Appendix A

Work Package 1 – Existing Conditions

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Work Package 1 – Existing Conditions

Jarvis Master Servicing Plan Update

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1.0 INTRODUCTION

1.1 Project Overview

The community of Jarvis is located approximately 15 kilometres north of Lake Erie in the western part of Haldimand County (the County) at the cross roads of Highway 6 and Highway 3. The community has a population of approximately 2,000 residents (Watson, 2018) and development there is predominantly residential. Industrial, commercial, and institutional (ICI) development is concentrated in the north side of the community along Highway 6.

In 2010, the Jarvis Master Servicing Plan (MSP) for Water, Wastewater, Stormwater, and Transportation (Stantec, 2010) was completed. To support planned growth and intensification identified in the County's Official Plan, Haldimand County is undertaking an engineering study to update the 2010 Master Servicing Plan (MSP). The purpose of the study is to update the four (4) servicing components (water, wastewater, stormwater, and transportation) of the 2010 Jarvis MSP to reflect updated land use and growth forecasts in the study area, and identify updates to existing conditions and related assumptions based on growth that has since occurred.

1.2 Objectives of the Master Plan

The Master Plan update will consider the findings from the 2010 MSP, as well as changes to the environment (as defined in the EA Act) and infrastructure since it was completed. Each component of the MSP update will be provided in the framework provided below:

- Work Package 1 – Background Review and Updates to Existing Conditions
- Work Package 2 – Growth Forecast and Assessment of Future Needs
- Work Package 3 – Development of Preferred Servicing Strategies
- Work Package 4 – Implementation Plan, Final Report and Presentation.

As well as updating the MSP, the County is concurrently conducting a Class EA to determine the preferred alternative to increase wastewater treatment capacity for Jarvis. The Class EA will be documented in a separate report.

1.3 Study Area Overview

The study area for the MSP update encompasses the urban boundary of Jarvis, consistent with the 2010 Jarvis MSP study area. Figure 1 illustrates the study area boundary. Municipal infrastructure in Jarvis includes a municipal water and wastewater system, stormwater infrastructure, and a transportation network.

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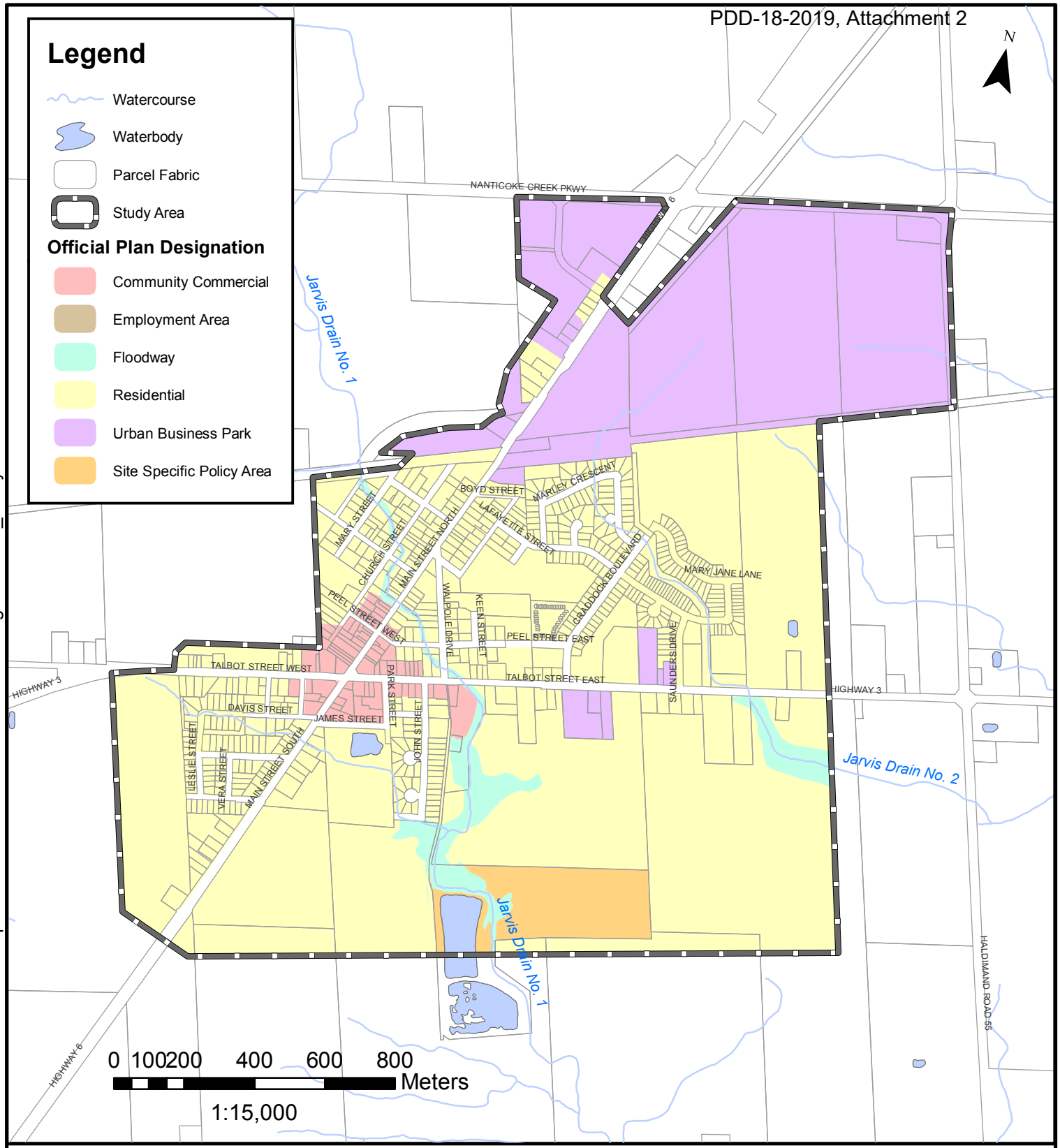

PROJECT:

JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

DRAWING:

STUDY AREA BOUNDARY AND DESIGNATED LAND USES

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FIGURE 1

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Community water is supplied via a transmission main from the Nanticoke Water Treatment Plant (WTP) and stored in a shared elevated tank north of Townsend. Wastewater in Jarvis is conveyed to the Jarvis wastewater treatment lagoons which are owned and operated by the County. The storm system in Jarvis generally consists of traditional stormwater management infrastructure (e.g. ditches, urban curb and gutter networks) and two (2) stormwater management (SWM) facilities. The community of Jarvis is built adjacent to Highway 6 (Main Street) and Highway 3 (Talbot Street). Both those highways are “connecting links” in the Provincial highway network.

1.4 Previous Studies

In 2010, a Master Servicing Plan (MSP) was prepared (Stantec, 2010) to help guide the development of water, wastewater, storm and transportation services with respect to the County’s Official Plan to accommodate future development. Further details of the report findings are discussed in each of the respective servicing subsections.

In addition to the 2010 MSP referenced throughout this report, the following studies related to water, wastewater, stormwater, and transportation infrastructure in Jarvis are referenced in the preparation of this Master Servicing Plan Update.

2010 MSP – present

Haldimand County Services and Planning Division. *Design Criteria*, Version 4.0, April 2015.

Ministry of Municipal Affairs and Housing. Ontario Government, *Provincial Policy Statement, 2014*, Section 3 Planning Act, 30 April 2014.

Haldimand County Planning & Economic Development Department. *The Haldimand County Official Plan*, Council adopted 26 June 2006, Ministry approved 8 June 2009.

Lake Erie Region Source Protection Committee. Long Point Region Source Protection Area Approved Source Protection Plan, Under Clean Water Act 2006, 4 November 2015.

Watson & Associates Economists Limited. *Population, Housing and Employment Projections Study Update*, 2016-2046 - Preliminary Draft Findings. October 2018.

Upper Canada Consultants. *Topographic Volumetric Survey of Jarvis Sewage Lagoons*, 17 July 2018.

Dave Chapman (CPO Inc.). *Jarvis lagoons: Capacity Assessment & Contingency and Abatement Plan Technical Memo,* 6 June 2011.

CPO Inc. and Haldimand County. *Jarvis lagoon Effluent Phosphorous Offsetting,* 20 July 2016.

Stantec Consulting Ltd. *Jarvis Master Servicing Plan Water, Wastewater, Stormwater, and Transportation*, September 2010.

Prior to 2010 MSP

Stantec Consulting Ltd. *Jarvis Inflow and Infiltration Study*, March 2010.

2.0 CLASS ENVIRONMENTAL ASSESSMENT

2.1 Class Environmental Assessment and Master Planning Process

The Ontario Environmental Assessment Act (Act) sets out a planning and decision-making process to consider potential environmental effects before a project begins. The purpose of the Act is to provide for the protection and conservation of the natural environment (R.S.O. 1990, c.E.18, s.2).

The Municipal Class EA process is followed for common types of projects to streamline the review process while ensuring that the project meets the requirements of the Act. In 1987, the first Class EA document prepared by the Municipal Engineers Association (MEA) on behalf of Ontario Municipalities was approved under the Act. Updates and amendments were subsequently made in 1993, 2000, 2007, 2011 and 2015.

This Master Servicing Plan Update is being completed with sufficient detail to fulfil the requirements for Schedule B projects (Approach #2), concurrently with a Class Environmental Assessment, for additional wastewater treatment capacity at the Jarvis Wastewater Treatment Lagoons.

Projects categorized as Schedule B or Schedule C undertakings have the potential for significant environmental impacts and are required to follow specific phases under the Municipal Class EA. This includes consultation with all parties that may potentially be affected by the project and the preparation of a Class EA Project File or Environmental Study Report that documents the Class EA process.

For the Master Servicing Plan Update, a Project File or Environmental Study Report will be made available for public and agency review at the completion of the Class EA process for a mandatory 30-day period. If there are no requests to the Minister of the Environment, Conservation and Parks (MECP) for a ‘Part II Order’ within the review period, then the project can proceed to implementation (Phase 5).

2.2 Problem Statement

To support planned growth and intensification identified in the County’s Official Plan, Haldimand County is undertaking an engineering study to update the 2010 Master Servicing Plan (MSP) The purpose of the Master Servicing Plan Update is to evaluate the community’s long-term infrastructure needs and identify a preferred solution to be implemented to match growth in Jarvis over the next 20 years.

The Class EA framework will enable consideration of options and identify a preferred solution that is environmentally, socially, and financially responsible and sustainable.

The study will consider the needs and viewpoints of all participating stakeholders including, but not limited to, residents, government agencies, the general population, and Indigenous communities.

2.3 Public Consultation Plan

Public and agency consultation for this assignment is anticipated to consist of:

- Notice of Commencement
- Meetings with Review Agencies (as required)
- Project Committee Meetings
- Public Information Centre(s)
- Filing of the Project File/ESR and Notice of Completion

Consultation activities undertaken as part of the MSP Update will be documented in subsequent Work Packages.

3.0 EXISTING CONDITIONS

3.1 Planning Policy Context

3.1.1 Provincial Policy Statement

The Provincial Policy Statement (PPS) enacted in 2005 was in place at the time of the 2010 MSP. Its purpose was to establish the planning framework for all future development within the province.

The 2005 PPS was replaced on April 30, 2014 by the 2014 Provincial Policy Statement (PPS). Like the earlier version, the updated Statement provides general policy guidance on matters of provincial interest related to land use planning and development. The 2014 PPS also provides policy direction for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural environment.

All local planning matters must be consistent with the 2014 PPS, which is issued under Section 3 of the Planning Act.

As part of the update, changes were made to policies related to infrastructure, servicing (sewer and water), climate change, natural heritage wetlands and water, and aboriginal interests that may have implications at the Master Plan level. In subsequent phases of this Master Plan and Class EA, alternatives will be assessed on the basis of conformance with the 2014 PPS.

3.1.2 Places to Grow

The Growth Plan for the Greater Golden Horseshoe, 2017 was released on May 18, 2017 and came into effect on July 1, replacing the Growth Plan for the Greater Golden Horseshoe, 2006. The present study area is in the Greater Golden Horseshoe Growth Plan Area.

3.1.3 Haldimand County Official Plan

The Haldimand County Official plan was adopted by Council in 2006 and approved by the Ontario Ministry of Municipal Affairs & Housing in 2009. The Official Plan has not been updated since the completion of the 2010 MSP and an update is underway to incorporate changes from the Growth Plan for the Greater Golden Horseshoe.

3.2 Population and Household Forecast

3.2.1 Population

Estimates of population and household growth for Jarvis are currently being prepared in the Population, Housing, and Employment Projections Study Update, 2016-2046 (Watson, 2018). A preliminary version of the study indicates that that the population of Jarvis was 2,000 in 2016, down from the 2011 population of 2,500 persons.

3.2.2 Equivalent Population

The following assumptions updated from 2010 MSP based on Haldimand County Design Criteria Version 4.0, April 2015 and input from County staff were used to calculate equivalent population.

- Low/medium density housing equivalent population of 55 persons/ha.
- High density housing equivalent population of 135 persons/ha.
- Commercial equivalent population of 90 persons/ha.
- Actual development coverage to be 75% of vacant land for industrial, commercial and institutional land uses.

Since the completion of the 2010 MSP, approximately 5.9 ha (99 units) of low density residential land, 0.65 ha (24 units) of high density residential land, and 0.51 ha of commercial land has been developed.

A summary of existing equivalent population is provided in Table 1

Table 1 Summary of Equivalent Population for Jarvis

Year(s)	Equivalent Population
2010	2168 (1)
2010-2018 Residential Growth	345
2010-2018 ICI Growth	47
Total Existing	**2560**

Table 1 Notes:

1. From 2010 MSP.

3.2.3 Land Use and Existing Development

Existing land use in Jarvis consists of residential, industrial, institutional, and commercial uses. Since the completion of the 2010 MSP, in spite of an overall decline in population, approximately 5.9 ha (99 units) of low density residential land, 0.65 ha (24 units) of high density residential land, and 0.51 ha of commercial land has been developed. The distribution of existing development, highlighting new development since the 2010 MSP is provided in Figure 2.

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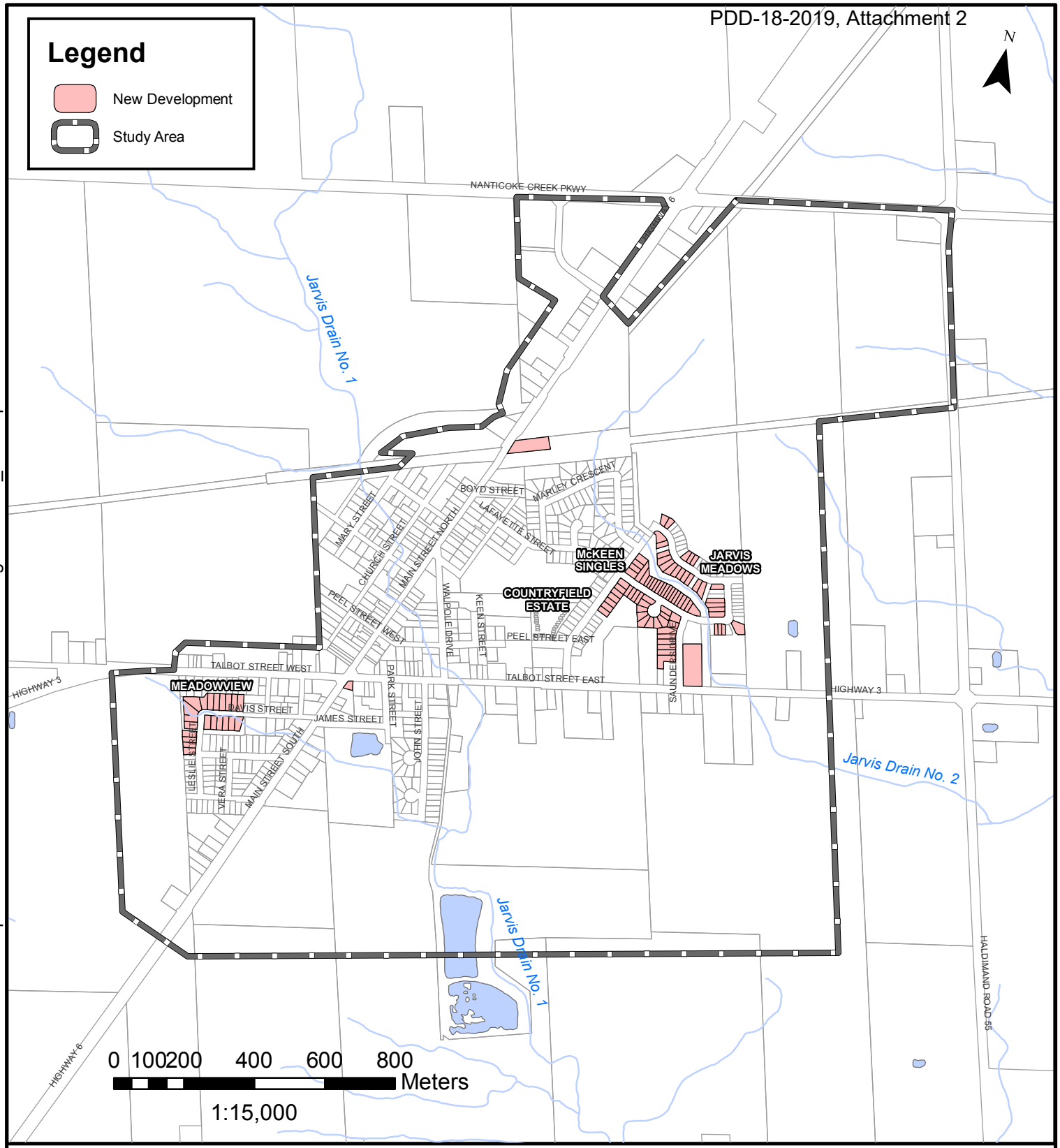

PROJECT:

JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

DRAWING:

DEVELOPMENT FROM 2010 TO 2018

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FIGURE 2

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3.3 Environmental Features

3.3.1 Source Water Protection

Ontario's Clean Water Act provides the mandate for a provincial drinking water source protection program in Ontario. Its focus is on the protection of water sources for municipal drinking water systems, with additional attention to surface water and groundwater sources on the broader landscape.

The Long Point Region Source Protection Area Approved Source Protection Plan (the Source Protection Plan) released in 2015 identified Intake Protection Zones to protect the source water for municipal residential drinking water systems. Jarvis' drinking water comes from the Nanticoke Industrial Pump Station Intake at the Nanticoke WTP.

Changes near the intake at the Nanticoke WTP are beyond the scope of this study, and no part of the Intake Protection Zone (IPZ), or any other IPZ, is located within the study area boundary for this Master Plan and Class EA. As such, impacts to the IPZ are not anticipated as part of the alternatives considered.

3.3.2 Subsurface Natural Gas

As part of the Jarvis 2010 MSP, Stantec conducted a Methane Review in June 2009. The review followed two (2) separate house explosions that occurred in Jarvis between 1991 and 2009 as a result of the release of subsurface natural gas. The review conclusions showed that Jarvis is situated on highly fractured bedrock, providing an easy pathway for natural gas to reach the surface. Stantec concluded that the release and accumulation of natural gas is an ongoing threat in Jarvis.

3.3.3 Geology and Hydrogeology

Results of the Jarvis 2010 MSP indicate the area has a relatively flat landscape and the topography is divided into two (2) drain subwatersheds that drain to Jarvis Municipal Drain No. 1 and No. 2 respectively. It was found that overland drainage is generally restricted by the limited relief which results in flooding.

Information regarding soil in the Jarvis 2010 MSP was gathered from Ontario Soil Survey 57 – Regional Municipality of Haldimand-Norfolk. The soil survey conclusions showed the watershed soils are situated entirely on the poorly draining Haldimand Clay Plain, and site soils are primarily lacustrine heavy clay with limited infiltration capability.

The bedrock is shallow in several areas of Jarvis, including Municipal Drain No. 1. Portions of the channel bottom are formed by bedrock. The Jarvis 2010 MSP included a Canada Land Inventory (CLI) review that classified the soil in the urban boundary of Jarvis as Class 2D agricultural soil. Class 2 soils have moderate limitations and can be managed and cropped with little difficulty. Subclass D classifies undesirable soil structure and/or low permeability with critical clay contents in the upper soil profile.

Geotechnical or hydrological conditions in the study area are generally understood to be consistent with the 2010 MSP. Investigations should be completed prior to any construction to verify site specific conditions.

3.3.4 Natural Heritage

As part of the Jarvis 2010 MSP, Stantec conducted a Fisheries Habitat and Community Inventory Survey in June 2009. The survey concluded that Jarvis Municipal Drains No. 1 and 2 are classified as warm water intermittent systems, but only Jarvis Municipal Drain No. 1 was found to support direct fish habitat.

Stantec also completed a Vegetation Survey in 2009 as part of the Jarvis 2010 MSP that included a review of Long Point Region Conservation Authority (LPRCA) wetland/woodlot mapping for the study area, and an Ecological Land Classification field survey. The study concluded that 1) a large portion of Jarvis contained agricultural land, 2) there are two (2) different forest community types, 3) no wetland communities exist, and 4) all communities are considered provincially common.

All species observed are ranked S5 (secure) with the exception of black walnut S4 (apparently secure) which is noted as common in Haldimand County. No nationally, provincially, or locally rare, threatened, or endangered species were observed.

As part of the environmental features survey in the Jarvis 2010 MSP, Stantec conducted a review of the National Heritage Information Centre (NHIC), as well as Department of Fisheries and Oceans (DFO) databases to identify species at risk in the study area. None were identified within the Jarvis study area.

Based on the findings from these previous studies, the potential for disruption to the natural environment is relatively low. However, that should be confirmed prior to implementation of the preferred alternative, particularly if work in or near a watercourse is proposed.

3.3.5 Archaeological Resources

No archaeological studies were completed as part of the Jarvis 2010 MSP. It is recommended that if ground disturbance is associated with future developments, an archaeological assessment (Stage 1 or Stage 2) should be conducted by a licenced consultant archaeologist prior to implementation of the preferred alternative.

3.3.6 Cultural Heritage

No cultural heritage studies were completed as part of the Jarvis 2010 MSP. It is recommended that a Cultural Heritage Assessment Report be conducted prior to project implementation, if required.

3.3.7 Hydrologic Setting

Hydrologic setting details/information were established in the Jarvis 2010 MSP. One change to the established hydrologic setting is that Jarvis Municipal Drain No.2 now also flows through the Jarvis Meadows development to the south-east of Craddock Boulevard, as well as predominately agricultural and open space lands.

4.0 WATER SERVICING

4.1 Summary of Findings from the 2010 MSP

As part of the Stantec 2010 MSP Report, a hydraulic model was developed to analyze the existing water distribution system and aid in the selection of preferred future system upgrades. The hydraulic model was prepared using H2OMAP Water software with County Geographic Information Systems (GIS) information to provide a basis for model infrastructure.

Existing water demands were based on available metering records, while future demands were generated based on projected growth areas. Haldimand County Design Criteria was used to supplement unavailable water usage data.

Conclusions from the 2010 MSP Report found that the water pressures throughout the Jarvis water distribution system were acceptable. A watermain restriction was observed, however, near the intersection of Main Street and Boyd Street where the pipe diameter reduces to 200 mm diameter. The restriction creates a bottleneck that limits fire flows availability, but the limited flows remain within acceptable limits.

The report recommended a new 400 mm diameter watermain be constructed along Talbot and Main Street and connect to the existing 750 mm diameter watermain on Keith Richardson Parkway. This proposed watermain would add a secondary connection to the Nanticoke WTP and eliminate the bottleneck restriction near the Main and Boyd intersection.

The report also recommended construction of new watermains to service proposed growth areas as well as to those vacant lots that provide opportunities to loop the existing water distribution system.

4.2 Water Demand Update

4.2.1 Average Day Water Demand

A review of available flow data from 2013 to 2017 was conducted to confirm the estimated existing demand. Water demand in Jarvis is measured at the main meter, at the Jarvis water depot, and on a customer-by-customer basis at the point of use.

The average annual day flows from each recording device are summarized in Table 2.

Table 2 Historical Average Water Demand (2013-2017)

Year	Jarvis Main Meter (m^3/day)	Jarvis Internal Meters (m^3/day)	Jarvis Depot (m^3/day)	Jarvis Unaccounted (m^3/day)	Jarvis Unaccounted (%)
2013	637	353	198	86	14%
2014	651	477	187	81	12%
2015	640	441	269	65	10%
2016	709	--(1)	252	55	--(1)
2017	741	409	220	42	6%
Average (m^3/day)	676	420	225	66	10%
Average (L/s)	7.82	4.86	2.61	0.76	10%

Table 2 Notes:

1. Internal water meter read records were incomplete for 2016 and only included January and February. This year was removed from the calculation of the average meter readings and unaccounted water.

4.2.2 Maximum and Peak Hour Demand

Because maximum day and peak hour flows are not recorded at the Jarvis metering points, no further assessment could be made of those flows. In the following section, maximum day and peak hour demands are estimated based on peaking factors recommended by Haldimand County staff.

4.3 Updated System Information and Modelling

4.3.1 Water Distribution System Modelling

The water model was updated in the Innovyze modelling software, InfoWater as the software developer no longer supports the H20MAP platform used at the time of the 2010 MSP. All model inputs can be found in Appendix A.

4.3.2 Water Treatment Plant

Water for Jarvis is supplied by the Nanticoke WTP (which also supplies Hagersville, Townsend, and the Nanticoke Industrial Park) with a rated capacity of 13,625 m^3/day. As per discussions with the County, water supply was assumed to be adequate and was not further reviewed.

4.3.3 Water Distribution System

The County's GIS data was used to update the watermain in the InfoWater model and the existing water distribution system is shown in Figure 3. Watermain extensions or upgrades since the 2010 MSP are highlighted in yellow. No other major changes to the water distribution system were noted since completion of the 2010 MSP.

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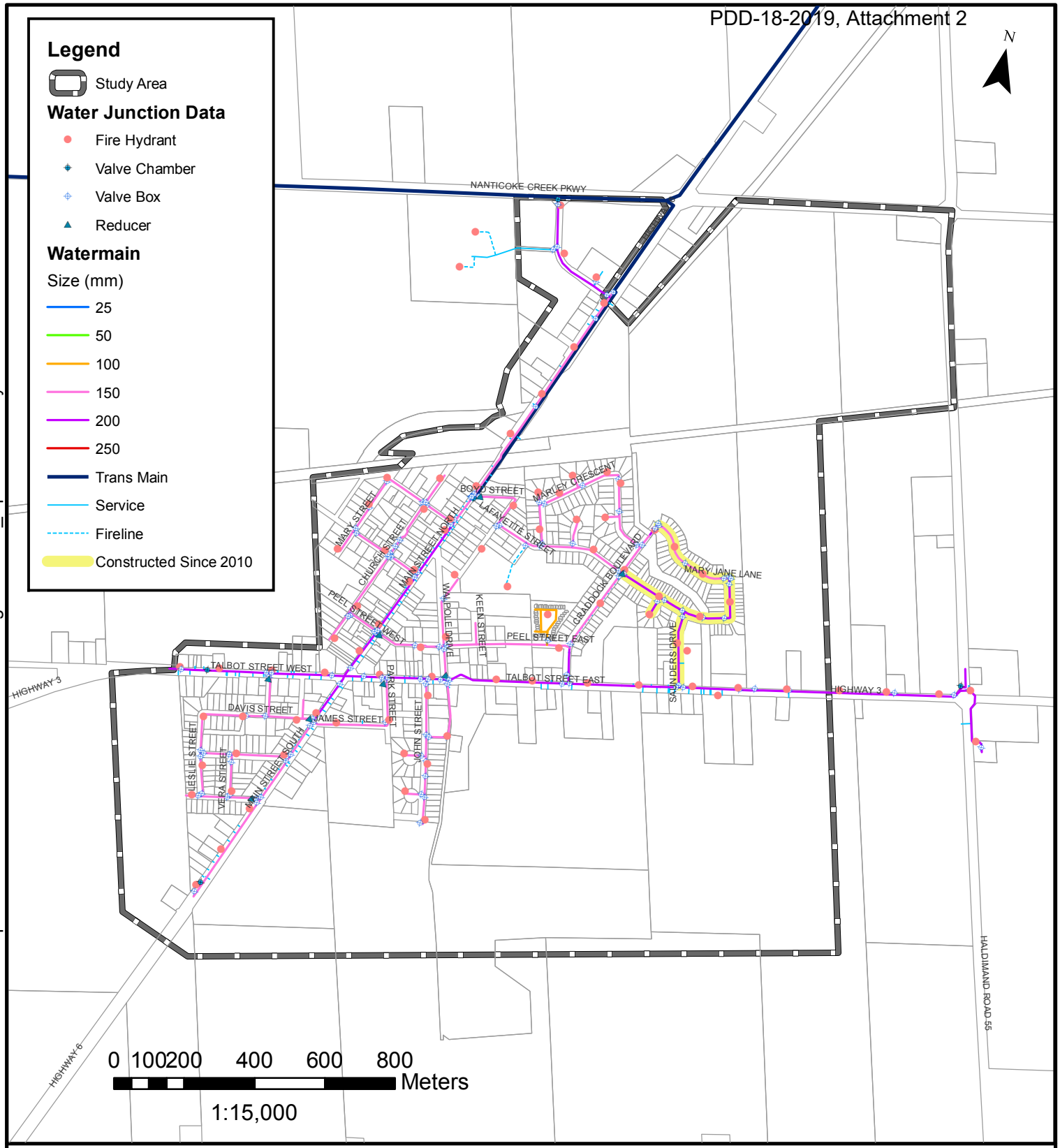

PROJECT:

JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

DRAWING:

UPDATES TO EXISTING WATER SYSTEM

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FIGURE 3

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4.3.4 Modelled Water Demand

Since the completion of the 2010 MSP, approximately 5.9 ha (99 units) of low density residential land, 0.65 ha (24 units) of high density residential and 0.51 ha of commercial land has been developed. To update the existing conditions in the model, the metered flow from each new parcel from 2017 was used. Metered flows were increased by 10% (per Table 1) to adjust for unaccounted water. Based on input from the County, the maximum day and peak hour factors used are maximum day factor of 2.0 and a peak hour demand factor of 3.0. This new demand was added to the 2010 MSP existing conditions water demand. The demand from the water depot has been updated to reflect average usage. The updated average, maximum, and peak water demands included in the model are summarized in Table 3.

Table 3 Summary of Modelled Water Demands (Existing)

Land Use	Average Day (L/s)	Maximum Day (L/s)	Peak Hour (L/s)
2010 Residential Demand	3.94	8.87	15.76
2010 ICI Demand	0.94	1.88	2.82
Water Depot	2.61	5.22	7.83
Additional Residential to 2017	0.39	0.79	1.18
Additional ICI to 2017 (1), (2)	0.006	0.012	0.018
Total 2017 Water Demand	**7.89**	**16.77**	**27.61**

Table 3 Notes:

1. Inconsistent internal meter records for Tim Hortons (2120 Main Street North) ICI development. Only internal meter records for August 2017 – December 2017 were included for average day flow calculation.

2. No internal meter records available for Motorcycle Sales & Service Operation (1 Talbot Street East) ICI development. Meter records for 2002 Main Street South (Neighbouring property owned by same company) were used in place.

As shown above the updated existing average, maximum, and peak water demands are estimated to be 7.89, 16.77, and 27.61 L/s, respectively. The updated average day demand is consistent with measured demand of 7.82 L/s noted in the previous section.

4.3.5 Storage Requirements

An elevated storage tank located at the north-east of Townsend provides storage for both Jarvis and Townsend. The storage volume provided by the tank is 2,300 m^3. Storage requirements were calculated based on the MECP (formally MOE) Design Guidelines for Drinking-Water Systems (2008), with fire storage requirements modified to assume that 50% of fire flow volume is pumped and the remainder is from storage. Using this approach adopted by Haldimand County, there is adequate storage to serve existing development. Table 4 summarizes the existing total water storage volume required for Jarvis, Townsend, and for overall.

Table 4 Existing Treated Water Storage Requirements

Area	Maximum Daily Demand (m^3/day)	Average Day Demand (m^3/day)	Equivalent Population	Fire Storage Volume Required (m^3) A	Equalization Storage (m^3) B	Emergency Storage (m^3) C	Total Water Storage Volume Required (m^3) A+B+C
Jarvis	1,449 (1)	681 (1)	2,560	372	362	184	918
Townsend	772 (2)	386 (2)	1,000 (3)	230	193	106	529
Total	**2,221**	**1,067**	**3,560**	**603**	**555**	**289**	**1,447**

Table 4 Notes:

1. Refer to Table 3 for development of Jarvis maximum daily and average day demand. The maximum daily demand and average day demand includes Water Depot Demand of 5.22 L/s (451 m^3/day) and 2.61 L/s (226m^3/day) respectively.
2. Calculated Average Daily Demand using Townsend 2017 internal meter records and calculated Maximum Daily Demand using Maximum Day Factor of 2.0.
3. Townsend equivalent population from preliminary findings of Watson & Associates Economists Limited update for the Halidmand County Population, Housing and Employment Projections Study for 2016 to 2046 (Watson, 2018).

The existing storage capacity of the elevated storage tower is 2,300 m^3 and the existing storage capacity required is 1,447 m^3. The existing storage capacity provided is sufficient for the total required storage with available surplus.

4.4 Existing Water Servicing Conditions and Constraints

4.4.1 Service Pressure

No existing service pressure deficiencies were identified in Jarvis. Modeling results indicate that the system currently operates within the MECP recommended pressure range of 275 kPa to 550 kPa during the peak hour demand scenario. Existing system pressures are shown in Figure 4.

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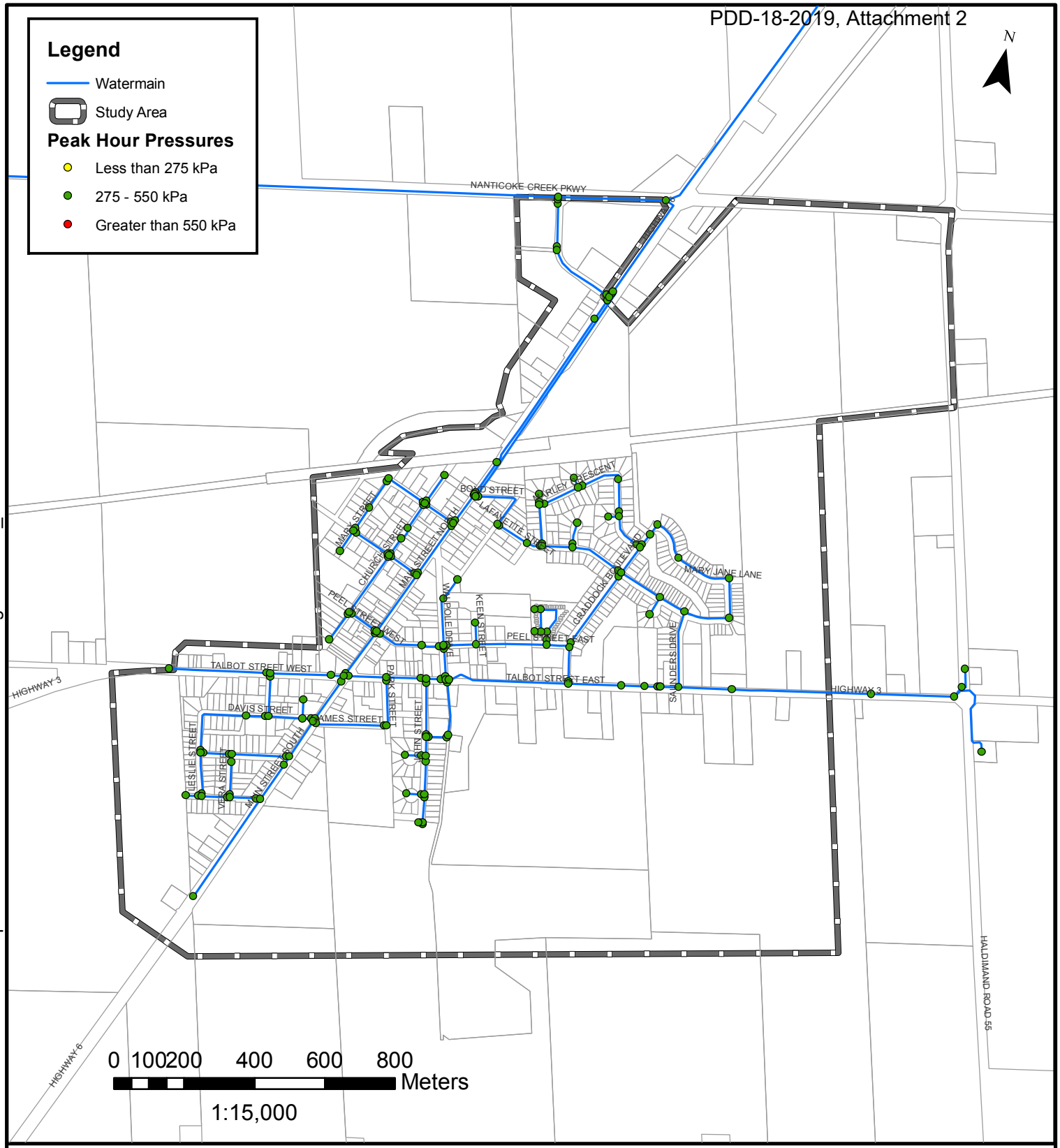

PROJECT:

JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

DRAWING:

SYSTEM PRESSURES UNDER PEAK HOUR DEMAND

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FIGURE 4

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4.4.2 Available Fire Flow

Existing fire flow availability in Jarvis was found to range between 33 L/s and 294 L/s during the maximum day demand scenario. Areas with low available fire flow are at the extremities (dead-ends) of the system, and include the Water Depot, located at 1342 Nanticoke Rd., Jarvis.

Table 5 presents a baseline for the percentage of junctions in the water model that are capable of meeting the indicated fire flow under existing conditions. Fire flow availability from the existing water distribution system is shown in Figure 5 .

The County is currently developing design criteria for minimum fire flow requirements for new developments. It is anticipated that that the minimum flow permitted will be approximately 160 L/s from two (2) adjacent hydrants (approximately 80L/s from each hydrant).

Approximately 40% of junctions are capable of meeting the proposed requirement of 80 L/s under existing conditions.

Table 5 Percentage of Junctions Capable of Meeting Fire Flow (2018)

EXISTING - Max Day + Fire Flow	
Fire Flow (L/s)	**Percentage (%) of Junctions Capable of Meeting the Fire Flow Indicated**
60	85.6%
80	39.4%
100	10.6%
150	9.6%
200	6.4%
250	3.2%

4.4.3 System Redundancy

As noted in the 2010 MSP, is a single connection via a 500 mm diameter transmission main provides water to Jarvis and Hagersville. The County may wish to consider an additional connection from the Nanticoke WTP to increase water supply redundancy and improve system looping.

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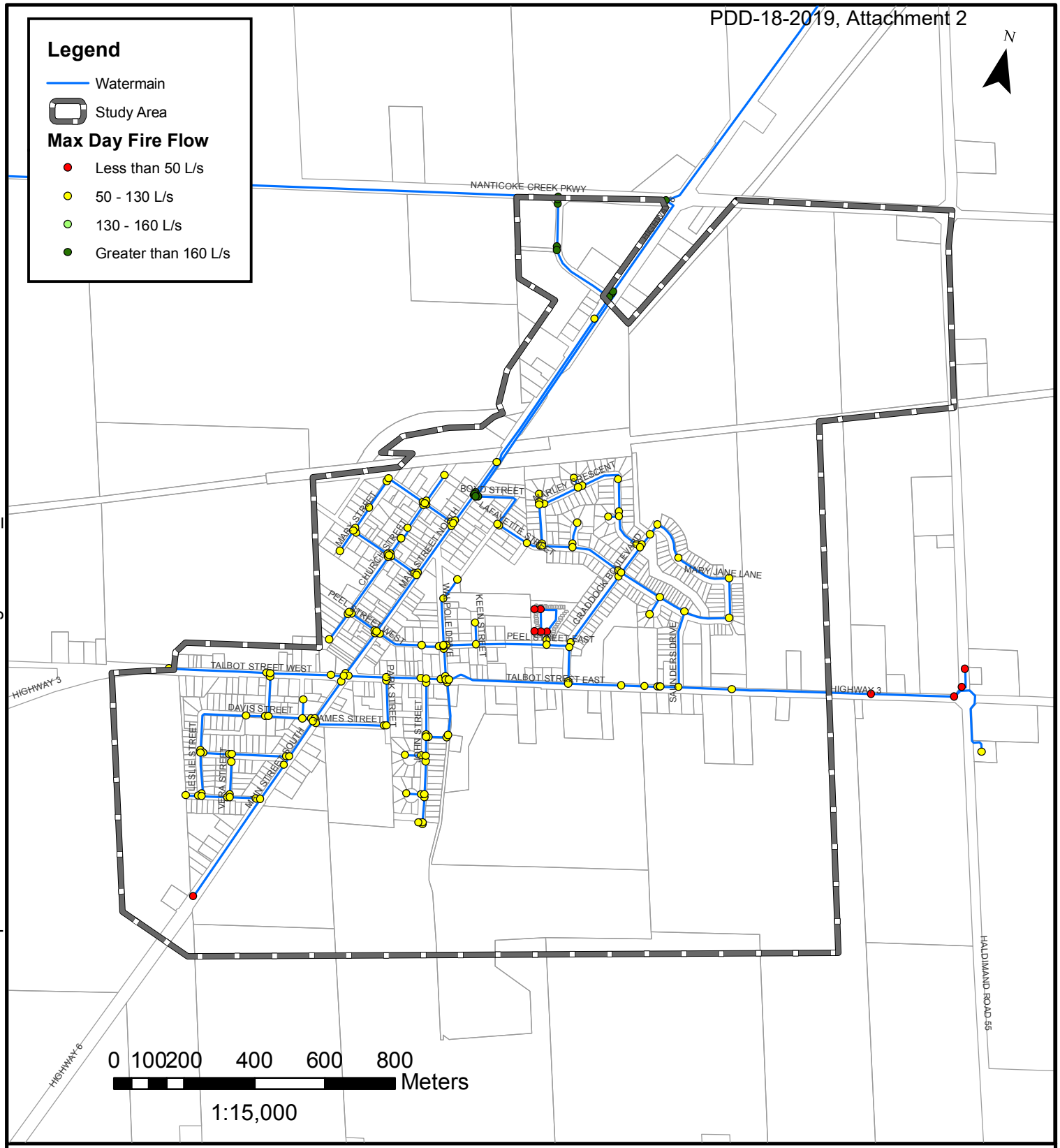

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JARVIS MASTER SERVICING PLAN UPDATE

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DRAWING:

AVAILABLE FIRE FLOW UNDER MAXIMUM DAY DEMAND

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FIGURE 5

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5.0 WASTEWATER SERVICING

5.1 Summary of Findings from 2010 Master Servicing Plan

As part of the 2010 MSP, a steady state simulation model was prepared using H2OMAP Sewer GIS Professional (Version 9.0) software. Infrastructure information was generated by means of a field survey of the wastewater collection system, which was supplemented as required by the County's GIS system, 'As-built' plan and profile drawings, design briefs, and partial Aqua Data GIS files. Flow rate data was calculated using results from the Inflow & Infiltration (I&I) study, following Haldimand County Design Criteria procedure. Future flows were generated using the Design Criteria.

Conclusions from the 2010 MSP found the wastewater collection system operates as designed for the majority of the year, with the exception of one (1) bottleneck that forms at the intersection of Talbot Street and Walpole Street. The report found that overloading of the Peel Street Sewer and portions of the Main Street Trunk occurs following spring freshet flows. There is significant demand on the collection system from additional inflow and infiltration sources particularly in the spring. The flow velocities were found to be for the most part acceptable except for select upstream areas with flat pipes and small drainage areas.

Overall, in the 2020 MSP, many areas of the wastewater collection system demonstrated capacity to accept future growth. Provided I&I reduction efforts are successful in reducing extraneous flows to system design levels, the wastewater system can accommodate peak design flows until 2018. Construction of the Municipal Drain No. 1 channel will also help to reduce amounts of extraneous flows entering the system.

5.2 Wastewater Flow Update

5.2.1 Average Wastewater Flow Rates

Since 2007, raw sewage flow to the lagoon has been measured by a magnetic flow meter. A new replacement magnetic flow meter was installed in April 2017 and in 2009, a Milltronic Multi-Ranger unit was installed to calculate flows based on the level in the pump wet well. In recent years, effluent flow has been measured by two (2) Palmer Bowlus Flumes, one for Cell No. 1 and/or 2 and one for Cell No. 3 and/or 4.

The average annual day flows from each recording device are summarized in Table 6.

Table 6 Historical Average Raw Sewage Flows (2013 – 2017)

Year	Magnetic Flow Meter (m^3/day)	Multi-Ranger Unit (m^3/day)	Palmer Bowlus Flumes (m^3/day) (1)
2013	887	623	739
2014	1295	594	945
2015	697	605	739
2016	691	553	583
2017	985	855	867
Average	911	646	775

Table 6 Notes:

1. Effluent flows measured by the Palmer Bowlus Flumes were adjusted by adding annual precipitation (from the Hamilton International Airport) and subtracting evaporation, estimated at 554 mm/year from CPO, Inc (2011).

In 2018, the Jarvis Lagoons Operation and Capacity Update study was conducted by Haldimand County to assess the capacity of the Jarvis Lagoons for re-rating (Haldimand County, 2018). The study reviewed historical average influent flow measurements and concluded that due to improper equipment installation, the flow measurement devices are unreliable and all the influent flow data is potentially inaccurate. The 2017 Magnetic Meter average day flow value appears to be representative of a wet year with a higher and more conservative estimate of the average day flow. As such, the 2017 Magnetic Meter average day flow volume of 985 m^3/day will be used for treatment system design purposes at the lagoon (documented in a separate Class EA report). Refer to section 5.3.5 for an estimation of existing wastewater collection system flows.

5.2.2 Maximum Day Wastewater Flow Rates

The maximum day flows from each recording device are summarized in the Table 7.

Table 7 Historical Maximum Day Raw Sewage Flows (2013 – 2017)

Year	Magnetic Flow Meter (m^3/day)	Multi-Ranger Unit (m^3/day)
2013	5210	1100
2014	5991	1065
2015	5620	9266
2016	4515	1070
2017	5363	2157 (1)
Average	5340	2932

Table 7 Notes:

1. Multi-Ranger Unit in 2017 had an error reading of 11,046 m^3/day as the maximum day raw sewage flow. This entry was excluded and the next highest maximum day raw sewage flow reading of 2157 m^3/day for 2017 was used.

For maximum day flow, the most accurate data is believed to be from the magnetic flow meter. The average maximum day flow is 5,340 m^3/day which will be used for treatment system design purposes at the lagoon (documented in a separate Class EA report).

5.3 Updated System Information and Modelling

5.3.1 Hydrologic and Hydraulic Modelling

PCSWMM was the preferred software used for model development. The 2010 MSP used H2OMAP Sewer GIS Professional for wastewater analysis, but this software is now obsolete. The selection of PCSWMM was based on cost efficiency and consistency with the stormwater modelling. It also uses the open-source EPA SWMM engine, which can be freely downloaded from the EPA website. PCSWMM also produces shapefiles, which can be exported and used in a GIS database. The SWMM engine can perform a steady state analysis as was accepted in 2010 as the study was primarily focussed on conveyance capacity and this remains the case.

Infrastructure attributes, including flow rates for existing areas, were entered into the model from the previous H2OMAP model. Flow rates for areas developed since 2010, specifically the Jarvis Meadows area, were calculated as per Section 5.1.1. Wastewater catchment areas for the Jarvis Meadows development were generated so that flows were assigned to the nearest upstream manhole. As per the 2010 MSP, extraneous flow allowances were calculated in the model using the design rate per hectare and multiplying by the contributing catchment area for each pipe section. All model inputs can be found in Appendix B.

5.3.2 Wastewater Treatment Lagoon

The gravity sewer network collects all sewage flow from the Jarvis community that is directed to the Jarvis Sewage Pumping Station (SPS) from which flow proceeds south via a 250 mm diameter forcemain to the Jarvis Wastewater Lagoons for treatment (rated capacity of 853 m^3/day). The Jarvis Treatment Lagoon system is being reviewed as part of a Class EA being conducted concurrently with this Master Plan update. Refer to Class EA documents for additional information about the Jarvis Treatment Lagoon.

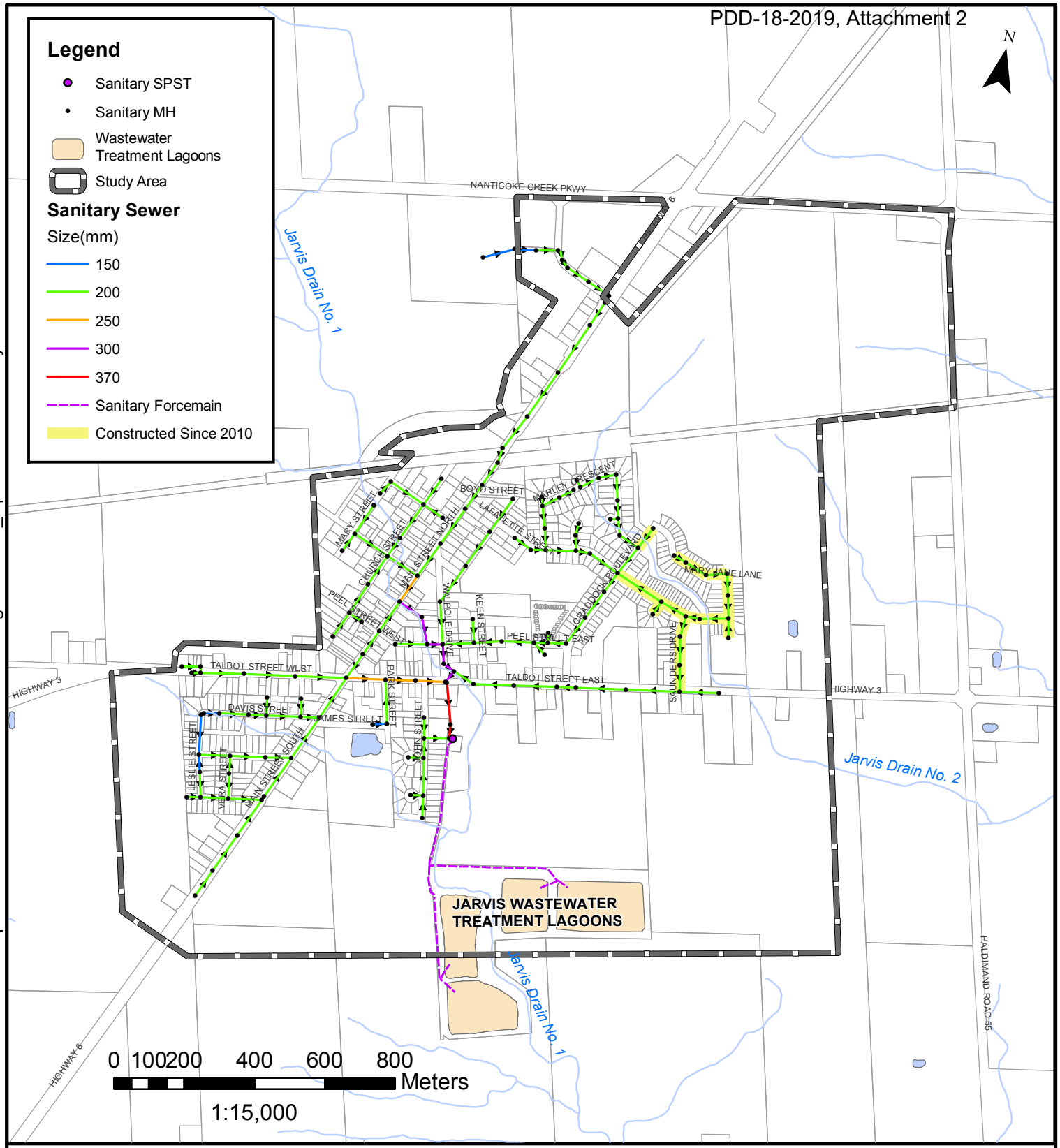
5.3.3 Pumping Station

The Jarvis SPS is located south of Talbot Street and east of the access road. The station has three (3) submersible pumps, each with an approximate pumping capacity of 60 L/s. A pump has been upgraded since the 2010 MSP and the current the firm capacity of the SPS is 120 L/s.

5.3.4 Wastewater Collection System

The County's GIS data was used to update the sewermain in the model. There are six (6) primary sewersheds: Main Street North, Craddock Boulevard/Peel Street, Talbot Street West, Talbot Street East, Walpole Street/John Street, and Jarvis Meadows. The existing wastewater collection system is shown in Figure 6. Sewermains added or upgraded since the 2010 MSP are highlighted in yellow. There have been no other changes to the wastewater collection system since the 2010 MSP was completed.

PDD-18-2019, Attachment 2



PROJECT:

JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

DRAWING:

UPDATES TO EXISTING WASTEWATER COLLECTION SYSTEM

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FIGURE 6

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5.3.5 Modelled Wastewater Flows Collection System

Since the 2010 MSP, approximately 5.9 ha (99 units) of low density residential land, 0.65 ha (24 units) of high density residential land and 0.51 ha of commercial land has been developed. In the 2010 MSP, the existing wastewater flow rates were calculated using a uniform per capita generation rate and an equivalent population. To add wastewater flow on lands developed since 2010 into the model, the equivalent population for each residential parcel added since the 2010 MSP was calculated. The 2015 Haldimand County Design Criteria equivalent population density for single family home is 55 persons/ha (3 person/unit). Once equivalent populations for newly developed parcels were established, the total existing flow was determined as follows:

- The average dry weather flow was calculated for each new parcel using the per capita sewage generation rate from the 2010 MSP of 280 L/capita/day.
- Peaking factors, based on the Harmon formula, were then used to determine the peak flow rates generated from newly added and existing parcels.
- Wet weather flow rates were calculated by assuming an inflow and infiltration (I/I) rate of 0.23 L/s/ha per the 2015 Haldimand County Design.

The updated average, peaked dry weather, inflow and infiltration, and total peaked wet weather flow are summarized in Table 8

Table 8 Summary of Modelled Wastewater Flow (Existing)

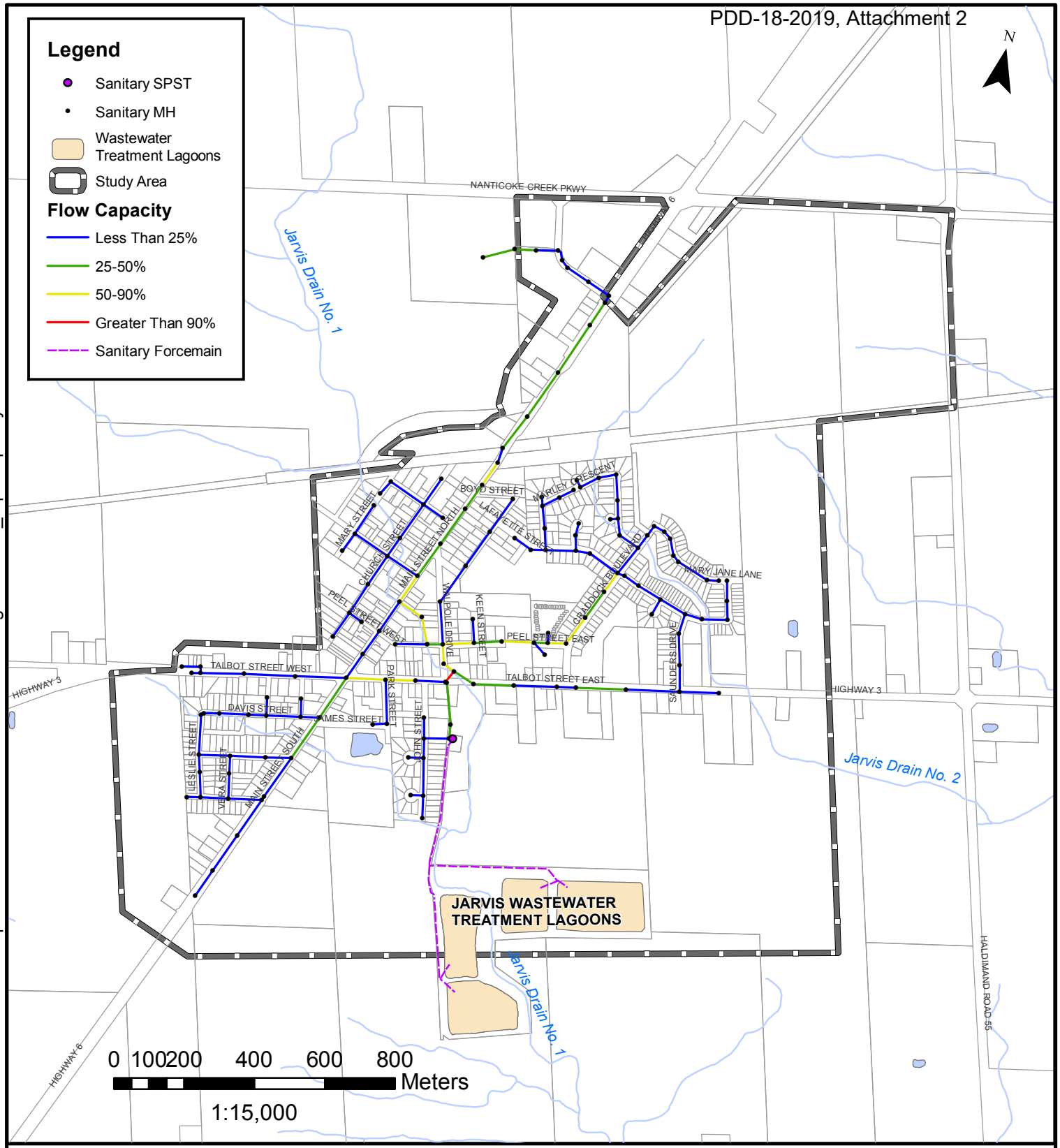
Land Use	Average Day Dry Weather (L/s)	Peaked Dry Weather (L/s)	Inflow and Infiltration (L/s)	Total Peaked Wet Weather Flow (L/s)
2010 Residential & ICI Flow	7.3	25.9	25.0	50.9
Additional Residential to 2017	1.12	4.76	2.68	7.44
Additional ICI to 2017	0.15	0.64	0.96	1.60
Total 2017 Wastewater Flow	**8.56**	**31.3**	**28.7**	**60.0**

Using this approach the updated existing peaked wet weather wastewater flow rate is estimated to be 60.0 L/s (5,184 m^3/day). As noted in the 2010 MSP, actual I&I rates during the spring can be higher than the design value; however, for normal wet weather events the I&I rates are within the design range.

5.4 Existing Wastewater Servicing Conditions and Constraints

The modelling results show that the wastewater conveyance system appears to operate as intended with the exception of one location. There is a bottleneck in the system at the intersection of Talbot Street and Walpole Street, which accepts flow from the north and eastern portion of Jarvis. The surcharge experienced in the system during the design dry weather peak condition remains just above the pipe. The remainder of the system exhibits several locations where there is available residual capacity to accept growth. Velocities in the system under design conditions range from 0.15 m/s to 1.34 L/s, with the low velocities occurring in upstream areas where flat pipes and small drainage areas exist. Figure 7 shows the flow to pipe capacity ratio for the existing wastewater conveyance system.

PDD-18-2019, Attachment 2



PROJECT:

JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

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FLOW TO PIPE CAPACITY RATIO

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FIGURE 7

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6.0 STORMWATER

6.1 Summary of Findings from 2010 Master Servicing Plan

Stormwater servicing assessed as part of the 2010 MSP included conveyance infra-structure and stormwater management practices. Hydrologic and hydraulic modelling was completed using Wallingford Software (MWH-Soft) InfoWorks CS and generated GIS, field survey data and previous modeling files. The model was used to estimate stormwater runoff rates and the capacity of the storm sewer and drainage network. Conclusions from the 2010 MSP found that the stormwater drainage system functions as expected for regular rainfall events. Based on synthetic design rainfall events, the hydraulic modeling shows that the majority of the storm sewers are surcharged under the design 5-year event. The report found water to be contained below the surface for the 5-year event with the exception of three (3) locations where water surcharges to the surface: Marley/Craddock, Talbot Street East and Main Street North.

The report recommended a stormwater management servicing strategy for each development area in Jarvis, including conveyance and stormwater management practices to be implemented. Report recommendations included improvements to existing storm sewers to handle 5-year storm events, new stormwater sewers to serve future developed areas, and stormwater management facilities to improve water quality and limit peak flows within respective areas.

6.2 Updated System Information and Modelling

6.2.1 Hydrologic and Hydraulic Modelling

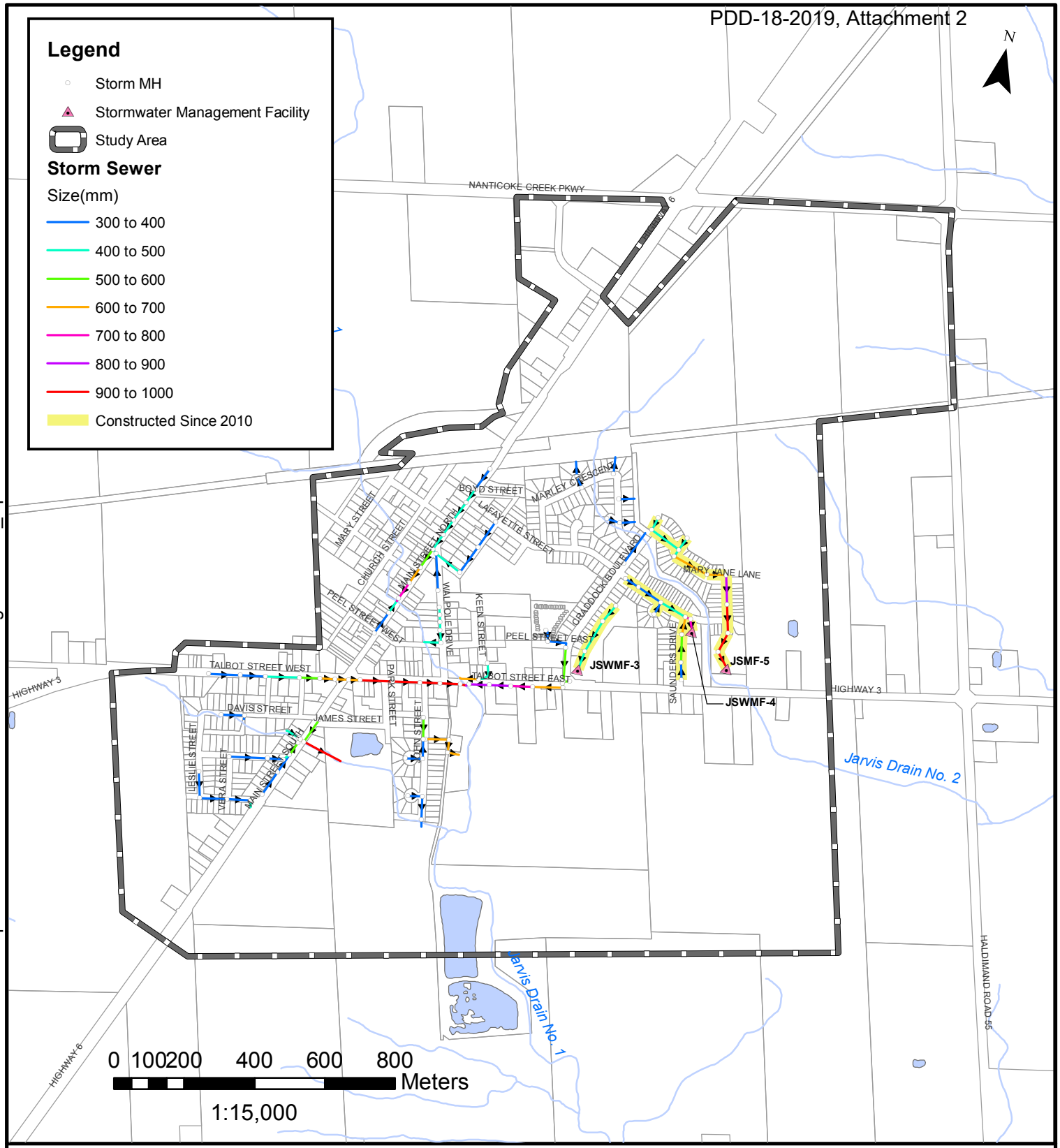
The computer simulation model was updated from the 2010 MSP and converted from the InfoWorks CS to PCSWMM. The PCSWMM modeling software uses the open source EPA SWMM 5.0 engine in a GIS environment. The model was constructed using the validated inputs from the 2010 Master Plan model with some updates.

The PCSWMM model was used to generate peak flows for the 2-year, 5-year, and 100-year design storm events. Jarvis was modeled using subcatchments, junctions, and conduits to represent the drainage areas, maintenance holes/inlets, storm sewers, culverts, roads, drains, and ditches. The drainage system was analyzed under existing conditions to determine where constraints exist. No flow monitoring was undertaken for the update. The general impervious land use characteristics have been updated to reflect the sub-area routing in the SWMM engine. No model verification was undertaken for the update. All parameters are from the previous model completed for the 2010 MSP that did go through a verification process. Detailed input files are found in Appendix C.

6.2.2 Stormwater Drainage System

The minor drainage system is intended to handle drainage from relatively frequent storms generally having a return period of less than five (5) years. These works typically consist of storm sewers and roadside ditches/swales. The existing stormwater drainage system is shown in Figure 8. Roads and drainage infrastructure added or upgraded since the 2010 MSP are highlighted in yellow.

PDD-18-2019, Attachment 2



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JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

DRAWING:

UPDATES TO EXISTING STORMWATER DRAINAGE SYSTEM

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FIGURE 8

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6.2.3 Municipal Storm Drainage Infrastructure

The storm sewer system is divided into seven (7) main sewersheds. The Jarvis Meadows area to the south east of the town has been developed since the previous MSP in 2010. Both phases of the Jarvis Meadows residential subdivision outlet to Jarvis Municipal Drain No. 2, upstream of Talbot Street.

A storm sewer on the northeast side of the Jarvis Meadows area builds to a 900 mm diameter sewer, which discharges into a stormwater management facility to provide quantity and quality control prior to release into Jarvis Municipal Drain No. 2. Phase 2 of the development on the west side of Jarvis Municipal Drain No.2 drains via 675 mm diameter sewer to a Stormwater Management Facility which also provides quantity and quality control prior to discharging to Jarvis Municipal Drain No.2.

The Countryfield Estate property is a combined higher density residential and commercial site that drains westerly to Jarvis Municipal Drain No. 1. A 450 mm diameter storm sewer conveys flows from the development to a stormwater management facility, which provides quantity and quality control prior to discharge to Jarvis Municipal Drain No.1 via the existing storm sewers conveying flow west on Talbolt Street.

Four (4) stormwater management facilities are included in the model. Since Jarvis is mainly an older settlement that was constructed prior to the widespread implementation of integrated drainage design and SWM practices, there was only one (1) SWM facility included in the 2010 Master Plan. Three (3) SWM facilities have been constructed since 2010 and are included in the model using:

- Jarvis Meadows Phase 1 SWM Facility (JSWMF5) - Environmental Compliance Approval, Number 8730-A26JD4, Issue Date: September 10, 2015
- Jarvis Meadows Phase 2 SWM Facility (JSWMF6) - Certificate Of Approval, Municipal and Private Sewage Works, Number 7850-8C4K63, Issue Date: December 22, 2010
- Countryfield Estate SWM Facility (JSWMF6) – 2010 Master Plan Appendix I, SWMF Conceptual Sizing Calculations

6.3 Existing Stormwater Servicing Conditions and Constraints

6.3.1 Surcharge Under Rainfall Events (5-Year Storm)

In general, the existing stormwater servicing system operates as intended under everyday rainfall events. In comparison with design rainfall events, the majority of storm sewers are surcharged under the design 5-year event (refer to Figure 9); however, water is mostly contained below ground surface.

There are two (2) locations where water surcharges to the surface in the 5-year event, both of which are in the Marley/Craddock sewershed.

6.3.2 Flow to Pipe Capacity Ratio

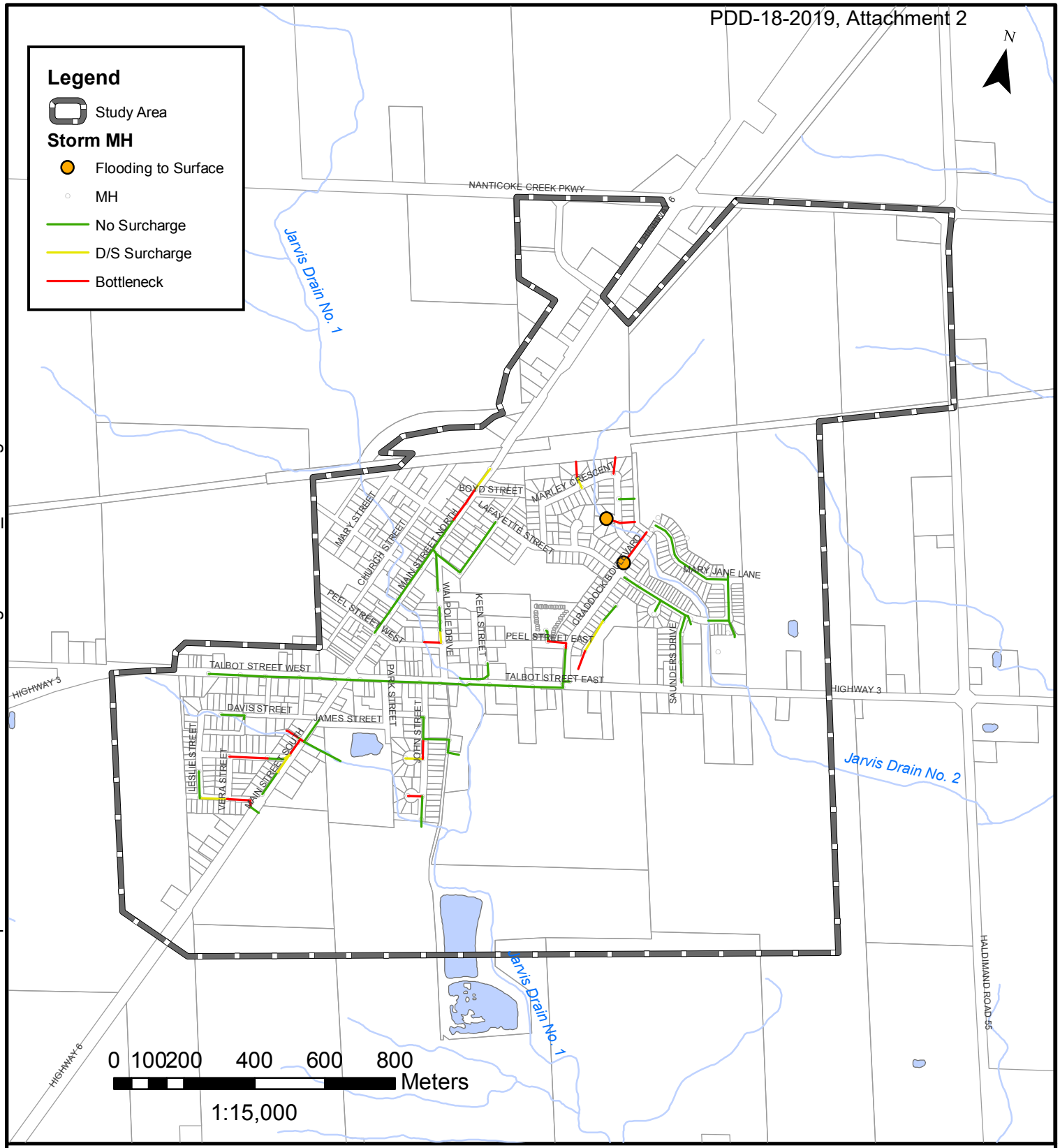
As shown in Figure 10, two (2) independent inlets and sewers discharging to Jarvis Municipal Drain No. 1 on Cabot Court and Craddock Boulevard accept more inflow than the sewer capacity can handle, causing surcharge to the surface. In the case of Cabot Court, the road grade slopes away from Marley Crescent and traps overland drainage which sits and ponds over the inlet. The water level of Jarvis Municipal Drain No. 2 will also influence the ability for this sewer to outlet under extreme events. Surcharge occurs in the 2-year storm at Cabot, but does not flood the surface.

6.4 Limitations of Stormwater Modelling

The results of the PCSWMM model were compared to the 2010 MSP results for each subcatchment to confirm the appropriateness of the PCSWMM simulation. Most of the subcatchments have runoff values similar to the previous model. Due to differences in the simulation of minor system capture via catchbasins in the PCSWMM model, there are slight differences in the results of the modelling, however overall the results are consistent with those of the 2010 MSP model. Further details are included in Appendix C.

It is noted that this MSP was not conducted as a subwatershed study and is intended to address the storm sewer conveyance and SWM servicing requirements to accommodate future development. While background information was reviewed, detailed water quality, fluvial geomorphology, and floodplain analyses were out of scope for this MSP that primarily focused on the urban drainage conveyance systems. Any future watershed or subwatershed planning on the Jarvis Municipal Drains will further augment and/or supersede the recommendations presented herein.

PDD-18-2019, Attachment 2



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JARVIS MASTER SERVICING PLAN UPDATE

JARVIS, HALDIMAND COUNTY, ONTARIO

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SURCHARGE TO SURFACE MAP UNDER 5-YEAR

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FIGURE 9

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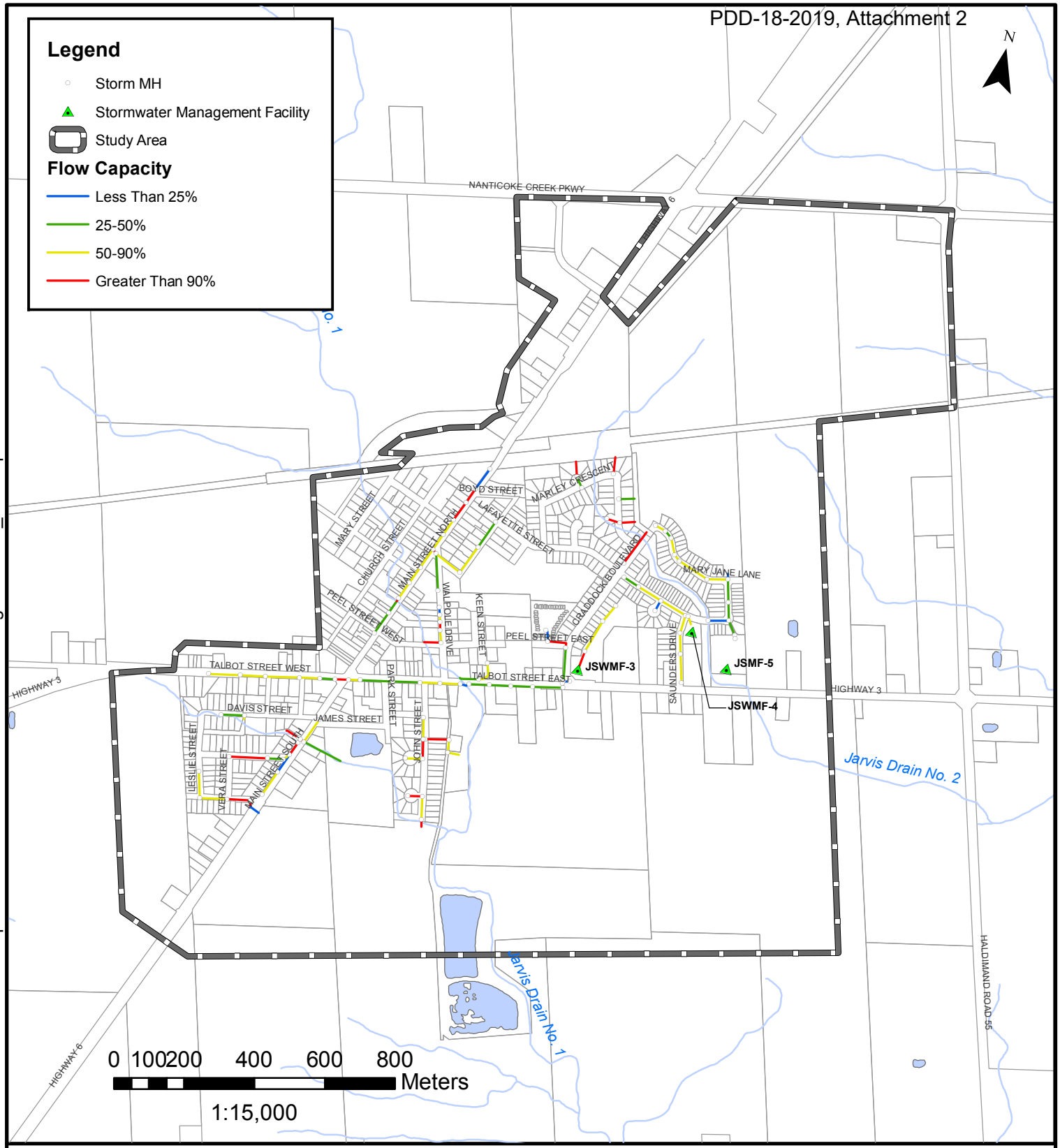

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JARVIS MASTER SERVICING PLAN UPDATE

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FLOW TO PIPE CAPACITY RATIO

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FIGURE 10

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7.0 TRANSPORTATION SERVICING

The study area intersections were analyzed under existing traffic conditions, using Synchro 9.2 software which implements Highway Capacity Manual (HCM) 2000 procedures. The results indicate the study area intersections are operating with acceptable levels of service and well within capacity. No critical movements are identified at any of the study intersections.

Please refer to Appendix D for the full report.

8.0 CONCLUSION

This Work Package has been prepared for the exclusive use of Haldimand County, for the stated purpose. Its discussions and conclusions are summary in nature and cannot be properly used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations. This report was prepared for the sole benefit and use of Haldimand County and may not be used or relied on by any other party without the express written consent of J.L. Richards & Associates Limited.

J.L. RICHARDS & ASSOCIATES LIMITED

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Reviewed by

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9.0 REFERENCES

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Appendix A

Water Model Parameters

28176 Jarvis - EXISTING - Peak Hour Pressures

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1	☐	NANT_04	0.000000	260.000000	254.283661	-56.015629
2	☐	NANT_03	0.000000	260.000000	254.415390	-54.724766
3	☐	NANT_02	0.000000	260.000000	254.428085	-54.600437
4	☐	NANT_01	0.000000	260.000000	259.987732	-0.120139
5	☑	60V0030-B	0.000000	217.500015	253.183914	349.674255
6	☑	60DEPO01	20.999851	209.307343	245.573532	355.380096
7	☑	60V0108-B	0.000000	217.000000	253.270905	355.426270
8	☑	60V0050	0.000000	216.484467	253.263885	360.409363
9	☑	60D0016	0.525424	213.013535	250.084290	363.264191
10	☑	60V0108	0.000000	216.121643	253.268265	364.007599
11	☑	60V0060	0.000000	215.645859	253.222580	368.222198
12	☑	60T0102	0.000000	215.500000	253.115417	368.601440
13	☑	60V0008	0.000000	215.500000	253.117874	368.625519
14	☑	60V0067	0.000000	215.500000	253.119339	368.639923
15	☑	60T0101	0.029824	215.500000	253.123978	368.685303
16	☑	60V0044	0.000000	212.000015	249.625183	368.697052
17	☑	60T0073	0.263026	212.000015	249.631699	368.761047
18	☑	60T0104	0.000000	215.565323	253.217834	368.964874
19	☑	60V0043	0.000000	212.000015	249.694229	369.373749
20	☑	60T0115	0.170255	211.933945	249.631668	369.407959
21	☑	60T0114	0.149255	212.000015	249.702515	369.454895
22	☑	60V0042	0.000000	212.000015	249.702545	369.455261
23	☑	60T0071	0.199511	211.944672	249.702560	369.997742
24	☑	60V0004	0.000000	209.500000	247.302719	370.436768
25	☑	60V0045	0.389853	211.650864	249.568115	371.559204
26	☑	60D0013	0.023168	208.500000	246.476120	372.136047
27	☑	60CHAM01	0.000000	208.500000	246.476120	372.136047
28	☑	60T0110	0.000000	208.500000	246.476120	372.136047
29	☑	60T0117	0.209351	211.500000	249.527527	372.639771
30	☑	60T0066	0.000000	211.500000	249.527603	372.640503
31	☑	60V0046	0.088523	211.500000	249.532623	372.689728
32	☑	60V0068	0.000000	215.000000	253.128540	373.629578
33	☑	60T0116	0.196119	211.500000	249.667847	374.014862
34	☑	FUT14	0.003402	211.059418	249.409836	375.803894
35	☑	60V0047	0.210687	211.116364	249.495087	376.081177
36	☑	60T0094	0.040812	212.304474	250.770035	376.932190
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38	☑	60V0048	0.000000	211.000000	249.488831	377.160187
39	☑	60T0063	0.113255	211.000000	249.491547	377.186798
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42	☑	60V0038	0.341278	211.000000	249.502548	377.294556
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44	☑	60T0050	0.000000	210.668259	249.294205	378.503784
45	☑	60T0049	0.000000	210.651367	249.294205	378.669312
46	☑	J10	0.021852	210.809509	249.476028	378.901337
47	☑	60V0039	0.000000	211.000000	249.667984	378.915741
48	☑	60T0068	0.300550	211.000000	249.668015	378.916107
49	☑	60V0005	0.000000	210.582504	249.300674	379.407715
50	☑	FUT30	0.064719	210.500015	249.239151	379.613159

28176 Jarvis - EXISTING - Peak Hour Pressures

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
51	☑	60T0052	0.256440	209.935852	248.696289	379.821686
52	☑	60V0041	0.000000	210.945236	249.777496	380.525726
53	☑	60V0006	0.666901	210.500015	249.338028	380.582092
54	☑	60T0118	0.268618	210.912445	249.781860	380.889587
55	☑	FUT20	0.121595	210.557388	249.431610	380.936707
56	☑	60V0040	0.000000	210.926422	249.802582	380.955688
57	☑	FUT92	0.000000	210.500015	249.412903	381.315826
58	☑	FUT26	0.056265	210.504349	249.447510	381.612457
59	☑	60T0069	0.065536	210.950851	249.939346	382.056580
60	☑	60T0009	0.277510	210.987991	250.058411	382.859344
61	☑	60V0017	0.000000	211.000000	250.085327	383.005463
62	☑	60V0098	0.000000	210.954376	250.058411	383.188751
63	☑	60V0099	0.573160	210.934845	250.058533	383.381226
64	☑	FUT18	0.065823	210.248367	249.403275	383.687347
65	☑	60T0017	0.273888	210.923599	250.085373	383.754486
66	☑	60V0016	0.000000	210.902222	250.084473	383.955383
67	☑	60D0008	0.000000	210.195251	249.478119	384.941132
68	☑	60D0004	0.000000	210.773239	250.057999	384.959747
69	☑	60V0065	0.000000	210.509949	250.058029	387.539948
70	☑	FUT28	0.126470	209.834488	249.396133	387.672882
71	☑	60V0095	0.000000	210.474167	250.058365	387.893860
72	☑	60V0066	0.000000	210.466293	250.057999	387.967560
73	☑	60T0006	0.269718	210.453217	250.057999	388.095673
74	☑	60T0060	0.000000	210.003021	249.622437	388.239227
75	☑	60T0010	0.401197	210.391907	250.058365	388.699951
76	☑	60V0033	0.000000	210.607468	250.288727	388.845215
77	☑	60T0077	0.432645	210.591934	250.311447	389.219879
78	☑	60V0096	0.000000	210.312668	250.058289	389.475677
79	☑	60V0064	0.000000	210.300110	250.057983	389.595856
80	☑	60V0063	0.400913	210.278503	250.057983	389.807739
81	☑	60D0019	0.000000	209.826233	249.622437	389.971466
82	☑	60T0004	0.000000	210.257309	250.057983	390.015259
83	☑	60V0087	0.225046	210.174545	250.069748	390.941650
84	☑	60V0029	0.277210	212.792007	252.695679	391.024750
85	☑	60T0014	0.226118	210.042816	250.074539	392.279358
86	☑	60V0020	0.000000	210.038116	250.073395	392.314148
87	☑	60D0002	0.000000	210.000000	250.058075	392.537598
88	☑	60V0036	0.259490	209.404602	249.579697	393.684357
89	☑	60V0062	0.000000	209.811752	250.058060	394.382111
90	☑	60T0002	0.313392	209.763763	250.058075	394.852539
91	☑	60D0009	0.072495	209.571365	249.914261	395.328644
92	☑	60T0058	0.000000	209.218567	249.622437	395.926086
93	☑	60V0081	0.000000	210.039459	250.457016	396.060181
94	☑	60T0059	0.000000	209.192245	249.622437	396.184052
95	☑	60T0096	0.572064	210.492371	250.934540	396.301575
96	☑	60D0007	0.079533	210.000000	250.457001	396.446655
97	☑	60V0027	0.000000	210.451721	250.922134	396.578308
98	☑	60V0026	0.000000	210.392151	250.920334	397.144409
99	☑	60V0103	0.000000	210.554169	251.094086	397.259247
100	☑	60T0023	0.098307	209.500000	250.046005	397.318909

28176 Jarvis - EXISTING - Peak Hour Pressures

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
101	☑	60V0011	0.000000	209.491943	250.046707	397.404785
102	☑	60T0085	0.199213	209.892593	250.457031	397.499664
103	☑	60V0082	0.000000	209.867691	250.447845	397.653473
104	☑	60T0047	0.216938	208.974655	249.585190	397.951294
105	☑	60V0056	0.000000	208.969894	249.585220	397.998291
106	☑	60T0045	0.000000	208.958603	249.585648	398.113098
107	☑	60T0080	0.131041	209.646225	250.306290	398.436554
108	☑	60D0020	0.000000	208.939255	249.622437	398.663147
109	☑	60T0044	1.526909	208.906113	249.622437	398.987915
110	☑	60V0014	0.000000	209.367783	250.093307	399.078094
111	☑	60V0052	0.000000	208.896820	249.622437	399.079102
112	☑	60T0015	0.000000	209.257446	250.076065	399.990326
113	☑	60V0015	0.000000	209.211105	250.092926	400.609589
114	☑	60V0013-B	0.000000	209.199997	250.095032	400.739044
115	☑	60V0013	0.221216	209.184113	250.104202	400.984741
116	☑	60V0091	0.000000	209.817917	250.770050	401.298645
117	☑	60V0019	0.000000	209.098526	250.059662	401.386841
118	☑	60V0012	0.000000	209.109009	250.089661	401.578156
119	☑	60V0092	0.000000	209.743240	250.768173	402.012024
120	☑	60T0091	0.179135	209.706726	250.770050	402.388397
121	☑	60V0090	0.000000	209.683838	250.781433	402.724091
122	☑	60D0021	0.148371	208.929535	250.075974	403.202667
123	☑	60V0089	0.000000	209.558136	250.765854	403.803253
124	☑	60V0018	0.000000	208.859222	250.076736	403.899353
125	☑	60T0090	0.215738	209.472870	250.732071	404.307587
126	☑	60V0105	0.000000	208.740967	250.072891	405.020264
127	☑	60V0097	0.000000	208.723145	250.059937	405.068024
128	☑	60V0034	0.149855	208.878708	250.221344	405.125275
129	☑	60V0076	0.000000	209.347702	250.729889	405.512817
130	☑	60V0028	0.000000	211.093811	252.481842	405.570038
131	☑	60T0098	0.404153	211.190002	252.626999	406.049927
132	☑	60T0013	0.382733	208.588837	250.060028	406.385040
133	☑	60V0106	0.000000	208.597763	250.072159	406.416412
134	☑	60T0016	0.108289	208.595398	250.077011	406.487183
135	☑	60T0113	0.000000	211.122955	252.624100	406.678497
136	☑	60T0021	0.121303	208.500000	250.055817	407.214203
137	☑	60V0107	0.000000	208.500000	250.056366	407.219666
138	☑	60V0021	0.000000	208.744949	250.332352	407.523773
139	☑	60T0097	0.000000	211.058395	252.653076	407.595154
140	☑	85CHAM01	0.000000	211.054688	252.653076	407.631470
141	☑	60V0022	0.000000	208.706741	250.345612	408.028168
142	☑	60T0038	0.243002	208.248505	249.914291	408.291901
143	☑	60V0093	0.000000	208.294495	249.988647	408.569855
144	☑	60V0023	0.000000	208.613220	250.323273	408.725647
145	☑	60T0036	0.361157	208.601425	250.343048	409.035004
146	☑	60V0007	0.000000	211.054688	252.931259	410.357391
147	☑	60V0069	0.000000	208.019089	249.977966	411.164124
148	☑	60T0024	0.315340	207.831192	249.979538	413.020538
149	☑	60V0035	0.000000	207.715210	250.051071	414.858032
150	☑	60T0087	0.054200	208.223663	250.685684	416.094391

28176 Jarvis - EXISTING - Peak Hour Pressures

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
151	☑	60T0040	0.000000	207.551987	250.058853	416.533844
152	☑	60T0039	0.210691	207.459885	250.059052	417.438202
153	☑	60V0032	0.000000	208.000000	250.683609	418.265656
154	☑	60T0088	0.148523	208.000000	250.685699	418.286255
155	☑	60V0104	0.000000	208.000000	250.688187	418.310516
156	☑	60V0080	0.000000	207.292313	250.052170	419.012817
157	☑	60V0049	0.209247	207.944290	250.719589	419.164154
158	☑	60V0079	0.000000	207.194122	250.073563	420.184692
159	☑	60V0077	0.149999	207.816422	250.705551	420.279846
160	☑	60V0009	0.000000	207.053787	249.965530	420.501373
161	☑	60V0074	0.000000	207.000000	249.956482	420.939667
162	☑	60V0073	0.000000	207.000000	249.956573	420.940582
163	☑	60T0031	0.149799	207.000000	249.956619	420.940948
164	☑	60V0071	0.000000	207.000000	249.958084	420.955353
165	☑	60T0029	0.234978	207.000000	249.958267	420.957184
166	☑	60T0108	0.255054	206.997284	249.956436	420.965759
167	☑	60V0070	0.000000	207.000000	249.959198	420.966278
168	☑	60T0027	0.000000	206.985001	249.956635	421.088104
169	☑	60V0102	0.000000	206.950684	249.956833	421.426422
170	☑	60V0078	0.000000	207.000000	250.128052	422.620850
171	☑	60V0025	0.000000	207.510071	250.668793	422.921509
172	☑	60V0051	0.000000	206.792816	249.952972	422.935486
173	☑	60T0081	0.439407	207.435562	250.657608	423.542053
174	☑	60V0024	0.000000	207.433746	250.657730	423.560913
175	☑	60T0112	0.000000	207.463470	250.691299	423.598694
176	☑	60T0025	0.269240	206.671402	249.961014	424.203979
177	☑	60T0026	0.000000	206.635651	249.952728	424.473206
178	☑	60V0010	0.000000	206.603424	249.970245	424.960754
179	☑	60V0086	0.000000	207.281921	250.660355	425.074554
180	☑	60V0072	0.000000	206.561234	249.955643	425.231049
181	☑	60V0085	0.000000	207.242386	250.662231	425.480225
182	☑	60T0083	0.255014	207.215729	250.659119	425.710999
183	☑	60D0006	0.000000	206.506790	249.955643	425.764557
184	☑	60V0031	0.000000	207.189072	250.652985	425.912231
185	☑	60V0072-B	0.000000	206.475525	249.955643	426.070923
186	☑	60V0100-B	0.000000	206.467896	249.955643	426.145691
187	☑	60V0084	0.000000	207.131897	250.659012	426.531403
188	☑	60T0032	0.159695	206.390778	249.955643	426.901367
189	☑	60V0100	0.000000	206.381790	249.955643	426.989471
190	☑	60V0101	0.000000	206.339981	249.955612	427.398773
191	☑	60T0107	0.266822	206.270767	249.955460	428.075562
192	☑	65WBS01	34.499756	209.000015	252.852325	429.718231
193	☑	TOWNSEND_01	47.999660	209.000015	254.157959	442.512390

28176 Jarvis - EXISTING - Maximum Day + Fire Flow

		ID	Total Demand (L/s)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)
1	☐	60D0019	89.999359	35.554634	137.862915	137.860916	60D0019	137.862915	223.895004
2	☐	60T0060	89.999359	38.743347	137.862915	137.861145	60T0060	137.862915	224.071777
3	☐	60D0020	89.999359	39.183861	137.862915	137.861267	60D0020	137.862915	223.008026
4	☐	60CHAM01	89.999359	40.427551	137.862915	146.369492	60DEPO01	129.394455	222.511932
5	☐	60T0110	89.999359	40.427578	137.862915	149.844437	60DEPO01	125.777473	222.142822
6	☐	60D0013	90.025429	40.453590	137.862915	140.216980	60DEPO01	135.511337	223.136154
7	☐	60D0002	89.999359	40.687832	137.862915	137.862213	60D0002	137.862915	224.068787
8	☐	60T0059	89.999359	43.243244	137.862915	137.860992	60T0059	137.862915	223.261017
9	☐	60V0004	89.999359	45.792122	137.862915	143.923569	60DEPO01	131.748718	222.752167
10	☐	60T0058	89.999359	46.392704	137.862915	145.548203	60T0060	130.176041	223.287338
11	☐	60DEPO01	103.999260	50.026215	137.862915	137.986877	60DEPO01	137.862915	223.376114
12	☐	60V0072-B	89.999359	50.157124	137.862915	137.862350	60V0072-B	137.862915	220.544312
13	☐	60V0072	89.999359	50.268768	137.862915	137.861084	60V0072	137.862915	220.630020
14	☐	60D0006	89.999359	50.546635	137.862915	137.861496	60D0006	137.862915	220.575562
15	☐	60V0100-B	89.999359	50.716194	137.862915	138.775879	60V0072	136.948288	220.536682
16	☐	60T0107	90.149445	53.032333	137.862915	137.862244	60T0107	137.862930	220.339539
17	☐	60V0100	89.999359	55.684406	137.862915	139.621384	60V0072	136.104507	220.450562
18	☐	60V0101	89.999359	55.840473	137.862915	137.861008	60V0101	137.862930	220.408768
19	☐	60T0032	90.089188	56.412308	137.862915	139.532150	60V0072	136.192596	220.459549
20	☐	60T0115	90.095131	56.825520	137.862915	137.860687	60T0115	137.862930	226.002731
21	☐	60D0004	89.999359	57.333740	137.862915	137.861450	60D0004	137.862930	224.842026
22	☐	60T0116	90.109680	57.541771	137.862915	137.860474	60T0116	137.862930	225.568787
23	☐	60V0052	89.999359	58.537735	137.862915	148.701263	60T0060	127.023026	222.965576
24	☐	60T0117	90.117126	58.828690	137.862915	137.860245	60T0117	137.862930	225.568787
25	☐	60D0016	90.294914	58.967121	137.862915	137.860565	60D0016	137.862930	227.082306
26	☐	60T0114	90.083321	59.315521	137.862915	137.861389	60T0114	137.862930	226.068771
27	☐	60V0044	89.999359	59.953796	137.862915	137.860184	60V0044	137.862930	226.068771
28	☐	60T0073	90.147316	60.269714	137.862915	137.861008	60T0073	137.862930	226.068771
29	☐	60V0045	90.218658	60.567242	137.862915	137.860550	60V0045	137.862930	225.719635
30	☐	60T0108	90.142830	60.718586	137.862915	138.286926	60T0108	137.862930	221.066055
31	☐	60T0052	90.236000	60.812786	137.862915	146.151840	60DEPO01	129.566071	222.529434
32	☐	60D0009	90.040138	60.962345	137.862915	137.861740	60D0009	137.862930	223.640121
33	☐	60V0066	89.999359	61.354588	137.862915	140.869659	60D0004	134.855087	224.535080
34	☐	60V0042	89.999359	62.178154	137.862915	137.860367	60T0114	137.862823	226.068771
35	☐	60V0046	90.049156	62.240135	137.862915	137.860764	60V0046	137.862930	225.568787

28176 Jarvis - EXISTING - Maximum Day + Fire Flow

		ID	Total Demand (L/s)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)
36	☐	60T0066	89.999359	62.586231	137.862915	137.860916	60T0117	137.862671	225.568741
37	☐	60T0002	90.190239	62.748310	137.862915	140.595032	60D0002	135.547989	223.832535
38	☐	60T0006	90.151077	62.805202	137.862915	140.997025	60D0004	134.726959	224.522003
39	☐	60V0043	89.999359	62.818447	137.862915	137.860764	60V0043	137.862930	226.068771
40	☐	60V0065	89.999359	62.942307	137.862915	138.802460	60D0004	136.927917	224.746597
41	☐	60V0062	89.999359	62.994846	137.862915	138.283875	60V0062	137.862930	223.880539
42	☐	60T0071	90.111588	63.514038	137.862915	138.403671	60T0114	137.320465	226.013428
43	☐	60V0064	89.999359	64.316223	137.862915	138.262009	60V0064	137.862930	224.368896
44	☐	60V0063	90.224876	64.632530	137.862915	138.241379	60V0063	137.862930	224.347260
45	☐	60T0004	89.999359	64.642685	137.862915	138.252701	60T0004	137.862930	224.326080
46	☐	60T0094	90.045273	64.964897	137.862915	138.109055	60T0094	137.862930	226.373260
47	☐	60V0096	89.999359	65.018875	137.862915	138.242752	60V0096	137.862930	224.381454
48	☐	FUT26	90.036873	65.173729	137.862915	137.861252	FUT26	137.862930	224.573105
49	☐	60D0021	90.096123	65.226318	137.862915	138.189865	60D0021	137.862930	222.998322
50	☐	60V0098	89.999359	65.340508	137.862915	138.244690	60V0098	137.862930	225.023163
51	☐	60V0039	89.999359	65.441666	137.862915	142.761261	60T0116	132.962875	225.068741
52	☐	60V0074	89.999359	65.460251	137.862915	138.196762	60V0074	137.862930	221.068771
53	☐	60V0095	89.999359	65.712608	137.862915	138.228439	60V0095	137.862930	224.542953
54	☐	60T0009	90.155464	65.714073	137.862915	138.229630	60T0009	137.862930	225.056778
55	☐	60V0073	89.999359	65.774429	137.862915	138.188950	60V0073	137.862930	221.068771
56	☐	60V0099	90.333435	65.968239	137.862915	138.214752	60V0099	137.862930	225.003632
57	☐	60T0010	90.225037	66.211174	137.862915	138.206848	60T0010	137.862930	224.460678
58	☐	60V0019	89.999359	66.439415	137.862915	138.191620	60V0019	137.862930	223.167313
59	☐	J10	90.013931	66.535591	137.862915	137.862686	J10	137.862930	224.878296
60	☐	60D0008	89.999359	66.974609	137.862915	142.887466	J10	132.859879	224.367737
61	☐	FUT14	90.001633	67.497391	137.862915	137.860962	FUT14	137.862930	225.128189
62	☐	60T0031	90.083626	67.719902	137.862915	138.144745	60V0074	137.862442	221.068726
63	☐	60V0047	90.117874	68.186638	137.862915	137.862900	60V0047	137.862930	225.185135
64	☐	60V0048	89.999359	68.536064	137.862915	137.861969	60V0048	137.862930	225.068771
65	☐	60V0097	89.999359	68.609306	137.862915	144.154495	60D0004	132.241318	224.268341
66	☐	60D0007	90.048615	68.688095	137.862915	138.068298	60D0007	137.862930	224.068787
67	☐	60T0068	90.168419	68.983368	137.862915	143.127396	60T0116	132.962738	225.068726
68	☐	60T0013	90.217529	69.045158	137.862915	146.968292	60D0004	129.523865	223.991013
69	☐	60T0065	89.999359	69.197830	137.862915	138.253510	60T0065	137.862930	225.088959
70	☐	FUT18	90.043243	69.508774	137.862915	144.103516	FUT14	132.079025	224.537964

28176 Jarvis - EXISTING - Maximum Day + Fire Flow

		ID	Total Demand (L/s)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)
71	☐	FUT22	90.081543	69.889503	137.862915	138.245682	FUT22	137.862930	224.999573
72	☐	FUT30	90.042511	70.299637	137.862915	143.165894	60DEPO01	132.558624	222.834824
73	☐	60V0087	90.149391	71.061485	137.862915	138.090286	60V0087	137.862930	224.243301
74	☐	60T0050	89.999359	71.177017	137.862915	138.907181	60DEPO01	137.229691	223.311508
75	☐	60T0049	89.999359	71.177078	137.862915	139.400467	60DEPO01	136.742111	223.261749
76	☐	60V0005	89.999359	71.287941	137.862915	139.808167	60DEPO01	136.339798	223.220688
77	☐	60V0017	89.999359	71.336029	137.862915	157.839294	60D0016	118.128334	225.068420
78	☐	60T0017	90.164482	72.189079	137.862915	158.567276	60D0016	117.379524	224.992004
79	☐	FUT20	90.080421	72.287750	137.862915	141.831741	FUT22	134.203873	224.626160
80	☐	60V0041	89.999359	72.296898	137.862915	144.307220	60T0114	131.839951	225.454147
81	☐	FUT28	90.083679	72.311180	137.862915	147.866547	FUT14	128.267059	224.148941
82	☐	60V0016	89.999359	72.591759	137.862915	150.878418	60D0016	125.536552	225.824417
83	☐	60V0006	90.671356	72.615097	137.862915	139.264236	60DEPO01	136.832001	223.270920
84	☐	60V0037	90.089790	72.638847	137.862915	138.150055	60V0037	137.862930	225.068771
85	☐	60V0038	90.191330	72.823380	137.862915	138.142090	60V0038	137.862930	225.068771
86	☐	FUT92	89.999359	73.199593	137.862915	138.147003	FUT92	137.862930	224.568787
87	☐	60T0118	90.150459	73.206413	137.862915	144.998688	60T0114	131.126953	225.381378
88	☐	60V0040	89.999359	73.427589	137.862915	143.850769	60T0114	132.278305	225.498871
89	☐	60T0063	90.074867	73.516777	137.862915	138.127075	60T0063	137.862930	225.068771
90	☐	60T0087	90.029846	73.548195	137.862915	137.974182	60T0087	137.862930	222.292450
91	☐	60T0044	90.858246	74.008110	137.862915	148.817978	60T0060	127.114243	222.974899
92	☐	60V0020	89.999359	74.012444	137.862915	138.030640	60V0020	137.862930	224.106903
93	☐	60T0038	90.136047	74.036842	137.862915	151.001297	60D0009	124.899994	222.317276
94	☐	60T0014	90.126556	75.331963	137.862915	138.005585	60T0014	137.862930	224.111588
95	☐	60T0069	90.036224	76.095139	137.862915	138.542419	60T0114	137.394363	226.020966
96	☐	60V0071	89.999359	76.889626	137.862915	137.974701	60V0071	137.862930	221.068771
97	☐	60V0102	89.999359	77.044418	137.862915	137.971008	60V0102	137.862930	221.019455
98	☐	60V0070	89.999359	77.094986	137.862915	137.971451	60V0070	137.862930	221.068771
99	☐	60T0029	90.131538	77.104851	137.862915	137.977951	60V0074	137.856903	221.068161
100	☐	60T0027	89.999359	77.126999	137.862915	137.970627	60T0027	137.862930	221.053787
101	☐	60V0056	89.999359	77.275917	137.862915	156.358795	60DEPO01	119.865150	221.539459
102	☐	60V0036	90.145325	77.309952	137.862915	138.008118	60V0036	137.862930	223.473358
103	☐	60T0047	90.148582	77.384270	137.862915	157.014389	60DEPO01	119.162964	221.467804
104	☐	60T0015	89.999359	77.575905	137.862915	137.963608	60T0015	137.862930	223.326218
105	☐	60V0014	89.999359	77.857002	137.862915	172.095200	60D0016	104.026726	223.629364

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		ID	Total Demand (L/s)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)
106	☐	60T0045	89.999359	77.975967	137.862915	147.335052	60DEPO01	129.042831	222.476044
107	☐	60V0107	89.999359	78.398087	137.862915	137.948669	60V0107	137.862930	222.568787
108	☐	60T0021	90.088715	78.623779	137.862915	137.946106	60T0021	137.862930	222.568787
109	☐	60V0018	89.999359	79.074844	137.862915	151.133774	60D0016	126.243835	225.896591
110	☐	60V0105	89.999359	79.296806	137.862915	157.755646	60D0016	119.968712	225.256226
111	☐	60T0016	90.080597	79.349365	137.862915	164.782410	60D0016	113.009758	224.546066
112	☐	60V0106	89.999359	79.370346	137.862915	155.028290	60D0016	122.712990	225.536285
113	☐	60V0015	89.999359	79.798691	137.862915	171.516052	60D0016	104.892250	223.717697
114	☐	60V0013-B	90.000053	79.876015	137.862915	175.300430	60D0016	100.512123	223.270706
115	☐	60V0012	89.999359	80.088295	137.862915	173.602112	60D0016	102.631508	223.486969
116	☐	60V0013	90.248230	80.326447	137.862915	175.040802	60D0016	100.858086	223.306000
117	☐	60V0011	89.999359	81.128075	137.862915	156.215729	60D0016	120.859314	225.347107
118	☐	60T0023	90.109962	81.414230	137.862915	162.079056	60D0016	114.766258	224.725311
119	☐	60V0034	90.083656	82.696289	137.862915	137.898315	60V0034	137.862930	222.947495
120	☐	60V0076	89.999359	82.735298	137.862915	137.888977	60V0076	137.862930	223.416489
121	☐	60T0090	90.120712	82.901718	137.862915	137.889114	60T0090	137.862930	223.541656
122	☐	60V0081	89.999359	83.090454	137.862915	137.889923	60V0081	137.862930	224.108246
123	☐	60V0093	89.999359	83.258987	137.862915	163.554535	60D0016	114.324364	224.680222
124	☐	60V0069	89.999359	83.702316	137.862915	151.240387	60D0016	126.379509	225.910431
125	☐	60T0024	90.196899	83.769707	137.862915	166.813156	60D0016	111.455444	224.387466
126	☐	60V0009	89.999359	84.177994	137.862915	171.655502	60D0016	107.359077	223.969421
127	☐	60V0091	89.999359	84.205284	137.862915	162.247467	60T0094	113.496521	223.886688
128	☐	60V0077	90.089363	84.269310	137.862915	137.878326	60V0077	137.862930	221.885193
129	☐	60V0051	89.999359	84.385567	137.862915	162.150772	60D0016	117.036919	224.957047
130	☐	60T0026	89.999359	84.492996	137.862915	174.047302	60D0016	105.389877	223.768463
131	☐	60T0025	90.172752	84.580292	137.862915	175.297348	60D0016	104.058800	223.632645
132	☐	60V0010	89.999359	84.790352	137.862915	168.877609	60D0016	110.759651	224.316452
133	☐	60T0085	90.132538	85.077133	137.862915	139.317245	60V0081	136.423615	223.961365
134	☐	60V0104	89.999359	85.210938	137.862915	137.874100	60V0104	137.862930	222.068771
135	☐	60T0088	90.082909	85.285202	137.862915	140.065979	60T0087	135.671188	222.068771
136	☐	60V0082	89.999359	85.478012	137.862915	137.874603	60V0082	137.862930	223.936478
137	☐	60V0033	89.999359	85.687561	137.862915	143.425446	60T0114	132.649536	225.536774
138	☐	60V0032	89.999359	85.956451	137.862915	138.190399	60T0087	137.546249	222.260132
139	☐	60V0021	89.999359	86.265472	137.862915	177.272049	60D0016	99.258827	223.142807
140	☐	60V0035	89.999359	86.619987	137.862915	150.129913	60D0009	125.969437	222.426407

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		ID	Total Demand (L/s)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)
141	☐	60V0022	89.999359	86.781616	137.862915	175.948807	60D0016	100.886215	223.308884
142	☐	60T0080	90.087669	86.831413	137.862915	149.314758	60T0114	127.263489	224.987122
143	☐	60V0023	89.999359	86.851044	137.862915	161.167068	60D0016	116.699432	224.922607
144	☐	60T0077	90.242722	86.876038	137.862915	144.524704	60T0114	131.583160	225.427933
145	☐	60V0080	89.999359	86.962204	137.862915	155.566818	60D0016	122.943771	225.559830
146	☐	60T0036	90.331573	87.014175	137.862915	178.923096	60D0016	97.600250	222.973557
147	☐	60V0078	89.999359	87.098511	137.862915	139.158066	60D0016	136.864090	226.980377
148	☐	60T0091	90.100121	87.116386	137.862915	163.324219	60T0094	112.406776	223.775482
149	☐	60V0079	89.999359	87.189224	137.862915	153.691330	60D0016	124.701859	225.739243
150	☐	60V0092	89.999359	87.230988	137.862915	157.780930	60T0094	118.405769	224.387665
151	☐	60T0039	90.117874	87.335846	137.862915	157.672577	60D0016	120.908249	225.352112
152	☐	60V0089	89.999359	87.348495	137.862915	160.104446	60T0094	116.082741	224.150604
153	☐	60T0040	89.999359	87.392815	137.862915	154.760727	60D0016	123.517960	225.618423
154	☐	60V0090	89.999359	87.555656	137.862915	161.750107	60T0094	114.189186	223.957367
155	☐	60V0049	90.117065	89.817474	137.862915	146.372879	60T0094	130.287430	225.600189
156	☐	60T0112	89.999359	90.359001	137.862915	152.455383	60T0094	125.411774	225.102615
157	☐	60V0024	89.999359	91.868851	137.862915	177.769226	60D0016	101.296318	223.350723
158	☐	60V0085	89.999359	92.079491	137.862915	166.395050	60T0094	111.687340	223.702057
159	☐	60V0086	89.999359	92.155487	137.862915	164.345474	60T0094	113.735664	223.911102
160	☐	60V0025	89.999359	92.221085	137.862915	179.126389	60D0016	99.710754	223.188934
161	☐	60T0081	90.261124	92.292343	137.862915	180.832352	60D0016	97.946083	223.008850
162	☐	60V0084	89.999359	92.388405	137.862915	168.185120	60D0016	111.556656	224.397781
163	☐	60V0031	89.999359	92.422348	137.862915	164.823288	60D0016	114.692635	224.717804
164	☐	60T0083	90.142807	92.503937	137.862915	168.789230	60T0094	109.220253	223.450287
165	☐	60V0027	89.999359	95.480591	137.862915	152.054276	60T0094	123.993423	224.957886
166	☐	60V0026	89.999359	96.217209	137.862915	153.288696	60D0016	123.555466	225.622253
167	☐	60T0096	90.321144	96.892761	137.862915	154.487228	60D0016	122.329163	225.497101
168	☐	60V0103	89.999359	99.545090	137.862915	153.043701	60D0016	123.827141	225.649963
169	☐	60V0029	90.275513	103.613586	137.862915	137.874252	60V0029	137.862946	226.860779
170	☐	60V0030	90.035599	116.804520	137.862915	137.891205	60V0030	137.862961	228.568787
171	☐	60V0028	89.999359	160.887909	137.862915	137.866806	60V0028	137.863007	225.162598
172	☐	60T0098	90.226692	180.583542	137.862915	137.868332	60T0098	137.863022	225.258789
173	☐	85CHAM01	89.999359	181.247513	137.862915	137.867035	85CHAM01	137.863022	225.123474
174	☐	60T0113	89.999359	188.272202	137.862915	153.928879	60D0016	122.420570	225.506439
175	☐	60V0008	89.999359	191.284348	137.862915	137.864258	60V0008	137.863052	229.568802

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		ID	Total Demand (L/s)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)
176	☐	60T0097	89.999359	194.865662	137.862915	168.206848	60D0016	107.547371	223.988632
177	☐	60T0104	89.999359	216.249680	137.862915	137.864792	60T0104	137.863083	229.634109
178	☐	60V0060	89.999359	218.368637	137.862915	137.865067	60V0060	137.863083	229.714645
179	☐	60V0068	89.999359	226.358093	137.862915	137.866882	60V0068	137.863098	229.068787
180	☐	60T0101	90.016136	227.373505	137.862915	137.867340	60T0101	137.863113	229.568802
181	☐	60V0007	89.999359	234.366257	137.862915	168.510864	60D0016	107.281952	223.961548
182	☐	60V0067	89.999359	242.602570	137.862915	137.870499	60V0067	137.863129	229.568802
183	☐	65WBS01	124.499115	266.357208	137.862915	137.863647	65WBS01	137.863113	223.068802
184	☐	60V0050	89.999359	270.988586	137.862915	137.872620	60V0050	137.863190	230.553284
185	☐	60T0102	89.999359	273.001953	137.862915	137.882675	60T0102	137.863190	229.568802
186	☐	60V0030-B	89.999359	281.780121	137.862915	137.883713	60V0030-B	137.863205	231.568802
187	☐	60V0108	89.999359	288.145416	137.862915	141.055176	60V0050	134.692017	230.229645
188	☐	60V0108-B	89.999359	294.122864	137.862915	143.375565	60V0030-B	132.368561	231.008072

Appendix B

Wastewater Model Parameters

Appendix B – PCSWMM Model Parameters

The following sets out a description of each of the parameters used in the steady state wastewater conveyance system modelling for the Jarvis Master Plan. Any differences from the below at any of the specific elements are noted in the description in the model. The PCSWMM model has been based on the previous H2OMAP modelling completed for the 2010 Master Plan.

A1.0 Link Elements

A1.1 Conduits

Conduits represent sanitary sewers.

Parameter	Units	Description / Values
Name	-	Conduits taken from the 2010 Master Plan maintain the same name which appears to be linked to one of the connecting nodes. New conduits are named based on the supplied GIS data.
Inlet Node	-	Upstream node of the link element.
Outlet Node	-	Downstream node of the link element.
Tag	-	No tags were used in the model.
Length	m	Length is auto-calculated in PCSWMM and is consistent with the 2010 Master Plan except for new links.
Roughness	-	For links from the 2010 Master Plan the roughness coefficient is maintained. For new sections a roughness coefficient of 0.013 is used.
Inlet Offset	m	Inlet elevation of the conduit element. Consistent with the 2010 Master Plan or the supplied GIS data for new links.
Outlet Offset	m	Outlet elevation of the conduit element. Consistent with the 2010 Master Plan or the supplied GIS data for new links.
Initial Flow	m^3/s	No initial flows are set in the model
Flow Limit	m^3/s	No flow limits are set in the model
Entry Loss Coeff.	-	No losses are used in a steady state conveyance model.

Parameter	Units	Description / Values
Exit Loss Coeff.	-	No losses are used in a steady state conveyance model.
Ave. Loss Coeff.	-	No losses are used in a steady state conveyance model.
Seepage Rate	mm/hr	There is no seepage applied to conduits in this model.
Flap Gate	-	No flapgates are used in the model.
Cross Section	-	Cross sections are generally circular for sewers, rectangular for streets, trapezoidal for open channel flow and either circular, elliptical or rectangular for cuvlerts. Cross sections are consistent with the 2010 Master Plan.
Geom1	m	**Type** — **Description** Circular — Pipe diameter Ellipse — Maximum Depth or Standard Size ID
Geom2	m	**Type** — **Description** Circular — Not used Ellipse — Maximum Width or not used
Barrels	-	The number of identical sewers within the conduit, usually 1.
Transect	-	Refers to transect data, if used, for the open channel links.
Shape Curve	-	Not used in this model.
Culvert Code	-	Not used in this model.

A2.0 Node elements

A2.1 Storage

Storage nodes are used to represent manholes in the system.

Parameter	Units	Description / Values
Name	-	Naming is as per 2010 Master Plan.
Tag	-	No tags were used.

Parameter	Units	Description / Values
Inflows	-	Sanitary sewer flows are included as inflows as per Section A2.3.
Treatment	-	No treatment is modelled
Invert Elevation	m	Invert elevations are taken from the 2010 Master Plan except new nodes where it is based on GIS data.
Rim Elevation	m	Elevation at the lid of the node taken from the 2010 Master Plan except new nodes where it is based on GIS data..
Depth	m	The depth is internally calculated in PCSWMM as the difference between the invert and rim elevations.
Initial Depth	m	Initial depths are used if there is backwater in the system at the start of the simulation. It is not used here.
Ponded Area	m^2	No ponded areas are set in the model.
Evaporation Factor	fraction	No evaporation is considered in design event analysis.
Storage Curve	-	Manholes have an assumed storage of 1.13 m^2 representing a 1200 mm diameter manhole.

A2.2 Outfalls

A single outfall is present in the model at the pump station location. Since only a steady state analysis is being carried out the downstream boundary condition does not impact results.

Parameter	Units	Description / Values
Name	-	Outfalls are named as per the 2010 Master Plan.
Tag	-	No tags were used for the outfalls.
Inflows	-	No external inflows are applied at outfall nodes
Treatment	-	No treatment is modelled
Invert Elevation	m	Invert elevation of the node is as per the 2010 Master Plan.

Parameter	Units	Description / Values
Rim Elevation	m	Elevation at the lid of the node as per the 2010 Master Plan.
Tide Gate	-	No backflow is prevented in the model outfalls and therefore 'No' is selected.
Route To	-	If flow from the outfall is directed to another subcatchment but this is not done in the model and this parameter is left blank.
Type	-	All outfalls have NORMAL outfall type which means depth of flow at the outlet is not affected by downstream conditions.

A2.3 Inflows

Parameter	Units	Description / Values
Baseline	m^3/s	For direct flow into a drainage system, not used in the model.
Baseline Pattern	-	For direct flow into a drainage system, not used in the model.
Timeseries	-	For direct flow into a drainage system, not used in the model.
Scale Factor	-	For direct flow into a drainage system, not used in the model.
Average Value	m^3/s	The average value represents the DWF into the system at the node. It consists of the base flow multiplied by the peaking factor and the infiltration component.
Time Patterns	-	Where no time patterns are applied to the average value the time value is 1.0.
Hydrograph	-	Used for wet weather flows and not included in the model.
Sewershed Area	ha	The sewershed areas contributing to the node.

Appendix C

Stormwater Model Parameters

Appendix A – PCSWMM Model Parameters

The following sets out a description of each of the parameters used in the dual drainage modelling for the Jarvis Master Plan. Any differences from the below at any of the specific elements are noted in the description in the model. The PCSWMM model has been based on the previous Infoworks CS modelling completed for the 2010 Master Plan.

A1.0 Subcatchments

Parameter	Units	Description
Name	-	The name of the subcatchment as per the 2010 Master Plan and is based on the receiving node ID. New areas have a name based on the downstream receiving node ID.
Tag	-	The catchments are tagged by one of the land use covers identified in the 2010 Master Plan. The catchments representing the most recent development occurred in 2010 were tagged as 'Recent_Development'. The catchments representing the future development that will occur by 2020 were tagged as 'Future_Development'.
Rain Gauge	-	The storm type selected for the model run. The following IDF parameters, as per the 2010 Master Plan, were used to create the 3-hour Chicago design storms: **Return Period** / **a** / **b** / **c** / **Depth (mm)** 1:2 year / 646.0 / 6.0 / 0.781 / 32.6 1:5 year / 1,049.5 / 8.0 / 0.803 / 47.0 1:100 year / 2,317.4 / 11.0 / 0.836 / 86.1
Outlet	-	The subcatchment runoff receiving node which is the same location as per the 2010 Master Plan. New areas have been allocated to the lowest elevation major system node in the catchment.
Area	ha	The area is calculated internally by PCSWMM through GIS and is the same as the 2010 Master Plan value used.

Parameter	Units	Description
Width / Flow Length	m	The width parameter has been taken from the 2010 Master Plan where the catchment has remained unchanged from 2010. For the regular shaped new subcatchments the width parameter has been calculated as the length perpendicular to overland flow direction within subcatchment. The width parameter of any new irregular shaped subcatchment are calculated to take in the account for skew within the subcatchment using the approach proposed by Guo and Urbonas (2007) (refer to EPA Storm Water Management Model Reference Manual Vol I – Hydrology (EPA, 2016)).
Slope	%	Slopes are from the 2010 Master Plan except where noted in the comments. Some subcatchments had 0 slope in 2010 and a shallow slope of 0.2 has been used in the PCSWMM model to obtain similar peak flows as 2010. Three of the large agricultural subcatchments, noted in the model descriptions, have had slopes altered to provide similar flows to the 2010 model.
Imperv	%	For subcatchments from the 2010 Master Plan the Imperv is the directly and indirectly connected imperviousness used in the model. For new areas this value has been calculated based on impervious land cover. **Land Cover** — **IMP %** Agricultural — 8 EXTERNAL W/ SOME URBAN — 13 ICI - Heavy Clay — 94 Mixed LD RES with Commercial. — 40 Open Spaces — 8 Residential - LD Cul-Sac — 67 Residential - LD Heavy Clay — 70 School — 64
N Imperv	-	A constant of 0.013 is selected as the Manning's N for impervious surfaces such as roads, sidewalk and parking areas. The value is representative of smooth impervious surface as per Table 3-5 of the EPA Storm Water Management Model Reference Manual Vol I – Hydrology (EPA, 2016).
N Perv	-	A constant of 0.25 is used as the Manning's N for pervious areas. The value is representative of light to tense turf land cover as per Table 3-5 of the EPA Storm Water Management Model Reference Manual Vol I – Hydrology (EPA, 2016).

<table>
<tr><th>Parameter</th><th>Units</th><th>Description</th></tr>
<tr><td>DStore Imperv</td><td>mm</td><td>A standard value of 1.57 mm is used as the impervious depression storage.</td></tr>
<tr><td>DStore Perv</td><td>mm</td><td>The pervious depression storage is linked to the Curve Number (CN) and Soil Storage (S) using the following relationship:

CN — DStore Perv
≤ 70 — 0.075*S
> 70 ≤ 80 — 0.10*S
> 80 ≤ 90 — 0.155*S
> 90 — 0.2*S

Note: $S = \frac{25400}{CN} - 254$</td></tr>
<tr><td>Zero Imperv</td><td>%</td><td>Across areas of water it is considered that there is no depression storage. This value has been set to 0.</td></tr>
<tr><td>Subarea Routing</td><td>-</td><td>For subcatchments in the 2010 Master Plan the subrouting is either to PERVIOUS or IMPERVIOUS in accordance with the pervious model. The value is the receiving subarea of flow from other subareas in the catchment.

For new subcatchments the constant ‘PERVIOUS’ is entered to simulate the subarea of impervious surface which may flow over pervious areas prior to discharging to the outlet of the subcatchment.</td></tr>
<tr><td>Percent Routed</td><td>%</td><td>The percent of routed subarea is taken from the 2010 Master Plan for each catchment. For new subcatchments this is estimated based on direction of runoff from impervious areas in the new development areas.

Land Cover — %IMP to PERVIOUS — % PERV. to IMP
Agricultural — 62.5 — 0
EXTERNAL W/ SOME URBAN — 0 — 17.2
ICI - Heavy Clay — 0 — 100
Mixed LD RES with Commercial. — 15 — 0
Open Spaces — 75 — 0
Residential - LD Cul-Sac — 15 — 0
Residential - LD Heavy Clay — 6 — 0
School — 0 — 100</td></tr>
</table>

Parameter	Units	Description
CN Value	-	The following CN values have been used based on the soil type from the OMAFRA mapping and the land cover. The OMAFRA mapping indicated that soils of hydrologic soil group C and D are prevalent in the area. In the urban areas a soil class D was assumed. **Land Cover** — **C CN Value** — **D CN Value** Agricultural — 79 — 84 EXTERNAL W/ SOME URBAN — 79 — 84 ICI - Heavy Clay — 76 — 81 Mixed LD RES with Commercial. — 71 — 78 Open Spaces — 71 — 78 Residential - LD Cul-Sac — 71 — 78 Residential - LD Heavy Clay — 71 — 78 School — 71 — 78 The CN value was area weighted based on the percentage of soil class in the subcatchment. A modified CN value (CN*) was calculated for each subcatchment to account for the difference in initial abstraction from the standard value of 0.2S.
Drying Time	days	The time for a fully saturated soil to completely dry is set at 7 days though this is not used in design event analysis.

The parameters Curb Length, Snow Pack, LID Controls, Groundwater and Erosion are not used in the model.

A2.0 Link Elements

A2.1 Conduits

Conduits represent either open channels or culverts.

Parameter	Units	Description / Values
Name	-	Conduits taken from the 2010 Master Plan maintain the same name which appears to be linked to one of the connecting nodes. New conduits are named based on the supplied GIS data.
Inlet Node	-	Upstream node of the link element.
Outlet Node	-	Downstream node of the link element.

Parameter	Units	Description / Values
Tag	-	Conduits are tagged as follows which is consistent with the type in the 2010 Master Plan model: **Tag** — **Description** Storm_Sewer — Underground piped infrastructure FUT_Storm_Sewer — Underground piped infrastructure of future development Street — Flow through streets Culvert — Piped flow with open channel flow either side SWMF_Outlet — Outlet Pipe from Stormwater Management Facility (SWMF) Overland — Open channel flow
Length	m	Length is auto-calculated in PCSWMM and is consistent with the 2010 Master Plan except for new links.
Roughness	-	For links from the 2010 Master Plan the roughness coefficient is maintained. For new sections the roughness coefficient of 0.013 is used for all sewer and culverts links. For channels the roughness coefficient of 0.035 is used for the channel.
Inlet Offset	m	Inlet elevation of the conduit element. Consistent with the 2010 Master Plan or the supplied GIS data for new links.
Outlet Offset	m	Outlet elevation of the conduit element. Consistent with the 2010 Master Plan or the supplied GIS data for new links.
Initial Flow	m^3/s	No initial flows are set in the model
Flow Limit	m^3/s	No flow limits are set in the model
Entry Loss Coeff.	-	Culvert entry losses are dependent on the type of inlet used and are consistent with the 2010 Master Plan.

<table>
<tr><th>Parameter</th><th>Units</th><th>Description / Values</th></tr>
<tr><td>Exit Loss Coeff.</td><td>-</td><td>Exit loss coefficients are applied to culverts to simulate the losses to open channel flow and are consistent with the losses applied in the 2010 Master Plan. Sewer losses are dependent on the change in direction of flow

Angle (deg) — Loss Coef.
0 — 0.02
10 — 0.045
20 — 0.118
30 — 0.21
40 — 0.325
50 — 0.46
60 — 0.635
70 — 0.84
80 — 1.065
90 — 1.32

No losses are applied to overland or street flow.</td></tr>
<tr><td>Ave. Loss Coeff.</td><td>-</td><td>The average loss coefficient is not used in this model.</td></tr>
<tr><td>Seepage Rate</td><td>mm/hr</td><td>There is no seepage applied to conduits in this model.</td></tr>
<tr><td>Flap Gate</td><td>-</td><td>No flapgates are used in the model.</td></tr>
<tr><td>Cross Section</td><td>-</td><td>Cross sections are generally circular for sewers, rectangular for streets, trapezoidal for open channel flow and either circular, elliptical or rectangular for cuvlerts. Cross sections are consistent with the 2010 Master Plan.</td></tr>
<tr><td>Geom1</td><td>m</td><td>Type — Description
Circular — Pipe diameter
Rectangular — Maximum Depth
Trapezoidal — Maximum Depth
Ellipse — Maximum Depth or Standard Size ID</td></tr>
<tr><td>Geom2</td><td>m</td><td>Type — Description
Circular — Not used
Rectangular — Bottom Width
Trapezoidal — Bottom Width
Ellipse — Maximum Width or not used</td></tr>
</table>

Parameter	Units	Description / Values
Geom3	m/m	**Type** — **Description** Circular — Not used Rectangular — Not used Trapezoidal — Left slope Ellipse — Not used
Geom4	m/m	**Type** — **Description** Circular — Not used Rectangular — Not used Trapezoidal — Right slope Ellipse — Not used
Barrels	-	The number of identical sewers within the conduit, usually 1.
Transect	-	Refers to transect data, if used, for the open channel links.
Shape Curve	-	Not used in this model
Culvert Code	-	The culvert code is used for culvert inlet links to ensure that the model treats the link as a culvert opening. Culvert codes have been selected to maintain consistency with the culvert coefficients used in the 2010 Master Plan.

A2.2 Weirs

Weirs have been used to carry overland flow through urban flow routes and across roads where culverts are overtopped. They are consistent in location with the 2010 Master Plan.

Parameter	Units	Description / Values
Name	-	Weirs maintain the same name as per the 2010 Master Plan which appears to be linked to one of the connecting nodes.
Inlet Node	-	Upstream node of the link element.
Outlet Node	-	Downstream node of the link element.
Tag	-	No tags used.
Type	-	All weirs links are transverse weirs where a rectangular cross section is perpendicular to the direction of flow.

Parameter	Units	Description / Values
Height	m	Maximum height of weir flow, consistent with Rim Elevation of the Inlet Node.
Length	m	Opening width of the weir.
Side Slope	m/m	Not used for rectangular transverse weirs
Inlet Elevation	m	Elevation of the crest of the weir.
Discharge Coefficient	-	Standard value of 0.85 in SI units used to represent a broad crested weir structure.
Flap Gate	-	No flap gates are applied.
End Contractions	-	Not used as consistent with the 2010 Master Plan.
End Coefficient	m^3/s	Not used as consistent with the 2010 Master Plan.
Can surcharge	-	Weirs have not been allowed to surcharge in order to represent free flow conditions in open channel flow.

A2.3 Outlets

These have been added in the model from the 2010 Master Plan. In Infoworks CS the major and minor system can be connected at the same node. In SWMM models the major and minor system must have separate nodes and be connected via an outlet link which represents catchbasin or multiple catchbasin inflows. The flows into the minor system are therefore under greater control in the updated SWMM model and may affect the behaviour of the system.

Parameter	Units	Description / Values
Name	-	Naming is based on the inlet node.
Inlet Node	-	Inlet node of the outlet link (the major system).
Outlet Node	-	Receiving node of the outlet link (minor system).
Tag	-	No tags used.
Inlet Elevation	m	The inlet elevation is set as the invert of the major system node.

<table>
<tr><th>Parameter</th><th>Units</th><th>Description / Values</th></tr>
<tr><td>Flap Gate</td><td>-</td><td>No flapgate restrictions are set so that backflow from the minor system into the major is allowed.</td></tr>
<tr><td>Rating Curve</td><td>-</td><td>All rating curves are set as TABULAR/HEAD in order that the minor system HGL affects the inlet capacity of the system. The curves are created using the inlet rating curve of a standard catchbasin grate and/or 600mm x 600mm ditch inlet grate. The curve data contains the number of catchbasins and ditch inlets lumped in each rating curve.
<table>
<tr><th>Head above grate (m)</th><th>Catchbasin Inlet Capacity (m³/s)</th><th>Ditch Inlet Capacity (m³/s)</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0.01</td><td>0.002</td><td>0.012</td></tr>
<tr><td>0.015</td><td>0.002</td><td>0.013</td></tr>
<tr><td>0.021</td><td>0.003</td><td>0.016</td></tr>
<tr><td>0.03</td><td>0.005</td><td>0.018</td></tr>
<tr><td>0.04</td><td>0.006</td><td>0.023</td></tr>
<tr><td>0.05</td><td>0.008</td><td>0.027</td></tr>
<tr><td>0.054</td><td>0.010</td><td>0.028</td></tr>
<tr><td>0.06</td><td>0.013</td><td>0.03</td></tr>
<tr><td>0.08</td><td>0.022</td><td>0.04</td></tr>
<tr><td>0.09</td><td>0.034</td><td>0.045</td></tr>
<tr><td>0.1</td><td>0.048</td><td>0.053</td></tr>
<tr><td>0.104</td><td>0.052</td><td>0.054</td></tr>
<tr><td>0.11</td><td>0.06</td><td>0.06</td></tr>
<tr><td>0.14</td><td>0.08</td><td>0.081</td></tr>
<tr><td>0.15</td><td>0.085</td><td>0.09</td></tr>
<tr><td>0.16</td><td>0.09</td><td>0.099</td></tr>
<tr><td>0.17</td><td>0.095</td><td>0.105</td></tr>
<tr><td>0.2</td><td>0.097</td><td>0.12</td></tr>
<tr><td>0.3</td><td>0.1</td><td>0.237</td></tr>
<tr><td>1</td><td>0.1</td><td>0.9</td></tr>
</table>
Rating curve for 1200mm x 600mm ditch inlet representing the outlet structure at JM_Pond_2 was obtained for as-built information (DWG: 0674-SWM2 - Phase 2 Development-Upper Canada Consultants) and Chart 4.20 ‘Ditch Inlet Capacity’ from MTO Drainage Manual:
<table>
<tr><th>Head above grate (m)</th><th>Ditch Inlet Capacity (m³/s)</th></tr>
<tr><td>0</td><td>0.0000</td></tr>
<tr><td>0.02</td><td>0.0216</td></tr>
<tr><td>0.06</td><td>0.0540</td></tr>
</table></td></tr>
</table>

Parameter	Units	Description / Values
		0.1 0.1080 0.2 0.3360 0.3 0.7200 0.4 1.3200 0.5 2.0400
Curve Name	-	The name of the lumped curve used for the outlet link.

A3.0 Node elements

A3.1 Junctions

Junctions are used to connect the links and have no hydraulic properties associated with them.

Parameter	Units	Description / Values
Name	-	Naming as per 2010 Master Plan or standard naming convention for new nodes.
Tag	-	No tags used for junction nodes.
Inflows	-	No additional inflows to the system are modelled.
Treatment	-	No treatment is modelled
Invert Elevation	m	Invert elevation of the node taken from 2010 Master Plan. For new nodes the invert elevation is based on grading for major system nodes.
Rim Elevation	m	Elevation at the top of the node based on the depth of the connecting links, generally taken from the 2010 Master Plan or updated for connectivity. New nodes it is set on the depth of the adjoining conduits.
Depth	m	The depth is internally calculated in PCSWMM as the difference between the invert and rim elevations.
Initial Depth	m	Initial depths are used if there is backwater in the system at the start of the simulation. It is not used in this model as there is no downstream backwater control.
Surcharge Depth	m	No surcharge depth is applied.

Parameter	Units	Description / Values
Ponded Area	m²	No ponded areas are set in the model.

A3.2 Storage

Storage nodes are used to represent manholes in the system, sag storage in the surface along street sections or natural/man-made storage facilities.

Parameter	Units	Description / Values
Name	-	Naming is as per 2010 Master Plan except the major and minor nodes have been separated so the minor system storage nodes have an STM- prefix.
Tag	-	Minor system manholes are tagged.
Inflows	-	No additional inflows to the system are modelled.
Treatment	-	No treatment is modelled
Invert Elevation	m	Invert elevations are taken from the 2010 Master Plan except new nodes where it is based on GIS data or surface topography.
Rim Elevation	m	Elevation at the top of the node based on the depth of the connecting links. Taken from the 2010 Master Plan but updated at some locations to maintain connectivity.
Depth	m	The depth is internally calculated in PCSWMM as the difference between the invert and rim elevations.
Initial Depth	m	Initial depths are used if there is backwater in the system at the start of the simulation. It is not used here.
Ponded Area	m²	No ponded areas are set in the model.
Evaporation Factor	fraction	No evaporation is considered in design event analysis.

Parameter	Units	Description / Values
Storage Curve	-	For sag storage and manholes a FUNCTIONAL storage curve is selected where the constant value is the footprint of the storage. Manholes have an assumed storage of 1.13 m² representing a 1200 mm diameter manhole. Sag storage has a constant of 10m² as per the 2010 Master Plan. New areas use similar values. For natural or man-made storage facilities such as SWM facilities the storage curve is TABULAR and the curve is based on the area – depth relationship of the facility.

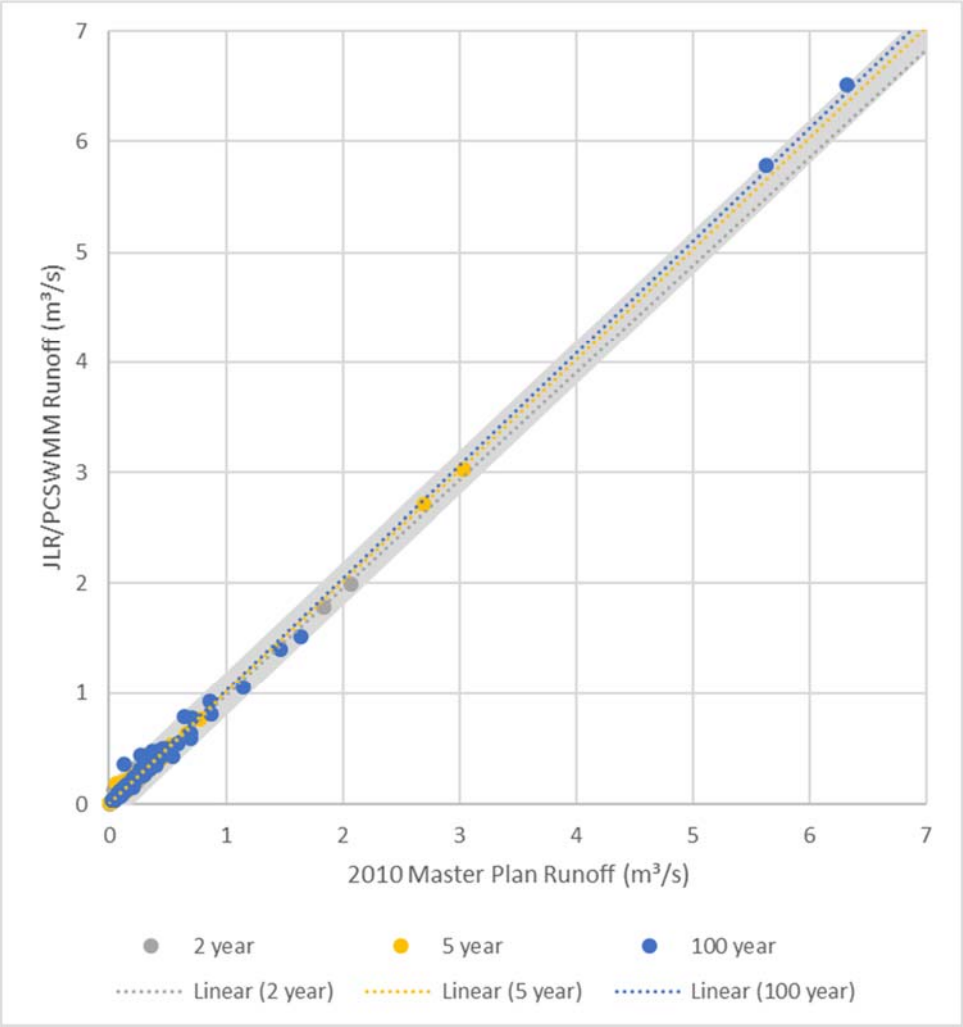
A3.3 Outfalls

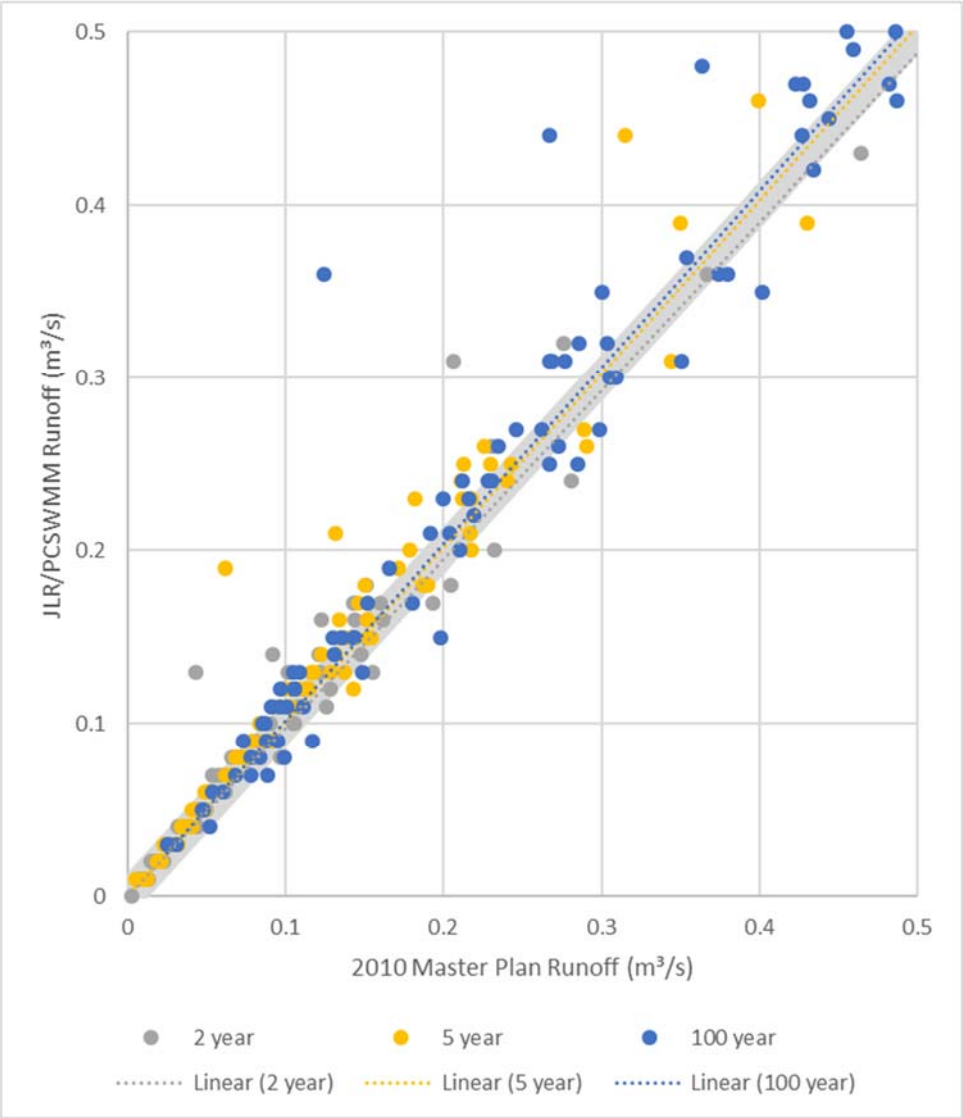
Parameter	Units	Description / Values
Name	-	Outfalls are named as per the 2010 Master Plan.
Tag	-	No tags were used for the outfalls.
Inflows	-	No external inflows are applied at outfall nodes
Treatment	-	No treatment is modelled
Invert Elevation	m	Invert elevation of the node is as per the 2010 Master Plan.
Rim Elevation	m	Elevation at the top of the node based on the depth of the connecting links.
Tide Gate	-	No backflow is prevented in the model outfalls and therefore 'No' is selected.
Route To	-	If flow from the outfall is directed to another subcatchment but this is not done in the model and this parameter is left blank.
Type	-	All outfalls have NORMAL outfall type which means depth of flow at the outlet is not affected by downstream conditions.

A4.0 Model Comparison

The results of the PCSWMM model can be compared to the 2010 Master Plan results for each subcatchment to confirm the appropriateness of the PCSWMM simulation. The graph in the figure below shows the runoff for each subcatchment in the 2010 Master Plan against the runoff

in the PCSWMM model. The majority of the subcatchments have runoff values similar (within the grey line) to the previous model. The graph confirms that the PCSWMM model represents the runoff within the study area to a similar degree as the 2010 Master Plan.




0.5
0.4
0.3
0.2
0.1
0
JLR/PCSWMM Runoff (m³/s)
0
0.1
0.2
0.3
0.4
0.5
2010 Master Plan Runoff (m³/s)
2 year
5 year
100 year
Linear (2 year)
Linear (5 year)
Linear (100 year)

Existing Condition Storm Subcatchment Hydrologic Parameters

Name	Receiving Node	Area (ha)	%Imp	Width (m)	Slope (m/m)	Land Use and Soil	Model Peak Runoff Results (m³/s)		
							1:2 year	1:5 year	1:100 year
60CBMH0018	60CBMH0018_OUT	0.86	70	52.4	0.0002	Residential - LD Heavy Clay	0.09	0.13	0.26
60CBMH0026	60CBMH0026_OUT	0.83	70	51.3	0.0006	Residential - LD Heavy Clay	0.1	0.14	0.27
60CBMH0037	60CBMH0037_OUT	2.48	70	88.8	0.0007	Residential - LD Heavy Clay	0.26	0.39	0.78
60CBMH0069	60CBMH0069_OUT	0.07	70	14.9	0.0027	Residential - LD Heavy Clay	0.01	0.01	0.03
60CBMH0070	60CBMH0070_OUT	1.03	70	83.85	0.0007	Residential - LD Heavy Clay	0.13	0.19	0.36
60CBMH0072	60CBMH0072_OUT	0.2	70	25	0.0027	Residential - LD Heavy Clay	0.03	0.04	0.07
60CBMH0074	60CBMH0074_OUT	0.41	70	36.1	0.0022	Residential - LD Heavy Clay	0.05	0.08	0.15
60CBMH0075	60CBMH0075_OUT	0.23	70	26.9	0.0004	Residential - LD Heavy Clay	0.03	0.04	0.08
60CBMH0077	60CBMH0077_OUT	0.36	67	33.6	0.0024	Residential - LD Cul-Sac	0.04	0.06	0.13
60CBMH0079	60CBMH0079_OUT	0.07	70	14.8	0.0052	Residential - LD Heavy Clay	0.01	0.01	0.03
60CBMH0082	60CBMH0082_OUT	0.62	70	44.4	0.0026	Residential - LD Heavy Clay	0.08	0.12	0.23
60CBMH0082.1	60STCB0082_OUT	0.74	70	48.4	0.0008	Residential - LD Heavy Clay	0.09	0.13	0.26
60CBMH0142	60CBMH0142_OUT	1.06	94	58.1	0.0005	ICI - Heavy Clay	0.16	0.23	0.46
60CBMH2000	60CBMH2000_OUT	1.5	70	59.083	0.0007	Residential - LD Heavy Clay	0.16	0.24	0.47
60CULV2002.4	60CULV2002d	0.14	70	20.8	0.0015	Residential - LD Heavy Clay	0.02	0.03	0.05
60CULV2013.1	60STOF2008	0.71	70	47.6	0.0005	Residential - LD Heavy Clay	0.08	0.12	0.24
60DICB0080	60DICB0080_OUT	0.29	70	30.1	0.0014	Residential - LD Heavy Clay	0.04	0.05	0.11
60DICB0081	60DICB0081_OUT	0.66	70	45.7	0.0013	Residential - LD Heavy Clay	0.08	0.12	0.24
60DICB0128	60DICB0128_OUT	0.45	67	37.6	0.0013	Residential - LD Cul-Sac	0.05	0.07	0.15
60DICB0198	60DICB0198_OUT	0.37	67	34.3	0.0013	Residential - LD Cul-Sac	0.04	0.06	0.13
60RYCB2000	60RYCB2000_OUT	0.86	8	52.4	0.0004	Open Spaces	0	0.01	0.03
60STCB0002	60STCB0002_OUT	3.29	13	102.3	0.0006	EXTERNAL DRAINAGE W/ SOME URBAN	0.09	0.12	0.25
60STCB0008	60STCB0008_OUT	2.5	13	89.3	0.0008	EXTERNAL DRAINAGE W/ SOME URBAN	0.07	0.09	0.2
60STCB0023	60STCB0023_OUT	1.61	40	71.5	0.0011	Mixed LD RES with Commercial.	0.11	0.15	0.31
60STCB0038	60STCB0038_OUT	6.48	13	143.6	0.0004	EXTERNAL DRAINAGE W/ SOME URBAN	0.16	0.23	0.46
60STCB0044	60STCB0044_OUT	1.13	94	60.1	0.0005	ICI - Heavy Clay	0.16	0.25	0.49
60STCB0045	60STCB0045_OUT	1.56	40	70.4	0.002	Mixed LD RES with Commercial.	0.11	0.15	0.31
60STCB0049	60STCB0049_OUT	0.29	70	30.2	0.0045	Residential - LD Heavy Clay	0.04	0.06	0.12
60STCB0051	60STCB0051_OUT	0.13	70	20.7	0.0004	Residential - LD Heavy Clay	0.02	0.03	0.05
60STCB0055	60STCB0055_OUT	0.58	40	42.8	0.0013	Mixed LD RES with Commercial.	0.04	0.06	0.12
60STCB0057	60STCB0057_OUT	0.45	40	38	0.0018	Mixed LD RES with Commercial.	0.03	0.05	0.1
60STCB0059	60STCB0059_OUT	0.39	40	35.1	0.0017	Mixed LD RES with Commercial.	0.03	0.04	0.09
60STCB0060	60STCB0060_OUT	0.6	40	43.8	0.0002	Mixed LD RES with Commercial.	0.04	0.06	0.11
60STCB0061	60STCB0061_OUT	0.55	40	41.7	0.0013	Mixed LD RES with Commercial.	0.04	0.05	0.11
60STCB0064	60STCB0054	0.68	94	46.4	0.0012	ICI - Heavy Clay	0.12	0.17	0.32
60STCB0068	60STCB0068_OUT	0.47	40	38.6	0.0005	Mixed LD RES with Commercial.	0.03	0.05	0.09
60STCB0073	60STCB0073_OUT	1.8	40	75.8	0.0002	Mixed LD RES with Commercial.	0.1	0.15	0.3
60STCB0075	60STCB0075_OUT	1.19	64	61.7	0.0008	School	0.14	0.2	0.37
60STCB0078	60STCB0064_OUT	0.35	94	33.2	0.0025	ICI - Heavy Clay	0.07	0.09	0.17
60STCB0079	60STCB0079_OUT	0.57	40	42.7	0.0021	Mixed LD RES with Commercial.	0.04	0.06	0.12
60STCB0082	60STCB0082_OUT	0.39	70	35.4	0.0008	Residential - LD Heavy Clay	0.05	0.07	0.14
60STCB0083	60STCB0078_OUT	0.33	94	32.2	0.0006	ICI - Heavy Clay	0.06	0.08	0.15
60STCB0088	60STCB0088_OUT	1.24	70	62.7	0.0002	Residential - LD Heavy Clay	0.12	0.18	0.36
60STCB0090	60STCB0097_OUT	0.59	70	43.4	0.0015	Residential - LD Heavy Clay	0.08	0.11	0.21
60STCB0097	60STCB0103	0.67	70	46.2	0.0013	Residential - LD Heavy Clay	0.09	0.12	0.23
60STCB0098	60STCB0098_OUT	1.4	70	66.8	0.0005	Residential - LD Heavy Clay	0.15	0.23	0.44
60STCB0101	60STCB0101_OUT	0.51	70	40.2	0.0083	Residential - LD Heavy Clay	0.07	0.1	0.19
60STCB2000	60STCB2000_OUT	0.72	70	47.9	0.001	Residential - LD Heavy Clay	0.09	0.13	0.24
60STMH0008	60STMH0008_OUT	0.28	40	29.7	0.002	Mixed LD RES with Commercial.	0.02	0.03	0.06
60STMH0009	60STMH0009_OUT	0.26	70	28.6	0.0019	Residential - LD Heavy Clay	0.03	0.05	0.1
60STMH0010	60STMH0010_OUT	0.44	70	37.2	0.0003	Residential - LD Heavy Clay	0.05	0.08	0.15
60STMH0011	60STMH0011_OUT	0.27	70	29.2	0.0124	Residential - LD Heavy Clay	0.04	0.05	0.11
60STMH0014	60STMH0014_OUT	0.97	70	55.5	0.001	Residential - LD Heavy Clay	0.12	0.17	0.32
60STMH0015	60STMH0015_OUT	0.63	70	44.9	0.0005	Residential - LD Heavy Clay	0.08	0.11	0.21
60STMH0016	60STMH0016_OUT	0.71	70	47.6	0.0005	Residential - LD Heavy Clay	0.08	0.12	0.24
60STMH0017	60STMH0017_OUT	0.68	70	46.6	0.0005	Residential - LD Heavy Clay	0.08	0.12	0.22
60STMH0019	60STMH0019_OUT	0.46	40	38.1	0.0011	Mixed LD RES with Commercial.	0.03	0.04	0.1
60STMH0020	60STMH0020_OUT	0.84	70	51.8	0.0022	Residential - LD Heavy Clay	0.11	0.16	0.31
60STMH0193	60STMH0193_OUT	0.95	70	55.1	0.0053	Residential - LD Heavy Clay	0.13	0.18	0.35
60STMH2000	60STMH2000_OUT	1.5	70	69.2	0.001	Residential - LD Heavy Clay	0.18	0.26	0.5
DICB026	DICB026_OUT	0.17	70	23.5	0.0006	Residential - LD Heavy Clay	0.02	0.03	0.06
60CULV2003.1	60CULV2004c	1.54	70	70	0.0002	Residential - LD Heavy Clay	0.14	0.21	0.44
60CULV2004.1	60CULV2004a	16.73	13	230.8	0.0002	EXTERNAL DRAINAGE W/ SOME URBAN	0.36	0.53	1.05
60CULV2006.1	60CULV2006	370.79	8	1086.4	0.0015	Agricultural	1.79	2.71	5.78
60CULV2000.1	60CULV2000	21.39	8	260.9	0.0009	Agricultural	0.13	0.19	0.45
60CULV2000.4	60SWALE2001b	1.41	70	66.9	0.0017	Residential - LD Heavy Clay	0.17	0.25	0.47
60CULV2001.2	60CULV2001	1.22	70	62.2	0.0002	Residential - LD Heavy Clay	0.11	0.18	0.36
60CULV2005.1	60CULV2005b	1.64	94	72.1	0.0209	ICI - Heavy Clay	0.31	0.44	0.79
60CULV2005.4	60STOV2009	1.18	70	61.2	0.0209	Residential - LD Heavy Clay	0.16	0.23	0.48
60CULV2007.1	60CULV2006d	4.48	13	119.4	0.0002	EXTERNAL DRAINAGE W/ SOME URBAN	0.11	0.16	0.31
60CULV2008.1	60CULV2007d	2.6	40	91	0.0002	Mixed LD RES with Commercial.	0.14	0.21	0.42
60CULV2009.1	60CULV2008d	1.78	40	75.3	0.0002	Mixed LD RES with Commercial.	0.1	0.15	0.3
60CULV2011.4	60CULV2011d	9.22	8	171.3	0.0002	Open Spaces	0.04	0.05	0.13
60CULV2012.4	60CULV2012d	3.23	64	101.4	0.0002	School	0.24	0.39	0.81
60CULV2013.4	60STOF2009_OUT	1.85	8	76.7	0.0001	Open Spaces	0.01	0.01	0.04
60STOF2000a	J4	1.04	13	57.6	0.0003	EXTERNAL DRAINAGE W/ SOME URBAN	0.03	0.04	0.08
60STOF2004a	60STOF2004a_OUT	0.51	40	40.3	0.0002	Mixed LD RES with Commercial.	0.03	0.05	0.09

Existing Condition Storm Subcatchment Hydrologic Parameters

Name	Receiving Node	Area (ha)	%Imp	Width (m)	Slope (m/m)	Land Use and Soil	Model Peak Runoff Results (m^3/s)		
							1:2 year	1:5 year	1:100 year
60STOF2007	60CULV2010d	1.21	94	62	0.0004	ICI - Heavy Clay	0.17	0.25	0.5
60STOF2009	60STOF2009_OUT	27.28	8	294.7	0.0001	Agricultural	0.13	0.2	0.43
60STOV2001	60STOV2001_OUT	2.01	70	79.9	0.0002	Residential - LD Heavy Clay	0.17	0.26	0.55
60STOV2002	60STOV2002_OUT	6.41	8	142.8	0.0002	Open Spaces	0.03	0.04	0.09
60STOV2011	60STOV2011_OUT	0.91	70	53.7	0.0001	Residential - LD Heavy Clay	0.08	0.12	0.25
60STOV2016	60STOV2016_OUT	0.77	70	49.5	0.0011	Residential - LD Heavy Clay	0.1	0.14	0.27
60SWALE2002.1	60SWALE2002	3.49	8	105.5	0.0002	Open Spaces	0.01	0.02	0.07
60SWALE2003a	60SWALE2003a_OUT	0.91	13	53.9	0.0002	EXTERNAL DRAINAGE W/ SOME URBAN	0.02	0.03	0.07
60SWALE2004.1	60SWALE2004a	7.68	8	156.4	0.0002	Agricultural	0.04	0.07	0.15
60SWALE2004.1.9	60SWALE2004a	0.55	70	41.9	0.0002	Residential - LD Heavy Clay	0.06	0.09	0.17
CA_314,_315,_316	CA_314,_315,_316_OUT	231.21	8	857.9	0.0015	Agricultural	1.19	1.79	3.85
CULV025.1	60CULV2002e	3.86	8	110.8	0.0002	Open Spaces	0.02	0.02	0.08
EAST_OUTFALL	60CULV2012d	36.23	8	339.6	0.0002	Agricultural	0.18	0.27	0.59
north_culvert	north_culvert_a	12.24	13	197.4	0.0035	EXTERNAL DRAINAGE W/ SOME URBAN	0.32	0.46	0.93
Ultimate_Outlet_SE	CA_314,_315,_316_OUT	421.32	8	1158.1	0.0015	Agricultural	1.99	3.03	6.51
60STCB0107	60STCB0103	0.49	40	89.8	0.0023	Mixed LD RES with Commercial.	0.03	0.05	0.13
60STOF2000.4.1	60SWALE2003b	5.32	8	540	0.0003	Agricultural	0.03	0.06	0.3
60STOF2003-ex	60STOF2003	3.56	13	109.2	0.0002	EXTERNAL DRAINAGE W/ SOME URBAN	0.09	0.13	0.25
60STOV2006	60STOV2006.1	2.6	40	117.3	0.0002	Mixed LD RES with Commercial.	0.15	0.22	0.42
60UNCON0001	60UNCON0001_OUT	83.79	8	516.7	0.0005	Agricultural	0.43	0.64	1.4
CNR_culv_a	CNR_culv_a_OUT	25.1	13	282.4	0.0002	EXTERNAL DRAINAGE W/ SOME URBAN	0.5	0.76	1.52
JM'1'	60STMH0272_OUT	0.27	40	29.2	0.0004	Mixed LD RES with Commercial.	0.02	0.03	0.05
JM'2'	JM'2'_OUT	0.41	40	36	0.0001	Mixed LD RES with Commercial.	0.03	0.04	0.07
JM'3'	60STMH0279_OUT	0.29	40	30.4	0.0005	Mixed LD RES with Commercial.	0.02	0.03	0.05
JM'3b'	60STMH0279_OUT	0.44	40	37.5	0.0005	Mixed LD RES with Commercial.	0.03	0.04	0.08
JM'4'	60STMH0282_OUT	0.25	8	28.2	0.0008	Open Spaces	0	0	0.01
JM'5'	60STMH0289_OUT	0.3	40	31	0.0006	Mixed LD RES with Commercial.	0.02	0.03	0.06
JM'6'	60STMH0303_OUT	0.45	40	37.7	0.0003	Mixed LD RES with Commercial.	0.03	0.04	0.08
JM'7'	60STMH0300_OUT	0.2	40	25.1	0.0004	Mixed LD RES with Commercial.	0.01	0.02	0.04
JM'7'comm	60STMH0300_OUT	0.67	70	46	0.0004	Residential - LD Heavy Clay	0.08	0.11	0.22
JM'8'	60STMH0296_OUT	0.75	40	48.8	0.0001	Mixed LD RES with Commercial.	0.04	0.06	0.12
JM11	60STMH0339_OUT	0.6	40	43.6	0.0004	Mixed LD RES with Commercial.	0.04	0.06	0.11
JM12	60STMH0338_OUT	0.42	40	36.7	0.0004	Mixed LD RES with Commercial.	0.03	0.04	0.08
JM16	60STMH0336_OUT	0.51	40	40.2	0.0002	Mixed LD RES with Commercial.	0.03	0.05	0.09
JM17	60STMH0335_OUT	0.62	40	44.2	0.0004	Mixed LD RES with Commercial.	0.04	0.06	0.11
JM18	60STMH0334_OUT	0.47	40	38.5	0.0001	Mixed LD RES with Commercial.	0.03	0.04	0.08
JM19	60STMH0332_OUT	0.63	40	44.8	0.0023	Mixed LD RES with Commercial.	0.04	0.06	0.12
JM8	60STMH0341_OUT	0.43	40	37	0.0002	Mixed LD RES with Commercial.	0.03	0.04	0.08
JM_Pond_1	JSWMF-4	0.31	70	31.2	0.0001	Residential - LD Heavy Clay	0.03	0.05	0.1
JM_Pond_2	JSMF-5	1.07	70	58.4	0.0001	Residential - LD Heavy Clay	0.09	0.14	0.29
w1	w1_OUT	0.87	70	52.7	0.0008	Residential - LD Heavy Clay	0.11	0.15	0.29
w2	w2_OUT	0.5	70	39.7	0.0009	Residential - LD Heavy Clay	0.06	0.09	0.17
w3	w3_OUT	0.6	70	43.5	0.004	Residential - LD Heavy Clay	0.08	0.11	0.22
walker_SWM_FACILITY	JSWMF-3	0.63	70	44.8	0.0001	Residential - LD Heavy Clay	0.06	0.09	0.19
DN_8	J3	2.4	13	87.3	0.0001	EXTERNAL DRAINAGE W/ SOME URBAN	0.06	0.08	0.16
EX_S1	St_EX_S1	3.68	8	150	0.00211	Agricultural	0.02	0.05	0.24
60STOF2000.4.1_1	60CULV2012b	4.48	8	245	0.0003	Agricultural	0.03	0.04	0.17

Future Population Storm Subcatchment Hydrologic Parameters

Name	Receiving Node	Area (ha)	%Imp	Width (m)	Slope (m/m)	Land Use and Soil	Model Peak Runoff Results (m³/s)		
							1:2 year	1:5 year	1:100 year
60CBMH0018	60CBMH0018_OUT	0.863	70	52.4	0.2	Residential_-_LD_Heavy_Clay	0.09	0.13	0.26
60CBMH0026	60CBMH0026_OUT	0.827	70	51.3	0.6	Residential_-_LD_Heavy_Clay	0.1	0.14	0.27
60CBMH0037	60CBMH0037_OUT	2.477	70	88.8	0.7	Residential_-_LD_Heavy_Clay	0.26	0.39	0.78
60CBMH0069	60CBMH0069_OUT	0.07	70	14.9	2.7	Residential_-_LD_Heavy_Clay	0.01	0.01	0.03
60CBMH0070	60CBMH0070_OUT	1.032	70	83.85	0.7	Residential_-_LD_Heavy_Clay	0.13	0.19	0.36
60CBMH0072	60CBMH0072_OUT	0.197	70	25	2.7	Residential_-_LD_Heavy_Clay	0.03	0.04	0.07
60CBMH0074	60CBMH0074_OUT	0.41	70	36.1	2.2	Residential_-_LD_Heavy_Clay	0.05	0.08	0.15
60CBMH0075	60CBMH0075_OUT	0.227	70	26.9	0.4	Residential_-_LD_Heavy_Clay	0.03	0.04	0.08
60CBMH0077	60CBMH0077_OUT	0.355	67	33.6	2.4	Residential_-_LD_Cul-Sac	0.04	0.06	0.13
60CBMH0079	60CBMH0079_OUT	0.069	70	14.8	5.2	Residential_-_LD_Heavy_Clay	0.01	0.01	0.03
60CBMH0082	60CBMH0082_OUT	0.618	70	44.4	2.6	Residential_-_LD_Heavy_Clay	0.08	0.12	0.23
60CBMH0082.1	60STCB0082_OUT	0.736	70	48.4	0.8	Residential_-_LD_Heavy_Clay	0.09	0.13	0.26
60CBMH0142	60CBMH0142_OUT	1.06	94	58.1	0.5	ICI_-_Heavy_Clay	0.16	0.23	0.46
60CBMH2000	60CBMH2000_OUT	1.499	70	59.083	0.7	Residential_-_LD_Heavy_Clay	0.16	0.24	0.47
60CULV2002.4	60CULV2002d	0.135	70	20.8	1.5	Residential_-_LD_Heavy_Clay	0.02	0.03	0.05
60CULV2013.1	M_CULV_c	0.712	70	47.6	0.5	Residential_-_LD_Heavy_Clay	0.08	0.12	0.24
60DICB0080	60DICB0080_OUT	0.285	70	30.1	1.4	Residential_-_LD_Heavy_Clay	0.04	0.05	0.11
60DICB0081	60DICB0081_OUT	0.657	70	45.7	1.3	Residential_-_LD_Heavy_Clay	0.08	0.12	0.24
60DICB0128	60DICB0128_OUT	0.445	67	37.6	1.3	Residential_-_LD_Cul-Sac	0.05	0.07	0.15
60DICB0198	60DICB0198_OUT	0.369	67	34.3	1.3	Residential_-_LD_Cul-Sac	0.04	0.06	0.13
60RYCB2000	60RYCB2000_OUT	0.861	8	52.4	0.4	Open_Spaces	0	0.01	0.03
60STCB0002	60STCB0002_OUT	3.29	13	102.3	0.6	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.09	0.12	0.25
60STCB0008	60STCB0008_OUT	2.503	13	89.3	0.8	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.07	0.09	0.2
60STCB0023	60STCB0023_OUT	1.606	40	71.5	1.1	Mixed_LD_RES_with_Commercial.	0.11	0.15	0.31
60STCB0038	60STCB0038_OUT	6.476	13	143.6	0.4	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.16	0.23	0.46
60STCB0044	60STCB0044_OUT	1.134	94	60.1	0.5	ICI_-_Heavy_Clay	0.16	0.25	0.49
60STCB0045	60STCB0045_OUT	1.556	40	70.4	2	Mixed_LD_RES_with_Commercial.	0.11	0.15	0.31
60STCB0049	60STCB0049_OUT	0.286	70	30.2	4.5	Residential_-_LD_Heavy_Clay	0.04	0.06	0.12
60STCB0051	60STCB0051_OUT	0.134	70	20.7	0.4	Residential_-_LD_Heavy_Clay	0.02	0.03	0.05
60STCB0055	60STCB0055_OUT	0.575	40	42.8	1.3	Mixed_LD_RES_with_Commercial.	0.04	0.06	0.12
60STCB0057	60STCB0057_OUT	0.453	40	38	1.8	Mixed_LD_RES_with_Commercial.	0.03	0.05	0.1
60STCB0059	60STCB0059_OUT	0.386	40	35.1	1.7	Mixed_LD_RES_with_Commercial.	0.03	0.04	0.09
60STCB0060	60STCB0060_OUT	0.603	40	43.8	0.2	Mixed_LD_RES_with_Commercial.	0.04	0.06	0.11
60STCB0061	60STCB0061_OUT	0.547	40	41.7	1.3	Mixed_LD_RES_with_Commercial.	0.04	0.05	0.11
60STCB0064	60STCB0054	0.678	94	46.4	1.2	ICI_-_Heavy_Clay	0.12	0.17	0.32
60STCB0068	60STCB0068_OUT	0.467	40	38.6	0.5	Mixed_LD_RES_with_Commercial.	0.03	0.05	0.09
60STCB0073	60STCB0073_OUT	1.803	40	75.8	0.2	Mixed_LD_RES_with_Commercial.	0.1	0.15	0.3
60STCB0075	60STCB0075_OUT	1.194	64	61.7	0.8	School	0.14	0.2	0.37
60STCB0078	60STCB0064_OUT	0.346	94	33.2	2.5	ICI_-_Heavy_Clay	0.07	0.09	0.17
60STCB0079	60STCB0079_OUT	0.572	40	42.7	2.1	Mixed_LD_RES_with_Commercial.	0.04	0.06	0.12
60STCB0082	60STCB0082_OUT	0.393	70	35.4	0.8	Residential_-_LD_Heavy_Clay	0.05	0.07	0.14
60STCB0083	60STCB0078_OUT	0.325	94	32.2	0.6	ICI_-_Heavy_Clay	0.06	0.08	0.15
60STCB0088	60STCB0088_OUT	1.237	70	62.7	0.2	Residential_-_LD_Heavy_Clay	0.12	0.18	0.36
60STCB0090	60STCB0097_OUT	0.592	70	43.4	1.5	Residential_-_LD_Heavy_Clay	0.08	0.11	0.21
60STCB0097	60STCB0103	0.67	70	46.2	1.3	Residential_-_LD_Heavy_Clay	0.09	0.12	0.23
60STCB0098	60STCB0098_OUT	1.402	70	66.8	0.5	Residential_-_LD_Heavy_Clay	0.15	0.23	0.44
60STCB0101	60STCB0101_OUT	0.508	70	40.2	8.3	Residential_-_LD_Heavy_Clay	0.07	0.1	0.19
60STCB2000	60STCB2000_OUT	0.719	70	47.9	1	Residential_-_LD_Heavy_Clay	0.09	0.13	0.24
60STMH0008	60STMH0008_OUT	0.278	40	29.7	2	Mixed_LD_RES_with_Commercial.	0.02	0.03	0.06
60STMH0009	60STMH0009_OUT	0.257	70	28.6	1.9	Residential_-_LD_Heavy_Clay	0.03	0.05	0.1
60STMH0010	60STMH0010_OUT	0.435	70	37.2	0.3	Residential_-_LD_Heavy_Clay	0.05	0.08	0.15
60STMH0011	60STMH0011_OUT	0.268	70	29.2	12.4	Residential_-_LD_Heavy_Clay	0.04	0.05	0.11
60STMH0014	60STMH0014_OUT	0.969	70	55.5	1	Residential_-_LD_Heavy_Clay	0.12	0.17	0.32
60STMH0015	60STMH0015_OUT	0.632	70	44.9	0.5	Residential_-_LD_Heavy_Clay	0.08	0.11	0.21
60STMH0016	60STMH0016_OUT	0.713	70	47.6	0.5	Residential_-_LD_Heavy_Clay	0.08	0.12	0.24
60STMH0017	60STMH0017_OUT	0.682	70	46.6	0.5	Residential_-_LD_Heavy_Clay	0.08	0.12	0.22
60STMH0019	60STMH0019_OUT	0.455	40	38.1	1.1	Mixed_LD_RES_with_Commercial.	0.03	0.04	0.1
60STMH0020	60STMH0020_OUT	0.843	70	51.8	2.2	Residential_-_LD_Heavy_Clay	0.11	0.16	0.31
60STMH0193	60STMH0193_OUT	0.954	70	55.1	5.3	Residential_-_LD_Heavy_Clay	0.13	0.18	0.35
60STMH2000	60STMH2000_OUT	1.504	70	69.2	1	Residential_-_LD_Heavy_Clay	0.18	0.26	0.5
DICB026	DICB026_OUT	0.173	70	23.5	0.6	Residential_-_LD_Heavy_Clay	0.02	0.03	0.06
60CULV2003.1	60CULV2004c	1.54	70	70	0.2	Residential_-_LD_Heavy_Clay	0.14	0.21	0.44
60CULV2004.1	60CULV2004a	16.733	13	230.8	0.2	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.36	0.53	1.05
60STOV2011	60STOV2011_OUT	0.906	70	53.7	0.1	Residential_-_LD_Heavy_Clay	0.08	0.12	0.25
60STOV2016	60STOV2016_OUT	0.77	70	49.5	1.1	Residential_-_LD_Heavy_Clay	0.1	0.14	0.27
w1	w1_OUT	0.8723	70	52.7	0.8	Recent_Development	0.11	0.15	0.29
w2	w2_OUT	0.4962	70	39.7	0.9	Recent_Development	0.06	0.09	0.17
w3	w3_OUT	0.5954	70	43.5	4	Recent_Development	0.08	0.11	0.22
walker_SWM_FACILITY	JSWMF-3	0.6298	70	44.8	0.1	Recent_Development	0.06	0.09	0.19
60CULV2000.1	60CULV2000	21.387	8	260.9	0.9	Agricultural	0.13	0.19	0.45
60CULV2000.4	60SWALE2001b	1.407	70	66.9	1.7	Residential_-_LD_Heavy_Clay	0.17	0.25	0.47
60CULV2001.2	60CULV2001	1.215	70	62.2	0.2	Residential_-_LD_Heavy_Clay	0.11	0.18	0.36
60CULV2005.1	60CULV2005b	1.635	94	72.1	20.9	ICI_-_Heavy_Clay	0.31	0.44	0.79
60CULV2005.4	60STOV2009	1.177	70	61.2	20.9	Residential_-_LD_Heavy_Clay	0.16	0.23	0.48
60CULV2007.1	60CULV2006d	4.478	13	119.4	0.2	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.11	0.16	0.31
60CULV2008.1	60CULV2007d	2.603	40	91	0.2	Mixed_LD_RES_with_Commercial.	0.14	0.21	0.42
60CULV2009.1	60CULV2008d	1.781	40	75.3	0.2	Mixed_LD_RES_with_Commercial.	0.1	0.15	0.3

Future Population Storm Subcatchment Hydrologic Parameters

Name	Receiving Node	Area (ha)	%Imp	Width (m)	Slope (m/m)	Land Use and Soil	Model Peak Runoff Results (m³/s)		
							1:2 year	1:5 year	1:100 year
60CULV2011.4	60CULV2011d	8.493	8	164.4	0.2	Open_Spaces	0.03	0.05	0.13
60CULV2013.4	60STOF2009_OUT	1.846	8	76.7	0.1	Open_Spaces	0.01	0.01	0.04
60STOF2000a	J4	1.041	13	57.6	0.3	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.03	0.04	0.08
60STOF2002.1	60STOF2002	0.374	13	34.5	0.2	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.01	0.01	0.03
60STOF2004a	60STOF2004a_OUT	0.511	40	40.3	0.2	Mixed_LD_RES_with_Commercial.	0.03	0.05	0.09
60STOF2007	60CULV2010d	1.207	94	62	0.4	ICI_-_Heavy_Clay	0.17	0.25	0.5
60STOV2001	60STOV2001_OUT	2.005	70	79.9	0.2	Residential_-_LD_Heavy_Clay	0.17	0.26	0.55
60STOV2002	60STOV2002_OUT	6.405	8	142.8	0.2	Open_Spaces	0.03	0.04	0.09
60SWALE2002.1	60SWALE2002	3.494	8	105.5	0.2	Open_Spaces	0.01	0.02	0.07
60SWALE2003a	60SWALE2003a_OUT	0.912	13	53.9	0.2	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.02	0.03	0.07
60SWALE2004.1	60SWALE2004a	7.681	8	156.4	0.2	Agricultural	0.04	0.07	0.15
60SWALE2004.1.9	60SWALE2004a	0.551	70	41.9	0.2	Residential_-_LD_Heavy_Clay	0.06	0.09	0.17
60UNCON0001	60UNCON0001_OUT	82.336	8	511.9	0.5	Agricultural	0.42	0.63	1.37
CA_314,_315,_316	CA_314,_315,_316_OUT	229.674	8	858.6	1.5	Agricultural	1.19	1.78	3.83
CNR_CULV_c.1	CNR_CULV_c	1.076	13	58.5	0.2	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.03	0.04	0.08
CULV025.1	60CULV2002e	3.857	8	110.8	0.2	Open_Spaces	0.02	0.02	0.08
Ultimate_Outlet_SE	CA_314,_315,_316_OUT	421.318	8	1158.1	1.5	Agricultural	1.99	3.03	6.51
D_SWM_FACILITY.1	D_SWM_FACILITY	0.989	40	56.1	0.2	Future_Development	0.06	0.09	0.17
D1	D1_OUT	1.284	40	63.9	0.2	Future_Development	0.07	0.11	0.21
D2	D2_OUT	2.029	40	80.4	0.3	Future_Development	0.12	0.17	0.33
D3	D3_OUT	1.191	40	61.6	24.8	Future_Development	0.08	0.12	0.25
JM1	JM1_OUT	1.097	40	59.1	0.1	Future_Development	0.06	0.09	0.17
JM10	JM10_OUT	0.537	40	41.3	0.1	Future_Development	0.03	0.05	0.09
JM13	JM13_OUT	1.106	40	59.3	0.1	Future_Development	0.06	0.09	0.18
JM14	JM14_OUT	1.055	40	57.9	0.6	Future_Development	0.07	0.1	0.19
JM2	JM2_OUT	0.512	40	40.4	0.1	Future_Development	0.03	0.05	0.09
JM3	JM3_OUT	0.76	40	49.2	0.6	Future_Development	0.05	0.07	0.14
JM4	JM4_OUT	0.811	40	50.8	0.1	Future_Development	0.05	0.07	0.13
JM5	JM5_OUT	1.092	40	58.9	0.1	Future_Development	0.06	0.09	0.18
JM6	JM6_OUT	0.652	40	45.5	0.1	Future_Development	0.04	0.06	0.11
JM7	JM7_OUT	0.568	40	42.5	0.1	Future_Development	0.03	0.05	0.1
M1	M1_OUT	0.564	70	42.4	3.3	Residential_-_LD_Heavy_Clay	0.08	0.11	0.22
M3	M3_OUT	0.784	67	49.9	1.7	Residential_-_LD_Cul-Sac	0.09	0.13	0.26
M4	M4_OUT	0.666	70	46	0.3	Residential_-_LD_Heavy_Clay	0.07	0.11	0.22
STCP-5	STCP-5_OUT	0.418	70	36.5	5.4	Residential_-_LD_Heavy_Clay	0.06	0.08	0.17
60CULV2006.1	60CULV2006	371.578	8	1086.4	1.5	Agricultural	1.79	2.71	5.79
CNR_culv_a	CNR_culv_a_OUT	18.1134	13	282.4	0.2	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.4	0.59	1.17
60STOF2009	60STOF2009_OUT	27.2955	8	294.7	0.1	Agricultural	0.13	0.2	0.43
north_culvert	north_culvert_a	12.2446	13	197.4	3.5	EXTERNAL_DRAINAGE_W/_SOME_URBAN	0.32	0.46	0.93
60STCB0107	60STCB0103	0.4906	40	89.8	2.3	Mixed_LD_RES_with_Commercial	0.03	0.05	0.13
60STOV2006	60STOV2006.1	2.5991	40	117.3	0.2	Mixed_LD_RES_with_Commercial	0.15	0.22	0.42
60STOF2000.4.1	60SWALE2003b	5.3221	8	540	0.3	Agricultural	0.03	0.06	0.3
DN_8	J3	2.3981	13	87.3	0.1	Recent_Development	0.06	0.08	0.16
JM_Pond_1	JSWMF-4	0.3066	70	31.2	0.1	Recent_Development	0.03	0.05	0.1
JM_Pond_2	JSMF-5	1.0719	70	58.4	0.1	Recent_Development	0.09	0.14	0.29
JM'1'	60STMH0272_OUT	0.2684	40	29.2	0.4	Recent_Development	0.02	0.03	0.05
JM11	60STMH0339_OUT	0.5988	40	43.6	0.4	Recent_Development	0.04	0.06	0.11
JM12	60STMH0338_OUT	0.4175	40	36.7	0.4	Recent_Development	0.03	0.04	0.08
JM16	60STMH0336_OUT	0.5073	40	40.2	0.2	Recent_Development	0.03	0.05	0.09
JM17	60STMH0335_OUT	0.6152	40	44.2	0.4	Recent_Development	0.04	0.06	0.11
JM18	60STMH0334_OUT	0.4668	40	38.5	0.1	Recent_Development	0.03	0.04	0.08
JM19	60STMH0332_OUT	0.6319	40	44.8	2.3	Recent_Development	0.04	0.06	0.12
JM'2'	JM'2'_OUT	0.4076	40	36	0.1	Recent_Development	0.03	0.04	0.07
JM'3'	60STMH0279_OUT	0.2909	40	30.4	0.5	Recent_Development	0.02	0.03	0.05
JM'3b'	60STMH0279_OUT	0.4418	40	37.5	0.5	Recent_Development	0.03	0.04	0.08
JM'4'	60STMH0282_OUT	0.2493	8	28.2	0.8	Recent_Development	0.00	0.00	0.01
JM'5'	60STMH0289_OUT	0.3025	40	31	0.6	Recent_Development	0.02	0.03	0.06
JM'6'	60STMH0303_OUT	0.4456	40	37.7	0.3	Recent_Development	0.03	0.04	0.08
JM'7'	60STMH0300_OUT	0.1988	40	25.1	0.4	Recent_Development	0.01	0.02	0.04
JM'7'comm	60STMH0300_OUT	0.6658	70	46	0.4	Recent_Development	0.08	0.11	0.22
JM8	60STMH0341_OUT	0.4298	40	37	0.2	Recent_Development	0.03	0.04	0.08
JM'8'	60STMH0296_OUT	0.7501	40	48.8	0.1	Recent_Development	0.04	0.06	0.12
E_Talbot	60CULV2012a	4.527	8	120	0.65	Agricultural	0.03	0.04	0.14
60CULV2012.4	60CULV2012d	3.232	64	101.4	0.2	School	0.24	0.39	0.81
EAST_OUTFALL	60CULV2012d	36.064	8	338.8	0.2	Agricultural	0.18	0.27	0.59

Appendix D

Transportation Report

Memorandum

13 November 2018
Project: 180197

To
Jane Wilson
Environmental Engineer
J.L. Richards & Associates Limited

From
Rajan Philips, P.Eng.
Senior Transportation Consultant
Paradigm Transportation Solutions Limited

RE: JARVIS MASTER SERVICING PLAN, TECHNICAL MEMORADUM 1, SUMMARY OF EXISTING CONDITIONS

Introduction

Haldimand County is undertaking an update of the 2010 Master Servicing Plan (MSP) for the community of Jarvis in support of planned growth and intensification identified in the County's Official Plan. The updated MSP will address the four servicing components (transportation, storm, water and wastewater) of the 2010 Jarvis MSP corresponding to changes in land use and growth forecasts within the study area, as well as changes to existing conditions and related assumptions based on growth that has occurred within the study area.

The study area for the update includes the network of municipal services, local environment, and community make up, consistent with the 2010 Jarvis MSP study area. The community of Jarvis is built along and adjacent to Highway 6 (Main Street) and Highway 3 (Talbot Street) in the southwest part of Haldimand County. The study area road system is centered on the intersection of Highway 6 and Highway 3 and is generally bounded by Haldimand Road 69 to the north, Haldimand Road 55 to the east, Haldimand Road 70 to the west, and Concession 6 Walpole to the south. Both Highway 6 and Highway 3 are "connecting links" in the Provincial highway network. All other roads in Jarvis are local roads.

The MSP update, including transportation, is being undertaken within the following framework:

- Class Environmental Assessment Master Planning
- Background Review and Updates to Existing Conditions

- Growth Forecast and Assessment of Future Needs
- Development of Preferred Servicing Strategies
- Implementation Plan Development and Final Report

The purpose of this memorandum is to provide background review and updates to existing conditions.

Background

The 2010 MSP, 2009 Trails Master Plan and the 2013 Streetscape Plan provide the background to addressing the transportation component of the current Master Servicing Plan Update.

The transportation component of the 2010 Jarvis MSP identified the intersection of Main Street (Highway 6) and Talbot Street (Highway 3) and the intersection of Main Street and Nanticoke Road as “problem areas” in the community. Overall, however, the key intersections in Jarvis were found to operate at Level-of-Service (LOS) ‘D’, or better.

The 2010 MSP, which identified infrastructure requirements over a 20-year timeframe, recommended the following transportation initiatives:

- Monitoring and implementing mitigative measures (e.g., parking restrictions, revised lane designations) to improve LOS and safety at the Main Street and Talbot Street intersection.
- Need for a new collector road connecting to Highway 3 to accommodate developments in southwest Jarvis.
- Addition of sidewalks on one or both sides of Highway 3 from Highway 6 to the easterly Town limits.
- Potential re-striping of Highway 6 and Highway 3 to accommodate bicycle lanes.

Prior to the 2010 MSP, the County completed the *Trails Master Plan and Partnership Framework Study* in 2009, which identified short and long-term trail network needs and priorities in Jarvis, including recommendations for future bikeways.

In addition, the *Jarvis Streetscape Plan* was completed in 2013 for the purpose of creating visually attractive public spaces and pedestrian friendly environments in the Jarvis central business area.

Existing Transportation System Update

Roadways

Figure 1 (attached) illustrates the study area roadways and the intersections analyzed under existing traffic conditions, noted as follows:

- Highway 6 & Nanticoke Creek Parkway;
- Highway 6 (Main Street) & Ontario Highway 3 (Talbot Street);
- Highway 3 (Talbot Street) & Craddock Boulevard;
- Highway 3 (Talbot Street) & Saunders Drive; and
- Highway 3 (Talbot Street) & Haldimand Road 55.

The main study area roadways include Highway 6, Highway 3, Craddock Boulevard, Saunders Drive and Haldimand Road 55. The characteristics of these roadways are as follows:

- **Highway 6** is a north-south, two-lane, roadway that operates under the jurisdiction of the Ontario Ministry of Transportation. The roadway is classified as a provincial highway in the County's Official Plan.[1] The roadway has an urban cross-section in the Town of Jarvis, and a rural cross-section outside of the urban built-up area. The posted maximum speed limit varies from 50 kilometres per hour within the Town, to 80 kilometres outside of the Town. Within the Town of Jarvis, the roadway is referred to as Main Street and serves as a connecting link. The surrounding land uses are predominantly low-density residential and agricultural.
- **Highway 3** is an east-west, two-lane, roadway that operates under the jurisdiction of the Ontario Ministry of Transportation. The roadway is classified as a provincial highway in the County's Official Plan. The roadway has an urban cross-section within the Town of Jarvis, and a rural cross-section outside of the urban built-up area. The posted maximum speed limit varies from 50 kilometres per hour within the Town to 80 kilometres per hour outside of the Town. Within the urban area of the Town of Jarvis the roadway is referred to as Talbot Street and serves as a connecting link. The surrounding land uses are predominantly low-density residential and agricultural.
- **Nanticoke Creek Parkway (County Road 69)** is an east-west, two-lane roadway that operates under the jurisdiction of Haldimand County. The roadway is classified as an arterial road in the County's Official Plan. Within the study area, the roadway has a rural cross-section. The posted maximum speed limit is 80 kilometres per hour. The surrounding land uses are primarily agricultural.
- **Nanticoke Road (County Road 55)** is a north-south, two-lane roadway that operates under the jurisdiction of Haldimand County. The roadway is classified as an arterial road in the County's Official Plan. Within the study area, the roadway has a rural cross-

[1] Haldimand County. *Official Plan Schedule F.2: Haldimand County Southwest Transportation Plan.* Consolidated January 2014.

section. The posted maximum speed limit is 80 kilometres per hour. The surrounding land uses are primarily agricultural.

- **Craddock Boulevard** is a north-south, two-lane roadway that operates under the jurisdiction of Haldimand County. The roadway is classified as a local roadway in the County's Official Plan. Within the study area, the roadway has a semi-urban cross-section. The maximum speed limit is not posted and is assumed to be 50 kilometres per hour. The surrounding land uses are low-density residential.
- **Saunders Drive** is a north-south, two-lane roadway that operates under the jurisdiction of Haldimand County. The roadway is classified as a local roadway in the County's Official Plan. Within the study area, the roadway has an urban cross-section. The maximum speed limit is not posted and assumed to be 50 kilometres per hour. The surrounding land uses are low-density residential.

Figure 2 (attached) illustrates the existing lane configurations and traffic control at the study intersections.

Active Transportation

Sidewalks are generally provided on at least one side of the majority of the study roadways, in addition to other roadways in the Town. Sidewalks are provided on both sides of Main Street from Karsten Avenue to 190 metres north of Boyd Street. A further 500 metres of sidewalk is provided on the west side of Main Street north of an existing Tim Hortons restaurant. Sidewalks are provided on both sides of Talbot Street from approximately 255 metres west of Radical Street to 165 metres east of Saunders Drive.

Dedicated cycling facilities are not provided on any of the six (6) study roadways, requiring cyclists to share the roadway with motorists. The Haldimand County Cycling Map identifies five (5) general cycling routes navigating the County. None of the roadways in the Town of Jarvis form a part of these cycling routes.

Existing Traffic Volumes

Paradigm conducted eight-hour turning movement counts (TMCs) on Tuesday 02 October 2018 from 7:00 AM to 10:00 AM, 11:30 AM to 1:30 PM, and 3:00 PM to 6:00 PM. All traffic movements including pedestrian crossings were counted in 15-minute intervals and vehicles were classified by type. Due to the large distance between intersections, and the varying peak hours, volume balancing has not been applied.

The existing traffic conditions indicate AM peak hour volumes of approximately 210 to 275 vehicles on Main Street, and 125 to 150 vehicles on Talbot Street.

Similarly, the PM peak hour volumes range from approximately 280 to 390 vehicles on Main Street, and 156 to 170 vehicles on Talbot Street.

Figure 3 and **Figure 4** (attached) illustrate the existing AM and PM peak hour traffic volumes respectively.

Appendix A contains the raw turning movement count data.

Existing Traffic Operations

The study area intersections were analyzed under existing traffic conditions, using Synchro 9.2 software which implements Highway Capacity Manual (HCM) 2000 procedures.

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay related to the number of vehicles desiring to make a through or turning movement, compared to the estimated capacity for that movement. The capacity is based on several criteria including, but not limited to vehicle headways, intersection geometry, vehicle composition, opposing traffic flows, and for signalized intersections, signal timing. Capacity is evaluated in terms of the ratio of demand flow to capacity with an at-capacity condition represented by a v/c ratio of 1.00 (i.e. volume demand equals capacity).

Table 1 summarizes the level of service (LOS) criteria for signalized and stop-controlled intersections. The highest possible rating is LOS A, in which the average total delay is equal to or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume-to-capacity ratio is greater than 1.00, the movement is classed as LOS F and improvements are implemented, if they are feasible. LOS E is generally used as a guideline for the determination of road improvements needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on capacity and safety considerations.

TABLE 1: LEVEL OF SERVICE DEFINITIONS

Level of Service	Signalized Intersections Average Total Delay (sec/veh)	Unsignalized Intersections Average Total Delay (sec/veh)
A	< = 10	< = 10
B	> 10 & < = 20	> 10 & < = 15
C	> 20 & < = 35	> 15 & < = 25
D	> 35 & < = 55	> 25 & < = 35
E	> 55 & < = 80	> 35 & < = 50
F	> 80	> 50

The intersection analyses considered the following measures of effectiveness:

- The volume-to-capacity ratio for each movement, where applicable;
- The LOS, based on the average control delay for each vehicle, for each turning movement; and

- The estimated 95th percentile queue length.

The key parameters used in the analysis include:

- Existing intersection lane configurations and traffic controls;
- Signal timing data as provided by Haldimand County, and included for reference in **Appendix A**;
- Heavy vehicle percentages, conflicting pedestrian volumes, and overall intersection peak hour factors (PHF) as derived from existing turning movement counts; and
- Synchro default values for all other inputs.

Table 2 summarizes the analysis results for the existing weekday AM and weekday PM peak hour intersection operations. The results indicate the study area intersections are operating with acceptable levels of service and well within capacity. No critical movements are identified at any of the study intersections.

Appendix B contains the detailed Synchro reports.

TABLE 2: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Highway 6 & Natntticoke Creek Parkway	TWSC	LOS	<	B	>	**B**	<	C	>	**C**	A	A	A	**A**	A	A	A	**A**	
			Delay	<	14	>	**14**	<	15	>	**15**	8	0	0	**1**	0	0	0	**0**	
			V/C	<	0.20	>		<	0.06	>		0.03	0.18	0.01		0.00	0.12	0.04		
			Q	<	6	>		<	2	>		1	0	0		0	0	0		
			Ex	<	-	>		<	-	>		120	-	120		90	-	90		
			Avail.	<	-	>		<	-	>		119	-	120		90	-	120		
	2 - Talbot Street & Main Street	TCS	LOS	<	B	>	**B**	<	B	>	**B**	<	B	>	**B**	<	B	>	**B**	**B**
			Delay	<	13	>	**13**	<	12	>	**12**	<	12	>	**12**	<	12	>	**12**	**12**
			V/C	<	0.30	>		<	0.23	>		<	0.27	>		<	0.25	>		**0.28**
			Q	<	25	>		<	21	>		<	24	>		<	19	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	3 - Talbot Street & Craddock Boulevard	TWSC	LOS	<	A		**A**		A	>	**A**					<	A	>	**A**	
			Delay	<	0		**0**		0	>	**0**					<	10	>	**10**	
			V/C	<	0.00				0.10	>						<	0.03	>		
			Q	<	0				0	>						<	1	>		
			Ex	<	-				-	>						<	-	>		
			Avail.	<	-				-	>						<	-	>		
	4 - Talbot Street & Saunders Drive	TWSC	LOS	<	A		**A**		A	>	**A**					<	A	>	**C**	
			Delay	<	0		**0**		0	>	**0**					<	1	>	**15**	
			V/C	<	0.00				0.00	>						<	0.00	>		
			Q	<	0				0	>						<	0	>		
			Ex	<	-				-	>						<	-	>		
			Avail.	<	-				-	>						<	-	>		
	5 - Talbot Street & Haldimand Road 55	TCS	LOS	B	B	B	**B**	B	B	>	**B**	B	B	B	**B**	B	C	>	**C**	**B**
			Delay	13	13	13	**17**	13	14	>	**14**	19	20	18	**19**	18	21	>	**20**	**17**
			V/C	0.02	0.11	0.01		0.03	0.14	>		0.06	0.12	0.00		0.01	0.21	>		**0.17**
			Q	5	17	0		5	20	>		8	17	0		3	28	>		
			Ex	85	-	100		110	-	>		85	-	100		105	-	>		
			Avail.	80	-	100		105	-	>		77	-	100		102	-	>		
PM Peak Hour	1 - Highway 6 & Natntticoke Creek Parkway	TWSC	LOS	<	C	>	**C**	<	C	>	**C**	A	A	A	**A**	A	A	A	**A**	
			Delay	<	19	>	**19**	<	18	>	**18**	8	0	0	**1**	9	0	0	**0**	
			V/C	<	0.32	>		<	0.07	>		0.03	0.16	0.00		0.00	0.23	0.04		
			Q	<	11	>		<	2	>		1	0	0		0	0	0		
			Ex	<	-	>		<	-	>		120	-	120		90	-	90		
			Avail.	<	-	>		<	-	>		119	-	120		90	-	120		
	2 - Talbot Street & Main Street	TCS	LOS	<	B	>	**B**	<	B	>	**B**	<	B	>	**B**	<	B	>	**B**	**B**
			Delay	<	15	>	**15**	<	12	>	**12**	<	12	>	**12**	<	18	>	**18**	**15**
			V/C	<	0.46	>		<	0.25	>		<	0.21	>		<	0.60	>		**0.53**
			Q	<	39	>		<	21	>		<	19	>		<	57	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	3 - Talbot Street & Craddock Boulevard	TWSC	LOS	<	A		**A**		A	>	**A**					<	B	>	**B**	
			Delay	<	1		**1**		0	>	**0**					<	10	>	**10**	
			V/C	<	0.02				0.12	>						<	0.02	>		
			Q	<	0				0	>						<	1	>		
			Ex	<	-				-	>						<	-	>		
			Avail.	<	-				-	>						<	-	>		
	4 - Talbot Street & Saunders Drive	TWSC	LOS	<	A		**A**		A	>	**A**					<	A	>	**A**	
			Delay	<	1		**1**		0	>	**0**					<	10	>	**10**	
			V/C	<	0.01				0.11	>						<	0.02	>		
			Q	<	0				0	>						<	0	>		
			Ex	<	-				-	>						<	-	>		
			Avail.	<	-				-	>						<	-	>		
	5 - Talbot Street & Haldimand Road 55	TCS	LOS	B	B	B	**B**	B	B	>	**B**	B	B	B	**B**	B	B	>	**B**	**B**
			Delay	13	14	13	**14**	13	14	>	**14**	19	20	18	**20**	19	19	>	**19**	**16**
			V/C	0.02	0.18	0.01		0.00	0.16	>		0.07	0.16	0.01		0.05	0.08	>		**0.17**
			Q	4	27	0		1	24	>		10	24	0		8	12	>		
			Ex	85	-	100		110	-	>		85	-	100		105	-	>		
			Avail.	81	-	100		109	-	>		75	-	100		98	-	>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

<- Shared Left/Through Lane
>- Shared Right/Through Lane

We trust that this memorandum adequately summarizes the existing transportation conditions and operations in the study area intersections.

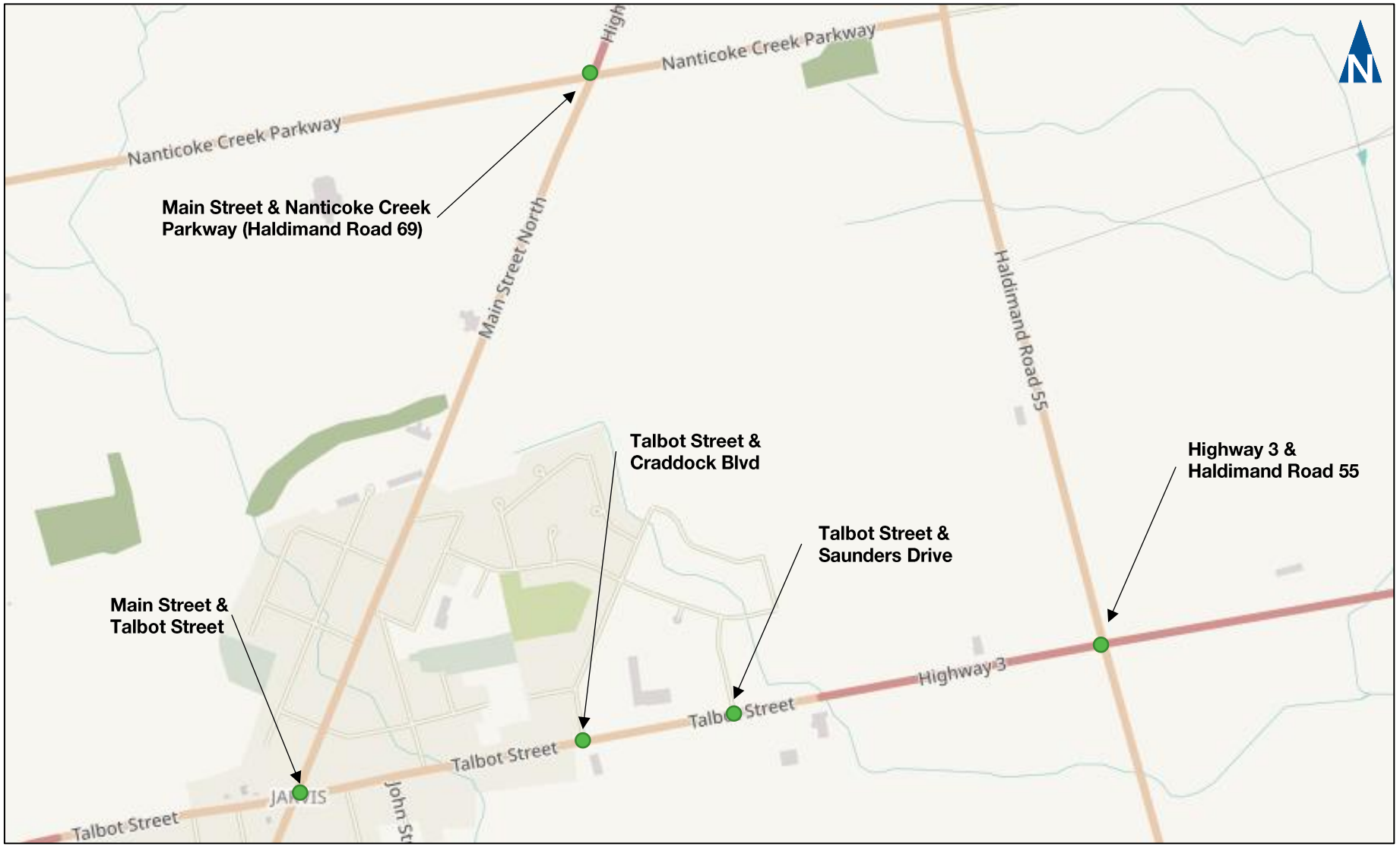
Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED

Rajan Philips
M.A.Sc., P.Eng, FITE
Senior Transportation Consultant

Gene Chartier
M.A.Sc., P.Eng, FITE
Vice-President

Attachments



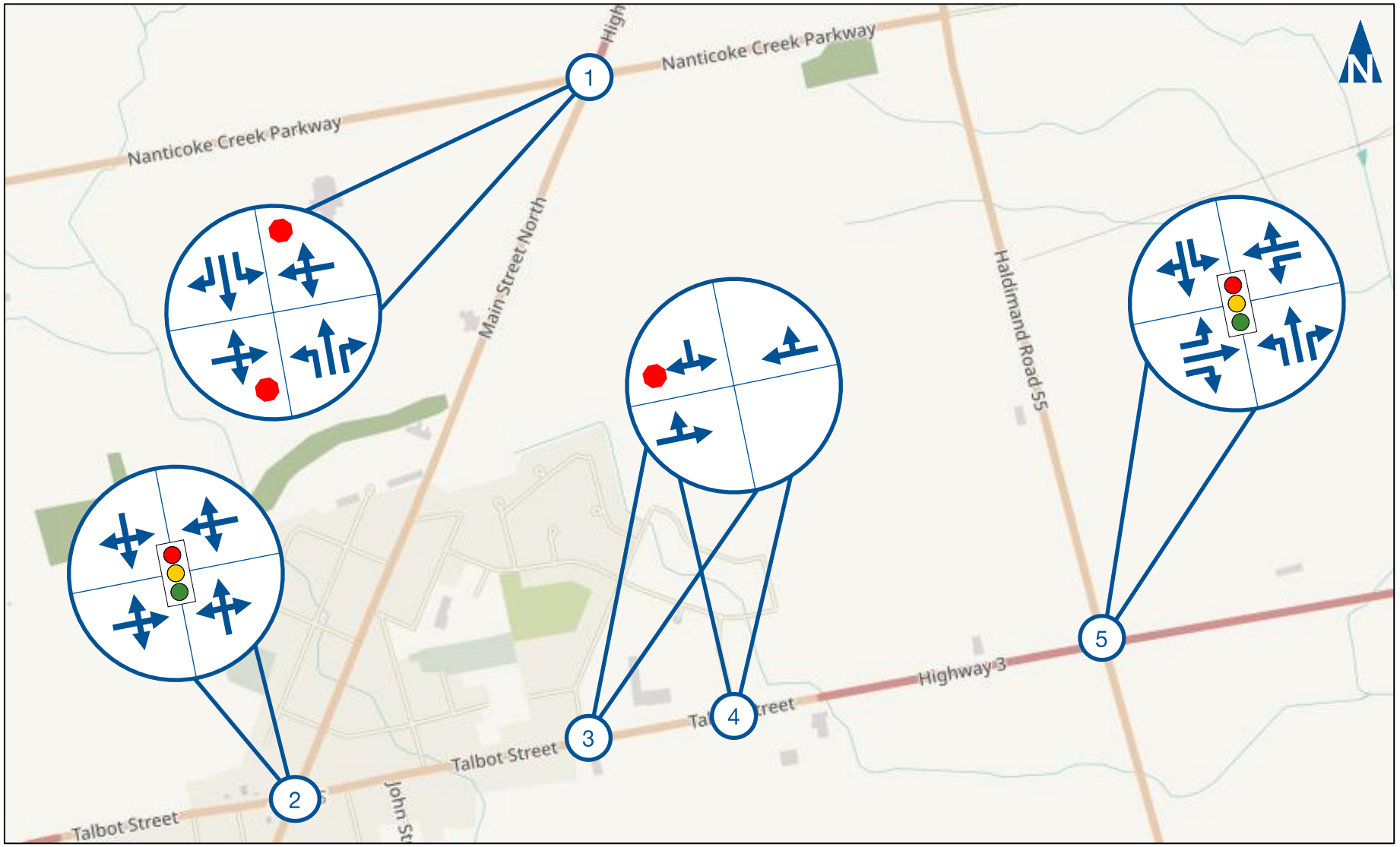
paradigm TRANSPORTATION SOLUTIONS LIMITED

Study Area Intersections

Jarvis Master Service Plan
180197

Figure 1

PDD-18-2019, Attachment 2



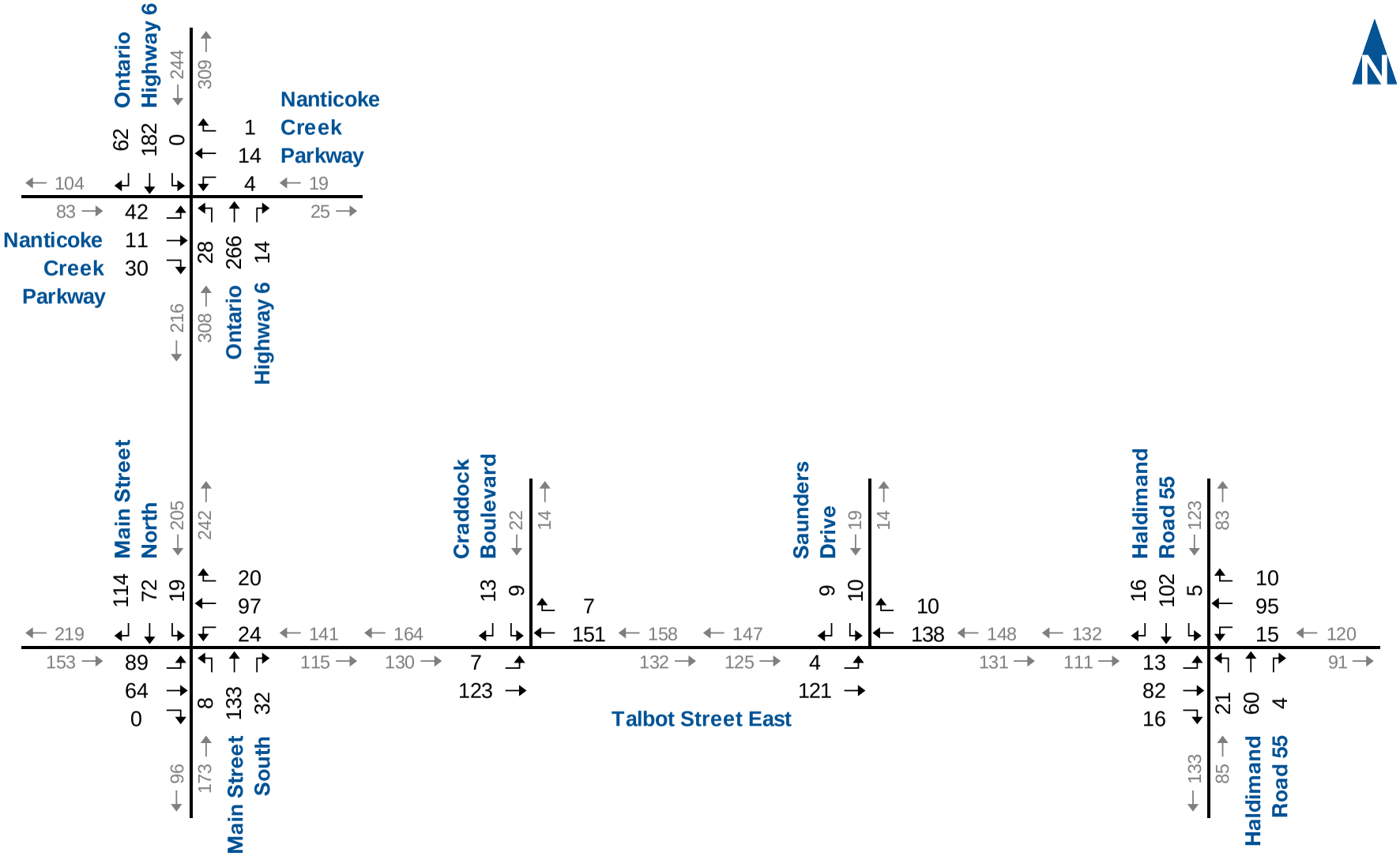
paradigm TRANSPORTATION SOLUTIONS LIMITED

Existing Lane Configurations and Traffic Control

Jarvis Master Service Plan
180197

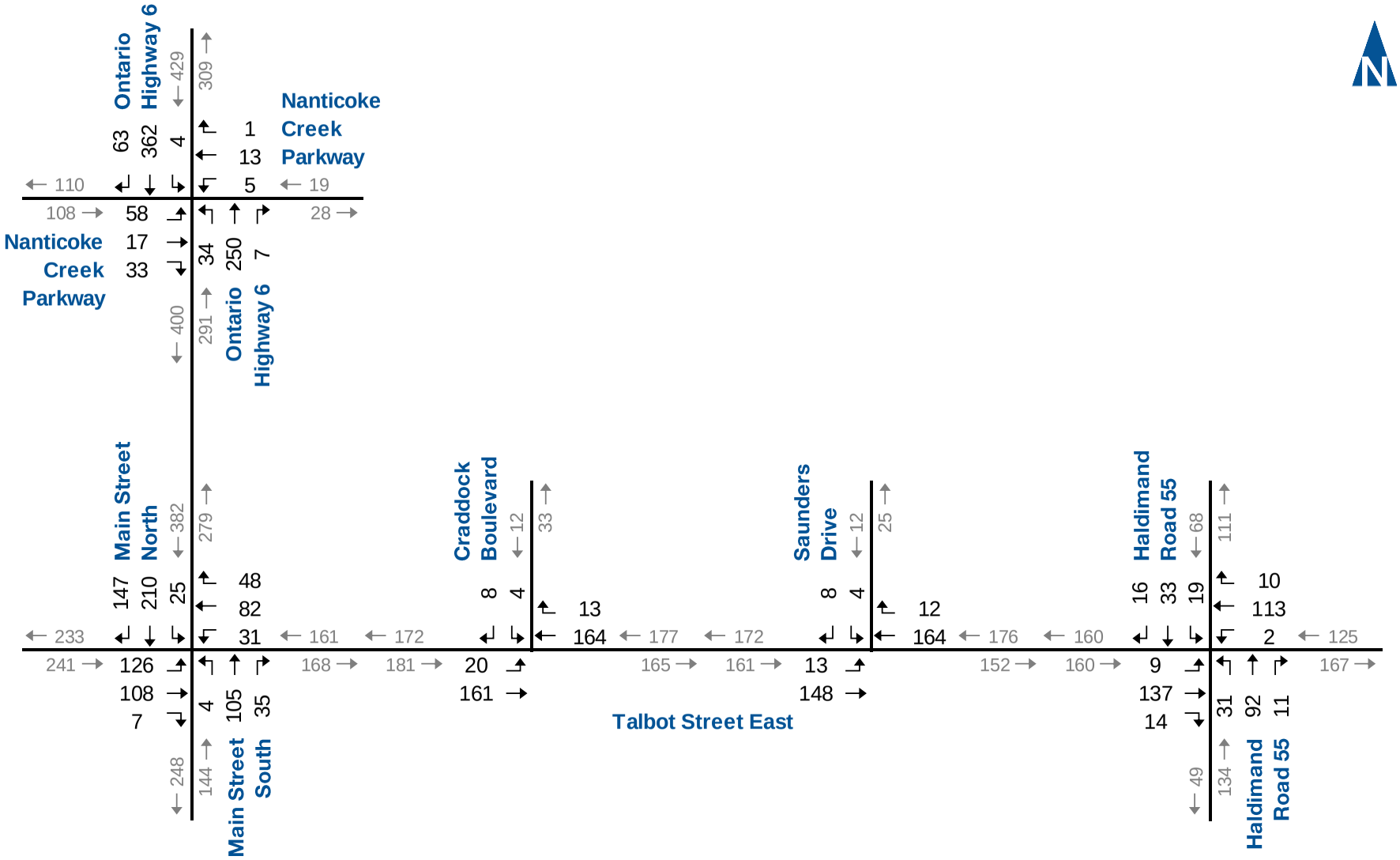
Figure 2

PDD-18-2019, Attachment 2



Existing Traffic Volumes
AM Peak Hour

Figure 3



Existing Traffic Volumes
PM Peak Hour

Figure 4

Jarvis Master Service Plan
180197

PDD-18-2019, Attachment 2

Appendix A

Existing Turning Movement Count Data and Signal Timings

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018

Turning Movement Data

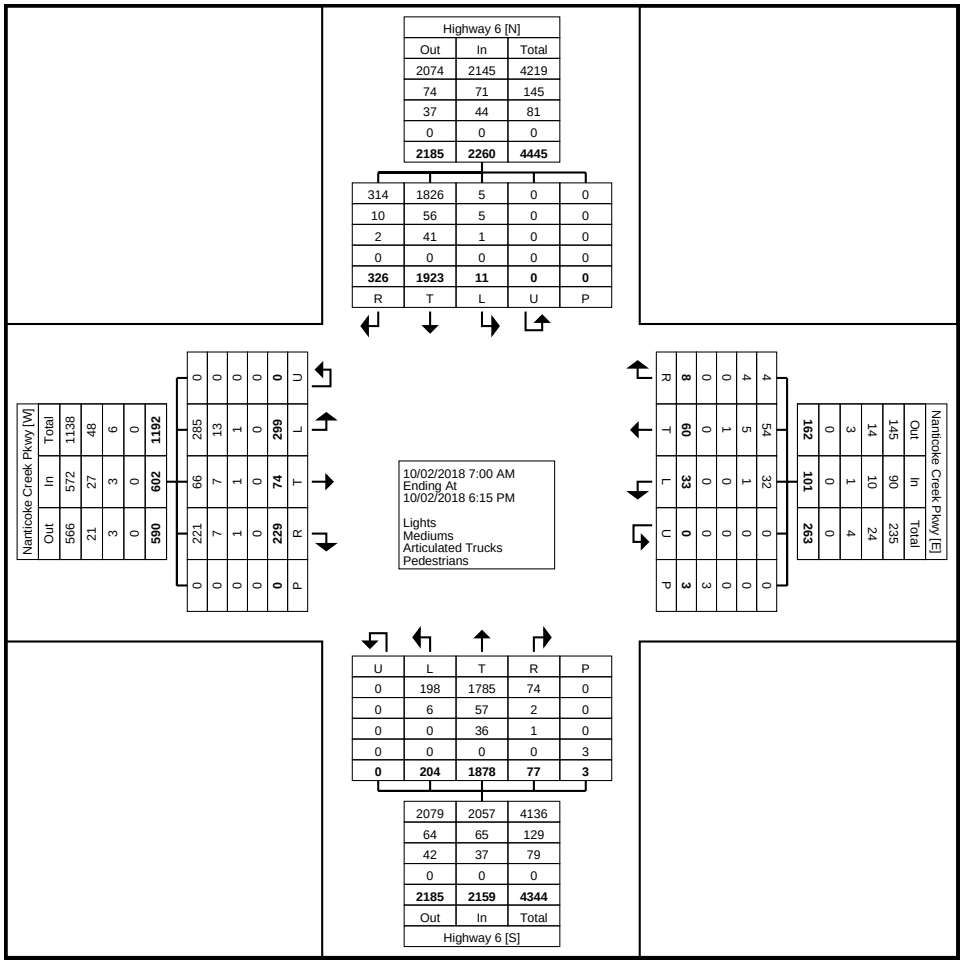
Start Time	Nanticoke Creek Pkwy Eastbound						Nanticoke Creek Pkwy Westbound						Highway 6 Northbound						Highway 6 Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	10	2	6	0	0	18	2	0	0	0	0	2	1	65	4	0	0	70	0	22	5	0	0	27	117
7:15 AM	9	2	6	0	0	17	3	0	1	0	0	4	4	68	3	0	0	75	0	26	7	0	0	33	129
7:30 AM	6	2	8	0	0	16	1	3	1	0	0	5	9	63	1	0	0	73	2	50	7	0	0	59	153
7:45 AM	17	0	7	0	0	24	1	4	0	0	0	5	11	83	2	0	0	96	0	46	12	0	0	58	183
Hourly Total	42	6	27	0	0	75	7	7	2	0	0	16	25	279	10	0	0	314	2	144	31	0	0	177	582
8:00 AM	4	5	6	0	0	15	1	1	0	0	0	2	6	61	6	0	0	73	0	52	13	0	0	65	155
8:15 AM	13	3	7	0	0	23	1	4	0	0	0	5	7	56	2	0	0	65	0	32	23	0	0	55	148
8:30 AM	8	3	10	0	0	21	1	5	1	0	0	7	4	55	4	0	0	63	0	52	14	0	0	66	157
8:45 AM	8	1	12	0	0	21	3	4	1	0	0	8	8	55	3	0	0	66	1	34	11	0	0	46	141
Hourly Total	33	12	35	0	0	80	6	14	2	0	0	22	25	227	15	0	0	267	1	170	61	0	0	232	601
9:00 AM	9	4	6	0	0	19	1	3	0	0	0	4	8	55	3	0	0	66	0	48	1	0	0	49	138
9:15 AM	7	2	6	0	0	15	0	1	0	0	0	1	3	54	4	0	0	61	0	44	7	0	0	51	128
9:30 AM	4	2	12	0	0	18	2	0	0	0	0	2	11	67	4	0	0	82	0	45	5	0	0	50	152
9:45 AM	2	0	7	0	0	9	3	2	0	0	0	5	5	37	4	0	0	46	0	46	15	0	0	61	121
Hourly Total	22	8	31	0	0	61	6	6	0	0	0	12	27	213	15	0	0	255	0	183	28	0	0	211	539
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
11:30 AM	7	1	8	0	0	16	0	2	0	0	0	2	3	50	1	0	0	54	0	45	12	0	0	57	129
11:45 AM	8	3	6	0	0	17	0	0	0	0	0	0	5	56	2	0	0	63	0	44	9	0	0	53	133
Hourly Total	15	4	14	0	0	33	0	2	0	0	0	2	8	106	3	0	0	117	0	89	21	0	0	110	262
12:00 PM	8	0	13	0	0	21	0	1	0	0	0	1	3	102	3	0	0	108	0	55	7	0	0	62	192
12:15 PM	6	1	8	0	0	15	0	3	0	0	0	3	11	40	0	0	0	51	1	52	7	0	0	60	129
12:30 PM	2	1	4	0	0	7	0	1	0	0	0	1	6	44	0	0	0	50	0	63	6	0	0	69	127
12:45 PM	10	3	4	0	0	17	0	0	0	0	0	0	6	62	3	0	0	71	0	74	8	0	0	82	170
Hourly Total	26	5	29	0	0	60	0	5	0	0	0	5	26	248	6	0	0	280	1	244	28	0	0	273	618
1:00 PM	13	1	4	0	0	18	2	1	0	0	0	3	3	63	2	0	0	68	0	53	7	0	0	60	149
1:15 PM	9	2	6	0	0	17	0	2	0	0	0	2	8	54	5	0	0	67	0	57	7	0	0	64	150
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	22	3	10	0	0	35	2	3	0	0	0	5	11	117	7	0	0	135	0	110	14	0	0	124	299
3:00 PM	11	3	5	0	0	19	0	1	1	0	0	2	4	59	1	0	0	64	1	57	4	0	0	62	147
3:15 PM	9	1	6	0	0	16	1	1	0	0	0	2	6	60	3	0	0	69	0	70	17	0	0	87	174
3:30 PM	8	3	2	0	0	13	1	1	0	0	0	2	6	66	1	0	0	73	0	67	4	0	0	71	159
3:45 PM	10	2	8	0	0	20	0	2	1	0	0	3	4	46	0	0	0	50	0	96	10	0	0	106	179
Hourly Total	38	9	21	0	0	68	2	5	2	0	0	9	20	231	5	0	0	256	1	290	35	0	0	326	659
4:00 PM	12	3	8	0	0	23	2	2	0	0	0	4	7	48	3	0	0	58	1	100	9	0	0	110	195
4:15 PM	17	4	8	0	0	29	1	1	0	0	0	2	6	57	2	0	0	65	0	77	15	0	0	92	188

4:30 PM	20	5	9	0	0	34	1	1	0	0	0	2	10	68	2	0	0	80	0	91	15	0	0	106	222
4:45 PM	13	8	6	0	0	27	2	3	0	0	3	5	10	62	4	0	3	76	1	111	10	0	0	122	230
Hourly Total	62	20	31	0	0	113	6	7	0	0	3	13	33	235	11	0	3	279	2	379	49	0	0	430	835
5:00 PM	14	3	10	0	0	27	2	3	1	0	0	6	6	55	1	0	0	62	1	77	18	0	0	96	191
5:15 PM	11	1	8	0	0	20	0	6	0	0	0	6	8	65	0	0	0	73	2	83	20	0	0	105	204
5:30 PM	5	3	7	0	0	15	0	1	0	0	0	1	9	41	3	0	0	53	1	82	13	0	0	96	165
5:45 PM	9	0	6	0	0	15	2	1	1	0	0	4	5	61	1	0	0	67	0	72	8	0	0	80	166
Hourly Total	39	7	31	0	0	77	4	11	2	0	0	17	28	222	5	0	0	255	4	314	59	0	0	377	726
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	299	74	229	0	0	602	33	60	8	0	3	101	204	1878	77	0	3	2159	11	1923	326	0	0	2260	5122
Approach %	49.7	12.3	38.0	0.0	-	-	32.7	59.4	7.9	0.0	-	-	9.4	87.0	3.6	0.0	-	-	0.5	85.1	14.4	0.0	-	-	-
Total %	5.8	1.4	4.5	0.0	-	11.8	0.6	1.2	0.2	0.0	-	2.0	4.0	36.7	1.5	0.0	-	42.2	0.2	37.5	6.4	0.0	-	44.1	-
Lights	285	66	221	0	-	572	32	54	4	0	-	90	198	1785	74	0	-	2057	5	1826	314	0	-	2145	4864
% Lights	95.3	89.2	96.5	-	-	95.0	97.0	90.0	50.0	-	-	89.1	97.1	95.0	96.1	-	-	95.3	45.5	95.0	96.3	-	-	94.9	95.0
Mediums	13	7	7	0	-	27	1	5	4	0	-	10	6	57	2	0	-	65	5	56	10	0	-	71	173
% Mediums	4.3	9.5	3.1	-	-	4.5	3.0	8.3	50.0	-	-	9.9	2.9	3.0	2.6	-	-	3.0	45.5	2.9	3.1	-	-	3.1	3.4
Articulated Trucks	1	1	1	0	-	3	0	1	0	0	-	1	0	36	1	0	-	37	1	41	2	0	-	44	85
% Articulated Trucks	0.3	1.4	0.4	-	-	0.5	0.0	1.7	0.0	-	-	1.0	0.0	1.9	1.3	-	-	1.7	9.1	2.1	0.6	-	-	1.9	1.7
Pedestrians	-	-	-	-	0	-	-	-	-	-	3	-	-	-	-	-	3	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (7:45 AM)

Start Time	Nanticoke Creek Pkwy Eastbound						Nanticoke Creek Pkwy Westbound						Highway 6 Northbound						Highway 6 Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:45 AM	17	0	7	0	0	24	1	4	0	0	0	5	11	83	2	0	0	96	0	46	12	0	0	58	183
8:00 AM	4	5	6	0	0	15	1	1	0	0	0	2	6	61	6	0	0	73	0	52	13	0	0	65	155
8:15 AM	13	3	7	0	0	23	1	4	0	0	0	5	7	56	2	0	0	65	0	32	23	0	0	55	148
8:30 AM	8	3	10	0	0	21	1	5	1	0	0	7	4	55	4	0	0	63	0	52	14	0	0	66	157
Total	42	11	30	0	0	83	4	14	1	0	0	19	28	255	14	0	0	297	0	182	62	0	0	244	643
Approach %	50.6	13.3	36.1	0.0	-	-	21.1	73.7	5.3	0.0	-	-	9.4	85.9	4.7	0.0	-	-	0.0	74.6	25.4	0.0	-	-	-
Total %	6.5	1.7	4.7	0.0	-	12.9	0.6	2.2	0.2	0.0	-	3.0	4.4	39.7	2.2	0.0	-	46.2	0.0	28.3	9.6	0.0	-	37.9	-
PHF	0.618	0.550	0.750	0.000	-	0.865	1.000	0.700	0.250	0.000	-	0.679	0.636	0.768	0.583	0.000	-	0.773	0.000	0.875	0.674	0.000	-	0.924	0.878
Lights	39	8	28	0	-	75	4	12	1	0	-	17	25	247	13	0	-	285	0	171	58	0	-	229	606
% Lights	92.9	72.7	93.3	-	-	90.4	100.0	85.7	100.0	-	-	89.5	89.3	96.9	92.9	-	-	96.0	-	94.0	93.5	-	-	93.9	94.2
Mediums	3	3	1	0	-	7	0	2	0	0	-	2	3	3	1	0	-	7	0	7	3	0	-	10	26
% Mediums	7.1	27.3	3.3	-	-	8.4	0.0	14.3	0.0	-	-	10.5	10.7	1.2	7.1	-	-	2.4	-	3.8	4.8	-	-	4.1	4.0
Articulated Trucks	0	0	1	0	-	1	0	0	0	0	-	0	0	5	0	0	-	5	0	4	1	0	-	5	11
% Articulated Trucks	0.0	0.0	3.3	-	-	1.2	0.0	0.0	0.0	-	-	0.0	0.0	2.0	0.0	-	-	1.7	-	2.2	1.6	-	-	2.0	1.7
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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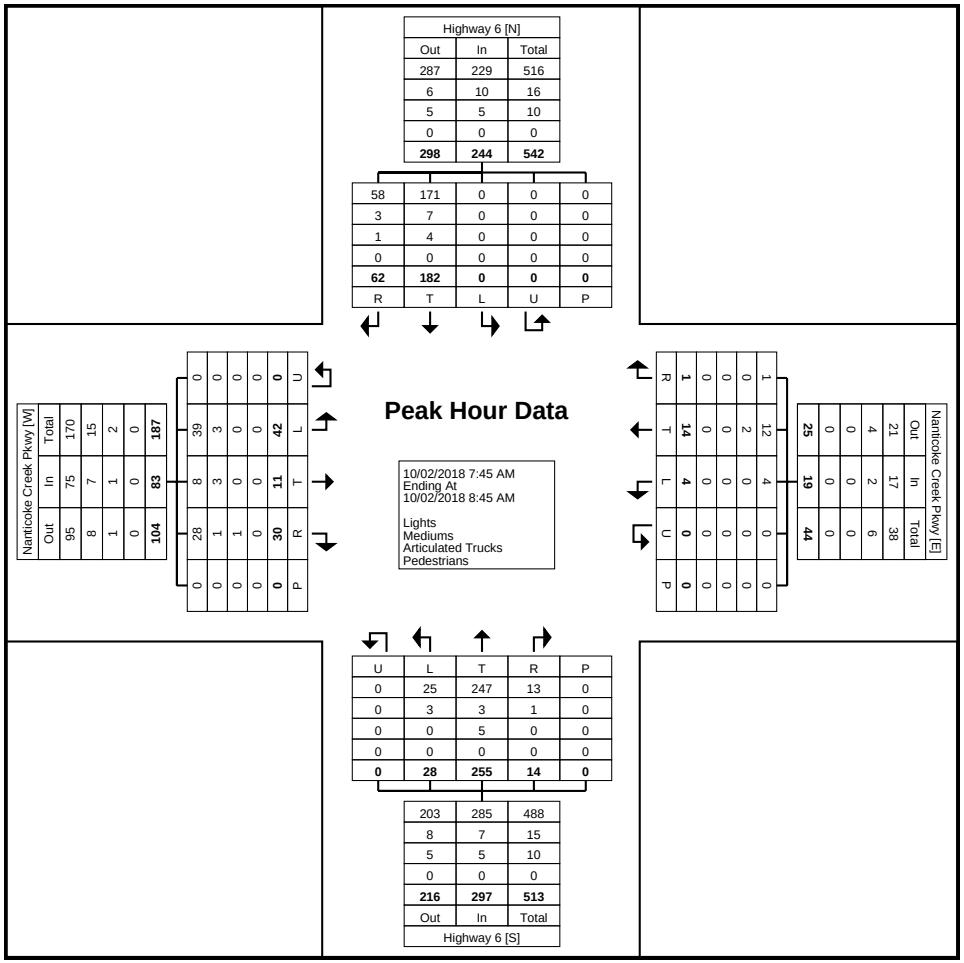

Turning Movement Peak Hour Data Plot (7:45 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (12:00 PM)

Start Time	Nanticoke Creek Pkwy Eastbound						Nanticoke Creek Pkwy Westbound						Highway 6 Northbound						Highway 6 Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:00 PM	8	0	13	0	0	21	0	1	0	0	0	1	3	102	3	0	0	108	0	55	7	0	0	62	192
12:15 PM	6	1	8	0	0	15	0	3	0	0	0	3	11	40	0	0	0	51	1	52	7	0	0	60	129
12:30 PM	2	1	4	0	0	7	0	1	0	0	0	1	6	44	0	0	0	50	0	63	6	0	0	69	127
12:45 PM	10	3	4	0	0	17	0	0	0	0	0	0	6	62	3	0	0	71	0	74	8	0	0	82	170
Total	26	5	29	0	0	60	0	5	0	0	0	5	26	248	6	0	0	280	1	244	28	0	0	273	618
Approach %	43.3	8.3	48.3	0.0	-	-	0.0	100.0	0.0	0.0	-	-	9.3	88.6	2.1	0.0	-	-	0.4	89.4	10.3	0.0	-	-	-
Total %	4.2	0.8	4.7	0.0	-	9.7	0.0	0.8	0.0	0.0	-	0.8	4.2	40.1	1.0	0.0	-	45.3	0.2	39.5	4.5	0.0	-	44.2	-
PHF	0.650	0.417	0.558	0.000	-	0.714	0.000	0.417	0.000	0.000	-	0.417	0.591	0.608	0.500	0.000	-	0.648	0.250	0.824	0.875	0.000	-	0.832	0.805
Lights	25	3	28	0	-	56	0	3	0	0	-	3	26	238	6	0	-	270	0	233	28	0	-	261	590
% Lights	96.2	60.0	96.6	-	-	93.3	-	60.0	-	-	-	60.0	100.0	96.0	100.0	-	-	96.4	0.0	95.5	100.0	-	-	95.6	95.5
Mediums	1	1	1	0	-	3	0	1	0	0	-	1	0	5	0	0	-	5	1	6	0	0	-	7	16
% Mediums	3.8	20.0	3.4	-	-	5.0	-	20.0	-	-	-	20.0	0.0	2.0	0.0	-	-	1.8	100.0	2.5	0.0	-	-	2.6	2.6
Articulated Trucks	0	1	0	0	-	1	0	1	0	0	-	1	0	5	0	0	-	5	0	5	0	0	-	5	12
% Articulated Trucks	0.0	20.0	0.0	-	-	1.7	-	20.0	-	-	-	20.0	0.0	2.0	0.0	-	-	1.8	0.0	2.0	0.0	-	-	1.8	1.9
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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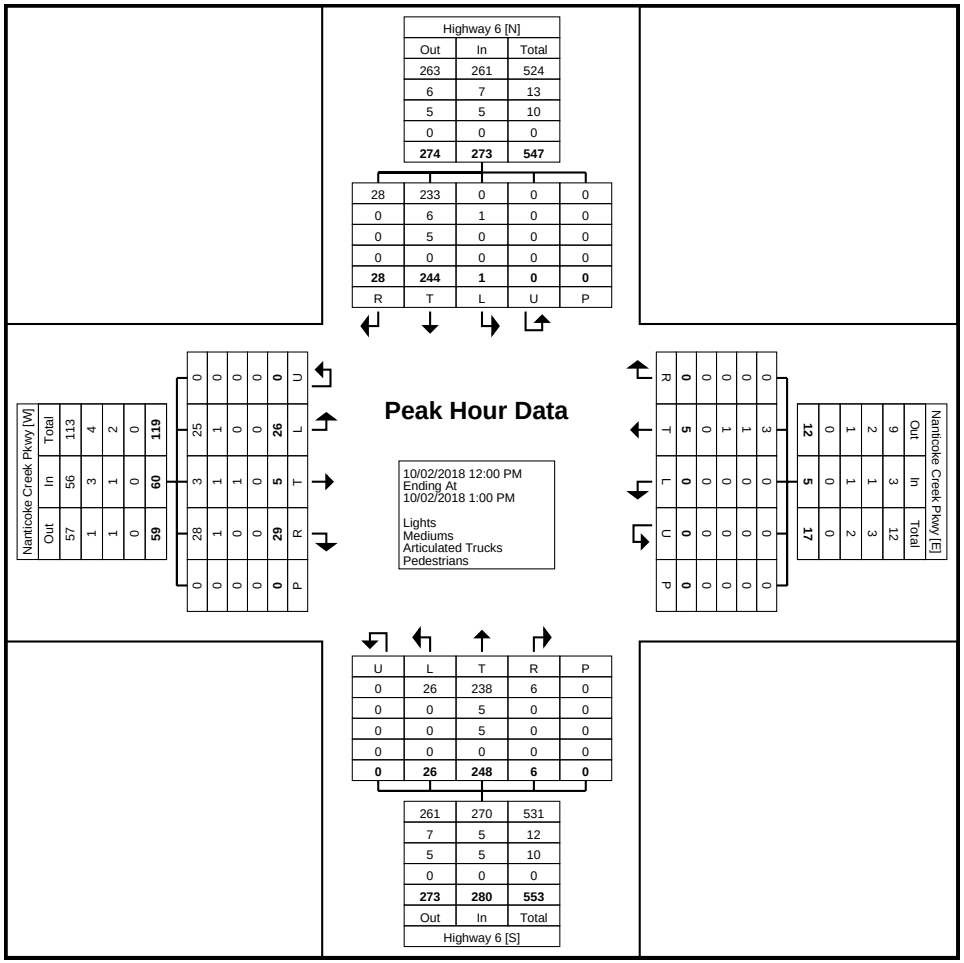
Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (12:00 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018

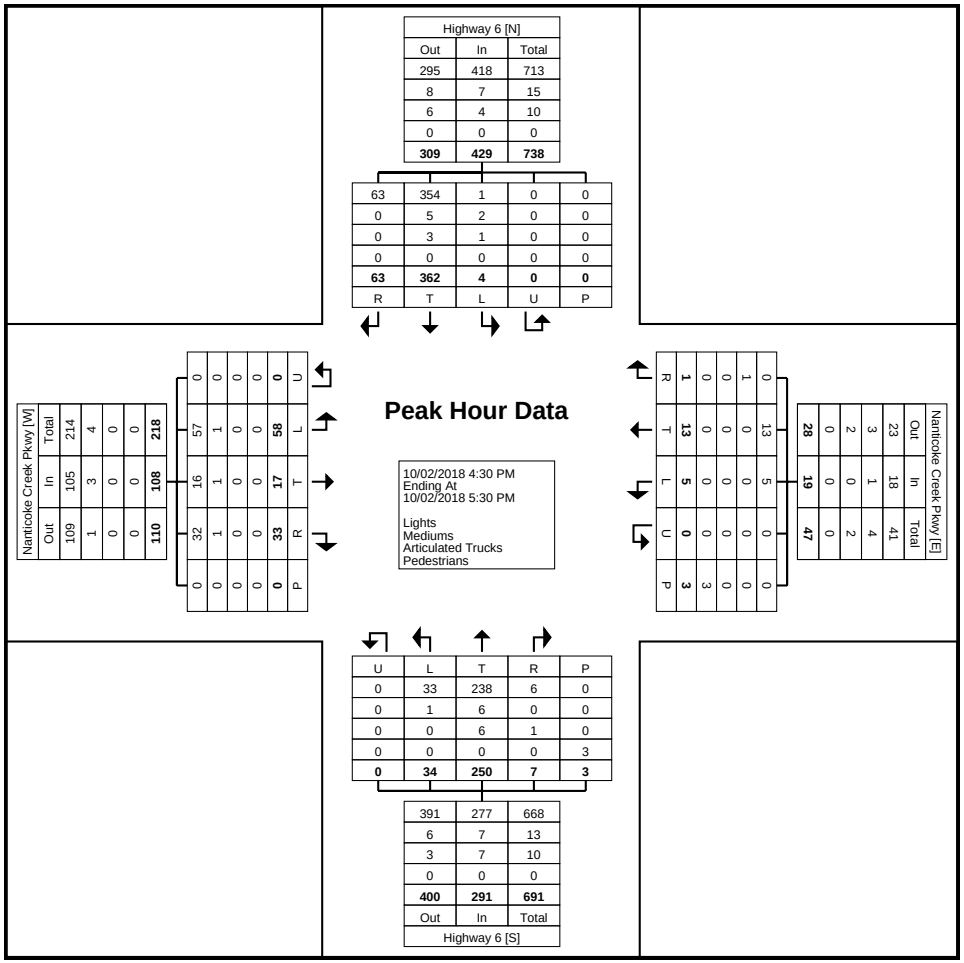
Turning Movement Peak Hour Data (4:30 PM)

Start Time	Nanticoke Creek Pkwy Eastbound						Nanticoke Creek Pkwy Westbound						Highway 6 Northbound						Highway 6 Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:30 PM	20	5	9	0	0	34	1	1	0	0	0	2	10	68	2	0	0	80	0	91	15	0	0	106	222
4:45 PM	13	8	6	0	0	27	2	3	0	0	3	5	10	62	4	0	3	76	1	111	10	0	0	122	230
5:00 PM	14	3	10	0	0	27	2	3	1	0	0	6	6	55	1	0	0	62	1	77	18	0	0	96	191
5:15 PM	11	1	8	0	0	20	0	6	0	0	0	6	8	65	0	0	0	73	2	83	20	0	0	105	204
Total	58	17	33	0	0	108	5	13	1	0	3	19	34	250	7	0	3	291	4	362	63	0	0	429	847
Approach %	53.7	15.7	30.6	0.0	-	-	26.3	68.4	5.3	0.0	-	-	11.7	85.9	2.4	0.0	-	-	0.9	84.4	14.7	0.0	-	-	-
Total %	6.8	2.0	3.9	0.0	-	12.8	0.6	1.5	0.1	0.0	-	2.2	4.0	29.5	0.8	0.0	-	34.4	0.5	42.7	7.4	0.0	-	50.6	-
PHF	0.725	0.531	0.825	0.000	-	0.794	0.625	0.542	0.250	0.000	-	0.792	0.850	0.919	0.438	0.000	-	0.909	0.500	0.815	0.788	0.000	-	0.879	0.921
Lights	57	16	32	0	-	105	5	13	0	0	-	18	33	238	6	0	-	277	1	354	63	0	-	418	818
% Lights	98.3	94.1	97.0	-	-	97.2	100.0	100.0	0.0	-	-	94.7	97.1	95.2	85.7	-	-	95.2	25.0	97.8	100.0	-	-	97.4	96.6
Mediums	1	1	1	0	-	3	0	0	1	0	-	1	1	6	0	0	-	7	2	5	0	0	-	7	18
% Mediums	1.7	5.9	3.0	-	-	2.8	0.0	0.0	100.0	-	-	5.3	2.9	2.4	0.0	-	-	2.4	50.0	1.4	0.0	-	-	1.6	2.1
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	6	1	0	-	7	1	3	0	0	-	4	11
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	2.4	14.3	-	-	2.4	25.0	0.8	0.0	-	-	0.9	1.3
Pedestrians	-	-	-	-	0	-	-	-	-	-	3	-	-	-	-	-	3	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (4:30 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Highway 6 (Main Street) & Nanticoke Creek Pkwy
Site Code:
Start Date: 10/02/2018

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Main Street
Site Code:
Start Date: 10/02/2018

Turning Movement Data

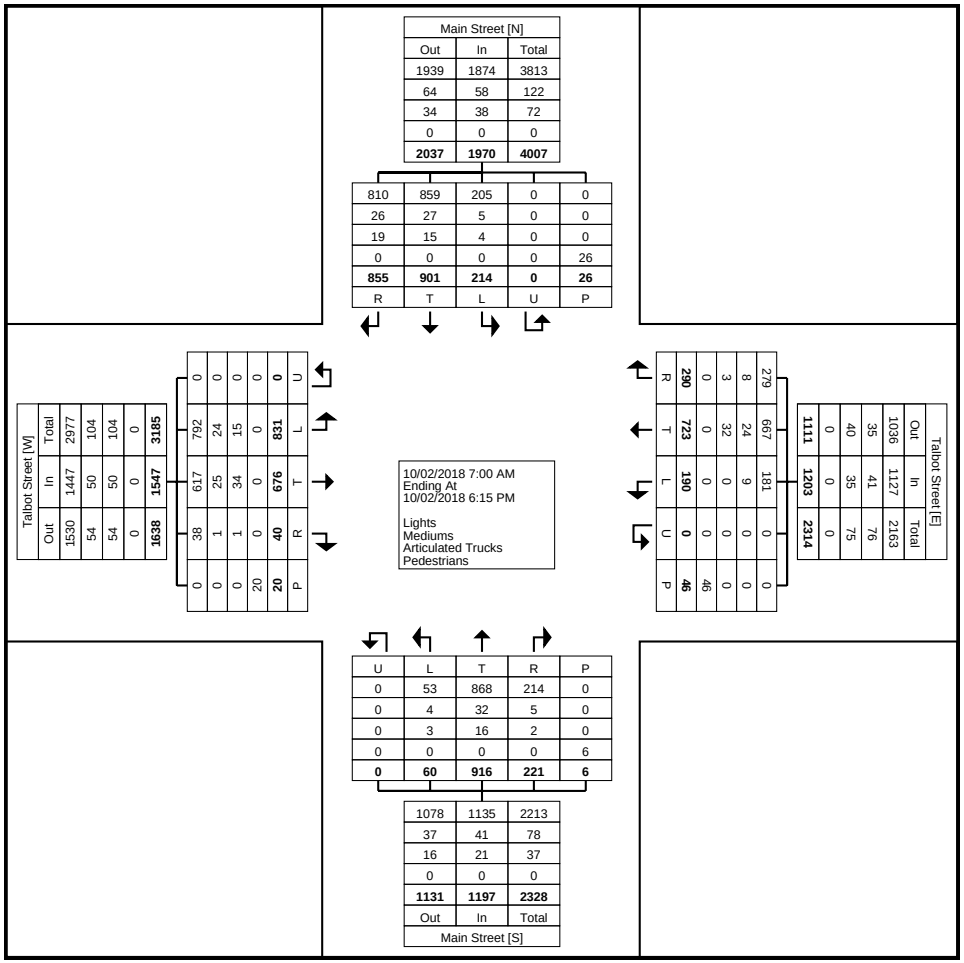
Start Time	Talbot Street Eastbound						Talbot Street Westbound						Main Street Northbound						Main Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	20	11	0	0	0	31	1	6	4	0	0	11	1	37	8	0	0	46	4	6	15	0	0	25	113
7:15 AM	25	13	1	0	0	39	1	15	7	0	0	23	1	25	17	0	0	43	3	10	23	0	0	36	141
7:30 AM	23	17	1	0	0	41	0	24	2	0	1	26	0	35	10	0	0	45	7	8	32	0	0	47	159
7:45 AM	22	22	0	0	0	44	10	27	7	0	1	44	3	45	6	0	0	54	4	12	30	0	0	46	188
Hourly Total	90	63	2	0	0	155	12	72	20	0	2	104	5	142	41	0	0	188	18	36	100	0	0	154	601
8:00 AM	24	13	0	0	1	37	3	16	6	0	0	25	3	29	7	0	0	39	6	21	32	0	0	59	160
8:15 AM	23	17	0	0	1	40	7	21	4	0	0	32	2	28	9	0	0	39	4	14	25	0	0	43	154
8:30 AM	20	12	0	0	0	32	4	33	3	0	0	40	0	31	10	0	0	41	5	25	27	0	0	57	170
8:45 AM	16	14	3	0	0	33	2	14	7	0	0	23	3	39	5	0	0	47	8	15	21	0	0	44	147
Hourly Total	83	56	3	0	2	142	16	84	20	0	0	120	8	127	31	0	0	166	23	75	105	0	0	203	631
9:00 AM	26	19	1	0	0	46	12	29	12	0	2	53	1	32	5	0	0	38	7	13	22	0	4	42	179
9:15 AM	15	19	1	0	0	35	7	25	10	0	0	42	1	26	3	0	0	30	5	15	26	0	2	46	153
9:30 AM	27	18	0	0	0	45	4	20	13	0	0	37	3	38	5	0	1	46	6	21	21	0	0	48	176
9:45 AM	15	14	2	0	0	31	8	29	5	0	4	42	1	15	4	0	0	20	6	22	20	0	0	48	141
Hourly Total	83	70	4	0	0	157	31	103	40	0	6	174	6	111	17	0	1	134	24	71	89	0	6	184	649
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	29	19	2	0	0	50	5	28	11	0	0	44	3	18	5	0	0	26	10	22	15	0	0	47	167
11:45 AM	54	17	0	0	1	71	3	20	6	0	0	29	4	31	7	0	0	42	5	23	18	0	0	46	188
Hourly Total	83	36	2	0	1	121	8	48	17	0	0	73	7	49	12	0	0	68	15	45	33	0	0	93	355
12:00 PM	45	19	1	0	0	65	5	27	13	0	0	45	3	29	7	0	0	39	12	21	22	0	1	55	204
12:15 PM	17	27	2	0	0	46	5	26	8	0	1	39	3	25	9	0	0	37	10	26	19	0	1	55	177
12:30 PM	9	19	1	0	0	29	7	22	8	0	0	37	4	33	8	0	0	45	8	31	17	0	0	56	167
12:45 PM	26	20	1	0	1	47	6	25	13	0	0	44	3	30	2	0	0	35	11	31	31	0	0	73	199
Hourly Total	97	85	5	0	1	187	23	100	42	0	1	165	13	117	26	0	0	156	41	109	89	0	2	239	747
1:00 PM	21	26	3	0	0	50	2	28	8	0	3	38	2	38	8	0	1	48	6	22	29	0	0	57	193
1:15 PM	25	18	1	0	1	44	1	22	10	0	2	33	5	32	7	0	0	44	13	26	26	0	0	65	186
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	46	44	4	0	1	94	3	50	18	0	5	71	7	70	15	0	1	92	19	48	55	0	0	122	379
3:00 PM	26	34	1	0	0	61	8	21	12	0	10	41	2	35	8	0	0	45	8	37	20	0	1	65	212
3:15 PM	24	30	3	0	2	57	13	23	11	0	12	47	1	19	6	0	2	26	4	35	32	0	2	71	201
3:30 PM	30	18	1	0	2	49	8	22	8	0	3	38	3	29	6	0	0	38	7	28	33	0	5	68	193
3:45 PM	30	35	3	0	1	68	5	13	8	0	1	26	1	22	5	0	0	28	5	42	39	0	3	86	208
Hourly Total	110	117	8	0	5	235	34	79	39	0	26	152	7	105	25	0	2	137	24	142	124	0	11	290	814
4:00 PM	27	17	4	0	6	48	8	24	8	0	3	40	0	28	5	0	0	33	3	59	36	0	4	98	219

4:15 PM	25	29	2	0	0	56	8	18	11	0	0	37	0	30	7	0	0	37	7	42	39	0	0	88	218
4:30 PM	31	31	1	0	0	63	7	20	14	0	2	41	3	22	8	0	0	33	6	57	31	0	0	94	231
4:45 PM	43	31	0	0	0	74	8	20	15	0	0	43	1	25	15	0	0	41	9	52	41	0	0	102	260
Hourly Total	126	108	7	0	6	241	31	82	48	0	5	161	4	105	35	0	0	144	25	210	147	0	4	382	928
5:00 PM	28	21	1	0	0	50	8	18	18	0	0	44	1	20	2	0	0	23	11	49	34	0	1	94	211
5:15 PM	39	22	0	0	0	61	7	34	10	0	0	51	0	29	7	0	0	36	6	36	33	0	0	75	223
5:30 PM	16	29	1	0	3	46	8	26	11	0	1	45	1	22	7	0	1	30	4	42	23	0	2	69	190
5:45 PM	30	24	3	0	1	57	9	27	7	0	0	43	1	19	3	0	1	23	4	38	23	0	0	65	188
Hourly Total	113	96	5	0	4	214	32	105	46	0	1	183	3	90	19	0	2	112	25	165	113	0	3	303	812
6:00 PM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	831	676	40	0	20	1547	190	723	290	0	46	1203	60	916	221	0	6	1197	214	901	855	0	26	1970	5917
Approach %	53.7	43.7	2.6	0.0	-	-	15.8	60.1	24.1	0.0	-	-	5.0	76.5	18.5	0.0	-	-	10.9	45.7	43.4	0.0	-	-	-
Total %	14.0	11.4	0.7	0.0	-	26.1	3.2	12.2	4.9	0.0	-	20.3	1.0	15.5	3.7	0.0	-	20.2	3.6	15.2	14.4	0.0	-	33.3	-
Lights	792	617	38	0	-	1447	181	667	279	0	-	1127	53	868	214	0	-	1135	205	859	810	0	-	1874	5583
% Lights	95.3	91.3	95.0	-	-	93.5	95.3	92.3	96.2	-	-	93.7	88.3	94.8	96.8	-	-	94.8	95.8	95.3	94.7	-	-	95.1	94.4
Mediums	24	25	1	0	-	50	9	24	8	0	-	41	4	32	5	0	-	41	5	27	26	0	-	58	190
% Mediums	2.9	3.7	2.5	-	-	3.2	4.7	3.3	2.8	-	-	3.4	6.7	3.5	2.3	-	-	3.4	2.3	3.0	3.0	-	-	2.9	3.2
Articulated Trucks	15	34	1	0	-	50	0	32	3	0	-	35	3	16	2	0	-	21	4	15	19	0	-	38	144
% Articulated Trucks	1.8	5.0	2.5	-	-	3.2	0.0	4.4	1.0	-	-	2.9	5.0	1.7	0.9	-	-	1.8	1.9	1.7	2.2	-	-	1.9	2.4
Pedestrians	-	-	-	-	20	-	-	-	-	-	46	-	-	-	-	-	6	-	-	-	-	-	26	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Main Street
Site Code:
Start Date: 10/02/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Main Street
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (7:45 AM)

Start Time	Talbot Street Eastbound						Talbot Street Westbound						Main Street Northbound						Main Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:45 AM	22	22	0	0	0	44	10	27	7	0	1	44	3	45	6	0	0	54	4	12	30	0	0	46	188
8:00 AM	24	13	0	0	1	37	3	16	6	0	0	25	3	29	7	0	0	39	6	21	32	0	0	59	160
8:15 AM	23	17	0	0	1	40	7	21	4	0	0	32	2	28	9	0	0	39	4	14	25	0	0	43	154
8:30 AM	20	12	0	0	0	32	4	33	3	0	0	40	0	31	10	0	0	41	5	25	27	0	0	57	170
Total	89	64	0	0	2	153	24	97	20	0	1	141	8	133	32	0	0	173	19	72	114	0	0	205	672
Approach %	58.2	41.8	0.0	0.0	-	-	17.0	68.8	14.2	0.0	-	-	4.6	76.9	18.5	0.0	-	-	9.3	35.1	55.6	0.0	-	-	-
Total %	13.2	9.5	0.0	0.0	-	22.8	3.6	14.4	3.0	0.0	-	21.0	1.2	19.8	4.8	0.0	-	25.7	2.8	10.7	17.0	0.0	-	30.5	-
PHF	0.927	0.727	0.000	0.000	-	0.869	0.600	0.735	0.714	0.000	-	0.801	0.667	0.739	0.800	0.000	-	0.801	0.792	0.720	0.891	0.000	-	0.869	0.894
Lights	84	57	0	0	-	141	23	90	19	0	-	132	8	128	31	0	-	167	18	69	108	0	-	195	635
% Lights	94.4	89.1	-	-	-	92.2	95.8	92.8	95.0	-	-	93.6	100.0	96.2	96.9	-	-	96.5	94.7	95.8	94.7	-	-	95.1	94.5
Mediums	3	5	0	0	-	8	1	2	1	0	-	4	0	5	1	0	-	6	1	2	4	0	-	7	25
% Mediums	3.4	7.8	-	-	-	5.2	4.2	2.1	5.0	-	-	2.8	0.0	3.8	3.1	-	-	3.5	5.3	2.8	3.5	-	-	3.4	3.7
Articulated Trucks	2	2	0	0	-	4	0	5	0	0	-	5	0	0	0	0	-	0	0	1	2	0	-	3	12
% Articulated Trucks	2.2	3.1	-	-	-	2.6	0.0	5.2	0.0	-	-	3.5	0.0	0.0	0.0	-	-	0.0	0.0	1.4	1.8	-	-	1.5	1.8
Pedestrians	-	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
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Count Name: Talbot Street & Main Street
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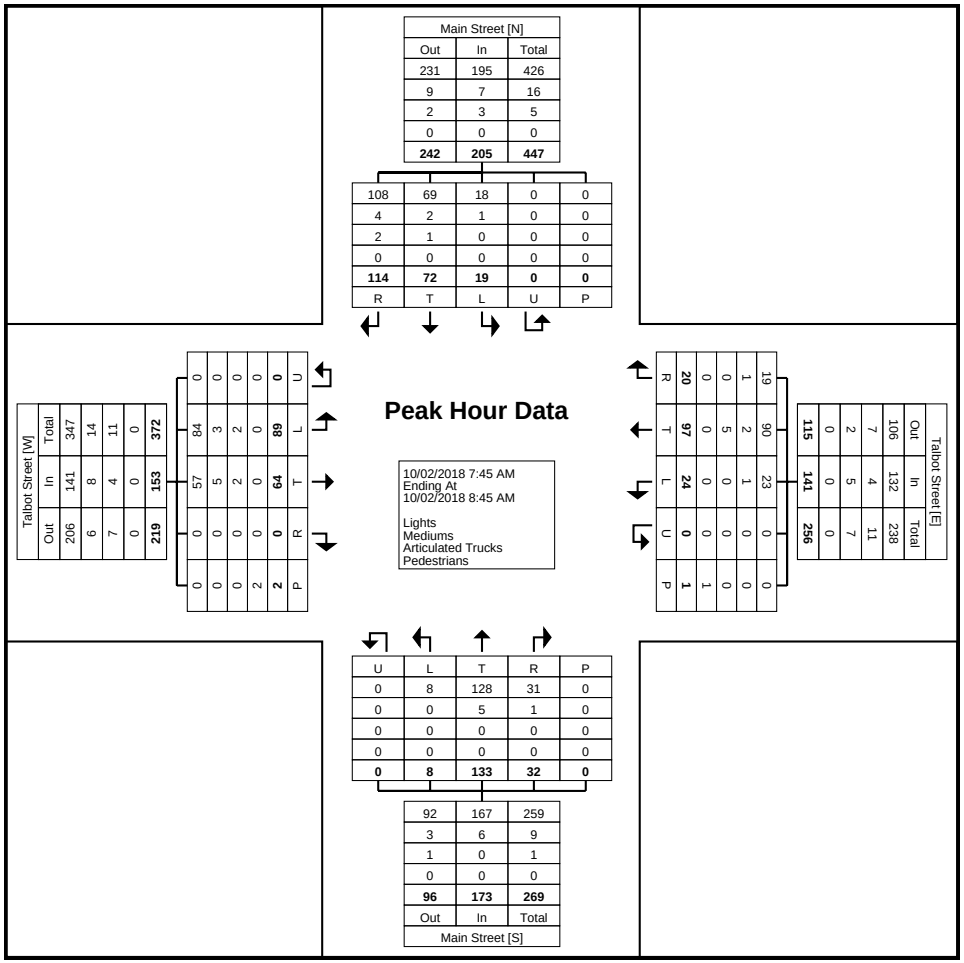

Turning Movement Peak Hour Data Plot (7:45 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Main Street
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (12:00 PM)

Start Time	Talbot Street Eastbound						Talbot Street Westbound						Main Street Northbound						Main Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:00 PM	45	19	1	0	0	65	5	27	13	0	0	45	3	29	7	0	0	39	12	21	22	0	1	55	204
12:15 PM	17	27	2	0	0	46	5	26	8	0	1	39	3	25	9	0	0	37	10	26	19	0	1	55	177
12:30 PM	9	19	1	0	0	29	7	22	8	0	0	37	4	33	8	0	0	45	8	31	17	0	0	56	167
12:45 PM	26	20	1	0	1	47	6	25	13	0	0	44	3	30	2	0	0	35	11	31	31	0	0	73	199
Total	97	85	5	0	1	187	23	100	42	0	1	165	13	117	26	0	0	156	41	109	89	0	2	239	747
Approach %	51.9	45.5	2.7	0.0	-	-	13.9	60.6	25.5	0.0	-	-	8.3	75.0	16.7	0.0	-	-	17.2	45.6	37.2	0.0	-	-	-
Total %	13.0	11.4	0.7	0.0	-	25.0	3.1	13.4	5.6	0.0	-	22.1	1.7	15.7	3.5	0.0	-	20.9	5.5	14.6	11.9	0.0	-	32.0	-
PHF	0.539	0.787	0.625	0.000	-	0.719	0.821	0.926	0.808	0.000	-	0.917	0.813	0.886	0.722	0.000	-	0.867	0.854	0.879	0.718	0.000	-	0.818	0.915
Lights	97	80	4	0	-	181	21	91	40	0	-	152	12	110	25	0	-	147	40	101	86	0	-	227	707
% Lights	100.0	94.1	80.0	-	-	96.8	91.3	91.0	95.2	-	-	92.1	92.3	94.0	96.2	-	-	94.2	97.6	92.7	96.6	-	-	95.0	94.6
Mediums	0	1	0	0	-	1	2	4	1	0	-	7	1	3	0	0	-	4	1	7	1	0	-	9	21
% Mediums	0.0	1.2	0.0	-	-	0.5	8.7	4.0	2.4	-	-	4.2	7.7	2.6	0.0	-	-	2.6	2.4	6.4	1.1	-	-	3.8	2.8
Articulated Trucks	0	4	1	0	-	5	0	5	1	0	-	6	0	4	1	0	-	5	0	1	2	0	-	3	19
% Articulated Trucks	0.0	4.7	20.0	-	-	2.7	0.0	5.0	2.4	-	-	3.6	0.0	3.4	3.8	-	-	3.2	0.0	0.9	2.2	-	-	1.3	2.5
Pedestrians	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	2	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

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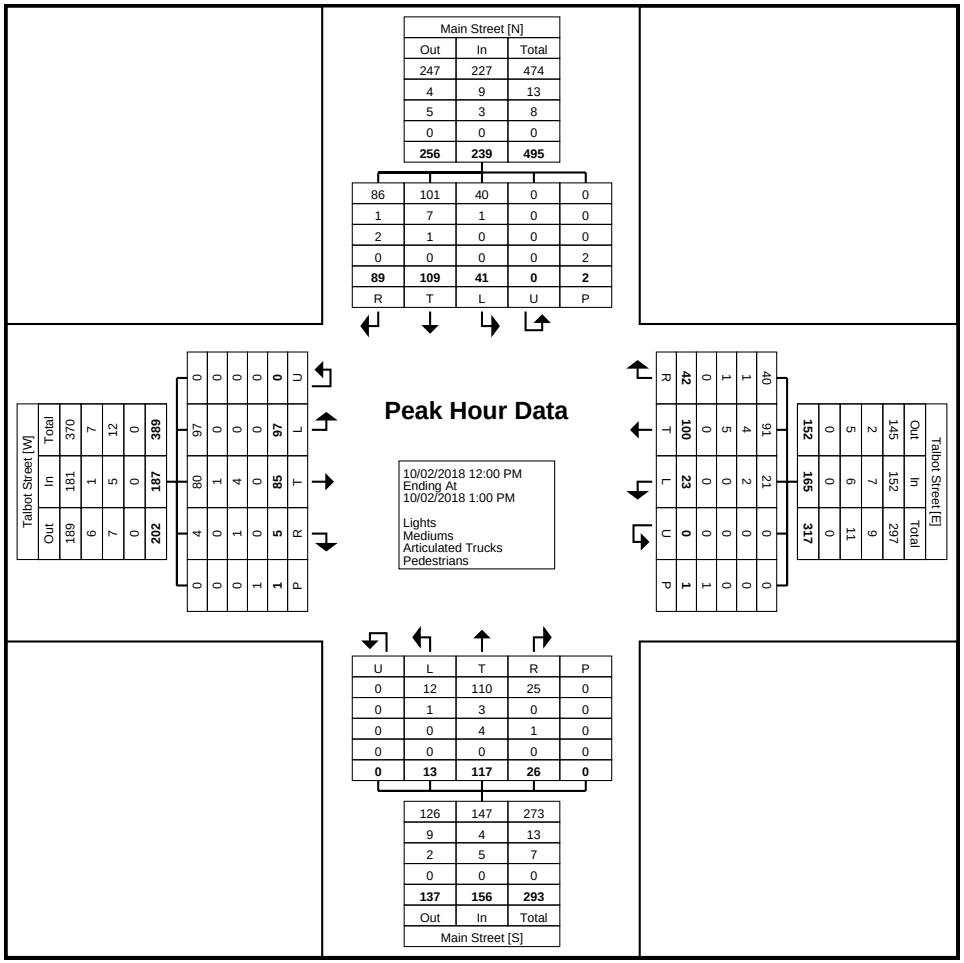
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (12:00 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Main Street
Site Code:
Start Date: 10/02/2018

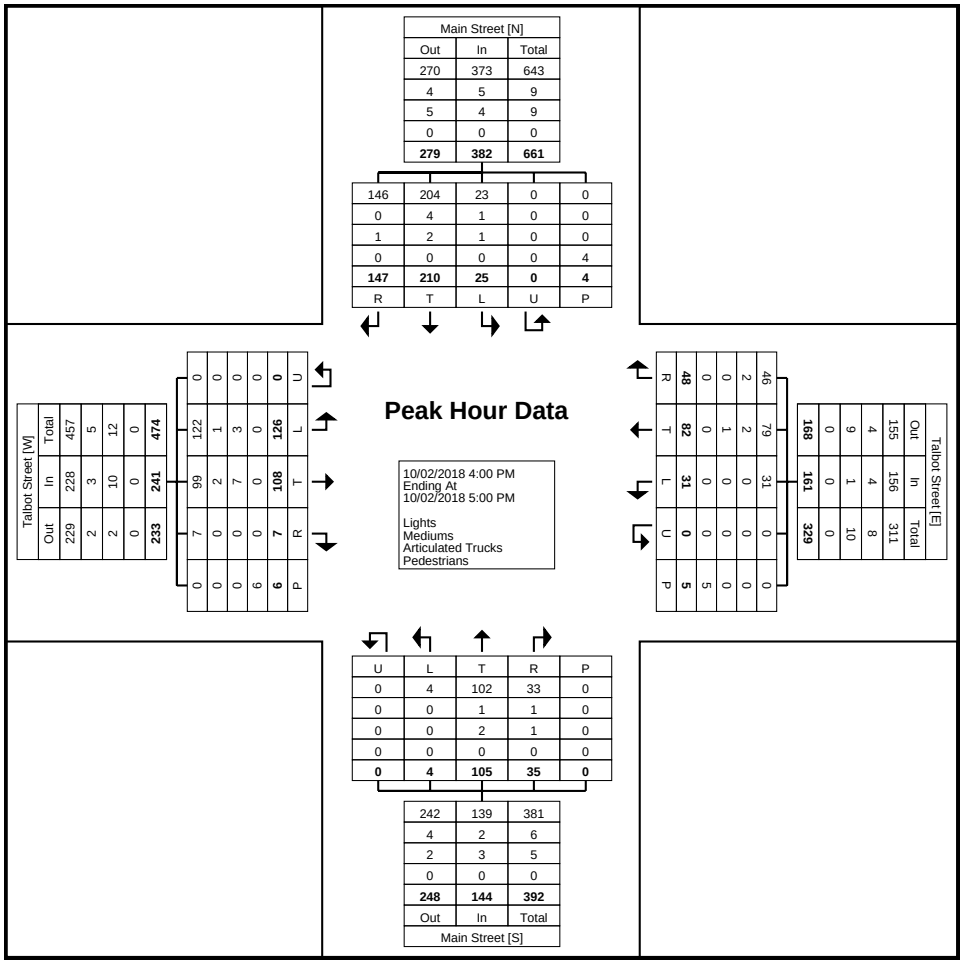
Turning Movement Peak Hour Data (4:00 PM)

Start Time	Talbot Street Eastbound						Talbot Street Westbound						Main Street Northbound						Main Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:00 PM	27	17	4	0	6	48	8	24	8	0	3	40	0	28	5	0	0	33	3	59	36	0	4	98	219
4:15 PM	25	29	2	0	0	56	8	18	11	0	0	37	0	30	7	0	0	37	7	42	39	0	0	88	218
4:30 PM	31	31	1	0	0	63	7	20	14	0	2	41	3	22	8	0	0	33	6	57	31	0	0	94	231
4:45 PM	43	31	0	0	0	74	8	20	15	0	0	43	1	25	15	0	0	41	9	52	41	0	0	102	260
Total	126	108	7	0	6	241	31	82	48	0	5	161	4	105	35	0	0	144	25	210	147	0	4	382	928
Approach %	52.3	44.8	2.9	0.0	-	-	19.3	50.9	29.8	0.0	-	-	2.8	72.9	24.3	0.0	-	-	6.5	55.0	38.5	0.0	-	-	-
Total %	13.6	11.6	0.8	0.0	-	26.0	3.3	8.8	5.2	0.0	-	17.3	0.4	11.3	3.8	0.0	-	15.5	2.7	22.6	15.8	0.0	-	41.2	-
PHF	0.733	0.871	0.438	0.000	-	0.814	0.969	0.854	0.800	0.000	-	0.936	0.333	0.875	0.583	0.000	-	0.878	0.694	0.890	0.896	0.000	-	0.936	0.892
Lights	122	99	7	0	-	228	31	79	46	0	-	156	4	102	33	0	-	139	23	204	146	0	-	373	896
% Lights	96.8	91.7	100.0	-	-	94.6	100.0	96.3	95.8	-	-	96.9	100.0	97.1	94.3	-	-	96.5	92.0	97.1	99.3	-	-	97.6	96.6
Mediums	1	2	0	0	-	3	0	2	2	0	-	4	0	1	1	0	-	2	1	4	0	0	-	5	14
% Mediums	0.8	1.9	0.0	-	-	1.2	0.0	2.4	4.2	-	-	2.5	0.0	1.0	2.9	-	-	1.4	4.0	1.9	0.0	-	-	1.3	1.5
Articulated Trucks	3	7	0	0	-	10	0	1	0	0	-	1	0	2	1	0	-	3	1	2	1	0	-	4	18
% Articulated Trucks	2.4	6.5	0.0	-	-	4.1	0.0	1.2	0.0	-	-	0.6	0.0	1.9	2.9	-	-	2.1	4.0	1.0	0.7	-	-	1.0	1.9
Pedestrians	-	-	-	-	6	-	-	-	-	-	5	-	-	-	-	-	0	-	-	-	-	-	4	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Main Street
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (4:00 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Main Street
Site Code:
Start Date: 10/02/2018

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018

Turning Movement Data

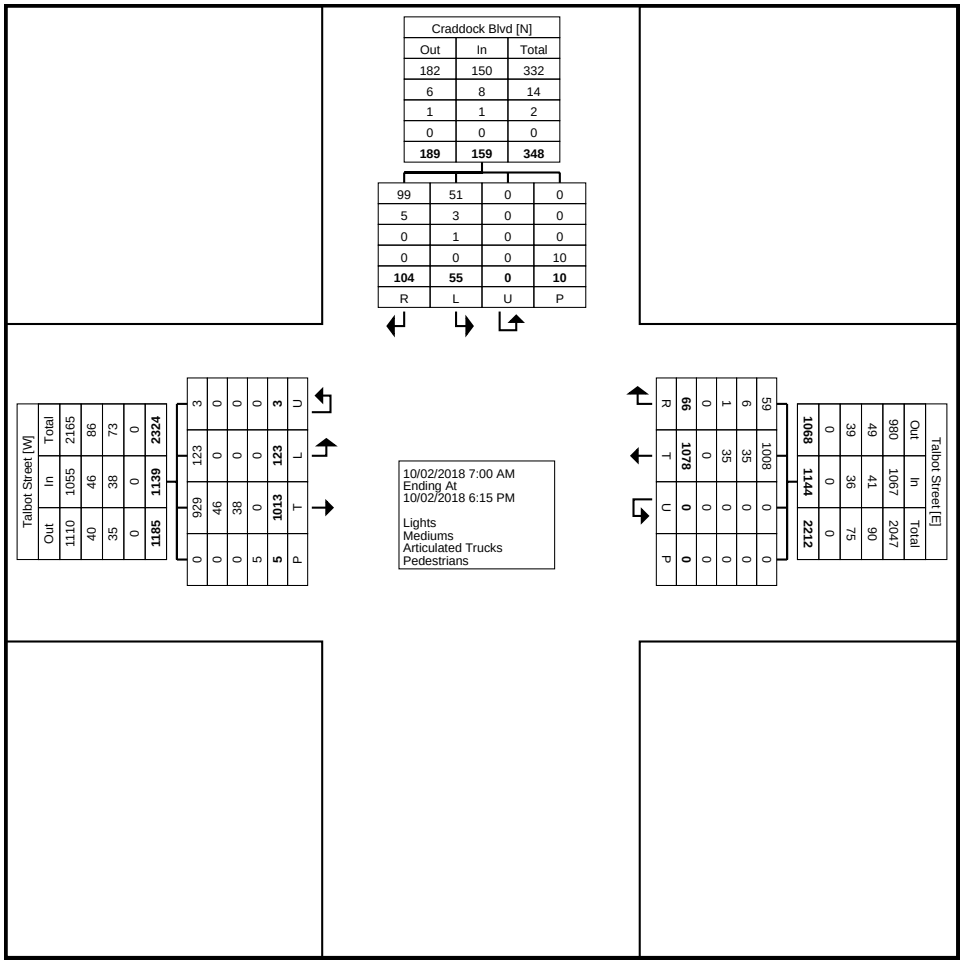
Start Time	Talbot Street Eastbound					Talbot Street Westbound					Craddock Blvd Southbound					Int. Total
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
7:00 AM	2	22	0	0	24	15	2	0	0	17	1	2	0	0	3	44
7:15 AM	1	33	0	0	34	22	1	0	0	23	3	4	0	1	7	64
7:30 AM	2	35	0	0	37	23	3	0	0	26	1	3	0	0	4	67
7:45 AM	1	34	0	0	35	38	3	0	0	41	2	4	0	0	6	82
Hourly Total	6	124	0	0	130	98	9	0	0	107	7	13	0	1	20	257
8:00 AM	4	25	0	0	29	28	2	0	0	30	2	2	0	1	4	63
8:15 AM	2	32	0	0	34	36	1	0	0	37	1	5	0	0	6	77
8:30 AM	1	30	0	0	31	33	1	0	0	34	3	5	0	0	8	73
8:45 AM	1	34	0	0	35	33	3	0	0	36	2	3	0	0	5	76
Hourly Total	8	121	0	0	129	130	7	0	0	137	8	15	0	1	23	289
9:00 AM	3	27	0	0	30	44	1	0	0	45	3	3	0	2	6	81
9:15 AM	2	32	0	0	34	41	2	0	0	43	1	2	0	3	3	80
9:30 AM	5	24	0	0	29	32	1	0	0	33	2	5	0	0	7	69
9:45 AM	5	20	0	0	25	36	1	0	0	37	4	5	0	0	9	71
Hourly Total	15	103	0	0	118	153	5	0	0	158	10	15	0	5	25	301
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	3	29	0	0	32	38	1	0	0	39	4	6	0	0	10	81
11:45 AM	3	31	0	0	34	26	2	0	0	28	1	4	0	0	5	67
Hourly Total	6	60	0	0	66	64	3	0	0	67	5	10	0	0	15	148
12:00 PM	6	30	0	0	36	36	1	0	0	37	0	3	0	0	3	76
12:15 PM	5	39	0	0	44	34	2	0	0	36	2	2	0	0	4	84
12:30 PM	4	31	0	0	35	31	2	0	0	33	4	3	0	0	7	75
12:45 PM	4	21	3	0	28	29	3	0	0	32	3	7	0	0	10	70
Hourly Total	19	121	3	0	143	130	8	0	0	138	9	15	0	0	24	305
1:00 PM	3	30	0	0	33	35	4	0	0	39	0	2	0	0	2	74
1:15 PM	6	36	0	0	42	31	1	0	0	32	0	3	0	0	3	77
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	9	66	0	0	75	66	5	0	0	71	0	5	0	0	5	151
3:00 PM	5	43	0	2	48	39	0	0	0	39	1	5	0	0	6	93
3:15 PM	6	42	0	0	48	37	2	0	0	39	1	4	0	1	5	92
3:30 PM	7	21	0	0	28	32	3	0	0	35	0	5	0	0	5	68
3:45 PM	4	38	0	0	42	26	0	0	0	26	2	1	0	0	3	71
Hourly Total	22	144	0	2	166	134	5	0	0	139	4	15	0	1	19	324
4:00 PM	4	27	0	0	31	30	4	0	0	34	2	2	0	0	4	69
4:15 PM	6	33	0	2	39	31	3	0	0	34	5	2	0	1	7	80

4:30 PM	6	44	0	0	50	34	2	0	0	36	0	1	0	0	1	87
4:45 PM	5	48	0	0	53	45	4	0	0	49	1	2	0	0	3	105
Hourly Total	21	152	0	2	173	140	13	0	0	153	8	7	0	1	15	341
5:00 PM	6	37	0	0	43	33	2	0	0	35	1	2	0	0	3	81
5:15 PM	3	32	0	0	35	52	5	0	0	57	2	3	0	0	5	97
5:30 PM	4	33	0	1	37	43	3	0	0	46	0	0	0	0	0	83
5:45 PM	4	20	0	0	24	35	1	0	0	36	1	4	0	1	5	65
Hourly Total	17	122	0	1	139	163	11	0	0	174	4	9	0	1	13	326
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	123	1013	3	5	1139	1078	66	0	0	1144	55	104	0	10	159	2442
Approach %	10.8	88.9	0.3	-	-	94.2	5.8	0.0	-	-	34.6	65.4	0.0	-	-	-
Total %	5.0	41.5	0.1	-	46.6	44.1	2.7	0.0	-	46.8	2.3	4.3	0.0	-	6.5	-
Lights	123	929	3	-	1055	1008	59	0	-	1067	51	99	0	-	150	2272
% Lights	100.0	91.7	100.0	-	92.6	93.5	89.4	-	-	93.3	92.7	95.2	-	-	94.3	93.0
Mediums	0	46	0	-	46	35	6	0	-	41	3	5	0	-	8	95
% Mediums	0.0	4.5	0.0	-	4.0	3.2	9.1	-	-	3.6	5.5	4.8	-	-	5.0	3.9
Articulated Trucks	0	38	0	-	38	35	1	0	-	36	1	0	0	-	1	75
% Articulated Trucks	0.0	3.8	0.0	-	3.3	3.2	1.5	-	-	3.1	1.8	0.0	-	-	0.6	3.1
Pedestrians	-	-	-	5	-	-	-	-	0	-	-	-	-	10	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018

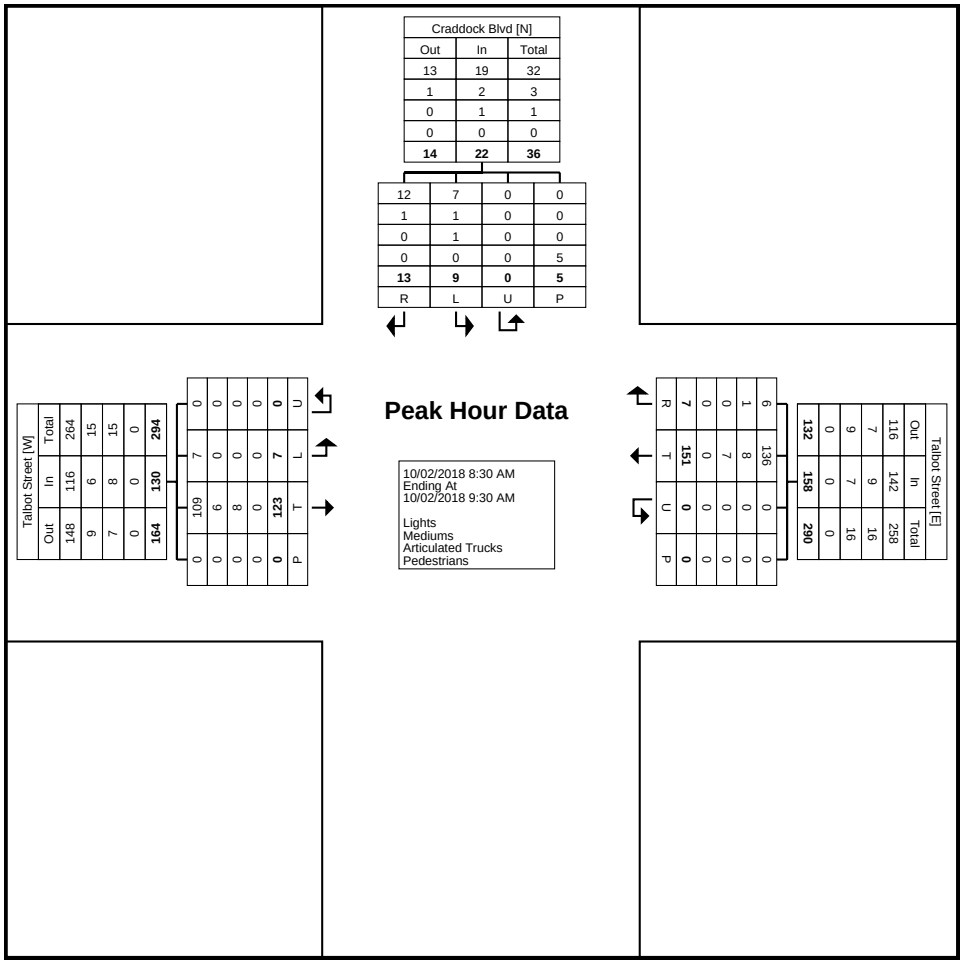
Turning Movement Peak Hour Data (8:30 AM)

Start Time	Talbot Street Eastbound					Talbot Street Westbound					Craddock Blvd Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
8:30 AM	1	30	0	0	31	33	1	0	0	34	3	5	0	0	8	73
8:45 AM	1	34	0	0	35	33	3	0	0	36	2	3	0	0	5	76
9:00 AM	3	27	0	0	30	44	1	0	0	45	3	3	0	2	6	81
9:15 AM	2	32	0	0	34	41	2	0	0	43	1	2	0	3	3	80
Total	7	123	0	0	130	151	7	0	0	158	9	13	0	5	22	310
Approach %	5.4	94.6	0.0	-	-	95.6	4.4	0.0	-	-	40.9	59.1	0.0	-	-	-
Total %	2.3	39.7	0.0	-	41.9	48.7	2.3	0.0	-	51.0	2.9	4.2	0.0	-	7.1	-
PHF	0.583	0.904	0.000	-	0.929	0.858	0.583	0.000	-	0.878	0.750	0.650	0.000	-	0.688	0.957
Lights	7	109	0	-	116	136	6	0	-	142	7	12	0	-	19	277
% Lights	100.0	88.6	-	-	89.2	90.1	85.7	-	-	89.9	77.8	92.3	-	-	86.4	89.4
Mediums	0	6	0	-	6	8	1	0	-	9	1	1	0	-	2	17
% Mediums	0.0	4.9	-	-	4.6	5.3	14.3	-	-	5.7	11.1	7.7	-	-	9.1	5.5
Articulated Trucks	0	8	0	-	8	7	0	0	-	7	1	0	0	-	1	16
% Articulated Trucks	0.0	6.5	-	-	6.2	4.6	0.0	-	-	4.4	11.1	0.0	-	-	4.5	5.2
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	5	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (8:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (11:30 AM)

Start Time	Talbot Street Eastbound					Talbot Street Westbound					Craddock Blvd Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
11:30 AM	3	29	0	0	32	38	1	0	0	39	4	6	0	0	10	81
11:45 AM	3	31	0	0	34	26	2	0	0	28	1	4	0	0	5	67
12:00 PM	6	30	0	0	36	36	1	0	0	37	0	3	0	0	3	76
12:15 PM	5	39	0	0	44	34	2	0	0	36	2	2	0	0	4	84
Total	17	129	0	0	146	134	6	0	0	140	7	15	0	0	22	308
Approach %	11.6	88.4	0.0	-	-	95.7	4.3	0.0	-	-	31.8	68.2	0.0	-	-	-
Total %	5.5	41.9	0.0	-	47.4	43.5	1.9	0.0	-	45.5	2.3	4.9	0.0	-	7.1	-
PHF	0.708	0.827	0.000	-	0.830	0.882	0.750	0.000	-	0.897	0.438	0.625	0.000	-	0.550	0.917
Lights	17	120	0	-	137	128	6	0	-	134	7	15	0	-	22	293
% Lights	100.0	93.0	-	-	93.8	95.5	100.0	-	-	95.7	100.0	100.0	-	-	100.0	95.1
Mediums	0	6	0	-	6	3	0	0	-	3	0	0	0	-	0	9
% Mediums	0.0	4.7	-	-	4.1	2.2	0.0	-	-	2.1	0.0	0.0	-	-	0.0	2.9
Articulated Trucks	0	3	0	-	3	3	0	0	-	3	0	0	0	-	0	6
% Articulated Trucks	0.0	2.3	-	-	2.1	2.2	0.0	-	-	2.1	0.0	0.0	-	-	0.0	1.9
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Waterloo, Ontario, Canada N2J 1N8
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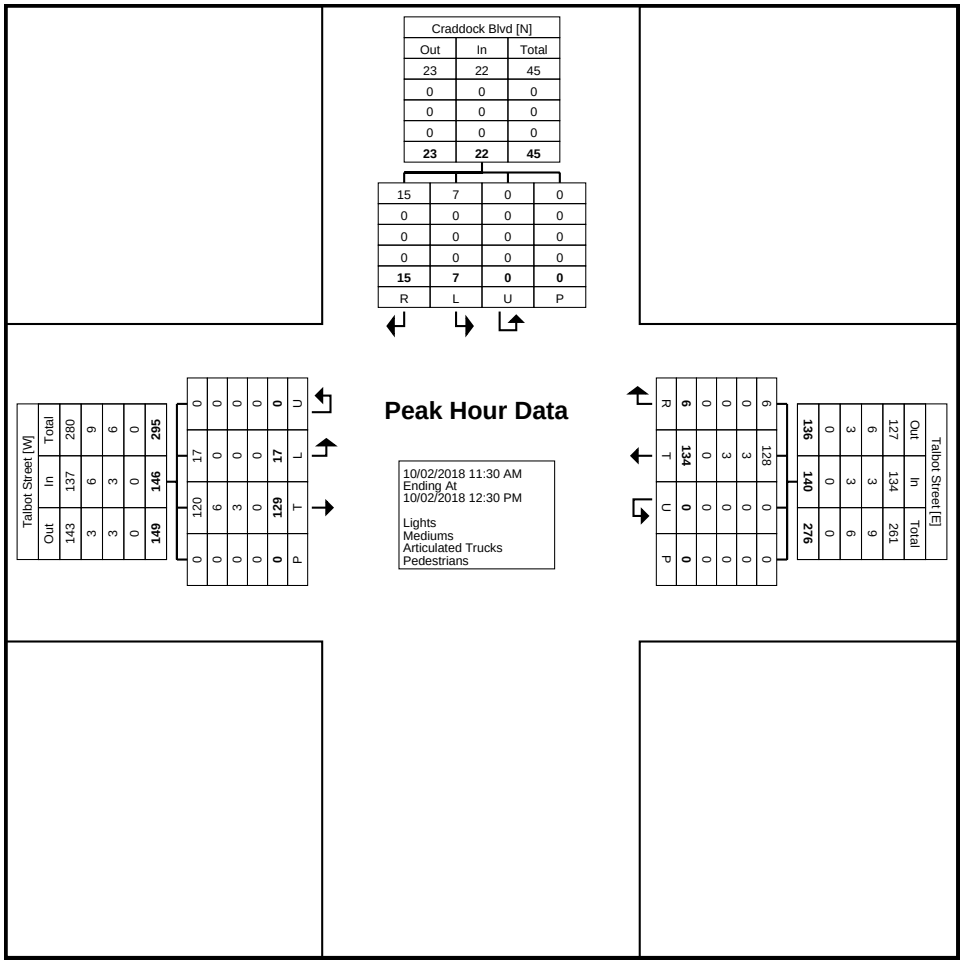
Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (11:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Talbot Street Eastbound					Talbot Street Westbound					Craddock Blvd Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
4:30 PM	6	44	0	0	50	34	2	0	0	36	0	1	0	0	1	87
4:45 PM	5	48	0	0	53	45	4	0	0	49	1	2	0	0	3	105
5:00 PM	6	37	0	0	43	33	2	0	0	35	1	2	0	0	3	81
5:15 PM	3	32	0	0	35	52	5	0	0	57	2	3	0	0	5	97
Total	20	161	0	0	181	164	13	0	0	177	4	8	0	0	12	370
Approach %	11.0	89.0	0.0	-	-	92.7	7.3	0.0	-	-	33.3	66.7	0.0	-	-	-
Total %	5.4	43.5	0.0	-	48.9	44.3	3.5	0.0	-	47.8	1.1	2.2	0.0	-	3.2	-
PHF	0.833	0.839	0.000	-	0.854	0.788	0.650	0.000	-	0.776	0.500	0.667	0.000	-	0.600	0.881
Lights	20	152	0	-	172	159	13	0	-	172	3	8	0	-	11	355
% Lights	100.0	94.4	-	-	95.0	97.0	100.0	-	-	97.2	75.0	100.0	-	-	91.7	95.9
Mediums	0	3	0	-	3	3	0	0	-	3	1	0	0	-	1	7
% Mediums	0.0	1.9	-	-	1.7	1.8	0.0	-	-	1.7	25.0	0.0	-	-	8.3	1.9
Articulated Trucks	0	6	0	-	6	2	0	0	-	2	0	0	0	-	0	8
% Articulated Trucks	0.0	3.7	-	-	3.3	1.2	0.0	-	-	1.1	0.0	0.0	-	-	0.0	2.2
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
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Waterloo, Ontario, Canada N2J 1N8
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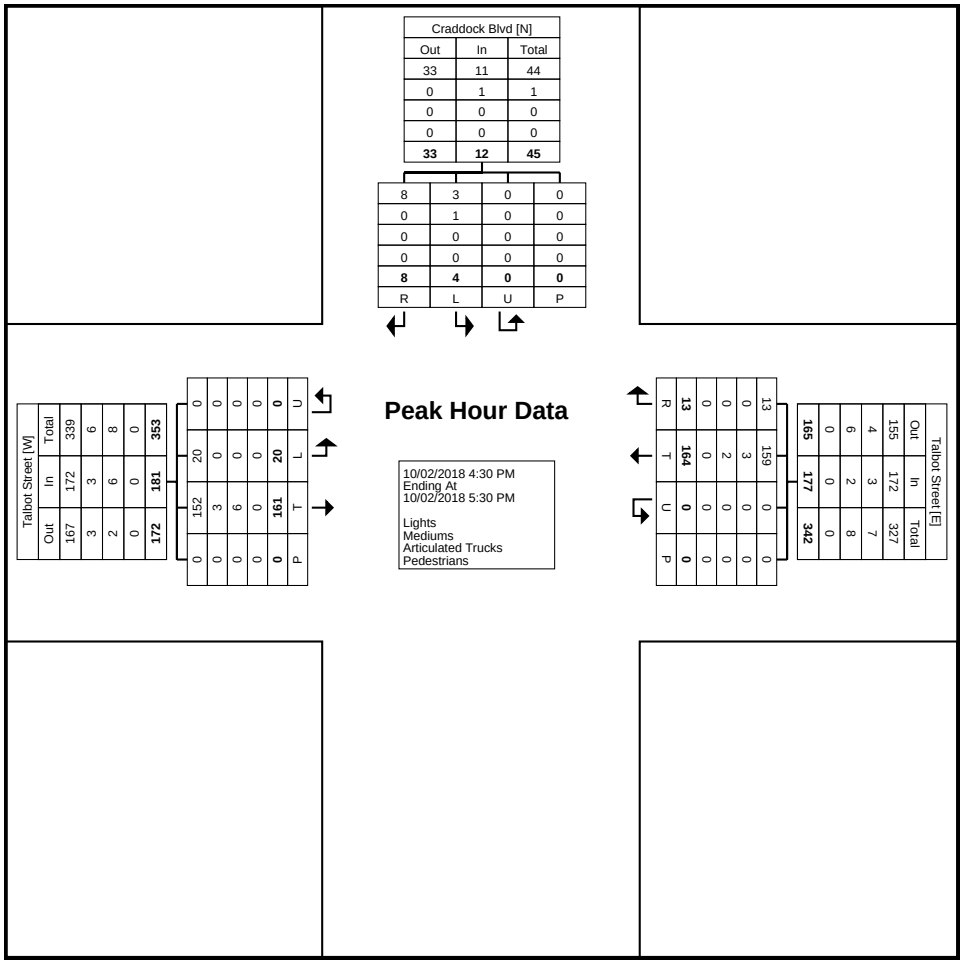
Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018
Page No: 9



Turning Movement Peak Hour Data Plot (4:30 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Carddock Blvd
Site Code:
Start Date: 10/02/2018

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018

Turning Movement Data

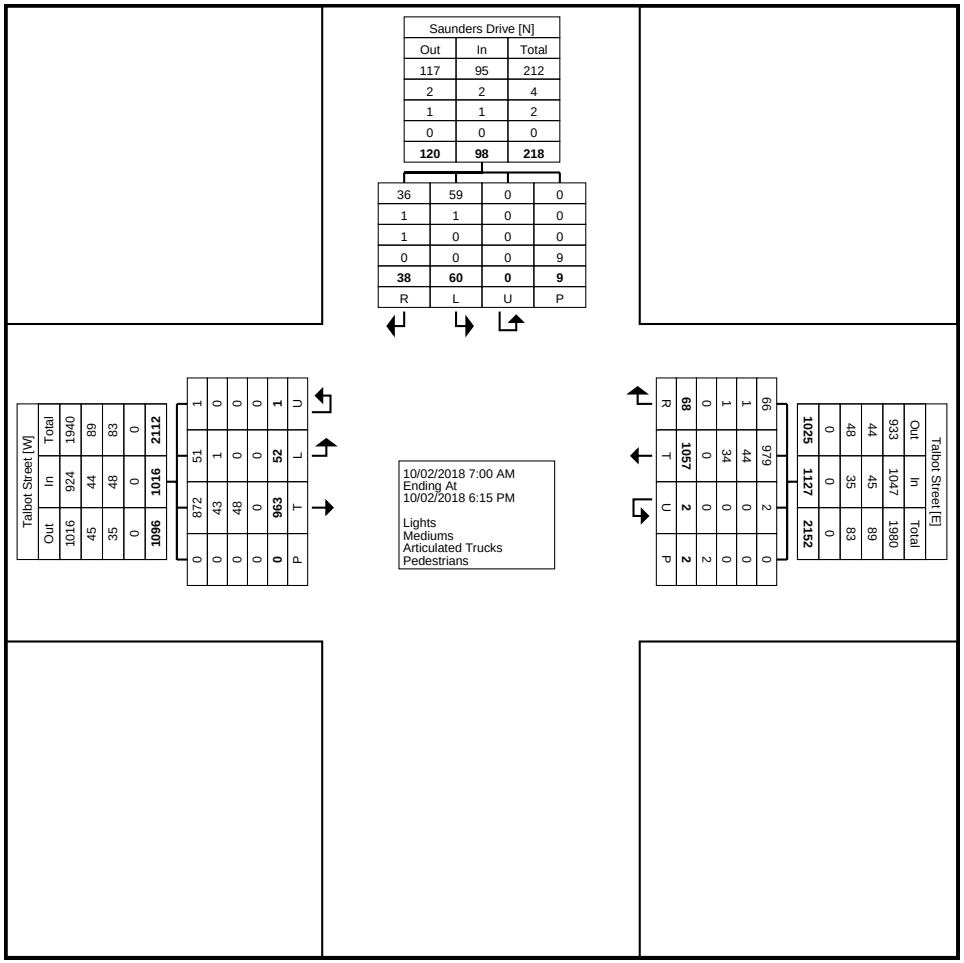
Start Time	Talbot Street Eastbound					Talbot Street Westbound					Saunders Drive Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
7:00 AM	0	21	0	0	21	22	0	0	0	22	4	0	0	0	4	47
7:15 AM	3	34	0	0	37	27	0	0	0	27	3	1	0	1	4	68
7:30 AM	1	27	0	0	28	31	3	0	0	34	2	2	0	0	4	66
7:45 AM	1	25	0	0	26	38	2	0	0	40	3	3	0	0	6	72
Hourly Total	5	107	0	0	112	118	5	0	0	123	12	6	0	1	18	253
8:00 AM	4	24	0	0	28	31	0	0	0	31	2	1	0	1	3	62
8:15 AM	0	32	0	0	32	30	2	0	0	32	1	1	0	0	2	66
8:30 AM	1	31	0	0	32	28	5	0	0	33	5	2	0	0	7	72
8:45 AM	1	28	0	0	29	30	3	0	0	33	2	2	0	0	4	66
Hourly Total	6	115	0	0	121	119	10	0	0	129	10	6	0	1	16	266
9:00 AM	0	30	0	0	30	39	2	0	0	41	1	3	0	1	4	75
9:15 AM	2	32	0	0	34	41	0	0	0	41	2	2	0	2	4	79
9:30 AM	2	28	0	0	30	29	1	0	0	30	1	1	0	0	2	62
9:45 AM	2	16	0	0	18	27	0	0	0	27	0	1	0	0	1	46
Hourly Total	6	106	0	0	112	136	3	0	0	139	4	7	0	3	11	262
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	1	35	0	0	36	35	2	0	0	37	2	0	0	0	2	75
11:45 AM	1	29	0	0	30	21	3	1	0	25	3	1	0	0	4	59
Hourly Total	2	64	0	0	66	56	5	1	0	62	5	1	0	0	6	134
12:00 PM	1	26	0	0	27	35	4	0	0	39	1	2	0	0	3	69
12:15 PM	1	36	0	0	37	35	0	0	0	35	0	1	0	1	1	73
12:30 PM	2	32	0	0	34	29	1	0	0	30	1	2	0	0	3	67
12:45 PM	1	20	0	0	21	29	2	0	0	31	2	0	0	0	2	54
Hourly Total	5	114	0	0	119	128	7	0	0	135	4	5	0	1	9	263
1:00 PM	1	29	0	0	30	35	3	0	0	38	2	1	0	0	3	71
1:15 PM	1	30	1	0	32	29	1	0	0	30	3	2	0	0	5	67
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	2	59	1	0	62	64	4	0	0	68	5	3	0	0	8	138
3:00 PM	2	42	0	0	44	40	0	1	1	41	2	0	0	0	2	87
3:15 PM	4	37	0	0	41	31	1	0	0	32	1	0	0	0	1	74
3:30 PM	0	22	0	0	22	35	3	0	0	38	0	0	0	0	0	60
3:45 PM	2	35	0	0	37	23	2	0	0	25	3	0	0	0	3	65
Hourly Total	8	136	0	0	144	129	6	1	1	136	6	0	0	0	6	286
4:00 PM	1	29	0	0	30	34	2	0	0	36	2	2	0	0	4	70
4:15 PM	2	33	0	0	35	35	5	0	0	40	1	2	0	0	3	78

4:30 PM	2	44	0	0	46	35	2	0	0	37	0	2	0	0	2	85
4:45 PM	4	43	0	0	47	38	4	0	0	42	3	1	0	0	4	93
Hourly Total	9	149	0	0	158	142	13	0	0	155	6	7	0	0	13	326
5:00 PM	4	33	0	0	37	39	3	0	1	42	1	1	0	0	2	81
5:15 PM	3	28	0	0	31	52	3	0	0	55	4	0	0	1	4	90
5:30 PM	1	32	0	0	33	39	7	0	0	46	2	1	0	0	3	82
5:45 PM	1	20	0	0	21	35	2	0	0	37	1	1	0	2	2	60
Hourly Total	9	113	0	0	122	165	15	0	1	180	8	3	0	3	11	313
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	52	963	1	0	1016	1057	68	2	2	1127	60	38	0	9	98	2241
Approach %	5.1	94.8	0.1	-	-	93.8	6.0	0.2	-	-	61.2	38.8	0.0	-	-	-
Total %	2.3	43.0	0.0	-	45.3	47.2	3.0	0.1	-	50.3	2.7	1.7	0.0	-	4.4	-
Lights	51	872	1	-	924	979	66	2	-	1047	59	36	0	-	95	2066
% Lights	98.1	90.6	100.0	-	90.9	92.6	97.1	100.0	-	92.9	98.3	94.7	-	-	96.9	92.2
Mediums	1	43	0	-	44	44	1	0	-	45	1	1	0	-	2	91
% Mediums	1.9	4.5	0.0	-	4.3	4.2	1.5	0.0	-	4.0	1.7	2.6	-	-	2.0	4.1
Articulated Trucks	0	48	0	-	48	34	1	0	-	35	0	1	0	-	1	84
% Articulated Trucks	0.0	5.0	0.0	-	4.7	3.2	1.5	0.0	-	3.1	0.0	2.6	-	-	1.0	3.7
Pedestrians	-	-	-	0	-	-	-	-	2	-	-	-	-	9	-	-
% Pedestrians	-	-	-	-	-	-	-	-	100.0	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (8:30 AM)

Start Time	Talbot Street Eastbound					Talbot Street Westbound					Saunders Drive Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
8:30 AM	1	31	0	0	32	28	5	0	0	33	5	2	0	0	7	72
8:45 AM	1	28	0	0	29	30	3	0	0	33	2	2	0	0	4	66
9:00 AM	0	30	0	0	30	39	2	0	0	41	1	3	0	1	4	75
9:15 AM	2	32	0	0	34	41	0	0	0	41	2	2	0	2	4	79
Total	4	121	0	0	125	138	10	0	0	148	10	9	0	3	19	292
Approach %	3.2	96.8	0.0	-	-	93.2	6.8	0.0	-	-	52.6	47.4	0.0	-	-	-
Total %	1.4	41.4	0.0	-	42.8	47.3	3.4	0.0	-	50.7	3.4	3.1	0.0	-	6.5	-
PHF	0.500	0.945	0.000	-	0.919	0.841	0.500	0.000	-	0.902	0.500	0.750	0.000	-	0.679	0.924
Lights	4	105	0	-	109	123	9	0	-	132	10	8	0	-	18	259
% Lights	100.0	86.8	-	-	87.2	89.1	90.0	-	-	89.2	100.0	88.9	-	-	94.7	88.7
Mediums	0	8	0	-	8	8	0	0	-	8	0	0	0	-	0	16
% Mediums	0.0	6.6	-	-	6.4	5.8	0.0	-	-	5.4	0.0	0.0	-	-	0.0	5.5
Articulated Trucks	0	8	0	-	8	7	1	0	-	8	0	1	0	-	1	17
% Articulated Trucks	0.0	6.6	-	-	6.4	5.1	10.0	-	-	5.4	0.0	11.1	-	-	5.3	5.8
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

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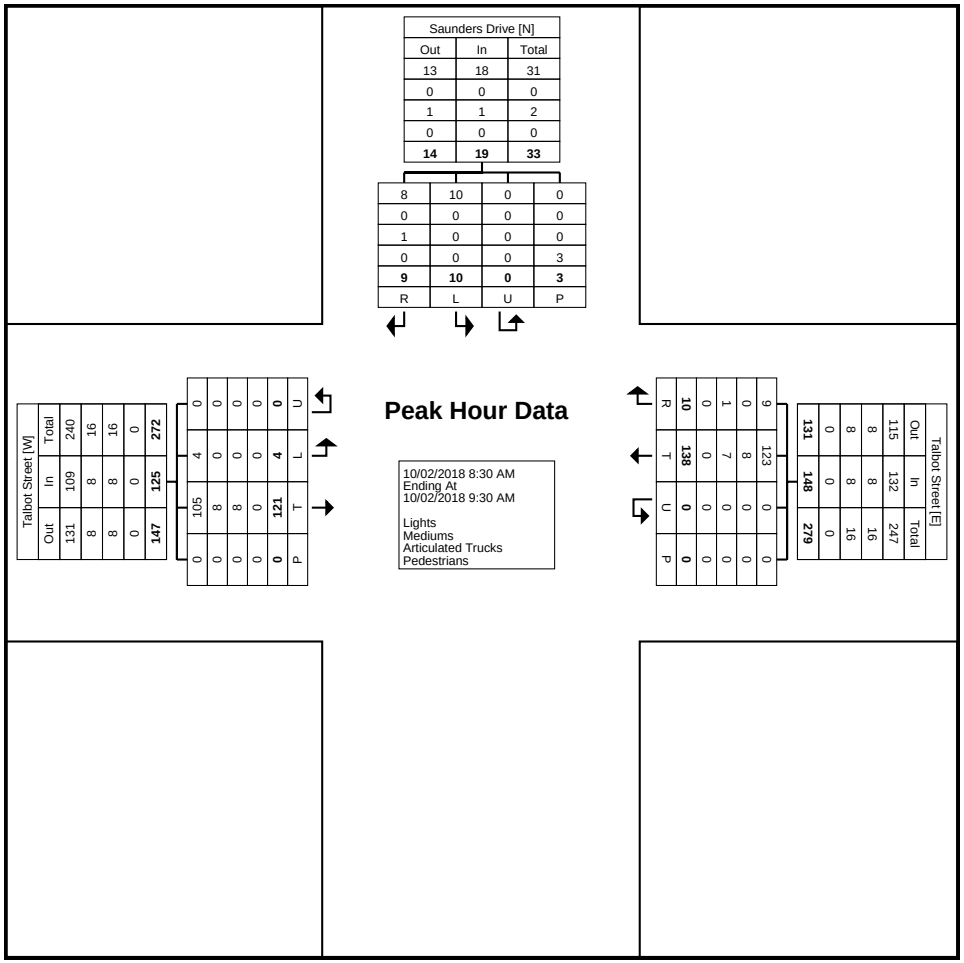
Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018
Page No: 5



Turning Movement Peak Hour Data Plot (8:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (11:30 AM)

Start Time	Talbot Street Eastbound					Talbot Street Westbound					Saunders Drive Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
11:30 AM	1	35	0	0	36	35	2	0	0	37	2	0	0	0	2	75
11:45 AM	1	29	0	0	30	21	3	1	0	25	3	1	0	0	4	59
12:00 PM	1	26	0	0	27	35	4	0	0	39	1	2	0	0	3	69
12:15 PM	1	36	0	0	37	35	0	0	0	35	0	1	0	1	1	73
Total	4	126	0	0	130	126	9	1	0	136	6	4	0	1	10	276
Approach %	3.1	96.9	0.0	-	-	92.6	6.6	0.7	-	-	60.0	40.0	0.0	-	-	-
Total %	1.4	45.7	0.0	-	47.1	45.7	3.3	0.4	-	49.3	2.2	1.4	0.0	-	3.6	-
PHF	1.000	0.875	0.000	-	0.878	0.900	0.563	0.250	-	0.872	0.500	0.500	0.000	-	0.625	0.920
Lights	4	111	0	-	115	119	9	1	-	129	6	4	0	-	10	254
% Lights	100.0	88.1	-	-	88.5	94.4	100.0	100.0	-	94.9	100.0	100.0	-	-	100.0	92.0
Mediums	0	6	0	-	6	5	0	0	-	5	0	0	0	-	0	11
% Mediums	0.0	4.8	-	-	4.6	4.0	0.0	0.0	-	3.7	0.0	0.0	-	-	0.0	4.0
Articulated Trucks	0	9	0	-	9	2	0	0	-	2	0	0	0	-	0	11
% Articulated Trucks	0.0	7.1	-	-	6.9	1.6	0.0	0.0	-	1.5	0.0	0.0	-	-	0.0	4.0
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

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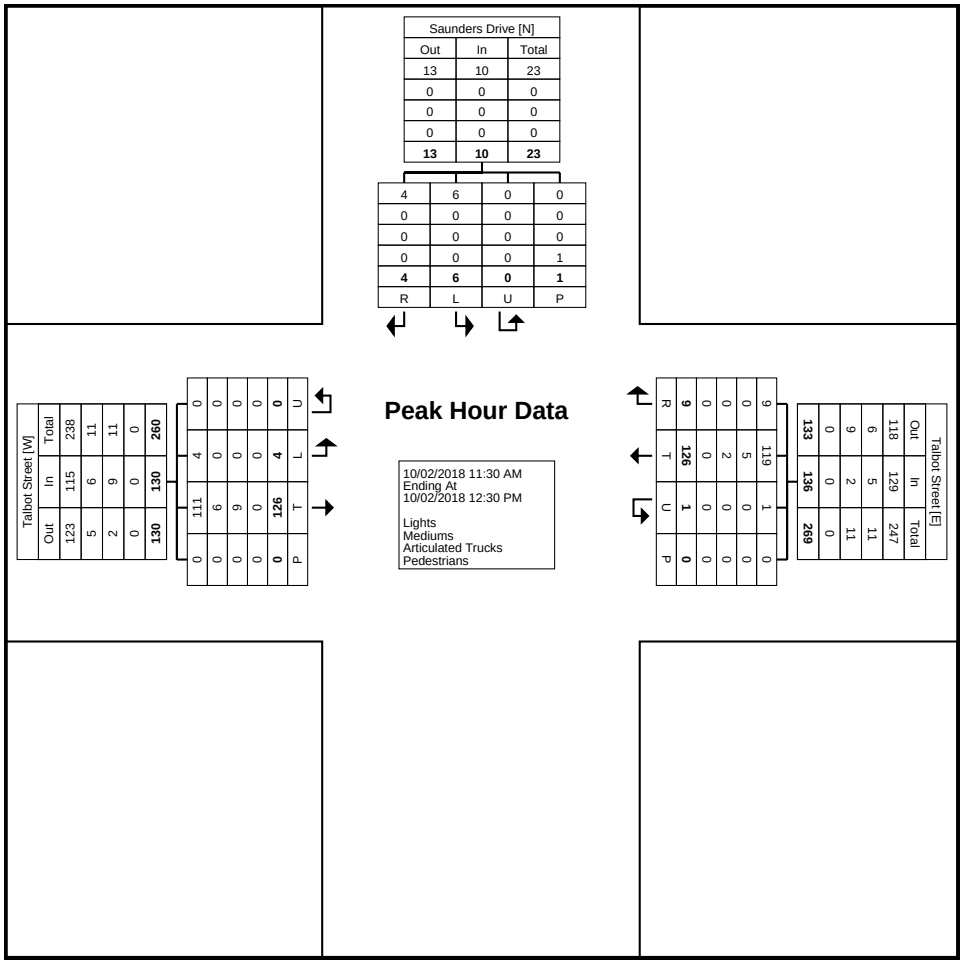
Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (11:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Talbot Street Eastbound					Talbot Street Westbound					Saunders Drive Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
4:30 PM	2	44	0	0	46	35	2	0	0	37	0	2	0	0	2	85
4:45 PM	4	43	0	0	47	38	4	0	0	42	3	1	0	0	4	93
5:00 PM	4	33	0	0	37	39	3	0	1	42	1	1	0	0	2	81
5:15 PM	3	28	0	0	31	52	3	0	0	55	4	0	0	1	4	90
Total	13	148	0	0	161	164	12	0	1	176	8	4	0	1	12	349
Approach %	8.1	91.9	0.0	-	-	93.2	6.8	0.0	-	-	66.7	33.3	0.0	-	-	-
Total %	3.7	42.4	0.0	-	46.1	47.0	3.4	0.0	-	50.4	2.3	1.1	0.0	-	3.4	-
PHF	0.813	0.841	0.000	-	0.856	0.788	0.750	0.000	-	0.800	0.500	0.500	0.000	-	0.750	0.938
Lights	13	139	0	-	152	159	12	0	-	171	8	4	0	-	12	335
% Lights	100.0	93.9	-	-	94.4	97.0	100.0	-	-	97.2	100.0	100.0	-	-	100.0	96.0
Mediums	0	3	0	-	3	3	0	0	-	3	0	0	0	-	0	6
% Mediums	0.0	2.0	-	-	1.9	1.8	0.0	-	-	1.7	0.0	0.0	-	-	0.0	1.7
Articulated Trucks	0	6	0	-	6	2	0	0	-	2	0	0	0	-	0	8
% Articulated Trucks	0.0	4.1	-	-	3.7	1.2	0.0	-	-	1.1	0.0	0.0	-	-	0.0	2.3
Pedestrians	-	-	-	0	-	-	-	-	1	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	-	-	-	-	100.0	-	-	-	-	100.0	-	-

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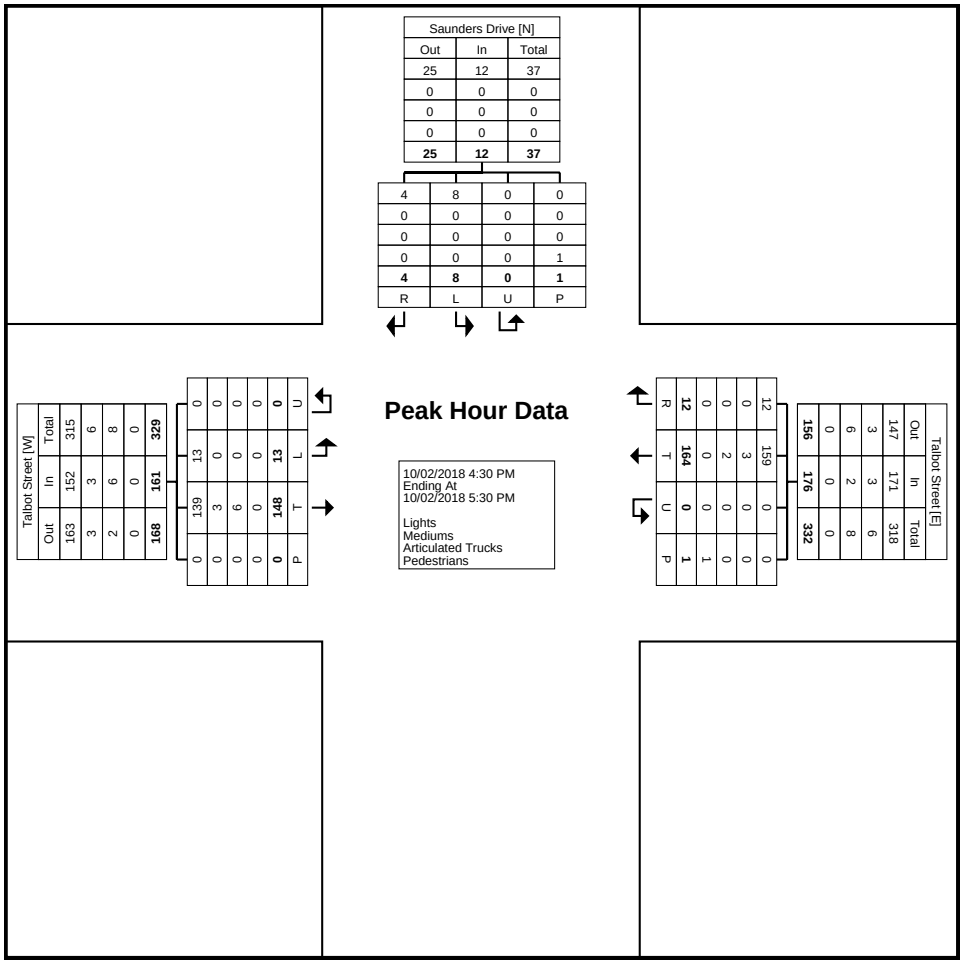
Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (4:30 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street & Saunders Drive
Site Code:
Start Date: 10/02/2018

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street (Hwy 3) & Hwy 55 (Nanticoke Road)
Site Code:
Start Date: 10/02/2018

Turning Movement Data

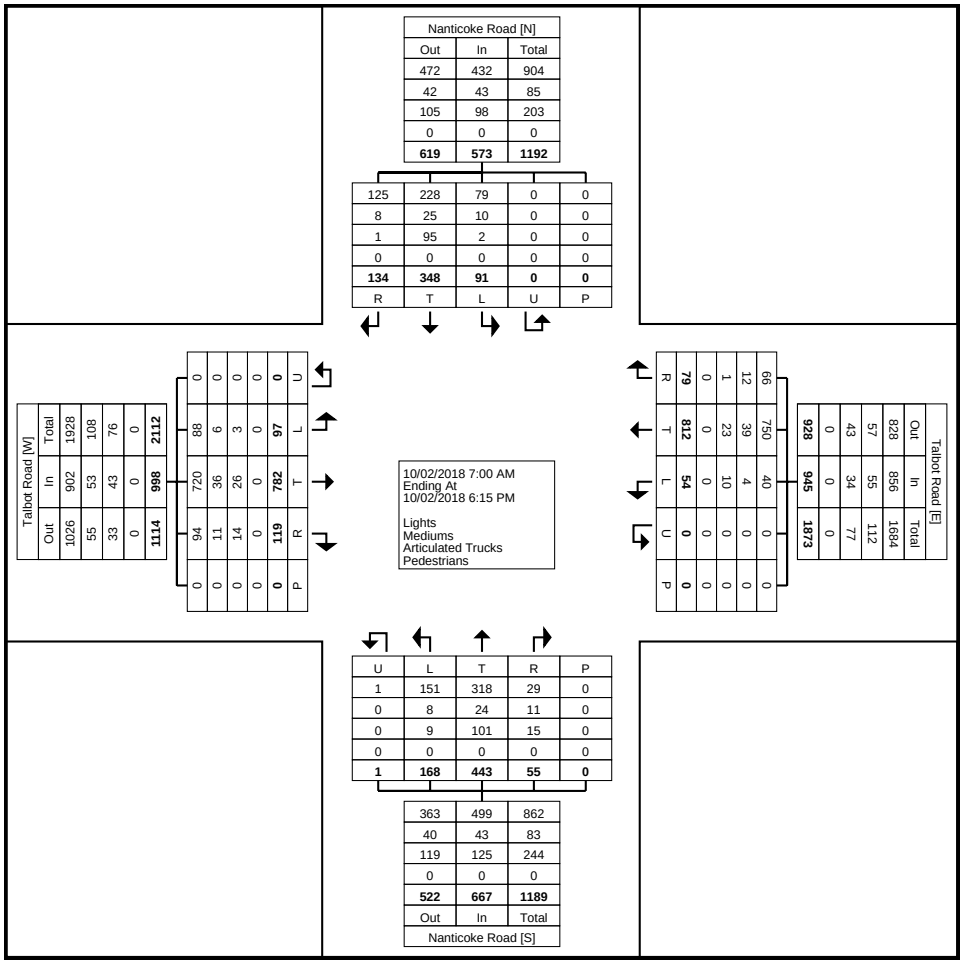
Start Time	Talbot Road Eastbound						Talbot Road Westbound						Nanticoke Road Northbound						Nanticoke Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	4	18	2	0	0	24	1	13	1	0	0	15	7	21	1	0	0	29	2	24	2	0	0	28	96
7:15 AM	3	21	8	0	0	32	8	19	3	0	0	30	6	17	1	0	0	24	0	35	5	0	0	40	126
7:30 AM	3	21	4	0	0	28	5	27	1	0	0	33	2	10	1	0	0	13	3	22	5	0	0	30	104
7:45 AM	3	22	2	0	0	27	1	36	5	0	0	42	6	12	1	0	0	19	0	21	4	0	0	25	113
Hourly Total	13	82	16	0	0	111	15	95	10	0	0	120	21	60	4	0	0	85	5	102	16	0	0	123	439
8:00 AM	1	14	3	0	0	18	4	23	3	0	0	30	5	10	3	0	0	18	3	10	5	0	0	18	84
8:15 AM	1	24	3	0	0	28	1	26	3	0	0	30	2	3	3	0	0	8	3	12	5	0	0	20	86
8:30 AM	5	20	6	0	0	31	0	18	6	0	0	24	6	8	1	0	0	15	2	9	5	0	0	16	86
8:45 AM	3	22	6	0	0	31	2	24	9	0	0	35	2	4	1	0	0	7	2	18	4	0	0	24	97
Hourly Total	10	80	18	0	0	108	7	91	21	0	0	119	15	25	8	0	0	48	10	49	19	0	0	78	353
9:00 AM	4	24	2	0	0	30	2	32	2	0	0	36	12	6	0	0	0	18	6	5	6	0	0	17	101
9:15 AM	3	17	3	0	0	23	2	32	4	0	0	38	6	12	2	0	0	20	3	7	2	0	0	12	93
9:30 AM	4	17	4	0	0	25	0	26	2	0	0	28	3	3	1	0	0	7	1	11	6	0	0	18	78
9:45 AM	2	13	5	0	0	20	0	24	1	0	0	25	1	8	0	0	0	9	2	9	3	0	0	14	68
Hourly Total	13	71	14	0	0	98	4	114	9	0	0	127	22	29	3	0	0	54	12	32	17	0	0	61	340
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	6	24	4	0	0	34	3	23	2	0	0	28	5	9	2	1	0	17	2	9	5	0	0	16	95
11:45 AM	3	26	8	0	0	37	2	16	0	0	0	18	4	11	3	0	0	18	1	8	5	0	0	14	87
Hourly Total	9	50	12	0	0	71	5	39	2	0	0	46	9	20	5	1	0	35	3	17	10	0	0	30	182
12:00 PM	4	23	1	0	0	28	2	26	1	0	0	29	8	8	2	0	0	18	1	10	2	0	0	13	88
12:15 PM	2	30	2	0	0	34	3	24	5	0	0	32	6	14	1	0	0	21	2	16	1	0	0	19	106
12:30 PM	3	24	5	0	0	32	0	24	3	0	0	27	5	7	0	0	0	12	2	6	1	0	0	9	80
12:45 PM	2	16	3	0	0	21	0	18	0	0	0	18	6	15	0	0	0	21	3	6	8	0	0	17	77
Hourly Total	11	93	11	0	0	115	5	92	9	0	0	106	25	44	3	0	0	72	8	38	12	0	0	58	351
1:00 PM	1	25	5	0	0	31	2	30	3	0	0	35	2	7	1	0	0	10	1	7	6	0	0	14	90
1:15 PM	4	28	3	0	0	35	1	19	2	0	0	22	6	17	2	0	0	25	1	7	4	0	0	12	94
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	5	53	8	0	0	66	3	49	5	0	0	57	8	24	3	0	0	35	2	15	10	0	0	27	185
3:00 PM	4	34	3	0	0	41	2	33	1	0	0	36	6	14	1	0	0	21	6	9	3	0	0	18	116
3:15 PM	6	33	1	0	0	40	0	21	3	0	0	24	3	21	3	0	0	27	2	7	0	0	0	9	100
3:30 PM	3	16	4	0	0	23	2	26	1	0	0	29	7	13	4	0	0	24	5	9	3	0	0	17	93
3:45 PM	1	36	3	0	0	40	2	20	4	0	0	26	2	20	1	0	0	23	2	7	4	0	0	13	102
Hourly Total	14	119	11	0	0	144	6	100	9	0	0	115	18	68	9	0	0	95	15	32	10	0	0	57	411
4:00 PM	5	23	5	0	0	33	0	20	2	0	0	22	9	39	5	0	0	53	5	7	8	0	0	20	128

4:15 PM	4	26	3	0	0	33	3	35	0	0	0	38	4	19	4	0	0	27	7	4	4	0	0	15	113
4:30 PM	0	38	6	0	0	44	1	28	1	0	0	30	3	23	4	0	0	30	7	9	3	0	0	19	123
4:45 PM	2	42	2	0	0	46	1	29	2	0	0	32	6	7	1	0	0	14	4	5	5	0	0	14	106
Hourly Total	11	129	16	0	0	156	5	112	5	0	0	122	22	88	14	0	0	124	23	25	20	0	0	68	470
5:00 PM	5	33	2	0	0	40	0	21	2	0	0	23	12	37	4	0	0	53	8	11	4	0	0	23	139
5:15 PM	2	24	4	0	0	30	0	35	5	0	0	40	10	25	2	0	0	37	0	8	4	0	0	12	119
5:30 PM	1	32	2	0	0	35	2	34	1	0	0	37	4	15	0	0	0	19	5	7	7	0	0	19	110
5:45 PM	3	16	5	0	0	24	2	30	1	0	0	33	2	8	0	0	0	10	0	12	5	0	0	17	84
Hourly Total	11	105	13	0	0	129	4	120	9	0	0	133	28	85	6	0	0	119	13	38	20	0	0	71	452
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	97	782	119	0	0	998	54	812	79	0	0	945	168	443	55	1	0	667	91	348	134	0	0	573	3183
Approach %	9.7	78.4	11.9	0.0	-	-	5.7	85.9	8.4	0.0	-	-	25.2	66.4	8.2	0.1	-	-	15.9	60.7	23.4	0.0	-	-	-
Total %	3.0	24.6	3.7	0.0	-	31.4	1.7	25.5	2.5	0.0	-	29.7	5.3	13.9	1.7	0.0	-	21.0	2.9	10.9	4.2	0.0	-	18.0	-
Lights	88	720	94	0	-	902	40	750	66	0	-	856	151	318	29	1	-	499	79	228	125	0	-	432	2689
% Lights	90.7	92.1	79.0	-	-	90.4	74.1	92.4	83.5	-	-	90.6	89.9	71.8	52.7	100.0	-	74.8	86.8	65.5	93.3	-	-	75.4	84.5
Mediums	6	36	11	0	-	53	4	39	12	0	-	55	8	24	11	0	-	43	10	25	8	0	-	43	194
% Mediums	6.2	4.6	9.2	-	-	5.3	7.4	4.8	15.2	-	-	5.8	4.8	5.4	20.0	0.0	-	6.4	11.0	7.2	6.0	-	-	7.5	6.1
Articulated Trucks	3	26	14	0	-	43	10	23	1	0	-	34	9	101	15	0	-	125	2	95	1	0	-	98	300
% Articulated Trucks	3.1	3.3	11.8	-	-	4.3	18.5	2.8	1.3	-	-	3.6	5.4	22.8	27.3	0.0	-	18.7	2.2	27.3	0.7	-	-	17.1	9.4
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street (Hwy 3) & Hwy 55 (Nanticoke Road)
Site Code:
Start Date: 10/02/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street (Hwy 3) & Hwy 55 (Nanticoke Road)
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Talbot Road Eastbound						Talbot Road Westbound						Nanticoke Road Northbound						Nanticoke Road Southbound						
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Int. Total
7:00 AM	4	18	2	0	0	24	1	13	1	0	0	15	7	21	1	0	0	29	2	24	2	0	0	28	96
7:15 AM	3	21	8	0	0	32	8	19	3	0	0	30	6	17	1	0	0	24	0	35	5	0	0	40	126
7:30 AM	3	21	4	0	0	28	5	27	1	0	0	33	2	10	1	0	0	13	3	22	5	0	0	30	104
7:45 AM	3	22	2	0	0	27	1	36	5	0	0	42	6	12	1	0	0	19	0	21	4	0	0	25	113
Total	13	82	16	0	0	111	15	95	10	0	0	120	21	60	4	0	0	85	5	102	16	0	0	123	439
Approach %	11.7	73.9	14.4	0.0	-	-	12.5	79.2	8.3	0.0	-	-	24.7	70.6	4.7	0.0	-	-	4.1	82.9	13.0	0.0	-	-	-
Total %	3.0	18.7	3.6	0.0	-	25.3	3.4	21.6	2.3	0.0	-	27.3	4.8	13.7	0.9	0.0	-	19.4	1.1	23.2	3.6	0.0	-	28.0	-
PHF	0.813	0.932	0.500	0.000	-	0.867	0.469	0.660	0.500	0.000	-	0.714	0.750	0.714	1.000	0.000	-	0.733	0.417	0.729	0.800	0.000	-	0.769	0.871
Lights	13	74	11	0	-	98	12	89	10	0	-	111	19	46	4	0	-	69	5	88	16	0	-	109	387
% Lights	100.0	90.2	68.8	-	-	88.3	80.0	93.7	100.0	-	-	92.5	90.5	76.7	100.0	-	-	81.2	100.0	86.3	100.0	-	-	88.6	88.2
Mediums	0	5	2	0	-	7	1	5	0	0	-	6	1	1	0	0	-	2	0	2	0	0	-	2	17
% Mediums	0.0	6.1	12.5	-	-	6.3	6.7	5.3	0.0	-	-	5.0	4.8	1.7	0.0	-	-	2.4	0.0	2.0	0.0	-	-	1.6	3.9
Articulated Trucks	0	3	3	0	-	6	2	1	0	0	-	3	1	13	0	0	-	14	0	12	0	0	-	12	35
% Articulated Trucks	0.0	3.7	18.8	-	-	5.4	13.3	1.1	0.0	-	-	2.5	4.8	21.7	0.0	-	-	16.5	0.0	11.8	0.0	-	-	9.8	8.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

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519-896-3163 cbowness@ptsl.com

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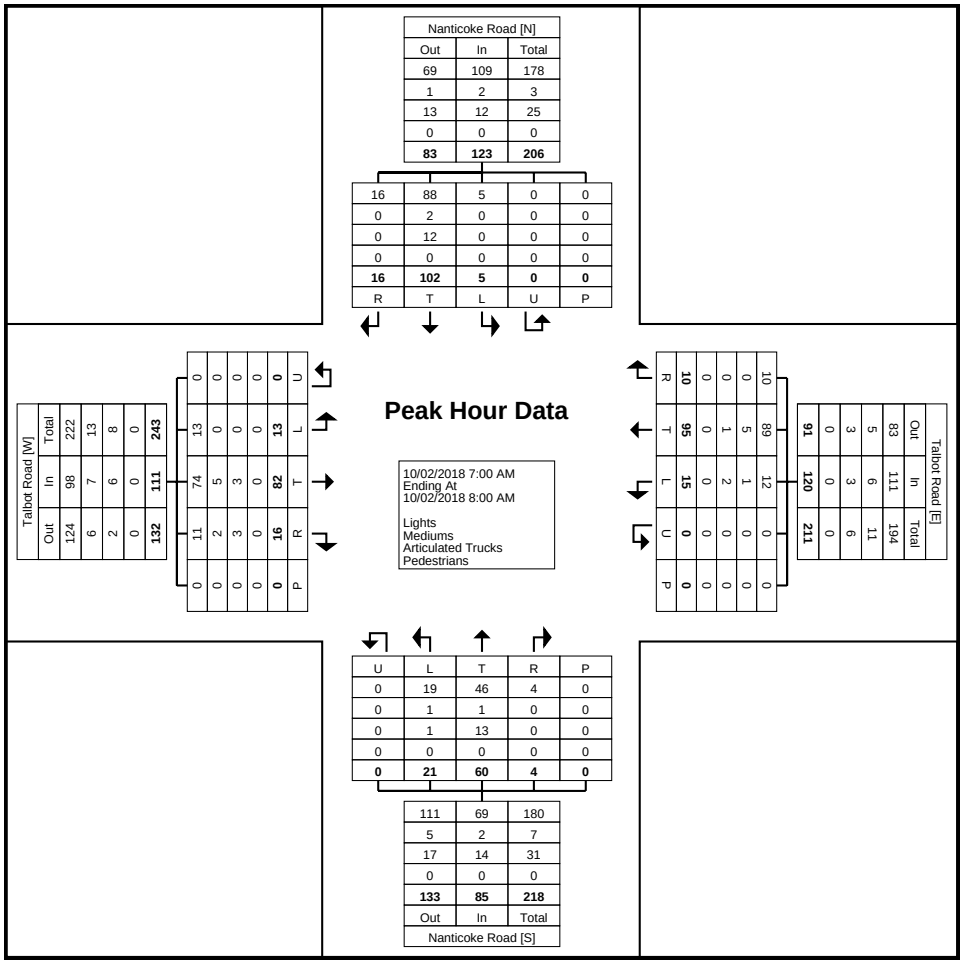
Site Code:
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (7:00 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street (Hwy 3) & Hwy 55 (Nanticoke Road)
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (11:30 AM)

Start Time	Talbot Road Eastbound						Talbot Road Westbound						Nanticoke Road Northbound						Nanticoke Road Southbound						
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Int. Total
11:30 AM	6	24	4	0	0	34	3	23	2	0	0	28	5	9	2	1	0	17	2	9	5	0	0	16	95
11:45 AM	3	26	8	0	0	37	2	16	0	0	0	18	4	11	3	0	0	18	1	8	5	0	0	14	87
12:00 PM	4	23	1	0	0	28	2	26	1	0	0	29	8	8	2	0	0	18	1	10	2	0	0	13	88
12:15 PM	2	30	2	0	0	34	3	24	5	0	0	32	6	14	1	0	0	21	2	16	1	0	0	19	106
Total	15	103	15	0	0	133	10	89	8	0	0	107	23	42	8	1	0	74	6	43	13	0	0	62	376
Approach %	11.3	77.4	11.3	0.0	-	-	9.3	83.2	7.5	0.0	-	-	31.1	56.8	10.8	1.4	-	-	9.7	69.4	21.0	0.0	-	-	-
Total %	4.0	27.4	4.0	0.0	-	35.4	2.7	23.7	2.1	0.0	-	28.5	6.1	11.2	2.1	0.3	-	19.7	1.6	11.4	3.5	0.0	-	16.5	-
PHF	0.625	0.858	0.469	0.000	-	0.899	0.833	0.856	0.400	0.000	-	0.836	0.719	0.750	0.667	0.250	-	0.881	0.750	0.672	0.650	0.000	-	0.816	0.887
Lights	12	95	13	0	-	120	7	85	5	0	-	97	21	19	4	1	-	45	4	17	12	0	-	33	295
% Lights	80.0	92.2	86.7	-	-	90.2	70.0	95.5	62.5	-	-	90.7	91.3	45.2	50.0	100.0	-	60.8	66.7	39.5	92.3	-	-	53.2	78.5
Mediums	0	4	1	0	-	5	0	3	2	0	-	5	1	4	1	0	-	6	2	3	1	0	-	6	22
% Mediums	0.0	3.9	6.7	-	-	3.8	0.0	3.4	25.0	-	-	4.7	4.3	9.5	12.5	0.0	-	8.1	33.3	7.0	7.7	-	-	9.7	5.9
Articulated Trucks	3	4	1	0	-	8	3	1	1	0	-	5	1	19	3	0	-	23	0	23	0	0	-	23	59
% Articulated Trucks	20.0	3.9	6.7	-	-	6.0	30.0	1.1	12.5	-	-	4.7	4.3	45.2	37.5	0.0	-	31.1	0.0	53.5	0.0	-	-	37.1	15.7
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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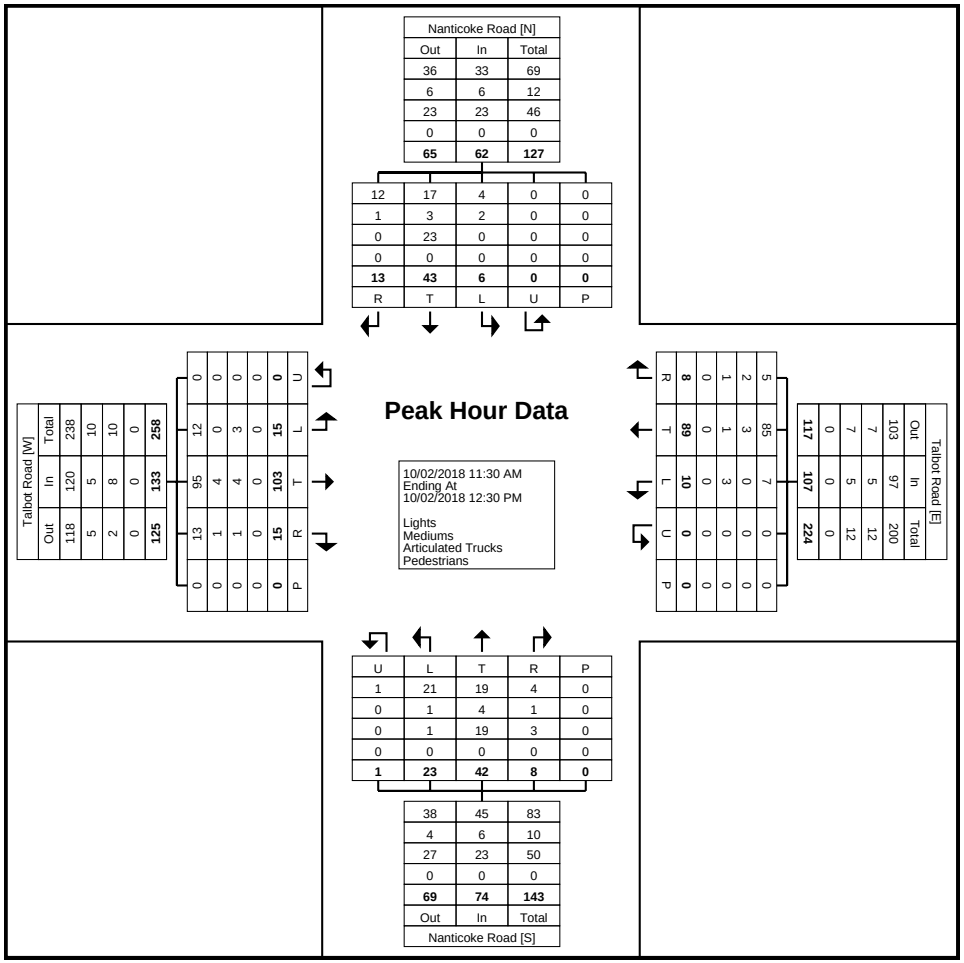
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (11:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street (Hwy 3) & Hwy 55 (Nanticoke Road)
Site Code:
Start Date: 10/02/2018

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Talbot Road Eastbound						Talbot Road Westbound						Nanticoke Road Northbound						Nanticoke Road Southbound						
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Int. Total
4:30 PM	0	38	6	0	0	44	1	28	1	0	0	30	3	23	4	0	0	30	7	9	3	0	0	19	123
4:45 PM	2	42	2	0	0	46	1	29	2	0	0	32	6	7	1	0	0	14	4	5	5	0	0	14	106
5:00 PM	5	33	2	0	0	40	0	21	2	0	0	23	12	37	4	0	0	53	8	11	4	0	0	23	139
5:15 PM	2	24	4	0	0	30	0	35	5	0	0	40	10	25	2	0	0	37	0	8	4	0	0	12	119
Total	9	137	14	0	0	160	2	113	10	0	0	125	31	92	11	0	0	134	19	33	16	0	0	68	487
Approach %	5.6	85.6	8.8	0.0	-	-	1.6	90.4	8.0	0.0	-	-	23.1	68.7	8.2	0.0	-	-	27.9	48.5	23.5	0.0	-	-	-
Total %	1.8	28.1	2.9	0.0	-	32.9	0.4	23.2	2.1	0.0	-	25.7	6.4	18.9	2.3	0.0	-	27.5	3.9	6.8	3.3	0.0	-	14.0	-
PHF	0.450	0.815	0.583	0.000	-	0.870	0.500	0.807	0.500	0.000	-	0.781	0.646	0.622	0.688	0.000	-	0.632	0.594	0.750	0.800	0.000	-	0.739	0.876
Lights	9	129	13	0	-	151	2	110	8	0	-	120	30	86	5	0	-	121	17	23	15	0	-	55	447
% Lights	100.0	94.2	92.9	-	-	94.4	100.0	97.3	80.0	-	-	96.0	96.8	93.5	45.5	-	-	90.3	89.5	69.7	93.8	-	-	80.9	91.8
Mediums	0	3	0	0	-	3	0	3	2	0	-	5	0	0	1	0	-	1	1	1	1	0	-	3	12
% Mediums	0.0	2.2	0.0	-	-	1.9	0.0	2.7	20.0	-	-	4.0	0.0	0.0	9.1	-	-	0.7	5.3	3.0	6.3	-	-	4.4	2.5
Articulated Trucks	0	5	1	0	-	6	0	0	0	0	-	0	1	6	5	0	-	12	1	9	0	0	-	10	28
% Articulated Trucks	0.0	3.6	7.1	-	-	3.8	0.0	0.0	0.0	-	-	0.0	3.2	6.5	45.5	-	-	9.0	5.3	27.3	0.0	-	-	14.7	5.7
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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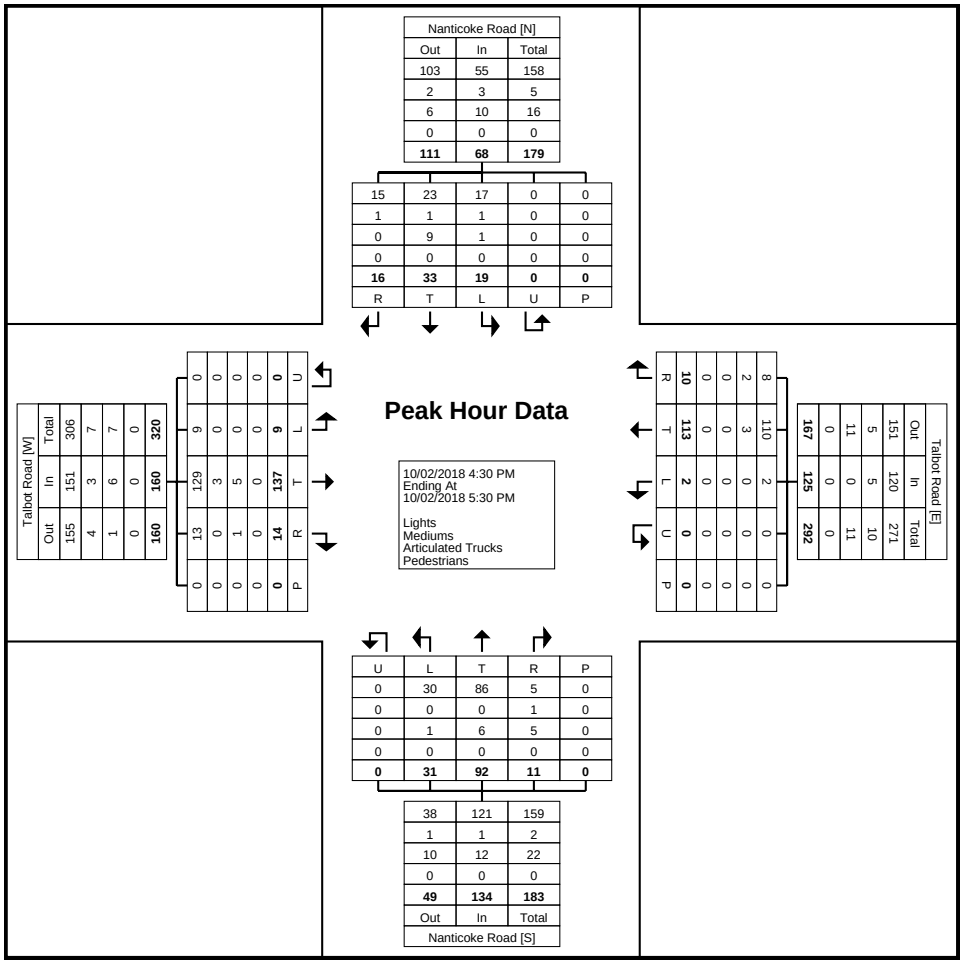
Start Date: 10/02/2018



Turning Movement Peak Hour Data Plot (4:30 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Talbot Street (Hwy 3) & Hwy 55 (Nanticoke Road)
Site Code:
Start Date: 10/02/2018

Cover Sheet

Location: Hwy 3 @ Haldiman-Norfolk 55 (Nanticoke)

Area/District:

Timing Based On T.M. Dated:

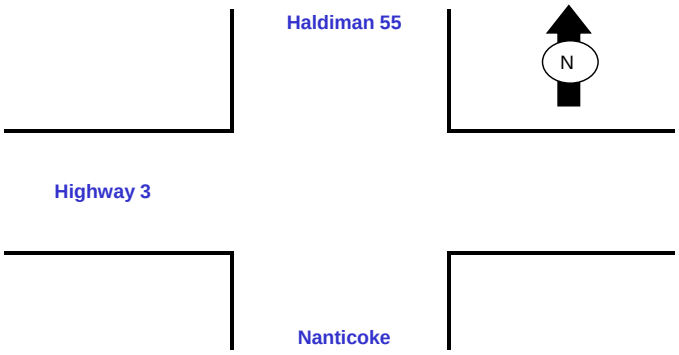
Traffic Signal : 60

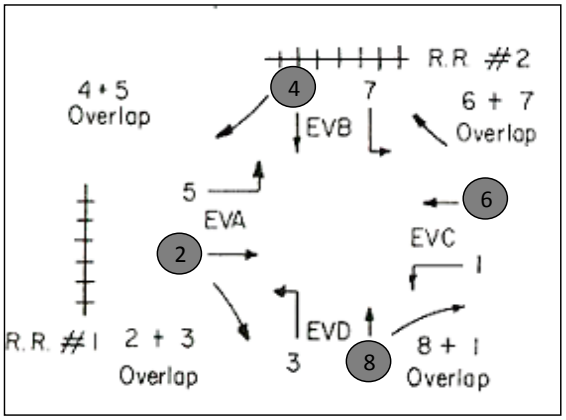
Timing Developed By: H Nichols

Approved By: K Plut

Installed By:

Installation Date: 25-Jan-17





Circle Movements and Operations

COMMUNICATIONS ADDRESSING

COMM ADDRESS
(C/0 + 0 + 0) = **1**

ZONE ADDRESS
(C/0 + 0 + 1) = **1**

AREA NUMBER
(C/0 + 0 + 2) = **1**

AREA ADDRESS **60**
(C/0 + 0 + 3) =

CELL # :

UDP PORT:

IP ADDRESS:

AMPIFIER:

PROGRAM: 233ON1.C

DISABLE ALARM REPORTING

Column F

		1	2	3	4	5	6	7	8
0	OMIT ALARMS					X			

< C + 0 + C = 5 >

1 = STOP TIME
2 = FLASH SENSE
3 = KEYBOARD ENTRY
4 = MANUAL PLAN SELECT
5 = ENABLE POLICE CNTRL (Not Used)
6 = EXTERNAL ALARM (Door Alarm)
7 = DETECTOR FAILURE

ACTUATED INTERVAL TIMING AND FAZE FUNCTIONS

		PHASE 1	2	3	4	5	6	7	8
0	WALK	-		-		-		-	
1	DON'T WALK	-		-		-		-	
2	MIN INITIAL		20		10		20		10
3	TYPE 3 LIMIT	-		-		-		-	
4	ADD PER VEH	-	1.9	-	1.9	-	1.9	-	1.9
5	VEH EXT		4.0		1.5		4.0		1.5
6	MAX GAP		4.0		1.5		4.0		1.5
7	MIN GAP		4.0		1.5		4.0		1.5
8	MAX LIMIT		50		40		50		40
9	MAXIMUM 2	-		-		-		-	
A	ADV /DLY WALK	-		-		-		-	
B	SEQUENCE TO	-		-		-		-	
C	COND SRV MIN	-		-		-		-	
D	REDUCE EVERY	-		-		-		-	
E	YELLOW		5.9		5.9		5.9		5.9
F	RED CLEAR		1.4		1.3		1.4		1.3

PHASE BANK # 1 < C + O + F = 1 >

		9	A	B	C	D		E
0							RR1 DLY	
1	PHASE 1	-					RR1 CLR	
2	PHASE 2	35					EVA DLY	
3	PHASE 3	-					EVA CLR	
4	PHASE 4	35					EVB DLY	
5	PHASE 5	-					EVB CLR	
6	PHASE 6	35					EVC DLY	
7	PHASE 7	-					EVC CLR	
8	PHASE 8	35					EVD DLY	
							EVD CLR	
		MAX INT	ALT WALK	ALT FLH D/W	ALT INT	ALT EXT	RR2 DLY	
							RR2 CLR	
							EV CLR	
							EV DLY	
							RR CLR	
							RR DLY	

ALL RED START
(F/1 + C +O) = **5.0**
RED REVERT
(F/1 + O + F) = **5.0**

		COLUMN F PHASES 1	2	3	4	5	6	7	8
0	PERMIT		X		X		X		X
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL		X				X		
4	PED RECALL								
5	PEDESTRIANS			View Only					
6	YIELD AT FLSH D/W								
7	RED REST								
8	DOUBLE ENTRY		X		X		X		X
9	VEH MAX CALL								
A	SOFT RECALL								
B	MAXIMUM 2								
C	COND SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES				X				X

< C + O + F = 1 >

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
*Traffic Signal Program **233** Ontario*
Timing Sheet #2

Date: 25-Jan-17

LOCATION
Hwy: Hwy 3
At: Haldiman 55

		A	B	C
PREEMPT MINIMUMS		RR1-2 SPEV1	SP EV2	EMER VEH
A	WLK (DFLT)	4	4	4
B	FD WALK			
C	INITAL			

< C + O + F = 1 >

Column E Phases / Bits

		1	2	3	4	5	6	7	8
0	EXCLUSIVE								
1	RR1 CLEAR								
2	RR2 CLEAR								
3	RR2 LTD SRV								
4	PROT/PERM								
5	FLH TO PREMT								
6	FLASH ENTRY								
7	DISABL MIN YEL								
8	DISABL OVP YEL								
9	OVP FLH YEL								
A	EM VEH A								
B	EM VEH B								
C	EM VEH C								
D	EM VEH D								
E	EXTRA 1	X		X		X			
F	IC SELECT		X						

Column F Phases / Bits

		1	2	3	4	5	6	7	8
0									
1	EXT PERMIT 1								
2	EXT PERMIT 2								
3	EXCLU PED								
4									
5	PED 2P OUT								
6	PED 6P OUT								
7	PED 4P OUT								
8	PED 8P OUT								
9	FLH YELLOW								
A									
B									
C									
D									
E	RESTRICTED								
F	EXTRA 2								

< C + O + E = 125 >

Column F Phases / Bits

		1	2	3	4	5	6	7	8
0	ADV GRN FLH								
1	PHASE FLASH								
2	FLASH WALK								
3	GUAR PASS								
4	SIMUL GAP		X		X		X		X
5	SEQ TIMING								
6	ADV WALK								
7	DELAY WALK								
8	EXT RECALL								
9									
A	MAX EXTEN								
B	INH PED RSRV								
C	SEMI ACTUATED								
D									
E	STRT VEH CALL		X		X		X		X
F	STRT PED CALL								

SPECIALS < C + O + F = 2 >

MANUAL PLAN	0
< C/0 + A + 1 >	
MANUAL OFFSET	0
< C/0 + B + 1 >	

MANUAL SELECTION

MANUAL PLAN
0 = Automatic (Master)
9 = Control Plan 1 - 9
14 (E) = Free (Isolated)
15 (F) = Software Flash

MANUAL OFFSET
0 = Automatic (Master)
1 = Offset A
2 = Offset B
3 = Offset C

FLASH TO PREEMPT
1 = EVA
2 = EVB
3 = EVC
4 = EVD
5 = RR1
6 = RR2
7 = SE1
8 = SE2

EXTRA 1
1 = TBC TYPE 1
2 = NEMA EXT. COORD.
3 = DAYLIGHT SAVINGS
4 =
5 = EXPANDED STATUS REPORTING
6 = INTERNATIONAL PED
7 = CLEAR OUTPUTS DURING FLASH
8 = SPLIT RING

EXTRA 2
1 = AWR ON DURING PHASE INITAL
2 = LMU INSTALLED

IC SELECT
2 = 2 WAY MODEM
3 = 7 WIRE SLAVE
4 = FLASH / FREE
5 = SIMPLEX MASTER
7 = 7 WIRE MASTER
8 = OFFSET INTURP

Pretimed

PHASE

	1	2	3	4	5	6	7	8
WALK	-		-		-		-	
DON'T WALK	-		-		-		-	
MIN INTIAL		20		10		20		10
TYPE 3 LIMIT	-		-		-		-	
ADD PER VEH	-	1.9	-	1.9	-	1.9	-	1.9
VEH EXT		4.0		1.5		4.0		1.5
MAX GAP		4.0		1.5		4.0		1.5
MIN GAP		4.0		1.5		4.0		1.5
MAX LIMIT		50		40		50		40
MAXIMUM 2	-		-		-		-	
ADV / DLY WALK	-		-		-		-	
SEQUENCE TO	-		-		-		-	
COND SRV MIN	-		-		-		-	
REDUCE EVERY	-		-		-		-	
YELLOW		5.9		5.9		5.9		5.9
RED CLEAR		1.4		1.3		1.4		1.3

PHASE BANK # < C + O + F = 1 >

Column F

PHASES

		1	2	3	4	5	6	7	8
0	PERMIT		X		X		X		X
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL		X				X		
4	PED RECALL								
5	PEDESTRIANS								
6	REST IN WALK								
7	RED REST								
8	DOUBLE ENTRY		X		X		X		X
9	VEH MAX CALL		X		X		X		X
A	SOFT RECALL								
B	MAXIMUM 2								
C	CORD SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES				X				X

< C + O + F = 1 >

LOCATION: **Hwy 3 @ Haldiman-Norfolk 55 (Nanticoke)**

Issued Date: 25-Jan-17

Installed Date: 25-Jan-17

BI Tran Systems, Inc.
510 Bercut Dr., Sacremento, Calif. 95814
916/441-0260
Traffic Signal Program ***233*** *Ontario*
Timing Sheet #2
Revised (02/95)

Time of Day

Actuated

T.O.D FUNCTIONS

	TIME HH	MM	FUN	DAY OF WEEK S 1	M 2	T 3	W 4	T 5	F 6	S 7
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
A										
B										
C										
D										
E										
F										

< C + O + 7 = 1 >

Column 4 PHASE / BITS

1	2	3	4	5	6	7	8

< C + O + E = 27 >

T.O.D FUNCTIONS

A = VEH SOFT RECALL
B = MAXIMUM 2
C = CONDITIONAL SERVICE
D = LAG PHASES
E= BIT 1- LOCAL OVERIDE
BIT 4- DISABLE DET OFF MONITOR
BIT 7- DET COUNT MONITOR
BIT 8- REAL TIME SPLIT MONITOR
F = OUTPUT BITS 1 THRU 4

0 = PERMIT PHASES
1 = RED LOCK
2 = YELLOW LOCK
3 = VEH MIN RECALL
4 = PED RECALL
5 -
6 - REST IN WALK
7 = RED REST
8 = DOUBLE ENTRY
9 = VEH MAX RECALL

LOCATION: **Hwy 3 @ Haldiman 55**

Issued Date: 17-Oct-14

Installed Date: 17-Oct-14

Pretimed

T.O.D FUNCTIONS

	TIME HH	MM	FUN	DAY OF WEEK S 1	M 2	T 3	W 4	T 5	F 6	S 7
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
A										
B										
C										
D										
E										
F										

< C + O + 7 = 1 >

Column 4 PHASE / BITS

1	2	3	4	5	6	7	8

< C + O + E = 27 >

T.O.D FUNCTIONS

A = VEH SOFT RECALL
B = MAXIMUM 2
C = CONDITIONAL SERVICE
D = LAG PHASES
E = BIT 1- LOCAL OVERIDE
BIT 4- DISABLE DET OFF MONITOR
BIT 7- DET COUNT MONITOR
BIT 8- REAL TIME SPLIT MONITOR
F = OUTPUT BITS 1 THRU 4

0 = PERMIT PHASES
1 = RED LOCK
2 = YELLOW LOCK
3 = VEH MIN RECALL
4 = PED RECALL
5 -
6 - REST IN WALK
7 = RED REST
8 = DOUBLE ENTRY
9 = VEH MAX RECALL

LOCATION: **Hwy 3 @ Haldiman 55**

Issued Date: 17-Oct-14

Installed Date: 17-Oct-14

BI Tran Systems, Inc.
510 Bercut Dr., Sacremento, Calif. 95814
916/441-0260
Traffic Signal Program ***233*** *Ontario*
Timing Sheet #2
Revised (02/95)

DETECTOR ASSIGNMENTS

STANDARD 332 CABINET LOCATION	column	1 delay	3 carry over
I-2 U	0		
J-2 U	1		
I-6 U	2	5	
J-6 U	3	5	
1-2 L	4		
J-2 L	5		
1-6 L	6	10	
J-6 L	7	5	
I-4	8		
J-4	9		
I-8	A		
J-8	B		4.5
J-1	C		
I-1	D		
J-5	E		
I-5	F		
	< C + O + D = 0 >		

Column 0	Column 1								Column 2								Column 3							
	ATTRIBUTES								PHASE(S)								ASSIGNMENTS							
C1 Pin #	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
0 39				X	X					X							X	X	X					X
1 40				X	X									X			X	X	X					X
2 41					X		X					X					X	X	X					X
3 42					X		X									X	X	X	X					X
4 43																								
5 44																								
6 45					X		X					X					X	X	X					X
7 46					X		X									X	X	X	X					X
8 47																								
9 48																								
A 49																								
B 50				X	X											X	X	X	X					X
C 55																								
D 56																								
E 57																								
F 58																								

DETECTOR ASSIGNMENTS < C + O + E = 126>

STANDARD 332 CABINET LOCATION	column	2 delay	4 carry over
J-9 U	0		
I-9 U	1		
I-9 L	2		
J-9 L	3		
I-3 U	4		
J-3 U	5		
I-7 U	6		4.5
J-7 U	7	5	
I-12 U	8		
I-13 U	9		
I-12 L	A		
I-13 L	B		
I-3 L	C		
J-3 L	D		
I-7 L	E		
J-7 L	F		
	< C + O + D = 0 >		

Column 4	Column 5								Column 6								Column 7							
	ATTRIBUTES								PHASE(S)								ASSIGNMENTS							
C1 Pin #	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
0 59																								
1 60																								
2 61																								
3 62																								
4 63																								
5 64																								
6 65				X	X							X					X	X	X					X
7 66					X		X									X	X	X	X					X
8 67																								
9 68																								
A 69																								
B 70																								
C 76																								
D 77																								
E 78																								
F 79																								

DETECTOR ASSIGNMENTS < C + O + E = 126 >

DETECTOR ASSIGNMENT SHEET
ONTARIO 233 PROGRAM

LOCATION:

Hwy Hwy 3

at Haldiman 55 (Nanticoke)

Issued Date: 25-Jan-17

Installed Date: 25-Jan-17

DETECTOR ATTRIBUTES

1 = FULL TIME DELAY
2 = PEDESTRIAN CALL
3 =
4 = COUNT
5 = EXTENSION
6 = TYPE 3
7 = CALLING
8 = ALTERNATE

DETECTOR ASSIGNMENTS

1 = DET. SET # 1
2 = DET. SET # 2
3 = DET. SET # 3
4 =
5 =
6 = MIN RECALL ON FAILURE
7 = MAX RECALL ON FAILURE
8 - REPORT ON FAILURE

DETECTOR MONITOR

MAX OFF: D/0+0+1=120
MAX ON: D/0+0+2=60

ADVANCE WARNING BEACONS

SIGN #1 SIGN #2
PHASE NUMBER
(F/1+C+F)= (F/1+D+F)=
TIME BEFORE YELLOW
(F/1+C+E)= (F/1+D+E)=
OUTPUT PIN NUMBER
(E/127+E+8)= (E/127+E+9)=

Input File Layout

Input File Slot No. →	1	2	3	4	5	6	7	8	9	10	11	12	13	14
"I" FILE	**1** Ext, Cnt, Call <C1-56>	**2** Ext, Cnt, Call <C1-39>	**2** Ext, Cnt, Call <C1-63>	**2** Type 3, Call <C1-47>	**3** Ext, Cnt, Call <C1-58>	**4** Ext, Cnt, Call <C1-41>	**4** Ext, Cnt, Call <C1-65>	**4** Type 3, Call <C1-49>	**1** Ext, Cnt, Call <C1-60>	NOT WIRED	Not Assigned <C1-80>	**2** Ped Call <C1-67>	**6** Ped Call <C1-68>	Flash Sense <C1-81>
		2 Ext, Cnt, Call <C1-43>	**2** Ext, Cnt, Call <C1-76>			**4** Ext, Cnt, Call <C1-45>	**4** Ext, Cnt, Call <C1-78>		**3** Ext, Cnt, Call <C1-62>		Not Assigned <C1-53>	**4** Ped Call <C1-69>	**8** Ped Call <C1-70>	Stop Time <C1-82>
"J" FILE	**5** Ext, Cnt, Call <C1-55>	**6** Ext, Cnt, Call <C1-40>	**6** Ext, Cnt, Call <C1-64>	**6** Type 3, Call <C1-48>	**7** Ext, Cnt, Call <C1-57>	**8** Ext, Cnt, Call <C1-42>	**8** Ext, Cnt, Call <C1-66>	**8** Type 3, Call <C1-50>	**5** Ext, Cnt, Call <C1-59>	NOT WIRED	Not Assigned <C1-54>	EV **A** Preempt <C1-71>	EV **B** Preempt <C1-72>	Railroad 1 <C1-51>
		6 Ext, Cnt, Call <C1-44>	**6** Ext, Cnt, Call <C1-77>			**8** Ext, Cnt, Call <C1-46>	**8** Ext, Cnt, Call <C1-79>		**7** Ext, Cnt, Call <C1-61>		Not Assigned <C1-75>	EV **C** Preempt <C1-73>	EV **D** Preempt <C1-74>	Railroad

DETECTOR TYPES

Ext = Extension Detector
Detector is only active during the Phase's GREEN Intervals (ie, will NOT *Call* the Phase)

Cnt = Count Detector
Used in computing "Added Initial"

Call = Calling Detector
Detector is only active during the Phase's NON-GREEN Intervals (ie, will NOT *Extend* the Phase)

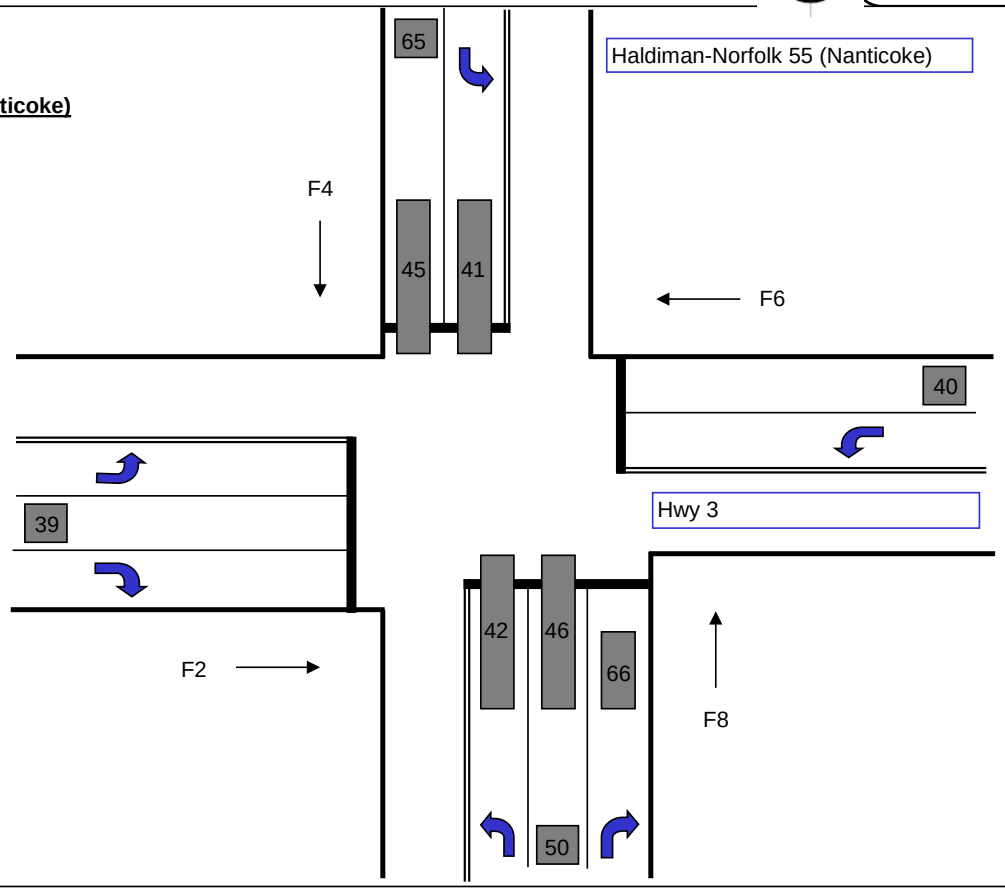
Type 3 = Type 3 Disconnect
Will allow a Calling Detector to Extend its Phase until the Call first drops or the "Type 3 Limit" is reached

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260

Traffic Signal Program 233
Initialized Detector Assignments
(Revised 8/92) *332 Cabinet*

Intersection Of: **Hwy 3**

At: **Haldiman-Norfolk 55 (Nanticoke)**



DEFAULT DETECTOR ASSIGNMENTS

PDD-18-2019, Attachment 2

Standard 332 Cabinet Location		Column 0	Column 1 ATTRIBUTES								Column 2 PHASE(S)								Column 3 ASSIGNMENTS							
		C1 PIN NUMBER	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
I-2 U	→	0 **39**				X	X		X			X							X	X	X					X
J-2 U	→	1 **40**				X	X		X						X				X	X	X					X
I-6 U	→	2 **41**				X	X		X					X					X	X	X					X
J-6 U	→	3 **42**				X	X		X									X	X	X	X					X
I-2 L	→	4 **43**				X	X		X			X							X	X	X					X
J-2 L	→	5 **44**				X	X		X							X			X	X	X					X
I-6 L	→	6 **45**				X	X		X					X					X	X	X					X
J-6 L	→	7 **46**				X	X		X									X	X	X	X					X
I-4	→	8 **47**						X	X			X							X	X	X					X
J-4	→	9 **48**						X	X							X			X	X	X					X
I-8	→	A **49**						X	X					X					X	X	X					X
J-8	→	B **50**						X	X									X	X	X	X					X
J-1	→	C **55**				X	X		X						X				X	X	X					X
I-1	→	D **56**				X	X		X		X								X	X	X					X
J-5	→	E **57**				X	X		X								X		X	X	X					X
I-5	→	F **58**				X	X		X				X						X	X	X					X

"INITIALIZED" DETECTOR ASSIGNMENTS
< C + 0 + E = 126 >

Standard 332 Cabinet Location		Column 4	Column 5 ATTRIBUTES								Column 6 PHASE(S)								Column 7 ASSIGNMENTS							
		C1 PIN NUMBER	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
J-9 U	→	0 **59**				X	X		X						X				X	X	X					X
I-9 U	→	1 **60**				X	X		X		X								X	X	X					X
J-9 L	→	2 **61**				X	X		X								X		X	X	X					X
I-9 L	→	3 **62**				X	X		X				X						X	X	X					X
I-3 U	→	4 **63**				X	X		X			X							X	X	X					X
J-3 U	→	5 **64**				X	X		X								X		X	X	X					X
I-7 U	→	6 **65**				X	X		X						X				X	X	X					X
J-7 U	→	7 **66**				X	X		X									X	X	X	X					X
I-12 U	→	8 **67**		X								X							X	X	X					X
I-13 U	→	9 **68**		X												X			X	X	X					X
I-12 L	→	A **69**		X											X				X	X	X					X
I-13 L	→	B **70**		X														X	X	X	X					X
I-3 L	→	C **76**				X	X		X			X							X	X	X					X
J-3 L	→	D **77**				X	X		X							X			X	X	X					X
I-7 L	→	E **78**				X	X		X						X				X	X	X					X
J-7 L	→	F **79**				X	X		X									X		X	X					X

"INITIALIZED" DETECTOR ASSIGNMENTS
< C + 0 + E = 126 >

DETECTOR ATTRIBUTES

1= Full time Delay
2 = Pedestrian call
3 =
4 = Count
5 = Extention
6 = Type 3
7 = Calling
8 = Alternate

DETECTOR ASSIGNMENTS

1 = Det. Set #1
2 = Det. Set #2
3 = Det. Set #3
4 =
5 =
6 = MIN Recall On Failure
7 = MAX Recall On Failure
8 = Report On Failure

Input File →

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
"I" FILE	**1** Ext, Cnt, Call <C1-56>	**2** Ext, Cnt, Call <C1-39>	**2** Ext, Cnt, Call <C1-63>	**2** Type 3, Call <C1-47>	**3** Ext, Cnt, Call <C1-58>	**4** Ext, Cnt, Call <C1-41>	**4** Ext, Cnt, Call <C1-65>	**4** Type 3, Call <C1-49>	**1** Ext, Cnt, Call <C1-60>	NOT WIRED	Not Assigned <C1-80>	**2** Ped Call <C1-67>	**6** Ped Call <C1-68>	Flash Sense <C1-81>
		2 Ext, Cnt, Call <C1-43>	**2** Ext, Cnt, Call <C1-76>			**4** Ext, Cnt, Call <C1-45>	**4** Ext, Cnt, Call <C1-78>		**3** Ext, Cnt,		Not Assigned <C1-53>	**4** Ped Call <C1-69>	**8** Ped Call	Stop Time <C1-82>
"J" FILE	**5** Ext, Cnt, Call <C1-55>	**6** Ext, Cnt, Call <C1-40>	**6** Ext, Cnt, Call <C1-64>	**6** Type 3, Call <C1-48>	**7** Ext, Cnt, Call <C1-57>	**8** Ext, Cnt, Call <C1-42>	**8** Ext, Cnt, Call <C1-66>	**8** Type 3, Call <C1-50>	**5** Ext, Cnt, Call <C1-59>	NOT WIRED	Not Assigned <C1-54>	**EV A** Preempt <C1-71>	**EV B** Preempt <C1-72>	Railroad 1 <C1-51>
		6 Ext, Cnt, Call <C1-44>	**6** Ext, Cnt, Call <C1-77>			**8** Ext, Cnt, Call <C1-46>	**8** Ext, Cnt, Call <C1-79>		**7** Ext, Cnt, Call <C1-61>		Not Assigned <C1-75>	**EV C** Ped Call <C1-73>	**EV D** Preempt <C1-74>	Railroad 2 <C1-52>

DETECTOR TYPES

Ext = Extension Detector
Detector is only active during the Phase's GREEN Intervals (ie, will NOT *Call* the Phase)
Cnt = Count Detector
Used in computing "Added Initial"
Call = Calling Detector
Detector is only active during the Phase's NON-GREEN Intervals (ie, will NOT *Extend* the Phase)
Type 3 = Type 3 Disconnect
Will allow a Calling Detector to Extend its Phase until the Call first drops or the "Type 3 Limit" is reached

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260

Traffic Signal Program 233
Initialized Detector Assignments
(Revised 8/92) *332 Cabinet*

REFERENCE SHEET

Controller Intervals

0 = Walk	8 = Red Rest
1 = FDW	9 = Preemption
2 = Min. Green	A = Stop Time
3 =	B = Red Revert
4= Var. Initial	C = Yellow-Gap Termination
5 = Extension	D = Yellow-Max. Termination
6 =	E = Yellow-Forceoff Termination
7 = Reduce Gap	F = Red Clearance

Continuous Memory Error Monitoring

The controller's RAM and EPROM memories are continuously checked for errors. If an erro is found, the intersection will go into FLASH (via Watch Dog Timer), and one of the following will be shown on the controller's display:

bAd A = An error was detected in the CPU's RAM, or a new program has been installed on the memory module. Often caused by a bad controller "gel-cell" battery.

bAd b = An error was detected in the memory module's RAM. Often caused by a bad "lithium" battery on the memory module.

bAd E = An error was detected in the 233 Program EPROM.

bAd F = An error was detected in the Z-RAM (Dallas chip) on the memory module.

412/C Memory Module
Lithium Battery Condition

To check the condition of the 3.6 volt Lithium Battery on the 412/C Memory Module:

If E/112 + 0 + A = 84 - the battery is BAD
If E/112 + 0 + A = 85 - the battery is O.K.

Monitor "Activate" Flags

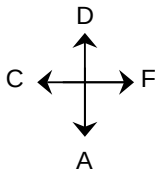
(Also Requires T.O.D. Function "E" Flag)

Detector Count Recording:
E/2 + 0 + 9 = Not Zero

Real Time Split Monitor:
E/2 + 0 + E = Not Zero

E Page Enable: F/1 + 9 + E = Not Zero

Display Movement Codes



A = Advance ROW
D = Decrement ROW
C = COLUMN Back
F = Forward COLUMN

Special Event Schedules

Special Event #1: C + 0 + E = 27
Special Event #2: C + 0 + E = 28

Current Interval = E + 5 + 0
Current Interval Timer = E + 5 + B
Current Interval Clearance Phases = E + 5 + C

Time of Day Function (7 Key)

Current T.O.D. "E Function" Control Bits = C/0 + E + E
Current T.O.D. "F Function" Output Bits = C/0 + E + F

Logic DELAY Gate
Delay Timer Display

DELAY A Timer = C/0 + 9 +A
DELAY B Timer = C/0 + 9 + B
thru thru
DELAY F Timer = C/0 + 9 + F

Interval Timer Display

Ring A = F/0 + A + Interval Row
Ring B = F/0 + B + (Interval Row From PHASE BANK data)

Display Locations

	Plan Select	Offset Select
Manual =	C/0 + A + 1	C/0 + B + 1
Master =	C/0 + A + 2	C/0 + B + 2
Current =	C/0 + A + 3	C/0 + B + 3
Next =	C/0 + A + 4	C/0 + B + 4
TOD =	C/0 + A +5	C/0 + B + 5

Master Cycle = C/0 + A + 0
Ring A Cycle = C/0 + B + 0
Ring B Cycle = C/0 + D + 0

MIN Cycle = C/0 + A + E
MAX Cycle = C/0 + B + E

Phase Hold = C/0 + F + D
Phase Next = C/0 + F + E
Force Off = C/0 + F + F
(with Ring A Cycle Timer)

Current Calculated Cycle Length = C/0 + B + F
Current Permitted Phases = E/0 + 7 +8
Current Phase Bank = F/0 + C + E

Last Power Failure:
(HR-MIN-DOW) = 8 + 4
(DOW-YR-MONTH) = 8 + 5
Last Cabinet Flash
(HR-MIN-DOW) = 8 + 6
(DOW-YR-MONTH) = 8 + 7
Power Fail Counts:
(Long Failures) = F/1 + 0 + C
(Short Failures) = F/1 + 0 + D
Current Time:
(HR-MIN-DOW) = 8 + 0
(DOW-YR-MONTH) = 8 + 1
(MIN-SEC-1/10SEC) = 8 + F

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233
"View" Locations
(Revised 03/94

Appendix B

Existing Traffic Operations Summary Reports

Lanes, Volumes, Timings
1: Highway 6 & Nanticoke Creek Parkway

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	11	30	4	14	1	28	266	14	0	182	62
Future Volume (vph)	42	11	30	4	14	1	28	266	14	0	182	62
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	120.0		120.0	90.0		90.0
Storage Lanes	0		0	0		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	1.00	1.00	1.00	1.00	1.00
Frt		0.952			0.994				0.850			0.850
Flt Protected		0.975			0.989		0.950					
Satd. Flow (prot)	0	1628	0	0	1695	0	1626	1845	1509	1900	1810	1524
Flt Permitted		0.975			0.989		0.950					
Satd. Flow (perm)	0	1628	0	0	1695	0	1626	1845	1509	1900	1810	1524
Link Speed (k/h)		80			80			60			60	
Link Distance (m)		334.7			473.5			426.8			479.3	
Travel Time (s)		15.1			21.3			25.6			28.8	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	7%	27%	3%	0%	14%	0%	11%	3%	7%	0%	5%	6%
Adj. Flow (vph)	48	13	34	5	16	1	32	302	16	0	207	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	95	0	0	22	0	32	302	16	0	207	70
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.3%		ICU Level of Service A	
Analysis Period (min) 15			

HCM Unsignalized Intersection Capacity Analysis
1: Highway 6 & Nanticoke Creek Parkway

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	11	30	4	14	1	28	266	14	0	182	62
Future Volume (Veh/h)	42	11	30	4	14	1	28	266	14	0	182	62
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	48	13	34	5	16	1	32	302	16	0	207	70
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	582	589	207	614	643	302	277			318		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	582	589	207	614	643	302	277			318		
tC, single (s)	7.2	6.8	6.2	7.1	6.6	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.2	3.3	3.5	4.1	3.3	2.3			2.2		
p0 queue free %	88	97	96	99	96	100	97			100		
cM capacity (veh/h)	395	379	831	373	367	742	1236			1253		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	95	22	32	302	16	0	207	70
Volume Left	48	5	32	0	0	0	0	0
Volume Right	34	1	0	0	16	0	0	70
cSH	483	377	1236	1700	1700	1700	1700	1700
Volume to Capacity	0.20	0.06	0.03	0.18	0.01	0.00	0.12	0.04
Queue Length 95th (m)	5.8	1.5	0.6	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	14.3	15.1	8.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	C	A					
Approach Delay (s)	14.3	15.1	0.7			0.0		
Approach LOS	B	C						

Intersection Summary					
Average Delay		2.6			
Intersection Capacity Utilization		37.3%	ICU Level of Service		A
Analysis Period (min)		15			

Lanes, Volumes, Timings
2: Main Street & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	89	64	0	24	97	20	8	133	32	19	72	114
Future Volume (vph)	89	64	0	24	97	20	8	133	32	19	72	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Ped Bike Factor								1.00			0.99	
Frt					0.981			0.975			0.925	
Flt Protected		0.972			0.992			0.998			0.995	
Satd. Flow (prot)	0	1709	0	0	1567	0	0	1599	0	0	1485	0
Flt Permitted		0.768			0.942			0.986			0.968	
Satd. Flow (perm)	0	1350	0	0	1488	0	0	1580	0	0	1445	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					17			24			128	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		190.6			627.7			265.6			263.4	
Travel Time (s)		13.7			45.2			19.1			19.0	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	6%	11%	0%	4%	7%	5%	0%	4%	3%	5%	4%	5%
Parking (#/hr)					0			0			0	
Adj. Flow (vph)	100	72	0	27	109	22	9	149	36	21	81	128
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	172	0	0	158	0	0	194	0	0	230	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.14	1.00	1.00	1.14	1.00	1.00	1.14	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Minimum Split (s)	30.5	30.5		30.5	30.5		30.5	30.5		30.5	30.5	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	25.5	25.5		25.5	25.5		25.5	25.5		25.5	25.5	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		25.5			25.5			25.5			25.5	
Actuated g/C Ratio		0.42			0.42			0.42			0.42	

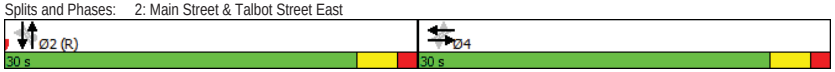
Lanes, Volumes, Timings
2: Main Street & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.30			0.25			0.28			0.33	
Control Delay		13.2			11.1			11.2			6.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		13.2			11.1			11.2			6.9	
LOS		B			B			B			A	
Approach Delay		13.2			11.1			11.2			6.9	
Approach LOS		B			B			B			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 60			
Offset: 0 (0%), Referenced to phase 2:NBSB and 6:, Start of Green			
Natural Cycle: 65			
Control Type: Pretimed			
Maximum v/c Ratio: 0.33			
Intersection Signal Delay: 10.3		Intersection LOS: B	
Intersection Capacity Utilization 45.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Main Street & Talbot Street East



Queues
2: Main Street & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	172	158	194	230
v/c Ratio	0.30	0.25	0.28	0.33
Control Delay	13.2	11.1	11.2	6.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.2	11.1	11.2	6.9
Queue Length 50th (m)	12.5	9.9	12.1	7.0
Queue Length 95th (m)	24.7	20.6	24.1	19.0
Internal Link Dist (m)	166.6	603.7	241.6	239.4
Turn Bay Length (m)				
Base Capacity (vph)	573	642	685	687
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.30	0.25	0.28	0.33

Intersection Summary

HCM Signalized Intersection Capacity Analysis
2: Main Street & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	89	64	0	24	97	20	8	133	32	19	72	114
Future Volume (vph)	89	64	0	24	97	20	8	133	32	19	72	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			0.98			0.97			0.92	
Flt Protected		0.97			0.99			1.00			1.00	
Satd. Flow (prot)		1708			1566			1599			1486	
Flt Permitted		0.77			0.94			0.99			0.97	
Satd. Flow (perm)		1349			1488			1580			1445	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	100	72	0	27	109	22	9	149	36	21	81	128
RTOR Reduction (vph)	0	0	0	0	10	0	0	14	0	0	74	0
Lane Group Flow (vph)	0	172	0	0	148	0	0	180	0	0	156	0
Confl. Peds. (#/hr)							2		1	1		2
Heavy Vehicles (%)	6%	11%	0%	4%	7%	5%	0%	4%	3%	5%	4%	5%
Parking (#/hr)					0			0			0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		25.5			25.5			25.5			25.5	
Effective Green, g (s)		25.5			25.5			25.5			25.5	
Actuated g/C Ratio		0.42			0.42			0.42			0.42	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Lane Grp Cap (vph)		573			632			671			614	
v/s Ratio Prot												
v/s Ratio Perm		c0.13			0.10			c0.11			0.11	
v/c Ratio		0.30			0.23			0.27			0.25	
Uniform Delay, d1		11.4			11.0			11.2			11.1	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		1.3			0.9			1.0			1.0	
Delay (s)		12.7			11.9			12.2			12.1	
Level of Service		B			B			B			B	
Approach Delay (s)		12.7			11.9			12.2			12.1	
Approach LOS		B			B			B			B	

Intersection Summary					
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B		
HCM 2000 Volume to Capacity ratio	0.28				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0		
Intersection Capacity Utilization	45.0%	ICU Level of Service	A		
Analysis Period (min)	15				

c Critical Lane Group

Lanes, Volumes, Timings
3: Talbot Street East & Craddock Blvd

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	7	123	151	7	9	13
Future Volume (vph)	7	123	151	7	9	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt			0.994		0.918	
Flt Protected		0.997			0.981	
Satd. Flow (prot)	0	1715	1714	0	1508	0
Flt Permitted		0.997			0.981	
Satd. Flow (perm)	0	1715	1714	0	1508	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		627.7	323.8		121.4	
Travel Time (s)		45.2	23.3		8.7	
Confl. Peds. (#/hr)	5			5		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	11%	10%	14%	22%	8%
Adj. Flow (vph)	7	128	157	7	9	14
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	135	164	0	23	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	22.2%	ICU Level of Service A	
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Talbot Street East & Craddock Blvd

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	123	151	7	9	13
Future Volume (Veh/h)	7	123	151	7	9	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	7	128	157	7	9	14
Pedestrians					5	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	169				308	166
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	169				308	166
tC, single (s)	4.1				6.6	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.7	3.4
p0 queue free %	100				99	98
cM capacity (veh/h)	1415				639	860

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	135	164	23
Volume Left	7	0	9
Volume Right	0	7	14
cSH	1415	1700	758
Volume to Capacity	0.00	0.10	0.03
Queue Length 95th (m)	0.1	0.0	0.8
Control Delay (s)	0.4	0.0	9.9
Lane LOS	A		A
Approach Delay (s)	0.4	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	22.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
4: Talbot Street East & Saunders Blvd

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	4	121	138	10	10	9
Future Volume (vph)	4	121	138	10	10	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt			0.991		0.936	
Flt Protected		0.999			0.974	
Satd. Flow (prot)	0	1700	1697	0	1638	0
Flt Permitted		0.999			0.974	
Satd. Flow (perm)	0	1700	1697	0	1638	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		323.8	805.7		146.6	
Travel Time (s)		23.3	58.0		10.6	
Confl. Peds. (#/hr)	3			3		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	12%	11%	10%	11%	0%
Adj. Flow (vph)	4	132	150	11	11	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	136	161	0	21	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Talbot Street East & Saunders Blvd

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	4	121	138	10	10	9
Future Volume (Veh/h)	4	121	138	10	10	9
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	132	150	11	11	10
Pedestrians					3	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	164				298	158
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	164				298	158
tC, single (s)	4.1				6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.3
p0 queue free %	100				98	99
cM capacity (veh/h)	1423				671	890

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	136	161	21
Volume Left	4	0	11
Volume Right	0	11	10
cSH	1423	1700	760
Volume to Capacity	0.00	0.09	0.03
Queue Length 95th (m)	0.1	0.0	0.7
Control Delay (s)	0.2	0.0	9.9
Lane LOS	A		A
Approach Delay (s)	0.2	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	82	16	15	95	10	21	60	4	5	102	16
Future Volume (vph)	13	82	16	15	95	10	21	60	4	5	102	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	85.0		100.0	110.0		0.0	85.0		100.0	105.0		0.0
Storage Lanes	1		1	1		0	1		1	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	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.986				0.850		0.980	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1727	1233	1504	1777	0	1641	1545	1615	1805	1661	0
Flt Permitted	0.680			0.696			0.671			0.712		
Satd. Flow (perm)	1292	1727	1233	1102	1777	0	1159	1545	1615	1353	1661	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			51		8				52		10	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		805.7			412.7			457.4			469.5	
Travel Time (s)		36.3			18.6			20.6			21.1	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	0%	10%	31%	20%	6%	0%	10%	23%	0%	0%	14%	0%
Adj. Flow (vph)	15	94	18	17	109	11	24	69	5	6	117	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	94	18	17	120	0	24	69	5	6	135	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8		8	4		
Minimum Split (s)	27.3	27.3	27.3	27.3	27.3		25.2	25.2	25.2	25.2	25.2	
Total Split (s)	50.0	50.0	50.0	50.0	50.0		40.0	40.0	40.0	40.0	40.0	
Total Split (%)	55.6%	55.6%	55.6%	55.6%	55.6%		44.4%	44.4%	44.4%	44.4%	44.4%	
Maximum Green (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9		5.9	5.9	5.9	5.9	5.9	
All-Red Time (s)	1.4	1.4	1.4	1.4	1.4		1.3	1.3	1.3	1.3	1.3	
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)	7.3	7.3	7.3	7.3	7.3		7.2	7.2	7.2	7.2	7.2	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.47		0.36	0.36	0.36	0.36	0.36	
v/c Ratio	0.02	0.11	0.03	0.03	0.14		0.06	0.12	0.01	0.01	0.22	
Control Delay	12.8	13.7	0.2	12.9	13.0		19.2	19.9	0.0	18.4	19.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	

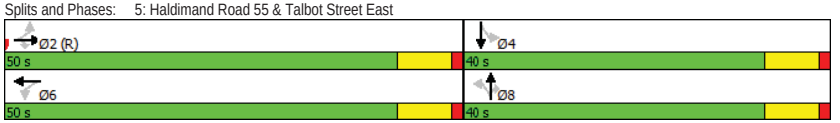
Lanes, Volumes, Timings
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	12.8	13.7	0.2	12.9	13.0		19.2	19.9	0.0	18.4	19.5	
LOS	B	B	A	B	B		B	B	A	B	B	
Approach Delay		11.7			13.0			18.7			19.4	
Approach LOS		B			B			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 55			
Control Type: Pretimed			
Maximum v/c Ratio: 0.22			
Intersection Signal Delay: 15.6		Intersection LOS: B	
Intersection Capacity Utilization 59.8%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 5: Haldimand Road 55 & Talbot Street East



Queues
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	15	94	18	17	120	24	69	5	6	135
v/c Ratio	0.02	0.11	0.03	0.03	0.14	0.06	0.12	0.01	0.01	0.22
Control Delay	12.8	13.7	0.2	12.9	13.0	19.2	19.9	0.0	18.4	19.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	13.7	0.2	12.9	13.0	19.2	19.9	0.0	18.4	19.5
Queue Length 50th (m)	1.4	9.2	0.0	1.6	11.0	2.8	8.2	0.0	0.7	15.4
Queue Length 95th (m)	4.6	17.3	0.3	5.0	20.3	7.8	16.8	0.0	3.1	27.9
Internal Link Dist (m)		781.7			388.7		433.4			445.5
Turn Bay Length (m)	85.0		100.0	110.0		85.0		100.0	105.0	
Base Capacity (vph)	612	819	611	522	847	422	563	621	493	611
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	0.02	0.11	0.03	0.03	0.14	0.06	0.12	0.01	0.01	0.22

Intersection Summary

HCM Signalized Intersection Capacity Analysis
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: AM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	82	16	15	95	10	21	60	4	5	102	16
Future Volume (vph)	13	82	16	15	95	10	21	60	4	5	102	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.3	7.3	7.3	7.3	7.3		7.2	7.2	7.2	7.2	7.2	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1727	1233	1504	1777		1641	1545	1615	1805	1661	
Flt Permitted	0.68	1.00	1.00	0.70	1.00		0.67	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	1292	1727	1233	1102	1777		1158	1545	1615	1353	1661	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	15	94	18	17	109	11	24	69	5	6	117	18
RTOR Reduction (vph)	0	0	9	0	4	0	0	0	3	0	6	0
Lane Group Flow (vph)	15	94	9	17	116	0	24	69	2	6	129	0
Heavy Vehicles (%)	0%	10%	31%	20%	6%	0%	10%	23%	0%	0%	14%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Effective Green, g (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.47		0.36	0.36	0.36	0.36	0.36	
Clearance Time (s)	7.3	7.3	7.3	7.3	7.3		7.2	7.2	7.2	7.2	7.2	
Lane Grp Cap (vph)	612	819	584	522	843		422	563	588	493	605	
v/s Ratio Prot		0.05			c0.07			0.04			c0.08	
v/s Ratio Perm	0.01		0.01	0.02			0.02		0.00	0.00		
v/c Ratio	0.02	0.11	0.01	0.03	0.14		0.06	0.12	0.00	0.01	0.21	
Uniform Delay, d1	12.6	13.1	12.5	12.6	13.3		18.6	19.0	18.2	18.3	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.3	0.0	0.1	0.3		0.3	0.4	0.0	0.0	0.8	
Delay (s)	12.6	13.4	12.6	12.7	13.6		18.8	19.5	18.2	18.3	20.5	
Level of Service	B	B	B	B	B		B	B	B	B	C	
Approach Delay (s)		13.2			13.5			19.2			20.4	
Approach LOS		B			B			B			C	

Intersection Summary				
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.17			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.5	
Intersection Capacity Utilization	59.8%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Lanes, Volumes, Timings
1: Highway 6 & Nanticoke Creek Parkway

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	17	33	5	13	1	34	250	7	4	362	63
Future Volume (vph)	58	17	33	5	13	1	34	250	7	4	362	63
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	120.0		120.0	90.0		90.0
Storage Lanes	0		0	0		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	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.958			0.993				0.850			0.850
Flt Protected		0.974			0.988		0.950			0.950		
Satd. Flow (prot)	0	1723	0	0	1775	0	1752	1810	1417	1031	1863	1615
Flt Permitted		0.974			0.988		0.950			0.950		
Satd. Flow (perm)	0	1723	0	0	1775	0	1752	1810	1417	1031	1863	1615
Link Speed (k/h)		80			80			60			60	
Link Distance (m)		334.7			473.5			426.8			479.3	
Travel Time (s)		15.1			21.3			25.6			28.8	
Confl. Peds. (#/hr)			3	3					3	3		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	6%	3%	0%	0%	100%	3%	5%	14%	75%	2%	0%
Adj. Flow (vph)	63	18	36	5	14	1	37	272	8	4	393	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	117	0	0	20	0	37	272	8	4	393	68
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: Highway 6 & Nanticoke Creek Parkway

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	58	17	33	5	13	1	34	250	7	4	362	63
Future Volume (Veh/h)	58	17	33	5	13	1	34	250	7	4	362	63
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	63	18	36	5	14	1	37	272	8	4	393	68
Pedestrians					3			3				
Lane Width (m)					3.6			3.6				
Walking Speed (m/s)					1.2			1.2				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	755	758	396	798	818	275	461			283		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	755	758	396	798	818	275	461			283		
tC, single (s)	7.1	6.6	6.2	7.1	6.5	7.2	4.1			4.8		
tC, 2 stage (s)												
tF (s)	3.5	4.1	3.3	3.5	4.0	4.2	2.2			2.9		
p0 queue free %	79	94	94	98	95	100	97			100		
cM capacity (veh/h)	303	318	650	267	300	577	1095			953		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	117	20	37	272	8	4	393	68
Volume Left	63	5	37	0	0	4	0	0
Volume Right	36	1	0	0	8	0	0	68
cSH	366	298	1095	1700	1700	953	1700	1700
Volume to Capacity	0.32	0.07	0.03	0.16	0.00	0.00	0.23	0.04
Queue Length 95th (m)	10.8	1.7	0.8	0.0	0.0	0.1	0.0	0.0
Control Delay (s)	19.4	17.9	8.4	0.0	0.0	8.8	0.0	0.0
Lane LOS	C	C	A			A		
Approach Delay (s)	19.4	17.9	1.0			0.1		
Approach LOS	C	C						

Intersection Summary					
Average Delay	3.2				
Intersection Capacity Utilization	44.3%	ICU Level of Service		A	
Analysis Period (min)	15				

Lanes, Volumes, Timings
2: Main Street & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	126	108	7	31	82	48	4	105	35	25	210	147
Future Volume (vph)	126	108	7	31	82	48	4	105	35	25	210	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Ped Bike Factor		1.00			0.99			0.99			0.99	
Frt		0.996			0.960			0.967			0.948	
Flt Protected		0.974			0.990			0.999			0.997	
Satd. Flow (prot)	0	1753	0	0	1563	0	0	1584	0	0	1560	0
Flt Permitted		0.773			0.913			0.991			0.977	
Satd. Flow (perm)	0	1389	0	0	1441	0	0	1571	0	0	1528	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			44			33			65	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		190.6			627.7			265.6			263.4	
Travel Time (s)		13.7			45.2			19.1			19.0	
Confl. Peds. (#/hr)	4					4	6		5	5		6
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	3%	8%	0%	0%	4%	4%	0%	3%	6%	8%	3%	1%
Parking (#/hr)					0			0			0	
Adj. Flow (vph)	142	121	8	35	92	54	4	118	39	28	236	165
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	271	0	0	181	0	0	161	0	0	429	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.14	1.00	1.00	1.14	1.00	1.00	1.14	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Minimum Split (s)	30.5	30.5		30.5	30.5		30.5	30.5		30.5	30.5	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0		30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	25.5	25.5		25.5	25.5		25.5	25.5		25.5	25.5	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		25.5			25.5			25.5			25.5	
Actuated g/C Ratio		0.42			0.42			0.42			0.42	

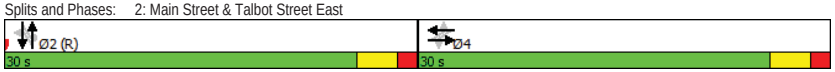
Lanes, Volumes, Timings
2: Main Street & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio		0.46			0.28			0.23			0.63	
Control Delay		15.3			9.9			9.8			16.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		15.3			9.9			9.8			16.2	
LOS		B			A			A			B	
Approach Delay		15.3			9.9			9.8			16.2	
Approach LOS		B			A			A			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 60			
Offset: 0 (0%), Referenced to phase 2:NBSB and 6:, Start of Green			
Natural Cycle: 65			
Control Type: Pretimed			
Maximum v/c Ratio: 0.63			
Intersection Signal Delay: 13.9		Intersection LOS: B	
Intersection Capacity Utilization 69.7%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 2: Main Street & Talbot Street East



Queues
2: Main Street & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	271	181	161	429
v/c Ratio	0.46	0.28	0.23	0.63
Control Delay	15.3	9.9	9.8	16.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	15.3	9.9	9.8	16.2
Queue Length 50th (m)	21.1	9.6	8.8	30.9
Queue Length 95th (m)	38.8	21.1	19.2	57.2
Internal Link Dist (m)	166.6	603.7	241.6	239.4
Turn Bay Length (m)				
Base Capacity (vph)	592	637	686	686
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.46	0.28	0.23	0.63

Intersection Summary

HCM Signalized Intersection Capacity Analysis
2: Main Street & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

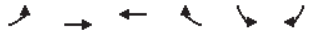
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	126	108	7	31	82	48	4	105	35	25	210	147
Future Volume (vph)	126	108	7	31	82	48	4	105	35	25	210	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			0.99			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			0.96			0.97			0.95	
Flt Protected		0.97			0.99			1.00			1.00	
Satd. Flow (prot)		1751			1563			1584			1559	
Flt Permitted		0.77			0.91			0.99			0.98	
Satd. Flow (perm)		1389			1440			1572			1527	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	142	121	8	35	92	54	4	118	39	28	236	165
RTOR Reduction (vph)	0	2	0	0	25	0	0	19	0	0	37	0
Lane Group Flow (vph)	0	269	0	0	156	0	0	142	0	0	392	0
Confl. Peds. (#/hr)	4					4	6		5	5		6
Heavy Vehicles (%)	3%	8%	0%	0%	4%	4%	0%	3%	6%	8%	3%	1%
Parking (#/hr)					0			0			0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		25.5			25.5			25.5			25.5	
Effective Green, g (s)		25.5			25.5			25.5			25.5	
Actuated g/C Ratio		0.42			0.42			0.42			0.42	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Lane Grp Cap (vph)		590			612			668			648	
v/s Ratio Prot												
v/s Ratio Perm		c0.19			0.11			0.09			c0.26	
v/c Ratio		0.46			0.25			0.21			0.60	
Uniform Delay, d1		12.3			11.1			10.9			13.3	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		2.5			1.0			0.7			4.1	
Delay (s)		14.8			12.1			11.6			17.5	
Level of Service		B			B			B			B	
Approach Delay (s)		14.8			12.1			11.6			17.5	
Approach LOS		B			B			B			B	

Intersection Summary					
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B		
HCM 2000 Volume to Capacity ratio	0.53				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0		
Intersection Capacity Utilization	69.7%	ICU Level of Service	C		
Analysis Period (min)	15				

c Critical Lane Group

Lanes, Volumes, Timings
3: Talbot Street East & Craddock Blvd

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

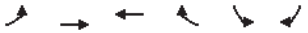


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	20	161	164	13	4	8
Future Volume (vph)	20	161	164	13	4	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.990		0.913	
Flt Protected		0.994			0.982	
Satd. Flow (prot)	0	1793	1830	0	1564	0
Flt Permitted		0.994			0.982	
Satd. Flow (perm)	0	1793	1830	0	1564	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		627.7	323.8		121.4	
Travel Time (s)		45.2	23.3		8.7	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	0%	6%	3%	0%	25%	0%
Adj. Flow (vph)	23	183	186	15	5	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	206	201	0	14	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Talbot Street East & Craddock Blvd

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	20	161	164	13	4	8
Future Volume (Veh/h)	20	161	164	13	4	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	23	183	186	15	5	9
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	201				422	194
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	201				422	194
tC, single (s)	4.1				6.6	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.7	3.3
p0 queue free %	98				99	99
cM capacity (veh/h)	1383				538	853

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	206	201	14
Volume Left	23	0	5
Volume Right	0	15	9
cSH	1383	1700	705
Volume to Capacity	0.02	0.12	0.02
Queue Length 95th (m)	0.4	0.0	0.5
Control Delay (s)	1.0	0.0	10.2
Lane LOS	A		B
Approach Delay (s)	1.0	0.0	10.2
Approach LOS			B

Intersection Summary				
Average Delay		0.8		
Intersection Capacity Utilization		32.3%	ICU Level of Service	A
Analysis Period (min)		15		

Lanes, Volumes, Timings
4: Talbot Street East & Saunders Blvd

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	13	148	164	12	4	8
Future Volume (vph)	13	148	164	12	4	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt			0.991		0.907	
Flt Protected		0.996			0.985	
Satd. Flow (prot)	0	1794	1832	0	1697	0
Flt Permitted		0.996			0.985	
Satd. Flow (perm)	0	1794	1832	0	1697	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		323.8	805.7		146.6	
Travel Time (s)		23.3	58.0		10.6	
Confl. Peds. (#/hr)	1			1	1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	0%	6%	3%	0%	0%	0%
Adj. Flow (vph)	14	157	174	13	4	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	171	187	0	13	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	28.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Talbot Street East & Saunders Blvd

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	148	164	12	4	8
Future Volume (Veh/h)	13	148	164	12	4	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	14	157	174	13	4	9
Pedestrians			1		1	
Lane Width (m)			3.6		3.6	
Walking Speed (m/s)			1.2		1.2	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	188				368	182
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	188				368	182
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	99
cM capacity (veh/h)	1397				629	866

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	171	187	13
Volume Left	14	0	4
Volume Right	0	13	9
cSH	1397	1700	776
Volume to Capacity	0.01	0.11	0.02
Queue Length 95th (m)	0.2	0.0	0.4
Control Delay (s)	0.7	0.0	9.7
Lane LOS	A		A
Approach Delay (s)	0.7	0.0	9.7
Approach LOS			A

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	28.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	137	14	2	113	10	31	92	11	19	33	16
Future Volume (vph)	9	137	14	2	113	10	31	92	11	19	33	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	85.0		100.0	110.0		0.0	85.0		100.0	105.0		0.0
Storage Lanes	1		1	1		0	1		1	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	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.988				0.850		0.952	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1792	1509	1805	1799	0	1752	1776	1042	1626	1479	0
Flt Permitted	0.668			0.658			0.720			0.689		
Satd. Flow (perm)	1269	1792	1509	1250	1799	0	1328	1776	1042	1179	1479	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			51		7				52		18	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		805.7			412.7			457.4			469.5	
Travel Time (s)		36.3			18.6			20.6			21.1	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	0%	6%	7%	0%	3%	20%	3%	7%	55%	11%	30%	6%
Adj. Flow (vph)	10	156	16	2	128	11	35	105	13	22	38	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	156	16	2	139	0	35	105	13	22	56	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8		8	4		
Minimum Split (s)	27.3	27.3	27.3	27.3	27.3		25.2	25.2	25.2	25.2	25.2	
Total Split (s)	50.0	50.0	50.0	50.0	50.0		40.0	40.0	40.0	40.0	40.0	
Total Split (%)	55.6%	55.6%	55.6%	55.6%	55.6%		44.4%	44.4%	44.4%	44.4%	44.4%	
Maximum Green (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9		5.9	5.9	5.9	5.9	5.9	
All-Red Time (s)	1.4	1.4	1.4	1.4	1.4		1.3	1.3	1.3	1.3	1.3	
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)	7.3	7.3	7.3	7.3	7.3		7.2	7.2	7.2	7.2	7.2	
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.47		0.36	0.36	0.36	0.36	0.36	
v/c Ratio	0.02	0.18	0.02	0.00	0.16		0.07	0.16	0.03	0.05	0.10	
Control Delay	12.8	14.4	0.1	12.5	13.4		19.3	20.2	0.2	19.1	14.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	

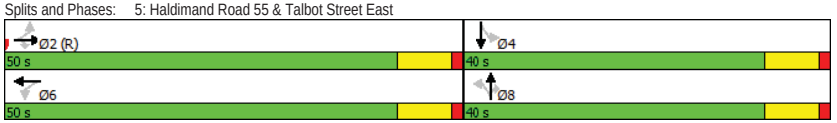
Lanes, Volumes, Timings
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	12.8	14.4	0.1	12.5	13.4		19.3	20.2	0.2	19.1	14.7	
LOS	B	B	A	B	B		B	C	A	B	B	
Approach Delay		13.0			13.4			18.3			15.9	
Approach LOS		B			B			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 55			
Control Type: Pretimed			
Maximum v/c Ratio: 0.18			
Intersection Signal Delay: 15.0		Intersection LOS: B	
Intersection Capacity Utilization 59.8%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 5: Haldimand Road 55 & Talbot Street East



Queues
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	10	156	16	2	139	35	105	13	22	56
v/c Ratio	0.02	0.18	0.02	0.00	0.16	0.07	0.16	0.03	0.05	0.10
Control Delay	12.8	14.4	0.1	12.5	13.4	19.3	20.2	0.2	19.1	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	14.4	0.1	12.5	13.4	19.3	20.2	0.2	19.1	14.7
Queue Length 50th (m)	0.9	15.7	0.0	0.2	13.1	4.1	12.7	0.0	2.6	4.4
Queue Length 95th (m)	3.6	26.9	0.0	1.4	23.5	10.4	23.8	0.0	7.5	12.2
Internal Link Dist (m)		781.7			388.7		433.4			445.5
Turn Bay Length (m)	85.0		100.0	110.0		85.0		100.0	105.0	
Base Capacity (vph)	602	850	742	593	857	483	647	412	429	550
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	0.02	0.18	0.02	0.00	0.16	0.07	0.16	0.03	0.05	0.10

Intersection Summary

HCM Signalized Intersection Capacity Analysis
5: Haldimand Road 55 & Talbot Street East

2018 Base Year: PM Peak Hour
180197: Jarvis Master Servicing Plan

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	137	14	2	113	10	31	92	11	19	33	16
Future Volume (vph)	9	137	14	2	113	10	31	92	11	19	33	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.3	7.3	7.3	7.3	7.3		7.2	7.2	7.2	7.2	7.2	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1792	1509	1805	1799		1752	1776	1042	1626	1479	
Flt Permitted	0.67	1.00	1.00	0.66	1.00		0.72	1.00	1.00	0.69	1.00	
Satd. Flow (perm)	1270	1792	1509	1250	1799		1329	1776	1042	1180	1479	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	10	156	16	2	128	11	35	105	12	22	38	18
RTOR Reduction (vph)	0	0	8	0	4	0	0	0	8	0	11	0
Lane Group Flow (vph)	10	156	8	2	135	0	35	105	5	22	45	0
Heavy Vehicles (%)	0%	6%	7%	0%	3%	20%	3%	7%	55%	11%	30%	6%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Effective Green, g (s)	42.7	42.7	42.7	42.7	42.7		32.8	32.8	32.8	32.8	32.8	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.47		0.36	0.36	0.36	0.36	0.36	
Clearance Time (s)	7.3	7.3	7.3	7.3	7.3		7.2	7.2	7.2	7.2	7.2	
Lane Grp Cap (vph)	602	850	715	593	853		484	647	379	430	539	
v/s Ratio Prot		c0.09			0.08			c0.06			0.03	
v/s Ratio Perm	0.01		0.01	0.00			0.03		0.00	0.02		
v/c Ratio	0.02	0.18	0.01	0.00	0.16		0.07	0.16	0.01	0.05	0.08	
Uniform Delay, d1	12.5	13.6	12.5	12.4	13.4		18.7	19.3	18.3	18.5	18.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.0	0.0	0.4		0.3	0.5	0.1	0.2	0.3	
Delay (s)	12.6	14.1	12.5	12.5	13.8		19.0	19.9	18.3	18.7	19.0	
Level of Service	B	B	B	B	B		B	B	B	B	B	
Approach Delay (s)		13.9			13.8			19.5			19.0	
Approach LOS		B			B			B			B	

Intersection Summary				
HCM 2000 Control Delay	16.1	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.17			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.5	
Intersection Capacity Utilization	59.8%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group