plastic limit 4) Groundwater well installed			4.6						178

LITHOLOGY SYMBOLS
Organics
Clay

Water Level (No Measureable Product)

Casing (m asl): 184.15
Grade Elevation (m asl) : 183.17

DILLON CONSULTING

Borehole ID: MW22-105

Client: Lakefront Heights Inc	Project: Riverside Sportsman Club - Phase Two ESA/Excess Soils
Project No.: 21-2104	Location : 10835 Riverside Drive East, Windsor, ON
Drilling Co.: Landshark Drilling	Drilling Method: Direct Push (Geoprobe 7822DT)
Observer: M.Antaya	Date Started: Sept 9, 2022 Date Completed: Sept 9, 2022

Depth Scale (m)	Stratigraphic Description	Letter Symbol	Stratigraphy	Depth (m)	Sample Analysis	Vapour PID/OVM	Rec %	Blows/6"	Borehole Completion Detail	Elev. (m asl)
	TOPSOIL Dark brown, roots, dry, loose		Organics							
	SILTY CLAY Dark brown to light brown, orange and grey mottling, DPL, brittle, trace cobbles/gravel, trace roots		Clay	0.16					Bentonite	183
							67		Well Sand	
1										182
	Brown into dark brown at 1.52 to 3.20 mbgs								Jun. 22, 2023	
2							100			181
									Well Screen	
3	Grey/orange and stiff at 3.20 mbgs									180
	Grey, some orange mottling at 3.83 mbgs to 4.60 mbgs						100			
4										179
									Screw on drive point	
	End of borehole at 4.57m bgs (15.0 ft) **Notes:** 1) mbgs = metres below ground surface 2) DPL = Drier than plastic limit 3) APL = At Plastic Limit 4) Groundwater well installed			4.6						
5										178

LITHOLOGY SYMBOLS
- Organics
- Clay

∇ Water Level (No Measureable Product)

Casing (m asl): 184.49
Grade Elevation (m asl) : 183.34

Appendix B

Laboratory Certificates of Analysis

1780 North Talbot Rd, Unit 2
Windsor, ON, N9A 6J3
1-800-749-1947
www.paracellabs.com

Subcontracted Analysis

Dillon Consulting Ltd (Windsor)
3200 Dezial Dr. Suite 608
Windsor, ON N8W 5K8
Attn: Taryn Azzopardi

Paracel Report No.	**2242038**	Order Date:	22-Sep-22
Client Project(s):	**Tec Hamlet 20-2559**	Report Date:	26-Oct-22
Client PO:			
Reference:	**#22-490 Tecumseh Hamlet**		
CoC Number:			

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	**Client ID**	**Analysis**
2242038-01	Grain Size 7	Grain Size - Sieve & Hydrometer
2242038-02	Grain Size 6	Grain Size - Sieve & Hydrometer
2242038-03	Grain Size 3	Grain Size - Sieve & Hydrometer
2242038-04	Grain Size 9	Grain Size - Sieve & Hydrometer

ALS Canada Ltd.

right solutions.
right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **SK2205827**	Page	: 1 of 5
Client	: **Paracel Laboratories Ltd**	Laboratory	: Saskatoon - Environmental
Contact	: Donna Bloom	Account Manager	: Kimberley Head
Address	: 351 Nash Road North, Unit 9B Hamilton ON Canada L8H 7P4	Address	: 819 58 Street East Saskatoon SK Canada S7K 6X5
Telephone	: ----	Telephone	: +1 306 668 8370
Project	: 2242038	Date Samples Received	: 14-Oct-2022 12:35
PO	: 2242038	Date Analysis Commenced	: 14-Oct-2022
C-O-C number	: ----	Issue Date	: 26-Oct-2022 15:51
Sampler	: Client		
Site	: ----		
Quote number	: ----		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.
Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	Description
-	No Unit
%	percent

>: greater than.

<: less than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

SK2205827-001
Sub-Matrix: **Soil** *Client sample ID:* Grain Size 7
(Matrix: **Soil/Solid**) *Client sampling date / time:* 08-Sep-2022 15:00

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Particle Size								
grain size curve	----	See Attached	-	-	E185	-	26-Oct-2022	-
passing (0.0312 mm)	----	60.0	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (4.75 mm)	----	99.1	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.020 mm)	----	54.1	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (1.0 mm)	----	92.9	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (9.5 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.005 mm)	----	35.8	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.841 mm)	----	92.4	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (19 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.004 mm)	----	33.0	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.50 mm)	----	89.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (25.4 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.002 mm)	----	25.5	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.420 mm)	----	89.1	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (38.1 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.250 mm)	----	84.3	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (50.8 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.149 mm)	----	77.6	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (76.2 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.125 mm)	----	75.3	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.075 mm)	----	70.5	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.063 mm)	----	68.0	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.05 mm)	----	65.3	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

SK2205827-002
Sub-Matrix: **Soil** *Client sample ID:* Grain Size 6
(Matrix: **Soil/Solid**) *Client sampling date / time:* 08-Sep-2022 15:20

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Particle Size								
grain size curve	----	See Attached	-	-	E185	-	26-Oct-2022	-
passing (0.0312 mm)	----	86.2	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (4.75 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.020 mm)	----	80.2	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (1.0 mm)	----	98.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (9.5 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.005 mm)	----	43.5	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.841 mm)	----	98.7	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (19 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.004 mm)	----	39.4	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899

Analytical Results

SK2205827-002

Sub-Matrix: **Soil** | Client sample ID: Grain Size 6
(Matrix: **Soil/Solid**) | Client sampling date / time: 08-Sep-2022 15:20

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Particle Size								
passing (0.50 mm)	----	98.0	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (25.4 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.002 mm)	----	28.9	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.420 mm)	----	97.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (38.1 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.250 mm)	----	96.4	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (50.8 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.149 mm)	----	94.1	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (76.2 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.125 mm)	----	93.3	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.075 mm)	----	91.5	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.063 mm)	----	90.1	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.05 mm)	----	88.7	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

SK2205827-003

Sub-Matrix: **Soil** | Client sample ID: Grain Size 3
(Matrix: **Soil/Solid**) | Client sampling date / time: 08-Sep-2022 15:35

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Particle Size								
grain size curve	----	See Attached	-	-	E185	-	26-Oct-2022	-
passing (0.0312 mm)	----	58.8	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (4.75 mm)	----	99.2	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.020 mm)	----	53.3	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (1.0 mm)	----	95.2	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (9.5 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.005 mm)	----	37.0	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.841 mm)	----	94.9	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (19 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.004 mm)	----	34.6	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.50 mm)	----	92.3	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (25.4 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.002 mm)	----	28.0	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.420 mm)	----	91.6	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (38.1 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.250 mm)	----	85.7	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (50.8 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.149 mm)	----	76.5	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (76.2 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.125 mm)	----	73.3	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.075 mm)	----	66.6	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.063 mm)	----	64.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898

Analytical Results

SK2205827-003

Sub-Matrix: **Soil** — *Client sample ID:* Grain Size 3

(Matrix: **Soil/Solid)** — *Client sampling date / time:* 08-Sep-2022 15:35

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Particle Size								
passing (0.05 mm)	----	62.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

SK2205827-004

Sub-Matrix: **Soil** — *Client sample ID:* Grain Size 9

(Matrix: **Soil/Solid)** — *Client sampling date / time:* 08-Sep-2022 15:35

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Particle Size								
grain size curve	----	See Attached	-	-	E185	-	26-Oct-2022	-
passing (0.0312 mm)	----	65.4	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (4.75 mm)	----	98.7	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.020 mm)	----	61.5	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (1.0 mm)	----	93.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (9.5 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.005 mm)	----	45.9	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.841 mm)	----	93.4	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (19 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.004 mm)	----	43.4	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.50 mm)	----	90.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (25.4 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.002 mm)	----	35.8	1.0	%	E183	14-Oct-2022	14-Oct-2022	696899
passing (0.420 mm)	----	90.1	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (38.1 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.250 mm)	----	85.8	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (50.8 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.149 mm)	----	79.5	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (76.2 mm)	----	100	1.0	%	E181	14-Oct-2022	14-Oct-2022	696897
passing (0.125 mm)	----	77.3	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.075 mm)	----	72.6	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.063 mm)	----	70.6	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898
passing (0.05 mm)	----	68.4	1.0	%	E182	14-Oct-2022	14-Oct-2022	696898

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: SK2205827	Page	: 1 of 7
Client	: Paracel Laboratories Ltd	Laboratory	: Saskatoon - Environmental
Contact	: Donna Bloom	Account Manager	: Kimberley Head
Address	: 351 Nash Road North, Unit 9B Hamilton ON Canada L8H 7P4	Address	: 819 58 Street East Saskatoon, Saskatchewan Canada S7K 6X5
Telephone	: ----	Telephone	: +1 306 668 8370
Project	: 2242038	Date Samples Received	: 14-Oct-2022 12:35
PO	: 2242038	Issue Date	: 26-Oct-2022 15:56
C-O-C number	: ----		
Sampler	: Client		
Site	: ----		
Quote number	: ----		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap Grain Size 3	E185	08-Sep-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap Grain Size 6	E185	08-Sep-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap Grain Size 7	E185	08-Sep-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap Grain Size 9	E185	08-Sep-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap Grain Size 3	E183	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap Grain Size 6	E183	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap Grain Size 7	E183	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap Grain Size 9	E183	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap Grain Size 3	E182	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap Grain Size 6	E182	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap Grain Size 7	E182	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap Grain Size 9	E182	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap Grain Size 3	E181	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap Grain Size 6	E181	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap Grain Size 7	E181	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap Grain Size 9	E181	08-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	365 days	36 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Particle Size Analysis - Hydrometer	E183	696899	1	6	16.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	696898	1	6	16.6	5.0	✓
Laboratory Control Samples (LCS)							
Particle Size Analysis - Hydrometer	E183	696899	1	6	16.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	696898	1	6	16.6	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	696897	1	6	16.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dry and Grind in Soil/Solid <60°C	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

QUALITY CONTROL REPORT

Work Order	: **SK2205827**	Page	: 1 of 5
Client	: Paracel Laboratories Ltd	Laboratory	: Saskatoon - Environmental
Contact	: Donna Bloom	Account Manager	: Kimberley Head
Address	: 351 Nash Road North, Unit 9B Hamilton ON Canada L8H 7P4	Address	: 819 58 Street East Saskatoon, Saskatchewan Canada S7K 6X5
Telephone	:	Telephone	: +1 306 668 8370
Project	: 2242038	Date Samples Received	: 14-Oct-2022 12:35
PO	: 2242038	Date Analysis Commenced	: 14-Oct-2022
C-O-C number	: ----	Issue Date	: 26-Oct-2022 15:51
Sampler	: Client ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Hedy Lai	Team Leader - Inorganics	Saskatoon Sask Soils, Saskatoon, Saskatchewan

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Particle Size (QC Lot: 696898)											
SK2205827-001	Grain Size 7	passing (0.05 mm)	----	E182	1.0	%	65.3	66.1	1.22%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	68.0	68.3	0.406%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	70.5	70.3	0.300%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	75.3	75.2	0.110%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	77.6	77.6	0.0279%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	84.3	84.2	0.0540%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	89.1	89.0	0.0562%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	89.8	89.7	0.0762%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	92.4	92.3	0.164%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	92.9	92.7	0.144%	15%	----
Particle Size (QC Lot: 696899)											
SK2205827-001	Grain Size 7	passing (0.002 mm)	----	E183	1.0	%	25.5	25.8	0.885%	20%	----
		passing (0.004 mm)	----	E183	1.0	%	33.0	33.2	0.438%	20%	----
		passing (0.005 mm)	----	E183	1.0	%	35.8	35.4	1.19%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	54.1	55.4	2.48%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	60.0	61.3	2.10%	20%	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

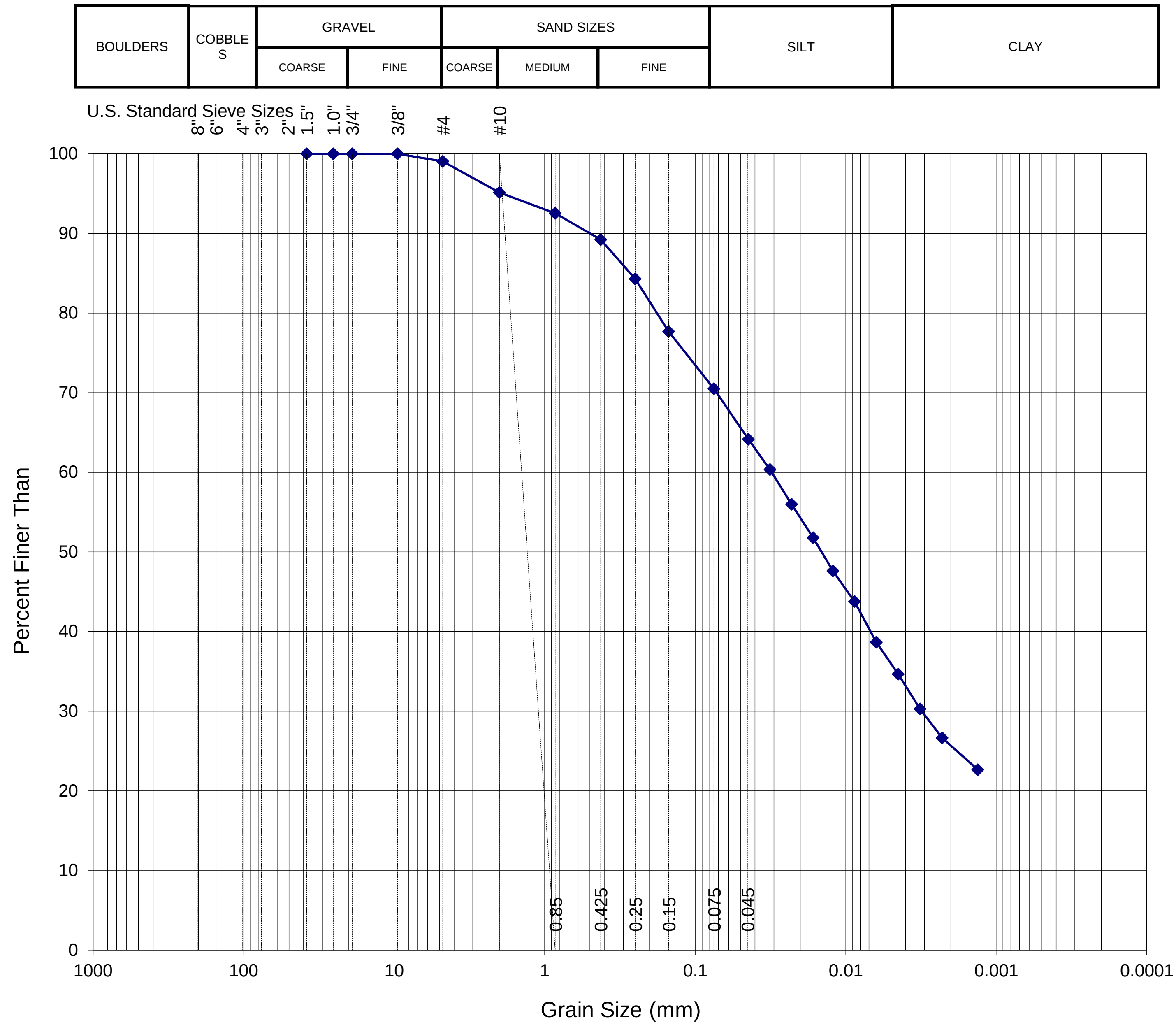
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Particle Size (QCLot: 696897)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----
Particle Size (QCLot: 696898)									
	RM	passing (0.05 mm)	----	E182	49.81 %	99.6	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	98.2	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	97.1	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	96.6	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	96.4	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	98.0	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.4	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.4	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.5	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.6	94.9	105	----
Particle Size (QCLot: 696899)									
	RM	passing (0.002 mm)	----	E183	21.14 %	100	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	101	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	100	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	103	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	103	88.0	112	----

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	SK2205827001
Project Number:	
Client Sample ID	Grain Size 7
Lab Sample ID	SK2205827001
Date Sample Received	00-Jan-00
Test Completion Date:	25-Oct-22
Analyst:	SIH



METHOD DESCRIPTION	
Method Reference: ASTM D6913 & D7928	
Dispersion method: Mechanical	
Dispesion period: 1 minute	cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

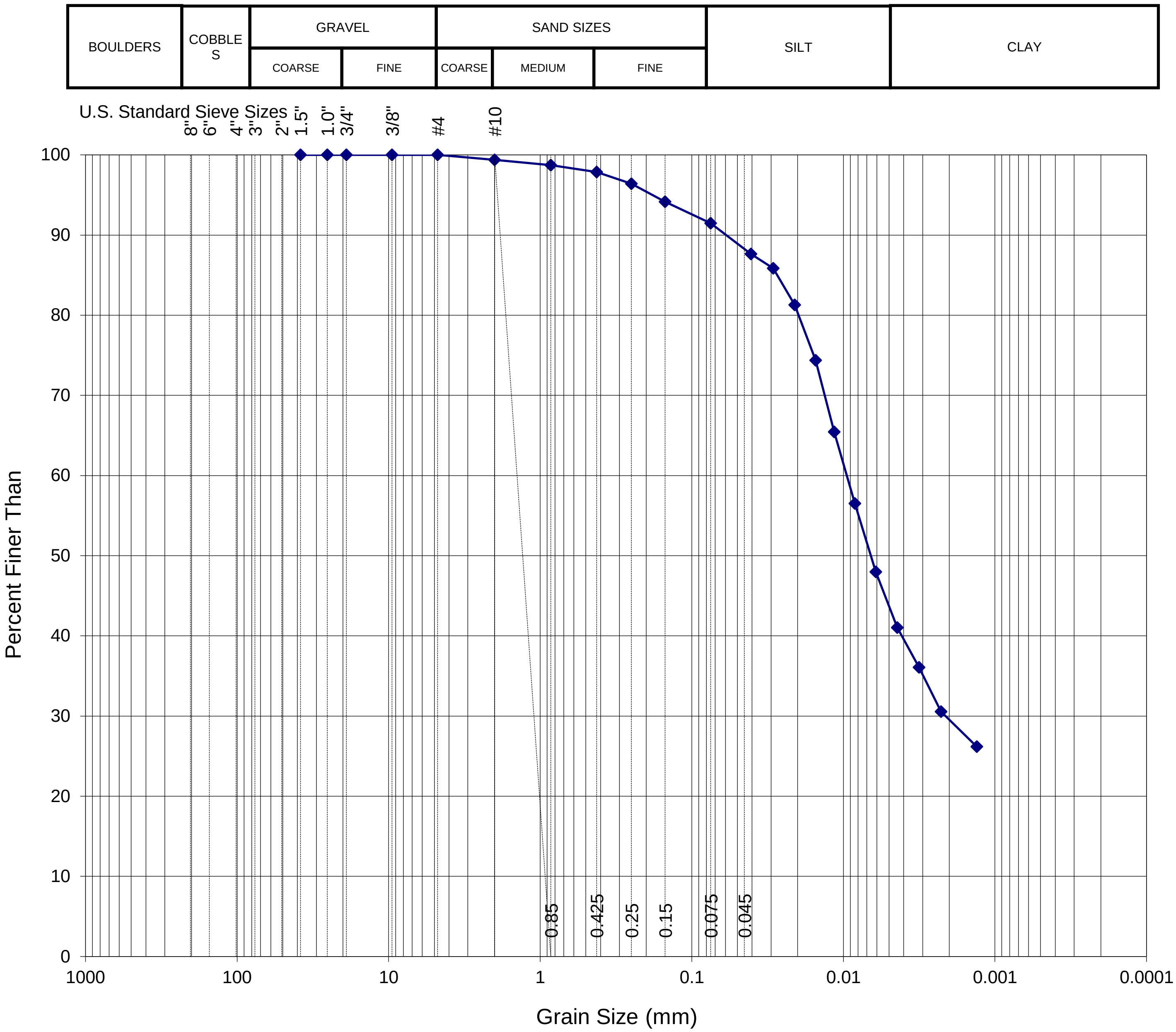
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	3.91	2.0 - 4.75
% MEDIUM SAND :	5.92	0.425 - 2.0
% FINE SAND :	18.73	0.075 - 0.425
% SILT :	34.52	0.075 - 0.005
% CLAY :	35.98	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	SK2205827002
Project Number:	
Client Sample ID	Grain Size 6
Lab Sample ID	SK2205827002
Date Sample Received	00-Jan-00
Test Completion Date:	25-Oct-22
Analyst:	SIH



METHOD DESCRIPTION	
Method Reference: ASTM D6913 & D7928	
Dispersion method: Mechanical	
Dispesion period: 1 minute	cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	<1	2.0 - 4.75
% MEDIUM SAND :	1.54	0.425 - 2.0
% FINE SAND :	6.37	0.075 - 0.425
% SILT :	47.74	0.075 - 0.005
% CLAY :	43.74	< 0.005

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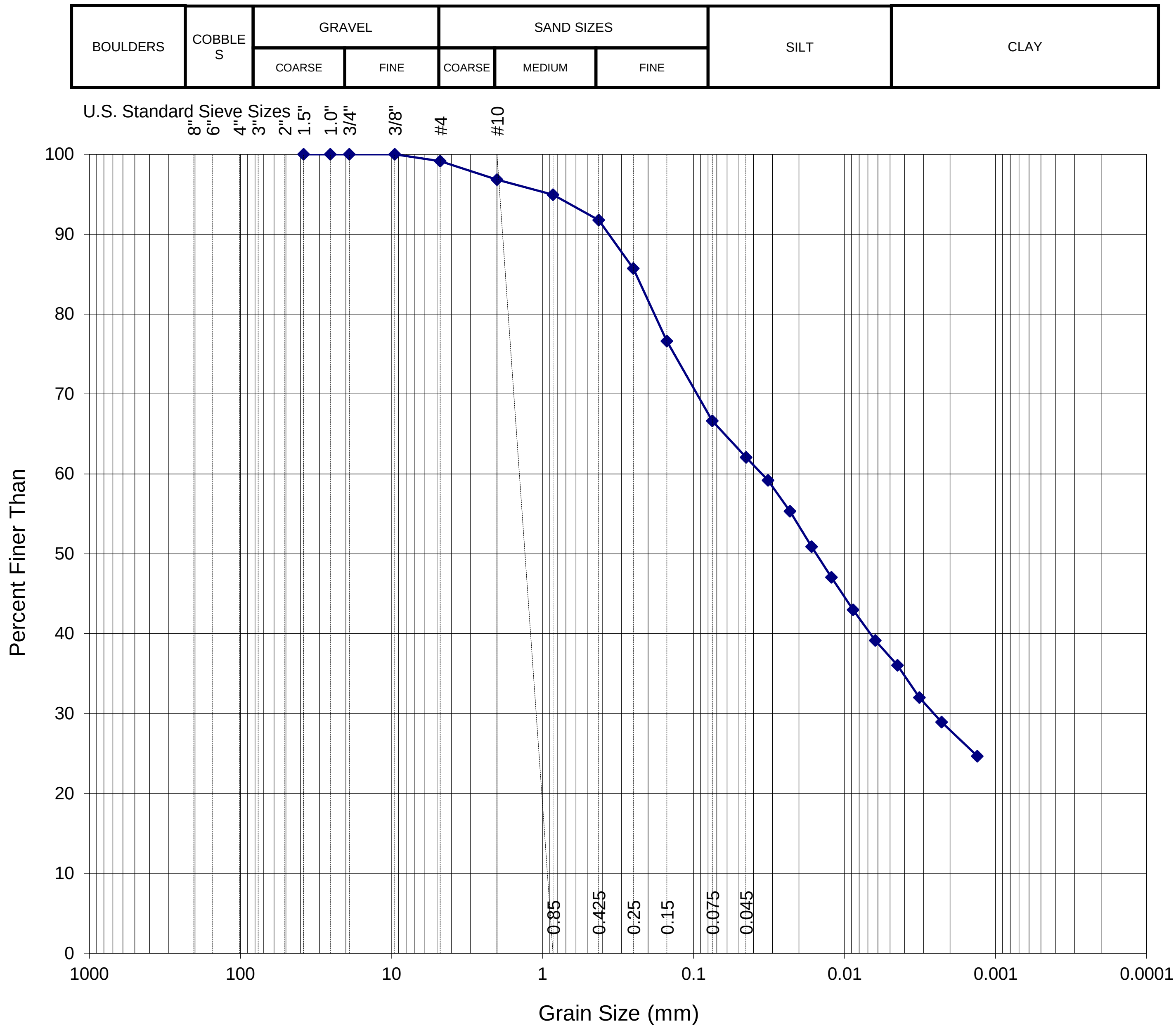
819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	SK2205827003
Project Number:	
Client Sample ID	Grain Size 3
Lab Sample ID	SK2205827003
Date Sample Received	00-Jan-00
Test Completion Date:	25-Oct-22
Analyst:	SIH



METHOD DESCRIPTION	
Method Reference: ASTM D6913 & D7928	
Dispersion method: Mechanical	
Dispesion period: 1 minute	cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

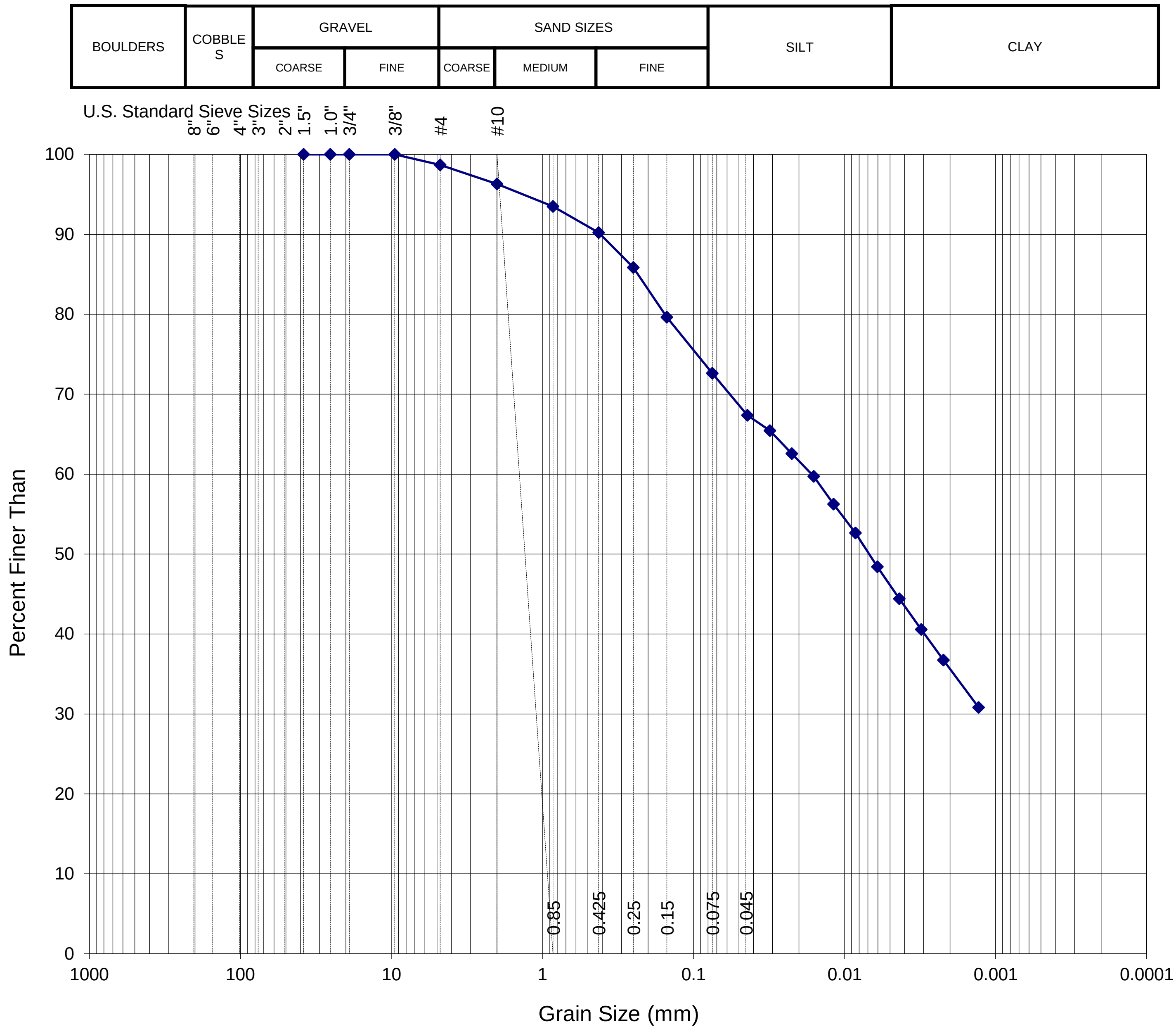
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	2.30	2.0 - 4.75
% MEDIUM SAND :	5.07	0.425 - 2.0
% FINE SAND :	25.14	0.075 - 0.425
% SILT :	29.53	0.075 - 0.005
% CLAY :	37.09	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	SK2205827004
Project Number:	
Client Sample ID	Grain Size 9
Lab Sample ID	SK2205827004
Date Sample Received	00-Jan-00
Test Completion Date:	25-Oct-22
Analyst:	SIH



METHOD DESCRIPTION	
Method Reference: ASTM D6913 & D7928	
Dispersion method: Mechanical	
Dispesion period: 1 minute	cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	1.33	> 4.75
% COARSE SAND :	2.38	2.0 - 4.75
% MEDIUM SAND :	6.07	0.425 - 2.0
% FINE SAND :	17.59	0.075 - 0.425
% SILT :	26.52	0.075 - 0.005
% CLAY :	46.11	< 0.005

ALS www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: ...

Environmental Division
Saskatoon
Work Order Reference
SK2205827

Telephone : +1 306 668 8370

Report To	Contact and company name below will appear on the final report
Company:	PARACEL LABORATORIES
Contact:	DONNA BLOOM ; DALE ROBERTSON
Phone:	(613) 731 9577
	Company address below will appear on the final report
Street:	2319 ST. LAURENT BLVD SUITE 300
City/Province:	OTTAWA ONTARIO
Postal Code:	K1G 4J8
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax dbloom@paracellabs.com

Email 2 drobertson@paracellabs.com

Email 3 mfoto@paracellabs.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax dbloom@paracellabs.com

Email 2

Select Service Level Below - Contact y... apply)

Regular [R] ☑ Standard TAT if recei...

PRIORITY (Business Days): 4 day [P4-20%] ☐ ; 3 day [P3-25%] ☐ ; 2 day [P2-50%] ☐

EMERGENCY: 1 ... ☐ ; San... %; (Lat... ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service ...

Ana...

Project Information

ALS Account # / Quote #:

Job #: 2242038

PO / AFE: 2242038

LSD:

ALS Lab Work Order # (lab use only):

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Grain Size Sieve	+ Hydrometer	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	Grain Size 7	08/09/22		Soil	1	X	X		
	Grain Size 6	08/09/22		Soil	1	X	X		
	Grain Size 3	08/09/22		Soil	1	X	X		
	Grain Size 9	08/09/22		Soil	1	X	X		

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C: 2.8

FINAL COOLER TEMPERATURES °C:

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: K. Jakobsen	Date: Oct. 12/22	Time: 1500	Received by: JB13	Date: 14 Oct 22	Time: 10:35	Received by: JB13	Date: 14 Oct 22	Time: 10:35

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NOV 2018 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

351 Nash Road North, unit 9B
Hamilton, ON L8H 7P4
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Dillon Consulting Ltd (Windsor)
3200 Dezial Dr. Suite 608
Windsor, ON N8W 5K8
Attn: Taryn Azzopardi

Report Date: 28-Jun-2023
Order Date: 22-Jun-2023

Client PO:
Project: 202559
Custody:

Order #: 2325404

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2325404-01	MW22-101
2325404-02	MW22-103
2325404-03	MW22-104
2325404-04	MW22-105
2325404-05	MW22-DUP
2325404-06	Trip Blank

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	26-Jun-23	26-Jun-23
Ammonia, as N	EPA 351.2 - Auto Colour	27-Jun-23	27-Jun-23
Anions	EPA 300.1 - IC	26-Jun-23	26-Jun-23
Chemical Oxygen Demand	EPA 410.1 - Digestion, Colourimetric	26-Jun-23	27-Jun-23
Conductivity	EPA 9050A- probe @25 °C	26-Jun-23	26-Jun-23
Dissolved Organic Carbon	MOE 3247B - Combustion IR	23-Jun-23	28-Jun-23
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	23-Jun-23	26-Jun-23
Metals, ICP-MS	EPA 200.8 - ICP-MS	26-Jun-23	26-Jun-23
MOE Landfill VOCs	EPA 624 - P&T GC-MS	27-Jun-23	28-Jun-23
pH	EPA 150.1 - pH probe @25 °C	26-Jun-23	26-Jun-23
Phenolics	EPA 420.2 - Auto Colour, 4AAP	26-Jun-23	26-Jun-23
Phosphorus, total, water	EPA 365.4 - Auto Colour, digestion	26-Jun-23	26-Jun-23
Total Dissolved Solids	SM 2540C - gravimetric, filtration	26-Jun-23	27-Jun-23
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	26-Jun-23	26-Jun-23

Certificate of Analysis

Client: Dillon Consulting Ltd (Windsor)

Client PO:

Report Date: 28-Jun-2023

Order Date: 22-Jun-2023

Project Description: 202559

Client ID:		MW22-101	MW22-103	MW22-104	MW22-105	-	-
Sample Date:		22-Jun-23 09:25	22-Jun-23 10:55	22-Jun-23 12:35	22-Jun-23 13:40	-	-
Sample ID:		2325404-01	2325404-02	2325404-03	2325404-04		
Matrix:		Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
General Inorganics							
Alkalinity, total	5 mg/L	396	354	406	436	-	-
Ammonia as N	0.01 mg/L	<0.01	<0.01	0.01	<0.01	-	-
Chemical Oxygen Demand	10 mg/L	<10	14	15	10	-	-
Dissolved Organic Carbon	0.5 mg/L	2.3	5.0	5.2	4.2	-	-
Conductivity	5 uS/cm	1160	1120	1940	1720	-	-
pH	0.1 pH Units	7.7	7.7	7.6	7.6	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	<0.001	<0.001	-	-
Phosphorus, total	0.01 mg/L	0.02	0.07	0.02	0.02	-	-
Total Dissolved Solids	10 mg/L	668	658	1270	1140	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	<0.1	0.3	0.3	0.2	-	-
Anions							
Chloride	1 mg/L	61	66	166	118	-	-
Nitrate as N	0.1 mg/L	0.3	1.1	0.3	0.5	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	<0.05	-	-
Sulphate	1 mg/L	162	165	474	399	-	-
Metals							
Arsenic	10 ug/L	<10	<10	<10	<10	-	-
Barium	10 ug/L	51	59	41	41	-	-
Boron	50 ug/L	397	182	218	287	-	-
Cadmium	1 ug/L	<1	<1	<1	<1	-	-
Calcium	200 ug/L	109000	118000	206000	171000	-	-
Chromium	50 ug/L	<50	<50	<50	<50	-	-
Copper	5 ug/L	<5	<5	<5	<5	-	-
Iron	200 ug/L	<200	<200	<200	<200	-	-
Lead	1 ug/L	2	<1	<1	<1	-	-

Certificate of Analysis

Report Date: 28-Jun-2023

Client: **Dillon Consulting Ltd (Windsor)**

Order Date: 22-Jun-2023

Client PO:

Project Description: 202559

	Client ID:	MW22-101	MW22-103	MW22-104	MW22-105	-	-
	Sample Date:	22-Jun-23 09:25	22-Jun-23 10:55	22-Jun-23 12:35	22-Jun-23 13:40		
	Sample ID:	2325404-01	2325404-02	2325404-03	2325404-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Metals							
Magnesium	200 ug/L	62900	76500	125000	127000	-	-
Manganese	50 ug/L	<50	<50	<50	<50	-	-
Mercury	0.1 ug/L	<0.1	<0.1	<0.1	<0.1	-	-
Potassium	200 ug/L	3990	4380	5910	5700	-	-
Sodium	200 ug/L	56500	35100	104000	61200	-	-
Zinc	20 ug/L	<20	<20	<20	<20	-	-
Volatiles							
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5	-	-
Methylene Chloride	5 ug/L	<5.0	<5.0	<5.0	<5.0	-	-
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5	-	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	<0.5	-	-

Certificate of Analysis

Client: **Dillon Consulting Ltd (Windsor)**

Client PO:

Report Date: 28-Jun-2023

Order Date: 22-Jun-2023

Project Description: 202559

	Client ID:	MW22-DUP	Trip Blank			-	-
	Sample Date:	22-Jun-23 12:00	13-Jun-23 00:00				
	Sample ID:	2325404-05	2325404-06				
	Matrix:	Ground Water	Water				
	MDL/Units						
General Inorganics							
Alkalinity, total	5 mg/L	358	-	-	-	-	-
Ammonia as N	0.01 mg/L	<0.01	-	-	-	-	-
Chemical Oxygen Demand	10 mg/L	12	-	-	-	-	-
Dissolved Organic Carbon	0.5 mg/L	5.1	-	-	-	-	-
Conductivity	5 uS/cm	1120	-	-	-	-	-
pH	0.1 pH Units	7.7	-	-	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-	-	-
Phosphorus, total	0.01 mg/L	0.07	-	-	-	-	-
Total Dissolved Solids	10 mg/L	658	-	-	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.3	-	-	-	-	-
Anions							
Chloride	1 mg/L	67	-	-	-	-	-
Nitrate as N	0.1 mg/L	1.1	-	-	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-	-	-
Sulphate	1 mg/L	165	-	-	-	-	-
Metals							
Arsenic	10 ug/L	<10	-	-	-	-	-
Barium	10 ug/L	59	-	-	-	-	-
Boron	50 ug/L	180	-	-	-	-	-
Cadmium	1 ug/L	<1	-	-	-	-	-
Calcium	200 ug/L	117000	-	-	-	-	-
Chromium	50 ug/L	<50	-	-	-	-	-
Copper	5 ug/L	<5	-	-	-	-	-
Iron	200 ug/L	<200	-	-	-	-	-
Lead	1 ug/L	<1	-	-	-	-	-

Certificate of Analysis

Report Date: 28-Jun-2023

Client: **Dillon Consulting Ltd (Windsor)**

Order Date: 22-Jun-2023

Client PO:

Project Description: 202559

	Client ID:	MW22-DUP	Trip Blank				
	Sample Date:	22-Jun-23 12:00	13-Jun-23 00:00			-	-
	Sample ID:	2325404-05	2325404-06				
	Matrix:	Ground Water	Water				
	MDL/Units						
Metals							
Magnesium	200 ug/L	77700	-	-	-	-	-
Manganese	50 ug/L	<50	-	-	-	-	-
Mercury	0.1 ug/L	<0.1	-	-	-	-	-
Potassium	200 ug/L	4340	-	-	-	-	-
Sodium	200 ug/L	36100	-	-	-	-	-
Zinc	20 ug/L	<20	-	-	-	-	-
Volatiles							
Benzene	0.5 ug/L	<0.5	<0.5	-	-	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-	-	-
Methylene Chloride	5 ug/L	<5.0	<5.0	-	-	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-	-	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	-	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	1	mg/L					
Nitrate as N	ND	0.1	mg/L					
Nitrite as N	ND	0.05	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
Alkalinity, total	ND	5	mg/L					
Ammonia as N	ND	0.01	mg/L					
Chemical Oxygen Demand	ND	10	mg/L					
Dissolved Organic Carbon	ND	0.5	mg/L					
Conductivity	ND	5	uS/cm					
Phenolics	ND	0.001	mg/L					
Phosphorus, total	ND	0.01	mg/L					
Total Dissolved Solids	ND	10	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Metals								
Arsenic	ND	10	ug/L					
Barium	ND	10	ug/L					
Boron	ND	50	ug/L					
Cadmium	ND	1	ug/L					
Calcium	ND	200	ug/L					
Chromium	ND	50	ug/L					
Copper	ND	5	ug/L					
Iron	ND	200	ug/L					
Lead	ND	1	ug/L					
Magnesium	ND	200	ug/L					
Mercury	ND	0.1	ug/L					
Manganese	ND	50	ug/L					
Potassium	ND	200	ug/L					
Sodium	ND	200	ug/L					
Zinc	ND	20	ug/L					
Volatiles								
Benzene	ND	0.5	ug/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
1,4-Dichlorobenzene	ND	0.5	ug/L					
Methylene Chloride	ND	5.0	ug/L					
Toluene	ND	0.5	ug/L					
Vinyl chloride	ND	0.5	ug/L					
Surrogate: 4-Bromofluorobenzene	*81.8*		*%*	*102*	*50-140*			
Surrogate: Dibromofluoromethane	*91.3*		*%*	*114*	*50-140*			
Surrogate: Toluene-d8	*82.3*		*%*	*103*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	288	1	mg/L	288			0.1	20	
Nitrate as N	0.14	0.1	mg/L	0.13			2.2	20	
Nitrite as N	ND	0.05	mg/L	ND			NC	20	
Sulphate	53.8	1	mg/L	53.1			1.2	10	
General Inorganics									
Alkalinity, total	396	5	mg/L	396			0.2	14	
Ammonia as N	0.026	0.01	mg/L	0.023			9.1	18	
Chemical Oxygen Demand	ND	10	mg/L	ND			NC	12	
Dissolved Organic Carbon	1.2	0.5	mg/L	1.3			5.6	37	
Conductivity	1210	5	uS/cm	1160			4.1	5	
pH	7.7	0.1	pH Units	7.7			0.0	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Phosphorus, total	ND	0.01	mg/L	ND			NC	15	
Total Dissolved Solids	806	10	mg/L	810			0.5	10	
Total Kjeldahl Nitrogen	ND	0.1	mg/L	ND			NC	16	
Metals									
Arsenic	ND	10	ug/L	ND			NC	20	
Barium	910	10	ug/L	953			4.6	20	
Boron	263	50	ug/L	328			NC	20	
Cadmium	ND	1	ug/L	ND			NC	20	
Calcium	68300	200	ug/L	85300			22.2	20	QR-05
Chromium	ND	50	ug/L	ND			NC	20	
Copper	9.2	5	ug/L	11.4			NC	20	
Iron	649	200	ug/L	808			NC	20	
Lead	1.2	1	ug/L	1.4			14.6	20	
Mercury	ND	0.1	ug/L	ND			NC	20	
Manganese	ND	50	ug/L	ND			NC	20	
Potassium	19500	200	ug/L	20300			3.8	20	
Sodium	449000	200	ug/L	493000			9.3	20	
Volatiles									

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Benzene	ND	0.5	ug/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
Methylene Chloride	ND	5.0	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
Vinyl chloride	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*82.9*		*%*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*89.8*		*%*		*112*	*50-140*			
Surrogate: Toluene-d8	*82.0*		*%*		*103*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	299	1	mg/L	288	108	70-124			
Nitrate as N	1.16	0.1	mg/L	0.13	103	77-126			
Nitrite as N	0.901	0.05	mg/L	ND	90.1	82-115			
Sulphate	62.4	1	mg/L	53.1	92.6	74-126			
General Inorganics									
Ammonia as N	1.01	0.01	mg/L	0.023	98.8	81-124			
Chemical Oxygen Demand	203	10	mg/L	ND	102	85-111			
Dissolved Organic Carbon	12.0	0.5	mg/L	1.3	108	60-133			
Phenolics	0.026	0.001	mg/L	ND	106	67-133			
Phosphorus, total	0.982	0.01	mg/L	ND	98.2	80-120			
Total Dissolved Solids	96.0	10	mg/L	ND	96.0	75-125			
Total Kjeldahl Nitrogen	1.02	0.1	mg/L	ND	102	81-126			
Metals									
Arsenic	54.8	10	ug/L	ND	109	80-120			
Barium	152	10	ug/L	95.3	114	80-120			
Boron	86.3	50	ug/L	ND	107	80-120			
Cadmium	55.7	1	ug/L	ND	111	80-120			
Calcium	18100	200	ug/L	8530	95.5	80-120			
Copper	57.4	5	ug/L	ND	112	80-120			
Iron	2710	200	ug/L	ND	105	80-120			
Lead	52.0	1	ug/L	ND	104	80-120			
Magnesium	15600	200	ug/L	4110	115	80-120			
Mercury	2.71	0.1	ug/L	ND	90.3	70-130			
Manganese	60.3	50	ug/L	ND	118	80-120			
Potassium	13100	200	ug/L	2030	111	80-120			
Sodium	59100	200	ug/L	49300	98.2	80-120			
Zinc	53.7	20	ug/L	ND	100	80-120			
Volatiles									
Benzene	31.7	0.5	ug/L	ND	79.2	60-130			
1,4-Dichlorobenzene	41.1	0.5	ug/L	ND	103	60-130			

Certificate of Analysis

Report Date: 28-Jun-2023

Client: **Dillon Consulting Ltd (Windsor)**

Order Date: 22-Jun-2023

Client PO:

Project Description: 202559

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methylene Chloride	41.4	5.0	ug/L	ND	103	60-130			
Toluene	42.8	0.5	ug/L	ND	107	60-130			
Vinyl chloride	48.6	0.5	ug/L	ND	122	50-140			
m,p-Xylenes	88.0	0.5	ug/L	ND	110	60-130			
o-Xylene	43.4	0.5	ug/L	ND	109	60-130			
Surrogate: 4-Bromofluorobenzene	*87.2*		*%*		*109*	*50-140*			
Surrogate: Dibromofluoromethane	*93.3*		*%*		*117*	*50-140*			
Surrogate: Toluene-d8	*77.3*		*%*		*96.6*	*50-140*			

Qualifier Notes:

QC Qualifiers:

QR-05 Duplicate RPDs higher than normally accepted. Remaining batch QA\QC was acceptable. May be sample effect.

Sample Data Revisions:

None

Work Order Revisions / Comments:

The Sample Date for lab provided Trip QC samples is based on the date of preparation at the lab.

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

PARACEL LABORATORIES LTD.

Paracel ID: 2325404

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2325404	

Client Name: Dillon Consulting Ltd.
Contact Name: Taryn Azzopardi
Address: 3200 Deziel Dr. Suite 608 Windsor, ON N8W 5K8
Telephone: 226-345-6754

Project Ref: 202559
Quote #: 22490
PO #:
E-mail: tazzopardi@dillon.ca tfoote@dillon.ca

Page 1 of 1

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular
Date Required:

☐ REG 153/04 ☐ REG 406/19
☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other
☐ Table ___
For RSC: ☐ Yes ☐ No

Other Regulation
☒ REG 558 ☐ PWQO
☐ CCME ☐ MISA
☐ SU - Sani ☐ SU - Storm
Mun:
☐ Other: REG 232

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	MOE Landfill Stds, Clm #1, Comp. GW				
1	MW22-101	GW		10	22/06/23	9:25								X				
2	MW22-103	GW		10		10:55								X				
3	MW22-104	GW		10		12:35								X				
4	MW22-105	GW		10		13:40								X				
5	MW22-DUP	GW		10		12:00								X				
6	Trip Blank	–		1	13/06/23	–		X										
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Walk in

Relinquished By (Sign): Tonya Foote
Relinquished By (Print): Tonya Foote
Date/Time: 22/06/23 14:55

Received By Driver/Depot: K. Jakobsen
Date/Time: June 22/23 14:45
Temperature: 27.1 °C

Received at Lab:
Date/Time: Jun 23 2023 1103
Temperature: 5.9, 2.8

Verified By:
Date/Time: Jun 23 2023 1434
pH Verified: ☐ By:

Appendix H

Shields Avenue Town of Tecumseh Stormwater Management Report

SHIELDS AVENUE
TOWN OF TECUMSEH
STORM WATER MANAGEMENT PLAN

hgs LIMITED
Consulting Engineers

File No.: C108-1438

July 2008
Revised October 2008

SHIELDS AVENUE

TOWN OF TECUMSEH

STORM WATER

MANAGEMENT REPORT

AMENDED OCTOBER 2008

Submitted by:
HGS Limited

File No.: C108-1438

Introduction

This report provides a storm water management plan for Shields Avenue located on the east side of Banwell Road north of County Road 42 in the Town of Tecumseh.

The recommended storm water management (SWM) plan was selected to minimize the hydrologic impacts of the proposed Development on the existing drainage system and to protect the quality of the receiving waters in the most effective way.

Quantitative and qualitative protection measures will include:
- On site source controls
- Conveyance system controls
- End-of-pipe controls
- Construction period best management practices.

Background

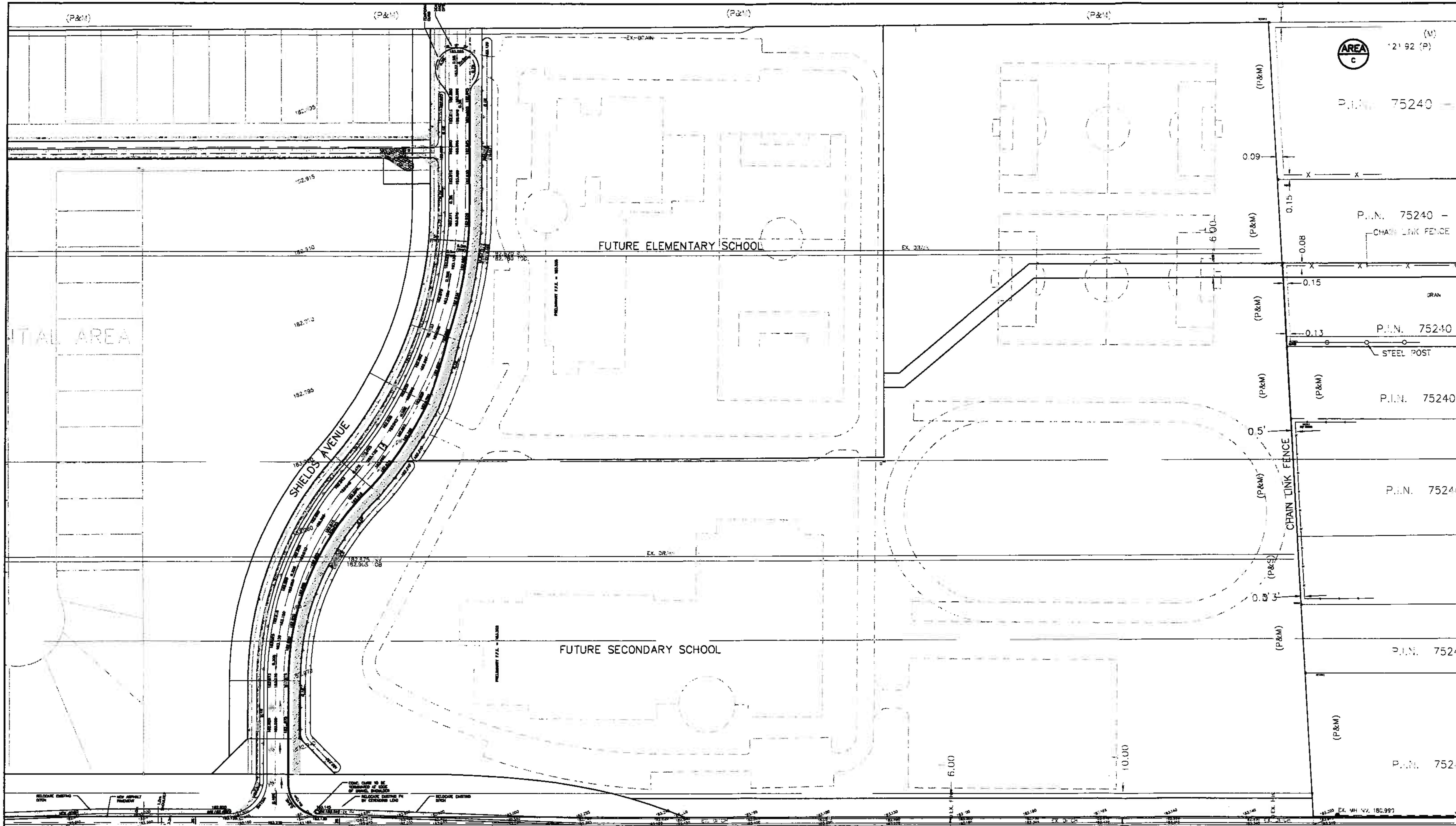
The concept plan is appended which describes the proposed Shields Avenue 300m east of Banwell Road as well as the surrounding drainage area which includes 15.24 Ha of adjacent lands. The land on the north side of Shields Avenue is zoned for commercial development and the land on the south side of Shields Avenue is zoned for an elementary and a secondary school.

Shields Avenue will be constructed in two phases. The first phase will include the construction of the south side of Shields Avenue up to the north edge of the westbound lane, including a temporary 1.5m wide shoulder and swales on both sides. The storm sewer and watermain will be constructed during this phase, while the sanitary sewer, sidewalk, and multi-use trail will be constructed during the second phase.

The Township of Sandwich South prepared a Master Drainage Plan in December 1987. This site is part of the Desjardins drain subwatershed as shown in Figure 13 of the Master Drainage Plan. At this time, the site was not designated for development; therefore the lands were excluded from the drainage scheme.

The Town of Tecumseh, in conjunction with the City of Windsor and ERCA, is working on preparing a Master Drainage Plan for the Little River Basin (to which this site ultimately drains to). Even though this area is part of the eventual Master Drainage Plan, the Town has required that stormwater be managed on-site to pre-development levels for both the 5 and 100 year storm with the storm sewers being designed to the 2 year AES event.

The storm sewer on Shields Avenue is designed to release the pre-developed 2 year storm for the total 15.24 Ha of land. The proposed storm sewer will drain easterly to a temporary private pumping station that will, via a temporary ditch, discharge to the existing municipal drain (Desjardins Drain) running parallel to the CPR tracks to the north. Stormwater quantity detention and quality treatment are required.



hgs LIMITED Consulting Engineers WINDSOR, ONTARIO	DESIGN A.M.C. CHECKED R.C.S. DRAWN A.M.C. CHECKED R.C.S. DATE SEP 2008 SCALE 1:1500	NO.	REVISION	DATE	BY
SHIELDS AVENUE					
CONCEPT PLAN					
PROJECT NO. C108-1438					
SHEET NO. CP					

Figure 13

WATERSHED SUB-AREAS and PEAK FLOWS

SUB-AREA	5 YEAR	100 YEAR
10	65/1.8	110/3.1
20	460/13.0	575/16.3
30	45/1.3	100/2.8
35	20/0.6	45/1.3
40	45/1.3	110/3.1
45	95/2.7	255/7.2
50	60/1.7	130/3.7
60	40/1.1	130/3.7
65	45/1.3	140/4.0
70	10/0.3	30/0.8
75	40/1.1	120/3.4
80	135/3.8	230/6.5
85	105/3.0	150/4.2
90	90/2.6	205/5.8

SUB-AREA	5 YEAR	100 YEAR
100	55/1.6	285/8.1
200	80/2.3	135/5.2
201	145/4.1	285/8.1
300	7/0.2	20/0.6
400	1410/40	1625/46

FLOWS ARE IN cfs / cms

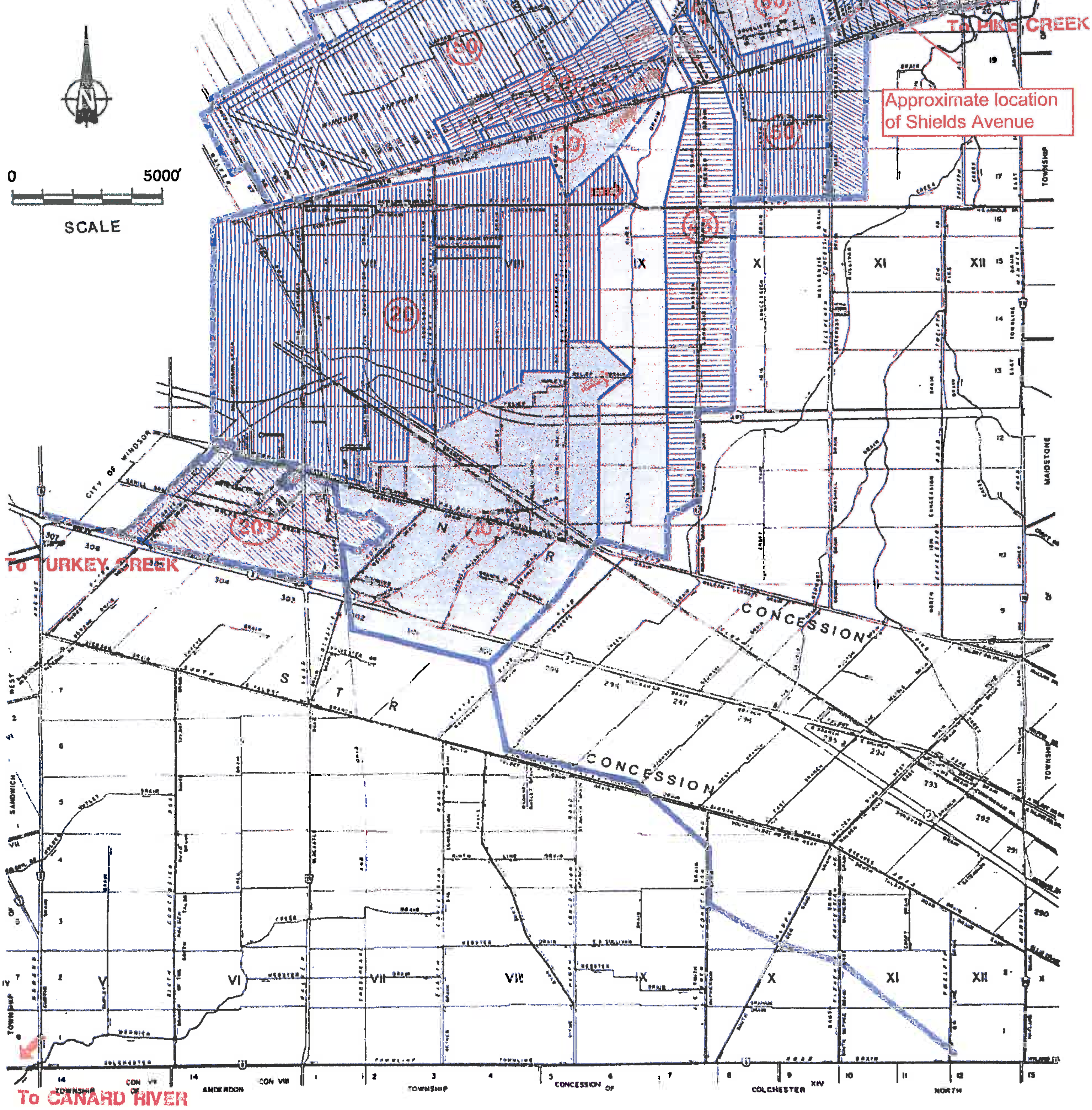


Figure 13

The pumping station is to include one pump that will discharge the peak flow and two overflow pipes that will discharge one half of the peak flow each (in the event of pump failure).

Maintenance of overland flow from the future school lands is a concern of the Town of Tecumseh and ERCA relative to the potential obstruction created by the Shields Avenue roadway construction.

Design Criteria

The storm sewer design is based on the AES Environment Canada 2-year IDF Curve applied to the Rational Method. The peak flow is therefore 245 l/s (0.245 cms).

The pump station is designed with one pump having a capacity of 245 l/s and two overflow pipes having a capacity of 125 l/s each.

The maximum ponding elevation on Shields Avenue must be lower than the existing elevations on Banwell Road, so that Banwell Road will not be impacted by this development.

The minimum building elevation for adjacent lands must be 300mm above the maximum ponding elevation on Shields Avenue.

In considering water quality sizing criteria, the volumetric criteria of a 13mm rainfall event over the entire paved area of the roadway was used.

Stormwater Quantity

The storm sewers are designed for a 2 year peak flow of 245 l/s. A 600mm diameter sewer @ 0.16% shall be used to restrict this flow. Each of the three contributing sites will be required to limit outflow to pre-development runoff (C=0.2) for the developed condition.

The allowable release rates for the elementary school, secondary school and commercial sites are 0.051cms, 0.145cms, and 0.032cms respectively.

Quantity storage for the roadway development shall be provided in the pipe system and on the surface as shown in the attached calculations. Storage for future developments shall be provided separately on each site. Preliminary storage volume calculations are attached for each site.

Considering the invert of the existing municipal drain, gravity drainage is not attainable; therefore a temporary private pump station is required. The pump station is designed to have one pump and two overflow pipes. The storm sewer's profile provides for gravity drainage for the most remote areas of the future recreational sites.

The pump shall be designed to discharge 245 l/s. The pump chosen is a Flygt NP3171.181 LT with a 274mm Impeller.

The 2 overflow pipes are designed with a 125 l/s capacity. A 300mm diameter pipe at 1.7% shall suffice.

For the major storm event (1:100 year), during the first phase of construction, the overland flow from the school sites will be routed using a cut-off swale on the south side of Shields Avenue with ditch inlet catchbasins connecting to the storm sewer. Upon the development of each site, these catchbasins can be removed. Since the release rate is restricted to the 2 year storm, the 100 year storm shall be stored in the swales. Once the school site is developed, the major storm event shall be restricted to pre-developed condition and any excess flows shall be stored on the school site.

Maintenance of the cut-off swale drainage will be required until both school sites are fully developed. Interim measures will be considered at the time of site plan application.

Stormwater Quality

The volumetric criterion of a 13mm rainfall event over the entire paved area of the roadway requires 62 cubic metres of quality storage. Quality storage for future developments shall be provided separately based on MOE guidelines and as approved by the Town and ERCA.

An oil-grit separator (OGS) approved by the Ministry of the Environment is the recommended solution for this project subject to meeting the following criteria:

- 70% long term TSS removal
- 85% of the total runoff volume to be treated

A submission has been made by Advanced Drainage System Inc. to ERCA, proposing the ADS Water Quality Unit 3620WQA. It has been confirmed to be acceptable for this development.

Sediment and Erosion Controls During Construction

During the construction phase of this development, it will be necessary to minimize the potential for impairment of the quality of the drain. It will be necessary to provide sediment control in accordance with the techniques for erosion and sediment control described in U.P.I.C. 1987 report entitled "Guidelines on Erosion and Sediment Control for Urban Construction Sites". It is proposed to implement the following:

- Catchbasins to be protected by placing filter cloth screens or Stream Guard filter devices therein.
- The boulevards behind curbs to be graded towards a roadside swale.
- Silt fencing to be installed within the Desjardins Drain adjacent to the location of construction.

Appendix A

Advanced Drainage System Water Quality Unit

Advanced Drainage Systems Net Annual TSS Removal Efficiency

Project Location: Ottawa

Mean Annual Rainfall: 733.2 mm

Site Drainage Area: 0.77 ha

Runoff Coefficient, C: 0.76

Length, L: 0.315 km

Slope, S: 1 %

Assumed Sediment: OK-110

Proposed Unit: 3620WQA

Number of Units: 1

Time of Concentration: 0.31 hrs.

	Rainfall Intensities for Standard Return Periods (mm/hr)					
Duration (h)	2 year	5 year	10 year	25 year	50 year	100 year
0.083	126.5	160.3	183.9	212.0	233.5	254.9
0.167	77.1	98.0	112.4	129.8	143.0	156.2
0.25	57.7	73.4	84.3	97.4	107.4	117.2
0.50	35.1	44.9	51.5	59.6	65.8	71.8
1	21.4	27.4	31.5	36.5	40.3	44.0
2	13.0	16.7	19.3	22.3	24.7	27.0
6	5.9	7.7	8.8	10.3	11.4	12.4
12	3.6	4.7	5.4	6.3	7.0	7.6
24	2.2	2.9	3.3	3.8	4.3	4.7

	Runoff (Rational Method) for Standard Return Periods (m^3/s)					
Duration (h)	2 year	5 year	10 year	25 year	50 year	100 year
0.083	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.167	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.5	0.057	0.073	0.084	0.097	0.107	0.117
1	0.035	0.045	0.051	0.059	0.066	0.072
2	0.021	0.027	0.031	0.036	0.040	0.044
6	0.010	0.012	0.014	0.017	0.018	0.020
12	0.006	0.008	0.009	0.010	0.011	0.012
24	0.004	0.005	0.005	0.006	0.007	0.008

Cumulative Frequency (%)	10.0%	20.0%	30.0%	40.0%	50.0%	60.0%	70.0%	80.0%	82.0%	84.0%	86.0%	88.0%	90.0%	92.0%	94.0%	96.0%	98.0%	98.5%	99.0%	99.5%	100.0%
Intensity (mm/hr)	0.113	0.496	1.035	1.739	2.650	3.845	5.466	7.815	9.858	10.715	11.697	12.844	14.212	15.894	18.058	21.048	25.771	30.972	34.323	39.551	51.318
Flow (m^3/s)	0.000	0.001	0.002	0.003	0.004	0.006	0.009	0.013	0.016	0.017	0.019	0.021	0.023	0.026	0.029	0.034	0.042	0.050	0.056	0.064	0.083
Treated Flow per Unit (m^3/s)	0.000	0.001	0.002	0.003	0.004	0.006	0.009	0.013	0.016	0.017	0.019	0.021	0.023	0.026	0.029	0.034	0.042	0.042	0.042	0.042	0.042
Total Bypassed Flow (m^3/s)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.014	0.022	0.041
Critical Particle Diameter (mm)	0.009	0.018	0.026	0.034	0.042	0.050	0.060	0.072	0.080	0.084	0.088	0.092	0.097	0.102	0.109	0.118	0.130	0.130	0.130	0.130	0.130
Removal Efficiency (%)	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	99.20%	98.19%	93.83%	91.27%	88.46%	83.03%	76.60%	69.11%	56.52%	34.51%	12.82%	12.77%	12.77%	12.77%	12.77%

Removal Efficiency–Treated Flow: 92.12%

Net Removal Efficiency: 92.04%

Portion of Total Runoff Treated: 99.37%

ADS Water Quality Unit - Inlet Control

ADVANCED DRAINAGE SYSTEMS INC.

Project: Shield Avenue

WQU Standard Part Number: 3620WQA24

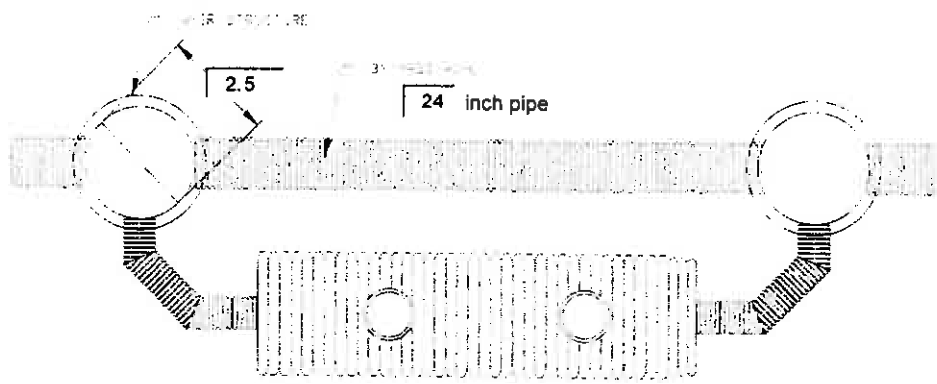
Outlet:	10	in
Orifice:	15	in
Orifice Area:	1.23	sq. ft
Bypass:	24	

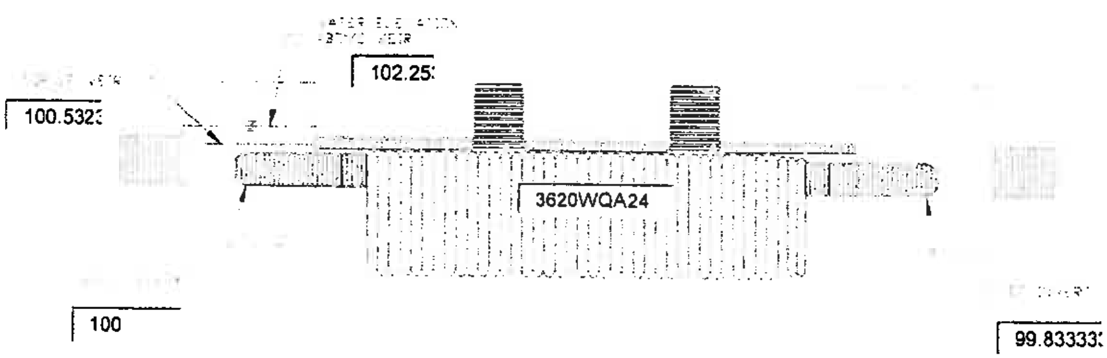
Inlet Elevation:	100	
Weir Length:	2.5	ft.
Q_{storm}:	19	

Q_{treat}:	1.5	cfs
C_d	0.56	
C_w	3.1	

H_{water}:	1.72	ft.
H_{weir}:	0.07	ft.

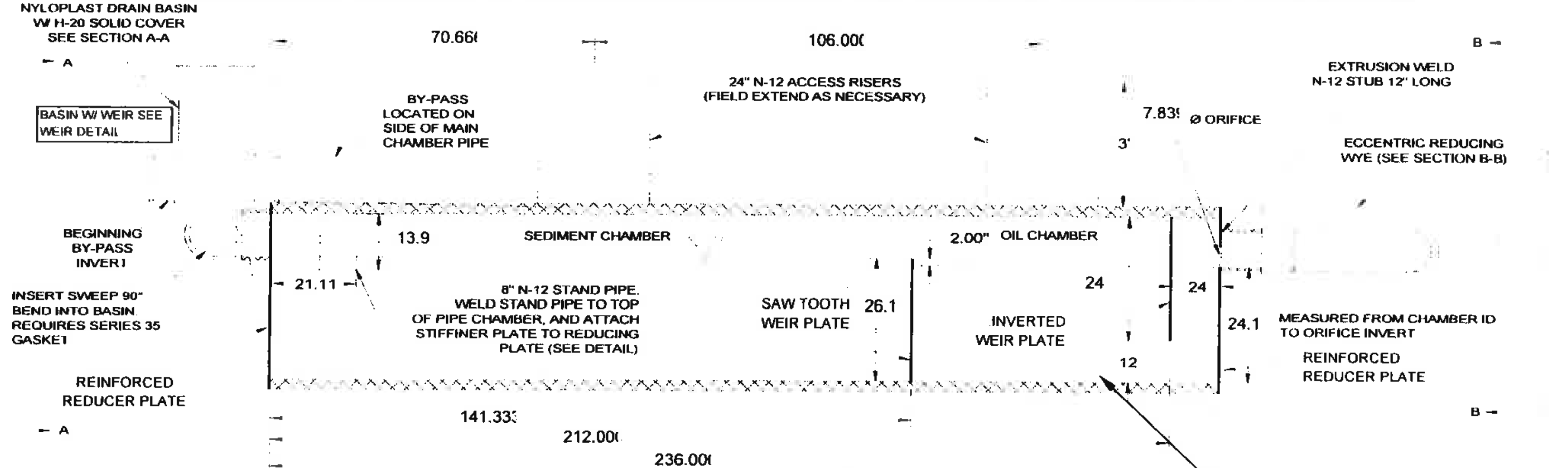
$H_{weir\ above\ inlet\ invert}$:	0.53	ft.
$H_{water\ above\ weir}$:	1.72	ft.





SHIELD AVE.

FABRICATION DRAWING 1 FOR 36 IN. WATER QUALITY UNIT WITH 24 IN. BY-PASS AND 1.5 CFS FLOW

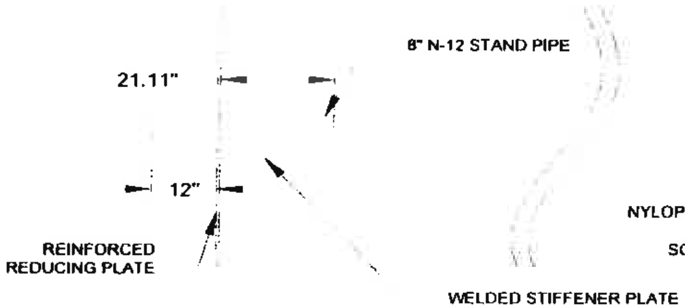


THE SYSTEM CONSISTS OF 1 FULL STICK OF PIPE

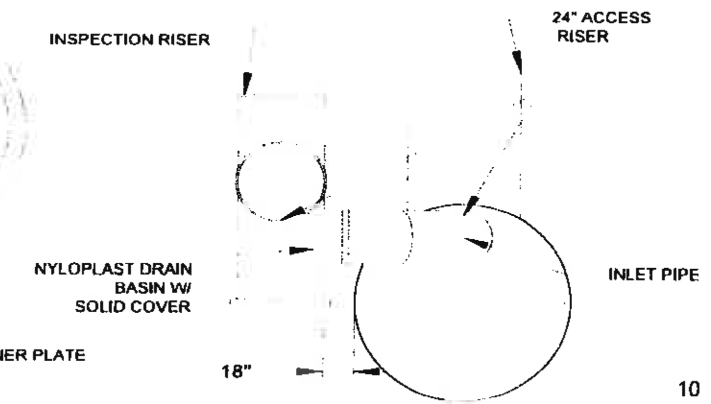
THE SEDIMENT WEIR IS 141.33 IN. ON THE 1ST STICK OF PIPE AND THE SEDIMENT RISER IS 70.67 IN. ON THE 1ST STICK OF PIPE MEASURED FROM THE BELL/INLET END

THE OIL RISER IS PLACED 212.00 IN. ON THE 1ST STICK OF PIPE

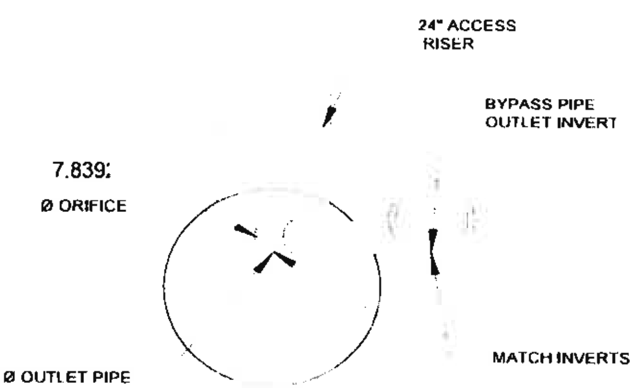
36 IN.WT IB PIPE FOR MAIN CHAMBER WITH 10 IN. INLET STUB AND 10 IN. OUTLET STUB



TOP VIEW 8 IN. STANDPIPE DETAIL



SECTION A-A FOR 24 IN.BY-PASS WITH 10 IN. INLET



SECTION B-B FOR 24 IN.BY-PASS WITH 10 IN. OUTLET

*ALL DIMENSIONS ARE IN INCHES UNLESS SPECIFIED

* FOR DESIGN PLEASE ACCOUNT FOR APPROXIMATELY 11.9 IN. OF FALL FROM BEGINNING BY-PASS INLET INVERT TO BY-PASS OUTLET INVERT

*ASSUMES 140 SIEVE SIZE

ADS

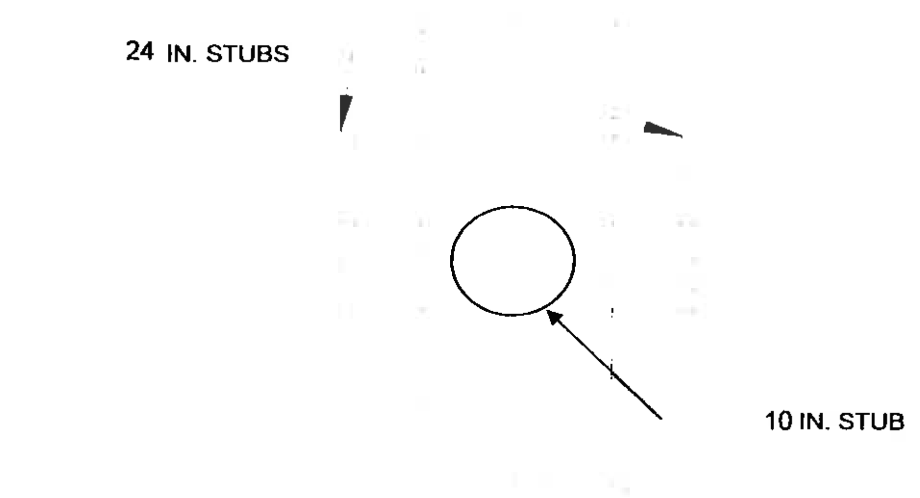
SCALE: NTS

Marseilles

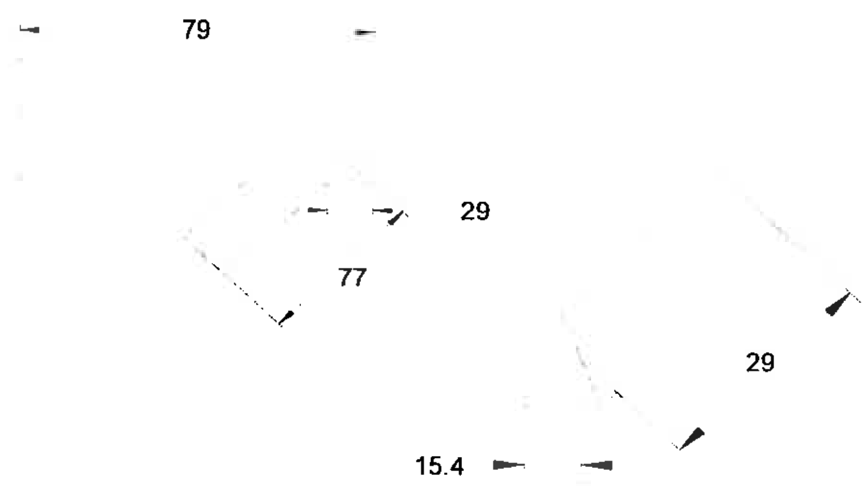
9.03.08

SHIELD AVE.

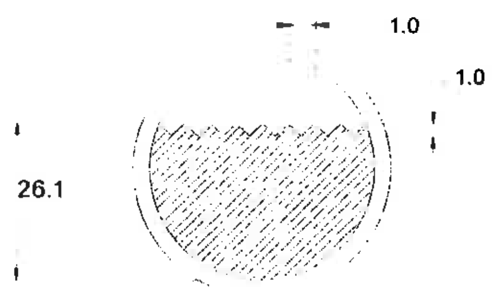
FABRICATION DRAWING 2 FOR 36 IN. WATER QUALITY UNIT WITH 24 IN. BY-PASS



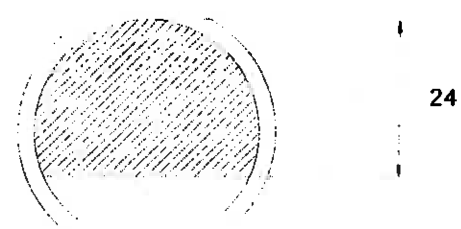
24 IN. NYLOPLAST INLET DRAIN BASIN



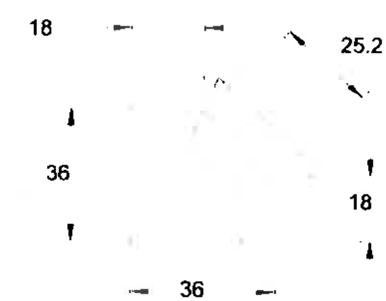
24 IN. X 10 IN.ECCENTRIC REDUCING WYE



1/2" THICK SAW TOOTH WEIR PLATE FOR SEDIMENT CHAMBER



1/2" THICK HDPE INVERTED WEIR PLATE IN OIL CHAMBER



10 IN. SWEEP 90 BEND FOR INLET BASIN

*ALL DIMENSIONS ARE IN INCHES UNLESS SPECIFIED

ADS

SCALE: NTS

Marseilles

9.03.08

ADS

ADS CUSTOM Water Quality Unit
Bill of Materials

Project: Shield Ave.
Date: 9.03.08

Part Number	Qty.
1011AA	3
1059AG	1
2465MG	4
2495-0020	25.0

* SURFACE TREATMENTS TO BE ORDERED BY SALES PERSON
Connections in and out of manholes are not accounted for.

Appendix B

Shields Avenue Cut-Off Swale Calculations

SHIELDS AVENUE
CUT-OFF SWALE

1 October 2008
C108-1438

STORM DETENTION CALCULATION (1:2 YEAR STORM)

Existing Conditions: 2 year storm

$I = 25 * (T/60)^{-0.712}$

T = Time in min.
I = Intensity (mm/hr)

Q= Aci/36
Q= m^3/sec
i= cm/hr

Total Area = 12.65 Ha

surface c = 0.20

t_c = 45 min. ==> i = 3.07 cm/hr

Q_{EX} = 15.24 * 0.20 * 2.85 / 36 = 0.216 m^3/sec

Existing Conditions: 100 year storm

$I = 51.4 * (T/60)^{-0.711}$

T = Time in min.
I = Intensity (mm/hr)

Q= Aci/36
Q= m^3/sec
i= cm/hr

Total Area = 12.65 Ha

surface c = 0.20

t_c = 45 min. ==> i = 6.31 cm/hr

Q_{EX} = 15.24 * 0.20 * 2.85 / 36 = 0.443 m^3/sec

STORM WATER DETENTION CALCULATIONS (SWALES)

PROJECT: Shields Avenue
LOCATION: Town of Tecumseh
DATE: 1 October 2008
FILE: C108-1438

EXISTING CONDITIONS (2 YEAR RELEASE)

AREA 12.65 ha
COEFFICIENT 0.20
INTENSITY 3.07 cm/hr

Q_{EX} = 12.65 * 0.2 * 3.07 / 36 = 0.216 m^3/sec

EXISTING CONDITIONS (100 YEAR EVENT)

AREA 12.65 ha
COEFFICIENT 0.20
INTENSITY 6.31 cm/hr

Q_{NEW} = 12.65 * 0.2 * 6.31 / 36 = 0.443 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 12.65 Ha
RELEASE Q: 0.216 m^3/sec
TIME (Tc): 45 min.
PEAK Q: 0.443 m^3/sec
CA: 2.53

TIME (Tc) (min)	**INTENSITY** (cm/hr)	**PEAK Q** (cms)	**VOLUME** (cm)	**RELEASE VOLUME** (cm)	**STORAGE** (cm)
5	30.08	0.235	70.46	64.69	6
10	18.38	0.287	172.18	129.38	43
15	13.77	0.323	290.38	194.07	96
20	11.23	0.351	420.74	258.76	162
25	9.58	0.374	560.96	323.45	238
30	8.41	0.394	709.57	388.14	321
35	7.54	0.412	865.54	452.83	413
40	6.86	0.428	1028.11	517.52	511
45	6.31	0.443	1196.68	582.21	614
50	5.85	0.411	1233.67	646.90	587
55	5.47	0.384	1268.13	711.59	557
60	5.14	0.361	1300.42	776.28	524

THEREFORE, MAXIMUM STORAGE REQUIRED IS **614** CUBIC METERS

SHIELDS AVENUE **1 October 2008**

SWALE **C108-1438**

STORAGE VOLUME CALCULATIONS IN SWALES

Storage in swales

Existing Swale on Elementary School Property:

Width =	2 m	
Depth =	0.23 m	
Length =	406 m	
Volume =	93.4 m^3	*(Width / 2 x Depth x Length)*

Existing Swale on Secondary School Property:

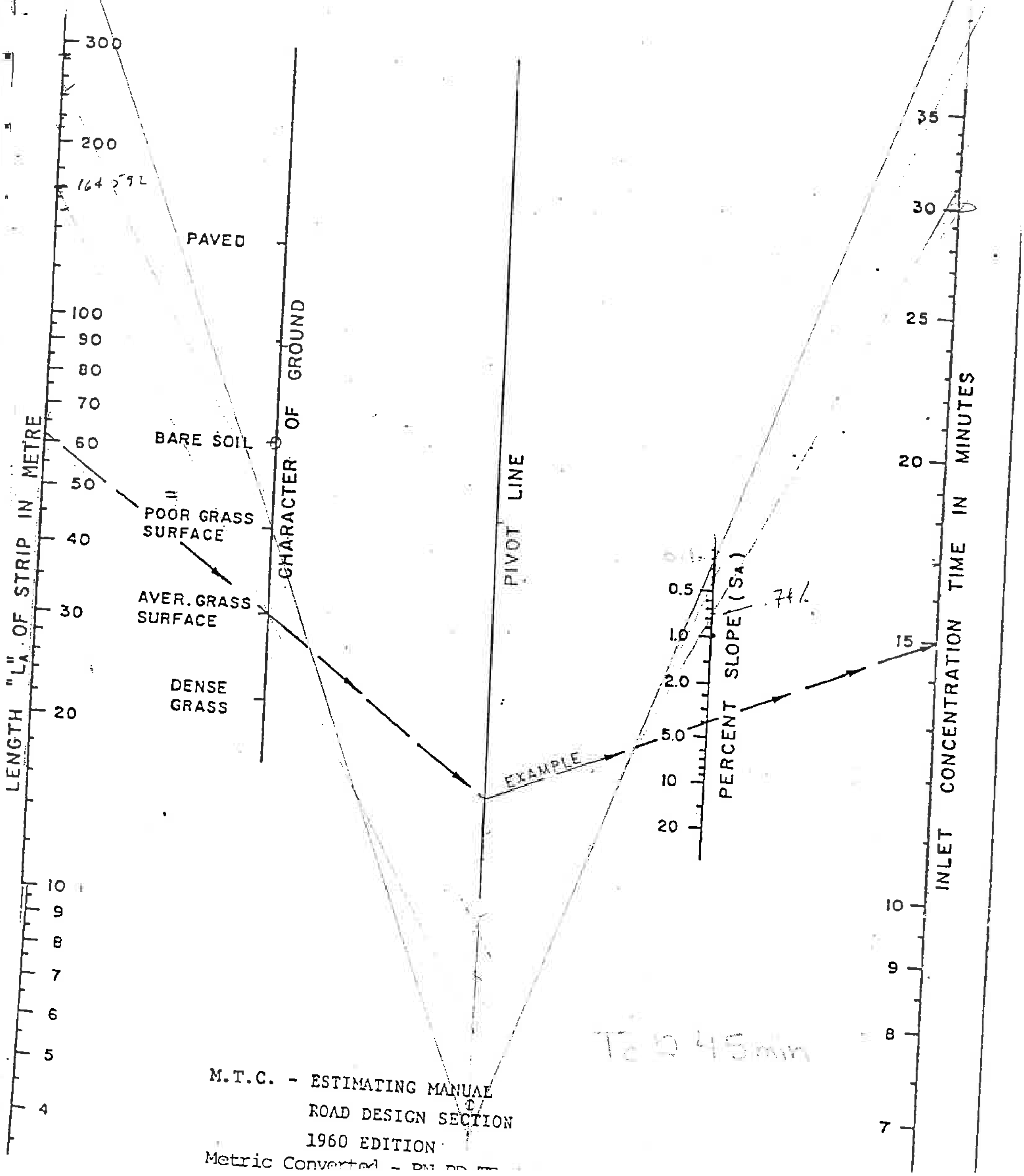
Width =	2 m	
Depth =	0.16 m	
Length =	340 m	
Volume =	54.4 m^3	*(Width / 2 x Depth x Length)*

New Swale on South Side of Shields Avenue:

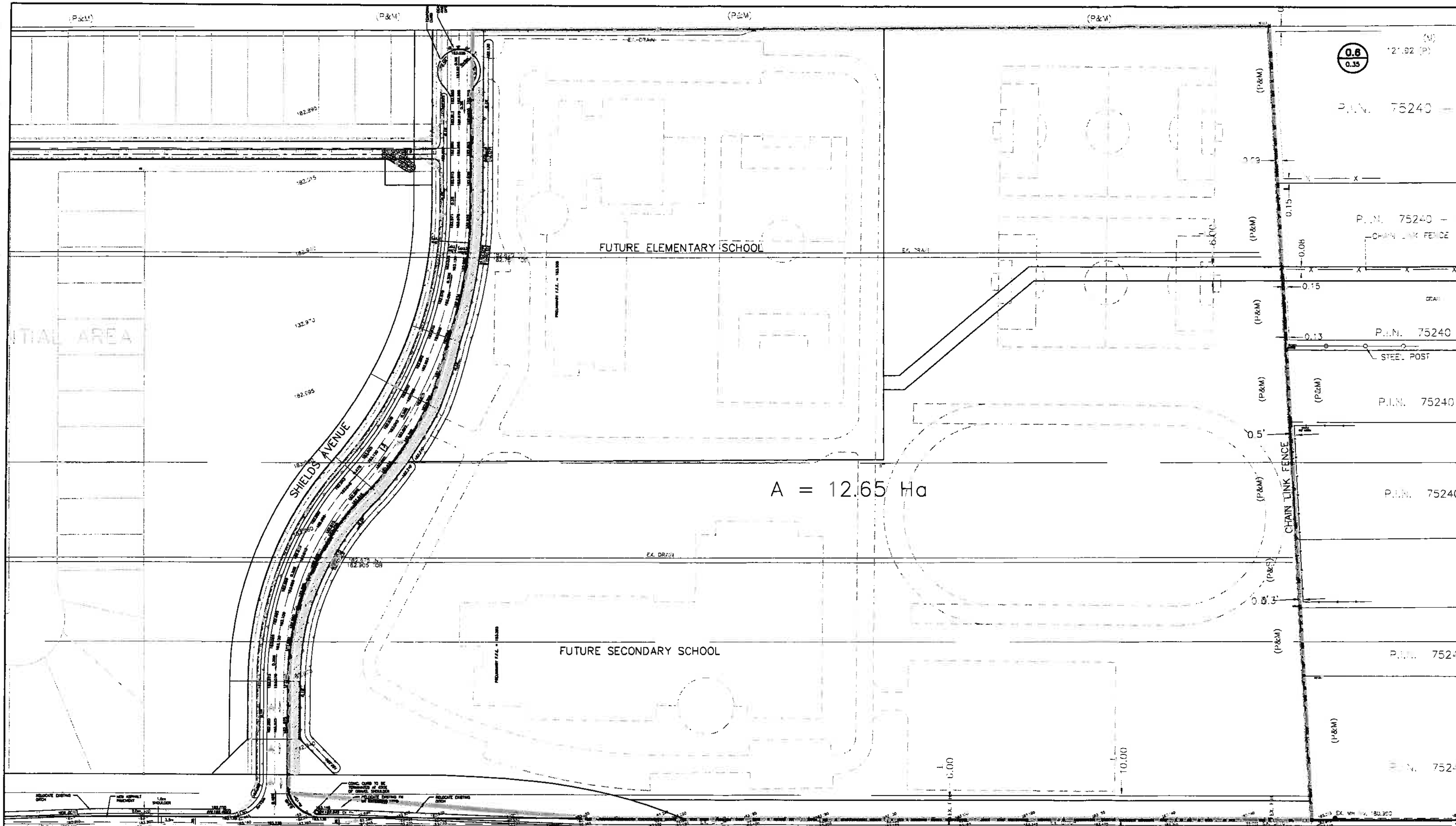
Width =	4.2 m	
Depth =	0.7 m	
Length =	330 m	
Volume =	485 m^3	*(Width / 2 x Depth x Length)*

Total Storage in Swales =	**633**	**c.m. OK!**
Storage required for 100-year event	614	c.m.

OVERLAND FLOW TIME (Tc)



M.T.C. - ESTIMATING MANUAL
ROAD DESIGN SECTION
1960 EDITION
Metric Converted - RN RD ...



hgs LIMITED
Consulting Engineers
WINDSOR , ONTARIO

NO.	REVISION	DATE	BY

DESIGN	A.M.C.
CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	SEP 2008
SCALE	1:1500

SHIELDS AVENUE

STORM DRAIN CALCULATIONS

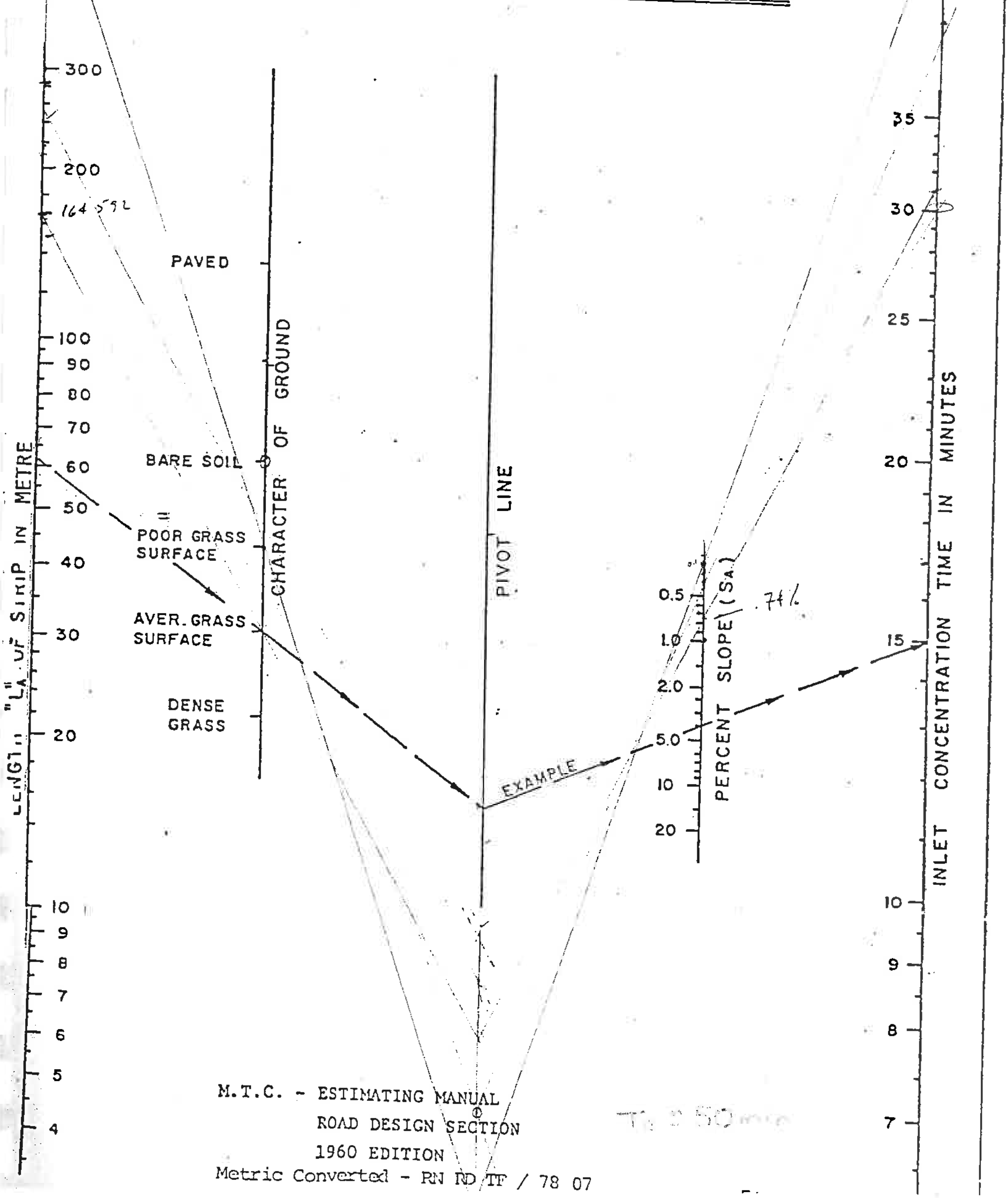
PROJECT NO. C108-1438

SHEET NO. FIG 1

Appendix C

Storm Water Detention Calculations

OVERLAND FLOW TIME (Tc)



M.T.C. - ESTIMATING MANUAL
ROAD DESIGN SECTION
1960 EDITION
Metric Converted - RN RD TF / 78 07

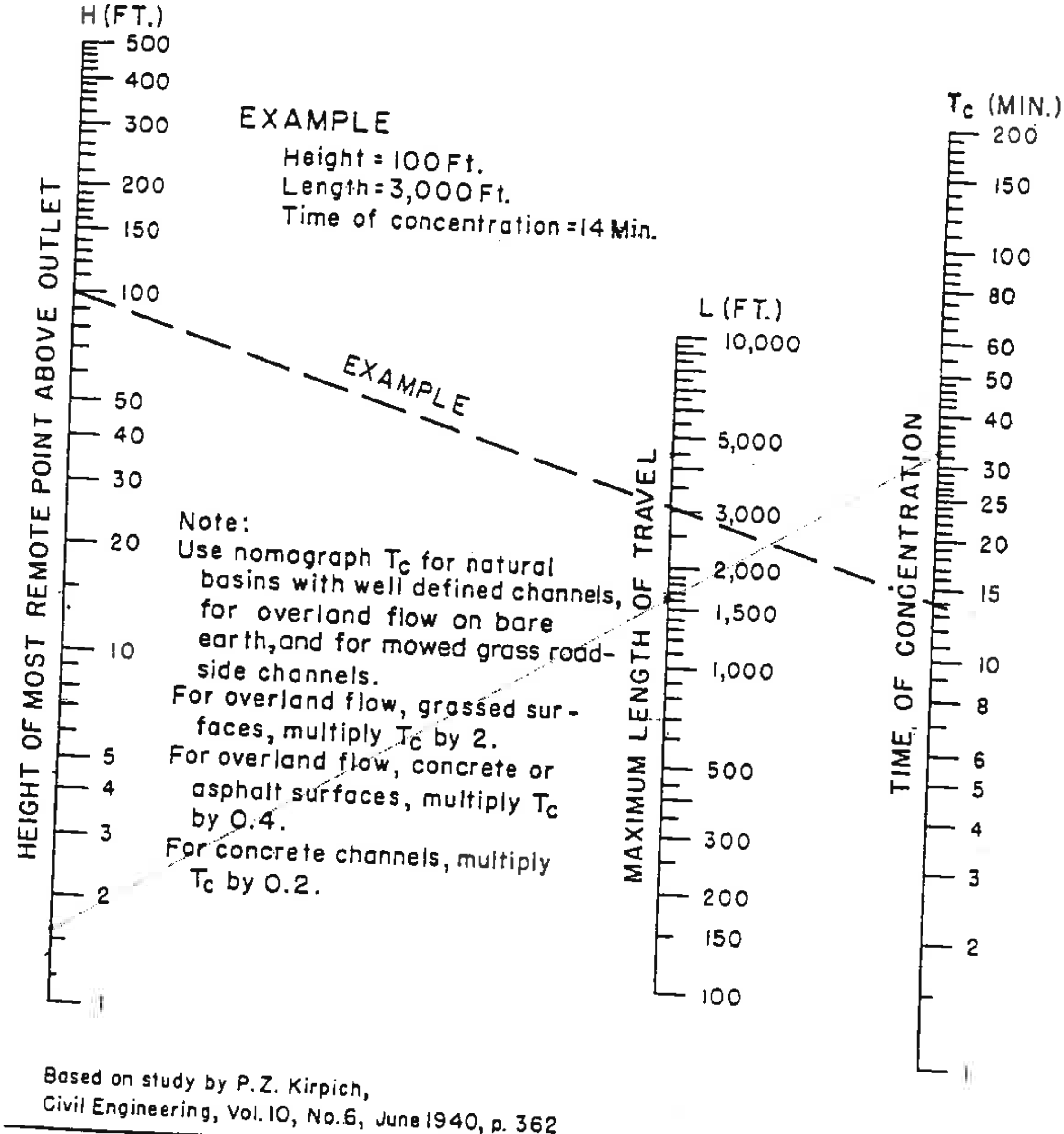


FIG. 5 – TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

Figure 5.—Time of concentration of small drainage basins.

t_c = 32x2 = 64 min

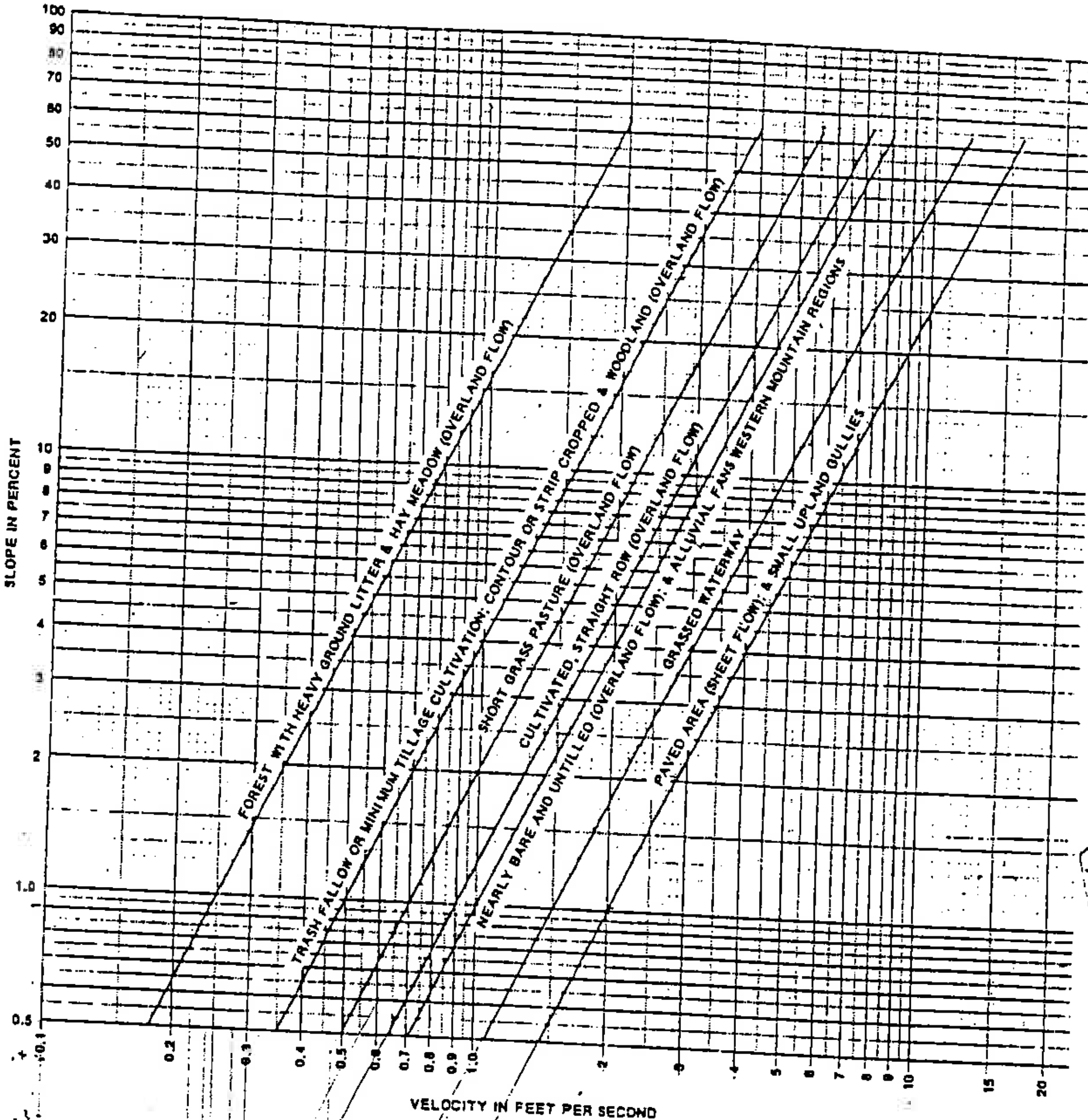


Figure 15.2.—Velocities for upland method of estimating T_c

SHIELDS AVENUE **22 September 2008**

OVERALL SITE **C108-1438**

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712}$

Q= Aci/36

T = Time in min. Q= m^3/sec

I = Intensity (mm/hr) i= cm/hr

Total Area = 15.24 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.85 cm/hr

Q_{EX} = 15.24 * 0.20 * 2.85 / 36 = 0.241 m^3/sec

Proposed Conditions:

area roadway =	0.80 Ha	==>	c =	0.76
area commercial =	2.03 Ha	==>	c =	0.70
area school sites =	12.41 Ha	==>	c =	0.45

AC_{TOTAL}= 0.80 x 0.76 + 2.03 x 0.70 + 12.41 x 0.45 = 7.61

t_c = 20 min. ==> i = 5.47 cm/hr

Q_{NEW} = 7.61 * 5.47 / 36 = 1.156 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

SHIELDS AVENUE

OVERALL SITE

22 September 2008

C108-1438

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711}$

Q= Aci/36

Q= m^3/sec

i= cm/hr

T = Time in min.

I = Intensity (mm/hr)

Total Area = 15.24 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 5.85 cm/hr

Q_{EX} = 15.24 * 0.20 * 5.85 / 36 = 0.495 m^3/sec

Proposed Conditions:

area roadway =	0.80 Ha	==>	c =	0.76
area commercial =	2.03 Ha	==>	c =	0.70
area school sites =	12.41 Ha	==>	c =	0.45

AC_{TOTAL} = 0.80 x 0.76 + 2.03 x 0.70 + 12.41 x 0.45 = 7.61

t_c = 20 min. ==> i = 11.23 cm/hr

Q_{NEW} = 7.61 * 11.23 / 36 = 2.374 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

SHIELDS AVENUE **22 September 2008**

ROADWAY AREA **C108-1438**

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712}$

$Q = Aci/36$

T = Time in min.

$Q = m^3/sec$

I = Intensity (mm/hr)

i= cm/hr

Total Area = 0.8 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.85 cm/hr

$Q_{EX} = 0.80 * 0.20 * 2.85 / 36 =$ 0.013 m^3/sec

Proposed Conditions:

area roadway = 0.80 Ha ==> c = 0.76

$AC_{TOTAL} = 0.80 \times 0.76 =$ 0.61

t_c = 20 min. ==> i = 5.47 cm/hr

$Q_{NEW} = 0.61 * 5.47 / 36 =$ 0.092 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (ROADWAY AREA) **(1:2 YEAR STORM)**

PROJECT: Shields Avenue
LOCATION: Town of Tecumseh
DATE: 22 September 2008
FILE: C108-1438

EXISTING CONDITIONS

AREA 0.8 ha
COEFFICIENT 0.2
INTENSITY 2.85 cm/hr

Q_{EX} = 0.80 * 0.2 * 2.85 / 36 = 0.013 m^3/sec

PROPOSED CONDITIONS

AREA 0.8 ha
COEFFICIENT 0.76
INTENSITY 5.47 cm/hr

Q_{NEW} = 0.80 * 0.76 * 5.47 / 36 = 0.092 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 0.8 Ha
RELEASE Q: 0.013 m^3/sec
TIME (Tc): 20 min.
PEAK Q: 0.092 m^3/sec
CA: 0.61

TIME (Tc) (min)	**INTENSITY** (cm/hr)	**PEAK Q** (cms)	**VOLUME** (cm)	**RELEASE VOLUME** (cm)	**STORAGE** (cm)
20	5.47	0.092	110.77	15.18	96
25	4.66	0.079	118.13	18.98	99
30	4.10	0.069	124.49	22.77	102
35	3.67	0.062	130.15	26.57	104
40	3.34	0.056	135.25	30.36	105
45	3.07	0.052	139.91	34.16	106
50	2.85	0.048	144.22	37.95	106
55	2.66	0.045	148.24	41.75	106
60	2.50	0.042	152.00	45.54	106
65	2.36	0.040	155.54	49.34	106
70	2.24	0.038	158.90	53.14	106
75	2.13	0.036	162.09	56.93	105

THEREFORE, MAXIMUM STORAGE REQUIRED IS **106** CUBIC METERS

SHIELDS AVENUE **22 September 2008**

ROADWAY AREA **C108-1438**

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711}$

Q= Aci/36

T = Time in min.

Q= m^3/sec

I = Intensity (mm/hr)

i= cm/hr

Total Area = 0.8 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 5.85 cm/hr

Q_{EX} = 15.24 * 0.20 * 5.85 / 36 = 0.026 m^3/sec

Proposed Conditions:

area roadway = 0.80 Ha ==> c = 0.76

AC_{TOTAL}= 0.80 x 0.76 = 0.61

t_c = 20 min. ==> i = 11.23 cm/hr

Q_{NEW} = 0.61 * 11.23 / 36 = 0.190 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (ROADWAY AREA) **(1:100 YEAR STORM)**

PROJECT: Shields.Avenue
LOCATION: Town of Tecumseh
DATE: 22 September 2008
FILE: C108-1438

EXISTING CONDITIONS

AREA 0.8 ha
COEFFICIENT 0.2
INTENSITY 5.85 cm/hr

Q_{EX} = 0.80 * 0.2 * 5.85 / 36 = 0.026 m^3/sec

PROPOSED CONDITIONS

AREA 0.8 ha
COEFFICIENT 0.76
INTENSITY 11.23 cm/hr

Q_{NEW} = 0.80 * 0.76 * 11.23 / 36 = 0.190 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 0.8 ha
RELEASE Q: 0.013 m^3/sec
TIME (Tc): 20 min.
PEAK Q: 0.190 m^3/sec
CA: 0.608

TIME (Tc) (min)	INTENSITY (cm/hr)	PEAK Q (cms)	VOLUME (cm)	RELEASE VOLUME (cm)	STORAGE (cm)
50	5.85	0.099	296.47	37.95	259
60	5.14	0.087	312.51	45.54	267
70	4.61	0.078	326.75	53.14	274
80	4.19	0.071	339.60	60.73	279
90	3.85	0.065	351.36	68.32	283
100	3.57	0.060	362.23	75.91	286
110	3.34	0.056	372.34	83.50	289
120	3.14	0.053	381.83	91.09	291
130	2.97	0.050	390.76	98.68	292
140	2.81	0.048	399.22	106.27	293
150	2.68	0.045	407.26	113.86	293
190	2.26	0.038	436.05	144.22	292

THEREFORE, MAXIMUM STORAGE REQUIRED IS **293** CUBIC METERS

SHIELDS AVENUE **1 October 2008**

ROADWAY AREA **C108-1438**

STORAGE VOLUME CALCULATIONS ON ROADWAY AREA

<u>Storage in sewers</u>

catchbasins (9 CB's 0.6x0.6m 1.2m deep)		
9x0.6x0.6x1.2 =	3.89	c.m.
Manholes (2 MH's 1.2m dia. 3m deep average)		
2x3.14x0.6x0.6x3 =	6.78	c.m.
Manholes (3 MH's 1.5m dia. 3m deep average)		
2x3.14x0.75x0.75x3 =	15.9	c.m.
Manholes (1 MH's 1.8m dia. 3m deep average)		
2x3.14x0.9x0.9x3 =	7.63	c.m.
Manholes (1 MH's 2.4m dia. 2m deep average)		
2x3.14x1.2x1.2x3 =	9.04	c.m.
Pipes (From storm sewer design sheet)		
	59	c.m.
subtotal in sewers	<u>102</u>	<u>c.m.</u>
Storage required for 2-year event	106	c.m.
Roadway Storage Required	4	c.m.
Storage required for 100-year event	293	c.m.
Roadway Storage Required	191	c.m.
Roadway Storage Provided	230	c.m. OK!

(BASED ON MAX. WL = 183.000 FOR OVERLAND FLOW ROUTE EASTERLY FROM BANWELL ROAD)

SHIELDS AVENUE
COMMERCIAL SITE

22 September 2008
C108-1438

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712}$

T = Time in min.
I = Intensity (mm/hr)

Q= Aci/36
Q= m^3/sec
i= cm/hr

Total Area = 2.03 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.85 cm/hr

Q_{EX} = 2.03 * 0.20 * 2.85 / 36 = 0.032 m^3/sec

Proposed Conditions:

area commercial = 2.03 Ha ==> c = 0.70

AC_{TOTAL}= 2.03 x 0.70 = 1.42

t_c = 20 min. ==> i = 5.47 cm/hr

Q_{NEW} = 1.42 * 5.47 / 36 = 0.216 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (COMMERCIAL SITE) (1:2 YEAR STORM)

PROJECT: Shields Avenue
LOCATION: Town of Tecumseh
DATE: 22 September 2008
FILE: C108-1438

EXISTING CONDITIONS

AREA 2.03 ha
COEFFICIENT 0.2
INTENSITY 2.85 cm/hr

Q_{EX} = 2.03 * 0.2 * 2.85 / 36 = 0.032 m^3/sec

PROPOSED CONDITIONS

AREA 2.03 ha
COEFFICIENT 0.70
INTENSITY 5.47 cm/hr

Q_{NEW} = 2.03 * 0.70 * 5.47 / 36 = 0.216 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 2.03 Ha
RELEASE Q: 0.032 m^3/sec
TIME (Tc): 20 min.
PEAK Q: 0.216 m^3/sec
CA: 1.421

TIME (Tc) (min)	INTENSITY (cm/hr)	PEAK Q (cms)	VOLUME (cm)	RELEASE VOLUME (cm)	STORAGE (cm)
20	5.47	0.216	258.89	38.52	220
25	4.66	0.184	276.08	48.15	228
30	4.10	0.162	290.96	57.78	233
35	3.67	0.145	304.17	67.42	237
40	3.34	0.132	316.10	77.05	239
45	3.07	0.121	327.00	86.68	240
50	2.85	0.112	337.08	96.31	241
55	2.66	0.105	346.46	105.94	241
60	2.50	0.099	355.25	115.57	240
65	2.36	0.093	363.53	125.20	238
70	2.24	0.088	371.38	134.83	237
75	2.13	0.084	378.83	144.46	234

THEREFORE, MAXIMUM STORAGE REQUIRED IS **241** CUBIC METERS
Note: Storage required is estimate only, need to verify during final design stage

SHIELDS AVENUE

COMMERCIAL SITE

22 September 2008

C108-1438

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711}$

$Q = Aci/36$

$Q = m^3/sec$

$i = cm/hr$

T = Time in min.

I = Intensity (mm/hr)

Total Area = 2.03 Ha

<u>Existing Conditions:</u> surface c = 0.20

t_c = 50 min. ==> i = 5.85 cm/hr

$Q_{EX} = 2.03 * 0.20 * 5.85 / 36 =$ 0.066 m^3/sec

<u>Proposed Conditions:</u>

area commercial = 2.03 Ha ==> c = 0.70

$AC_{TOTAL} = 2.03 \times 0.70 =$ 1.42

t_c = 20 min. ==> i = 11.23 cm/hr

$Q_{NEW} = 1.42 * 11.23 / 36 =$ 0.443 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (COMMERCIAL SITE) **(1:100 YEAR STORM)**

PROJECT: Shields Avenue
LOCATION: Town of Tecumseh
DATE: 22 September 2008
FILE: C108-1438

EXISTING CONDITIONS

AREA 2.03 ha
COEFFICIENT 0.2
INTENSITY 5.85 cm/hr

Q_{EX} = 2.03 * 0.2 * 5.85 / 36 = 0.066 m^3/sec

PROPOSED CONDITIONS

AREA 2.03 ha
COEFFICIENT 0.70
INTENSITY 11.23 cm/hr

Q_{NEW} = 2.03 * 0.70 * 11.23 / 36 = 0.443 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 2.03 ha
RELEASE Q: 0.032 m^3/sec
TIME (Tc): 20 min.
PEAK Q: 0.443 m^3/sec
CA: 1.421

TIME (Tc) (min)	**INTENSITY** (cm/hr)	**PEAK Q** (cms)	**VOLUME** (cm)	**RELEASE VOLUME** (cm)	**STORAGE** (cm)
50	5.85	0.231	692.91	96.31	597
60	5.14	0.203	730.39	115.57	615
70	4.61	0.182	763.67	134.83	629
80	4.19	0.165	793.71	154.09	640
90	3.85	0.152	821.20	173.35	648
100	3.57	0.141	846.59	192.62	654
110	3.34	0.132	870.23	211.88	658
120	3.14	0.124	892.39	231.14	661
130	2.97	0.117	913.27	250.40	663
140	2.81	0.111	933.04	269.66	663
150	2.68	0.106	951.84	288.92	663
160	2.56	0.101	969.76	308.19	662

THEREFORE, MAXIMUM STORAGE REQUIRED IS **663** CUBIC METERS
Note: Storage required is estimate only, need to verify during final design stage

SHIELDS AVENUE
ELEMENTARY SCHOOL SITE

22 September 2008
C108-1438

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712}$

Q= Aci/36
Q= m^3/sec
i= cm/hr

T = Time in min.
I = Intensity (mm/hr)

Total Area = 3.24 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.85 cm/hr

Q_{EX} = 3.24 * 0.20 * 2.85 / 36 = 0.051 m^3/sec

Proposed Conditions:

area school sites = 3.24 Ha ==> c = 0.45

AC_{TOTAL}= 3.24 x 0.45 = 1.46

t_c = 20 min. ==> i = 5.47 cm/hr

Q_{NEW} = 1.46 * 5.47 / 36 = 0.221 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (ELEMENTARY SITE) **(1:2 YEAR STORM)**

PROJECT: Shields Avenue
LOCATION: Town of Tecumseh
DATE: 22 September 2008
FILE: C108-1438

EXISTING CONDITIONS

AREA 3.24 ha
COEFFICIENT 0.2
INTENSITY 2.85 cm/hr

Q_{EX} = 3.24 * 0.2 * 2.85 / 36 = 0.051 m^3/sec

PROPOSED CONDITIONS

AREA 3.24 ha
COEFFICIENT 0.45
INTENSITY 5.47 cm/hr

Q_{NEW} = 3.24 * 0.45 * 5.47 / 36 = 0.221 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 3.24 Ha
RELEASE Q: 0.051 m^3/sec
TIME (Tc): 20 min.
PEAK Q: 0.221 m^3/sec
CA: 1.458

TIME (Tc) (min)	INTENSITY (cm/hr)	PEAK Q (cms)	VOLUME (cm)	RELEASE VOLUME (cm)	STORAGE (cm)
5	14.67	0.148	44.55	15.37	29
10	8.95	0.181	108.78	30.74	78
15	6.71	0.204	183.39	46.11	137
20	5.47	0.221	265.64	61.49	204
25	4.66	0.189	283.27	76.86	206
30	4.10	0.166	298.54	92.23	206
35	3.67	0.149	312.09	107.60	204
40	3.34	0.135	324.33	122.97	201
45	3.07	0.124	335.52	138.34	197
50	2.85	0.115	345.85	153.71	192
55	2.66	0.108	355.48	169.08	186
60	2.50	0.101	364.50	184.46	180

THEREFORE, MAXIMUM STORAGE REQUIRED IS **206** CUBIC METERS
Note: Storage required is estimate only, need to verify during final design stage

SHIELDS AVENUE
ELEMENTARY SCHOOL SITE

22 September 2008
C108-1438

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711}$

T = Time in min.
I = Intensity (mm/hr)

Q= Aci/36
Q= m^3/sec
i= cm/hr

Total Area = 3.24 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 5.85 cm/hr

Q_{EX} = 3.24 * 0.20 * 5.85 / 36 = 0.105 m^3/sec

Proposed Conditions:

area school sites = 3.24 Ha ==> c = 0.45

AC_{TOTAL} = 3.24 x 0.45 = 1.46

t_c = 20 min. ==> i = 11.23 cm/hr

Q_{NEW} = 1.46 * 11.23 / 36 = 0.455 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (ELEMENTARY SITE) **(1:100 YEAR STORM)**

PROJECT: Shields Avenue
LOCATION: Town of Tecumseh
DATE: 22 September 2008
FILE: C108-1438

EXISTING CONDITIONS

AREA 3.24 ha
COEFFICIENT 0.2
INTENSITY 5.85 cm/hr

Q_{EX} = 3.24 * 0.2 * 5.85 / 36 = 0.105 m^3/sec

PROPOSED CONDITIONS

AREA 3.24 ha
COEFFICIENT 0.45
INTENSITY 11.23 cm/hr

Q_{NEW} = 3.24 * 0.45 * 11.23 / 36 = 0.455 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 3.24 ha
RELEASE Q: 0.051 m^3/sec
TIME (Tc): 20 min.
PEAK Q: 0.455 m^3/sec
CA: 1.458

TIME (Tc) (min)	INTENSITY (cm/hr)	PEAK Q (cms)	VOLUME (cm)	RELEASE VOLUME (cm)	STORAGE (cm)
20	11.23	0.455	545.55	61.49	484
30	8.41	0.341	613.37	92.23	521
35	7.54	0.305	641.31	107.60	534
40	6.86	0.278	666.55	122.97	544
45	6.31	0.255	689.63	138.34	551
50	5.85	0.237	710.95	153.71	557
55	5.47	0.221	730.80	169.08	562
60	5.14	0.208	749.41	184.46	565
65	4.86	0.197	766.95	199.83	567
70	4.61	0.187	783.55	215.20	568
75	4.39	0.178	799.33	230.57	569
80	4.19	0.170	814.38	245.94	568

THEREFORE, MAXIMUM STORAGE REQUIRED IS **569** CUBIC METERS
Note: Storage required is estimate only, need to verify during final design stage

SHIELDS AVENUE
SECONDARY SCHOOL SITE

22 September 2008
C108-1438

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712}$

Q= Aci/36
Q= m^3/sec
i= cm/hr

T = Time in min.
I = Intensity (mm/hr)

Total Area = 9.17 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.85 cm/hr

$Q_{EX} = 9.17 * 0.20 * 2.85 / 36 =$ 0.145 m^3/sec

Proposed Conditions:

area school sites = 9.17 Ha ==> c = 0.45

$AC_{TOTAL} = 9.17 \times 0.45 =$ 4.13

t_c = 20 min. ==> i = 5.47 cm/hr

$Q_{NEW} = 4.13 * 5.47 / 36 =$ 0.627 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (SECONDARY SITE) **(1:2 YEAR STORM)**

PROJECT:	Shields Avenue
LOCATION:	Town of Tecumseh
DATE:	22 September 2008
FILE:	C108-1438

EXISTING CONDITIONS

AREA	9.17 ha
COEFFICIENT	0.2
INTENSITY	2.85 cm/hr

Q_{EX} = 9.17 * 0.2 * 2.85 / 36 = 0.145 m^3/sec

PROPOSED CONDITIONS

AREA	9.17 ha
COEFFICIENT	0.45
INTENSITY	5.47 cm/hr

Q_{NEW} = 9.17 * 0.45 * 5.47 / 36 = 0.627 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY:	1:2 YEARS
TOTAL AREA:	9.17 Ha
RELEASE Q:	0.145 m^3/sec
TIME (Tc):	20 min.
PEAK Q:	0.627 m^3/sec
CA:	4.127

TIME (Tc) (min)	**INTENSITY** (cm/hr)	**PEAK Q** (cms)	**VOLUME** (cm)	**RELEASE VOLUME** (cm)	**STORAGE** (cm)
5	14.67	0.420	126.08	43.50	83
10	8.95	0.513	307.88	87.01	221
15	6.71	0.577	519.03	130.51	389
20	5.47	0.627	751.81	174.02	578
25	4.66	0.534	801.72	217.52	584
30	4.10	0.469	844.94	261.03	584
35	3.67	0.421	883.30	304.53	579
40	3.34	0.382	917.93	348.04	570
45	3.07	0.352	949.60	391.54	558
50	2.85	0.326	978.85	435.05	544
55	2.66	0.305	1006.09	478.55	528
60	2.50	0.287	1031.63	522.06	510

THEREFORE, MAXIMUM STORAGE REQUIRED IS **584** CUBIC METERS

Note: Storage required is estimate only, need to verify during final design stage

SHIELDS AVENUE 22 September 2008

SECONDARY SCHOOL SITE C108-1438

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711}$

$Q = Aci/36$

$Q = m^3/sec$

T = Time in min.

I = Intensity (mm/hr)

i = cm/hr

Total Area = 9.17 Ha

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 5.85 cm/hr

$Q_{EX} = 9.17 * 0.20 * 5.85 / 36 =$ 0.298 m^3/sec

Proposed Conditions:

area school sites = 9.17 Ha ==> c = 0.45

$AC_{TOTAL} = 9.17 \times 0.45 =$ 4.13

t_c = 20 min. ==> i = 11.23 cm/hr

$Q_{NEW} = 4.13 * 11.23 / 36 =$ 1.287 m^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS (SECONDARY SITE) **(1:100 YEAR STORM)**

PROJECT: Shields Avenue
LOCATION: Town of Tecumseh
DATE: 22 September 2008
FILE: C108-1438

EXISTING CONDITIONS

AREA 9.17 ha
COEFFICIENT 0.2
INTENSITY 5.85 cm/hr

Q_{EX} = 9.17 * 0.2 * 5.85 / 36 = 0.298 m^3/sec

PROPOSED CONDITIONS

AREA 9.17 ha
COEFFICIENT 0.45
INTENSITY 11.23 cm/hr

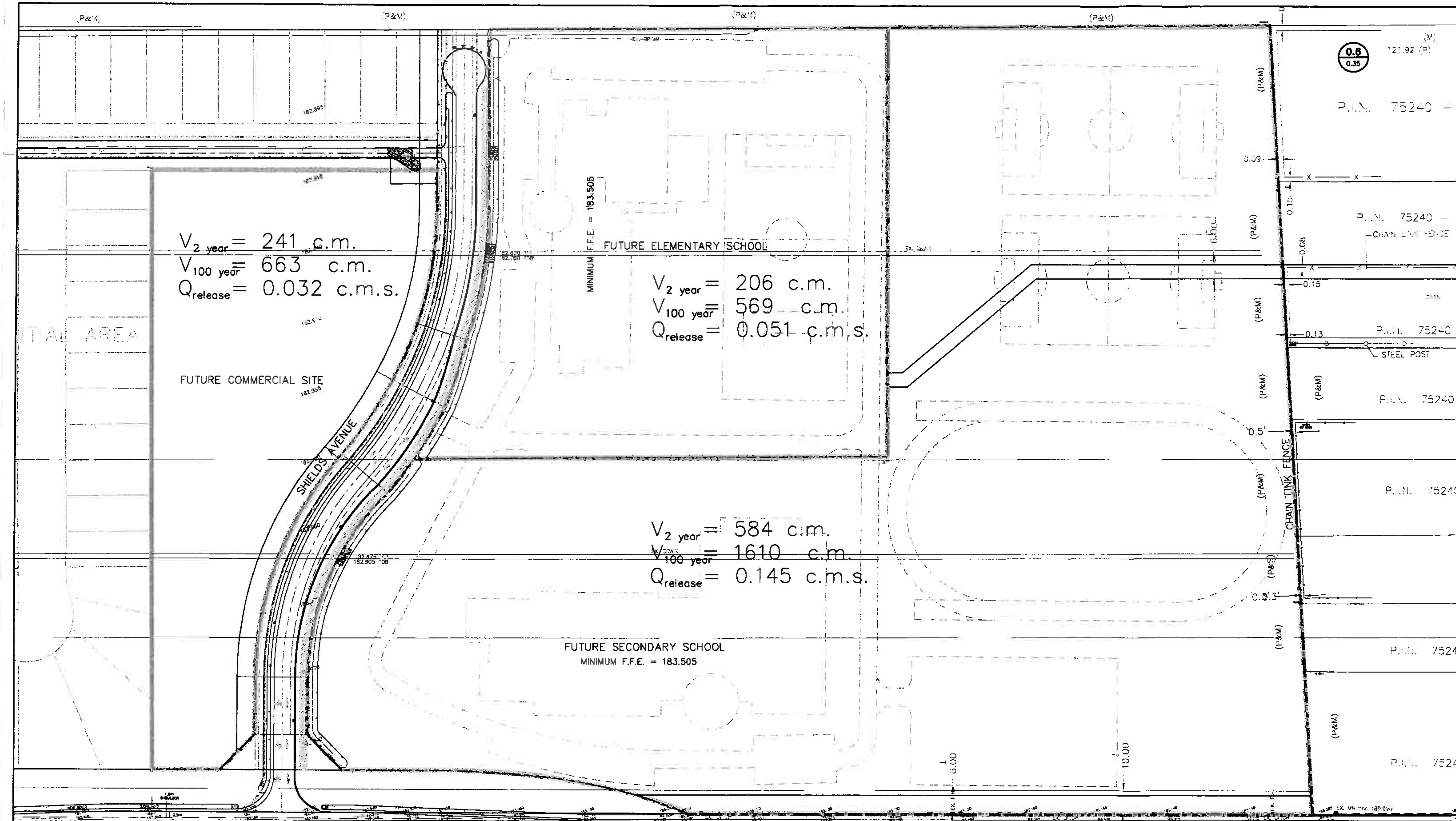
Q_{NEW} = 9.17 * 0.45 * 11.23 / 36 = 1.287 m^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 9.17 ha
RELEASE Q: 0.145 m^3/sec
TIME (Tc): 20 min.
PEAK Q: 1.287 m^3/sec
CA: 4.127

TIME (Tc) (min)	INTENSITY (cm/hr)	PEAK Q (cms)	VOLUME (cm)	RELEASE VOLUME (cm)	STORAGE (cm)
20	11.23	1.287	1544.03	174.02	1370
30	8.41	0.964	1735.99	261.03	1475
35	7.54	0.864	1815.08	304.53	1511
40	6.86	0.786	1886.49	348.04	1538
45	6.31	0.723	1951.81	391.54	1560
50	5.85	0.671	2012.16	435.05	1577
55	5.47	0.627	2068.35	478.55	1590
60	5.14	0.589	2121.02	522.06	1599
65	4.86	0.557	2170.66	565.56	1605
70	4.61	0.528	2217.65	609.06	1609
75	4.39	0.503	2262.31	652.57	1610
80	4.19	0.480	2304.90	696.07	1609

THEREFORE, MAXIMUM STORAGE REQUIRED IS **1610** CUBIC METERS
Note: Storage required is estimate only, need to verify during final design stage



				DESIGN	A.M.C.
				CHECKED	R.C.S.
				DRAWN	A.M.C.
				CHECKED	R.C.S.
				DATE	SEP 2008
NO.	REVISION	DATE	BY	SCALE	1:1500

hgs LIMITED
Consulting Engineers
WINDSOR, ONTARIO

SHIELDS AVENUE

SITE STORAGE REQUIREMENTS AND RELEASE RATES

PROJECT NO. C108-1438

SHEET NO. FIG 2

Appendix D

Storm Sewer Design Chart

STORM WATER MANAGEMENT - METRIC UNITS

PROJECT NAME: SHIELDS AVENUE
PROJECT NO. C108-1438
CLIENT: TOWN OF TECUMSEH
DATE: 22 SEPTEMBER 2008

DESIGN CRITERIA - TOWN OF TECUMSEH

STORM CURVE:	2 YEAR	C FACTORS:	LAWNS - 0.20	$I(mm/hr) = 25.0{*}T(hr)^{-0.712}$
ENTRY TIME:	45 MINUTES		PAVED - 0.90	
MIN. VELOCITY:	0.75m/s		ROOF - 0.95	
MAX. VELOCITY:	3.0m/s	n FACTOR:	0.013	

LOCATION			AREA				A X C			RAINFALL INTENSITY			Q	SEWER DESIGN									
STREET	FROM	TO	AREA ha	TOTAL AREA ha	RUNOFF COEFF "C"	INCR. AXC	TOTAL LAT. AXC	TOTAL SEWER AXC	FLOW SECT.	TIME ACCUM.	INTEN-SITY cm/HR		REQ'D cms	PIPE DIA.	SLOPE %	CAP. cms	VEL. m/s	LENGTH m	FLOW TIME MINS.	STOR-AGE CM	INV. U.S.	INV. D.S.	
SHIELDS AVE	MH 1	MH 2	3.11	3.11	0.20	0.622		0.622	0.87	45.0	3.1		0.053	0.300	0.300	0.053	0.75	39.0	0.87	3	180.915	180.798	
SHIELDS AVE	MH 2	MH 3	0.61	3.72	0.20	0.122	0.62	0.744	0.83	45.9	3.0		0.063	0.375	0.230	0.084	0.76	38.0	0.83	4	180.768	180.681	
SHIELDS AVE	MH 3	MH 4	6.81	10.53	0.20	1.362	0.74	2.106	1.63	46.7	3.0		0.175	0.600	0.120	0.213	0.75	73.5	1.63	21	180.651	180.562	
SHIELDS AVE	MH 4	MH 5	1.13	11.66	0.20	0.226	2.11	2.332	1.05	48.3	2.9		0.189	0.600	0.120	0.213	0.75	47.5	1.05	13	180.532	180.475	
SHIELDS AVE	MH 5	MH 6	3.58	15.24	0.20	0.716	2.33	3.048	1.19	49.4	2.9		0.243	0.600	0.160	0.246	0.87	62.0	1.19	18	180.445	180.346	
SHIELDS AVE	MH 6	PS					3.05	3.048	0.31	50.6	2.8		0.243	0.600	0.160	0.246	0.87	16.0	0.31	5	180.316	180.291	
																		TOTAL STORAGE =		59			

Appendix E

Storm Pumping Station Design

Shield's Avenue
Storm Pumping Station Design

22 September 2008
C108-1438

Peak Flow

Q_{peak} = 0.245 c.m.s. ==> 245 l/s

Pump Design Flow

$Q_{pump} = Q_{peak}$

Q_{pump} = 0.245 c.m.s. ==> 245 l/s

2 Overflow Pipes

$Q_{pipe} = 1/2Q_{peak}$

Q_{pipe} = 0.123 c.m.s. ==> 123 l/s

Try 300mmø @ 1.7%

Q_{pipe} = 0.123 m^3/s
D = 0.300 m
A = 0.071 m^2
Rh = 0.08 m
So = 0.017
$V = kR_h^{2/3}S_o^{1/2}/n$
V = 1.78 m/s
Q = VA
Q = **0.126** m^3/s

Shield's Avenue | **22 September 2008**
Storm Pumping Station Design | **C108-1438**

Design Flow

Flow = 0.245 c.m.s. ==> 245 l/s

Forcemain

use 375 mm diameter

velocity = flow/area
= $0.25 / (\pi \times 0.375^2 / 4)$ = 2.22 m/s

System Head Loss

Forcemain

C=120,	H_L= (0.71 x 18.9 / 1000) x 6.5 =	0.087 m
C=130,	H_L= (0.62 x 18.9 / 1000) x 6.5 =	0.036 m
C=140,	H_L= (0.54 x 18.9 / 1000) x 6.5 =	0.066 m

Fittings

Check Valve	1 x 40 x 0.375 =	15.0
Gate Valve	0 x 17 x 0.375 =	0.0
300mm dia. 45 deg. bend	1 x 15 x 0.375 =	5.6
300mm dia. 90 deg. bend	1 x 32 x 0.375 =	12.0
		32.6 m

C=120,	H_L= (0.71 x 18.9 / 1000) x 32.6 =	0.438 m
C=130,	H_L= (0.62 x 18.9 / 1000) x 32.6 =	0.382 m
C=140,	H_L= (0.54 x 18.9 / 1000) x 32.6 =	0.333 m

Static Head

C=120,	LWL =	182.760 - 179.600 =	3.16 m
C=130,	MWL =	182.760 - 180.150 =	2.61 m
C=140,	HWL =	182.760 - 180.700 =	2.06 m

Total Head Loss

LWL = 0.087 + 0.438 + 3.160 = 3.69 m
MWL = 0.036 + 0.382 + 2.610 = 3.03 m
HWL = 0.066 + 0.333 + 2.06 = 2.46 m

Select Pump

Flygt NP3171.181 LT,
250mm dia. Volute, 274mm Impeller, 25hp

Shield's Avenue
Storm Pumping Station Design

22 September 2008
C108-1438

Pump Capacity

From Pump Curve

LWL = 249 L/s
MWL = 258 L/s
HWL = 270 L/s

Check Forcemain Velocity

$LWL = 0.249 / (\pi \times 0.375^2 / 4) =$ 2.26 m/s
$MWL = 0.258 / (\pi \times 0.375^2 / 4) =$ 2.34 m/s
$HWL = 0.270 / (\pi \times 0.375^2 / 4) =$ 2.45 m/s

Shield's Avenue
Storm Pumping Station Design

22 September 2008
C108-1438

Buoyancy Calculation

	Metric		
Pump Station Chamber Size	2400	mm	dia.
Wall Thickness	230	mm	
Outside Dimensions	2860	mm	dia.
Height of Manhole	4876	mm	

Upward Force

6.4 x 4.4 x 9.8 = **307 kN UP**

Downward Force

Weight of Structure

Flat Cap	4,210	kg/pc			4,210	
Base Slab	4,620	kg/pc			4,620	
Riser Section	4,598	kg/m x	4.9	m	22,420	kg
					31,250	kg

neglecting the weight of the benching, pump and minimum water

Total Downward Force 307 **kN**

FLYGT

PERFORMANCE CURVE

PRODUCT	TYPE
NP3171.181	LT

DATE	PROJECT	CURVE NO	ISSUE
2008-09-19		63-614-00-7510	1

	1/1-LOAD	3/4-LOAD	1/2-LOAD
MOTOR COS PHI	0.85	0.80	0.70
MOTOR EFFICIENCY	86.5 %	88.0 %	88.0 %
GEAR EFFICIENCY	---	---	---

MOTOR SHAFT POWER	18.6	kW
STARTING CURRENT	141	A
RATED CURRENT ...	24	A
RATED SPEED	1165	rpm
TOT.MOM.OF INERTIA ...	0.25	kgm2
NO. OF BLADES	2	

IMPELLER DIAMETER: 274 mm

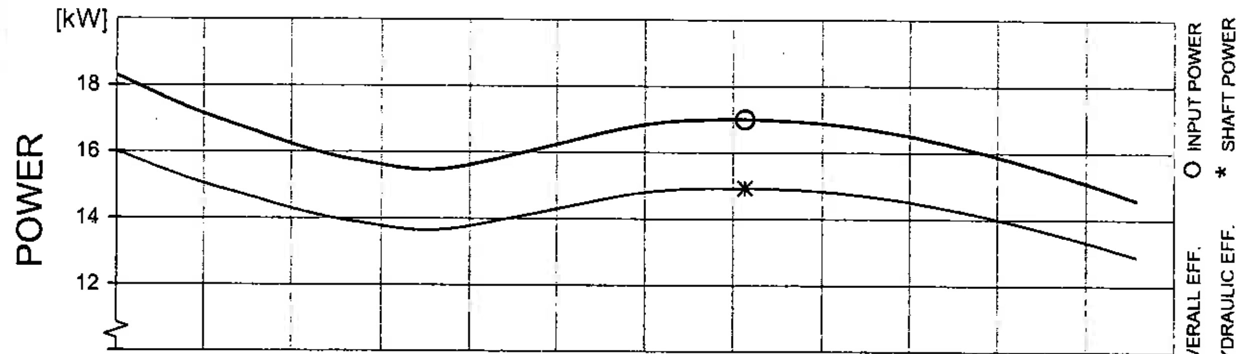
MOTORTYPE	STATOR	REV
25-18-6BB	06D	11

FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	600 V	6

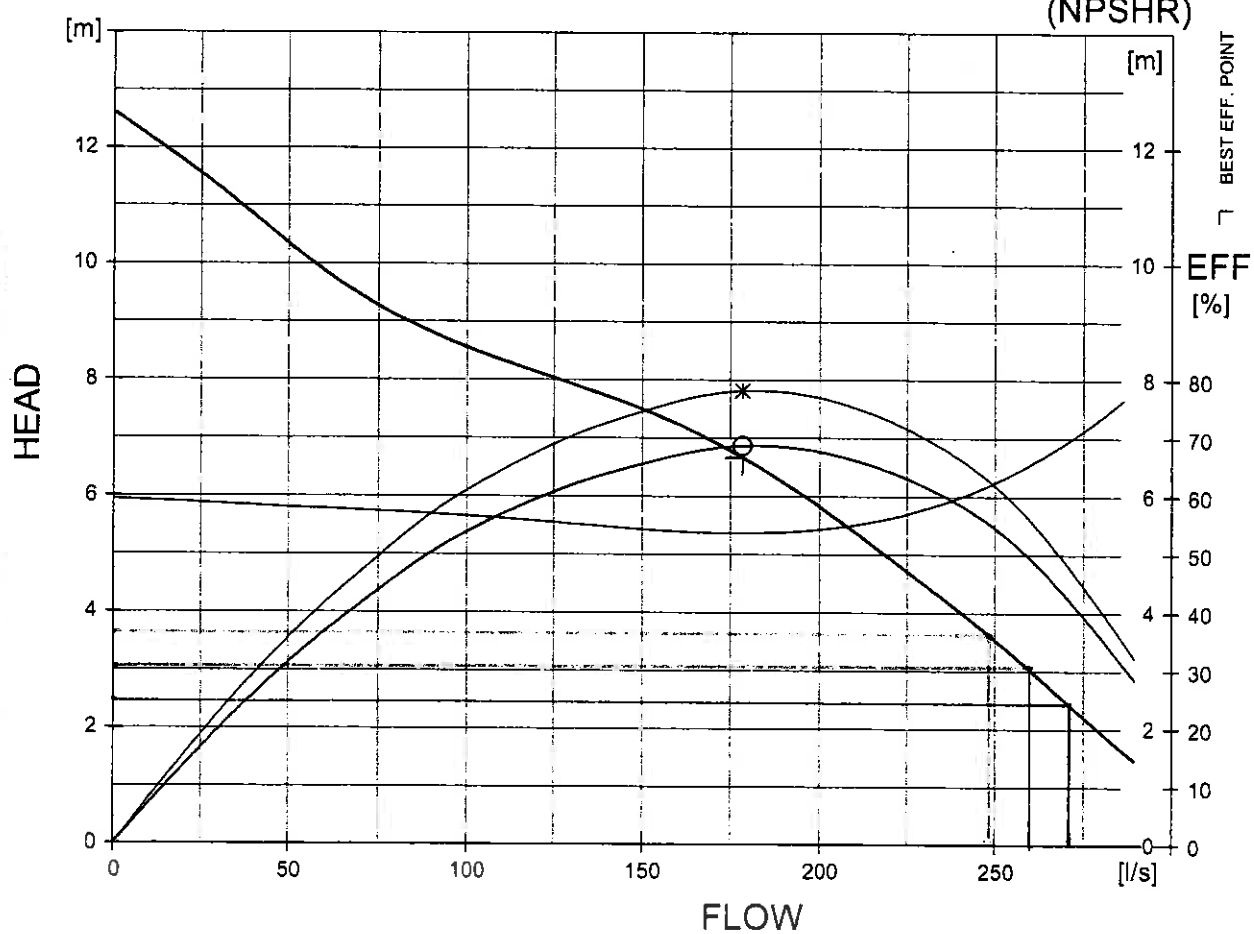
GEARTYPE	RATIO
---	---

COMMENTS

INLET/OUTLET	IMP. THROUGHLET
-/250 mm	---



DUTY-POINT	FLOW [l/s]	HEAD [m]	POWER [kW]	EFF [%]	(NPSHR)[m]
B.E.P.	178	6.67	17.0 (15.0)	68.7 (78.2)	5.4



FLYPS3.1.6.3 (20060531)

(NPSHR) = (NPSH3) + margins

Performance with clear water and rating data at 40 °C

FLYGT CURVE

TECUMSEH ACADEMY
TOWN OF TECUMSEH
STORM WATER MANAGEMENT PLAN

RC SPENCER ASSOCIATES INC.
Consulting Engineers

File No.: 09-57 **Revised 18 May 2010**

TECUMSEH ACADEMY

TOWN OF TECUMSEH

STORM WATER MANAGEMENT REPORT

REVISED 18 MAY 2010

Submitted by:
RC Spencer Associates Inc.

File No.: 09-57

Introduction

In addition to the Shields Avenue storm water management plan revised December 2008, this report provides a storm water management plan for the Tecumseh Academy site located on the east side of Banwell Road fronting Shields Avenue in the Town of Tecumseh.

The recommended storm water management (SWM) plan was selected to minimize the hydrologic impacts of the proposed Development on the existing drainage system and to protect the quality of the receiving waters in the most effective way.

Quantitative and qualitative protection measures will include:
- On site source controls
- Conveyance system controls
- End-of-pipe controls
- Construction period best management practices.

Background

The storm water management plan for Shields Avenue describes the proposed roadway and the surrounding drainage area. The Tecumseh Academy site is the 30.67 acres of land located on the south side of Shields Avenue which is zoned for an elementary and a secondary school. The original plan included a separate elementary and secondary schools; however, the site plan has been amended to a single building which will include both elementary and secondary students.

The storm sewer from the site will outlet to the storm sewer on Shields Avenue which is designed to release the pre-developed 2 year storm for the surrounding lands, therefore, the site must be restricted to release the pre-developed 2 year storm. There are two storm connections provided during the construction of Shields Avenue, and the site is divided into two drainage areas. Storm water quantity detention and quality treatment are required.

Design Criteria

The storm sewer system is restricted to the pre-developed 2 year storm based on the AES Environment Canada 2-year IDF Curve applied to the Rational Method. The site is divided into two drainage areas as shown in Figure 1. Drainage area one includes all of the parking lot area and most of the roof drainage (11.23 acres), while drainage area two includes all of the grassed area south of the building and some of the roof area (19.44 acres).

The discharge locations for the two drainage areas are the connections provided to the storm sewer on Shields Avenue. The drainage area one is connected to the manhole approximately 370’ east of Banwell, originally provided for the secondary school and drainage area two is connected to the manhole approximately 1,000’ east of Banwell, originally provided for the elementary school.

Quantity storage for the post developed conditions for minor and major storm events must be handled on site as described in the Shields Avenue Stormwater Management Report.

The minimum building elevation must be a minimum of one foot above the maximum ponding elevation on Shields Avenue. The maximum ponding elevation of Shields Avenue for the 100 year storm event is 600.40’.

In considering water quality, the criteria for the normal protection level were considered, treating the entire paved area of the parking lots.

Stormwater Quantity

The Tecumseh Academy site is required to limit outflow to pre-development runoff (C=0.2) for the developed condition. The allowable release rates provided in the Shields Avenue report for the secondary school, and elementary school sites were 5.12cfs, and 1.80cfs, respectively. Since the site was amended to a single building, the discharge points for area one and two are now restricted to 2.52cfs and 4.36cfs respectively.

The storm system for area one is designed for a restricted flow of 2.52cfs. A 6” diameter orifice plate shall be used at the outlet manhole to restrict this flow.

The storm system for area two is designed for a restricted flow of 4.36cfs. A 15” diameter pipe at 0.4% shall be used to restrict this flow.

Quantity storage for the development shall be provided in the pipe system, in the swales and on the parking lot surface as shown in the attached calculations (Appendix A). For the minor storm event, the 1:2 year storm event shall be stored underground in the pipe system only, while the 1:5 year storm event shall have a maximum of 6” of water storage in the parking lots for a water level of 599.90’ for the entire site. For the major storm event (1:100 year), the water level for the entire site is 600.40’, which provides a maximum of 1’ of water storage in the parking lots.

The overland flow from the school sites is currently routed to the temporary cut-off swales provided on the south side of Shields Avenue with ditch inlet catchbasins connecting to the storm sewer. Upon the development of this site, these catchbasins and swales are to be removed as described in the Shields Avenue report.

Stormwater Quality

It is recommended to treat the storm water runoff from area one which is the entire paved area of the site.

An oil-grit separator (OGS) is the recommended solution for this project subject to meeting the following criteria based on normal protection level:

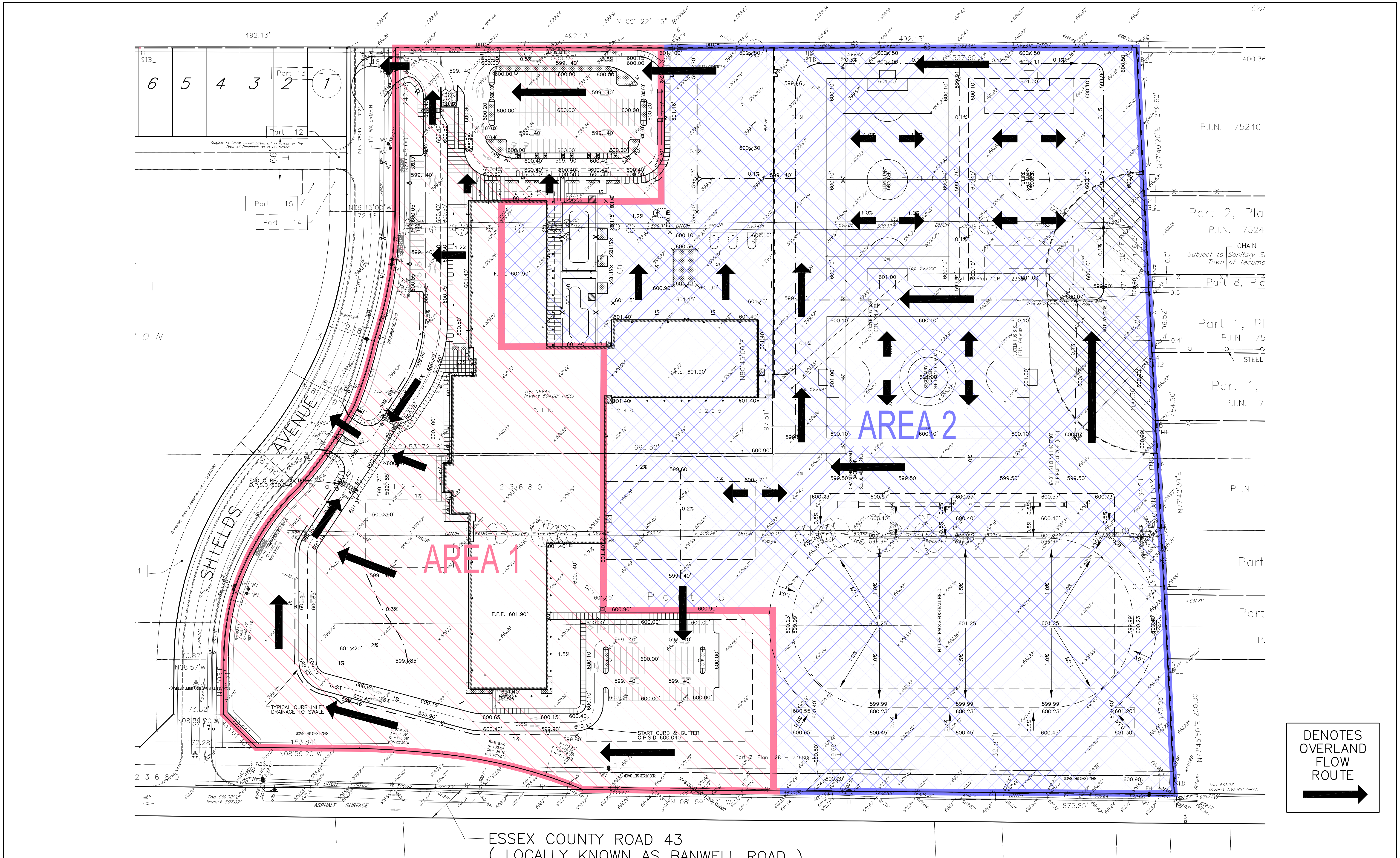
- 70% long term TSS removal
- 85% of the total runoff volume to be treated

The proposed water quality unit for this site is the Advanced Drainage Systems Water Quality Unit 3620WQA. Attached in Appendix B is the Water Quality Unit brochure, along with the removal efficiency calculations and the installation guide specifying inspection and maintenance procedures.

Sediment and Erosion Controls During Construction

During the construction phase of this development, it will be necessary to minimize the potential for impairment of the quality of the surrounding drains and existing storm sewer. It will be necessary to provide sediment control in accordance with the techniques for erosion and sediment control described in U.P.I.C. 1987 report entitled “Guidelines on Erosion and Sediment Control for Urban Construction Sites”. It is proposed to implement the following:

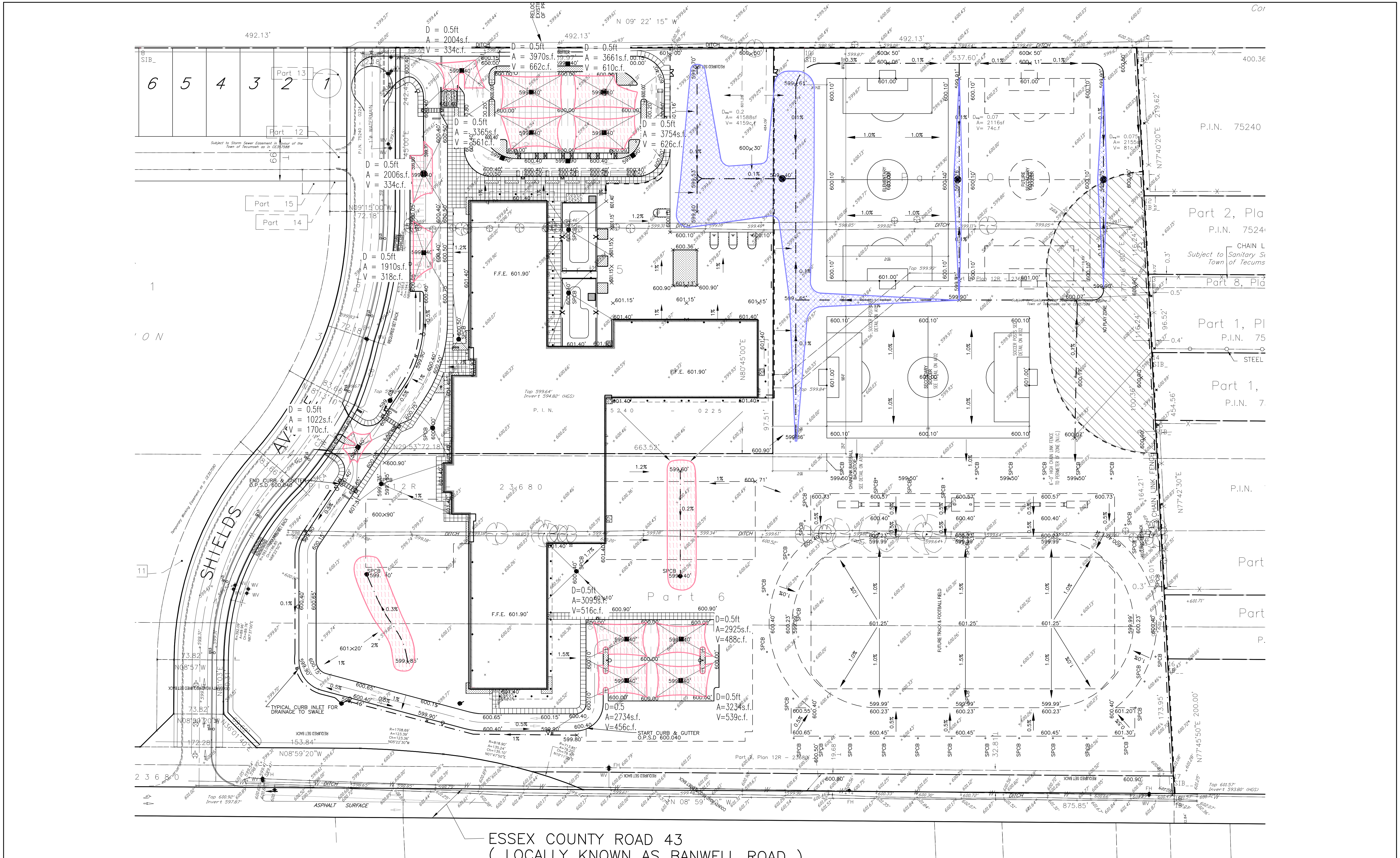
- All catchbasins on site and existing catchbasins on south side of Shields Avenue to be protected by placing filter cloth screens or Stream Guard filter devices therein.
- Silt fencing to be installed surrounding the site (OPSD 219.110).
- Straw bale check dams (OPSD 219.180) to be installed within the drains on the east and west side of the property, at the north side of construction.



RC Spencer Associates Inc. 3100 Temple Drive, Suite 100, Windsor, Ontario, N8W 5J6 Phone: (519) 944-3090 Fax: (519) 944-3636 — Professional Engineers Ontario	DESIGN A.M.C. / CHECKED R.C.S. / DRAWN A.M.C. / CHECKED R.C.S. / DATE APRIL 2009 / SCALE 1"=60'	REVISED TECUMSEH ACADEMY	PROJECT NO. 09-57	
		DRAINAGE AREAS	SHEET NO. FIG 1	OF 3

NO.	REVISION	DATE	BY	APP.	NO.	REVISION	DATE	BY	APP.
1.					6.				
2.					7.				
3.					8.				
4.					9.				
5.					10.				

09-05-01.dwg MAY 20, 2010



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CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	APRIL 2009
SCALE	1"=60'

NO.	REVISION	DATE	BY	APP.	NO.	REVISION	DATE	BY	APP.
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4.					9.				
5.					10.				

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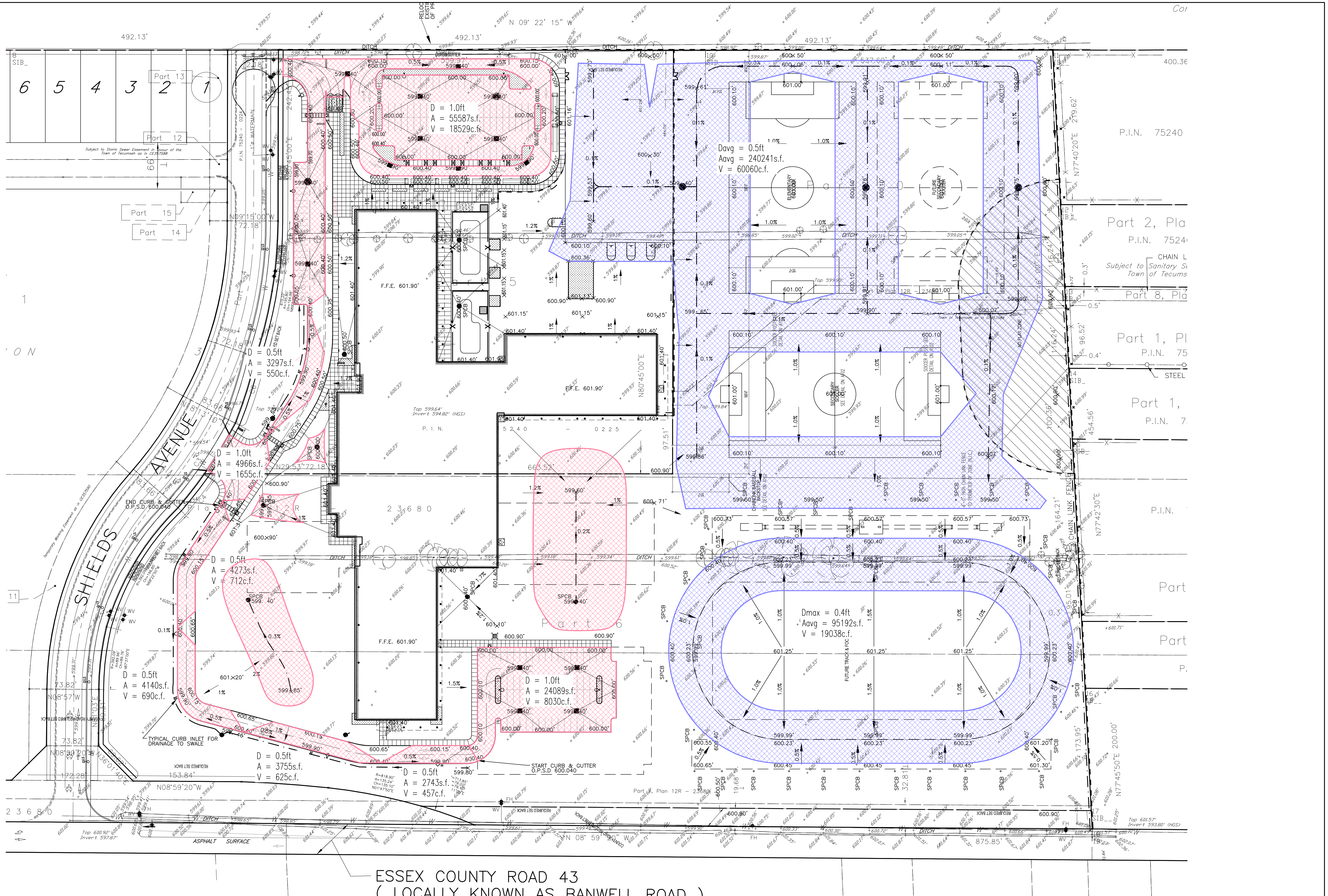
Fax: (519) 944-5636
Professional Engineers Ontario

TECUMSEH ACADEMY

STORM DETENTION CALCS
1:5 YEAR STORM

PROJECT NO. 09-57
SHEET NO. FIG 2
OF 3

09-05-01.dwg APRIL 8, 2009



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Professional Engineers Ontario

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5.					10.				

DESIGN	A.M.C.
CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	APRIL 2009
SCALE	1"=60'

TECUMSEH ACADEMY

STORM DETENTION CALCS
1:100 YEAR STORM

PROJECT NO. 09-57

SHEET NO. FIG 3

OF 3

09-05-01.dwg APRIL 8, 2009

Appendix A

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 1 - SEE FIG 1 **09-57**

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712} / 25.4$

T = Time in min.

I = Intensity (in/hr)

Q= Aci

Q= ft^3/sec

i= in/hr

Total Area = 11.23 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.12 in/hr

Q_{EX} = 11.23 * 0.20 * 1.12 = $\boxed{2.52\ ft^3/sec}$ **Release Rate*

Proposed Conditions:

area building =	2.26	acre	==>	c =	0.95
area pavement =	3.69	acre	==>	c =	0.90
area lawn=	5.28	acre	==>	c =	0.20

AC_{TOTAL}= 2.26 x 0.95 + 3.69 x 0.9 + 5.28 x 0.2= 6.52

t_c = 20 min. ==> i = 2.15 in/hr

Q_{NEW} = 6.52 x 2.15 = 14.04 ft^3/sec

$\mathbf{Q_{NEW} > Q_{EX}}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 1 - SEE FIG 1 **09-57**

STORM DETENTION CALCULATION (1:5 YEAR STORM)

$I = 32 * (T/60)^{-0.712} / 25.4$

T	=	Time in min.	Q=	Aci
I	=	Intensity (in/hr)	Q=	ft^3/sec
			i=	in/hr

Total Area = 11.23 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.43 in/hr

Q_{EX} = 11.23 * 0.20 * 1.43 = 3.222 ft^3/sec

Proposed Conditions:

area building =	2.26	acre	==>	c =	0.95
area pavement =	3.69	acre	==>	c =	0.90
area lawn=	5.28	acre	==>	c =	0.20

AC_{TOTAL}= 2.26 x 0.95 + 3.69 x 0.9 + 5.28 x 0.2= 6.52

t_c = 20 min. ==> i = 2.75 in/hr

Q_{NEW} = 6.52 x 2.75 = 17.97 ft^3/sec

$\mathbf{Q_{NEW} > Q_{EX}}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 1 - SEE FIG 1 **09-57**

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711} / 25.4$

Q= Aci

T = Time in min.

Q= ft^3/sec

I = Intensity (in/hr)

i= in/hr

Total Area = 11.23 acre

<u>Existing Conditions:</u> surface c = 0.20

t_c = 50 min. ==> i = 2.30 in/hr

Q_{EX} = 11.23 * 0.20 * 2.30 = 5.174 ft^3/sec

<u>Proposed Conditions:</u>

area building =	2.26 acre	==>	c =	0.95
area pavement =	3.69 acre	==>	c =	0.90
area lawn=	5.28 acre	==>	c =	0.20

AC_{TOTAL}= 2.26 x 0.95 + 3.69 x 0.9 + 5.28 x 0.2= 6.52

t_c = 20 min. ==> i = 4.42 in/hr

Q_{NEW} = 6.52 x 4.42 = 28.83 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS **(1:2 YEAR STORM)**

AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 May 2010
FILE: 09-57

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 1.12 in/hr

Q_{EX} = 11.23 * 0.2 * 1.12 = 2.52 ft^3/sec

PROPOSED CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.58
INTENSITY 2.15 in/hr

Q_{NEW} = 11.23 * 0.58 * 2.15 = 14.04 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 11.23 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 14.04 ft^3/sec
CA: 6.52

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
5	5.77	9.42	2825.26	755.12	2070
10	3.52	11.50	6898.98	1510.23	5389
15	2.64	12.92	11630.30	2265.35	9365
20	2.15	14.04	16846.58	3020.47	13826
25	1.84	11.98	17964.78	3775.59	14189
30	1.61	10.52	18933.29	4530.70	14403
35	1.44	9.43	19792.78	5285.82	14507
40	1.31	8.57	20568.78	6040.94	14528
45	1.21	7.88	21278.47	6796.05	14482
50	1.12	7.31	21934.04	7551.17	14383
55	1.05	6.83	22544.45	8306.29	14238
60	0.98	6.42	23116.54	9061.41	14055

THEREFORE, MAXIMUM STORAGE REQUIRED IS **14528** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:5 YEAR STORM)**

AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 May 2010
FILE: 09-57

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 1.43 in/hr

Q_{EX} = 11.23 * 0.2 * 1.43 = 3.22 ft^3/sec

PROPOSED CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.58
INTENSITY 2.75 in/hr

Q_{NEW} = 11.23 * 0.58 * 2.75 = 17.97 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:5 YEARS
TOTAL AREA: 11.23 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 17.97 ft^3/sec
CA: 6.52

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
20	2.75	17.97	21563.63	3020.47	18543
25	2.35	15.33	22994.92	3775.59	19219
30	2.06	13.46	24234.61	4530.70	19704
35	1.85	12.06	25334.76	5285.82	20049
40	1.68	10.97	26328.03	6040.94	20287
45	1.55	10.09	27236.44	6796.05	20440
50	1.43	9.36	28075.57	7551.17	20524
55	1.34	8.74	28856.90	8306.29	20551
60	1.26	8.22	29589.17	9061.41	20528
65	1.19	7.76	30279.19	9816.52	20463
70	1.13	7.36	30932.38	10571.64	20361
75	1.07	7.01	31553.16	11326.76	20226

THEREFORE, MAXIMUM STORAGE REQUIRED IS **20551** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:100 YEAR STORM)**

AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 May 2010
FILE: 09-57

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 2.30 in/hr

Q_{EX} = 11.23 * 0.2 * 2.30 = 5.17 ft^3/sec

PROPOSED CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.58
INTENSITY 4.42 in/hr

Q_{NEW} = 11.23 * 0.58 * 4.42 = 28.83 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 11.23 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 28.83 ft^3/sec
CA: 6.52

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
80	1.65	10.76	51647.96	12081.87	39566
85	1.58	10.31	52560.83	12836.99	39724
90	1.52	9.90	53436.28	13592.11	39844
95	1.46	9.52	54277.80	14347.23	39931
100	1.41	9.18	55088.40	15102.34	39986
105	1.36	8.87	55870.67	15857.46	40013
110	1.32	8.58	56626.88	16612.58	40014
115	1.27	8.31	57359.03	17367.69	39991
120	1.24	8.07	58068.89	18122.81	39946
125	1.20	7.83	58758.02	18877.93	39880
130	1.17	7.62	59427.82	19633.05	39795
135	1.14	7.42	60079.54	20388.16	39691

THEREFORE, MAXIMUM STORAGE REQUIRED IS **40014** CUBIC FEET

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 1 - SEE FIG 1 **09-57**

STORAGE VOLUME CALCULATIONS ON PARKING LOT AREA

Storage in sewers

catchbasins	(11 CB's 2'x2' 4'deep)		
	11x2'x2'x4' =	176	c.f.
Manholes	(1 MH's 4' dia. 4' deep average)		
	1x3.14x2'x2'x4' =	50	c.f.
	(2 MH's 5' dia. 6' deep average)		
	5x3.14x2.5'x2.5'x6' =	236	c.f.
	(4 MH's 6' dia. 6' deep average)		
	4x3.14x3'x3'x6' =	678	c.f.
Pipes			
	(36" dia. L=1476')		
	3.14x1.5'x1.5'x1476' =	10428	c.f.
	(30" dia. L=594')		
	3.14x1.25'x1.25'x594' =	2914	c.f.
	(12" dia. L=294')		
	3.14x0.5'x0.5'x294' =	231	c.f.
	(6" dia. L=650')		
	3.14x0.25'x0.25'x650' =	128	c.f.
	(6" dia. Big'O' w/ Clearstone L=850')		
	1.0'x1.0'x0.4x850' =	340	c.f.
subtotal in sewers		15181	c.f.

Storage provided on surface

5-year event	5614	c.f.	*Based on 6" max storage
100-year event	31248	c.f.	*Based on 12" max storage

Storage required for 2-year event	**14528**	**c.f.**	
Total Provided	**15181**	**c.f.**	**OK!**
Storage required for 5-year event	**20551**	**c.f.**	
Total Provided	**20795**	**c.f.**	**OK!**
Storage required for 100-year event	**40014**	**c.f.**	
Total Provided	**46429**	**c.f.**	**OK!**

RESTRICTION OPENING CALCULATIONS

ORIFICE PLATE CALCULATIONS @ OUTLET MANHOLE

$Q = C_d A(2gH)^{0.5}$

Q =	2.517	ft^3/s
C_d =	0.6	
g =	32.17	
H =	7.28	ft

$2.517 = 0.6\ A\ (2 \times 32.17 \times 7.28)^{0.5}$

A =	0.194	ft^2
D =	0.50	ft

Therefore, 6" Diameter Orifice plate to be installed on 15"ø outlet pipe

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712} / 25.4$

T = Time in min.
I = Intensity (in/hr)

Q= Aci
Q= ft^3/sec
i= in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.12 in/hr

Q_{EX} = 19.44 * 0.20 * 1.12 = $\boxed{4.36\ ft^3/sec}$ **Max Release Rate*

Proposed Conditions:

area building =	0.93 acre	==>	c =	0.95
area pavement =	1.37 acre	==>	c =	0.90
area lawn=	17.14 acre	==>	c =	0.20

AC_{TOTAL}= 0.93 x 0.95 + 1.37 x 0.9 + 17.14 x 0.2= 5.54

t_c = 20 min. ==> i = 2.15 in/hr

Q_{NEW} = 5.54 x 2.15 = 11.93 ft^3/sec

$\mathbf{Q_{NEW} > Q_{EX}}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 2 - SEE FIG 1 **09-57**

STORM DETENTION CALCULATION (1:5 YEAR STORM)

$I = 32 * (T/60)^{-0.712} / 25.4$

T = Time in min.

I = Intensity (in/hr)

Q= Aci

Q= ft^3/sec

i= in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.43 in/hr

Q_{EX} = 19.44 * 0.20 * 1.43 = 5.58 ft^3/sec

Proposed Conditions:

area building =	0.93	acre	==>	c =	0.95
area pavement =	1.37	acre	==>	c =	0.90
area lawn=	17.14	acre	==>	c =	0.20

AC_{TOTAL}= 0.93 x 0.95 + 1.37 x 0.9 + 17.14 x 0.2= 5.54

t_c = 20 min. ==> i = 2.75 in/hr

Q_{NEW} = 5.54 x 2.75 = 15.27 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 2 - SEE FIG 1 **09-57**

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711} / 25.4$

T	=	Time in min.	Q=	Aci
I	=	Intensity (in/hr)	Q=	ft^3/sec
			i=	in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.30 in/hr

Q_{EX} = 19.44 * 0.20 * 2.30 = 8.957 ft^3/sec

Proposed Conditions:

area building =	0.93	acre	==>	c =	0.95
area pavement =	1.37	acre	==>	c =	0.90
area lawn=	17.14	acre	==>	c =	0.20

AC_{TOTAL}= 0.93 x 0.95 + 1.37 x 0.9 + 17.14 x 0.2= 5.54

t_c = 20 min. ==> i = 4.42 in/hr

Q_{NEW} = 5.54 x 4.42 = 24.50 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS **(1:2 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 May 2010
FILE: 09-57

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 1.12 in/hr

Q_{EX} = 19.44 * 0.2 * 1.12 = 4.36 ft^3/sec

PROPOSED CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.29
INTENSITY 2.15 in/hr

Q_{NEW} = 19.44 * 0.29 * 2.15 = 11.93 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 19.44 acre
RELEASE Q: 4.09 ft^3/sec *15"ø @ 0.4%*
TIME (Tc): 20 min.
PEAK Q: 11.93 ft^3/sec
CA: 5.54

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
5	5.77	8.00	2401.08	1228.34	1173
10	3.52	9.77	5863.19	2456.67	3407
15	2.64	10.98	9884.15	3685.01	6199
20	2.15	11.93	14317.27	4913.34	9404
25	1.84	10.18	15267.58	6141.68	9126
30	1.61	8.94	16090.69	7370.02	8721
35	1.44	8.01	16821.13	8598.35	8223
40	1.31	7.28	17480.62	9826.69	7654
45	1.21	6.70	18083.76	11055.02	7029
50	1.12	6.21	18640.90	12283.36	6358
55	1.05	5.81	19159.67	13511.70	5648
60	0.98	5.46	19645.87	14740.03	4906

THEREFORE, MAXIMUM STORAGE REQUIRED IS **9404** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:5 YEAR STORM)**

AREA 2 - SEE FIG 1

PROJECT:	Tecumseh Academy
LOCATION:	Town of Tecumseh
DATE:	Revised 12 May 2010
FILE:	09-57

EXISTING CONDITIONS

AREA	19.44	acre
COEFFICIENT	0.2	
INTENSITY	1.43	in/hr

Q_{EX} = 19.44 * 0.2 * 1.43 = 5.58 ft^3/sec

PROPOSED CONDITIONS

AREA	19.44	acre
COEFFICIENT	0.29	
INTENSITY	2.75	in/hr

Q_{NEW} = 19.44 * 0.29 * 2.75 = 15.27 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY:	1:5	YEARS	
TOTAL AREA:	19.44	acre	
RELEASE Q:	4.09	ft^3/sec	*15"ø @ 0.4%*
TIME (Tc):	20	min.	
PEAK Q:	15.27	ft^3/sec	
CA:	5.54		

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
10	4.51	12.51	7504.88	2456.67	5048
15	3.38	11.25	10121.37	3685.01	6436
20	2.75	15.27	18326.11	4913.34	13413
25	2.35	13.03	19542.51	6141.68	13401
30	2.06	11.44	20596.08	7370.02	13226
35	1.85	10.25	21531.05	8598.35	12933
40	1.68	9.32	22375.20	9826.69	12549
45	1.55	8.57	23147.22	11055.02	12092
50	1.43	7.95	23860.36	12283.36	11577
55	1.34	7.43	24524.38	13511.70	11013
60	1.26	6.99	25146.71	14740.03	10407
65	1.19	6.60	25733.13	15968.37	9765

THEREFORE, MAXIMUM STORAGE REQUIRED IS **13413** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:100 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 May 2010
FILE: 09-57

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 2.30 in/hr

Q_{EX} = 19.44 * 0.2 * 2.30 = 8.96 ft^3/sec

PROPOSED CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.29
INTENSITY 4.42 in/hr

Q_{NEW} = 19.44 * 0.29 * 4.42 = 24.50 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 19.44 acre
RELEASE Q: 4.09 ft^3/sec *15"ø @ 0.4%*
TIME (Tc): 20 min.
PEAK Q: 24.50 ft^3/sec
CA: 5.54

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
20	4.42	24.50	29403.99	4913.34	24491
25	3.77	20.91	31362.69	6141.68	25221
30	3.31	18.37	33059.53	7370.02	25690
35	2.97	16.46	34565.61	8598.35	25967
40	2.70	14.97	35925.59	9826.69	26099
45	2.48	13.77	37169.52	11055.02	26114
50	2.30	12.77	38318.71	12283.36	26035
55	2.15	11.94	39388.86	13511.70	25877
60	2.02	11.22	40391.90	14740.03	25652
65	1.91	10.60	41337.15	15968.37	25369
70	1.81	10.06	42232.03	17196.70	25035
75	1.73	9.57	43082.54	18425.04	24657

THEREFORE, MAXIMUM STORAGE REQUIRED IS **26114** CUBIC FEET

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 2 - SEE FIG 1 **09-57**

STORAGE VOLUME CALCULATIONS ON PARKING LOT AREA

<u>Storage in sewers</u>

Manholes	(4 MH's 4' dia. 5' deep average)		
	4x3.14x2'x2'x5' =	251	c.f.
	(1 MH's 5' dia. 6' deep average)		
	1x3.14x2.5'x2.5'x6' =	118	c.f.
	(1 MH's 6' dia. 6' deep average)		
	1x3.14x3'x3'x6' =	170	c.f.
Pipes			
	(30" dia. L=649')		
	3.14x1.25'x1.25'x649' =	3184	c.f.
	(24" dia. L=1359')		
	3.14x1'x1'x1359' =	4267	c.f.
	(15" dia. L=185')		
	3.14x0.625'x0.625'x185' =	227	c.f.
	(12" dia. L=272')		
	3.14x0.5'x0.5'x272' =	214	c.f.
	(6" dia. L=265)		
	3.14x0.25'x0.25'x265' =	52	c.f.
	(6" dia. Big'O' w/ Clearstone L=2687')		
	1.0'x1.0'x0.4x2687' =	1075	c.f.
subtotal in sewers		<u>9557</u>	<u>c.f.</u>

<u>Storage provided on surface</u>

5-year event	4314	c.f.	*Based on water level = 599.90'
100-year event	79098	c.f.	*Based on water level = 600.40'

Storage required for 2-year event	**9404**	**c.f.**	
Total Provided	**9557**	**c.f.**	**OK!**
Storage required for 5-year event	**13413**	**c.f.**	
Total Provided	**13871**	**c.f.**	**OK!**
Storage required for 100-year event	**26114**	**c.f.**	
Total Provided	**88655**	**c.f.**	**OK!**

TECUMSEH ACADEMY **Revised 12 May 2010**

AREA 2 - SEE FIG 1 **09-57**

RESTRICTION CALCULATIONS

Storm Drainage Piping Using 15"ø @ 0.4%

Q_{max} =	**4.36**	ft^3/s
D =	15	"
A =	1.227	ft^2
R_h =	0.313	ft
S_o =	0.004	
$V = kR_h^{2/3}S_o^{1/2}/n$		
V =	3.34	ft/s
Q = VA		
Q =	**4.09**	ft^3/s

Appendix B

ADVANCED DRAINAGE SYSTEMS NET ANNUAL TSS REMOVAL EFFICIENCY

Units:	Metric	
Project Location:	Windsor	
Mean Annual Rainfall:	805.20	mm
Site Drainage Area:	4.54	ha
Runoff Coefficient, C:	0.61	
Length, L:	0.25	km
Slope, S:	0.1	%
Assumed Sediment:	F-95	
Proposed Unit:	3620WQA	
Number of Units:	1	
Time of Concentration:	0.33	hrs
Intensity Scaling Factor:	20.74	
Restricted Flow per Unit:	0.071	m3/s

	Rainfall Intensities for Standard Return Periods (mm/hr)					
Duration (h)	2 year	5 year	10 year	25 year	50 year	100 year
0.083	138.2	178.6	206.3	240.4	266.4	291.7
0.167	84.6	109.5	126.5	147.5	163.4	179.0
0.25	63.5	82.2	95.0	110.8	122.8	134.5
0.50	38.9	50.4	58.2	68.0	75.3	82.5
1	23.8	30.9	35.7	41.7	46.2	50.6
2	14.6	18.9	21.9	25.6	28.3	31.0
6	6.7	8.7	10.1	11.8	13.1	14.3
12	4.1	5.3	6.2	7.2	8.0	8.8
24	2.5	3.3	3.8	4.4	4.9	5.4

	Runoff (Rational Method) for Standard Return Periods (m3/s)					
Duration (h)	2 year	5 year	10 year	25 year	50 year	100 year
0.083	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.167	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.5	0.299	0.388	0.448	0.523	0.579	0.635
1	0.183	0.238	0.275	0.321	0.355	0.389
2	0.112	0.146	0.168	0.197	0.218	0.239
6	0.051	0.067	0.078	0.091	0.100	0.110
12	0.032	0.041	0.048	0.056	0.062	0.068
24	0.019	0.025	0.029	0.034	0.038	0.041

Removal Efficiency-Treated Flow:	84.53%
Net Removal Efficiency:	70.13%
Portion of Total Runoff Treated:	79.56%
(Restricted) Removal Efficiency-Treated Flow:	84.53%
(Restricted) Net Removal Efficiency:	75.75%
(Restricted) Portion of Total Runoff Treated:	87.54%

For more information about this Efficiency Calculation Spreadsheet please contact:

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506.455.2888

Water Quality Units

*The Most **Advanced** Name in Drainage Systems®*

ADS

WATER QUALITY UNITS

Standards for storm water quality will necessarily vary by location and land use. The most targeted sources of runoff pollution are paved areas in urban and industrial sites. These are generally small (< 1 acre), or 40 ha with high traffic loads, such as parking lots and gas stations, that generate significant concentrations of contaminant particles and hydrocarbons.

Because of land constraints, ADS underground Water Quality Units have become an increasingly efficient solution for treating storm water. These durable, lightweight structures have been specifically designed for fast installation and easy maintenance.

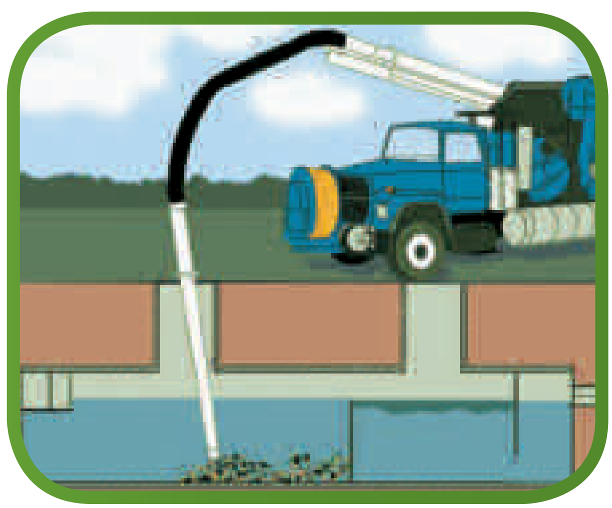
BENEFITS

- Independent testing shows the following:
  - 80% TSS removal
  - 80% oil & grease removal
  - Greater than 43% TP removal
  - 74% heavy metals removal
- Removes floatable debris such as oils and greases.
- Available in 36" (900mm) through 60" (1500mm) diameters.
- Lightweight High Density Polyethylene (HDPE) unit installs easily with a minimum of manpower. Heavy cranes are not necessary to install the unit.
- Each unit is fitted with access risers for easy inspection and maintenance of the sediment and oil chambers.
- The unit is inexpensive because the design is simple and there are no moving parts.
- The bypass system prevents re-suspension of captured solids by diverting water flows greater than the first flush.
- HDPE resists abrasion and chemicals found in storm water and in the surrounding soil.

The ADS Water Quality Unit (above) is lightweight and easy to install, requiring little in the way of manpower or heavy equipment.

A bypass system (above right) is installed to prevent water flows greater than the first flush from re-suspending captured pollutant particles.

The ADS Water Quality Unit (below) is fitted with access risers for easy inspection and maintenance.



STANDARD MODELS

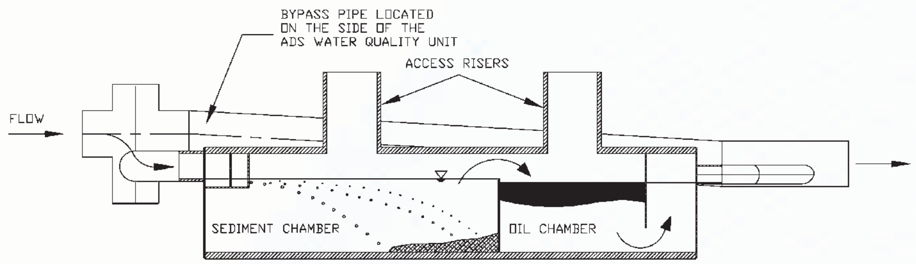
Product Number	Diameter in (mm)	Length ft (m)	Inlet Size in (mm)	Outlet Size in (mm)	Treated Flow Rate cfs (L/S)	Sed. Vol. ft^3 (m^3)	Oil Vol. ft^3 (m^3)	Sieve Size
3620WQA	36 (900)	20 (6)	10 (250)	10 (250)	1.5 (42)	65 (1.8)	30 (0.8)	140
3640WQA	36 (900)	40 (12)	10 (250)	10 (250)	2.38 (67)	137 (3.9)	63 (1.8)	140
3620WQB	36 (900)	20 (6)	10 (250)	10 (250)	0.7 (20)	65 (1.8)	30 (0.8)	200
3640WQB	36 (900)	40 (12)	10 (250)	10 (250)	1.6 (45)	137 (3.9)	63 (1.8)	200
4220WQA	42 (1050)	20 (6)	12 (300)	12 (300)	1.75 (49)	83 (2.3)	38 (1.1)	140
4240WQA	42 (1050)	40 (12)	12 (300)	12 (300)	3.66 (104)	175 (5.)	81 (2.3)	140
4220WQB	42 (1050)	20 (6)	12 (300)	12 (300)	0.86 (24)	83 (2.3)	38 (1.1)	200
4240WQB	42 (1050)	40 (12)	12 (300)	12 (300)	1.83 (52)	175 (5.)	81 (2.3)	200
4820WQA	48 (1200)	20 (6)	12 (300)	12 (300)	2.26 (64)	116 (3.3)	55 (1.6)	140
4840WQA	48 (1200)	40 (12)	12 (300)	12 (300)	3.94 (112)	245 (6.9)	115 (3.3)	140
4820WQB	48 (1200)	20 (6)	12 (300)	12 (300)	1.13 (32)	116 (3.3)	55 (1.6)	200
4840WQB	48 (1200)	40 (12)	12 (300)	12 (300)	2.39 (68)	245 (6.9)	115 (3.3)	200
6020WQA	60 (1500)	20 (6)	15 (375)	15 (375)	2.95 (84)	183 (5.2)	87 (2.5)	140
6040WQA	60 (1500)	40 (12)	15 (375)	15 (375)	6.23 (176)	385 (10.9)	184 (5.2)	140
6020WQB	60 (1500)	20 (6)	15 (375)	15 (375)	1.47 (42)	183 (5.2)	87 (2.5)	200
6040WQB	60 (1500)	40 (12)	15 (375)	15 (375)	3.12 (88)	385 (10.9)	184 (5.2)	200

140 sieve is equal to a particle size of 0.0042" (0.106mm) 200 sieve is equal to a particle size of 0.0030" (0.075mm)

DESIGN VARIATIONS

The standard models listed above will provide efficient removal of pollutant particles and hydrocarbons for the majority of site conditions. For unusual conditions, ADS can recommend a system combining a variety of sizes and configurations.

ADS STORM WATER QUALITY UNIT



Unit configuration & availability subject to change without notice. Product detail may differ slightly from actual product appearance.

PEAK FLOW RATE

The by-pass pipe of the ADS WQU is designed to convey the peak storm water flow of the storm line.

For example, @ a 1% slope, peak flow rates for the by-pass line are as follows:

	CFS	L/S
12"	3.8419	103.9
15"	6.971	188.0
18"	11.343	307.0
24"	24.451	661.0
30"	44.37	1,240.0
36"	72.19	1,950.0
42"	108.95	2,950.0
48"	155.61	4,210.0
60"	282.36	7,630.0

DESIGN AND INSTALLATION

Available in 36” (900mm) through 60” (1500mm) diameters, ADS Water Quality Units are modified sections of N-12® pipe with weir plates at certain locations and heights to remove high percentages of sediment and oils from the first flush of a storm event. They can be installed at any point in the subsurface drainage system, and are ideally suited to treat “hot spots” in existing storm water lines.

The unit is designed using the fundamental principles of Stoke’s Law and a standard orifice outlet control. The settling velocity of a particle is calculated based on the smallest particle to be removed. Standard units offer a choice of 140 or 200 sieve size removal.

The outlet orifice is sized to release a typical first flush discharge, and to redirect any excess flow to a bypass piping system installed with the unit.

140 Sieve Size	200 Sieve Size
0.0042" Particle Diameter 0.106 mm	0.0030" Particle Diameter 0.075 mm

SIZING AND INSTALLATION

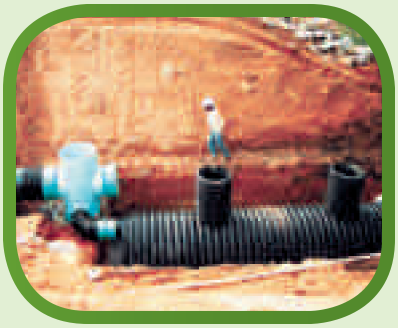
Installation of Water Quality Units follows the same accepted practices as for the installation of large diameter flexible pipe.

Specific installation instructions, along with details on specifying the proper size of a Water Quality Unit, are available in Technical Note 1.03 & Installation Guide 2.01. You can also find more information on our website at www.ads-pipe.com.

TOP: Setting the Water Quality Unit and the inlet tee fitting

MIDDLE: Bedding and backfilling the unit in 12” lifts

BOTTOM: Backfill over the Water Quality Unit and installation of bypass line complete



THE HEART OF THE TREATMENT TRAIN

For many drainage sites, the Water Quality Unit by itself can provide the required degree of pollutant removal. However, certain sites with higher concentrations of hydrocarbons or sediment runoff will need further treatment upstream and/or downstream of the Unit. This multi-tiered approach to storm water quality is known as the *treatment train*.

Upstream measures include sediment prevention (vegetated swales, etc.) and inlet protection devices such as screens, filters and silt fences. These techniques are designed to prevent a large percentage of pollutants from ever entering the storm drain system. For impervious surfaces such as paved parking areas, catch basin insert filters are most commonly used for early stage treatment.

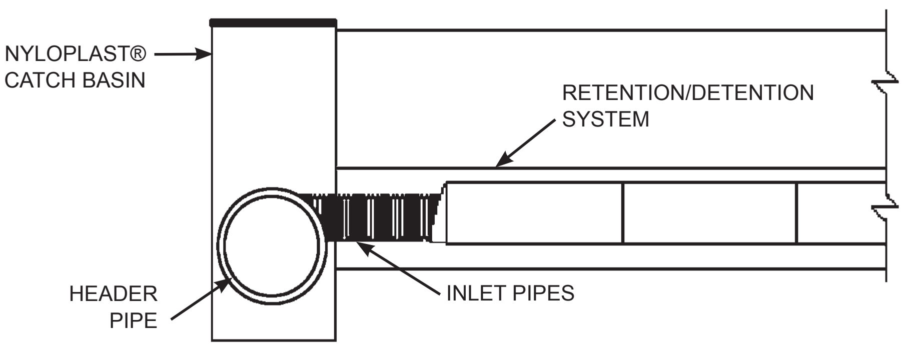
RETENTION/DETENTION

Treatment downstream from the Water Quality Unit generally involves some form of retention or detention system. Retention allows accumulated storm water to gradually percolate into the surrounding soil, while detention meters the water through an outlet to a ditch, stream or other receiving area.

Inlet designs to such underground storage vessels can also enhance pollutant removal. The "eccentric header system" consists of a large diameter manifold pipe with an invert positioned lower than those of the smaller inlet pipes to the storage vessels. The large header pipe thus acts as a sump into which suspended particles may settle. Manholes and/or risers may be installed to facilitate inspection and cleaning.

Designers can choose between two methods of constructing the retention or detention system. The first is the use of ADS N-12® large diameter corrugated high density polyethylene pipe, known for its economy and ease of installation. The second option is StormTech®, specially engineered to meet the demands of subsurface storm water management applications.

ADS supplies a complete line of pipe, fittings and fabricated manifolds, along with detailed sizing, design and installation instructions on our website at www.ads-pipe.com.



The "eccentric header" is installed with its invert lower than the inlet pipes, thus acting as a sump to collect suspended sediment.

ADS STORM WATER QUALITY UNIT PRODUCT SPECIFICATION

SCOPE

This specification describes 36- through 60-inch (900 to 1500 mm) Storm Water Quality Units for use in on-site point source storm water treatment applications.

REQUIREMENTS

Storm Water Quality Units shall have a smooth interior and annular exterior corrugations. The unit shall have at least three containment zones, each zone separated from the next by use of a weir or baffle plate Weir and baffle plates shall be welded at all interfaces between the plate and water quality unit. First weir plate shall incorporate a saw tooth design and shall be reinforced with stiffeners positioned horizontally on the downstream side of the plate to be retained. Storm Water Quality Units shall provide adequate clean-out and inspection access.

JOINT PERFORMANCE

Connections for the bypass line and the unit shall utilize the same joint quality as specified for the main storm sewer pipe. Couplers for the bypass line may be either split couplers, in-line bell couplers, snap couplers, bell-bell couplers, or welded bell couplers.

MATERIAL PROPERTIES

Virgin material for pipe & fittings used to produce Storm Water Quality Units shall be high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250 mm) diameters, and 435400C for 12- through 60-inch (300 to 1500mm) diameters as defined and described in the latest version of ASTM D3350. The virgin pipe material shall be evaluated using the notched constant ligament-stress (NCLS) test as specified in Section 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectively. All smooth baffle and weir plates shall be high density polyethylene.

INSTALLATION

Installation shall be in accordance with the ADS installation guidelines, utilizing a class I (ASTM D2321) structural backfill material or flowable fill (CLSM – Controlled Low Strength Material). Contact your local ADS representative or visit www.ads-pipe.com for the latest installation instructions.

PERFORMANCE

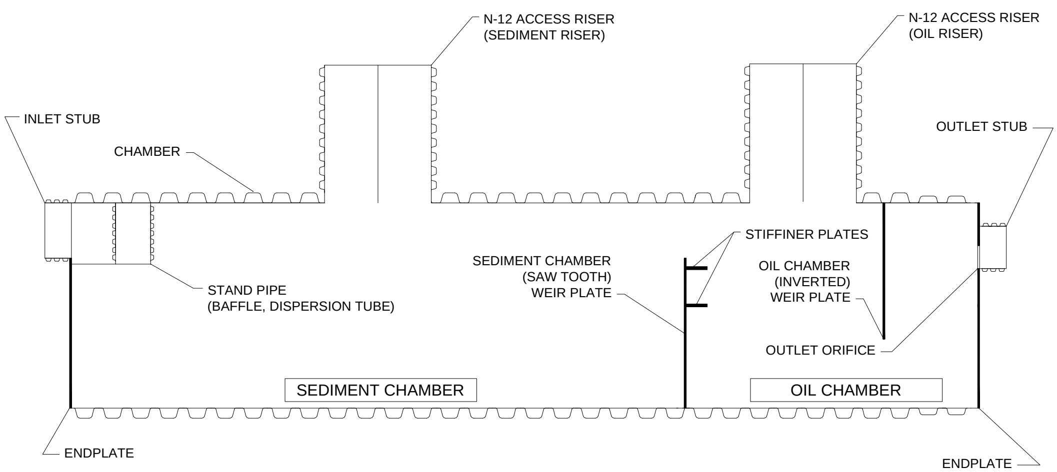
Water Quality Units shall remove a minimum of 80% of the first flush total suspended solids (TSS) based on flow rates and corresponding sieve sizes shown in Table 1. Water Quality units shall be installed “offline” to prevent re-suspension of solids in high flow situations. Offline installation shall be constructed utilizing an ADS By-Pass structure. Flow through the unit shall be controlled by an orifice fabricated on the outlet end of the structure.

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

Description / Basic Function

The ADS Water Quality Unit harnesses the proven concepts utilized in municipal sewage treatment systems and transforms it into a compact Water Quality Unit.

The unit is ideal for storm water applications including gas stations and fast food restaurants; this system gives you a highly effective BMP solution to meet EPA requirements.



Risers

The ADS Water Quality Unit consists of two risers. A 24" riser is centered over Sediment and Oil Chambers. These two risers provide access to the individual chambers of the Storm Water Quality Unit for maintenance and inspection. Entry into the WQU should be considered an OSHA confined space and appropriate guidelines should be followed.

Maintenance Overview

The purpose of maintaining a clean and obstruction free Water Quality Unit is to ensure the system performs its intended function. A build up of debris in excess of the design storage volume could reduce the efficiency of the system.

A company specializing in such activities should perform inspection and maintenance of the Water Quality Unit.

Inspection / Maintenance Frequency for the ADS Water Quality Unit

- Inspected quarterly (4 times a year) and after major storm events.
- Cleaned (pumped and pressure washed) a minimum of once a calendar year
- Site or surrounding site conditions may require more inspections and maintenance

Inspection

An inspection should be performed when the system is installed. This allows the owner to measure the invert prior to accumulation of sediment. This survey will allow the monitoring of sediment build-up without entering the system, thereby eliminating the need for confined space entry. Documentation of pre-inspection data should be captured.

Procedures

1. In the By-Pass Structure inspect for blockage. Inspect the diversion structure and weir for damage and sediment buildup. Any damage should be repaired and sediment should be removed as required.
2. On the Water Quality Unit, locate the risers. The risers will be 24" in diameter.
3. Remove the lid of each riser. It is recommend that this be done one at a time so an open riser is not left exposed during inspection or maintenance of the other risers.
4. In the 24" riser over the Sediment Chamber, inspect the amount of floatable debris. Then measure the sediment buildup with a measuring device such as a Sludge Judge® Also inspect that the inlet pipe does not have any blockage. Blockage inspection is better suited after unit is vacuumed. Any confined space entry would be done through this riser and OSHA requirements must be followed.
5. In the 24" riser over the Oil Chamber, measure / inspect the oil depth.
6. Inspect structure and components for any damage.
7. Replace all riser lids.

Maintenance

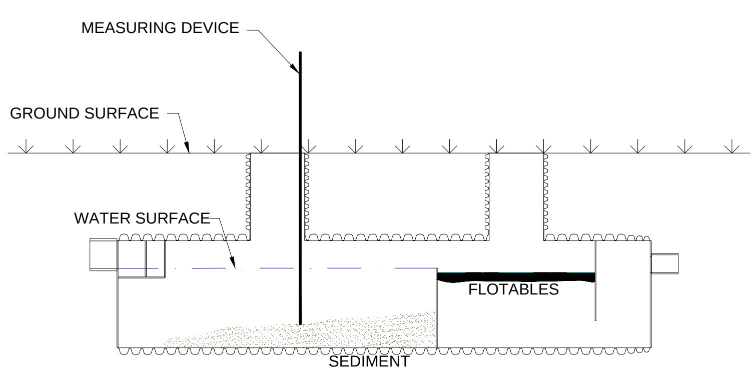
Cleaning should be performed if ***sediment volume has reduced the storage area by 20% or if the depth of sediment has reached approximately 25% of the diameter of the structure (See Table 1 for cleanout depth information).*** Furthermore, the system may need cleaning in the event a spill of a foreign substance enters the unit.

Inspection Procedures (Measuring Sediment Depth)

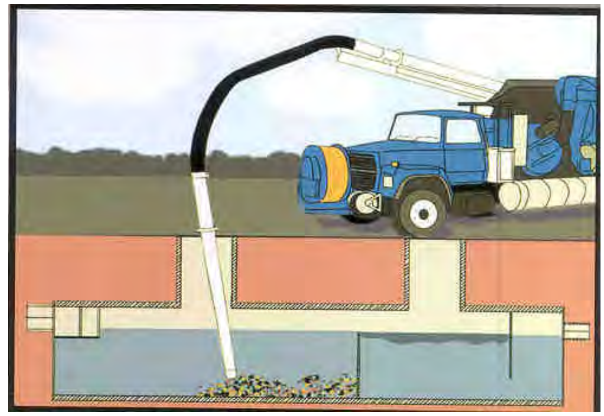
1. Lower measuring device into sediment riser of unit.
2. Read measurement at ground surface.
3. Subtract the current measurement reading from the distance between the ground surface to the invert of the SWQU (obtained when unit was first installed or is clean).
4. Compare calculated difference to the respective value in Table 1. If resulting value is equal to or greater than the respective value on the Table 1, maintenance shall be performed. The figure below illustrates the inspection procedure.

Table 1
Sediment Depth at Cleanout

Model Number	Diameter (jn)	Sediment Depth (in)
3620WQ	36	9
3640WQ	36	9
4220WQ	42	10
4240WQ	42	10
4820WQ	48	12
4840WQ	48	12
6020WQ	60	15
6040WQ	60	15



Cleaning Procedures



1. Insert vacuum hose into By-Pass Structure and pump out. Inspect By-Pass Structure for any damage.
2. Insert vacuum hose into 24" riser and pump out the Sediment Chamber. Pressure wash this Chamber if needed. Inspect for any damage. Inspect the inlet pipe for any blockage. Also inspect weir plate for damage.
3. Insert vacuum hose into other 24" riser. This will pump out the Oil Chamber. Inspect for any structural damage. Pressure wash this Chamber if needed.
4. Refill water quality unit with water.
5. Replace all riser lids.

The owner or operator is responsible for meeting all federal, state, and local laws and regulations during the maintenance and cleanout operations.

Material Disposal

Owners are responsible for complying with all federal, state, and local regulations when disposing of material collected from the storm water quality unit. Water and sediment from cleanout procedures should not be dumped into sanitary sewer.

TECUMSEH VISTA ACADEMY

TOWN OF TECUMSEH

ADDENDUM/REVISION TO STORM WATER MANAGEMENT REPORT

18 MAY 2010

LICENSED PROFESSIONAL ENGINEER
R.C. SPENCER
43858018
PROVINCE OF ONTARIO

Submitted by:
RC Spencer Associates Inc.

File No.: 09-57/14-383

14 July 2014
File No.: 14-383

Tecumseh Vista Academy
Addendum/Revision to Storm Water Management Report
Executive Summary

The following provides our executive summary of the storm water management calculations dated 12 June 2014. These calculations are an amendment to the original storm water management plan dated 18 May 2010. It is understood that the proposed portables and hard surfaces are a temporary condition and are to be removed prior to constructing the future addition.

As required by the original design, the storm sewer system is restricted to the pre-developed 2 year storm event, and any additional flow from the portables and surrounding hard surfaces will be stored on site along with the storage provided for the existing development. The release rate from the current storm outlets to Shields Avenue **will not change** due to the addition of the portables and surrounding hard surfaces.

Currently, the site is divided into two separate drainage areas, which outlet to Shields Avenue. The portables at the North West corner of the school are to be included in Drainage Area 1, and the portables at the South East corner of the school are to be included in Drainage Area 2. The maximum water elevation for a 5 year storm event in both areas is 599.90', which provides a maximum 6" depth of storage at the catchbasins in the parking lot. The maximum water elevation for a 100 year storm event in both areas is 600.40', which provides a maximum 12" depth of storage at the catchbasins in the parking lot.

In order to accommodate the additional storage for the portables in Area 2, a small dry pond was added to the grassed area south east of the portables. The maximum water level for a 2 year storm event is 599.40' (minimum parking lot catchbasin elevation), with the pond catchbasin at an elevation of 599.10'. This provides for a maximum depth in the pond of only 0.3' (3.6") during the 2 year storm event, and 1.3' (15.6") during the 100 year storm event.

The minimum building elevation shall be **601.40'**, which is 1' above the 100 year water level. The building elevation provided for the existing school site is actually **601.90'** (additional 6" freeboard).

The existing flow restriction to the Area 2 drainage area (15 inch diameter sewer @ 0.40%, Qcap = 4.09 c.f.s. < Qmax = 4.36 c.f.s.) remains in place, as approved by the Town's third party engineer, Dillon Consulting, and the Essex Region Conservation Authority (by Permit). However, the Town of Tecumseh is requiring that an orifice be placed in the upstream manhole of the 15 inch diameter sewer flow restriction. We therefore include the orifice plate calculations in the report, requiring that an 8" diameter orifice be installed in the 15" diameter outlet restriction pipe.

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 1 - SEE FIG 1 **14-383**

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712} / 25.4$

Q= Aci

T = Time in min.

Q= ft^3/sec

I = Intensity (in/hr)

i= in/hr

Total Area = 11.23 acre

<u>Existing Conditions:</u>

surface c = 0.20

t_c = 50 min. ==> i = 1.12 in/hr

Q_{EX} = 11.23 * 0.20 * 1.12 = $\boxed{2.52\ ft^3/sec}$ **Release Rate*

<u>Proposed Conditions:</u>

area building =	2.40 acre	==>	c =	0.95
area pavement =	3.90 acre	==>	c =	0.90
area lawn=	4.93 acre	==>	c =	0.20

AC_{TOTAL}= 2.40 x 0.95 + 3.90 x 0.9 + 4.93 x 0.2= 6.78

t_c = 20 min. ==> i = 2.15 in/hr

Q_{NEW} = 6.78 x 2.15 = 14.58 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 1 - SEE FIG 1 **14-383**

STORM DETENTION CALCULATION (1:5 YEAR STORM)

$I = 32 * (T/60)^{-0.712} / 25.4$

Q= Aci

Q= ft^3/sec

i= in/hr

T = Time in min.

I = Intensity (in/hr)

Total Area = 11.23 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.43 in/hr

Q_{EX} = 11.23 * 0.20 * 1.43 = 3.222 ft^3/sec

Proposed Conditions:

area building =	2.40 acre	==>	c =	0.95
area pavement =	3.90 acre	==>	c =	0.90
area lawn=	4.93 acre	==>	c =	0.20

AC_{TOTAL}= 2.40 x 0.95 + 3.90 x 0.9 + 4.93 x 0.2= 6.78

t_c = 20 min. ==> i = 2.75 in/hr

Q_{NEW} = 6.78 x 2.75 = 18.66 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 1 - SEE FIG 1 **14-383**

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711} / 25.4$

Q= Aci

T = Time in min.

Q= ft^3/sec

I = Intensity (in/hr)

i= in/hr

Total Area = 11.23 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.30 in/hr

Q_{EX} = 11.23 * 0.20 * 2.30 = 5.174 ft^3/sec

Proposed Conditions:

area building =	2.40 acre	==>	c =	0.95
area pavement =	3.90 acre	==>	c =	0.90
area lawn=	4.93 acre	==>	c =	0.20

AC_{TOTAL}= 2.40 x 0.95 + 3.90 x 0.9 + 4.93 x 0.2= 6.78

t_c = 20 min. ==> i = 4.42 in/hr

Q_{NEW} = 6.78 x 4.42 = 29.95 ft^3/sec

Q_{NEW} > Q_{EX} **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS **(1:2 YEAR STORM)**
AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 June 2014
FILE: 14-383

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 1.12 in/hr

Q_{EX} = 11.23 * 0.2 * 1.12 = 2.52 ft^3/sec

PROPOSED CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.60
INTENSITY 2.15 in/hr

Q_{NEW} = 11.23 * 0.60 * 2.15 = 14.58 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 11.23 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 14.58 ft^3/sec
CA: 6.78

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
5	5.77	9.78	2934.39	755.12	2179
10	3.52	11.94	7165.47	1510.23	5655
15	2.64	13.42	12079.53	2265.35	9814
20	2.15	14.58	17497.31	3020.47	14477
25	1.84	12.44	18658.70	3775.59	14883
30	1.61	10.92	19664.62	4530.70	15134
35	1.44	9.79	20557.31	5285.82	15271
40	1.31	8.90	21363.28	6040.94	15322
45	1.21	8.19	22100.38	6796.05	15304
50	1.12	7.59	22781.27	7551.17	15230
55	1.05	7.10	23415.27	8306.29	15109
60	0.98	6.67	24009.45	9061.41	14948

THEREFORE, MAXIMUM STORAGE REQUIRED IS **15322** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:5 YEAR STORM)**
AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 June 2014
FILE: 14-383

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 1.43 in/hr

Q_{EX} = 11.23 * 0.2 * 1.43 = 3.22 ft^3/sec

PROPOSED CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.60
INTENSITY 2.75 in/hr

Q_{NEW} = 11.23 * 0.60 * 2.75 = 18.66 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:5 YEARS
TOTAL AREA: 11.23 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 18.66 ft^3/sec
CA: 6.78

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
20	2.75	18.66	22396.56	3020.47	19376
25	2.35	15.92	23883.13	3775.59	20108
30	2.06	13.98	25170.71	4530.70	20640
35	1.85	12.53	26313.35	5285.82	21028
40	1.68	11.39	27345.00	6040.94	21304
45	1.55	10.48	28288.49	6796.05	21492
50	1.43	9.72	29160.03	7551.17	21609
55	1.34	9.08	29971.54	8306.29	21665
60	1.26	8.54	30732.09	9061.41	21671
65	1.19	8.06	31448.77	9816.52	21632
70	1.13	7.65	32127.20	10571.64	21556
75	1.07	7.28	32771.95	11326.76	21445

THEREFORE, MAXIMUM STORAGE REQUIRED IS **21671** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:100 YEAR STORM)**
AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 June 2014
FILE: 14-383

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 2.30 in/hr

Q_{EX} = 11.23 * 0.2 * 2.30 = 5.17 ft^3/sec

PROPOSED CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.60
INTENSITY 4.42 in/hr

Q_{NEW} = 11.23 * 0.60 * 4.42 = 29.95 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 11.23 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 29.95 ft^3/sec
CA: 6.78

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
80	1.65	11.18	53642.94	12081.87	41561
85	1.58	10.70	54591.08	12836.99	41754
90	1.52	10.28	55500.34	13592.11	41908
95	1.46	9.89	56374.37	14347.23	42027
100	1.41	9.54	57216.28	15102.34	42114
105	1.36	9.21	58028.76	15857.46	42171
110	1.32	8.91	58814.18	16612.58	42202
115	1.27	8.63	59574.62	17367.69	42207
120	1.24	8.38	60311.89	18122.81	42189
125	1.20	8.14	61027.64	18877.93	42150
130	1.17	7.91	61723.31	19633.05	42090
135	1.14	7.70	62400.21	20388.16	42012

THEREFORE, MAXIMUM STORAGE REQUIRED IS **42207** CUBIC FEET

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 1 - SEE FIG 1 **14-383**

STORAGE VOLUME CALCULATIONS ON PARKING LOT AREA

Storage in sewers

catchbasins	(11 CB's 2'x2' 4'deep)		
	11x2'x2'x4' =	176	c.f.
Manholes	(1 MH's 4' dia. 4' deep average)		
	1x3.14x2'x2'x4' =	50	c.f.
	(2 MH's 5' dia. 6' deep average)		
	5x3.14x2.5'x2.5'x6' =	236	c.f.
	(4 MH's 6' dia. 6' deep average)		
	4x3.14x3'x3'x6' =	678	c.f.
Pipes			
	(36" dia. L=1476')		
	3.14x1.5'x1.5'x1476' =	10428	c.f.
	(30" dia. L=594')		
	3.14x1.25'x1.25'x594' =	2914	c.f.
	(12" dia. L=294')		
	3.14x0.5'x0.5'x294' =	231	c.f.
	(6" dia. L=650')		
	3.14x0.25'x0.25'x650' =	128	c.f.
	(6" dia. Big'O' w/ Clearstone L=1371')		
	1.0'x1.0'x0.4x1371' =	548	c.f.
subtotal in sewers		15389	c.f.

Storage provided on surface

5-year event	**7236**	c.f.	*Based on 6" max storage
100-year event	**41324**	c.f.	*Based on 12" max storage

Storage required for 2-year event	**15322**	**c.f.**
Total Provided	**15389**	**c.f. OK!**
Storage required for 5-year event	**21671**	**c.f.**
Total Provided	**22625**	**c.f. OK!**
Storage required for 100-year event	**42207**	**c.f.**
Total Provided	**56713**	**c.f. OK!**

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 1 - SEE FIG 1 **14-383**

RESTRICTION OPENING CALCULATIONS

ORIFICE PLATE CALCULATIONS @ OUTLET MANHOLE

$Q = C_d A(2gH)^{0.5}$

$Q = 2.517\ ft^3/s$

$C_d = 0.6$

$g = 32.17$

$H = 7.28\ ft$

$2.517 = 0.6\ A\ (2 \times 32.17 \times 7.28)^{0.5}$

$A = 0.194\ ft^2$

$D = 0.50\ ft$

Therefore, 6" Diameter Orifice plate to be installed on 15"ø outlet pipe

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 2 - SEE FIG 1 **14-383**

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712} / 25.4$

Q= Aci

T = Time in min. Q= ft^3/sec

I = Intensity (in/hr) i= in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.12 in/hr

Q_{EX} = 19.44 * 0.20 * 1.12 = $\boxed{4.36\ ft^3/sec}$ **Max Release Rate*

Proposed Conditions:

area building =	1.09 acre	==>	c =	0.95
area pavement =	1.65 acre	==>	c =	0.90
area lawn=	16.70 acre	==>	c =	0.20

AC_{TOTAL}= 1.09 x 0.95 + 1.65 x 0.9 + 16.70 x 0.2= 5.86

t_c = 20 min. ==> i = 2.15 in/hr

Q_{NEW} = 5.86 x 2.15 = 12.61 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 2 - SEE FIG 1 **14-383**

STORM DETENTION CALCULATION (1:5 YEAR STORM)

$I = 32 * (T/60)^{-0.712} / 25.4$ Q= Aci

T = Time in min. Q= ft^3/sec

I = Intensity (in/hr) i= in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.43 in/hr

$Q_{EX} = 19.44 * 0.20 * 1.43 =$ 5.58 ft^3/sec

Proposed Conditions:

area building =	1.09 acre	==>	c =	0.95
area pavement =	1.65 acre	==>	c =	0.90
area lawn=	16.70 acre	==>	c =	0.20

AC_{TOTAL}= 1.09 x 0.95 + 1.65 x 0.9 + 16.70 x 0.2= 5.86

t_c = 20 min. ==> i = 2.75 in/hr

Q_{NEW} = 5.86 x 2.75 = 16.14 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 2 - SEE FIG 1 **14-383**

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711} / 25.4$

Q= Aci

T = Time in min.

Q= ft^3/sec

I = Intensity (in/hr)

i= in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.30 in/hr

Q_{EX} = 19.44 * 0.20 * 2.30 = 8.957 ft^3/sec

Proposed Conditions:

area building =	1.09 acre	==>	c =	0.95
area pavement =	1.65 acre	==>	c =	0.90
area lawn=	16.70 acre	==>	c =	0.20

AC_{TOTAL}= 1.09 x 0.95 + 1.65 x 0.9 + 16.70 x 0.2= 5.86

t_c = 20 min. ==> i = 4.42 in/hr

Q_{NEW} = 5.86 x 4.42 = 25.90 ft^3/sec

Q_{NEW} > Q_{EX} **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS **(1:2 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 June 2014
FILE: 14-383

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 1.12 in/hr

Q_{EX} = 19.44 * 0.2 * 1.12 = 4.36 ft^3/sec

PROPOSED CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.30
INTENSITY 2.15 in/hr

Q_{NEW} = 19.44 * 0.30 * 2.15 = 12.61 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 19.44 acre
RELEASE Q: 4.09 ft^3/sec *15"ø @ 0.4%*
TIME (Tc): 20 min.
PEAK Q: 12.61 ft^3/sec
CA: 5.86

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
5	5.77	8.46	2537.93	1228.34	1310
10	3.52	10.33	6197.35	2456.67	3741
15	2.64	11.61	10447.48	3685.01	6762
20	2.15	12.61	15133.26	4913.34	10220
25	1.84	10.76	16137.74	6141.68	9996
30	1.61	9.45	17007.75	7370.02	9638
35	1.44	8.47	17779.83	8598.35	9181
40	1.31	7.70	18476.90	9826.69	8650
45	1.21	7.08	19114.42	11055.02	8059
50	1.12	6.57	19703.31	12283.36	7420
55	1.05	6.14	20251.65	13511.70	6740
60	0.98	5.77	20765.55	14740.03	6026

THEREFORE, MAXIMUM STORAGE REQUIRED IS **10220** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:5 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 June 2014
FILE: 14-383

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 1.43 in/hr

Q_{EX} = 19.44 * 0.2 * 1.43 = 5.58 ft^3/sec

PROPOSED CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.30
INTENSITY 2.75 in/hr

Q_{NEW} = 19.44 * 0.30 * 2.75 = 16.14 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:5 YEARS
TOTAL AREA: 19.44 acre
RELEASE Q: 4.09 ft^3/sec *15"ø @ 0.4%*
TIME (Tc): 20 min.
PEAK Q: 16.14 ft^3/sec
CA: 5.86

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
10	4.51	13.22	7932.61	2456.67	5476
15	3.38	11.89	10698.22	3685.01	7013
20	2.75	16.14	19370.57	4913.34	14457
25	2.35	13.77	20656.30	6141.68	14515
30	2.06	12.09	21769.92	7370.02	14400
35	1.85	10.84	22758.18	8598.35	14160
40	1.68	9.85	23650.44	9826.69	13824
45	1.55	9.06	24466.46	11055.02	13411
50	1.43	8.41	25220.24	12283.36	12937
55	1.34	7.86	25922.11	13511.70	12410
60	1.26	7.38	26579.91	14740.03	11840
65	1.19	6.97	27199.75	15968.37	11231

THEREFORE, MAXIMUM STORAGE REQUIRED IS **14515** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:100 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 12 June 2014
FILE: 14-383

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 2.30 in/hr

Q_{EX} = 19.44 * 0.2 * 2.30 = 8.96 ft^3/sec

PROPOSED CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.30
INTENSITY 4.42 in/hr

Q_{NEW} = 19.44 * 0.30 * 4.42 = 25.90 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 19.44 acre
RELEASE Q: 4.09 ft^3/sec *15"ø @ 0.4%*
TIME (Tc): 20 min.
PEAK Q: 25.90 ft^3/sec
CA: 5.86

TIME (Tc) (min)	INTENSITY (in/hr)	PEAK Q (cfs)	VOLUME (cf)	RELEASE VOLUME (cf)	STORAGE (cf)
20	4.42	25.90	31079.82	4913.34	26166
25	3.77	22.10	33150.15	6141.68	27008
30	3.31	19.41	34943.70	7370.02	27574
35	2.97	17.40	36535.62	8598.35	27937
40	2.70	15.82	37973.11	9826.69	28146
45	2.48	14.55	39287.94	11055.02	28233
50	2.30	13.50	40502.63	12283.36	28219
55	2.15	12.62	41633.76	13511.70	28122
60	2.02	11.86	42693.97	14740.03	27954
65	1.91	11.20	43693.10	15968.37	27725
70	1.81	10.63	44638.97	17196.70	27442
75	1.73	10.12	45537.96	18425.04	27113

THEREFORE, MAXIMUM STORAGE REQUIRED IS **28233** CUBIC FEET

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 2 - SEE FIG 1 **14-383**

STORAGE VOLUME CALCULATIONS ON PARKING LOT AREA

Storage in sewers

Manholes	(4 MH's 4' dia. 5' deep average)		
	4x3.14x2'x2'x5' =	251	c.f.
	(1 MH's 5' dia. 6' deep average)		
	1x3.14x2.5'x2.5'x6' =	118	c.f.
	(1 MH's 6' dia. 6' deep average)		
	1x3.14x3'x3'x6' =	170	c.f.
Pipes			
	(30" dia. L=649')		
	3.14x1.25'x1.25'x649' =	3184	c.f.
	(24" dia. L=1359')		
	3.14x1'x1'x1359' =	4267	c.f.
	(15" dia. L=185')		
	3.14x0.625'x0.625'x185' =	227	c.f.
	(12" dia. L=272')		
	3.14x0.5'x0.5'x272' =	214	c.f.
	(6" dia. L=265)		
	3.14x0.25'x0.25'x265' =	52	c.f.
	(6" dia. Big'O' w/ Clearstone L=2527')		
	1.0'x1.0'x0.4x2527' =	1011	c.f.
subtotal in sewers		9493	c.f.

Storage provided on surface

2-year event	**1092**	c.f. *Based on water level = 599.40'
5-year event	**6802**	c.f. *Based on water level = 599.90'
100-year event	**82838**	c.f. *Based on water level = 600.40'

Storage required for 2-year event	**10220**	**c.f.**
Total Provided	**10585**	**c.f. OK!**
Storage required for 5-year event	**14515**	**c.f.**
Total Provided	**16295**	**c.f. OK!**
Storage required for 100-year event	**28233**	**c.f.**
Total Provided	**92331**	**c.f. OK!**

TECUMSEH ACADEMY **Revised 12 June 2014**

AREA 2 - SEE FIG 1 **14-383**

ORIFICE PLATE CALCULATIONS @ OUTLET MANHOLE

$Q = C_d A(2gH)^{0.5}$

$Q =$ 4.36 ft^3/s

$C_d =$ 0.6

$g =$ 32.17

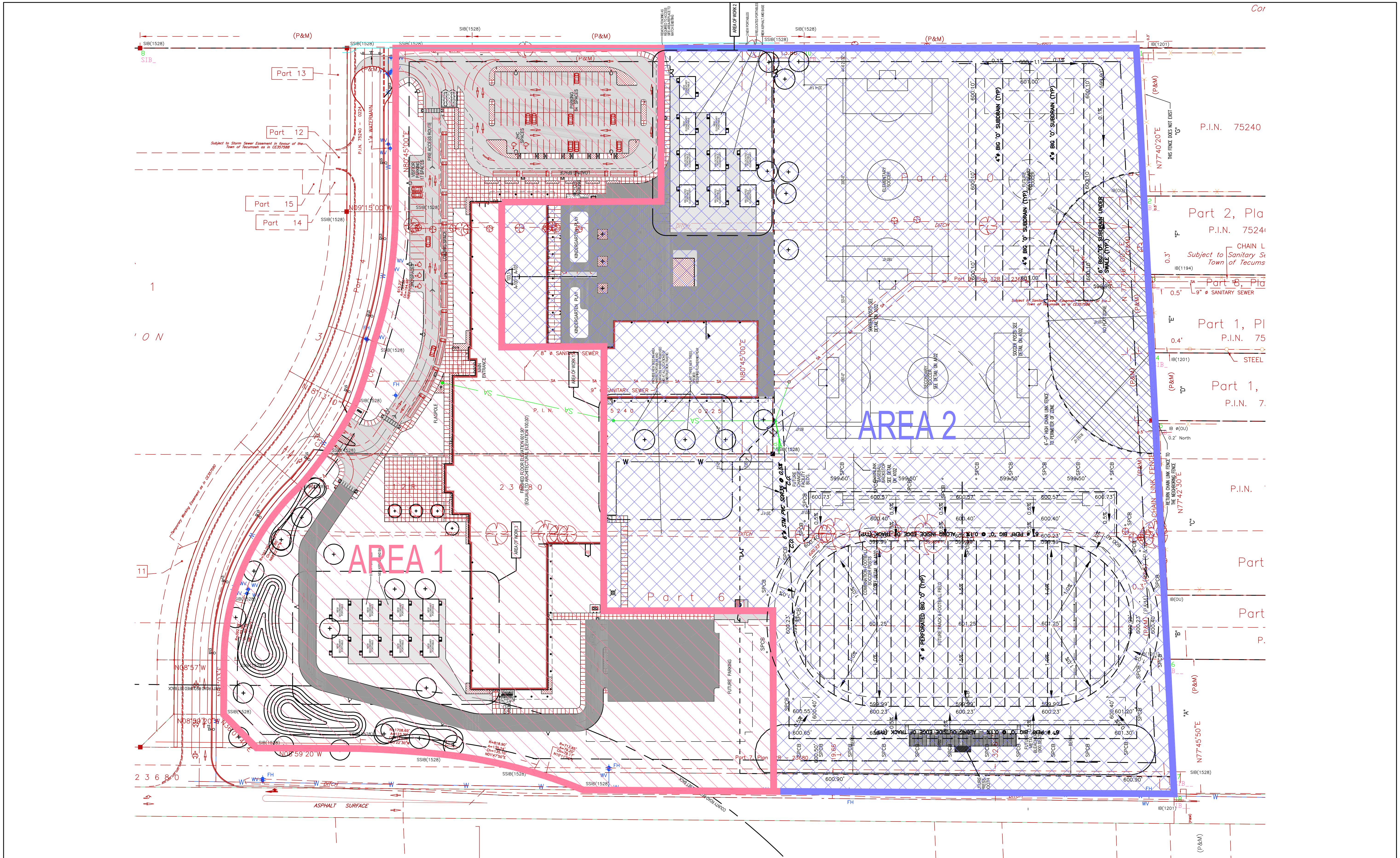
$H =$ 6.85 ft

$2.517 = 0.6 A (2 \times 32.17 \times 7.28)^{0.5}$

$A =$ 0.346 ft^2

$D =$ 0.66 ft = **8 "**

Therefore, 8" Diameter Orifice plate to be installed on 15"ø outlet pipe



DESIGN A.M.C.	REVISED TECUMSEH ACADEMY	PROJECT NO. 09–57
CHECKED R.C.S.		
DRAWN A.M.C.	DRAINAGE AREAS	SHEET NO. FIG 1
CHECKED R.C.S.		
DATE APRIL 2009		OF 3
SCALE 1"=60'		

RC Spencer Associates Inc.

3100 Temple Drive, Suite 100,
Windsor, Ontario, N8W 5J6
Phone: (519) 944-3090
Fax: (519) 944-5636

Professional Engineers Ontario

NO.	REVISION	DATE	BY	APP.
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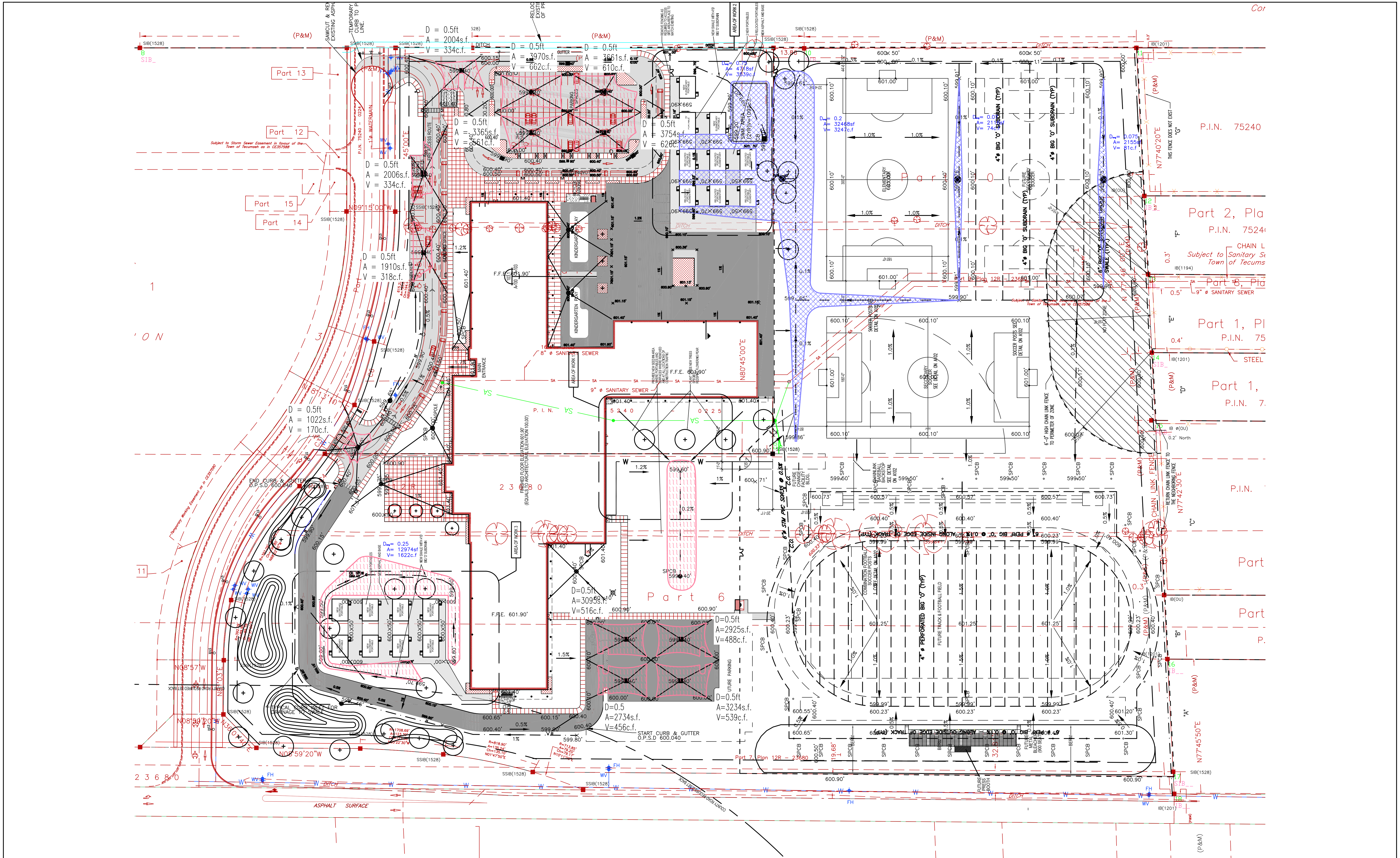

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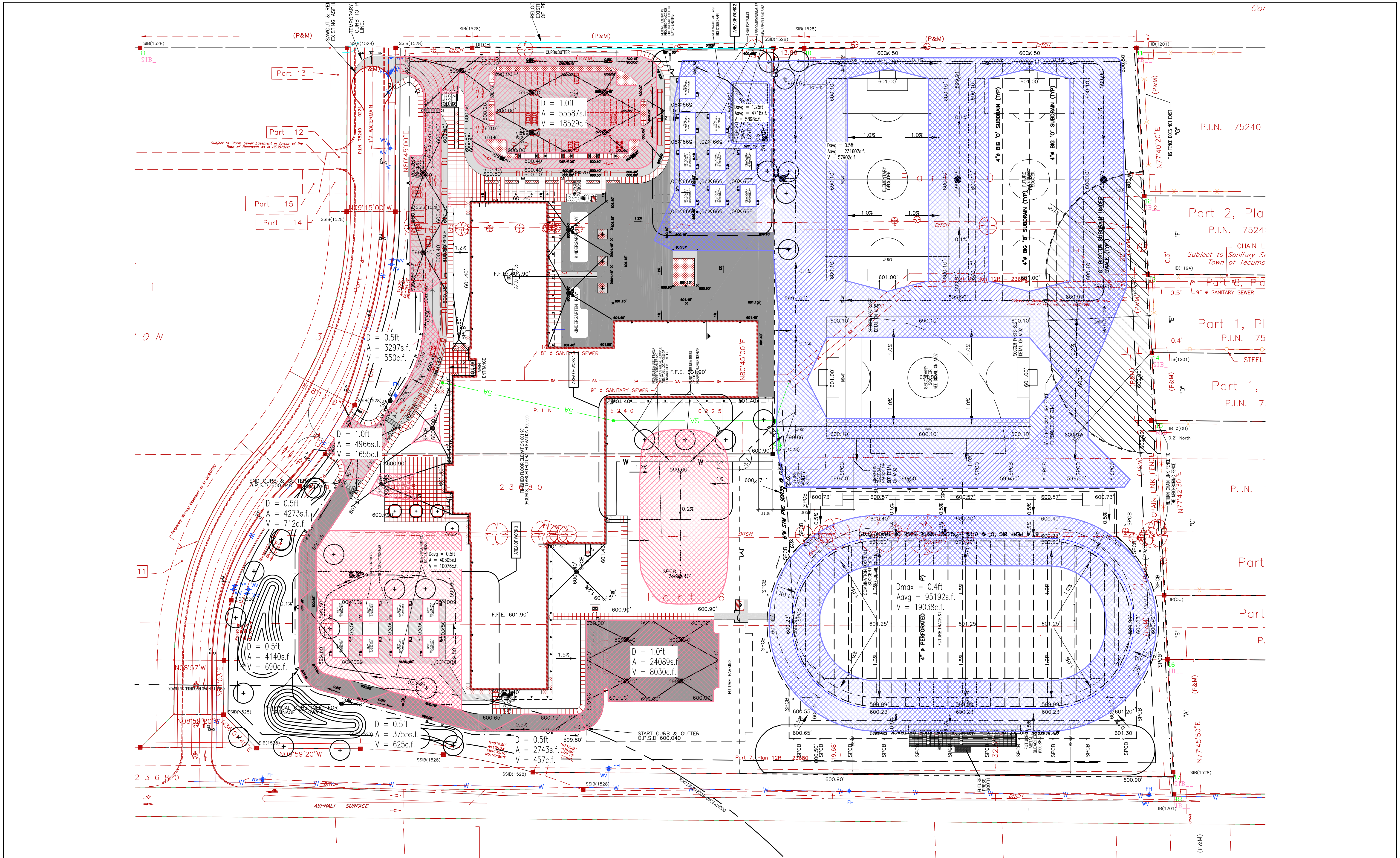
DESIGN	A.M.C.
CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	APRIL 2009
SCALE	1"=60'

TECUMSEH ACADEMY

STORM DETENTION CALCS
1:5 YEAR STORM

PROJECT NO. 09-57
SHEET NO. FIG 2
OF 3

09-05-01.dwg APRIL 8, 2009



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NO.	REVISION	DATE	BY	APP.	NO.	REVISION	DATE	BY	APP.
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DESIGN	A.M.C.
CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	APRIL 2009
SCALE	1"=60'

TECUMSEH ACADEMY

STORM DETENTION CALCS
1:100 YEAR STORM

PROJECT NO. 09-57

SHEET NO. FIG 3

OF 3

09-05-01.dwg APRIL 8, 2009

TECUMSEH VISTA ACADEMY

TOWN OF TECUMSEH

ADDENDUM / REVISION NO. 2 TO

STORM WATER

MANAGEMENT REPORT

18 MAY 2010

Submitted by:
RC Spencer Associates Inc.

File No.: 09-57/14-383/14-395

18 August 2014
File No.: 14-395

Tecumseh Vista Academy
Revision to Storm Water Management Report
Executive Summary

The following provides an executive summary of the storm water management calculations dated 18 August 2014. These calculations are an amendment to the original storm water management plan dated 18 May 2010 (revised 14 July 2014). The calculations are provided for the permanent building addition with existing temporary portables still in place (worst case scenario).

As required by the original design, the storm sewer system is restricted to the pre-developed 2 year storm event, and any additional flow from the building addition will be stored on site along with the storage provided for the existing development. The release rate from the current storm outlets to Shields Avenue **will not change** due to the proposed addition.

Currently, the site is divided into two separate drainage areas which outlet to Shields Avenue. The storm sewers from the building additions are to be added to Drainage Area 1 (the south addition being diverted away from Area 2). The flat portion of the roof is to be restricted to a runoff coefficient of C=0.2 and storage is provided on the roof. The maximum water elevation for a 5 year storm event in both areas, Area 1 and Area 2, is 599.90', which provides a maximum 6" depth of storage at the catchbasins in the parking lot. The maximum water elevation for a 100 year storm event in both areas, Area 1 and Area 2, is 600.40', which provides a maximum 12" depth of storage at the catchbasins in the parking lot.

In order to accommodate the additional storage required, a small dry pond was added to the grassed area north west of the school. The proposed dry pond is permanent and will remain once the portables are removed. The maximum water level for a 2 year storm event is 599.40' (minimum parking lot catchbasin elevation), with the pond catchbasin at an elevation of 598.40'. This provides for a maximum depth in the pond of 1.0' during the 2 year storm event and 2.0' during the 100 year storm event.

The minimum building elevation shall be **601.40'**, which is 1' above the 100 year water level. The building elevation provided for the existing school site and the proposed addition is actually **601.90'** (additional freeboard).

The previous addendum / revision to the stormwater management report dated 14 July 2014 pertains to the temporary portables. This application is for the proposed permanent building and parking lot addition for a total of 46,550s.f. additional building space and 48,225s.f. additional hard surface.

The building addition consists of:
10,050s.f. North addition;
25,750s.f. South classroom addition; and
10,750s.f. South gym addition).

The roof area for the building additions are as follows:
10,990s.f. flat roof over the North addition;
18,850s.f. flat roof and 20,230s.f. sloped roof over the South addition.

The hard surfaces consist of an additional:
7,825s.f. North courtyard;
30,854s.f. South parking lot asphalt; and
9,546s.f. South sidewalks

TECUMSEH VISTA PERMANENT ADDITION **Revised 18 August 2014**

AREA 1 - SEE FIG 1 **14-395**

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712} / 25.4$

Q= Aci

T = Time in min. Q= ft^3/sec

I = Intensity (in/hr) i= in/hr

Total Area = 11.23 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.12 in/hr

Q_{EX} = 11.23 * 0.20 * 1.12 = $\boxed{2.52\ ft^3/sec}$ *Release Rate*

Proposed Conditions:

area building =	2.66 acre	==>	c =	0.95
area building =	0.59 acre	==>	c =	0.20 *roof restricted*
area portables =	0.14 acre	==>	c =	0.95
area portable pavement =	0.21 acre	==>	c =	0.90
area pavement =	4.80 acre	==>	c =	0.90
area lawn =	3.91 acre	==>	c =	0.20
Total Area =	12.31 acre			

AC_{TOTAL}= 2.8x0.95 + 0.59x0.2 + 5.01x0.9 + 3.91x.2= 8.07

t_c = 20 min. ==> i = 2.15 in/hr

Q_{NEW} = 8.07 x 2.15 = 17.36 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH VISTA PERMANENT ADDITION **Revised 18 August 2014**

AREA 1 - SEE FIG 1 **14-395**

STORM DETENTION CALCULATION (1:5 YEAR STORM)

$I = 32 * (T/60)^{-0.712} / 25.4$

Q= Aci

T = Time in min. Q= ft^3/sec

I = Intensity (in/hr) i= in/hr

Total Area = 11.23 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.43 in/hr

Q_{EX} = 11.23 * 0.20 * 1.43 = 3.222 ft^3/sec

Proposed Conditions:

area building =	2.66 acre	==>	c =	0.95
area building =	0.59 acre	==>	c =	0.20 **roof restricted*
area portables =	0.14 acre	==>	c =	0.95
area portable pavement =	0.21 acre	==>	c =	0.90
area pavement =	4.80 acre	==>	c =	0.90
area lawn =	3.91 acre	==>	c =	0.20
Total Area =	12.31 acre			

AC_{TOTAL}= 2.8x0.95 + 0.59x0.2 + 5.01x0.9 + 3.91x.2= 8.07

t_c = 20 min. ==> i = 2.75 in/hr

Q_{NEW} = 8.07 x 2.75 = 22.23 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH VISTA PERMANENT ADDITION | **Revised 18 August 2014**

AREA 1 - SEE FIG 1 | **14-395**

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711} / 25.4$ Q= Aci

T = Time in min. Q= ft^3/sec

I = Intensity (in/hr) i= in/hr

Total Area = 11.23 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.30 in/hr

Q_{EX} = 11.23 * 0.20 * 2.30 = 5.174 ft^3/sec

Proposed Conditions:

area building =	2.66 acre	==>	c =	0.95	
area building =	0.59 acre	==>	c =	0.20	**roof restricted*
area portables =	0.14 acre	==>	c =	0.95	
area portable pavement =	0.21 acre	==>	c =	0.90	
area pavement =	4.80 acre	==>	c =	0.90	
area lawn =	3.91 acre	==>	c =	0.20	
Total Area =	12.31 acre				

AC_{TOTAL}= 2.8x0.95 + 0.59x0.2 + 5.01x0.9 + 3.91x.2= 8.07

t_c = 20 min. ==> i = 4.42 in/hr

Q_{NEW} = 8.07 x 4.42 = 35.66 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS **(1:2 YEAR STORM)**
AREA 1 - SEE FIG 1 - ROOF STORAGE

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 0.59 acre
COEFFICIENT 0.2
INTENSITY 1.12 in/hr

Q_{EX} = 0.59 * 0.2 * 1.12 = 0.13 ft^3/sec

PROPOSED CONDITIONS

AREA 0.59 acre
COEFFICIENT 0.95
INTENSITY 2.15 in/hr

Q_{NEW} = 0.59 * 0.95 * 2.15 = 1.21 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 0.59 acre
RELEASE Q: 0.13 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 1.21 ft^3/sec
CA: 0.56

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
5	5.77	0.81	242.73	39.67	203
10	3.52	0.99	592.72	79.34	513
15	2.64	1.11	999.20	119.02	880
20	2.15	1.21	1447.35	158.69	1289
30	1.61	0.90	1626.63	238.03	1389
40	1.31	0.74	1767.14	317.38	1450
50	1.12	0.63	1884.43	396.72	1488
60	0.98	0.55	1986.02	476.07	1510
70	0.88	0.49	2076.18	555.41	1521
75	0.84	0.47	2117.85	595.08	1523
80	0.80	0.45	2157.58	634.76	1523
85	0.77	0.43	2195.58	674.43	1521

THEREFORE, MAXIMUM STORAGE REQUIRED IS **1523** CUBIC FEET
(AVG. DEPTH = 1523/25600 = 0.06' = 0.7")

STORM WATER DETENTION CALCULATIONS **(1:5 YEAR STORM)**
AREA 1 - SEE FIG 1 - ROOF STORAGE

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 0.59 acre
COEFFICIENT 0.2
INTENSITY 1.43 in/hr

Q_{EX} = 0.59 * 0.2 * 1.43 = 0.17 ft^3/sec

PROPOSED CONDITIONS

AREA 0.59 acre
COEFFICIENT 0.95
INTENSITY 2.75 in/hr

Q_{NEW} = 0.59 * 0.95 * 2.75 = 1.54 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:5 YEARS
TOTAL AREA: 0.59 acre
RELEASE Q: 0.13 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 1.54 ft^3/sec
CA: 0.56

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
20	2.75	1.54	1852.61	158.69	1694
30	2.06	1.16	2082.08	238.03	1844
40	1.68	0.94	2261.93	317.38	1945
50	1.43	0.80	2412.07	396.72	2015
60	1.26	0.71	2542.11	476.07	2066
70	1.13	0.63	2657.51	555.41	2102
80	1.03	0.58	2761.70	634.76	2127
90	0.94	0.53	2856.99	714.10	2143
100	0.88	0.49	2945.01	793.44	2152
110	0.82	0.46	3026.97	872.79	2154
115	0.79	0.44	3065.97	912.46	2154
120	0.77	0.43	3103.78	952.13	2152

THEREFORE, MAXIMUM STORAGE REQUIRED IS **2154** CUBIC FEET
(AVG. DEPTH = 2154/25600 = 0.08' = 1")

STORM WATER DETENTION CALCULATIONS **(1:100 YEAR STORM)**
AREA 1 - SEE FIG 1 - ROOF STORAGE

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 0.59 acre
COEFFICIENT 0.2
INTENSITY 2.30 in/hr

Q_{EX} = 0.59 * 0.2 * 2.30 = 0.27 ft^3/sec

PROPOSED CONDITIONS

AREA 0.59 acre
COEFFICIENT 0.95
INTENSITY 4.42 in/hr

Q_{NEW} = 0.59 * 0.95 * 4.42 = 2.48 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 0.59 acre
RELEASE Q: 0.13 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 2.48 ft^3/sec
CA: 0.56

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
60	2.02	1.13	4083.26	476.07	3607
80	1.65	0.92	4437.26	634.76	3803
100	1.41	0.79	4732.84	793.44	3939
120	1.24	0.69	4988.90	952.13	4037
140	1.11	0.62	5216.18	1110.82	4105
160	1.01	0.56	5421.41	1269.51	4152
180	0.93	0.52	5609.13	1428.20	4181
200	0.86	0.48	5782.55	1586.89	4196
210	0.83	0.47	5864.66	1666.23	4198
215	0.82	0.46	5904.68	1705.91	4199
220	0.80	0.45	5944.04	1745.58	4198
225	0.79	0.44	5982.77	1785.25	4198

THEREFORE, MAXIMUM STORAGE REQUIRED IS **4199** CUBIC FEET
(AVG. DEPTH = 4199/25600 = 0.16' = 2")

STORM WATER DETENTION CALCULATIONS **(1:2 YEAR STORM)**

AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 1.12 in/hr

Q_{EX} = 11.23 * 0.2 * 1.12 = 2.52 ft^3/sec

PROPOSED CONDITIONS

AREA 12.31 acre
COEFFICIENT 0.66
INTENSITY 2.15 in/hr

Q_{NEW} = 12.31 * 0.66 * 2.15 = 17.36 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 12.31 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 17.36 ft^3/sec
CA: 8.07

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
5	5.77	11.65	3494.33	755.12	2739
10	3.52	14.22	8532.79	1510.23	7023
15	2.64	15.98	14384.56	2265.35	12119
20	2.15	17.36	20836.16	3020.47	17816
25	1.84	14.81	22219.16	3775.59	18444
30	1.61	13.01	23417.03	4530.70	18886
35	1.44	11.66	24480.06	5285.82	19194
40	1.31	10.60	25439.83	6040.94	19399
50	1.12	9.04	27128.41	7551.17	19577
55	1.05	8.45	27883.38	8306.29	19577
60	0.98	7.94	28590.94	9061.41	19530
65	0.93	7.50	29257.69	9816.52	19441

THEREFORE, MAXIMUM STORAGE REQUIRED IS **19577** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:5 YEAR STORM)**
AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 1.43 in/hr

Q_{EX} = 11.23 * 0.2 * 1.43 = 3.22 ft^3/sec

PROPOSED CONDITIONS

AREA 12.31 acre
COEFFICIENT 0.66
INTENSITY 2.75 in/hr

Q_{NEW} = 12.31 * 0.66 * 2.75 = 22.23 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:5 YEARS
TOTAL AREA: 12.31 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 22.23 ft^3/sec
CA: 8.07

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
20	2.75	22.23	26670.28	3020.47	23650
30	2.06	16.65	29973.80	4530.70	25443
40	1.68	13.57	32562.98	6040.94	26522
50	1.43	11.57	34724.36	7551.17	27173
60	1.26	10.17	36596.41	9061.41	27535
65	1.19	9.60	37449.84	9816.52	27633
70	1.13	9.11	38257.73	10571.64	27686
75	1.07	8.67	39025.51	11326.76	27699
80	1.03	8.28	39757.66	12081.87	27676
85	0.98	7.93	40457.92	12836.99	27621
90	0.94	7.62	41129.44	13592.11	27537
95	0.91	7.33	41774.89	14347.23	27428

THEREFORE, MAXIMUM STORAGE REQUIRED IS **27699** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:100 YEAR STORM)**
AREA 1 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 11.23 acre
COEFFICIENT 0.2
INTENSITY 2.30 in/hr

Q_{EX} = 11.23 * 0.2 * 2.30 = 5.17 ft^3/sec

PROPOSED CONDITIONS

AREA 12.31 acre
COEFFICIENT 0.66
INTENSITY 4.42 in/hr

Q_{NEW} = 12.31 * 0.66 * 4.42 = 35.66 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 12.31 acre
RELEASE Q: 2.52 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 35.66 ft^3/sec
CA: 8.07

TIME (Tc) (min)	INTENSITY (in/hr)	PEAK Q (cfs)	VOLUME (cf)	RELEASE VOLUME (cf)	STORAGE (cf)
80	1.65	13.31	63879.12	12081.87	51797
90	1.52	12.24	66090.95	13592.11	52499
100	1.41	11.36	68134.32	15102.34	53032
110	1.32	10.61	70037.14	16612.58	53425
120	1.24	9.98	71820.64	18122.81	53698
130	1.17	9.42	73501.39	19633.05	53868
140	1.11	8.94	75092.56	21143.28	53949
145	1.08	8.72	75857.98	21898.40	53960
150	1.05	8.51	76604.85	22653.52	53951
155	1.03	8.32	77334.23	23408.63	53926
160	1.01	8.13	78047.07	24163.75	53883
165	0.99	7.95	78744.23	24918.87	53825

THEREFORE, MAXIMUM STORAGE REQUIRED IS **53960** CUBIC FEET

TECUMSEH VISTA PERMANENT ADDITION **Revised 2 September 2014**

AREA 1 - SEE FIG 1 **14-395**

STORAGE VOLUME CALCULATIONS ON PARKING LOT AREA

Storage in sewers

catchbasins	(15 CB's 2'x2' 4'deep)		
	15x2'x2'x4' =	240	c.f.
Manholes	(1 MH's 4' dia. 4' deep average)		
	1x3.14x2'x2'x4' =	50	c.f.
	(2 MH's 5' dia. 6' deep average)		
	5x3.14x2.5'x2.5'x6' =	236	c.f.
	(4 MH's 6' dia. 6' deep average)		
	4x3.14x3'x3'x6' =	678	c.f.
Pipes			
	(36" dia. L=1476')		
	3.14x1.5'x1.5'x1476' =	10428	c.f.
	(30" dia. L=594')		
	3.14x1.25'x1.25'x594' =	2914	c.f.
	(12" dia. L=294')		
	3.14x0.5'x0.5'x294' =	231	c.f.
	(6" dia. L=1164')		
	3.14x0.25'x0.25'x1164' =	228	c.f.
	(6" dia. Big'O' w/ Clearstone L=850')		
	1.0'x1.0'x0.4x850' =	340	c.f.
subtotal in sewers		15345	c.f.

Storage provided surrounding portables and in pond

2-year event	4448	c.f.	*Based on water level = 599.40'
5-year event	8511	c.f.	*Based on water level = 599.90'
100-year event	13827	c.f.	*Based on water level = 600.40'

Storage provided on surface

5-year event	7959	c.f.	*Based on 6" max storage
100-year event	41940	c.f.	*Based on 12" max storage

Storage required for 2-year event	**19750**	**c.f.**	
Total Provided	**19793**	**c.f.**	**OK!**
Storage required for 5-year event	**27941**	**c.f.**	
Total Provided	**31815**	**c.f.**	**OK!**
Storage required for 100-year event	**54430**	**c.f.**	
Total Provided	**71112**	**c.f.**	**OK!**

TECUMSEH VISTA PERMANENT ADDITION **Revised 18 August 2014**

AREA 2 - SEE FIG 1 **14-395**

STORM DETENTION CALCULATION (1:2 YEAR STORM)

$I = 25 * (T/60)^{-0.712} / 25.4$

T = Time in min.

I = Intensity (in/hr)

Q= Aci

Q= ft^3/sec

i= in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 1.12 in/hr

Q_{EX} = 19.44 * 0.20 * 1.12 = $\boxed{4.36\ ft^3/sec}$ *Max Release Rate*

Proposed Conditions:

area building =	0.93 acre	==>	c =	0.95
area portables =	0.16 acre	==>	c =	0.95
area portables pavement=	0.28 acre	==>	c =	0.90
area pavement =	1.37 acre	==>	c =	0.90
area lawn=	15.63 acre	==>	c =	0.20
Total Area =	18.37 acre			

AC_{TOTAL}= 1.09 x 0.95 + 1.65 x 0.9 + 15.63 x 0.2= 5.65

t_c = 20 min. ==> i = 2.15 in/hr

Q_{NEW} = 5.65 x 2.15 = 12.15 ft^3/sec

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH VISTA PERMANENT ADDITION **Revised 18 August 2014**

AREA 2 - SEE FIG 1 **14-395**

STORM DETENTION CALCULATION (1:5 YEAR STORM)

$I = 32 * (T/60)^{-0.712} / 25.4$

T = Time in min.

I = Intensity (in/hr)

$Q = Aci$

$Q = ft^3/sec$

i = in/hr

Total Area = 19.44 acre

Existing Conditions: surface $c = 0.20$

t_c = 50 min. ==> i = 1.43 in/hr

$Q_{EX} = 19.44 * 0.20 * 1.43 = 5.58\ ft^3/sec$

Proposed Conditions:

area building =	0.93 acre	==>	c =	0.95
area portables =	0.16 acre	==>	c =	0.95
area portables pavement=	0.28 acre	==>	c =	0.90
area pavement =	1.37 acre	==>	c =	0.90
area lawn=	15.63 acre	==>	c =	0.20
Total Area =	18.37 acre			

$AC_{TOTAL} = 1.09 \times 0.95 + 1.65 \times 0.9 + 15.63 \times 0.2 = 5.65$

t_c = 20 min. ==> i = 2.75 in/hr

$Q_{NEW} = 5.65 \times 2.75 = 15.55\ ft^3/sec$

$Q_{NEW} > Q_{EX}$ **Storm Detention Required**

TECUMSEH VISTA PERMANENT ADDITION **Revised 18 August 2014**

AREA 2 - SEE FIG 1 **14-395**

STORM DETENTION CALCULATION (1:100 YEAR STORM)

$I = 51.4 * (T/60)^{-0.711} / 25.4$

Q= Aci

T = Time in min. Q= ft^3/sec

I = Intensity (in/hr) i= in/hr

Total Area = 19.44 acre

Existing Conditions: surface c = 0.20

t_c = 50 min. ==> i = 2.30 in/hr

Q_{EX} = 19.44 * 0.20 * 2.30 = 8.957 ft^3/sec

Proposed Conditions:

area building =	0.93 acre	==>	c =	0.95
area portables =	0.16 acre	==>	c =	0.95
area portables pavement=	0.28 acre	==>	c =	0.90
area pavement =	1.37 acre	==>	c =	0.90
area lawn=	15.63 acre	==>	c =	0.20
Total Area =	18.37 acre			

AC_{TOTAL}= 1.09 x 0.95 + 1.65 x 0.9 + 15.63 x 0.2= 5.65

t_c = 20 min. ==> i = 4.42 in/hr

Q_{NEW} = 5.65 x 4.42 = 24.95 ft^3/sec

Q_{NEW} > Q_{EX} **Storm Detention Required**

STORM WATER DETENTION CALCULATIONS **(1:2 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 1.12 in/hr

Q_{EX} = 19.44 * 0.2 * 1.12 = 4.36 ft^3/sec

PROPOSED CONDITIONS

AREA 18.37 acre
COEFFICIENT 0.31
INTENSITY 2.15 in/hr

Q_{NEW} = 18.37 * 0.31 * 2.15 = 12.15 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:2 YEARS
TOTAL AREA: 18.37 acre
RELEASE Q: 4.36 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 12.15 ft^3/sec
CA: 5.65

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
5	5.77	8.15	2445.25	1307.17	1138
10	3.52	9.95	5971.05	2614.33	3357
15	2.64	11.18	10065.98	3921.50	6144
20	2.15	12.15	14580.66	5228.67	9352
25	1.84	10.37	15548.46	6535.83	9013
30	1.61	9.10	16386.70	7843.00	8544
35	1.44	8.16	17130.58	9150.16	7980
40	1.31	7.42	17802.21	10457.33	7345
45	1.21	6.82	18416.44	11764.50	6652
50	1.12	6.33	18983.83	13071.66	5912
55	1.05	5.91	19512.15	14378.83	5133
60	0.98	5.56	20007.28	15686.00	4321

THEREFORE, MAXIMUM STORAGE REQUIRED IS **9352** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:5 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 1.43 in/hr

Q_{EX} = 19.44 * 0.2 * 1.43 = 5.58 ft^3/sec

PROPOSED CONDITIONS

AREA 18.37 acre
COEFFICIENT 0.31
INTENSITY 2.75 in/hr

Q_{NEW} = 18.37 * 0.31 * 2.75 = 15.55 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:5 YEARS
TOTAL AREA: 18.37 acre
RELEASE Q: 4.36 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 15.55 ft^3/sec
CA: 5.65

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
10	4.51	12.74	7642.94	2614.33	5029
15	3.38	11.45	10307.56	3921.50	6386
20	2.75	15.55	18663.25	5228.67	13435
25	2.35	13.27	19902.02	6535.83	13366
30	2.06	11.65	20974.98	7843.00	13132
35	1.85	10.44	21927.15	9150.16	12777
40	1.68	9.49	22786.82	10457.33	12329
45	1.55	8.73	23573.05	11764.50	11809
50	1.43	8.10	24299.31	13071.66	11228
55	1.34	7.57	24975.55	14378.83	10597
60	1.26	7.11	25609.32	15686.00	9923
65	1.19	6.72	26206.53	16993.16	9213

THEREFORE, MAXIMUM STORAGE REQUIRED IS **13435** CUBIC FEET

STORM WATER DETENTION CALCULATIONS **(1:100 YEAR STORM)**
AREA 2 - SEE FIG 1

PROJECT: Tecumseh Academy
LOCATION: Town of Tecumseh
DATE: Revised 18 August 2014
FILE: 14-395

EXISTING CONDITIONS

AREA 19.44 acre
COEFFICIENT 0.2
INTENSITY 2.30 in/hr

Q_{EX} = 19.44 * 0.2 * 2.30 = 8.96 ft^3/sec

PROPOSED CONDITIONS

AREA 18.37 acre
COEFFICIENT 0.31
INTENSITY 4.42 in/hr

Q_{NEW} = 18.37 * 0.31 * 4.42 = 24.95 ft^3/sec

DESIGN CRITERIA

STORM FREQUENCY: 1:100 YEARS
TOTAL AREA: 18.37 acre
RELEASE Q: 4.36 ft^3/sec
TIME (Tc): 20 min.
PEAK Q: 24.95 ft^3/sec
CA: 5.65

TIME (Tc) (min)	**INTENSITY** (in/hr)	**PEAK Q** (cfs)	**VOLUME** (cf)	**RELEASE VOLUME** (cf)	**STORAGE** (cf)
20	4.42	24.95	29944.92	5228.67	24716
25	3.77	21.29	31939.65	6535.83	25404
30	3.31	18.70	33667.71	7843.00	25825
35	2.97	16.76	35201.50	9150.16	26051
40	2.70	15.24	36586.50	10457.33	26129
45	2.48	14.02	37853.32	11764.50	26089
50	2.30	13.01	39023.65	13071.66	25952
55	2.15	12.16	40113.48	14378.83	25735
60	2.02	11.43	41134.97	15686.00	25449
65	1.91	10.79	42097.61	16993.16	25104
70	1.81	10.24	43008.95	18300.33	24709
75	1.73	9.75	43875.11	19607.49	24268

THEREFORE, MAXIMUM STORAGE REQUIRED IS **26129** CUBIC FEET

TECUMSEH VISTA PERMANENT ADDITION **Revised 2 September 2014**

AREA 2 - SEE FIG 1 **14-395**

STORAGE VOLUME CALCULATIONS ON PARKING LOT AREA

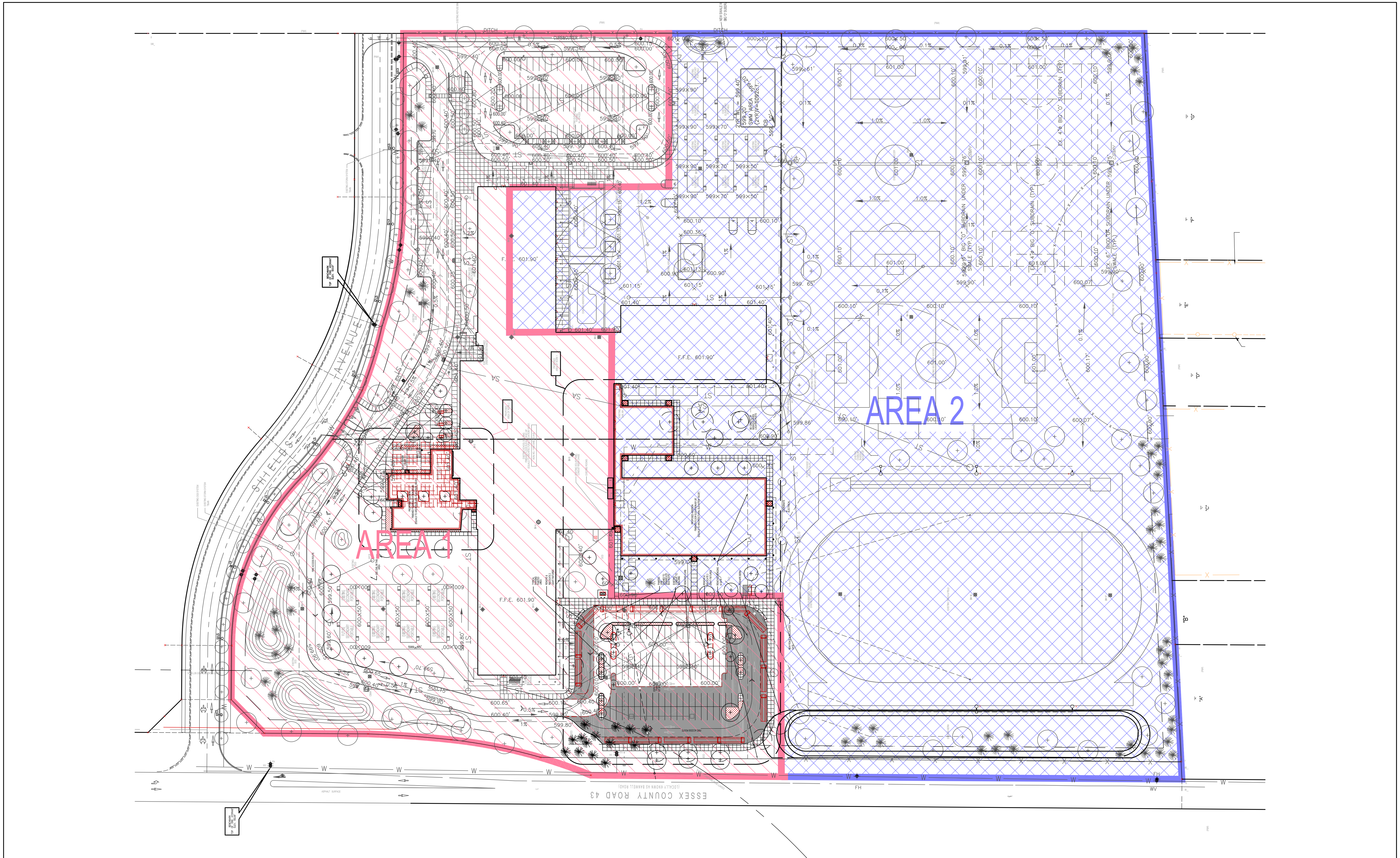
Storage in sewers

Manholes	(4 MH's 4' dia. 5' deep average)		
	4x3.14x2'x2'x5' =	251	c.f.
	(1 MH's 5' dia. 6' deep average)		
	1x3.14x2.5'x2.5'x6' =	118	c.f.
	(1 MH's 6' dia. 6' deep average)		
	1x3.14x3'x3'x6' =	170	c.f.
Pipes			
	(30" dia. L=649')		
	3.14x1.25'x1.25'x649' =	3184	c.f.
	(24" dia. L=1359')		
	3.14x1'x1'x1359' =	4267	c.f.
	(15" dia. L=185')		
	3.14x0.625'x0.625'x185' =	227	c.f.
	(12" dia. L=272')		
	3.14x0.5'x0.5'x272' =	214	c.f.
	(6" dia. L=265)		
	3.14x0.25'x0.25'x265' =	52	c.f.
	(6" dia. Big'O' w/ Clearstone L=2527')		
	1.0'x1.0'x0.4x2527' =	1011	c.f.
subtotal in sewers		9493	c.f.

Storage provided on surface

2-year event	**1092**	c.f.	*Based on water level = 599.40'
5-year event	**6802**	c.f.	*Based on water level = 599.90'
100-year event	**82838**	c.f.	*Based on water level = 600.40'

Storage required for 2-year event	**9442**	**c.f.**	
Total Provided	**10585**	**c.f.**	**OK!**
Storage required for 5-year event	**13550**	**c.f.**	
Total Provided	**16295**	**c.f.**	**OK!**
Storage required for 100-year event	**26356**	**c.f.**	
Total Provided	**92331**	**c.f.**	**OK!**



RC SPENCER ASSOCIATES INC.
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Phone: (519) 946-1122

Professional Engineers Ontario

18 Talbot St. W.
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NO.	REVISION	DATE	BY	APP.
1.				
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NO.	REVISION	DATE	BY	APP.
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DESIGN	A.M.C.
CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	AUGUST 2014
SCALE	1"=60'

REVISED TECUMSEH ACADEMY

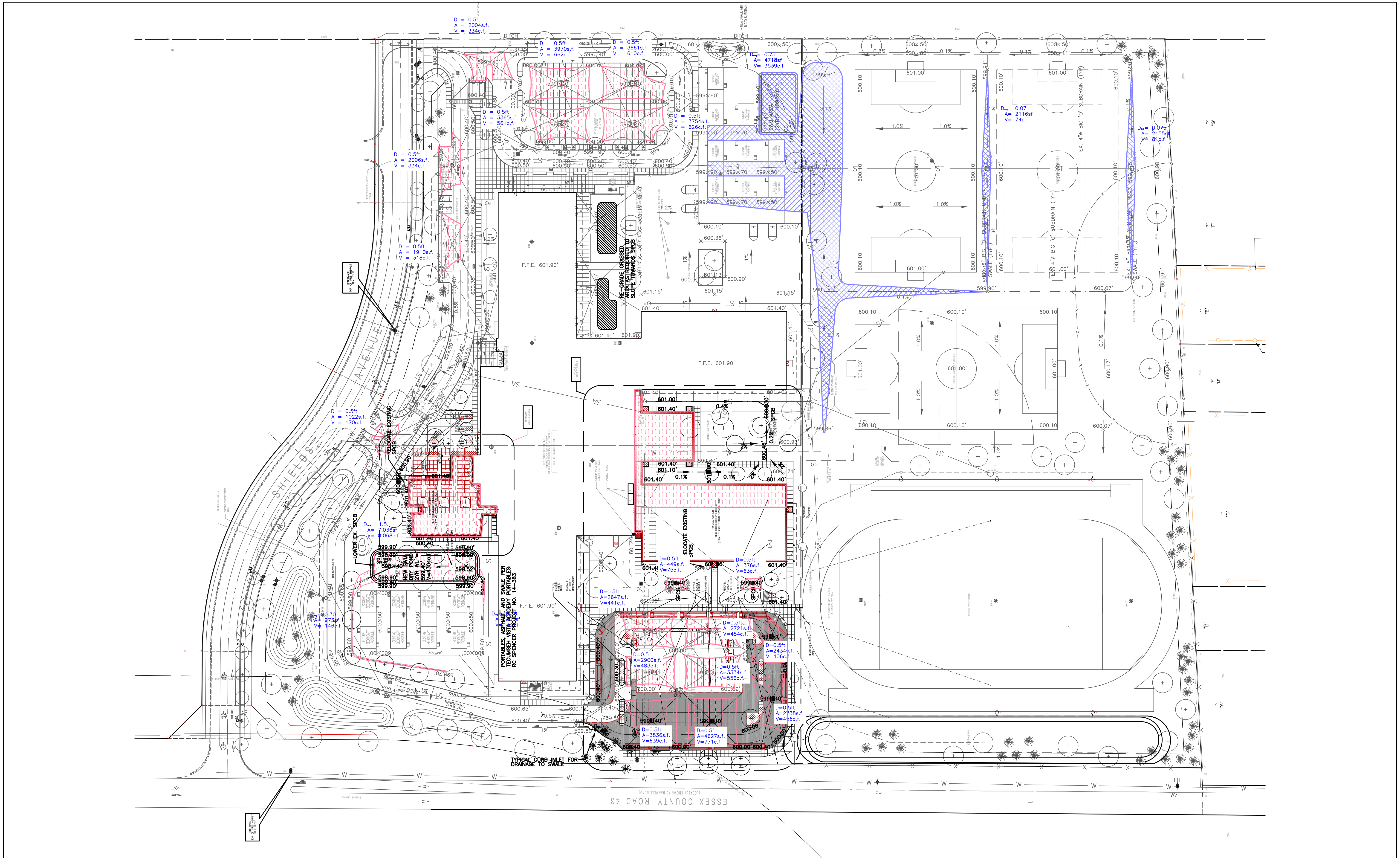
DRAINAGE AREAS

PROJECT NO. 09-57

SHEET NO. FIG 1

OF 3

09-05-01.dwg APRIL 8, 2009



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NO.	REVISION	DATE	BY	APP.	NO.	REVISION	DATE	BY	APP.
1.					6.				
2.					7.				
3.					8.				
4.					9.				
5.					10.				

DESIGN	A.M.C.
CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	AUGUST 2014
SCALE	1"=60'

TECUMSEH ACADEMY

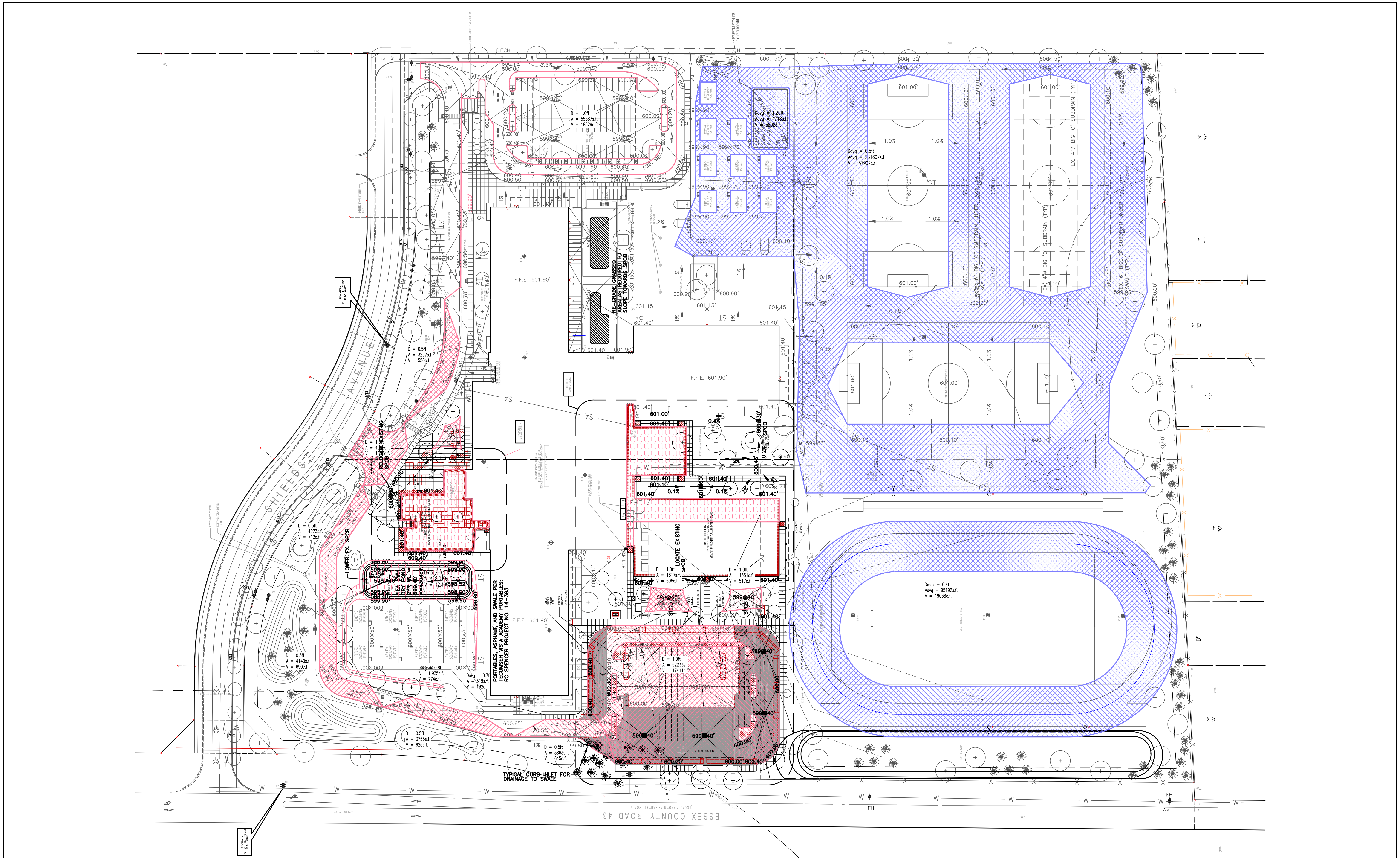
STORM DETENTION CALCS
1:5 YEAR STORM

PROJECT NO. 09-57

SHEET NO. FIG 2

OF 3

09-05-01.dwg APRIL 8, 2009



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NO.	REVISION	DATE	BY	APP.	NO.	REVISION	DATE	BY	APP.
1.					6.				
2.					7.				
3.					8.				
4.					9.				
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DESIGN	A.M.C.
CHECKED	R.C.S.
DRAWN	A.M.C.
CHECKED	R.C.S.
DATE	AUGUST 2014
SCALE	1"=60'

TECUMSEH ACADEMY

STORM DETENTION CALCS
1:100 YEAR STORM

PROJECT NO. 09-57

SHEET NO. FIG 3

OF 3

09-05-01.dwg APRIL 8, 2009

Appendix I

Town of Tecumseh Report PWES-2023-42

AECOM Imagine it. Delivered.

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105 Commerce Valley Drive West
7th Floor
Markham, ON L3T 7W3
Canada

T: 905.886.7022
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To:
Mr. Shane McVitty, P.Eng.
Development Engineer
The Corporation of the Town of Tecumseh
917 Lesperance Road,
Tecumseh, ON, N8N 1W9

CC:
Benny Wan
Phil Bartnik
John Henderson

Project name:
Tecumseh South Future Development Hydraulic Analysis – Change Order - Hydraulic Analysis of the Planned Watermains in the Tecumseh Hamlet Secondary Plan Area (THSPA)

Project ref:
60678079

From:
Vincent Tsang

Date:
November 2024

Technical Memorandum

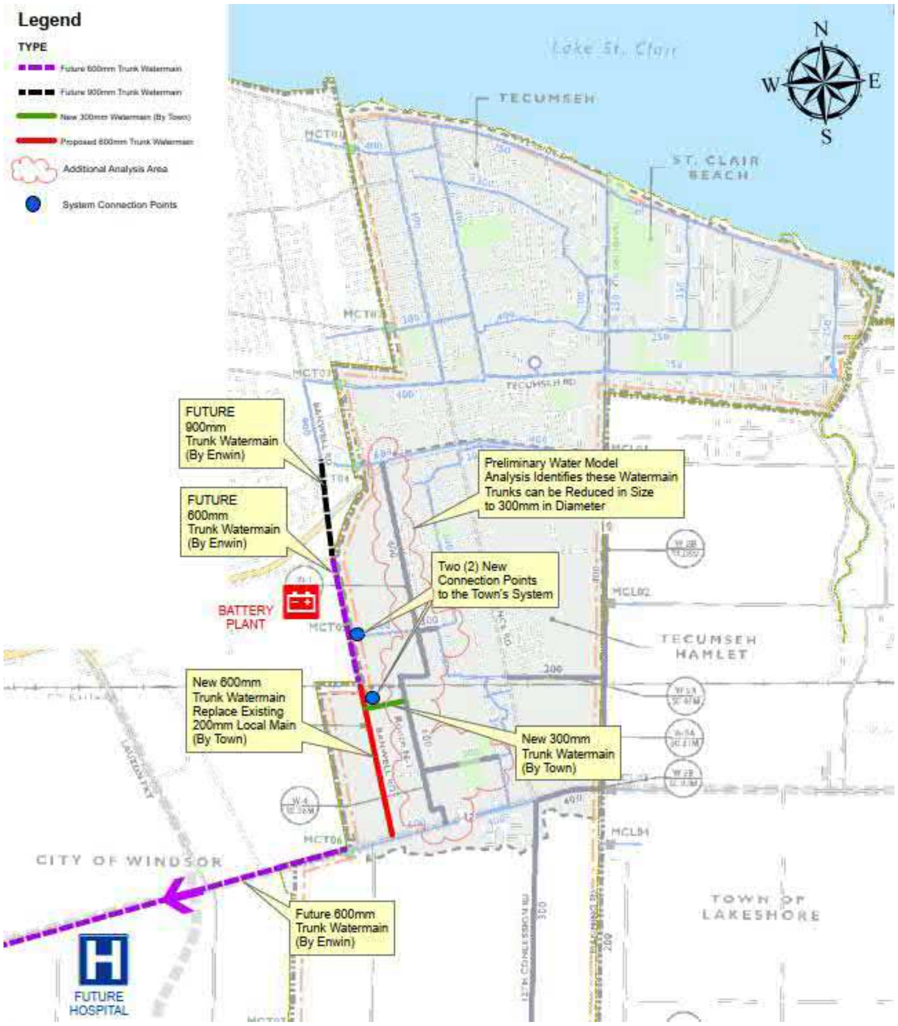
1. Introduction

AECOM Canada Ltd. has been retained by the Town of Tecumseh ("the Town") to evaluate the adequacy of the capacity of the planned watermains within the Tecumseh Hamlet Secondary Plan Area (THSPA). This assessment focuses on the future water system in North Tecumseh and the adjacent area in Windsor, taking into account recent updates to land use plans and projected population densities. This analysis aims to determine if the existing and planned watermains will support current and future demands, ensuring sustainable flows under ultimate build-out conditions.

In the Draft Functional Service Report for the THSPA, a proposed 300 mm watermain is planned to extend south from County Road 22, crossing the CP Rail Tracks, and tying into a proposed 600 mm trunk watermain on County Road 43. Additionally, a future 300 mm trunk watermain is planned to connect Banwell Road and Intersection Road, where a future 600 mm trunk watermain is proposed by the City of Windsor. These infrastructure upgrades are intended to provide robust water transmission and redundancy within the Hamlet. This analysis will involve investigation on the planned watermains as articulated in **Figure 1-1**.

The analysis will confirm whether current watermain sizing recommendations are sufficient or if upgrades are necessary to ensure reliable flow of the Town of Tecumseh.

Figure 1-1: Planned Watermains Improvement Works



2. Background Information on the Development and Water Demand Updates

The Town provided the latest population projections for THSPA, developed by a third-party consultant. These projections account for updated land use plans and anticipated population growth in the area. In addition to residential development, the area will also accommodate a future hospital and a battery plant, both of which will have significant water demand requirements. After confirmation with ENWIN and in agreement with the Town, the projected future water demands for these facilities have been established at 36.50 L/s for the hospital and 102 L/s for the battery plant.

As additional residential development is expected in the Manning Road Secondary Plan Area (MRSPA), the growth of population in this area will also impact the overall hydraulic performance of the system. Consequently, the increased population in the MRSPA has been incorporated into the hydraulic model to ensure a comprehensive evaluation of system demands. The location plan of MRSPA is shown in **Figure 2-1**.

The estimated water demands for both THSPA and MRSPA are shown in **Table 2-1**.

Figure 2-1: Location Plan of MRSPA

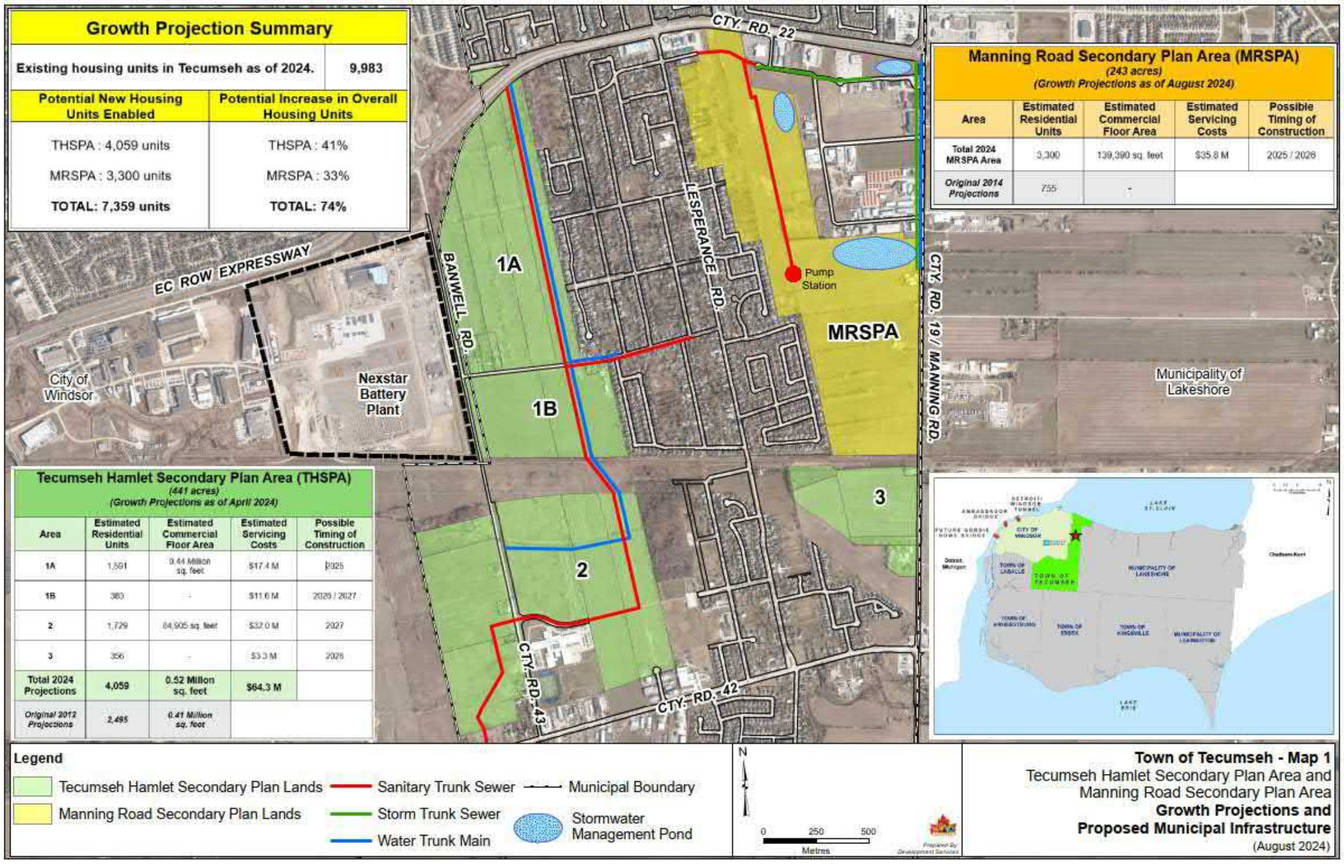


Table 2-1: Adopted Water Demands for THSPA and MRSPA

Area	Type of Development	Population	Area (Ha)	Unit Consumption[1]	ADD (L/s)	MDD (L/s)[2]
THSPA	Residential	11,511	-	347 Lpcd	46.23	92.46
THSPA	Employment	-	33.31	21,430 Lphd	8.26	16.52
MRSPA	Residential	9,359	-	347 Lpcd	37.59	75.17

1. Unit consumption rates were extracted from the Tecumseh Water Master Plan Update Study in 2023 and same as the 2018 Tecumseh Water Master Plan Study.
2. Maximum Day Demand factor of 2 as per Tecumseh Master Plan Study 2018.

2.1 Modelling Assumptions and Design Criteria

The following assumptions were made during this hydraulic analysis:

- The hydraulic model is an Extended Period Simulation model and the existing diurnal patterns are used for the analysis.
- Pressure and velocity for this modelling results were evaluated based on the following standards:
  - Minimum acceptable pressure - 275 kPa (40 psi) (*Ministry of the Environment Design Guidelines for Drinking-Water Systems*)
  - Maximum acceptable pressure - 700 kPa (100 psi) (*Ministry of the Environment Design Guidelines for Drinking-Water Systems)*

- Maximum acceptable velocity – 2 m/s

2.2 Model Establishment

The hydraulic model was established with reference to the hydraulic model updated in the previous study. The hydraulic model was updated with the proposed watermains. Demand nodes were assigned to the proposed watermains at the connection points indicated by the developer's design. Elevations were estimated from 1m DEM obtained from Canada Open Portal. Estimated water demands of the proposed development were assigned to the demand nodes.

3. Scenario Development

To evaluate system performance, two scenarios will be modeled:

Scenario 1: Model adjusted to include updated population forecasts within the THSPA based on latest Land Use Plan (updated population numbers provided by Dillon). All previously planned watermain works on Banwell and County Road 43, including looped connections from the Hamlet will remain.

Scenario 2: Model adjusted to include updated population forecasts within the THSPA based on latest Land Use Plan (updated population numbers provided by Dillon), but with the removal of the future 600mm trunk watermain on Banwell and the 300mm connection at Banwell/Intersection Road.

Details of Scenario 1 and Scenario 2 are shown in **Figure 3-1** and **Figure 3-2**, respectively.

Figure 3-1: Scenario 1

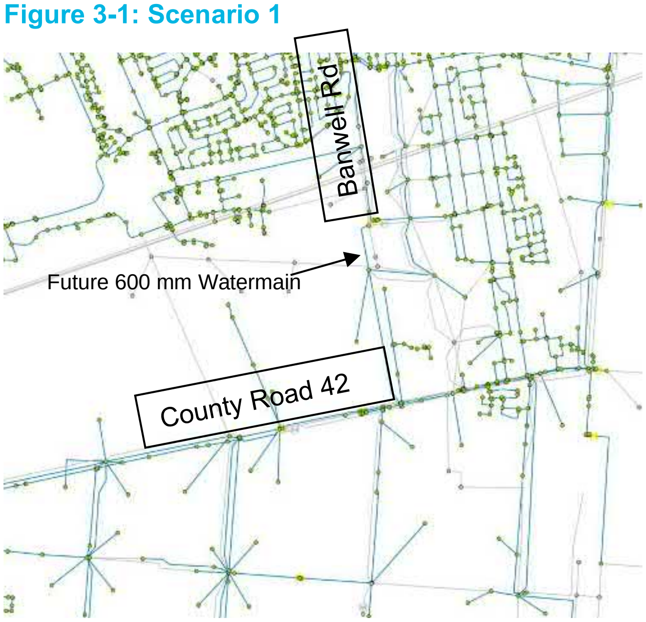
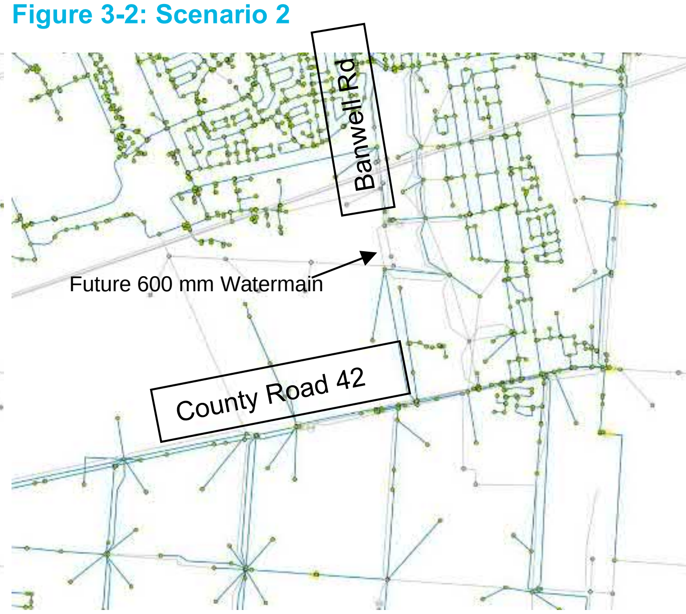


Figure 3-2: Scenario 2



4. Hydraulic Analysis and Results

A hydraulic modeling analysis was completed to evaluate whether the existing and planned watermains can adequately support the projected future water demands in THSPA and MRSPA. The analysis incorporated updated population projections, as well as the additional water demands from the future hospital and battery plant. Two scenarios were modeled to assess the system's capacity.

4.1 Simulated Pressures and Maximum Velocity

The proposed water distribution system could meet the minimum pressure (40 psi) under all scenarios with average and maximum day demands. All watermains were found with maximum velocity below 2m/s. The simulated minimum pressures and maximum velocity for Scenario 1 and Scenario 2 are shown in **Figure A-1** and **Figure A-2** in **Appendix A**, respectively. In Scenario 2, the velocity in the future 300 mm trunk watermain increased from less than 1 m/s to above 1 m/s due to the removal of the future 600 mm trunk watermain in the model but remained below 2 m/s, the maximum velocity in the design criteria.

4.2 Flow Split

In Scenario 1, with the future 600 mm trunk watermain in the simulation, the majority of water flows from the north toward THSPA, while a portion of the flow (32 L/s) leaves THSPA through the future main along County Road 42. Flow direction under Scenario 1 is shown in **Figure A-3** in **Appendix A**.

In Scenario 2, without the future 600 mm trunk watermain, water is supplied to THSPA from both the north and south. A portion of the water comes from the south via the future main along County Road 42, with the flow varying from -32 L/s in Scenario 1 to 144 L/s in Scenario 2. Flow direction under Scenario 2 is shown in **Figure A-4** in **Appendix A**.

5. Conclusions and Recommendations

To formulate and assess the water servicing for the future developments under THSPA and MRSPA, the following work was performed:

- Estimated water demand under Maximum Day Demand conditions based on the following parameters:
    - Total area for employment under THSPA: 33.31 ha
    - Average water consumption rates:
        - Residential development: 347 L/c/d
        - ICI development: 21,430 L/ha/d
    - Maximum Day Demand = Average Water Demand x 2.0
- Established a hydraulic model to evaluate the minimum pressures and maximum velocity in THSPA and MRSPA.
- Established and evaluated Scenario 1 (with planned watermains scenario) and Scenario 2 (without 600 mm trunk watermain scenario) to assess the serviceability of the proposed water distribution system in terms of operating pressure and maximum velocity.

Evaluation of the two scenarios, concluded that both the systems could meet the required minimum pressure (>=40 psi) to distribute the required demands in the development area. All scenarios also showed the proposed distribution watermains would have maximum velocity below 2 m/s.

In Scenario 1, the analysis indicates that the 600 mm trunk watermain and 300 mm connection watermain provide sufficient capacity to accommodate the future development in both THSPA and MRSPA, as well as the future hospital and battery plant. Based on the results, no upgrades to the currently planned watermains are required to meet the projected future demands.

In Scenario 2, although the future 300mm trunk watermain velocity remained within the acceptable design criteria, it is recommended to upsize the future 300 mm trunk watermain (from County Road 22 to the connection with the new 600mm watermain south of the railway) to 400 mm to maintain adequate flow capacity and to better accommodate potential future development. Location of the future 300 mm truck watermain recommended for upgrade is shown in **Figure A-5** in **Appendix A**. Velocity profiles for the future 300 mm trunk watermain under Scenario 1 and Scenario 2 are shown in **Figure A-6** and **Figure A-7** in **Appendix A**, respectively.

We trust that the details presented herein area sufficient to meet the Town's needs. Should you have any questions, please feel free to contact the undersigned.

Yours sincerely,

Report Prepared by:	Report Reviewed by:
4 November, 2024	4 November, 2024
Vincent Tsang, P.Eng. Hydraulic Analysis Modeller	Benny Wan, P.Eng. Senior Technical Director - Hydraulic Modelling
AECOM Canada Ltd.	AECOM Canada Ltd.

Appendix A– Modelling Results

Figure A-1: Scenario 1 – Minimum Pressure and Maximum Velocity (MDD)

Figure A-2: Scenario 2 – Minimum Pressure and Maximum Velocity (MDD)

Figure A-3: Flow Direction under Scenario 1

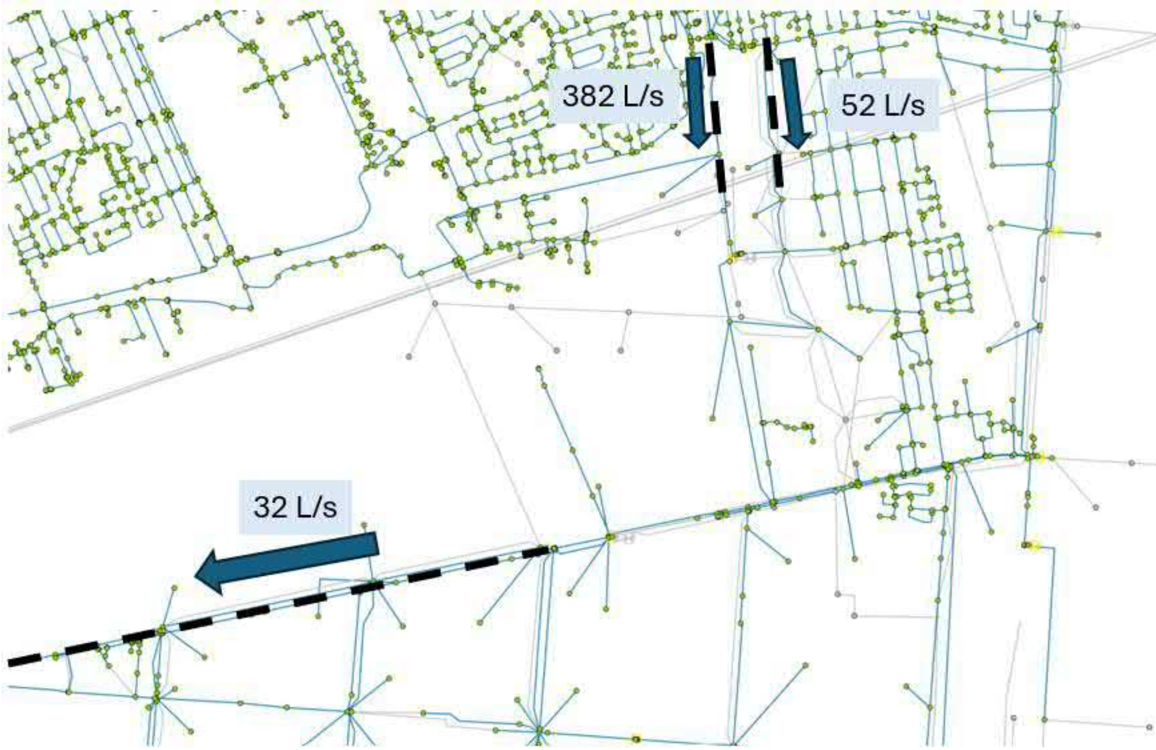


Figure A-4: Flow Direction under Scenario 2

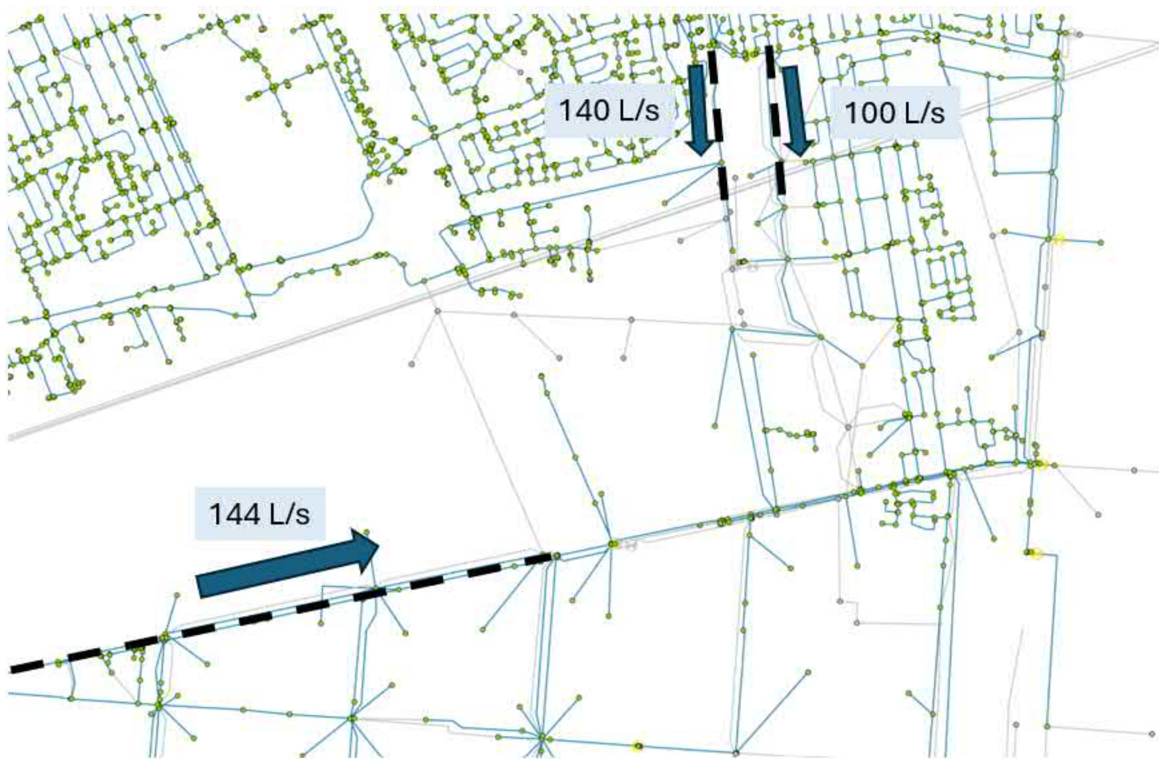


Figure A-5: Future 300 mm Trunk Watermain Recommended to be Further Upgraded

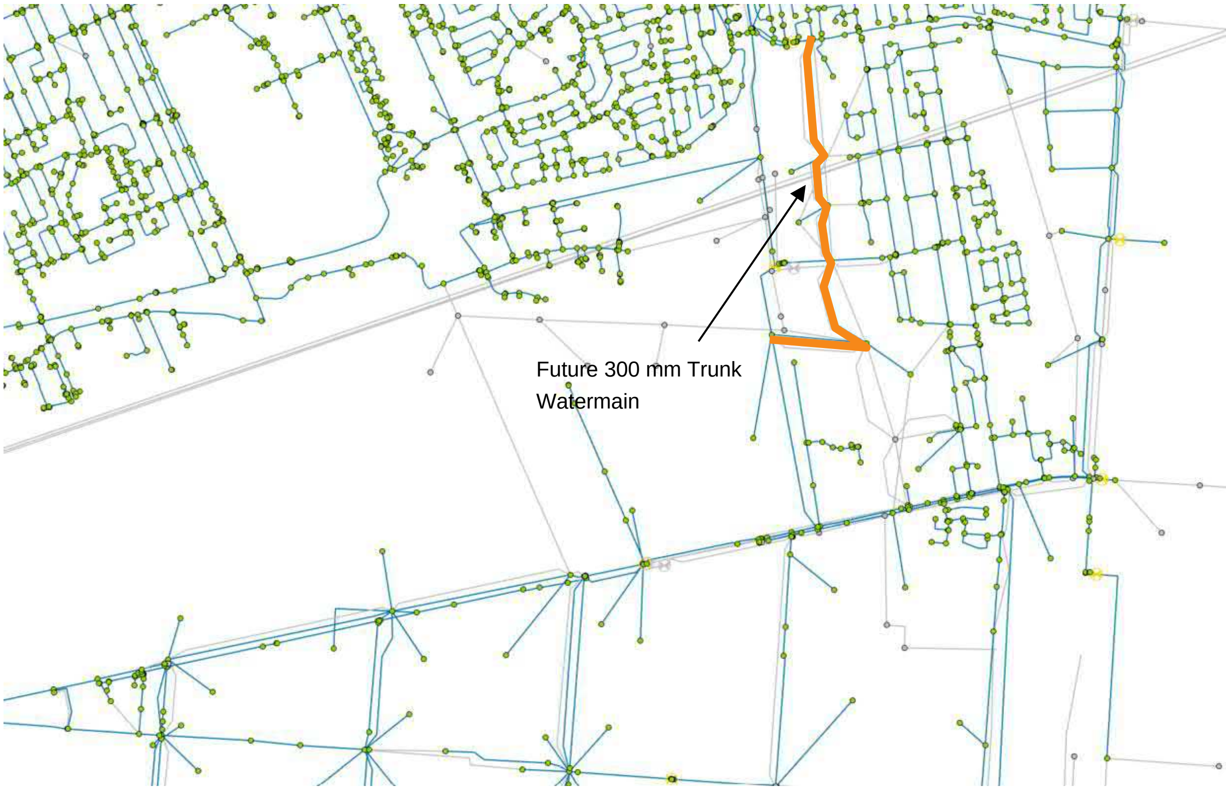


Figure A-6: Velocity of the Future 300 mm Trunk Watermain under Scenario 1

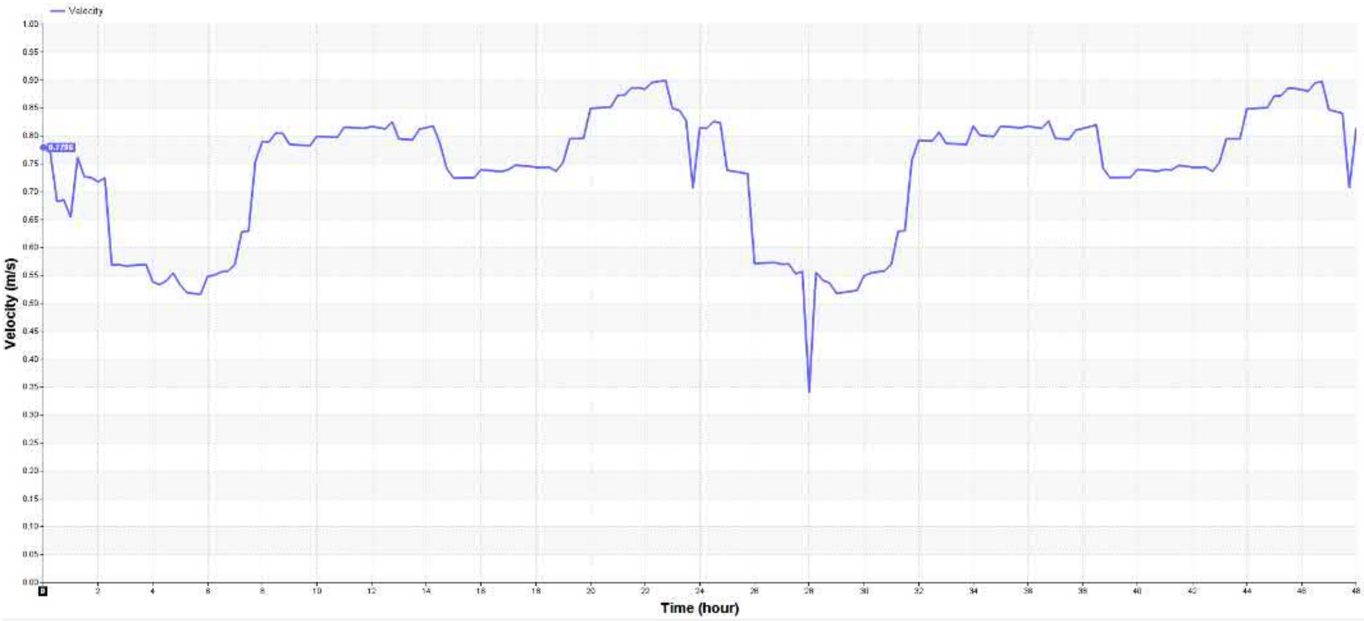
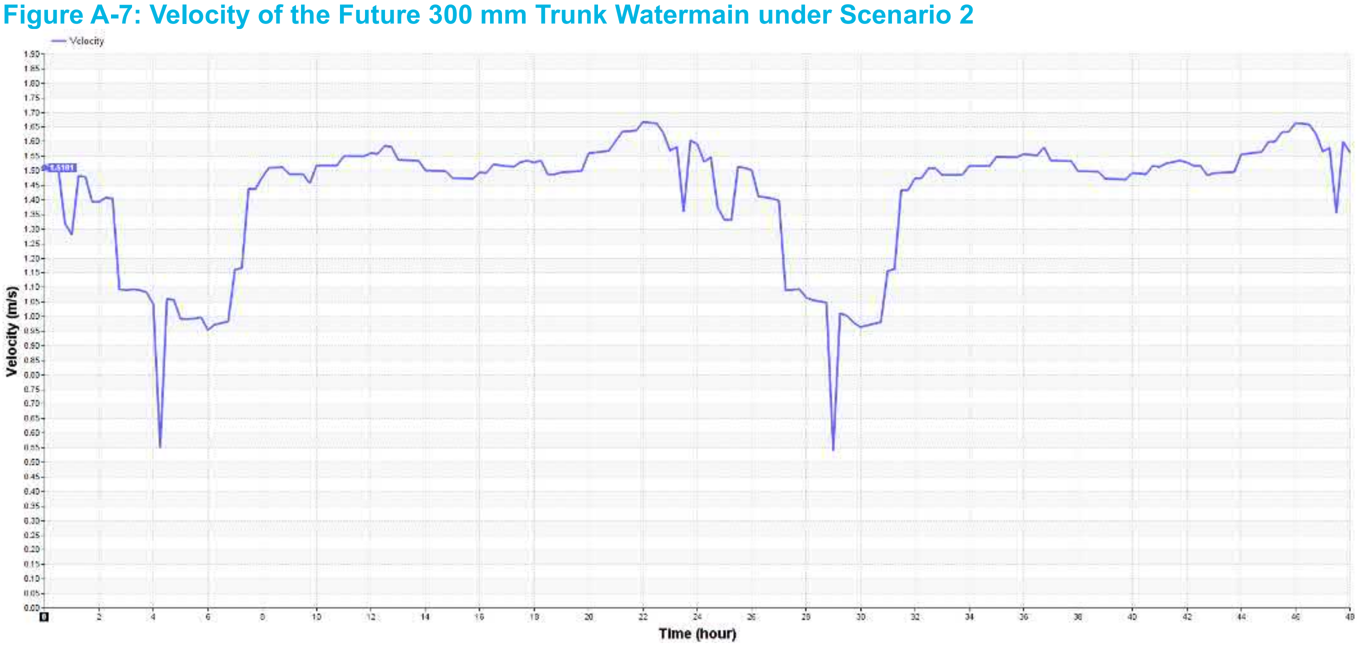


Figure A-7: Velocity of the Future 300 mm Trunk Watermain under Scenario 2



Appendix J

Utility Coordination Meeting Minutes

MEETING MINUTES

DILLON CONSULTING

Subject:	Tecumseh Hamlet Utility Meeting Start-Up
Date and Time:	February 14, 2022 at 1:00 p.m.
Location:	Video Conference Via Google Meet
Project Name:	West Tecumseh Hamlet OP Update
Our File:	22-4679

Attendees

Phil Bartnik	Town of Tecumseh
Shane McVitty	Town of Tecumseh
Steve Messer	Hydro One
Nick Toth	Hydro One
Fayez Youssef	Cogeco Cable
Tyson Fuerth	Bell Canada
Dave Hartlieb	MNSi
Fred Sua	Telus
Kaitlyn Watson	Enbridge
Laura Herlehy	Dillon Consulting Limited
Kristine Wilkinson	Dillon Consulting Limited

Notes

Item	Discussion	Action By
1.	**Overview of Project**	
1.1	The Town of Tecumseh has retained Dillon Consulting to complete a Class C EA and a Functional Service Report for the West Tecumseh Hamlet Study Area. A brief project overview was provided.	**Info.**
	Dillon will provide each utility with the following documents: - Proposed Land Use Plan; and - Proposed Population.	**Dillon Consulting Limited**
	It is anticipated that development will begin in the north portion of the study area, County Road 22 north to Intersection Road.	**Info**
	The Town of Tecumseh has initiated an RFP for the design and construction of the trunk sanitary sewer within the Tecumseh Hamlet study area (south of CR 22 to Intersection Road). Anticipated construction commencement is Spring 2024.	**Info.**
	Dillon has asked each utility to provide Dillon with mapping illustrating existing plant within the study area, as well as any future plans/ servicing requirements within the study area. It is anticipated that each utility will service the study area underground. Aerial lines will only be provided along main arterial roads (Banwell & Intersection)	**Bell/ Cogeco/MSNi/ Hydro One/Enbridge**

2.	**Hydro One**	
2.1	Existing plant within this area consists of three phase aerial hydro along the north side of Intersection Road (fed from Lesperance Road). This three-phase aerial plant continues on the west side of Banwell Road until CR 22. Servicing the Hamlet area north of intersection road will be done from this three-phase line. Hydro One indicated that servicing the Hamlet study area south of the tracks will require a rail crossing.	**Info.**
	Servicing the south eastern portion of the Hamlet study area, would be done through a Manning Road feed.	**Info**
	Hydro One has future plans to utilize the high voltage corridor as a feed for the westerly City of Windsor Lands.	**Info**
	During this conversation it was discussed that a joint rail crossing for all utilities would be beneficial.	**Info**
	Hydro One will provide Dillon with contact information for the high voltage Hydro One Corridor within the Study Area for further inquiries on crossings within their lands.	**Hydro One**
2.2	An additional rail crossing to account for future infrastructure needs may be requested by Hydro One.	**Hydro One**
	Hydro One inquired who the property owners are within the Hamlet study area. It was indicated that there were multiple property owners within the study area, and that in the future there may be potential for the developers to work together to service the properties.	**Info**
3.	**Bell Canada**	
3.1	The areas surrounding the Hamlet study area are presently serviced by existing Bell infrastructure. Bell does not foresee any issues feeding the study area with the existing plant in the area. The only area of concern is the south eastern portion of the Hamlet, this will require a rail crossing. This crossing may require a permit (further discussions about a shared rail crossing should be held).	**Info**
4.	**Enbridge**	
4.1	Once Enbridge receives the proposed land use plan and the proposed population within the Hamlet, Enbridge will meet internally to discuss the required infrastructure for the study area. Enbridge will assess future substation needs within the area, including the existing substation along Manning Road.	**Info.**
5.	**Cogeco**	
	Cogeco does not foresee any complications arising from servicing the Hamlet study area with the infrastructure that currently surrounds the Hamlet.	**Info.**

		A rail crossing may be required to facilitate the servicing of the south eastern portion of the study area.	**Info.**
6.		**MNSI**	
		MNSi anticipates feeding the study area off of their existing main feed that runs along Lesperance Road.	**Info.**
		MNSi is ready to service this area as soon as development begins.	**Info.**
7.		**Telus**	
		Presently, Telus has no intentions to service the study area with infrastructure.	
		The only plant present in the area is a main transmission along CR 42.	
8.		**Town of Tecumseh**	
	8.1	As part of this EA process, the Town has requested that Dillon assess the feasibility of incorporating interconnected trails within the study area, which would include a pedestrian rail crossing.	**Dillon**
	8.2	The Town has recommended that Dillon and all the utilities speak with the County of Essex and the City of Windsor regarding the imminent reconstruction of County Road 43. The Town has indicated that prior to the reconstruction of CR 43 it could be advantageous to upgrade any utilities along the corridor (rather than come back in the future).	**Bell/Cogeco/MSNi/ Hydro One/ Enbridge/ Dillon**
		The Town has also indicated that in the coming weeks, they will confirm the trunk watermain sizing for the proposed watermain along CR 43. Dillon will follow up with the Town regarding this matter, and ensure updates are incorporated into the CR 43 design.	**Dillon**

Errors and/or Omissions

These minutes were prepared by Kristine Wilkinson, P.Eng., who should be notified of any errors and/or omissions.

Distribution

All Present

KW:jm

February 16, 2023

Appendix K

Tecumseh Hamlet Secondary Plan Transportation Study Addendum

MEMO

DILLON CONSULTING

TO: Laura Herlehy

FROM: Mike Walters
Brent Hooton

DATE: June 12, 2024

SUBJECT: **Tecumseh Hamlet Secondary Plan Transportation Study Addendum**

OUR FILE: 22-4679, 23-5735

1.0 Introduction

1.1 Purpose

This memo is an update to the Tecumseh Hamlet Secondary Plan Transportation Impact Study (the Hamlet TIS), prepared by Dillon in 2015. It presents updated traffic projections and intersection analyses to reflect changes to the development concept that have been made since the original analyses were undertaken in 2015, along with changes to background conditions associated with background developments in the area.

1.2 Background

1.2.1 Tecumseh Hamlet TIS

The 2015 Tecumseh Hamlet Transportation Impact Study outlined the potential impact of traffic generated by the development of the Tecumseh Hamlet, and the transportation infrastructure required to serve anticipated travel demands. In that study, the analyses considered the following:

- The anticipated background traffic conditions at a 20-year horizon, considering general traffic growth (including traffic generated by background development in the City of Windsor, the Town of Tecumseh and Municipality of Lakeshore) and planned infrastructure modifications;
- The amount of traffic expected to be generated by development in the Tecumseh Hamlet Secondary Plan Area ('Hamlet') (as well as the adjacent Manning Road Secondary Plan area (MRSPA));
- The expected traffic operations with the Hamlet and MRSPA fully built out, and infrastructure requirements to accommodate Hamlet / MRSPA traffic;
- Potential interim development levels that could be accommodated in advance of substantial improvements on County Road 22 (CR 22);
- Identification of measures to encourage and facilitate cycling and pedestrian activity;
- Identification of potential traffic calming measures to encourage reduced vehicular travel speeds and volumes; and
- Other local road needs including recommended road classifications and right-of-way implications.

At that time, the Hamlet was anticipated to accommodate approximately 3,100 residential units, and 413,000 sq. ft. of commercial space (most of which would be focused in the northwest area of the Hamlet, near the proposed CR 22 and Banwell Road interchange). DIALOG was retained by the Town to develop a land use plan and street network; the plans developed to date form a traditional grid network and block pattern with an emphasis on walkability and include a commercial district with a traditional “main street” environment.

The study also considered traffic generated by the MRSPA, generally covering the currently non-urbanized area between Lesperance Road and Manning Road, and between CR 22 / Sylvestre Drive and the CPR corridor. The MRSPA was expected to accommodate an additional 755 residential units, in addition to two commercial blocks accommodating approximately 178,000 sq. ft. of commercial GFA.

Since that time, the residential development projections have been increased in the Hamlet and the MRSPA. The planned density of some of the residential blocks has been increased, resulting in an adjusted yield of approximately 4,300 units, or approximately 1,180 more (a 38% increase) compared to the 2015 Hamlet concept. The adjusted yield for the MRSPA is approximately 1,700 units, or approximately 950 more (a 125% increase).

The commercial development projections have increased in the Hamlet by an additional 193,000 sq. ft. of GFA (a 47% increase). The planned commercial area for the MRSPA has decreased by 70,000 sq. ft. compared to the previous concept (a 39% decrease), although this decrease is offset by a newly proposed hotel that is not included in the GFA for “general commercial” space.

1.2.2 Twin Oaks Battery Plant

An industrial facility is under construction on the southwest corner of Banwell Road and the E.C. Row Expressway, within the Twin Oaks Business Park in Windsor. The plant will be operated by Stellantis and will manufacture batteries for electric vehicles. The battery plant site extends west from Banwell Road to the current built-out limits of the Twin Oaks Business Park, and from the E.C. Row Expressway south to the CPR corridor. Employee access to the battery plant will be via three driveways extending from Banwell Road:

- A signalized full-movement driveway opposite the planned Maisonneuve Street extension;
- A signalized full-movement driveway opposite Intersection Road; and
- An unsignalized right-in / right-out (RI/RO) driveway midway between the two signalized accesses.

Truck access to the battery plant will be via Twin Oaks Drive on the west side of the site.

At the time of the 2015 Tecumseh Hamlet TIS, the development plans for the battery plant were not confirmed. The Hamlet TIS considered the lands to be developed as a generic industrial park, while the Banwell Road EA anticipated a potential commercial development. In either case, the existing road network within the business park would be extended to Banwell Road, at locations corresponding to the signalized battery plant accesses.

A Transportation Impact Study (TIS) was prepared by Dillon in February 2023 documenting the anticipated traffic volumes associated with the battery plant and the impact on traffic operations in the surrounding area. These analyses reflected both short-term conditions (up to 2027, reflecting a 5-year horizon) and longer-term conditions; the longer-term analyses were presented for convenience as nominally reflecting a 2037 horizon, but more accurately this horizon was intended to reflect long-term conditions following the completion of planned roadway improvements (including the widening of Banwell Road and construction of the planned interchange at the E.C. Row Expressway) and build-out of significant development areas. The full-build-out of the Tecumseh Hamlet (i.e., the previous 2015 concept) was included in the 2037 background traffic projections; the Hamlet volumes were taken directly from the 2015 Hamlet TIS.

2.0 Site Traffic Forecasts

2.1 Changes to Demonstration Plan Concept

Attachment 1 presents the updated demonstration plan concept provided for the purpose of this assessment, along with the concept that was assessed in the 2015 Hamlet TIS. The street network and block layout are largely unchanged. The main changes within the Tecumseh Hamlet area are as follows:

- The "anchor commercial" blocks have been relocated and the land use clarified. In the original plan, this land use was subdivided into two blocks straddling Maisonneuve Street, east of Banwell Road, whereas in the current plan, the "anchor commercial" space has been consolidated into one large block and shifted northerly, to the southeast corner of Banwell Road and Gouin Street. This block is now anticipated to house a large-format retail building.
- The institutional block on Maisonneuve Street has been relocated to south of Intersection Road and enlarged, and has been identified for use as a school with an approximate population of 500 (including students and staff).
- The density has been increased in some blocks (e.g., a change from low to medium density; the introduction of higher-density forms such as mid-rise apartment buildings).

Within the MRSPA, a new plan was not available, but the following changes are anticipated:

- The anticipated unit and population density has significantly increased compared to what was planned in 2015; in the absence of a more specific plan, this has been applied as a general percentage increase MRSPA-wide.
- Some commercial development has subsequently occurred near CR 22, and a development is under construction that includes a 142-room, 5-storey hotel and a 10,900 sq. ft. multi-unit commercial building lands along the south side of CR 22 from east of Lesperance Road to west of the Sylvestre Drive / CR 22 fly-off. These prior and proposed developments offset some of the commercial space that was included in the MRSPA forecasts in 2015.

Table 1 presents the currently anticipated development statistics in the Tecumseh Hamlet and MRSPA, and the change in potential development yield compared to the concepts that were analyzed in the 2015 Hamlet TIS.

The MRSPA residential unit estimation was determined by multiplying the residential land area by an anticipated average density of 30 units per hectare, and then estimating a potential proportion of low-density vs. medium-density units. Further clarification on the development of this population density is explained in the MRSPA Functional Servicing Report (July 2023).

Table 1: Change in Potential Development Yield

Land use	Tecumseh Hamlet			MRSPA		
	Previous concept	Current concept	Change	Previous concept	Current concept	Change
Low-density units	1,306	915	-391	755	421	-344
Medium-density units	1,794	1,640	-154	0	1,264	+1,264
High-density units	0	1,386	+1,386	0	0	0
"Mixed use" zone units	0	337	+337	0	0	0
Total residential units	**3,100**	**4,278**	**+1,178**	**755**	**1,685**	**+930**
Plaza commercial GFA (sq. ft.)	82,000	170,000	+88,000	178,000	97,000	-81,000
Anchor commercial GFA (sq. ft.)	173,000	244,000	+71,000	0	11,000	+11,000
"Main street" commercial GFA (sq. ft.)	158,000	192,000	+34,000	0	0	0
Total commercial GFA (sq. ft.)	**413,000**	**606,000**	**+193,000**	**178,000**	**108,000**	**-70,000**
Hotel rooms	0	0	0	0	142	+142
Institutional students	0	500	+500	0	0	0

2.2 Trip Generation

The trip generation calculations from the 2015 Hamlet study were adjusted to reflect the revised potential development yield documented in ***Section 2.1***. They were also adjusted to reflect updated trip generation rates. The 2015 analyses used trip generation rates from the 9th edition of the ITE *Trip Generation Manual*. For the revised analyses, the trip generation rates have been updated to reflect the current (11th) edition of the manual. The main changes since the 9th edition include:

- The data for condominiums / townhouses have been subdivided into separate land use codes for single-family (detached and attached) units and mid-rise and high-rise multi-family dwelling units. These were applied as follows:
  - The "Single-Family Detached Housing" rates were applied to the low-density units;
  - An average of the "Single-Family Attached Housing" rates and "Multifamily Housing (Low-Rise)" rates was applied to the medium-density units;
  - The "Multifamily Housing (Mid-Rise)" rates were applied to the high-density units; and
  - The "Multifamily Housing (Low-Rise)" rates were applied to the mixed-use (upper floor) units.
- The data for shopping centres have been subdivided into separate land use codes depending on the size and nature of the shopping centre (under 40,000 sq. ft.; under 150,000 sq. ft.; more than 150,000 sq. ft.). Different trip generation rates are also noted depending on whether the shopping centre includes a supermarket (i.e., a large anchor that would attract trips at a higher rate).
  - The rates for "Shopping Center (40-150k)" were applied to the "plaza" commercial blocks, using an average of the rates of the "Supermarket – Yes" and "Supermarket – No" subcategories.
  - An average of the "Shopping Center (40-150k) – Supermarket – No" and "Small Office Building" rates was applied to the "main street" commercial blocks.
  - The rates for "Strip Retail Plaza (<40k)" were applied to the multi-unit retail development application located in the MRSPA.

The updated edition also includes some other minor adjustments to trip generation rates due to incorporating newer, additional data.

In addition, the following other trip generation rates were applied in the updated analyses:

- The "anchor commercial" block, previously assessed as a generic shopping centre, is now anticipated to be a single large-format commercial building. For analysis purposes, this block has been analyzed using ITE Land Use Code 813 ("Free-Standing Discount Superstore"), the rates for which are generally comparable to a number of different retail categories.
- The proposed hotel in the MRSPA has been analyzed using ITE Land Use Code 310 ("Hotel").
- The proposed school was analyzed from first principles, assuming that all external trips would be related to staff.

Table 2 and ***Table 3*** present the number of trips associated with the updated concept, and a comparison with the previous concept, for the Hamlet and MRSPA, respectively. The commercial and institutional (school) trips represent externally generated (primary and pass-by) trips, after discounting trips generated from within the Hamlet and MRSPA (assumed to be 15% of larger-format commercial trips; and 50% of "main street" type commercial trips, similar to the 2015 TIS parameters).

Table 2: Updated Trip Generation – Tecumseh Hamlet

	2015 analyses					2024 revisions					Change				
Land Use	Units/ ksf	Rate	In	Out	Total	Units/ ksf	Rate	In	Out	Total	Units/ ksf	Rate	In	Out	Total
AM peak hour															
Res. (LD)	1306	0.75	245	730	975	915	0.70	161	480	641	-391	-0.05	-84	-250	-334
Res. (MD)	1794	0.51	183	726	909	1640	0.44	181	542	723	-154	-0.07	-2	-184	-186
Res. (HD)	0	0	0	0	0	1386	0.37	118	395	513	1386	0.37	118	395	513
Res. (MU)	0	0	0	0	0	337	0.40	32	102	134	337	0.40	32	102	134
Com. (Plaza)	82	1	42	27	70	170	2.63	235	145	380	88	1.63	193	118	310
Com. (Anch.)	173	1	89	58	147	244	1.86	216	170	386	71	0.86	127	112	239
Com. (MS)	158	1	48	31	79	192	1.70	117	46	163	34	0.70	69	15	84
Inst.	0	0	0	0	0	500	n/a	50	0	50	500	–	50	0	50
Total Res.	**3100**	–	**428**	**1456**	**1884**	**4278**	–	**492**	**1519**	**2011**	**1178**	–	**64**	**63**	**127**
Total Com.	**413**	–	**180**	**116**	**296**	**606**	–	**568**	**361**	**929**	**193**	–	**388**	**245**	**633**
Total	–	–	**608**	**1572**	**2180**	–	–	**1110**	**1880**	**2990**	–	–	**502**	**308**	**810**
PM peak hour															
Res. (LD)	1306	1.01	826	485	1311	915	0.94	542	317	859	-391	-0.07	-284	-168	-452
Res. (MD)	1794	0.52	625	307	932	1640	0.54	541	344	885	-154	0.02	-84	37	-47
Res. (HD)	0	0	0	0	0	1386	0.39	330	211	541	1386	0.39	330	211	541
Res. (MU)	0	0	0	0	0	337	0.51	109	63	172	337	0.51	109	63	172
Com. (Plaza)	82	3.73	130	130	260	170	7.11	494	534	1028	88	3.38	364	404	768
Com. (Anch.)	173	3.73	275	274	548	244	4.33	441	458	899	71	0.60	166	184	351
Com. (MS)	158	3.73	148	147	295	192	3.68	157	196	353	34	-0.05	9	49	58
Inst.	0	0	0	0	0	500	n/a	0	13	13	500	–	0	13	13
Total Res.	**3100**	–	**1451**	**792**	**2243**	**4278**	–	**1522**	**935**	**2457**	**1178**	–	**71**	**143**	**214**
Total Com.	**413**	–	**553**	**550**	**1103**	**606**	–	**1092**	**1188**	**2280**	**193**	–	**539**	**638**	**1177**
Total	–	–	**2004**	**1342**	**3346**	–	–	**2614**	**2136**	**4750**	–	–	**610**	**794**	**1404**

The updated Hamlet concept is anticipated to generate approximately 2,990 trips during the AM peak hour and 4,750 trips during the PM peak hour. By comparison, the previous concept (including the previously applied trip generation rates) was estimated to generate 2,180 trips during the AM peak hour and 3,346 trips during the PM peak hour.

Table 3: Updated Trip Generation – MRSPA

	2015 analyses					2024 revisions					Change				
Land Use	**Units/ ksf**	**Rate**	**In**	**Out**	**Total**	**Units/ ksf**	**Rate**	**In**	**Out**	**Total**	**Units/ ksf**	**Rate**	**In**	**Out**	**Total**
AM peak hour															
Res. (LD)	755	0.75	142	424	566	421	0.70	74	221	295	-334	-0.05	-68	-203	-271
Res. (MD)	0	0	0	0	0	1264	0.44	139	417	556	1264	0.44	139	417	556
Com. (Plaza)	178	1	92	59	151	97	2.63	134	83	217	-81	1.63	42	24	66
Com. (CRU)	0	0	0	0	0	11	2.36	13	9	22	11	2.36	13	9	22
Hotel	0	0	0	0	0	142	0.46	36	29	65	142	0.46	36	29	65
Inst.	0	0	0	0	0	0	n/a	0	0	0	0	–	0	0	0
Total Res.	**755**	**–**	**142**	**424**	**566**	**1685**	**–**	**213**	**638**	**851**	**930**	**–**	**71**	**214**	**285**
Total Com.	**178**	**–**	**92**	**59**	**151**	**108**	**–**	**183**	**121**	**304**	**-70**	**–**	**91**	**62**	**153**
Total	**–**	**–**	**234**	**483**	**717**	**–**	**–**	**396**	**759**	**1155**	**–**	**–**	**162**	**276**	**438**
PM peak hour															
Res. (LD)	755	1.01	481	282	763	421	0.94	249	147	396	-334	-0.07	-232	-135	-367
Res. (MD)	0	0	0	0	0	1264	0.54	417	266	683	1264	0.54	417	266	683
Com. (Plaza)	178	3.73	283	281	564	97	7.11	282	306	588	-81	3.38	-1	25	24
Com. (CRU)	0	0	0	0	0	11	2.94	14	13	27	11	2.94	14	13	27
Hotel	0	0	0	0	0	142	0.59	43	41	84	142	0.59	43	41	84
Inst.	0	0	0	0	0	0	n/a	0	0	0	0	–	0	0	0
Total Res.	**755**	–	**481**	**282**	**763**	**1685**	–	**666**	**413**	**1079**	**930**	–	**185**	**131**	**316**
Total Com.	**178**	–	**283**	**281**	**564**	**108**	–	**339**	**360**	**699**	**-70**	–	**56**	**79**	**135**
Total	**–**	–	**764**	**563**	**1327**	**–**	–	**1005**	**773**	**1778**	**–**	–	**241**	**210**	**451**

The updated MRSPA concept is expected to generate approximately 1,155 trips during the AM peak hour and 1,778 trips during the PM peak hour. The previous concept (including the previously applied trip generation rates) was estimated to generate 717 trips during the AM peak hour and 1,327 trips during the PM peak hour.

2.3 Trip Distribution and Assignment

The same trip distribution was applied as in the 2015 analyses. This distribution is presented in ***Table 4***.

Table 4: Trip Distribution

Direction	Possible approach routes	Residential		Commercial
		Peak direction	Counter-peak direction	All trips
North	Banwell Road Lesperance Road Manning Road	25%	35%	35%
West	E.C. Row Expressway CR 42	55%	40%	40%
East	CR 22 CR 42	10%	15%	20%
South	Banwell Road (minor) Lesperance Road (minor) Manning Road	10%	10%	5%

The trip assignment in the 2015 analyses was based on the CR 22 intersections with Lesperance Road and Manning Road being replaced with a partial interchange and a full interchange, respectively. The partial interchange at Lesperance Road would have only accommodated trips destined to/from the west, and therefore Hamlet traffic destined to/from the east was required to use the Banwell Road or Manning Road interchanges. At this time, the timing for the Lesperance Road and Manning Road interchanges is unknown; therefore, the updated analyses have been prepared on the basis of the existing at-grade intersections remaining in place, and the Hamlet trip assignment has been adjusted accordingly.

Figure 5 (see ***Section 5.1***) illustrates the network of existing, new and extended collector roads within the Hamlet and MRSPA that has been assumed to be in place for the purpose of trip assignment. Included in this network is the easterly extension of Westlake Drive to Sylvestre Drive and the fly-off from CR 22, and the eventual westerly extension of Shields Street into the adjacent development lands west of the Hamlet.

The trip assignment related to the large-format commercial block southeast of Banwell Road and Gouin Street will be highly dependent on factors such as access locations, building design and location within the site, and the layout of parking and drive aisles. For analysis purposes, it was assumed that this block would have a right-in access from Gouin Street, a right-in / right-out midblock access to Banwell Road, a full-movement rear access to the north-south street running along the east side of the site, and an interconnection across the lands to the south to Maisonneuve Street. Site access arrangements would need to be reviewed and justified by the applicant as part of the development application for the site.

The following figures illustrate the assignment of the Hamlet and MRSPA trips (combined):

- ***Figure 1*** presents the trip assignment associated with the original development concept (with the traffic assignment reflecting at-grade intersections on CR 22 at Lesperance Road and Manning Road).
- ***Figure 2*** presents the trip assignment associated with the updated development concept.

The volumes in these figures are expressed in vehicles per hour to match the trip generation forecasts. (The total future traffic volumes are expressed in vehicles per half hour, as explained in ***Section 3.1***.)

Figure 1: Site Trip Assignment — Original Development Concept

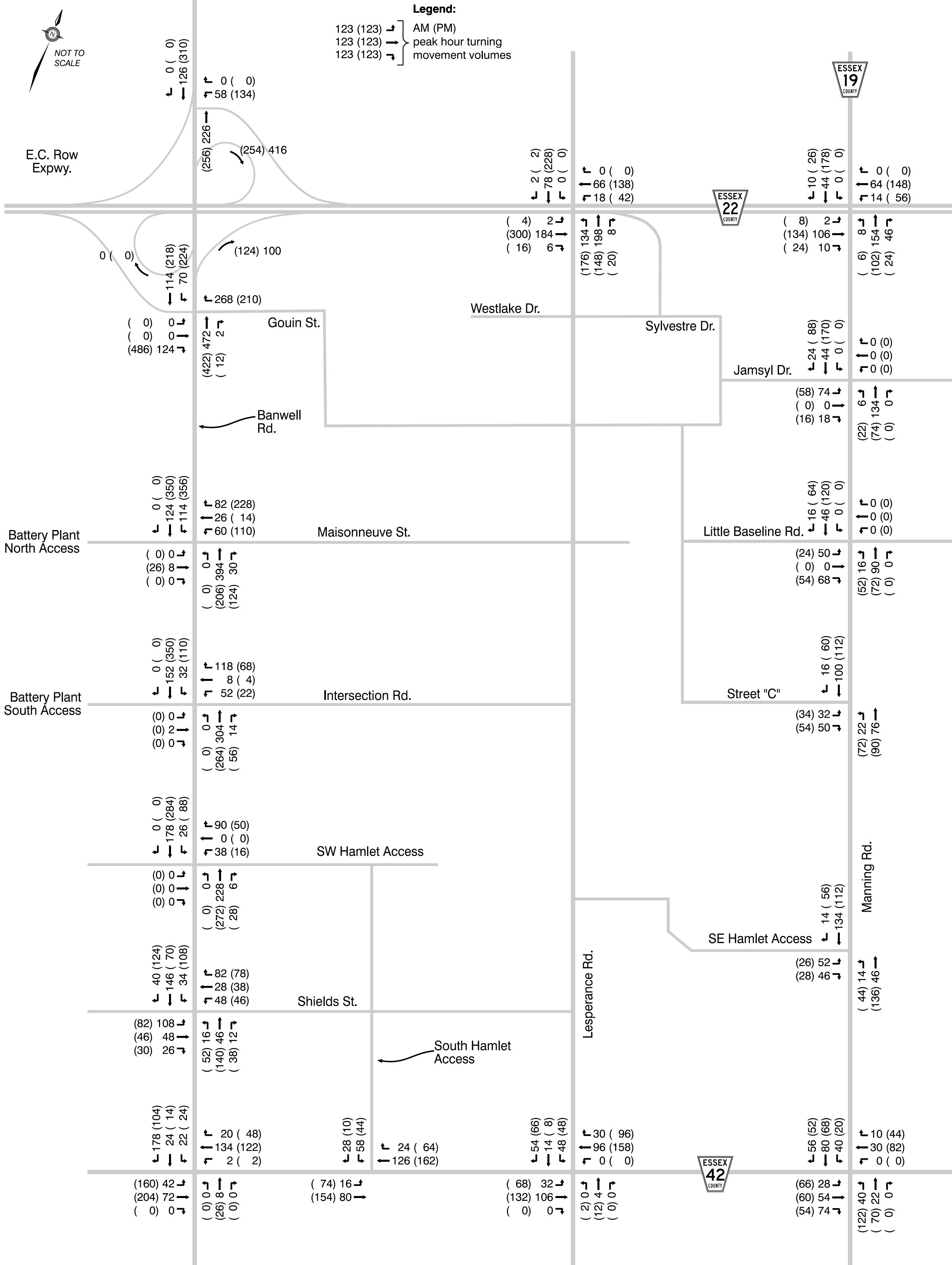
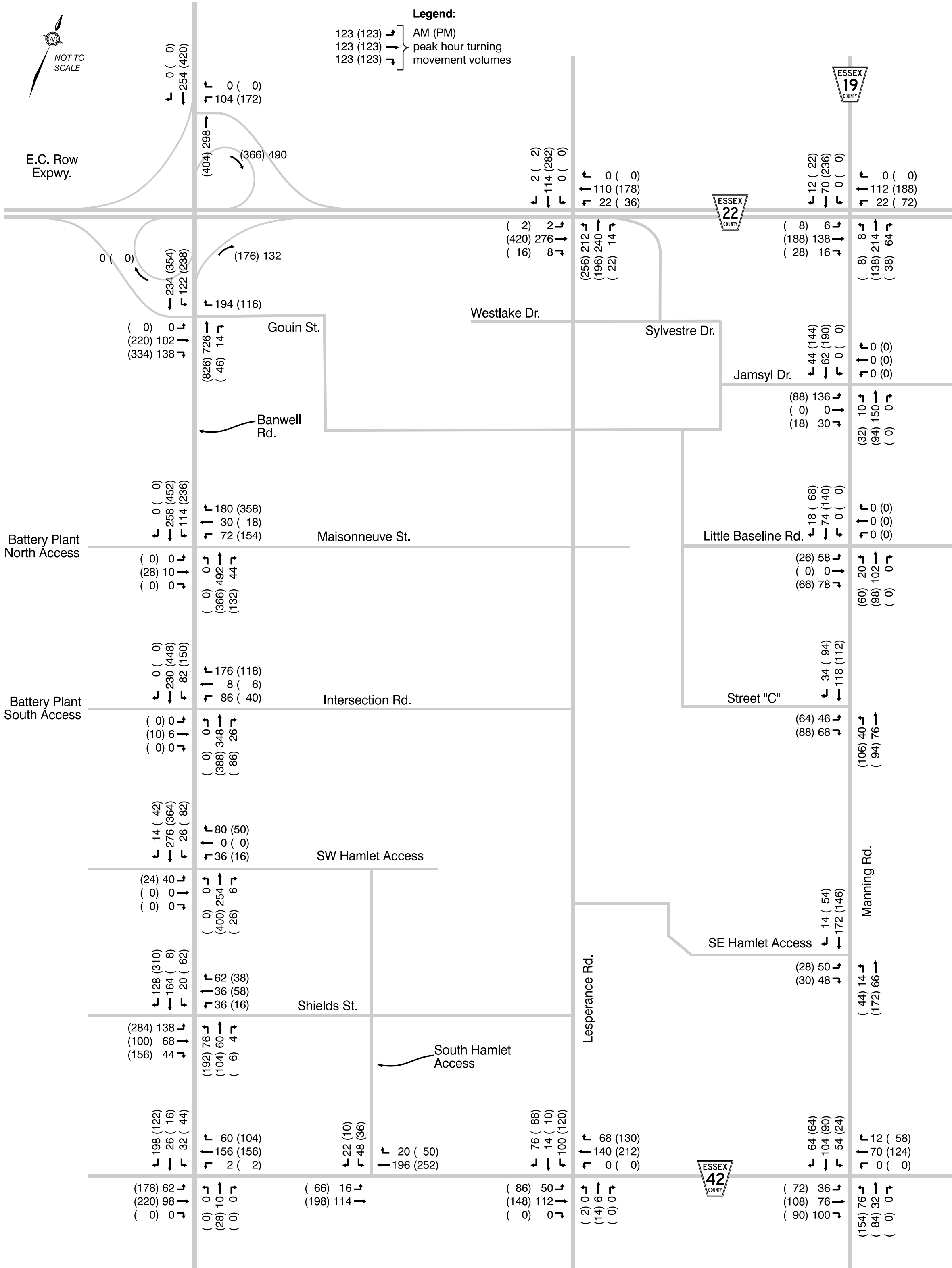


Figure 2: Site Trip Assignment — Updated Development Concept



3.0 Future Traffic Projections

3.1 Application of Previous Forecasts

A number of traffic studies have been undertaken in and around the study area since the original analyses were completed for the Tecumseh Hamlet in 2015. These include the County Road 42 Secondary Plan Transportation Background Study (Lea Consulting, January 2018), which accounted for development of the East Pelton Secondary Plan and CR 42 Secondary Plan, including the regional hospital; and the 2023 TIS for the battery plant.

The battery plant TIS contains the most recent comprehensive set of long-term intersection traffic projections in the study area. They reflect anticipated conditions at an assumed[1] 2037 horizon. In addition to traffic generated by the battery plant, it includes model forecasts from the CR 42 Secondary Plan study noted above, and includes traffic generated by the original Tecumseh Hamlet concept (including the MRSPA). The analysis in the battery plant TIS includes at-grade intersections on CR 22 at Lesperance Road and at Manning Road, and the traffic assignment for the Tecumseh Hamlet and Manning Road Secondary Plan trips was adjusted to reflect that road network.

The battery plant study area largely overlaps the Tecumseh Hamlet TIS study area, but did not include several intersections along Banwell Road, Manning Road and CR 42 that were included in the 2015 Tecumseh Hamlet TIS. The traffic volumes at those intersections were derived by applying the side street forecasts from the 2015 Hamlet study, and balancing the main street through movements with adjacent intersections.

The battery plant TIS forecasts reflect peak half-hour volumes rather than peak hour volumes. Traffic conditions in and around the battery plant will be closely related to shift change times, with significant surges in traffic activity during the periods before and after shift changes, and very little traffic entering and exiting the site at other times. The battery plant TIS analyses focused on four specific half-hour periods when shift change traffic surges will coincide with the peak periods on the surrounding road network:

- AM outbound half hour: 7:00–7:30 AM
- AM inbound half hour: 8:00–8:30 AM
- PM outbound half hour: 4:30–5:00 PM
- PM inbound half hour: 6:00–6:30 PM

Because of the Hamlet's proximity to the battery plant and the significant effect of shift change traffic on conditions on Banwell Road, and to provide a consistent point of reference, a similar approach was applied to the updated Tecumseh Hamlet analyses. The PM inbound half hour falls on the shoulder of the PM peak period and was found to experience lower traffic volumes and better intersection operations; therefore, the analyses focused on the remaining three half-hour periods. In this report, they are referred to as follows:

- AM early peak half hour: 7:00–7:30 AM
- AM late peak half hour: 8:00–8:30 AM
- PM peak half hour: 4:30–5:00 PM

[1] The actual horizon is more related to the timing of road network improvements and development activity than to a specific year; the horizon year could be later if the assessed level of development takes longer to materialize.

3.2 Total Future Volumes

Total future volumes were calculated for two analysis scenarios:

- Scenario 1: original Tecumseh Hamlet and MRSPA concepts
- Scenario 2: updated Tecumseh Hamlet and MRSPA concepts

Both sets of total future volumes were calculated by adding the traffic associated with the Tecumseh Hamlet and MRSPA to the background traffic volumes. The Tecumseh Hamlet / MRSPA volumes shown in ***Section 2.3*** were converted to half-hourly volumes by dividing the hourly forecasts in half.

The total future traffic volumes are presented in the following figures:

- ***Figure 3*** presents the total future volumes under the original Hamlet / MRSPA concepts; and
- ***Figure 4*** presents the total future volumes under updated revised Hamlet / MRSPA concepts.

The volumes on both figures are expressed in vehicles per half hour. Hourly flow rates can be determined by multiplying these values by 2.

Figure 3: Total Future Volumes, Original Tecumseh Hamlet / MRSPA Concepts

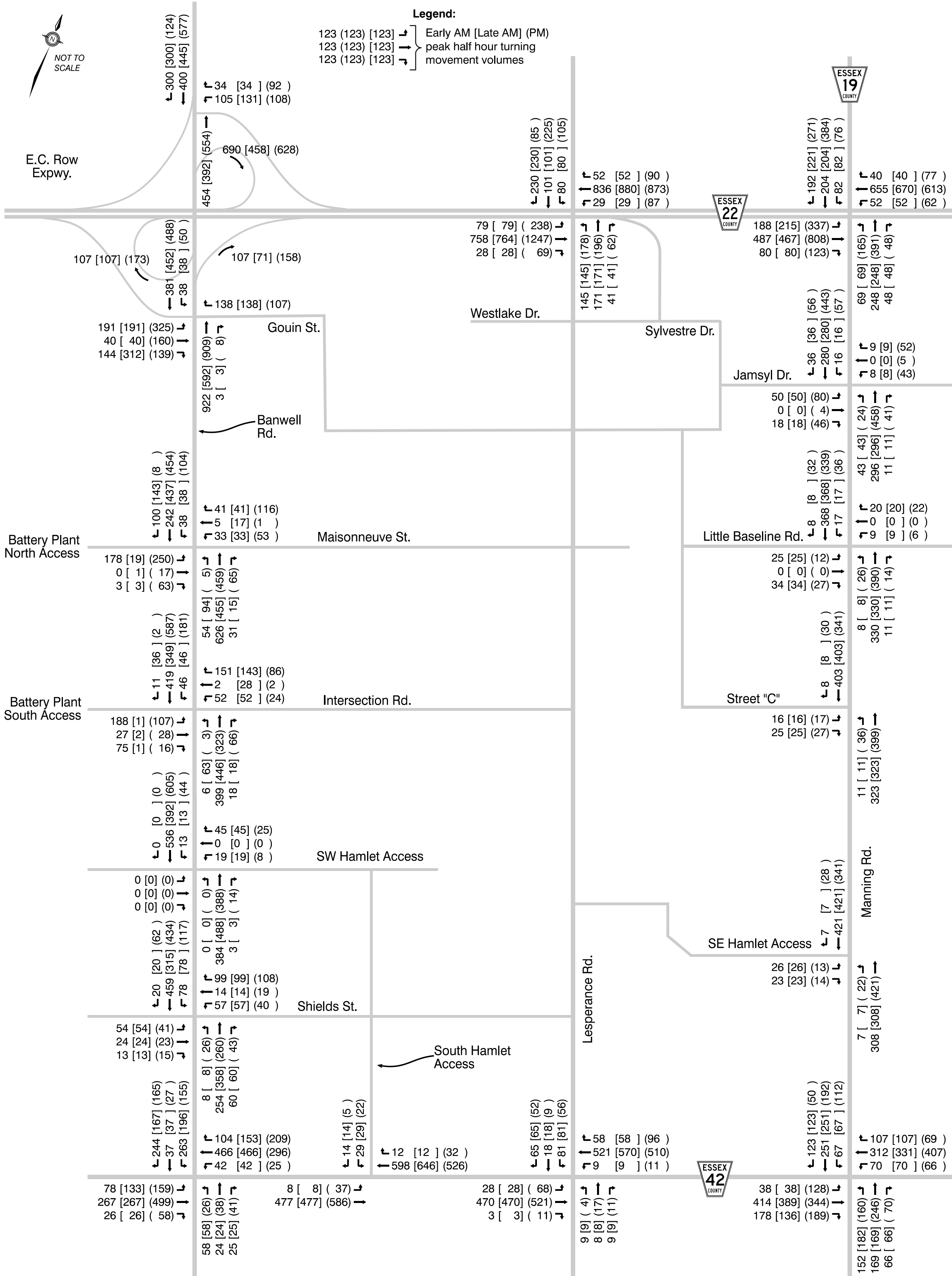
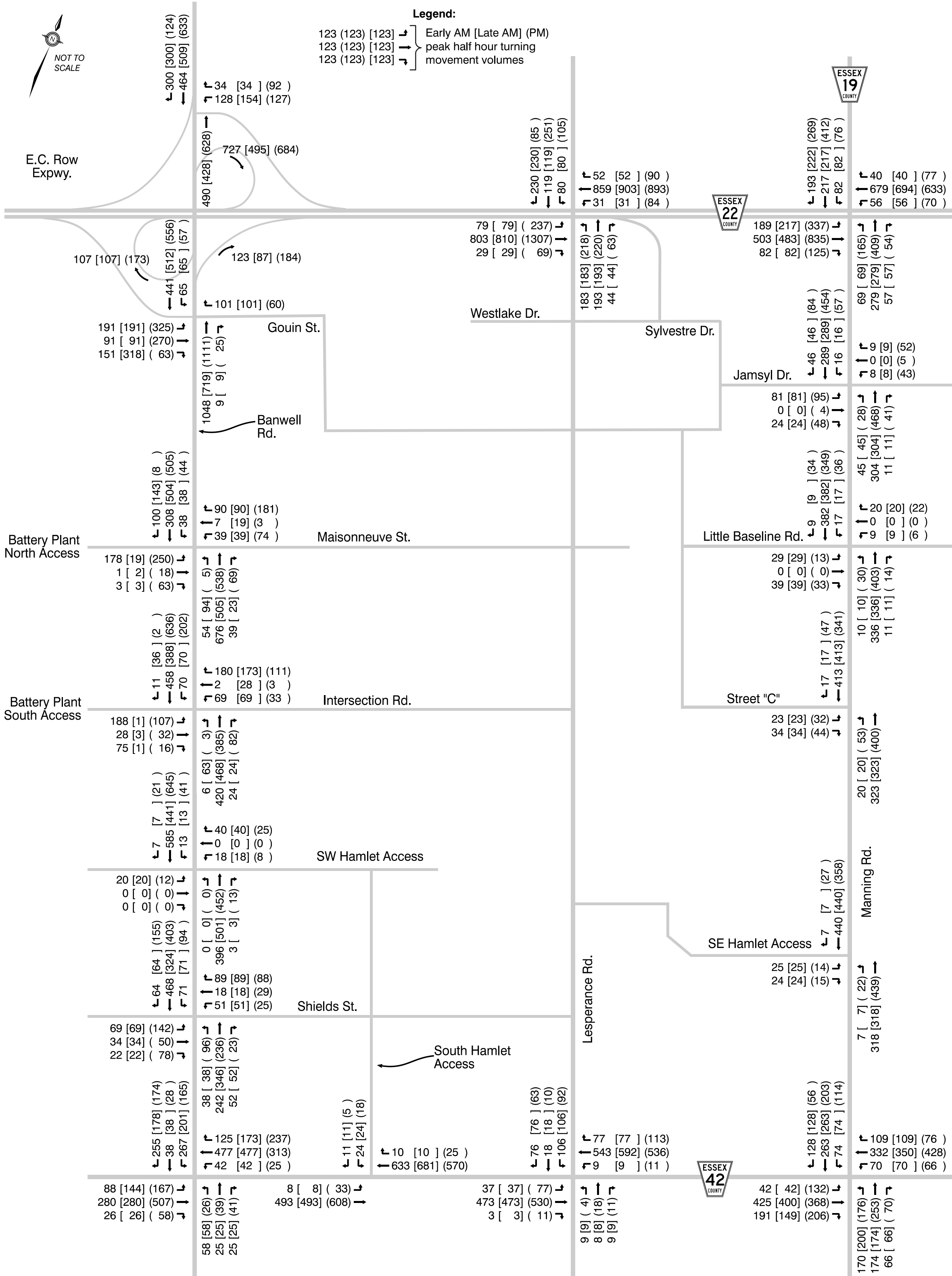


Figure 4: Total Future Volumes, Updated Tecumseh Hamlet / MRSPA Concepts



4.0 Projected Intersection Operations

The study area intersections were analyzed using Synchro software (version 11); the roundabout analyses were undertaken using SIDRA. The half-hour volumes were converted to hourly flow rates by applying a 2.0x growth factor and a peak hour factor of 1.00 (reflecting less potential for variability over a half-hour period). At intersections analyzed within the battery plant TIS, the same signal timings were applied; this includes an assumption of variable time-of-day timing plans to favour peak-direction movements leading to/from the battery plant during shift changes. At other intersections not analyzed within the battery plant TIS, the same intersection control (traffic signals vs. two-way stop control) was assumed as in the 2015 Hamlet TIS. Detailed analysis worksheets are provided in ***Attachment 2***.

At each intersection, critical movements were identified. For this study, critical movements are defined as:

- Any individual movement at a signalized intersection operating at a v/c ratio of 0.85 or greater; and
- Any individual movement at an unsignalized intersection operating at LOS F.

4.1 Banwell Road at E.C. Row Expressway North Ramp Terminal

The north ramp terminal intersection has been changed since the 2015 report. At that time, the westbound off-ramp intersected with Banwell Road at a two-lane roundabout opposite Wildwood Drive. The preferred interchange configuration was subsequently changed so that the off-ramp meets Banwell Road at a conventional intersection south of Wildwood Drive. More recently, it is understood that the City of Windsor proposes a two-lane roundabout at the north ramp terminal, with the N-W ramp extending west from the roundabout. The analyses were updated accordingly to reflect the currently preferred interchange configuration. The north ramp terminal intersection was analyzed as a two-lane roundabout.

Table 5 presents the anticipated operations at Banwell Road and the north ramp terminal intersection.

Table 5: Projected Intersection Operations, Banwell Road at E.C. Row Expressway North Ramp Terminal

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
NB approach	0.27	A	2.8	0	0.23	A	2.8	0	0.33	A	2.7	0
WB approach	0.19	B	10.3	6	0.24	B	10.4	7	0.25	A	9.8	7
SB approach	0.50	A	4.2	29	0.55	A	4.5	33	0.50	A	4.2	30
Overall	—	**A**	**4.3**	—	—	**A**	**4.7**	—	—	**A**	**4.4**	—
Updated Hamlet concept												
NB approach	0.29	A	2.8	0	0.26	A	2.8	0	0.38	A	2.7	0
WB approach	0.24	B	10.7	8	0.28	B	10.7	9	0.26	B	10.5	8
SB approach	0.56	A	4.5	35	0.62	A	5.0	40	0.56	A	4.5	35
Overall	—	**A**	**4.6**	—	—	**A**	**5.1**	—	—	**A**	**4.6**	—

The roundabout at the north ramp terminal is anticipated to operate at a good level of service (LOS A) with no critical movements.

4.2 Banwell Road at E.C. Row Expressway South Ramp Terminal / Gouin Street

Table 6 presents the anticipated operations at Banwell Road and the south ramp terminal intersection opposite the Gouin Street extension.

Table 6: Projected Intersection Operations, Banwell Road at E.C. Row Expressway South Ramp Terminal / Gouin Street

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.71	E	55.8	61	0.71	E	55.8	61	0.77	D	48.7	92
EB through	0.27	D	46.3	32	0.27	D	46.3	32	0.70	D	49.7	98
EB right	0.18	A	0.2	0	0.39	A	0.7	0	0.17	A	0.2	0
WB right	0.80	D	50.0	73	0.80	D	50.3	73	0.76	D	47.3	56
NB through	0.65	C	24.4	125	0.42	B	14.7	63	0.71	B	18.6	113
SB left	0.20	B	13.2	15	0.15	A	3.8	7	0.34	B	16.4	19
SB through	0.28	A	4.2	31	0.34	A	4.0	32	0.41	A	8.0	80
SB right	0.13	A	0.2	0	0.13	A	0.2	0	0.21	A	0.3	0
Overall	—	**C**	**22.5**	—	—	**B**	**16.2**	—	—	**C**	**21.5**	—
Updated Hamlet concept												
EB left	0.71	E	55.3	61	0.71	E	55.3	61	0.61	D	38.0	89
EB through	0.62	E	56.5	64	0.62	E	56.5	64	0.93	E	63.7	193
EB right	0.19	A	0.3	0	0.39	A	0.7	0	0.08	A	0.1	0
WB right	0.75	D	45.8	52	0.75	D	45.8	52	0.59	C	31.2	28
NB through	0.69	B	13.2	149	0.48	C	25.9	136	0.91	C	24.2	220
SB left	0.46	C	22.3	27	0.35	B	11.3	20	0.55	C	26.2	22
SB through	0.33	A	4.0	31	0.38	A	4.6	43	0.52	B	13.2	109
SB right	0.13	A	0.2	0	0.13	A	0.2	0	0.21	A	0.3	0
Overall	—	**B**	**17.1**	—	—	**C**	**20.1**	—	—	**C**	**25.7**	—

During the AM peak half hours, the south ramp terminal intersection is anticipated to operate at a reasonable overall level of service (LOS B to C) with no critical movements. However, during the PM peak half hour, the eastbound and northbound through movements are anticipated to exceed the critical v/c threshold.

To mitigate conditions during the PM peak half hour, the eastbound off-ramp lane configuration was adjusted. The ramp geometry would be unchanged, but the middle lane would be converted from an exclusive left turn lane to a shared through / left turn lane. This would require that Gouin Street be widened from one to two eastbound lanes along the block east of Banwell Road. ***Table 6*** presents the anticipated intersection operations under this lane configuration.

Table 7: Mitigated Intersection Operations, Banwell Road at E.C. Row Expressway South Ramp Terminal / Gouin Street

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Updated Hamlet concept												
EB left									0.84	E	57.2	141
EB through									0.83	D	48.6	124
EB right									0.08	A	0.1	0
WB right									0.67	D	38.9	33
NB through									0.84	B	18.9	136
SB left									0.64	C	33.8	28
SB through									0.50	B	11.4	96
SB right									0.21	A	0.3	0
Overall									—	**C**	**23.7**	—

With the lane reallocation in place on the eastbound off-ramp, the south ramp terminal would operate at an improved overall level of service (LOS C). All individual movements would be below the critical v/c threshold. On this basis, it is recommended that the lane reallocation on the eastbound off-ramp be applied, along with the additional eastbound lane on Gouin Street east of the intersection.

4.3 Banwell Road at Maisonneuve Street

Table 8 presents the projected operations at Banwell Road and Maisonneuve Street.

The west leg of this intersection is the proposed northerly access to the battery plant. The battery plant site plan indicates three eastbound lanes exiting the site, which would allow for the potential for dual left turn lanes. However, because dual left turn lanes would require a fully protected left turn phase, the battery plant TIS first tested the intersection with a single eastbound left turn lane. The analyses in ***Table 8*** also assume a single eastbound left turn lane.

Table 8: Projected Intersection Operations, Banwell Road at Maisonneuve Street

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.88	E	61.9	115	0.38	E	60.4	20	0.97	E	63.2	187
EB through	0.01	A	0.0	0	0.05	C	31.2	5	0.19	A	5.2	16
WB left	0.15	C	28.9	21	0.51	E	64.7	30	0.18	B	18.4	26
WB through	0.16	A	7.6	13	0.51	C	25.9	26	0.26	A	2.9	14
NB left	0.19	A	9.1	15	0.35	A	4.6	10	0.04	B	19.5	5
NB through	0.49	B	14.8	71	0.25	A	2.9	18	0.72	D	45.5	107
SB left	0.31	B	13.5	11	0.15	A	2.1	3	0.78	E	61.4	69
SB through	0.19	B	12.1	21	0.24	A	3.3	24	0.44	C	21.8	51
SB right	0.22	A	1.0	3	0.23	A	0.7	1	0.02	A	0.6	0
Overall	—	**B**	**19.3**	—	—	**A**	**6.4**	—	—	**D**	**36.2**	—
Updated Hamlet concept												
EB left	0.95	E	74.7	140	0.60	F	86.9	21	1.18	F	134	216
EB through	0.01	B	15.9	4	0.06	C	32.4	6	0.18	A	5.2	16
WB left	0.16	C	27.3	25	0.55	E	65.1	34	0.24	B	18.9	35
WB through	0.29	A	7.1	21	0.67	C	22.0	33	0.39	A	6.4	33
NB left	0.24	B	10.3	16	0.39	A	6.5	14	0.04	B	16.4	3
NB through	0.59	B	17.6	80	0.28	A	3.7	24	0.80	D	44.2	126
SB left	0.34	B	17.3	18	0.17	A	4.8	10	0.44	D	40.3	31
SB through	0.26	B	17.6	39	0.28	A	10.0	53	0.51	C	25.9	64
SB right	0.23	A	2.9	11	0.24	A	3.7	18	0.02	A	0.9	0
Overall	—	**C**	**22.6**	—	—	**B**	**10.2**	—	—	**D**	**44.5**	—

Under the original Hamlet concept, the intersection was anticipated to operate at a good level of service (LOS A to B) during the AM peaks and an acceptable level of service (LOS D) during the PM peak. The only critical movement was the eastbound left turn during the early AM and PM peaks, which corresponds to the surge in traffic exiting the battery plant at shift change. This left turn movement would operate just within capacity and queues could be accommodated within the driveway.

The revised Hamlet traffic projections resulted in increased overall delays, and the eastbound left turn would operate over capacity during the PM peak hour assuming no changes to traffic signal timings compared to the "original concept" analysis. The eastbound left turn was originally anticipated to operate nearly at capacity, and increased volume on other movements would reduce the eastbound left turn capacity by 18% assuming no other changes to signal timings/operations.

The first measure tested to mitigate the effect of this increased traffic was adjusted signal timings. Green time was reallocated from the north/south phases to the east/west phases during the early AM and PM peaks:

- During the early AM peak, 18 seconds of green time was reallocated; and
- During the PM peak, 8 seconds of green time was reallocated.

The results of these signal timing adjustments are presented in ***Table 9***.

Table 9: Projected Intersection Operations, Banwell Road at Maisonneuve Street (Signal Timing Adjustments)

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Updated Hamlet concept												
EB left	0.87	E	55.1	102					0.99	E	64.4	194
EB through	0.01	B	11.8	3					0.16	A	4.0	14
WB left	0.15	C	23.2	20					0.21	B	14.4	30
WB through	0.27	A	4.5	14					0.37	A	7.0	38
NB left	0.25	B	19.2	26					0.05	C	23.6	4
NB through	0.61	C	30.3	119					0.94	E	55.6	139
SB left	0.39	C	25.5	27					0.52	D	46.4	30
SB through	0.27	C	25.7	57					0.61	C	31.9	67
SB right	0.24	A	8.1	26					0.03	A	1.1	0
Overall	—	**C**	**28.4**	—					—	**D**	**40.3**	—

After applying signal timing adjustments, the eastbound left turn would be just over the critical v/c threshold during the early AM peak. However, it would still operate at capacity during the PM peak, and the northbound through movement would also be approaching capacity.

As an additional measure, the battery plant driveway was tested with two outbound left turn lanes. The driveway is being constructed with three outbound lanes, but the base analyses were conducted assuming only one left turn lane and a shared through/right turn lane; the third lane would be hatched out or used as a potential bypass lane for buses/shuttles exiting the site. A single left turn lane has the benefit of a simpler signal phasing plan and therefore lower delays at lower-volume times; a dual left turn lane can process more vehicles at a time during the left turn phase and provides more space for queue storage but requires a fully protected left turn phase that would be applicable at all times of the day. The results of the dual left turn lane analysis are presented in ***Table 10***.

Table 10: Projected Intersection Operations, Banwell Road at Maisonneuve Street (Dual Eastbound Left Turn Lanes)

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Updated Hamlet concept												
EB left	0.83	E	68.7	68	0.19	E	55.9	11	0.85	E	63.1	86
EB through	0.02	B	19.2	4	0.04	C	24.7	5	0.21	A	5.6	16
WB left	0.54	E	64.1	34	0.55	E	65.1	34	0.58	D	51.0	50
WB through	0.68	C	29.9	38	0.67	C	22.0	31	0.85	D	46.3	86
NB left	0.21	A	7.8	14	0.45	B	13.6	34	0.04	B	17.8	4
NB through	0.50	B	13.2	71	0.31	A	8.7	43	0.60	D	35.8	126
SB left	0.31	B	10.6	12	0.19	A	6.6	11	0.42	C	30.5	27
SB through	0.22	B	13.2	35	0.30	A	9.5	40	0.42	B	19.1	55
SB right	0.21	A	2.5	11	0.25	A	2.4	13	0.02	A	0.1	0
Overall	—	**C**	**21.1**	—	—	**B**	**11.7**	—	—	**C**	**34.9**	—

The revised configuration would allow all movements to operate at or below the critical v/c threshold. It would increase queues and delays on the westbound approach (because westbound green time would be reduced to accommodate the eastbound left turn phase). It would also increase delays exiting the battery plant at lower-volume periods because of the need to wait for a dedicated left turn phase. However, dual eastbound left turn lanes would improve conditions on the Banwell Road approaches and would considerably reduce queue lengths exiting the battery plant at the end of a shift.

Given that the driveway is already planned to be constructed with three outbound lanes, no geometric modifications would be required to implement dual outbound left turn lanes; the main change would be associated infrastructure (poles, traffic signal heads, etc.). The intersection could be opened with a single left turn lane, with the configuration adjusted as such time as conditions warrant.

4.4 Banwell Road at Intersection Road

Table 11 presents the projected operations at Banwell Road and Intersection Road.

The west leg of this intersection is the proposed southerly access to the battery plant. The battery plant site plan indicates three eastbound lanes exiting the site, which would allow for the potential for dual left turn lanes. However, because dual left turn lanes would require a fully protected left turn phase, the battery plant TIS first tested the intersection with a single eastbound left turn lane. The analyses in ***Table 11*** also assume a single eastbound left turn lane.

Table 11: Projected Intersection Operations, Banwell Road at Intersection Road

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.97	E	73.4	150	0.03	D	40.5	3	0.88	E	76.6	75
EB through	0.26	A	6.9	22	0.02	C	33.7	5	0.20	C	24.8	24
WB left	0.22	C	22.2	28	0.53	E	56.1	39	0.16	C	34.4	18
WB through	0.39	A	9.4	38	0.83	C	34.5	61	0.35	A	6.9	17
NB left	0.04	B	18.0	5	0.21	A	5.0	16	0.02	B	10.8	2
NB through	0.42	C	28.5	70	0.27	A	8.7	48	0.32	C	20.4	67
SB left	0.32	C	20.5	19	0.20	A	4.5	10	0.66	B	11.6	60
SB through	0.54	C	24.5	77	0.30	A	8.3	49	0.51	B	11.0	168
SB right	0.03	A	0.4	0	0.07	A	1.1	2	0.00	A	0.0	0
Overall	—	**C**	**28.9**	—	—	**B**	**13.9**	—	—	**B**	**19.1**	—
Updated Hamlet concept												
EB left	1.02	F	85.7	161	0.03	D	35.5	3	0.94	F	89.7	84
EB through	0.25	A	7.2	23	0.02	C	30.4	5	0.21	C	25.6	26
WB left	0.27	C	22.5	37	0.54	D	50.2	46	0.20	C	33.8	23
WB through	0.44	B	12.4	53	0.86	D	40.2	80	0.40	A	6.4	19
NB left	0.05	B	18.2	5	0.25	A	7.2	19	0.02	B	12.8	3
NB through	0.48	C	30.6	75	0.30	B	11.5	60	0.44	C	26.8	87
SB left	0.56	C	28.5	28	0.34	A	8.9	15	0.76	B	18.7	74
SB through	0.63	C	27.9	138	0.36	A	7.0	33	0.57	B	12.4	187
SB right	0.03	A	0.5	1	0.07	A	0.2	0	0.00	A	0.0	0
Overall	—	**C**	**32.1**	—	—	**B**	**16.0**	—	—	**C**	**22.9**	—

The intersection is anticipated to operate at a good to reasonable overall level of service (LOS B to C) during all analysis periods. The eastbound left turn is anticipated to be critical during periods when traffic is exiting the battery plant after shift change. Under the volumes associated with the original Hamlet concept, the eastbound left turn would operate within capacity in a single lane despite being critical. The higher volumes associated with the revised Hamlet concept would result in reduced capacity on the eastbound left turn at outbound shift change time, and the eastbound left turn would slightly exceed capacity during the early AM peak. The higher Hamlet volumes would also result in the westbound through/right turn lane slightly exceeding the critical v/c threshold during the late AM peak.

To mitigate the critical movements, the intersection was first tested with the following signal timing adjustments:

- During the early and late AM peaks, 2 seconds of green time was reallocated from the north/south phases to the east/west phases; and
- During the PM peak, 12 seconds of green time was reallocated from the southbound left phase to the northbound phase.

The results of the mitigation are presented in ***Table 12***.

Table 12: Projected Intersection Operations, Banwell Road at Intersection Road (Signal Timing Adjustments)

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Updated Hamlet concept												
EB left	0.99	E	76.3	89	0.03	C	34.0	3	0.94	F	89.7	84
EB through	0.24	A	6.5	8	0.02	C	29.1	5	0.21	C	25.6	26
WB left	0.27	C	21.4	20	0.50	D	47.0	45	0.20	C	33.8	23
WB through	0.44	B	11.8	27	0.85	D	41.2	83	0.40	A	6.4	19
NB left	0.06	B	19.2	2	0.26	A	8.0	20	0.02	B	10.8	3
NB through	0.49	C	31.7	63	0.31	B	12.5	62	0.40	C	21.7	74
SB left	0.57	C	30.5	12	0.34	B	10.0	17	0.84	C	30.6	141
SB through	0.64	C	25.4	49	0.36	A	7.3	35	0.57	B	19.9	189
SB right	0.03	A	0.3	0	0.07	A	0.5	1	0.00	A	0.2	0
Overall	—	**C**	**30.4**	—	—	**B**	**16.5**	—	—	**C**	**25.9**	—

The signal timing adjustments would allow all movements at the intersection to operate at or below capacity. The eastbound left turn would still be critical during the early AM and PM peaks.

As an additional measure, the battery plant driveway was tested with two outbound left turn lanes. The driveway is being constructed with three outbound lanes, but the base analyses were conducted assuming only one left turn lane and a shared through/right turn lane; the third lane would be hatched out or used as a potential bypass lane for buses/shuttles exiting the site. A single left turn lane has the benefit of a simpler signal phasing plan and therefore lower delays at lower-volume times; a dual left turn lane can process more vehicles at a time during the left turn phase and provides more space for queue storage but requires a fully protected left turn phase that would be applicable at all times of the day. The results of the dual left turn lane analysis are presented in ***Table 13***.

Table 13: Projected Intersection Operations, Banwell Road at Intersection Road (Dual Eastbound Left Turn Lanes)

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Updated Hamlet concept												
EB left	0.78	E	61.4	64	0.01	D	54.5	2	0.75	E	70.7	44
EB through	0.28	A	7.3	21	0.03	C	29.0	5	0.24	C	28.2	28
WB left	0.58	D	51.7	48	0.62	E	57.5	48	0.53	E	66.0	30
WB through	0.85	D	46.2	85	0.84	C	31.7	67	0.65	B	15.9	25
NB left	0.04	B	17.9	6	0.26	A	7.8	23	0.02	A	7.7	2
NB through	0.40	C	25.9	79	0.30	B	11.8	69	0.36	B	17.6	63
SB left	0.48	C	21.3	26	0.34	A	9.0	13	0.82	D	36.7	121
SB through	0.54	C	21.9	127	0.35	A	9.3	31	0.54	B	15.6	114
SB right	0.03	A	0.0	0	0.07	A	0.7	0	0.00	A	0.0	0
Overall	—	**C**	**31.0**	—	—	**B**	**15.9**	—	—	**C**	**23.9**	—

The revised configuration would allow all movements to operate at or below the critical v/c threshold. In many cases it would result in longer delays for the side street approaches, but it would improve conditions on the Banwell Road approaches and would considerably reduce queue lengths exiting the battery plant.

Given that the driveway is already planned to be constructed with three outbound lanes, no geometric modifications would be required to implement dual outbound left turn lanes; the main change would be associated infrastructure (poles, traffic signal heads, etc.). The intersection could be opened with a single left turn lane, with the configuration adjusted as such time as conditions warrant.

4.5 Banwell Road at Southwest Hamlet Access

Table 14 presents the projected operations at Banwell Road (also known as County Road 43 in this section) and the southwest Hamlet access (located between the CPR tracks and Shields Road).

In the original Hamlet analyses, this intersection was analyzed in a previously proposed “T” configuration (side street approach on the east side). The “original Hamlet” values in ***Table 14*** reflect that prior configuration. The “updated Hamlet” results reflect the currently proposed configuration as a four-legged intersection.

Traffic operations at this intersection were assessed under two-way stop control. The projected side street approach volumes would not meet traffic signal warrants, and the street network in this area of the Hamlet provides connectivity to the Shields Street intersection with Banwell Road, which would be an appropriate candidate for traffic signals. Traffic signal warrant analyses at this intersection could be revisited as development plans are brought forward and the internal street network is confirmed.

Table 14: Projected Intersection Operations, Banwell Road at Southwest Hamlet Access

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
WB approach	0.43	D	25.7	16	0.48	D	30.7	20	0.26	C	24.2	8
SB left	0.03	A	9.4	1	0.04	B	10.4	1	0.11	A	9.9	3
Updated Hamlet concept												
EB left	0.80	F	199	26	0.60	F	120	21	0.79	F	285	21
EB through	0.00	A	0.0	0	0.00	A	0.0	0	0.00	A	0.0	0
WB left	0.39	F	66.9	13	0.44	F	79.4	14	0.31	F	102	9
WB through	0.13	B	11.9	4	0.16	B	13.3	4	0.09	B	12.3	2
NB left	0.00	A	0.0	0	0.00	A	0.0	0	0.00	A	0.0	0
SB left	0.03	A	9.5	1	0.09	B	10.5	1	0.11	B	10.5	3

The previous Hamlet concept would result in the westbound approach operating at a reasonable level of service (LOS C to D).

After applying the adjustments to the Hamlet statistics and reassigning traffic to the west leg of the intersection, the side street left turn movements are anticipated to operate at LOS F, reflecting longer delays waiting for a gap in north/south through traffic; however, the approach volumes would be within capacity.

4.6 Banwell Road at Shields Street

Table 15 presents the projected operations at Banwell Road and Shields Street. The original 2015 Hamlet TIS assessed this intersection under traffic signal control and with a four-lane cross-section on Shields Street. The results presented in ***Table 15*** continue to reflect traffic signal control, but with a two-lane cross-section on Shields Street.

Table 15: Projected Intersection Operations, Banwell Road at Shields Street

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.70	D	53.1	30	0.70	D	53.1	30	0.71	E	60.2	24
EB through	0.22	B	19.4	15	0.22	B	19.4	15	0.24	B	19.2	15
WB left	0.49	D	35.0	28	0.49	D	35.0	28	0.37	C	32.0	21
WB through	0.50	A	9.8	19	0.50	A	9.8	19	0.56	B	11.2	22
NB left	0.05	A	6.9	4	0.03	A	6.7	4	0.18	B	14.5	14
NB through	0.27	A	5.8	33	0.35	A	6.6	48	0.32	B	11.8	46
SB left	0.30	A	8.9	26	0.39	B	11.1	31	0.39	A	7.1	28
SB through	0.40	A	7.3	59	0.28	A	6.4	38	0.42	A	6.9	61
Overall	—	**B**	**11.2**	—	—	**B**	**11.4**	—	—	**B**	**11.9**	—
Updated Hamlet concept												
EB left	0.75	D	52.8	37	0.75	D	52.8	37	0.97	E	77.8	94
EB through	0.30	B	18.6	21	0.30	B	18.6	21	0.46	B	17.1	41
WB left	0.41	C	31.6	26	0.41	C	31.6	26	0.18	C	23.7	15
WB through	0.47	A	9.8	20	0.47	A	9.8	20	0.39	A	8.9	24
NB left	0.26	B	10.6	16	0.18	A	8.4	13	0.96	F	80.2	71
NB through	0.25	A	6.2	31	0.34	A	7.1	45	0.34	B	15.7	39
SB left	0.27	A	8.9	23	0.35	B	10.8	26	0.37	A	9.8	22
SB through	0.46	A	8.3	67	0.34	A	6.9	44	0.57	B	11.3	67
Overall	—	**B**	**12.0**	—	—	**B**	**11.8**	—	—	**C**	**23.9**	—

The intersection is anticipated to operate at a good overall level of service (LOS B to C) during all peak periods. However, after accounting for the updated Hamlet traffic forecasts, the eastbound and northbound left turns are anticipated to be approaching capacity during the PM peak hour.

To improve conditions on the northbound and eastbound left turns, the intersection was tested with left turn phases added to those movements during the PM peak hour. This scenario also included a southbound left turn phase that had been included in the previous analyses. The cycle length was also increased to 90 seconds. ***Table 16*** presents the results of the mitigation scenario.

Table 16: Projected Intersection Operations, Banwell Road at Shields Street (Additional Left Turn Phases)

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Updated Hamlet concept												
EB left									0.83	D	46.4	78
EB through									0.39	B	16.9	45
WB left									0.21	C	33.8	19
WB through									0.50	B	17.6	39
NB left									0.85	D	50.2	62
NB through									0.35	C	20.7	51
SB left									0.41	B	15.4	32
SB through									0.78	C	29.0	126
Overall									—	**C**	**27.8**	—

The additional left turn phases would permit all movements to operate at the critical v/c threshold or below. However, they would also increase the overall intersection delay. Recognizing that the volume on the eastbound left turn movement may change depending on the nature of any commercial development on the west side of Banwell Road, it is recommended that the intersection be designed with left turn phases on the northbound and southbound approaches only, and that the need for a left turn phase be re-evaluated when development applications in this area are brought forward.

4.7 CR 22 at Lesperance Road

Table 17 presents the anticipated operations at CR 22 and Lesperance Road in its current configuration as an at-grade intersection.

Table 17: Projected Intersection Operations, CR 22 at Lesperance Road

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.88	F	103	88	0.88	F	103	88	1.44	F	254	250
EB through	0.87	D	38.0	274	0.88	D	38.5	278	1.55	F	277	558
EB right	0.07	A	1.4	3	0.07	A	1.4	3	0.17	A	8.1	19
WB left	0.48	F	85.6	21	0.48	F	84.9	21	1.32	F	206	60
WB through	1.07	D	53.1	284	1.12	E	76.9	305	1.40	F	201	261
WB right	0.14	A	0.8	1	0.14	A	0.8	1	0.27	A	0.5	1
NB left	0.87	E	68.0	119	0.87	E	68.0	119	1.84	F	420	197
NB through	1.10	F	124	206	1.10	F	124	206	1.28	F	186	254
SB left	0.86	E	75.7	70	0.86	E	75.7	70	1.08	F	124	100
SB through	0.52	D	54.2	79	0.52	D	54.2	79	1.10	F	123	211
SB right	0.92	D	54.4	147	0.92	D	54.8	147	0.37	B	13.6	28
Overall	**—**	**E**	**56.5**	**—**	**—**	**E**	**64.6**	**—**	**—**	**F**	**221**	**—**
Updated Hamlet concept												
EB left	0.88	F	103.0	88	0.88	F	103.0	88	1.44	F	252	249
EB through	0.92	D	43.1	304	0.93	D	44.0	308	1.62	F	309	593
EB right	0.07	A	1.6	4	0.07	A	1.6	4	0.17	A	8.1	19
WB left	0.49	F	85.4	23	0.49	F	84.6	22	1.27	F	189	55
WB through	1.10	E	64.3	285	1.15	F	89.0	305	1.43	F	215	262
WB right	0.14	A	0.7	1	0.14	A	0.7	1	0.27	A	0.5	1
NB left	1.22	F	164.6	195	1.22	F	164.6	195	2.25	F	599	249
NB through	1.22	F	167.1	240	1.22	F	167.1	240	1.40	F	233	285
SB left	0.86	E	75.7	70	0.86	E	75.7	70	1.08	F	124	100
SB through	0.61	E	57.5	93	0.61	E	57.5	93	1.23	F	166	244
SB right	0.93	E	58.3	152	0.93	E	58.4	152	0.37	B	13.6	28
Overall	**—**	**E**	**72.8**	**—**	**—**	**F**	**81.0**	**—**	**—**	**F**	**255**	**—**

The intersection is anticipated to operate at a poor level of service (LOS E during the AM peaks; LOS F during the PM peak). During the AM peaks, the westbound and northbound through movements are projected to exceed capacity; during the PM peak, the majority of movements are projected to exceed capacity. The revised Tecumseh Hamlet concept is not anticipated to significantly affect this condition.

The results in ***Table 17*** are based on the intersection's current configuration. The Town of Tecumseh has initiated interim improvements to the Lesperance/CR 22 intersection through the implementation of a northbound right turn lane that is scheduled for construction in 2025. This will provide additional capacity on the northbound approach that would help to mitigate the critical northbound through movement, or allow some green time to be reallocated to other critical movements.

The battery plant TIS similarly found many capacity constraints at this intersection, and tested a mitigation scenario with a six-lane cross-section on CR 22. No additional turning lanes were assumed, given property constraints in the vicinity of the intersection, although a longer eastbound left turn lane and southbound right turn lane would reduce the potential for queue interaction. For this addendum, a similar configuration was tested. The results are presented in ***Table 18***.

Table 18: Projected Intersection Operations, CR 22 at Lesperance Road (6 Lanes on CR 22)

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Updated Hamlet concept												
EB left	0.88	F	103.0	88	0.88	F	103.0	88	1.44	F	252	249
EB through	0.70	C	31.9	153	0.69	C	30.8	155	1.13	F	97.4	338
EB right	0.07	A	1.6	4	0.07	A	1.6	4	0.17	A	7.2	18
WB left	0.49	F	93.7	30	0.49	F	92.3	29	1.27	F	216	83
WB through	0.84	B	18.5	42	0.86	B	18.5	46	1.00	D	38.9	218
WB right	0.15	A	0.7	1	0.15	A	0.7	1	0.27	A	1.3	1
NB left	1.03	F	97.1	189	1.08	F	110.9	190	2.25	F	599	249
NB through	1.03	F	100.0	240	1.07	F	113.4	240	1.40	F	233	285
SB left	0.87	E	74.2	77	0.87	E	74.6	75	1.08	F	124	100
SB through	0.51	D	50.9	93	0.53	D	52.7	93	1.23	F	166	244
SB right	0.84	D	43.1	151	0.86	D	46.4	152	0.37	B	13.6	28
Overall	**—**	**D**	**42.9**	**—**	**—**	**D**	**44.6**	**—**	**—**	**F**	**136**	**—**

The wider cross-section would improve the overall level of service to LOS D during the AM peaks, and would significantly reduce overall delays during the PM peak. All movements would operate within capacity during the AM peaks, although several movements would continue to exceed capacity during the PM peak. It is possible that some movements at this intersection may be partly mitigated through diversion to the Banwell Road interchange (e.g., the northbound left turn) or to other routes (e.g., some existing traffic may migrate from CR 22 to CR 42 once the latter has been widened; some trips may shift to the CR 22 and Manning Road intersection depending on relative capacity availability).

4.8 CR 22 at Manning Road

Table 19 presents the anticipated operations at CR 22 and Manning Road in its current configuration as an at-grade intersection.

Table 19: Projected Intersection Operations, CR 22 at Manning Road

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay (s/veh)	95th %ile queue (m)	v/c	LOS	Delay (s/veh)	95th %ile queue (m)	v/c	LOS	Delay (s/veh)	95th %ile queue (m)
Original Hamlet concept												
EB left	1.02	F	95.4	75	1.17	F	140.3	93	1.38	F	221.5	61
EB through	0.75	C	31.4	169	0.72	C	30.4	161	1.48	F	238.6	154
EB right	0.26	A	6.4	14	0.26	A	6.3	14	0.41	A	2.5	3
WB left	0.76	F	93.0	57	0.76	F	93.0	57	0.83	F	98.2	69
WB through	1.01	E	71.0	256	1.04	E	76.9	265	1.26	F	166.2	271
WB right	0.12	A	1.9	4	0.12	A	1.9	4	0.27	A	6.7	17
NB left	0.69	F	82.0	34	0.69	F	82.0	34	1.36	F	233.1	95
NB through	1.14	F	132.8	240	1.14	F	132.8	240	1.32	F	194.1	364
NB right	0.22	A	5.5	10	0.22	A	5.5	10	0.17	A	3.7	8
SB left	0.70	E	79.9	38	0.70	E	79.9	38	0.62	E	72.5	34
SB through	0.85	E	66.9	169	0.85	E	66.9	169	1.34	F	199.9	358
SB right	0.24	A	0.4	0	0.28	A	0.4	0	0.34	A	0.6	0
Overall	**—**	**E**	**61.5**	**—**	**—**	**E**	**67.0**	**—**	**—**	**F**	**170.8**	**—**
Updated Hamlet concept												
EB left	1.03	F	94.3	68	1.18	F	142.7	86	1.38	F	222	57
EB through	0.78	C	31.7	166	0.75	C	30.3	157	1.55	F	269	144
EB right	0.26	A	5.9	13	0.26	A	5.9	12	0.43	A	2.8	3
WB left	0.79	F	97.0	63	0.79	F	97.0	63	0.90	F	110	80
WB through	1.05	F	81.0	271	1.07	F	88.4	281	1.30	F	183	283
WB right	0.12	A	1.9	4	0.12	A	1.9	4	0.27	A	6.7	17
NB left	0.69	F	82.0	34	0.69	F	82.0	34	1.36	F	233	95
NB through	1.28	F	184.6	280	1.28	F	184.6	280	1.38	F	219	385
NB right	0.26	A	8.2	16	0.26	A	8.2	16	0.19	A	5.2	11
SB left	0.70	E	79.9	38	0.70	E	79.9	38	0.62	E	72.5	34
SB through	0.91	E	73.8	187	0.91	E	73.8	187	1.43	F	240	392
SB right	0.24	A	0.4	0	0.28	A	0.4	0	0.34	A	0.6	0
Overall	**—**	**E**	**71.6**	**—**	**—**	**E**	**77.3**	**—**	**—**	**F**	**189.7**	**—**

The intersection is anticipated to operate at a poor level of service (LOS E during the AM peaks; LOS F during the PM peak). During the AM peaks, the eastbound left turn and westbound through movement are projected to operate at capacity, and the northbound through movement is anticipated exceed capacity. During the PM peak, the majority of through and left turn movements are projected to exceed capacity. The revised Tecumseh Hamlet concept is not anticipated to significantly affect this condition.

A similar finding was made in the battery plant TIS, where two mitigation scenarios were tested: one with the north and south legs widened to accommodate two exclusive through lanes (in addition to the new northbound right turn lane that was included in the 2037 baseline analyses); and a second alternative that widened CR 22 to a six-lane cross-section (three through lanes per direction at Manning Road). For this addendum, similar configurations were tested. The results are presented in ***Table 20***.

Table 20: Projected Intersection Operations, CR 22 at Manning Road (Mitigation Scenarios)

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Mitigation scenario 1 (widened Manning Road):												
EB left	0.82	E	63.6	55	0.90	E	67.1	65	1.38	F	221.5	57
EB through	0.69	C	24.7	164	0.65	C	23.5	157	1.21	F	117.0	131
EB right	0.24	A	4.5	10	0.24	A	4.4	10	0.36	A	2.5	2
WB left	0.79	F	97.0	63	0.79	F	97.0	63	0.90	F	109.5	80
WB through	0.98	E	60.7	267	1.02	E	69.6	277	0.99	E	65.1	237
WB right	0.11	A	1.8	4	0.11	A	1.8	4	0.22	A	5.0	15
NB left	0.69	F	82.0	34	0.69	F	82.0	34	1.36	F	233.1	95
NB through	0.86	E	67.2	105	0.86	E	67.2	105	1.01	F	86.7	171
NB right	0.31	A	9.8	17	0.31	A	9.8	17	0.25	A	7.0	13
SB left	0.70	E	79.9	38	0.70	E	79.9	38	0.62	E	72.5	34
SB through	0.61	D	54.2	79	0.61	D	54.2	79	1.06	F	97.6	175
SB right	0.24	A	0.4	0	0.28	A	0.4	0	0.34	A	0.6	0
Overall	—	**D**	**47.0**	—	—	**D**	**49.4**	—	—	**F**	**98.8**	—
Mitigation scenario 2 (same, plus widened CR 22)												
EB left	0.82	D	54.4	64	0.90	E	60.9	88	1.05	F	87.8	78
EB through	0.48	C	24.0	111	0.46	C	23.4	106	0.92	B	18.5	98
EB right	0.24	A	8.6	28	0.24	A	8.5	28	0.38	A	1.4	5
WB left	0.79	F	97.0	63	0.79	F	97.0	63	0.90	F	109.5	80
WB through	0.68	D	36.7	140	0.71	D	37.8	144	0.88	D	54.1	144
WB right	0.11	A	1.8	4	0.11	A	1.8	4	0.27	A	5.8	15
NB left	0.69	F	82.0	34	0.69	F	82.0	34	0.91	F	88.2	76
NB through	0.86	E	67.2	105	0.86	E	67.2	105	0.87	E	58.8	150
NB right	0.31	A	9.8	17	0.31	A	9.8	17	0.21	A	2.1	3
SB left	0.70	E	79.9	38	0.70	E	79.9	38	0.62	E	72.5	34
SB through	0.61	D	54.2	79	0.61	D	54.2	79	1.06	F	97.6	175
SB right	0.24	A	0.4	0	0.28	A	0.4	0	0.34	A	0.6	0
Overall	—	**D**	**39.6**	—	—	**D**	**40.2**	—	—	**D**	**49.7**	—

At CR 22 and Manning Road, widening the north and south approaches would allow the intersection to operate within capacity during the early AM peak, but there would still be several movements exceeding capacity during the late AM and PM peaks.

Widening CR 22 to a six-lane cross-section would enable most movements at Manning Road to operate within capacity during all peaks.

4.9 CR 42 at Banwell Road

A two-lane roundabout is planned at CR 42 and the realigned Banwell Road to replace the existing signalized intersection. In the 2015 Hamlet study, the roundabout was analyzed using Synchro, which is based on the HCM/NCHRP methodology. Over the course of the battery plant study, it was determined that the AUSTROADS methodology (facilitated using SIDRA software) would yield a better estimate of roundabout capacity (e.g., the roundabout will have generous dimensions to accommodate side-by-side truck movements, and the AUSTROADS methodology is sensitive to variability in roundabout geometry while HCM is not). The analyses in this addendum reflect the use of SIDRA to analyze roundabout capacity and operations. ***Table 21*** presents the roundabout analysis results.

Table 21: Projected Roundabout Operations, CR 42 at Banwell Road

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
NB approach	0.13	A	7.6	5	0.13	A	7.1	5	0.17	A	7.3	7
WB approach	0.52	A	4.7	26	0.61	A	6.2	38	0.51	A	5.5	27
SB approach	0.76	B	11.9	44	0.61	B	10.6	30	0.37	A	7.8	14
EB approach	0.40	A	6.3	18	0.41	A	6.5	18	0.64	A	6.6	38
Overall	—	**A**	**7.7**	—	—	**A**	**7.5**	—	—	**A**	**6.5**	—
Updated Hamlet concept												
NB approach	0.14	A	7.9	6	0.14	A	7.4	5	0.19	A	7.7	8
WB approach	0.56	A	5.0	30	0.65	A	6.8	44	0.56	A	6.0	32
SB approach	0.81	B	13.1	54	0.64	B	11.0	32	0.41	A	8.2	17
EB approach	0.43	A	6.7	21	0.44	A	6.7	20	0.67	A	7.0	42
Overall	—	**A**	**8.3**	—	—	**A**	**7.9**	—	—	**A**	**6.9**	—

The planned roundabout is anticipated to operate at a good overall level of service (LOS A); all roundabout approaches are anticipated to operate at LOS B or better and within capacity. The revised Hamlet concept is not anticipated to significantly affect roundabout operations.

4.10 CR 42 at South Hamlet Access

Table 22 presents the projected intersection operations at the south Hamlet access, located between Banwell Road and Lesperance Road. The intersection was analyzed under two-way stop control with separate left and right turn lanes on the southbound approach.

Table 22: Projected Intersection Operations, CR 42 at South Hamlet Access

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.03	B	11.5	1	0.03	B	12.1	1	0.12	B	11.6	3
SB left	0.72	F	124	28	0.84	F	167	32	0.69	F	140	24
SB right	0.06	B	13.6	2	0.07	B	14.3	2	0.02	B	12.4	1
Updated Hamlet concept												
EB left	0.03	B	11.9	1	0.03	B	12.6	1	0.11	B	12.0	3
SB left	0.69	F	130	25	0.80	F	173	28	0.65	F	149	21
SB right	0.05	B	14.0	1	0.06	B	14.7	1	0.02	B	12.9	1

The eastbound left and southbound right turn movements are expected to operate at a good level of service (LOS B). The southbound left turn movement is anticipated to operate at LOS F due to the delay; however, it will operate within capacity. The updated Hamlet volumes were not found to significantly affect intersection operations.

4.11 CR 42 at Lesperance Road

Table 23 presents the projected intersection operations at CR 42 and Lesperance Road.

Table 23: Projected Intersection Operations, CR 42 at Lesperance Road

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.26	B	13.0	12	0.30	B	14.4	13	0.51	B	16.9	28
EB through	0.53	B	11.4	63	0.52	B	11.1	63	0.54	A	9.4	60
WB left	0.07	A	9.2	5	0.07	A	9.1	5	0.09	A	7.5	5
WB through	0.58	B	11.9	71	0.61	B	12.3	80	0.51	A	9.0	56
WB right	0.13	A	2.4	7	0.13	A	2.4	7	0.19	A	1.7	7
NB left	0.07	C	20.9	7	0.07	C	20.9	7	0.03	C	21.8	4
NB through	0.09	B	13.9	8	0.09	B	13.9	8	0.15	B	16.1	13
SB left	0.48	C	26.0	39	0.49	C	27.5	39	0.40	C	26.9	28
SB through	0.36	B	14.1	26	0.38	B	16.9	29	0.30	B	12.0	17
Overall	—	**B**	**12.4**	—	—	**B**	**12.7**	—	—	**B**	**10.1**	—
Updated Hamlet concept												
EB left	0.40	B	18.6	19	0.45	C	22.0	21	0.69	C	32.9	53
EB through	0.55	B	12.6	67	0.53	B	12.3	67	0.57	B	11.7	78
WB left	0.08	B	10.3	5	0.07	B	10.1	5	0.10	A	9.9	6
WB through	0.61	B	13.5	80	0.65	B	14.0	90	0.56	B	11.5	76
WB right	0.18	A	2.4	8	0.17	A	2.5	9	0.23	A	2.1	10
NB left	0.06	C	20.3	7	0.07	C	20.9	7	0.03	C	20.6	4
NB through	0.08	B	13.4	8	0.08	B	13.7	8	0.14	B	15.5	12
SB left	0.57	C	28.7	50	0.59	C	30.2	50	0.55	C	30.2	43
SB through	0.38	B	16.0	31	0.40	B	18.4	34	0.32	B	14.5	22
Overall	—	**B**	**14.1**	—	—	**B**	**14.5**	—	—	**B**	**13.4**	—

The intersection of CR 42 and Lesperance Road is anticipated to operate at a good overall level of service (LOS B) with no critical movements. The updated Hamlet volumes were not found to significantly affect intersection operations.

4.12 CR 42 at Manning Road

A two-lane roundabout is planned at CR 42 and Manning Road to replace the existing signalized intersection. As noted in ***Section 4.9***, the roundabout analyses have been revised compared to the 2015 Hamlet study, to use SIDRA (and the AUSTROADS methodology) in place of Synchro (and the NCHRP/HCM methodology). ***Table 24*** presents the roundabout analysis results.

Table 24: Projected Roundabout Operations, CR 42 at Manning Road

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
NB approach	0.47	A	6.6	22	0.48	A	6.6	21	0.66	A	9.5	41
WB approach	0.55	A	7.1	29	0.58	A	7.6	32	0.78	B	13.2	60
SB approach	0.56	A	8.2	30	0.59	A	9.2	34	0.53	A	9.5	28
EB approach	0.67	A	7.1	41	0.61	A	6.5	34	0.71	A	7.9	43
Overall	**—**	**A**	**7.2**	**—**	**—**	**A**	**7.4**	**—**	**—**	**A**	**10.0**	**—**
Updated Hamlet concept												
NB approach	0.53	A	7.5	27	0.56	A	7.4	25	0.74	B	11.9	53
WB approach	0.60	A	7.7	34	0.64	A	8.5	39	0.86	B	18.0	81
SB approach	0.62	A	9.3	36	0.67	B	11.0	42	0.59	B	10.7	34
EB approach	0.73	A	8.0	49	0.66	A	7.1	39	0.78	A	9.0	55
Overall	**—**	**A**	**8.1**	**—**	**—**	**A**	**8.4**	**—**	**—**	**B**	**11.4**	**—**

The planned roundabout at CR 42 and Manning Road is anticipated to operate at a good overall level of service (LOS A to B); all roundabout approaches are anticipated to operate at LOS B or better and within capacity. The revised Hamlet concept is not anticipated to significantly affect roundabout operations. The westbound approach is projected to be approximately at the critical signalized v/c ratio during the PM peak hour but is anticipated to continue operating at a reasonable level of service from a delay perspective.

4.13 Manning Road at Jamsyl Drive

The intersection of Manning Road and Jamsyl Drive was previously assessed under traffic signal control. ***Table 25*** presents the projected traffic operations at this intersection.

Table 25: Projected Intersection Operations, CR 42 at Jamsyl Drive

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.32	B	14.6	13	0.52	D	41.5	29	0.48	C	22.2	36
EB through	0.07	A	0.2	0	0.08	A	0.4	0	0.21	A	6.7	11
WB left	0.05	B	10.8	4	0.08	C	29.5	8	0.26	B	18.1	21
WB through	0.03	A	0.1	0	0.04	A	0.2	0	0.24	A	7.9	14
NB left	0.19	A	8.4	10	0.14	A	5.1	11	0.15	A	9.1	8
NB through	0.30	A	7.1	23	0.22	A	4.3	26	0.45	A	9.0	51
NB right	0.02	A	2.1	2	0.02	A	0.9	1	0.09	A	2.4	5
SB left	0.07	A	7.3	5	0.05	A	4.7	5	0.37	B	13.3	21
SB through	0.29	A	7.0	22	0.21	A	4.3	24	0.44	A	8.9	49
SB right	0.08	A	2.7	5	0.06	A	1.4	4	0.12	A	2.2	6
Overall	**—**	**A**	**7.1**	**—**	**—**	**A**	**6.7**	**—**	**—**	**A**	**9.6**	**—**
Updated Hamlet concept												
EB left	0.64	D	41.9	41	0.64	D	41.9	41	0.70	D	42.4	46
EB through	0.10	A	0.4	0	0.10	A	0.4	0	0.25	A	8.2	12
WB left	0.07	C	25.4	7	0.07	C	25.4	7	0.31	C	28.2	22
WB through	0.04	A	0.2	0	0.04	A	0.2	0	0.28	B	10.3	15
NB left	0.17	A	7.2	14	0.17	A	7.2	14	0.16	A	9.3	11
NB through	0.26	A	6.3	32	0.26	A	6.3	32	0.41	A	8.8	61
NB right	0.02	A	1.2	2	0.02	A	1.2	2	0.08	A	2.3	6
SB left	0.06	A	6.4	6	0.06	A	6.4	6	0.35	B	12.6	24
SB through	0.25	A	6.2	31	0.25	A	6.2	31	0.41	A	8.7	59
SB right	0.08	A	1.8	6	0.08	A	1.8	6	0.16	A	1.9	8
Overall	**—**	**A**	**9.4**	**—**	**—**	**A**	**9.4**	**—**	**—**	**B**	**11.3**	**—**

The intersection of Manning Road and Jamsyl Drive is anticipated to operate at a good overall level of service (LOS A to B). All individual movements are anticipated to operate under capacity and at LOS D or better. The higher traffic associated with the proposed density increase in the MRSPA will increase delays on the eastbound left turn, but otherwise are not anticipated to significantly affect the analysis results, and no critical movements are identified.

4.14 Manning Road at Little Baseline Road

The intersection of Manning Road and Little Baseline Road was previously assessed under traffic signal control. ***Table 26*** presents the projected intersection operations at this intersection.

Table 26: Projected Intersection Operations, Manning Road at Little Baseline Road

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB left	0.16	B	15.2	9	0.16	B	15.2	9	0.08	B	14.6	6
EB through	0.17	A	2.1	3	0.17	A	2.1	3	0.13	A	0.7	0
WB left	0.06	B	14.2	5	0.06	B	14.2	5	0.04	B	14.2	4
WB right	0.12	A	4.9	4	0.12	A	4.9	4	0.14	A	5.6	5
NB left	0.03	A	5.8	3	0.03	A	5.8	3	0.11	A	6.1	6
NB through	0.28	A	5.2	24	0.28	A	5.2	24	0.33	A	5.3	27
SB left	0.07	A	6.0	5	0.07	A	6.0	5	0.16	A	6.6	8
SB through	0.31	A	5.4	27	0.31	A	5.4	27	0.31	A	5.1	24
Overall	—	**A**	**5.6**	—	—	**A**	**5.6**	—	—	**A**	**5.4**	—
Updated Hamlet concept												
EB left	0.18	B	15.4	10	0.18	B	15.4	10	0.09	B	14.7	6
EB through	0.20	A	3.0	4	0.20	A	3.0	4	0.17	A	1.4	1
WB left	0.08	B	14.4	5	0.08	B	14.4	5	0.04	B	14.2	4
WB right	0.12	A	4.8	4	0.12	A	4.8	4	0.14	A	5.5	5
NB left	0.05	A	6.1	3	0.05	A	6.1	3	0.13	A	6.3	7
NB through	0.33	A	6.4	25	0.33	A	6.4	25	0.34	A	5.4	28
SB left	0.08	A	6.4	5	0.08	A	6.4	5	0.16	A	6.7	8
SB through	0.38	A	6.8	29	0.38	A	6.8	29	0.32	A	5.2	25
Overall	—	**A**	**6.8**	—	—	**A**	**6.8**	—	—	**A**	**5.5**	—

The intersection of Manning Road and Little Baseline Road is anticipated to operate at a very good overall level of service (LOS A), and all individual movements are anticipated to operate at LOS B or better. The proposed changes to the Hamlet development concept are not anticipated to significantly affect the analysis results.

4.15 Manning Road at Street "C"

The intersection of Manning Road and Street "C" was previously assessed under two-way stop control. ***Table 27*** presents the projected intersection operations at this intersection.

Table 27: Intersection Operations, Manning Road at Street "C"

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB approach	0.26	C	20.5	8	0.26	C	20.5	8	0.30	C	22.4	10
NB left	0.03	A	9.6	1	0.03	A	9.6	1	0.08	A	9.6	2
Updated Hamlet concept												
EB approach	0.40	D	25.4	15	0.40	D	25.4	15	0.61	E	39.7	29
NB left	0.05	A	9.9	1	0.05	A	9.9	1	0.13	A	9.9	4

Under the original MRSPA and Hamlet development scenario, the stop-controlled eastbound approach was anticipated to operate at a reasonable level of service (LOS C) and within capacity. The proposed changes to the MRSPA and Hamlet development concepts were found to increase delays, resulting in the eastbound approach operating at LOS D to E; however, the eastbound approach is still anticipated to operate within capacity.

4.16 Manning Road at Southeast Hamlet Access

The intersection of Manning Road and the southeast Hamlet access was previously assessed under two-way stop control. ***Table 28*** presents the projected intersection operations at this intersection.

Table 28: Intersection Operations, Manning Road at Southeast Hamlet Access

Movement	Early AM peak				Late AM peak				PM peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Original Hamlet concept												
EB approach	0.37	D	26.1	13	0.37	D	26.1	13	0.19	C	21.1	6
NB left	0.02	A	9.7	0	0.02	A	9.7	0	0.05	A	9.4	1
Updated Hamlet concept												
EB approach	0.38	D	27.6	14	0.38	D	27.6	14	0.22	C	22.9	7
NB left	0.02	A	9.9	1	0.02	A	9.9	1	0.05	A	9.5	1

The stop-controlled eastbound approach is anticipated to operate at a reasonable level of service (LOS C to D) and within capacity. The proposed changes to the Hamlet development concept are not anticipated to significantly affect the analysis results.

4.17 Summary of Results

At most locations within the study area, the proposed changes to the Hamlet development concept are not anticipated to significantly affect the analysis results. The primary change from a volume perspective is in the northwest portion of the study area, due in part to the increased residential density in the northern Tecumseh Hamlet and in the MRSPA, higher trip generation rates for the commercial blocks, and changes to the originally proposed “anchor commercial” block.

The change in volumes is projected to result in new critical movements at the south ramp terminal of the new Banwell Road interchange. These can be mitigated by adjusting the lane configuration on the eastbound off-ramp so that the middle lane is converted from a dedicated left turn lane to a shared left turn / through lane. This will necessitate the widening of Gouin Street from one to two eastbound lanes along the block east of Banwell Road.

Higher demand than previously projected on Maisonneuve Street and Intersection Road, east of Banwell Road, will also decrease capacity and increase delays exiting the NextStar battery plant at shift change times at both its proposed signalized accesses. At Maisonneuve Street this effect could be largely offset by signal timing adjustments, but a minor increase in delay would still be experienced at the south access opposite Intersection Road during the PM peak hour. The battery plant driveways have been designed with enough room to accommodate three outbound lanes in anticipation of the potential need to provide outbound dual left turn lanes. This measure would increase capacity and decrease delays on the battery plant driveways during shift change times but would generally increase delays due to the need for a dedicated eastbound left turn phase. It is recommended that the driveways open with a single left turn lane but that conditions be monitored for the need to provide a second outbound left turn lane. The only significant modifications that would be required to facilitate the change in intersection operations would be modified traffic signal heads (and associated infrastructure such as poles and detection).

At Banwell Road and Shields Street, a northbound left turn phase is now recommended, in addition to the previously recommended southbound left turn phase. The analyses also considered an eastbound left turn phase, but found that it would adversely affect other movements at the intersection; the need for an eastbound left turn phase should be reviewed when development applications west of Banwell Road are brought forward.

The CR 22 intersections at Lesperance Road and at Manning Road were found to exceed capacity on several movements. Previous studies (e.g., the 2015 Hamlet TIS; the battery plant TIS) have identified that some movements at these intersections already exceed practical capacity under existing conditions. The number and magnitude of critical movements will increase as a result of background growth in Tecumseh, Windsor and Lakeshore as well as proposed development plans (e.g., Hamlet, MRSPA, battery plant). The projected midblock volumes on CR 22, particularly during the PM peak, are closer to the capacity of 3 arterial lanes (or 2 freeway lanes); the signalized intersections are constraint points due to the need to also accommodate high-volume turning movements and cross street traffic. Grade separations and interchanges have been planned and approved at both intersections as County initiatives as part of previous EA studies for CR 22 and CR 19; however, given that these measures are not currently funded or scheduled, the County may consider potential intersection modifications as an interim measure. Through this study, potential interim modifications to accommodate existing volumes and general growth in the area have been identified at Manning Road (additional lanes on the north and south approaches) and at Lesperance Road (longer turning lanes); in the event that the planned interchanges at those locations cannot be constructed, consideration may be given to widening CR 22 to six lanes through this section.

5.0 Internal Street Network

5.1 Proposed Collector Roads

Figure 5 illustrates the previously proposed road classification system within and surrounding the Hamlet. Within the Hamlet, the following streets were proposed to be classified as collector roads:

- Gouin Street (with a one-block north-south jog east of Banwell Road);
- Maisonneuve Street;
- Intersection Road;
- Shields Street; and
- The north-south roadway connecting Shields Street and CR 42, east of Banwell Road.

Within the MRSPA:

- Westlake Drive will be extended easterly to connect to Sylvestre Drive west of the CR 22 fly-off;
- A new north-south collector road is proposed to begin at Sylvestre Drive opposite the CR 22 fly-off, and extend 1.2 km south where it will turn to the east to connect to Manning Road opposite Little Baseline Road; and
- Gouin Street will be extended easterly as a collector road and connect to Manning Road via Jamsyl Drive, which will also be designated as a collector road.

The road network is unchanged from the previous iteration of the site plan, and no changes to the collector road designations are proposed.

All other existing local roads in the study area will continue to be designated as local roads.

The 2017 Complete Streets Design Handbook that accompanied the Tecumseh Transportation Master Plan includes a section on road classification policy. Amongst the proposed characteristics of different road functions, it suggests a daily traffic volume of 1,000 vehicles/day or less for local streets in the urban area. The streets listed above are all anticipated to exceed this threshold. It is likely that some north-south street sections in the commercial section will also exceed this threshold despite their local function, as a result of traffic accessing commercial blocks; this will depend on specific development details (size and nature of commercial development; access locations, etc.). Those streets continue to be designated as local streets but with consideration for additional right-of-way (see ***Section 5.3***).

5.2 Active Transportation Network

Figure 6 illustrates the current conceptual active transportation network within the Hamlet. It includes on- or off-road cycling facilities on all collector roads, connecting to potential regional facilities on the surrounding arterial network. Consideration is also being given to the potential for trails to be incorporated within stormwater blocks and for a north-south "green street" east of Banwell Road (including a potential crossing of the CPR tracks), as shown in ***Figure 7***.

Figure 5: Proposed Collector Road Network

Figure 6: Conceptual Cycling Network

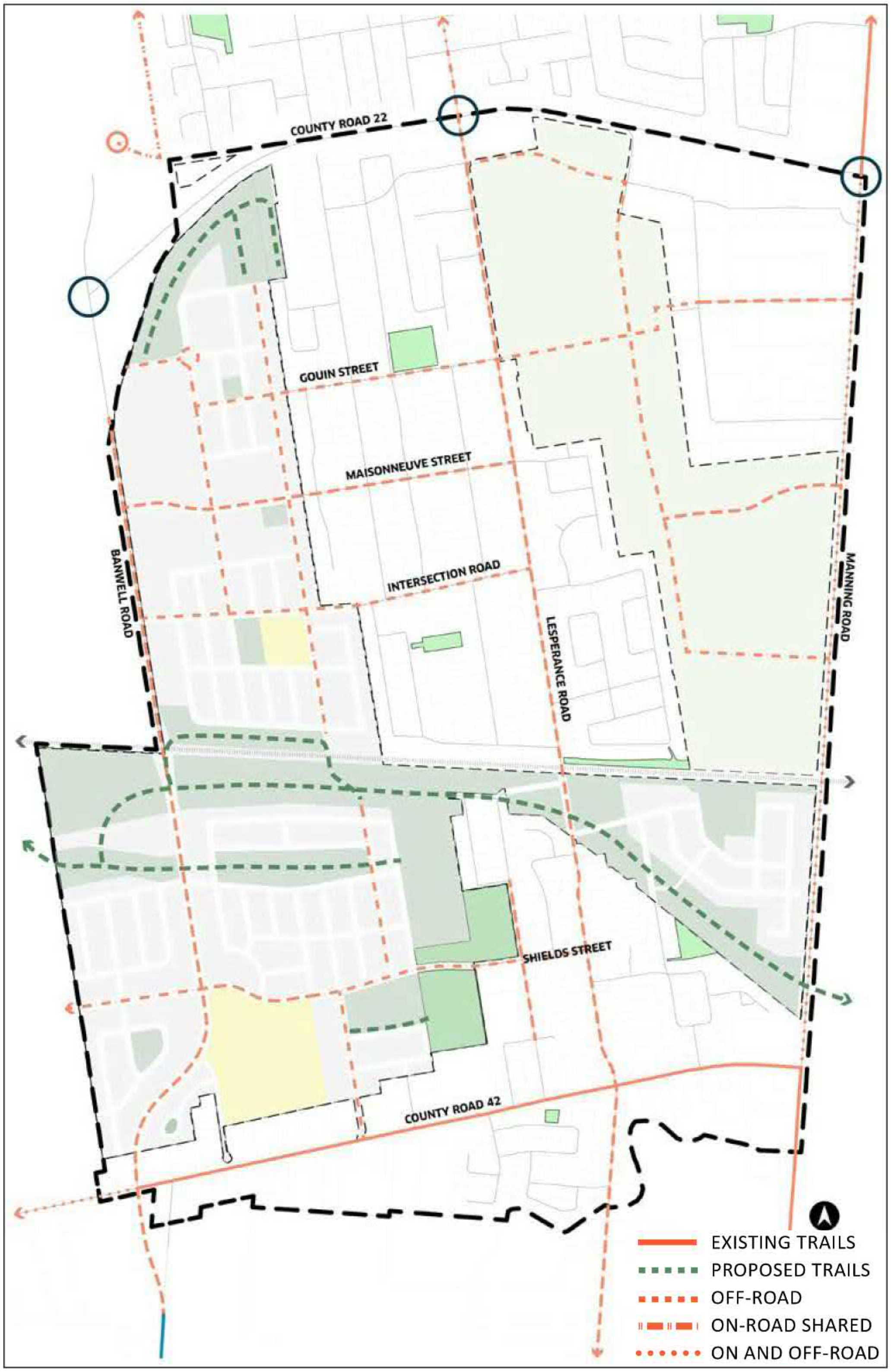
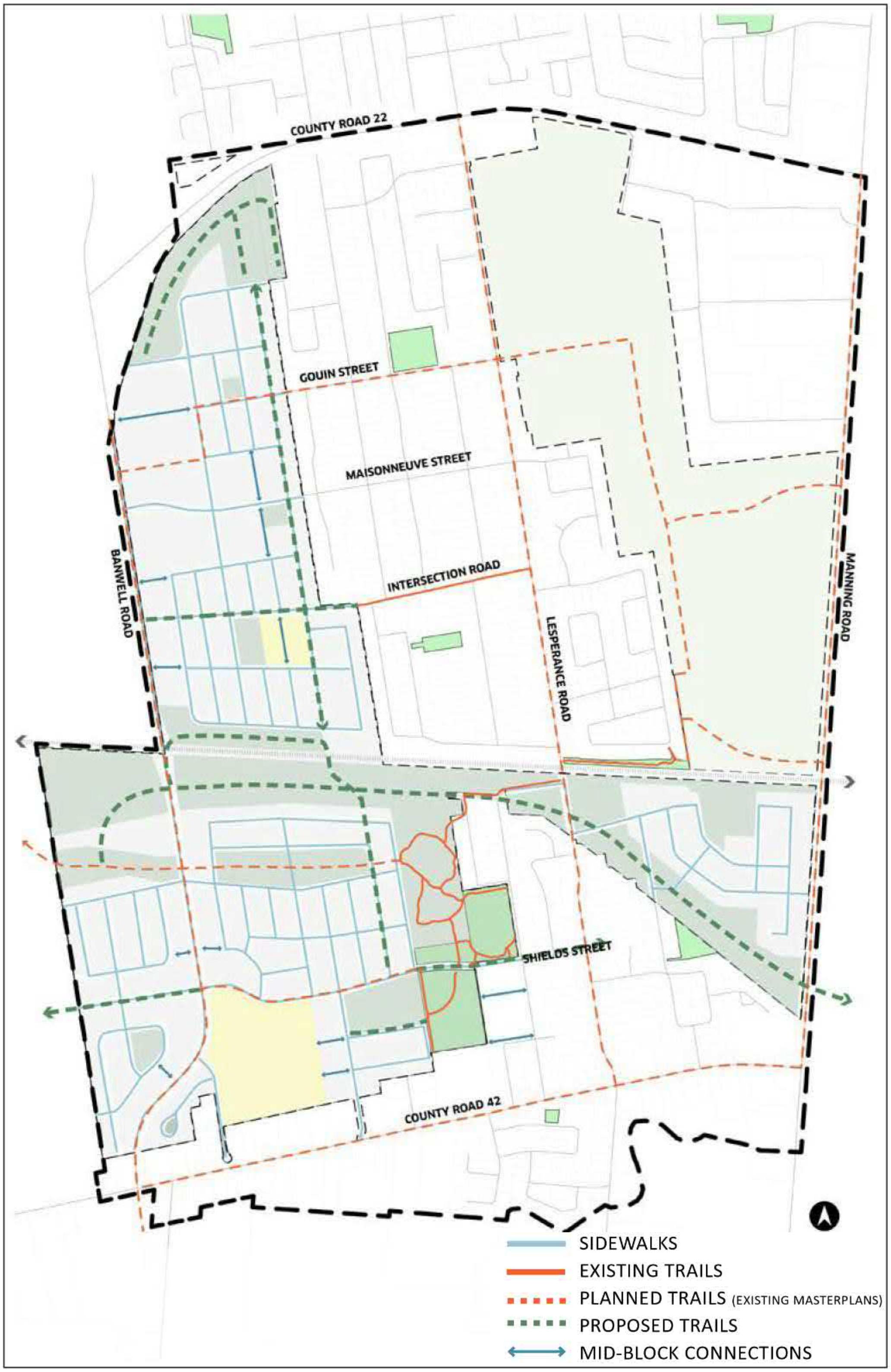


Figure 7: Conceptual Trail System



5.3 Roadway Cross-Section and Right-of-Way Widths

The Town's Complete Streets Design Handbook includes typical cross-sections for various roadway classifications:

- 20 metres for urban local streets, which includes sidewalks on both sides of the street, and an 8.5-metre roadway width[2] that accommodates on-street parking
- 23 metres for urban collector roads, which includes sidewalks on both sides of the street, and an 11.0-metre roadway width with on-street bicycle lanes and no on-street parking

The handbook specifies that the recommended road cross-sections were intended "not to establish a 'one size fits all' set of guidelines, but rather to provide a functional 'base-case' condition from which more detailed street and public realm designs can be created during the future construction of new roads and reconstruction of existing facilities." Within the Tecumseh Hamlet, specific cross-section details may vary depending on the priority placed on different elements, including on-street parking, sidewalks on both sides of the street, bicycle facilities (whether on- or off-street), space for landscaping, and utility requirements. A further consideration is the desired scale and "feel" of the street after accounting for building setbacks, and compatibility with adjacent existing streets.

Cross-sections alternatives for the new collector roads were established and reviewed at the EA stage (*Attachment # 3*). At the outset of that assessment, consideration was given to two different potential right-of-way widths:

- A 23-metre right-of-way that would match the typical Town standard width; and
- A narrower 20-metre right-of-way that would provide a more intimate urban form for traffic calming purposes and would be compatible with the current right-of-way widths on the existing roads to the east.

For the new proposed sections of road, the preference was to maintain the Town standard 23-metre right-of-way, and three design concept alternatives were established to allocate the space within this width:

- Design Concept #1: A 10.1-metre roadway width with on-street parking, a 3-metre multi-use path on one side and a 1.5-metre sidewalk on the other side.
- Design Concept #2: A 7.3-metre roadway width that is similar to the preceding cross-section but with the parking lane removed to allow the roadway width to be reduced.
- Design Concept #3: An 11.5-metre roadway width with buffered on-street bicycle lanes, no on-street parking, and 2-metre sidewalks on both sides of the street. (This is comparable to the Town's standard collector road cross-section described above.)

(Design Concept #4was developed specifically for the Shields Street extension through McAuliffe Park and is described elsewhere in this section.)

The existing sections of Gouin Street, Maisonneuve Street and Intersection Road between the east Hamlet limits and Lesperance Road typically have 20-metre ROWs, and considerable sections of these streets are built to rural cross-sections, are not wide enough to accommodate two travel lanes plus parking, and/or do not have sidewalks. In these cases, alternate cross-sections were applied that urbanize the roads and

[2] All roadway widths refer to the distance from curb face to curb face (i.e., including gutter width).

(for Gouin Street and Maisonneuve Street) reconfigure them to serve a collector road function while maintaining the existing 20-metre ROW.

The 7.3-metre roadway cross-section alternative (Design Concept # 2) was selected that accommodates cycling in a multi-use path and does not include a parking lane. Any parking requirements would be expected to be accommodated off-street or on intersecting local roads. This alternative reduces the pavement width as a measure to encourage lower travel speeds, and allows the road width to be consistent when entering the existing sections to the east. The right-of-way is wide enough that left turn lanes can be accommodated where necessary (e.g., on the westbound approaches to Banwell Road). In those sections where the existing right-of-way is narrower, the same 7.3-metre road width will be applied, and the sidewalk and multi-use path will continue, but the boulevard width will be reduced to accommodate those features without requiring a wider right-of-way.

As noted in ***Section 4.2***, Gouin Street is recommended to be widened to two eastbound lanes to increase the capacity of the Banwell Road south ramp terminal intersection. A second eastbound lane would also mitigate the impact of right turns at a potential driveway serving the relocated anchor commercial block. The conceptual designs prepared to date are based on a single eastbound lane and should be reviewed to consider the impact of a second eastbound lane on the right-of-way cross-section and the roundabout design.

A 300-metre section of Maisonneuve Street is intended to have a “main street” configuration lined by continuous development directly adjacent to the property line. The design of this street should be considered separately from the generic EA cross-sections in order to meet localized urban design objectives. This street is intended to have a smaller-scale, more intimate environment comparable to traditional early 20th-century main streets. This should be considered both in terms of roadway design (opportunities to reduce roadway footprint and provide a narrower right-of-way; the need for on-street parking to serve streetfront retail uses; landscaping to increase the sense of enclosure) and development context (minimum building setbacks; primary building entrances from the street to encourage use of on-street parking).

The Shields Street extension is also proposed to have a non-standard cross-section (Design Concept #4) to reduce the impact of the road alignment bisecting McAuliffe Park. The 23-metre cross-section includes a pair of 3.35-metre lanes divided by a 2.3-metre median, with 4-metre multi-use paths on both sides of the road. This cross-section will apply along the section between the Tecumseh Vista Academy west driveway and Lesperance Road. Refer to *Attachment # 3.*

A north-south bicycle boulevard is envisioned along one of the local streets in the central to eastern area of the Hamlet. The location is intended to connect a number of proposed community facilities (parks, trails, school). Consideration may be given to widening the generic local street ROW width from 20 to 21 metres to enable one of the sidewalks to be changed to a multi-use path.

All other local streets are anticipated to have 20-metre ROW widths, matching the typical local road ROW width in the Town’s guidelines.

Attachment 1:

Updated Hamlet Concept

LEGEND

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MAIN STREET MIXED-USE
- ANCHOR COMMERCIAL
- PLAZA COMMERCIAL
- INSTITUTIONAL / CEMETERY
- PARK SPACE
- STORMWATER MANAGEMENT POND
- NATURAL HERITAGE / WOODLOT
- ENVIRONMENTALLY PROTECTED AREA
- MAJOR INFRASTRUCTURE EASEMENT
- HYDRO CORRIDOR

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

SECONDARY LAND USE PLAN

FIGURE 2.1

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:6000
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 06, 2024

File Location: c:\pw working directory\projects 2023\dillon_32kyd\dms05551\235735-02-sana-des.dwg June, 06, 2024 8:19 PM

Attachment 2:

Synchro and SIDRA Analysis Worksheets

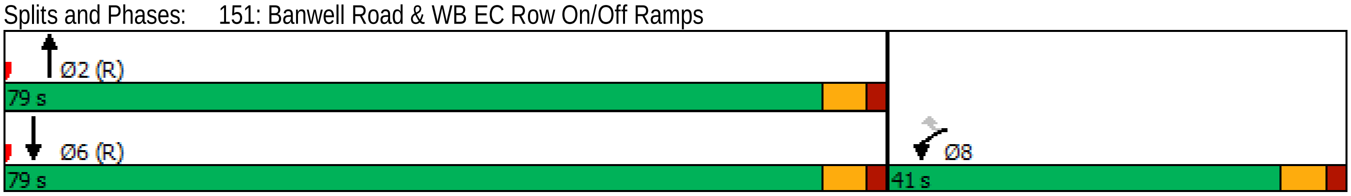
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	105	0	34	0	454	690	0	400	300
Future Volume (vph)	0	0	0	105	0	34	0	454	690	0	400	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		60.0
Storage Lanes	0		0	1		1	0		1	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt						0.850						
Flt Protected				0.950								
Satd. Flow (prot)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Flt Permitted				0.950								
Satd. Flow (perm)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						68			953			522
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		217.2			320.8			302.3			226.6	
Travel Time (s)		15.6			23.1			18.1			13.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	210	0	68	0	908	1380	0	800	600
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	210	0	68	0	908	1380	0	800	600
Turn Type				Prot		Perm		NA	Free		NA	Free
Protected Phases				8				2			6	
Permitted Phases						8			Free			Free
Detector Phase				8		8		2			6	
Switch Phase												
Minimum Initial (s)				5.0		5.0		5.0			5.0	
Minimum Split (s)				24.0		24.0		24.0			24.0	
Total Split (s)				41.0		41.0		79.0			79.0	
Total Split (%)				34.2%		34.2%		65.8%			65.8%	
Maximum Green (s)				35.0		35.0		73.0			73.0	
Yellow Time (s)				4.0		4.0		4.0			4.0	
All-Red Time (s)				2.0		2.0		2.0			2.0	
Lost Time Adjust (s)				0.0		0.0		0.0			0.0	
Total Lost Time (s)				6.0		6.0		6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Recall Mode				None		None		C-Max			C-Max	
Walk Time (s)				7.0		7.0		7.0			7.0	
Flash Dont Walk (s)				11.0		11.0		11.0			11.0	
Pedestrian Calls (#/hr)				0		0		0			0	
Act Effct Green (s)				19.3		19.3		88.7	120.0		88.7	120.0
Actuated g/C Ratio				0.16		0.16		0.74	1.00		0.74	1.00
v/c Ratio				0.72		0.22		0.34	0.73		0.21	0.32
Control Delay				61.6		10.9		4.9	9.1		5.4	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.0		0.0		0.0	0.0		0.0	0.0
Total Delay				61.6		10.9		4.9	9.1		5.4	0.4
LOS				E		B		A	A		A	A
Approach Delay					49.2			7.5			3.3	
Approach LOS					D			A			A	
Queue Length 50th (m)				50.0		0.0		21.1	161.4		19.4	0.0
Queue Length 95th (m)				72.3		12.2		46.1	163.6		30.4	0.0
Internal Link Dist (m)		193.2			296.8			278.3			202.6	
Turn Bay Length (m)												60.0
Base Capacity (vph)				526		519		2668	1900		3834	1900
Starvation Cap Reductn				0		0		0	0		0	0
Spillback Cap Reductn				0		0		0	0		0	0
Storage Cap Reductn				0		0		0	0		0	0
Reduced v/c Ratio				0.40		0.13		0.34	0.73		0.21	0.32

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 100 (83%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 8.9 Intersection LOS: A
Intersection Capacity Utilization 45.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 151: Banwell Road & WB EC Row On/Off Ramps



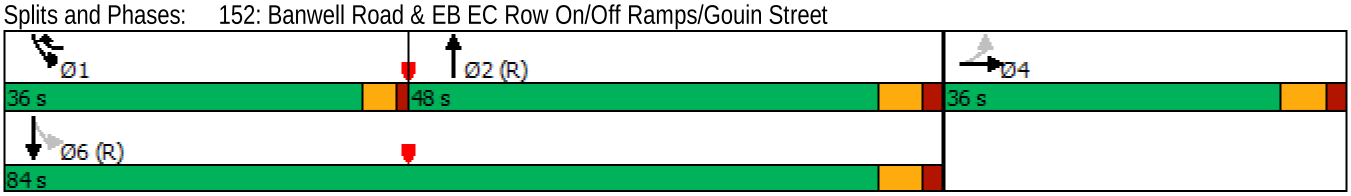
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	40	144	0	0	138	0	922	3	38	381	107
Future Volume (vph)	191	40	144	0	0	138	0	922	3	38	381	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		2	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865						0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	3502	1900	1615	0	0	1644	0	5187	0	1805	3610	1615
Flt Permitted	0.950									0.062		
Satd. Flow (perm)	3502	1900	1615	0	0	1644	0	5187	0	118	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			288			82						176
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	382	80	288	0	0	276	0	1844	6	76	762	214
Shared Lane Traffic (%)												
Lane Group Flow (vph)	382	80	288	0	0	276	0	1850	0	76	762	214
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	36.0	36.0				36.0		48.0		36.0	84.0	
Total Split (%)	30.0%	30.0%				30.0%		40.0%		30.0%	70.0%	
Maximum Green (s)	30.0	30.0				32.0		42.0		32.0	78.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	18.4	18.4	120.0			20.2		65.4		91.6	89.6	120.0
Actuated g/C Ratio	0.15	0.15	1.00			0.17		0.54		0.76	0.75	1.00
v/c Ratio	0.71	0.27	0.18			0.80		0.65		0.20	0.28	0.13
Control Delay	55.8	46.3	0.2			50.0		24.4		13.2	4.2	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	55.8	46.3	0.2			50.0		24.4		13.2	4.2	0.2
LOS	E	D	A			D		C		B	A	A
Approach Delay		33.4			50.0			24.4			4.1	
Approach LOS		C			D			C			A	
Queue Length 50th (m)	46.9	17.7	0.0			47.3		111.7		3.1	20.9	0.0
Queue Length 95th (m)	61.0	31.8	0.0			72.8		124.6		14.7	31.1	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	875	475	1615			498		2827		539	2696	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.44	0.17	0.18			0.55		0.65		0.14	0.28	0.13

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 116 (97%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 22.5 Intersection LOS: C
Intersection Capacity Utilization 77.1% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	758	28	29	836	52	145	171	41	80	101	230
Future Volume (vph)	79	758	28	29	836	52	145	171	41	80	101	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.971				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1719	3438	1568	1687	3406	1468	1770	1798	0	1770	1845	1599
Flt Permitted	0.950			0.950			0.469			0.135		
Satd. Flow (perm)	1719	3438	1568	1687	3406	1468	874	1798	0	251	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88			88		8				205
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	5%	5%	3%	7%	6%	10%	2%	2%	5%	2%	3%	1%
Adj. Flow (vph)	158	1516	56	58	1672	104	290	342	82	160	202	460
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	1516	56	58	1672	104	290	424	0	160	202	460
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	20.0	71.0	71.0	20.0	71.0	71.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	14.3%	50.7%	50.7%	14.3%	50.7%	50.7%	9.3%	25.7%		9.3%	25.7%	25.7%
Maximum Green (s)	15.0	64.0	64.0	15.0	64.0	64.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	14.6	71.1	71.1	10.2	64.4	64.4	43.0	29.7		43.0	29.7	29.7
Actuated g/C Ratio	0.10	0.51	0.51	0.07	0.46	0.46	0.31	0.21		0.31	0.21	0.21
v/c Ratio	0.88	0.87	0.07	0.48	1.07	0.14	0.87	1.10		0.86	0.52	0.92
Control Delay	103.0	38.0	1.4	85.6	53.1	0.8	68.0	123.5		75.7	54.2	54.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	103.0	38.0	1.4	85.6	53.1	0.8	68.0	123.5		75.7	54.2	54.4
LOS	F	D	A	F	D	A	E	F		E	D	D
Approach Delay		42.8			51.2			100.9			58.5	
Approach LOS		D			D			F			E	
Queue Length 50th (m)	46.0	206.8	0.0	17.7	~276.8	0.1	67.8	~137.5		34.4	52.6	79.1
Queue Length 95th (m)	#87.6	#274.1	2.8	m21.4	m#284.3	m0.6	#118.7	#206.2		#69.8	79.4	#146.7
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	184	1745	839	180	1566	722	332	387		185	391	500
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.86	0.87	0.07	0.32	1.07	0.14	0.87	1.10		0.86	0.52	0.92

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 47 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.10
Intersection Signal Delay: 56.5 Intersection LOS: E
Intersection Capacity Utilization 105.4% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	470	3	9	521	58	9	8	9	81	18	65
Future Volume (vph)	28	470	3	9	521	58	9	8	9	81	18	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	100.0		45.0	50.0		0.0	30.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999				0.850		0.921			0.883	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3468	0	1770	3539	1583	1770	1716	0	1770	1645	0
Flt Permitted	0.225			0.263			0.652			0.735		
Satd. Flow (perm)	419	3468	0	490	3539	1583	1215	1716	0	1369	1645	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				116		18			77	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		318.4			307.6			218.0			156.3	
Travel Time (s)		22.9			22.1			15.7			11.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	56	940	6	18	1042	116	18	16	18	162	36	130
Shared Lane Traffic (%)												
Lane Group Flow (vph)	56	946	0	18	1042	116	18	34	0	162	166	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Detector Phase	2	2		6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	
Minimum Split (s)	29.0	29.0		29.0	29.0	29.0	32.0	32.0		32.0	32.0	
Total Split (s)	50.0	50.0		50.0	50.0	50.0	32.0	32.0		32.0	32.0	
Total Split (%)	61.0%	61.0%		61.0%	61.0%	61.0%	39.0%	39.0%		39.0%	39.0%	
Maximum Green (s)	43.0	43.0		43.0	43.0	43.0	25.0	25.0		25.0	25.0	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Recall Mode	Min	Min		Min	Min	Min	None	None		None	None	
Walk Time (s)	12.0	12.0					15.0	15.0				
Flash Dont Walk (s)	10.0	10.0					10.0	10.0				
Pedestrian Calls (#/hr)	0	0					0	0				
Act Effct Green (s)	30.5	30.5		30.5	30.5	30.5	12.3	12.3		14.7	14.7	
Actuated g/C Ratio	0.51	0.51		0.51	0.51	0.51	0.21	0.21		0.25	0.25	
v/c Ratio	0.26	0.53		0.07	0.58	0.13	0.07	0.09		0.48	0.36	
Control Delay	13.0	11.4		9.2	11.9	2.4	20.9	13.9		26.0	14.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	13.0	11.4		9.2	11.9	2.4	20.9	13.9		26.0	14.1	
LOS	B	B		A	B	A	C	B		C	B	
Approach Delay		11.5			10.9			16.3			20.0	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	3.2	33.6		0.9	38.2	0.0	1.8	1.5		15.0	7.7	
Queue Length 95th (m)	12.3	63.2		4.7	71.0	7.1	7.1	8.3		38.5	26.0	
Internal Link Dist (m)		294.4			283.6			194.0			132.3	
Turn Bay Length (m)	100.0			100.0		45.0	50.0			30.0		
Base Capacity (vph)	313	2596		366	2649	1214	528	757		595	759	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.18	0.36		0.05	0.39	0.10	0.03	0.04		0.27	0.22	

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 59.8
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.58
Intersection Signal Delay: 12.4 — Intersection LOS: B
Intersection Capacity Utilization 70.3% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 167: Lesperance Road & CR 42

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	487	80	52	655	40	69	248	48	82	204	192
Future Volume (vph)	188	487	80	52	655	40	69	248	48	82	204	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3343	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3343	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			160			116			115			266
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	8%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	376	974	160	104	1310	80	138	496	96	164	408	384
Shared Lane Traffic (%)												
Lane Group Flow (vph)	376	974	160	104	1310	80	138	496	96	164	408	384
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	20.0	61.0	61.0	20.0	61.0	61.0	15.0	44.0	44.0	15.0	44.0	
Total Split (%)	14.3%	43.6%	43.6%	14.3%	43.6%	43.6%	10.7%	31.4%	31.4%	10.7%	31.4%	
Maximum Green (s)	15.0	53.2	53.2	15.0	53.2	53.2	10.0	36.1	36.1	10.0	36.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	15.0	54.6	54.6	13.6	53.2	53.2	9.7	36.3	36.3	9.8	36.4	140.0
Actuated g/C Ratio	0.11	0.39	0.39	0.10	0.38	0.38	0.07	0.26	0.26	0.07	0.26	1.00
v/c Ratio	1.02	0.75	0.26	0.76	1.01	0.12	0.69	1.14	0.22	0.70	0.85	0.24
Control Delay	95.4	31.4	6.4	93.0	71.0	1.9	82.0	132.8	5.5	79.9	66.9	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	95.4	31.4	6.4	93.0	71.0	1.9	82.0	132.8	5.5	79.9	66.9	0.4
LOS	F	C	A	F	E	A	F	F	A	E	E	A
Approach Delay		44.7			68.8			106.5			42.4	
Approach LOS		D			E			F			D	
Queue Length 50th (m)	~55.8	147.0	13.0	29.7	~205.2	0.0	20.5	~168.9	0.0	24.4	113.9	0.0
Queue Length 95th (m)	m#74.9	m168.6	m13.8	#56.8	#255.8	4.4	#34.1	#240.2	10.2	#37.9	#169.4	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	367	1304	626	152	1294	673	205	436	431	240	479	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.02	0.75	0.26	0.68	1.01	0.12	0.67	1.14	0.22	0.68	0.85	0.24

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.14
Intersection Signal Delay: 61.5 Intersection LOS: E
Intersection Capacity Utilization 100.3% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22

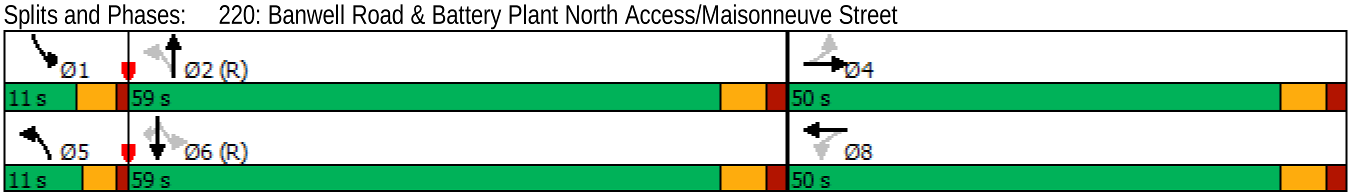
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	178	0	3	33	5	41	54	626	31	38	242	100
Future Volume (vph)	178	0	3	33	5	41	54	626	31	38	242	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.850			0.866			0.993				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1615	0	1805	1645	0	1805	5102	0	1805	5136	1615
Flt Permitted	0.697			0.754			0.454			0.151		
Satd. Flow (perm)	1324	1615	0	1433	1645	0	863	5102	0	287	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		352			82			8				200
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	356	0	6	66	10	82	108	1252	62	76	484	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	356	6	0	66	92	0	108	1314	0	76	484	200
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	50.0	50.0		50.0	50.0		11.0	59.0		11.0	59.0	59.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%		9.2%	49.2%		9.2%	49.2%	49.2%
Maximum Green (s)	44.0	44.0		44.0	44.0		7.0	53.0		6.5	53.0	53.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.5	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.5	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	36.7	36.7		36.7	36.7		70.1	62.5		68.3	60.5	60.5
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.58	0.52		0.57	0.50	0.50
v/c Ratio	0.88	0.01		0.15	0.16		0.19	0.49		0.31	0.19	0.22
Control Delay	61.9	0.0		28.9	7.6		9.1	14.8		13.5	12.1	1.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	61.9	0.0		28.9	7.6		9.1	14.8		13.5	12.1	1.0
LOS	E	A		C	A		A	B		B	B	A
Approach Delay		60.9			16.5			14.4			9.3	
Approach LOS		E			B			B			A	
Queue Length 50th (m)	82.3	0.0		11.7	1.7		8.5	58.4		4.7	12.8	0.0
Queue Length 95th (m)	114.5	0.0		21.3	12.7		m15.4	m70.8		11.0	20.7	2.7
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	485	815		525	655		558	2661		245	2587	912
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.73	0.01		0.13	0.14		0.19	0.49		0.31	0.19	0.22

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 104 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 19.3 Intersection LOS: B
Intersection Capacity Utilization 69.9% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



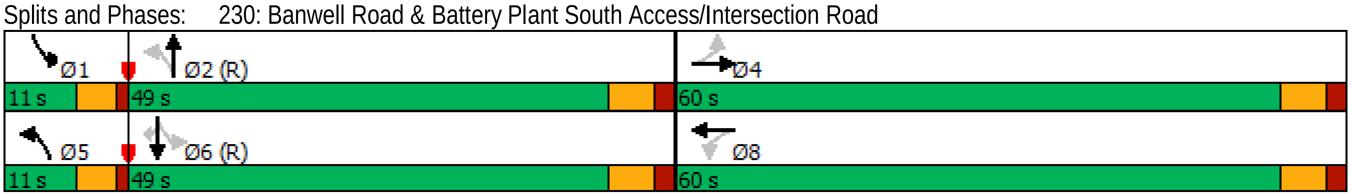
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	27	75	52	2	151	6	399	18	46	419	11
Future Volume (vph)	188	27	75	52	2	151	6	399	18	46	419	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.890			0.852			0.994				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1673	0	1787	1603	0	1805	5154	0	1787	3539	1615
Flt Permitted	0.483			0.595			0.242			0.241		
Satd. Flow (perm)	909	1673	0	1119	1603	0	460	5154	0	453	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		150			191			6				68
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	376	54	150	104	4	302	12	798	36	92	838	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	376	204	0	104	306	0	12	834	0	92	838	22
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	24.0	24.0		24.0	24.0		9.5	41.0		9.5	41.0	41.0
Total Split (s)	60.0	60.0		60.0	60.0		11.0	49.0		11.0	49.0	49.0
Total Split (%)	50.0%	50.0%		50.0%	50.0%		9.2%	40.8%		9.2%	40.8%	40.8%
Maximum Green (s)	54.0	54.0		54.0	54.0		6.5	43.0		6.5	43.0	43.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.5	4.0		3.5	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.5	6.0		4.5	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0			28.0			28.0	28.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	51.1	51.1		51.1	51.1		53.4	46.0		56.7	52.6	52.6
Actuated g/C Ratio	0.43	0.43		0.43	0.43		0.44	0.38		0.47	0.44	0.44
v/c Ratio	0.97	0.26		0.22	0.39		0.04	0.42		0.32	0.54	0.03
Control Delay	73.4	6.9		22.2	9.4		18.0	28.5		20.5	24.5	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	73.4	6.9		22.2	9.4		18.0	28.5		20.5	24.5	0.4
LOS	E	A		C	A		B	C		C	C	A
Approach Delay		50.0			12.7			28.3			23.5	
Approach LOS		D			B			C			C	
Queue Length 50th (m)	85.5	7.5		15.3	16.5		1.6	57.1		10.5	56.6	0.0
Queue Length 95th (m)	#150.3	22.0		27.9	37.5		5.2	69.9		19.0	76.6	0.4
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	409	835		503	826		279	1978		286	1550	745
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.92	0.24		0.21	0.37		0.04	0.42		0.32	0.54	0.03

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 108 (90%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 28.9 Intersection LOS: C
Intersection Capacity Utilization 85.8% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	19	45	384	3	13	536
Future Volume (Veh/h)	19	45	384	3	13	536
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	38	90	768	6	26	1072
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1359	387			774	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1359	387			774	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	72	85			97	
cM capacity (veh/h)	135	611			837	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	128	512	262	26	536	536
Volume Left	38	0	0	26	0	0
Volume Right	90	0	6	0	0	0
cSH	299	1700	1700	837	1700	1700
Volume to Capacity	0.43	0.30	0.15	0.03	0.32	0.32
Queue Length 95th (m)	16.4	0.0	0.0	0.8	0.0	0.0
Control Delay (s)	25.7	0.0	0.0	9.4	0.0	0.0
Lane LOS	D			A		
Approach Delay (s)	25.7	0.0		0.2		
Approach LOS	D					

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

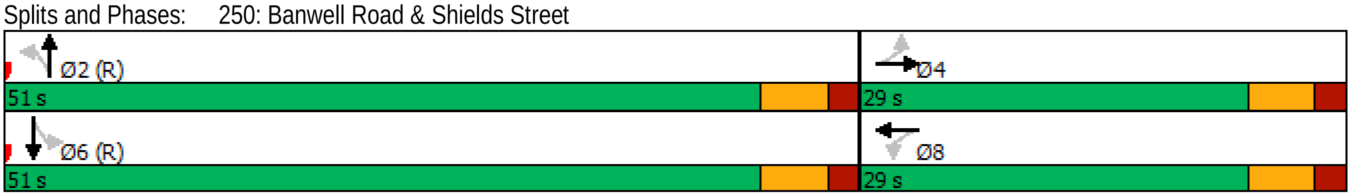
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	24	13	57	14	99	8	254	60	78	459	20
Future Volume (vph)	54	24	13	57	14	99	8	254	60	78	459	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.947			0.869			0.971			0.994	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1764	0	1770	1619	0	1770	3492	0	1770	3518	0
Flt Permitted	0.467			0.709			0.276			0.414		
Satd. Flow (perm)	870	1764	0	1321	1619	0	514	3492	0	771	3518	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		26			198			58			9	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		197.4			352.6			315.5			441.4	
Travel Time (s)		14.2			25.4			18.9			26.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	0%	2%	2%	2%	2%
Adj. Flow (vph)	108	48	26	114	28	198	16	508	120	156	918	40
Shared Lane Traffic (%)												
Lane Group Flow (vph)	108	74	0	114	226	0	16	628	0	156	958	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	29.0	29.0		29.0	29.0		26.0	26.0		26.0	26.0	
Total Split (s)	29.0	29.0		29.0	29.0		51.0	51.0		51.0	51.0	
Total Split (%)	36.3%	36.3%		36.3%	36.3%		63.8%	63.8%		63.8%	63.8%	
Maximum Green (s)	23.0	23.0		23.0	23.0		45.0	45.0		45.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	10	10		10	10		0	0		0	0	
Act Effct Green (s)	14.2	14.2		14.2	14.2		53.8	53.8		53.8	53.8	
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.67	0.67		0.67	0.67	
v/c Ratio	0.70	0.22		0.49	0.50		0.05	0.27		0.30	0.40	
Control Delay	53.1	19.4		35.0	9.8		6.9	5.8		8.9	7.3	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	53.1	19.4		35.0	9.8		6.9	5.8		8.9	7.3	
LOS	D	B		D	A		A	A		A	A	
Approach Delay		39.4			18.2			5.8			7.5	
Approach LOS		D			B			A			A	
Queue Length 50th (m)	16.6	6.6		16.7	3.8		0.7	15.6		8.5	29.8	
Queue Length 95th (m)	29.7	15.4		28.2	19.4		3.9	32.9		26.1	58.9	
Internal Link Dist (m)		173.4			328.6			291.5			417.4	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	250	525		379	606		345	2369		518	2370	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.43	0.14		0.30	0.37		0.05	0.27		0.30	0.40	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 76 (95%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 11.2 Intersection LOS: B
Intersection Capacity Utilization 74.7% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 250: Banwell Road & Shields Street



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	477	598	12	29	14
Future Volume (Veh/h)	8	477	598	12	29	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	16	954	1196	24	58	28
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1220				1705	598
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1220				1705	598
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				28	94
cM capacity (veh/h)	567				80	445

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	16	477	477	598	598	24	58	28
Volume Left	16	0	0	0	0	0	58	0
Volume Right	0	0	0	0	0	24	0	28
cSH	567	1700	1700	1700	1700	1700	80	445
Volume to Capacity	0.03	0.28	0.28	0.35	0.35	0.01	0.72	0.06
Queue Length 95th (m)	0.7	0.0	0.0	0.0	0.0	0.0	27.9	1.6
Control Delay (s)	11.5	0.0	0.0	0.0	0.0	0.0	124.1	13.6
Lane LOS	B						F	B
Approach Delay (s)	0.2			0.0			88.1	
Approach LOS							F	

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	0	18	8	0	9	43	296	11	16	280	36
Future Volume (vph)	50	0	18	8	0	9	43	296	11	16	280	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		75.0	75.0		75.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.850			0.850				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	1583	0	1770	3539	1583	1770	3505	1583
Flt Permitted	0.746			0.734			0.442			0.428		
Satd. Flow (perm)	1390	1583	0	1367	1583	0	823	3539	1583	797	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		244			223				40			72
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		483.1			165.4			845.7			233.8	
Travel Time (s)		34.8			11.9			60.9			16.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	100	0	36	16	0	18	86	592	22	32	560	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	36	0	16	18	0	86	592	22	32	560	72
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	4	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	33.0	33.0		33.0	33.0		24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	36.0	36.0		36.0	36.0		46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	43.9%	43.9%		43.9%	43.9%		56.1%	56.1%	56.1%	56.1%	56.1%	56.1%
Maximum Green (s)	30.0	30.0		30.0	30.0		40.0	40.0	40.0	40.0	40.0	40.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min	Min	Min	Min	Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	0
Act Effct Green (s)	8.4	8.4		8.4	8.4		21.0	21.0	21.0	21.0	21.0	21.0
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.56	0.56	0.56	0.56	0.56	0.56
v/c Ratio	0.32	0.07		0.05	0.03		0.19	0.30	0.02	0.07	0.29	0.08
Control Delay	14.6	0.2		10.8	0.1		8.4	7.1	2.1	7.3	7.0	2.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.6	0.2		10.8	0.1		8.4	7.1	2.1	7.3	7.0	2.7
LOS	B	A		B	A		A	A	A	A	A	A
Approach Delay		10.8			5.1			7.1			6.5	
Approach LOS		B			A			A			A	
Queue Length 50th (m)	5.0	0.0		0.8	0.0		3.0	11.4	0.0	1.0	10.7	0.0
Queue Length 95th (m)	13.3	0.0		3.6	0.0		10.4	22.8	1.8	4.7	21.6	4.5
Internal Link Dist (m)		459.1			141.4			821.7			209.8	
Turn Bay Length (m)	75.0			75.0			75.0		75.0	75.0		75.0
Base Capacity (vph)	1165	1366		1145	1362		814	3502	1567	789	3468	1567
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.03		0.01	0.01		0.11	0.17	0.01	0.04	0.16	0.05

Intersection Summary

Area Type: Other

Cycle Length: 82

Actuated Cycle Length: 37.5

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

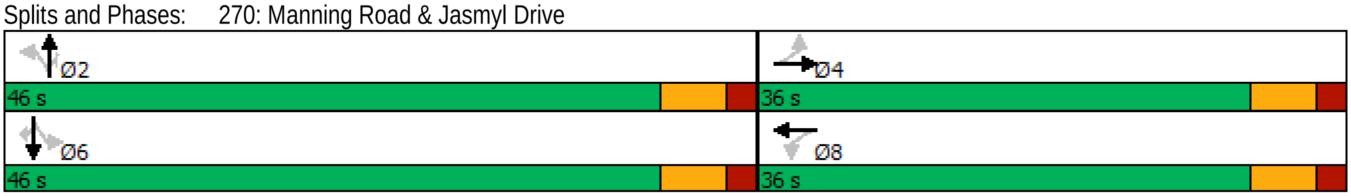
Maximum v/c Ratio: 0.32

Intersection Signal Delay: 7.1 Intersection LOS: A

Intersection Capacity Utilization 56.1% ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 270: Manning Road & Jasmyl Drive



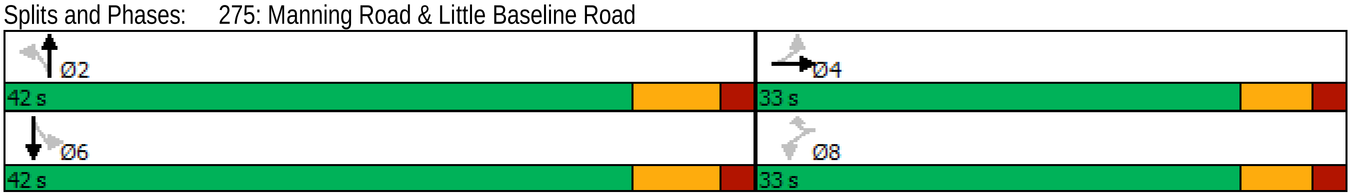
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	0	34	9	0	20	8	330	11	17	368	8
Future Volume (vph)	25	0	34	9	0	20	8	330	11	17	368	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.850				0.850		0.995			0.997	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	0	1583	1770	3522	0	1770	3495	0
Flt Permitted	0.950			0.909			0.366			0.392		
Satd. Flow (perm)	1770	1583	0	1693	0	1583	682	3522	0	730	3495	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		136				58		6			4	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		158.8			143.8			278.0			845.7	
Travel Time (s)		11.4			10.4			20.0			60.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	50	0	68	18	0	40	16	660	22	34	736	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	68	0	18	0	40	16	682	0	34	752	0
Turn Type	Perm	NA		Perm		Perm	Perm	NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8		8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0		7.0	20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		33.0		33.0	27.0	27.0		27.0	27.0	
Total Split (s)	33.0	33.0		33.0		33.0	42.0	42.0		42.0	42.0	
Total Split (%)	44.0%	44.0%		44.0%		44.0%	56.0%	56.0%		56.0%	56.0%	
Maximum Green (s)	27.0	27.0		27.0		27.0	35.0	35.0		35.0	35.0	
Yellow Time (s)	4.0	4.0		4.0		4.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0		6.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None		None	Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0		20.0	10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0		0	0	
Act Effct Green (s)	7.2	7.2		7.2		7.2	27.9	27.9		27.9	27.9	
Actuated g/C Ratio	0.18	0.18		0.18		0.18	0.70	0.70		0.70	0.70	
v/c Ratio	0.16	0.17		0.06		0.12	0.03	0.28		0.07	0.31	
Control Delay	15.2	2.1		14.2		4.9	5.8	5.2		6.0	5.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Delay	15.2	2.1		14.2		4.9	5.8	5.2		6.0	5.4	
LOS	B	A		B		A	A	A		A	A	
Approach Delay		7.6			7.8			5.2			5.4	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	3.1	0.0		1.1		0.0	0.5	13.7		1.1	15.6	
Queue Length 95th (m)	9.4	2.5		4.7		4.1	2.6	23.7		4.5	26.7	
Internal Link Dist (m)		134.8			119.8			254.0			821.7	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	1196	1114		1144		1088	620	3204		664	3179	
Starvation Cap Reductn	0	0		0		0	0	0		0	0	
Spillback Cap Reductn	0	0		0		0	0	0		0	0	
Storage Cap Reductn	0	0		0		0	0	0		0	0	
Reduced v/c Ratio	0.04	0.06		0.02		0.04	0.03	0.21		0.05	0.24	

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 40
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.31
Intersection Signal Delay: 5.6 Intersection LOS: A
Intersection Capacity Utilization 48.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 275: Manning Road & Little Baseline Road



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	25	11	323	403	8
Future Volume (Veh/h)	16	25	11	323	403	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	32	50	22	646	806	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					278	
pX, platoon unblocked						
vC, conflicting volume	1173	403	822			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1173	403	822			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	92	97			
cM capacity (veh/h)	180	597	803			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	82	22	323	323	403	403	16
Volume Left	32	22	0	0	0	0	0
Volume Right	50	0	0	0	0	0	16
cSH	314	803	1700	1700	1700	1700	1700
Volume to Capacity	0.26	0.03	0.19	0.19	0.24	0.24	0.01
Queue Length 95th (m)	8.2	0.7	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	20.5	9.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	20.5	0.3			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	26	23	7	308	421	7
Future Volume (Veh/h)	26	23	7	308	421	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	52	46	14	616	842	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1178	421	856			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1178	421	856			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	71	92	98			
cM capacity (veh/h)	180	581	780			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	98	14	308	308	421	421	14
Volume Left	52	14	0	0	0	0	0
Volume Right	46	0	0	0	0	0	14
cSH	267	780	1700	1700	1700	1700	1700
Volume to Capacity	0.37	0.02	0.18	0.18	0.25	0.25	0.01
Queue Length 95th (m)	12.9	0.4	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	26.1	9.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	A					
Approach Delay (s)	26.1	0.2			0.0		
Approach LOS	D						

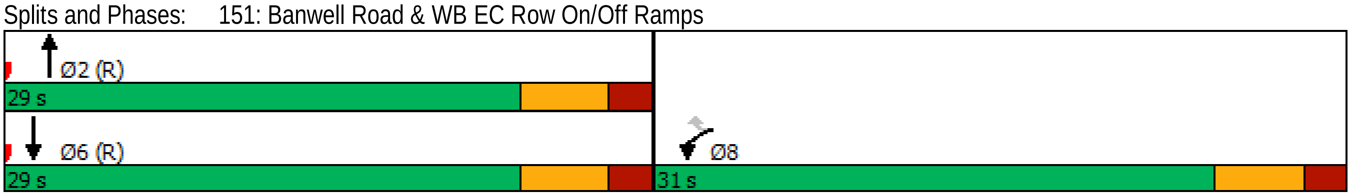
Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	131	0	34	0	392	458	0	445	300
Future Volume (vph)	0	0	0	131	0	34	0	392	458	0	445	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		60.0
Storage Lanes	0		0	1		1	0		1	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt						0.850						
Flt Protected				0.950								
Satd. Flow (prot)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Flt Permitted				0.950								
Satd. Flow (perm)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						68			916			600
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		217.2			320.8			302.3			226.6	
Travel Time (s)		15.6			23.1			18.1			13.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	262	0	68	0	784	916	0	890	600
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	262	0	68	0	784	916	0	890	600
Turn Type				Prot		Perm		NA	Free		NA	Free
Protected Phases				8				2			6	
Permitted Phases						8			Free			Free
Detector Phase				8		8		2			6	
Switch Phase												
Minimum Initial (s)				5.0		5.0		5.0			5.0	
Minimum Split (s)				24.0		24.0		24.0			24.0	
Total Split (s)				31.0		31.0		29.0			29.0	
Total Split (%)				51.7%		51.7%		48.3%			48.3%	
Maximum Green (s)				25.0		25.0		23.0			23.0	
Yellow Time (s)				4.0		4.0		4.0			4.0	
All-Red Time (s)				2.0		2.0		2.0			2.0	
Lost Time Adjust (s)				0.0		0.0		0.0			0.0	
Total Lost Time (s)				6.0		6.0		6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Recall Mode				None		None		C-Max			C-Max	
Walk Time (s)				7.0		7.0		7.0			7.0	
Flash Dont Walk (s)				11.0		11.0		11.0			11.0	
Pedestrian Calls (#/hr)				0		0		0			0	
Act Effct Green (s)				14.1		14.1		33.9	60.0		33.9	60.0
Actuated g/C Ratio				0.24		0.24		0.56	1.00		0.56	1.00
v/c Ratio				0.62		0.16		0.38	0.48		0.30	0.32
Control Delay				26.5		5.7		6.8	1.8		7.8	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.0		0.0		0.0	0.0		0.0	0.0
Total Delay				26.5		5.7		6.8	1.8		7.8	0.4
LOS				C		A		A	A		A	A
Approach Delay					22.2			4.1			4.9	
Approach LOS					C			A			A	
Queue Length 50th (m)				27.2		0.0		31.7	17.6		17.6	0.0
Queue Length 95th (m)				42.2		7.2		47.3	21.1		30.2	0.0
Internal Link Dist (m)		193.2			296.8			278.3			202.6	
Turn Bay Length (m)												60.0
Base Capacity (vph)				752		712		2042	1900		2934	1900
Starvation Cap Reductn				0		0		0	0		0	0
Spillback Cap Reductn				0		0		0	0		0	0
Storage Cap Reductn				0		0		0	0		0	0
Reduced v/c Ratio				0.35		0.10		0.38	0.48		0.30	0.32

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 32 (53%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.62	
Intersection Signal Delay: 6.1	Intersection LOS: A
Intersection Capacity Utilization 44.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 151: Banwell Road & WB EC Row On/Off Ramps



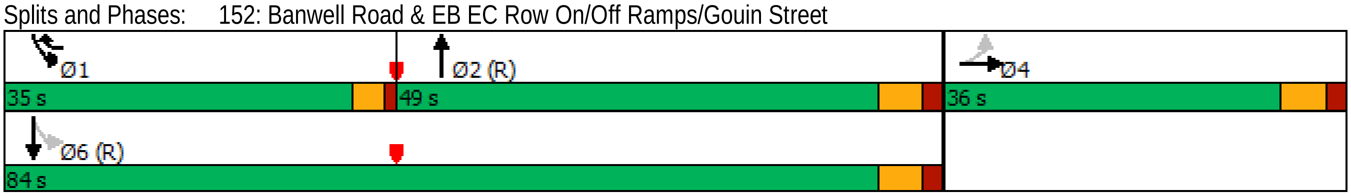
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	40	312	0	0	138	0	592	3	38	452	107
Future Volume (vph)	191	40	312	0	0	138	0	592	3	38	452	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		2	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.999				0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	3502	1900	1615	0	0	1644	0	5182	0	1805	3610	1615
Flt Permitted	0.950									0.175		
Satd. Flow (perm)	3502	1900	1615	0	0	1644	0	5182	0	332	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			440			82		1				148
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	382	80	624	0	0	276	0	1184	6	76	904	214
Shared Lane Traffic (%)												
Lane Group Flow (vph)	382	80	624	0	0	276	0	1190	0	76	904	214
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	36.0	36.0				35.0		49.0		35.0	84.0	
Total Split (%)	30.0%	30.0%				29.2%		40.8%		29.2%	70.0%	
Maximum Green (s)	30.0	30.0				31.0		43.0		31.0	78.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	18.4	18.4	120.0			20.1		65.5		91.6	89.6	120.0
Actuated g/C Ratio	0.15	0.15	1.00			0.17		0.55		0.76	0.75	1.00
v/c Ratio	0.71	0.27	0.39			0.80		0.42		0.15	0.34	0.13
Control Delay	55.8	46.3	0.7			50.3		14.7		3.8	4.0	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	55.8	46.3	0.7			50.3		14.7		3.8	4.0	0.2
LOS	E	D	A			D		B		A	A	A
Approach Delay		23.4			50.3			14.7			3.3	
Approach LOS		C			D			B			A	
Queue Length 50th (m)	46.9	17.7	0.0			47.3		47.4		2.6	26.8	0.0
Queue Length 95th (m)	61.0	31.8	0.0			72.8		63.4		6.7	32.1	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	875	475	1615			485		2828		633	2696	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.44	0.17	0.39			0.57		0.42		0.12	0.34	0.13

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 22 (18%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 16.2 Intersection LOS: B
Intersection Capacity Utilization 64.3% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	764	28	29	880	52	145	171	41	80	101	230
Future Volume (vph)	79	764	28	29	880	52	145	171	41	80	101	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.971				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1719	3438	1568	1687	3406	1468	1770	1798	0	1770	1845	1599
Flt Permitted	0.950			0.950			0.469			0.135		
Satd. Flow (perm)	1719	3438	1568	1687	3406	1468	874	1798	0	251	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88			88		8				204
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	5%	5%	3%	7%	6%	10%	2%	2%	5%	2%	3%	1%
Adj. Flow (vph)	158	1528	56	58	1760	104	290	342	82	160	202	460
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	1528	56	58	1760	104	290	424	0	160	202	460
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	20.0	71.0	71.0	20.0	71.0	71.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	14.3%	50.7%	50.7%	14.3%	50.7%	50.7%	9.3%	25.7%		9.3%	25.7%	25.7%
Maximum Green (s)	15.0	64.0	64.0	15.0	64.0	64.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	14.6	71.1	71.1	10.2	64.4	64.4	43.0	29.7		43.0	29.7	29.7
Actuated g/C Ratio	0.10	0.51	0.51	0.07	0.46	0.46	0.31	0.21		0.31	0.21	0.21
v/c Ratio	0.88	0.88	0.07	0.48	1.12	0.14	0.87	1.10		0.86	0.52	0.92
Control Delay	103.0	38.5	1.4	84.9	76.9	0.8	68.0	123.5		75.7	54.2	54.8

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	103.0	38.5	1.4	84.9	76.9	0.8	68.0	123.5		75.7	54.2	54.8
LOS	F	D	A	F	E	A	E	F		E	D	D
Approach Delay		43.2			73.0			100.9			58.7	
Approach LOS		D			E			F			E	
Queue Length 50th (m)	46.0	209.7	0.0	17.7	~305.2	0.1	67.8	~137.5		34.4	52.6	79.5
Queue Length 95th (m)	#87.6	#277.9	2.8	m21.3	m#305.0	m0.6	#118.7	#206.2		#69.8	79.4	#147.2
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	184	1745	839	180	1566	722	332	387		185	391	499
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.86	0.88	0.07	0.32	1.12	0.14	0.87	1.10		0.86	0.52	0.92

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 47 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.12
Intersection Signal Delay: 64.6 Intersection LOS: E
Intersection Capacity Utilization 107.8% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	470	3	9	570	58	9	8	9	81	18	65
Future Volume (vph)	28	470	3	9	570	58	9	8	9	81	18	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	100.0		45.0	50.0		0.0	30.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999				0.850		0.921			0.883	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3468	0	1770	3539	1583	1770	1716	0	1770	1645	0
Flt Permitted	0.192			0.265			0.652			0.735		
Satd. Flow (perm)	358	3468	0	494	3539	1583	1215	1716	0	1369	1645	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				116		18			59	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		318.4			307.6			218.0			156.3	
Travel Time (s)		22.9			22.1			15.7			11.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	56	940	6	18	1140	116	18	16	18	162	36	130
Shared Lane Traffic (%)												
Lane Group Flow (vph)	56	946	0	18	1140	116	18	34	0	162	166	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Detector Phase	2	2		6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	
Minimum Split (s)	29.0	29.0		29.0	29.0	29.0	32.0	32.0		32.0	32.0	
Total Split (s)	50.0	50.0		50.0	50.0	50.0	32.0	32.0		32.0	32.0	
Total Split (%)	61.0%	61.0%		61.0%	61.0%	61.0%	39.0%	39.0%		39.0%	39.0%	
Maximum Green (s)	43.0	43.0		43.0	43.0	43.0	25.0	25.0		25.0	25.0	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Recall Mode	Min	Min		Min	Min	Min	None	None		None	None	
Walk Time (s)	12.0	12.0					15.0	15.0				
Flash Dont Walk (s)	10.0	10.0					10.0	10.0				
Pedestrian Calls (#/hr)	0	0					0	0				
Act Effct Green (s)	33.1	33.1		33.1	33.1	33.1	13.8	13.8		15.1	15.1	
Actuated g/C Ratio	0.53	0.53		0.53	0.53	0.53	0.22	0.22		0.24	0.24	
v/c Ratio	0.30	0.52		0.07	0.61	0.13	0.07	0.09		0.49	0.38	
Control Delay	14.4	11.1		9.1	12.3	2.4	20.9	13.9		27.5	16.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	14.4	11.1		9.1	12.3	2.4	20.9	13.9		27.5	16.9	
LOS	B	B		A	B	A	C	B		C	B	
Approach Delay		11.3			11.3			16.3			22.1	
Approach LOS		B			B			B			C	
Queue Length 50th (m)	3.4	34.5		0.9	44.7	0.0	1.7	1.5		16.6	10.3	
Queue Length 95th (m)	13.3	63.2		4.7	80.4	7.1	7.1	8.3		38.5	28.8	
Internal Link Dist (m)		294.4			283.6			194.0			132.3	
Turn Bay Length (m)	100.0			100.0		45.0	50.0			30.0		
Base Capacity (vph)	254	2465		351	2515	1159	502	719		565	714	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.22	0.38		0.05	0.45	0.10	0.04	0.05		0.29	0.23	

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 62.7
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 12.7 Intersection LOS: B
Intersection Capacity Utilization 73.0% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 167: Lesperance Road & CR 42

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	467	80	52	670	40	69	248	48	82	204	221
Future Volume (vph)	215	467	80	52	670	40	69	248	48	82	204	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3312	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3312	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			160			116			115			306
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	9%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	430	934	160	104	1340	80	138	496	96	164	408	442
Shared Lane Traffic (%)												
Lane Group Flow (vph)	430	934	160	104	1340	80	138	496	96	164	408	442
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	20.0	61.0	61.0	20.0	61.0	61.0	15.0	44.0	44.0	15.0	44.0	
Total Split (%)	14.3%	43.6%	43.6%	14.3%	43.6%	43.6%	10.7%	31.4%	31.4%	10.7%	31.4%	
Maximum Green (s)	15.0	53.2	53.2	15.0	53.2	53.2	10.0	36.1	36.1	10.0	36.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	15.0	54.6	54.6	13.6	53.2	53.2	9.7	36.3	36.3	9.8	36.4	140.0
Actuated g/C Ratio	0.11	0.39	0.39	0.10	0.38	0.38	0.07	0.26	0.26	0.07	0.26	1.00
v/c Ratio	1.17	0.72	0.26	0.76	1.04	0.12	0.69	1.14	0.22	0.70	0.85	0.28
Control Delay	140.3	30.4	6.3	93.0	76.9	1.9	82.0	132.8	5.5	79.9	66.9	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	140.3	30.4	6.3	93.0	76.9	1.9	82.0	132.8	5.5	79.9	66.9	0.4
LOS	F	C	A	F	E	A	F	F	A	E	E	A
Approach Delay		58.9			74.1			106.5			40.0	
Approach LOS		E			E			F			D	
Queue Length 50th (m)	~75.0	141.0	12.8	29.7	~220.5	0.0	20.5	~168.9	0.0	24.4	113.9	0.0
Queue Length 95th (m)	m#93.1	m160.9	m13.7	#56.8	#265.3	4.4	#34.1	#240.2	10.2	#37.9	#169.4	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	367	1292	626	152	1294	673	205	436	431	240	479	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.17	0.72	0.26	0.68	1.04	0.12	0.67	1.14	0.22	0.68	0.85	0.28

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.17
Intersection Signal Delay: 67.0 Intersection LOS: E
Intersection Capacity Utilization 102.7% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22

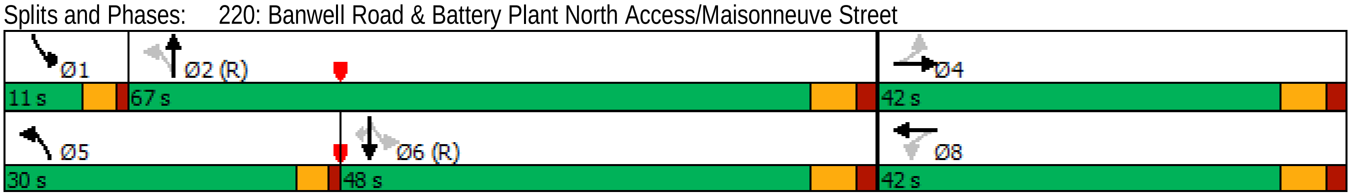
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	1	3	33	17	41	94	455	15	38	437	143
Future Volume (vph)	19	1	3	33	17	41	94	455	15	38	437	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.887			0.894			0.995				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1685	0	1805	1699	0	1805	5112	0	1805	5136	1615
Flt Permitted	0.588			0.752			0.297			0.292		
Satd. Flow (perm)	1117	1685	0	1429	1699	0	564	5112	0	555	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			82			6				286
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	38	2	6	66	34	82	188	910	30	76	874	286
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	8	0	66	116	0	188	940	0	76	874	286
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	42.0	42.0		42.0	42.0		30.0	67.0		11.0	48.0	48.0
Total Split (%)	35.0%	35.0%		35.0%	35.0%		25.0%	55.8%		9.2%	40.0%	40.0%
Maximum Green (s)	36.0	36.0		36.0	36.0		26.0	61.0		7.0	42.0	42.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	10.9	10.9		10.9	10.9		97.4	88.6		93.4	85.0	85.0
Actuated g/C Ratio	0.09	0.09		0.09	0.09		0.81	0.74		0.78	0.71	0.71
v/c Ratio	0.38	0.05		0.51	0.51		0.35	0.25		0.15	0.24	0.23
Control Delay	60.4	31.2		64.7	25.9		4.6	2.9		2.1	3.3	0.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	60.4	31.2		64.7	25.9		4.6	2.9		2.1	3.3	0.7
LOS	E	C		E	C		A	A		A	A	A
Approach Delay		55.4			39.9			3.2			2.6	
Approach LOS		E			D			A			A	
Queue Length 50th (m)	9.0	0.5		15.9	8.0		5.4	11.9		1.1	9.6	0.0
Queue Length 95th (m)	20.1	5.3		29.9	25.9		10.0	17.8		2.6	24.4	1.1
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	335	509		428	567		734	3777		507	3638	1227
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.11	0.02		0.15	0.20		0.26	0.25		0.15	0.24	0.23

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 6.4 Intersection LOS: A
Intersection Capacity Utilization 51.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



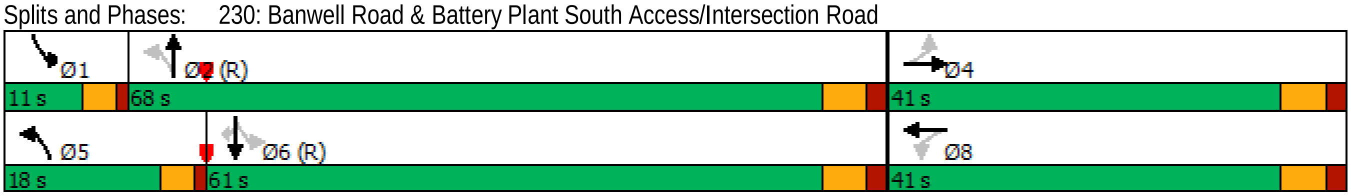
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	2	1	52	28	143	63	446	18	46	349	36
Future Volume (vph)	1	2	1	52	28	143	63	446	18	46	349	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.950			0.875			0.994				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1758	0	1787	1649	0	1805	5154	0	1787	3539	1615
Flt Permitted	0.241			0.754			0.360			0.288		
Satd. Flow (perm)	453	1758	0	1418	1649	0	684	5154	0	542	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			216			7				100
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	2	4	2	104	56	286	126	892	36	92	698	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	2	6	0	104	342	0	126	928	0	92	698	72
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.5	24.0		9.5	24.0	24.0
Total Split (s)	41.0	41.0		41.0	41.0		18.0	68.0		11.0	61.0	61.0
Total Split (%)	34.2%	34.2%		34.2%	34.2%		15.0%	56.7%		9.2%	50.8%	50.8%
Maximum Green (s)	35.0	35.0		35.0	35.0		14.0	62.0		7.0	55.0	55.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	16.6	16.6		16.6	16.6		90.5	80.8		88.3	79.7	79.7
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.75	0.67		0.74	0.66	0.66
v/c Ratio	0.03	0.02		0.53	0.83		0.21	0.27		0.20	0.30	0.07
Control Delay	40.5	33.7		56.1	34.5		5.0	8.7		4.5	8.3	1.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	40.5	33.7		56.1	34.5		5.0	8.7		4.5	8.3	1.1
LOS	D	C		E	C		A	A		A	A	A
Approach Delay		35.4			39.5			8.3			7.3	
Approach LOS		D			D			A			A	
Queue Length 50th (m)	0.4	0.9		24.5	31.1		6.0	29.9		3.2	33.2	0.0
Queue Length 95th (m)	2.8	4.5		39.0	61.0		15.8	48.4		9.8	48.8	2.3
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	132	514		413	633		663	3474		473	2350	1106
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.02	0.01		0.25	0.54		0.19	0.27		0.19	0.30	0.07

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 13.9 Intersection LOS: B
Intersection Capacity Utilization 60.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	19	45	488	3	13	392
Future Volume (Veh/h)	19	45	488	3	13	392
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	38	90	976	6	26	784
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1423	491			982	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1423	491			982	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	83			96	
cM capacity (veh/h)	122	523			699	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	128	651	331	26	392	392
Volume Left	38	0	0	26	0	0
Volume Right	90	0	6	0	0	0
cSH	265	1700	1700	699	1700	1700
Volume to Capacity	0.48	0.38	0.19	0.04	0.23	0.23
Queue Length 95th (m)	19.6	0.0	0.0	0.9	0.0	0.0
Control Delay (s)	30.7	0.0	0.0	10.4	0.0	0.0
Lane LOS	D			B		
Approach Delay (s)	30.7	0.0		0.3		
Approach LOS	D					

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

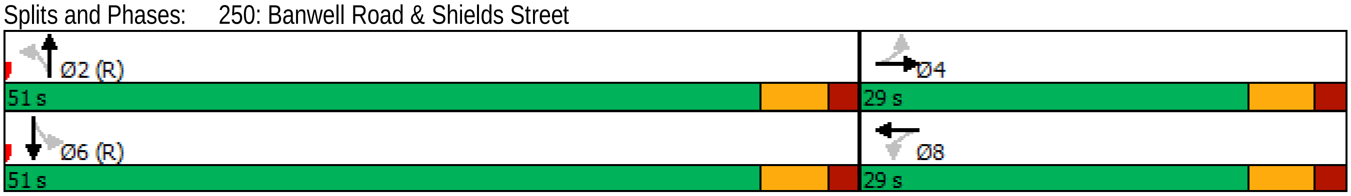
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	24	13	57	14	99	8	358	60	78	315	20
Future Volume (vph)	54	24	13	57	14	99	8	358	60	78	315	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.947			0.869			0.978			0.991	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1764	0	1770	1619	0	1770	3520	0	1770	3507	0
Flt Permitted	0.467			0.709			0.394			0.322		
Satd. Flow (perm)	870	1764	0	1321	1619	0	734	3520	0	600	3507	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		26			198			39			13	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		197.4			352.6			315.5			441.4	
Travel Time (s)		14.2			25.4			18.9			26.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	0%	2%	2%	2%	2%
Adj. Flow (vph)	108	48	26	114	28	198	16	716	120	156	630	40
Shared Lane Traffic (%)												
Lane Group Flow (vph)	108	74	0	114	226	0	16	836	0	156	670	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	29.0	29.0		29.0	29.0		26.0	26.0		26.0	26.0	
Total Split (s)	29.0	29.0		29.0	29.0		51.0	51.0		51.0	51.0	
Total Split (%)	36.3%	36.3%		36.3%	36.3%		63.8%	63.8%		63.8%	63.8%	
Maximum Green (s)	23.0	23.0		23.0	23.0		45.0	45.0		45.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	10	10		10	10		0	0		0	0	
Act Effct Green (s)	14.2	14.2		14.2	14.2		53.8	53.8		53.8	53.8	
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.67	0.67		0.67	0.67	
v/c Ratio	0.70	0.22		0.49	0.50		0.03	0.35		0.39	0.28	
Control Delay	53.1	19.4		35.0	9.8		6.7	6.6		11.1	6.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	53.1	19.4		35.0	9.8		6.7	6.6		11.1	6.4	
LOS	D	B		D	A		A	A		B	A	
Approach Delay		39.4			18.2			6.6			7.3	
Approach LOS		D			B			A			A	
Queue Length 50th (m)	16.6	6.6		16.7	3.8		0.7	23.7		9.2	18.5	
Queue Length 95th (m)	29.7	15.4		28.2	19.4		3.8	47.8		30.6	37.9	
Internal Link Dist (m)		173.4			328.6			291.5			417.4	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	250	525		379	606		493	2381		404	2364	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.43	0.14		0.30	0.37		0.03	0.35		0.39	0.28	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 76 (95%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 11.4 Intersection LOS: B
Intersection Capacity Utilization 71.9% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 250: Banwell Road & Shields Street



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	477	646	12	29	14
Future Volume (Veh/h)	8	477	646	12	29	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	16	954	1292	24	58	28
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1316				1801	646
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1316				1801	646
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				16	93
cM capacity (veh/h)	521				69	414

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	16	477	477	646	646	24	58	28
Volume Left	16	0	0	0	0	0	58	0
Volume Right	0	0	0	0	0	24	0	28
cSH	521	1700	1700	1700	1700	1700	69	414
Volume to Capacity	0.03	0.28	0.28	0.38	0.38	0.01	0.84	0.07
Queue Length 95th (m)	0.8	0.0	0.0	0.0	0.0	0.0	32.3	1.7
Control Delay (s)	12.1	0.0	0.0	0.0	0.0	0.0	167.1	14.3
Lane LOS	B						F	B
Approach Delay (s)	0.2			0.0			117.4	
Approach LOS							F	

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		

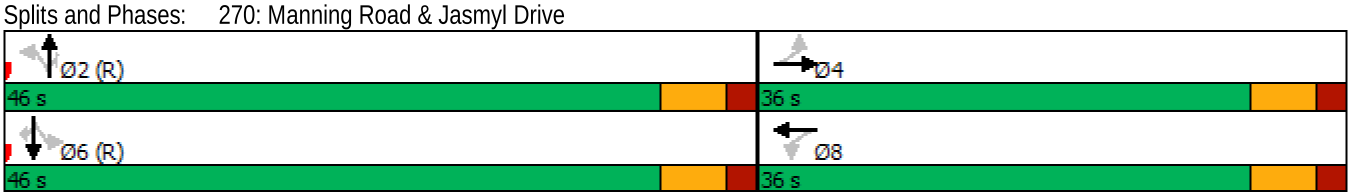
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	0	18	8	0	9	43	296	11	16	280	36
Future Volume (vph)	50	0	18	8	0	9	43	296	11	16	280	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		75.0	75.0		75.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.850			0.850				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	1583	0	1770	3539	1583	1770	3505	1583
Flt Permitted	0.746			0.734			0.442			0.428		
Satd. Flow (perm)	1390	1583	0	1367	1583	0	823	3539	1583	797	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		244			223				40			72
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		483.1			165.4			845.7			233.8	
Travel Time (s)		34.8			11.9			60.9			16.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	100	0	36	16	0	18	86	592	22	32	560	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	36	0	16	18	0	86	592	22	32	560	72
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	4	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	33.0	33.0		33.0	33.0		24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	36.0	36.0		36.0	36.0		46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	43.9%	43.9%		43.9%	43.9%		56.1%	56.1%	56.1%	56.1%	56.1%	56.1%
Maximum Green (s)	30.0	30.0		30.0	30.0		40.0	40.0	40.0	40.0	40.0	40.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	0
Act Effct Green (s)	11.4	11.4		11.4	11.4		62.4	62.4	62.4	62.4	62.4	62.4
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.76	0.76	0.76	0.76	0.76	0.76
v/c Ratio	0.52	0.08		0.08	0.04		0.14	0.22	0.02	0.05	0.21	0.06
Control Delay	41.5	0.4		29.5	0.2		5.1	4.3	0.9	4.7	4.3	1.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.5	0.4		29.5	0.2		5.1	4.3	0.9	4.7	4.3	1.4
LOS	D	A		C	A		A	A	A	A	A	A
Approach Delay		30.6			14.0			4.3			4.0	
Approach LOS		C			B			A			A	
Queue Length 50th (m)	15.5	0.0		2.3	0.0		3.7	14.3	0.0	1.3	13.4	0.0
Queue Length 95th (m)	28.9	0.0		7.5	0.0		10.5	25.7	1.3	4.7	24.3	4.0
Internal Link Dist (m)		459.1			141.4			821.7			209.8	
Turn Bay Length (m)	75.0			75.0			75.0		75.0	75.0		75.0
Base Capacity (vph)	508	733		500	720		626	2693	1214	606	2667	1221
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.05		0.03	0.03		0.14	0.22	0.02	0.05	0.21	0.06

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 82
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 6.7 Intersection LOS: A
Intersection Capacity Utilization 56.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 270: Manning Road & Jasmyl Drive



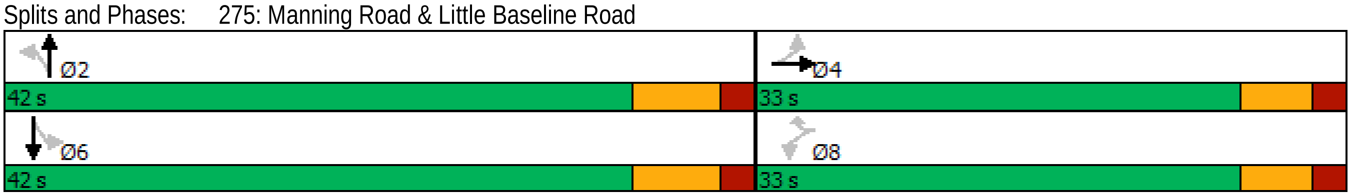
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	0	34	9	0	20	8	330	11	17	368	8
Future Volume (vph)	25	0	34	9	0	20	8	330	11	17	368	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.850				0.850		0.995			0.997	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	0	1583	1770	3522	0	1770	3495	0
Flt Permitted	0.950			0.909			0.366			0.392		
Satd. Flow (perm)	1770	1583	0	1693	0	1583	682	3522	0	730	3495	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		136				58		6			4	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		158.8			143.8			278.0			845.7	
Travel Time (s)		11.4			10.4			20.0			60.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	50	0	68	18	0	40	16	660	22	34	736	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	68	0	18	0	40	16	682	0	34	752	0
Turn Type	Perm	NA		Perm		Perm	Perm	NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8		8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0		7.0	20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		33.0		33.0	27.0	27.0		27.0	27.0	
Total Split (s)	33.0	33.0		33.0		33.0	42.0	42.0		42.0	42.0	
Total Split (%)	44.0%	44.0%		44.0%		44.0%	56.0%	56.0%		56.0%	56.0%	
Maximum Green (s)	27.0	27.0		27.0		27.0	35.0	35.0		35.0	35.0	
Yellow Time (s)	4.0	4.0		4.0		4.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0		6.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None		None	Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0		20.0	10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0		0	0	
Act Effct Green (s)	7.2	7.2		7.2		7.2	27.9	27.9		27.9	27.9	
Actuated g/C Ratio	0.18	0.18		0.18		0.18	0.70	0.70		0.70	0.70	
v/c Ratio	0.16	0.17		0.06		0.12	0.03	0.28		0.07	0.31	
Control Delay	15.2	2.1		14.2		4.9	5.8	5.2		6.0	5.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Delay	15.2	2.1		14.2		4.9	5.8	5.2		6.0	5.4	
LOS	B	A		B		A	A	A		A	A	
Approach Delay		7.6			7.8			5.2			5.4	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	3.1	0.0		1.1		0.0	0.5	13.7		1.1	15.6	
Queue Length 95th (m)	9.4	2.5		4.7		4.1	2.6	23.7		4.5	26.7	
Internal Link Dist (m)		134.8			119.8			254.0			821.7	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	1196	1114		1144		1088	620	3204		664	3179	
Starvation Cap Reductn	0	0		0		0	0	0		0	0	
Spillback Cap Reductn	0	0		0		0	0	0		0	0	
Storage Cap Reductn	0	0		0		0	0	0		0	0	
Reduced v/c Ratio	0.04	0.06		0.02		0.04	0.03	0.21		0.05	0.24	

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 40
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.31
Intersection Signal Delay: 5.6 Intersection LOS: A
Intersection Capacity Utilization 48.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 275: Manning Road & Little Baseline Road



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	25	11	323	403	8
Future Volume (Veh/h)	16	25	11	323	403	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	32	50	22	646	806	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					278	
pX, platoon unblocked						
vC, conflicting volume	1173	403	822			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1173	403	822			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	92	97			
cM capacity (veh/h)	180	597	803			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	82	22	323	323	403	403	16
Volume Left	32	22	0	0	0	0	0
Volume Right	50	0	0	0	0	0	16
cSH	314	803	1700	1700	1700	1700	1700
Volume to Capacity	0.26	0.03	0.19	0.19	0.24	0.24	0.01
Queue Length 95th (m)	8.2	0.7	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	20.5	9.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	20.5	0.3			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	26	23	7	308	421	7
Future Volume (Veh/h)	26	23	7	308	421	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	52	46	14	616	842	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1178	421	856			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1178	421	856			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	71	92	98			
cM capacity (veh/h)	180	581	780			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	98	14	308	308	421	421	14
Volume Left	52	14	0	0	0	0	0
Volume Right	46	0	0	0	0	0	14
cSH	267	780	1700	1700	1700	1700	1700
Volume to Capacity	0.37	0.02	0.18	0.18	0.25	0.25	0.01
Queue Length 95th (m)	12.9	0.4	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	26.1	9.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	A					
Approach Delay (s)	26.1	0.2			0.0		
Approach LOS	D						

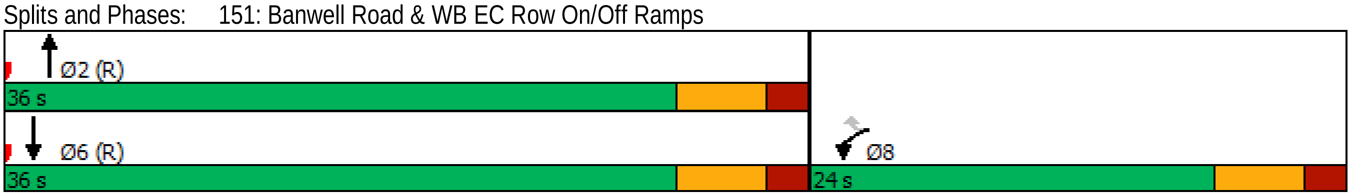
Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	108	0	92	0	554	628	0	577	124
Future Volume (vph)	0	0	0	108	0	92	0	554	628	0	577	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		60.0
Storage Lanes	0		0	1		1	0		1	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt						0.850						
Flt Protected				0.950								
Satd. Flow (prot)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Flt Permitted				0.950								
Satd. Flow (perm)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						56			1091			248
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		217.2			320.8			302.3			226.6	
Travel Time (s)		15.6			23.1			18.1			13.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	216	0	184	0	1108	1256	0	1154	248
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	216	0	184	0	1108	1256	0	1154	248
Turn Type				Prot		Perm		NA	Free		NA	Free
Protected Phases				8				2			6	
Permitted Phases						8			Free			Free
Detector Phase				8		8		2			6	
Switch Phase												
Minimum Initial (s)				5.0		5.0		5.0			5.0	
Minimum Split (s)				24.0		24.0		24.0			24.0	
Total Split (s)				24.0		24.0		36.0			36.0	
Total Split (%)				40.0%		40.0%		60.0%			60.0%	
Maximum Green (s)				18.0		18.0		30.0			30.0	
Yellow Time (s)				4.0		4.0		4.0			4.0	
All-Red Time (s)				2.0		2.0		2.0			2.0	
Lost Time Adjust (s)				0.0		0.0		0.0			0.0	
Total Lost Time (s)				6.0		6.0		6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Recall Mode				None		None		C-Max			C-Max	
Walk Time (s)				7.0		7.0		7.0			7.0	
Flash Dont Walk (s)				11.0		11.0		11.0			11.0	
Pedestrian Calls (#/hr)				0		0		0			0	
Act Effct Green (s)				12.4		12.4		35.6	60.0		35.6	60.0
Actuated g/C Ratio				0.21		0.21		0.59	1.00		0.59	1.00
v/c Ratio				0.58		0.49		0.52	0.66		0.37	0.13
Control Delay				27.3		18.2		8.9	4.9		7.3	0.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.0		0.0		0.0	0.0		0.0	0.0
Total Delay				27.3		18.2		8.9	4.9		7.3	0.1
LOS				C		B		A	A		A	A
Approach Delay					23.1			6.8			6.1	
Approach LOS					C			A			A	
Queue Length 50th (m)				22.7		12.9		51.4	21.1		22.2	0.0
Queue Length 95th (m)				37.4		26.3		106.0	229.5		37.0	0.0
Internal Link Dist (m)		193.2			296.8			278.3			202.6	
Turn Bay Length (m)												60.0
Base Capacity (vph)				541		523		2144	1900		3080	1900
Starvation Cap Reductn				0		0		0	0		0	0
Spillback Cap Reductn				0		0		0	0		0	0
Storage Cap Reductn				0		0		0	0		0	0
Reduced v/c Ratio				0.40		0.35		0.52	0.66		0.37	0.13

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 15 (25%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 8.1	Intersection LOS: A
Intersection Capacity Utilization 52.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 151: Banwell Road & WB EC Row On/Off Ramps



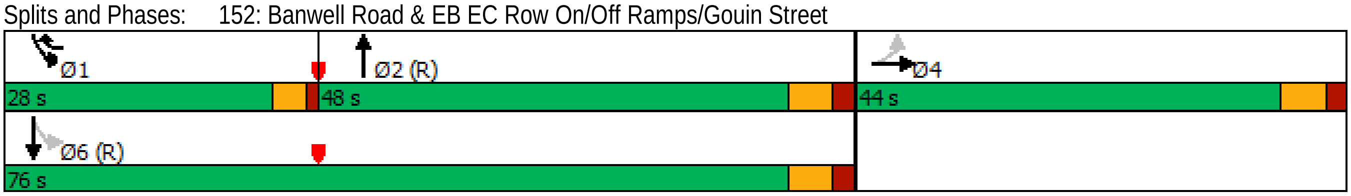
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	160	139	0	0	107	0	909	8	50	488	173
Future Volume (vph)	325	160	139	0	0	107	0	909	8	50	488	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		2	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.999				0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	3502	1900	1615	0	0	1644	0	5182	0	1805	3610	1615
Flt Permitted	0.950									0.063		
Satd. Flow (perm)	3502	1900	1615	0	0	1644	0	5182	0	120	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			278			82		1				222
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	650	320	278	0	0	214	0	1818	16	100	976	346
Shared Lane Traffic (%)												
Lane Group Flow (vph)	650	320	278	0	0	214	0	1834	0	100	976	346
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	44.0	44.0				28.0		48.0		28.0	76.0	
Total Split (%)	36.7%	36.7%				23.3%		40.0%		23.3%	63.3%	
Maximum Green (s)	38.0	38.0				24.0		42.0		24.0	70.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	28.9	28.9	120.0			15.4		59.7		81.1	79.1	120.0
Actuated g/C Ratio	0.24	0.24	1.00			0.13		0.50		0.68	0.66	1.00
v/c Ratio	0.77	0.70	0.17			0.76		0.71		0.34	0.41	0.21
Control Delay	48.7	49.7	0.2			47.3		18.6		16.4	8.0	0.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	48.7	49.7	0.2			47.3		18.6		16.4	8.0	0.3
LOS	D	D	A			D		B		B	A	A
Approach Delay		38.2			47.3			18.6			6.7	
Approach LOS		D			D			B			A	
Queue Length 50th (m)	77.4	72.4	0.0			32.0		75.4		8.5	30.1	0.0
Queue Length 95th (m)	91.8	97.5	0.0			55.7		m#113.4		19.1	80.1	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	1108	601	1615			394		2580		418	2380	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.59	0.53	0.17			0.54		0.71		0.24	0.41	0.21

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 11 (9%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 21.5 Intersection LOS: C
Intersection Capacity Utilization 80.6% ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	1247	69	87	873	90	178	196	62	105	225	85
Future Volume (vph)	238	1247	69	87	873	90	178	196	62	105	225	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.964				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	3406	1615	1787	3438	1599	1787	1796	0	1787	1863	1599
Flt Permitted	0.950			0.950			0.135			0.135		
Satd. Flow (perm)	1787	3406	1615	1787	3438	1599	254	1796	0	254	1863	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			91			132		11				137
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	6%	0%	1%	5%	1%	1%	2%	2%	1%	2%	1%
Adj. Flow (vph)	476	2494	138	174	1746	180	356	392	124	210	450	170
Shared Lane Traffic (%)												
Lane Group Flow (vph)	476	2494	138	174	1746	180	356	516	0	210	450	170
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	30.0	71.0	71.0	15.0	56.0	56.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	22.2%	52.6%	52.6%	11.1%	41.5%	41.5%	9.6%	26.7%		9.6%	26.7%	26.7%
Maximum Green (s)	25.0	64.0	64.0	10.0	49.0	49.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	25.0	64.0	64.0	10.0	49.0	49.0	43.0	29.7		43.0	29.7	29.7
Actuated g/C Ratio	0.19	0.47	0.47	0.07	0.36	0.36	0.32	0.22		0.32	0.22	0.22
v/c Ratio	1.44	1.55	0.17	1.32	1.40	0.27	1.84	1.28		1.08	1.10	0.37
Control Delay	254.7	277.0	8.1	206.4	200.6	0.5	420.2	185.5		123.5	122.7	13.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	254.7	277.0	8.1	206.4	200.6	0.5	420.2	185.5		123.5	122.7	13.6
LOS	F	F	A	F	F	A	F	F		F	F	B
Approach Delay		261.7			183.9			281.3			100.5	
Approach LOS		F			F			F			F	
Queue Length 50th (m)	~180.9	~517.0	7.0	~64.3	~335.8	0.8	~133.5	~181.4		~47.1	~142.8	7.4
Queue Length 95th (m)	#250.2	#557.5	19.2	m#60.1	m#260.7	m0.7	#197.4	#253.5		#100.4	#210.9	28.2
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	330	1614	813	132	1247	664	194	403		194	409	458
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	1.44	1.55	0.17	1.32	1.40	0.27	1.84	1.28		1.08	1.10	0.37

Intersection Summary

Area Type: Other
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 65 (48%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.84
Intersection Signal Delay: 221.2 — Intersection LOS: F
Intersection Capacity Utilization 140.6% — ICU Level of Service H
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	521	11	11	510	96	4	17	11	56	9	52
Future Volume (vph)	68	521	11	11	510	96	4	17	11	56	9	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	100.0		45.0	50.0		0.0	30.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997				0.850		0.941			0.872	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3462	0	1770	3539	1583	1770	1753	0	1770	1624	0
Flt Permitted	0.250			0.234			0.679			0.720		
Satd. Flow (perm)	466	3462	0	436	3539	1583	1265	1753	0	1341	1624	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				192		22			82	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		318.4			307.6			218.0			156.3	
Travel Time (s)		22.9			22.1			15.7			11.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	136	1042	22	22	1020	192	8	34	22	112	18	104
Shared Lane Traffic (%)												
Lane Group Flow (vph)	136	1064	0	22	1020	192	8	56	0	112	122	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Detector Phase	2	2		6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	
Minimum Split (s)	29.0	29.0		29.0	29.0	29.0	32.0	32.0		32.0	32.0	
Total Split (s)	50.0	50.0		50.0	50.0	50.0	32.0	32.0		32.0	32.0	
Total Split (%)	61.0%	61.0%		61.0%	61.0%	61.0%	39.0%	39.0%		39.0%	39.0%	
Maximum Green (s)	43.0	43.0		43.0	43.0	43.0	26.0	26.0		26.0	26.0	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Recall Mode	Min	Min		Min	Min	Min	None	None		None	None	
Walk Time (s)	12.0	12.0					15.0	15.0				
Flash Dont Walk (s)	10.0	10.0					10.0	10.0				
Pedestrian Calls (#/hr)	0	0					0	0				
Act Effct Green (s)	34.4	34.4		34.4	34.4	34.4	11.9	11.9		12.5	12.5	
Actuated g/C Ratio	0.57	0.57		0.57	0.57	0.57	0.20	0.20		0.21	0.21	
v/c Ratio	0.51	0.54		0.09	0.51	0.19	0.03	0.15		0.40	0.30	
Control Delay	16.9	9.4		7.5	9.0	1.7	21.8	16.1		26.9	12.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	16.9	9.4		7.5	9.0	1.7	21.8	16.1		26.9	12.0	
LOS	B	A		A	A	A	C	B		C	B	
Approach Delay		10.2			7.9			16.8			19.1	
Approach LOS		B			A			B			B	
Queue Length 50th (m)	8.3	34.5		1.0	32.4	0.0	0.7	3.0		10.5	3.5	
Queue Length 95th (m)	28.0	59.8		4.5	56.0	7.4	4.1	12.5		27.8	17.3	
Internal Link Dist (m)		294.4			283.6			194.0			132.3	
Turn Bay Length (m)	100.0			100.0		45.0	50.0			30.0		
Base Capacity (vph)	342	2543		320	2599	1213	561	790		595	766	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.40	0.42		0.07	0.39	0.16	0.01	0.07		0.19	0.16	

Intersection Summary	
Area Type:	Other
Cycle Length: 82	
Actuated Cycle Length: 60.3	
Natural Cycle: 70	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.54	
Intersection Signal Delay: 10.1	Intersection LOS: B
Intersection Capacity Utilization 67.4%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 167: Lesperance Road & CR 42

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	337	808	123	62	613	77	165	391	48	76	384	271
Future Volume (vph)	337	808	123	62	613	77	165	391	48	76	384	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	3438	1369	1421	3438	1599	3273	1881	1538	3433	1845	1599
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3467	3438	1369	1421	3438	1599	3273	1881	1538	3433	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			244			154			120			207
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	5%	18%	27%	5%	1%	7%	1%	5%	2%	3%	1%
Adj. Flow (vph)	674	1616	246	124	1226	154	330	782	96	152	768	542
Shared Lane Traffic (%)												
Lane Group Flow (vph)	674	1616	246	124	1226	154	330	782	96	152	768	542
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	24.0	50.0	50.0	20.0	46.0	46.0	15.0	50.0	50.0	15.0	50.0	
Total Split (%)	17.8%	37.0%	37.0%	14.8%	34.1%	34.1%	11.1%	37.0%	37.0%	11.1%	37.0%	
Maximum Green (s)	19.0	42.2	42.2	15.0	38.2	38.2	10.0	42.1	42.1	10.0	42.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	19.0	42.9	42.9	14.3	38.2	38.2	10.0	42.5	42.5	9.6	42.1	135.0
Actuated g/C Ratio	0.14	0.32	0.32	0.11	0.28	0.28	0.07	0.31	0.31	0.07	0.31	1.00
v/c Ratio	1.38	1.48	0.41	0.83	1.26	0.27	1.36	1.32	0.17	0.62	1.34	0.34
Control Delay	221.5	238.6	2.5	98.2	166.2	6.7	233.1	194.1	3.7	72.5	199.9	0.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	221.5	238.6	2.5	98.2	166.2	6.7	233.1	194.1	3.7	72.5	199.9	0.6
LOS	F	F	A	F	F	A	F	F	A	E	F	A
Approach Delay		211.2			144.3			189.6			112.8	
Approach LOS		F			F			F			F	
Queue Length 50th (m)	~127.5	~331.3	9.6	34.4	~226.7	0.0	~62.6	~284.6	0.0	21.7	~279.8	0.0
Queue Length 95th (m)	m60.9	m#153.9	m2.5	#68.8	#271.1	16.8	#94.5	#363.9	8.1	33.7	#358.4	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	487	1093	601	157	972	562	242	591	566	254	575	1599
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.38	1.48	0.41	0.79	1.26	0.27	1.36	1.32	0.17	0.60	1.34	0.34

Intersection Summary

Area Type: Other

Cycle Length: 135

Actuated Cycle Length: 135

Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.48

Intersection Signal Delay: 170.8 Intersection LOS: F

Intersection Capacity Utilization 124.4% ICU Level of Service H

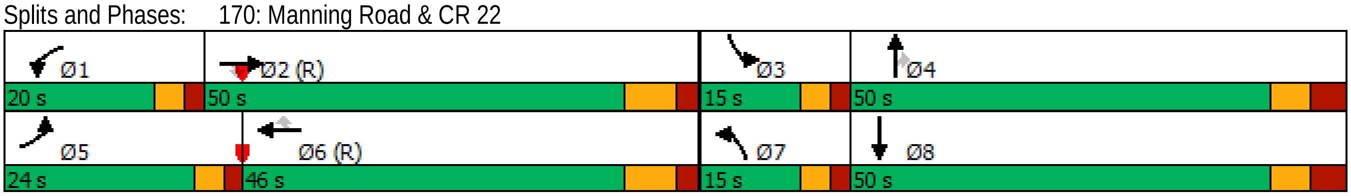
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22



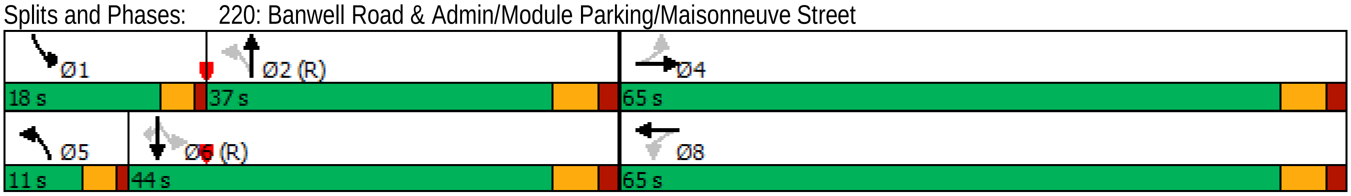
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	250	17	63	53	1	116	5	459	65	104	454	8
Future Volume (vph)	250	17	63	53	1	116	5	459	65	104	454	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.882			0.851			0.981				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1676	0	1805	1617	0	1805	5044	0	1805	5085	1615
Flt Permitted	0.576			0.654			0.302			0.116		
Satd. Flow (perm)	1094	1676	0	1243	1617	0	574	5044	0	220	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		126			232			21				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	500	34	126	106	2	232	10	918	130	208	908	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	500	160	0	106	234	0	10	1048	0	208	908	16
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	65.0	65.0		65.0	65.0		11.0	37.0		18.0	44.0	44.0
Total Split (%)	54.2%	54.2%		54.2%	54.2%		9.2%	30.8%		15.0%	36.7%	36.7%
Maximum Green (s)	59.0	59.0		59.0	59.0		7.0	31.0		14.0	38.0	38.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	56.8	56.8		56.8	56.8		42.2	34.2		53.2	49.0	49.0
Actuated g/C Ratio	0.47	0.47		0.47	0.47		0.35	0.28		0.44	0.41	0.41
v/c Ratio	0.97	0.19		0.18	0.26		0.04	0.72		0.78	0.44	0.02
Control Delay	63.2	5.2		18.4	2.9		19.5	45.5		61.4	21.8	0.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	63.2	5.2		18.4	2.9		19.5	45.5		61.4	21.8	0.6
LOS	E	A		B	A		B	D		E	C	A
Approach Delay		49.1			7.8			45.3			28.8	
Approach LOS		D			A			D			C	
Queue Length 50th (m)	112.6	4.2		14.2	0.3		1.7	96.7		38.5	41.7	0.0
Queue Length 95th (m)	#186.7	15.9		25.6	13.5		m4.8	107.2		#69.0	51.2	m0.4
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	537	888		611	912		278	1453		282	2077	697
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.93	0.18		0.17	0.26		0.04	0.72		0.74	0.44	0.02

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 36.2 Intersection LOS: D
Intersection Capacity Utilization 92.7% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Admin/Module Parking/Maisonneuve Street



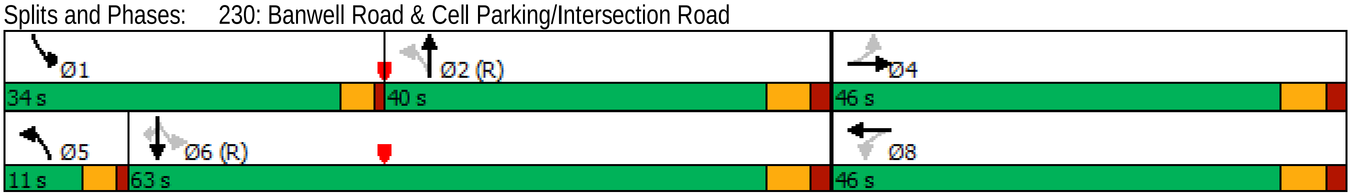
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	28	16	24	2	86	3	323	66	181	587	2
Future Volume (vph)	107	28	16	24	2	86	3	323	66	181	587	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.945			0.853			0.975				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1762	0	1787	1605	0	1805	4966	0	1787	3539	1615
Flt Permitted	0.555			0.700			0.233			0.293		
Satd. Flow (perm)	1044	1762	0	1317	1605	0	443	4966	0	551	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		26			172			36				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	3%	0%	1%	0%	1%	0%	2%	1%	1%	2%	0%
Adj. Flow (vph)	214	56	32	48	4	172	6	646	132	362	1174	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	214	88	0	48	176	0	6	778	0	362	1174	4
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.5	24.0		9.5	24.0	24.0
Total Split (s)	46.0	46.0		46.0	46.0		11.0	40.0		34.0	63.0	63.0
Total Split (%)	38.3%	38.3%		38.3%	38.3%		9.2%	33.3%		28.3%	52.5%	52.5%
Maximum Green (s)	40.0	40.0		40.0	40.0		7.0	34.0		30.0	57.0	57.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	28.0	28.0		28.0	28.0		66.7	59.0		82.0	78.0	78.0
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.56	0.49		0.68	0.65	0.65
v/c Ratio	0.88	0.20		0.16	0.35		0.02	0.32		0.66	0.51	0.00
Control Delay	76.6	24.8		34.4	6.9		10.8	20.4		11.6	11.0	0.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	76.6	24.8		34.4	6.9		10.8	20.4		11.6	11.0	0.0
LOS	E	C		C	A		B	C		B	B	A
Approach Delay		61.5			12.8			20.3			11.1	
Approach LOS		E			B			C			B	
Queue Length 50th (m)	51.3	12.2		9.5	0.8		0.4	38.7		29.4	74.8	0.0
Queue Length 95th (m)	74.5	23.6		18.0	16.8		2.4	67.1		60.0	167.7	m0.0
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)							60.0			60.0		
Base Capacity (vph)	348	604		439	649		330	2458		685	2299	1071
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.61	0.15		0.11	0.27		0.02	0.32		0.53	0.51	0.00

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 54 (45%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 19.1 Intersection LOS: B
Intersection Capacity Utilization 77.7% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 230: Banwell Road & Cell Parking/Intersection Road



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	8	25	388	14	44	605
Future Volume (Veh/h)	8	25	388	14	44	605
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	16	50	776	28	88	1210
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1571	402			804	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1571	402			804	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	82	92			89	
cM capacity (veh/h)	90	598			816	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	66	517	287	88	605	605
Volume Left	16	0	0	88	0	0
Volume Right	50	0	28	0	0	0
cSH	253	1700	1700	816	1700	1700
Volume to Capacity	0.26	0.30	0.17	0.11	0.36	0.36
Queue Length 95th (m)	8.1	0.0	0.0	2.9	0.0	0.0
Control Delay (s)	24.2	0.0	0.0	9.9	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	24.2	0.0		0.7		
Approach LOS	C					

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

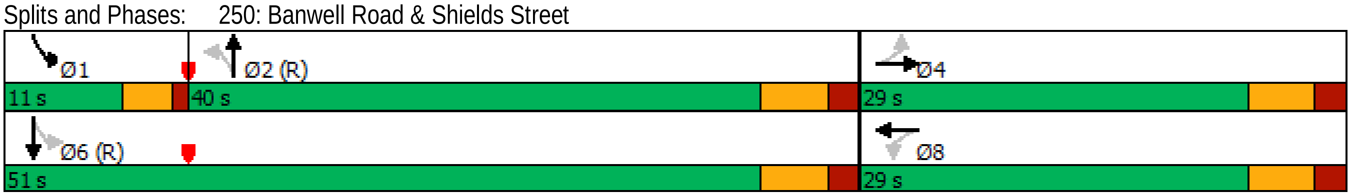
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	23	15	40	19	108	26	260	43	117	434	62
Future Volume (vph)	41	23	15	40	19	108	26	260	43	117	434	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.941			0.872			0.979			0.981	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1753	0	1770	1624	0	1770	3524	0	1770	3472	0
Flt Permitted	0.377			0.708			0.289			0.367		
Satd. Flow (perm)	702	1753	0	1319	1624	0	538	3524	0	684	3472	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		30			216			29			32	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		197.4			352.6			315.5			441.4	
Travel Time (s)		14.2			25.4			18.9			26.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	0%	2%	2%	2%	2%
Adj. Flow (vph)	82	46	30	80	38	216	52	520	86	234	868	124
Shared Lane Traffic (%)												
Lane Group Flow (vph)	82	76	0	80	254	0	52	606	0	234	992	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		7.0	10.0	
Minimum Split (s)	29.0	29.0		29.0	29.0		26.0	26.0		11.0	26.0	
Total Split (s)	29.0	29.0		29.0	29.0		40.0	40.0		11.0	51.0	
Total Split (%)	36.3%	36.3%		36.3%	36.3%		50.0%	50.0%		13.8%	63.8%	
Maximum Green (s)	23.0	23.0		23.0	23.0		34.0	34.0		7.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		4.0	6.0	
Lead/Lag							Lag	Lag		Lead		
Lead-Lag Optimize?							Yes	Yes		Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		None	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0			7.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		13.0	13.0			13.0	
Pedestrian Calls (#/hr)	10	10		10	10		0	0			0	
Act Effct Green (s)	13.3	13.3		13.3	13.3		42.5	42.5		56.7	54.7	
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.53	0.53		0.71	0.68	
v/c Ratio	0.71	0.24		0.37	0.56		0.18	0.32		0.39	0.42	
Control Delay	60.2	19.2		32.0	11.2		14.5	11.8		7.1	6.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	60.2	19.2		32.0	11.2		14.5	11.8		7.1	6.9	
LOS	E	B		C	B		B	B		A	A	
Approach Delay		40.5			16.2			12.0			7.0	
Approach LOS		D			B			B			A	
Queue Length 50th (m)	12.8	6.5		11.7	5.4		4.0	25.0		9.7	28.3	
Queue Length 95th (m)	24.3	15.3		20.8	21.7		13.6	45.6		27.5	60.6	
Internal Link Dist (m)		173.4			328.6			291.5			417.4	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	201	525		379	620		286	1887		595	2384	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.41	0.14		0.21	0.41		0.18	0.32		0.39	0.42	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 1 (1%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 11.9 Intersection LOS: B
Intersection Capacity Utilization 77.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 250: Banwell Road & Shields Street



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	37	586	526	32	22	5
Future Volume (Veh/h)	37	586	526	32	22	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	74	1172	1052	64	44	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1116				1786	526
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1116				1786	526
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				31	98
cM capacity (veh/h)	622				64	496

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	74	586	586	526	526	64	44	10
Volume Left	74	0	0	0	0	0	44	0
Volume Right	0	0	0	0	0	64	0	10
cSH	622	1700	1700	1700	1700	1700	64	496
Volume to Capacity	0.12	0.34	0.34	0.31	0.31	0.04	0.69	0.02
Queue Length 95th (m)	3.2	0.0	0.0	0.0	0.0	0.0	24.0	0.5
Control Delay (s)	11.6	0.0	0.0	0.0	0.0	0.0	140.3	12.4
Lane LOS	B						F	B
Approach Delay (s)	0.7			0.0			116.6	
Approach LOS							F	

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		

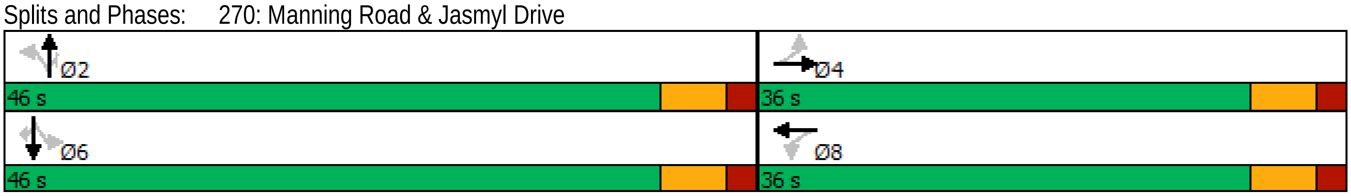
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	4	46	43	5	52	24	458	41	57	443	56
Future Volume (vph)	80	4	46	43	5	52	24	458	41	57	443	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		75.0	75.0		75.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.862			0.863				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1606	0	1770	1608	0	1770	3539	1583	1770	3505	1583
Flt Permitted	0.684			0.692			0.299			0.286		
Satd. Flow (perm)	1274	1606	0	1289	1608	0	557	3539	1583	533	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		92			90				82			112
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		483.1			165.4			845.7			233.8	
Travel Time (s)		34.8			11.9			60.9			16.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	160	8	92	86	10	104	48	916	82	114	886	112
Shared Lane Traffic (%)												
Lane Group Flow (vph)	160	100	0	86	114	0	48	916	82	114	886	112
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	4	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	33.0	33.0		33.0	33.0		24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	36.0	36.0		36.0	36.0		46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	43.9%	43.9%		43.9%	43.9%		56.1%	56.1%	56.1%	56.1%	56.1%	56.1%
Maximum Green (s)	30.0	30.0		30.0	30.0		40.0	40.0	40.0	40.0	40.0	40.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min	Min	Min	Min	Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	0
Act Effct Green (s)	11.9	11.9		11.9	11.9		26.4	26.4	26.4	26.4	26.4	26.4
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.58	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.48	0.21		0.26	0.24		0.15	0.45	0.09	0.37	0.44	0.12
Control Delay	22.2	6.7		18.1	7.9		9.1	9.0	2.4	13.3	8.9	2.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.2	6.7		18.1	7.9		9.1	9.0	2.4	13.3	8.9	2.2
LOS	C	A		B	A		A	A	A	B	A	A
Approach Delay		16.2			12.3			8.5			8.7	
Approach LOS		B			B			A			A	
Queue Length 50th (m)	9.4	0.4		4.8	1.3		2.0	24.2	0.0	5.4	23.3	0.0
Queue Length 95th (m)	35.9	11.2		20.6	13.7		8.4	51.1	5.3	20.6	49.2	6.1
Internal Link Dist (m)		459.1			141.4			821.7			209.8	
Turn Bay Length (m)	75.0			75.0			75.0		75.0	75.0		75.0
Base Capacity (vph)	909	1172		920	1173		485	3082	1389	464	3052	1393
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.09		0.09	0.10		0.10	0.30	0.06	0.25	0.29	0.08

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 45.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.48
Intersection Signal Delay: 9.6 Intersection LOS: A
Intersection Capacity Utilization 68.4% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 270: Manning Road & Jasmyl Drive



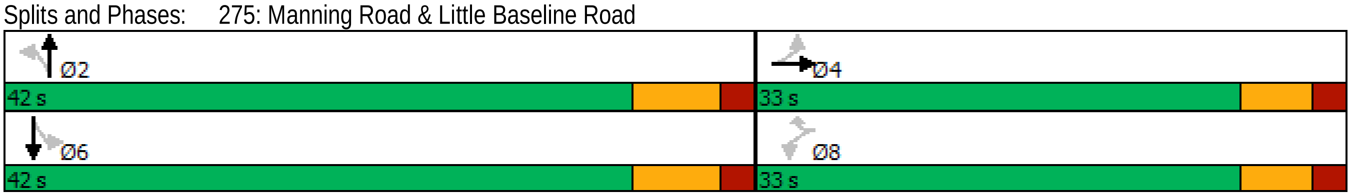
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	0	27	6	0	22	26	390	14	36	339	32
Future Volume (vph)	12	0	27	6	0	22	26	390	14	36	339	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.850				0.850		0.995			0.987	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	0	1583	1770	3522	0	1770	3462	0
Flt Permitted	0.950			0.930			0.370			0.347		
Satd. Flow (perm)	1770	1583	0	1732	0	1583	689	3522	0	646	3462	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		162				58		6			18	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		158.8			143.8			278.0			845.7	
Travel Time (s)		11.4			10.4			20.0			60.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	24	0	54	12	0	44	52	780	28	72	678	64
Shared Lane Traffic (%)												
Lane Group Flow (vph)	24	54	0	12	0	44	52	808	0	72	742	0
Turn Type	Perm	NA		Perm		Perm	Perm	NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8		8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0		7.0	20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		33.0		33.0	27.0	27.0		27.0	27.0	
Total Split (s)	33.0	33.0		33.0		33.0	42.0	42.0		42.0	42.0	
Total Split (%)	44.0%	44.0%		44.0%		44.0%	56.0%	56.0%		56.0%	56.0%	
Maximum Green (s)	27.0	27.0		27.0		27.0	35.0	35.0		35.0	35.0	
Yellow Time (s)	4.0	4.0		4.0		4.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0		6.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None		None	Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0		20.0	10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0		0	0	
Act Effct Green (s)	7.0	7.0		7.0		7.0	28.5	28.5		28.5	28.5	
Actuated g/C Ratio	0.17	0.17		0.17		0.17	0.70	0.70		0.70	0.70	
v/c Ratio	0.08	0.13		0.04		0.14	0.11	0.33		0.16	0.31	
Control Delay	14.6	0.7		14.2		5.6	6.1	5.3		6.6	5.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Delay	14.6	0.7		14.2		5.6	6.1	5.3		6.6	5.1	
LOS	B	A		B		A	A	A		A	A	
Approach Delay		5.0			7.4			5.4			5.3	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	1.5	0.0		0.7		0.0	1.8	17.0		2.6	15.0	
Queue Length 95th (m)	5.7	0.0		3.7		4.7	5.9	27.0		8.1	24.3	
Internal Link Dist (m)		134.8			119.8			254.0			821.7	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	1171	1102		1146		1067	637	3256		597	3202	
Starvation Cap Reductn	0	0		0		0	0	0		0	0	
Spillback Cap Reductn	0	0		0		0	0	0		0	0	
Storage Cap Reductn	0	0		0		0	0	0		0	0	
Reduced v/c Ratio	0.02	0.05		0.01		0.04	0.08	0.25		0.12	0.23	

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 40.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.33
Intersection Signal Delay: 5.4 Intersection LOS: A
Intersection Capacity Utilization 63.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 275: Manning Road & Little Baseline Road



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	17	27	36	399	341	30
Future Volume (Veh/h)	17	27	36	399	341	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	34	54	72	798	682	60
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					278	
pX, platoon unblocked						
vC, conflicting volume	1225	341	742			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1225	341	742			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	92	92			
cM capacity (veh/h)	157	655	861			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	88	72	399	399	341	341	60
Volume Left	34	72	0	0	0	0	0
Volume Right	54	0	0	0	0	0	60
cSH	294	861	1700	1700	1700	1700	1700
Volume to Capacity	0.30	0.08	0.23	0.23	0.20	0.20	0.04
Queue Length 95th (m)	9.8	2.2	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	22.4	9.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	22.4	0.8			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	14	22	421	341	28
Future Volume (Veh/h)	13	14	22	421	341	28
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	26	28	44	842	682	56
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1191	341	738			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1191	341	738			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	96	95			
cM capacity (veh/h)	171	655	864			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	54	44	421	421	341	341	56
Volume Left	26	44	0	0	0	0	0
Volume Right	28	0	0	0	0	0	56
cSH	277	864	1700	1700	1700	1700	1700
Volume to Capacity	0.19	0.05	0.25	0.25	0.20	0.20	0.03
Queue Length 95th (m)	5.7	1.3	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	21.1	9.4	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	21.1	0.5			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	35.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	128	0	34	0	490	727	0	464	300
Future Volume (vph)	0	0	0	128	0	34	0	490	727	0	464	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		60.0
Storage Lanes	0		0	1		1	0		1	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt						0.850						
Flt Protected				0.950								
Satd. Flow (prot)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Flt Permitted				0.950								
Satd. Flow (perm)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						55			1091			600
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		217.2			320.8			302.3			226.6	
Travel Time (s)		15.6			23.1			18.1			13.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	256	0	68	0	980	1454	0	928	600
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	256	0	68	0	980	1454	0	928	600
Turn Type				Prot		Perm		NA	Free		NA	Free
Protected Phases				8				2			6	
Permitted Phases						8			Free			Free
Detector Phase				8		8		2			6	
Switch Phase												
Minimum Initial (s)				5.0		5.0		5.0			5.0	
Minimum Split (s)				24.0		24.0		24.0			24.0	
Total Split (s)				31.0		31.0		29.0			29.0	
Total Split (%)				51.7%		51.7%		48.3%			48.3%	
Maximum Green (s)				25.0		25.0		23.0			23.0	
Yellow Time (s)				4.0		4.0		4.0			4.0	
All-Red Time (s)				2.0		2.0		2.0			2.0	
Lost Time Adjust (s)				0.0		0.0		0.0			0.0	
Total Lost Time (s)				6.0		6.0		6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Recall Mode				None		None		C-Max			C-Max	
Walk Time (s)				7.0		7.0		7.0			7.0	
Flash Dont Walk (s)				11.0		11.0		11.0			11.0	
Pedestrian Calls (#/hr)				0		0		0			0	
Act Effct Green (s)				13.9		13.9		34.1	60.0		34.1	60.0
Actuated g/C Ratio				0.23		0.23		0.57	1.00		0.57	1.00
v/c Ratio				0.61		0.16		0.48	0.77		0.31	0.32
Control Delay				26.5		7.7		7.8	10.7		7.8	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.0		0.0		0.0	0.0		0.0	0.0
Total Delay				26.5		7.7		7.8	10.7		7.8	0.4
LOS				C		A		A	B		A	A
Approach Delay					22.5			9.5			4.9	
Approach LOS					C			A			A	
Queue Length 50th (m)				26.6		1.2		37.0	176.8		18.3	0.0
Queue Length 95th (m)				41.6		8.3		81.7	307.7		31.4	0.0
Internal Link Dist (m)		193.2			296.8			278.3			202.6	
Turn Bay Length (m)												60.0
Base Capacity (vph)				752		705		2052	1900		2949	1900
Starvation Cap Reductn				0		0		0	0		0	0
Spillback Cap Reductn				0		0		0	0		0	0
Storage Cap Reductn				0		0		0	0		0	0
Reduced v/c Ratio				0.34		0.10		0.48	0.77		0.31	0.32

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 60

Offset: 32 (53%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

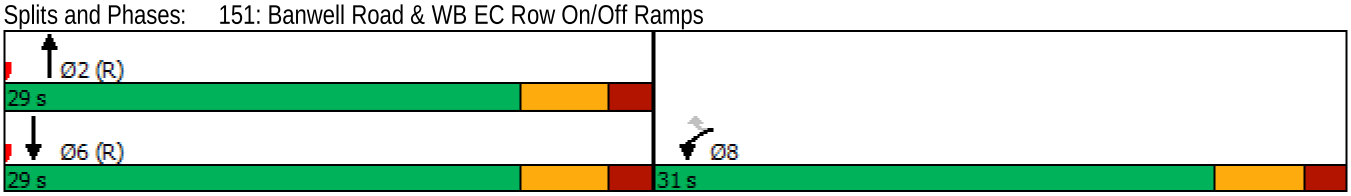
Maximum v/c Ratio: 0.77

Intersection Signal Delay: 8.8 Intersection LOS: A

Intersection Capacity Utilization 49.6% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 151: Banwell Road & WB EC Row On/Off Ramps



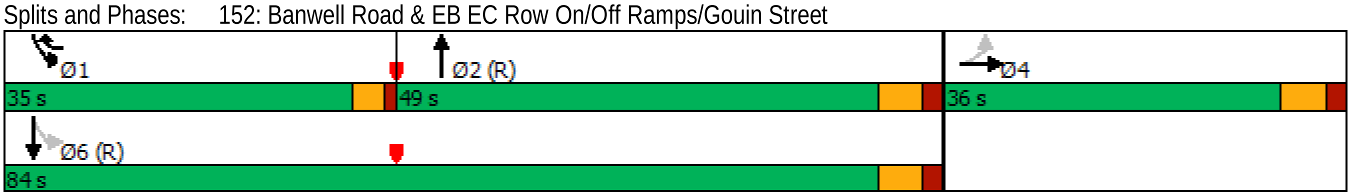
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	91	151	0	0	101	0	1048	9	65	441	107
Future Volume (vph)	191	91	151	0	0	101	0	1048	9	65	441	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		2	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.999				0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	3502	1900	1615	0	0	1644	0	5182	0	1805	3610	1615
Flt Permitted	0.950									0.053		
Satd. Flow (perm)	3502	1900	1615	0	0	1644	0	5182	0	101	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			302			82		1				152
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	382	182	302	0	0	202	0	2096	18	130	882	214
Shared Lane Traffic (%)												
Lane Group Flow (vph)	382	182	302	0	0	202	0	2114	0	130	882	214
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	36.0	36.0				35.0		49.0		35.0	84.0	
Total Split (%)	30.0%	30.0%				29.2%		40.8%		29.2%	70.0%	
Maximum Green (s)	30.0	30.0				31.0		43.0		31.0	78.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	18.5	18.5	120.0			14.6		70.9		91.5	89.5	120.0
Actuated g/C Ratio	0.15	0.15	1.00			0.12		0.59		0.76	0.75	1.00
v/c Ratio	0.71	0.62	0.19			0.75		0.69		0.46	0.33	0.13
Control Delay	55.3	56.5	0.3			45.8		13.2		22.3	4.0	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	55.3	56.5	0.3			45.8		13.2		22.3	4.0	0.2
LOS	E	E	A			D		B		C	A	A
Approach Delay		36.3			45.8			13.2			5.3	
Approach LOS		D			D			B			A	
Queue Length 50th (m)	46.9	42.8	0.0			29.0		55.1		13.2	25.5	0.0
Queue Length 95th (m)	60.5	64.2	0.0			52.2		149.0		26.5	31.2	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	875	475	1615			485		3061		517	2691	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.44	0.38	0.19			0.42		0.69		0.25	0.33	0.13

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 22 (18%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 17.0 Intersection LOS: B
Intersection Capacity Utilization 77.6% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	803	29	31	859	52	183	193	44	80	119	230
Future Volume (vph)	79	803	29	31	859	52	183	193	44	80	119	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.972				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1719	3438	1568	1687	3406	1468	1770	1801	0	1770	1845	1599
Flt Permitted	0.950			0.950			0.395			0.135		
Satd. Flow (perm)	1719	3438	1568	1687	3406	1468	736	1801	0	251	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88			88		7				195
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	5%	5%	3%	7%	6%	10%	2%	2%	5%	2%	3%	1%
Adj. Flow (vph)	158	1606	58	62	1718	104	366	386	88	160	238	460
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	1606	58	62	1718	104	366	474	0	160	238	460
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	20.0	71.0	71.0	20.0	71.0	71.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	14.3%	50.7%	50.7%	14.3%	50.7%	50.7%	9.3%	25.7%		9.3%	25.7%	25.7%
Maximum Green (s)	15.0	64.0	64.0	15.0	64.0	64.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	14.6	70.8	70.8	10.5	64.4	64.4	43.0	29.7		43.0	29.7	29.7
Actuated g/C Ratio	0.10	0.51	0.51	0.08	0.46	0.46	0.31	0.21		0.31	0.21	0.21
v/c Ratio	0.88	0.92	0.07	0.49	1.10	0.14	1.22	1.22		0.86	0.61	0.93
Control Delay	103.0	43.1	1.6	85.4	64.3	0.7	164.6	167.1		75.7	57.5	58.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	103.0	43.1	1.6	85.4	64.3	0.7	164.6	167.1		75.7	57.5	58.3
LOS	F	D	A	F	E	A	F	F		E	E	E
Approach Delay		47.0			61.4			166.0			61.3	
Approach LOS		D			E			F			E	
Queue Length 50th (m)	46.0	230.9	0.0	19.1	~291.5	0.1	~114.6	~168.5		34.4	63.3	82.6
Queue Length 95th (m)	#87.6	#304.0	3.5	m22.5	m#285.1	m0.5	#195.3	#239.6		#69.8	93.2	#151.6
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	184	1738	836	180	1566	722	299	387		185	391	492
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.86	0.92	0.07	0.34	1.10	0.14	1.22	1.22		0.86	0.61	0.93

Intersection Summary

Area Type:	Other
Cycle Length: 140	
Actuated Cycle Length: 140	
Offset: 47 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 125	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 72.8	Intersection LOS: E
Intersection Capacity Utilization 110.7%	ICU Level of Service H
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	473	3	9	543	77	9	8	9	106	18	76
Future Volume (vph)	37	473	3	9	543	77	9	8	9	106	18	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	100.0		45.0	50.0		0.0	30.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999				0.850		0.921			0.879	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3468	0	1770	3539	1583	1770	1716	0	1770	1637	0
Flt Permitted	0.201			0.253			0.639			0.735		
Satd. Flow (perm)	374	3468	0	471	3539	1583	1190	1716	0	1369	1637	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				154		18			69	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		318.4			307.6			218.0			156.3	
Travel Time (s)		22.9			22.1			15.7			11.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	74	946	6	18	1086	154	18	16	18	212	36	152
Shared Lane Traffic (%)												
Lane Group Flow (vph)	74	952	0	18	1086	154	18	34	0	212	188	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Detector Phase	2	2		6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	
Minimum Split (s)	29.0	29.0		29.0	29.0	29.0	32.0	32.0		32.0	32.0	
Total Split (s)	50.0	50.0		50.0	50.0	50.0	32.0	32.0		32.0	32.0	
Total Split (%)	61.0%	61.0%		61.0%	61.0%	61.0%	39.0%	39.0%		39.0%	39.0%	
Maximum Green (s)	43.0	43.0		43.0	43.0	43.0	25.0	25.0		25.0	25.0	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Recall Mode	Min	Min		Min	Min	Min	None	None		None	None	
Walk Time (s)	12.0	12.0					15.0	15.0				
Flash Dont Walk (s)	10.0	10.0					10.0	10.0				
Pedestrian Calls (#/hr)	0	0					0	0				
Act Effct Green (s)	31.9	31.9		31.9	31.9	31.9	15.2	15.2		17.2	17.2	
Actuated g/C Ratio	0.50	0.50		0.50	0.50	0.50	0.24	0.24		0.27	0.27	
v/c Ratio	0.40	0.55		0.08	0.61	0.18	0.06	0.08		0.57	0.38	
Control Delay	18.6	12.6		10.3	13.5	2.4	20.3	13.4		28.7	16.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	18.6	12.6		10.3	13.5	2.4	20.3	13.4		28.7	16.0	
LOS	B	B		B	B	A	C	B		C	B	
Approach Delay		13.0			12.1			15.8			22.8	
Approach LOS		B			B			B			C	
Queue Length 50th (m)	5.1	38.1		1.0	45.5	0.0	1.6	1.4		22.3	11.4	
Queue Length 95th (m)	18.6	67.1		4.9	79.5	8.4	6.9	8.3		50.1	31.4	
Internal Link Dist (m)		294.4			283.6			194.0			132.3	
Turn Bay Length (m)	100.0			100.0		45.0	50.0			30.0		
Base Capacity (vph)	265	2457		333	2507	1166	490	717		563	715	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.28	0.39		0.05	0.43	0.13	0.04	0.05		0.38	0.26	

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 63.9
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 14.1 Intersection LOS: B
Intersection Capacity Utilization 74.3% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 167: Lesperance Road & CR 42

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	189	503	82	56	679	40	69	279	57	82	217	193
Future Volume (vph)	189	503	82	56	679	40	69	279	57	82	217	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3312	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3312	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164			116			115			252
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	9%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	378	1006	164	112	1358	80	138	558	114	164	434	386
Shared Lane Traffic (%)												
Lane Group Flow (vph)	378	1006	164	112	1358	80	138	558	114	164	434	386
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	20.0	61.0	61.0	20.0	61.0	61.0	15.0	44.0	44.0	15.0	44.0	
Total Split (%)	14.3%	43.6%	43.6%	14.3%	43.6%	43.6%	10.7%	31.4%	31.4%	10.7%	31.4%	
Maximum Green (s)	15.0	53.2	53.2	15.0	53.2	53.2	10.0	36.1	36.1	10.0	36.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	15.0	54.3	54.3	13.9	53.2	53.2	9.7	36.3	36.3	9.8	36.4	140.0
Actuated g/C Ratio	0.11	0.39	0.39	0.10	0.38	0.38	0.07	0.26	0.26	0.07	0.26	1.00
v/c Ratio	1.03	0.78	0.26	0.79	1.05	0.12	0.69	1.28	0.26	0.70	0.91	0.24
Control Delay	94.3	31.7	5.9	97.0	81.0	1.9	82.0	184.6	8.2	79.9	73.8	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	94.3	31.7	5.9	97.0	81.0	1.9	82.0	184.6	8.2	79.9	73.8	0.4
LOS	F	C	A	F	F	A	F	F	A	E	E	A
Approach Delay		44.3			78.1			142.3			46.0	
Approach LOS		D			E			F			D	
Queue Length 50th (m)	~59.1	152.5	11.6	32.1	~226.2	0.0	20.5	~206.4	0.0	24.4	123.5	0.0
Queue Length 95th (m)	m#68.0	m165.6	m12.6	#62.8	#271.1	4.4	#34.1	#280.1	15.6	#37.9	#186.9	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	367	1284	626	152	1294	673	205	436	431	240	479	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.03	0.78	0.26	0.74	1.05	0.12	0.67	1.28	0.26	0.68	0.91	0.24

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.28
Intersection Signal Delay: 71.6 — Intersection LOS: E
Intersection Capacity Utilization 104.9% — ICU Level of Service G
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22

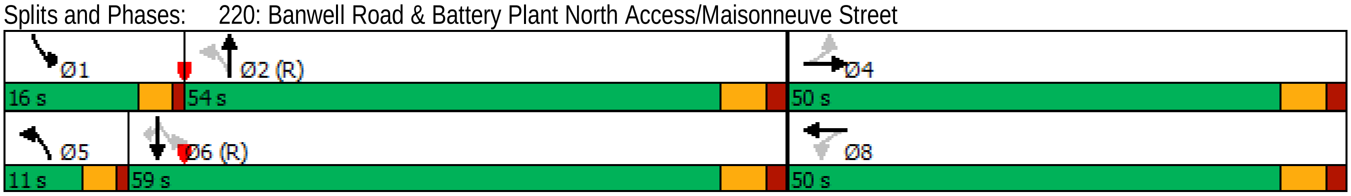
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↑↱		↰	↑↑↑	↱
Traffic Volume (vph)	178	1	3	39	7	90	54	676	39	38	308	100
Future Volume (vph)	178	1	3	39	7	90	54	676	39	38	308	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.887			0.861			0.992				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1685	0	1805	1636	0	1805	5097	0	1805	5136	1615
Flt Permitted	0.580			0.752			0.383			0.113		
Satd. Flow (perm)	1102	1685	0	1429	1636	0	728	5097	0	215	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			165			9				200
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	356	2	6	78	14	180	108	1352	78	76	616	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	356	8	0	78	194	0	108	1430	0	76	616	200
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	50.0	50.0		50.0	50.0		11.0	54.0		16.0	59.0	59.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%		9.2%	45.0%		13.3%	49.2%	49.2%
Maximum Green (s)	44.0	44.0		44.0	44.0		7.0	48.0		12.0	53.0	53.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	40.9	40.9		40.9	40.9		64.8	57.2		66.0	56.2	56.2
Actuated g/C Ratio	0.34	0.34		0.34	0.34		0.54	0.48		0.55	0.47	0.47
v/c Ratio	0.95	0.01		0.16	0.29		0.24	0.59		0.34	0.26	0.23
Control Delay	73.6	15.9		27.3	7.1		10.3	17.7		17.3	17.6	2.9

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	73.6	15.9		27.3	7.1		10.3	17.7		17.3	17.6	2.9
LOS	E	B		C	A		B	B		B	B	A
Approach Delay		72.3			12.9			17.2			14.3	
Approach LOS		E			B			B			B	
Queue Length 50th (m)	81.8	0.3		12.9	4.6		9.7	71.1		8.7	31.3	0.3
Queue Length 95th (m)	#139.8	3.8		24.5	20.5		m15.5	m80.1		18.4	38.8	11.2
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	404	621		523	704		456	2435		282	2406	862
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.88	0.01		0.15	0.28		0.24	0.59		0.27	0.26	0.23

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 104 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 22.5 Intersection LOS: C
Intersection Capacity Utilization 82.0% ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



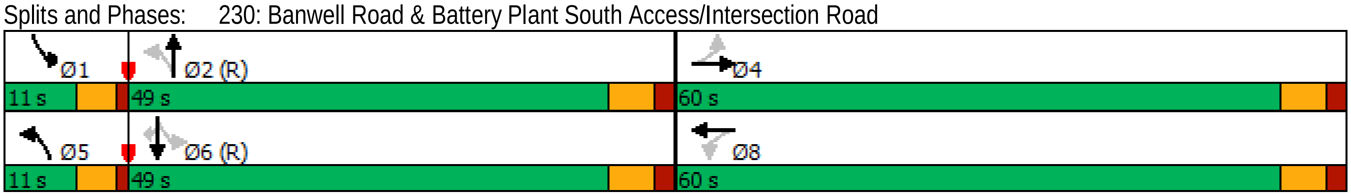
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	28	75	69	2	180	6	420	24	70	458	11
Future Volume (vph)	188	28	75	69	2	180	6	420	24	70	458	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.891			0.852			0.992				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1675	0	1787	1603	0	1805	5143	0	1787	3539	1615
Flt Permitted	0.436			0.599			0.191			0.210		
Satd. Flow (perm)	820	1675	0	1127	1603	0	363	5143	0	395	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		146			184			8				68
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	376	56	150	138	4	360	12	840	48	140	916	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	376	206	0	138	364	0	12	888	0	140	916	22
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	24.0	24.0		24.0	24.0		9.5	41.0		9.5	41.0	41.0
Total Split (s)	60.0	60.0		60.0	60.0		11.0	49.0		11.0	49.0	49.0
Total Split (%)	50.0%	50.0%		50.0%	50.0%		9.2%	40.8%		9.2%	40.8%	40.8%
Maximum Green (s)	54.0	54.0		54.0	54.0		6.5	43.0		6.5	43.0	43.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.5	4.0		3.5	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.5	6.0		4.5	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0			28.0			28.0	28.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	54.0	54.0		54.0	54.0		50.4	43.0		53.8	49.7	49.7
Actuated g/C Ratio	0.45	0.45		0.45	0.45		0.42	0.36		0.45	0.41	0.41
v/c Ratio	1.02	0.25		0.27	0.44		0.05	0.48		0.56	0.63	0.03
Control Delay	85.7	7.2		22.5	12.4		18.2	30.6		28.5	27.8	0.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	85.7	7.2		22.5	12.4		18.2	30.6		28.5	27.8	0.5
LOS	F	A		C	B		B	C		C	C	A
Approach Delay		57.9			15.2			30.5			27.4	
Approach LOS		E			B			C			C	
Queue Length 50th (m)	~98.8	8.3		21.0	27.9		1.6	61.5		14.7	55.8	0.0
Queue Length 95th (m)	#160.7	23.0		36.5	53.3		5.2	74.7		27.8	137.7	0.5
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	369	834		507	822		232	1848		252	1464	708
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	1.02	0.25		0.27	0.44		0.05	0.48		0.56	0.63	0.03

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 108 (90%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.02
Intersection Signal Delay: 32.1 Intersection LOS: C
Intersection Capacity Utilization 91.6% ICU Level of Service F
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	0	0	18	0	40	0	396	3	13	585	7
Future Volume (Veh/h)	20	0	0	18	0	40	0	396	3	13	585	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	0	0	36	0	80	0	792	6	26	1170	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1705	2027	592	1432	2031	399	1184			798		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1705	2027	592	1432	2031	399	1184			798		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	20	100	100	61	100	87	100			97		
cM capacity (veh/h)	50	55	449	92	55	601	586			820		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	40	0	36	80	0	528	270	26	780	404
Volume Left	40	0	36	0	0	0	0	26	0	0
Volume Right	0	0	0	80	0	0	6	0	0	14
cSH	50	1700	92	601	1700	1700	1700	820	1700	1700
Volume to Capacity	0.80	0.00	0.39	0.13	0.00	0.31	0.16	0.03	0.46	0.24
Queue Length 95th (m)	26.4	0.0	12.5	3.7	0.0	0.0	0.0	0.8	0.0	0.0
Control Delay (s)	199.2	0.0	66.9	11.9	0.0	0.0	0.0	9.5	0.0	0.0
Lane LOS	F	A	F	B				A		
Approach Delay (s)	199.2		29.0		0.0			0.2		
Approach LOS	F		D							

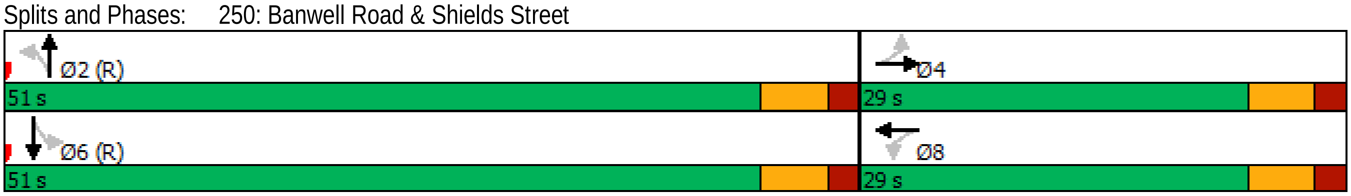
Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	34	22	51	18	89	38	242	52	71	468	64
Future Volume (vph)	69	34	22	51	18	89	38	242	52	71	468	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.941			0.875			0.973			0.982	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1753	0	1770	1630	0	1770	3500	0	1770	3476	0
Flt Permitted	0.515			0.685			0.236			0.430		
Satd. Flow (perm)	959	1753	0	1276	1630	0	440	3500	0	801	3476	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41			178			52			30	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		197.4			352.6			315.5			441.4	
Travel Time (s)		14.2			25.4			18.9			26.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	0%	2%	2%	2%	2%
Adj. Flow (vph)	138	68	44	102	36	178	76	484	104	142	936	128
Shared Lane Traffic (%)												
Lane Group Flow (vph)	138	112	0	102	214	0	76	588	0	142	1064	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	29.0	29.0		29.0	29.0		26.0	26.0		26.0	26.0	
Total Split (s)	29.0	29.0		29.0	29.0		51.0	51.0		51.0	51.0	
Total Split (%)	36.3%	36.3%		36.3%	36.3%		63.8%	63.8%		63.8%	63.8%	
Maximum Green (s)	23.0	23.0		23.0	23.0		45.0	45.0		45.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	10	10		10	10		0	0		0	0	
Act Effct Green (s)	15.5	15.5		15.5	15.5		52.5	52.5		52.5	52.5	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.66	0.66		0.66	0.66	
v/c Ratio	0.75	0.30		0.41	0.47		0.26	0.25		0.27	0.46	
Control Delay	52.8	18.6		31.6	9.8		10.6	6.2		8.9	8.3	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	52.8	18.6		31.6	9.8		10.6	6.2		8.9	8.3	
LOS	D	B		C	A		B	A		A	A	
Approach Delay		37.5			16.8			6.7			8.3	
Approach LOS		D			B			A			A	
Queue Length 50th (m)	21.0	9.6		14.4	4.8		4.4	15.9		8.3	37.2	
Queue Length 95th (m)	36.5	20.6		25.6	20.1		15.5	30.7		22.9	67.0	
Internal Link Dist (m)		173.4			328.6			291.5			417.4	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	275	533		366	595		288	2314		525	2291	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.50	0.21		0.28	0.36		0.26	0.25		0.27	0.46	

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 76 (95%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 12.0	Intersection LOS: B
Intersection Capacity Utilization 78.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 250: Banwell Road & Shields Street



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	493	633	10	24	11
Future Volume (Veh/h)	8	493	633	10	24	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	16	986	1266	20	48	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1286				1791	633
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1286				1791	633
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				31	95
cM capacity (veh/h)	535				70	422

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	16	493	493	633	633	20	48	22
Volume Left	16	0	0	0	0	0	48	0
Volume Right	0	0	0	0	0	20	0	22
cSH	535	1700	1700	1700	1700	1700	70	422
Volume to Capacity	0.03	0.29	0.29	0.37	0.37	0.01	0.69	0.05
Queue Length 95th (m)	0.7	0.0	0.0	0.0	0.0	0.0	24.7	1.3
Control Delay (s)	11.9	0.0	0.0	0.0	0.0	0.0	130.3	14.0
Lane LOS	B						F	B
Approach Delay (s)	0.2			0.0			93.8	
Approach LOS							F	

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

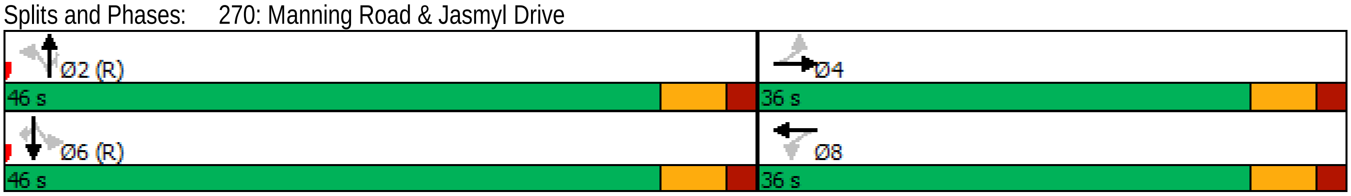
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	81	0	24	8	0	9	45	304	11	16	289	46
Future Volume (vph)	81	0	24	8	0	9	45	304	11	16	289	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		75.0	75.0		75.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.850			0.850				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	1583	0	1770	3539	1583	1770	3505	1583
Flt Permitted	0.746			0.726			0.434			0.422		
Satd. Flow (perm)	1390	1583	0	1352	1583	0	808	3539	1583	786	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		232			214				40			92
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		483.1			165.4			845.7			233.8	
Travel Time (s)		34.8			11.9			60.9			16.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	162	0	48	16	0	18	90	608	22	32	578	92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	162	48	0	16	18	0	90	608	22	32	578	92
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	4	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	33.0	33.0		33.0	33.0		24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	36.0	36.0		36.0	36.0		46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	43.9%	43.9%		43.9%	43.9%		56.1%	56.1%	56.1%	56.1%	56.1%	56.1%
Maximum Green (s)	30.0	30.0		30.0	30.0		40.0	40.0	40.0	40.0	40.0	40.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	0
Act Effct Green (s)	14.9	14.9		14.9	14.9		55.1	55.1	55.1	55.1	55.1	55.1
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.67	0.67	0.67	0.67	0.67	0.67
v/c Ratio	0.64	0.10		0.07	0.04		0.17	0.26	0.02	0.06	0.25	0.08
Control Delay	41.9	0.4		25.4	0.2		7.2	6.3	1.2	6.4	6.2	1.8

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.9	0.4		25.4	0.2		7.2	6.3	1.2	6.4	6.2	1.8
LOS	D	A		C	A		A	A	A	A	A	A
Approach Delay		32.4			12.1			6.3			5.7	
Approach LOS		C			B			A			A	
Queue Length 50th (m)	24.9	0.0		2.2	0.0		4.7	17.9	0.0	1.6	16.9	0.0
Queue Length 95th (m)	40.9	0.0		6.8	0.0		13.5	32.4	1.6	5.8	30.8	5.5
Internal Link Dist (m)		459.1			141.4			821.7			209.8	
Turn Bay Length (m)	75.0			75.0			75.0		75.0	75.0		75.0
Base Capacity (vph)	508	726		494	714		542	2376	1076	527	2353	1093
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.07		0.03	0.03		0.17	0.26	0.02	0.06	0.25	0.08

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 82
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 9.4 — Intersection LOS: A
Intersection Capacity Utilization 59.9% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 270: Manning Road & Jasmyl Drive



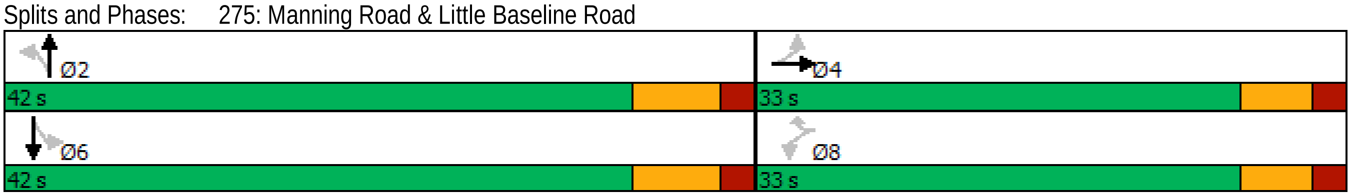
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	0	39	9	0	20	10	336	11	17	382	9
Future Volume (vph)	29	0	39	9	0	20	10	336	11	17	382	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.850				0.850		0.995			0.997	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	0	1583	1770	3522	0	1770	3495	0
Flt Permitted	0.950			0.706			0.356			0.388		
Satd. Flow (perm)	1770	1583	0	1315	0	1583	663	3522	0	723	3495	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		126				58		6			4	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		158.8			143.8			278.0			845.7	
Travel Time (s)		11.4			10.4			20.0			60.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	58	0	78	18	0	40	20	672	22	34	764	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	58	78	0	18	0	40	20	694	0	34	782	0
Turn Type	Perm	NA		Perm		Perm	Perm	NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8		8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0		7.0	20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		33.0		33.0	27.0	27.0		27.0	27.0	
Total Split (s)	33.0	33.0		33.0		33.0	42.0	42.0		42.0	42.0	
Total Split (%)	44.0%	44.0%		44.0%		44.0%	56.0%	56.0%		56.0%	56.0%	
Maximum Green (s)	27.0	27.0		27.0		27.0	35.0	35.0		35.0	35.0	
Yellow Time (s)	4.0	4.0		4.0		4.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0		6.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None		None	Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0		20.0	10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0		0	0	
Act Effct Green (s)	7.4	7.4		7.4		7.4	24.3	24.3		24.3	24.3	
Actuated g/C Ratio	0.18	0.18		0.18		0.18	0.60	0.60		0.60	0.60	
v/c Ratio	0.18	0.20		0.08		0.12	0.05	0.33		0.08	0.38	
Control Delay	15.4	3.0		14.4		4.8	6.1	6.4		6.4	6.8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Delay	15.4	3.0		14.4		4.8	6.1	6.4		6.4	6.8	
LOS	B	A		B		A	A	A		A	A	
Approach Delay		8.3			7.8			6.4			6.7	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	3.6	0.0		1.1		0.0	0.6	14.0		1.1	16.4	
Queue Length 95th (m)	10.4	4.1		4.8		4.1	3.1	24.8		4.6	28.7	
Internal Link Dist (m)		134.8			119.8			254.0			821.7	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	1171	1090		870		1067	591	3140		644	3116	
Starvation Cap Reductn	0	0		0		0	0	0		0	0	
Spillback Cap Reductn	0	0		0		0	0	0		0	0	
Storage Cap Reductn	0	0		0		0	0	0		0	0	
Reduced v/c Ratio	0.05	0.07		0.02		0.04	0.03	0.22		0.05	0.25	

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 40.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.38
Intersection Signal Delay: 6.8 Intersection LOS: A
Intersection Capacity Utilization 49.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 275: Manning Road & Little Baseline Road



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	23	34	20	323	413	17
Future Volume (Veh/h)	23	34	20	323	413	17
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	46	68	40	646	826	34
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					278	
pX, platoon unblocked	0.99	0.99	0.99			
vC, conflicting volume	1229	413	860			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1217	396	846			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	72	89	95			
cM capacity (veh/h)	163	600	782			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	114	40	323	323	413	413	34
Volume Left	46	40	0	0	0	0	0
Volume Right	68	0	0	0	0	0	34
cSH	288	782	1700	1700	1700	1700	1700
Volume to Capacity	0.40	0.05	0.19	0.19	0.24	0.24	0.02
Queue Length 95th (m)	14.5	1.3	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	25.4	9.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	A					
Approach Delay (s)	25.4	0.6			0.0		
Approach LOS	D						

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	24	7	318	440	7
Future Volume (Veh/h)	25	24	7	318	440	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	50	48	14	636	880	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1226	440	894			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1226	440	894			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	70	92	98			
cM capacity (veh/h)	168	565	755			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	98	14	318	318	440	440	14
Volume Left	50	14	0	0	0	0	0
Volume Right	48	0	0	0	0	0	14
cSH	256	755	1700	1700	1700	1700	1700
Volume to Capacity	0.38	0.02	0.19	0.19	0.26	0.26	0.01
Queue Length 95th (m)	13.7	0.5	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	27.6	9.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	A					
Approach Delay (s)	27.6	0.2			0.0		
Approach LOS	D						

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

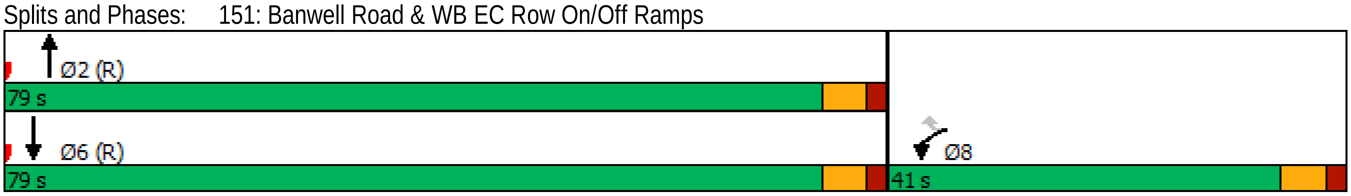
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	154	0	34	0	428	495	0	509	300
Future Volume (vph)	0	0	0	154	0	34	0	428	495	0	509	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		60.0
Storage Lanes	0		0	1		1	0		1	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt						0.850						
Flt Protected				0.950								
Satd. Flow (prot)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Flt Permitted				0.950								
Satd. Flow (perm)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						68			724			410
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		217.2			320.8			302.3			226.6	
Travel Time (s)		15.6			23.1			18.1			13.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	308	0	68	0	856	990	0	1018	600
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	308	0	68	0	856	990	0	1018	600
Turn Type				Prot		Perm		NA	Free		NA	Free
Protected Phases				8				2			6	
Permitted Phases						8			Free			Free
Detector Phase				8		8		2			6	
Switch Phase												
Minimum Initial (s)				5.0		5.0		5.0			5.0	
Minimum Split (s)				24.0		24.0		24.0			24.0	
Total Split (s)				41.0		41.0		79.0			79.0	
Total Split (%)				34.2%		34.2%		65.8%			65.8%	
Maximum Green (s)				35.0		35.0		73.0			73.0	
Yellow Time (s)				4.0		4.0		4.0			4.0	
All-Red Time (s)				2.0		2.0		2.0			2.0	
Lost Time Adjust (s)				0.0		0.0		0.0			0.0	
Total Lost Time (s)				6.0		6.0		6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Recall Mode				None		None		C-Max			C-Max	
Walk Time (s)				7.0		7.0		7.0			7.0	
Flash Dont Walk (s)				11.0		11.0		11.0			11.0	
Pedestrian Calls (#/hr)				0		0		0			0	
Act Effct Green (s)				25.7		25.7		82.3	120.0		82.3	120.0
Actuated g/C Ratio				0.21		0.21		0.69	1.00		0.69	1.00
v/c Ratio				0.80		0.17		0.35	0.52		0.29	0.32
Control Delay				59.4		8.9		4.9	4.1		8.2	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.0		0.0		0.0	0.0		0.0	0.0
Total Delay				59.4		8.9		4.9	4.1		8.2	0.4
LOS				E		A		A	A		A	A
Approach Delay					50.3			4.5			5.3	
Approach LOS					D			A			A	
Queue Length 50th (m)				72.8		0.0		26.6	147.5		32.8	0.0
Queue Length 95th (m)				97.5		11.1		30.6	58.5		49.0	0.0
Internal Link Dist (m)		193.2			296.8			278.3			202.6	
Turn Bay Length (m)												60.0
Base Capacity (vph)				526		519		2474	1900		3555	1900
Starvation Cap Reductn				0		0		0	0		0	0
Spillback Cap Reductn				0		0		0	0		0	0
Storage Cap Reductn				0		0		0	0		0	0
Reduced v/c Ratio				0.59		0.13		0.35	0.52		0.29	0.32

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 100 (83%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 9.3 Intersection LOS: A
Intersection Capacity Utilization 49.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 151: Banwell Road & WB EC Row On/Off Ramps



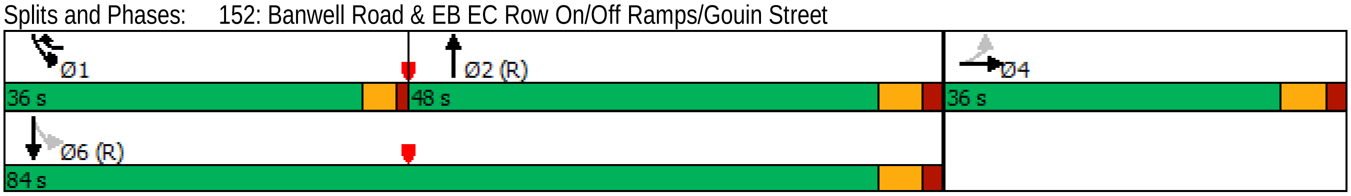
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	91	318	0	0	101	0	719	9	65	512	107
Future Volume (vph)	191	91	318	0	0	101	0	719	9	65	512	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		2	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.998				0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	3502	1900	1615	0	0	1644	0	5177	0	1805	3610	1615
Flt Permitted	0.950									0.128		
Satd. Flow (perm)	3502	1900	1615	0	0	1644	0	5177	0	243	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			412			82		2				131
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	382	182	636	0	0	202	0	1438	18	130	1024	214
Shared Lane Traffic (%)												
Lane Group Flow (vph)	382	182	636	0	0	202	0	1456	0	130	1024	214
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	36.0	36.0				36.0		48.0		36.0	84.0	
Total Split (%)	30.0%	30.0%				30.0%		40.0%		30.0%	70.0%	
Maximum Green (s)	30.0	30.0				32.0		42.0		32.0	78.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	18.5	18.5	120.0			14.6		70.9		91.5	89.5	120.0
Actuated g/C Ratio	0.15	0.15	1.00			0.12		0.59		0.76	0.75	1.00
v/c Ratio	0.71	0.62	0.39			0.75		0.48		0.35	0.38	0.13
Control Delay	55.3	56.5	0.7			45.8		25.9		11.3	4.6	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	55.3	56.5	0.7			45.8		25.9		11.3	4.6	0.2
LOS	E	E	A			D		C		B	A	A
Approach Delay		26.5			45.8			25.9			4.6	
Approach LOS		C			D			C			A	
Queue Length 50th (m)	46.9	42.8	0.0			29.0		106.8		5.3	29.0	0.0
Queue Length 95th (m)	60.5	64.2	0.0			52.2		135.8		19.7	42.7	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	875	475	1615			498		3058		601	2691	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.44	0.38	0.39			0.41		0.48		0.22	0.38	0.13

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 116 (97%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 20.1 Intersection LOS: C
Intersection Capacity Utilization 64.9% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	810	29	31	903	52	183	193	44	80	119	230
Future Volume (vph)	79	810	29	31	903	52	183	193	44	80	119	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.972				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1719	3438	1568	1687	3406	1468	1770	1801	0	1770	1845	1599
Flt Permitted	0.950			0.950			0.395			0.135		
Satd. Flow (perm)	1719	3438	1568	1687	3406	1468	736	1801	0	251	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88			88		7				194
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	5%	5%	3%	7%	6%	10%	2%	2%	5%	2%	3%	1%
Adj. Flow (vph)	158	1620	58	62	1806	104	366	386	88	160	238	460
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	1620	58	62	1806	104	366	474	0	160	238	460
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	20.0	71.0	71.0	20.0	71.0	71.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	14.3%	50.7%	50.7%	14.3%	50.7%	50.7%	9.3%	25.7%		9.3%	25.7%	25.7%
Maximum Green (s)	15.0	64.0	64.0	15.0	64.0	64.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	14.6	70.8	70.8	10.5	64.4	64.4	43.0	29.7		43.0	29.7	29.7
Actuated g/C Ratio	0.10	0.51	0.51	0.08	0.46	0.46	0.31	0.21		0.31	0.21	0.21
v/c Ratio	0.88	0.93	0.07	0.49	1.15	0.14	1.22	1.22		0.86	0.61	0.93
Control Delay	103.0	44.0	1.6	84.6	89.0	0.7	164.6	167.1		75.7	57.5	58.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	103.0	44.0	1.6	84.6	89.0	0.7	164.6	167.1		75.7	57.5	58.4
LOS	F	D	A	F	F	A	F	F		E	E	E
Approach Delay		47.8			84.2			166.0			61.4	
Approach LOS		D			F			F			E	
Queue Length 50th (m)	46.0	234.8	0.0	18.9	~319.7	0.1	~114.6	~168.5		34.4	63.3	82.9
Queue Length 95th (m)	#87.6	#308.4	3.5	m22.0	m#305.3	m0.5	#195.3	#239.6		#69.8	93.2	#152.1
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	184	1738	836	180	1566	722	299	387		185	391	492
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.86	0.93	0.07	0.34	1.15	0.14	1.22	1.22		0.86	0.61	0.93

Intersection Summary	
Area Type:	Other
Cycle Length: 140	
Actuated Cycle Length: 140	
Offset: 47 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 135	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 81.0	Intersection LOS: F
Intersection Capacity Utilization 113.1%	ICU Level of Service H
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	473	3	9	592	77	9	8	9	106	18	76
Future Volume (vph)	37	473	3	9	592	77	9	8	9	106	18	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	100.0		45.0	50.0		0.0	30.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999				0.850		0.921			0.879	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3468	0	1770	3539	1583	1770	1716	0	1770	1637	0
Flt Permitted	0.171			0.255			0.639			0.735		
Satd. Flow (perm)	319	3468	0	475	3539	1583	1190	1716	0	1369	1637	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				151		18			53	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		318.4			307.6			218.0			156.3	
Travel Time (s)		22.9			22.1			15.7			11.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	74	946	6	18	1184	154	18	16	18	212	36	152
Shared Lane Traffic (%)												
Lane Group Flow (vph)	74	952	0	18	1184	154	18	34	0	212	188	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Detector Phase	2	2		6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	
Minimum Split (s)	29.0	29.0		29.0	29.0	29.0	32.0	32.0		32.0	32.0	
Total Split (s)	50.0	50.0		50.0	50.0	50.0	32.0	32.0		32.0	32.0	
Total Split (%)	61.0%	61.0%		61.0%	61.0%	61.0%	39.0%	39.0%		39.0%	39.0%	
Maximum Green (s)	43.0	43.0		43.0	43.0	43.0	25.0	25.0		25.0	25.0	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Recall Mode	Min	Min		Min	Min	Min	None	None		None	None	
Walk Time (s)	12.0	12.0					15.0	15.0				
Flash Dont Walk (s)	10.0	10.0					10.0	10.0				
Pedestrian Calls (#/hr)	0	0					0	0				
Act Effct Green (s)	34.4	34.4		34.4	34.4	34.4	15.5	15.5		17.6	17.6	
Actuated g/C Ratio	0.52	0.52		0.52	0.52	0.52	0.23	0.23		0.26	0.26	
v/c Ratio	0.45	0.53		0.07	0.65	0.17	0.07	0.08		0.59	0.40	
Control Delay	22.0	12.3		10.1	14.0	2.5	20.9	13.7		30.2	18.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	22.0	12.3		10.1	14.0	2.5	20.9	13.7		30.2	18.4	
LOS	C	B		B	B	A	C	B		C	B	
Approach Delay		13.0			12.6			16.2			24.6	
Approach LOS		B			B			B			C	
Queue Length 50th (m)	5.5	39.4		1.1	53.5	0.2	1.8	1.6		24.5	14.4	
Queue Length 95th (m)	21.1	67.1		4.9	89.8	8.6	6.9	8.3		50.1	33.9	
Internal Link Dist (m)		294.4			283.6			194.0			132.3	
Turn Bay Length (m)	100.0			100.0		45.0	50.0			30.0		
Base Capacity (vph)	215	2343		321	2391	1118	467	685		537	675	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.34	0.41		0.06	0.50	0.14	0.04	0.05		0.39	0.28	

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 66.6
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 14.5 Intersection LOS: B
Intersection Capacity Utilization 77.0% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 167: Lesperance Road & CR 42

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	217	483	82	56	694	40	69	279	57	82	217	222
Future Volume (vph)	217	483	82	56	694	40	69	279	57	82	217	222
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3343	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3343	1357	1421	3406	1583	2870	1681	1335	3367	1845	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164			116			115			289
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	8%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	434	966	164	112	1388	80	138	558	114	164	434	444
Shared Lane Traffic (%)												
Lane Group Flow (vph)	434	966	164	112	1388	80	138	558	114	164	434	444
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	20.0	61.0	61.0	20.0	61.0	61.0	15.0	44.0	44.0	15.0	44.0	
Total Split (%)	14.3%	43.6%	43.6%	14.3%	43.6%	43.6%	10.7%	31.4%	31.4%	10.7%	31.4%	
Maximum Green (s)	15.0	53.2	53.2	15.0	53.2	53.2	10.0	36.1	36.1	10.0	36.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	15.0	54.3	54.3	13.9	53.2	53.2	9.7	36.3	36.3	9.8	36.4	140.0
Actuated g/C Ratio	0.11	0.39	0.39	0.10	0.38	0.38	0.07	0.26	0.26	0.07	0.26	1.00
v/c Ratio	1.18	0.75	0.26	0.79	1.07	0.12	0.69	1.28	0.26	0.70	0.91	0.28
Control Delay	142.7	30.3	5.9	97.0	88.4	1.9	82.0	184.6	8.2	79.9	73.8	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	142.7	30.3	5.9	97.0	88.4	1.9	82.0	184.6	8.2	79.9	73.8	0.4
LOS	F	C	A	F	F	A	F	F	A	E	E	A
Approach Delay		58.9			84.6			142.3			43.5	
Approach LOS		E			F			F			D	
Queue Length 50th (m)	~76.5	146.5	11.5	32.1	~235.7	0.0	20.5	~206.4	0.0	24.4	123.5	0.0
Queue Length 95th (m)	m#85.9	m157.2	m12.4	#62.8	#280.6	4.4	#34.1	#280.1	15.6	#37.9	#186.9	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	367	1296	626	152	1294	673	205	436	431	240	479	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.18	0.75	0.26	0.74	1.07	0.12	0.67	1.28	0.26	0.68	0.91	0.28

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.28

Intersection Signal Delay: 77.3 Intersection LOS: E

Intersection Capacity Utilization 107.4% ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22

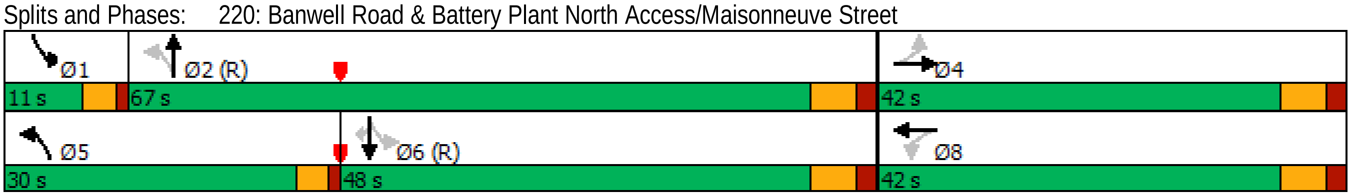
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	2	3	39	19	90	94	505	23	38	504	143
Future Volume (vph)	19	2	3	39	19	90	94	505	23	38	504	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.910			0.876			0.993				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1729	0	1805	1664	0	1805	5102	0	1805	5136	1615
Flt Permitted	0.336			0.751			0.253			0.258		
Satd. Flow (perm)	638	1729	0	1427	1664	0	481	5102	0	490	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			180			8				286
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	38	4	6	78	38	180	188	1010	46	76	1008	286
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	10	0	78	218	0	188	1056	0	76	1008	286
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	42.0	42.0		42.0	42.0		30.0	67.0		11.0	48.0	48.0
Total Split (%)	35.0%	35.0%		35.0%	35.0%		25.0%	55.8%		9.2%	40.0%	40.0%
Maximum Green (s)	36.0	36.0		36.0	36.0		26.0	61.0		7.0	42.0	42.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	11.9	11.9		11.9	11.9		96.5	87.6		92.2	83.9	83.9
Actuated g/C Ratio	0.10	0.10		0.10	0.10		0.80	0.73		0.77	0.70	0.70
v/c Ratio	0.60	0.06		0.55	0.67		0.39	0.28		0.17	0.28	0.24
Control Delay	86.9	32.4		65.1	22.0		6.5	3.7		4.8	10.0	3.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	86.9	32.4		65.1	22.0		6.5	3.7		4.8	10.0	3.7
LOS	F	C		E	C		A	A		A	A	A
Approach Delay		75.6			33.3			4.1			8.4	
Approach LOS		E			C			A			A	
Queue Length 50th (m)	9.2	0.9		18.7	8.8		6.4	17.6		4.5	41.5	5.4
Queue Length 95th (m)	21.1	6.1		33.9	33.1		13.8	24.0		9.9	53.3	18.2
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	191	522		428	625		679	3726		455	3589	1214
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.20	0.02		0.18	0.35		0.28	0.28		0.17	0.28	0.24

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 10.2 Intersection LOS: B
Intersection Capacity Utilization 65.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	3	1	69	28	173	63	468	24	70	388	36
Future Volume (vph)	1	3	1	69	28	173	63	468	24	70	388	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.962			0.871			0.993				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1775	0	1787	1641	0	1805	5148	0	1787	3539	1615
Flt Permitted	0.183			0.752			0.315			0.265		
Satd. Flow (perm)	344	1775	0	1415	1641	0	598	5148	0	499	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			206			10				100
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	2	6	2	138	56	346	126	936	48	140	776	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	2	8	0	138	402	0	126	984	0	140	776	72
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.5	24.0		9.5	24.0	24.0
Total Split (s)	41.0	41.0		41.0	41.0		18.0	68.0		11.0	61.0	61.0
Total Split (%)	34.2%	34.2%		34.2%	34.2%		15.0%	56.7%		9.2%	50.8%	50.8%
Maximum Green (s)	35.0	35.0		35.0	35.0		14.0	62.0		7.0	55.0	55.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	21.8	21.8		21.8	21.8		85.5	75.3		82.8	74.0	74.0
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.71	0.63		0.69	0.62	0.62
v/c Ratio	0.03	0.02		0.54	0.86		0.25	0.30		0.34	0.36	0.07
Control Delay	35.5	30.4		50.2	40.2		7.2	11.5		8.9	7.0	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	35.5	30.4		50.2	40.2		7.2	11.5		8.9	7.0	0.2
LOS	D	C		D	D		A	B		A	A	A
Approach Delay		31.4			42.7			11.0			6.8	
Approach LOS		C			D			B			A	
Queue Length 50th (m)	0.4	1.2		31.4	49.6		7.8	37.9		5.0	20.1	0.0
Queue Length 95th (m)	2.6	5.1		46.4	79.6		19.3	60.0		14.8	33.1	0.2
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	100	519		412	624		580	3235		420	2182	1034
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.02	0.02		0.33	0.64		0.22	0.30		0.33	0.36	0.07

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

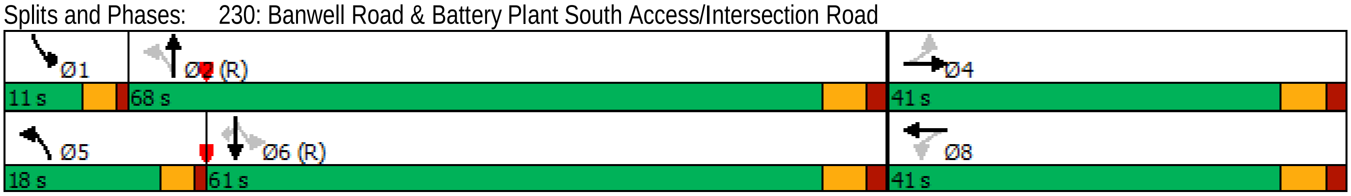
Maximum v/c Ratio: 0.86

Intersection Signal Delay: 16.0 Intersection LOS: B

Intersection Capacity Utilization 66.1% ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	0	0	18	0	40	0	501	3	13	441	7
Future Volume (Veh/h)	20	0	0	18	0	40	0	501	3	13	441	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	0	0	36	0	80	0	1002	6	26	882	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1522	1949	448	1498	1953	504	896			1008		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1522	1949	448	1498	1953	504	896			1008		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	40	100	100	56	100	84	100			96		
cM capacity (veh/h)	66	61	558	82	61	513	753			683		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	40	0	36	80	0	668	340	26	588	308
Volume Left	40	0	36	0	0	0	0	26	0	0
Volume Right	0	0	0	80	0	0	6	0	0	14
cSH	66	1700	82	513	1700	1700	1700	683	1700	1700
Volume to Capacity	0.60	0.00	0.44	0.16	0.00	0.39	0.20	0.04	0.35	0.18
Queue Length 95th (m)	20.5	0.0	14.3	4.4	0.0	0.0	0.0	0.9	0.0	0.0
Control Delay (s)	120.2	0.0	79.4	13.3	0.0	0.0	0.0	10.5	0.0	0.0
Lane LOS	F	A	F	B				B		
Approach Delay (s)	120.2		33.8		0.0			0.3		
Approach LOS	F		D							

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

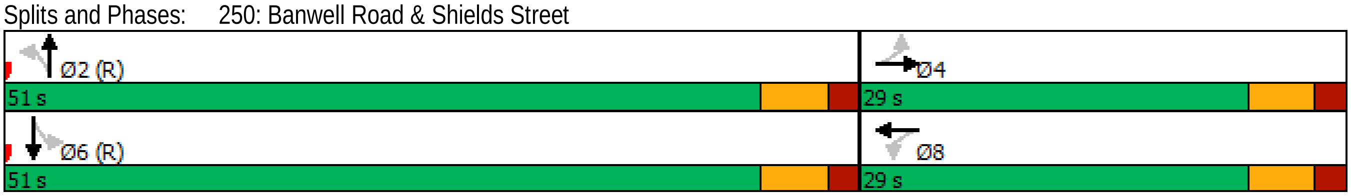
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	34	22	51	18	89	38	346	52	71	324	64
Future Volume (vph)	69	34	22	51	18	89	38	346	52	71	324	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.941			0.875			0.980			0.975	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1753	0	1770	1630	0	1770	3529	0	1770	3451	0
Flt Permitted	0.515			0.685			0.344			0.335		
Satd. Flow (perm)	959	1753	0	1276	1630	0	641	3529	0	624	3451	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41			178			34			47	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		197.4			352.6			315.5			441.4	
Travel Time (s)		14.2			25.4			18.9			26.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	0%	2%	2%	2%	2%
Adj. Flow (vph)	138	68	44	102	36	178	76	692	104	142	648	128
Shared Lane Traffic (%)												
Lane Group Flow (vph)	138	112	0	102	214	0	76	796	0	142	776	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	29.0	29.0		29.0	29.0		26.0	26.0		26.0	26.0	
Total Split (s)	29.0	29.0		29.0	29.0		51.0	51.0		51.0	51.0	
Total Split (%)	36.3%	36.3%		36.3%	36.3%		63.8%	63.8%		63.8%	63.8%	
Maximum Green (s)	23.0	23.0		23.0	23.0		45.0	45.0		45.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	10	10		10	10		0	0		0	0	
Act Effct Green (s)	15.5	15.5		15.5	15.5		52.5	52.5		52.5	52.5	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.66	0.66		0.66	0.66	
v/c Ratio	0.75	0.30		0.41	0.47		0.18	0.34		0.35	0.34	
Control Delay	52.8	18.6		31.6	9.8		8.4	7.1		10.8	6.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	52.8	18.6		31.6	9.8		8.4	7.1		10.8	6.9	
LOS	D	B		C	A		A	A		B	A	
Approach Delay		37.5			16.8			7.2			7.5	
Approach LOS		D			B			A			A	
Queue Length 50th (m)	21.0	9.6		14.4	4.8		4.1	24.4		8.8	23.2	
Queue Length 95th (m)	36.5	20.6		25.6	20.1		13.2	45.1		26.2	43.5	
Internal Link Dist (m)		173.4			328.6			291.5			417.4	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	275	533		366	595		420	2327		409	2280	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.50	0.21		0.28	0.36		0.18	0.34		0.35	0.34	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 76 (95%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 11.8 Intersection LOS: B
Intersection Capacity Utilization 71.3% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 250: Banwell Road & Shields Street



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	493	681	10	24	11
Future Volume (Veh/h)	8	493	681	10	24	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	16	986	1362	20	48	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1382				1887	681
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1382				1887	681
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				20	94
cM capacity (veh/h)	492				60	393

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	16	493	493	681	681	20	48	22
Volume Left	16	0	0	0	0	0	48	0
Volume Right	0	0	0	0	0	20	0	22
cSH	492	1700	1700	1700	1700	1700	60	393
Volume to Capacity	0.03	0.29	0.29	0.40	0.40	0.01	0.80	0.06
Queue Length 95th (m)	0.8	0.0	0.0	0.0	0.0	0.0	28.4	1.4
Control Delay (s)	12.6	0.0	0.0	0.0	0.0	0.0	173.0	14.7
Lane LOS	B						F	B
Approach Delay (s)	0.2			0.0			123.3	
Approach LOS							F	

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

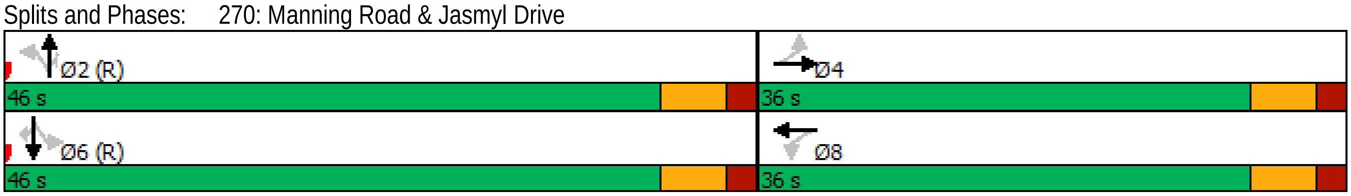
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	81	0	24	8	0	9	45	304	11	16	289	46
Future Volume (vph)	81	0	24	8	0	9	45	304	11	16	289	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		75.0	75.0		75.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.850			0.850				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	1583	0	1770	3539	1583	1770	3505	1583
Flt Permitted	0.746			0.726			0.434			0.422		
Satd. Flow (perm)	1390	1583	0	1352	1583	0	808	3539	1583	786	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		232			214				40			92
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		483.1			165.4			845.7			233.8	
Travel Time (s)		34.8			11.9			60.9			16.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	162	0	48	16	0	18	90	608	22	32	578	92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	162	48	0	16	18	0	90	608	22	32	578	92
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	4	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	33.0	33.0		33.0	33.0		24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	36.0	36.0		36.0	36.0		46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	43.9%	43.9%		43.9%	43.9%		56.1%	56.1%	56.1%	56.1%	56.1%	56.1%
Maximum Green (s)	30.0	30.0		30.0	30.0		40.0	40.0	40.0	40.0	40.0	40.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	0
Act Effct Green (s)	14.9	14.9		14.9	14.9		55.1	55.1	55.1	55.1	55.1	55.1
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.67	0.67	0.67	0.67	0.67	0.67
v/c Ratio	0.64	0.10		0.07	0.04		0.17	0.26	0.02	0.06	0.25	0.08
Control Delay	41.9	0.4		25.4	0.2		7.2	6.3	1.2	6.4	6.2	1.8

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.9	0.4		25.4	0.2		7.2	6.3	1.2	6.4	6.2	1.8
LOS	D	A		C	A		A	A	A	A	A	A
Approach Delay		32.4			12.1			6.3			5.7	
Approach LOS		C			B			A			A	
Queue Length 50th (m)	24.9	0.0		2.2	0.0		4.7	17.9	0.0	1.6	16.9	0.0
Queue Length 95th (m)	40.9	0.0		6.8	0.0		13.5	32.4	1.6	5.8	30.8	5.5
Internal Link Dist (m)		459.1			141.4			821.7			209.8	
Turn Bay Length (m)	75.0			75.0			75.0		75.0	75.0		75.0
Base Capacity (vph)	508	726		494	714		542	2376	1076	527	2353	1093
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.07		0.03	0.03		0.17	0.26	0.02	0.06	0.25	0.08

Intersection Summary

Area Type: Other
Cycle Length: 82
Actuated Cycle Length: 82
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 9.4 Intersection LOS: A
Intersection Capacity Utilization 59.9% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 270: Manning Road & Jasmyl Drive

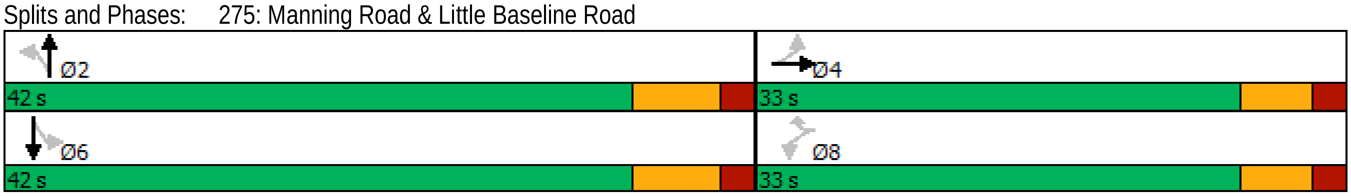


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	0	39	9	0	20	10	336	11	17	382	9
Future Volume (vph)	29	0	39	9	0	20	10	336	11	17	382	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.850				0.850		0.995			0.997	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	0	1583	1770	3522	0	1770	3495	0
Flt Permitted	0.950			0.706			0.356			0.388		
Satd. Flow (perm)	1770	1583	0	1315	0	1583	663	3522	0	723	3495	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		126				58		6			4	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		158.8			143.8			278.0			845.7	
Travel Time (s)		11.4			10.4			20.0			60.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	58	0	78	18	0	40	20	672	22	34	764	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	58	78	0	18	0	40	20	694	0	34	782	0
Turn Type	Perm	NA		Perm		Perm	Perm	NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8		8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0		7.0	20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		33.0		33.0	27.0	27.0		27.0	27.0	
Total Split (s)	33.0	33.0		33.0		33.0	42.0	42.0		42.0	42.0	
Total Split (%)	44.0%	44.0%		44.0%		44.0%	56.0%	56.0%		56.0%	56.0%	
Maximum Green (s)	27.0	27.0		27.0		27.0	35.0	35.0		35.0	35.0	
Yellow Time (s)	4.0	4.0		4.0		4.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0		6.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None		None	Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0		20.0	10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0		0	0	
Act Effct Green (s)	7.4	7.4		7.4		7.4	24.3	24.3		24.3	24.3	
Actuated g/C Ratio	0.18	0.18		0.18		0.18	0.60	0.60		0.60	0.60	
v/c Ratio	0.18	0.20		0.08		0.12	0.05	0.33		0.08	0.38	
Control Delay	15.4	3.0		14.4		4.8	6.1	6.4		6.4	6.8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Delay	15.4	3.0		14.4		4.8	6.1	6.4		6.4	6.8	
LOS	B	A		B		A	A	A		A	A	
Approach Delay		8.3			7.8			6.4			6.7	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	3.6	0.0		1.1		0.0	0.6	14.0		1.1	16.4	
Queue Length 95th (m)	10.4	4.1		4.8		4.1	3.1	24.8		4.6	28.7	
Internal Link Dist (m)		134.8			119.8			254.0			821.7	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	1171	1090		870		1067	591	3140		644	3116	
Starvation Cap Reductn	0	0		0		0	0	0		0	0	
Spillback Cap Reductn	0	0		0		0	0	0		0	0	
Storage Cap Reductn	0	0		0		0	0	0		0	0	
Reduced v/c Ratio	0.05	0.07		0.02		0.04	0.03	0.22		0.05	0.25	

Intersection Summary	
Area Type: Other	
Cycle Length: 75	
Actuated Cycle Length: 40.8	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.38	
Intersection Signal Delay: 6.8	Intersection LOS: A
Intersection Capacity Utilization 49.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 275: Manning Road & Little Baseline Road



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	23	34	20	323	413	17
Future Volume (Veh/h)	23	34	20	323	413	17
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	46	68	40	646	826	34
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					278	
pX, platoon unblocked	0.99	0.99	0.99			
vC, conflicting volume	1229	413	860			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1217	396	846			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	72	89	95			
cM capacity (veh/h)	163	600	782			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	114	40	323	323	413	413	34
Volume Left	46	40	0	0	0	0	0
Volume Right	68	0	0	0	0	0	34
cSH	288	782	1700	1700	1700	1700	1700
Volume to Capacity	0.40	0.05	0.19	0.19	0.24	0.24	0.02
Queue Length 95th (m)	14.5	1.3	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	25.4	9.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	A					
Approach Delay (s)	25.4	0.6			0.0		
Approach LOS	D						

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	24	7	318	440	7
Future Volume (Veh/h)	25	24	7	318	440	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	50	48	14	636	880	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1226	440	894			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1226	440	894			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	70	92	98			
cM capacity (veh/h)	168	565	755			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	98	14	318	318	440	440	14
Volume Left	50	14	0	0	0	0	0
Volume Right	48	0	0	0	0	0	14
cSH	256	755	1700	1700	1700	1700	1700
Volume to Capacity	0.38	0.02	0.19	0.19	0.26	0.26	0.01
Queue Length 95th (m)	13.7	0.5	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	27.6	9.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	A					
Approach Delay (s)	27.6	0.2			0.0		
Approach LOS	D						

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

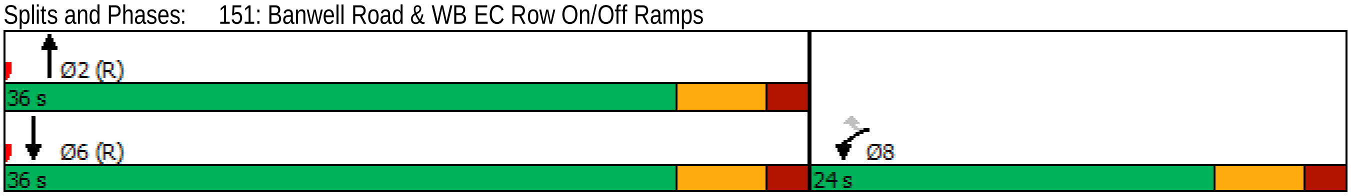
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	127	0	92	0	628	684	0	633	124
Future Volume (vph)	0	0	0	127	0	92	0	628	684	0	633	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		60.0
Storage Lanes	0		0	1		1	0		1	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt						0.850						
Flt Protected				0.950								
Satd. Flow (prot)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Flt Permitted				0.950								
Satd. Flow (perm)	0	0	0	1805	0	1615	0	3610	1900	0	5187	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						55			1091			248
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		217.2			320.8			302.3			226.6	
Travel Time (s)		15.6			23.1			18.1			13.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	254	0	184	0	1256	1368	0	1266	248
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	254	0	184	0	1256	1368	0	1266	248
Turn Type				Prot		Perm		NA	Free		NA	Free
Protected Phases				8				2			6	
Permitted Phases						8			Free			Free
Detector Phase				8		8		2			6	
Switch Phase												
Minimum Initial (s)				5.0		5.0		5.0			5.0	
Minimum Split (s)				24.0		24.0		24.0			24.0	
Total Split (s)				24.0		24.0		36.0			36.0	
Total Split (%)				40.0%		40.0%		60.0%			60.0%	
Maximum Green (s)				18.0		18.0		30.0			30.0	
Yellow Time (s)				4.0		4.0		4.0			4.0	
All-Red Time (s)				2.0		2.0		2.0			2.0	
Lost Time Adjust (s)				0.0		0.0		0.0			0.0	
Total Lost Time (s)				6.0		6.0		6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Recall Mode				None		None		C-Max			C-Max	
Walk Time (s)				7.0		7.0		7.0			7.0	
Flash Dont Walk (s)				11.0		11.0		11.0			11.0	
Pedestrian Calls (#/hr)				0		0		0			0	
Act Effct Green (s)				13.4		13.4		34.6	60.0		34.6	60.0
Actuated g/C Ratio				0.22		0.22		0.58	1.00		0.58	1.00
v/c Ratio				0.63		0.46		0.60	0.72		0.42	0.13
Control Delay				27.6		16.9		11.5	7.4		8.3	0.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.0		0.0		0.0	0.0		0.0	0.0
Total Delay				27.6		16.9		11.5	7.4		8.3	0.1
LOS				C		B		B	A		A	A
Approach Delay					23.1			9.3			6.9	
Approach LOS					C			A			A	
Queue Length 50th (m)				26.5		12.6		77.7	172.7		26.7	0.0
Queue Length 95th (m)				42.6		25.6		m114.1	m258.5		43.1	0.0
Internal Link Dist (m)		193.2			296.8			278.3			202.6	
Turn Bay Length (m)												60.0
Base Capacity (vph)				541		523		2079	1900		2987	1900
Starvation Cap Reductn				0		0		0	0		0	0
Spillback Cap Reductn				0		0		0	0		0	0
Storage Cap Reductn				0		0		0	0		0	0
Reduced v/c Ratio				0.47		0.35		0.60	0.72		0.42	0.13

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 15 (25%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 9.9 Intersection LOS: A
Intersection Capacity Utilization 57.1% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 151: Banwell Road & WB EC Row On/Off Ramps



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	270	63	0	0	60	0	1111	25	57	556	173
Future Volume (vph)	325	270	63	0	0	60	0	1111	25	57	556	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		2	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.997				0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	3502	1900	1615	0	0	1644	0	5171	0	1805	3610	1615
Flt Permitted	0.950									0.065		
Satd. Flow (perm)	3502	1900	1615	0	0	1644	0	5171	0	124	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			118			82		3				195
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	650	540	126	0	0	120	0	2222	50	114	1112	346
Shared Lane Traffic (%)												
Lane Group Flow (vph)	650	540	126	0	0	120	0	2272	0	114	1112	346
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	44.0	44.0				28.0		48.0		28.0	76.0	
Total Split (%)	36.7%	36.7%				23.3%		40.0%		23.3%	63.3%	
Maximum Green (s)	38.0	38.0				24.0		42.0		24.0	70.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	36.8	36.8	120.0			9.5		57.7		73.2	71.2	120.0
Actuated g/C Ratio	0.31	0.31	1.00			0.08		0.48		0.61	0.59	1.00
v/c Ratio	0.61	0.93	0.08			0.59		0.91		0.55	0.52	0.21
Control Delay	38.0	63.7	0.1			31.2		24.2		26.2	13.2	0.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	38.0	63.7	0.1			31.2		24.2		26.2	13.2	0.3
LOS	D	E	A			C		C		C	B	A
Approach Delay		44.9			31.2			24.2			11.3	
Approach LOS		D			C			C			B	
Queue Length 50th (m)	69.4	127.4	0.0			9.1		99.6		12.4	81.7	0.0
Queue Length 95th (m)	89.1	#192.5	0.0			27.8		m#220.0		21.8	109.1	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	1108	601	1615			394		2486		411	2141	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.59	0.90	0.08			0.30		0.91		0.28	0.52	0.21

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 11 (9%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 25.7 Intersection LOS: C

Intersection Capacity Utilization 92.1% ICU Level of Service F

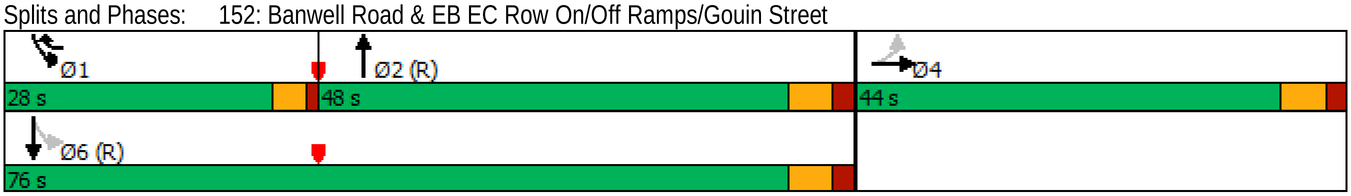
Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	237	1307	69	84	893	90	218	220	63	105	251	85
Future Volume (vph)	237	1307	69	84	893	90	218	220	63	105	251	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.967				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	3406	1615	1787	3438	1599	1787	1801	0	1787	1863	1599
Flt Permitted	0.950			0.950			0.135			0.135		
Satd. Flow (perm)	1787	3406	1615	1787	3438	1599	254	1801	0	254	1863	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			91			132		10				137
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	6%	0%	1%	5%	1%	1%	2%	2%	1%	2%	1%
Adj. Flow (vph)	474	2614	138	168	1786	180	436	440	126	210	502	170
Shared Lane Traffic (%)												
Lane Group Flow (vph)	474	2614	138	168	1786	180	436	566	0	210	502	170
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	30.0	71.0	71.0	15.0	56.0	56.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	22.2%	52.6%	52.6%	11.1%	41.5%	41.5%	9.6%	26.7%		9.6%	26.7%	26.7%
Maximum Green (s)	25.0	64.0	64.0	10.0	49.0	49.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	25.0	64.0	64.0	10.0	49.0	49.0	43.0	29.7		43.0	29.7	29.7
Actuated g/C Ratio	0.19	0.47	0.47	0.07	0.36	0.36	0.32	0.22		0.32	0.22	0.22
v/c Ratio	1.44	1.62	0.17	1.27	1.43	0.27	2.25	1.40		1.08	1.23	0.37
Control Delay	252.3	309.4	8.1	189.1	215.0	0.5	599.2	233.3		123.5	166.1	13.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	252.3	309.4	8.1	189.1	215.0	0.5	599.2	233.3		123.5	166.1	13.6
LOS	F	F	A	F	F	A	F	F		F	F	B
Approach Delay		288.1			194.9			392.5			126.6	
Approach LOS		F			F			F			F	
Queue Length 50th (m)	~179.7	~553.8	7.0	~60.6	~348.2	0.8	~180.8	~211.1		~47.1	~173.0	7.4
Queue Length 95th (m)	#249.0	#593.3	19.2	m#55.4	m#261.8	m0.8	#249.4	#285.0		#100.4	#243.5	28.2
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	330	1614	813	132	1247	664	194	404		194	409	458
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	1.44	1.62	0.17	1.27	1.43	0.27	2.25	1.40		1.08	1.23	0.37

Intersection Summary

Area Type: Other

Cycle Length: 135

Actuated Cycle Length: 135

Offset: 65 (48%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 145

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 2.25

Intersection Signal Delay: 255.4 — Intersection LOS: F

Intersection Capacity Utilization 150.7% — ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	530	11	11	536	113	4	18	11	92	10	63
Future Volume (vph)	77	530	11	11	536	113	4	18	11	92	10	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	100.0		45.0	50.0		0.0	30.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997				0.850		0.943			0.871	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3462	0	1770	3539	1583	1770	1757	0	1770	1622	0
Flt Permitted	0.219			0.215			0.664			0.719		
Satd. Flow (perm)	408	3462	0	400	3539	1583	1237	1757	0	1339	1622	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				226		22			71	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		318.4			307.6			218.0			156.3	
Travel Time (s)		22.9			22.1			15.7			11.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	154	1060	22	22	1072	226	8	36	22	184	20	126
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	1082	0	22	1072	226	8	58	0	184	146	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Detector Phase	2	2		6	6	6	8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	
Minimum Split (s)	29.0	29.0		29.0	29.0	29.0	32.0	32.0		32.0	32.0	
Total Split (s)	50.0	50.0		50.0	50.0	50.0	32.0	32.0		32.0	32.0	
Total Split (%)	61.0%	61.0%		61.0%	61.0%	61.0%	39.0%	39.0%		39.0%	39.0%	
Maximum Green (s)	43.0	43.0		43.0	43.0	43.0	26.0	26.0		26.0	26.0	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.0	7.0		7.0	7.0	7.0	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Recall Mode	None	None		None	None	None	None	None		None	None	
Walk Time (s)	12.0	12.0					15.0	15.0				
Flash Dont Walk (s)	10.0	10.0					10.0	10.0				
Pedestrian Calls (#/hr)	0	0					0	0				
Act Effct Green (s)	36.2	36.2		36.2	36.2	36.2	14.9	14.9		16.6	16.6	
Actuated g/C Ratio	0.54	0.54		0.54	0.54	0.54	0.22	0.22		0.25	0.25	
v/c Ratio	0.69	0.57		0.10	0.56	0.23	0.03	0.14		0.55	0.32	
Control Delay	32.9	11.7		9.9	11.5	2.1	20.6	15.5		30.2	14.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	32.9	11.7		9.9	11.5	2.1	20.6	15.5		30.2	14.5	
LOS	C	B		A	B	A	C	B		C	B	
Approach Delay		14.4			9.9			16.1			23.3	
Approach LOS		B			A			B			C	
Queue Length 50th (m)	13.1	43.5		1.2	42.8	0.0	0.9	4.1		23.7	8.8	
Queue Length 95th (m)	#52.7	78.2		5.7	76.4	9.9	4.0	12.4		42.8	22.4	
Internal Link Dist (m)		294.4			283.6			194.0			132.3	
Turn Bay Length (m)	100.0			100.0		45.0	50.0			30.0		
Base Capacity (vph)	277	2354		271	2405	1148	508	734		550	708	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.56	0.46		0.08	0.45	0.20	0.02	0.08		0.33	0.21	

Intersection Summary

Area Type: Other

Cycle Length: 82

Actuated Cycle Length: 66.5

Natural Cycle: 80

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 13.4 Intersection LOS: B

Intersection Capacity Utilization 71.9% ICU Level of Service C

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 167: Lesperance Road & CR 42

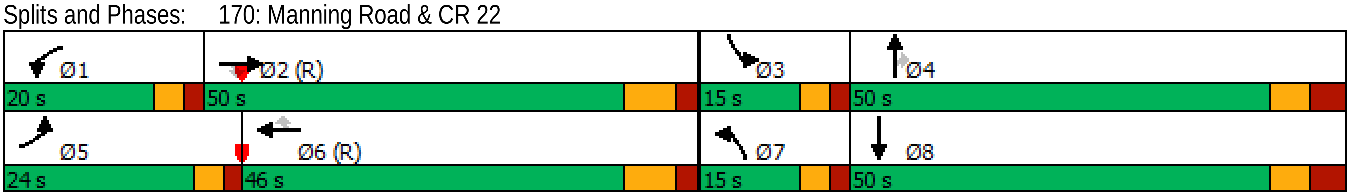
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	337	835	125	70	633	77	165	409	54	76	412	269
Future Volume (vph)	337	835	125	70	633	77	165	409	54	76	412	269
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	3438	1369	1421	3438	1599	3273	1881	1538	3433	1845	1599
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3467	3438	1369	1421	3438	1599	3273	1881	1538	3433	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			228			154			120			192
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	5%	18%	27%	5%	1%	7%	1%	5%	2%	3%	1%
Adj. Flow (vph)	674	1670	250	140	1266	154	330	818	108	152	824	538
Shared Lane Traffic (%)												
Lane Group Flow (vph)	674	1670	250	140	1266	154	330	818	108	152	824	538
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	24.0	50.0	50.0	20.0	46.0	46.0	15.0	50.0	50.0	15.0	50.0	
Total Split (%)	17.8%	37.0%	37.0%	14.8%	34.1%	34.1%	11.1%	37.0%	37.0%	11.1%	37.0%	
Maximum Green (s)	19.0	42.2	42.2	15.0	38.2	38.2	10.0	42.1	42.1	10.0	42.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	19.0	42.4	42.4	14.8	38.2	38.2	10.0	42.5	42.5	9.6	42.1	135.0
Actuated g/C Ratio	0.14	0.31	0.31	0.11	0.28	0.28	0.07	0.31	0.31	0.07	0.31	1.00
v/c Ratio	1.38	1.55	0.43	0.90	1.30	0.27	1.36	1.38	0.19	0.62	1.43	0.34
Control Delay	221.5	269.2	2.8	109.5	182.9	6.7	233.1	219.0	5.2	72.5	240.0	0.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	221.5	269.2	2.8	109.5	182.9	6.7	233.1	219.0	5.2	72.5	240.0	0.6
LOS	F	F	A	F	F	A	F	F	A	E	F	A
Approach Delay		231.1			158.9			204.3			138.1	
Approach LOS		F			F			F			F	
Queue Length 50th (m)	~127.4	~348.1	11.0	39.4	~239.0	0.0	~62.6	~305.6	0.0	21.7	~312.4	0.0
Queue Length 95th (m)	m57.3	m#143.5	m2.9	#80.4	#283.4	16.8	#94.5	#385.4	11.2	33.7	#392.2	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	487	1079	586	157	972	562	242	591	566	254	575	1599
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.38	1.55	0.43	0.89	1.30	0.27	1.36	1.38	0.19	0.60	1.43	0.34

Intersection Summary

Area Type: Other
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.55
Intersection Signal Delay: 189.7 Intersection LOS: F
Intersection Capacity Utilization 128.4% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22



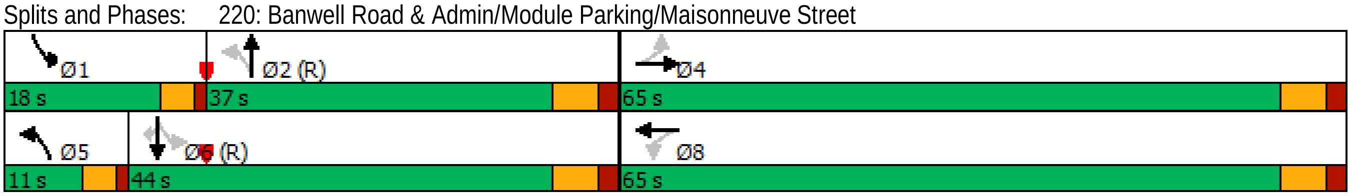
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	250	18	63	74	3	181	5	538	69	44	505	8
Future Volume (vph)	250	18	63	74	3	181	5	538	69	44	505	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.883			0.852			0.983				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1678	0	1805	1619	0	1805	5054	0	1805	5085	1615
Flt Permitted	0.453			0.654			0.226			0.100		
Satd. Flow (perm)	861	1678	0	1243	1619	0	429	5054	0	190	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		126			269			18				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	500	36	126	148	6	362	10	1076	138	88	1010	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	500	162	0	148	368	0	10	1214	0	88	1010	16
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	65.0	65.0		65.0	65.0		11.0	37.0		18.0	44.0	44.0
Total Split (%)	54.2%	54.2%		54.2%	54.2%		9.2%	30.8%		15.0%	36.7%	36.7%
Maximum Green (s)	59.0	59.0		59.0	59.0		7.0	31.0		14.0	38.0	38.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	59.0	59.0		59.0	59.0		43.9	36.0		51.0	46.9	46.9
Actuated g/C Ratio	0.49	0.49		0.49	0.49		0.37	0.30		0.42	0.39	0.39
v/c Ratio	1.18	0.18		0.24	0.39		0.04	0.80		0.44	0.51	0.02
Control Delay	133.6	5.2		18.9	6.4		16.4	44.2		40.3	25.9	0.9

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	133.6	5.2		18.9	6.4		16.4	44.2		40.3	25.9	0.9
LOS	F	A		B	A		B	D		D	C	A
Approach Delay		102.2			10.0			44.0			26.7	
Approach LOS		F			A			D			C	
Queue Length 50th (m)	~148.7	4.5		20.6	12.9		1.8	107.6		13.4	45.7	0.0
Queue Length 95th (m)	#216.3	16.2		34.8	33.0		m3.2	126.0		31.2	64.2	m0.2
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	423	889		611	932		241	1527		269	1985	669
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	1.18	0.18		0.24	0.39		0.04	0.80		0.33	0.51	0.02

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.18
Intersection Signal Delay: 44.5 Intersection LOS: D
Intersection Capacity Utilization 97.5% ICU Level of Service F
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Admin/Module Parking/Maisonneuve Street



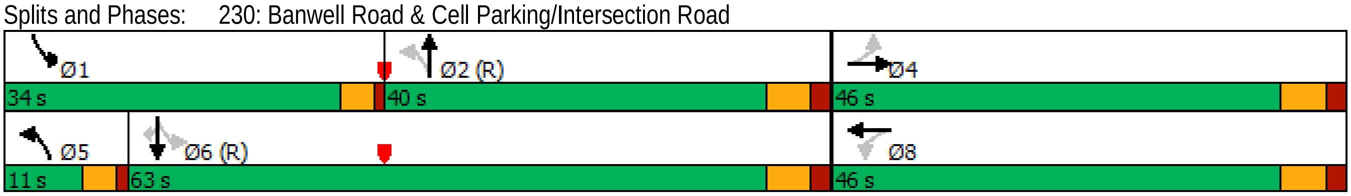
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	32	16	33	3	111	3	385	82	202	636	2
Future Volume (vph)	107	32	16	33	3	111	3	385	82	202	636	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.950			0.854			0.974				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1770	0	1787	1607	0	1805	4962	0	1787	3539	1615
Flt Permitted	0.475			0.695			0.216			0.217		
Satd. Flow (perm)	894	1770	0	1307	1607	0	410	4962	0	408	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			222			39				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	3%	0%	1%	0%	1%	0%	2%	1%	1%	2%	0%
Adj. Flow (vph)	214	64	32	66	6	222	6	770	164	404	1272	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	214	96	0	66	228	0	6	934	0	404	1272	4
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.5	24.0		9.5	24.0	24.0
Total Split (s)	46.0	46.0		46.0	46.0		11.0	40.0		34.0	63.0	63.0
Total Split (%)	38.3%	38.3%		38.3%	38.3%		9.2%	33.3%		28.3%	52.5%	52.5%
Maximum Green (s)	40.0	40.0		40.0	40.0		7.0	34.0		30.0	57.0	57.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	30.5	30.5		30.5	30.5		58.5	50.8		79.5	75.5	75.5
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.49	0.42		0.66	0.63	0.63
v/c Ratio	0.94	0.21		0.20	0.40		0.02	0.44		0.76	0.57	0.00
Control Delay	89.7	25.6		33.8	6.4		12.8	26.8		18.7	12.4	0.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	89.7	25.6		33.8	6.4		12.8	26.8		18.7	12.4	0.0
LOS	F	C		C	A		B	C		B	B	A
Approach Delay		69.9			12.5			26.8			13.9	
Approach LOS		E			B			C			B	
Queue Length 50th (m)	51.7	14.2		12.8	1.1		0.5	57.2		48.0	80.5	0.0
Queue Length 95th (m)	#83.6	25.8		22.8	18.7		2.5	87.2		74.0	186.9	m0.0
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)							60.0			60.0		
Base Capacity (vph)	298	604		435	683		285	2121		615	2226	1039
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.72	0.16		0.15	0.33		0.02	0.44		0.66	0.57	0.00

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 54 (45%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 22.9 Intersection LOS: C
Intersection Capacity Utilization 85.2% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 230: Banwell Road & Cell Parking/Intersection Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	0	0	8	0	25	0	452	13	41	645	21
Future Volume (Veh/h)	12	0	0	8	0	25	0	452	13	41	645	21
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	24	0	0	16	0	50	0	904	26	82	1290	42
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1977	2405	666	1726	2413	465	1332			930		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1977	2405	666	1726	2413	465	1332			930		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	21	100	100	69	100	91	100			89		
cM capacity (veh/h)	31	29	402	52	29	544	514			731		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	24	0	16	50	0	603	327	82	860	472
Volume Left	24	0	16	0	0	0	0	82	0	0
Volume Right	0	0	0	50	0	0	26	0	0	42
cSH	31	1700	52	544	1700	1700	1700	731	1700	1700
Volume to Capacity	0.79	0.00	0.31	0.09	0.00	0.35	0.19	0.11	0.51	0.28
Queue Length 95th (m)	21.0	0.0	8.6	2.4	0.0	0.0	0.0	3.0	0.0	0.0
Control Delay (s)	284.6	0.0	102.2	12.3	0.0	0.0	0.0	10.5	0.0	0.0
Lane LOS	F	A	F	B				B		
Approach Delay (s)	284.6		34.1		0.0			0.6		
Approach LOS	F		D							

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		

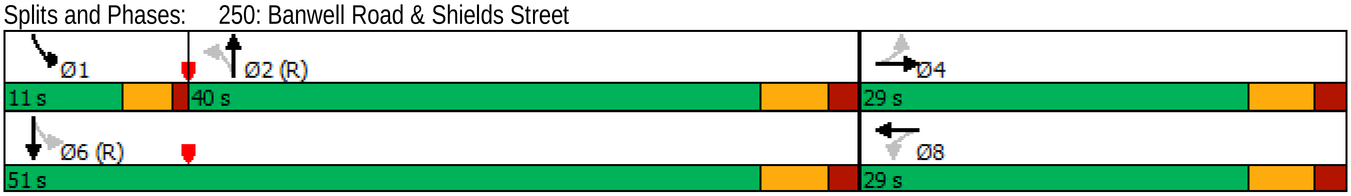
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	142	50	78	25	29	88	96	236	23	94	403	155
Future Volume (vph)	142	50	78	25	29	88	96	236	23	94	403	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.909			0.887			0.987			0.958	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1693	0	1770	1652	0	1770	3557	0	1770	3391	0
Flt Permitted	0.546			0.511			0.255			0.385		
Satd. Flow (perm)	1017	1693	0	952	1652	0	475	3557	0	717	3391	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		99			176			16			115	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		197.4			352.6			315.5			441.4	
Travel Time (s)		14.2			25.4			18.9			26.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	0%	2%	2%	2%	2%
Adj. Flow (vph)	284	100	156	50	58	176	192	472	46	188	806	310
Shared Lane Traffic (%)												
Lane Group Flow (vph)	284	256	0	50	234	0	192	518	0	188	1116	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		7.0	10.0	
Minimum Split (s)	29.0	29.0		29.0	29.0		26.0	26.0		11.0	26.0	
Total Split (s)	29.0	29.0		29.0	29.0		40.0	40.0		11.0	51.0	
Total Split (%)	36.3%	36.3%		36.3%	36.3%		50.0%	50.0%		13.8%	63.8%	
Maximum Green (s)	23.0	23.0		23.0	23.0		34.0	34.0		7.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		4.0	6.0	
Lead/Lag							Lag	Lag		Lead		
Lead-Lag Optimize?							Yes	Yes		Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		None	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0			7.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		13.0	13.0			13.0	
Pedestrian Calls (#/hr)	10	10		10	10		0	0			0	
Act Effct Green (s)	23.0	23.0		23.0	23.0		34.0	34.0		47.0	45.0	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.42	0.42		0.59	0.56	
v/c Ratio	0.97	0.46		0.18	0.39		0.96	0.34		0.37	0.57	
Control Delay	77.8	17.1		23.7	8.9		80.2	15.7		9.8	11.3	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	77.8	17.1		23.7	8.9		80.2	15.7		9.8	11.3	
LOS	E	B		C	A		F	B		A	B	
Approach Delay		49.1			11.5			33.2			11.1	
Approach LOS		D			B			C			B	
Queue Length 50th (m)	44.7	19.6		6.0	6.8		28.7	27.3		12.6	49.5	
Queue Length 95th (m)	#93.6	41.2		14.8	24.1		#71.0	39.1		22.1	67.3	
Internal Link Dist (m)		173.4			328.6			291.5			417.4	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	292	557		273	600		201	1520		513	1957	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.97	0.46		0.18	0.39		0.96	0.34		0.37	0.57	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 1 (1%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 23.9 Intersection LOS: C
Intersection Capacity Utilization 92.4% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 250: Banwell Road & Shields Street



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	33	608	570	25	18	5
Future Volume (Veh/h)	33	608	570	25	18	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	1216	1140	50	36	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1190				1880	570
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1190				1880	570
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				35	98
cM capacity (veh/h)	582				56	465

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	66	608	608	570	570	50	36	10
Volume Left	66	0	0	0	0	0	36	0
Volume Right	0	0	0	0	0	50	0	10
cSH	582	1700	1700	1700	1700	1700	56	465
Volume to Capacity	0.11	0.36	0.36	0.34	0.34	0.03	0.65	0.02
Queue Length 95th (m)	3.0	0.0	0.0	0.0	0.0	0.0	21.1	0.5
Control Delay (s)	12.0	0.0	0.0	0.0	0.0	0.0	148.6	12.9
Lane LOS	B						F	B
Approach Delay (s)	0.6			0.0			119.1	
Approach LOS							F	

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	4	48	43	5	52	28	468	41	57	454	84
Future Volume (vph)	95	4	48	43	5	52	28	468	41	57	454	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		75.0	75.0		75.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.862			0.863				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1606	0	1770	1608	0	1770	3539	1583	1770	3505	1583
Flt Permitted	0.684			0.690			0.286			0.275		
Satd. Flow (perm)	1274	1606	0	1285	1608	0	533	3539	1583	512	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		92			85				82			168
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		483.1			165.4			845.7			233.8	
Travel Time (s)		34.8			11.9			60.9			16.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	190	8	96	86	10	104	56	936	82	114	908	168
Shared Lane Traffic (%)												
Lane Group Flow (vph)	190	104	0	86	114	0	56	936	82	114	908	168
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	4	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		15.0	15.0	15.0	15.0	15.0	15.0
Minimum Split (s)	33.0	33.0		33.0	33.0		24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	36.0	36.0		36.0	36.0		46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	43.9%	43.9%		43.9%	43.9%		56.1%	56.1%	56.1%	56.1%	56.1%	56.1%
Maximum Green (s)	30.0	30.0		30.0	30.0		40.0	40.0	40.0	40.0	40.0	40.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0	0	0	0	0
Act Effct Green (s)	17.6	17.6		17.6	17.6		52.4	52.4	52.4	52.4	52.4	52.4
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.64	0.64	0.64	0.64	0.64	0.64
v/c Ratio	0.70	0.25		0.31	0.28		0.16	0.41	0.08	0.35	0.41	0.16
Control Delay	42.4	8.2		28.2	10.3		9.3	8.8	2.3	12.6	8.7	1.9

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.4	8.2		28.2	10.3		9.3	8.8	2.3	12.6	8.7	1.9
LOS	D	A		C	B		A	A	A	B	A	A
Approach Delay		30.3			18.0			8.3			8.1	
Approach LOS		C			B			A			A	
Queue Length 50th (m)	29.0	1.6		12.0	3.9		3.3	35.2	0.0	7.7	33.8	0.0
Queue Length 95th (m)	45.7	12.4		21.9	15.0		11.1	61.2	5.9	24.0	59.1	8.2
Internal Link Dist (m)		459.1			141.4			821.7			209.8	
Turn Bay Length (m)	75.0			75.0			75.0		75.0	75.0		75.0
Base Capacity (vph)	466	645		470	642		340	2262	1041	327	2240	1072
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.16		0.18	0.18		0.16	0.41	0.08	0.35	0.41	0.16

Intersection Summary

Area Type: Other

Cycle Length: 82

Actuated Cycle Length: 82

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

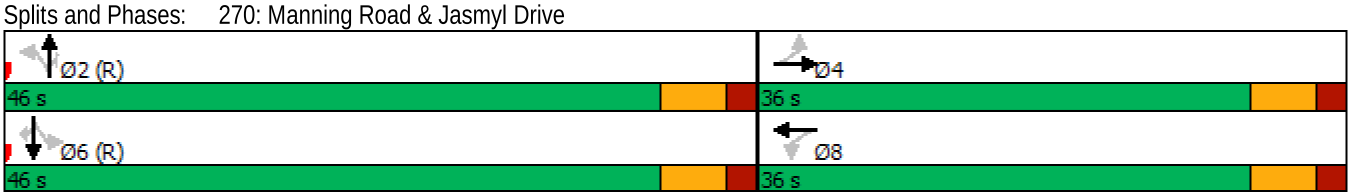
Maximum v/c Ratio: 0.70

Intersection Signal Delay: 11.3 Intersection LOS: B

Intersection Capacity Utilization 70.6% ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 270: Manning Road & Jasmyl Drive

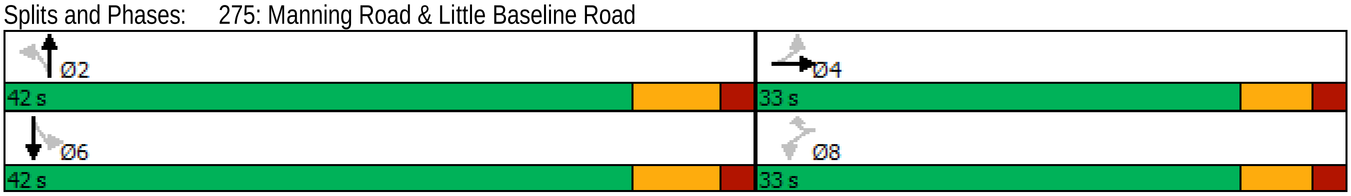


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	0	33	6	0	22	30	403	14	36	349	34
Future Volume (vph)	13	0	33	6	0	22	30	403	14	36	349	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.850				0.850		0.995			0.987	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1583	0	1770	0	1583	1770	3522	0	1770	3462	0
Flt Permitted	0.950			0.930			0.361			0.338		
Satd. Flow (perm)	1770	1583	0	1732	0	1583	672	3522	0	630	3462	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		152				58		6			18	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		158.8			143.8			278.0			845.7	
Travel Time (s)		11.4			10.4			20.0			60.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%
Adj. Flow (vph)	26	0	66	12	0	44	60	806	28	72	698	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	26	66	0	12	0	44	60	834	0	72	766	0
Turn Type	Perm	NA		Perm		Perm	Perm	NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8		8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0		7.0	20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		33.0		33.0	27.0	27.0		27.0	27.0	
Total Split (s)	33.0	33.0		33.0		33.0	42.0	42.0		42.0	42.0	
Total Split (%)	44.0%	44.0%		44.0%		44.0%	56.0%	56.0%		56.0%	56.0%	
Maximum Green (s)	27.0	27.0		27.0		27.0	35.0	35.0		35.0	35.0	
Yellow Time (s)	4.0	4.0		4.0		4.0	5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0		6.0	7.0	7.0		7.0	7.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None		None	Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0		20.0	10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0		0	0	
Act Effct Green (s)	7.0	7.0		7.0		7.0	28.5	28.5		28.5	28.5	
Actuated g/C Ratio	0.17	0.17		0.17		0.17	0.70	0.70		0.70	0.70	
v/c Ratio	0.09	0.17		0.04		0.14	0.13	0.34		0.16	0.32	
Control Delay	14.7	1.4		14.2		5.5	6.3	5.4		6.7	5.2	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0	
Total Delay	14.7	1.4		14.2		5.5	6.3	5.4		6.7	5.2	
LOS	B	A		B		A	A	A		A	A	
Approach Delay		5.1			7.4			5.5			5.3	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	1.6	0.0		0.7		0.0	2.1	17.7		2.6	15.6	
Queue Length 95th (m)	6.0	1.3		3.7		4.7	6.8	28.4		8.2	25.3	
Internal Link Dist (m)		134.8			119.8			254.0			821.7	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	1170	1098		1145		1066	621	3255		582	3200	
Starvation Cap Reductn	0	0		0		0	0	0		0	0	
Spillback Cap Reductn	0	0		0		0	0	0		0	0	
Storage Cap Reductn	0	0		0		0	0	0		0	0	
Reduced v/c Ratio	0.02	0.06		0.01		0.04	0.10	0.26		0.12	0.24	

Intersection Summary	
Area Type: Other	
Cycle Length: 75	
Actuated Cycle Length: 40.8	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.34	
Intersection Signal Delay: 5.5	Intersection LOS: A
Intersection Capacity Utilization 64.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 275: Manning Road & Little Baseline Road



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	32	44	53	400	341	47
Future Volume (Veh/h)	32	44	53	400	341	47
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	64	88	106	800	682	94
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					278	
pX, platoon unblocked						
vC, conflicting volume	1294	341	776			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1294	341	776			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	52	87	87			
cM capacity (veh/h)	135	655	836			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	152	106	400	400	341	341	94
Volume Left	64	106	0	0	0	0	0
Volume Right	88	0	0	0	0	0	94
cSH	249	836	1700	1700	1700	1700	1700
Volume to Capacity	0.61	0.13	0.24	0.24	0.20	0.20	0.06
Queue Length 95th (m)	28.9	3.5	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	39.7	9.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	A					
Approach Delay (s)	39.7	1.2			0.0		
Approach LOS	E						

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	14	15	22	439	358	27
Future Volume (Veh/h)	14	15	22	439	358	27
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	28	30	44	878	716	54
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1243	358	770			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1243	358	770			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	95	95			
cM capacity (veh/h)	158	638	840			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	58	44	439	439	358	358	54
Volume Left	28	44	0	0	0	0	0
Volume Right	30	0	0	0	0	0	54
cSH	258	840	1700	1700	1700	1700	1700
Volume to Capacity	0.22	0.05	0.26	0.26	0.21	0.21	0.03
Queue Length 95th (m)	6.7	1.3	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	22.9	9.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	22.9	0.5			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	189	503	82	56	679	40	69	279	57	82	217	193
Future Volume (vph)	189	503	82	56	679	40	69	279	57	82	217	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3312	1357	1421	3406	1583	2870	3195	1335	3367	3505	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3312	1357	1421	3406	1583	2870	3195	1335	3367	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164			116			115			386
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	9%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	378	1006	164	112	1358	80	138	558	114	164	434	386
Shared Lane Traffic (%)												
Lane Group Flow (vph)	378	1006	164	112	1358	80	138	558	114	164	434	386
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	25.0	67.0	67.0	20.0	62.0	62.0	15.0	38.0	38.0	15.0	38.0	
Total Split (%)	17.9%	47.9%	47.9%	14.3%	44.3%	44.3%	10.7%	27.1%	27.1%	10.7%	27.1%	
Maximum Green (s)	20.0	59.2	59.2	15.0	54.2	54.2	10.0	30.1	30.1	10.0	30.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	18.9	62.0	62.0	13.9	57.1	57.1	9.7	28.6	28.6	9.8	28.7	140.0
Actuated g/C Ratio	0.14	0.44	0.44	0.10	0.41	0.41	0.07	0.20	0.20	0.07	0.20	1.00
v/c Ratio	0.82	0.69	0.24	0.79	0.98	0.11	0.69	0.86	0.31	0.70	0.61	0.24
Control Delay	63.6	24.7	4.5	97.0	60.7	1.8	82.0	67.2	9.8	79.9	54.2	0.4

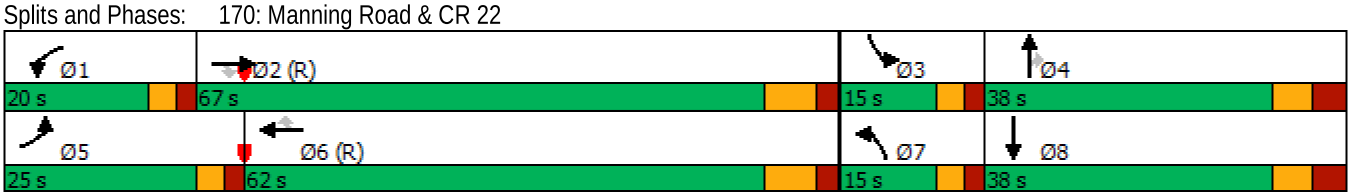
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.6	24.7	4.5	97.0	60.7	1.8	82.0	67.2	9.8	79.9	54.2	0.4
LOS	E	C	A	F	E	A	F	E	A	E	D	A
Approach Delay		32.0			60.3			61.6			37.4	
Approach LOS		C			E			E			D	
Queue Length 50th (m)	50.0	151.0	9.9	32.1	~222.3	0.0	20.5	82.2	0.0	24.4	60.2	0.0
Queue Length 95th (m)	m54.6	m164.3	m10.4	#62.8	#267.2	4.3	#34.1	105.0	16.5	#37.9	78.7	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	490	1466	692	152	1388	713	205	686	377	240	753	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.69	0.24	0.74	0.98	0.11	0.67	0.81	0.30	0.68	0.58	0.24

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 47.0 Intersection LOS: D
Intersection Capacity Utilization 92.2% ICU Level of Service F
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22



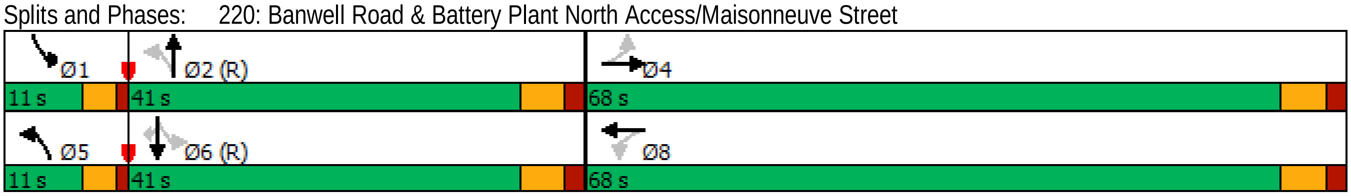
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	178	1	3	39	7	90	54	676	39	38	308	100
Future Volume (vph)	178	1	3	39	7	90	54	676	39	38	308	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.887			0.861			0.992				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1685	0	1805	1636	0	1805	5097	0	1805	5136	1615
Flt Permitted	0.590			0.752			0.372			0.110		
Satd. Flow (perm)	1121	1685	0	1429	1636	0	707	5097	0	209	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			180			7				200
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	356	2	6	78	14	180	108	1352	78	76	616	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	356	8	0	78	194	0	108	1430	0	76	616	200
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	68.0	68.0		68.0	68.0		11.0	41.0		11.0	41.0	41.0
Total Split (%)	56.7%	56.7%		56.7%	56.7%		9.2%	34.2%		9.2%	34.2%	34.2%
Maximum Green (s)	62.0	62.0		62.0	62.0		7.0	35.0		7.0	35.0	35.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	44.0	44.0		44.0	44.0		62.8	55.2		61.9	53.1	53.1
Actuated g/C Ratio	0.37	0.37		0.37	0.37		0.52	0.46		0.52	0.44	0.44
v/c Ratio	0.87	0.01		0.15	0.27		0.25	0.61		0.39	0.27	0.24
Control Delay	55.1	11.8		23.2	4.5		19.2	30.3		25.5	25.7	8.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	55.1	11.8		23.2	4.5		19.2	30.3		25.5	25.7	8.1
LOS	E	B		C	A		B	C		C	C	A
Approach Delay		54.1			9.8			29.5			21.7	
Approach LOS		D			A			C			C	
Queue Length 50th (m)	80.6	0.3		12.8	2.2		12.3	93.2		7.5	37.8	0.3
Queue Length 95th (m)	102.4	3.0		19.8	14.3		m26.2	m119.4		27.3	56.5	25.6
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	579	873		738	932		433	2347		201	2273	826
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.61	0.01		0.11	0.21		0.25	0.61		0.38	0.27	0.24

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 104 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 28.4 Intersection LOS: C
Intersection Capacity Utilization 82.0% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



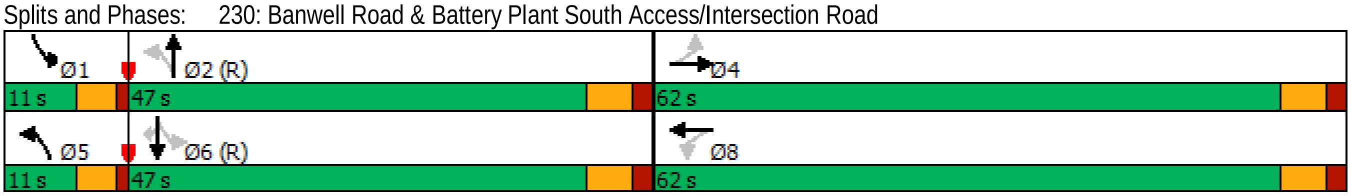
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	28	75	69	2	180	6	420	24	70	458	11
Future Volume (vph)	188	28	75	69	2	180	6	420	24	70	458	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.891			0.852			0.992				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1675	0	1787	1603	0	1805	5143	0	1787	3539	1615
Flt Permitted	0.441			0.601			0.183			0.206		
Satd. Flow (perm)	830	1675	0	1131	1603	0	348	5143	0	388	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		150			184			8				68
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	376	56	150	138	4	360	12	840	48	140	916	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	376	206	0	138	364	0	12	888	0	140	916	22
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.5	24.0		9.5	24.0	24.0
Total Split (s)	62.0	62.0		62.0	62.0		11.0	47.0		11.0	47.0	47.0
Total Split (%)	51.7%	51.7%		51.7%	51.7%		9.2%	39.2%		9.2%	39.2%	39.2%
Maximum Green (s)	56.0	56.0		56.0	56.0		6.5	41.0		6.5	41.0	41.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.5	4.0		3.5	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.5	6.0		4.5	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	55.1	55.1		55.1	55.1		49.4	41.9		52.7	48.6	48.6
Actuated g/C Ratio	0.46	0.46		0.46	0.46		0.41	0.35		0.44	0.40	0.40
v/c Ratio	0.99	0.24		0.27	0.44		0.06	0.49		0.57	0.64	0.03
Control Delay	76.3	6.5		21.4	11.8		19.2	31.7		30.5	25.4	0.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	76.3	6.5		21.4	11.8		19.2	31.7		30.5	25.4	0.3
LOS	E	A		C	B		B	C		C	C	A
Approach Delay		51.6			14.4			31.6			25.5	
Approach LOS		D			B			C			C	
Queue Length 50th (m)	88.7	7.5		20.3	26.9		1.6	63.2		12.1	48.5	0.0
Queue Length 95th (m)	#156.0	21.5		35.2	51.4		5.4	76.8		29.5	142.3	0.2
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	387	861		527	846		224	1801		245	1432	694
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.97	0.24		0.26	0.43		0.05	0.49		0.57	0.64	0.03

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 108 (90%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 30.4 Intersection LOS: C
Intersection Capacity Utilization 91.6% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



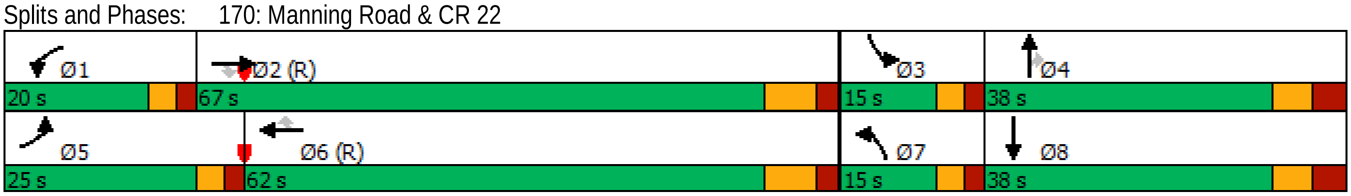
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	217	483	82	56	694	40	69	279	57	82	217	222
Future Volume (vph)	217	483	82	56	694	40	69	279	57	82	217	222
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3343	1357	1421	3406	1583	2870	3195	1335	3367	3505	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3343	1357	1421	3406	1583	2870	3195	1335	3367	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164			116			115			444
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	8%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	434	966	164	112	1388	80	138	558	114	164	434	444
Shared Lane Traffic (%)												
Lane Group Flow (vph)	434	966	164	112	1388	80	138	558	114	164	434	444
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	25.0	67.0	67.0	20.0	62.0	62.0	15.0	38.0	38.0	15.0	38.0	
Total Split (%)	17.9%	47.9%	47.9%	14.3%	44.3%	44.3%	10.7%	27.1%	27.1%	10.7%	27.1%	
Maximum Green (s)	20.0	59.2	59.2	15.0	54.2	54.2	10.0	30.1	30.1	10.0	30.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	19.7	62.0	62.0	13.9	56.2	56.2	9.7	28.6	28.6	9.8	28.7	140.0
Actuated g/C Ratio	0.14	0.44	0.44	0.10	0.40	0.40	0.07	0.20	0.20	0.07	0.20	1.00
v/c Ratio	0.90	0.65	0.24	0.79	1.02	0.11	0.69	0.86	0.31	0.70	0.61	0.28
Control Delay	67.1	23.5	4.4	97.0	69.6	1.8	82.0	67.2	9.8	79.9	54.2	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.1	23.5	4.4	97.0	69.6	1.8	82.0	67.2	9.8	79.9	54.2	0.4
LOS	E	C	A	F	E	A	F	E	A	E	D	A
Approach Delay		33.6			68.1			61.6			35.4	
Approach LOS		C			E			E			D	
Queue Length 50th (m)	59.6	142.6	9.8	32.1	~231.8	0.0	20.5	82.2	0.0	24.4	60.2	0.0
Queue Length 95th (m)	m64.9	m156.8	m10.3	#62.8	#276.7	4.3	#34.1	105.0	16.5	#37.9	78.7	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	490	1480	692	152	1367	704	205	686	377	240	753	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.65	0.24	0.74	1.02	0.11	0.67	0.81	0.30	0.68	0.58	0.28

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.02
Intersection Signal Delay: 49.4 Intersection LOS: D
Intersection Capacity Utilization 94.7% ICU Level of Service F
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	3	1	69	28	173	63	468	24	70	388	36
Future Volume (vph)	1	3	1	69	28	173	63	468	24	70	388	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.962			0.871			0.993				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1775	0	1787	1641	0	1805	5148	0	1787	3539	1615
Flt Permitted	0.169			0.752			0.321			0.258		
Satd. Flow (perm)	318	1775	0	1415	1641	0	610	5148	0	485	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			185			8				72
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	2	6	2	138	56	346	126	936	48	140	776	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	2	8	0	138	402	0	126	984	0	140	776	72
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.5	24.0		9.5	24.0	24.0
Total Split (s)	49.0	49.0		49.0	49.0		11.0	60.0		11.0	60.0	60.0
Total Split (%)	40.8%	40.8%		40.8%	40.8%		9.2%	50.0%		9.2%	50.0%	50.0%
Maximum Green (s)	43.0	43.0		43.0	43.0		7.0	54.0		7.0	54.0	54.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	23.6	23.6		23.6	23.6		82.4	73.6		82.4	73.6	73.6
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.69	0.61		0.69	0.61	0.61
v/c Ratio	0.03	0.02		0.50	0.85		0.26	0.31		0.34	0.36	0.07
Control Delay	34.0	29.1		47.0	41.2		8.0	12.5		10.0	7.3	0.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	34.0	29.1		47.0	41.2		8.0	12.5		10.0	7.3	0.5
LOS	C	C		D	D		A	B		B	A	A
Approach Delay		30.1			42.6			11.9			7.2	
Approach LOS		C			D			B			A	
Queue Length 50th (m)	0.4	1.2		30.8	54.6		8.3	39.7		5.3	20.8	0.0
Queue Length 95th (m)	2.6	4.9		45.3	83.3		20.4	62.4		17.0	34.5	1.1
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	113	637		507	706		489	3158		409	2170	1018
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.02	0.01		0.27	0.57		0.26	0.31		0.34	0.36	0.07

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

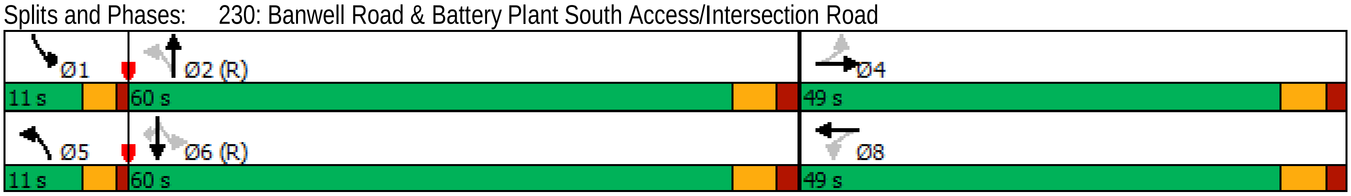
Maximum v/c Ratio: 0.85

Intersection Signal Delay: 16.5 Intersection LOS: B

Intersection Capacity Utilization 66.1% ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



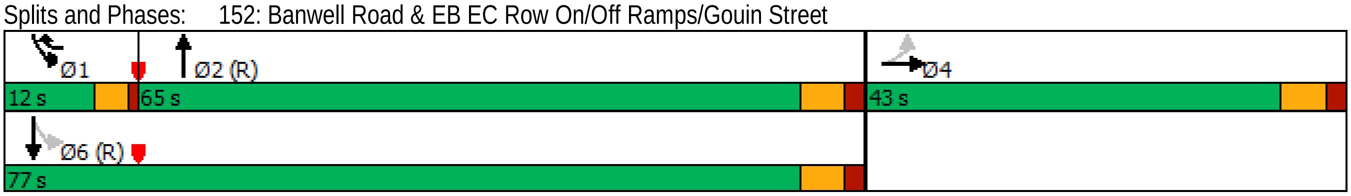
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	270	63	0	0	60	0	1111	25	57	556	173
Future Volume (vph)	325	270	63	0	0	60	0	1111	25	57	556	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		2	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.997				0.850
Flt Protected	0.950	0.984								0.950		
Satd. Flow (prot)	1643	3403	1615	0	0	1644	0	5171	0	1805	3610	1615
Flt Permitted	0.950	0.984								0.060		
Satd. Flow (perm)	1643	3403	1615	0	0	1644	0	5171	0	114	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			118			82		4				195
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	650	540	126	0	0	120	0	2222	50	114	1112	346
Shared Lane Traffic (%)	40%											
Lane Group Flow (vph)	390	800	126	0	0	120	0	2272	0	114	1112	346
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	43.0	43.0				12.0		65.0		12.0	77.0	
Total Split (%)	35.8%	35.8%				10.0%		54.2%		10.0%	64.2%	
Maximum Green (s)	37.0	37.0				8.0		59.0		8.0	71.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	33.9	33.9	120.0			7.6		62.5		76.1	74.1	120.0
Actuated g/C Ratio	0.28	0.28	1.00			0.06		0.52		0.63	0.62	1.00
v/c Ratio	0.84	0.83	0.08			0.67		0.84		0.64	0.50	0.21
Control Delay	57.2	48.6	0.1			38.9		18.9		33.8	11.4	0.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	57.2	48.6	0.1			38.9		18.9		33.8	11.4	0.3
LOS	E	D	A			D		B		C	B	A
Approach Delay		46.5			38.9			18.9			10.6	
Approach LOS		D			D			B			B	
Queue Length 50th (m)	97.3	99.6	0.0			9.2		99.1		15.3	78.8	0.0
Queue Length 95th (m)	#141.3	123.9	0.0			#33.3		136.3		#28.1	96.4	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	506	1049	1615			186		2696		185	2229	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.77	0.76	0.08			0.65		0.84		0.62	0.50	0.21

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 23.7 Intersection LOS: C
Intersection Capacity Utilization 87.4% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



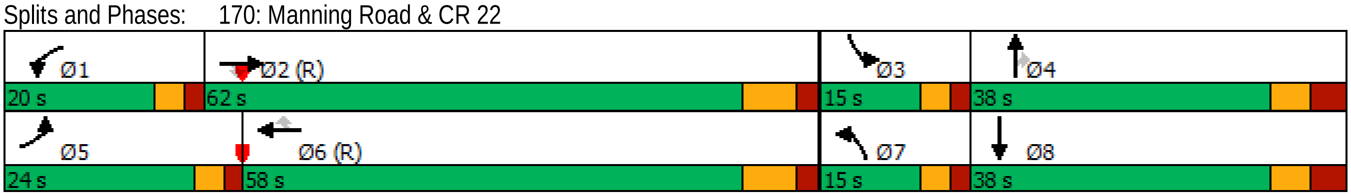
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	337	835	125	70	633	77	165	409	54	76	412	269
Future Volume (vph)	337	835	125	70	633	77	165	409	54	76	412	269
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	3438	1369	1421	3438	1599	3273	3574	1538	3433	3505	1599
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3467	3438	1369	1421	3438	1599	3273	3574	1538	3433	3505	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			250			154			120			364
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	5%	18%	27%	5%	1%	7%	1%	5%	2%	3%	1%
Adj. Flow (vph)	674	1670	250	140	1266	154	330	818	108	152	824	538
Shared Lane Traffic (%)												
Lane Group Flow (vph)	674	1670	250	140	1266	154	330	818	108	152	824	538
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	24.0	62.0	62.0	20.0	58.0	58.0	15.0	38.0	38.0	15.0	38.0	
Total Split (%)	17.8%	45.9%	45.9%	14.8%	43.0%	43.0%	11.1%	28.1%	28.1%	11.1%	28.1%	
Maximum Green (s)	19.0	54.2	54.2	15.0	50.2	50.2	10.0	30.1	30.1	10.0	30.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	19.0	54.4	54.4	14.8	50.2	50.2	10.0	30.5	30.5	9.6	30.1	135.0
Actuated g/C Ratio	0.14	0.40	0.40	0.11	0.37	0.37	0.07	0.23	0.23	0.07	0.22	1.00
v/c Ratio	1.38	1.21	0.36	0.90	0.99	0.22	1.36	1.01	0.25	0.62	1.06	0.34
Control Delay	221.5	117.0	2.5	109.5	65.1	5.0	233.1	86.7	7.0	72.5	97.6	0.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	221.5	117.0	2.5	109.5	65.1	5.0	233.1	86.7	7.0	72.5	97.6	0.6
LOS	F	F	A	F	E	A	F	F	A	E	F	A
Approach Delay		133.1			63.2			118.4			60.6	
Approach LOS		F			E			F			E	
Queue Length 50th (m)	~127.4	~304.7	9.8	39.4	184.8	0.0	~62.6	~128.6	0.0	21.7	~132.8	0.0
Queue Length 95th (m)	m57.3	m130.7	m2.0	#80.4	#236.5	14.6	#94.5	#170.6	12.8	33.7	#174.8	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	487	1385	701	157	1278	691	242	806	440	254	781	1599
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.38	1.21	0.36	0.89	0.99	0.22	1.36	1.01	0.25	0.60	1.06	0.34

Intersection Summary	
Area Type: Other	
Cycle Length: 135	
Actuated Cycle Length: 135	
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 150	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.38	
Intersection Signal Delay: 98.8	Intersection LOS: F
Intersection Capacity Utilization 107.8%	ICU Level of Service G
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Traffic Volume (vph)	142	50	78	25	29	88	96	236	23	94	403	155
Future Volume (vph)	142	50	78	25	29	88	96	236	23	94	403	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0		0.0	75.0		0.0	75.0		0.0	75.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.909			0.887			0.987			0.958	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1693	0	1770	1652	0	1770	3557	0	1770	3391	0
Flt Permitted	0.363			0.601			0.112			0.417		
Satd. Flow (perm)	676	1693	0	1120	1652	0	209	3557	0	777	3391	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		89			142			12			67	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		197.4			352.6			315.5			441.4	
Travel Time (s)		14.2			25.4			18.9			26.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	0%	2%	2%	2%	2%
Adj. Flow (vph)	284	100	156	50	58	176	192	472	46	188	806	310
Shared Lane Traffic (%)												
Lane Group Flow (vph)	284	256	0	50	234	0	192	518	0	188	1116	0
Turn Type	pm+pt	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	7 4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	7.0		7.0	7.0		7.0	10.0		7.0	10.0	
Minimum Split (s)	10.0	29.0		29.0	29.0		11.0	26.0		11.0	26.0	
Total Split (s)	14.0	43.0		29.0	29.0		11.0	46.0		11.0	46.0	
Total Split (%)	14.0%	43.0%		29.0%	29.0%		11.0%	46.0%		11.0%	46.0%	
Maximum Green (s)	9.0	37.0		23.0	23.0		7.0	40.0		7.0	40.0	
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	
Flash Dont Walk (s)		16.0		16.0	16.0			13.0			13.0	
Pedestrian Calls (#/hr)		10		10	10			0			0	
Act Effct Green (s)	36.4	35.4		21.4	21.4		51.3	41.6		50.0	40.9	
Actuated g/C Ratio	0.36	0.35		0.21	0.21		0.51	0.42		0.50	0.41	
v/c Ratio	0.83	0.39		0.21	0.50		0.85	0.35		0.41	0.78	
Control Delay	46.4	16.9		33.8	17.6		50.2	20.7		15.4	29.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	46.4	16.9		33.8	17.6		50.2	20.7		15.4	29.0	
LOS	D	B		C	B		D	C		B	C	
Approach Delay		32.4			20.4			28.7			27.0	
Approach LOS		C			C			C			C	
Queue Length 50th (m)	42.1	23.5		8.3	15.4		19.8	37.3		19.2	98.1	
Queue Length 95th (m)	#78.3	44.6		18.9	38.5		#62.4	51.0		31.8	125.7	
Internal Link Dist (m)		173.4			328.6			291.5			417.4	
Turn Bay Length (m)	75.0			75.0			75.0			75.0		
Base Capacity (vph)	355	682		257	489		227	1485		459	1427	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.80	0.38		0.19	0.48		0.85	0.35		0.41	0.78	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.85

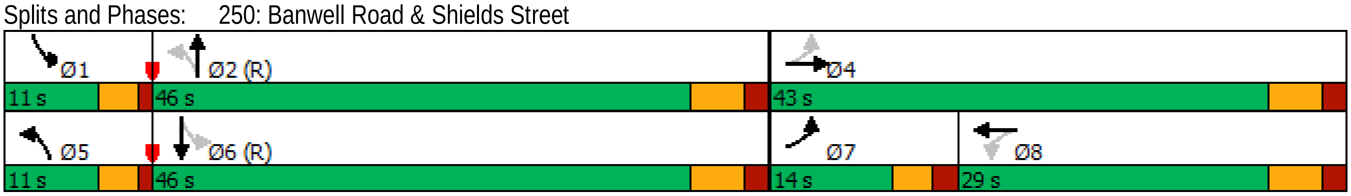
Intersection Signal Delay: 27.8 Intersection LOS: C

Intersection Capacity Utilization 89.9% ICU Level of Service E

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 250: Banwell Road & Shields Street



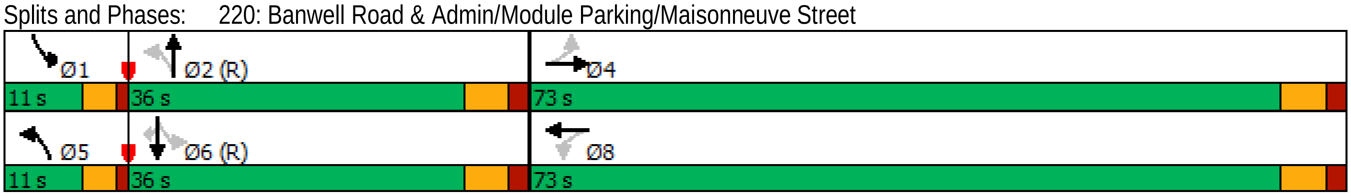
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	250	18	63	74	3	181	5	538	69	44	505	8
Future Volume (vph)	250	18	63	74	3	181	5	538	69	44	505	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.883			0.852			0.983				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1678	0	1805	1619	0	1805	5054	0	1805	5085	1615
Flt Permitted	0.480			0.654			0.180			0.116		
Satd. Flow (perm)	912	1678	0	1243	1619	0	342	5054	0	220	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		126			209			18				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	500	36	126	148	6	362	10	1076	138	88	1010	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	500	162	0	148	368	0	10	1214	0	88	1010	16
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	73.0	73.0		73.0	73.0		11.0	36.0		11.0	36.0	36.0
Total Split (%)	60.8%	60.8%		60.8%	60.8%		9.2%	30.0%		9.2%	30.0%	30.0%
Maximum Green (s)	67.0	67.0		67.0	67.0		7.0	30.0		7.0	30.0	30.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	66.7	66.7		66.7	66.7		38.4	30.4		42.5	39.1	39.1
Actuated g/C Ratio	0.56	0.56		0.56	0.56		0.32	0.25		0.35	0.33	0.33
v/c Ratio	0.99	0.16		0.21	0.37		0.05	0.94		0.52	0.61	0.03
Control Delay	64.4	4.0		14.4	7.0		23.6	55.6		46.4	31.9	1.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	64.4	4.0		14.4	7.0		23.6	55.6		46.4	31.9	1.1
LOS	E	A		B	A		C	E		D	C	A
Approach Delay		49.6			9.1			55.3			32.6	
Approach LOS		D			A			E			C	
Queue Length 50th (m)	115.7	3.8		17.6	18.4		1.7	108.2		12.5	48.9	0.0
Queue Length 95th (m)	#194.1	13.9		29.8	37.6		m4.2	#139.1		30.4	67.3	m0.2
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	509	992		694	996		197	1295		170	1658	569
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.98	0.16		0.21	0.37		0.05	0.94		0.52	0.61	0.03

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 40.3 Intersection LOS: D
Intersection Capacity Utilization 97.5% ICU Level of Service F
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Admin/Module Parking/Maisonneuve Street



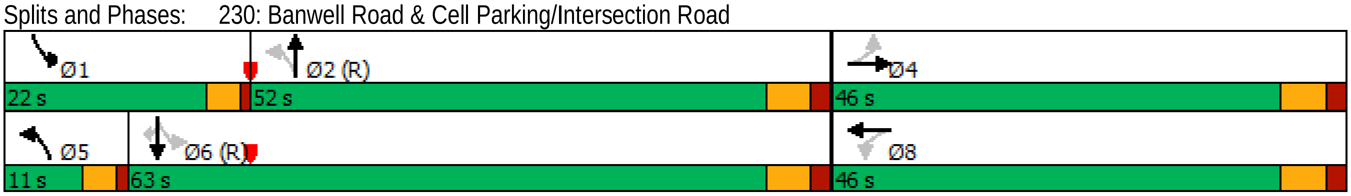
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	107	32	16	33	3	111	3	385	82	202	636	2
Future Volume (vph)	107	32	16	33	3	111	3	385	82	202	636	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.950			0.854			0.974				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1770	0	1787	1607	0	1805	4962	0	1787	3539	1615
Flt Permitted	0.475			0.695			0.194			0.230		
Satd. Flow (perm)	894	1770	0	1307	1607	0	369	4962	0	433	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			222			45				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	3%	0%	1%	0%	1%	0%	2%	1%	1%	2%	0%
Adj. Flow (vph)	214	64	32	66	6	222	6	770	164	404	1272	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	214	96	0	66	228	0	6	934	0	404	1272	4
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.5	24.0		9.5	24.0	24.0
Total Split (s)	46.0	46.0		46.0	46.0		11.0	52.0		22.0	63.0	63.0
Total Split (%)	38.3%	38.3%		38.3%	38.3%		9.2%	43.3%		18.3%	52.5%	52.5%
Maximum Green (s)	40.0	40.0		40.0	40.0		7.0	46.0		18.0	57.0	57.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	30.5	30.5		30.5	30.5		63.9	56.2		79.5	75.5	75.5
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.53	0.47		0.66	0.63	0.63
v/c Ratio	0.94	0.21		0.20	0.40		0.02	0.40		0.84	0.57	0.00
Control Delay	89.7	25.6		33.8	6.4		10.8	21.7		28.5	16.3	0.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	89.7	25.6		33.8	6.4		10.8	21.7		28.5	16.3	0.0
LOS	F	C		C	A		B	C		C	B	A
Approach Delay		69.9			12.5			21.7			19.2	
Approach LOS		E			B			C			B	
Queue Length 50th (m)	51.7	14.2		12.8	1.1		0.5	52.6		47.4	142.6	0.0
Queue Length 95th (m)	#83.6	25.8		22.8	18.7		2.5	73.6		#98.9	189.2	m0.0
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)							60.0			60.0		
Base Capacity (vph)	298	604		435	683		284	2346		490	2226	1039
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.72	0.16		0.15	0.33		0.02	0.40		0.82	0.57	0.00

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 54 (45%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 24.2 Intersection LOS: C
Intersection Capacity Utilization 85.2% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 230: Banwell Road & Cell Parking/Intersection Road



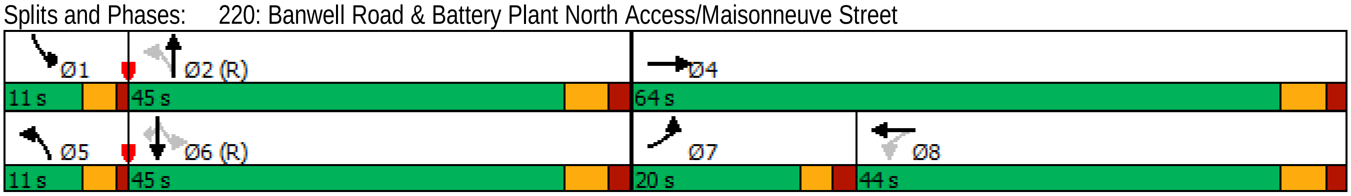
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	178	1	3	39	7	90	54	676	39	38	308	100
Future Volume (vph)	178	1	3	39	7	90	54	676	39	38	308	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	2		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.887			0.861			0.992				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3502	1685	0	1805	1636	0	1805	5097	0	1805	5136	1615
Flt Permitted	0.950			0.752			0.388			0.136		
Satd. Flow (perm)	3502	1685	0	1429	1636	0	737	5097	0	258	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			133			8				200
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	356	2	6	78	14	180	108	1352	78	76	616	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	356	8	0	78	194	0	108	1430	0	76	616	200
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	20.0	64.0		44.0	44.0		11.0	45.0		11.0	45.0	45.0
Total Split (%)	16.7%	53.3%		36.7%	36.7%		9.2%	37.5%		9.2%	37.5%	37.5%
Maximum Green (s)	15.0	58.0		38.0	38.0		7.0	39.0		7.0	39.0	39.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	14.7	31.8		12.1	12.1		75.1	67.5		74.0	65.4	65.4
Actuated g/C Ratio	0.12	0.26		0.10	0.10		0.63	0.56		0.62	0.54	0.54
v/c Ratio	0.83	0.02		0.54	0.68		0.21	0.50		0.31	0.22	0.21
Control Delay	68.7	19.2		64.1	29.9		8.2	15.4		10.6	13.2	2.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	68.7	19.2		64.1	29.9		8.2	15.4		10.6	13.2	2.5
LOS	E	B		E	C		A	B		B	B	A
Approach Delay		67.6			39.7			14.9			10.6	
Approach LOS		E			D			B			B	
Queue Length 50th (m)	44.9	0.4		18.7	14.4		9.9	69.7		5.5	27.6	0.3
Queue Length 95th (m)	#67.5	4.1		33.6	37.6		m17.4	91.8		12.4	35.2	11.2
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	437	817		452	608		523	2869		250	2798	970
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.81	0.01		0.17	0.32		0.21	0.50		0.30	0.22	0.21

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 22.1 Intersection LOS: C
Intersection Capacity Utilization 71.6% ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



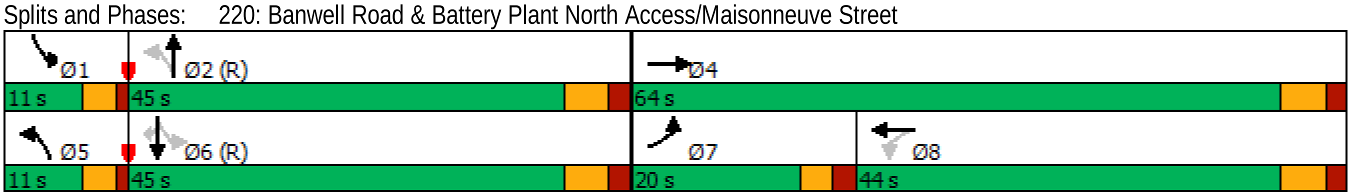
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	2	3	39	19	90	94	505	23	38	504	143
Future Volume (vph)	19	2	3	39	19	90	94	505	23	38	504	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	2		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.910			0.876			0.993				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3502	1729	0	1805	1664	0	1805	5102	0	1805	5136	1615
Flt Permitted	0.950			0.751			0.247			0.245		
Satd. Flow (perm)	3502	1729	0	1427	1664	0	469	5102	0	466	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			180			6				286
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	38	4	6	78	38	180	188	1010	46	76	1008	286
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	10	0	78	218	0	188	1056	0	76	1008	286
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	20.0	64.0		44.0	44.0		11.0	45.0		11.0	45.0	45.0
Total Split (%)	16.7%	53.3%		36.7%	36.7%		9.2%	37.5%		9.2%	37.5%	37.5%
Maximum Green (s)	15.0	58.0		38.0	38.0		7.0	39.0		7.0	39.0	39.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	6.8	19.4		11.9	11.9		87.6	80.0		86.1	77.6	77.6
Actuated g/C Ratio	0.06	0.16		0.10	0.10		0.73	0.67		0.72	0.65	0.65
v/c Ratio	0.19	0.04		0.55	0.67		0.45	0.31		0.19	0.30	0.25
Control Delay	55.9	24.7		65.1	22.0		11.9	7.3		6.6	9.5	2.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	55.9	24.7		65.1	22.0		11.9	7.3		6.6	9.5	2.4
LOS	E	C		E	C		B	A		A	A	A
Approach Delay		49.4			33.3			8.0			7.8	
Approach LOS		D			C			A			A	
Queue Length 50th (m)	4.7	0.8		18.7	8.8		10.0	30.1		3.8	25.0	0.0
Queue Length 95th (m)	10.5	5.3		33.9	33.1		24.8	34.3		11.5	46.1	14.8
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	437	838		451	649		420	3405		414	3322	1145
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.09	0.01		0.17	0.34		0.45	0.31		0.18	0.30	0.25

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 11.1 Intersection LOS: B
Intersection Capacity Utilization 59.5% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	250	18	63	74	3	181	5	538	69	44	505	8
Future Volume (vph)	250	18	63	74	3	181	5	538	69	44	505	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	2		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.883			0.852			0.983				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3502	1678	0	1805	1619	0	1805	5054	0	1805	5085	1615
Flt Permitted	0.950			0.654			0.238			0.127		
Satd. Flow (perm)	3502	1678	0	1243	1619	0	452	5054	0	241	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		126			132			19				109
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	500	36	126	148	6	362	10	1076	138	88	1010	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	500	162	0	148	368	0	10	1214	0	88	1010	16
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	42.0		42.0	42.0		11.0	24.0		9.5	24.0	24.0
Total Split (s)	26.0	68.0		42.0	42.0		11.0	41.0		11.0	41.0	41.0
Total Split (%)	21.7%	56.7%		35.0%	35.0%		9.2%	34.2%		9.2%	34.2%	34.2%
Maximum Green (s)	21.0	62.0		36.0	36.0		7.0	35.0		7.0	35.0	35.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	20.1	49.6		24.4	24.4		55.5	47.6		59.7	56.3	56.3
Actuated g/C Ratio	0.17	0.41		0.20	0.20		0.46	0.40		0.50	0.47	0.47
v/c Ratio	0.85	0.21		0.58	0.85		0.04	0.60		0.42	0.42	0.02
Control Delay	63.1	5.6		51.0	46.3		17.9	25.4		30.5	19.1	0.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	63.1	5.6		51.0	46.3		17.9	25.4		30.5	19.1	0.1
LOS	E	A		D	D		B	C		C	B	A
Approach Delay		49.0			47.6			25.3			19.7	
Approach LOS		D			D			C			B	
Queue Length 50th (m)	62.1	5.2		33.5	58.5		1.0	51.8		9.3	40.8	0.0
Queue Length 95th (m)	#86.2	15.5		49.7	86.0		m2.8	122.9		26.7	55.1	m0.0
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	612	927		372	578		292	2017		211	2384	815
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.82	0.17		0.40	0.64		0.03	0.60		0.42	0.42	0.02

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 100

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.85

Intersection Signal Delay: 31.3 Intersection LOS: C

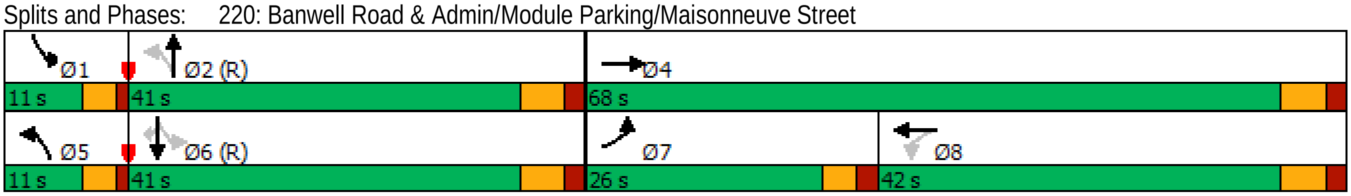
Intersection Capacity Utilization 83.2% ICU Level of Service E

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Admin/Module Parking/Maisonneuve Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	803	29	31	859	52	183	193	44	80	119	230
Future Volume (vph)	79	803	29	31	859	52	183	193	44	80	119	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.972				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1719	4940	1568	1687	4893	1468	1770	1801	0	1770	1845	1599
Flt Permitted	0.950			0.950			0.444			0.113		
Satd. Flow (perm)	1719	4940	1568	1687	4893	1468	827	1801	0	210	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88			104		7				196
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	5%	5%	3%	7%	6%	10%	2%	2%	5%	2%	3%	1%
Adj. Flow (vph)	158	1606	58	62	1718	104	366	386	88	160	238	460
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	1606	58	62	1718	104	366	474	0	160	238	460
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	20.0	71.0	71.0	20.0	71.0	71.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	14.3%	50.7%	50.7%	14.3%	50.7%	50.7%	9.3%	25.7%		9.3%	25.7%	25.7%
Maximum Green (s)	15.0	64.0	64.0	15.0	64.0	64.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	14.6	65.1	65.1	10.5	58.7	58.7	48.7	35.4		48.7	35.4	35.4
Actuated g/C Ratio	0.10	0.46	0.46	0.08	0.42	0.42	0.35	0.25		0.35	0.25	0.25
v/c Ratio	0.88	0.70	0.07	0.49	0.84	0.15	1.03	1.03		0.87	0.51	0.84
Control Delay	103.0	31.9	1.6	93.7	18.5	0.7	97.1	100.0		74.2	50.9	43.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	103.0	31.9	1.6	93.7	18.5	0.7	97.1	100.0		74.2	50.9	43.1
LOS	F	C	A	F	B	A	F	F		E	D	D
Approach Delay		37.1			20.0			98.7			51.1	
Approach LOS		D			B			F			D	
Queue Length 50th (m)	46.0	135.7	0.0	19.1	45.0	0.1	~91.9	~150.2		32.6	60.5	78.4
Queue Length 95th (m)	#87.6	153.1	3.5	m29.6	41.9	m0.9	#188.9	#239.6		#76.5	93.2	#151.1
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	184	2312	780	180	2236	727	355	460		184	466	550
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.86	0.69	0.07	0.34	0.77	0.14	1.03	1.03		0.87	0.51	0.84

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 47 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.03

Intersection Signal Delay: 42.9 Intersection LOS: D

Intersection Capacity Utilization 100.7% ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

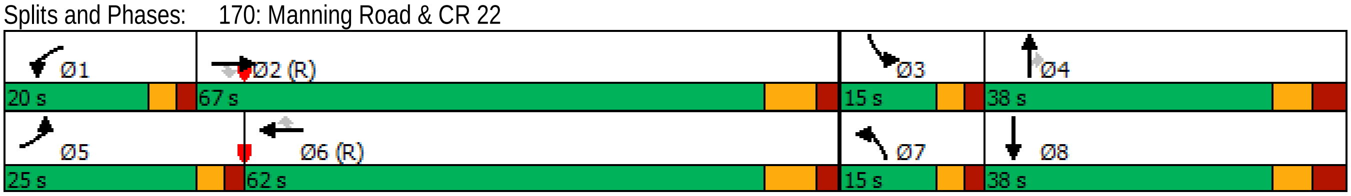
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	189	503	82	56	679	40	69	279	57	82	217	193
Future Volume (vph)	189	503	82	56	679	40	69	279	57	82	217	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	4759	1357	1421	4893	1583	2870	3195	1335	3367	3505	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	4759	1357	1421	4893	1583	2870	3195	1335	3367	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164			116			115			386
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	9%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	378	1006	164	112	1358	80	138	558	114	164	434	386
Shared Lane Traffic (%)												
Lane Group Flow (vph)	378	1006	164	112	1358	80	138	558	114	164	434	386
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	25.0	67.0	67.0	20.0	62.0	62.0	15.0	38.0	38.0	15.0	38.0	
Total Split (%)	17.9%	47.9%	47.9%	14.3%	44.3%	44.3%	10.7%	27.1%	27.1%	10.7%	27.1%	
Maximum Green (s)	20.0	59.2	59.2	15.0	54.2	54.2	10.0	30.1	30.1	10.0	30.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	18.9	62.0	62.0	13.9	57.1	57.1	9.7	28.6	28.6	9.8	28.7	140.0
Actuated g/C Ratio	0.14	0.44	0.44	0.10	0.41	0.41	0.07	0.20	0.20	0.07	0.20	1.00
v/c Ratio	0.82	0.48	0.24	0.79	0.68	0.11	0.69	0.86	0.31	0.70	0.61	0.24
Control Delay	54.4	24.0	8.6	97.0	36.7	1.8	82.0	67.2	9.8	79.9	54.2	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.4	24.0	8.6	97.0	36.7	1.8	82.0	67.2	9.8	79.9	54.2	0.4
LOS	D	C	A	F	D	A	F	E	A	E	D	A
Approach Delay		29.8			39.3			61.6			37.4	
Approach LOS		C			D			E			D	
Queue Length 50th (m)	43.3	98.0	22.4	32.1	122.0	0.0	20.5	82.2	0.0	24.4	60.2	0.0
Queue Length 95th (m)	m64.1	m110.7	m28.4	#62.8	140.4	4.3	#34.1	105.0	16.5	#37.9	78.7	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	490	2107	692	152	1994	713	205	686	377	240	753	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.48	0.24	0.74	0.68	0.11	0.67	0.81	0.30	0.68	0.58	0.24

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 39.6 Intersection LOS: D
Intersection Capacity Utilization 80.9% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	810	29	31	903	52	183	193	44	80	119	230
Future Volume (vph)	79	810	29	31	903	52	183	193	44	80	119	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.972				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1719	4940	1568	1687	4893	1468	1770	1801	0	1770	1845	1599
Flt Permitted	0.950			0.950			0.433			0.118		
Satd. Flow (perm)	1719	4940	1568	1687	4893	1468	807	1801	0	220	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88			100		7				195
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	5%	5%	3%	7%	6%	10%	2%	2%	5%	2%	3%	1%
Adj. Flow (vph)	158	1620	58	62	1806	104	366	386	88	160	238	460
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	1620	58	62	1806	104	366	474	0	160	238	460
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	20.0	71.0	71.0	20.0	71.0	71.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	14.3%	50.7%	50.7%	14.3%	50.7%	50.7%	9.3%	25.7%		9.3%	25.7%	25.7%
Maximum Green (s)	15.0	64.0	64.0	15.0	64.0	64.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	14.6	66.6	66.6	10.5	60.2	60.2	47.2	33.9		47.2	33.9	33.9
Actuated g/C Ratio	0.10	0.48	0.48	0.08	0.43	0.43	0.34	0.24		0.34	0.24	0.24
v/c Ratio	0.88	0.69	0.07	0.49	0.86	0.15	1.08	1.07		0.87	0.53	0.86
Control Delay	103.0	30.8	1.6	92.3	18.5	0.7	110.9	113.4		74.6	52.7	46.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	103.0	30.8	1.6	92.3	18.5	0.7	110.9	113.4		74.6	52.7	46.4
LOS	F	C	A	F	B	A	F	F		E	D	D
Approach Delay		36.1			19.9			112.3			53.4	
Approach LOS		D			B			F			D	
Queue Length 50th (m)	46.0	133.1	0.0	19.0	46.0	0.1	~101.2	~159.3		33.5	61.9	80.7
Queue Length 95th (m)	#87.6	154.9	3.5	m28.6	46.0	m0.8	#190.3	#239.6		#75.0	93.2	#151.6
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	184	2350	792	180	2236	725	340	441		184	446	534
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.86	0.69	0.07	0.34	0.81	0.14	1.08	1.07		0.87	0.53	0.86

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 47 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.08
Intersection Signal Delay: 44.6 Intersection LOS: D
Intersection Capacity Utilization 100.7% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	217	483	82	56	694	40	69	279	57	82	217	222
Future Volume (vph)	217	483	82	56	694	40	69	279	57	82	217	222
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	4759	1357	1421	4893	1583	2870	3195	1335	3367	3505	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	4759	1357	1421	4893	1583	2870	3195	1335	3367	3505	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164			116			115			444
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	2%	9%	19%	27%	6%	2%	22%	13%	21%	4%	3%	2%
Adj. Flow (vph)	434	966	164	112	1388	80	138	558	114	164	434	444
Shared Lane Traffic (%)												
Lane Group Flow (vph)	434	966	164	112	1388	80	138	558	114	164	434	444
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	25.0	67.0	67.0	20.0	62.0	62.0	15.0	38.0	38.0	15.0	38.0	
Total Split (%)	17.9%	47.9%	47.9%	14.3%	44.3%	44.3%	10.7%	27.1%	27.1%	10.7%	27.1%	
Maximum Green (s)	20.0	59.2	59.2	15.0	54.2	54.2	10.0	30.1	30.1	10.0	30.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	19.7	62.0	62.0	13.9	56.2	56.2	9.7	28.6	28.6	9.8	28.7	140.0
Actuated g/C Ratio	0.14	0.44	0.44	0.10	0.40	0.40	0.07	0.20	0.20	0.07	0.20	1.00
v/c Ratio	0.90	0.46	0.24	0.79	0.71	0.11	0.69	0.86	0.31	0.70	0.61	0.28
Control Delay	60.9	23.4	8.5	97.0	37.8	1.8	82.0	67.2	9.8	79.9	54.2	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.9	23.4	8.5	97.0	37.8	1.8	82.0	67.2	9.8	79.9	54.2	0.4
LOS	E	C	A	F	D	A	F	E	A	E	D	A
Approach Delay		32.2			40.2			61.6			35.4	
Approach LOS		C			D			E			D	
Queue Length 50th (m)	53.1	91.7	22.0	32.1	125.9	0.0	20.5	82.2	0.0	24.4	60.2	0.0
Queue Length 95th (m)	m#87.7	m105.8	m28.1	#62.8	144.4	4.3	#34.1	105.0	16.5	#37.9	78.7	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	490	2107	692	152	1965	704	205	686	377	240	753	1583
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.46	0.24	0.74	0.71	0.11	0.67	0.81	0.30	0.68	0.58	0.28

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 40.2 Intersection LOS: D

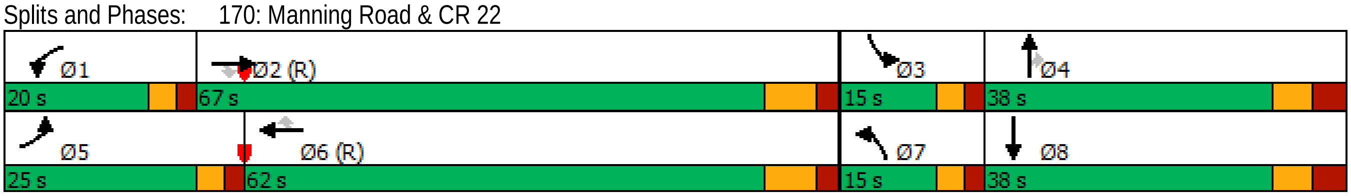
Intersection Capacity Utilization 83.1% ICU Level of Service E

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	237	1307	69	84	893	90	218	220	63	105	251	85
Future Volume (vph)	237	1307	69	84	893	90	218	220	63	105	251	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	165.0		100.0	125.0		100.0	30.0		0.0	90.0		30.0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.967				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	4893	1615	1787	4940	1599	1787	1801	0	1787	1863	1599
Flt Permitted	0.950			0.950			0.135			0.135		
Satd. Flow (perm)	1787	4893	1615	1787	4940	1599	254	1801	0	254	1863	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			99			156		10				137
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		652.0			157.3			282.1			193.5	
Travel Time (s)		29.3			7.1			20.3			13.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	6%	0%	1%	5%	1%	1%	2%	2%	1%	2%	1%
Adj. Flow (vph)	474	2614	138	168	1786	180	436	440	126	210	502	170
Shared Lane Traffic (%)												
Lane Group Flow (vph)	474	2614	138	168	1786	180	436	566	0	210	502	170
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6	8			4		4
Detector Phase	5	2	2	1	6	6	3	8		7	4	4
Switch Phase												
Minimum Initial (s)	9.0	50.0	50.0	5.0	45.0	45.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	14.0	57.0	57.0	10.0	52.0	52.0	8.0	35.3		8.0	35.3	35.3
Total Split (s)	30.0	71.0	71.0	15.0	56.0	56.0	13.0	36.0		13.0	36.0	36.0
Total Split (%)	22.2%	52.6%	52.6%	11.1%	41.5%	41.5%	9.6%	26.7%		9.6%	26.7%	26.7%
Maximum Green (s)	25.0	64.0	64.0	10.0	49.0	49.0	10.0	29.7		10.0	29.7	29.7
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.3		3.0	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	3.0		0.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0	3.0	6.3		3.0	6.3	6.3
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		22.0	22.0		22.0	22.0		22.0			22.0	22.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effct Green (s)	25.0	64.0	64.0	10.0	49.0	49.0	43.0	29.7		43.0	29.7	29.7
Actuated g/C Ratio	0.19	0.47	0.47	0.07	0.36	0.36	0.32	0.22		0.32	0.22	0.22
v/c Ratio	1.44	1.13	0.17	1.27	1.00	0.27	2.25	1.40		1.08	1.23	0.37
Control Delay	252.3	97.4	7.2	216.2	38.9	1.3	599.2	233.3		123.5	166.1	13.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	252.3	97.4	7.2	216.2	38.9	1.3	599.2	233.3		123.5	166.1	13.6
LOS	F	F	A	F	D	A	F	F		F	F	B
Approach Delay		116.3			49.7			392.5			126.6	
Approach LOS		F			D			F			F	
Queue Length 50th (m)	~179.7	~310.2	5.8	~60.5	171.6	0.9	~180.8	~211.1		~47.1	~173.0	7.4
Queue Length 95th (m)	#249.0	#337.7	17.9	m#83.1	#217.6	m1.1	#249.4	#285.0		#100.4	#243.5	28.2
Internal Link Dist (m)		628.0			133.3			258.1			169.5	
Turn Bay Length (m)	165.0		100.0	125.0		100.0	30.0			90.0		30.0
Base Capacity (vph)	330	2319	817	132	1793	679	194	404		194	409	458
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	1.44	1.13	0.17	1.27	1.00	0.27	2.25	1.40		1.08	1.23	0.37

Intersection Summary

Area Type: Other
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 65 (48%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 2.25
Intersection Signal Delay: 136.1 Intersection LOS: F
Intersection Capacity Utilization 132.9% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 165: Lesperance Road & CR 22

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	337	835	125	70	633	77	165	409	54	76	412	269
Future Volume (vph)	337	835	125	70	633	77	165	409	54	76	412	269
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	275.0		250.0	290.0		275.0	65.0		0.0	65.0		0.0
Storage Lanes	2		1	1		1	2		1	2		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	4940	1369	1421	4940	1599	3273	3574	1538	3433	3505	1599
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3467	4940	1369	1421	4940	1599	3273	3574	1538	3433	3505	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			250			161			160			364
Link Speed (k/h)		80			80			50			50	
Link Distance (m)		1130.8			736.6			176.0			255.4	
Travel Time (s)		50.9			33.1			12.7			18.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	5%	18%	27%	5%	1%	7%	1%	5%	2%	3%	1%
Adj. Flow (vph)	674	1670	250	140	1266	154	330	818	108	152	824	538
Shared Lane Traffic (%)												
Lane Group Flow (vph)	674	1670	250	140	1266	154	330	818	108	152	824	538
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Free
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			Free
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	7.0	30.0	30.0	7.0	30.0	30.0	7.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	12.0	37.8	37.8	12.0	37.8	37.8	12.0	27.9	27.9	12.0	27.9	
Total Split (s)	30.0	57.0	57.0	20.0	47.0	47.0	20.0	43.0	43.0	15.0	38.0	
Total Split (%)	22.2%	42.2%	42.2%	14.8%	34.8%	34.8%	14.8%	31.9%	31.9%	11.1%	28.1%	
Maximum Green (s)	25.0	49.2	49.2	15.0	39.2	39.2	15.0	35.1	35.1	10.0	30.1	
Yellow Time (s)	3.0	5.4	5.4	3.0	5.4	5.4	3.0	4.1	4.1	3.0	4.1	
All-Red Time (s)	2.0	2.4	2.4	2.0	2.4	2.4	2.0	3.8	3.8	2.0	3.8	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	7.8	7.8	5.0	7.8	7.8	5.0	7.9	7.9	5.0	7.9	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		11.0	11.0		11.0	11.0		11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	25.0	49.4	49.4	14.8	39.2	39.2	15.0	35.5	35.5	9.6	30.1	135.0
Actuated g/C Ratio	0.19	0.37	0.37	0.11	0.29	0.29	0.11	0.26	0.26	0.07	0.22	1.00
v/c Ratio	1.05	0.92	0.38	0.90	0.88	0.27	0.91	0.87	0.21	0.62	1.06	0.34
Control Delay	87.8	18.5	1.4	109.5	54.1	5.8	88.2	58.8	2.1	72.5	97.6	0.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.8	18.5	1.4	109.5	54.1	5.8	88.2	58.8	2.1	72.5	97.6	0.6
LOS	F	B	A	F	D	A	F	E	A	E	F	A
Approach Delay		34.8			54.3			61.7			60.6	
Approach LOS		C			D			E			E	
Queue Length 50th (m)	~103.6	133.1	6.3	39.4	124.5	0.0	47.9	116.4	0.0	21.7	~132.8	0.0
Queue Length 95th (m)	m77.5	m97.8	m4.5	#80.4	144.4	15.0	#76.3	#150.3	3.4	33.7	#174.8	0.0
Internal Link Dist (m)		1106.8			712.6			152.0			231.4	
Turn Bay Length (m)	275.0		250.0	290.0		275.0	65.0			65.0		
Base Capacity (vph)	642	1807	659	157	1434	578	363	939	522	254	781	1599
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.92	0.38	0.89	0.88	0.27	0.91	0.87	0.21	0.60	1.06	0.34

Intersection Summary

Area Type: Other
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 49.7 — Intersection LOS: D
Intersection Capacity Utilization 97.8% — ICU Level of Service F
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 170: Manning Road & CR 22

LANE SUMMARY

Site: 101 [North Ramp Terminal TF 2037 Early AM - with N-W ramp (Site Folder: General)]

Banwell Road EC ROW Interchange
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Banwell Road													
Lane 1	470	2.0	1605	0.293	100	2.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2[d]	574	2.0	1961	0.293	100	2.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1044	2.0		0.293		2.8	LOS A	0.0	0.0				
East: E-N/S Ramp													
Lane 1[d]	273	2.0	1136	0.241	100	11.9	LOS B	1.1	7.6	Full	500	0.0	0.0
Lane 2	72	2.0	768	0.094	100	6.5	LOS A	0.4	2.6	Full	500	0.0	0.0
Approach	346	2.0		0.241		10.7	LOS B	1.1	7.6				
North: Banwell Road													
Lane 1	716	2.0	1278	0.560	100	4.7	LOS A	4.6	32.7	Full	500	0.0	0.0
Lane 2[d]	924	2.0	1649	0.560	100	4.3	LOS A	4.9	34.7	Full	500	0.0	0.0
Approach	1640	2.0		0.560		4.5	LOS A	4.9	34.7				
Intersection	3030	2.0		0.560		4.6	LOS A	4.9	34.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Banwell Road

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	1	469	470	2.0	1605	0.293	100	NA	NA
Lane 2	-	574	574	2.0	1961	0.293	100	NA	NA
Approach	1	1043	1044	2.0		0.293			

East: E-N/S Ramp

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	272	1	-	273	2.0	1136	0.241	100	NA	NA
Lane 2	-	-	72	72	2.0	768	0.094	100	NA	NA

Approach	272	1	72	346	2.0		0.241			

North: Banwell Road									
Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	716	-	716	2.0	1278	0.560	100	NA	NA
Lane 2	292	632	924	2.0	1649	0.560	100	NA	NA
Approach	1009	632	1640	2.0		0.560			

	Total	%HV	Deg.Satn (v/c)
Intersection	3030	2.0	0.560

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Banwell Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Banwell Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: N-W Ramp Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [North Ramp Terminal TF 2037 Late AM - with N-W ramp (Site Folder: General)]

Banwell Road EC ROW Interchange
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Banwell Road													
Lane 1	410	2.0	1605	0.256	100	2.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2[d]	501	2.0	1961	0.256	100	2.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	912	2.0		0.256		2.8	LOS A	0.0	0.0				
East: E-N/S Ramp													
Lane 1[d]	329	2.0	1168	0.281	100	11.7	LOS B	1.3	9.0	Full	500	0.0	0.0
Lane 2	72	2.0	771	0.094	100	6.3	LOS A	0.4	2.5	Full	500	0.0	0.0
Approach	401	2.0		0.281		10.7	LOS B	1.3	9.0				
North: Banwell Road													
Lane 1	754	2.0	1227	0.615	100	5.6	LOS A	5.7	40.4	Full	500	0.0	0.0
Lane 2[d]	984	2.0	1602	0.615	100	4.7	LOS A	5.6	40.2	Full	500	0.0	0.0
Approach	1738	2.0		0.615		5.0	LOS A	5.7	40.4				
Intersection	3051	2.0		0.615		5.1	LOS A	5.7	40.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Banwell Road

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	1	409	410	2.0	1605	0.256	100	NA	NA
Lane 2	-	501	501	2.0	1961	0.256	100	NA	NA
Approach	1	911	912	2.0		0.256			

East: E-N/S Ramp

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	328	1	-	329	2.0	1168	0.281	100	NA	NA
Lane 2	-	-	72	72	2.0	771	0.094	100	NA	NA

Approach	328	1	72	401	2.0		0.281			

North: Banwell Road

Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	754	-	754	2.0	1227	0.615	100	NA	NA
Lane 2	353	632	984	2.0	1602	0.615	100	NA	NA
Approach	1107	632	1738	2.0		0.615			

	Total	%HV	Deg.Satn (v/c)
Intersection	3051	2.0	0.615

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Banwell Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Banwell Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: N-W Ramp Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [North Ramp Terminal TF 2037 Early PM - with N-W ramp (Site Folder: General)]

Banwell Road EC ROW Interchange
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Banwell Road													
Lane 1	602	2.0	1605	0.375	100	2.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2[d]	735	2.0	1961	0.375	100	2.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1337	2.0		0.375		2.7	LOS A	0.0	0.0				
East: E-N/S Ramp													
Lane 1[d]	271	2.0	1068	0.254	100	12.6	LOS B	1.2	8.4	Full	500	0.0	0.0
Lane 2	196	2.0	746	0.263	100	7.7	LOS A	1.1	8.0	Full	500	0.0	0.0
Approach	467	2.0		0.263		10.5	LOS B	1.2	8.4				
North: Banwell Road													
Lane 1	715	2.0	1275	0.561	100	4.7	LOS A	4.7	33.2	Full	500	0.0	0.0
Lane 2[d]	922	2.0	1645	0.561	100	4.3	LOS A	5.0	35.3	Full	500	0.0	0.0
Approach	1637	2.0		0.561		4.5	LOS A	5.0	35.3				
Intersection	3441	2.0		0.561		4.6	LOS A	5.0	35.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Banwell Road

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	1	601	602	2.0	1605	0.375	100	NA	NA
Lane 2	-	735	735	2.0	1961	0.375	100	NA	NA
Approach	1	1336	1337	2.0		0.375			

East: E-N/S Ramp

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	270	1	-	271	2.0	1068	0.254	100	NA	NA
Lane 2	-	-	196	196	2.0	746	0.263	100	NA	NA

Approach	270	1	196	467	2.0		0.263			

North: Banwell Road									
Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	715	-	715	2.0	1275	0.561	100	NA	NA
Lane 2	661	261	922	2.0	1645	0.561	100	NA	NA
Approach	1376	261	1637	2.0		0.561			

	Total	%HV	Deg.Satn (v/c)
Intersection	3441	2.0	0.561

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Banwell Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Banwell Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: N-W Ramp Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [CR 42 and 43 TF 2037 AM Early (Site Folder: General)]

Twin Oaks
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Manning Road													
Lane 1[d]	131	0.0	925	0.142	100	10.1	LOS B	0.8	5.6	Full	500	0.0	0.0
Lane 2	99	0.0	697	0.142	100	4.9	LOS A	0.7	4.6	Full	500	0.0	0.0
Approach	230	0.0		0.142		7.9	LOS A	0.8	5.6				
East: CR 42													
Lane 1	619	2.6	1113	0.556	100	5.8	LOS A	4.1	29.5	Full	500	0.0	0.0
Lane 2[d]	751	2.3	1350	0.556	100	4.3	LOS A	4.1	29.1	Full	500	0.0	0.0
Approach	1370	2.4		0.556		5.0	LOS A	4.1	29.5				
North: Manning Road													
Lane 1	580	4.0	715	0.812	100	19.5	LOS B	7.5	54.4	Full	500	0.0	0.0
Lane 2[d]	637	1.7	1003	0.635	78[5]	7.4	LOS A	5.0	35.6	Full	500	0.0	0.0
Approach	1217	2.8		0.812		13.1	LOS B	7.5	54.4				
West: CR 42													
Lane 1	370	2.5	858	0.431	100	9.1	LOS A	2.7	19.1	Full	500	0.0	0.0
Lane 2[d]	468	3.5	1085	0.431	100	4.8	LOS A	2.9	20.7	Full	500	0.0	0.0
Approach	838	3.1		0.431		6.7	LOS A	2.9	20.7				
Intersection	3656	2.5		0.812		8.3	LOS A	7.5	54.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane under-utilisation found by the program
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Manning Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	123	8	-	131	0.0	925	0.142	100	NA	NA
Lane 2	-	46	53	99	0.0	697	0.142	100	NA	NA
Approach	123	53	53	230	0.0		0.142			

East: CR 42

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	89	530	-	619	2.6	1113	0.556	100	NA	NA
Lane 2	-	485	266	751	2.3	1350	0.556	100	NA	NA
Approach	89	1015	266	1370	2.4		0.556			
North: Manning Road										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	580	-	-	580	4.0	715	0.812	100	NA	NA
Lane 2	-	83	554	637	1.7	1003	0.635	78 [5]	NA	NA
Approach	580	83	554	1217	2.8		0.812			
West: CR 42										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	187	183	-	370	2.5	858	0.431	100	NA	NA
Lane 2	-	413	55	468	3.5	1085	0.431	100	NA	NA
Approach	187	596	55	838	3.1		0.431			

	Total	%HV	Deg.Satn (v/c)
Intersection	3656	2.5	0.812

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
East Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [CR 42 and 43 TF 2037 AM Late (Site Folder: General)]

Twin Oaks
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Manning Road													
Lane 1[d]	131	0.0	969	0.135	100	9.6	LOS A	0.7	5.0	Full	500	0.0	0.0
Lane 2	99	0.0	731	0.135	100	4.4	LOS A	0.6	4.2	Full	500	0.0	0.0
Approach	230	0.0		0.135		7.4	LOS A	0.7	5.0				
East: CR 42													
Lane 1	658	2.6	1012	0.650	100	7.8	LOS A	6.0	43.1	Full	500	0.0	0.0
Lane 2[d]	814	2.1	1252	0.650	100	6.0	LOS A	6.2	44.2	Full	500	0.0	0.0
Approach	1472	2.3		0.650		6.8	LOS A	6.2	44.2				
North: Manning Road													
Lane 1	437	1.0	679	0.643	100	15.9	LOS B	4.6	32.3	Full	500	0.0	0.0
Lane 2[d]	470	1.6	933	0.503	78[5]	6.4	LOS A	3.5	24.9	Full	500	0.0	0.0
Approach	907	1.3		0.643		11.0	LOS B	4.6	32.3				
West: CR 42													
Lane 1	430	1.9	978	0.439	100	9.8	LOS A	2.6	18.3	Full	500	0.0	0.0
Lane 2[d]	528	3.6	1202	0.439	100	4.1	LOS A	2.7	19.5	Full	500	0.0	0.0
Approach	957	2.8		0.439		6.7	LOS A	2.7	19.5				
Intersection	3566	2.1		0.650		7.9	LOS A	6.2	44.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane under-utilisation found by the program
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Manning Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	123	8	-	131	0.0	969	0.135	100	NA	NA
Lane 2	-	46	53	99	0.0	731	0.135	100	NA	NA
Approach	123	53	53	230	0.0		0.135			

East: CR 42

Mov.	L2	T1	R2	Total	%HV	Deg.	Lane	Prob.	Ov.

From E To Exit:	S	W	N			Cap. veh/h	Satn v/c	Util. %	SL Ov. %	Lane No.
Lane 1	89	569	-	658	2.6	1012	0.650	100	NA	NA
Lane 2	-	446	368	814	2.1	1252	0.650	100	NA	NA
Approach	89	1015	368	1472	2.3		0.650			

North: Manning Road

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	437	-	-	437	1.0	679	0.643	100	NA	NA
Lane 2	-	83	387	470	1.6	933	0.503	78[5]	NA	NA
Approach	437	83	387	907	1.3		0.643			

West: CR 42

Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	306	123	-	430	1.9	978	0.439	100	NA	NA
Lane 2	-	473	55	528	3.6	1202	0.439	100	NA	NA
Approach	306	596	55	957	2.8		0.439			

	Total	%HV	Deg.Satn (v/c)
Intersection	3566	2.1	0.650

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
East Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [CR 42 and 43 TF 2037 PM (Site Folder: General)]

Twin Oaks
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Manning Road													
Lane 1	96	0.0	518	0.185	100	9.8	LOS A	0.9	6.3	Full	500	0.0	0.0
Lane 2[d]	129	0.0	698	0.185	100	6.2	LOS A	1.2	8.1	Full	500	0.0	0.0
Approach	226	0.0		0.185		7.7	LOS A	1.2	8.1				
East: CR 42													
Lane 1	543	3.6	975	0.557	100	6.7	LOS A	4.4	31.6	Full	500	0.0	0.0
Lane 2[d]	680	1.8	1220	0.557	100	5.4	LOS A	4.5	32.2	Full	500	0.0	0.0
Approach	1223	2.6		0.557		6.0	LOS A	4.5	32.2				
North: Manning Road													
Lane 1	359	5.0	876	0.410	100	12.3	LOS B	2.3	16.5	Full	500	0.0	0.0
Lane 2[d]	439	3.4	1130	0.389	95[5]	4.8	LOS A	2.2	16.2	Full	500	0.0	0.0
Approach	798	4.1		0.410		8.2	LOS A	2.3	16.5				
West: CR 42													
Lane 1	718	2.0	1081	0.665	100	9.3	LOS A	5.6	39.8	Full	500	0.0	0.0
Lane 2[d]	873	2.6	1313	0.665	100	5.0	LOS A	5.8	41.5	Full	500	0.0	0.0
Approach	1591	2.3		0.665		7.0	LOS A	5.8	41.5				
Intersection	3838	2.6		0.665		6.9	LOS A	5.8	41.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane under-utilisation found by the program
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Manning Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	55	41	-	96	0.0	518	0.185	100	NA	NA
Lane 2	-	42	87	129	0.0	698	0.185	100	NA	NA
Approach	55	83	87	226	0.0		0.185			

East: CR 42

Mov.	L2	T1	R2	Total	%HV		Deg.	Lane	Prob.	Ov.

From E To Exit:	S	W	N			Cap. veh/h	Satn v/c	Util. %	SL Ov. %	Lane No.
Lane 1	53	490	-	543	3.6	975	0.557	100	NA	NA
Lane 2	-	176	504	680	1.8	1220	0.557	100	NA	NA
Approach	53	666	504	1223	2.6		0.557			
North: Manning Road										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	359	-	-	359	5.0	876	0.410	100	NA	NA
Lane 2	-	61	378	439	3.4	1130	0.389	95[5]	NA	NA
Approach	359	61	378	798	4.1		0.410			
West: CR 42										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	363	355	-	718	2.0	1081	0.665	100	NA	NA
Lane 2	-	747	126	873	2.6	1313	0.665	100	NA	NA
Approach	363	1102	126	1591	2.3		0.665			

	Total	%HV	Deg.Satn (v/c)
Intersection	3838	2.6	0.665

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
East Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [CR 42 and Manning TF 2037 AM Early (Site Folder: General)]

Twin Oaks
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Manning Road													
Lane 1	375	3.0	715	0.525	100	11.5	LOS B	3.2	23.3	Full	500	0.0	0.0
Lane 2[d]	497	2.0	948	0.525	100	4.4	LOS A	3.8	26.9	Full	500	0.0	0.0
Approach	872	2.4		0.525		7.5	LOS A	3.8	26.9				
East: CR 42													
Lane 1	468	2.0	787	0.595	100	9.7	LOS A	4.4	31.0	Full	500	0.0	0.0
Lane 2[d]	619	2.0	1041	0.595	100	6.2	LOS A	4.7	33.6	Full	500	0.0	0.0
Approach	1087	2.0		0.595		7.7	LOS A	4.7	33.6				
North: Manning Road													
Lane 1	426	2.0	689	0.618	100	11.6	LOS B	4.4	31.1	Full	500	0.0	0.0
Lane 2[d]	585	2.0	946	0.618	100	7.7	LOS A	5.1	36.0	Full	500	0.0	0.0
Approach	1011	2.0		0.618		9.3	LOS A	5.1	36.0				
West: CR 42													
Lane 1	612	2.0	839	0.730	100	9.1	LOS A	6.2	43.8	Full	500	0.0	0.0
Lane 2[d]	788	4.1	1079	0.730	100	7.1	LOS A	6.8	49.0	Full	500	0.0	0.0
Approach	1400	3.2		0.730		8.0	LOS A	6.8	49.0				
Intersection	4370	2.5		0.730		8.1	LOS A	6.8	49.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Manning Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	362	13	-	375	3.0	715	0.525	100	NA	NA
Lane 2	-	357	140	497	2.0	948	0.525	100	NA	NA
Approach	362	370	140	872	2.4		0.525			

East: CR 42

Mov.	L2	T1	R2	Total	%HV	Deg.	Lane	Prob.	Ov.

From E To Exit:	 S	 W	 N			Cap. veh/h	Satn v/c	Util. %	SL Ov. %	Lane No.
Lane 1	149	319	-	468	2.0	787	0.595	100	NA	NA
Lane 2	-	387	232	619	2.0	1041	0.595	100	NA	NA
Approach	149	706	232	1087	2.0		0.595			
North: Manning Road										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	161	265	-	426	2.0	689	0.618	100	NA	NA
Lane 2	-	307	278	585	2.0	946	0.618	100	NA	NA
Approach	161	572	278	1011	2.0		0.618			
West: CR 42										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	89	523	-	612	2.0	839	0.730	100	NA	NA
Lane 2	-	381	406	788	4.1	1079	0.730	100	NA	NA
Approach	89	904	406	1400	3.2		0.730			

	Total	%HV	Deg.Satn (v/c)
Intersection	4370	2.5	0.730

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
East Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [CR 42 and Manning TF 2037 AM Late (Site Folder: General)]

Twin Oaks
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Manning Road													
Lane 1	426	4.0	759	0.561	100	11.6	LOS B	3.5	25.4	Full	500	0.0	0.0
Lane 2[d]	511	2.0	1009	0.506	90[5]	3.9	LOS A	3.4	24.4	Full	500	0.0	0.0
Approach	936	2.9		0.561		7.4	LOS A	3.5	25.4				
East: CR 42													
Lane 1	481	2.0	753	0.639	100	10.6	LOS B	4.9	35.2	Full	500	0.0	0.0
Lane 2[d]	644	2.0	1008	0.639	100	6.9	LOS A	5.4	38.6	Full	500	0.0	0.0
Approach	1126	2.0		0.639		8.5	LOS A	5.4	38.6				
North: Manning Road													
Lane 1	424	2.0	638	0.665	100	13.4	LOS B	5.0	35.7	Full	500	0.0	0.0
Lane 2[d]	587	2.0	883	0.665	100	9.3	LOS A	5.9	42.4	Full	500	0.0	0.0
Approach	1011	2.0		0.665		11.0	LOS B	5.9	42.4				
West: CR 42													
Lane 1	547	2.0	831	0.658	100	8.3	LOS A	4.9	35.2	Full	500	0.0	0.0
Lane 2[d]	711	2.4	1080	0.658	100	6.2	LOS A	5.4	38.9	Full	500	0.0	0.0
Approach	1257	2.3		0.658		7.1	LOS A	5.4	38.9				
Intersection	4330	2.3		0.665		8.4	LOS A	5.9	42.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane under-utilisation found by the program
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Manning Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	426	-	-	426	4.0	759	0.561	100	NA	NA
Lane 2	-	370	140	511	2.0	1009	0.506	90[5]	NA	NA
Approach	426	370	140	936	2.9		0.561			

East: CR 42

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	149	332	-	481	2.0	753	0.639	100	NA	NA
Lane 2	-	412	232	644	2.0	1008	0.639	100	NA	NA
Approach	149	745	232	1126	2.0		0.639			

North: Manning Road

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	161	263	-	424	2.0	638	0.665	100	NA	NA
Lane 2	-	309	278	587	2.0	883	0.665	100	NA	NA
Approach	161	572	278	1011	2.0		0.665			

West: CR 42

Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	89	457	-	547	2.0	831	0.658	100	NA	NA
Lane 2	-	394	317	711	2.4	1080	0.658	100	NA	NA
Approach	89	851	317	1257	2.3		0.658			

	Total	%HV	Deg.Satn (v/c)
Intersection	4330	2.3	0.665

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
East Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [CR 42 and Manning TF 2037 PM (Site Folder: General)]

Twin Oaks
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Manning Road													
Lane 1	454	2.8	618	0.735	100	15.5	LOS B	6.0	43.2	Full	500	0.0	0.0
Lane 2[d]	608	2.0	826	0.735	100	9.2	LOS A	7.4	52.6	Full	500	0.0	0.0
Approach	1062	2.4		0.735		11.9	LOS B	7.4	52.6				
East: CR 42													
Lane 1	502	2.0	584	0.860	100	21.5	LOS C	9.7	69.0	Full	500	0.0	0.0
Lane 2[d]	710	2.0	826	0.860	100	15.5	LOS B	11.4	81.4	Full	500	0.0	0.0
Approach	1213	2.0		0.860		18.0	LOS B	11.4	81.4				
North: Manning Road													
Lane 1	340	2.0	571	0.594	100	14.4	LOS B	4.0	28.2	Full	500	0.0	0.0
Lane 2[d]	471	2.0	793	0.594	100	8.0	LOS A	4.7	33.7	Full	500	0.0	0.0
Approach	811	2.0		0.594		10.7	LOS B	4.7	33.7				
West: CR 42													
Lane 1	677	2.0	871	0.777	100	11.2	LOS B	7.0	49.7	Full	500	0.0	0.0
Lane 2[d]	858	5.1	1105	0.777	100	7.2	LOS A	7.6	55.3	Full	500	0.0	0.0
Approach	1535	3.8		0.777		9.0	LOS A	7.6	55.3				
Intersection	4620	2.7		0.860		12.3	LOS B	11.4	81.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Manning Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	374	80	-	454	2.8	618	0.735	100	NA	NA
Lane 2	-	459	149	608	2.0	826	0.735	100	NA	NA
Approach	374	538	149	1062	2.4		0.735			

East: CR 42

Mov.	L2	T1	R2	Total	%HV		Deg.	Lane	Prob.	Ov.

From E To Exit:	S	W	N			Cap. veh/h	Satn v/c	Util. %	SL Ov. %	Lane No.
Lane 1	140	362	-	502	2.0	584	0.860	100	NA	NA
Lane 2	-	549	162	710	2.0	826	0.860	100	NA	NA
Approach	140	911	162	1213	2.0		0.860			

North: Manning Road

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	248	92	-	340	2.0	571	0.594	100	NA	NA
Lane 2	-	349	122	471	2.0	793	0.594	100	NA	NA
Approach	248	441	122	811	2.0		0.594			

West: CR 42

Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	287	390	-	677	2.0	871	0.777	100	NA	NA
Lane 2	-	410	448	858	5.1	1105	0.777	100	NA	NA
Approach	287	800	448	1535	3.8		0.777			

	Total	%HV	Deg.Satn (v/c)
Intersection	4620	2.7	0.860

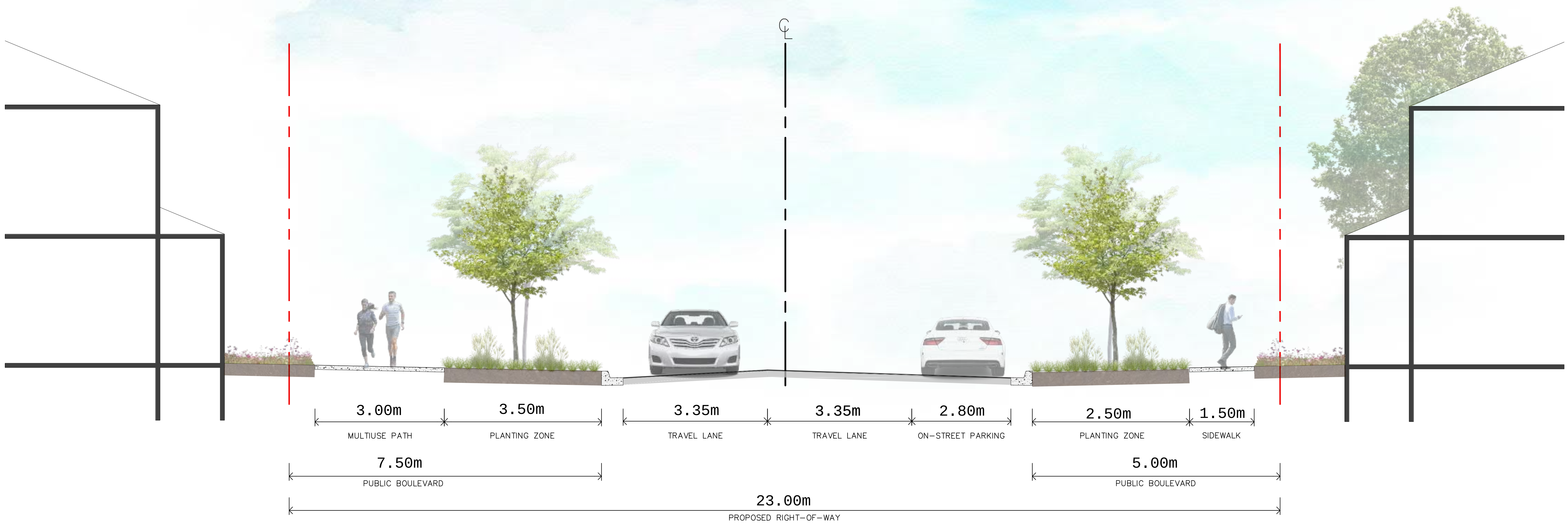
Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
East Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Manning Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: CR 42 Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

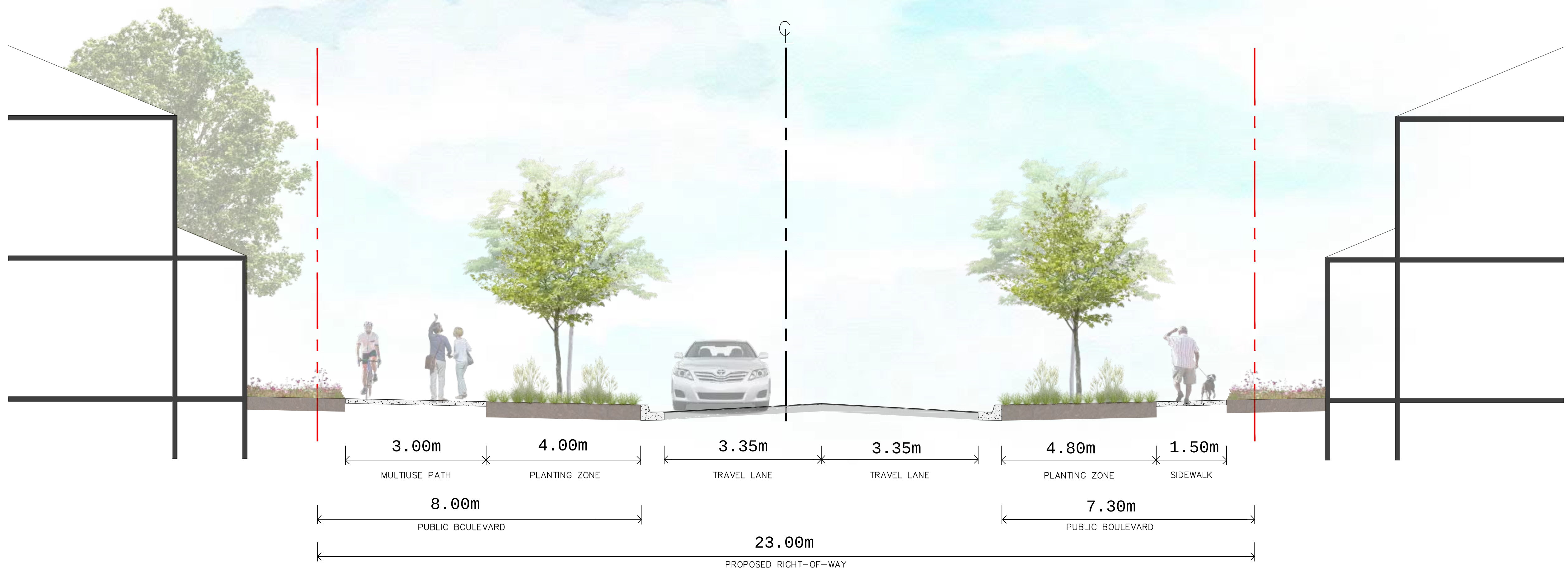
Attachment 3:

Roadway Cross-Sections



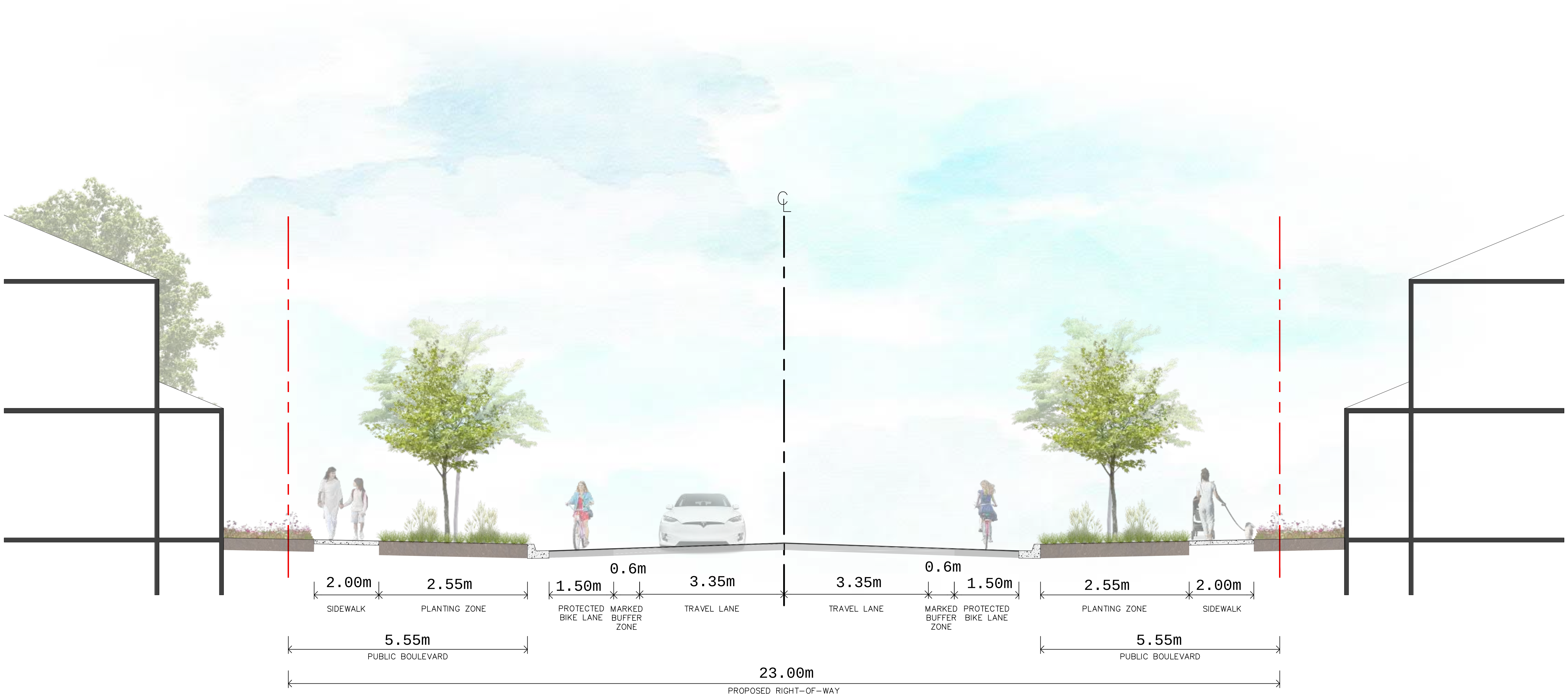
Design Concept #1 - 23m ROW

OFF-STREET CYCLING FACILITIES
(MUP) AND ON-STREET PARKING



Design Concept #2 - 23m ROW

OFF-STREET CYCLING FACILITIES
(MUP) AND NO PARKING

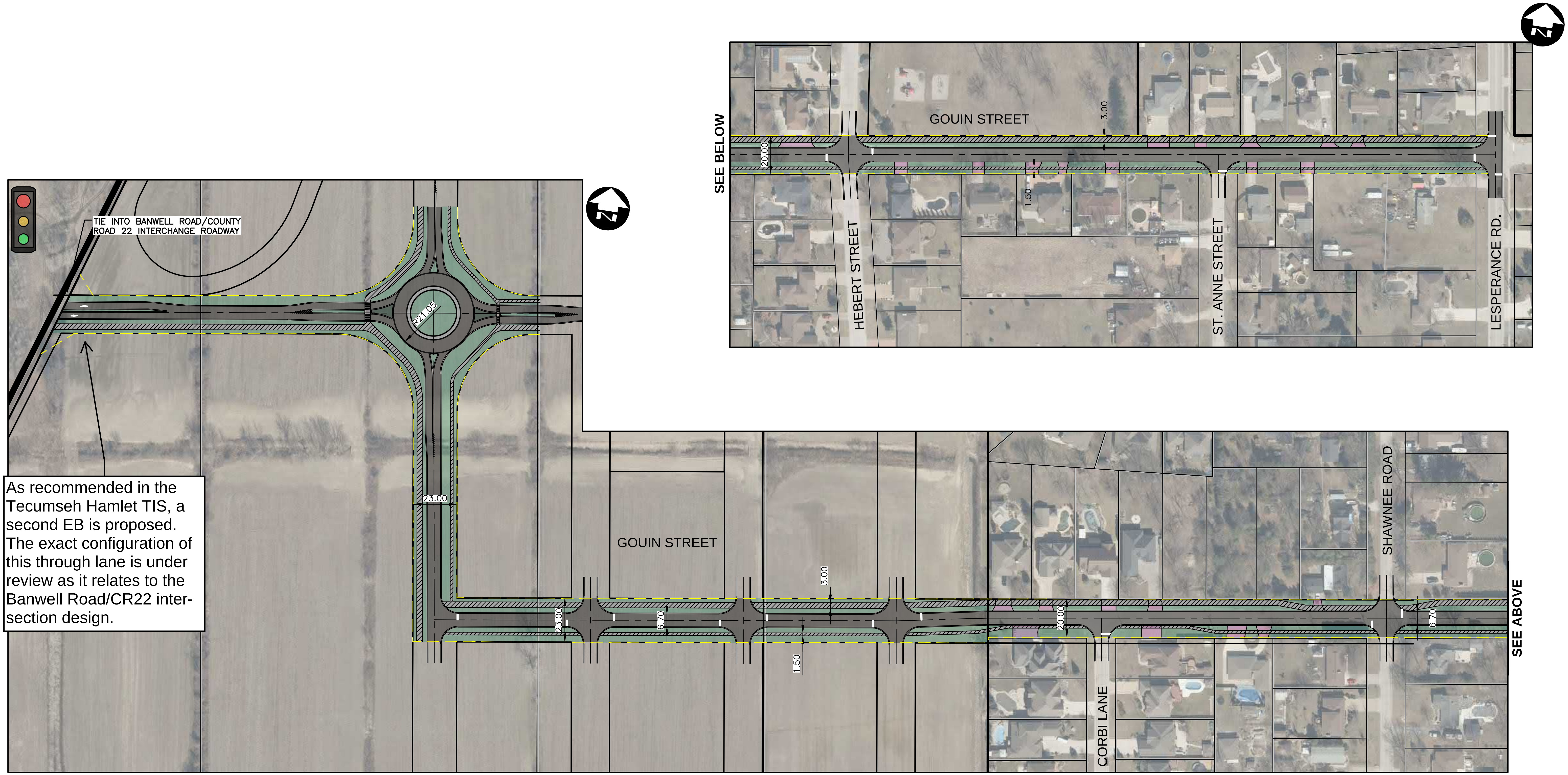


Design Concept #3 - 23m ROW

ON-STREET CYCLING FACILITIES
AND NO PARKING

Design Concept #4 - 23m ROW

OFF-STREET CYCLING FACILITIES (MUP),
NO PARKING, AND BIO SWALE MEDIAN



TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT GOUIN STREET

FIGURE 6.1

PROPOSED ROADWAY
PLANTING ZONE
PROPOSED SIDEWALK/MULTIUSE PATH
DRIVEWAYS TO BE REINSTATED
PROPOSED R.O.W. LIMITS
PROPOSED CENTERLINE
PROPOSED CURB
STOP BARS TO BE REINSTATED

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH

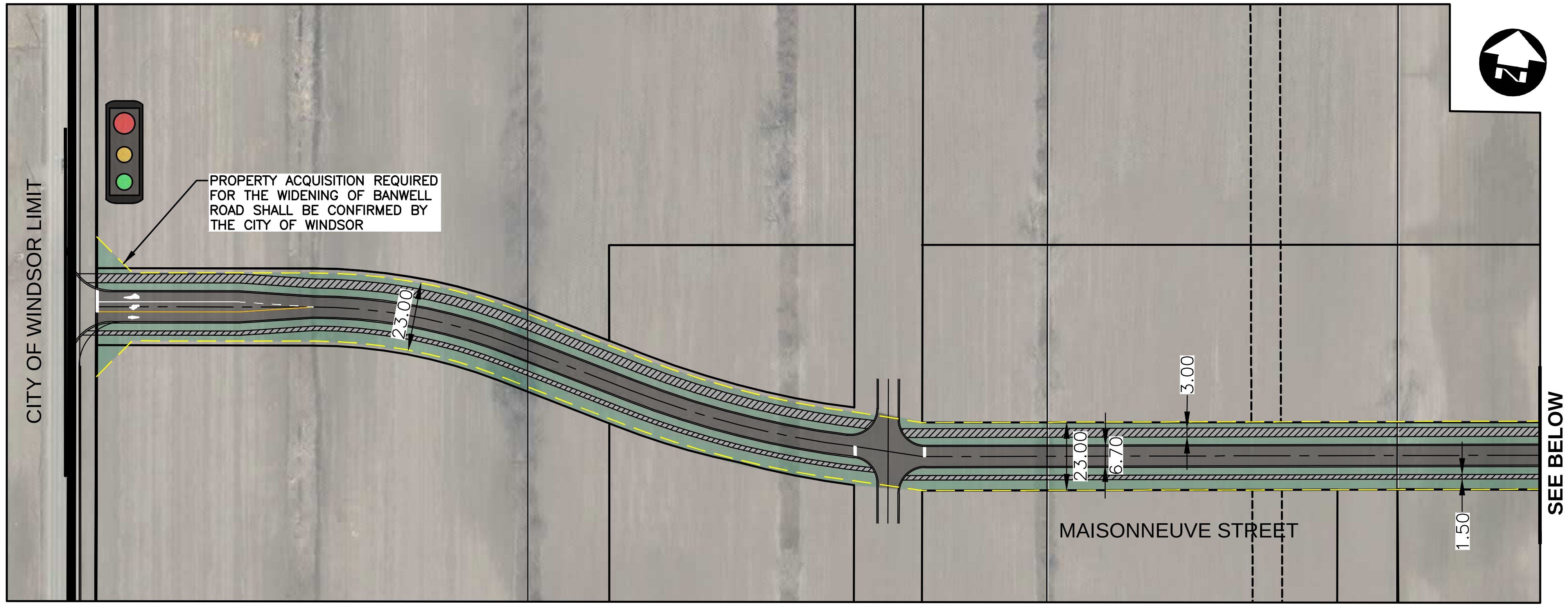
DILLON CONSULTING

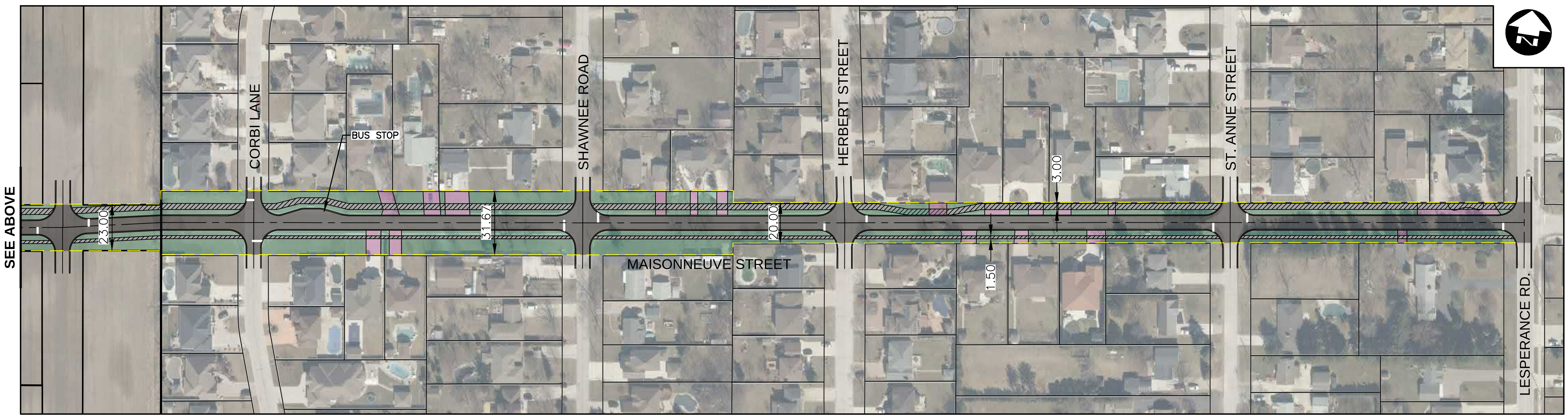
MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:2000
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 10, 2024

File Location: c:\pw working directory\projects 2020\32mm\dms18944\202559-02-site-fig.dwg June, 10, 2024 4:05 PM





TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT MAISONNEUVE ROAD

FIGURE 6.2

PROPOSED ROADWAY

PLANTING ZONE

PROPOSED SIDEWALK/MULTIUSE PATH

DRIVEWAYS TO BE REINSTATED

PROPOSED R.O.W. LIMITS

PROPOSED CENTERLINE

PROPOSED CURB

STOP BARS TO BE REINSTATED

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:2000
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 10, 2024

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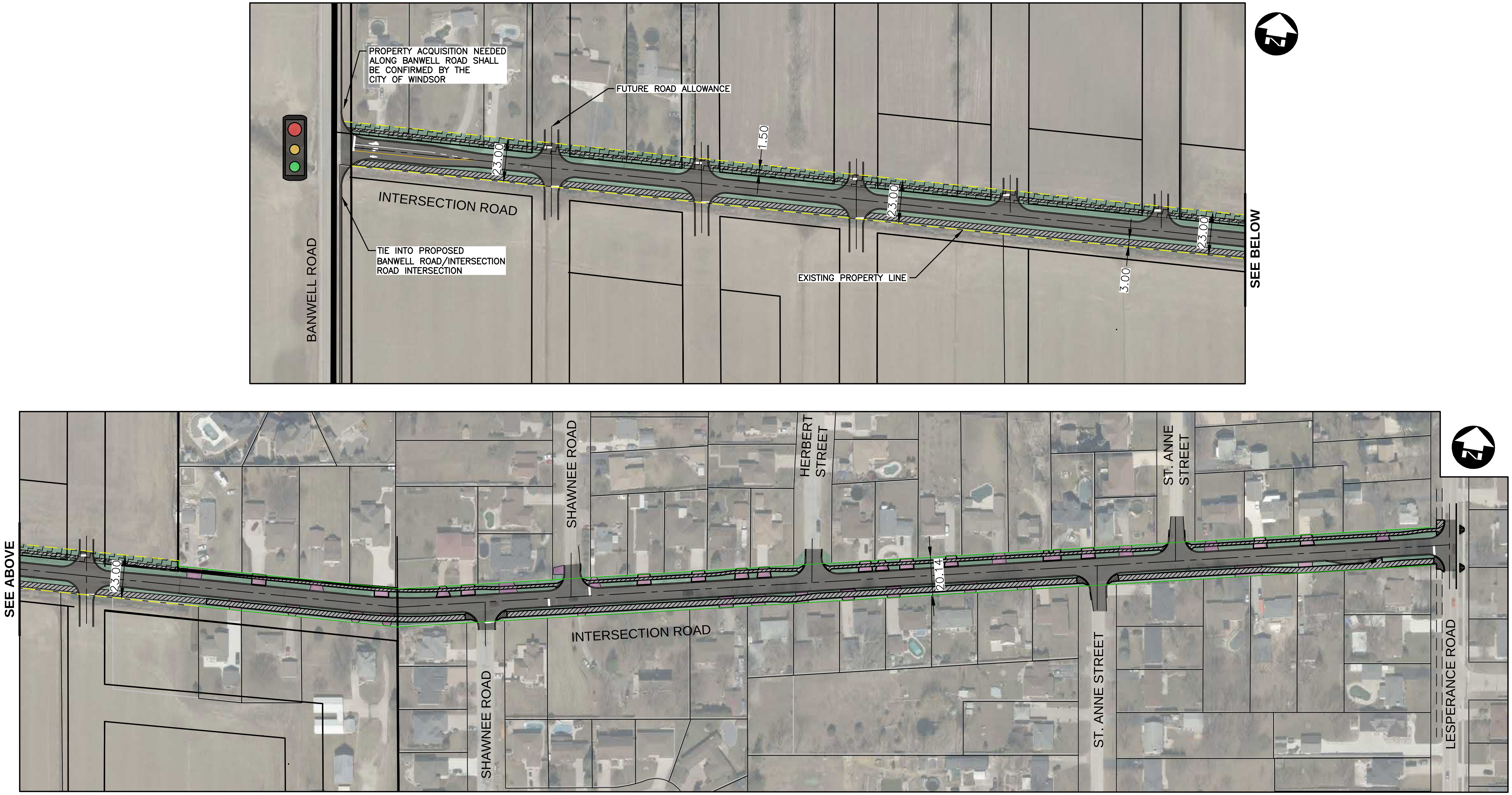

Legend	
PROPOSED ROADWAY	PROPOSED R.O.W. LIMITS
PLANTING ZONE	PROPOSED CENTERLINE
PROPOSED SIDEWALK/MULTIUSE PATH	PROPOSED CURB
DRIVEWAYS TO BE REINSTATED	STOP BARS TO BE REINSTATED
ADDITIONAL LAND THAT REQUIRES ACQUISITION	EXISTING R.O.W. LIMITS

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT INTERSECTION ROAD

FIGURE 6.3

TECUMSEH

DILLON CONSULTING

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:2000
STATUS: DRAFT
PROJECT: 23-5735

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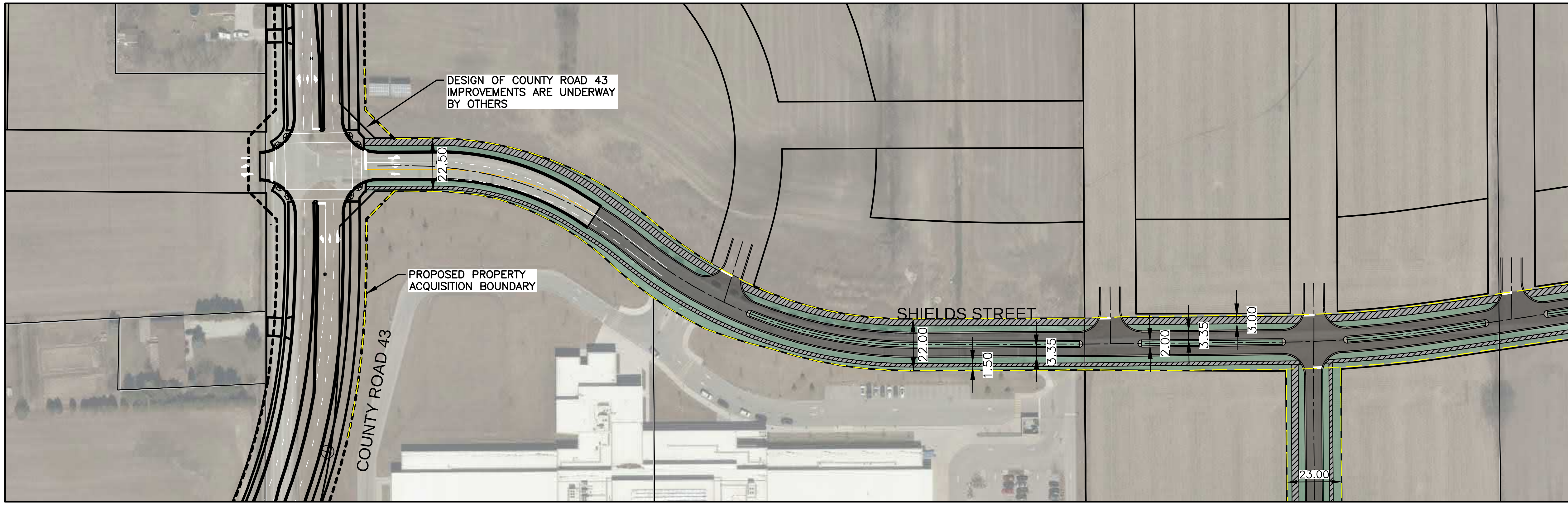

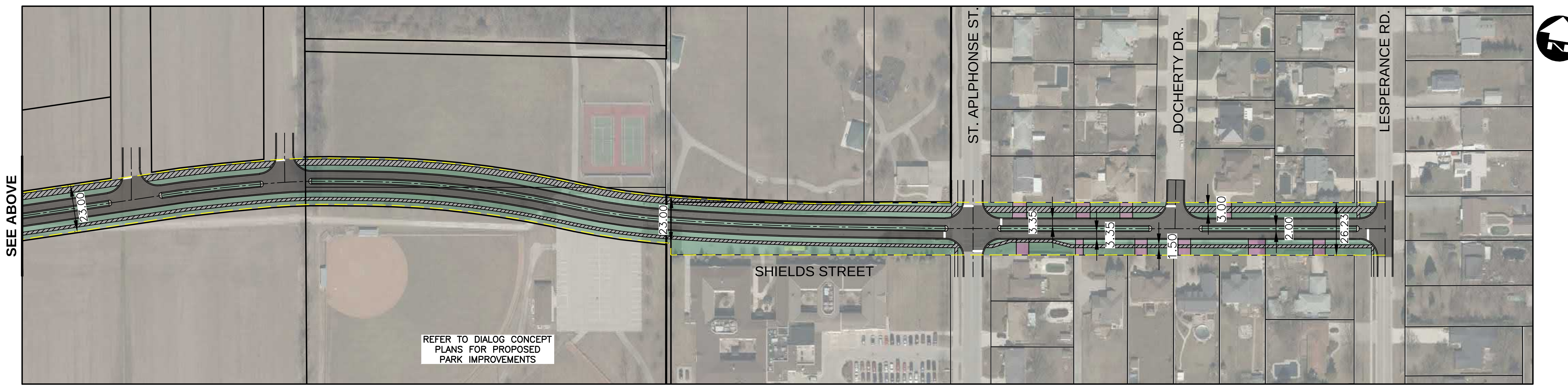

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

PROPOSED ROADWAY

PLANTING ZONE

PROPOSED SIDEWALK/MULTIUSE PATH

DRIVEWAYS TO BE REINSTATED

PROPOSED R.O.W. LIMITS

PROPOSED CENTERLINE

PROPOSED CURB

STOP BARS TO BE REINSTATED

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT SHIELDS STREET

FIGURE 6.4

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:2000
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 10, 2024

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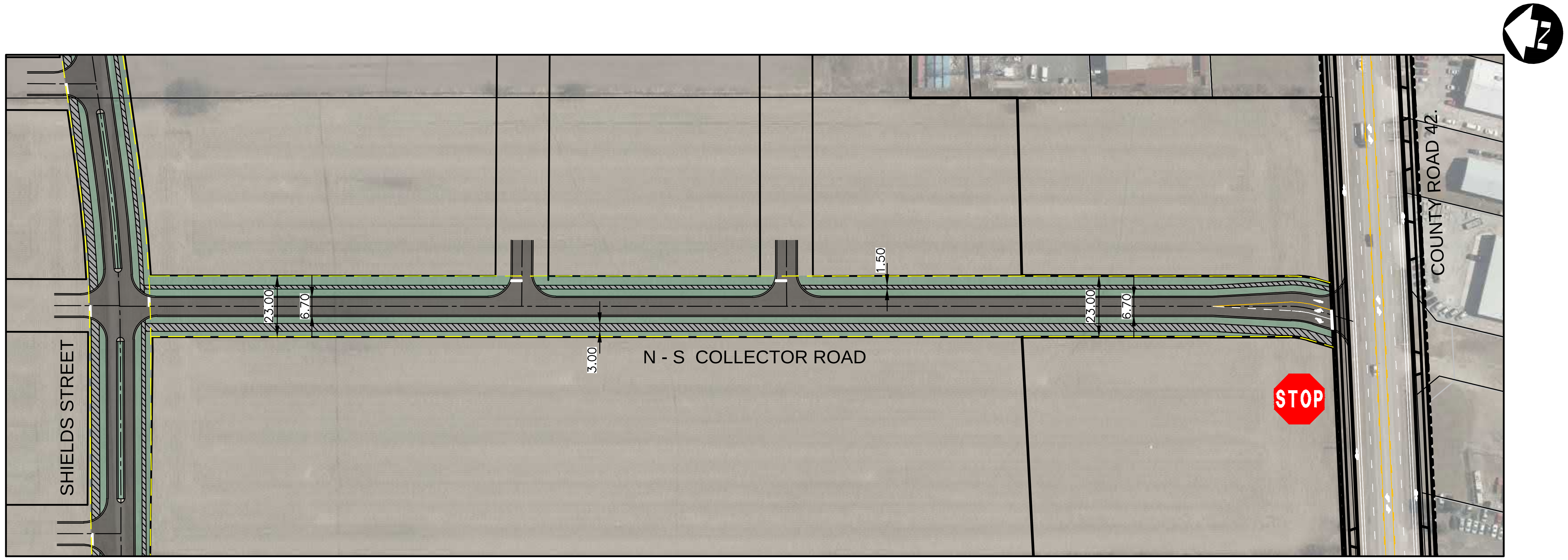


PROPOSED ROADWAY
PLANTING ZONE
PROPOSED SIDEWALK/MULTIUSE PATH
DRIVEWAYS TO BE REINSTATED
PROPOSED R.O.W. LIMITS
PROPOSED CENTERLINE
PROPOSED CURB
STOP BARS TO BE REINSTATED

THESE FIGURES ARE FOR SCHEMATIC USE ONLY

TECUMSEH HAMLET SECONDARY PLAN AREA FUNCTIONAL SERVICING REPORT

TECUMSEH HAMLET PROPOSED COLLECTOR ROAD ALIGNMENT
N-S COLLECTOR ROAD
FIGURE 6.5

MAP CREATED BY: LPJ
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

SCALE: 1:2000
STATUS: DRAFT
PROJECT: 23-5735

DATE: June 10, 2024

File Location: c:\pw working directory\projects 2020\32mm\dms18944\202559-02-site-fig.dwg June, 10, 2024 4:10 PM

MEMO

TO: Phil Bartnik, P.Eng. — Director of Public Works & Engineering Services, Town of Tecumseh

FROM: Brent Hooton, Dipl.T. — Transportation Engineering Technologist
Laura Herlehy, P.Eng. — Project Manager

DATE: December 5, 2024

SUBJECT: Tecumseh Hamlet Secondary Plan
Transportation Study Addendum — Supplemental Analysis
Effect of NextStar Shift Change Adjustments

OUR FILE: 23-5735

1.0 Purpose

This memo ("November 2024 Hamlet supplemental analysis") is an update to the Tecumseh Hamlet Secondary Plan Transportation Impact Study, prepared by Dillon in 2015, and a subsequent addendum prepared by Dillon and issued on June 12, 2024 (the June 2024 Hamlet TIS). In addition to the reports listed above, this analysis used consistent strategies and assumptions from the Twin Oaks Transportation Impact Study (the 2023 Battery Plant TIS), which was completed by Dillon for the City of Windsor in 2023 and focused on analyzing traffic associated with the NextStar battery plant currently under construction west of the Hamlet.

This memo presents updated traffic projections and intersection analyses as a result of updated staffing levels and shift change times associated with the NextStar battery plant, now that the plant is closer to opening. The purpose of this analysis is to update the anticipated ultimate condition findings of this corridor and to confirm if the recommendations and projected levels of service listed in the June 2024 Hamlet TIS are still valid.

The updated intersection analyses documented in this memo are focused on the three main signalized intersections along Banwell Road (at the new E.C. Row Expressway south ramp terminal; at Maisonneuve Street; at Intersection Road) where the NextStar volumes are expected to be highest and therefore where the effect of any staffing and/or shift changes will be the greatest.

2.0 Updated Traffic Volumes

2.1 Changes to **NextStar Operations**

In the June 2024 Hamlet TIS, the analyses were prepared based on the 2023 traffic forecasts for the NextStar battery plant, as detailed in the 2023 Battery Plant TIS. The anticipated shift times and numbers of employees per shift, provided by Stellantis, have since been updated as of October 2024. *Table 1* and ***Attachment** 1* present the updated anticipated staffing and shift change times provided by NextStar, and compare them with the shift changes that were applied in the previous analyses for the 2023 Battery Plant TIS and the June 2024 Hamlet TIS.

Table 1: Shift Change Times

Shift	# of employees	Shift start time	Arrival on site between	Shift end time	Leave site between
Original projections:					
Cell (day)	600	7:00 AM	6:00–6:30 AM	7:00 PM	7:00–7:30 PM
Module (day)	175	7:30 AM	7:00–7:30 AM	3:30 PM	3:30–4:00 PM
Admin	625	8:30 AM	8:00–8:30 AM	4:30 PM	4:30–5:00 PM
Module (evening)	175	3:30 PM	3:00–3:30 PM	11:30 PM	11:30 PM–12:00 AM
Cell (night)	600	7:00 PM	6:00–6:30 PM	7:00 AM	7:00–7:30 AM
Module (night)	175	11:30 PM	11:00–11:30 PM	7:30 AM	7:30–8:00 AM
Updated projections:					
Admin Staff	507	8:00 AM	7:30–8:00 AM	4:30 PM	4:30–5:00 PM
Cell & Module Production Staff (day)	795	6:00 AM	5:30–6:00 AM	6:00 PM	6:00–6:30 PM
Cell & Module Production Staff (night)	795	6:00 PM	5:30–6:00 PM	6:00 AM	6:00–6:30 AM

The shift changes that correspond to the background peak periods are:

- 507 administrative employees arriving prior to an 8:00 AM shift start time, and leaving after a 4:30 PM shift end time; and
- 795 cell and module production staff arriving prior to a 6:00 PM shift start time.

The remainder of shift change traffic will occur outside the background AM and PM peak periods.

2.2 Changes to NextStar Traffic Projections

For this updated assessment, the same peak half hour periods from the June 2024 Hamlet TIS were used. In addition, a "late PM" peak half hour was added to account for a shift change that was previously expected to occur after the end of the PM peak period but now is expected to occur within the peak period. The following time periods were analyzed, reflecting "peak of peak" conditions when battery plant shift change traffic will coincide with the typical commuter traffic peaks:

- AM early peak half hour: 7:00–7:30 AM
- AM late peak half hour: 8:00–8:30 AM
- PM early peak half hour: 4:30–5:00 PM
- PM late peak half hour: 5:30–6:00 PM *(additional peak period)*

The analyses reflect a 6.5% modal share for transit and active transportation combined and an assumption that 4% of the trips would be carpool passengers, consistent with the 2023 Battery Plant TIS. They also assume that 5% of employees will be picked up / dropped off (PU/DO), resulting in additional "deadhead" trips made by the driver after dropping off / before picking up the employee.

Table 2 presents the updated NextStar trip generation after applying the above factors.

Table 2: Updated NextStar Trip Generation

	AM peak			PM peak		
	Total	In	Out	Total	In	Out
2023 Battery Plant TIS:						
Early peak half hour	7:00–7:30 AM			4:30–5:00 PM		
Employees arriving / leaving	775	175	600	625	0	625
Carpool / transit / active @ 10.5%	-85	-20	-65	-65	0	-65
PU/DO deadhead trips @ 5%	40	30	10	30	30	0
Total vehicle trips	730	185	545	590	30	560
Late peak half hour	8:00–8:30 AM			6:00–6:30 PM		
Employees arriving / leaving	625	625	0	600	600	0
Carpool / transit / active @ 10.5%	-65	-65	0	-65	-65	0
PU/DO deadhead trips @ 5%	30	0	30	30	0	30
Total vehicle trips	590	560	30	565	535	30
November 2024 Hamlet Supplemental Analysis:						
Early peak half hour	7:00–7:30 AM			4:30–5:00 PM		
Employees arriving / leaving	507	507	0	507	0	507
Carpool / transit / active @ 10.5%	-55	-55	0	-55	0	-55
PU/DO deadhead trips @ 5%	25	0	25	25	25	0
Total vehicle trips	477	452	25	477	25	452
Late peak half hour	8:00–8:30 AM			6:00–6:30 PM		
Employees arriving / leaving	0	0	0	795	795	0
Carpool / transit / active @ 10.5%	0	0	0	-85	-85	0
PU/DO deadhead trips @ 5%	0	0	0	40	0	40
Total vehicle trips	0	0	0	750	710	40

The NextStar trip generation has changed as follows compared to the 2023 Battery Plant TIS analyses:

- Trips have decreased by approximately 35% (from 730 to 477 trips) during the early AM peak half hour, and have changed from primarily outbound to primarily inbound.
- There are no longer any trips projected to occur during the late AM peak half hour.
- Trips have decreased by approximately 20% (from 590 to 477 trips) during the early PM peak half hour (when most trips are outbound).
- A shift change is now expected to add traffic to the road network near the end of the PM peak period (the late PM peak half hour); these trips were previously expected to occur later in the day when background traffic volumes are lower.

2.3 Updated Total Future Volumes

The total future volumes from the June 2024 Hamlet TIS were revised by replacing the previous NextStar traffic forecasts with the updated forecasts that account for NextStar's currently proposed staffing and shift changes.

The updated NextStar traffic volumes are presented in the following figures:

- *Figure 1* presents the volume of traffic traveling to/from the NextStar site during the AM peak half hours; and
- *Figure 2* presents the volume of traffic traveling to/from the NextStar site during the PM peak half hours.

The total future traffic volumes are presented in the following figures:

- *Figure 3* presents the total future volumes during the AM peak half hours; and
- *Figure 4* presents the total future volumes during the PM peak half hours.

The volumes on both figures are expressed in vehicles per half hour. Hourly flow rates can be determined by multiplying these values by 2.

Figure 1: Updated NextStar Site Traffic Volumes, AM Peak Half Hours

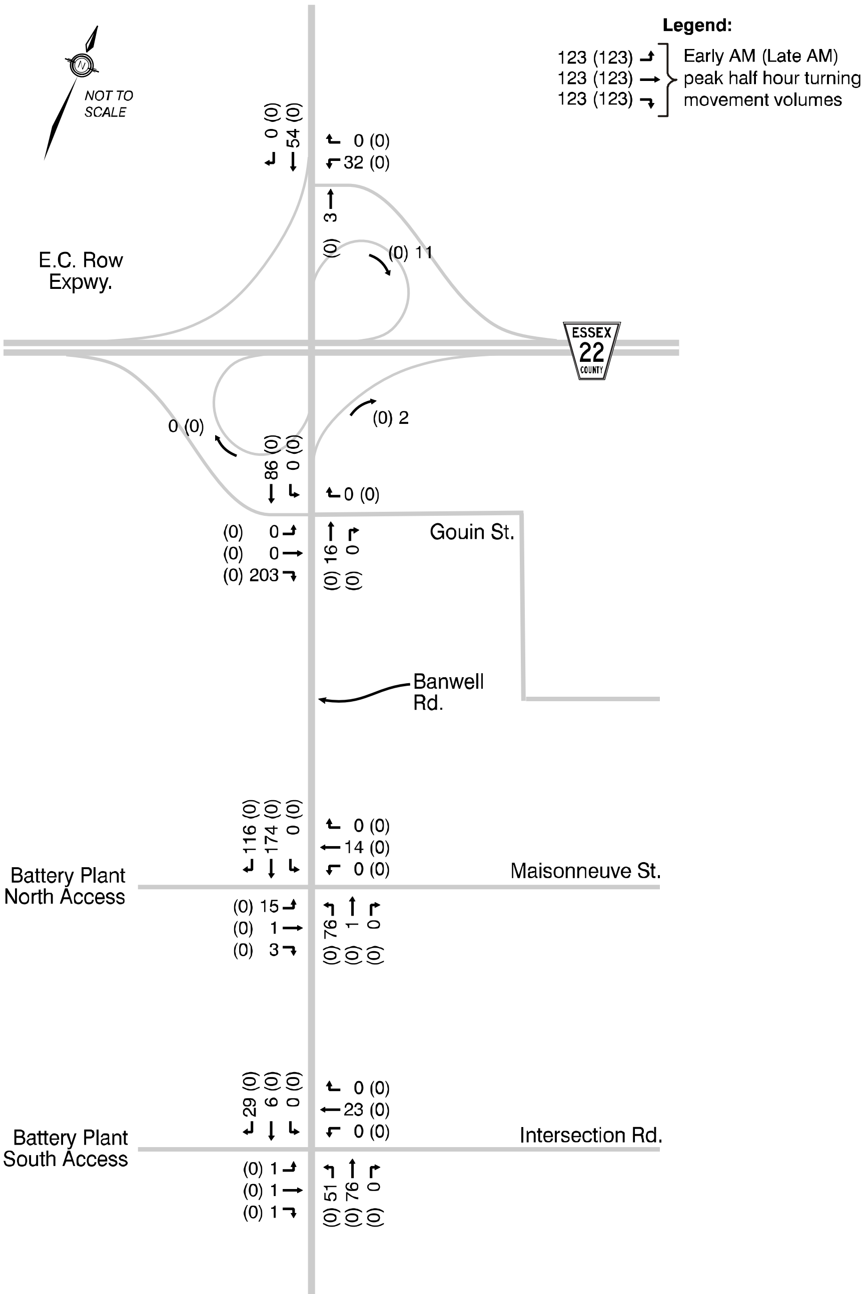


Figure 2: Updated NextStar Site Traffic Volumes, PM Peak Half Hours

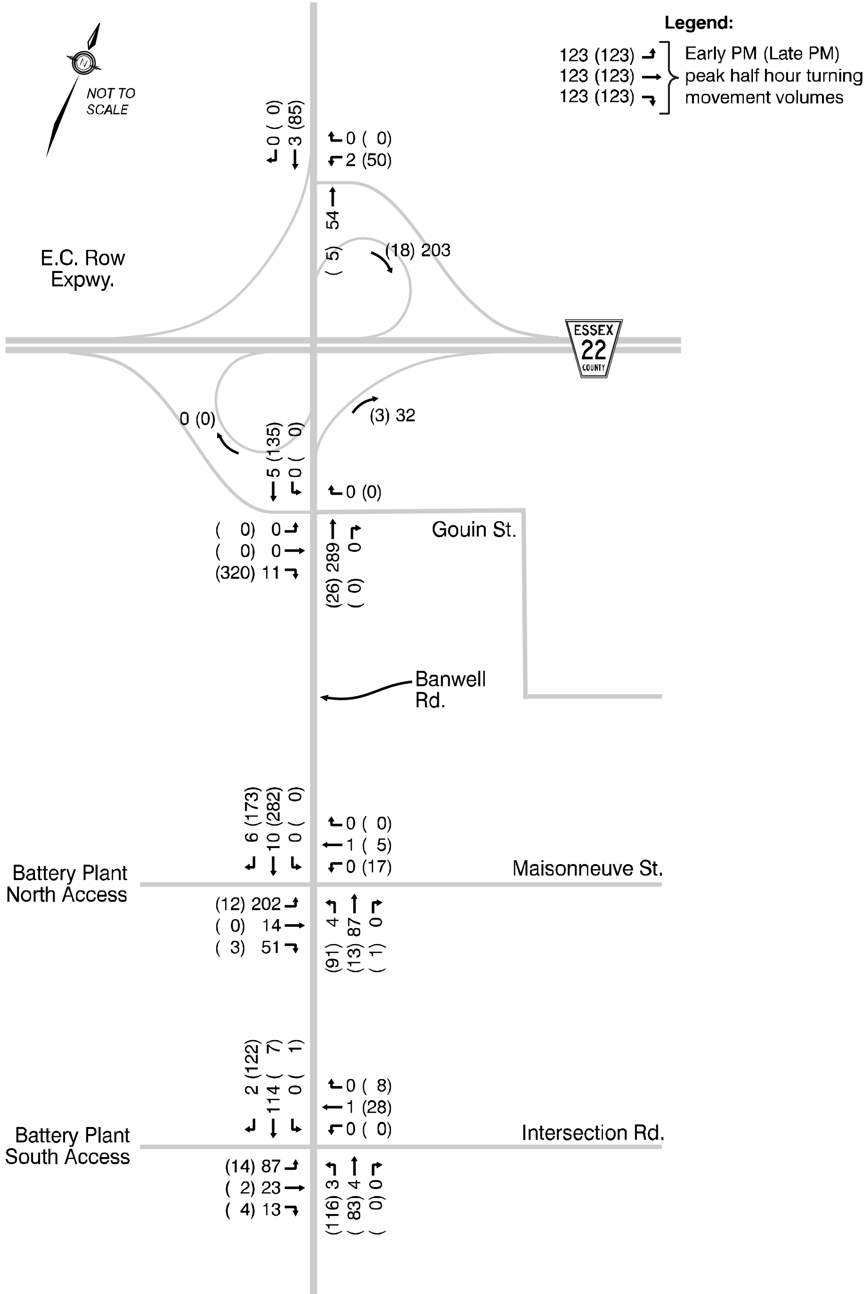


Figure 3: Total Future Volumes, AM Peak Half Hours

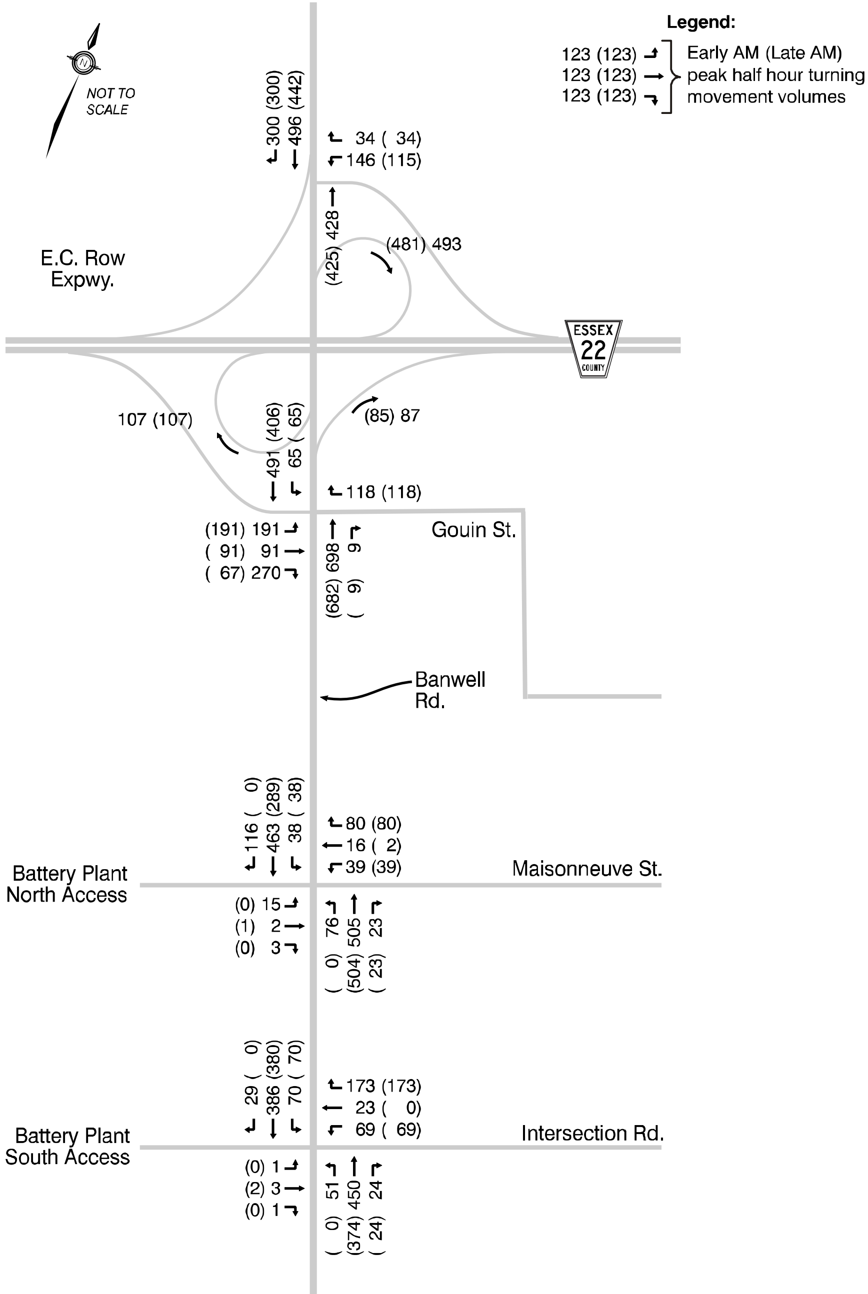
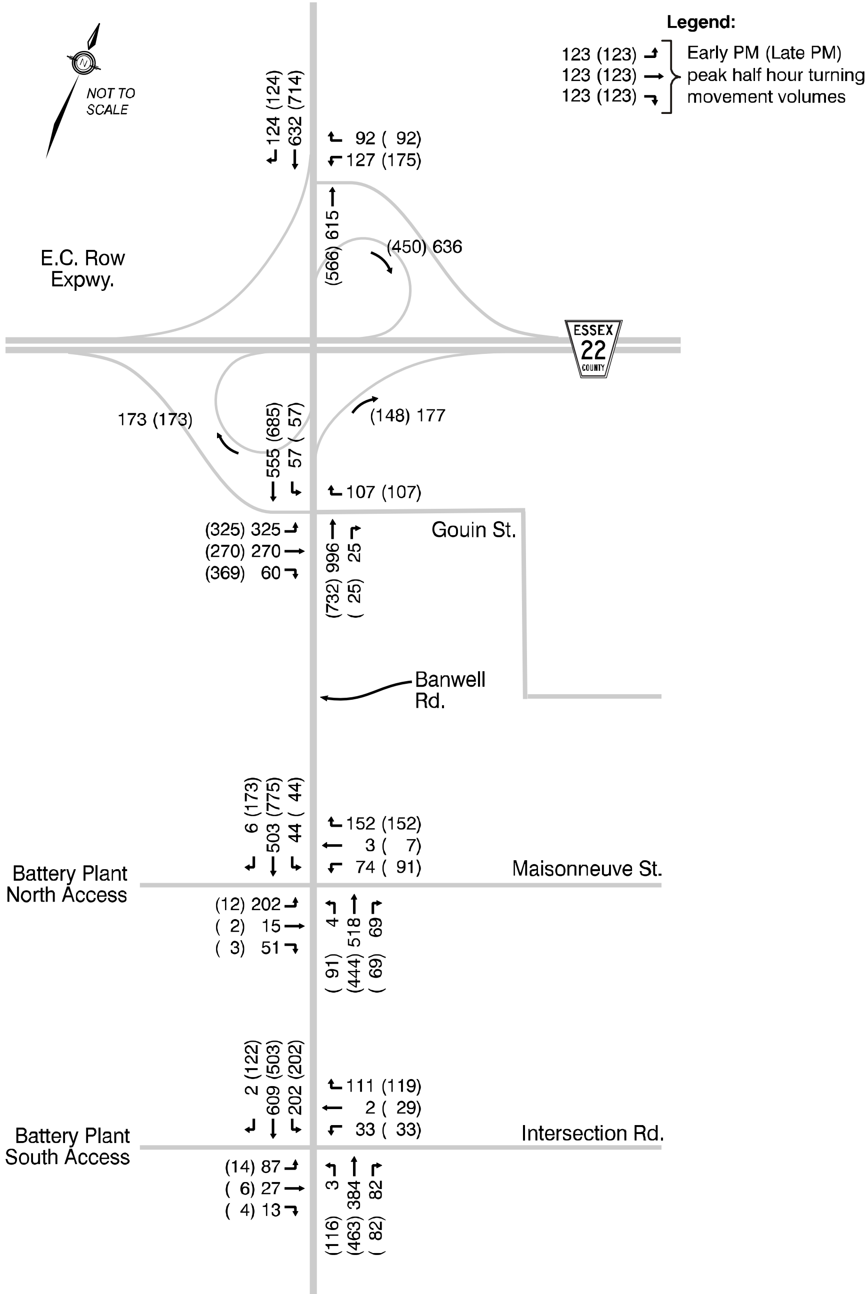


Figure 4: Total Future Volumes, PM Peak Half Hours



3.0 Projected Intersection Operations

The three intersections were analyzed using Synchro software (version 11). The half-hour volumes were converted to hourly flow rates by applying a 2.0x growth factor and a peak hour factor of 1.00 (reflecting less potential for variability over a half-hour period). The assumed signal timings were adjusted from previous analyses where warranted due to the updated driveway volumes; this includes an assumption of variable time-of-day timing plans to favour peak-direction movements leading to/from the battery plant during shift changes. Detailed analysis worksheets are provided in ***Attachment 2***.

At each intersection, critical movements were identified. For this study, critical movements are defined as any individual movement at a signalized intersection operating at a v/c ratio of 0.85 or greater (similar to the June 2024 Hamlet TIS).

3.1 Banwell Road at E.C. Row Expressway South Ramp Terminal / Gouin Street

Table 3 presents the anticipated operations at Banwell Road and the south ramp terminal intersection opposite the Gouin Street extension. The eastbound E.C. Row Expressway off-ramp was analyzed with the middle lane converted from an exclusive left turn lane to a shared through / left turn lane, in accordance with the recommendations from the June 2024 Hamlet TIS.

Table 3: Projected Intersection Operations, Banwell Road at E.C. Row Expressway South Ramp Terminal / Gouin Street

Movement	Early peak				Late peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
AM Peak Hour								
EB left	0.71	E	61.3	73	0.71	E	61.3	73
EB through	0.67	D	52.8	61	0.67	D	52.8	61
EB right	0.33	A	0.6	0	0.08	A	0.1	0
WB right	0.78	D	49.7	63	0.78	D	49.7	63
NB through	0.49	B	16.1	129	0.47	C	26.2	135
SB left	0.32	A	8.6	18	0.32	A	10.0	17
SB through	0.37	A	4.4	30	0.31	A	4.6	31
SB right	0.13	A	0.2	0	0.13	A	0.2	0
Overall	—	B	17.6	—	—	C	24.3	—
PM Peak Hour								
EB left	0.84	E	57.2	141	0.84	E	57.2	141
EB through	0.83	D	48.6	124	0.83	D	48.6	124
EB right	0.07	A	0.1	0	0.46	A	0.9	0
WB right	0.84	E	59.1	70	0.84	E	59.1	70
NB through	0.83	C	25.0	93	0.62	C	28.4	143
SB left	0.43	C	22.3	32	0.39	B	16.9	26
SB through	0.50	B	11.7	96	0.61	B	12.9	121
SB right	0.21	A	0.3	0	0.21	A	0.3	0
Overall	—	C	27.3	—	—	C	25.0	—

During the AM and PM peaks, the south ramp terminal intersection is anticipated to operate at a reasonable overall level of service (LOS B to C) with no critical movements. The projected overall level of service is unchanged from the June 2024 Hamlet TIS analyses, and the northbound v/c ratio is projected to be reduced.

The early PM peak hour is the most conservative time period, when a surge of NextStar outbound shift change traffic will coincide with the commuter peak (including trips to/from the Hamlet). The intersection can accommodate the projected traffic volumes and operate at acceptable levels during that time period. At other times (represented by the other three analysis periods), there will either be little to no NextStar traffic traveling through the intersection, or NextStar traffic will be mostly inbound and will primarily use the free-flow eastbound right turn, thus not significantly affecting intersection operations.

Previous comments provided by the City (August 6, 2024) expressed concern over the proposed anchor commercial block in the Tecumseh Hamlet. The weekday PM peak hour of the anchor commercial block coincides with the overall PM peak hour and has been accounted for in the intersection analyses. The Saturday midday peak hour traffic volumes for commercial uses are typically higher than the weekday peak hour volumes, but these are offset by reduced overall commuter traffic and the negligible amount of battery plant traffic during the middle of the day on Saturday when the commercial node will be busiest.

The PM analyses assume a single signal timing plan is in effect throughout the PM peak period. There are opportunities to rebalance green time and improve conditions on the off-ramp during the late PM peak if separate “shift change” and “typical” time-of-day plans are applied.

3.2 Banwell Road at Maisonneuve Street / Intersection Road

Table 4 presents the projected operations at the two signalized intersections on Banwell Road south of the interchange (at Maisonneuve Street and at Intersection Road).

The west legs of these intersections will be the main accesses to the NextStar battery plant. The battery plant site plan indicates three eastbound lanes exiting the site on both driveways, which would allow for the potential for dual left turn lanes. However, because dual left turn lanes would require a fully protected left turn phase, the battery plant TIS first tested the driveways with a single eastbound left turn lane. The analyses in *Table 4* also assume a single eastbound left turn lane on both driveways.

Table 4: Projected Intersection Operations, Banwell Road at Maisonneuve Street and Intersection Road (Single Eastbound Left Turn Lanes)

Movement	Early peak				Late peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Banwell Road at Maisonneuve Street — AM Peak Hour								
EB left	0.48	E	73.9	17	0.00	A	0.0	0
EB through	0.06	C	32.3	6	0.01	D	45.5	3
WB left	0.55	E	64.8	34	0.55	E	64.8	34
WB through	0.62	C	20.8	30	0.54	B	14.7	21
NB left	0.30	A	4.3	8	0.00	A	0.0	0
NB through	0.28	A	4.6	30	0.28	A	3.5	24
SB left	0.17	A	2.8	5	0.17	A	2.8	5
SB through	0.25	A	5.3	28	0.14	A	2.5	12
SB right	0.19	A	0.7	2	0.00	A	0.0	0
Overall	—	A	8.1	—	—	A	6.6	—
Banwell Road at Maisonneuve Street — PM Peak Hour								
EB left	0.91	D	53.2	124	0.38	E	57.9	14
EB through	0.16	A	4.5	12	0.03	C	24.7	5
WB left	0.25	B	18.3	30	0.71	E	60.2	62
WB through	0.36	A	6.3	26	0.68	C	22.0	51
NB left	0.03	C	22.8	4	0.71	C	23.5	47
NB through	0.68	D	38.1	132	0.32	B	12.6	76
SB left	0.48	D	41.9	31	0.22	A	8.6	16
SB through	0.48	C	26.4	67	0.49	B	15.7	106
SB right	0.02	A	0.5	0	0.32	A	8.0	49
Overall	—	C	31.0	—	—	B	17.4	—
Banwell Road at Intersection Road — AM Peak Hour								
EB left	0.03	C	34.0	3	0.00	A	0.0	0
EB through	0.02	C	29.0	5	0.02	D	40.0	4
WB left	0.50	D	47.4	45	0.67	E	63.9	51
WB through	0.84	D	39.3	79	0.76	C	23.5	51
NB left	0.21	A	7.6	17	0.00	A	0.0	0
NB through	0.30	B	12.3	60	0.23	A	8.6	39
SB left	0.33	B	12.6	25	0.27	A	4.6	11
SB through	0.35	B	16.3	56	0.28	A	3.9	26
SB right	0.06	A	6.3	6	0.00	A	0.0	0
Overall	—	B	19.3	—	—	B	12.6	—
Banwell Road at Intersection Road — PM Peak Hour								
EB left	0.96	F	103.0	70	0.45	E	68.0	16
EB through	0.20	C	26.4	23	0.09	C	30.8	9
WB left	0.23	D	37.5	24	0.38	D	52.2	27
WB through	0.43	A	7.2	19	0.81	D	35.5	55
NB left	0.02	A	9.3	2	0.53	B	10.7	26
NB through	0.37	B	19.0	70	0.37	B	13.5	69
SB left	0.80	C	24.8	126	0.77	C	28.5	112
SB through	0.52	B	14.8	179	0.42	B	17.7	146
SB right	0.00	A	0.0	0	0.21	A	8.4	40
Overall	—	C	22.5	—	—	B	19.2	—

Both intersections are anticipated to operate at a good level of service (LOS A to B) during the AM peaks and a reasonable level of service (LOS B to C) during the PM peak. The eastbound left turn from both driveways is expected to be critical during the early PM peak, corresponding to the surge in traffic exiting the battery plant at shift change. These left turn movements would still operate within capacity and the projected queues can be accommodated within the driveways.

The October 2024 updated NextStar traffic projections are projected to improve operations at both intersections compared to the results of the June 2024 Hamlet TIS analyses. The overall levels of service are expected to improve in some cases, and conditions on the northbound and southbound through movements are also expected to be improved. The eastbound left turn movements are no longer anticipated to exceed capacity; during the early PM peak half hour (when there will be an outbound surge of traffic following shift change), the eastbound left turn movements are projected to be at 91% of capacity at the north driveway and 96% of capacity at the south driveway.

As an additional measure, the battery plant driveways were tested with two outbound left turn lanes. The driveways are being constructed with three outbound lanes, but the base analyses were conducted assuming only one left turn lane and a shared through/right turn lane; the third lane would be hatched out or used as a potential bypass lane for buses/shuttles exiting the site. A single left turn lane has the benefit of a simpler signal phasing plan and therefore lower delays at lower-volume times; a dual left turn lane can process more vehicles at a time during the left turn phase and provides more space for queue storage but requires a fully protected left turn phase that would be applicable at all times of the day. The results of the dual left turn lane analysis are presented in *Table 5*.

Table 5: Projected Intersection Operations, Banwell Road at Maisonneuve Street and Intersection Road (Dual Eastbound Left Turn Lanes)

Movement	Early peak				Late peak			
	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*	v/c	LOS	Delay *(s/veh)*	95th %ile queue *(m)*
Banwell Road at Maisonneuve Street — AM Peak Hour								
EB left	0.16	E	55.6	9	0.00	A	0.0	0
EB through	0.04	C	24.9	5	0.01	D	45.5	3
WB left	0.55	E	65.1	34	0.55	E	64.8	34
WB through	0.62	C	20.9	30	0.54	B	14.7	21
NB left	0.33	A	7.1	11	0.00	A	0.0	0
NB through	0.31	A	7.3	36	0.28	A	5.1	28
SB left	0.19	A	5.3	8	0.17	A	2.9	6
SB through	0.28	A	8.8	52	0.14	A	2.5	13
SB right	0.21	A	1.2	6	0.00	A	0.0	0
Overall	—	B	10.4	—	—	A	7.5	—
Banwell Road at Maisonneuve Street — PM Peak Hour								
EB left	0.75	E	57.6	66	0.13	E	55.4	8
EB through	0.20	A	7.1	15	0.02	B	19.3	5
WB left	0.70	E	64.0	54	0.74	E	63.5	64
WB through	0.81	D	41.2	69	0.60	B	10.2	27
NB left	0.03	B	14.0	2	0.79	D	53.6	63
NB through	0.51	B	19.8	58	0.35	B	10.2	40
SB left	0.36	C	20.9	23	0.24	B	11.2	19
SB through	0.38	B	16.1	54	0.53	B	17.7	100
SB right	0.01	A	0.0	0	0.34	A	8.2	40
Overall	—	C	26.8	—	—	B	18.2	—
Banwell Road at Intersection Road — AM Peak Hour								
EB left	0.01	D	54.5	2	0.00	A	0.0	0
EB through	0.03	C	31.4	5	0.02	D	40.2	4
WB left	0.68	E	63.9	51	0.68	E	64.5	52
WB through	0.77	C	20.7	50	0.56	A	4.1	1
NB left	0.20	A	6.5	17	0.00	A	0.0	0
NB through	0.28	B	10.6	61	0.23	A	8.5	39
SB left	0.32	B	10.5	23	0.27	A	6.8	20
SB through	0.34	B	12.0	56	0.28	A	6.8	49
SB right	0.05	A	2.1	4	0.00	A	0.0	0
Overall	—	B	15.2	—	—	B	10.7	—
Banwell Road at Intersection Road — PM Peak Hour								
EB left	0.63	E	63.9	34	0.15	E	55.6	8
EB through	0.20	C	26.9	24	0.06	C	23.1	8
WB left	0.53	E	65.8	30	0.37	D	51.0	27
WB through	0.64	B	15.6	24	0.82	D	37.5	58
NB left	0.02	A	7.7	2	0.60	B	17.9	40
NB through	0.36	B	17.4	62	0.40	B	17.8	84
SB left	0.81	C	34.9	115	0.88	D	51.1	124

SB through	0.52	B	12.8	98	0.46	B	12.9	57
SB right	0.00	A	0.0	0	0.22	A	2.5	10
Overall	—	C	21.6	—	—	C	22.0	—

Implementing dual eastbound left turn lanes would allow all movements at both intersections to operate at or below the critical v/c threshold. It would increase queues and delays on the westbound approach (because westbound green time would be reduced to accommodate the eastbound left turn phase). The worst case is the Maisonneuve/Banwell westbound left turn during the PM Peak where the delay results in the level of service on the westbound left turns changing from LOS B to LOS E. In most cases, the LOS is within the D/E LOS range. It would also increase delays exiting the battery plant at lower-volume periods because of the need to wait for a dedicated left turn phase. However, dual eastbound left turn lanes would improve conditions on the Banwell Road approaches and would reduce queue lengths exiting the battery plant at the end of a shift.

Given that the driveways are already planned to be constructed with three outbound lanes, no geometric modifications would be required to implement dual outbound left turn lanes; the main change would be associated infrastructure (poles, traffic signal heads, etc.). The need for second left turn lanes has been reduced, now that the revised shift change and staffing projections enable the single left turn lanes to operate within capacity. As such, it is recommended that the intersections be opened with a single left turn lane, with the configuration adjusted as such time as conditions warrant.

4.0 Summary

The traffic projections and intersection analyses were updated based on the changes with staffing levels and shift change times associated with the NextStar battery plant. *Table 6* below provides a comparative summary of the overall levels of service at each intersection.

Table 6: Overall Level of Service Comparison

Analysis Scenario	Overall Level of Service (Total Future Traffic Volumes)				
	Banwell at E.C. Row Expressway South Ramp Terminal / Gouin Street	Banwell Road at Maisonneuve Street		Banwell Road at Intersection Road	
		1 eastbound left turn lane	2 eastbound left turn lanes	1 eastbound left turn lane	2 eastbound left turn lanes
Early AM Peak					
2023 Battery Plant TIS	C	B	B	C	C
2024 Hamlet TIS	B	C	C	C	C
2024 Updated Staffing & Shift Changes	B	A	B	B	B
Late AM Peak					
2023 Battery Plant TIS	B	A	A	B	B
2024 Hamlet TIS	C	B	B	B	B
2024 Updated Staffing & Shift Changes	C	A	A	B	B
Early PM Peak					
2023 Battery Plant TIS	C	D	D	B	B
2024 Hamlet TIS	C	C	C	C	C
2024 Updated Staffing & Shift Changes	C	C	C	C	C
Late PM Peak					
2023 Battery Plant TIS	C	D	D	B	B
2024 Hamlet TIS	n/a	n/a	n/a	n/a	n/a
2024 Updated Staffing & Shift Changes	C	B	B	B	C

The intersection of Banwell Road at E.C. Row Expressway South Ramp Terminal / Gouin Street is anticipated to operate at a reasonable level of service with the middle lane converted from an exclusive left turn lane to a shared through / left turn lane (as per the recommendations from the June 2024 Hamlet TIS). The updated traffic volumes have reduced pressure on the northbound through movement. The analyses of the updated shift change volumes draws a distinction between the outbound shift change (greatest traffic pressure due to high northbound volumes) and other times of day (when NextStar traffic will either largely contribute to the free-flow eastbound right turn or will be negligible). The intersection can accommodate the projected volumes during the most conservative time period (the outbound shift change).

At the Banwell Road intersections at Maisonneuve Street and at Intersection Road (the battery plant accesses), the eastbound left turns are still expected to be critical during the outbound shift change. However, the updated NextStar volumes are lower, and those left turns are now expected to operate within capacity. Implementing dual left turn lanes would increase capacity and reduce queue lengths exiting the plant after the shift change, but would result in increased delays on other movements and/or at lower-volume times. Considering that the Hamlet will develop over several years, and the volumes projected in these analyses will take some time to materialize, it is recommended that the intersections be opened with single outbound left turn lanes, with consideration for conversion to dual left turn lanes (signal head and pavement marking modifications) in the future should conditions warrant due to increased intersection volumes.

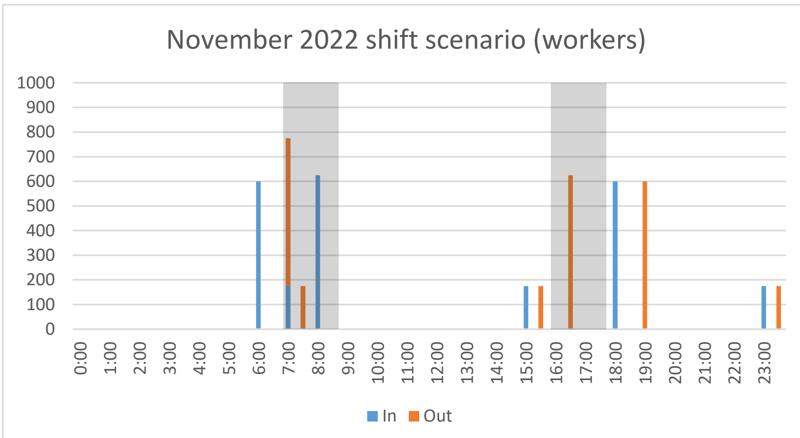
In summary, based on the updated shift change times associated with the NextStar battery plant and proposed corridor modifications to the Banwell Road Corridor, we reaffirm that the Banwell Road corridor will be able to support the development of the Tecumseh Hamlet Secondary Plan area development.

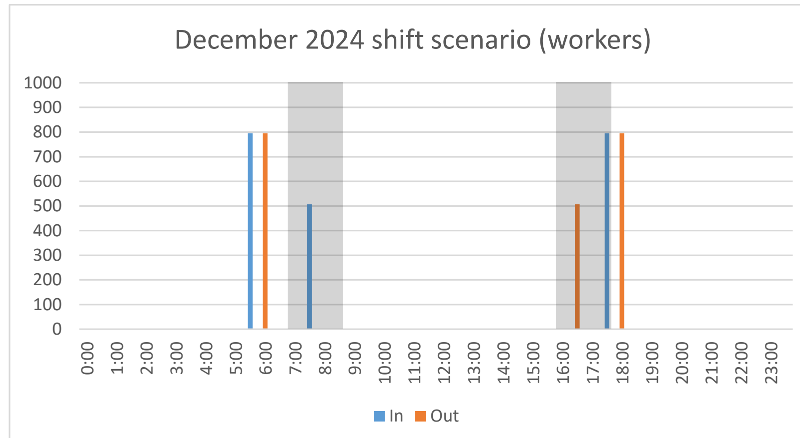
Attachment 1:

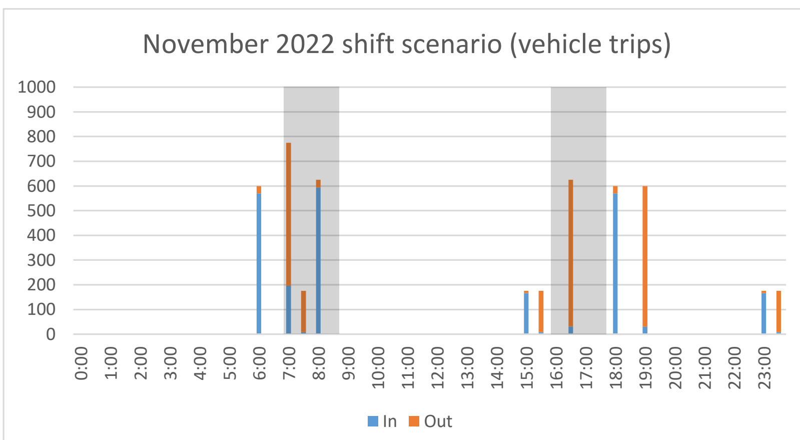
Comparison of November 2022 vs October 2024
NextStar Staffing and Shift Change Assumptions

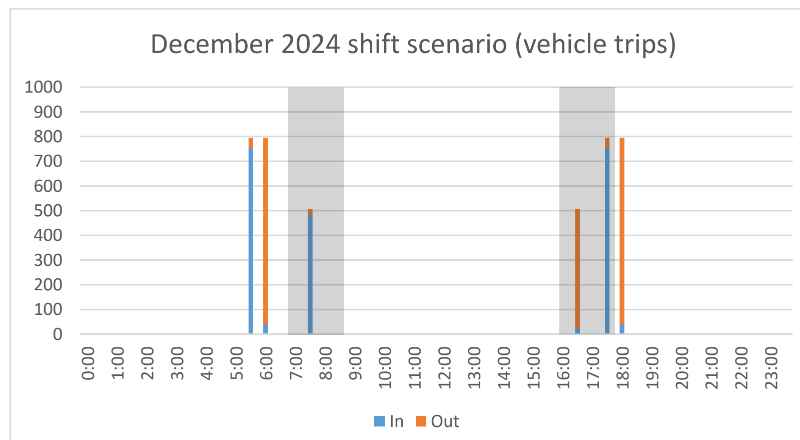
Stellantis/LG Battery Plant TIS
Comparison of November 2022 vs September 2024 staffing and shift change assumptions

	Previous assumptions (November 2022)					Updated assumptions (September 2024)				
Shift	# employees	Shift start time	Arrival on site between	Shift end time	Leave site between	# employees	Shift start time	Arrival on site between	Shift end time	Leave site between
Cell (day)	600	7:00 AM	6:00–6:30 AM	7:00 PM	7:00–7:30 PM	795	6:00 AM	5:30–6:00 AM	6:00 PM	6:00–6:30 PM
Module (day)	175	7:30 AM	7:00–7:30 AM	3:30 PM	3:30–4:00 PM					
Admin	625	8:30 AM	8:00–8:30 AM	4:30 PM	4:30–5:00 PM	507	8:00 AM	7:30–8:00 AM	4:30 PM	4:30–5:00 PM
Module (evening)	175	3:30 PM	3:00–3:30 PM	11:30 PM	11:30 PM–12:00 AM	0	—	—	—	—
Cell (night)	600	7:00 PM	7:00–7:30 PM	7:00 AM	7:00–7:30 AM	795	6:00 PM	5:30–6:00 PM	6:00 AM	6:00–6:30 AM
Module (night)	175	11:30 PM	11:00–11:30 PM	7:30 AM	7:30–8:00 AM					









Attachment 2:

Synchro Analysis Worksheets

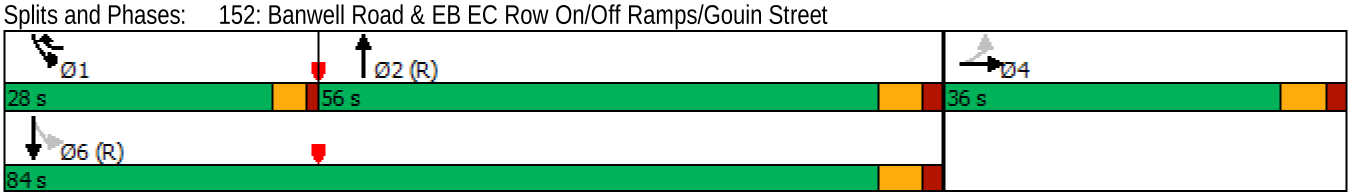
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	91	270	0	0	118	0	698	9	65	491	107
Future Volume (vph)	191	91	270	0	0	118	0	698	9	65	491	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		1	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.998				0.850
Flt Protected	0.950	0.975								0.950		
Satd. Flow (prot)	1643	3372	1615	0	0	1644	0	5177	0	1805	3610	1615
Flt Permitted	0.950	0.975								0.130		
Satd. Flow (perm)	1643	3372	1615	0	0	1644	0	5177	0	247	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			421			82		2				137
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	382	182	540	0	0	236	0	1396	18	130	982	214
Shared Lane Traffic (%)	50%											
Lane Group Flow (vph)	191	373	540	0	0	236	0	1414	0	130	982	214
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	36.0	36.0				28.0		56.0		28.0	84.0	
Total Split (%)	30.0%	30.0%				23.3%		46.7%		23.3%	70.0%	
Maximum Green (s)	30.0	30.0				24.0		50.0		24.0	78.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	19.7	19.7	120.0			16.8		67.4		90.3	88.3	120.0
Actuated g/C Ratio	0.16	0.16	1.00			0.14		0.56		0.75	0.74	1.00
v/c Ratio	0.71	0.67	0.33			0.78		0.49		0.32	0.37	0.13
Control Delay	61.3	52.8	0.6			49.7		16.2		8.6	4.4	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	61.3	52.8	0.6			49.7		16.2		8.6	4.4	0.2
LOS	E	D	A			D		B		A	A	A
Approach Delay		28.7			49.7			16.2			4.1	
Approach LOS		C			D			B			A	
Queue Length 50th (m)	50.0	48.5	0.0			37.4		89.1		5.5	25.1	0.0
Queue Length 95th (m)	73.0	61.3	0.0			62.8		128.9		17.5	29.5	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	410	843	1615			394		2910		497	2655	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.47	0.44	0.33			0.60		0.49		0.26	0.37	0.13

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 22 (18%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 17.6 Intersection LOS: B
Intersection Capacity Utilization 66.1% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



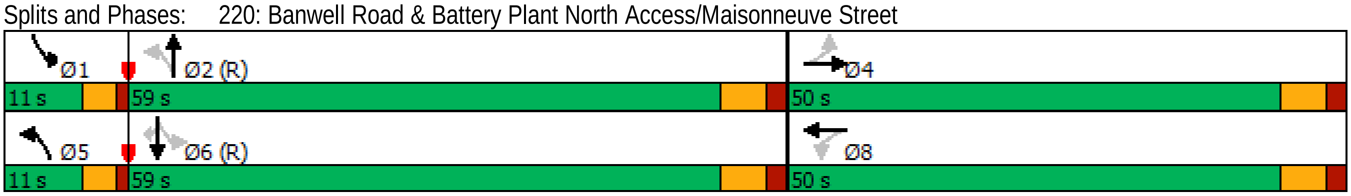
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	2	3	39	16	80	76	505	23	38	463	116
Future Volume (vph)	15	2	3	39	16	80	76	505	23	38	463	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.910			0.875			0.993				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1729	0	1805	1662	0	1805	5102	0	1805	5136	1615
Flt Permitted	0.333			0.751			0.284			0.254		
Satd. Flow (perm)	633	1729	0	1427	1662	0	540	5102	0	483	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			160			7				232
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	30	4	6	78	32	160	152	1010	46	76	926	232
Shared Lane Traffic (%)												
Lane Group Flow (vph)	30	10	0	78	192	0	152	1056	0	76	926	232
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	50.0	50.0		50.0	50.0		11.0	59.0		11.0	59.0	59.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%		9.2%	49.2%		9.2%	49.2%	49.2%
Maximum Green (s)	44.0	44.0		44.0	44.0		7.0	53.0		7.0	53.0	53.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	12.0	12.0		12.0	12.0		95.1	87.5		93.6	85.2	85.2
Actuated g/C Ratio	0.10	0.10		0.10	0.10		0.79	0.73		0.78	0.71	0.71
v/c Ratio	0.48	0.06		0.55	0.62		0.30	0.28		0.17	0.25	0.19
Control Delay	73.9	32.3		64.8	20.8		4.3	4.6		2.8	5.3	0.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	73.9	32.3		64.8	20.8		4.3	4.6		2.8	5.3	0.7
LOS	E	C		E	C		A	A		A	A	A
Approach Delay		63.5			33.5			4.6			4.3	
Approach LOS		E			C			A			A	
Queue Length 50th (m)	7.2	0.9		18.7	7.4		3.5	25.6		1.9	20.8	0.4
Queue Length 95th (m)	17.2	6.1		33.9	29.9		7.9	30.1		5.3	27.6	2.0
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	232	637		523	710		501	3723		456	3647	1214
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.13	0.02		0.15	0.27		0.30	0.28		0.17	0.25	0.19

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 104 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.62
Intersection Signal Delay: 8.1 Intersection LOS: A
Intersection Capacity Utilization 60.4% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



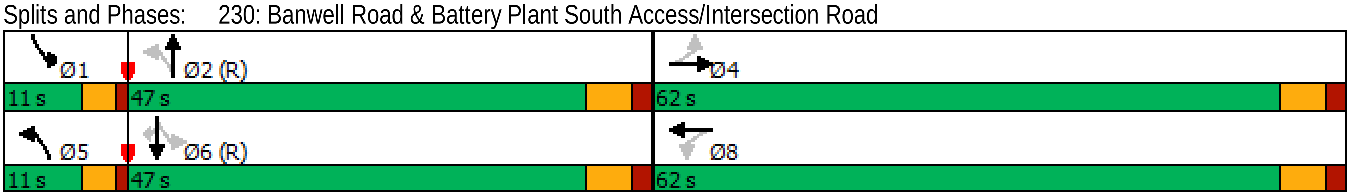
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	3	1	69	23	173	51	450	24	70	386	29
Future Volume (vph)	1	3	1	69	23	173	51	450	24	70	386	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.962			0.868			0.992				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1775	0	1787	1635	0	1805	5143	0	1787	3539	1615
Flt Permitted	0.172			0.752			0.324			0.270		
Satd. Flow (perm)	324	1775	0	1415	1635	0	616	5143	0	508	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			186			7				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	2	6	2	138	46	346	102	900	48	140	772	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	2	8	0	138	392	0	102	948	0	140	772	58
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	41.0		9.0	41.0	41.0
Total Split (s)	62.0	62.0		62.0	62.0		11.0	47.0		11.0	47.0	47.0
Total Split (%)	51.7%	51.7%		51.7%	51.7%		9.2%	39.2%		9.2%	39.2%	39.2%
Maximum Green (s)	56.0	56.0		56.0	56.0		7.0	41.0		7.0	41.0	41.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0			28.0			28.0	28.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	23.3	23.3		23.3	23.3		82.6	73.9		82.9	74.1	74.1
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.69	0.62		0.69	0.62	0.62
v/c Ratio	0.03	0.02		0.50	0.84		0.21	0.30		0.33	0.35	0.06
Control Delay	34.0	29.0		47.4	39.3		7.6	12.3		12.6	16.3	6.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	34.0	29.0		47.4	39.3		7.6	12.3		12.6	16.3	6.3
LOS	C	C		D	D		A	B		B	B	A
Approach Delay		30.0			41.4			11.8			15.1	
Approach LOS		C			D			B			B	
Queue Length 50th (m)	0.4	1.2		30.9	51.5		6.5	37.5		13.5	48.3	0.4
Queue Length 95th (m)	2.5	4.9		45.1	78.9		17.2	60.4		25.3	56.2	5.7
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	151	829		660	862		495	3170		426	2184	1021
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.01	0.01		0.21	0.45		0.21	0.30		0.33	0.35	0.06

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 108 (90%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 19.3 Intersection LOS: B
Intersection Capacity Utilization 64.1% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



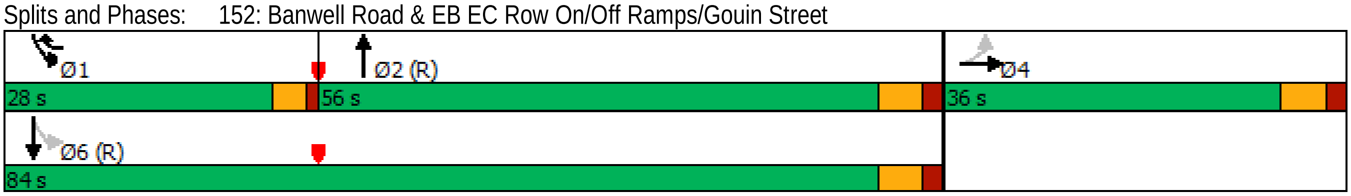
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	91	67	0	0	118	0	682	9	65	406	107
Future Volume (vph)	191	91	67	0	0	118	0	682	9	65	406	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		1	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.998				0.850
Flt Protected	0.950	0.975								0.950		
Satd. Flow (prot)	1643	3372	1615	0	0	1644	0	5177	0	1805	3610	1615
Flt Permitted	0.950	0.975								0.136		
Satd. Flow (perm)	1643	3372	1615	0	0	1644	0	5177	0	258	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			134			82		2				165
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	382	182	134	0	0	236	0	1364	18	130	812	214
Shared Lane Traffic (%)	50%											
Lane Group Flow (vph)	191	373	134	0	0	236	0	1382	0	130	812	214
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	36.0	36.0				28.0		56.0		28.0	84.0	
Total Split (%)	30.0%	30.0%				23.3%		46.7%		23.3%	70.0%	
Maximum Green (s)	30.0	30.0				24.0		50.0		24.0	78.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	19.7	19.7	120.0			16.8		67.4		90.3	88.3	120.0
Actuated g/C Ratio	0.16	0.16	1.00			0.14		0.56		0.75	0.74	1.00
v/c Ratio	0.71	0.67	0.08			0.78		0.47		0.32	0.31	0.13
Control Delay	61.3	52.8	0.1			49.7		26.2		10.0	4.6	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	61.3	52.8	0.1			49.7		26.2		10.0	4.6	0.2
LOS	E	D	A			D		C		A	A	A
Approach Delay		45.0			49.7			26.2			4.4	
Approach LOS		D			D			C			A	
Queue Length 50th (m)	50.0	48.5	0.0			37.4		87.4		5.8	23.4	0.0
Queue Length 95th (m)	73.0	61.3	0.0			62.8		135.2		17.0	31.3	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	410	843	1615			394		2910		503	2655	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.47	0.44	0.08			0.60		0.47		0.26	0.31	0.13

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 116 (97%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 24.3 Intersection LOS: C
Intersection Capacity Utilization 65.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street

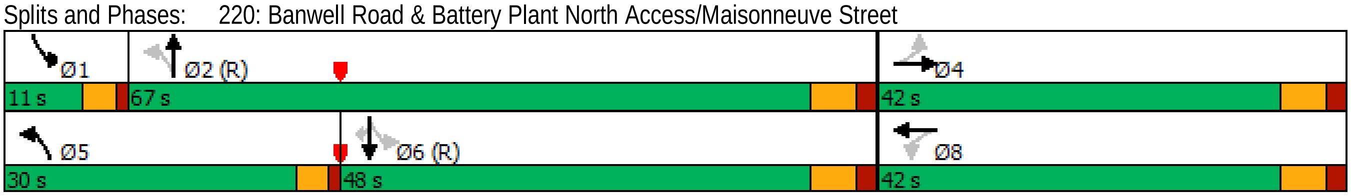


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1	0	39	2	80	0	504	23	38	289	0
Future Volume (vph)	0	1	0	39	2	80	0	504	23	38	289	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt					0.854			0.993				
Flt Protected				0.950						0.950		
Satd. Flow (prot)	1900	1900	0	1805	1623	0	1900	5102	0	1805	5136	1900
Flt Permitted				0.757						0.239		
Satd. Flow (perm)	1900	1900	0	1438	1623	0	1900	5102	0	454	5136	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					160			8				
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	0	2	0	78	4	160	0	1008	46	76	578	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2	0	78	164	0	0	1054	0	76	578	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	42.0	42.0		42.0	42.0		30.0	67.0		11.0	48.0	48.0
Total Split (%)	35.0%	35.0%		35.0%	35.0%		25.0%	55.8%		9.2%	40.0%	40.0%
Maximum Green (s)	36.0	36.0		36.0	36.0		26.0	61.0		7.0	42.0	42.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)		11.9		11.9	11.9			87.6		98.1	96.1	
Actuated g/C Ratio		0.10		0.10	0.10			0.73		0.82	0.80	
v/c Ratio		0.01		0.55	0.54			0.28		0.17	0.14	
Control Delay		45.5		64.8	14.7			3.5		2.8	2.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay		0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay		45.5		64.8	14.7			3.5		2.8	2.5	
LOS		D		E	B			A		A	A	
Approach Delay		45.5			30.9			3.5			2.5	
Approach LOS		D			C			A			A	
Queue Length 50th (m)		0.5		18.7	0.9			14.5		4.4	12.5	
Queue Length 95th (m)		3.0		33.9	20.8			23.8		4.8	12.2	
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0						60.0		
Base Capacity (vph)		570		431	598			3727		449	4112	
Starvation Cap Reductn		0		0	0			0		0	0	
Spillback Cap Reductn		0		0	0			0		0	0	
Storage Cap Reductn		0		0	0			0		0	0	
Reduced v/c Ratio		0.00		0.18	0.27			0.28		0.17	0.14	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 50 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.55	
Intersection Signal Delay: 6.6	Intersection LOS: A
Intersection Capacity Utilization 49.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street

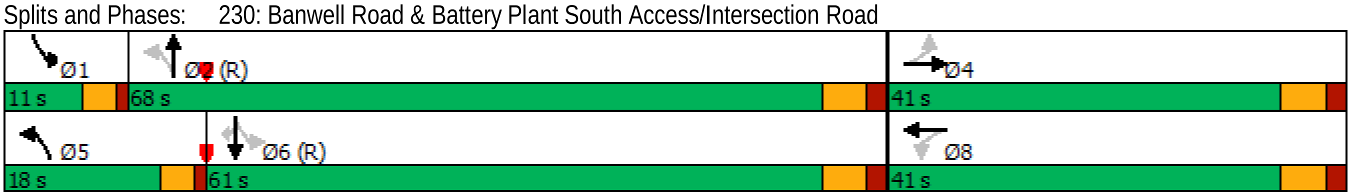


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2	0	69	0	173	0	374	24	70	380	0
Future Volume (vph)	0	2	0	69	0	173	0	374	24	70	380	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt					0.850			0.991				
Flt Protected				0.950						0.950		
Satd. Flow (prot)	1881	1827	0	1787	1599	0	1900	5137	0	1787	3539	1900
Flt Permitted				0.755						0.316		
Satd. Flow (perm)	1881	1827	0	1420	1599	0	1900	5137	0	594	3539	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					263			12				
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	0	4	0	138	0	346	0	748	48	140	760	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	4	0	138	346	0	0	796	0	140	760	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	41.0	41.0		41.0	41.0		18.0	68.0		11.0	61.0	61.0
Total Split (%)	34.2%	34.2%		34.2%	34.2%		15.0%	56.7%		9.2%	50.8%	50.8%
Maximum Green (s)	35.0	35.0		35.0	35.0		14.0	62.0		7.0	55.0	55.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)		17.3		17.3	17.3			79.9		92.7	90.7	
Actuated g/C Ratio		0.14		0.14	0.14			0.67		0.77	0.76	
v/c Ratio		0.02		0.67	0.76			0.23		0.27	0.28	
Control Delay		40.0		63.9	23.5			8.6		4.6	3.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay		0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay		40.0		63.9	23.5			8.6		4.6	3.9	
LOS		D		E	C			A		A	A	
Approach Delay		40.0			35.1			8.6			4.0	
Approach LOS		D			D			A			A	
Queue Length 50th (m)		0.9		33.0	18.9			25.6		5.5	18.2	
Queue Length 95th (m)		4.0		51.3	50.5			39.4		10.5	25.6	
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0						60.0		
Base Capacity (vph)		532		414	652			3422		528	2674	
Starvation Cap Reductn		0		0	0			0		0	0	
Spillback Cap Reductn		0		0	0			0		0	0	
Storage Cap Reductn		0		0	0			0		0	0	
Reduced v/c Ratio		0.01		0.33	0.53			0.23		0.27	0.28	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 12.6	Intersection LOS: B
Intersection Capacity Utilization 59.9%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



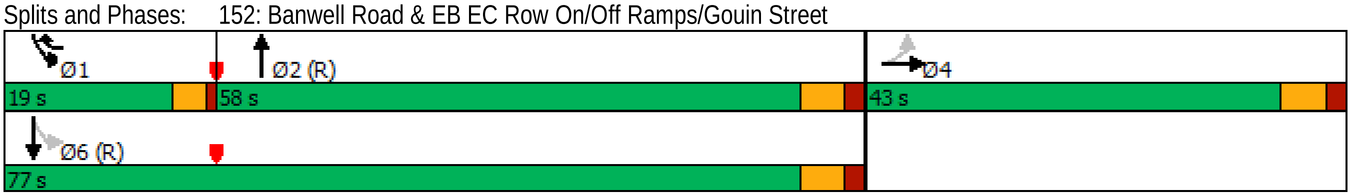
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	270	60	0	0	107	0	996	25	57	555	173
Future Volume (vph)	325	270	60	0	0	107	0	996	25	57	555	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		1	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.996				0.850
Flt Protected	0.950	0.984								0.950		
Satd. Flow (prot)	1643	3403	1615	0	0	1644	0	5166	0	1805	3610	1615
Flt Permitted	0.950	0.984								0.066		
Satd. Flow (perm)	1643	3403	1615	0	0	1644	0	5166	0	125	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			118			82		4				196
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	650	540	120	0	0	214	0	1992	50	114	1110	346
Shared Lane Traffic (%)	40%											
Lane Group Flow (vph)	390	800	120	0	0	214	0	2042	0	114	1110	346
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	43.0	43.0				19.0		58.0		19.0	77.0	
Total Split (%)	35.8%	35.8%				15.8%		48.3%		15.8%	64.2%	
Maximum Green (s)	37.0	37.0				15.0		52.0		15.0	71.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	33.9	33.9	120.0			13.3		56.8		76.1	74.1	120.0
Actuated g/C Ratio	0.28	0.28	1.00			0.11		0.47		0.63	0.62	1.00
v/c Ratio	0.84	0.83	0.07			0.84		0.83		0.43	0.50	0.21
Control Delay	57.2	48.6	0.1			59.1		25.0		22.3	11.7	0.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	57.2	48.6	0.1			59.1		25.0		22.3	11.7	0.3
LOS	E	D	A			E		C		C	B	A
Approach Delay		46.7			59.1			25.0			9.9	
Approach LOS		D			E			C			A	
Queue Length 50th (m)	97.3	99.6	0.0			32.1		186.0		15.3	78.6	0.0
Queue Length 95th (m)	#141.3	123.9	0.0			#70.1		93.1		31.6	96.2	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	506	1049	1615			277		2447		289	2229	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.77	0.76	0.07			0.77		0.83		0.39	0.50	0.21

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 11 (9%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 27.3 Intersection LOS: C
Intersection Capacity Utilization 88.7% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



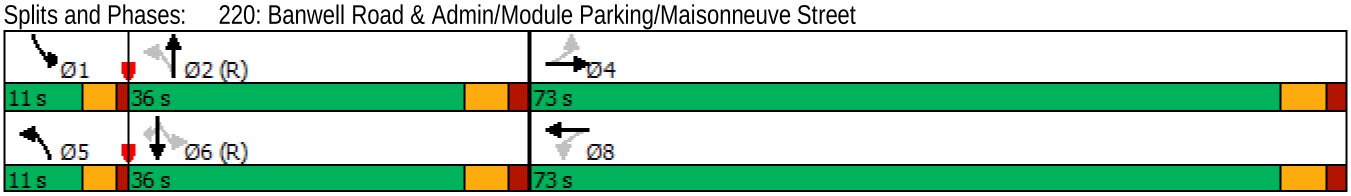
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	202	15	51	74	3	152	4	518	69	44	503	6
Future Volume (vph)	202	15	51	74	3	152	4	518	69	44	503	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.884			0.853			0.982				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1680	0	1805	1621	0	1805	5049	0	1805	5085	1615
Flt Permitted	0.499			0.673			0.222			0.112		
Satd. Flow (perm)	948	1680	0	1279	1621	0	422	5049	0	213	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		102			209			19				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	404	30	102	148	6	304	8	1036	138	88	1006	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	404	132	0	148	310	0	8	1174	0	88	1006	12
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	73.0	73.0		73.0	73.0		11.0	36.0		11.0	36.0	36.0
Total Split (%)	60.8%	60.8%		60.8%	60.8%		9.2%	30.0%		9.2%	30.0%	30.0%
Maximum Green (s)	67.0	67.0		67.0	67.0		7.0	30.0		7.0	30.0	30.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	56.5	56.5		56.5	56.5		48.6	40.7		52.8	49.4	49.4
Actuated g/C Ratio	0.47	0.47		0.47	0.47		0.40	0.34		0.44	0.41	0.41
v/c Ratio	0.91	0.16		0.25	0.36		0.03	0.68		0.48	0.48	0.02
Control Delay	53.2	4.5		18.3	6.3		22.8	38.1		45.9	36.4	1.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	53.2	4.5		18.3	6.3		22.8	38.1		45.9	36.4	1.1
LOS	D	A		B	A		C	D		D	D	A
Approach Delay		41.2			10.2			38.0			36.7	
Approach LOS		D			B			D			D	
Queue Length 50th (m)	86.1	3.7		20.5	13.2		1.2	94.7		16.4	67.5	0.0
Queue Length 95th (m)	124.1	12.3		29.6	26.4		m3.9	#131.8		34.7	88.2	m0.1
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	529	983		714	997		255	1724		186	2092	702
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.76	0.13		0.21	0.31		0.03	0.68		0.47	0.48	0.02

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 34.2 Intersection LOS: C
Intersection Capacity Utilization 87.8% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Admin/Module Parking/Maisonneuve Street



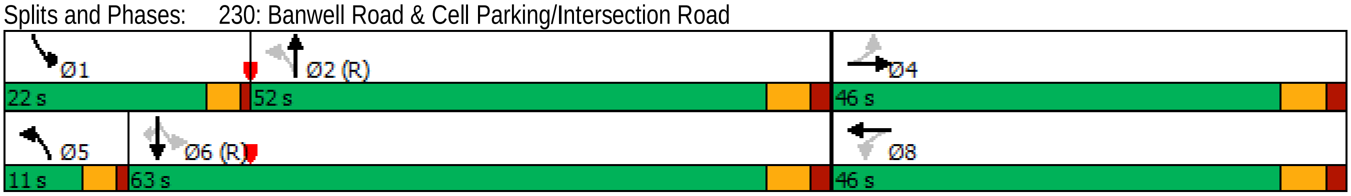
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	87	27	13	33	2	111	3	384	82	202	609	2
Future Volume (vph)	87	27	13	33	2	111	3	384	82	202	609	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.951			0.853			0.974				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1771	0	1787	1605	0	1805	4962	0	1787	3539	1615
Flt Permitted	0.441			0.705			0.223			0.240		
Satd. Flow (perm)	830	1771	0	1326	1605	0	424	4962	0	451	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			222			45				64
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	3%	0%	1%	0%	1%	0%	2%	1%	1%	2%	0%
Adj. Flow (vph)	174	54	26	66	4	222	6	768	164	404	1218	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	174	80	0	66	226	0	6	932	0	404	1218	4
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	46.0	46.0		46.0	46.0		11.0	52.0		22.0	63.0	63.0
Total Split (%)	38.3%	38.3%		38.3%	38.3%		9.2%	43.3%		18.3%	52.5%	52.5%
Maximum Green (s)	40.0	40.0		40.0	40.0		7.0	46.0		18.0	57.0	57.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	26.2	26.2		26.2	26.2		68.2	60.5		83.8	79.7	79.7
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.57	0.50		0.70	0.66	0.66
v/c Ratio	0.96	0.20		0.23	0.43		0.02	0.37		0.80	0.52	0.00
Control Delay	103.0	26.4		37.5	7.2		9.3	19.0		25.9	16.0	0.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	103.0	26.4		37.5	7.2		9.3	19.0		25.9	16.0	0.0
LOS	F	C		D	A		A	B		C	B	A
Approach Delay		78.9			14.0			18.9			18.4	
Approach LOS		E			B			B			B	
Queue Length 50th (m)	42.9	11.7		13.5	0.8		0.4	48.0		59.3	99.4	0.0
Queue Length 95th (m)	#70.2	22.6		23.6	18.8		2.3	70.2		#126.2	179.1	m0.0
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)							60.0			60.0		
Base Capacity (vph)	276	605		442	683		326	2525		515	2351	1094
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.63	0.13		0.15	0.33		0.02	0.37		0.78	0.52	0.00

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 54 (45%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 23.1 Intersection LOS: C
Intersection Capacity Utilization 82.8% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 230: Banwell Road & Cell Parking/Intersection Road



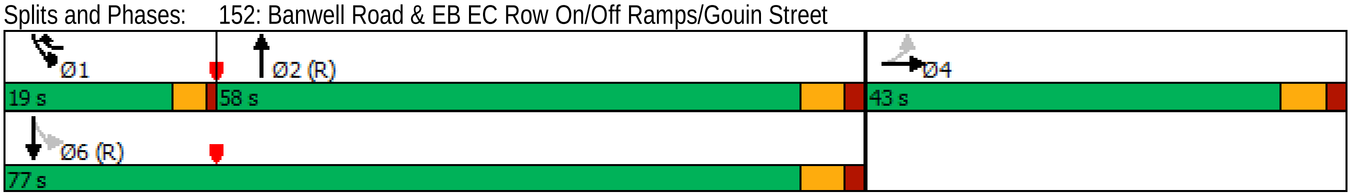
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	270	369	0	0	107	0	732	25	57	685	173
Future Volume (vph)	325	270	369	0	0	107	0	732	25	57	685	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	0.0		0.0	60.0		0.0
Storage Lanes	1		1	0		1	0		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt			0.850			0.865		0.995				0.850
Flt Protected	0.950	0.984								0.950		
Satd. Flow (prot)	1643	3403	1615	0	0	1644	0	5161	0	1805	3610	1615
Flt Permitted	0.950	0.984								0.091		
Satd. Flow (perm)	1643	3403	1615	0	0	1644	0	5161	0	173	3610	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			420			82		5				158
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		318.7			237.0			90.3			153.4	
Travel Time (s)		22.9			17.1			5.4			9.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	650	540	738	0	0	214	0	1464	50	114	1370	346
Shared Lane Traffic (%)	40%											
Lane Group Flow (vph)	390	800	738	0	0	214	0	1514	0	114	1370	346
Turn Type	Perm	NA	Free			Over		NA		pm+pt	NA	Free
Protected Phases		4				1		2		1	6	
Permitted Phases	4		Free							6		Free
Detector Phase	4	4				1		2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0				5.0		5.0		5.0	5.0	
Minimum Split (s)	34.0	34.0				9.5		26.0		9.5	24.0	
Total Split (s)	43.0	43.0				19.0		58.0		19.0	77.0	
Total Split (%)	35.8%	35.8%				15.8%		48.3%		15.8%	64.2%	
Maximum Green (s)	37.0	37.0				15.0		52.0		15.0	71.0	
Yellow Time (s)	4.0	4.0				3.0		4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0				1.0		2.0		1.0	2.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0				4.0		6.0		4.0	6.0	
Lead/Lag						Lead		Lag		Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0				3.0		3.0		3.0	3.0	
Recall Mode	None	None				None		C-Max		None	C-Max	
Walk Time (s)	7.0	7.0						7.0				
Flash Dont Walk (s)	21.0	21.0						13.0				
Pedestrian Calls (#/hr)	0	0						0				
Act Effct Green (s)	33.9	33.9	120.0			13.3		56.8		76.1	74.1	120.0
Actuated g/C Ratio	0.28	0.28	1.00			0.11		0.47		0.63	0.62	1.00
v/c Ratio	0.84	0.83	0.46			0.84		0.62		0.39	0.61	0.21
Control Delay	57.2	48.6	0.9			59.1		28.4		16.9	12.9	0.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0			0.0		0.0		0.0	0.0	0.0
Total Delay	57.2	48.6	0.9			59.1		28.4		16.9	12.9	0.3
LOS	E	D	A			E		C		B	B	A
Approach Delay		32.1			59.1			28.4			10.7	
Approach LOS		C			E			C			B	
Queue Length 50th (m)	97.3	99.6	0.0			32.1		124.4		10.9	105.1	0.0
Queue Length 95th (m)	#141.3	123.9	0.0			#70.1		142.6		m25.5	121.3	0.0
Internal Link Dist (m)		294.7			213.0			66.3			129.4	
Turn Bay Length (m)	100.0		100.0							60.0		
Base Capacity (vph)	506	1049	1615			277		2446		313	2229	1615
Starvation Cap Reductn	0	0	0			0		0		0	0	0
Spillback Cap Reductn	0	0	0			0		0		0	0	0
Storage Cap Reductn	0	0	0			0		0		0	0	0
Reduced v/c Ratio	0.77	0.76	0.46			0.77		0.62		0.36	0.61	0.21

Intersection Summary	
Area Type:	Other
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 11 (9%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.84	
Intersection Signal Delay: 25.0	Intersection LOS: C
Intersection Capacity Utilization 78.5%	ICU Level of Service D
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 152: Banwell Road & EB EC Row On/Off Ramps/Gouin Street



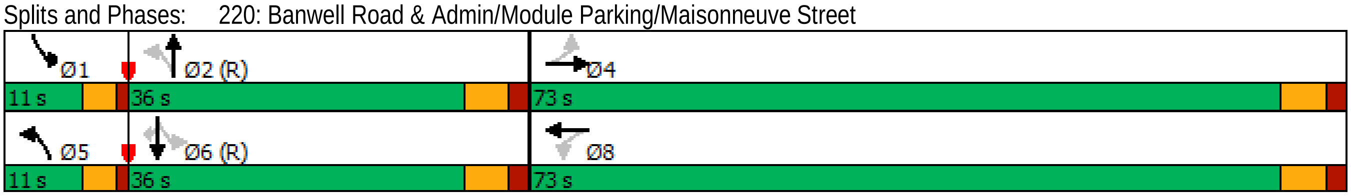
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	2	3	91	7	152	91	444	69	44	775	173
Future Volume (vph)	12	2	3	91	7	152	91	444	69	44	775	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.910			0.857			0.980				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1729	0	1805	1628	0	1805	5040	0	1805	5085	1615
Flt Permitted	0.185			0.751			0.123			0.248		
Satd. Flow (perm)	352	1729	0	1427	1628	0	234	5040	0	471	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			213			23				207
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	24	4	6	182	14	304	182	888	138	88	1550	346
Shared Lane Traffic (%)												
Lane Group Flow (vph)	24	10	0	182	318	0	182	1026	0	88	1550	346
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	42.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	73.0	73.0		73.0	73.0		11.0	36.0		11.0	36.0	36.0
Total Split (%)	60.8%	60.8%		60.8%	60.8%		9.2%	30.0%		9.2%	30.0%	30.0%
Maximum Green (s)	67.0	67.0		67.0	67.0		7.0	30.0		7.0	30.0	30.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	29.0	29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	21.6	21.6		21.6	21.6		84.7	75.7		84.0	75.4	75.4
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.71	0.63		0.70	0.63	0.63
v/c Ratio	0.38	0.03		0.71	0.68		0.71	0.32		0.22	0.49	0.32
Control Delay	57.9	24.7		60.2	22.0		23.5	12.6		9.8	19.6	10.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	57.9	24.7		60.2	22.0		23.5	12.6		9.8	19.6	10.7
LOS	E	C		E	C		C	B		A	B	B
Approach Delay		48.1			35.9			14.3			17.6	
Approach LOS		D			D			B			B	
Queue Length 50th (m)	5.3	0.8		42.9	23.4		19.9	56.3		7.4	101.3	26.3
Queue Length 95th (m)	13.6	5.3		62.4	50.7		#46.7	75.6		m16.4	126.2	63.5
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	196	968		796	1003		256	3189		408	3193	1091
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.12	0.01		0.23	0.32		0.71	0.32		0.22	0.49	0.32

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 19.3 Intersection LOS: B
Intersection Capacity Utilization 73.3% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Admin/Module Parking/Maisonneuve Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	6	4	33	29	119	116	463	82	202	503	122
Future Volume (vph)	14	6	4	33	29	119	116	463	82	202	503	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.940			0.879			0.977				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1754	0	1787	1657	0	1805	4976	0	1787	3539	1615
Flt Permitted	0.270			0.744			0.285			0.210		
Satd. Flow (perm)	508	1754	0	1400	1657	0	542	4976	0	395	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			185			34				244
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	3%	0%	1%	0%	1%	0%	2%	1%	1%	2%	0%
Adj. Flow (vph)	28	12	8	66	58	238	232	926	164	404	1006	244
Shared Lane Traffic (%)												
Lane Group Flow (vph)	28	20	0	66	296	0	232	1090	0	404	1006	244
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	41.0	41.0		41.0	41.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	46.0	46.0		46.0	46.0		11.0	52.0		22.0	63.0	63.0
Total Split (%)	38.3%	38.3%		38.3%	38.3%		9.2%	43.3%		18.3%	52.5%	52.5%
Maximum Green (s)	40.0	40.0		40.0	40.0		7.0	46.0		18.0	57.0	57.0
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)	28.0	28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	14.8	14.8		14.8	14.8		80.2	71.2		95.2	82.2	82.2
Actuated g/C Ratio	0.12	0.12		0.12	0.12		0.67	0.59		0.79	0.68	0.68
v/c Ratio	0.45	0.09		0.38	0.81		0.53	0.37		0.77	0.42	0.21
Control Delay	68.0	30.8		52.2	35.5		10.7	13.5		29.6	20.7	10.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	68.0	30.8		52.2	35.5		10.7	13.5		29.6	20.7	10.5
LOS	E	C		D	D		B	B		C	C	B
Approach Delay		52.5			38.6			13.0			21.4	
Approach LOS		D			D			B			C	
Queue Length 50th (m)	6.6	2.7		15.3	26.9		10.9	46.4		65.1	83.1	21.8
Queue Length 95th (m)	15.6	9.4		27.3	55.0		25.8	69.0		#115.6	145.9	47.9
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)							60.0			60.0		
Base Capacity (vph)	169	590		466	675		435	2966		522	2424	1183
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.17	0.03		0.14	0.44		0.53	0.37		0.77	0.42	0.21

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 54 (45%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

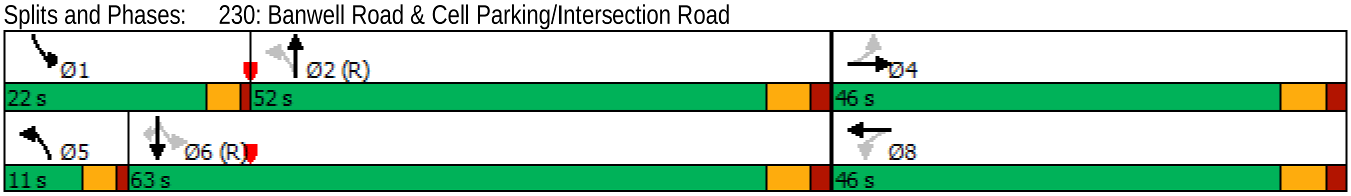
Intersection Signal Delay: 20.4 Intersection LOS: C

Intersection Capacity Utilization 80.5% ICU Level of Service D

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 230: Banwell Road & Cell Parking/Intersection Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	2	3	39	16	80	76	505	23	38	463	116
Future Volume (vph)	15	2	3	39	16	80	76	505	23	38	463	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	2		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.910			0.875			0.993				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3502	1729	0	1805	1662	0	1805	5102	0	1805	5136	1615
Flt Permitted	0.950			0.751			0.275			0.244		
Satd. Flow (perm)	3502	1729	0	1427	1662	0	522	5102	0	464	5136	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			160			6				232
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	30	4	6	78	32	160	152	1010	46	76	926	232
Shared Lane Traffic (%)												
Lane Group Flow (vph)	30	10	0	78	192	0	152	1056	0	76	926	232
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	20.0	64.0		44.0	44.0		11.0	45.0		11.0	45.0	45.0
Total Split (%)	16.7%	53.3%		36.7%	36.7%		9.2%	37.5%		9.2%	37.5%	37.5%
Maximum Green (s)	15.0	58.0		38.0	38.0		7.0	39.0		7.0	39.0	39.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	6.5	19.2		11.9	11.9		87.8	80.2		86.5	78.0	78.0
Actuated g/C Ratio	0.05	0.16		0.10	0.10		0.73	0.67		0.72	0.65	0.65
v/c Ratio	0.16	0.04		0.55	0.62		0.33	0.31		0.19	0.28	0.21
Control Delay	55.6	24.9		65.1	20.9		7.1	7.3		5.3	8.8	1.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	55.6	24.9		65.1	20.9		7.1	7.3		5.3	8.8	1.2
LOS	E	C		E	C		A	A		A	A	A
Approach Delay		48.0			33.7			7.2			7.2	
Approach LOS		D			C			A			A	
Queue Length 50th (m)	3.7	0.8		18.7	7.4		8.3	27.6		3.9	38.5	1.1
Queue Length 95th (m)	8.8	5.3		33.9	29.9		10.8	36.2		8.2	52.3	6.2
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0			60.0			60.0		60.0
Base Capacity (vph)	437	838		451	635		456	3413		414	3338	1131
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.07	0.01		0.17	0.30		0.33	0.31		0.18	0.28	0.21

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

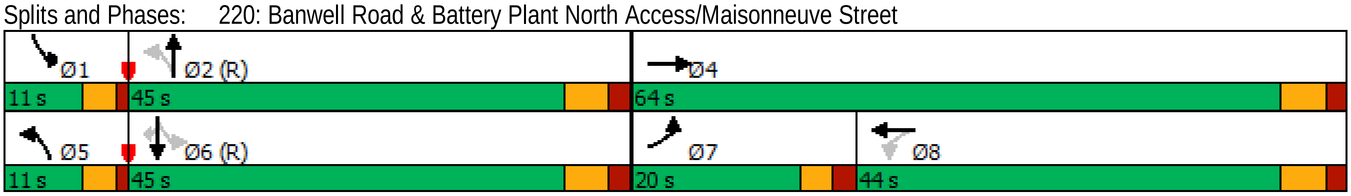
Maximum v/c Ratio: 0.62

Intersection Signal Delay: 10.4 Intersection LOS: B

Intersection Capacity Utilization 52.5% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street

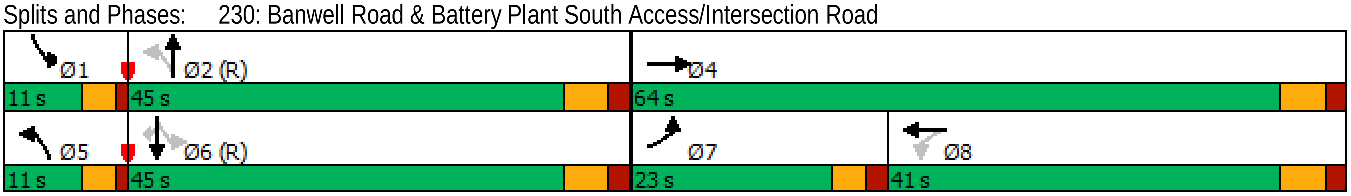


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	3	1	69	23	173	51	450	24	70	386	29
Future Volume (vph)	1	3	1	69	23	173	51	450	24	70	386	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	2		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.962			0.868			0.992				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	1775	0	1787	1635	0	1805	5143	0	1787	3539	1615
Flt Permitted	0.950			0.752			0.323			0.269		
Satd. Flow (perm)	3467	1775	0	1415	1635	0	614	5143	0	506	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			319			7				109
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	2	6	2	138	46	346	102	900	48	140	772	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	2	8	0	138	392	0	102	948	0	140	772	58
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	24.0		24.0	24.0		9.0	41.0		9.0	41.0	41.0
Total Split (s)	23.0	64.0		41.0	41.0		11.0	45.0		11.0	45.0	45.0
Total Split (%)	19.2%	53.3%		34.2%	34.2%		9.2%	37.5%		9.2%	37.5%	37.5%
Maximum Green (s)	18.0	58.0		35.0	35.0		7.0	39.0		7.0	39.0	39.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		11.0		11.0	11.0			28.0			28.0	28.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	5.6	19.6		17.4	17.4		86.3	77.6		86.6	77.8	77.8
Actuated g/C Ratio	0.05	0.16		0.14	0.14		0.72	0.65		0.72	0.65	0.65
v/c Ratio	0.01	0.03		0.68	0.77		0.20	0.28		0.32	0.34	0.05
Control Delay	54.5	31.4		63.9	20.7		6.5	10.6		10.5	12.0	2.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	54.5	31.4		63.9	20.7		6.5	10.6		10.5	12.0	2.1
LOS	D	C		E	C		A	B		B	B	A
Approach Delay		36.0			32.0			10.2			11.2	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	0.2	1.3		33.0	16.5		5.1	31.9		6.9	27.2	0.0
Queue Length 95th (m)	1.7	4.9		51.2	49.5		17.3	60.6		22.6	55.6	4.4
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0			60.0			60.0		
Base Capacity (vph)	520	858		412	702		512	3328		440	2293	1085
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.00	0.01		0.33	0.56		0.20	0.28		0.32	0.34	0.05

Intersection Summary	
Area Type:	Other
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 85	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.77	
Intersection Signal Delay: 15.2	Intersection LOS: B
Intersection Capacity Utilization 64.1%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road

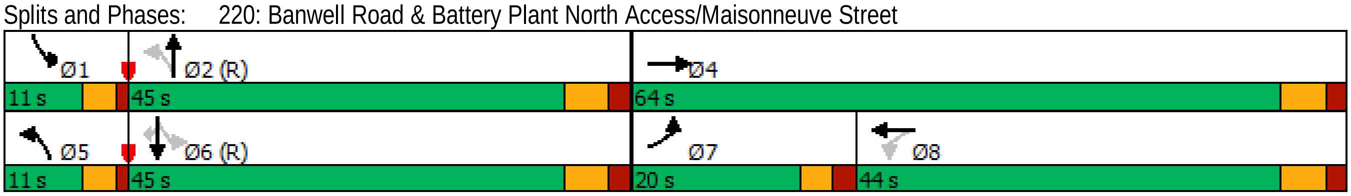


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1	0	39	2	80	0	504	23	38	289	0
Future Volume (vph)	0	1	0	39	2	80	0	504	23	38	289	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	30.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	2		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt					0.854			0.993				
Flt Protected				0.950						0.950		
Satd. Flow (prot)	3686	1900	0	1805	1623	0	1900	5102	0	1805	5136	1900
Flt Permitted				0.757						0.239		
Satd. Flow (perm)	3686	1900	0	1438	1623	0	1900	5102	0	454	5136	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					160			6				
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Adj. Flow (vph)	0	2	0	78	4	160	0	1008	46	76	578	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2	0	78	164	0	0	1054	0	76	578	0
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	20.0	64.0		44.0	44.0		11.0	45.0		11.0	45.0	45.0
Total Split (%)	16.7%	53.3%		36.7%	36.7%		9.2%	37.5%		9.2%	37.5%	37.5%
Maximum Green (s)	15.0	58.0		38.0	38.0		7.0	39.0		7.0	39.0	39.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)		11.9		11.9	11.9			87.6		98.1	96.1	
Actuated g/C Ratio		0.10		0.10	0.10			0.73		0.82	0.80	
v/c Ratio		0.01		0.55	0.54			0.28		0.17	0.14	
Control Delay		45.5		64.8	14.7			5.1		2.9	2.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay		0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay		45.5		64.8	14.7			5.1		2.9	2.5	
LOS		D		E	B			A		A	A	
Approach Delay		45.5			30.9			5.1			2.5	
Approach LOS		D			C			A			A	
Queue Length 50th (m)		0.5		18.7	0.9			21.4		2.3	7.7	
Queue Length 95th (m)		3.0		33.9	20.8			27.9		5.9	12.6	
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)				30.0						60.0		
Base Capacity (vph)		918		455	623			3726		449	4112	
Starvation Cap Reductn		0		0	0			0		0	0	
Spillback Cap Reductn		0		0	0			0		0	0	
Storage Cap Reductn		0		0	0			0		0	0	
Reduced v/c Ratio		0.00		0.17	0.26			0.28		0.17	0.14	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 85	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.55	
Intersection Signal Delay: 7.5	Intersection LOS: A
Intersection Capacity Utilization 49.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



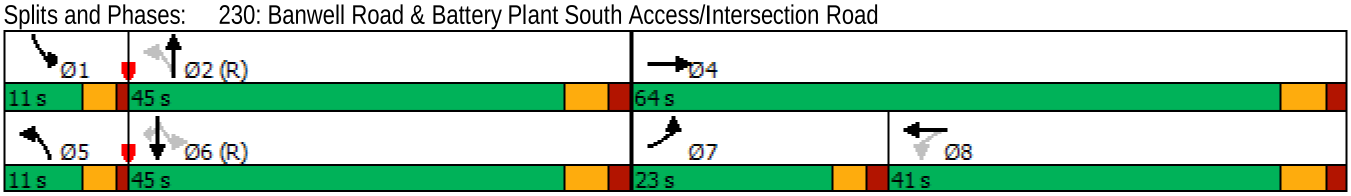
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2	0	69	0	173	0	374	24	70	380	0
Future Volume (vph)	0	2	0	69	0	173	0	374	24	70	380	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	50.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	2		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt					0.850			0.991				
Flt Protected				0.950						0.950		
Satd. Flow (prot)	3650	1827	0	1787	1599	0	1900	5137	0	1787	3539	1900
Flt Permitted				0.755						0.316		
Satd. Flow (perm)	3650	1827	0	1420	1599	0	1900	5137	0	594	3539	1900
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					456			9				
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	4%	0%	1%	0%	1%	0%	0%	1%	1%	2%	0%
Adj. Flow (vph)	0	4	0	138	0	346	0	748	48	140	760	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	4	0	138	346	0	0	796	0	140	760	0
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	41.0		41.0	41.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	23.0	64.0		41.0	41.0		11.0	45.0		11.0	45.0	45.0
Total Split (%)	19.2%	53.3%		34.2%	34.2%		9.2%	37.5%		9.2%	37.5%	37.5%
Maximum Green (s)	18.0	58.0		35.0	35.0		7.0	39.0		7.0	39.0	39.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)		17.2		17.2	17.2			80.0		92.8	90.8	
Actuated g/C Ratio		0.14		0.14	0.14			0.67		0.77	0.76	
v/c Ratio		0.02		0.68	0.56			0.23		0.27	0.28	
Control Delay		40.2		64.5	4.1			8.5		6.8	6.8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay		0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay		40.2		64.5	4.1			8.5		6.8	6.8	
LOS		D		E	A			A		A	A	
Approach Delay		40.3			21.3			8.5			6.8	
Approach LOS		D			C			A			A	
Queue Length 50th (m)		0.9		33.0	0.0			25.7		9.4	35.2	
Queue Length 95th (m)		4.0		51.6	1.4			39.0		20.2	49.0	
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)				50.0						60.0		
Base Capacity (vph)		883		414	789			3426		528	2677	
Starvation Cap Reductn		0		0	0			0		0	0	
Spillback Cap Reductn		0		0	0			0		0	0	
Storage Cap Reductn		0		0	0			0		0	0	
Reduced v/c Ratio		0.00		0.33	0.44			0.23		0.27	0.28	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 10.7 Intersection LOS: B
Intersection Capacity Utilization 59.9% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	202	15	51	74	3	152	4	518	69	44	503	6
Future Volume (vph)	202	15	51	74	3	152	4	518	69	44	503	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	2		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.884			0.853			0.982				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3502	1680	0	1805	1621	0	1805	5049	0	1805	5085	1615
Flt Permitted	0.950			0.673			0.252			0.155		
Satd. Flow (perm)	3502	1680	0	1279	1621	0	479	5049	0	294	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		102			142			20				109
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	404	30	102	148	6	304	8	1036	138	88	1006	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	404	132	0	148	310	0	8	1174	0	88	1006	12
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	26.0	68.0		42.0	42.0		11.0	41.0		11.0	41.0	41.0
Total Split (%)	21.7%	56.7%		35.0%	35.0%		9.2%	34.2%		9.2%	34.2%	34.2%
Maximum Green (s)	21.0	62.0		36.0	36.0		7.0	35.0		7.0	35.0	35.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	18.5	43.2		19.8	19.8		61.8	54.0		66.1	62.7	62.7
Actuated g/C Ratio	0.15	0.36		0.16	0.16		0.52	0.45		0.55	0.52	0.52
v/c Ratio	0.75	0.20		0.70	0.81		0.03	0.51		0.36	0.38	0.01
Control Delay	57.6	7.1		64.0	41.2		14.0	19.8		20.9	16.1	0.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	57.6	7.1		64.0	41.2		14.0	19.8		20.9	16.1	0.0
LOS	E	A		E	D		B	B		C	B	A
Approach Delay		45.2			48.5			19.7			16.3	
Approach LOS		D			D			B			B	
Queue Length 50th (m)	49.6	4.8		35.2	41.4		0.7	46.4		9.2	40.1	0.0
Queue Length 95th (m)	66.0	15.4		53.5	69.0		m2.2	57.9		23.3	54.1	m0.0
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	612	917		383	585		328	2282		250	2655	895
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.66	0.14		0.39	0.53		0.02	0.51		0.35	0.38	0.01

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

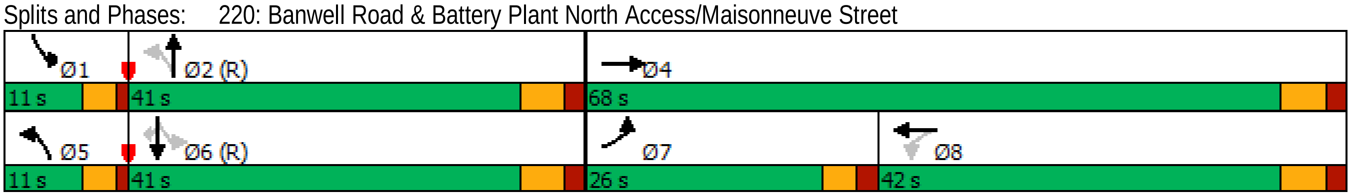
Intersection Signal Delay: 26.8 Intersection LOS: C

Intersection Capacity Utilization 76.1% ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	87	27	13	33	2	111	3	384	82	202	609	2
Future Volume (vph)	87	27	13	33	2	111	3	384	82	202	609	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	2		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.951			0.853			0.974				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	1771	0	1787	1605	0	1805	4962	0	1787	3539	1615
Flt Permitted	0.950			0.705			0.219			0.243		
Satd. Flow (perm)	3467	1771	0	1326	1605	0	416	4962	0	457	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25			222			41				109
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	3%	0%	1%	0%	1%	0%	2%	1%	1%	2%	0%
Adj. Flow (vph)	174	54	26	66	4	222	6	768	164	404	1218	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	174	80	0	66	226	0	6	932	0	404	1218	4
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	41.0		41.0	41.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	15.0	56.0		41.0	41.0		11.0	44.0		20.0	53.0	53.0
Total Split (%)	12.5%	46.7%		34.2%	34.2%		9.2%	36.7%		16.7%	44.2%	44.2%
Maximum Green (s)	10.0	50.0		35.0	35.0		7.0	38.0		16.0	47.0	47.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	9.6	26.0		11.3	11.3		69.7	62.0		84.0	80.0	80.0
Actuated g/C Ratio	0.08	0.22		0.09	0.09		0.58	0.52		0.70	0.67	0.67
v/c Ratio	0.63	0.20		0.53	0.64		0.02	0.36		0.81	0.52	0.00
Control Delay	63.9	26.9		65.8	15.6		7.7	17.4		34.9	12.8	0.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	63.9	26.9		65.8	15.6		7.7	17.4		34.9	12.8	0.0
LOS	E	C		E	B		A	B		C	B	A
Approach Delay		52.2			27.0			17.3			18.3	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	21.8	11.1		15.9	0.9		0.4	46.4		40.9	57.3	0.0
Queue Length 95th (m)	34.0	23.6		29.9	24.3		2.0	62.3		#114.9	97.9	m0.0
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)							60.0			60.0		
Base Capacity (vph)	288	752		386	625		327	2584		497	2359	1113
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.60	0.11		0.17	0.36		0.02	0.36		0.81	0.52	0.00

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 21.6 Intersection LOS: C

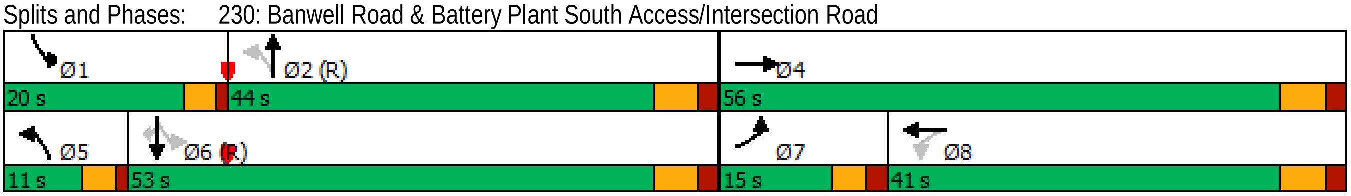
Intersection Capacity Utilization 77.3% ICU Level of Service D

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	2	3	91	7	152	91	444	69	44	775	173
Future Volume (vph)	12	2	3	91	7	152	91	444	69	44	775	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		0.0	60.0		60.0
Storage Lanes	2		0	1		0	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt		0.910			0.857			0.980				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3502	1729	0	1805	1628	0	1805	5040	0	1805	5085	1615
Flt Permitted	0.950			0.751			0.111			0.237		
Satd. Flow (perm)	3502	1729	0	1427	1628	0	211	5040	0	450	5085	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			304			25				219
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		255.0			517.5			353.1			367.5	
Travel Time (s)		18.4			37.3			21.2			22.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Adj. Flow (vph)	24	4	6	182	14	304	182	888	138	88	1550	346
Shared Lane Traffic (%)												
Lane Group Flow (vph)	24	10	0	182	318	0	182	1026	0	88	1550	346
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	42.0		42.0	42.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	26.0	68.0		42.0	42.0		11.0	41.0		11.0	41.0	41.0
Total Split (%)	21.7%	56.7%		35.0%	35.0%		9.2%	34.2%		9.2%	34.2%	34.2%
Maximum Green (s)	21.0	62.0		36.0	36.0		7.0	35.0		7.0	35.0	35.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		29.0		29.0	29.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	6.3	27.9		20.8	20.8		78.5	69.5		77.7	69.1	69.1
Actuated g/C Ratio	0.05	0.23		0.17	0.17		0.65	0.58		0.65	0.58	0.58
v/c Ratio	0.13	0.02		0.74	0.60		0.79	0.35		0.24	0.53	0.34
Control Delay	55.4	19.3		63.5	10.2		53.6	10.2		11.2	17.7	8.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	55.4	19.3		63.5	10.2		53.6	10.2		11.2	17.7	8.2
LOS	E	B		E	B		D	B		B	B	A
Approach Delay		44.8			29.6			16.8			15.8	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	2.9	0.7		43.3	2.9		24.9	31.6		6.6	70.0	11.6
Queue Length 95th (m)	7.5	4.6		63.8	27.1		#63.0	39.7		m18.9	100.1	40.0
Internal Link Dist (m)		231.0			493.5			329.1			343.5	
Turn Bay Length (m)							60.0			60.0		60.0
Base Capacity (vph)	612	896		428	701		230	2927		371	2927	1022
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.04	0.01		0.43	0.45		0.79	0.35		0.24	0.53	0.34

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 95

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 18.2 — Intersection LOS: B

Intersection Capacity Utilization 72.9% — ICU Level of Service C

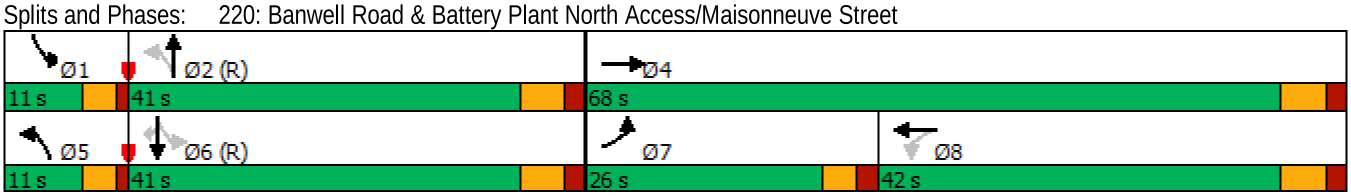
Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 220: Banwell Road & Battery Plant North Access/Maisonneuve Street



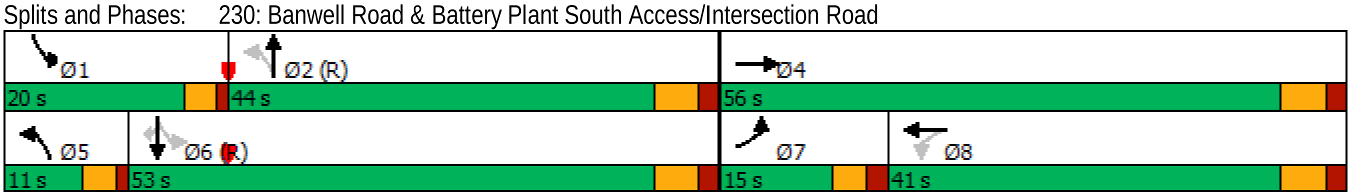
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	6	4	33	29	119	116	463	82	202	503	122
Future Volume (vph)	14	6	4	33	29	119	116	463	82	202	503	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	60.0		60.0	60.0		0.0
Storage Lanes	2		0	1		0	1		1	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.95	1.00
Frt		0.940			0.879			0.977				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3467	1754	0	1787	1657	0	1805	4976	0	1787	3539	1615
Flt Permitted	0.950			0.744			0.263			0.197		
Satd. Flow (perm)	3467	1754	0	1400	1657	0	500	4976	0	371	3539	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			174			31				244
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		278.1			687.4			281.8			353.1	
Travel Time (s)		20.0			49.5			16.9			21.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Heavy Vehicles (%)	1%	3%	0%	1%	0%	1%	0%	2%	1%	1%	2%	0%
Adj. Flow (vph)	28	12	8	66	58	238	232	926	164	404	1006	244
Shared Lane Traffic (%)												
Lane Group Flow (vph)	28	20	0	66	296	0	232	1090	0	404	1006	244
Turn Type	Prot	NA		Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Detector Phase	7	4		8	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	10.0	41.0		41.0	41.0		9.0	24.0		9.0	24.0	24.0
Total Split (s)	15.0	56.0		41.0	41.0		11.0	44.0		20.0	53.0	53.0
Total Split (%)	12.5%	46.7%		34.2%	34.2%		9.2%	36.7%		16.7%	44.2%	44.2%
Maximum Green (s)	10.0	50.0		35.0	35.0		7.0	38.0		16.0	47.0	47.0
Yellow Time (s)	3.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0		6.0	6.0		4.0	6.0		4.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0		7.0	7.0			7.0			7.0	7.0
Flash Dont Walk (s)		28.0		28.0	28.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0		0	0			0			0	0
Act Effct Green (s)	6.5	22.6		15.4	15.4		74.4	65.4		87.4	74.4	74.4
Actuated g/C Ratio	0.05	0.19		0.13	0.13		0.62	0.54		0.73	0.62	0.62
v/c Ratio	0.15	0.06		0.37	0.82		0.60	0.40		0.88	0.46	0.22
Control Delay	55.6	23.1		51.0	37.5		17.9	17.8		51.1	12.9	2.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	55.6	23.1		51.0	37.5		17.9	17.8		51.1	12.9	2.5
LOS	E	C		D	D		B	B		D	B	A
Approach Delay		42.0			40.0			17.9			20.7	
Approach LOS		D			D			B			C	
Queue Length 50th (m)	3.5	2.4		15.2	29.8		18.1	57.8		66.3	54.5	6.4
Queue Length 95th (m)	8.4	8.0		27.2	57.8		#40.1	83.9		#124.2	57.0	10.4
Internal Link Dist (m)		254.1			663.4			257.8			329.1	
Turn Bay Length (m)							60.0			60.0		
Base Capacity (vph)	288	735		408	606		386	2727		458	2195	1094
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.10	0.03		0.16	0.49		0.60	0.40		0.88	0.46	0.22

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 22.0 Intersection LOS: C
Intersection Capacity Utilization 75.0% ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 230: Banwell Road & Battery Plant South Access/Intersection Road



Appendix L

Detailed Cost Estimate

Tecumseh Hamlet Budgetary Cost Estimate Summary

PROJECT			TOTAL ESTIMATED PROJECT COSTS
1	GOUIN STORMWATER MANAGEMENT		
	a)	DRY POND & PUMPING STATION	$ 20,116,000
	b)	STORM SEWER SYSTEM – EAST OUTLET	$ 9,730,000
	c)	STORM SEWER SYSTEM – WEST OUTLET	$ 8,220,000
	TOTAL GOUIN STORMWATER MANAGEMENT		$ 38,066,000
2	LACHANCE STORMWATER MANAGEMENT		
	a)	WET POND & PUMPING STATION	$ 10,695,000
	b)	STORM SEWER SYSTEM – EAST OUTLET	$ 2,510,000
	c)	STORM SEWER SYSTEM – WEST OUTLET	$ 1,991,000
	TOTAL LACHANCE STORMWATER MANAGEMENT		$ 15,196,000
3	DESJARDINS WEST STORMWATER MANAGEMENT		
	a)	WET POND & PUMPING STATION	$ 8,114,000
	b)	STORM SEWER SYSTEM	$ 4,814,000
	TOTAL DESJARDINS WEST STORMWATER MANAGEMENT		$ 12,928,000
4	DESJARDINS EAST STORMWATER MANAGEMENT		
	a)	WET POND	$ 8,570,000
	b)	STORM SEWER SYSTEM – SOUTH OUTLET	$ 4,799,000
	c)	STORM SEWER SYSTEM – NORTH OUTLET	$ 976,000
	d)	STORM SEWER SYSTEM – EAST OUTLET	$ 1,664,000
	TOTAL DESJARDINS EAST STORMWATER MANAGEMENT		$ 16,009,000
5	SOUTHEAST HAMLET STORMWATER MANAGEMENT		
	a)	WET POND & PUMPING STATION	$ 4,603,000
	b)	STORM SEWER SYSTEM	$ 4,731,000
	TOTAL SOUTHEAST HAMLET STORMWATER MANAGEMENT		$ 9,334,000
TOTAL STORMWATER MANAGEMENT COSTS			$ 91,533,000
6	SANITARY SEWER FROM CR 22 TO CP RAILWAY		
	a)	TRUNK SEWER – MH TH335 to MH TAO (WW-1)	$ 11,821,000
	b)	TRUNK SEWER – MH TAO to MH TAC (WW-6A)	$ 9,045,000
	c)	SUBTRUNK ‘A’ – MH AA to MH TBA	$ 288,800
	d)	SUBTRUNK ‘A’ – MH AC to MH TAW	$ 356,800
	e)	SUBTRUNK ‘B’ – MH BA to MH TAS	$ 908,640
	f)	SUBTRUNK ‘C’ – MH CA to MH TAO	$ 912,700
	g)	SUBTRUNK ‘D’ – MH DA to MH DQ	$ 1,707,200
	TOTAL SANITARY SEWER FROM CR 22 TO CP RAILWAY		$ 25,040,140
7	SANITARY DIVERSION SEWER (INTERSECTION ROAD)		
	a)	TRUNK SEWER – MH TAI to MH TAO (WW-2)	$ 2,438,000
	TOTAL SANITARY DIVERSION SEWER		$ 2,438,000
8	SANITARY SEWER FROM CP RAILWAY TO CR 42		
	a)	TRUNK SEWER – MH TAC to MH TW (WW-6B)	$ 4,498,000
	a)	TRUNK SEWER – MH TW to MH TP (WW-7)	$ 3,378,000
	a)	TRUNK SEWER – MH TW to MH TA (WW-8A)	$ 11,923,000
	a)	SUBTRUNK ‘E’ – MH EA to MH TZ & MH EJ to MH TZ	$ 2,407,640
	b)	SUBTRUNK ‘F’ – MH FA to MH TAC	$ 302,680
	c)	SUBTRUNK ‘G’ – MH GA to MH TI	$ 677,960
	d)	SUBTRUNK ‘H’ – MH HA to MH TJ	$ 276,080
	TOTAL SANITARY SEWER FROM CP RAILWAY TO CR 42		$ 23,463,360

9	SANITARY PUMPING STATIONS		
	a) SOUTHEAST HAMLET (WW-3)	$	1,208,000
	TOTAL SANITARY PUMPING STATIONS	$	1,208,000
10	SANITARY SETTLEMENT AREA EXPANSION		
	a) FUTUTE SANTARY SEWER FOR THE SETTLEMENT AREA EXPANSION	$	1,020,000
	TOTAL SANITARY SETTLEMENT AREA EXPANSION	$	1,020,000
TOTAL WASTEWATER COSTS		$	53,169,500
11	TRUNK WATERMAIN FROM CR 22 TO CP RAILWAY (W-1)	$	4,563,000
	TRUNK WATERMAIN FROM LESPERANCE TO MANNING (W-2A)	$	3,094,000
	TRUNK WATERMAIN ON MANNING ROAD FROM CR22 TO CP RAILWAY (EXCLUDING RAIL CROSSING) (W-2B)	$	3,563,000
	TRUNK WATERMAIN FROM CP RAILWAY TO CR 42 (W-4)	$	5,468,000
	TRUNK WATERMAIN ON MANNING ROAD FROM CP RAILWAY TO CR42 (INCLUDING RAIL CROSSING) (W-5A)	$	1,754,000
TOTAL WATERMAIN COSTS		$	18,442,000
12	PROPOSED ROADWAYS		
	a) SHIELDS STREET	$	5,158,525
	b) MAISONNEUVE STREET	$	2,130,060
	c) GOUIN STREET	$	2,304,875
13	ROAD RECONSTRUCTION		
	a) GOUIN STREET – LESPERANCE TO HEBERT	$	1,476,210
	b) GOUIN STREET – HEBERT TO TECUMSEH HAMLET SITE	$	1,317,163
	c) MAISONNEUVE STREET – LESPERANCE TO HEBERT	$	1,499,198
	d) MAISONNEUVE STREET – HEBERT TO SHAWNEE	$	641,519
	e) MAISONNEUVE STREET – SHAWNEE TO CORBI	$	824,889
	f) MAISONNEUVE – CORBI TO TECUMSEH HAMLET SITE	$	294,093
	g) INTERSECTION ROAD – LESPERANCE TO SHAWNEE	$	2,481,595
	h) INTERSECTION ROAD – SHAWNEE TO BANWELL	$	3,237,350
TOTAL ROADWAY CONSTRUCTION AND RECONSTRUCTION		$	21,365,479

Tecumseh Hamlet Budgetary Cost Estimates Water Distribution Capital Cost					
					Date: June 2025
Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
W-1	**West Tecumseh Trunk Watermain CR 22 to Intersection Road**				
1.0	Construction				
	400mm Trunk Watermain from CR 22 to Intersection Road	m	1,850	$ 1,500.00	$ 2,775,000
	400mm Trunk Watermain on Intersection Road	m	685	$ 1,500.00	$ 1,027,500
SUBTOTAL					$ 3,802,500
Construction Cost Contingency (10%) - Based on Detailed Pre-Tender Cost Estimate					$ 380,250
Engineering Fee Estimate (10%)					$ 380,250
TOTAL					**$ 4,563,000**
			0		
W-2A	**East Tecumseh Hamlet Watermain Connection**				
1.0	Construction				
	300mm Trunk Watermain Lesperance to Manning	m	825	$ 3,000.00	$ 2,475,000
SUBTOTAL					$ 2,475,000
Construction Cost Contingency (15%)					$ 371,250
Engineering Fee Estimate (10%)					$ 247,500
TOTAL					**$ 3,094,000**
W-2B	**Trunk Watermain on Manning Road CR 22 to CP Railway (excluding CP Rail Crossing)**				
1.0	Construction				
	400mm Trunk Watermain on Manning Road	m	1,900	$ 1,500.00	$ 2,850,000
SUBTOTAL					$ 2,850,000
Construction Cost Contingency (15%)					$ 427,500
Engineering Fee Estimate (10%)					$ 285,000
TOTAL					**$ 3,563,000**
W-4	**West Tecumseh Trunk Watermain CP Railway to CR 42**				
1.0	Construction				
W-4	300mm Trunk Watermain South of 600mm trunk to Shields St	m	355	$ 900.00	$ 319,500
W-4	400mm Trunk Watermain South of CPR to 600mm trunk	m	150	$ 1,500.00	$ 225,000
W-4B	600mm Trunk Watermain from 400mm trunk to Country Rd 43	m	614	$ 3,000.00	$ 1,842,000
W-4B	600mm Trunk Watermain Country Rd 43 (Constructed)	m	-	-	-
W-4A	400mm Trunk Watermain Jack and Bore under CPR Corridor	m	266	$ 6,000.00	$ 1,596,000
W-4C	300mm Trunk Watermain between Tecumseh Hamlet SPA Boundary and St. Alphonse Ave.	m	435	$ 900.00	$ 391,500
SUBTOTAL					$ 4,374,000
Construction Cost Contingency (15%)					$ 656,100
Engineering Fee Estimate (10%)					$ 437,400
TOTAL					**$ 5,468,000**
W-5A	**Trunk Watermain on Manning Road CP Railway to CR 42 (including CP Rail Corridor)**				
1.0	Construction				
	400mm Trunk Watermain on County Road 42	m	935	$ 1,500.00	$ 1,402,500
SUBTOTAL					$ 1,402,500
Construction Cost Contingency (15%)					$ 210,375
Engineering Fee Estimate (10%)					$ 140,250
TOTAL					**$ 1,754,000**

Tecumseh Hamlet Budgetary Cost Estimates Wastewater Capital Cost					
					Date:June 2025
Item No.	**Description**	**Unit**	**Estimated Quantity**	**Unit Price**	**Amount**
WW-1	**West Tecumseh Trunk Sewer from CR 22 to Intersection Road**				
1	Construction				
	1200mm SAN trunk Sewer	m	1403	$ 6,500.00	$ 9,119,500
	Trenchless (@Forest Area, Municipal Drain)	L.S	1	$ 1,040,000.00	$ 1,040,000
	Metering Flume c/w SCADA connection	L.S	1	$ 586,000.00	$ 586,000
SUBTOTAL					$ 10,745,500
Construction Cost Contingency (10%) - Based on Detailed Pre-Tender Cost Estimate					$ 1,074,550
TOTAL CONSTRUCTION COST					$ 11,820,050
TOTAL					**$ 11,821,000**
			0		
WW-2	**Tecumseh Hamlet Diversion Sewer**				
1	Construction				
	600 mm Diversion Sewer on Intersection Road	m	530	$ 3,000.00	$ 1,590,000
	Trenchless (Intersection Municipal Drain)	L.S	1	$ 520,000.00	$ 520,000
SUBTOTAL					$ 2,110,000
Construction Cost Contingency (10%) - Based on Detailed Pre-Tender Cost Estimate					$ 211,000
TOTAL CONSTRUCTION COST					$ 2,321,000
Engineering Fee Estimate (5%)					$ 116,050
TOTAL					**$ 2,438,000**
WW-3	**Southeast Hamlet and Pumping Station**				
1	Construction				
	Pump Station	L.S	1	$1,054,600.00	$ 800,000
	200 mm SAN trunk Sewer	m	193	$ 800.00	$ 154,400
SUBTOTAL					$ 954,400
Construction Cost Contingency (15%)					$ 143,160
TOTAL CONSTRUCTION COST					$ 1,097,560
Engineering Fee Estimate (10%)					$ 109,756
TOTAL					**$ 1,208,000**
WW-6A	**West Tecumseh Trunk Sewer from Intersection to north of CP Railway**				
1	Construction				
	1200mm SAN trunk Sewer	m	700	$ 6,500.00	$ 4,550,000
	Extra-Over for Undercrossing of CP Railway, HEPC Corridor	m	200	$ 13,000.00	$ 2,600,000
SUBTOTAL					$ 7,150,000
Construction Cost Contingency (15%)					$ 1,072,500
TOTAL CONSTRUCTION COST					$ 8,222,500
Engineering Fee Estimate (10%)					$ 822,250
TOTAL					**$ 9,045,000**
WW-6B	**West Tecumseh Trunk Sewer from north of CP Railway to Shields St.**				
1	Construction				
	1200mm SAN trunk Sewer	m	547	$ 6,500.00	$ 3,555,500
SUBTOTAL					$ 3,555,500
Construction Cost Contingency (15%)					$ 533,325
TOTAL CONSTRUCTION COST					$ 4,088,825
Engineering Fee Estimate (10%)					$ 408,883
TOTAL					**$ 4,498,000**

WW-7	**Shields and St. Alphonse Diversion Sewer**				
1	Construction				
	600mm SAN trunk Sewer (Shields connection)	m	408	$ 3,000.00	$ 1,224,000
	600mm SAN trunk Sewer (St. Alphonse St.)	m	432	$ 3,000.00	$ 1,296,000
	Decommission St Alphonse Pumping Station	L.S	1	$ 150,000.00	$ 150,000
SUBTOTAL					$ 2,670,000
Construction Cost Contingency (15%)					$ 400,500
TOTAL CONSTRUCTION COST					$ 3,070,500
Engineering Fee Estimate (10%)					$ 307,050
TOTAL					**$ 3,378,000**
WW-8A	**West Tecumseh Trunk Sewer along Shields St. and Extension to CR42.**				
1.0	Construction				
	1200mm SAN trunk Sewer	m	1450	$ 6,500.00	$ 9,425,000
SUBTOTAL					$ 9,425,000
Construction Cost Contingency (15%)					$ 1,413,750
TOTAL CONSTRUCTION COST					$ 10,838,750
Engineering Fee Estimate (10%)					$ 1,083,875
TOTAL					**$ 11,923,000**
Settlement Area Expansion					
1.0	Construction				
	250mm SAN trunk Sewer	m	806	$ 1,000.00	$ 806,000
SUBTOTAL					$ 806,000
Construction Cost Contingency (15%)					$ 120,900
TOTAL CONSTRUCTION COST					$ 926,900
Engineering Fee Estimate (10%)					$ 92,690
TOTAL					**$ 1,020,000**

Tecumseh Hamlet Budgetary Cost Estimates Wastewater Construction Cost Estimate					
					Date: June 2025
ASSUMPTIONS					
- To simplify the costs for the proposed works, the unit prices for sanitary sewers and maintenance holes were developed on a per meter basis - The unit price for the sanitary sewer on Intersection Road includes restoration and replacement of existing services					
Item No.	**Description**	**Unit**	**Estimated Quantity**	**Unit Price**	**Amount**
SUBTRUNK 'A' - MH AA TO MH TBA					
1	Sanitary Sewer - 200mm dia.	m	210	$ 800.00	$ 168,000.00
2	Concrete Manholes - (1200mm to 1800mm)	m	210	$ 280.00	$ 58,800.00
SUBTOTAL					**$ 226,800.00**
Construction Cost Contingency (15%)					$ 35,000.00
TOTAL CONSTRUCTION COST					$ 261,800.00
Engineering Fee Estimate (10%)					$ 27,000.00
TOTAL SUBTRUNK 'A' - MH AA TO MH TBA					**$ 288,800.00**
SUBTRUNK 'A' - MH AC TO MH TAW					
1	Sanitary Sewer - 200mm dia.	m	260	$ 800.00	$ 208,000.00
2	Concrete Manholes - (1200mm to 1800mm)	m	260	$ 280.00	$ 72,800.00
SUBTOTAL					**$ 280,800.00**
Construction Cost Contingency (15%)					$ 43,000.00
TOTAL CONSTRUCTION COST					$ 323,800.00
Engineering Fee Estimate (10%)					$ 33,000.00
TOTAL SUBTRUNK 'A' - MH AC TO MH TAW					**$ 356,800.00**
SUBTRUNK 'B' - MH BA TO MH TAS					
1	Sanitary Sewer - 250mm dia.	m	282	$ 1,000.00	$ 282,000.00
2	Sanitary Sewer - 300mm dia.	m	241	$ 1,200.00	$ 289,200.00
3	Concrete Manholes - (1200mm to 1800mm)	m	523	$ 280.00	$ 146,440.00
SUBTOTAL					**$ 717,640.00**
Construction Cost Contingency (15%)					$ 108,000.00
TOTAL CONSTRUCTION COST					$ 825,640.00
Engineering Fee Estimate (10%)					$ 83,000.00
SUBTRUNK 'B' - MH BA TO MH TAS					**$ 908,640.00**
SUBTRUNK 'C' - MH CA TO MH TAO					
1	Sanitary Sewer - 200mm dia.	m	176	$ 800.00	$ 140,800.00
2	Sanitary Sewer - 250mm dia.	m	97	$ 1,000.00	$ 97,000.00
3	Sanitary Sewer - 300mm dia.	m	81	$ 1,200.00	$ 97,200.00
4	Sanitary Sewer - 375mm dia.	m	161	$ 1,500.00	$ 241,500.00
5	Concrete Manholes - (1200mm to 1800mm)	m	515	$ 280.00	$ 144,200.00
SUBTOTAL					**$ 720,700.00**
Construction Cost Contingency (15%)					$ 109,000.00
TOTAL CONSTRUCTION COST					$ 829,700.00
Engineering Fee Estimate (10%)					$ 83,000.00
TOTAL SUBTRUNK 'C' - MH CA TO MH TAO					**$ 912,700.00**
SUBTRUNK 'D' - MH DA TO MH DQ					
	MH DA TO MH TAH				
1	Sanitary Sewer - 200mm dia.	m	282	$ 800.00	$ 225,600.00
2	Sanitary Sewer - 375mm dia.	m	4	$ 1,500.00	$ 6,000.00
3	Concrete Manholes - (1200mm to 1800mm)	m	286	$ 280.00	$ 80,080.00
	MH DE & MH DG TO MH TAQ				
4	Sanitary Sewer - 200mm dia.	m	325	$ 800.00	$ 260,000.00
5	Concrete Manholes - (1200mm to 1800mm)	m	325	$ 280.00	$ 91,000.00
	MH DJ TO MH TAW				
6	Sanitary Sewer - 200mm dia.	m	301	$ 800.00	$ 240,800.00
7	Sanitary Sewer - 250mm dia.	m	4	$ 1,000.00	$ 4,000.00
8	Concrete Manholes - (1200mm to 1800mm)	m	305	$ 280.00	$ 85,400.00
	MH DN TO MH TBA				
9	Sanitary Sewer - 200mm dia.	m	329	$ 800.00	$ 263,200.00
10	Concrete Manholes - (1200mm to 1800mm)	m	329	$ 280.00	$ 92,120.00
SUBTOTAL					**$ 1,348,200.00**
Construction Cost Contingency (15%)					$ 203,000.00
TOTAL CONSTRUCTION COST					$ 1,551,200.00
Engineering Fee Estimate (10%)					$ 156,000.00
TOTAL SUBTRUNK 'D' - MH DA TO MH DQ					**$ 1,707,200.00**

SUBTRUNK 'E' - MH EA to MH TZ & MH EJ to MH TZ					
1	Sanitary Sewer - 200mm dia.	m	991	$ 800.00	$ 792,800.00
2	Sanitary Sewer - 250mm dia.	m	441	$ 1,000.00	$ 441,000.00
3	Sanitary Sewer - 300mm dia.	m	181	$ 1,200.00	$ 217,200.00
4	Concrete Manholes - (1200mm to 1800mm)	m	1613	$ 280.00	$ 451,640.00
SUBTOTAL					**$ 1,902,640.00**
Construction Cost Contingency (15%)					$ 286,000.00
TOTAL CONSTRUCTION COST					$ 2,188,640.00
Engineering Fee Estimate (10%)					$ 219,000.00
TOTAL SUBTRUNK 'E' - MH EA to MH TZ & MH ET to MH TZ					**$ 2,407,640.00**
SUBTRUNK 'F' - MH FA TO MH TAC					
1	Sanitary Sewer - 200mm dia.	m	221	$ 800.00	$ 176,800.00
2	Concrete Manholes - (1200mm to 1800mm)	m	221	$ 280.00	$ 61,880.00
SUBTOTAL					**$ 238,680.00**
Construction Cost Contingency (15%)					$ 36,000.00
TOTAL CONSTRUCTION COST					$ 274,680.00
Engineering Fee Estimate (10%)					$ 28,000.00
TOTAL SUBTRUNK 'F' - MH FA TO MH TAC					**$ 302,680.00**
SUBTRUNK 'G' - MH GA TO MH TI					
1	Sanitary Sewer - 200mm dia.	m	240	$ 800.00	$ 192,000.00
2	Sanitary Sewer - 250mm dia.	m	79	$ 1,000.00	$ 79,000.00
3	Sanitary Sewer - 300mm dia.	m	118	$ 1,200.00	$ 141,600.00
4	Concrete Manholes - (1200mm to 1800mm)	m	437	$ 280.00	$ 122,360.00
SUBTOTAL					**$ 534,960.00**
Construction Cost Contingency (15%)					$ 81,000.00
TOTAL CONSTRUCTION COST					$ 615,960.00
Engineering Fee Estimate (10%)					$ 62,000.00
TOTAL SUBTRUNK 'G' - MH GA TO MH TI					**$ 677,960.00**
SUBTRUNK 'H' - MH HA TO MH TJ					
1	Sanitary Sewer - 200mm dia.	m	201	$ 800.00	$ 160,800.00
2	Concrete Manholes - (1200mm to 1800mm)	m	201	$ 280.00	$ 56,280.00
SUBTOTAL					**$ 217,080.00**
Construction Cost Contingency (15%)					$ 33,000.00
TOTAL CONSTRUCTION COST					$ 250,080.00
Engineering Fee Estimate (10%)					$ 26,000.00
TOTAL SUBTRUNK 'H' - MH HA TO MH TJ					**$ 276,080.00**

Tecumseh Hamlet Budgetary Cost Estimates
Gouin Stormwater Management Construction Cost Estimate

Date: June 2025

ASSUMPTIONS

- Estimate based on a Gouin SWMF as a dry pond, additional cost for upstream treatment infrastructure has been estimated and included. Refinements to the appropriate type and configuration of treatment is required.
- Pumping station will discharge into the receiving municipal drain
- The recreational trail will be 4m wide and run along the entire perimeter of the pond to provide maintenance access.
- Excess soil excavations from the pond may be used throughout the Tecumseh Hamlet as fill. An allowance was provided for 5% of the excess soils from the Gouin SWMF to be removed from the site due to contamination from the neighboring MTO Landfill Site. 80% of the material is expected to be temporarily stockpiled and 10% is expected to be
- Pond landscaping includes heavily vegetated side slopes and pond bottom as part of a greater waterfowl mitigation plan for dry ponds only
- A sediment forebay will be provided at each inlet into the SWMF in place of headwalls
- A headwall is provided at the outlet from the pond to the pumping station
- An OGS unit will be provided upstream of each inlet into the SWMF for dry ponds only
- To simplify the costs for the proposed works, the unit prices for storm sewers and maintenance holes were developed on a per meter basis

Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
DRY POND					
1	Pond Excavation, Grading, Topsoil Stripping and Clearing	m^3	144,825	$ 30.00	$ 4,344,750.00
2	Pond Landscaping (shrubs, trees, waterfowl mitigation, long grasses)	m	1,400	$ 800.00	$ 1,120,000.00
3	Erosion Protection of New Inlet Channel, Sediment Forebay - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	3,000	$ 227.00	$ 681,000.00
4	Pond Outlet to Pumping Station a) Precast Channel Outlet Headwall, Including Grate and Safety Rail	EA	1	$ 35,000.00	$ 35,000.00
	b) Erosion Protection of New Outlet Channel: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	300	$ 227.00	$ 68,100.00
	c) Pond Outlet Conduit to the Pumping Station - 1200mm Diameter	m	43	$ 2,160.00	$ 92,880.00
5	Groundwater quality protection barrier allowance	Allow.	1	$ 20,000.00	$ 20,000.00
6	Transportation of Contaminated Soil Off-Site (5% Allowance Only)	m^3	7,241	$ 20.00	$ 144,825.00
7	Stockpile of Topsoil and Excess Fill (Banks and Flat Lands)	Allow.	1	$ 50,000.00	$ 50,000.00
8	Restoration (Topsoil and Hydroseed and Sod along Trail)	m^2	28,000	$ 10.00	$ 280,000.00
9	Recreational Trail	m^2	5,600	$ 100.00	$ 560,000.00
10	OGS unit* (Allowance Only)	EA	2	$ 110,000.00	$ 220,000.00
11	Storm Tech - Isolator ROW Plus Units * (Allowance Only)	ha	1	$ 1,000,000.00	$ 1,000,000.00
12	Drainage Tile Abandonment	Allow.	1	$ 160,000.00	$ 160,000.00
13	Fencing and Access	Allow.	1	$ 60,000.00	$ 60,000.00
14	2400mm Maintenance Hole (for 1350mm Trunk Sewer)	Allow.	1	$ 40,000.00	$ 40,000.00
SUBTOTAL					**$ 8,876,555.00**
Construction Cost Contingency (30%)					$ 2,663,000.00
TOTAL CONSTRUCTION COST					$ 11,539,555.00
Engineering Fee Estimate (20%)					$ 2,308,000.00
TOTAL DRY POND					**$ 13,847,555.00**
PUMPING STATION					
1	Construct Storm Pumping Station: - Structural, Mechanical and Electrical - Installation and Coordination of Hydro Service for pumping station	L.S	--	$ 3,550,000.00	$ 3,550,000.00
2	Cost of generator set with standard enclosure for supply, installation, testing and commissioning at site	EA	1	$ 200,000.00	$ 200,000.00
3	Individual Pump Discharge Pipe - 750mm Diameter	m	10	$ 870.00	$ 8,700.00
4	Pumping Station Outlet Sewer to Receiver (Gouin Drain) - 1050mm Diameter	m	110	$ 1,730.00	$ 190,300.00
5	Erosion Protection of New Outlet to Drain: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	300	$ 227.00	$ 68,100.00
SUBTOTAL					**$ 4,017,100.00**
Construction Cost Contingency (30%)					$ 1,206,000.00
TOTAL CONSTRUCTION COST					$ 5,223,100.00
Engineering Fee Estimate (20%)					$ 1,045,000.00
TOTAL PUMPING STATION					**$ 6,268,100.00**
TOTAL GOUIN DRY POND AND PUMPING STATION					**$ 20,115,655.00**

STORM SEWER: EAST OUTLET							
1	900mm Diameter Trunk Sewer	m	141	$	1,230.00	$	173,430.00
2	1800mm Maintenance Hole (for 900mm Trunk Sewer)	m	141	$	280.00	$	39,480.00
3	1200mm Diameter Trunk Sewer	m	100	$	2,000.00	$	200,000.00
4	2400mm Maintenance Hole (for 1200mm Trunk Sewer)	m	100	$	700.00	$	70,000.00
5	1500mm Diameter Trunk Sewer	m	231	$	2,800.00	$	646,800.00
6	3000mm Maintenance Hole (for 1500mm Trunk Sewer)	m	231	$	700.00	$	161,700.00
7	2100mm Diameter Trunk Sewer	m	262	$	5,040.00	$	1,320,480.00
8	3600mm Maintenance Hole (for 2100mm Trunk Sewer)	m	262	$	700.00	$	183,400.00
9	2400mm Diameter Trunk Sewer	m	297	$	7,200.00	$	2,138,400.00
10	3600mm Maintenance Hole (for 2400mm Trunk Sewer)	m	297	$	700.00	$	207,900.00
11	2550mm Diameter Trunk Sewer	m	127	$	7,920.00	$	1,005,840.00
12	3600mm Maintenance Hole (for 2550mm Trunk Sewer)	m	127	$	700.00	$	88,900.00
SUBTOTAL						**$**	**6,236,330.00**
Construction Cost Contingency (30%)						$	1,871,000.00
TOTAL CONSTRUCTION COST						$	8,107,330.00
Engineering Fee Estimate (20%)						$	1,622,000.00
TOTAL STORM SEWER: EAST OUTLET						**$**	**9,729,330.00**
STORM SEWER: WEST OUTLET							
1	1050mm Diameter Trunk Sewer	m	162	$	1,730.00	$	280,260.00
2	1800mm Maintenance Hole (for 1050mm Trunk Sewer)	m	162	$	280.00	$	45,360.00
3	1800mm Diameter Trunk Sewer	m	254	$	3,600.00	$	914,400.00
4	3000mm Maintenance Hole (for 1800mm Trunk Sewer)	m	254	$	700.00	$	177,800.00
5	2100mm Diameter Trunk Sewer	m	507	$	5,040.00	$	2,555,280.00
6	3600mm Maintenance Hole (for 2100mm Trunk Sewer)	m	507	$	700.00	$	354,900.00
7	2400mm Diameter Trunk Sewer	m	119	$	7,200.00	$	856,800.00
8	3600mm Maintenance Hole (for 2400mm Trunk Sewer)	m	119	$	700.00	$	83,300.00
SUBTOTAL						**$**	**5,268,100.00**
Construction Cost Contingency (30%)						$	1,581,000.00
TOTAL CONSTRUCTION COST						$	6,849,100.00
Engineering Fee Estimate (20%)						$	1,370,000.00
TOTAL STORM SEWER: WEST OUTLET						**$**	**8,219,100.00**

Tecumseh Hamlet Budgetary Cost Estimates Lachance Stormwater Management Construction Cost Estimate					
					Date: June 2025
ASSUMPTIONS					
- Pumping station will discharge into the receiving municipal drain - The recreational trail will be 4m wide and run along the entire perimeter of the pond to provide maintenance access. - Excess soil excavations from the pond may be used throughout the THSPA as fill. - A sediment forebay will be provided at each inlet into the SWMF in place of headwalls - A headwall is provided at the outlet from the pond to the pumping station - To simplify the costs for the proposed works, the unit prices for storm sewers and maintenance holes were developed on a per meter basis					
Item No.	**Description**	**Unit**	**Estimated Quantity**	**Unit Price**	**Amount**
WET POND					
1	Pond Excavation, Grading, Topsoil Stripping and Clearing	m^3	81,178	$ 30.00	$ 2,435,340.00
2	Stockpile of Topsoil and Excess Fill (Banks and Flat Lands)	Allow.	1	$ 50,000.00	$ 50,000.00
3	Pond Landscaping (shrubs, trees, hydroseeding, etc.)	m	1,150	$ 800.00	$ 920,000.00
4	Erosion Protection of New Inlet Channel, Sediment Forebay - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	400	$ 227.00	$ 90,800.00
5	Pond Outlet to Pumping Station a) Precast Channel Outlet Headwall, Including Grate and Safety Rail	EA	1	$ 35,000.00	$ 35,000.00
	b) Erosion Protection of New Outlet Channel: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	300	$ 227.00	$ 68,100.00
	c) Pond Outlet Conduit to the Pumping Station - 1050mm Diameter	m	33	$ 1,730.00	$ 57,090.00
6	Restoration (Topsoil and Sod along Trail)	m^2	5,750	$ 10.00	$ 57,500.00
7	Recreational Trail	m^2	3,450	$ 100.00	$ 345,000.00
SUBTOTAL					**$ 4,058,830.00**
Construction Cost Contingency (30%)					$ 1,218,000.00
TOTAL CONSTRUCTION COST					$ 5,276,830.00
					$ 1,056,000.00
TOTAL WET POND					**$ 6,332,830.00**
PUMPING STATION					
1	Construct Storm Pumping Station: - Structural, Mechanical and Electrical - Installation and Coordination of Hydro Service for pumping station	L.S	--	$ 2,440,000.00	$ 2,440,000.00
2	Cost of generator set with standard enclosure for supply, installation, testing and commissioning at site	EA	1	$ 200,000.00	$ 200,000.00
3	Individual Pump Discharge Pipe - 600mm Diameter	m	10	$ 720.00	$ 7,200.00
4	Pumping Station Outlet Sewer to Receiver (Lachance Drain) - 900mm Diameter	m	60	$ 2,090.00	$ 125,400.00
5	Erosion Protection of New Outlet to Drain: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	100	$ 227.00	$ 22,700.00
SUBTOTAL					**$ 2,795,300.00**
Construction Cost Contingency (30%)					$ 839,000.00
TOTAL CONSTRUCTION COST					$ 3,634,300.00
Engineering Fee Estimate (20%)					$ 727,000.00
TOTAL PUMPING STATION					**$ 4,361,300.00**
STORM SEWER: EAST OUTLET					
1	1200mm Diameter Trunk Sewer	m	45	$ 2,000.00	$ 90,000.00
2	2400mm Maintenance Hole (for 1200mm Trunk Sewer)	m	45	$ 700.00	$ 31,500.00
3	1350mm Diameter Trunk Sewer	m	62	$ 2,300.00	$ 142,600.00
4	2400mm Maintenance Hole (for 1350mm Trunk Sewer)	m	62	$ 700.00	$ 43,400.00
5	1500mm Diameter Trunk Sewer	m	220	$ 2,800.00	$ 616,000.00
6	2400mm Maintenance Hole (for 1500mm Trunk Sewer)	m	220	$ 700.00	$ 154,000.00
7	1650mm Diameter Trunk Sewer	m	136	$ 3,200.00	$ 435,200.00
8	3000mm Maintenance Hole (for 1650mm Trunk Sewer)	m	136	$ 700.00	$ 95,200.00
SUBTOTAL					**$ 1,607,900.00**
Construction Cost Contingency (30%)					$ 483,000.00
TOTAL CONSTRUCTION COST					$ 2,090,900.00
Engineering Fee Estimate (20%)					$ 419,000.00
TOTAL STORM SEWER: EAST OUTLET					**$ 2,509,900.00**

STORM SEWER: WEST OUTLET					
1	450mm Diameter Trunk Sewer	m	83	$ 580.00	$ 48,140.00
2	1200mm Maintenance Hole (for 450mm Trunk Sewer)	m	83	$ 280.00	$ 23,240.00
3	600mm Diameter Trunk Sewer	m	81	$ 720.00	$ 58,320.00
4	1200mm Maintenance Hole (for 600mm Trunk Sewer)	m	81	$ 280.00	$ 22,680.00
5	1050mm Diameter Trunk Sewer	m	84	$ 1,730.00	$ 145,320.00
6	1800mm Maintenance Hole (for 1050mm Trunk Sewer)	m	84	$ 280.00	$ 23,520.00
7	1200mm Diameter Trunk Sewer	m	82	$ 2,000.00	$ 164,000.00
8	2400mm Maintenance Hole (for 1200mm Trunk Sewer)	m	82	$ 700.00	$ 57,400.00
9	1500mm Diameter Trunk Sewer	m	186	$ 2,800.00	$ 520,800.00
10	2400mm Maintenance Hole (for 1500mm Trunk Sewer)	m	186	$ 700.00	$ 130,200.00
11	1800mm Diameter Trunk Sewer	m	19	$ 3,600.00	$ 68,400.00
12	3000mm Maintenance Hole (for 1800mm Trunk Sewer)	m	19	$ 700.00	$ 13,300.00
SUBTOTAL					**$ 1,275,320.00**
Construction Cost Contingency (30%)					$ 383,000.00
TOTAL CONSTRUCTION COST					$ 1,658,320.00
Engineering Fee Estimate (20%)					$ 332,000.00
TOTAL STORM SEWER LACHANCE: WEST OUTLET					**$ 1,990,320.00**

Tecumseh Hamlet Budgetary Cost Estimates
Desjardins West Stormwater Management Construction Cost Estimate

Date: June 2025

ASSUMPTIONS

- Pumping station will discharge into the receiving municipal drain
- The recreational trail will be 4m wide and run along the entire perimeter of the pond to provide maintenance access.
- Excess soil excavations from the pond may be used throughout the THSPA as fill.
- A sediment forebay will be provided at each inlet into the SWMF in place of headwalls
- A headwall is provided at the outlet from the pond to the pumping station and the inlet from the pipe interconnection from the Desjardins East SWM pond
- To simplify the costs for the proposed works, the unit prices for storm sewers and maintenance holes were developed on a per meter basis

Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
WET POND					
1	Pond Excavation and Grading	m^3	79,798	$ 30.00	$ 2,393,940.00
2	Stockpile of Topsoil and Excess Fill (Banks and Flat Lands)	Allow.	1	$ 50,000.00	$ 50,000.00
3	Pond Landscaping (shrubs, trees, hydroseeding, etc.)	m	895	$ 800.00	$ 716,000.00
4	Erosion Protection of New Inlet Channel, Sediment Forebay - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	200	$ 227.00	$ 45,400.00
5	Pond Outlet to Pumping Station a) Precast Channel Outlet Headwall, Including Grate and Safety Rail	EA	1	$ 35,000.00	$ 35,000.00
	b) Erosion Protection of New Outlet Channel: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	300	$ 227.00	$ 68,100.00
	c) Pond Outlet Conduit to the Pumping Station -750mm Diameter	m	26	$ 870.00	$ 22,620.00
6	Restoration (Topsoil and Sod along Trail)	m^2	6,265	$ 10.00	$ 62,650.00
7	Recreational Trail	m^2	2,685	$ 100.00	$ 268,500.00
SUBTOTAL					**$ 3,662,210.00**
Construction Cost Contingency (30%)					$ 1,099,000.00
TOTAL CONSTRUCTION COST					$ 4,761,210.00
					$ 953,000.00
TOTAL WET POND					**$ 5,714,210.00**
PUMPING STATION					
1	Construct Storm Pumping Station: - Structural, Mechanical and Electrical - Installation and Coordination of Hydro Service for Pumping Station	L.S	--	$ 1,210,000.00	$ 1,210,000.00
2	Cost of generator set with standard enclosure for supply, installation, testing and commissioning at site	EA	1	$ 200,000.00	$ 200,000.00
3	Individual Pump Discharge Pipe - 500mm Diameter	m	10	$ 650.00	$ 6,500.00
4	Pumping Station Outlet Sewer to Receiver (Desjardins Drain) - 500mm Diameter	m	113	$ 870.00	$ 98,310.00
5	Erosion Protection of New Outlet to Drain: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	100	$ 227.00	$ 22,700.00
SUBTOTAL					**$ 1,537,510.00**
Construction Cost Contingency (30%)					$ 462,000.00
TOTAL CONSTRUCTION COST					$ 1,999,510.00
Engineering Fee Estimate (20%)					$ 400,000.00
TOTAL PUMPING STATION					**$ 2,399,510.00**
STORM SEWER					
1	600mm Diameter Trunk Sewer	m	10	$ 720.00	$ 7,200.00
2	1200mm Maintenance Hole (for 600mm Trunk Sewer)	m	10	$ 280.00	$ 2,800.00
3	900mm Diameter Trunk Sewer (Interconnect Desjardin W and Desjardin E pond)	m	157	$ 1,230.00	$ 193,110.00
4	1800mm Maintenance Hole (for 900mm Trunk Sewer)	m	157	$ 280.00	$ 43,960.00
5	1050mm Diameter Trunk Sewer	m	149	$ 1,730.00	$ 257,770.00
6	1800mm Maintenance Hole (for 1050mm Trunk Sewer)	m	149	$ 280.00	$ 41,720.00
7	1350mm Diameter Trunk Sewer	m	91	$ 2,300.00	$ 209,300.00
8	2400mm Maintenance Hole (for 1350mm Trunk Sewer)	m	91	$ 700.00	$ 63,700.00
9	1500mm Diameter Trunk Sewer	m	101	$ 2,800.00	$ 282,800.00
10	2400mm Maintenance Hole (for 1500mm Trunk Sewer)	m	101	$ 700.00	$ 70,700.00
11	1800mm Diameter Trunk Sewer	m	407	$ 3,600.00	$ 1,465,200.00
12	3000mm Maintenance Hole (for 1800mm Trunk Sewer)	m	407	$ 700.00	$ 284,900.00
13	1950mm Diameter Trunk Sewer	m	30	$ 4,680.00	$ 140,400.00
14	3000mm Maintenance Hole (for 1950mm Trunk Sewer)	m	30	$ 700.00	$ 21,000.00
SUBTOTAL					**$ 3,084,560.00**
Construction Cost Contingency (30%)					$ 926,000.00
TOTAL CONSTRUCTION COST					$ 4,010,560.00
Engineering Fee Estimate (20%)					$ 803,000.00
TOTAL STORM SEWER					**$ 4,813,560.00**

Tecumseh Hamlet Budgetary Cost Estimates
Desjardins East Stormwater Management Construction Cost Estimate

Date: June 2025

ASSUMPTIONS

- The recreational trail will be 4m wide and run along the entire perimeter of the pond to provide maintenance access.
- Excess soil excavations from the pond may be used throughout the THSPA as fill.
- A sediment forebay will be provided at each inlet into the SWMF in place of headwalls
- The pond interconnection between the Desjardins East and Desjardins West ponds will be a 900mm diameter pipe.
- A headwall is provided at the outlet for the pipe interconnection to the Desjardins West SWM pond
- To simplify the costs for the proposed works, the unit prices for storm sewers and maintenance holes were developed on a per meter basis

Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
WET POND					
1	Pond Excavation and Grading	m^3	130,720	$ 30.00	$ 3,921,600.00
2	Stockpile of Topsoil and Excess Fill (Banks and Flat Lands)	Allow.	1	$ 50,000.00	$ 50,000.00
3	Pond Landscaping (shrubs, trees, hydroseeding, etc.)	m	1,095	$ 800.00	$ 876,000.00
4	Erosion Protection of New Inlet Channel, Sediment Forebay - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	600	$ 227.00	$ 136,200.00
5	Pond Interconnection to Desjardins West Pond a) Precast Channel Outlet Headwall, Including Grate and Safety Rail	EA	1	$ 35,000.00	$ 35,000.00
	b) Erosion Protection of New Outlet Channel: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	300	$ 227.00	$ 68,100.00
6	Restoration (Topsoil and Sod along Trail)	m^2	7,665	$ 10.00	$ 76,650.00
7	Recreational Trail	m^2	3,285	$ 100.00	$ 328,500.00
SUBTOTAL					**$ 5,492,050.00**
Construction Cost Contingency (30%)					$ 1,648,000.00
TOTAL CONSTRUCTION COST					$ 7,140,050.00
					$ 1,429,000.00
TOTAL WET POND					**$ 8,569,050.00**
STORM SEWER: NORTH OUTLET					
1	600mm Diameter Trunk Sewer	m	71	$ 720.00	$ 51,120.00
2	1200mm Maintenance Hole (for 600mm Trunk Sewer)	m	71	$ 280.00	$ 19,880.00
3	1350mm Diameter Trunk Sewer	m	68	$ 2,300.00	$ 156,400.00
4	2400mm Maintenance Hole (for 1350mm Trunk Sewer)	m	68	$ 700.00	$ 47,600.00
5	1500mm Diameter Trunk Sewer	m	100	$ 2,800.00	$ 280,000.00
6	2400mm Maintenance Hole (for 1500mm Trunk Sewer)	m	100	$ 700.00	$ 70,000.00
SUBTOTAL					**$ 625,000.00**
Construction Cost Contingency (30%)					$ 188,000.00
TOTAL CONSTRUCTION COST					$ 813,000.00
Engineering Fee Estimate (20%)					$ 163,000.00
TOTAL STORM SEWER: NORTH OUTLET					**$ 976,000.00**
STORM SEWER: SOUTH OUTLET					
1	600mm Diameter Trunk Sewer	m	66	$ 720.00	$ 47,520.00
2	1200mm Maintenance Hole (for 600mm Trunk Sewer)	m	66	$ 280.00	$ 18,480.00
3	675mm Diameter Trunk Sewer	m	80	$ 800.00	$ 64,000.00
4	1200mm Maintenance Hole (for 675mm Trunk Sewer)	m	80	$ 280.00	$ 22,400.00
5	750mm Diameter Trunk Sewer	m	94	$ 870.00	$ 81,780.00
6	1200mm Maintenance Hole (for 750mm Trunk Sewer)	m	94	$ 280.00	$ 26,320.00
7	825mm Diameter Trunk Sewer	m	188	$ 1,010.00	$ 189,880.00
8	1500mm Maintenance Hole (for 825mm Trunk Sewer)	m	188	$ 280.00	$ 52,640.00
9	975mm Diameter Trunk Sewer	m	78	$ 1,440.00	$ 112,320.00
10	1800mm Maintenance Hole (for 1050mm Trunk Sewer)	m	78	$ 280.00	$ 21,840.00
11	1200mm Diameter Trunk Sewer	m	29	$ 2,000.00	$ 58,000.00
12	2400mm Maintenance Hole (for 1200mm Trunk Sewer)	m	29	$ 700.00	$ 20,300.00
13	1350mm Diameter Trunk Sewer	m	570	$ 2,300.00	$ 1,311,000.00
14	2400mm Maintenance Hole (for 1350mm Trunk Sewer)	m	570	$ 700.00	$ 399,000.00
15	1500mm Diameter Trunk Sewer	m	160	$ 2,800.00	$ 448,000.00
16	2400mm Maintenance Hole (for 1500mm Trunk Sewer)	m	160	$ 700.00	$ 112,000.00
17	1800mm Diameter Trunk Sewer	m	21	$ 3,600.00	$ 75,600.00
18	2400mm Maintenance Hole (for 1800mm Trunk Sewer)	m	21	$ 700.00	$ 14,700.00
SUBTOTAL					**$ 3,075,780.00**
Construction Cost Contingency (30%)					$ 923,000.00
TOTAL CONSTRUCTION COST					$ 3,998,780.00
Engineering Fee Estimate (20%)					$ 800,000.00
TOTAL STORM SEWER: SOUTH OUTLET					**$ 4,798,780.00**

STORM SEWER: EAST OUTLET					
1	900mm Diameter Trunk Sewer	m	76	$ 1,230.00	$ 93,480.00
2	1800mm Maintenance Hole (for 900mm Trunk Sewer)	m	76	$ 280.00	$ 21,280.00
3	1050mm Diameter Trunk Sewer	m	132	$ 1,730.00	$ 228,360.00
4	1800mm Maintenance Hole (for 1050mm Trunk Sewer)	m	132	$ 280.00	$ 36,960.00
5	1350mm Diameter Trunk Sewer	m	197	$ 2,300.00	$ 453,100.00
6	2400mm Maintenance Hole (for 1350mm Trunk Sewer)	m	197	$ 700.00	$ 137,900.00
7	1500mm Diameter Trunk Sewer	m	27	$ 2,800.00	$ 75,600.00
8	2400mm Maintenance Hole (for 1500mm Trunk Sewer)	m	27	$ 700.00	$ 18,900.00
SUBTOTAL					**$ 1,065,580.00**
Construction Cost Contingency (30%)					$ 320,000.00
TOTAL CONSTRUCTION COST					$ 1,385,580.00
Engineering Fee Estimate (20%)					$ 278,000.00
TOTAL STORM SEWER: EAST OUTLET					**$ 1,663,580.00**

Tecumseh Hamlet Budgetary Cost Estimates
Southeast Hamlet Stormwater Management Construction Cost Estimate

Date: June 2025

ASSUMPTIONS

- Pumping station will discharge into the receiving municipal drain
- The recreational trail will be 4m wide and run along the entire perimeter of the pond to provide maintenance access.
- Excess soil excavations from the pond may be used throughout the THSPA as fill.
- A sediment forebay will be provided at each inlet into the SWMF in place of headwalls
- A headwall is provided at the outlet from the pond to the pumping station
- To simplify the costs for the proposed works, the unit prices for storm sewers and maintenance holes were developed on a per meter basis
- No cost estimate is provided for the storm sewer network within the Southeast Hamlet area since the design was not included in the Functional Servicing Report.

Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
WET POND					
1	Pond Excavation, Grading, Topsoil Stripping and Clearing	m^3	41,890	$ 30.00	$ 1,256,700.00
2	Stockpile of Topsoil and Excess Fill (Banks and Flat Lands)	m	1	$ 50,000.00	$ 50,000.00
3	Pond Landscaping (shrubs, trees, hydroseeding, etc.)	m	660	$ 800.00	$ 528,000.00
4	Erosion Protection of New Inlet Channel, Sediment Forebay - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	200	$ 227.00	$ 45,400.00
5	Pond Outlet to Pumping Station				
	a) Precast Channel Outlet Headwall, Including Grate and Safety Rail	EA	1	$ 35,000.00	$ 35,000.00
	b) Erosion Protection of New Outlet Channel: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	300	$ 227.00	$ 68,100.00
	c) Pond Outlet Conduit to the Pumping Station - 450mm Diameter	m	28	$ 580.00	$ 16,240.00
6	Restoration (Topsoil and Sod along Trail)	m^2	3,960	$ 10.00	$ 39,600.00
7	Recreational Trail	m^2	1,980	$ 100.00	$ 198,000.00
SUBTOTAL					**$ 2,237,040.00**
Construction Cost Contingency (30%)					$ 672,000.00
					$ 2,909,040.00
Engineering Fee Estimate (20%)					$ 582,000.00
TOTAL WET POND					**$ 3,491,040.00**
PUMPING STATION					
1	Construct Storm Pumping Station: - Structural, Mechanical and Electrical - Installation and Coordination of Hydro Service for Pumping Station	L.S	--	$ 405,000.00	$ 405,000.00
2	2400mm Maintenance Hole (for 1350mm Trunk Sewer)	EA	1	$ 200,000.00	$ 200,000.00
3	Individual Pump Discharge Pipe - 350mm Diameter	m	10	$ 560.00	$ 5,600.00
4	Pumping Station Outlet Sewer to Receiver (East Townline Drain) - 300mm Diameter	m	164	$ 475.00	$ 77,900.00
5	Erosion Protection of New Outlet to Drain: - Including Cable Concrete, Rip Rap, and Filter Cloth	m^2	100	$ 227.00	$ 22,700.00
SUBTOTAL					**$ 711,200.00**
Construction Cost Contingency (30%)					$ 214,000.00
TOTAL CONSTRUCTION COST					$ 925,200.00
Engineering Fee Estimate (20%)					$ 186,000.00
TOTAL PUMPING STATION					**$ 1,111,200.00**
STORM SEWER					
1	1800mm Diameter Trunk Sewer	m	705	$ 3,600.00	$ 2,538,000.00
2	3000mm Maintenance Hole (for 1800mm Trunk Sewer)	m	705	$ 700.00	$ 493,500.00
SUBTOTAL					**$ 3,031,500.00**
Construction Cost Contingency (30%)					$ 910,000.00
TOTAL CONSTRUCTION COST					$ 3,941,500.00
Engineering Fee Estimate (20%)					$ 789,000.00
TOTAL STORM SEWER					**$ 4,730,500.00**
TOTAL SOUTHEAST STORMWATER MANAGEMENT FACILITY					**$ 9,332,740.00**

Tecumseh Hamlet Budgetary Cost Estimates
Shields Street Construction

Date: June 2025

[East-West Road] Tecumseh Hamlet Site

Full Road Construction	
Length of Road (m) B-B east property line of Tecumseh vista to N-S Collector Rd	98
Length of Road (m) F-F N-S Collector Rd to McAuliffe Park Parking	595
Number of Lanes	2
Residential or Arterial/Collector Road	Collector
Road Surface	Asphalt

Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
ROADWORK CROSS-SECTION B-B FROM COUNTY ROAD 43 TO N-S COLLECTOR RD					
1	Improvements to Shields From east property line of Tecumseh vista to Country Rd 43	Allow.	1	$ 150,000.00	$ 150,000.00
2	Clearing, Grubbing, Stripping of Topsoil and Tree Removal	m	98	$ 5.00	$ 490.00
3	Earth Excavating and Grading	m	98	$ 120.00	$ 11,760.00
4	Supply and Place Compacted Granular "A"	m	98	$ 350.00	$ 34,300.00
5	Asphalt Pavement	m	98	$ 250.00	$ 24,500.00
6	Multi-Use Path (3m wide - Incl. Granular Base) - one side of the road	m	98	$ 300.00	$ 29,400.00
7	Concrete Sidewalk (1.5m wide - Incl. Granular Base and AODA Warning Pads) - one side of the road	m	98	$ 75.00	$ 7,350.00
8	Concrete Storm Precast Catchbasins and Leads	m	98	$ 100.00	$ 9,800.00
9	Subdrains (2 lanes)	m	98	$ 60.00	$ 5,880.00
10	Concrete Curb and Gutter	m	98	$ 90.00	$ 8,820.00
11	Topsoil, Hydraulic Seed and Mulch	m	98	$ 100.00	$ 9,800.00
12	Permanent Pavement Markings	m	98	$ 30.00	$ 2,940.00
13	Traffic Control During Construction (Residential)	LS	-	-	$ 5,000.00
14	Streetlighting (Collector)	m	98	$ 400.00	$ 39,200.00
15	Street Trees (In Boulevard / 12m spacing each side)	m	98	$ 120.00	$ 11,760.00
SUBTOTAL					**$ 351,000.00**
Construction Cost Contingency (30%)					$ 106,000.00
TOTAL CONSTRUCTION COST					$ 457,000.00
Engineering Fee Estimate (20%)					$ 92,000.00
TOTAL ROADWORK CROSS-SECTION B-B FROM COUNTY ROAD 43 TO N-S COLLECTOR RD					**$ 549,000.00**
ROADWORK CROSS-SECTION F-F FROM N-S COLLECTOR RD TO ST ALPHONES ST					
1	Clearing, Grubbing, Stripping of Topsoil and Tree Removal	m	595	$ 5.00	$ 2,975.00
2	Earth Excavating and Grading	m	595	$ 120.00	$ 71,400.00
3	Supply and Place Compacted Granular "A"	m	595	$ 350.00	$ 208,250.00
4	Asphalt Pavement	m	595	$ 250.00	$ 148,750.00
5	Multi-Use Path (4m wide - Incl. Granular Base) - both sides of road	m	1190	$ 400.00	$ 476,000.00
6	Concrete Storm Precast Catchbasins and Leads	m	595	$ 100.00	$ 59,500.00
7	Subdrains (2 lanes)	m	595	$ 60.00	$ 35,700.00
8	Concrete Curb and Gutter	m	1190	$ 90.00	$ 107,100.00
9	Topsoil, Hydraulic Seed and Mulch (Median)	m	595	$ 100.00	$ 59,500.00
10	Permanent Pavement Markings	m	595	$ 30.00	$ 17,850.00
11	Bioswale	m	595	$ 300.00	$ 178,500.00
12	Planting Bench	m	595	$ 1,700.00	$ 1,011,500.00
13	Traffic Control During Construction (Residential)	LS	-	-	$ 10,000.00
14	Streetlighting (Collector)	m	595	$ 400.00	$ 238,000.00
15	Street Trees (In Boulevard / 12m spacing each side)	m	892.5	$ 200.00	$ 178,500.00
16	Removals and Reconfiguration of pavement from THSPA to St Alphonses St	Allow.	1	$ 65,000.00	$ 65,000.00
SUBTOTAL					**$ 2,803,525.00**
Construction Cost Contingency (30%)					$ 842,000.00
TOTAL CONSTRUCTION COST					$ 3,645,525.00
Engineering Fee Estimate (20%)					$ 730,000.00
TOTAL ROADWORK CROSS-SECTION F-F FROM N-S COLLECTOR RD TO ST ALPHONES ST					**$ 4,375,525.00**
ROADWORK CROSS-SECTION B-B FROM ALPHONES ST TO LESPERANCE RD					
1	Improvements to Shields From THSPA to Lespearance Road (Allowance)	Allow.	1	$ 150,000.00	$ 150,000.00
SUBTOTAL					**$ 150,000.00**
Construction Cost Contingency (30%)					$ 45,000.00
TOTAL CONSTRUCTION COST					$ 195,000.00
Engineering Fee Estimate (20%)					$ 39,000.00
TOTAL ROADWORK CROSS-SECTION B-B FROM ALPHONES ST TO LESPERANCE RD					**$ 234,000.00**

Tecumseh Hamlet Budgetary Cost Estimates
Maisonneuve Street Road Construction Cost Estimate

Date: June 2025

[East-West Road] Tecumseh Hamlet Site

Length of Road (m) B-B	248
Length of Road (m) E-E	242
Number of Lanes	2
Length of Road (m) B-B (Banwell Intersection)	110
Number of Lanes	3
Residential or Arterial/Collector Road	Residential
Road Surface	Asphalt

Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
ROADWORK CROSS-SECTION B-B (BANWELL RD INTERSECTION)					
1	Clearing, Grubbing, Stripping of Topsoil and Tree Removal	m	110	$ 5.00	$ 550.00
2	Earth Excavating and Grading	m	110	$ 120.00	$ 13,200.00
3	Supply and Place Compacted Granular "A"	m	110	$ 350.00	$ 38,500.00
4	Asphalt Pavement (105mm)	m	165	$ 250.00	$ 41,250.00
5	Multi-Use Path (4m wide - Incl. Granular Base) - one side of the road	m	110	$ 300.00	$ 33,000.00
6	Concrete Sidewalk (1.5m wide - Incl. Granular Base and AODA Warning Pads) - one side of the	m	110	$ 75.00	$ 8,250.00
7	Concrete Storm Precast Catchbasins and Leads	m	110	$ 100.00	$ 11,000.00
8	Subdrains (2 lanes)	m	110	$ 60.00	$ 6,600.00
9	Concrete Curb and Gutter	m	110	$ 90.00	$ 9,900.00
10	Topsoil, Hydraulic Seed and Mulch	m	110	$ 100.00	$ 11,000.00
11	Permanent Pavement Markings	m	110	$ 30.00	$ 3,300.00
12	Traffic Control During Construction (Residential)	LS	-	-	$ 5,000.00
13	Streetlighting (Collector)	m	110	$ 400.00	$ 44,000.00
14	Street Trees (In Boulevard / 12m spacing each side)	m	110	$ 120.00	$ 13,200.00
SUBTOTAL					**$ 238,750.00**
Construction Cost Contingency (30%)					$ 72,000.00
TOTAL CONSTRUCTION COST					$ 310,750.00
Engineering Fee Estimate (20%)					$ 63,000.00
TOTAL ROADWORK CROSS-SECTION B-B (BANWELL RD INTERSECTION)					**$ 373,750.00**
ROADWORK CROSS-SECTION B-B REDUCTION TO 2 LANES TO WEST N-S INTERSECTION & EAST N-S INTERSECTION TO PROPERTY BOUNDARY					
1	Clearing, Grubbing, Stripping of Topsoil and Tree Removal	m	248	$ 5.00	$ 1,240.00
2	Earth Excavating and Grading	m	248	$ 120.00	$ 29,760.00
3	Supply and Place Compacted Granular "A"	m	248	$ 350.00	$ 86,800.00
4	Asphalt Pavement (105mm)	m	248	$ 250.00	$ 62,000.00
5	Multi-Use Path (4m wide - Incl. Granular Base) - one side of the road	m	248	$ 300.00	$ 74,400.00
6	Concrete Sidewalk (1.5m wide - Incl. Granular Base and AODA Warning Pads) - one side of the road	m	248	$ 75.00	$ 18,600.00
7	Concrete Storm Precast Catchbasins and Leads	m	248	$ 100.00	$ 24,800.00
8	Subdrains (2 lanes)	m	248	$ 60.00	$ 14,880.00
9	Concrete Curb and Gutter	m	248	$ 90.00	$ 22,320.00
10	Topsoil, Hydraulic Seed and Mulch	m	248	$ 100.00	$ 24,800.00
11	Permanent Pavement Markings	m	248	$ 30.00	$ 7,440.00
12	Traffic Control During Construction (Residential)	LS	-	-	$ 5,000.00
13	Streetlighting (Collector)	m	248	$ 400.00	$ 99,200.00
14	Street Trees (In Boulevard / 12m spacing each side)	m	248	$ 120.00	$ 29,760.00
SUBTOTAL					**$ 501,000.00**
Construction Cost Contingency (30%)					$ 151,000.00
TOTAL CONSTRUCTION COST					$ 652,000.00
Engineering Fee Estimate (20%)					$ 131,000.00
TOTAL ROADWORK CROSS-SECTION B-B REDUCTION TO 2 LANES TO WEST N-S INTERSECTION & EAST N-S INTERSECTION TO PROPERTY BOUNDAI					**$ 783,000.00**
ROADWORK CROSS-SECTION E-E FROM WEST N-S INTERSECTION TO EAST N-S INTERSECTION					
1	Clearing, Grubbing, Stripping of Topsoil and Tree Removal	m	242	$ 5.00	$ 1,210.00
2	Earth Excavating and Grading	m	242	$ 120.00	$ 29,040.00
3	Supply and Place Compacted Granular "A"	m	242	$ 700.00	$ 169,400.00
4	Asphalt Pavement	m	484	$ 250.00	$ 121,000.00
5	Concrete Sidewalk (3.9m wide - Incl. Granular Base and AODA Warning Pads) - both sides of	m	484	$ 150.00	$ 72,600.00
6	Concrete Storm Precast Catchbasins and Leads	m	242	$ 100.00	$ 24,200.00
7	Subdrains (2 lanes)	m	242	$ 60.00	$ 14,520.00
8	Concrete Curb and Gutter	m	242	$ 90.00	$ 21,780.00
9	Topsoil, Hydraulic Seed and Mulch	m	242	$ 100.00	$ 24,200.00
10	Permanent Pavement Markings	m	484	$ 30.00	$ 14,520.00
11	Traffic Control During Construction (Residential)	LS	-	-	$ 5,000.00
12	Streetlighting (Collector)	m	242	$ 400.00	$ 96,800.00
13	Street Trees (In Boulevard / 12m spacing each side)	m	242	$ 120.00	$ 29,040.00
SUBTOTAL					**$ 623,310.00**
Construction Cost Contingency (30%)					$ 187,000.00
TOTAL CONSTRUCTION COST					$ 810,310.00
Engineering Fee Estimate (20%)					$ 163,000.00
TOTAL ROADWORK CROSS-SECTION E-E FROM WEST N-S INTERSECTION TO EAST N-S INTERSECTION					**$ 973,310.00**

Tecumseh Hamlet Budgetary Cost Estimates
Gouin Street Construction Cost Estimate

Date: June 2025

[East-West Road] Tecumseh Hamlet Site

Length of Road (m) B-B	335
Number of Lanes	2
Length of Road (m) D-D	325
Number of Lanes	3
Residential or Arterial/Collector Road	Collector
Road Surface	Asphalt

Item No.	Description	Unit	Estimated Quantity	Unit Price	Amount
ROADWORK CROSS-SECTION B-B SOUTH OF ROUND ABOUT REDUCTION TO 2 LANES TO PROPERTY BOUNDARY					
1	Clearing, Grubbing, Stripping of Topsoil and Tree Removal	m	335	$ 5.00	$ 1,675.00
2	Earth Excavating and Grading	m	335	$ 120.00	$ 40,200.00
3	Supply and Place Compacted Granular "A"	m	335	$ 350.00	$ 117,250.00
4	Asphalt Pavement	m	502.5	$ 250.00	$ 125,625.00
5	Multi-Use Path (3m wide - Incl. Granular Base) - one side of the road	m	335	$ 300.00	$ 100,500.00
6	Concrete Sidewalk (1.5m wide - Incl. Granular Base and AODA Warning Pads) - one side of the road	m	335	$ 75.00	$ 25,125.00
7	Concrete Storm Precast Catchbasins and Leads	m	335	$ 100.00	$ 33,500.00
8	Subdrains (2 lanes)	m	335	$ 60.00	$ 20,100.00
9	Concrete Curb and Gutter	m	335	$ 90.00	$ 30,150.00
10	Topsoil, Hydraulic Seed and Mulch	m	335	$ 100.00	$ 33,500.00
11	Permanent Pavement Markings	m	335	$ 30.00	$ 10,050.00
12	Traffic Control During Construction (Residential)	LS	-	-	$ 5,000.00
13	Streetlighting (Collector)	m	335	$ 400.00	$ 134,000.00
14	Street Trees (In Boulevard / 12m spacing each side)	m	335	$ 120.00	$ 40,200.00
SUBTOTAL					**$ 716,875.00**
Construction Cost Contingency (30%)					$ 216,000.00
TOTAL CONSTRUCTION COST					$ 932,875.00
Engineering Fee Estimate (20%)					$ 187,000.00
TOTAL ROADWORK CROSS-SECTION B-B SOUTH OF ROUND ABOUT REDUCTION TO 2 LANES TO PROPERTY BOUNDARY					**$ 1,119,875.00**
ROADWORK CROSS-SECTION D-D WEST OF ROUND-A-BOUT & SOUTH OF ROUND-A-BOUT TO REDUCTION TO TWO LANES					
1	Clearing, Grubbing, Stripping of Topsoil and Tree Removal	m	325	$ 5.00	$ 1,625.00
2	Earth Excavating and Grading	m	325	$ 120.00	$ 39,000.00
3	Supply and Place Compacted Granular "A"	m	325	$ 350.00	$ 113,750.00
4	Asphalt Pavement	m	487.5	$ 250.00	$ 121,875.00
5	Multi-Use Path (3m wide - Incl. Granular Base) - one side of the road	m	325	$ 300.00	$ 97,500.00
6	Concrete Sidewalk (1.5m wide - Incl. Granular Base and AODA Warning Pads) - one	m	325	$ 75.00	$ 24,375.00
7	Concrete Storm Precast Catchbasins and Leads	m	325	$ 100.00	$ 32,500.00
8	Subdrains (3 lanes)	m	325	$ 60.00	$ 19,500.00
9	Concrete Curb and Gutter	m	650	$ 90.00	$ 58,500.00
10	Topsoil, Hydraulic Seed and Mulch	m	325	$ 100.00	$ 32,500.00
11	Permananent Pavement Markings	m	650	$ 30.00	$ 19,500.00
12	Traffic Control During Construction (Residential)	LS	-	-	$ 5,000.00
13	Streetlighting (Collector)	m	325	$ 400.00	$ 130,000.00
14	Street Trees (In Boulevard / 12m spacing each side)	m	325	$ 120.00	$ 39,000.00
15	Concrete Median	m	325	$ 75.00	$ 24,375.00
SUBTOTAL					**$ 759,000.00**
Construction Cost Contingency (30%)					$ 228,000.00
TOTAL CONSTRUCTION COST					$ 987,000.00
Engineering Fee Estimate (20%)					$ 198,000.00
TOTAL ROADWORK CROSS-SECTION D-D WEST OF ROUND-A-BOUT & SOUTH OF ROUND-A-BOUT TO REDUCTION TO TWO LANES					**$ 1,185,000.00**

Gouin- Lesperance to Hebert

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	1020	$ 6.00	$ 6,120.00
2	Full Depth Asphalt Pavement Removal	m^2	3000	$ 12.00	$ 36,000.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	100	$ 20.00	$ 2,000.00
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	0	$ 559.00	$ -
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	3	$ 1,150.00	$ 3,450.00
9	Multi-Use Path Removal	m^2	0	$ 12.00	$ -
10	Driveway/Parking Area Removal	m^2	540	$ 15.00	$ 8,100.00
11	Sidewalk Removal	m^2	0	$ 22.00	$ -
TOTAL SECTION 'A'					**$ 60,970.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	1920	$ 45.00	$ 86,400.00
13	Sub excavation	m^3	192	$ 45.00	$ 8,640.00
14	Granular "A" (500mm)	Tonnes	4700	$ 40.42	$ 189,958.33
15	Provisional Granular "A"	Tonnes	500	$ 40.42	$ 20,208.33
16	Subdrains (placed)	m	680	$ 33.00	$ 22,440.00
17	Curb and Gutter	m	680	$ 94.00	$ 63,920.00
18	Driveway Restoration	m^2	540	$ 75.00	$ 40,500.00
19	Asphalt Pavement a) Surface and Base (125mm)	Tonnes	750	$ 203.85	$ 152,884.62
20	Tack Coat	m^2	2278	$ 1.50	$ 3,417.00
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	340	$ 25.00	$ 8,500.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 7,700.00
TOTAL SECTION 'B'					**$ 617,068.28**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	0	$ 45.00	$ -
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	0	$ 40.42	$ -
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	0	$ 203.85	$ -
28	Multi-Use Path Including Granular Base	m^2	1020	$ 110.00	$ 112,200.00
29	Concrete Sidewalk	m^2	510	$ 112.00	$ 57,120.00
TOTAL SECTION 'C'					**$ 169,320.00**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	9	$ 15,000.00	$ 135,000.00
31	Streetlighting Removal	Each	9	$ 750.00	$ 6,750.00
TOTAL SECTION 'D'					**$ 141,750.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	8	$ 5,200.00	$ 41,600.00
33	Catch Basin Leads (all sizes)	m	50	$ 400.00	$ 20,000.00
TOTAL SECTION 'E'					**$ 61,600.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	2652	$ 10.00	$ 26,520.00
35	Hydro Seed and Mulch	m^2	2652	$ 5.00	$ 13,260.00
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ -
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 42,780.00**

SECTION 'A' - REMOVALS	**$ 60,970.00**
SECTION 'B' - ROADWORK	**$ 617,068.28**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 169,320.00**
SECTION 'D' - STREETLIGHTING	**$ 141,750.00**
SECTION 'E' - STORM SEWERS	**$ 61,600.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 42,780.00**
CONTINGENCY (20%)	**$ 218,698.00**
ENGINEERING (15%)	**$ 164,024.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 1,476,210.28**

Notes: New Road based on TMP Urban Collector cross-section
Sidewalk on one side
MUP on one side
Storm Sewers not included
Drain enclosures not included
DC Eligible

Gouin- Hebert to Hamlet Boundary

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	900	$ 6.00	$ 5,400.00
2	Full Depth Asphalt Pavement Removal	m^2	3000	$ 12.00	$ 36,000.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	600	$ 20.00	$ 12,000.00
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	8	$ 500.00	$ 4,000.00
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	3	$ 1,150.00	$ 3,450.00
9	Multi-Use Path Removal	m^2	0	$ 12.00	$ -
10	Driveway/Parking Area Removal	m^2	270	$ 15.00	$ 4,050.00
11	Sidewalk Removal	m^2	0	$ 22.00	$ -
TOTAL SECTION 'A'					**$ 70,200.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	1690	$ 45.00	$ 76,050.00
13	Sub excavation	m^3	169	$ 45.00	$ 7,605.00
14	Granular "A" (500mm)	Tonnes	4100	$ 40.42	$ 165,708.33
15	Provisional Granular "A"	Tonnes	500	$ 40.42	$ 20,208.33
16	Subdrains (placed)	m	600	$ 33.00	$ 19,800.00
17	Curb and Gutter	m	600	$ 94.00	$ 56,400.00
18	Driveway Restoration	m^2	270	$ 75.00	$ 20,250.00
19	Asphalt Pavement a) Surface and Base (125mm)	Tonnes	660	$ 203.85	$ 134,538.46
20	Tack Coat	m^2	2010	$ 1.50	$ 3,015.00
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	300	$ 25.00	$ 7,500.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 6,800.00
TOTAL SECTION 'B'					**$ 530,375.13**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	0	$ 45.00	$ -
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	0	$ 40.42	$ -
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	0	$ 203.85	$ -
28	Multi-Use Path Including Granular Base	m^2	900	$ 110.00	$ 99,000.00
29	Concrete Sidewalk	m^2	450	$ 112.00	$ 50,400.00
TOTAL SECTION 'C'					**$ 149,400.00**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	8	$ 15,000.00	$ 120,000.00
31	Streetlighting Removal	Each	8	$ 750.00	$ 6,000.00
TOTAL SECTION 'D'					**$ 126,000.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	8	$ 5,200.00	$ 41,600.00
33	Catch Basin Leads (all sizes)	m	50	$ 400.00	$ 20,000.00
TOTAL SECTION 'E'					**$ 61,600.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	2340	$ 10.00	$ 23,400.00
35	Hydro Seed and Mulch	m^2	2340	$ 5.00	$ 11,700.00
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ -
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 38,100.00**

SECTION 'A' - REMOVALS	**$ 70,200.00**
SECTION 'B' - ROADWORK	**$ 530,375.13**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 149,400.00**
SECTION 'D' - STREETLIGHTING	**$ 126,000.00**
SECTION 'E' - STORM SEWERS	**$ 61,600.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 38,100.00**
CONTINGENCY (20%)	**$ 195,136.00**
ENGINEERING (15%)	**$ 146,352.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 1,317,163.13**

Notes: New Road based on TMP Urban Collector cross-section
Sidewalk on one side
MUP on one side
Storm Sewers not included
Drain enclosures not included
DC Eligible

Maisonneuve- Lesperance to Hebert

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	1050	$ 6.00	$ 6,300.00
2	Full Depth Asphalt Pavement Removal	m^2	3000	$ 12.00	$ 36,000.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	140	$ 20.00	$ 2,800.00
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	6	$ 559.00	$ 3,354.00
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	3	$ 1,150.00	$ 3,450.00
9	Multi-Use Path Removal	m^2	0	$ 12.00	$ -
10	Driveway/Parking Area Removal	m^2	405	$ 15.00	$ 6,075.00
11	Sidewalk Removal	m^2	0	$ 22.00	$ -
TOTAL SECTION 'A'					**$ 63,279.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	1970	$ 45.00	$ 88,650.00
13	Sub excavation	m^3	197	$ 45.00	$ 8,865.00
14	Granular "A" (500mm)	Tonnes	4800	$ 40.42	$ 194,000.00
15	Provisional Granular "A"	Tonnes	500	$ 40.42	$ 20,208.33
16	Subdrains (placed)	m	700	$ 33.00	$ 23,100.00
17	Curb and Gutter	m	700	$ 94.00	$ 65,800.00
18	Driveway Restoration	m^2	405	$ 75.00	$ 30,375.00
19	Asphalt Pavement a) Surface and Base (125mm)	Tonnes	770	$ 203.85	$ 156,961.54
20	Tack Coat	m^2	2345	$ 1.50	$ 3,517.50
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	350	$ 25.00	$ 8,750.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 7,900.00
TOTAL SECTION 'B'					**$ 620,627.37**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	0	$ 45.00	$ -
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	0	$ 40.42	$ -
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	0	$ 203.85	$ -
28	Multi-Use Path Including Granular Base	m^2	1050	$ 110.00	$ 115,500.00
29	Concrete Sidewalk	m^2	630	$ 112.00	$ 70,560.00
TOTAL SECTION 'C'					**$ 186,060.00**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	9	$ 15,000.00	$ 135,000.00
31	Streetlighting Removal	Each	0	$ 750.00	$ -
TOTAL SECTION 'D'					**$ 135,000.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	8	$ 5,200.00	$ 41,600.00
33	Catch Basin Leads (all sizes)	m	50	$ 400.00	$ 20,000.00
TOTAL SECTION 'E'					**$ 61,600.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	2730	$ 10.00	$ 27,300.00
35	Hydro Seed and Mulch	m^2	2730	$ 5.00	$ 13,650.00
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ -
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 43,950.00**

SECTION 'A' - REMOVALS	**$ 63,279.00**
SECTION 'B' - ROADWORK	**$ 620,627.37**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 186,060.00**
SECTION 'D' - STREETLIGHTING	**$ 135,000.00**
SECTION 'E' - STORM SEWERS	**$ 61,600.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 43,950.00**
CONTINGENCY (20%)	**$ 222,104.00**
ENGINEERING (15%)	**$ 166,578.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 1,499,198.37**

Notes: New Road based on TMP Urban Collector cross-section
Sidewalk on one side
MUP on one side
Storm Sewers not included
Drain enclosures not included
DC Eligible

Maisonneuve- Hebert to Shawnee

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	420	$ 6.00	$ 2,520.00
2	Full Depth Asphalt Pavement Removal	m^2	1350	$ 12.00	$ 16,200.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	280	$ 20.00	$ 5,600.00
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	4	$ 559.00	$ 2,236.00
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	2	$ 1,150.00	$ 2,300.00
9	Multi-Use Path Removal	m^2	0	$ 12.00	$ -
10	Driveway/Parking Area Removal	m^2	90	$ 15.00	$ 1,350.00
11	Sidewalk Removal	m^2	0	$ 22.00	$ -
TOTAL SECTION 'A'					**$ 35,506.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	790	$ 45.00	$ 35,550.00
13	Sub excavation	m^3	79	$ 45.00	$ 3,555.00
14	Granular "A" (500mm)	Tonnes	1900	$ 40.42	$ 76,791.67
15	Provisional Granular "A"	Tonnes	200	$ 40.42	$ 8,083.33
16	Subdrains (placed)	m	280	$ 33.00	$ 9,240.00
17	Curb and Gutter	m	280	$ 94.00	$ 26,320.00
18	Driveway Restoration	m^2	90	$ 75.00	$ 6,750.00
19	Asphalt Pavement a) Surface and Base (125mm)	Tonnes	310	$ 203.85	$ 63,192.31
20	Tack Coat	m^2	938	$ 1.50	$ 1,407.00
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	140	$ 25.00	$ 3,500.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 3,200.00
TOTAL SECTION 'B'					**$ 250,089.31**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	0	$ 45.00	$ -
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	0	$ 40.42	$ -
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	0	$ 203.85	$ -
28	Multi-Use Path Including Granular Base	m^2	420	$ 110.00	$ 46,200.00
29	Concrete Sidewalk	m^2	252	$ 112.00	$ 28,224.00
TOTAL SECTION 'C'					**$ 74,424.00**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	4	$ 15,000.00	$ 60,000.00
31	Streetlighting Removal	Each	4	$ 750.00	$ 3,000.00
TOTAL SECTION 'D'					**$ 63,000.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	4	$ 5,200.00	$ 20,800.00
33	Catch Basin Leads (all sizes)	m	30	$ 400.00	$ 12,000.00
TOTAL SECTION 'E'					**$ 32,800.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	1092	$ 10.00	$ 10,920.00
35	Hydro Seed and Mulch	m^2	1092	$ 5.00	$ 5,460.00
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ -
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 19,380.00**

SECTION 'A' - REMOVALS	**$ 35,506.00**
SECTION 'B' - ROADWORK	**$ 250,089.31**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 74,424.00**
SECTION 'D' - STREETLIGHTING	**$ 63,000.00**
SECTION 'E' - STORM SEWERS	**$ 32,800.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 19,380.00**
CONTINGENCY (20%)	**$ 95,040.00**
ENGINEERING (15%)	**$ 71,280.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 641,519.31**

Notes: New Road based on TMP Urban Collector cross-section
Sidewalk on one side
MUP on one side
Storm Sewers not included
Drain enclosures not included

Maisonneuve- Shawnee to Corbi

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	540	$ 6.00	$ 3,240.00
2	Full Depth Asphalt Pavement Removal	m^2	1620	$ 12.00	$ 19,440.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	360	$ 20.00	$ 7,200.00
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	4	$ 559.00	$ 2,236.00
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	2	$ 1,150.00	$ 2,300.00
9	Multi-Use Path Removal	m^2	0	$ 12.00	$ -
10	Driveway/Parking Area Removal	m^2	225	$ 15.00	$ 3,375.00
11	Sidewalk Removal	m^2	270	$ 22.00	$ 5,940.00
TOTAL SECTION 'A'					**$ 49,031.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	1020	$ 45.00	$ 45,900.00
13	Sub excavation	m^3	102	$ 45.00	$ 4,590.00
14	Granular "A" (500mm)	Tonnes	2500	$ 40.42	$ 101,041.67
15	Provisional Granular "A"	Tonnes	300	$ 40.42	$ 12,125.00
16	Subdrains (placed)	m	360	$ 33.00	$ 11,880.00
17	Curb and Gutter	m	360	$ 94.00	$ 33,840.00
18	Driveway Restoration	m^2	225	$ 75.00	$ 16,875.00
19	Asphalt Pavement a) Surface and Base (125mm)	Tonnes	400	$ 203.85	$ 81,538.46
20	Tack Coat	m^2	1206	$ 1.50	$ 1,809.00
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	180	$ 25.00	$ 4,500.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 4,100.00
TOTAL SECTION 'B'					**$ 330,699.13**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	0	$ 45.00	$ -
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	0	$ 40.42	$ -
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	0	$ 203.85	$ -
28	Multi-Use Path Including Granular Base	m^2	540	$ 110.00	$ 59,400.00
29	Concrete Sidewalk	m^2	324	$ 112.00	$ 36,288.00
TOTAL SECTION 'C'					**$ 95,688.00**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	5	$ 15,000.00	$ 75,000.00
31	Streetlighting Removal	Each	5	$ 750.00	$ 3,750.00
TOTAL SECTION 'D'					**$ 78,750.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	4	$ 5,200.00	$ 20,800.00
33	Catch Basin Leads (all sizes)	m	30	$ 400.00	$ 12,000.00
TOTAL SECTION 'E'					**$ 32,800.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	1404	$ 10.00	$ 14,040.00
35	Hydro Seed and Mulch	m^2	1404	$ 5.00	$ 7,020.00
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ -
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 24,060.00**

SECTION 'A' - REMOVALS	**$ 49,031.00**
SECTION 'B' - ROADWORK	**$ 330,699.13**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 95,688.00**
SECTION 'D' - STREETLIGHTING	**$ 78,750.00**
SECTION 'E' - STORM SEWERS	**$ 32,800.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 24,060.00**
CONTINGENCY (20%)	**$ 122,206.00**
ENGINEERING (15%)	**$ 91,655.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 824,889.13**

Notes: New Road based on TMP Urban Collector cross-section

Sidewalk on one side

MUP on one side

Storm Sewers not included

Drain enclosures not included

DC Eligible

Maisonneuve- Corbi to Tecumseh Hamlet

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	1150	$ 6.00	$ 6,900.00
2	Full Depth Asphalt Pavement Removal	m^2	50	$ 12.00	$ 600.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	0	$ 20.00	$ -
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	0	$ 559.00	$ -
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	1	$ 1,150.00	$ 1,150.00
9	Multi-Use Path Removal	m^2	0	$ 12.00	$ -
10	Driveway/Parking Area Removal	m^2	0	$ 15.00	$ -
11	Sidewalk Removal	m^2	0	$ 22.00	$ -
TOTAL SECTION 'A'					**$ 13,950.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	290	$ 45.00	$ 13,050.00
13	Sub excavation	m^3	29	$ 45.00	$ 1,305.00
14	Granular "A" (500mm)	Tonnes	700	$ 40.42	$ 28,291.67
15	Provisional Granular "A"	Tonnes	100	$ 40.42	$ 4,041.67
16	Subdrains (placed)	m	100	$ 33.00	$ 3,300.00
17	Curb and Gutter	m	100	$ 94.00	$ 9,400.00
18	Driveway Restoration	m^2	0	$ 75.00	$ -
19	Asphalt Pavement a) Surface and Base (125mm)	Tonnes	110	$ 203.85	$ 22,423.08
20	Tack Coat	m^2	335	$ 1.50	$ 502.50
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	50	$ 25.00	$ 1,250.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 1,700.00
TOTAL SECTION 'B'					**$ 97,763.91**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	94	$ 45.00	$ 4,230.00
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	200	$ 40.42	$ 8,083.33
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	49	$ 203.85	$ 9,988.46
28	Multi-Use Path Including Granular Base	m^2	150	$ 110.00	$ 16,500.00
29	Concrete Sidewalk	m^2	90	$ 112.00	$ 10,080.00
TOTAL SECTION 'C'					**$ 48,881.79**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	2	$ 15,000.00	$ 30,000.00
31	Streetlighting Removal	Each	0	$ 750.00	$ -
TOTAL SECTION 'D'					**$ 30,000.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	2	$ 5,200.00	$ 10,400.00
33	Catch Basin Leads (all sizes)	m	20	$ 400.00	$ 8,000.00
TOTAL SECTION 'E'					**$ 18,400.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	390	$ 10.00	$ 3,900.00
35	Hydro Seed and Mulch	m^2	390	$ 5.00	$ 1,950.00
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ -
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 8,850.00**

SECTION 'A' - REMOVALS	**$ 13,950.00**
SECTION 'B' - ROADWORK	**$ 97,763.91**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 48,881.79**
SECTION 'D' - STREETLIGHTING	**$ 30,000.00**
SECTION 'E' - STORM SEWERS	**$ 18,400.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 8,850.00**
CONTINGENCY (20%)	**$ 43,570.00**
ENGINEERING (15%)	**$ 32,677.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 294,092.71**

Notes: New Road based on TMP Urban Collector cross-section
Sidewalk on one side
MUP on one side
Storm Sewers not included
Drain enclosures not included
DC Eligible

Intersection- Lesperance to Shawnee

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	1650	$ 6.00	$ 9,900.00
2	Full Depth Asphalt Pavement Removal	m^2	4000	$ 12.00	$ 48,000.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	0	$ 20.00	$ -
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	6	$ 559.00	$ 3,354.00
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	5	$ 1,150.00	$ 5,750.00
9	Multi-Use Path Removal	m^2	1650	$ 12.00	$ 19,800.00
10	Driveway/Parking Area Removal	m^2	1395	$ 15.00	$ 20,925.00
11	Sidewalk Removal	m^2	0	$ 22.00	$ -
TOTAL SECTION 'A'					**$ 113,029.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	3100	$ 45.00	$ 139,500.00
13	Sub excavation	m^3	310	$ 45.00	$ 13,950.00
14	Granular "A" (500mm)	Tonnes	7500	$ 40.42	$ 303,125.00
15	Provisional Granular "A"	Tonnes	800	$ 40.42	$ 32,333.33
16	Subdrains (placed)	m	1100	$ 33.00	$ 36,300.00
17	Curb and Gutter	m	1100	$ 94.00	$ 103,400.00
18	Driveway Restoration	m^2	1395	$ 75.00	$ 104,625.00
19	Asphalt Pavement a) Surface and Base (125mm)	Tonnes	1260	$ 203.85	$ 256,846.15
20	Tack Coat	m^2	3850	$ 1.50	$ 5,775.00
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	550	$ 25.00	$ 13,750.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 12,900.00
TOTAL SECTION 'B'					**$ 1,035,004.49**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	0	$ 45.00	$ -
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	0	$ 40.42	$ -
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	0	$ 203.85	$ -
28	Multi-Use Path Including Granular Base	m^2	1650	$ 110.00	$ 181,500.00
29	Concrete Sidewalk	m^2	990	$ 112.00	$ 110,880.00
TOTAL SECTION 'C'					**$ 292,380.00**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	14	$ 15,000.00	$ 210,000.00
31	Streetlighting Removal	Each	14	$ 750.00	$ 10,500.00
TOTAL SECTION 'D'					**$ 220,500.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	14	$ 5,200.00	$ 72,800.00
33	Catch Basin Leads (all sizes)	m	90	$ 400.00	$ 36,000.00
TOTAL SECTION 'E'					**$ 108,800.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	4367	$ 10.00	$ 43,670.00
35	Hydro Seed and Mulch	m^2	4367	$ 5.00	$ 21,835.00
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ -
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 68,505.00**

SECTION 'A' - REMOVALS	**$ 113,029.00**
SECTION 'B' - ROADWORK	**$ 1,035,004.49**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 292,380.00**
SECTION 'D' - STREETLIGHTING	**$ 220,500.00**
SECTION 'E' - STORM SEWERS	**$ 108,800.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 68,505.00**
CONTINGENCY (20%)	**$ 367,644.00**
ENGINEERING (15%)	**$ 275,733.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 2,481,595.49**

Notes: New Road based on TMP Urban Collector cross-section
Sidewalk on one side
MUP on one side
Storm Sewers not included
Drain enclosures not included
DC Eligible

Intersection- Shawnee to Banwell

Item No.	Description	Unit	Est. Qty.	Unit Price	Amount
SECTION 'A' - REMOVALS					
1	Clearing, Grubbing and Stripping of Topsoil	m^2	2250	$ 6.00	$ 13,500.00
2	Full Depth Asphalt Pavement Removal	m^2	5000	$ 12.00	$ 60,000.00
3	Milling of asphalt headers	m^2	40	$ 120.00	$ 4,800.00
4	Removal of Existing Curb and Gutter	m	0	$ 20.00	$ -
5	Saw-cut Existing Pavement	m	50	$ 10.00	$ 500.00
6	Catch Basin Removal	Each	0	$ 559.00	$ -
7	Adjust Existing Catch Basin	Each	0	$ 559.00	$ -
8	Adjust Existing Manhole	Each	7	$ 1,150.00	$ 8,050.00
9	Multi-Use Path Removal	m^2	0	$ 12.00	$ -
10	Driveway/Parking Area Removal	m^2	1395	$ 15.00	$ 20,925.00
11	Sidewalk Removal	m^2	0	$ 22.00	$ -
TOTAL SECTION 'A'					**$ 107,775.00**
SECTION 'B' - ROADWORK					
12	Earth Excavation and Grading	m^3	4220	$ 45.00	$ 189,900.00
13	Sub excavation	m^3	422	$ 45.00	$ 18,990.00
14	Granular "A" (500mm)	Tonnes	10200	$ 40.42	$ 412,250.00
15	Provisional Granular "A"	Tonnes	1100	$ 40.42	$ 44,458.33
16	Subdrains (placed)	m	1500	$ 33.00	$ 49,500.00
17	Curb and Gutter	m	1500	$ 94.00	$ 141,000.00
18	Driveway Restoration	m^2	1395	$ 75.00	$ 104,625.00
19	Asphalt Pavement a) Surface and Base (125mm)	sanitary	1640	$ 203.85	$ 334,307.69
20	Tack Coat	m^2	5025	$ 1.50	$ 7,537.50
21	Dust Control	L.S.	-	-	$ 2,500.00
22	Pavement Markings	m	750	$ 25.00	$ 18,750.00
23	Traffic Control	L.S.	-	-	$ 10,000.00
24	Asphalt Cement Price Adjustment	L.S.	-	-	$ 16,800.00
TOTAL SECTION 'B'					**$ 1,350,618.53**
SECTION 'C' - ACTIVE TRANSPORTATION					
25	Earth Excavation and Grading a) Bike Lanes	m^3	0	$ 45.00	$ -
26	Granular 'A' a) Bike Lanes (500mm Thickness)	Tonnes	0	$ 40.42	$ -
27	Asphalt Pavement a) Bike Lane Surface and Base (125mm)	Tonnes	0	$ 203.85	$ -
28	Multi-Use Path Including Granular Base	m^2	2250	$ 110.00	$ 247,500.00
29	Concrete Sidewalk	m^2	1125	$ 112.00	$ 126,000.00
TOTAL SECTION 'C'					**$ 373,500.00**
SECTION 'D' - STREETLIGHTING					
30	New Streetlighting	Each	19	$ 15,000.00	$ 285,000.00
31	Streetlighting Removal	Each	0	$ 750.00	$ -
TOTAL SECTION 'D'					**$ 285,000.00**
SECTION 'E' - STORM SEWERS					
32	Supply and Install Catchbasins Including Debris Trap, Frame and Grate: a) Standard Curb Inlet Catchbasin	Each	18	$ 5,200.00	$ 93,600.00
33	Catch Basin Leads (all sizes)	m	110	$ 400.00	$ 44,000.00
34	Engineered fill: Municipal Drain and swale	m^3	6750	$ 20.00	$ 135,000.00
TOTAL SECTION 'E'					**$ 272,600.00**

SECTION 'F' - RESTORATION AND MISCELLANEOUS					
34	Imported, Screened Topsoil (100mm thick)	m^2	36.18	$ 10.00	$ 361.80
35	Hydro Seed and Mulch	m^2	36.18	$ 5.00	$ 180.90
36	Install New Regulatory Signage and Posts	L.S.	-	-	$ 3,000.00
37	Sediment and Erosion Control	L.S.	-	-	$ 5,000.00
38	Engineer's Site Office	L.S.	-	-	$ -
TOTAL SECTION 'F'					**$ 8,542.70**

SECTION 'A' - REMOVALS	**$ 107,775.00**
SECTION 'B' - ROADWORK	**$ 1,350,618.53**
SECTION 'C' - ACTIVE TRANSPORTATION	**$ 373,500.00**
SECTION 'D' - STREETLIGHTING	**$ 285,000.00**
SECTION 'E' - STORM SEWERS	**$ 272,600.00**
SECTION 'F' - RESTORATION AND MISCELLANEOUS	**$ 8,542.70**
CONTINGENCY (20%)	**$ 479,608.00**
ENGINEERING (15%)	**$ 359,706.00**
ESTIMATE SUBTOTAL (excl. HST)	**$ 3,237,350.23**

Notes: New Road based on TMP Urban Collector cross-section
Sidewalk on one side
MUP on one side
Storm Sewers not included
Drain enclosures not included
DC Eligible

Appendix M

Sandwich South SWM Pond Design and Waterfowl Monitoring Mitigation Plan

Memo

To: Patrick Winter, P.Eng., Project Manager, City of Windsor

From: Caitlin Vandermeer, Dillon Consulting Limited
Laura Herlehy, P.Eng., Dillon Consulting Limited

cc: Phil Roberts

Date: April 10, 2023

Subject: Supplementary Waterfowl Adaptive Mitigation Plan for Stormwater Management Facilities Sandwich South Master Planning Area

Our File: 19-9817

The purpose of this document is to supplement the functional design of the stormwater management facilities proposed to service the Sandwich South Master Planning Area, as well as the proposed Natural Environment system is required to protect, preserve and, where appropriate, enhance the natural environment. This document should be reviewed in conjunction with the Sandwich South Master Servicing Plan report which provides additional context on the overall serving strategy for the Sandwich South (SS) Area.

The purpose of this document is to provide guidance on the design of stormwater management ponds within the Sandwich South Secondary Plan area. Necessary due diligence and engineering shall be completed to ensure that the designs meet Transport Canada's requirements, the airport has been consulted through the design process and that the ponds do not pose additional safety risk associated with bird hazards. This plan focuses on risks associated with stormwater management facilities and does not address waterfowl mitigation required for other land uses such as park lands or for other open areas.

1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by the City of Windsor (City) to complete a Master Servicing Plan for the Sandwich South (SS) area which will provide a framework for future infrastructure required to meet the growing needs of the community. The Sandwich South Master Servicing Plan (SSMSP) is building upon the stormwater management (SWM) recommendations that were developed through the Upper Little River Watershed and Master Drainage and Stormwater Management Plan Environmental Assessment (ULRMP) plan, 2023. As a result of the ULRMP, several linear stormwater management facilities are proposed within the SS area to support residential, institutional, industrial and commercial development. The SWM facilities were proposed to be regional wet ponds that provide both quality and quantity control of runoff to meet the design criteria outlined in the Windsor/Essex Region Stormwater Management Standards Manual (2018) as well as to attenuate flows to acceptable release rates determined in the ULRMP.

Through the SSMSP, refinement to the SWM strategy has resulted in the recommendation to propose a hybrid approach where dry ponds are proposed in areas that are within the identified Zone of No Confidence.

It is understood that SWM ponds, especially those have permanent standing water pools have the potential to attract waterfowl and are identified as a hazardous when in the vicinity of airports per Transportation Canada Aviation guidelines such as the Canadian Aviation Regulations (CARs). See Section 2 below for additional context on regulatory requirements. Windsor International Airport (noted herein as "WIA") is located within the SS study area and therefore precautionary and active management of waterfowl is required to mitigate risks of collisions that pose hazard to human health and safety. WIA is 813 hectares (ha) and is located, north of County Road 42, east of the existing CN Rail line, south of Rhodes Drive and west of Lauzon Parkway.

Currently, WIA conducts regular monitoring within and adjacent to the airport lands to meet the CAR requirements and to facilitate safe operation of the airport. The introduction of SWM facilities to the area will require additional monitoring and continued management throughout the lifetime of these facilities. It is necessary to consider the long-term operational needs of the ponds as it relates to waterfowl mitigation and is discussed in more detail in this document.

The purpose of this memo is to provide a framework for mitigation, monitoring, and adaptive management for the long-term use of SWM ponds proposed to service the SS area. The proposed monitoring outlined herein is intended to build upon monitoring and mitigation currently being applied by the WIA.

1.1 Existing Conditions

The SS area is approximately 25.4 km^2 (2,540 ha) in size and sits within the Little River watershed along the southeastern region of the City of Windsor. The area is considered the largest portion of undeveloped land within the City boundary, bound by Highway 401 to the south, Walker Road and the Canadian National (CN) Rail to the West, the Town of Tecumseh municipal boundary to the east and the EC Row Expressway to the North (the Study Area; **Attachment A** - Figure 1).

The Study Area is currently dominated by agricultural lands with scattered residential homes. Natural heritage features (woodlands, watercourses, fish habitat, wetlands, etc.) are limited, however, tend to be localized to the Little River watercourse. In addition, several municipal drains exist within agricultural fields and along existing roadways which conveys runoff from the watershed downstream to the Little River drain and eventually to Lake St. Clair. It is not the purpose of the drains to provide quality control and they do not contain standing water for long periods of time. While there are Provincially Significant Wetlands (PSW) swamp communities present directly within WIA lands, there are limited aquatic habitats present within the SS area that would attract waterfowl or other wildlife to WIA. Although minimal natural habitat is present, it is noted that two wet SWM ponds are present within the broader landscape outside of the Study Area to the north (Central Avenue) and west (Captain John Wilson), respectively (**Attachment A** – Figure 1); the WIA monitors these ponds as part of their monthly risk assessment activities to manage waterfowl hazards.

1.2 Proposed Conditions

As mentioned previously, to facilitate the proposed land use for the SSMSP area, several open water SWM ponds are proposed to occur along the existing municipal drains including Little River watercourse, 6th Concession Drain and the proposed 7th Concession drain re-alignment (**Attachment A** – Figure 1). In addition to the construction of the linear SWM ponds, the adjacent drains are also proposed to be modified to be suitable for the future urbanization of this area. The side slopes and depths of the municipal drains were set to provide sufficient capacity to provide conveyance of drainage under interim and proposed conditions. The proposed SWM plan is detailed in the SSMSP Stormwater Management Report (Appendix D) being completed for the SSMSP. Public safety has also been considered as the proposed SWM ponds will be recreational corridors that will have active transportation linkages and natural environment areas. While the widening of drains may increase the observable surface area of water within drains, it is anticipated that flow within the drains to be temporary for the purposes of drainage lands after rain events and not to contain permanent standing water.

The proposed SWM ponds are to be constructed on the landscape via a phased approach to follow the construction of developable areas based on the established land use plan found in the related Secondary Plans. It is anticipated that the SWM ponds located, south of Baseline Road, within the East Pelton Secondary Plan area (P1), and adjacent to Lauzon Parkway, north of CR42 (P7 and P8) will be required first (**Attachment A** – Figure 1). The remaining SWM ponds will be added to the landscape as development continues within the East Pelton and Country Road 42 Secondary Plan Areas. The SWM Ponds outside of the two secondary plan areas will be constructed in the future as development areas expand and the necessary planning studies have been completed to support that development. Exact timing of pond construction is not known and it is anticipated that the full build out of the area will take more than 20 years.

Both wet and dry SWM ponds have the potential to attract waterfowl, therefore, recommendations included in this report apply to both types of facilities.

2.0 Aviation Perspective

Transport Canada regulates airports and aerodromes through legislated regulations (Canadian Aviation Regulations (CAR's)) and policy, standards and practices (TP) manuals. Wildlife control and mitigation is one of many legislated considerations in the operation of an airport. CAR's Part III – Aerodromes, Airports and Heliports, Division III – Airport Wildlife Planning and Management, Section 302.304(1) Risk Analysis (Attachment A), outlines the Airport Operators obligations to undertake a risk assessment of hazards presented by wildlife and wildlife attractions.

Stormwater retention ponds are known wildlife attractants. Transport Canada's TP1247E – Land Use in the Vicinity of Aerodromes, Part III – Bird Hazards and Wildlife, Section 3.2 - Hazardous Land-use Acceptability, Table 1 – Hazardous Land-use Acceptability by Hazard Zone (Attachment B), identifies SWM ponds as being a potentially low level of risk in secondary and special hazard zones but not a land use for primary hazard zones.

Portions of the proposed SWM facilities fall within the primary hazard zone of the Windsor Airport. That zone being defined in TP1247E as, generally enclosed airspace in which aircraft are at or below altitudes of 1500 feet AGL (457 meters above ground level). These are the altitudes most populated by hazardous birds, and at which collisions with birds have the potential to result in the greatest damage.

The proposed SWM features are in closest proximity to Runway 12-30/RWY 30 approach, which has a northwest/southeast alignment. RWY 30 is Windsor's primary runway for passenger carriers operating turbo prop, regional and corporate jet aircraft as well as recreational and training aircraft use. The approach surface for RWY 30, as protected by the Airport Registered Zoning (AZR), is a 50:1 surface extending 10,000 feet from the pavement threshold. This is the second most used approach at Windsor Airport and aircraft using this approach could legally be less than 200 feet AGL (Above Ground Level) crossing over some of the proposed SWM features. Circuits for landing RWY 12 or 30 are all below 1000 feet AGL. Refer to **Attachment A** - Figure 3, which illustrates these boundaries.

Stormwater features in our region are known to attract waterfowl, herons and gulls. Species of principal interest due to their abundance, behaviour and size are Canada Goose (Branta canadensis maxima), Mallard Duck (Anas platyrhynchos), Great Blue Heron (Ardea herodias) and Ring-billed Gull (Larus delawarensis). These species rank high in wildlife hazard risk from North American birdstrike databases, TP11500 – Wildlife Control Procedures Manual and the Windsor Airport Wildlife Control Plan risk assessment database (Attachment D – Species Hazard Ranking).

These species rely on access to open water for both feeding and safety and often are in close proximity for breeding and fledging young. These species are grazers with gulls and herons being "grubbers", eating a variety of turf, soil and aquatic insects, invertebrates and small vertebrates. These species for the most part prefer open wetland and grassland habitats are not adept to swamp wetlands or course habitat features.

3.0 Waterfowl Adaptive Mitigation Plan

The waterfowl adaptive mitigation plan was developed to follow guidelines provided in the 2018 *Template for the Development of an Airport Wildlife Management Plan* by Transport Canada and considered risk assessment parameters currently in use by the WIA. Additional documents, current research, government protocols, and best management practices, used for the development of this plan are listed below:

- Land Use in the Vicinity of Aerodromes, Ninth Edition, Transport Canada (2013);
- Wildlife Control Procedures Manual. Transport Canada Aerodromes Standards Branch (2015);
- Landscape Design Guidelines for Stormwater Facilities. City of Hamilton (May 2009);
- Wildlife Hazard Mitigation, Federal Aviation Administration, United States Department of Transportation (August, 2020);
- Airport Wildlife Management. Bulletin No. 38. Transport Canada (2007);
- 2005 Sustainability Report for Toronto Pearson International Airport;
- Bird Control at Schiphol, Amsterdam Airport Schipol (2019);

- Wildlife at Airports; Wildlife Damage Management Technical Series. U.S. Department of Agriculture, Animal and Plant Health Inspection Service (February 2017);
- Waterbird Deterrent Techniques. Exxon Biomedical Sciences, Inc. Marine Spill Response Corporation (1994);
- Upper Little River Watershed Master Drainage and Stormwater Management Plan, Environmental Assessment Environmental Study Report (Stantec, 2017 DRAFT); and,
- Bird Use of Stormwater Management Ponds: Decreasing Avian Attractants on Airports. Landscape and Urban Planning (Blackwell et al., 2008).

While the SWM ponds will be considered infrastructure owned by the City, risk assessment parameters and existing monitoring practises of WIA will need to be considered for the development of a waterfowl adaptive mitigation plan to ensure congruence.

As part of the risk assessment, WIA has several zones it uses to monitor avian species, as shown on Figure 1 (**Attachment A**):

Zone of No Tolerance – Runway areas within the Airport lands. Waterfowl are not permitted and are removed immediately.

Zone of No Confidence – Airport and private lands located adjacent to the runway areas. Wildlife officers monitor and remove waterfowl as necessary.

Zone of Monitoring – Lands present within a 2-4 km radius from the airport lands. All features containing habitat supportive of waterfowl (i.e., wetlands, SWM ponds etc.,) within this radius are monitored monthly by airport staff. Bird populations are monitored and removed if it is determined that they present danger to the airport.

The majority of the proposed SWM ponds are located within the Zone of Monitoring, however, two ponds, P1 and P3, overlap with the Zone of No Confidence (**Attachment A** – Figure 1).

While interactions with all species are documented by WIA, the key target species that have the potential to cause harm and hazards to human health and safety at the airport due to collisions are Canada Geese (*Branta canadensis*) and Ring-billed Gulls (*Larus delawarensis*). As such, the waterfowl adaptive mitigation plan has been developed to consider the behaviour and life history of these species. In addition, the waterfowl adaptive mitigation plan considers the existing and future conditions in the land use plan proposed for the Study Area.

In accordance with guidance documents provided by Transport Canada (2018), the following objectives are to be considered when developing a wildlife/waterfowl adaptive mitigation plan for SWM ponds within the vicinity of the airport:

- Determine and implement waterfowl management actions;
- Establish a monitoring program for all aspects of the monitoring program, including performance monitoring and annual reporting;

- Describe the roles and responsibilities; and
- Establish communication procedures with respect to wildlife hazards.

Descriptions for each of the objectives are provided in Section 3.1 below.

3.1 Waterfowl Management Actions

As mentioned above, direct bird strikes and hazards due to waterfowl would be limited to interactions with infrastructure and vehicles within the airport lands, however, mitigation is required in the greater SS area as a precaution to prevent the aggregation of waterfowl. In accordance with guidance recommendations provided by Transport Canada (2018), passive or active management measures were considered for the proposed SWM ponds. In the event that waterfowl do enter the proposed SWM ponds despite, a notification system should be in place in order to communicate potential bird strikes.

Passive and active management measures fall within the following four principals of wildlife management:

1. Habitat Modification;
2. Wildlife Exclusion;
3. Behavior Modification; and
4. Physical Removal.

Habitat modifications incorporate engineering and landscaping designs to create spaces that are unappealing to waterfowl. The designs consider the life history patterns and preferences of key target species (Canada Geese and Ring-billed Gulls). Designed areas may limit the available habitat for foraging and nesting, or restrict terrestrial movement or space needed for flight (or takeoff/landing). The habitat modifications are considered passive management measures as they are integrated into the long-term function of the proposed SWM ponds.

Conversely, wildlife exclusion, behaviour modification, and physical removals are considered active management measures because effort is required to disperse wildlife. Wildlife exclusion refers to the application of netting or fencing which prevent access to areas. Behaviour modifications include the deployment of predator decoys, amplified distress calls, loud concussion Moises, laser light, falcons or dogs, and reflective flagging as a measure to deter wildlife by making areas appear unsafe. Finally, physical removals include acts to trap and relocate waterfowl from high risk areas to areas outside of the zone of monitoring.

The four principals outlined above present a hierarchy in management, with habitat modification identified as the first step to mitigation. The three remaining active strategies are intended to be employed as supplementary or temporary deterrents. To this end, it is anticipated that the majority of SWM pond wildlife management will be achieved by habitat modification.

3.1.1 Passive Management

Passive management consisting of habitat modifications for the SWM pond designs included several engineering and landscaping elements described in the following subsections.

SWM Pond Design

A representative cross section of the proposed SWM pond layout is provided in **Attachment A** – Figure 2.1 and Figure 2.2. It is noted that the dimensions provided in the cross section are considered variable and that the size of individual ponds may increase or decrease depending on the pond location within the landscape. Details pertaining to permanent pools only apply to wet ponds. The dimensions identified in this plan are considered approximate and are subject to adjustment during detailed design, however, the general shape and location on the landscape is assumed to be accurate for the purposes of the SSMSP.

The scale and dimensions of the ponds have been designed in accordance with the design criteria identified in the ULRMP (Stantec, Draft 2017). Details regarding the volume, outflow and quality criteria can be referenced in the SSMSP Stormwater Management Report. The geometric configuration of the SWM ponds have been established to accommodate the SWM criteria and to reduce the attractiveness of the ponds to waterfowl. The configurations and designs are generally in-line with the high-level recommendations provided in the ULRMP (Stantec, Draft 2017); which proposed a system of interconnected permanent pools surrounded by heavily vegetated plantings. Adapting from this schematic, SWM pond designs were adjusted in order to meet the feasible servicing needs of the Study Area, as well as to reduce the visible size of available open water. Based on additional research and guidance documents, long-linear ponds were chosen instead of the concept plans proposed in the ULRMP to reduce pond perimeter and area of open water (Blackwell et al, 2008). Furthermore, the orientation of the proposed SWM ponds on the landscape are positioned perpendicular to Runway 12-30 reducing the habitat footprint in the critical operational area of the runway.

As depicted in the cross-section, included in **Attachment A**, ponds P2, P4, P5-P8 have both permanent pools and active storage areas. Permanent pools are anticipated to contain water year-round, whereas the active storage areas are intended to collect and temporarily store stormwater during rain events. The permanent pool width has been kept to a maximum width of 15 m along all linear ponds. Considerations for narrowing the permanent pool further was reviewed, however, based on the total volume requiring settlement reduction to the permanent pool volume was not possible. Draw down period of 48 hours within the active storage area for the 1:100 year storm to ensure the area of open water is minimized during large rainfall events. For a 1:100 year storm events, the maximum water level is approximately 0.5 m to 2.5 m below the top of bank, the remaining pond volume is considered surplus for storm events more severe than a 1:100 year storm.

In the proposed cross-section, the side slopes of the permanent pool were designed to have steep slopes (1.5:1) to ensure the collected stormwater is deep and prevents the growth of emergent and floating vegetation (food for waterfowl). The deep water storage has a two-fold design benefit, as wading and swimming species are deterred from areas containing deeper water, as it is difficult to observe underwater predators. The sloped edges of the permanent pool and active storage areas provide uneasy staging and nesting conditions for waterfowl as visibility is reduced and predator detection is limited. This deviates from the pond design proposed in the ULRMP (Stantec, Draft 2017) report, where larger flat areas were proposed at the permanent pool water level. Those areas would promote growth of plantings that these species eat and provide places for nesting and therefore have been eliminated from the functional design. More narrow, heavy planted benching areas will be incorporated at 50 m intervals along the length of the pond as a mechanism to provide additional woody vegetation for the purposes of limiting the visual appearance of a visual water runway to geese and gulls during flight. Finally, outlets and pump stations will be designed to have the functionality to completely drain permanent pools for maintenance as well as for waterfowl mitigation purposes.

For Dry ponds, measures to mitigate growth of attractive vegetation along the bottom surfaces shall be implemented along with all other screening measures described.

In summary, engineering design elements have been incorporated into the proposed SWM pond designs to achieve waterfowl management in the following ways:

- Linear SWM ponds limit the area of surface water visible to flying waterfowl;
- Linear SWM ponds provide insecure habitat to foraging and nesting waterfowl (cannot hide in open habitat; closer access to predators along banks);
- Benching provide along SWM pond length will add additional vegetation to break-up the appearance of a 'visual runway' from the sky;
- Deep permanent pools prevent growth of submergent aquatic vegetation (food for ducks);
- Deep permanent pools provide habitat insecurity as waterfowl cannot easily detect underwater predators;
- Fast draw-down period (48 hours) in active storage areas limit open water available during storm periods; and
- Design outlets and pump stations will have the functionality to drain permanent pools for maintenance and as extreme waterfowl mitigation.

Landscaping

Typical SWM pond designs in parks and residential areas may include grassed areas that are regularly mowed; these types of SWM ponds and associated landscaping are preferred by geese as the mowed grass provides a source of food, and clear line of site for observing predators. Mowed grassed areas are also preferred by ducks and geese as they provide a clear pathway for movement and flight take off.

Conversely, Blackwell et al. (2008), The City of Hamilton (2009), and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (2017) recommends that woody vegetation be planted within the active storage area of the SWM pond as a mechanism to deter geese and ducks by providing a difficult terrain to navigate, as well as to provide limited canopy cover over the permanent pool to further reduce the visibility of open water from the sky.

Edges of the active storage area are tapered to gradually descend toward the permanent pool, the maximum depth of the active storage area is 2.7 m, including freeboard. As mentioned above, the active storage area is meant to collect surface flows up to the 1:100 year storm event. As such, woody species chosen to be planted within the active storage area have been chosen based on their ability to withstand periodic flooding, and to grow tall enough so that they would not be completely submerged during large storm events. The shrub and willow species chosen are also preferred as the height achieved at maturity does not exceed the allowable height within the runway approach surface.

A list of species included in the planting detail include the following:

- Bebb's Willow;
- Peach-leaved Willow;
- Pussy Willow;
- Button Willow;
- Red-osier Dogwood;
- Gray Dogwood;
- Eastern Ninebark;
- Nannyberry and other Viburnum species; and
- Cloudberry.

Woody vegetation should be planted fairly densely (0.5 m on the center) in order to provide an effective deterrent to waterfowl. It is intended that these plantings will be naturalized so regular maintenance by the City of Windsor is not anticipated.

A representative detail for plantings proposed within a 20 m length of the active storage area is provided in **Attachment B** – Detail 1. Renderings of the planting plan illustrated as a cross-section of the SWM ponds and proposed benching are also provided in **Attachment B** – Details 2 and 3. It is intended that the plans provided in **Attachment B** can be extrapolated to cover the length of the SWM pond. A high-level costing list has been included alongside the planting plan detail to provide an approximate cost for the landscaping designs; it is noted that larger stock (35 mm Cal. B.B. trees and 50 mm ht. 3 shrubs) have been included in this estimate because these trees will take less time to reach maturity. Cost estimates for smaller stock may be less, however, will take longer to provide maximum canopy cover over the active and permanent pools.

As it is anticipated that the species identified for planting the active storage area will take between two and five years to mature in height, interim measures are recommended for mitigation before sufficient canopy cover to the permanent pool can be achieved. Wherever possible, SWM ponds should be placed adjacent to areas with mature trees (hedgerows, woodlands, swamps, etc.) in order to make use of the existing canopy cover. The placement of SWM ponds adjacent to retained natural heritage features should be located outside of buffers assigned to protect the ecological form and function. It is noted that a 30 m buffer is typically assigned to PSWs, whereas a minimum 15 m buffer is applied to the top of bank of watercourses such as the Little River; buffer areas are intended to be planted with natural vegetation to provide additional protection to the retained features. For this reason, trails, access roads and pathways associated with the SWM pond designs may not be permitted within buffer areas.

It is generally recommended that the conditions of the SWM ponds be monitored by the City once per month during the growing season (April – October) to ensure the passive management mitigation is established and is working effectively to restrict available habitat. Maintenance for the proposed SWM ponds should be conducted so that disturbance to the planted vegetation within the active storage area is minimized. Dredging within the permanent pool should be conducted outside of the migratory and breeding windows for waterfowl so that potential impacts to the canopy cover. Dredged materials/raked algae should be taken offsite so that potential food sources for waterfowl are removed.

For future maintenance of the permanent pool area, lane ways and clear areas will need to be accommodated in planting plans; it is anticipated that laneways to access the permanent pool will be required every 50 m along the length of the SWM ponds. Refer to the **Waterfowl Mitigation Pond Segment Plan** Figure included in Attachment B. It is recommended that access paths as well as areas adjacent to maintenance corridors be planted using Canada "Certified" seed or "Canada No. Lawn Grass Mixture" which were specifically developed to deter geese. The composition of the grass seed mixtures consists of the below ratio:

- 45% RTF Rhizominous Tall Fescue;
- 20% Kent Creeping Red Fescue;
- 25% Primary Perrennial Ryegrass;
- 5% Shark Creeping Bentgrass; and,
- 5% Leo Birdsfoot Trefoil.

It is recommended that grassed areas be allowed to naturalized and not mowed as another deterrent to limit terrestrial geese movement.

The addition of armor landscaping stones to the edges of SWM pond blocks and outside of the planted woody vegetation should also be included in planting details. Large rocks are difficult for ducks and geese to navigate around by foot and are considered a deterrent. In addition, chain link fencing may be installed along the edge of woody vegetation of the active storage areas to prevent terrestrial movement of waterfowl and geese into the SWM pond area.

Muskrat Management

While Muskrat (*Ondatra zibethicus*) are not a target species, the life history and habits of this aquatic mammal may provide reciprocal benefits to waterfowl. Muskrat build mounds with stalks and reeds of emergent vegetation as entrances to burrows which are excavated along the banks of watercourses, wetlands, and in urban settings. The external mounds of vegetation provide ideal nesting sites for waterfowl. As such, additional mitigation should be considered to manage and mitigate their presence within municipal infrastructure as a mechanism to prevent the mutual attraction of waterfowl to these areas.

To remove or mitigate Muskrat habitat, it is recommended that chain-link fencing be applied horizontally to the ground surface along the interface of the active storage area and permanent pool. The metal fencing will prevent burrowing and therefore deter Muskrat from inhabiting the SWM Ponds. While permanent pools have been sized to prevent the growth of aquatic vegetation, invasive species including Common Reed (*Phragmites australis*) are known to be pervasive throughout Southern Ontario and therefore should be anticipated to occur overtime. The spacing of holes for the metal chain-link fencing will not prevent the growth of woody species identified in planting plans for the active storage area.

3.1.2 Active Management

Active management mitigation is intended to exclude or remove waterfowl from the proposed SWM ponds. These active mitigation measures are intended to supplement the passive management strategies incorporated into the designs for the SWM ponds and associated landscaping.

As it is understood that residential, business park, commercial and institutional land uses are proposed within the SS area, the active management mitigation discussed herein is limited to devices and techniques that are unlikely to disturb the public (i.e. pyro techniques, gas cannons, report shells, loud sirens/bangers). In addition, active management mitigation that would be able to coexist with the proposed plantings in the active storage areas of the SWM pond would be preferred. Descriptions of, and details for the active management mitigation identified as a good fit for the proposed SWM ponds are described in **Table 1**.

For any of the active management mitigations chosen, it is recommended that signage be posted along trails and access roads to SWM pond blocks to notify the public of the mitigation in use in order to provide awareness and to reduce vandalism.

Table 1: Supplementary SWM Pond Active Management Mitigation for Waterfowl Deterrents

Deterrent	Description	Wildlife Management Principal	Advantages	Disadvantages	Materials and Approximate Cost (assumes 20 m length of SWM pond)	Anticipated Monitoring Schedule	Recommendation
Tension Wire/ Netting Suspended Over Pulley System	Cable pulley system installed using wooden poles to suspend netting over active storage and permanent pool areas of SWM ponds to exclude waterfowl from landing. Netting can be deployed year round or be lowered or raised seasonally, depending on need.	Wildlife Exclusion	• Effective exclusion achieved. • Can be deployed seasonally or year-round as needed. • Can be combined with other mitigation techniques. • Does not interfere with quality of life for neighboring residents (no light or sound emitted).	• Large installation required to set up; not easy to take down once installed. • Requires monthly monitoring and maintenance to ensure working properly. • Maintenance may be difficult once vegetation matures to full height • Structures may be prone to unwanted vegetation growth (vines). • In rare cases, birds may become tangled in netting (can be mitigated with flags/reflective tape).	4 poles, each approximately 8 m high and supported in a concrete base. Assumes panels for 20 m length of pond, 45 m wide will cover area of 900 m^2. One pole will be installed on each corner in a rectangular shape. Each pair of poles will support 4.8 mm diameter stainless steel cables (4 cables total = two 45 m, two 20 m) which will support monofilaments (40 lb test fishing line) spaced approximately 2 m intervals along the cables (10 monofilaments stretched over the active and permanent ponds over the 20 m length; 225 m). Each stainless-steel cable will be attached at the north end to a fixed eye strap with a carbine hook. The cable panel's tension will be adjustable through a system of boom bails attached to a "T' track. A similar system has been deployed by the City of Ottawa for two pedestrian beaches; see **Attachment C** for detailed drawings). <u>Cost Estimate for Key Components</u> 8 m Wooden Poles: $350 each x 4 = $1400 Concrete (320 lbs total – 80 lbs per post): $600 130 m of 4.8 mm stainless steel cable: $200 450 m 40 lb monofilament: $60 Initial set up: 1 week: 40 hours of labour Monitoring by City Staff – one 10 hour day per month (120 hours of labour).	Can be used year-round (weather permitting). Peak season this system should be deployed is during the migratory and breeding seasons (April-November). System should be monitored by City Staff once a month when deployed to ensure no damage. Inspections may be required more often following periods of bad weather.	Recommended for ponds as interim mitigation while woody vegetation in active storage area matures. Recommended for open areas or areas where no other natural woody vegetation exists (i.e. retained hedgerows, forests, swamps).
Flags, Reflective tape	Flags consisting of either opaque plastic (red, orange or black) or reflective materials installed using stakes or on wires/cables over permanent and active storage areas.	Behaviour Modification	• Can be deployed simultaneously with netting (above) • Humane deterrent for waterfowl • Effective deterrent against waterfowl • Does not make noise • Cheap to replace	• Can become damaged/removed due to poor weather May be visually distracting to pedestrians during the day time.	Reflective bunting safety flags (45 flags per 30 m roll; orange - $30 each). For a 20 m length of pond it is recommended that two 30 m rolls of flags be spaced 5 m apart across the 15 m width of the permanent pool (90 flags per 20 m stretch).	General inspection should occur once a year alongside installation and deployment of greater cable system.	Recommended for open areas or areas reported to have high volumes of waterfowl. Recommended to be deployed alongside cable pulley system.

Deterrent	Description	Wildlife Management Principal	Advantages	Disadvantages	Materials and Approximate Cost (assumes 20 m length of SWM pond)	Anticipated Monitoring Schedule	Recommendation
	Movement of flags/reflective surfaces scares waterfowl, as well as indicates placement of netting suspended over SWM ponds.				Cost for two rolls: $60	If flags are installed independently they should be inspected by City staff once every month to ensure they are in place; inspections may be required more often in times of bad weather.	
Lights/lasers	Low-level solar powered strobe lights installed along the edges of the permanent pool. Lights emit a series of quick flashes every two seconds with 360-degree coverage. Lights are to be installed at "goose height" for the purposes of deterring them. Geese have sensitive eyes and cannot sleep when lights are deployed.	Behaviour Modification	- Highly effective; self-sufficient. - East to install and replace. - Humane deterrent for geese. - Installation within the areas of woody vegetation would reduce the amount of light seen in residential areas and roads.	- Installation/placement of lights are limited to SWM pond interior; cannot be installed near roadways. - Lights may attract pedestrians to ponds at night. - Additional signage may be required to inform residents.	Industrial Geese Deterrent Strobe Lights: $400/unit. One recommended for every 100 m length of SWM pond.	Should be inspected monthly by City staff to ensure lights remain installed in place and solar batteries are working effectively.	Recommended for SWM ponds located away from residential subdivisions to not disturb residents. May be used in interior sections of ponds located away from residential areas or roadways.
Predator Decoys and Light Deterrents	May consist of plastic models of coyotes or alligators. Coyote decoys can be installed within or adjacent to the active storage areas. Alligator decoys may be deployed within the permanent pools. Low level lights mimicking predator eyes/eye shine may also be deployed for nocturnal deterrents.	Behaviour Modification	- Effective for short-term deployment. - Easily mobile; can be relocated efficiently.	- Decoy needs to be moved around to new areas to be seen as effective. - High habituation rate - May be subject to vandalism/theft.	Terrestrial Coyote Decoy: $150/unit Floating Alligator Decoy: $70/unit Solar powered Predator Eye Lights: $110/ 4 units 1 decoy recommended per 2 ha of SWM pond	Should be inspected/moved by City staff once every two weeks while in use to reduce likelihood of habituation by waterfowl.	Should not be used for long-term use. Should be deployed as interim measure for other mitigation/deterrents.

Deterrent	Description	Wildlife Management Principal	Advantages	Disadvantages	Materials and Approximate Cost (assumes 20 m length of SWM pond)	Anticipated Monitoring Schedule	Recommendation
Falconry	A trained bird of prey (falcon, hawk or eagle) is released in the area by a handler for the purposes of scaring and expelling waterfowl from an area.	Behaviour Modification	- Effective for short term deployment and removal. - Can be used as needed. - No monitoring required.	- Expensive and laborious; requires contractor to be on site. - Likely requires repeat visits to achieve success. - Permitting may be required for the handling of falcons/use of drones.	Up to $1200.00 - $2500.00 or more per visit by a licenced professional.	No monitoring required.	Recommended as needed to remove waterfowl detected within SWM Ponds.
Drones	A drone is maneuvered by an operator over a SWM pond for the purposes of scaring or expelling waterfowl from an area.						
Capture and Release	A licensed wildlife control officer will trap and remove nuisance waterfowl and release them to areas well outside of the jurisdiction of the airport	Physical Removal	- Ensures direct removal nuisance wildlife from area. - Can be used as needed as last resort.	- Cannot guarantee waterfowl will not return after trapping and removal. - Expensive - Permitting may be required for handling, trapping and transporting waterfowl. - Unpopular with the general public.	Up to $5,000 – $7,000 or more per visit by licenced wildlife professional. Dependent on the level of effort and amount of geese.	No monitoring required; unless otherwise stated in required permits.	Recommended as needed to remove persistent waterfowl detected within SWM Ponds.

As noted in **Table 1**, several mitigation/deterrent techniques are proposed based on the existing conditions associated with anticipated location of each individual SWM pond within the SSMSP Area. A matrix which outlines appropriate active management strategies per ponds identified in **Attachment A** – **Figure 1** is provided in **Table 2**. In addition, the active management techniques may be deployed as supplementary mitigation, as needed, to provide cover during periods of maintenance or to improve deterrence methods as a form of adaptive management. The supplementary active management mitigation may also be used to remove waterfowl should they be detected within SWM ponds during regular monitoring.

Table 2: Active Management Strategies SWM Pond Matrix

Active Management Strategies	Stormwater Ponds[1]										Notes
	East Pelton (EP)		Baseline Road/County Road 42 SPA (CR42SPA)				Little River		Lauzon Parkway		
	EP North (P1)	EP South (P2)	CR42SPA West (P3)	CR42SPA Central (P3)	CR42SPA East (P3)	CR42SPA SE (P6)	East Little River (P4)	West Little River (P5)	Lauzon Parkway East (P7)	Lauzon Parkway East (P8)	
Wildlife Exclusion											
Tension Wire/Netting Suspended Over Pulley System	✓	✓	✓	✓	✓	✓	---	✓	---	✓	Temporary installment recommended throughout Study Area except for areas where existing woody vegetation (woodland, hedgerows) are being retained.
Landscaping stones, fencing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Appropriate for use throughout Study Area.
Behaviour Modification											
Flags, Reflective Tape	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Appropriate for use throughout Study Area.
Lights/Lasers	---	---	---	---	✓	✓	---	✓	✓	✓	Recommended in SWM ponds located away from residential land uses
Predator Decoys and light deterrents	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Appropriate for use throughout Study Area.
Falconry/Drones	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Appropriate for use throughout Study Area.
Physical Removal											
Capture and Release	---	---	---	---	✓	✓	✓	✓	✓	✓	Recommended for use in SWM ponds located away from residential land uses.

1- Pond names depicted on Figure 1 of **Attachment A**

Notification System

To maintain congruency with monitoring conducted by WIA, the identification of waterfowl within the additional SWM ponds proposed within the Zone of No Confidence and Zone of Monitoring will continue to be carried out by the WIA Staff. Should waterfowl be observed within the SWM Ponds, the City will be notified by WIA and will be required to remove waterfowl via active management techniques. The City will be responsible for confirming to WIA that they have been successful in excluding/removing waterfowl from the area; the City will also be responsible for recording all occurrences of waterfowl identified within the proposed SWM pond.

For SWM ponds proposed to be located within the 'Zone of Monitoring' monitored by WIA, the City will monitor for the presence of waterfowl. Should gulls, ducks or geese be observed by the City, it will be the City's responsibility to document and potentially remove them. Notification of this activity will be provided to WIA for due diligence purposes.

3.2 Adaptive Mitigation Plan

Monitoring Methods

As mentioned above, the majority of SWM ponds are proposed to be located within the Zone of Monitoring. WIA is required to monitor features providing potential habitat once per month as part of their risk assessment. To maintain congruency with existing monitoring plans of the airport, monitoring of the new ponds will be conducted once per month to observe and document the presence of waterfowl. Similarly, monthly monitoring should also be conducted within the SWM ponds to ensure that landscaping and engineering designs (habitat modifications) are working effectively. Monthly monitoring will consist of single site visits to each feature/SWM pond to visibly assess if waterfowl are present (species and number), evidence of woody vegetation dieback, or damage to the SWM ponds is present. Key performance indicators (KPI) to be assessed during monthly monitoring will evaluate the effectiveness of the wildlife management initiatives by their ability to deter and exclude waterfowl from the Zone of No Confidence and Zone of Monitoring through active and passive management. In short, the City will aim to continually improve waterfowl management mitigation through the implementation of the wildlife management hierarchy for the purposes of reducing the occurrence of waterfowl on City-owned lands within the vicinity of the airport.

Adaptive Management

The management of waterfowl will be dependent on the location of SWM ponds within the Study Area. As mentioned previously, one SWM pond (EP North; **Attachment A** – Figure 1) overlaps with the Zone of No Confidence (P1), and SWM ponds within the County Road 42 Secondary Plan Area (P3) are located within the extended runway approach of WIA. The remaining ponds (P4, P5, P6 P7, P8) are located within the 2km-4 km outer radius in the Zone of Monitoring.

Based on this plan and alignment with ongoing monitoring of WIA, waterfowl observed in SWM ponds within the Zone of No Confidence or runway approach surface along Baseline Road will be immediately removed by supplemental active management measures (exclusion, behavioural management, and physical removal). On the other hand, waterfowl observed as a result of monthly monitoring within the greater Zone of Monitoring will be documented and continually monitored. Monitoring may increase in frequency if necessary, and deterrents and removals may be applied on a site-by site basis as determined by a Wildlife Management Officer. The management of waterfowl present within features of the Zone of Monitoring will be initiated by the number of waterfowl observed and the frequency of SWM pond use.

Supplementary active management mitigation should be deployed to the target SWM pond as a mechanism for preventing further aggregations of waterfowl. The additional mitigation (**Table 1** and **Table 2**) will be chosen based on the behaviour of the offending species, the adjacent land uses, and degree of habituation. The SWM pond and new mitigation will be monitored closely and checked after initial deployment to ensure waterfowl are deterred. Should waterfowl persist within the SWM ponds after this period, a new or additional mitigation should be deployed. It is recommended that installed mitigation remain in place during the spring (March –May) and fall migration windows (September - November), as these are considered high risk time periods when waterfowl are expected to travel through the SSMSP area in high numbers.

Outside of the migration windows, deployed temporary mitigation may be removed/halted for select SWM ponds should it be determined through monitoring that waterfowl have been successfully excluded and are no longer present within or in lands adjacent to the zone of no confidence.

As a last measure, SWM ponds may be temporarily drained in circumstances where waterfowl mitigation has failed until persistent waterfowl have been removed/displaced.

Reporting

A record of waterfowl removals, and adaptive management will be recorded as part of a wildlife management log. The log will list the detection events including start and finish times, the numbers and species present, as well as the methods used for removal. In addition, the logs will report any changes or maintenance to the passive management mitigation associated with the SWM pond engineering or landscaping.

A summary of the wildlife management logs will be produced once a month in order to discuss any environmental changes that may have occurred, or changes that may lead to wildlife hazard conditions that may increase risk to the adjacent airport lands. The monthly summary reports will be provided to WIA for review to assist with their risk assessment initiatives.

3.2.1 Outcomes and Lessons Learned

There are two cumulative effects to consider to which there is very little opportunity to predict outcome once a SWM feature is constructed. How mitigation of these affects has been implemented locally at the other SWM ponds in the area has been included as Case History below. These notes have been provided by former WIA staff involved in these mitigation activities.

One is the cumulative effects of SWM ponds is multiple or extensive habitats combining to attract wildlife acerbating a problem of overall management. How ponds in the vicinity of open grassland (airfield), agricultural land or other natural or man-made wetlands interact to support wildlife. For reference, Figures in **Attachment A**, show the existing stormwater management ponds located in the vicinity of the Windsor Airport. Central Pond is located at the southeast corner of Grand Marais and Central Avenue

Case History: The creation of a SWM pond at Grand Marais and Central Avenue caused an immediate wildlife hazard from Canada Goose loafing overnight on the safety of the open pond and flying the short distance over the E.C. Rowe Expressway to graze by day on the grassland along Runway 07-25. This situation was eventually mitigated by mechanically pumping down the pond until trees and course vegetation could be established. Now with appropriate cover, the pond is no longer attractive to geese and the proximity to foraging at the airport is dissolved.

The second cumulative effect is called Founder's Effect. This occurs when geese and ducks do manage to successfully nest and fledge young on or in the vicinity of a pond to which the fledged birds return as breeding adults. It is the main reason that relatively small populations of Canada Geese so quickly become burgeoning populations on single ponds.

Case History: The Captain Wilson Park SWM Pond and associated manicured turf grass fields surrounding the pond, in the course of 5 years saw a population of 3 nesting pair develop into 226 individual birds. This situation is managed with periodic round up and re-location of geese in an attempt to immediately reduce the number of birds in the vicinity of the airport and to by-pass Founder's Affect in relocated juvenile birds.

3.3 Roles and Responsibilities

The proposed SWM ponds are to be constructed on the landscape via a phased approach to follow the phased construction of developable areas detailed on the established of the land use plan. **Section 1.2** of this memo indicated that the SWM ponds located south of Baseline Road to the far west within the East Pelton Secondary Plan area (P1), as well as the pond located adjacent to the Lauzon Parkway (P7 and P8) will occur first (**Attachment A** – Figure 1). The remaining SWM ponds will be added to the landscape as development continues within the East Pelton and Country Road 42 Secondary Plan Area, to the east along County Road 42 Secondary Plan Area and along the Little River.

As it is intended that the ownership of the SWM pond infrastructure will be conveyed from individual land owners (the proponents) to the City, it is understood that responsibility for and management of the ponds will change overtime as development within the Study Area continues through the Construction, Post-Construction and Implementation Phases.

Design

Detailed design of the stormwater management facilities shall follow the most current Transport Canada, airport and regional guidelines. Each pond has a unique location, orientation and proximity to the airport runways. The design shall consider site specific elements such as, but not limited to, plane altitudes, flight paths, bird migration patterns, maintenance access. In addition to the typical municipal review, the designs shall be reviewed with Transport Canada and the Airport to confirm that the designs satisfy mitigation requirements listed herein.

Construction and Post-Construction Phase

Construction of the SWM ponds are intended to be carried out by proponents of each development application. As part of the construction phase, it is anticipated that initial monitoring of the SWM ponds and landscaping will be carried out by the proponent as part of an Environmental Monitoring Program (EMP) to ensure the constructed infrastructure and plantings are successful. The length of the construction and post-construction monitoring periods are to be determined as part of the draft plan and detailed design process; however, it is anticipated that construction monitoring will occur during the active construction period, and post-construction monitoring will be required for at least three years once construction is complete.

Since habitat modification is a key component of the engineering and landscaping designs, monthly waterfowl and SWM pond monitoring should be included and carried out as part of the EMPs by the proponent during the construction and post-construction phases.

During the construction and three-year (minimum) post-construction period, supplementary mitigation or active management strategies will also be deployed as a responsibility of the proponent. Monthly monitoring reports which detail waterfowl mitigation and monitoring shall be provided to the City by proponents on a monthly basis to provide a record of adaptive management taken at each SWM pond. Monitoring and mitigation carried out by individual proponents should be documented by a Wildlife Management Officer, nominated by the City, who will act as the conduit of information between proponents, the City, and WIA.

Implementation Phase

Following the completion of the EMP and post-construction monitoring period, it is anticipated that the ponds will be conveyed to the City for their long-term management. At this time, senior City staff/Wildlife Management Officer, will be responsible for coordinating, supervising and the overall management of the waterfowl management plan on a long-term and a daily basis at the site-specific level. This will include the co-ordination of training, safety assurance and ensuring that the necessary equipment is available. Senior City Staff will also be responsible for conveying monitoring results to operations managers at WIA.

The Wildlife Management Officer will be responsible for:

1. Establishment and maintenance of the Waterfowl Management Log (e.g., details on wildlife numbers and activity; mitigation measures undertaken, adaptive management requirements, and monthly summaries);
2. Co-ordination of the monitoring program;
3. Ensure that the City's monitoring operations are consistent with the requirements of WIA;
4. Ensure plantings included in the active storage areas of the proposed SWM ponds are maintained and healthy as expected;
5. Undertake deterrent activities;
6. Ensure all activities are undertaken following standard practices and safety protocols; and
7. Identify equipment, resource and training needs.

3.3.1 Communication Procedures

The following communication procedures should be established for the purposes of waterfowl management by the City:

1. Waterfowl detection information will be provided directly from monitoring staff to the Waterfowl Management Officer of the City.
2. The Waterfowl Management Officer will be responsible for ensuring that updated information is provided to WIA immediately if an urgent situation arises and on a regular basis depending on the conditions, or when requested by WIA. WIA will also relay any information received regarding waterfowl observations to monitoring staff and the City in a timely manner.
3. WIA will provide information to pilots on current wildlife hazards and will ask pilots to report any waterfowl observations to the airport.
4. Waterfowl activity will be regularly updated by the City in daily logs and monthly summary memos.

4.0 Closure

The recommendations of this document will be incorporated into the development standards that will become part of the minimum design standards and implementation plan for this area. This document shall be reviewed regularly by the City of Windsor and Windsor International Airport staff to confirm that the implementation, monitoring, and maintenance recommended above is providing sufficient mitigation to meet safety requirements throughout the life cycle of these facilities.

Regards,

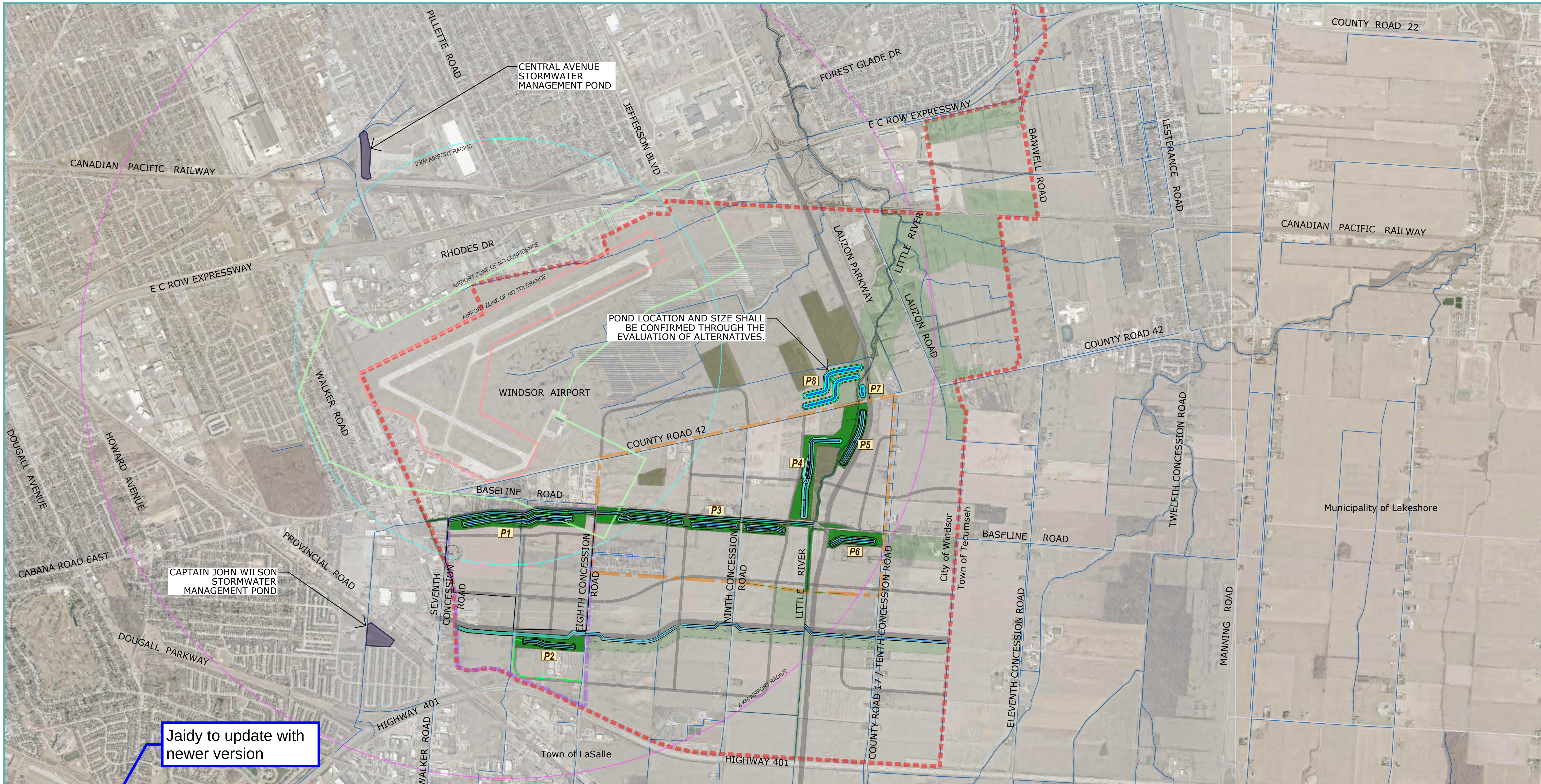
Caitlin Vandermeer, P.Eng.
Senior Biologist

Laura Herlehy, P.Eng.
Project Engineer

Attachment A

Figures

DILLON
CONSULTING



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SANDWICH SOUTH MASTER SERVICING PLAN

DRAFT

FIGURE 1

PUBLIC CONSULTATION - MAY 2022

Waterfowl Adaptive Mitigation Plan

STORMWATER MANAGEMENT STRATEGY
WINDSOR AIRPORT MONITORING

- STUDY AREA
- EAST PELTON SPA
- CR42 SPA
- FUTURE COLLECTOR AND ARTERIAL ROADS
- EXISTING STORMWATER MANAGEMENT PONDS
- OPEN SPACE / STORMWATER MANAGEMENT CORRIDOR
- NATURAL HERITAGE AREA
- P1 TYPICAL POND NAME
- STORMWATER PERMANENT POOL
- STORMWATER MANAGEMENT POND - ACTIVE STORAGE
- MUNICIPAL DRAIN RELOCATION OR NEW DRAIN

AIRPORT ZONES LEGEND
- 2 KM RADIUS FROM AIRFIELD CENTRE (WILDLIFE CONTROL ZONE)
- 4 KM RADIUS FROM AIRFIELD CENTRE (WILDLIFE CONTROL ZONE)
- ZONE OF NO TOLERANCE
- ZONE OF NO CONFIDENCE

THE CITY OF WINDSOR ONTARIO, CANADA

DILLON CONSULTING

MAP DRAWING INFORMATION:
DATA PROVIDED BY CITY OF WINDSOR 2019, MNRF 2019, TOWN OF TECUMSEH 2019, *ESSEX REGION CONSERVATION AUTHORITY 2019, **COUNTY OF ESSEX

CREATED BY: RBH
CHECKED BY: LMH
DESIGNED BY: DCR
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

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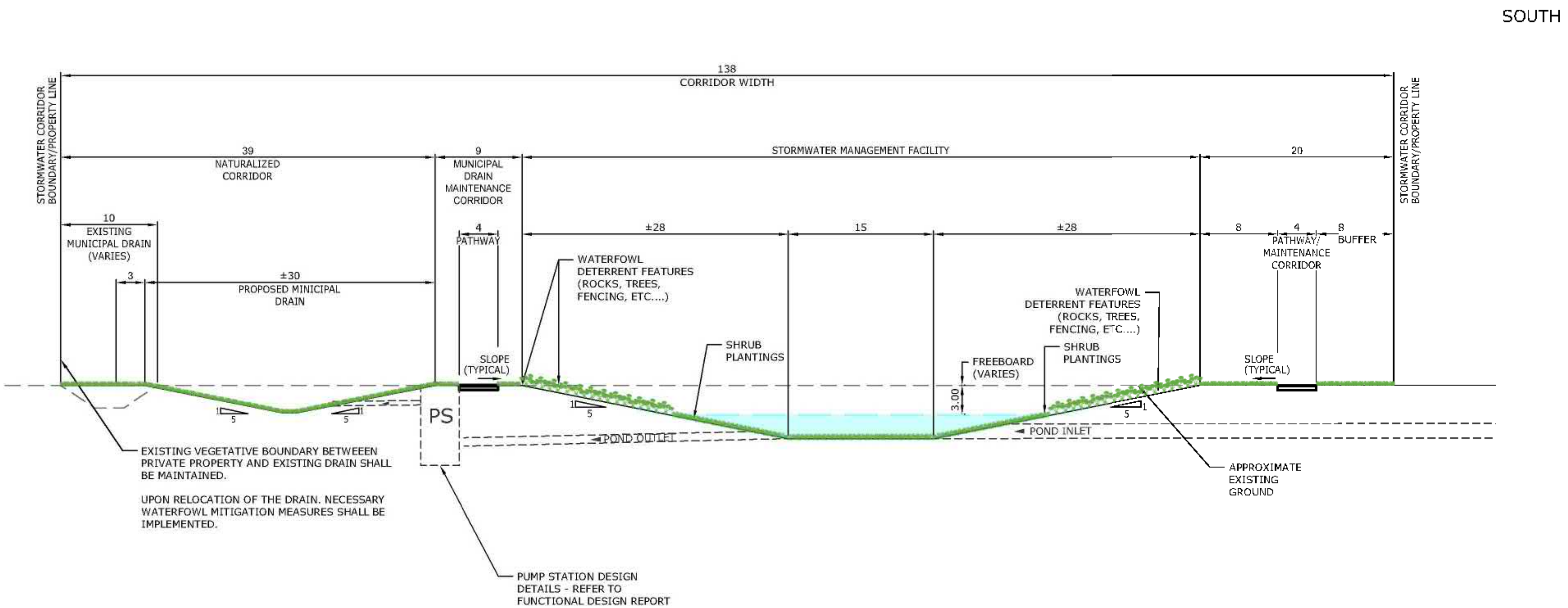

EAST PELTON NORTH (P1)

STORMWATER MANAGEMENT POND - ACTIVE STORAGE

SANDWICH SOUTH MASTER SERVICING PLAN

P1-STORMWATER MANAGEMENT CORRIDOR (DRY POND)
FIGURE 2.1

THE CITY OF WINDSOR ONTARIO, CANADA

DILLON CONSULTING

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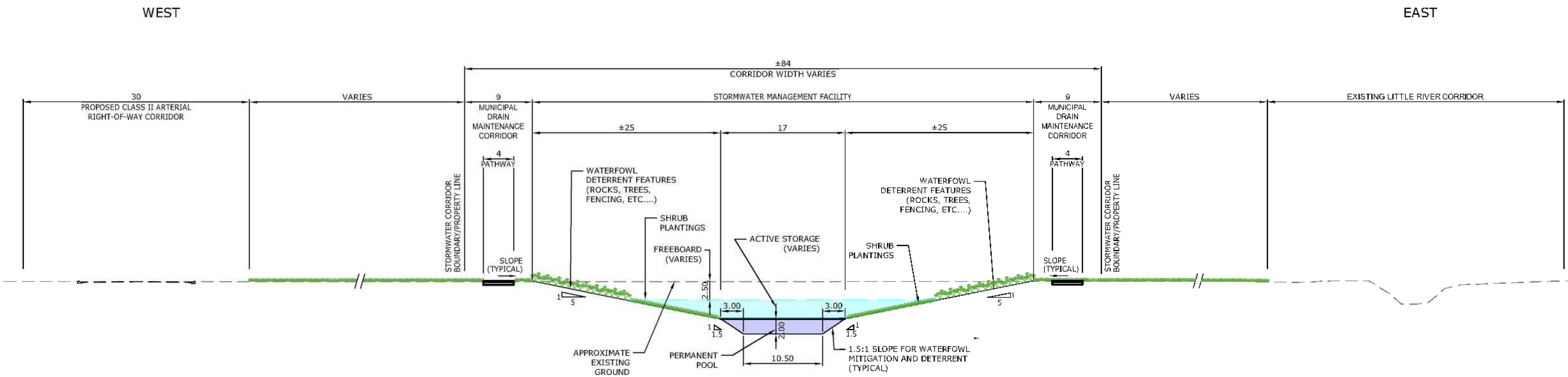

CR42SPA NW (P4)

SANDWICH SOUTH MASTER SERVICING PLAN

STORMWATER MANAGEMENT POND- PERMANENT POOL

STORMWATER MANAGEMENT POND - ACTIVE STORAGE

STORMWATER MANAGEMENT CORRIDOR WITH OFFLINE FOREBAY
FIGURE 2.2

MAP DRAWING INFORMATION:
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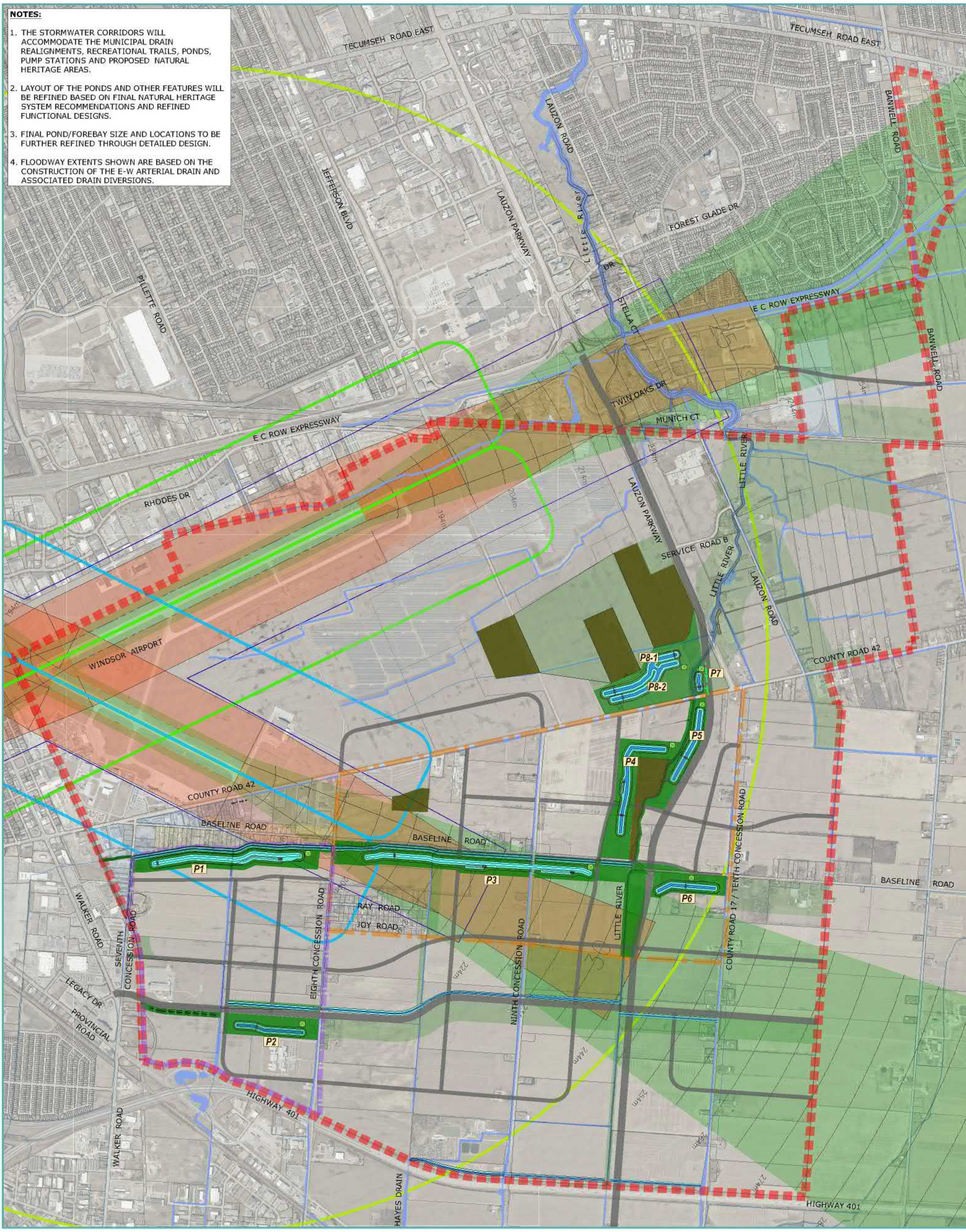
NOTES:

1. THE STORMWATER CORRIDORS WILL ACCOMMODATE THE MUNICIPAL DRAIN REALIGNMENTS, RECREATIONAL TRAILS, PONDS, PUMP STATIONS AND PROPOSED NATURAL HERITAGE AREAS.
2. LAYOUT OF THE PONDS AND OTHER FEATURES WILL BE REFINED BASED ON FINAL NATURAL HERITAGE SYSTEM RECOMMENDATIONS AND REFINED FUNCTIONAL DESIGNS.
3. FINAL POND/FOREBAY SIZE AND LOCATIONS TO BE FURTHER REFINED THROUGH DETAILED DESIGN.
4. FLOODWAY EXTENTS SHOWN ARE BASED ON THE CONSTRUCTION OF THE E-W ARTERIAL DRAIN AND ASSOCIATED DRAIN DIVERSIONS.



SANDWICH SOUTH MASTER SERVICING PLAN

Jaidy to update with newer version

AIRPORT ZONE OVERLAY

FIGURE 3

- STUDY AREA
- EAST PELTON SPA
- CR42 SPA
- TRUNK STORM SEWER
- 1:100 YEAR FLOODWAY EXTENTS
- FUTURE COLLECTOR AND ARTERIAL ROADS
- NATURAL HERITAGE AREA
- P1 TYPICAL POND NAME
- OPEN SPACE / STORMWATER MANAGEMENT CORRIDOR
- PROPOSED STORM SEWER DRAINAGE
- STORMWATER PUMP STATION
- STORMWATER MANAGEMENT POND- PERMANENT POOL
- STORMWATER MANAGEMENT POND - ACTIVE STORAGE
- MUNICIPAL DRAIN RELOCATION OR NEW DRAIN

AIRPORT ZONES LEGEND

- 4 KM DIAMETER FROM AIRFIELD CENTRE (WILDLIFE CONTROL ZONE)
- TYPICAL TRAFFIC PATTERN (East-West)
- TYPICAL TRAFFIC PATTERN (North-South)
- OBSTACLE LIMITATION SURFACES (OLS)

MAP DRAWING INFORMATION:
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MAP CREATED BY: RBH
MAP CHECKED BY: LMH
MAP COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 17N

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STATUS: FINAL
PROJECT: 19-9817

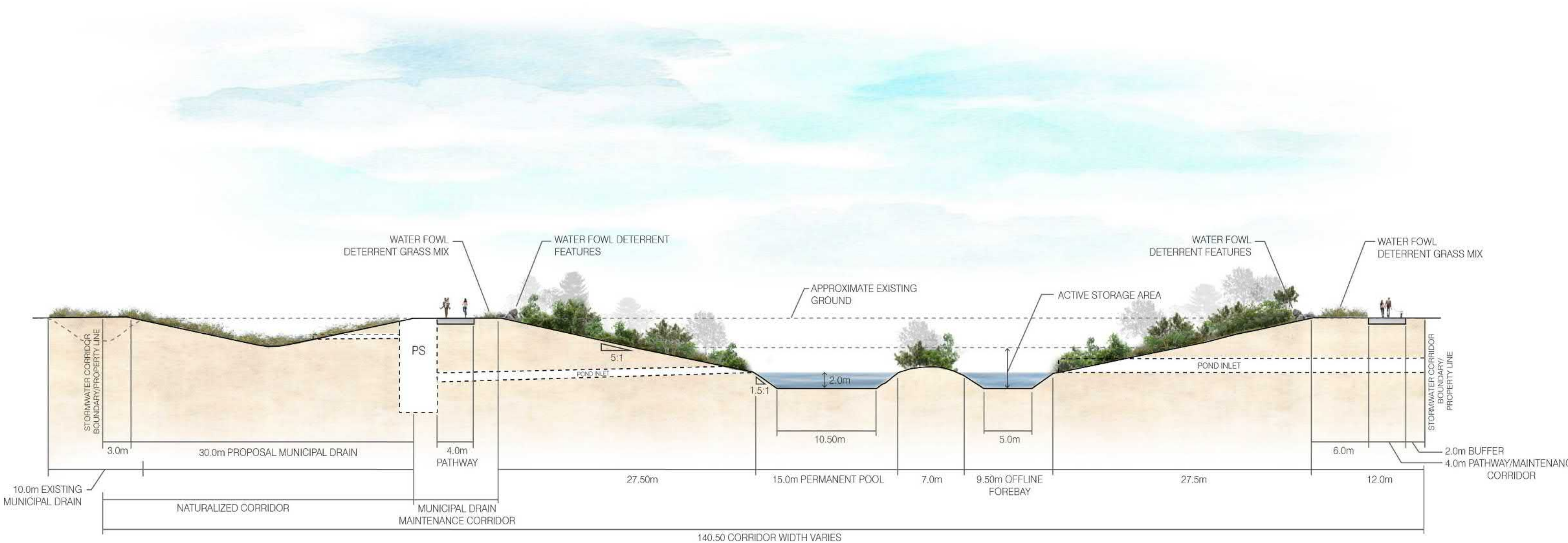
DATE: April 04, 2023

File Location: c:\pw working directory\projects 2019\32rbh\dms90713\199817-02-swm-ponds.dwg April, 04, 2023 9:05 AM

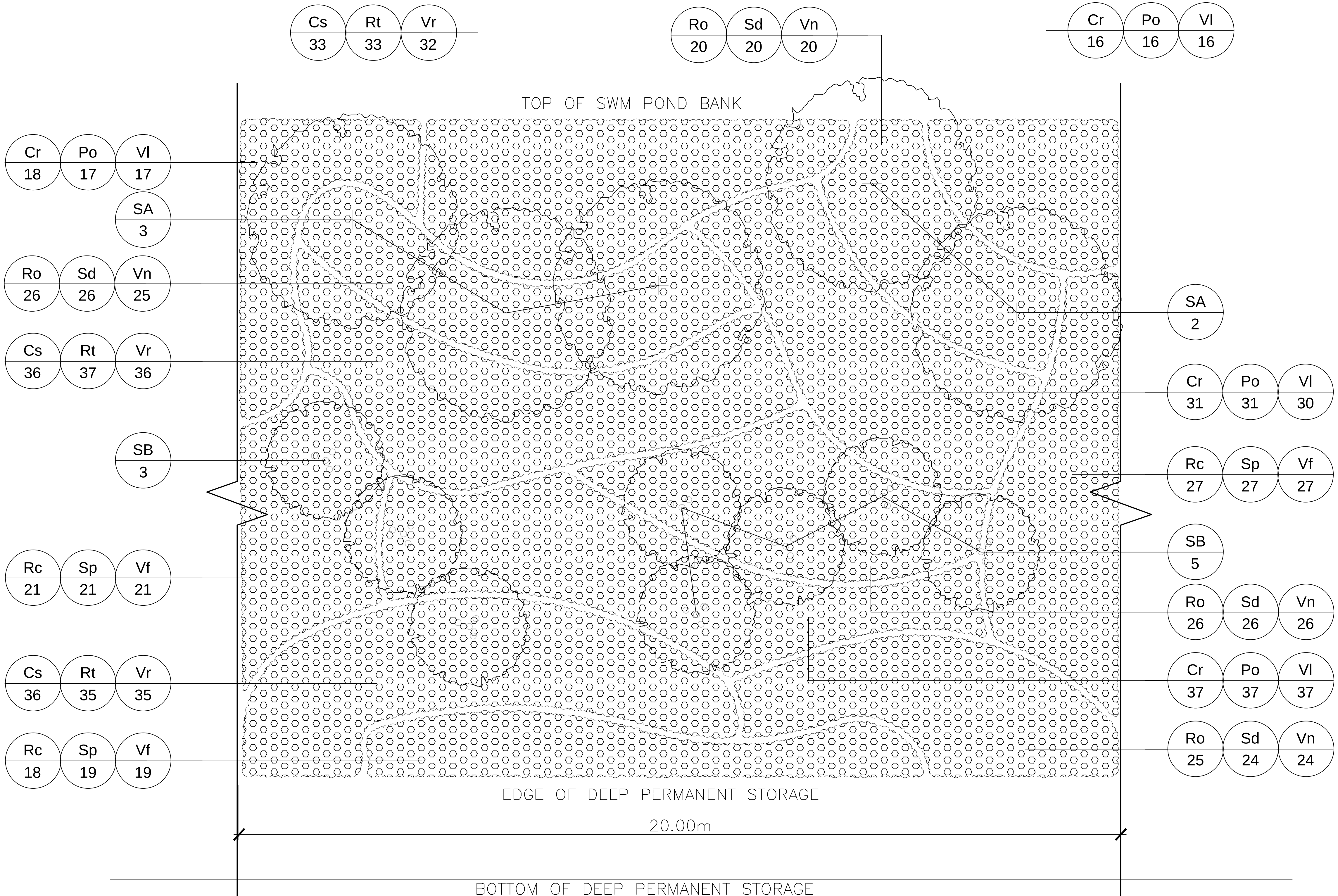
Attachment B

Landscaping Planting Plans and Approximate Costs, Cross-Section Renderings

Sandwich South Master Servicing Plan
Typical Stormwater Management Pond Cross Section



SEE FIGURE L2 FOR PLANTING DETAILS, PLANT SCHEDULE AND MAINTENANCE RECOMMENDATIONS



SANDWICH SOUTH MASTER SERVICING PLAN

Symbol	Legend
Cr 16	PLANT CODE PLANT QUANTITY
	PROPOSED SHRUBS
	PROPOSED TREE
	PROPOSED MULTI STEM TREE

SUPPLEMENTARY WATERFOWL ADAPTIVE MITIGATION PLAN FOR STORMWATER MANAGEMENT FACILITIES
20M SWM POND PLANTING CELL

FIGURE L1

0 1m 4m

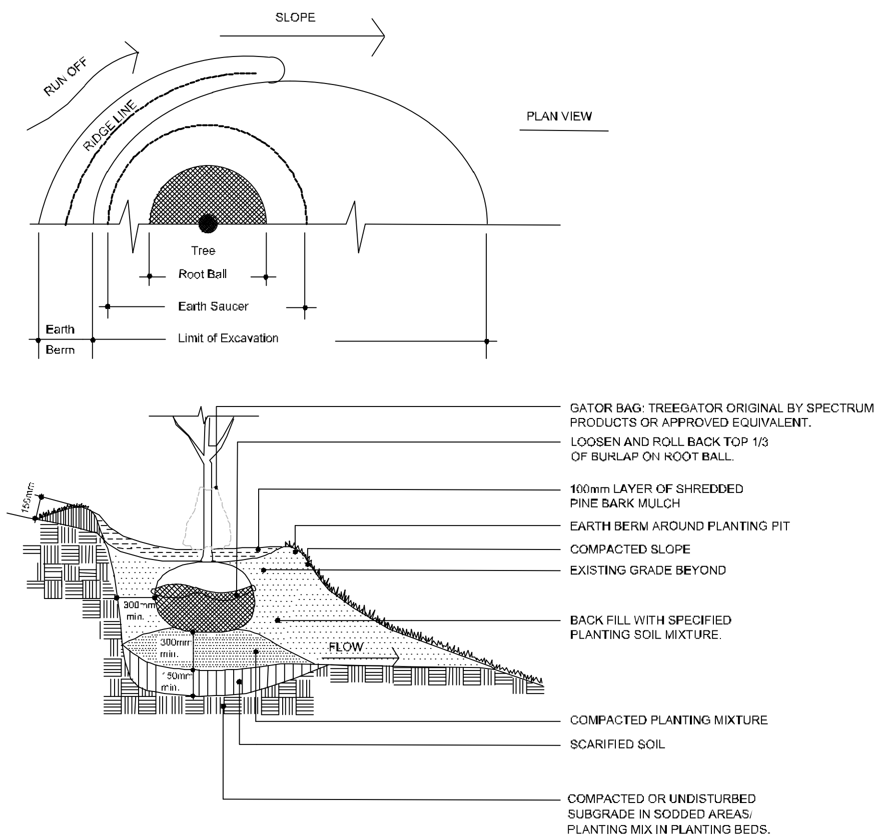
SCALE 1:100

N W E S

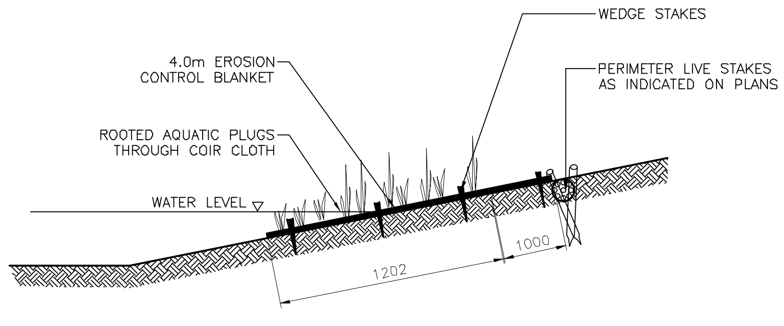
STATUS: FINAL

PROJECT: 19-9817

DATE: July 15, 2022



1 L1 DECIDUOUS TREE PLANTING ON A SLOPE
NTS



NOTE:
CURLEX® NETFREE™ 100% BIODEGRADABLE EROSION CONTROL BLANKETS SHALL BE USED FOR ALL EROSION CONTROL.

2 L1 FLOOD FRINGE AQUATIC PLANTING
NTS

MASTER PLANT LIST

CODE	BOTANICAL NAME	COMMON NAME	QTY	SIZE	COND.	SPACING
MULTI-STEM TREES						
SA	Salix amygdaloides	PEACH-LEAVED WILLOW	5	35mm cal.	B.B.	4.0m O.C.
SB	Salix bebbiana	BEBB'S WILLOW	8	35mm cal.	B.B.	4.0m O.C.
DECIDUOUS SHRUBS						
Cr	Cornus racemosa	GRAY DOGWOOD	102	50cm ht.	3 gal.	0.5m O.C.
Cs	Cornus sericea	RED-OSIER DOGWOOD	105	50cm ht.	3 gal.	0.5m O.C.
Po	Physocarpus opulifolius	EASTERN NINEBARK	101	50cm ht.	3 gal.	0.5m O.C.
Rt	Rhus typhina	STAGHORN SUMAC	105	50cm ht.	3 gal.	0.5m O.C.
Rc	Rubus occidentalis	BLACK RASPBERRY	66	n/a	2 gal.	0.5m O.C
Ro	Rubus oderatus	FLOWERING RASPBERRY	97	n/a	2 gal.	0.5m O.C.
Sd	Salix discolor	PUSSY WILLOW	96	60cm ht.	3 gal.	0.5m O.C.
Sp	Spirea alba	MEADOWSWEET	67	n/a	2 gal.	0.5m O.C
Vl	Viburnum lentago	NANNYBERRY	100	50cm ht.	3 gal.	0.5m O.C.
Vn	Viburnum nudum	WILD RAISIN	95	n/a	2 gal.	0.5m O.C
Vf	Viburnum rafinesquianum	DOWNY ARROWWOOD	67	50cm ht.	3 gal.	0.5m O.C
Vr	Viburnum recognitum	SMOOTH ARROWWOOD	103	50cm ht.	3 gal.	0.5m O.C.

PLANTING NOTES:

1. PLANTINGS SHOULD BE AN ASYMMETRICAL, RANDOM MIX.
2. SPECIES SHOULD BE PLANTED TOGETHER IN GROUPS OF 5-7.
3. SEE INDIVIDUAL PLANT LISTS FOR RECOMMENDED PLANT SPACING.
4. ALL PLANT MATERIALS SHALL BE #1 NURSERY STOCK MEETING CANADIAN STANDARDS.
5. STAKE ALL DECIDUOUS TREES.
6. DIG ALL TREE PITS 500mm LARGER ALL AROUND THAN THE ROOT BALL AND PLACE TREE CENTRED IN PIT ON UNDISTURBED SOIL. BACKFILL WITH PARENT MATERIAL AND REPLACE DEBRIS (EG. BRICK, DRY WALL, ETC) WITH SCREENED TOPSOIL.
7. FOR GRADING AND DRAINAGE, SEE ENGINEERING PLANS.
8. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
9. ALL PLANT MATERIALS TO BE GUARANTEED FOR TWO GROWING SEASONS FROM THE DATE OF PROVISIONAL ACCEPTANCE.
10. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL EXISTING UNDERGROUND UTILITIES WITHIN THE LIMITS OF THE CONSTRUCTION SITE SHALL BE LOCATED AND MARKED. ANY UTILITIES DAMAGES OR DISTURBED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE OWNER AT NO ADDITIONAL COST.
11. PLANT MATERIALS TO BE INSTALLED AS SHOWN; SUBSTITUTIONS ALLOWED ONLY AFTER CONSULTATION WITH THE LANDSCAPE CONSULTANT.

MAINTENANCE NOTES:

1. MINIMUM MAINTENANCE REQUIREMENTS SHALL FOLLOW THE MOST CURRENT EDITIONS OF THE WINDSOR/ESSEX REGION STORMWATER MANAGEMENT STANDARDS MANUAL AND THE TRCA - INSPECTION AND MAINTENANCE GUIDE FOR STORMWATER MANAGEMENT PONDS AND CONSTRUCTED WETLANDS
2. MAINTENANCE SCHEDULE SHALL CONTINUE FOR A PERIOD OF NOT LESS THAN TWO (2) YEARS AFTER SUBSTANTIAL PERFORMANCE OF THE WORK HAS BEEN GRANTED.
3. VEGETATION SHALL BE INSPECTED AFTER EVERY SIGNIFICANT RAIN EVENT (I.E. 25 YEAR STORM OR GREATER) TO ENSURE SUFFICIENT FUNCTIONING OF THE POND.
4. PLANTED AREAS OF SWM PONDS SHALL BE INSPECTED AND HAVE WEEDS AND OTHER INVASIVE MATERIALS (i.e. Phragmites australis ssp. australis) REMOVED ON A MONTHLY BASIS.
5. SCHEDULE PHRAGMITES REMOVALS TO COINCIDE WITH ANY PLANNED SEDIMENT REMOVALS.
6. TRASH AND DEBRIS WITHIN THE SWM POND SHALL BE PROMPTLY REMOVED ON A WEEKLY BASIS.
7. IF OIL/SHEEN IS OBSERVED, IT SHOULD BE REMOVED IMMEDIATELY BY USE OF OIL-ABSORBENT PADS OR A PROFESSIONAL WITH A VACUUM TRUCK. SPECIAL DISPOSAL REQUIREMENTS MAY APPLY.
8. APPLY BARLEY STRAW ON THE DRY LAND SURROUNDING THE POND AT A RATE OF 1KG PER 1000m2 OF SWM POND AREA TO INHIBIT ALGAE GROWTH.
9. IF ALGAL MATTS DEVELOP OVER 10% OF THE WATER SURFACE OR MORE, THEY SHOULD BE REMOVED USING A RAKE AND DISPOSED OF OFF SITE. ALGAE SHOULD NOT BE LEFT ON SITE.
10. IF MOWING IS TO OCCUR NEAR THE SWM PONDS, CUT GRASS TO 4-6 INCHES IN HEIGHT, MINIMUM. COLLECT GRASS CUTTINGS AND REMOVE FROM SITE, DO NOT MULCH.
11. AVOID USE OF FERTILIZERS, PESTICIDES AND HERBICIDES IN OR NEAR SWM PONDS.

SANDWICH SOUTH MASTER SERVICING PLAN

Cr 16 PLANT CODE PLANT QUANTITY

PROPOSED SHRUBS

PROPOSED TREE

PROPOSED MULTI STEM TREE

SUPPLEMENTARY WATERFOWL ADAPTIVE MITIGATION PLAN FOR STORMWATER MANAGEMENT FACILITIES
20M SWM POND PLANTING CELL

FIGURE L2

THE CITY OF WINDSOR ONTARIO, CANADA

DILLON CONSULTING

N W E S

STATUS: FINAL

PROJECT: 19-9817

DATE: July 15, 2022

File Location: c:\pw working directory\projects 2019\20jtg\d0104858\199817-06-land-de.dwg July, 15, 2022 12:39 PM

PLOT DATE: 2022-07-15 @ 12:39:41 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STD-HALF.CTB

City of Windsor

South Sandwich SWM Pond planting cell (20mx15m)

Dillon Consulting

13/04/2022

Opinion of Probable Costs

ITEM	DESCRIPTION	UNIT	EST. QTY	UNIT COST		ITEM COST	
OPINION OF PROBABLE COSTS							
1.0	**Plantings**						
1.1	Planting medium to 300mm depth	m2	300	$	50.00	$	15,000.00
1.2	Fine grading	m2	300	$	5.00	$	1,500.00
1.3	**Trees (35mm Cal. B.B.)**						
1.3.1	Salix amygdaloides	Ea.	5	$	550.00	$	2,750.00
1.3.2	Salix bebbiana	Ea.	8	$	550.00	$	4,400.00
1.4	**Shrubs (50mm ht. 3 gal)**						
	Cornus racemosa	Ea.	102	$	30.00	$	3,060.00
	Cornus sericea	Ea.	105	$	27.00	$	2,835.00
	Physocarpus opulifolius	Ea.	101	$	30.00	$	3,030.00
	Rhus typhina	Ea.	105	$	27.00	$	2,835.00
	Salix discolor	Ea.	96	$	27.00	$	2,592.00
	Viburnum lentago	Ea.	100	$	30.00	$	3,000.00
	Viburnum rafinesquianum	Ea.	67	$	30.00	$	2,010.00
	Viburnum recognitum	Ea.	103	$	30.00	$	3,090.00
1.5	**Shrubs (2 gal.)**						
	Rubus occidentalis	Ea.	66	$	24.00	$	1,584.00
	Rubus oderatus	Ea.	97	$	24.00	$	2,328.00
	Spirea alba	Ea.	67	$	25.00	$	1,675.00
	Viburnum nudum	Ea.	95	$	42.00	$	3,990.00
					Estimated Construction Development Costs	**$**	**55,679.00**
					10% Contingency	**$**	**5,567.90**
					Total Costs including 10% Contingency	$	61,246.90

Attachment C

Example Pulley and Cable System

DILLON
CONSULTING

Manual

Stantec

CITY OF OTTAWA
GULL MANAGEMENT FACILITIES
(MOONEY'S BAY & BRITANNIA BEACH)

OPERATIONS & MAINTENANCE MANUAL

Prepared for:

City of Ottawa
Surface Operations Branch

Prepared by:

Stantec Consulting Ltd.
1505 Laperrière Avenue
Ottawa, Ontario, K1Z 7T1

October 2003 020A

TABLE OF CONTENTS

1. INTRODUCTION

The beaches of the City of Ottawa have been subject to closures over the years due to higher than accepted pollution counts. One of the main sources of pollution has been bird droppings - specifically gull droppings.

From studies and monitoring, it has been shown that gulls tend to assemble and occupy areas adjacent to beaches and parks, places where people tend to gather and discard residual foodstuffs, and upon flight takeoffs, defecate over the beach or water depositing the source of pollution. It became necessary to find how to eliminate or at least minimize this source of pollution.

From research, it was found that the congregation of gulls at beaches, and thus their droppings, could be controlled. The main controlling device was a series of parallel overhead monofilament lines strung over an area of beach/water, which deterred the gulls from over flying the protected area.

The task then became the design and implementation of this type of facility at Ottawa's beaches. This has come to be called "Gull Management Facility" or its acronym "GMF".

In the early 1990's, a rectangular system of gull wiring, approximately 26,000 m^2 (400m x 65 m), was erected over the beach at Mooney's Bay covering a strip of beach and swimming area. Between the late 1990's and 2002, an "L" shaped system of gull wiring, approximately 22,000 m^2 was erected over the beach and swimming area at Britannia Beach with a possible future extension of 5,000 m^2. The results of these two installations have been lower pollution counts, fewer beach closures and a greater use of these two beaches.

Due to river flow and ice conditions and bird migration habits, there are only a few days when the water based poles and wiring can be installed and removed. They must be installed after the spring freshet and removed in late summer before the fall bird migration. Installation and disassembly of the system, together with the in-use conditions, causes wear-and-tear on the system. This creates the need for a maintenance program to ensure all components of the system are available at time of reinstatement and that the system components are in good working order. This cyclic installation and removal of the system creates the need for an operations program to ensure the system components are stored systematically and contractors are retained and scheduled to install and disassemble the facilities.

This operations and maintenance manual is intended to be a guide to describe and maintain the components and the annual operations of the facilities in detail and be in the possession of the City staff who is responsible for the maintenance and operations of the gull management facilities.

2. PURPOSE

The purpose of the gull management facilities is to deter gulls from polluting the bathing areas at City beaches. The overhead monofilament wiring interferes with gulls that are flying in the area and they shortly avoid the area. This Manual provides direction to City staff and contractors about the operations associated with the implementation, maintenance and storage of the various components of the GMF systems, including drawings describing the GMFs and the work involved in repairing, installing and removing them.

Planning for the installation each year must start before spring to allow time for contracts to be awarded, procurement of wiring and repair of damaged poles, cables and footings.

3. RESPONSIBILITIES OF CITY STAFF

3.1. Mooney's Bay

There are only a few days in April when river levels are low enough to install the poles in dry working conditions and the earliest date varies from year to year, depending on the time and duration of the spring freshet. Starting the beginning of April, inspect the foundation location every few days. When they are above the water level, start installing the poles. Parks Canada usually starts the installation of the stop logs at Hog's Back Dam the last Monday in April, so the water level is raised to the summer level over the next few days. Pole installation must be completed by this time, if it is to be done in dry working conditions. If the work is not done by this time, the remaining poles will have to be installed underwater using qualified divers and a barge.

3.2. Britannia Beach

The pole foundations are always under water. There are only a few weeks in April and May when river levels are low enough to install poles without problems with high water and ice. The earliest date varies from year to year, depending on the time and duration of the spring freshet. Starting in mid-April, check the water level every few days. Generally, there are two peaks, the second one occurring in May. When it appears that the water level is low enough, pole installation should begin.

3.3. Both Beaches

The wires must be installed by the first weekend in June, when the beach is first opened. Contact the Area Manager in the Community Services Branch for further information. It is efficient to coordinate the installation of the GMF system(s) with the installation of the beach buoy lines.

3.4. Removal

There are only a few days in late summer to complete the removal of the wiring. Generally, the beaches are closed the third week in August, but continue to be used until Labour Day. Start the removal immediately after this date. The wiring must be completely removed by September 9, when the fall bird migration starts. If the wiring is not completely removed by this date, migrating birds will likely become entangled and killed, which may jeopardize the overhead wiring program. The poles should be removed by mid-November to avoid being frozen in place. If this occurs, the remaining poles will likely be damaged by ice during the spring freshet.

As indicated earlier, the GMF components are erected and installed in the spring and disassembled and taken down and stored in late summer. Actual dates will be determined by the City staff responsible for the organization of the actions associated with the operations and maintenance of the facilities. These actions require planning and scheduling to implement on time and within budget.

The sequence of events required each year include:

1. Solicit quotations from interested and experienced contractors to erect/install and disassemble/takedown including loading at and transporting from storage site and transporting to and offloading at storage site. Request for quotation should include erection/installation and disassembly/takedown approximate dates.
2. Evaluate quotations and experience of contractors and select a contractor.
3. Coordinate and assist contractor with his tasks at storage site.
4. Monitor installation, in-use period and takedown operations. Arrange for removal, disposal and reinstatement of ruptured monofilament during in use period.
5. Should a bird become entangled in the wires, it is imperative that it be IMMEDIATELY removed and disposed of. Failure to remove entangled birds will result in substantial negative public relations. This is the responsibility of the Zone Supervisor(s) in Surface Operations.

6. Upon takedown and return to storage area dispose of all monofilament and procure and identify new monofilament in accordance with the tables of monofilament lengths appended to this manual. Closely inspect the condition of all steel components returned to storage and repair as required. Repairs will typically include cleaning corrosion by wire brush or mechanical grinding and touching up exposed area with a durable zinc coating.
7. Procure all other components and materials that have worn out or reached the end of their useful life.
8. Place all components and materials clearly identified and carefully protected in the storage area.

The individual facilities and their installation and dismantling details are described in the following sections of this manual and are separated according to the beach location.

Specifications and erection/installation and dismantling/storage procedures are described in subsequent sections of this manual and separate attachments of these will be provided for inclusion in the "Request for Quotation" packages.

4. DESCRIPTION OF THE SYSTEM

This section describes the component parts of the gull management systems at each location.

4.1. Mooney's Bay

This facility covers approximately 26,000 m^2 of beach and swimming area and consists of seven panels of monofilament in a 425m long by 70m wide rectangular configuration supported by sixteen poles, seven poles situated in the water and nine poles situated on land (see Figure A1 in Appendix A). Approximately 25m of beach and 45m of water are covered.

Each pole is approximately eight meters high and supported in a concrete base (see Figure A4). The onshore poles remain in place year around and are bolted to the concrete bases. The offshore poles are supported in sleeves in the concrete bases.

Each panel consists of four poles laid out in a roughly rectangular footprint. Each pair of poles support parallel 4.8mm diameter stainless steel cables, which in turn support monofilaments (40 lb test fishing line) spaced at approximately 3m intervals along the cables. Each panel of stainless steel cables and monofilament is independent from adjacent panels except for the common poles they share.

Each stainless steel cable is attached at its north end to a fixed eyestrap with a carbine hook, with no adjustment capability (see Figure A4). The cable runs up the pole through a boom bail and crosses to the next pole south, through a boom bail and down the pole and is attached to a 'T' track assembly that is adjustable to increase or decrease cable tension and sag in the system. Attached to the cables at specified intervals (nominally 3m) are pairs of retaining rings with swivel clips to attach the ends of the monofilament. The retaining rings allow the swivel clips to move freely around the cable without allowing the monofilament to slide along the cable.

The monofilaments are cut in lengths to the nearest centimeter (held tight but not over-stretched) with brass fishing leaders at each end to connect to the swivel clips. The lengths of the monofilament are important in order to maintain equal tension in each monofilament and thus each monofilament has an alphanumeric identification and specified location along the cable (see Figure A3).

4.2. Britannia Beach

This facility covers approximately 22,000m^2 of beach and swimming area and consists of five panels of monofilament in an "L" shaped configuration supported by twelve poles, five poles situated in the water and seven poles situated on land. The policy has been to leave the seven land-based poles in place all year and only remove, store and reinstate the five water-based poles, including the "boot" at pole location P3. The "boot" is described in the next paragraph. The water-based poles are removed to prevent damage from ice (see Figure B1 in Appendix B).

All poles with the exception of P1 are supported by approximately 1200mm diameter concrete caissons of variable length (see Figure B2). Steel sleeves, 900 mm deep, are embedded in the top of the caissons to receive the poles. At pole location P1 a 2000 mm deep steel sleeve is embedded into bedrock. At pole location P3, because of an inaccuracy in setting the sleeve, a "boot" was fabricated to rectify the non-plumb position of the sleeve (see Figure B3). This "boot" consists of an upper and lower section. The sections are not co-linear by design. The upper section, of similar diameter as the sleeve in the caisson, receives the pole while the lower section, of similar diameter as the pole fits into the sleeve. Orientation of the "boot" is critical to ensure pole is plumb.

The sleeve openings in the five water-based pole locations are covered with a steel cover plate with handle and neoprene gasket when the poles are not in place. Location of water-based poles is normally found using metal detectors. Inserted at the bottom of the sleeves are "sleeve inserts" needed to receive the "pole tip assembly" to concentrically position the base of the poles due to the difference in the inside diameter of the sleeve and the outside diameter of the pole. These can remain in place in the off-season.

The pole is concentrically positioned at the top of the sleeve with the adjustable "ring flange/wedge assembly" (see Figure B2 & B3). These components at the water-based pole locations must also be removed, stored and reinstated with the poles. The "sleeve inserts" and "pole tip assemblies" are in place at all land-based poles. The various terms for the components are described and detailed on the drawings that form part of this manual.

The poles are fabricated from variable height DN200 STD Pipe lower section with 3.5m height DN150 STD Pipe upper section to provide approximate clearances of 9m above average summer water levels and beach. Some components are attached to the poles to facilitate lifting the poles and stringing the cables that support the monofilament. These attachments include the "halo assembly" to attach the pulley block and tackles to, lift lugs to facilitate lifting the pole and T-tracks, sliders and eyestraps to secure fixed and tensioning ends of the cables. Carbine hooks at ends of cable permit securing the cables to the poles and fastening clips and stop clips on the cables permit securing the ends of the monofilament to the cables using fishing line leaders.

5. ERECTION OF THE SYSTEM

Both systems have their similarities and differences. One major difference is the considerably heavier poles at Britannia Beach. Another major difference results from the lowered water level of the Rideau River from late Fall to mid Spring which leaves the water based pole foundations at Mooney's Bay Beach in the dry. Typically, at both locations, the land based poles are left in place and the water based poles are removed and stored over the winter.

Refer to drawings included in Appendix A (Mooney's Bay) or Appendix B (Britannia Beach) in conjunction with the procedures outlined below.

5.1. Mooney's Bay

First locate the concrete foundations for the seven offshore poles. With the lowered water level comes the opportunity to inspect the exposed areas of the concrete caissons and repair any conditions that may be deemed detrimental to the durability and/or functioning of the system.

Having located all pole foundations, remove the steel covers for storage during beach season, and thoroughly clean out each of the steel sleeves. Each of the poles should be rigged with 6mm rope passing through the boom rails prior to erection. This rope will later be attached to the cables and used to erect the wiring (see Figure A4 in Appendix A). The poles can then be inserted into corresponding sleeves using appropriate lifting equipment (pole OS7 weighs approximately 150kg). Note that not all of the poles are identical – pole OS1 requires a "steel sleeve adapter" which should be installed directly into the foundation sleeve (see Figure A2). Also the poles at OS1 and OS7 are steel, whereas poles at locations OS2 to OS6 are aluminum. Poles should be oriented in the sleeves such that the T-tracks and sliders are on the north side of the pole.

The next stage is the connection of monofilaments to the cables. New monofilament line should be procured and used each year, and should be 178N (40lb) "Berkley XT" type. Cables should be laid out on the beach in their approximate locations, and the fastening clips, stop clips, and fishing line leaders attached as shown on Figure A4. Monofilaments should be cut to the lengths shown on Figure A3 – it may be easier to pre-measure and label monofilaments prior to arrival at the site. Care is needed to ensure that monofilament lines do not become entangled or break.

The system is best installed one bay at a time, starting at the ends (Bays 'A and 'G') and working towards the central bay (Bay 'D'). Attach the rope through boom rails to each end of the cable, and slowly raise the cable sufficiently that the carbine hook can be attached to the eyestrap on the "fixed" pole (the eyestrap should be on the south side of each pole, so the north end of the cable is raised first). The rope attached to this end can then be removed. The rope on the opposite end of the cable is then used to raise the system into position, using the sliders and micro-track assemblies attached to each of the poles to tension the cable and secure it in position. This process is then repeated for each of the bays. Final adjustment may be required to ensure sufficient tension in each of the cables.

Following installation any debris should be removed, and the beach area left in a clean and safe condition.

5.2. Britannia Beach

Unlike Mooney's Bay Beach, the water-based poles at Britannia Beach are permanently under 1.5m to 3.0m of water and must be located each spring. Locating the foundations is done by coordinated survey directing divers with metal detection devices. Further research is also being conducted to install "homing" devices in the sleeves of the foundations to facilitate the locating of the foundations.

Once located, remove the steel covers for storage during the beach season and clean out the sleeves. Four of the five water based pole foundations, P1, P5, P7 and P9, are similar. Pole foundation P3 is different as a result of an undetected movement of the steel sleeve at the time concrete was being placed in the caisson. To remedy the out of plumb sleeve, a sleeve adaptor or "boot" as it has been termed, was designed and fabricated to insert into the caisson sleeve (see Figure B3 in Appendix B). The "boot" consists of a lower piston that is inserted into the caisson sleeve and an upper sleeve into which the pole is inserted. The alignment of the lower piston and upper sleeve is designed to offset the tilt in the caisson sleeve and the orientation of the "boot" is key. For quality control of the placement of the "boot", it will be required to position the "boot" using a level to ensure it is plumb and then score the "boot" flange and top of caisson with markings which can simply be aligned at subsequent installations.

It should be noted that correct positioning and alignment of the "boot" at this point is critical to ensure that the pole can be installed vertical and the system rigged correctly.

Poles should be rigged with rope through the pulleys attached to the halos prior to erection (see Figure B5). Erect the poles, which are identified, at their respective locations using a barge with lifting device on board. Use of mechanical land equipment that could leak oil or gas into the water is strictly prohibited.

Procure new monofilament, cut to specified lengths and fit ends with fishing line leaders and identify line in accordance with the Tables shown on Figure B4 in Appendix B.

Lay out cables, which are identified as to location, on the beach, attach the fastening clips and stop clips at the specified intervals along the cable and attach the pre-measured monofilament, to the cables with fishing line leaders. Pull the assembly between the pairs of poles and attach cable ends to the suspended ropes and hoist into position. One end of each cable is tied off at the eye strap and the other end is tensioned to the correct elevation and horizontal sag at the slider in T-track. These locations are designated "E" and "S", respectively, in Figure B5 in Appendix B. This procedure is repeated at each bay.

6. DISMANTLING THE SYSTEM

The GMF systems should be dismantled at each location according to the following procedures. Note that the timing of dismantling the wiring is critical (see section 3.4).

6.1. Mooney's Bay

The system is dismantled one bay at a time, starting at the central bay (Bay 'D') and working towards the end bays.

- Lower each cable to the slackest setting on the sliders.
- Attach the rope to the adjustable cable ends and lower the bay to working height.
- Lower the fixed end in a similar fashion.
- Detach the monofilament ends and clips.
- Lower, detach and label the cables.
- Inspect and report any damage to all hardware.
- Remove and label the offshore poles and the steel insert from footing OS1.
- Store the poles at the Mooney's Bay Beach confection area, as directed by the Zone Supervisor.

6.2. Britannia Beach

The system is dismantled one bay at a time in the reverse order it was erected.

- Tie ropes to each end of the cables and lower the cables.
- Detach the monofilament and clips from the cables.
- Inspect the clips and cable for damage and discard the monofilament. Damaged clips, cable and monofilament should be procured and stored for the following season's installation.
- Identify undamaged cables and store.
- Remove the offshore poles using the same methods used to erect them. Remove the "boot" at P3.
- Retrieve from storage and place steel covers over the caisson sleeve openings.
- Transport poles, boot, cables, etc., to the City of Ottawa's Swansea Road Yard for storage.
- Inspect poles for damage and make necessary repairs to the poles in conditions suitable for the type of repair required.

7. CONTACTS

GMF Operation & Maintenance and Beach Maintenance:

Jean Demers, Zone Supervisor (Surface Operations)
City of Ottawa,
1595 Telesat Court,
Gloucester, ON, K1B 1B6
Tel: 580-2424 ext. 12067,
Cell: 720-9045.

Beach Operation:

Judy Bates, Area Manager (Community Services Branch)
City of Ottawa,
495 Richmond Road,
Ottawa, ON, K2A 4B2
Tel: 724-4199 ext. 23166

Bathing Area Water Quality:

Martha Robinson, Environmental Health Analyst (Health and Long Term Care)
City of Ottawa,
495 Richmond Road,
Ottawa, ON, K2A 4B2
Tel: 724-4122 ext. 23658

River Water Quality:

Jane Scott, Program Manager (Water Environment Protection Program)
City of Ottawa Utility Services,
800 Green Creek Drive,
Gloucester, ON, K1J 1A6
Tel: 580-2424 ext. 22857

APPENDIX A

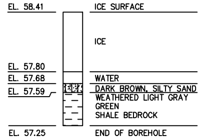
DRAWINGS – MOONEY'S BAY GMF

Figure A1 – General Arrangement

Figure A2 – Offshore Pole Installation Details

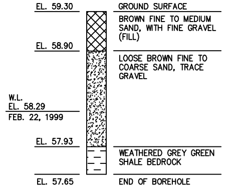
Figure A3 – Monofilament Arrangement

Figure A4 – Cable Installation Details



BOREHOLE NO.99-1

N.T.S.



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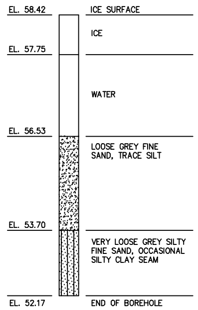

BOREHOLE NO.99-3

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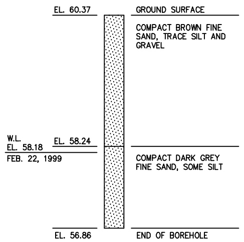
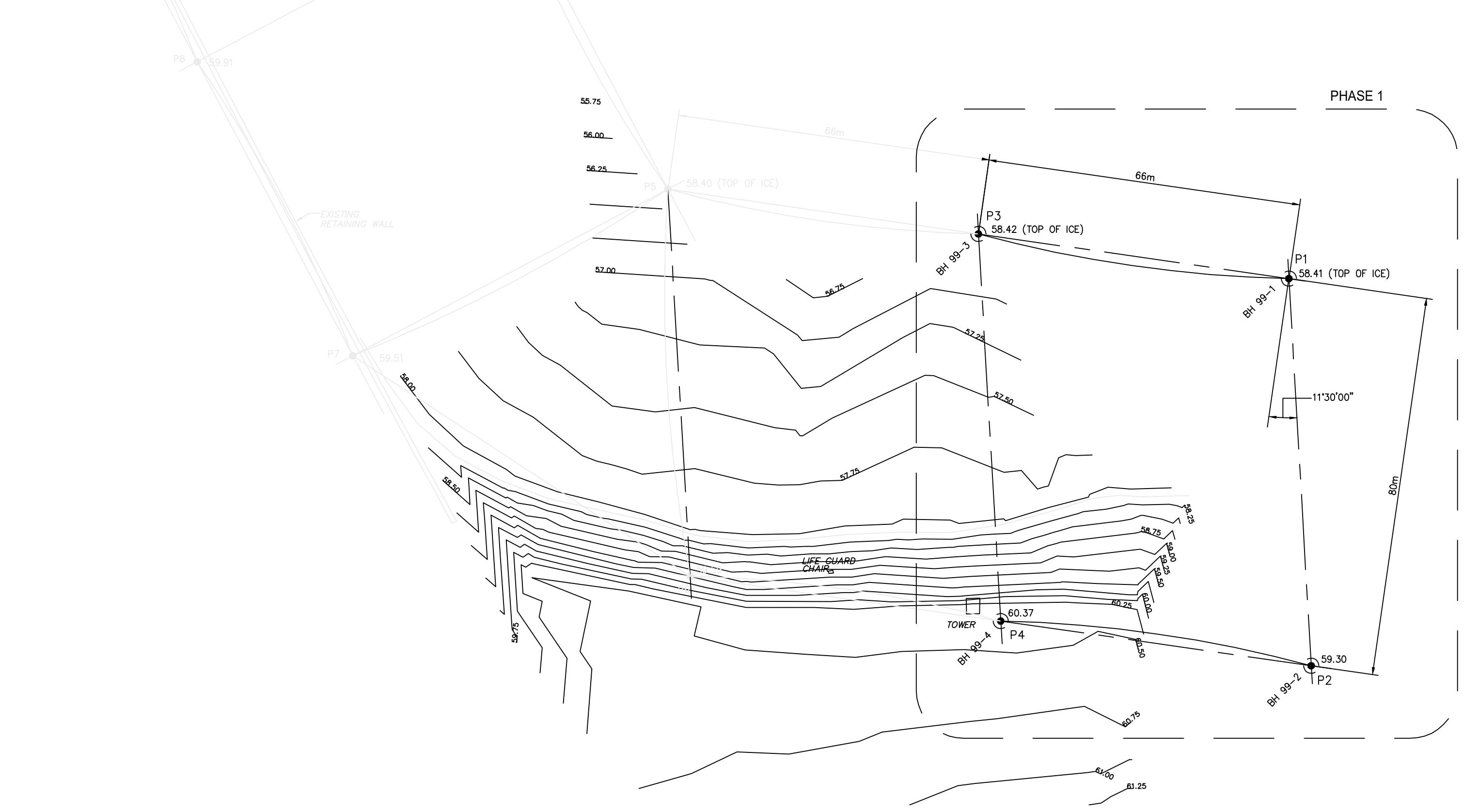


BOREHOLE NO.99-4

N.T.S.

NOTE: THE ABOVE CONDITIONS EXISTED ON FEBRUARY 22 AND 23, 1999.



SITE PLAN

1:500

Stantec Consulting Ltd.
400 – 1505 Laperriere
Ottawa ON Canada
K1Z 7T1
Tel. (613) 722-4420
Fax. (613) 722-2790
www.stantec.com

General Notes

1. THE SUCCESSFUL TENDERER SHALL BE REQUIRED TO PROVIDE DOCUMENTATION DEMONSTRATING EXPERIENCE IN THIS TYPE OF WORK.
2. THE SITE CONDITIONS AND ICE THICKNESSES GIVEN IN THE BOREHOLE LOGS EXISTED ON FEBRUARY 22 AND 23, 1999. THE CONTRACTOR SHOULD NOT EXPECT THAT CONDITIONS WILL BE SIMILAR AT THE TIME THE WORK IS DONE.
3. THE CONTRACTOR SHALL VERIFY THE CONDITIONS AT THE TIME OF CONSTRUCTION AND MAKE WHATEVER MODIFICATIONS ARE REQUIRED TO UNDERTAKE THE WORK IN THE WATER. IN THE EVENT THE ICE IS DEEMED UNACCEPTABLE TO SUPPORT THE CONSTRUCTION EQUIPMENT IT MAY BE PERMISSIBLE TO DELAY THE WORK IN THE WATER UNTIL SUCH TIME WHEN A BARGE COULD BE USED TO CONVEY THE CONSTRUCTION EQUIPMENT TO THE WATER LOCATIONS.

Construction Notes

1. THE FOLLOWING SUGGESTIONS ARE MADE FOR INFORMATION PURPOSES ONLY.
2. AT FOUNDATION LOCATIONS P3 AND P4, STEEL LINERS SHALL BE DRIVEN A MINIMUM 1 METRE BELOW THE SPECIFIED BOTTOM OF CAISSONS AND SHOULD EXTEND ABOVE THE ICE/GROUND LEVEL AT LOCATIONS P3 AND P4, RESPECTIVELY. MATERIAL SHALL BE EXCAVATED TO THE SPECIFIED BOTTOM OF CAISSONS AND SONOTUBE FORMS INSTALLED. SET AND SECURE THE REINFORCING STEEL AND STEEL SLEEVE ASSEMBLY. PLACE CONCRETE BY TREMIE METHOD AND EXTRACT STEEL LINER. CUT–OFF SONOTUBE FORM AT TOP OF CAISSON LEVEL. COVER HOLE WITH STEEL PLATE AND NEOPRENE GASKET.
3. AT FOUNDATION LOCATION P2, EXCAVATE TO APPROVED ROCK SURFACE. PLACE SAND BAG BERM AND REMOVE WATER. DRILL 37mm DIA. HOLES TO A MINIMUM 800mm DEPTH AND SET BENT 30M DOWELS WITH SPIRAL TIE A MINIMUM 750mm EMBEDMENT AND GROUT USING A NON–SHRINK GROUT SUCH AS SIKA 212 OR APPROVED EQUAL. SET SONOTUBE FORM AND STEEL SLEEVE ASSEMBLY AND PLACE CONCRETE IN THE DRY TO THE SPECIFIED LEVEL. COVER WITH STEEL PLATE AND NEOPRENE GASKET.
4. AT FOUNDATION LOCATION P1, CORE DRILL THE ROCK TO THE SPECIFIED DEPTH. GROUT THE STEEL SLEEVE WITH A NON–SHRINK GROUT SUCH AS SIKA 212 OR APPROVED EQUAL. PLACE GROUT LEVELING PAD ON ROCK SURFACE TO THE TOP OF SLEEVE FLANGE PLATE. COVER HOLE WITH STEEL PLATE AND NEOPRENE GASKET.
5. PLUMBNESS OF FOUNDATIONS, THE SLEEVES IN PARTICULAR, IS OF PRIME IMPORTANCE AND NO TOLERANCE IS SPECIFIED OR PERMISSIBLE.
6. CONTRACTOR SHALL SUBMIT PROPOSED CONSTRUCTION PROCEDURES TO THE ENGINEER FOR REVIEW.

Revision	By	Appd.	Date
0			

Issued	By	Appd.	Date
0 ISSUED FOR TENDER	G.A.M.		99.02.26

File Name: 6862-001.DWG	Dwn.	Chkd.	Dsgn.	Date
	T.J.N.	G.A.M.	G.A.M.	99.02.26

Permit/Seal

REGISTERED PROFESSIONAL ENGINEER
G.I.A.I.McROBIE
PROVINCE OF ONTARIO

Client/Project

BRITANNIA BEACH
GULL MANAGEMENT FACILITY

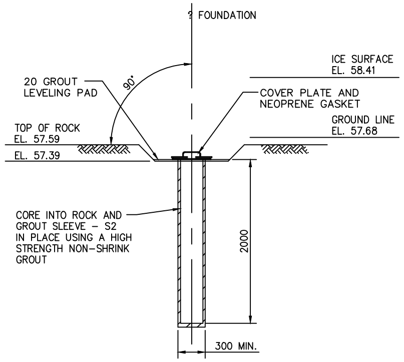
Ottawa, Ontario

Title

PHASE 1 - FOUNDATIONS
GENERAL ARRANGMENT

Project No.	Scale
S6862	AS SHOWN

Drawing No.	Sheet	Revision
6862-P1-001	1 of 2	0



FOUNDATION P1

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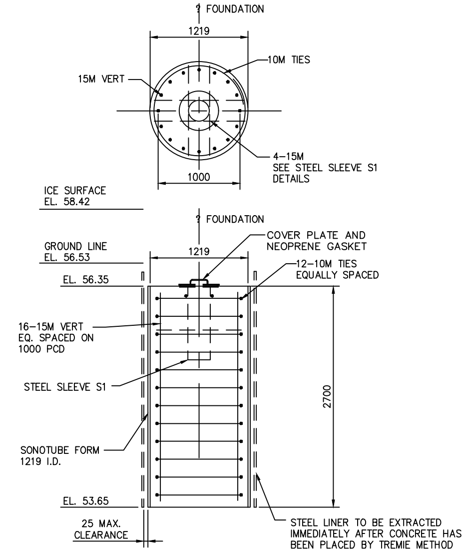

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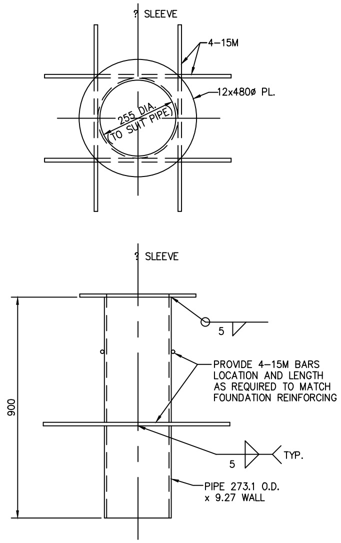

STEEL SLEEVE - S1

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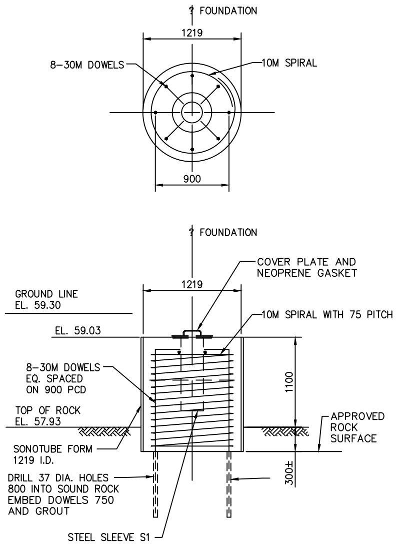

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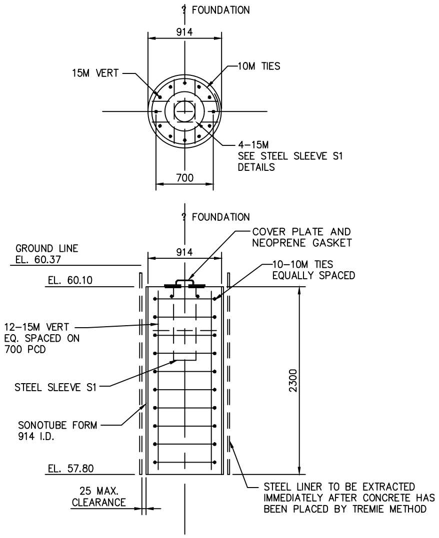

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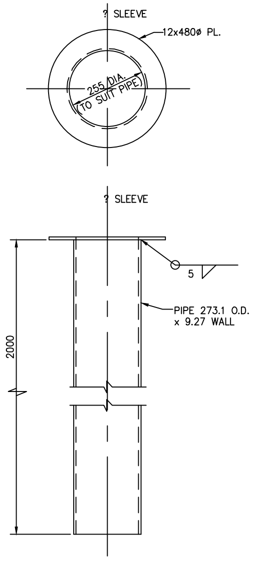

STEEL SLEEVE - S2

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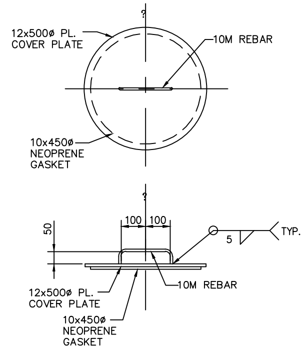
(1 REQUIRED)



COVER PLATE AND NEOPRENE GASKET

1:10

(4 OF EACH REQUIRED)

Stantec

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Consultants

Legend

Notes

1. CLASS OF CONCRETE SHALL BE 30 MPa.
2. REINFORCING STEEL SHALL BE GRADE 400.
3. CLEAR COVER TO REINFORCING STEEL SHALL BE 100mm ± 20mm
4. STEEL SLEEVE S2 AND DOWELS SHALL BE GROUTED IN PLACE USING A NON-SHRINK HIGH STRENGTH GROUT SUCH AS SIKA 212 OR APPROVED EQUAL.
5. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
6. SLEEVES SHALL BE STEEL PIPE SECTIONS TO ASTM A53, GRADE 240 (Fy = 240 MPa) ALL REMAINING STEEL SHALL BE IN ACCORDANCE WITH CAN/CSA G40.21 M92, GRADE 260W OR APPROVED EQUAL.
7. WELDING SHALL BE IN ACCORDANCE WITH CSA STANDARD W59, LATEST EDITION.

	By	Appd.	Date
0			
Revision	By	Appd.	Date
0 ISSUED FOR TENDER	G.A.M.		99.02.26
Issued	By	Appd.	Date

File Name: 6862-002.DWG	T.J.N.	G.A.M.	G.A.M.	99.02.26
	Dwn.	Chkd.	Dsgn.	Date

Permit/Seal

REGISTERED PROFESSIONAL ENGINEER
G.A.McROBIE
PROVINCE OF ONTARIO

Client/Project

BRITANNIA BEACH
GULL MANAGEMENT FACILITY
Ottawa, Ontario

Title

PHASE 1 - FOUNDATIONS
DETAILS

Project No.	Scale	
S6862	AS SHOWN	
Drawing No.	Sheet	Revision
6862-P1-002	2 of 2	0

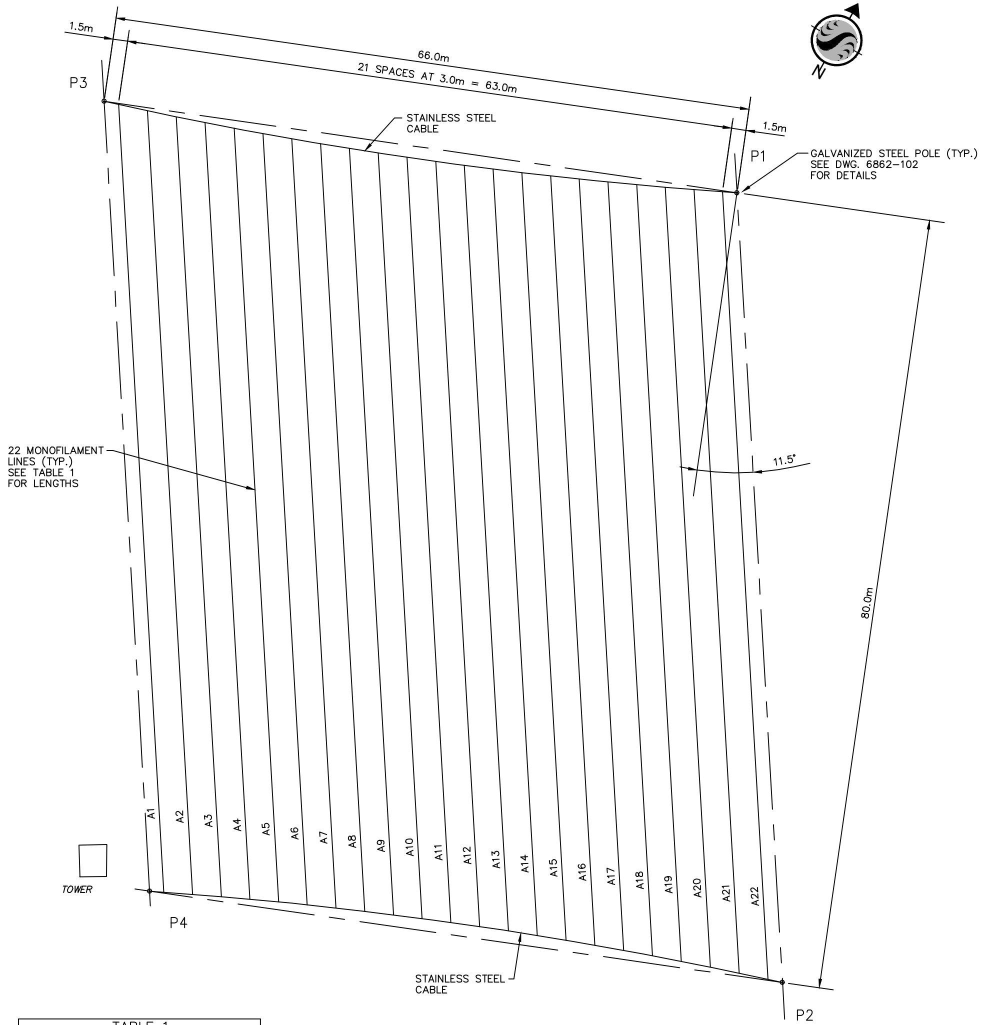
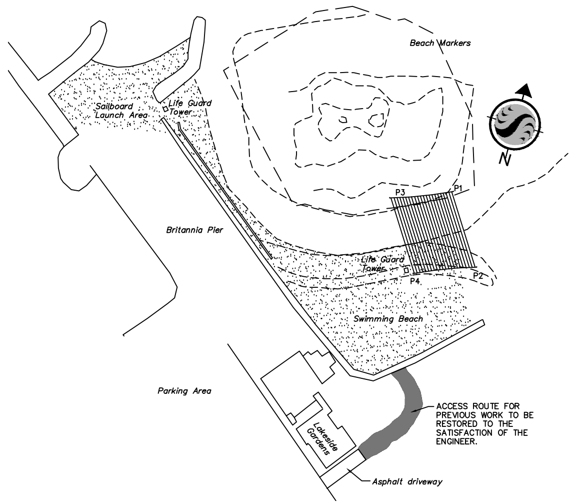


TABLE 1

MONOFILAMENT NO.	LENGTH (m)
A1	81.635
A2	81.585
A3	81.487
A4	81.337
A5	81.139
A6	80.891
A7	80.593
A8	80.247
A9	79.849
A10	79.403
A11	78.907
A12	78.907
A13	79.403
A14	79.849
A15	80.247
A16	80.593
A17	80.891
A18	81.139
A19	81.337
A20	81.487
A21	81.585
A22	81.635

MESH LAYOUT
1:250

NOTE: REFER TO DRAWINGS 6826-P1-001 AND 002 FOR DETAILS AND LOCATION OF FOUNDATIONS.



SITE PLAN
N.T.S.

SCOPE OF WORK

1. LOCATE POLE FOUNDATIONS WITH THE USE OF A METAL DETECTOR. (THE ENGINEER WILL PROVIDE APPROXIMATE LOCATIONS.) REMOVE SAND BAGS AND STEEL COVERS, ENSURE SLEEVES ARE COMPLETELY CLEAN OF SILT, SAND, DEBRIS, ETC PRIOR TO INSTALLATION OF SLEEVE INSERTS AND POLES. STEEL COVERS SHALL BE STORED FOR REUSE UPON DISASSEMBLY OF OVERHEAD WIRING SYSTEM AND REMOVAL OF POLES IN THE FALL AT THE DIRECTION OF THE CITY.
2. SUPPLY, FABRICATION GALVANIZING AND INSTALLATION OF POLES P1, P2, P3 AND P4 C/W ALL ATTACHED PLATES, STIFFENERS, AND SLIDE-ON ATTACHMENTS, TO THE MATERIAL AND DIMENSIONS AS SPECIFIED AND DETAILED ON THESE DRAWINGS.
3. SUPPLY, FABRICATION, GALVANIZING AND INSTALLATION OF FOUR STEEL SLEEVE INSERTS AS SPECIFIED AND DETAILED ON DWG. NO. 6862-P1-102.
4. SUPPLY, FABRICATION, GALVANIZING AND INSTALLATION OF FOUR RING FLANGE/WEDGE ASSEMBLIES AS SPECIFIED AND DETAILED ON DWG. NO. 6862-P1-102.
5. SUPPLY AND INSTALLATION OF STAINLESS STEEL CABLE, STAINLESS STEEL HARDWARE FOR CABLE ATTACHMENTS, MONOFILAMENT LINE AND ADJUSTABLE CONNECTORS AS SPECIFIED AND DETAILED ON DWG. NO. 6862-P1-103.
6. RESTORE ACCESS ROUTE USED FOR PREVIOUS WORK AS SHOWN ON THE ABOVE SITE PLAN. WORK REQUIRED INCLUDES FINE GRADING, TOPSOIL AND SOD OF APPROXIMATELY 300m²
7. RESTORE ALL SURFACES USED AS WORKING AREAS OR ACCESS TO THE WORK, TO ORIGINAL CONDITION AND ACCEPTIBLE TO THE ENGINEER. (INCIDENTAL TO THE CONTRACT)
8. DISASSEMBLE OVERHEAD WIRING, REMOVE POLES AT WATER LOCATIONS AND REPLACE STEEL COVERS AND SAND BAGS. WIRING AND CABLE SHALL BE ROLLED INTO NEAT BALES AND STORED WITH POLES AT A LOCATION TO BE DETERMINED BY THE CITY. POLES AT BEACH LOCATIONS MAY BE LEFT IN PLACE.

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General Notes
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.

Construction Notes

Revision	By	Appd.	Date
0			

Issued	By	Appd.	Date

File Name: 6862-101.DWG	T.J.N.	G.A.M.	G.A.M.	99.04.22
	Dwn.	Chkd.	Dsgn.	Date

Permit/Seal

REGISTERED PROFESSIONAL ENGINEER
G.T.A. McROBIE
PROVINCE OF ONTARIO

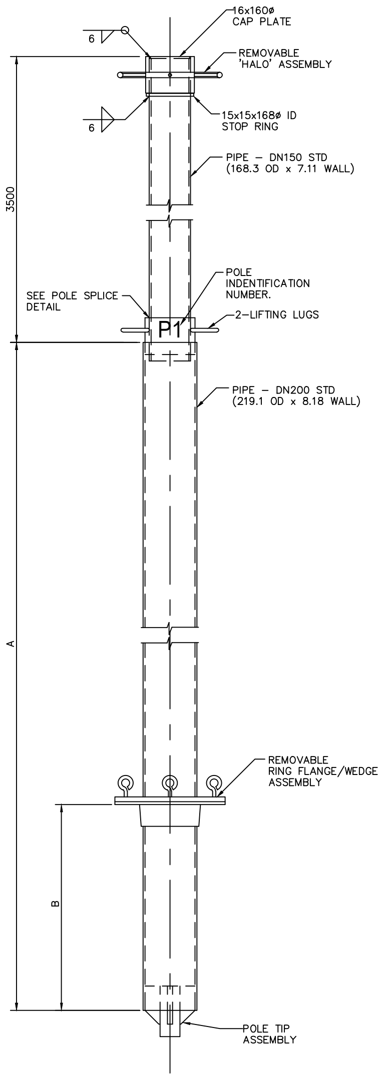
Client/Project

BRITANNIA BEACH
GULL MANAGEMENT FACILITY
Ottawa, Ontario

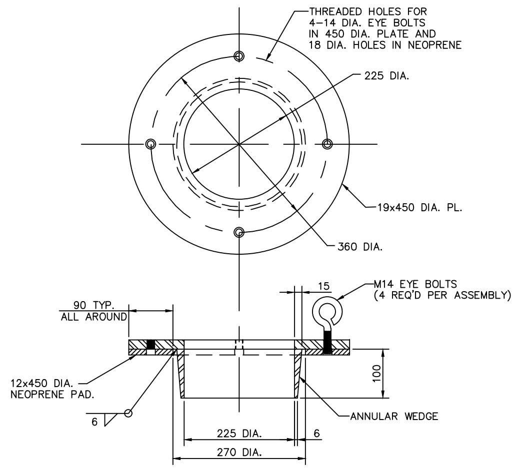
Title
PHASE 1
OVERHEAD WIRING SYSTEM
MESH LAYOUT

Project No.	Scale
S6862	AS SHOWN

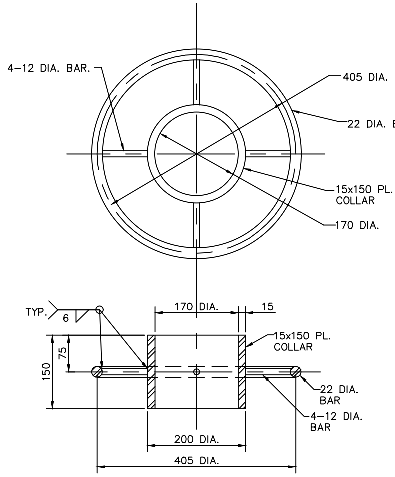
Drawing No.	Sheet	Revision
6862-P1-101	1 of 3	0



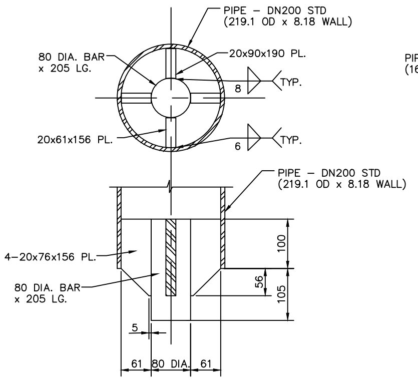
POLE DETAILS
(4 REQUIRED AS NOTED)
1:10



RING FLANGE/WEDGE ASSEMBLY
(4 REQUIRED)
1:5

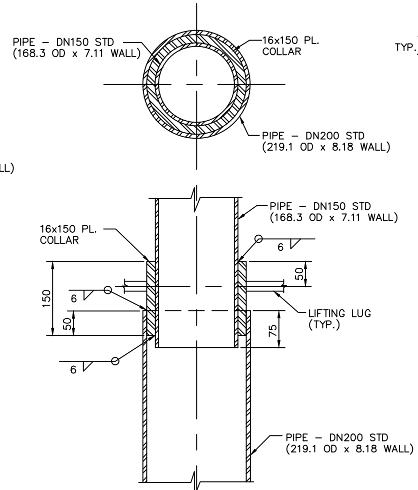


'HALO' ASSEMBLY
(4 REQUIRED)
1:5

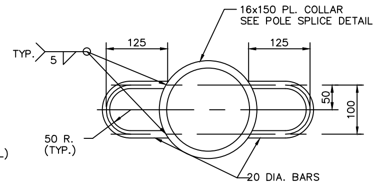


POLE TIP ASSEMBLY
(4 REQUIRED)
1:5

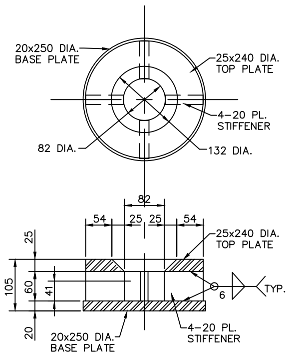
TABLE OF POLE DIMENSIONS		
POLE	'A'	'B'
P1	7680	1570
P2	6840	870
P3	8020	870
P4	5770	870



POLE SPLICE DETAIL
1:5



LIFTING LUG DETAILS
1:5



SLEEVE INSERT DETAILS
(4 REQUIRED)
1:5

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Notes

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. STEEL SHALL BE IN ACCORDANCE WITH CSA STANDARD G40.21M, LATEST EDITION, GRADE 300W.
3. PIPE SHALL BE IN ACCORDANCE WITH A.S.T.M. STANDARD A53, WITH A MINIMUM YIELD STRENGTH OF 205 MPa.
4. WELDING SHALL BE DONE IN ACCORDANCE WITH CSA STANDARD W59, LATEST EDITION. ELECTRODE CLASSIFICATION SHALL BE E480XX.
5. ALL STEEL, PIPE AND HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH CSA STANDARD G164–M, LATEST EDITION. MINIMUM 600 g/m^2
6. NEOPRENE PADS SHALL BE 50 DUROMETRE HARDNESS AND SHALL BE FASTENED TO RING FLANGE/WEDGE ASSEMBLIES AFTER ASSEMBLIES HAVE BEEN GALVANIZED USING AN ADHESIVE COMPATIBLE WITH GALVANIZED SURFACES AND AS APPROVED BY THE NEOPRENE MANUFACTURER.
7. THE CONTRACTOR SHALL SUBMIT STEEL FABRICATION SHOP DRAWINGS FOR REVIEW BY THE ENGINEER PRIOR TO FABRICATION.
8. MILL CERTIFICATES FOR ALL STEEL USED SHALL BE SUBMITTED FOR REVIEW BY THE ENGINEER PRIOR TO FABRICATION.
9. POLE IDENTIFICATION NUMBERS SHALL BE PAINTED ON TWO SIDES OF THE POLE AT LOCATION SHOWN, AFTER GALVANIZING. NUMBERS SHALL BE 80mm IN HEIGHT AND SHALL BE BLACK IN COLOUR.

Revision	By	Appd.	Date
0			

Issued	By	Appd.	Date

File Name: 6862-102.DWG	T.J.N.	G.A.M.	G.A.M.	99.04.22
	Dwn.	Chkd.	Dsgn.	Date

Permit/Seal

REGISTERED PROFESSIONAL ENGINEER
G.I.A. McROBIE
PROVINCE OF ONTARIO

Client/Project

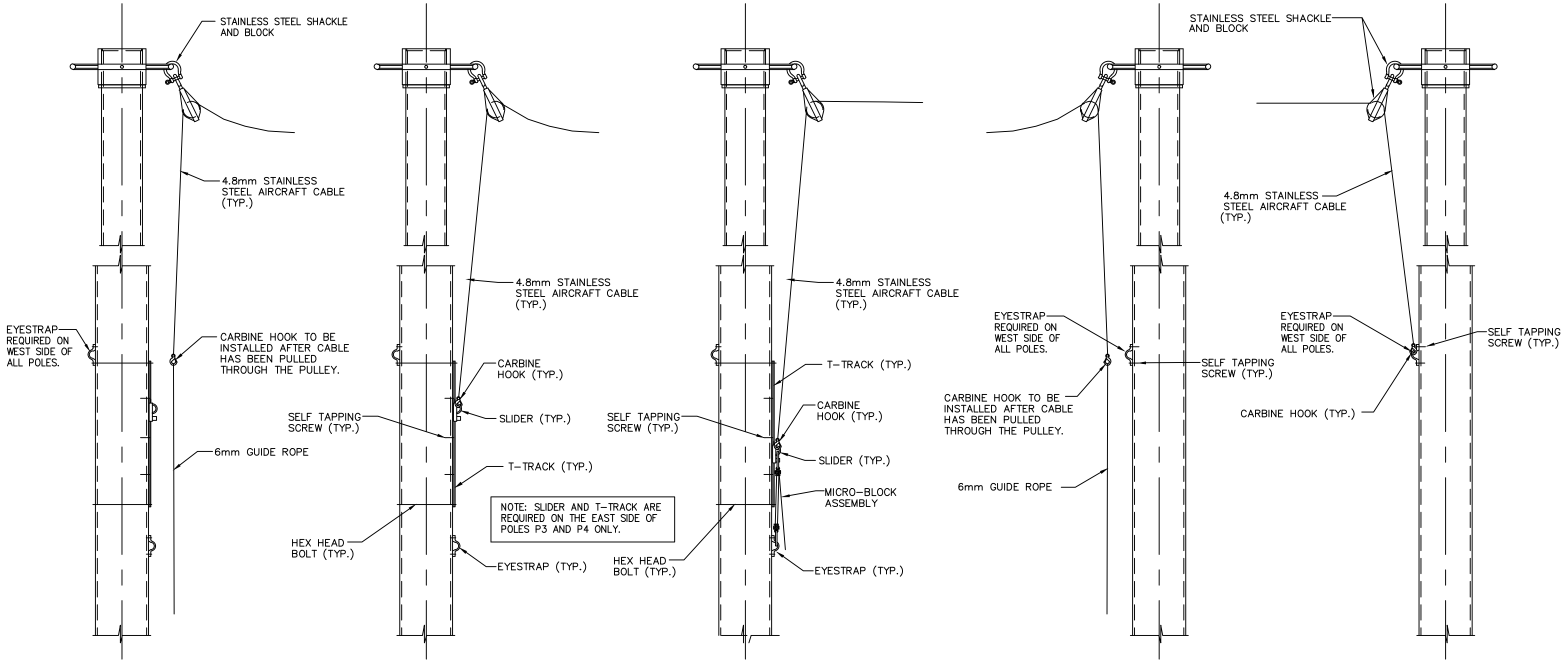
BRITANNIA BEACH
GULL MANAGEMENT FACILITY
Ottawa, Ontario

Title

PHASE 1
OVERHEAD WIRING SYSTEM
POLE DETAILS

Project No.	Scale
S6862	AS SHOWN

Drawing No.	Sheet	Revision
6862-P1-102	2 of 3	0



POLES P3 AND P4

POLES P1 AND P2

CABLE RIGGING

1:10

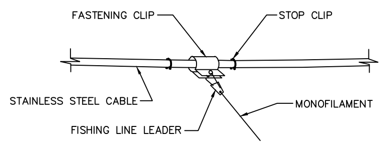
POLE AND CABLE INSTALLATION PROCEDURE

1. REMOVE COVERS FOR FOOTINGS (REFER TO DWG 6862-P1-002) AND CLEAN OUT STEEL SLEEVES. INSTALL STEEL SLEEVE INSERTS AS DETAILED ON DWG 6862-P1-102.
2. INSTALL 6mm GUIDE ROPE AND CABLE TENSIONING HARDWARE FOR EACH POLE.
3. ERECT POLES, INCLUDING ALL ASSEMBLIES AS SHOWN ON DWG. 6862-P1-102.
4. LAYOUT CABLE/MONOFILAMENT NETTING
5. FEED CABLE THROUGH PULLEYS AT POLES P1 AND P2. SECURE TO EYESTRAP USING A CARBINE HOOK.
6. FEED CABLE TROUGH PULLEYS AT POLES P3 AND P4. SECURE TO SLIDERS USING A CARBINE HOOK.

   NOTE: STEPS 5 AND 6 ARE TO BE PERFORMED SIMULTANEOUSLY.
7. INSTALL MICRO-BLOCK ASSEMBLIES.
8. TENSION CABLE USING MICRO-BLOCK ASSEMBLY AND SECURE SLIDER IN PLACE ONCE THE REQUIRED TENSION HAS BEEN REACHED.
9. REMOVE MICRO-BLOCK ASSEMBLIES.

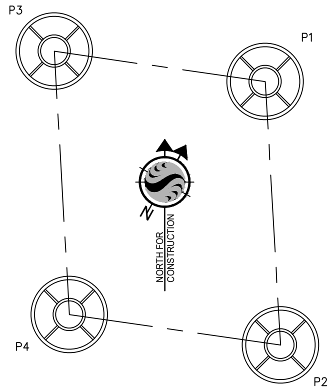
POLE AND CABLE REMOVAL PROCEDURE

1. INSTALL MIRCO-BLOCK ASSEMBLIES. (POLES P3 AND P4)
2. RELEASE SLIDER AND DETENSION CABLE USING THE MICRO-BLOCK ASSEMBLIES.
3. REMOVE CARBINE HOOK AND ATTACH 6mm ROPE TO CABLE. ALLOW CABLE TO PULL ROPE BACK THROUGH PULLEY SYSTEM.
4. REPEAT STEP 3 AT POLES P1 AND P2.
5. REMOVE POLES FROM FOUNDATIONS. USE EYE BOLTS ON THE RING FLANGE/WEDGE ASSEMBLIES TO LOOSEN POLES FROM FOUNDATION SLEEVES.
6. COVER FOUNDATIONS USING COVERS AS SHOWN ON DWG. 6862-P1-002.
7. STORE POLES, CABLES AND MONOFILAMENTS FOR REUSE.



TYPICAL MONOFILAMENT DETAIL

N.T.S



POLE AND HALO ORIENTATION

N.T.S

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Notes

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL HARDWARE, INCLUDING PULLEYS, CARBINES EYESTRAPS, SLIDERS AND T-TRACKS ARE TO BE STAINLESS STEEL.
3. CABLES SHALL BE 4.8mm (3/16") STAINLESS STEEL MULTI-STRAND AIRCRAFT CABLE.
4. MONOFILAMENT LINE SHALL BE 178 N (40 lb.) CLEAR "BERKLEY XT" LINE OR APPROVED EQUAL. REFER TO TABLE 1 ON DWG 6862-P1-101 FOR REQUIRED LENGTHS.
5. THE SUCCESSFUL CONTRACTOR SHALL SUBMIT ALL HARDWARE PRODUCT DATA SHEETS FOR REVIEW BY THE ENGINEER PRIOR TO PROCUREMENT. EQUAL OR BETTER ALTERNATIVES TO THE SPECIFIED OVERHEAD WIRING SYSTEM COMPONENTS MAY BE SUBMITTED FOR REVIEW BY THE ENGINEER. ALL STAINLESS STEEL COMPONENTS SHALL BE REQUIRED TO RESIST A WORKING LOAD OF 2 kN. (ULTIMATE LOAD OF 6 kN.)
6. NO WORK SHALL BE PERMITTED ON THE WEEKENDS.

Revision	By	Appd.	Date
0			

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	Dwn.	Chkd.	Dsgn.	Date

Permit/Seal

REGISTERED PROFESSIONAL ENGINEER
G.[A.]McROBIE
PROVINCE OF ONTARIO

Client/Project

BRITANNIA BEACH
GULL MANAGEMENT FACILITY
Ottawa, Ontario

Title

PHASE 1
OVERHEAD WIRING SYSTEM
WIRING INSTALLATION AND DETAILS

Project No.	Scale
S6862	AS SHOWN

Drawing No.	Sheet	Revision
6862-P1-103	3 of 3	0

NO.	REVISION	BY	DATE
1	ISSUED FOR TENDER	G.A.M.	15.01.02

Xref Z:\STANDARD\636_Structural_EngStamps\SRgordm.dwg

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

BRITANNIA BEACH
GULL MANAGEMENT FACILITY

PHASE 2
GENERAL ARRANGEMENT

R.G. HEWITT, P.ENG. Director Infrastructure Services		W. BENNETT, P.ENG. Manager Construction Services	
Dwn: C.L.D.	Chkd: G.A.M.	Des: C.L.D.	Chkd: G.A.M.

CONTRACT NO.	00902-75573-T01
DWG. NO.	S1
SHEET	1 OF 5
Date:	JANUARY 2002
Scale:	AS SHOWN

BOREHOLE NO.99-5
N.T.S.

BOREHOLE NO.99-6
N.T.S.

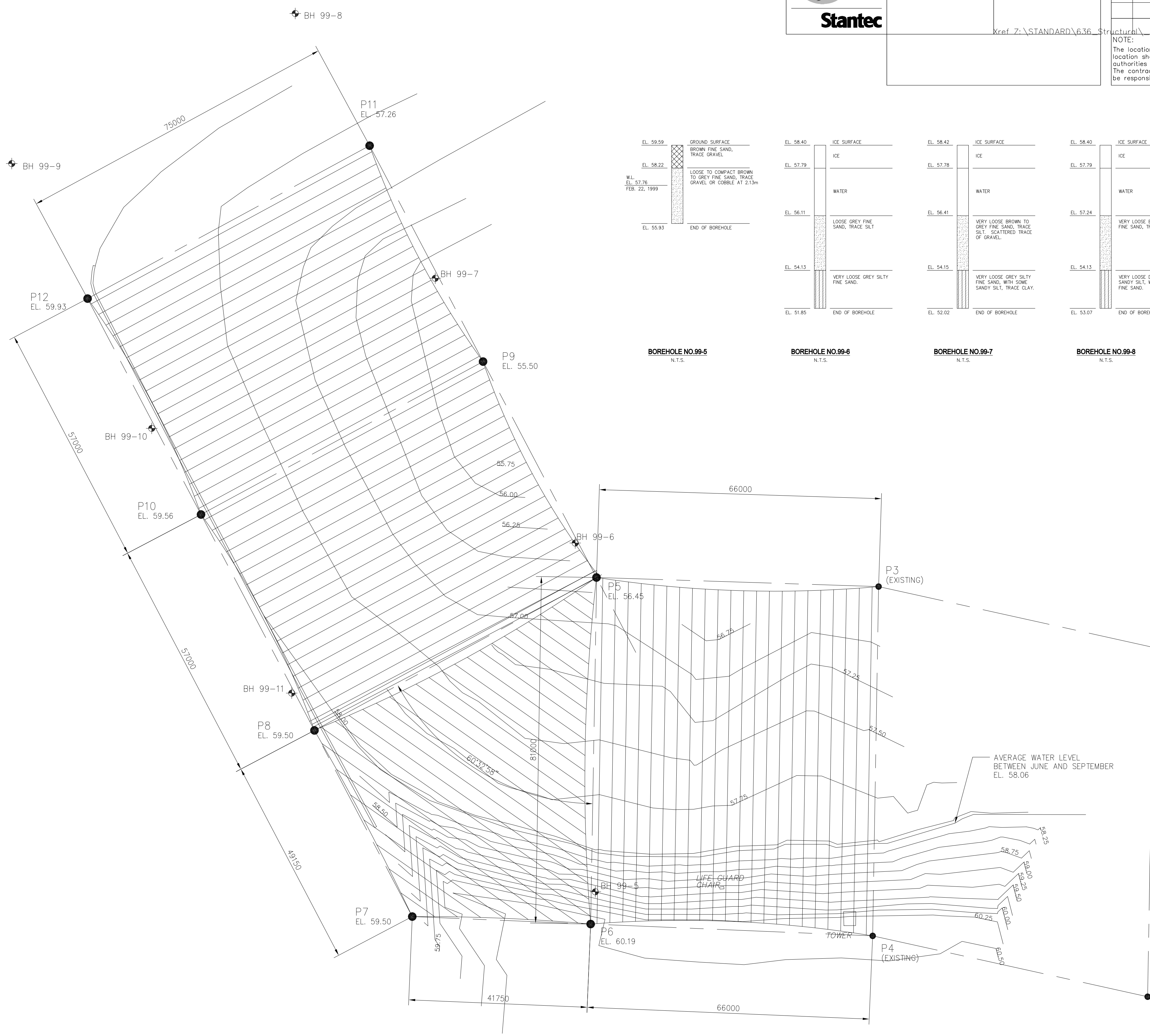
BOREHOLE NO.99-7
N.T.S.

BOREHOLE NO.99-8
N.T.S.

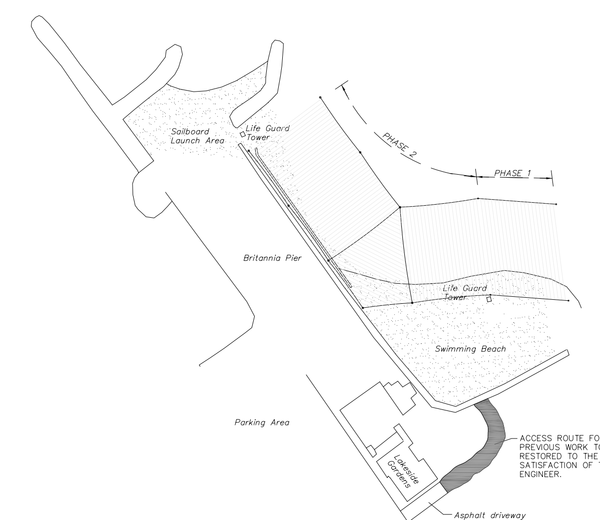
BOREHOLE NO.99-9
N.T.S.

BOREHOLE NO.99-10
N.T.S.

BOREHOLE NO.99-11
N.T.S.



SITE PLAN
1:500



LOCATION PLAN
N.T.S.

General Notes

1. THE SITE CONDITIONS AND ICE THICKNESSES GIVEN IN THE BOREHOLE LOGS EXISTED ON FEBRUARY 22 AND 23, 1999. THE CONTRACTOR SHOULD NOT EXPECT THAT CONDITIONS WILL BE SIMILAR AT THE TIME THE WORK IS DONE.
2. THE CONTRACTOR SHALL VERIFY THE CONDITIONS AT THE TIME OF CONSTRUCTION.
3. FOUNDATIONS FOR POLES P5, P9 & P11 MUST BE INSTALLED FROM THE SURFACE OF THE ICE, AT A TIME WHEN SUFFICIENT THICKNESS OF ICE HAS FORMED TO SAFELY SUPPORT THE REQUIRED CONSTRUCTION LOADS.

Construction Notes

1. THE FOLLOWING SUGGESTIONS ARE MADE FOR INFORMATION PURPOSES ONLY.
2. STEEL LINERS SHALL BE DRIVEN A MINIMUM 1 METRE BELOW THE SPECIFIED BOTTOM OF CAISSONS AND SHOULD EXTEND ABOVE THE ICE/GROUND LEVEL AS APPROPRIATE. MATERIAL SHALL BE EXCAVATED TO THE SPECIFIED BOTTOM OF CAISSONS.
3. IF EXCAVATION FILLS WITH WATER ON DEWATERING, EXCAVATE A FURTHER 0.5m AND PLACE A TREMIE CONCRETE PLUG.
4. PLUMBNESS OF FOUNDATIONS, THE SLEEVES IN PARTICULAR, IS OF PRIME IMPORTANCE AND NO TOLERANCE IS SPECIFIED OR PERMISSIBLE.
5. CONTRACTOR SHALL SUBMIT PROPOSED CONSTRUCTION PROCEDURES TO THE ENGINEER FOR REVIEW.

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NO.	REVISION	BY	DATE
1	ISSUED FOR TENDER	G.A.M.	15.01.02

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

BRITANNIA BEACH
GULL MANAGEMENT FACILITY

PHASE 2
FOUNDATION DETAILS

R.G. HEWITT, P.ENG.
Director Infrastructure Services

W. BENNETT, P.ENG.
Manager Construction Services

Dwn: H.S.D. Chkd: G.A.M. Des: C.L.D. Chkd: G.A.M.

Ottawa

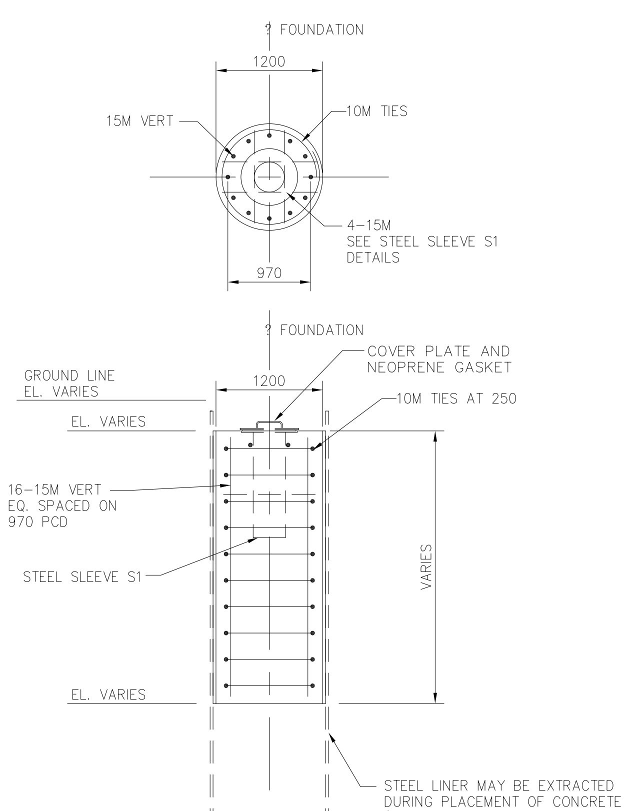
CONTRACT NO.
00902-75573-T01
DWG. NO.
S2
SHEET 2 OF 5
Date: JANUARY 2002
Scale: AS SHOWN

TABLE OF FOUNDATION DIMENSIONS & ELEVATIONS

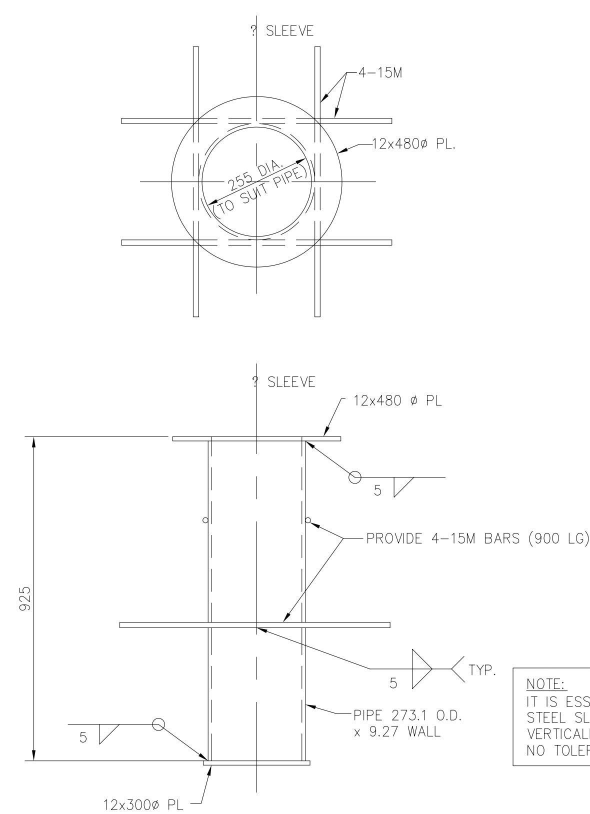
POLE	LOCATION	GROUND ELEVATION (m)	TOP OF FOUNDATION ELEVATION (m)	FOUNDATION DEPTH (m)	U/S FOUNDATION ELEVATION (m)
P5	OFFSHORE	56.45	56.20	2.70	53.50
P6	BEACH	60.19	59.90	2.70	57.20
P7	BEACH	59.50±	59.40	3.20	56.20
P8	BEHIND WALL	59.50	59.40	2.70	56.70
P9	OFFSHORE	55.50	55.25	2.70	53.55
P10	BEHIND WALL	59.56	59.45	2.70	56.75
P11	OFFSHORE	57.26	57.00	2.70	54.30
P12	BEHIND WALL	59.93	59.95	2.70	57.25

GENERAL NOTES:

1. CLASS OF CONCRETE SHALL BE 30 MPa, AIR ENTRAINED 5 TO 8%.
2. REINFORCING STEEL SHALL BE GRADE 400.
3. CLEAR COVER TO REINFORCING STEEL SHALL BE 100mm ± 20mm
4. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
5. SLEEVES SHALL BE STEEL PIPE SECTIONS TO ASTM A53, GRADE 240 (Fy = 240 MPa) ALL REMAINING STEEL SHALL BE IN ACCORDANCE WITH CAN/CSA G40.21 M92, GRADE 260W OR APPROVED EQUAL.
6. ALL STEEL SLEEVES ANDCOVER PLATES SHALL BE GALVANISED IN ACCORDANCE WITH CSA G164-M, MINIMUM 600g/m^2.
7. WELDING SHALL BE IN ACCORDANCE WITH CSA STANDARD W59, LATEST EDITION.
8. FOR LOCATION OF FOUNDATIONS, REFER TO DRAWING S1. THE ENGINEER WILL ASSIST WITH IDENTIFYING LOCATIONS IN THE FIELD IF REQUIRED.
9. FOUNDATIONS FOR POLES P5, P9 & P11 MUST BE INSTALLED FROM THE SURFACE OF THE ICE, AT A TIME WHEN SUFFICIENT ICE THICKNESS HAS FORMED TO SAFELY SUPPORT THE REQUIRED CONSTRUCTION LOADS.
10. NEOPRENE GASKET SHALL BE 50 DUROMETRE HARDNESS AND SHALL BE FASTENED TO THE COVER PLATE AFTER GALVANISING USING AN ADHESIVE COMPATIBLE WITH GALVANISED SURFACES AND APPROVED BY THE NEOPRENE MANUFACTURER.
11. COVER PLATE TO BE PLACED ON CAISSON FOLLOWING CONSTRUCTION.

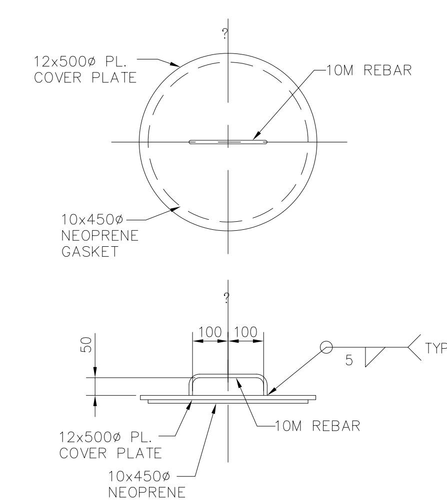


FOUNDATION
1:30



NOTE:
IT IS ESSENTIAL THAT THE STEEL SLEEVE IS INSTALLED VERTICALLY AT ALL LOCATIONS. NO TOLERANCES WILL BE PERMITTED.

STEEL SLEEVE - S1
1:10
(8 REQUIRED)



COVER PLATE AND NEOPRENE GASKET
1:10
(8 REQUIRED)

NO.	REVISION	BY	DATE
1	ISSUED FOR TENDER	G.A.M.	15.01.02

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Xref Z:\STANDARD\636_Structural_EngStamps\SRgordm.dwg

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

BRITANNIA BEACH GULL MANAGEMENT FACILITY

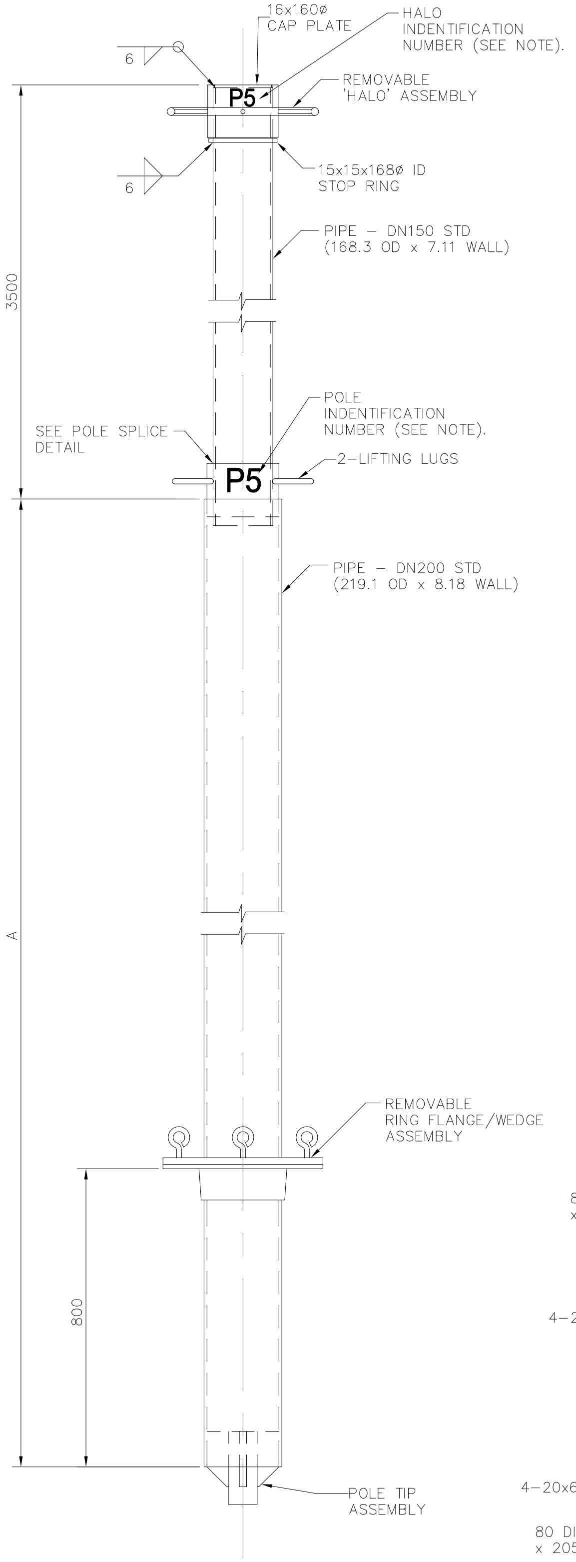
PHASE 2 – POLE DETAILS

R.G. HEWITT, P.ENG. Director Infrastructure Services
W. BENNETT, P.ENG. Manager Construction Services

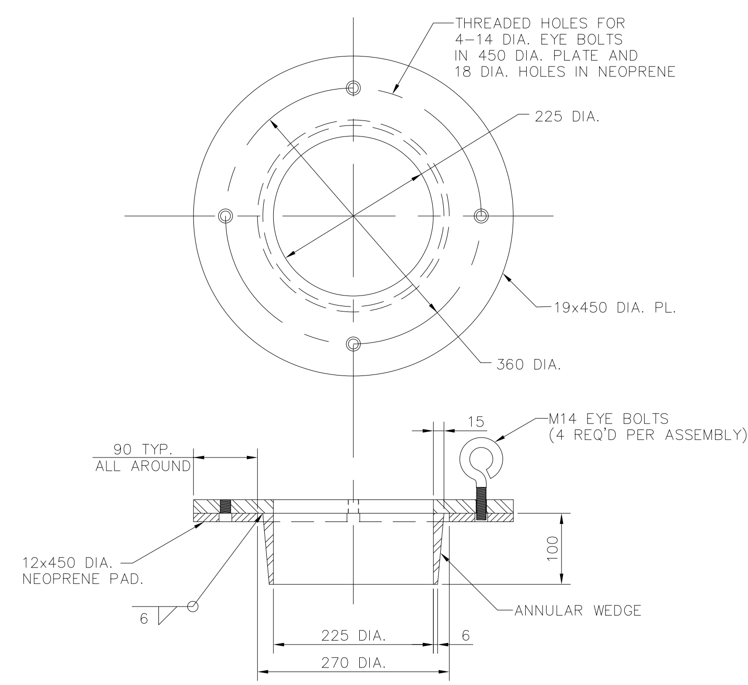
Dwn: C.L.D. Chkd: G.A.M. Des: C.L.D. Chkd: G.A.M.

Ottawa

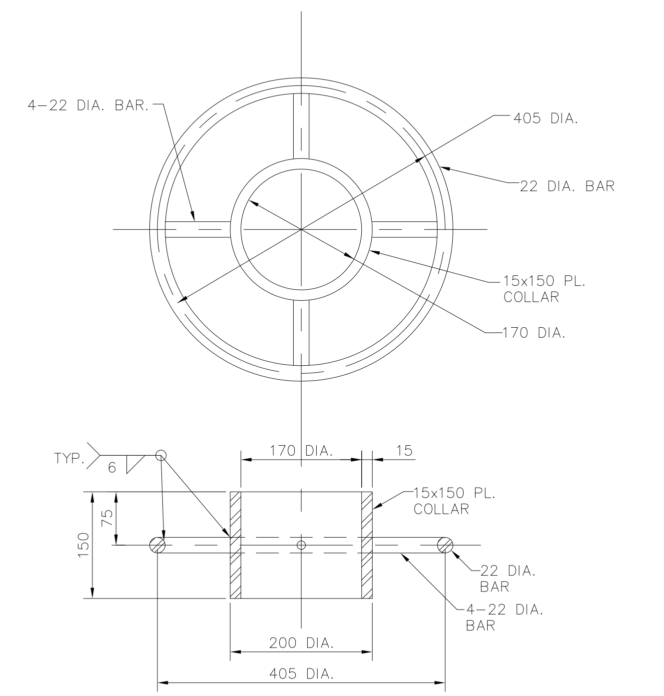
CONTRACT NO. 00902-75573-T01
DWG. NO. S3
SHEET 3 OF 5
Date: JANUARY 2002
Scale: AS SHOWN



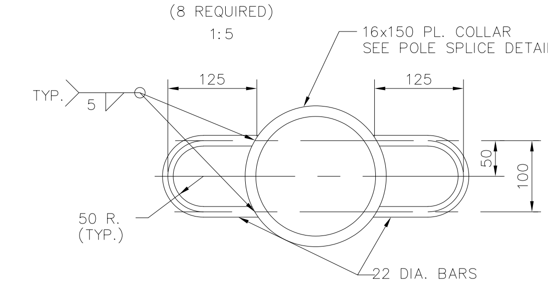
POLE DETAILS
(8 REQUIRED AS NOTED)
1:10



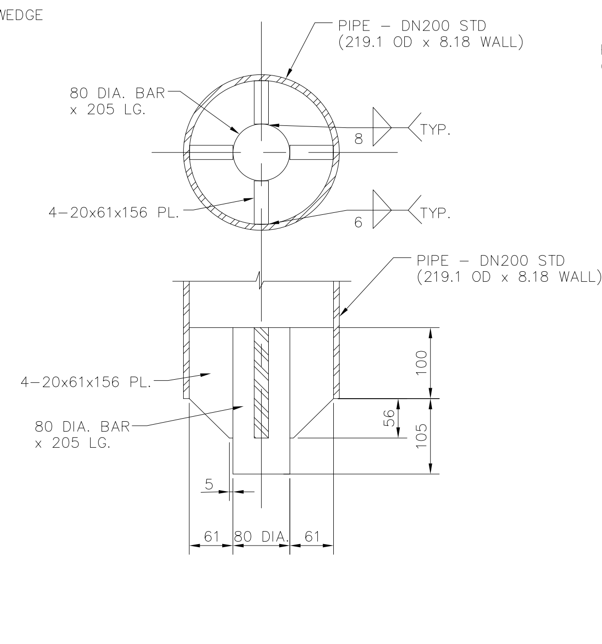
RING FLANGE/WEDGE ASSEMBLY
(8 REQUIRED)
1:5



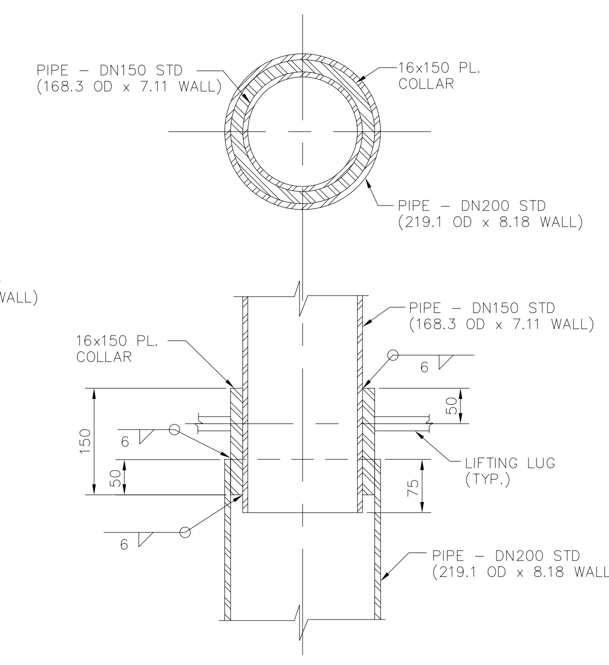
'HALO' ASSEMBLY
(8 REQUIRED)
1:5



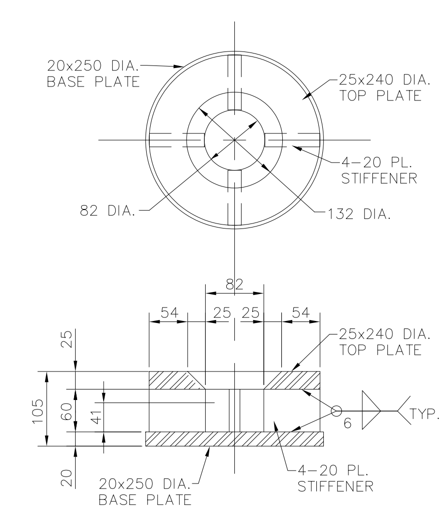
LIFTING LUG DETAILS
1:5



POLE TIP ASSEMBLY
(8 REQUIRED) 1:5



POLE SPLICE DETAIL
1:5



SLEEVE INSERT DETAILS
(8 REQUIRED) 1:5

NOTES:

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. STEEL SHALL BE IN ACCORDANCE WITH CSA STANDARD G40.21M, LATEST EDITION, GRADE 300W.
3. PIPE SHALL BE IN ACCORDANCE WITH A.S.T.M. STANDARD A53, WITH A MINIMUM YIELD STRENGTH OF 205 MPa.
4. WELDING SHALL BE DONE IN ACCORDANCE WITH CSA STANDARD W59, LATEST EDITION. ELECTRODE CLASSIFICATION SHALL BE E480XX.
5. ALL STEEL, PIPE AND HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH CSA STANDARD G164-M, LATEST EDITION. MINIMUM 600 g/m^2
6. NEOPRENE PADS SHALL BE 50 DUROMETRE HARDNESS AND SHALL BE FASTENED TO RING FLANGE/WEDGE ASSEMBLIES AFTER ASSEMBLIES HAVE BEEN GALVANIZED USING AN ADHESIVE COMPATIBLE WITH GALVANIZED SURFACES AND AS APPROVED BY THE NEOPRENE MANUFACTURER.
7. THE CONTRACTOR SHALL SUBMIT STEEL FABRICATION SHOP DRAWINGS FOR REVIEW BY THE ENGINEER PRIOR TO FABRICATION.
8. MILL CERTIFICATES FOR ALL STEEL USED SHALL BE SUBMITTED FOR REVIEW BY THE ENGINEER PRIOR TO FABRICATION.
9. POLE IDENTIFICATION NUMBERS SHALL BE PAINTED ON TWO SIDES OF THE POLE AT LOCATION SHOWN, AFTER GALVANIZING. NUMBERS SHALL BE 80mm IN HEIGHT AND SHALL BE BLACK IN COLOUR.
10. HALO IDENTIFICATION NUMBERS SHALL BE PAINTED ON TWO SIDES OF THE HALO AT LOCATION SHOWN, AFTER GALVANIZING. NUMBERS SHALL BE 40mm IN HEIGHT AND SHALL BE BLACK IN COLOUR.
11. NOTE THAT HALO ASSEMBLIES USED FOR POLES P3 AND P4 (PHASE 1) ARE NOW TO BE USED FOR POLES P10 AND P11. NEW HALO ASSEMBLIES ARE TO BE USED AT POLES P3 AND P4. HALO IDENTIFICATION NUMBERS SHOULD MATCH POLE IDENTIFICATION NUMBERS ACCORDINGLY.

TABLE OF POLE CHARACTERISTICS

POLE	"A"	WEIGHT (kg)
P5	8100	530
P6	5900	430
P7	6200	450
P8	6200	450
P9	9050	570
P10	6150	440
P11	7300	490
P12	5750	430

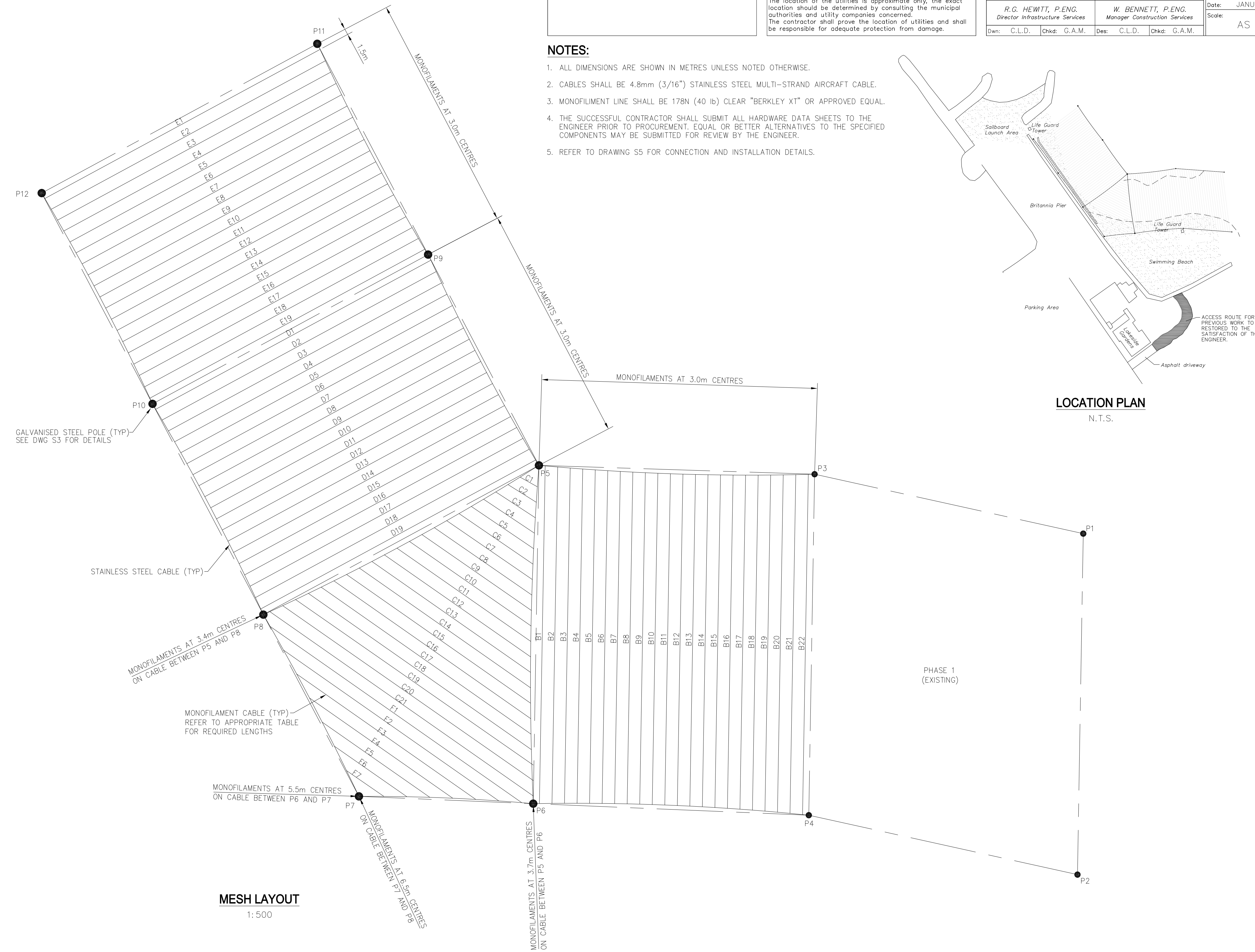
MONOFILAMENT NO.	LENGTH (m)
B1	80.839
B2	80.525
B3	80.268
B4	80.021
B5	79.830
B6	79.660
B7	79.524
B8	79.421
B9	79.351
B10	79.302
B11	79.310
B12	79.327
B13	79.389
B14	79.495
B15	79.624
B16	79.785
B17	79.979
B18	80.206
B19	80.467
B20	80.761
B21	81.087
B22	81.447

MONOFILAMENT NO.	LENGTH (m)
C1	4.733
C2	7.992
C3	11.294
C4	14.635
C5	18.011
C6	21.424
C7	24.872
C8	28.357
C9	31.877
C10	35.431
C11	39.022
C12	42.648
C13	46.309
C14	50.007
C15	53.739
C16	57.506
C17	61.309
C18	65.147
C19	69.308
C20	73.116
C21	76.941

MONOFILAMENT NO.	LENGTH (m)
D1	74.901
D2	74.613
D3	74.359
D4	74.137
D5	73.949
D6	73.794
D7	73.673
D8	73.584
D9	73.529
D10	73.507
D11	73.519
D12	73.563
D13	73.641
D14	73.752
D15	73.897
D16	74.074
D17	74.285
D18	74.529
D19	74.806

MONOFILAMENT NO.	LENGTH (m)
E1	74.901
E2	74.613
E3	74.359
E4	74.137
E5	73.949
E6	73.794
E7	73.673
E8	73.584
E9	73.529
E10	73.507
E11	73.519
E12	73.563
E13	73.641
E14	73.752
E15	73.897
E16	74.074
E17	74.285
E18	74.529
E19	74.806

MONOFILAMENT NO.	LENGTH (m)
F1	73.517
F2	62.886
F3	52.332
F4	41.851
F5	31.446
F6	21.116
F7	10.861



MESH LAYOUT

1:500

NO.	REVISION	BY	DATE
1	ISSUED FOR TENDER	G.A.M.	15.01.02

Xref Z:\STANDARD\636_Structural_EngStamps\SRgordm.dwg

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

Stantec

BRITANNIA BEACH
GULL MANAGEMENT FACILITY

PHASE 2 – CABLE AND MONOFILAMENT ARRANGEMENT

R.G. HEWITT, P.ENG.
Director Infrastructure Services

W. BENNETT, P.ENG.
Manager Construction Services

Dwn: C.L.D. Chkd: G.A.M. Des: C.L.D. Chkd: G.A.M.

Ottawa

CONTRACT NO. 00902–75573–T01

DWG. NO. S4

SHEET 4 OF 5

Date: JANUARY 2002

Scale: AS SHOWN

NOTES:

1. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. CABLES SHALL BE 4.8mm (3/16") STAINLESS STEEL MULTI-STRAND AIRCRAFT CABLE.
3. MONOFILIMENT LINE SHALL BE 178N (40 lb) CLEAR "BERKLEY XT" OR APPROVED EQUAL.
4. THE SUCCESSFUL CONTRACTOR SHALL SUBMIT ALL HARDWARE DATA SHEETS TO THE ENGINEER PRIOR TO PROCUREMENT. EQUAL OR BETTER ALTERNATIVES TO THE SPECIFIED COMPONENTS MAY BE SUBMITTED FOR REVIEW BY THE ENGINEER.
5. REFER TO DRAWING S5 FOR CONNECTION AND INSTALLATION DETAILS.

LOCATION PLAN

N.T.S.

NO.	REVISION	BY	DATE
1	ISSUED FOR TENDER	G.A.M.	15.01.02

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

Stantec

BRITANNIA BEACH
GULL MANAGEMENT FACILITY

PHASE 2
WIRING INSTALLATION DETAILS

R.G. HEWITT, P.ENG.
Director Infrastructure Services

W. BENNETT, P.ENG.
Manager Construction Services

Dwn: C.L.D. Chkd: G.A.M. Des: C.L.D. Chkd: G.A.M.

Ottawa

CONTRACT NO. 00902-75573-T01
DWG. NO. S5
SHEET 5 OF 5
Date: JANUARY 2002
Scale: AS SHOWN

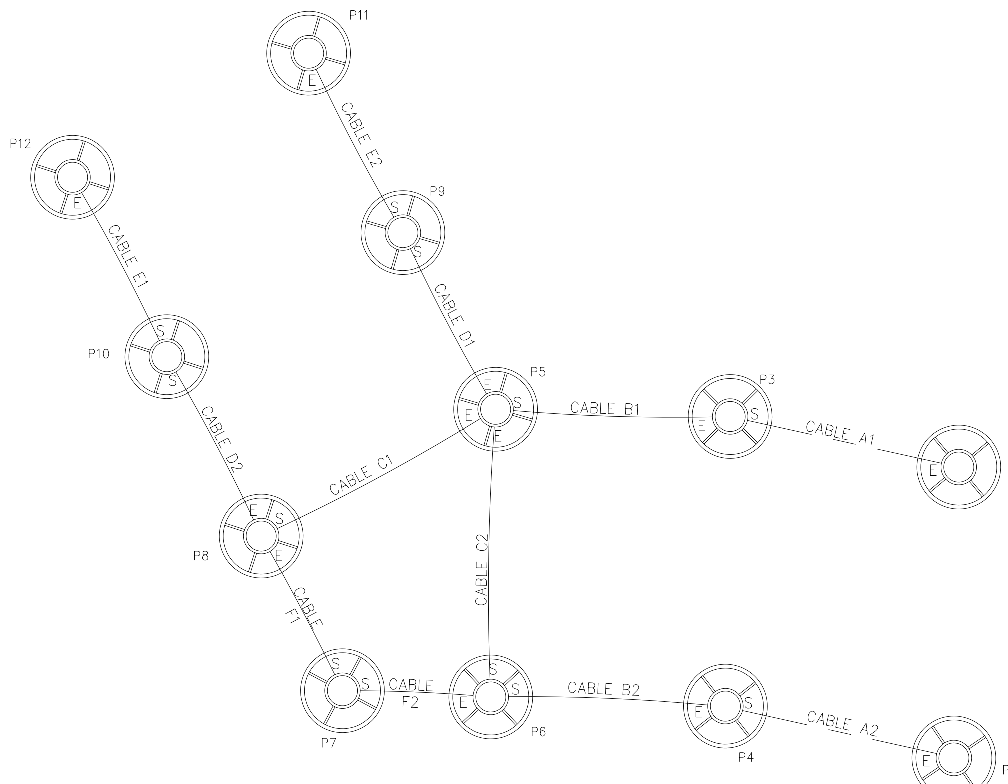
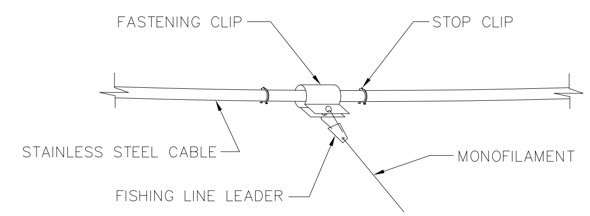


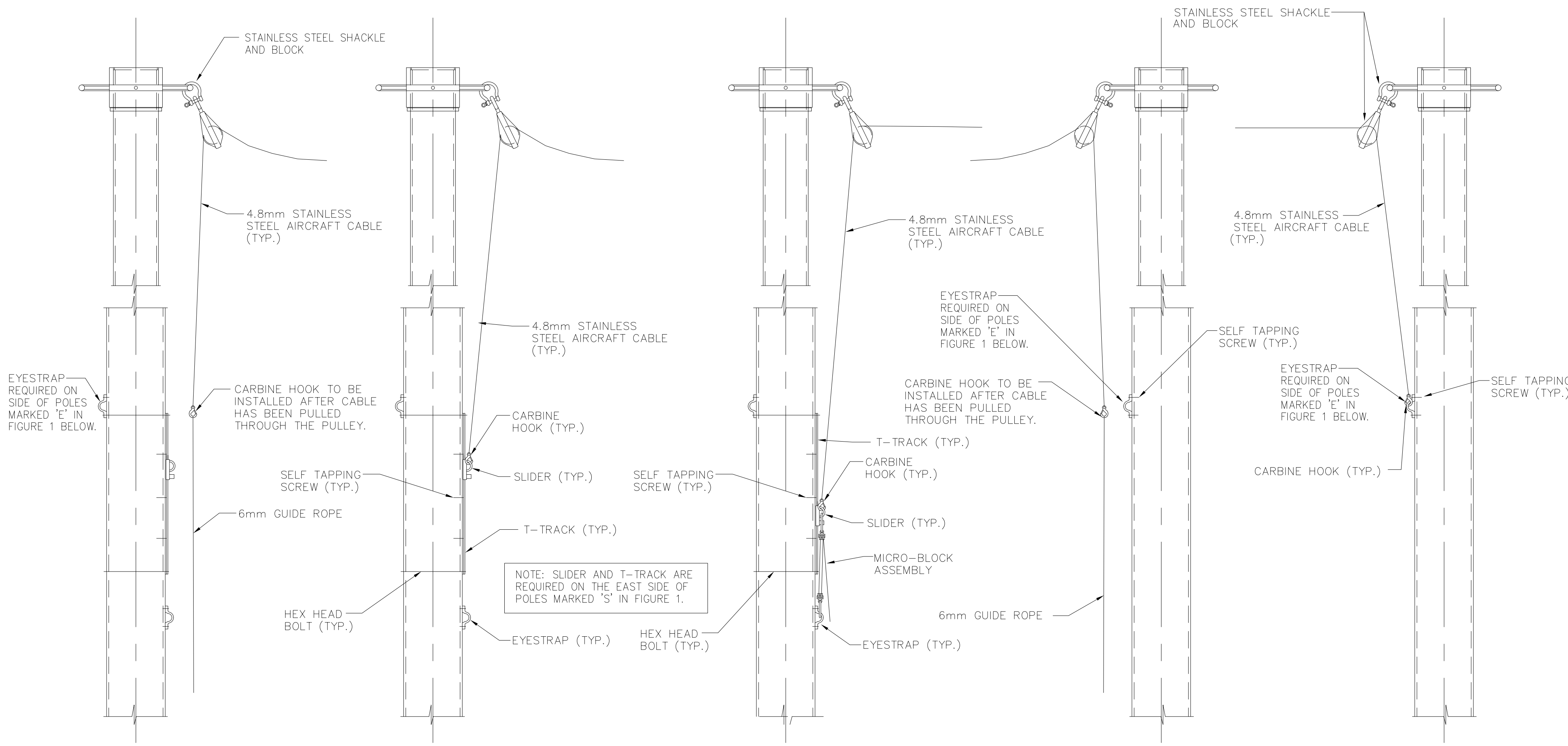
FIGURE 1 - HALO ORIENTATION, EYESTRAP & SLIDER LOCATIONS
N.T.S



TYPICAL MONOFILAMENT DETAIL
N.T.S

GENERAL NOTES

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL HARDWARE, INCLUDING PULLEYS, CARBINES, EYESTRAPS, SLIDERS AND T-TRACKS ARE TO BE STAINLESS STEEL.
3. CABLES SHALL BE 4.8mm (3/16") STAINLESS STEEL MULTI-STRAND AIRCRAFT CABLE.
4. MONOFILAMENT LINE SHALL BE 178 N (40 lb.) CLEAR "BERKELEY XT" LINE OR APPROVED EQUAL. REFER TO TABLES ON DRAWING S4 FOR REQUIRED LENGTHS.
5. THE SUCCESSFUL CONTRACTOR SHALL SUBMIT ALL HARDWARE PRODUCT DATA SHEETS FOR REVIEW BY THE ENGINEER PRIOR TO PROCUREMENT. EQUAL OR BETTER ALTERNATIVES TO THE SPECIFIED OVERHEAD WIRING SYSTEM COMPONENTS MAY BE SUBMITTED FOR REVIEW BY THE ENGINEER. ALL STAINLESS STEEL COMPONENTS SHALL BE REQUIRED TO RESIST A WORKING LOAD OF 2.4kN (ULTIMATE LOAD OF 6.0kN).
6. NO WORK SHALL BE PERMITTED ON THE WEEKENDS.
7. NOTE THAT ALL HARDWARE RELATING TO P1 TO P4 HAS ALREADY BEEN COMPLETED UNDER PHASE 1. THESE POLES ARE SHOWN HERE FOR COMPLETENESS.
8. FOR FIRST INSTALLATION OF PHASE 2 ONLY, HALO ASSEMBLIES FROM POLES P3 & P4 ARE TO BE TRANSFERRED TO POLES P11 & P12 REPECTIVELY. (REFER TO DRAWING 3 FOR MORE INFORMATION).



POLES WITH SLIDERS AND T-TRACKS (POLES P3 TO P10 - SEE ABOVE)

CABLE RIGGING
1:10

POLES WITH EYESTRAPS (P1 TO P8, P11 - SEE ABOVE)

POLE AND CABLE INSTALLATION PROCEDURE

1. REMOVE COVERS FOR FOOTINGS (REFER TO DWG S2) AND CLEAN OUT STEEL SLEEVES. INSTALL STEEL SLEEVE INSERTS AS DETAILED ON DWG S3.
2. INSTALL 6mm GUIDE ROPE AND CABLE TENSIONING HARDWARE FOR EACH POLE.
3. ERECT POLES, INCLUDING ALL ASSEMBLIES AS SHOWN ON DWG. S3.
4. LAYOUT CABLE/MONOFILAMENT NETTING
5. FEED CABLE THROUGH PULLEYS AT POLES MARKED 'E'. SECURE TO EYESTRAP USING A CARBINE HOOK.
6. FEED CABLE TROUGH PULLEYS AT POLES MARKED 'S'. SECURE TO SLIDERS USING A CARBINE HOOK.

   NOTE: STEPS 5 AND 6 ARE TO BE PERFORMED SIMULTANEOUSLY AT ALL POLES.
7. INSTALL MICRO-BLOCK ASSEMBLIES.
8. TENSION CABLE USING MICRO-BLOCK ASSEMBLY AND SECURE SLIDER IN PLACE ONCE THE REQUIRED TENSION HAS BEEN REACHED.
9. REMOVE MICRO-BLOCK ASSEMBLIES.

POLE AND CABLE REMOVAL PROCEDURE

1. INSTALL MIRCO-BLOCK ASSEMBLIES. (POLES MARKED 'S')
2. RELEASE SLIDER AND DETENSION CABLE USING THE MICRO-BLOCK ASSEMBLIES.
3. REMOVE CARBINE HOOK AND ATTACH 6mm ROPE TO CABLE. ALLOW CABLE TO PULL ROPE BACK THROUGH PULLEY SYSTEM.
4. REPEAT STEP 3 AT POLES MARKED 'E'.
5. REMOVE POLES FROM FOUNDATIONS. USE EYE BOLTS ON THE RING FLANGE/WEDGE ASSEMBLIES TO LOOSEN POLES FROM FOUNDATION SLEEVES.
6. REMOVE STEEL SLEEVE INSERTS FROM STEEL SLEEVES.
7. COVER FOUNDATIONS USING COVERS AS SHOWN ON DWG S2.
8. STORE POLES, SLEEVE INSERTS, CABLES AND MONOFILAMENTS FOR REINSTALLATION THE FOLLOWING SEASON.

ALTERNATIVE PROCEDURES (REFER TO CITY OF OTTAWA).

1. POLES AT BEACH AND LAND LOCATIONS MAY REMAIN IN PLACE YEAR-ROUND.
2. STEEL SLEEVE INSERTS MAY REMAIN IN SLEEVES OVER WINTER, BUT ARE REMOVABLE TO FACILITATE CLEANING DURING POLE INSTALLATION.

Attachment D

Species Hazard Ranking

DILLON
CONSULTING

Appendix D – Species Hazard Ranking

US / Canada Hazard Ranking Comparison

Species (Group)	Hazard Rank (USDA / FAA[1])	Hazard Rank (CAR's 322.302)	Hazard Rank (TP 11500)	Mass Rank (by kg)
White-tailed Deer	1	1	1*	1
Vultures	2	18	16	14
Geese (Swans)	3	2	1	3
Cranes	4	10	8	8
Osprey	5	n/a	n/a	7
Pelicans	6	n/a	n/a	5
Ducks	7	5	4	11
Hawks (buteos)	8	4	3	13
Eagles	9	9	7	6
Rock Dove	10	8	6	17
Gulls	11	3	2	15
Herons	12	17	15	9
Mourning Doves	13	16	14	19
Owls	14	7	5	12
Coyote	15	6	2*	2
American Kestrel	16	19	17	18
Shorebirds	17	12	10	21
Crows - Ravens	18	14	12	16
Blackbirds / E. Starling	19	13	11	20
Sparrows	20	11	9	22
Swallows	21	15	13	23
Wild Turkeys	n/a	20	n/a	4
Cormorants	n/a	21	n/a	10

(n/a - not assigned a hazard ranking)
*(TP11500 ranks birds and mammals separately)

Species (Group) (USDA / FAA)	Damage Ranking	Major Damage Ranking	Effect on Flight Ranking	Composite Ranking	Relative Hazard Score
White-tailed Deer	1	1	1	1	100
Vultures	2	2	2	2	63
Geese (Swans)	3	3	4	3	52
Cranes	4	4	7	4	48
Osprey	6	5	3	5	50
Pelicans	5	7	5	6	44
Ducks	7	6	8	7	37
Hawks (buteos)	9	13	10	8	25
Eagles	8	15	9	9	31
Rock Dove	11	8	11	10	24
Gulls	10	11	13	11	22
Herons	12	14	12	12	22
Mourning Doves	14	9	17	13	17
Owls	13	12	19	14	16
Coyote	15	17	6	15	20
American Kestrel	16	10	16	16	14
Shorebirds	17	19	14	17	12
Crows - Ravens	18	16	15	18	12
Blackbirds / E. Starling	19	18	18	19	9
Sparrows	20	21	290	20	4
Swallows	21	20	21	21	2

[1] As prescribed by Dr. Richard Dolbeer, USDA for US Federal Aviation Administration