Municipal Servicing Report
For

Proposed Residential Development at

0 Chippewa Avenue

Prepared for:
Mamta Homes

Prepared by:
Kresin Engineering Corporation

April 2024

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1 Introduction

1.1 Overview

Mamta Homes (Mamta) is proposing to develop vacant lands in the west end of Sault Ste. Marie for mixed density residential use. The proposed site plan is presented in Appendix 1, and includes: single family residential, semi-detached, row housing and apartment developments. Mamta has retained Kresin Engineering Corporation (Kresin) to prepare this functional servicing report (FSR) in support of an application for Draft Plan of Subdivision approval.

The site of the development (the "Site"), shown in Figure 1, is in the west end of Sault Ste. Marie north of Second Line and west of Goulais Avenue, an extension of the existing Broadview Gardens neighbourhood which was developed in the 1960s and 1970s. The 15.1 hectare site is bordered by conservation land to the north and west, industrial and institutional land to the south and residential areas to the east.

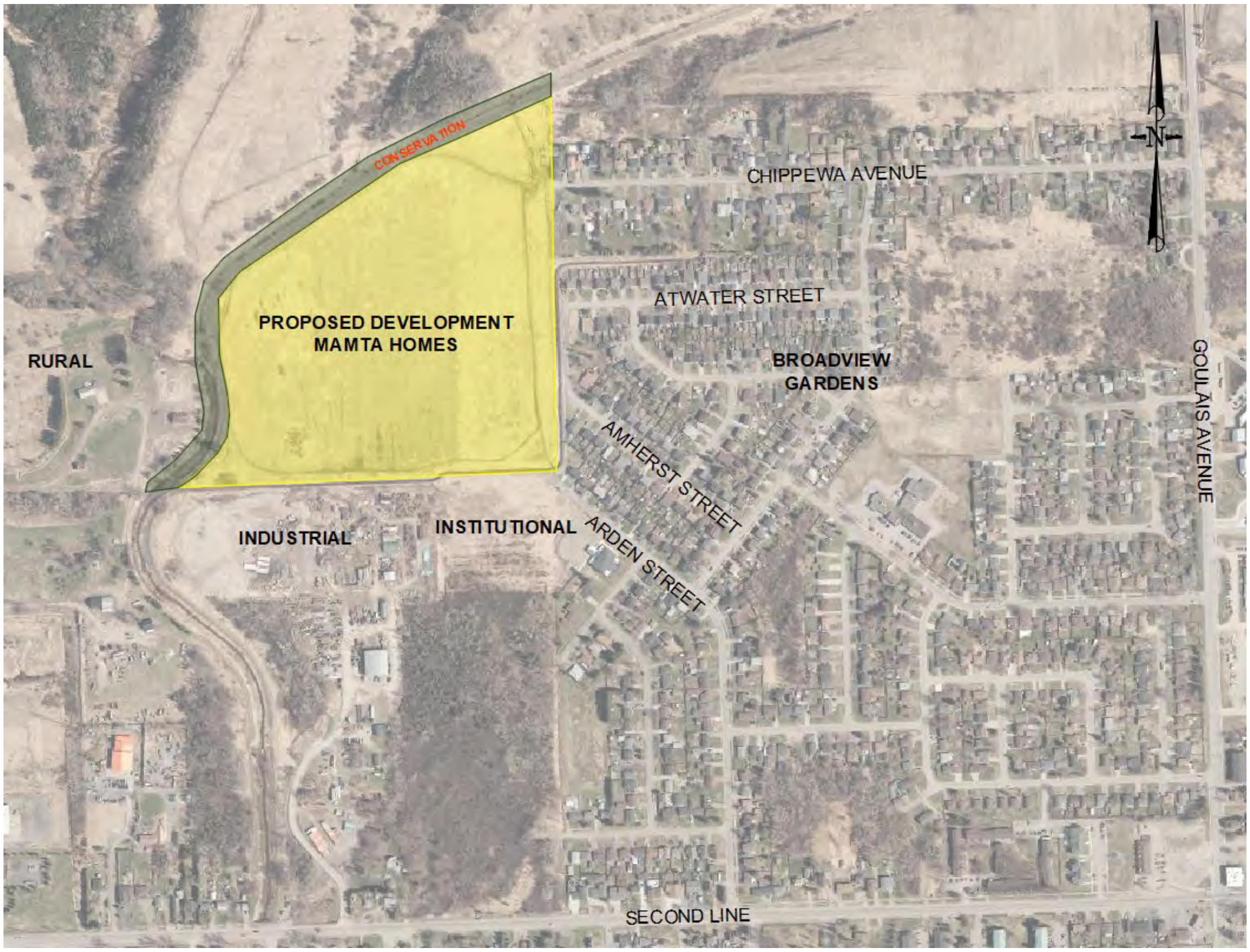


Figure 1: Location Plan (background image from soomaps.com)

Currently, the site is classified as a Rural Area Zone "RA" in the City's zoning by-law and is shown on the Official Plan Scheule C – Land Use (copy in Appendix 2) as a residential area.

The purpose of this FSR is to provide the necessary information to support the proposed Draft Plan of Subdivision and define the servicing requirements to meet the needs of the City.

1.2 Background

As shown on Schedule C of the City's Official Plan, the Site is designated for residential use, and is located within the Existing Urban Settlement Area. The proposed development appears to be compatible with the City's Official Plan. Further, based on the layout of the existing road network in Broadview Gardens, immediately east of the Site, it appears that a continuation of the residential neighbourhood was likely intended at the time it was developed.

2 Existing Conditions

2.1 Site Characterization

Currently, the Site is vacant land characterized by open grassy field with no significant tree cover. There is no evidence of recent agricultural use of the property. It is noted that there are some informal trails on the Site, apparently used by area residents for recreational purposes. In winter months, the Site is reportedly frequented by recreational snowmobilers.

2.2 Topography

The topography of the Site is relatively flat with an overall gentle slope towards the southeast. The total change in elevation between the southeast corner and the northwest limit of the Site is approximately 3.5 metres, providing an average slope of approximately 0.8%.

The site elevation is comparable to the adjacent lands, with no indication of large-scale historical grade adjustments by landfilling or excavation.

The existing site surface drainage is via overland flow directed towards a municipal ditch which borders the Site along the east and south sides. The ditch outlets at the West Davignon Creek near the southwest limit of the property.

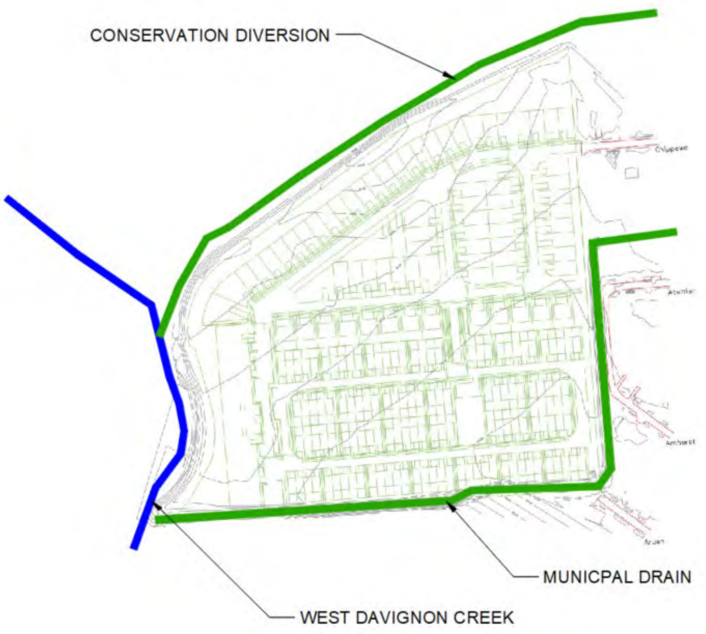


Figure 2 – Existing Site Conditions

2.3 Geotechnical

At the request of the developer, a geotechnical investigation has been completed for the Site. The investigation included advancement of a number of boreholes to obtain soil samples and measure in-situ conditions. Following analysis of the findings, recommendations regarding building foundations, buried infrastructure, roads and constructability were developed and are presented in the report, a copy of which is included in Appendix 3.

The existing sub-surface conditions are described in the geotechnical report as consisting of natural deposits of clays and silts below the organic topsoil layer. It was also noted that groundwater level is fairly consistent at about 1.2 metres below the surface.

2.4 Adjacent Infrastructure

The Site is adjacent to the existing Broadview Gardens neighbourhood. It is our understanding that Broadview Gardens was developed in the 1970s, and it appears to have been constructed anticipating the potential future development of the subject Site. Although no historical documentation to this effect has been provided by the City, this is inferred based on the layout of streets and subsurface utilities.

The existing roads, sewers and municipal water system in proximity of the Site are accessible to service the proposed development. The capacity of the existing infrastructure and ability to accommodate the development is discussed in the following sections.

3 Proposed Development

Mamta Homes is proposing to develop the Site in three parcels as shown on the site plan in Appendix 1.

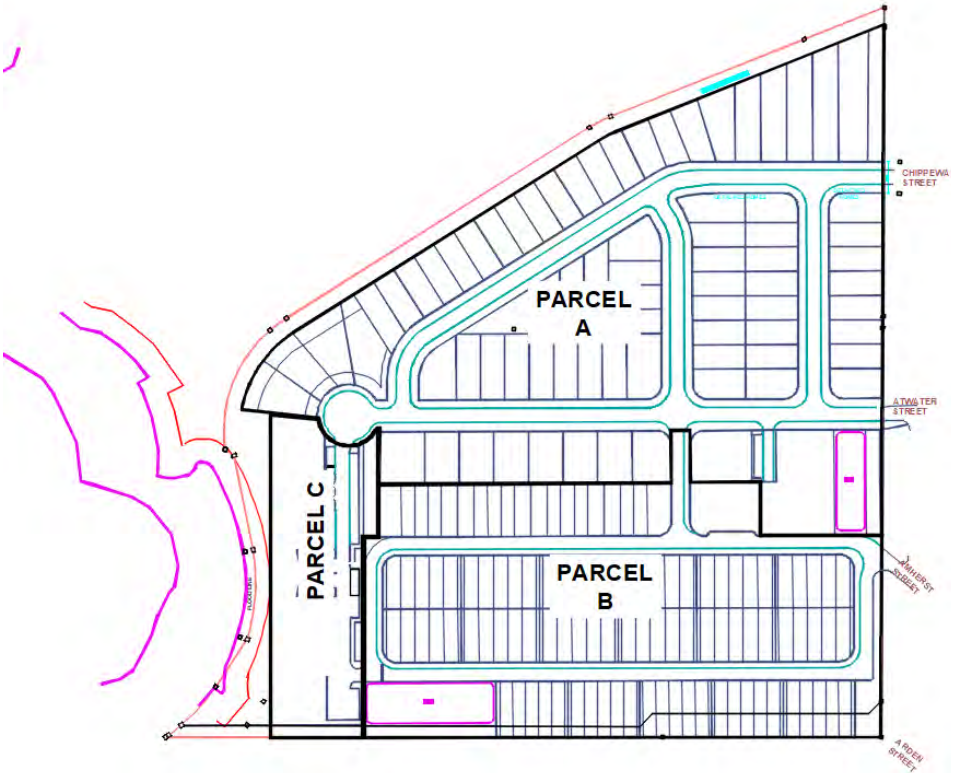


Figure 3 – Proposed Development Parcel Layout

3.1 Parcel A – Municipal Neighbourhood

Parcel A is a proposed extension of the existing Broadview Gardens neighbourhood. This parcel will include freehold lots for approximately 66 single family and 16 semi-detached houses, as well as a lot for commercial development and areas designated for public park space.

The road network in Parcel A will be constructed to municipal standard, and the City will ultimately assume ownership of the roads and sewers servicing these properties.

It is our understanding that the Parcel A development will be subject to a subdivision agreement with the City.

3.2 Parcel B – Townhouse Development

An adult lifestyle community is proposed in Parcel B, which will include approximately 104 townhouse units in a series of 4 to 5 unit blocks. This parcel will also include an amenity building for the use of residents. Roads, utilities, amenity building, etc. within Parcel B will be privately owned through a condominium corporation.

It is our understanding that the Parcel B development will be subject to a site plan control agreement with the City.

3.3 Parcel C – Apartment Buildings

It is proposed to construct two mid-rise (5 storey) apartment buildings in Parcel C, providing an estimated total of 180 residential units. The apartment buildings will be privately owned and operated.

Due to the location of the apartment buildings, servicing infrastructure such as sanitary sewer and watermain may transit Parcel B; thus a shared services agreement with the Parcel B condo corporation will be required.

It is our understanding that the Parcel C development will be subject to a site plan control agreement with the City.

4 Site Grading

4.1 Overall Considerations

As mentioned previously, the existing Site grading is relatively uniform with a low slope towards the southeast portion of the Site. There are existing drainage ditches and creeks bordering the south, west and north boundaries of the Site, and partially along the east boundary. The existing ditches have been constructed historically to provide storm water diversion and drainage for Broadview Gardens.

The proposed grading for the Site is intended to control stormwater surface runoff to ensure that adjacent properties are not adversely impacted by the development. This includes preventing the overland discharge of stormwater onto adjacent private property, accommodating existing flow paths to ensure drainage is maintained, avoiding flooding of adjacent properties, and conforming to other City requirements.

A Stormwater Management Plan (SWMP) has been developed and is presented in Appendix 4. The SWMP includes measures to ensure that the quantity/flow rate and quality of stormwater discharged from the Site meets the requirements of the City and the Sault Ste. Marie Region Conservation Authority (SSMRCA).

4.2 Parcel A Lot Grading and Yard Drainage

The City's Stormwater Design Guidelines stipulate that lot grading must ensure that positive drainage is provided for all lots; surface storage is not allowed in low-density and single-family residential developments. To accommodate this, minimum grades are established as shown on the Site grading plan in Appendix 5.

The Site grading plan illustrates that the surface drainage will meet or exceed the minimum required criteria, including:

- Minimum swale grade of 1%.
- Minimum swale depth of 200mm and width of 300mm.
- Rear-yard swales no longer than 90m.

Wherever possible, lots are graded to the street in order to avoid the need for rear-yard swales and catch basins.

4.3 Parcel B and Parcel C Site Grading

Similar to the grades in Parcel A, the proposed grading in Parcels B and C will be carried in order to avoid adverse impacts to abutting properties. Detailed grading plans will be included in the Site Plan Agreements for these future stages of the development.

5 Site Access and Egress

5.1 Existing Road Network

The Site is serviced with the following existing municipal streets in Broadview Gardens:

- Chippewa Avenue
- Atwater Street
- Amherst Street

The existing streets are Class A local roads consisting of paved surface with gravel shoulders and open ditches. The existing road network services the residential neighbourhood and connects to the collector and arterial routes at Goulais Avenue and Second Line.

5.2 Parcel A Proposed Roads

The proposed municipal roads in Parcel A will service the abutting single family and semi-detached lots, as well as the future townhouse development at Parcel B and the future apartments at Parcel C.

Municipal roads designs comply with the City's requirements, including:

- 20m road right-of-way.
- Class A construction including paved roads with concrete curb and gutter.
- Road catch basin drainage.
- Intersection configuration accommodating snow removal and turning movements.

The proposed municipal roads will connect to Chippewa and Atwater Streets.

5.3 Parcel B Proposed Roads

The townhouse development at Parcel B will be serviced by an internal loop road, connecting to the proposed extension of Atwater Street as well as to the end of Amherst Street. The road connection at Amherst Street will be configured to accommodate municipal snow clearing operations so that City equipment will not enter the private property.

5.4 Parcel C Proposed Roads

The apartment development at Parcel C will access the municipal road network via the proposed Atwater Street extension. Access will also be provided through the shared condo loop road at Parcel B.

5.5 Traffic Impacts

A traffic impact assessment has been completed for the proposed development. A copy of the study report is included in Appendix 6.

The conclusions presented in the traffic impact study indicate that the existing road network can accommodate the proposed development at full build-out.

6 Sanitary Sewer Servicing

6.1 Parcel A Sanitary Sewer

The proposed development at Parcel A will include the installation of sanitary sewers which will be assumed by the City. This municipal sewer system is designed in accordance with the provincial guidelines, as well as the City standards for sewer layout and construction.

The Parcel A sanitary sewer will discharge to the existing infrastructure on Chippewa Avenue. A review of the existing sanitary sewers on Chippewa Avenue and Goulais Avenue confirm that adequate capacity exists to accommodate the design flows.

The sanitary sewer design for Parcel A is based on the following criteria:

Population density	3.5 persons per lot
Domestic sewage flow rate	400 L/capita per day
Extraneous flow	0.15 L/h/s
Minimum sewer main size	250mm diameter

A copy of the sanitary sewer design calculations in included in Appendix 7.

6.2 Parcels B and C Sanitary Sewer

The proposed sanitary sewer accommodating flows from Parcels B and C will connect to the municipal sewer at the Arden Street.

The sanitary sewer design for Parcels B and C is based on the following criteria:

Population Density (townhouse)	3.5 persons per unit
Population Density (apartment)	2 persons per unit
Population Density (existing)	3.5 persons per lot
Domestic Sewage Flow Rate	400 L/capita per day
Extraneous Flow	0.15 L/h/s

A review of the Arden Street infrastructure reveals that the existing sanitary sewers may experience minor surcharge at full build-out and 100% occupancy of Parcels B and C. According to information provided by the City, approximately 120 metres of existing 300mm diameter sewer on Arden Street between Winfield Drive and Ascot Avenue is installed with a grade of 0.15% - well below the guideline minimum of 0.22%. Under the design criteria described herein, this section of existing sewer may experience pipe utilization of approximately 110% of capacity. The remainder of sewers on Arden Street are anticipated to operate at utilizations of less than 67% of capacity.

Although there is a portion of existing sewer which may experience flows 10% greater than capacity during the design peak flow scenarios, it is anticipated that the system will function without detrimental effects to the City and connected users.

7 Water Servicing

The existing water distribution system in Broadview Gardens, owned and operated by PUC Services Inc., includes the following potential connection points:

- 200mm watermain on Chippewa Avenue

- 300mm diameter watermain on Atwater Street
- 150mm diameter watermain on Amherst Street

Preliminary comments provided by PUC Services indicate that system pressures in this area are anticipated to be sufficient for the proposed development. Confirmatory hydrant flow testing will be required, and is to be coordinated with PUC Services Inc.

7.1 Domestic and Fire Flow Demand

The proposed development at the Site includes a total population at 100% build-out of approximately 855 people. The MECP Design Guidelines for Drinking Water Systems provides guidance for development of domestic flow demands as follows.

Using a design demand rate of 400 L per capita per day, and a maximum day factor of 2.75, the calculated maximum daily demand for water consumption at the Site is 10.89 L/s. The maximum hourly demand, with a peak rate factor of 4.13, is 16.35 L/s. The calculations are presented in Appendix 8.

Design fire flows for the Site are calculated using guidance from the Fire Underwriters Survey and the Ontario Building Code (OBC). For the purposes of determining the fire demand flow, it is proposed that a likely worst case condition design fire would include one entire 5 unit townhouse block with limited combustible contents.

Fire Underwriters Criteria	
Building footprint area	1500 sq. m.
Number of storeys	2
Construction Type	Type III (Common construction)
Occupancy	Group C residential
Exposure distance (side 1)	4m
Exposure distance (side 2)	4m
Exposure distance (rear)	20m

The calculations prepared in Appendix 8 conclude that a fire demand of 16,000 L/min (265 L/s) is appropriate for the proposed development at the Site. Note that this rate is calculated using the Fire Underwriters procedure as a worst case; OBC procedure results in a lower flow requirement.

The overall required design flow for the development is the sum of domestic (max day) and fire demand flows:

$$Q = 10.89+265 = 276 \text{ L/s (rounded)}$$

7.2 Parcel A Water Service

The proposed development on Parcel A will include water distribution infrastructure in accordance with the requirements of PUC Services Inc., including pipe size and material, hydrant spacing, isolation valve arrangements, etc.

Connections to the existing potable water network will be provided at Chippewa Avenue and Atwater Street. This will provide a looped water main with redundant supply and will provide pressure and flow balancing in the overall system. The proposed water system is shown on the design drawings attached in Appendix 9.

Service connections to private lots in Parcel A will be made in accordance with the requirements of PUC Services Inc.

7.3 Parcel B and Parcel C Water Service

The proposed water service for Parcels B and C will include a connection to the existing distribution system at Amherst Street, as well as the extension of Atwater Street in Parcel A. It is also proposed that there will be an interconnection between Parcels B and C. The proposed water system is shown on the drawings attached in Appendix 9.

PUC Services Inc. may require backflow prevention and metering at the property boundaries for Parcels B and C. The detailed design of this will be determined during the site plan approval process.

8 Stormwater Management

8.1 General Requirements

The City requires that the developer implement a stormwater management plan (SWMP) for the Site. The plan is intended to address the quantity/rate of stormwater discharge from the Site, as well as the quality of the water leaving the Site. The stormwater management design also includes the roadway drainage infrastructure such as sewers, maintenance holes, catch basins, inlet and outlet structures.

In accordance with the City of Sault Ste. Marie's Stormwater Management Policy, the peak rate of stormwater flow leaving the Site following development should not exceed the peak rate prior to development. In Sault Ste. Marie, this quantity control is typically accommodated through the construction of a dry pond or subsurface storage. The City policy also outlines quality parameters which must be addressed.

A copy of the SWMP for the Site is attached in Appendix 4.

8.2 Parcel A Stormwater Management

Stormwater drainage for Parcel A will be provided through a dual system approach consisting of a minor system of piped storm drains as well as a major system with overland drainage paths. The City requires that the minor system accommodate a storm event with a 10 year return period, whereas larger flows will be handled by the major system.

A stormwater management facility (SWMF) proposed for Parcel A will include one dry pond with an outlet piped to the West Davignon Creek channel. The pond will provide quantity and quality control as required by the City.

8.3 Parcel B and Parcel C Stormwater Management

Similar to the approach for Parcel A, the stormwater drainage system for Parcels B and C will be accommodated through a dual system approach consisting of minor and major systems.

A separate, private, SWMF will be constructed in Parcel C to accommodate the stormwater quantity and quality treatment required for these parcels. The SWMF will consist of a dry pond with outlet to the West Davignon Creek Channel.

9 Electrical and Roadway Lighting

Electrical servicing and roadway lighting for the proposed development will be provided by the local hydro utility, PUC Distribution Inc. During the detailed design of the development, PUC Distribution Inc. will be consulted to ensure their requirements are accommodated.

10 Other Utilities Servicing

It is anticipated that the proposed development will be serviced by additional utilities such as:

- Enbridge (natural gas)
- Rogers Communications (Telecom)
- Bell Canada (Telecom)

Each of these utilities currently have existing services in Broadview Gardens adjacent to the Site.

11 Conclusions

Based on the information above, the following conclusions are presented

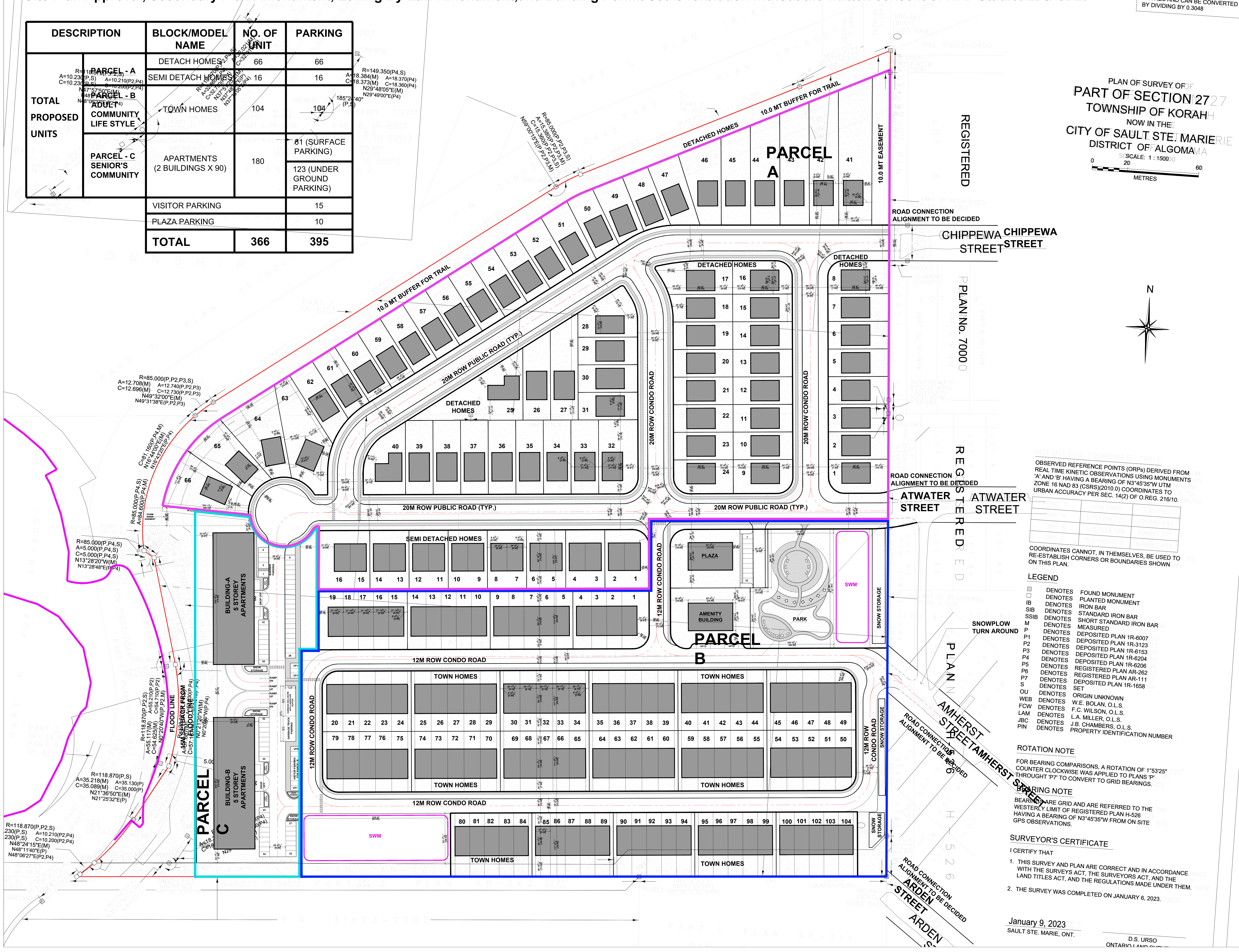
1. The proposed development of the Site is functionally feasible.
2. The site can be adequately serviced with Municipal sanitary sewer, potable water and transportation networks.
3. Stormwater management meeting the requirements of the City is achievable.
4. The extension of existing gas, hydro and telecommunications infrastructure will be required to service the proposed development.

Appendix 1

Proposed Site Plan

The Master Plan, Site Plan, Floor Plans, and Renderings are the copyright of the design firm-RPD Studio. Any reproduction including the preparation of the Draft Plan, Vacant Land Condominium Plan, Site Plan Approval, Secondary Plan Amendment, Zoning By-Law Amendment,and Building Permit Set is forbidden without the written consent of RPD Studio. E. & O. E.

DESCRIPTION		BLOCK/MODEL NAME	NO. OF UNIT	PARKING
TOTAL PROPOSED UNITS	PARCEL - A	DETACH HOMES	66	66
		SEMI DETACH HOMES	16	16
	PARCEL - B ADULT COMMUNITY LIFE STYLE	TOWN HOMES	104	104
	PARCEL - C SENIOR'S COMMUNITY	APARTMENTS (2 BUILDINGS X 90)	180	61 (SURFACE PARKING) 123 (UNDER GROUND PARKING)
		VISITOR PARKING		15
		PLAZA PARKING		10
		TOTAL	**366**	**395**



METRIC

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

PLAN OF SURVEY OF
PART OF SECTION 27
TOWNSHIP OF KORAH
NOW IN THE
CITY OF SAULT STE. MARIE
DISTRICT OF ALGOMA
SCALE: 1 : 1500
0 20 60
METRES

INTEGRATION COORDINATE TABLE

OBSERVED REFERENCE POINTS (ORPs) DERIVED FROM REAL TIME KINETIC OBSERVATIONS USING MONUMENTS 'A' AND 'B' HAVING A BEARING OF N3°45'35"W UTM ZONE 16 NAD 83 (CSRS)(2010.0) COORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O.REG. 216/10.

POINT ID	NORTHING	EASTING
ORP A	5157796.172	699895.642
ORP B	5157559.199	699911.217
ORP C	5157999.618	699882.453

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

LEGEND

■	DENOTES	FOUND MONUMENT
□	DENOTES	PLANTED MONUMENT
IB	DENOTES	IRON BAR
SIB	DENOTES	STANDARD IRON BAR
SSIB	DENOTES	SHORT STANDARD IRON BAR
M	DENOTES	MEASURED
P	DENOTES	DEPOSITED PLAN 1R-6007
P1	DENOTES	DEPOSITED PLAN 1R-3123
P2	DENOTES	DEPOSITED PLAN 1R-6153
P3	DENOTES	DEPOSITED PLAN 1R-6204
P4	DENOTES	DEPOSITED PLAN 1R-6206
P5	DENOTES	REGISTERED PLAN AR-262
P6	DENOTES	REGISTERED PLAN AR-111
P7	DENOTES	DEPOSITED PLAN 1R-1658
S	DENOTES	SET
OU	DENOTES	ORIGIN UNKNOWN
WEB	DENOTES	W.E. BOLAN, O.L.S.
FCW	DENOTES	F.C. WILSON, O.L.S.
LAM	DENOTES	L.A. MILLER, O.L.S.
JBC	DENOTES	J.B. CHAMBERS, O.L.S.
PIN	DENOTES	PROPERTY IDENTIFICATION NUMBER

ROTATION NOTE

FOR BEARING COMPARISONS, A ROTATION OF 1°53'25" COUNTER CLOCKWISE WAS APPLIED TO PLANS 'P' THROUGHT 'P7' TO CONVERT TO GRID BEARINGS.

BEARING NOTE

BEARINGS ARE GRID AND ARE REFERRED TO THE WESTERLY LIMIT OF REGISTERED PLAN H-526 HAVING A BEARING OF N3°45'35"W FROM ON SITE GPS OBSERVATIONS.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT, AND THE LAND TITLES ACT, AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON JANUARY 6, 2023.

January 9, 2023
SAULT STE. MARIE, ONT.

D.S. URSO
ONTARIO LAND SURVEYOR

RPDS
INTEGRATED DESIGN FIRM
SUITE 203, 7895 TRANMERE DR., MISSISSAUGA, ON L5S 1V9
MAIL: PROJECT@RPDSTUDIO.CA, CALL: 647-556-2596
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DEVELOPED BY:
MAMTA HOMES

CONSULTING ENGINEER :
KRESIN
Engineering Corporation

FOR REVIEW ONLY
(NOT FOR PERMIT)

No.	Revision	Date
01	Issued For Review	2023/08/23

Client Name:

Drawing Title:

Project:

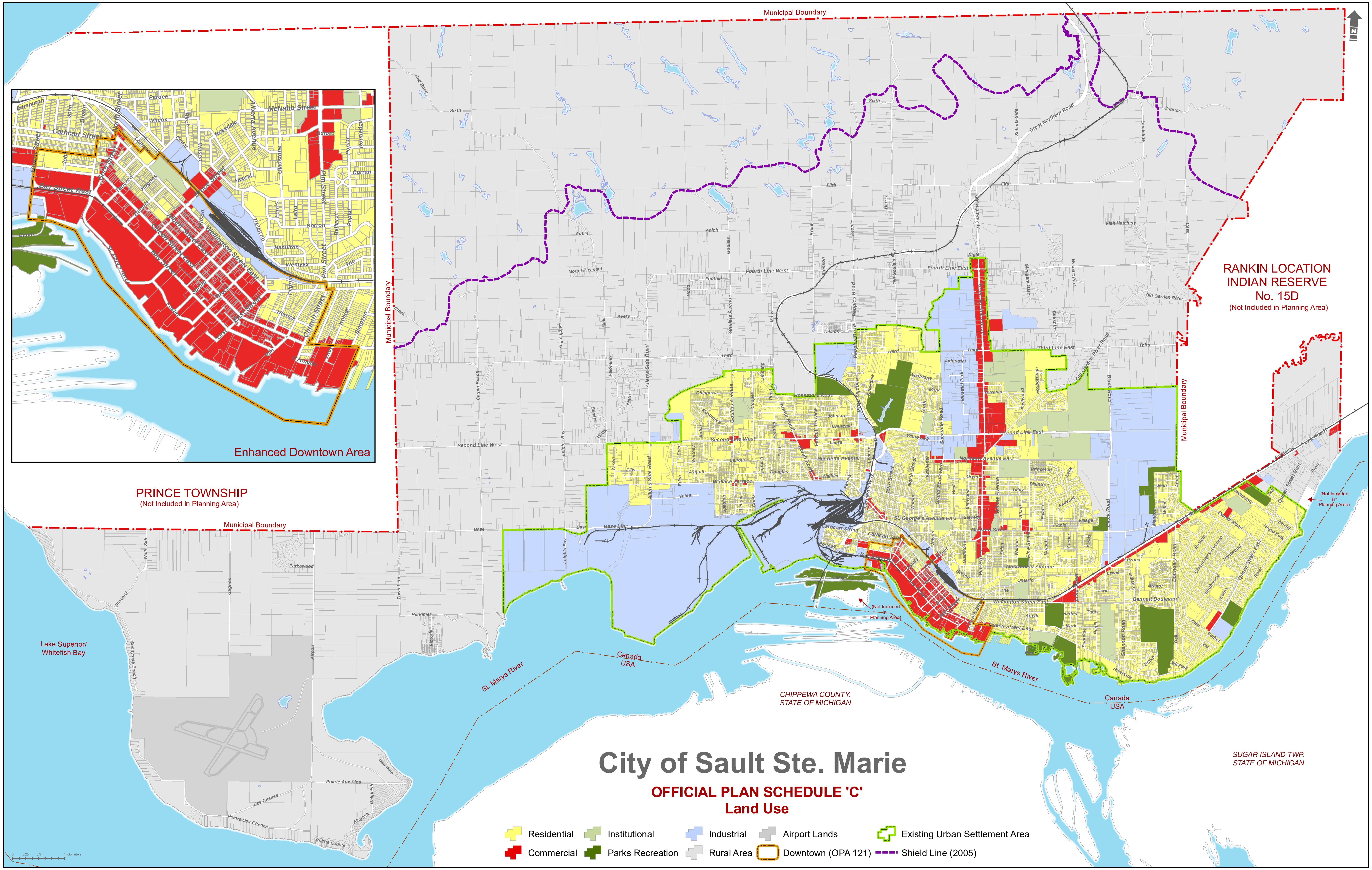
0 CHIPPEWA STREET
CITY OF SAULT STE. MARIE
DISTRICT OF ALGOMA

N

Scale: 1"=80'-0"
Drawn by: HL
Checked by: RP
Project No.:
Date: 2023/08/23
Drawing No.: **A-2.0**

Appendix 2

Sault Ste. Marie Official Plan Schedule C – Land use



City of Sault Ste. Marie

OFFICIAL PLAN SCHEDULE 'C'

Land Use

🟨	Residential
🟩	Institutional
🟦	Industrial
⬜	Airport Lands
🟩	Existing Urban Settlement Area
🟥	Commercial
🟩	Parks Recreation
⬜	Rural Area
🟧	Downtown (OPA 121)
╌	Shield Line (2005)

Appendix 3

Geotechnical Report

Geotechnical Investigation Report

Proposed New Subdivision

0 Chippewa Street, Sault Ste. Marie, Ontario

Prepared for:

Mr. Harjinder Kang, President
Mamta Homes
44 Aster Drive
Wasaga Beach, ON L9Z 2Z8

Prepared by:

Down to Earth Geotechnical Engineering
253 Old Garden River Road
Sault Ste. Marie, ON, P6B 5A7

February 21, 2023
Project No. G22042

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APPENDICES

FIGURES

1.0 INTRODUCTION & SCOPE

Down to Earth Geotechnical Engineering (Down To Earth) is pleased to provide our Geotechnical Investigation Report for a proposed new residential subdivision to be located on approximately 37 acres of vacant properties, at the west end of Chippewa Street in Sault Ste. Marie, Ontario. The Site location is shown on Figure 1 in Appendix A.

The geotechnical investigation and engineering evaluation was performed in accordance with Down to Earth's proposed scope of work outlined in our December 21, 2022 Proposal (G22042), which was signed off by Mr. Harjinder Kang of Mamta Homes.

It is understood by Down to Earth that the proposed new residential subdivision will comprise of detached homes, semi-detached homes, town homes, apartments, as well as the associated infrastructure required to develop a residential subdivision.

Since the project is in the early stages of development and there were no structural or architectural drawings available for the proposed apartment buildings, the geotechnical borehole investigation program was performed for the proposed residential houses and associated infrastructure (i.e. roadways, sewers and water services). As such, foundation recommendations for the proposed apartment buildings are not discussed in this report.

In general, the Geotechnical Investigation was required to delineate and evaluate the general subsurface soil and groundwater conditions, and based on the factual information obtained, provide geotechnical engineering design and construction recommendations, as well as provide engineering guidelines on the geotechnical aspects of the project that could influence design and construction decisions from a geotechnical perspective.

This was accomplished by advancing a total of 10 strategically placed exploratory boreholes (BH1 to BH10) and instrumenting 2 of the boreholes (BH9 and BH10) with piezometers (monitoring wells, MW1 and MW2) within the boundaries of the proposed subdivision, while avoiding underground site services. The approximate spatial location of the boreholes/monitoring wells are indicated on Figure 2 in Appendix A.

Based on the results of the geotechnical investigation, soil laboratory testing, and geotechnical engineering analysis, the following geotechnical investigative processes, recommendations and construction considerations are provided:

- Geotechnical Field Investigation and Methodology;
- Geophysical Logging of Subsurface Conditions & Soil Laboratory Test Results;
- General Subsurface Soil and Groundwater Conditions (Soil Stratigraphy);
- Borehole Logs and Location Plan;
- Foundation Type(s) and Soil Bearing Pressures at Serviceability Limit States (SLS) design for Residential Construction;
- Potential Total and Differential Foundation Settlements;
- Soil Subgrade Preparation and Improvement as/if required;
- Foundation Frost Protection Considerations;
- Interior Building Concrete Floor Slab-on-grade Granular Support Material;
- Suitability and Potential Re-use (recycling) of excavated soil as backfill;
- Sewer Pipe Bedding and Trench Backfill requirements;
- Granular Backfill and Compaction Requirements;

- Frost Mitigation Strategies for watermains (i.e. frost protection) using granular backfill and/or equivalent insulation thickness;

- Asphalt Pavement Structure Design Recommendations including subgrade, road base and construction recommendations in accordance with City practice;

- Surface and Subsurface Drainage Requirements (Systems) to enhance the performance and longevity of the pavement structure;

- Geotechnical Design Considerations for Constructability;

    - Open Cut Trench Excavations above and below the estimated groundwater table including the stability of temporary sloped excavations including bracing as/if required; and,

    - Anticipated Groundwater Management (dewatering).

This report contains our factual geotechnical comments and recommendations, based on our understanding of the project scope, our geotechnical field investigation, and previous geotechnical information in the area.

Abbreviations, terminology and principle symbols commonly used throughout the report and appendices are enclosed in Appendix B.

2.0 GEOTECHNICAL FIELD INVESTIGATION AND METHODOLOGY

The geotechnical field investigation consisted of advancing a total of 10 sampled exploratory boreholes (BH1 to BH10) from January 19 to 24, 2023. The boreholes were advanced to between about 4.4 to 5.9 meters (m) below existing grades, where they were terminated within a varved natural silt to silty clay soil deposit. The approximate spatial locations of the boreholes are indicated on Figure 2 in Appendix A.

The boreholes were advanced for the proposed roadway, sewer, water and residential building foundation construction.

To obtain the necessary subsurface geotechnical engineering data, the exploratory boreholes were advanced with conventional geotechnical drilling machinery, equipped with geotechnical soil sampling equipment consisting of 150 mm diameter continuous flight hollow stem augers, 51 mm outside diameter split-spoon sampler, and AW rods.

Soil samples were collected from the flights of the hollow stem augers, as well as from the split-spoon sampler in conjunction with Standard Penetration Tests (SPT), “N” values (ASTM D1586) at regular geotechnical intervals. The SPT “N” values were used to give a qualitative evaluation of the compactness condition of non-cohesive soils (i.e., sands and non-plastic silts) and roughly estimate the consistency of cohesive soils (i.e. plastic silt and clay). Field vane testing was performed in cohesive soils to estimate the materials in-situ undrained shear strength properties in accordance with ASTM D2573-72. We note that the soil stratums were interlayered with silt and clay seams. As such, the field vane measurements may have been performed in a more silty material than what was previously retrieved within the split spoon barrel, which tends to result in higher undrained shear strengths due to the increased silt content.

Upon completion of soil sampling, each borehole was checked for groundwater and then subsequently backfilled with auger cuttings and sealed with Bentonite pellets in accordance with MECP Regulation 903 (as amended).

Boreholes BH9 and BH10 were instrumented with a Casagrande piezometer (monitoring well) to a depth of about 6 m below the ground surface in accordance with MECP Regulation 903 (as amended), in order to measure the stabilized groundwater at a later date.

The borehole drilling operations were supervised fulltime by Down to Earth’s geotechnical engineering staff. Recovered soil samples were evaluated and logged in the field by an experienced geotechnical representative, in accordance with the Modified Unified Soil Classification System (M-USCS). Collected soil samples were sealed into moisture proof bags and transported back to our laboratory for further visual and tactile examination by the geotechnical engineer. Soil laboratory analysis was completed on representative select soil samples to determine natural moisture contents, and particle/grain size distribution.

3.0 GENERAL SUBSURFACE CONDITIONS

3.1 Geophysical Logging & Soil Laboratory Testing

The geophysical loggings of the soil and groundwater conditions were performed to collect geotechnical engineering design information.

The subsurface (soil and groundwater) conditions and laboratory tests performed on select representative soil samples encountered within the boreholes are presented in detail on the borehole logs in Appendix C. The borehole log indicates the subsurface conditions at the specific test location only.

The borehole logs include textural descriptions of the subsoil in accordance with the Modified Unified Soil Classification System (M-USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The M-USCS classification is explained in further detail in Appendix B.

Select soil samples collected from the boreholes were submitted to our Materials Testing Laboratory to determine the natural water content and particle size distribution of the soils. Laboratory analytical reports are included in Appendix D.

It is noted that due to the limitations of retrieving soil samples with a 51 mm outside diameter (35 mm inside diameter) split spoon barrel, the particle size distribution results may not be fully representative of the in-situ soil matrix and reflect the larger particles observed by geotechnical personnel in the field. These observations are reflected on the borehole logs and discussed throughout the report.

In addition, testing was performed on disturbed soil samples and is subject to an according degree of error. As such, all geotechnical data requires interpretation by Down to Earth or an experienced geotechnical engineering consultant who is familiar with the local soil types and conditions.

3.2 Subsurface Profile

3.2.1 Duff/Organics

Approximately 50 mm of duff/organics were encountered from the ground surface within all boreholes.

The duff/organics consisted of wild vegetation, such as wild grass, and other vegetative matter, such as leaves, twigs, and etcetera, that overlaid black organics that were wet at the time of the investigation.

3.2.2 Natural Subgrade Soils

The natural subgrade soils encountered below the duff/organics, consisted of transitioning phases/interlayering of varved silty clay to silt, which extended to the borehole termination depths of between about 4.4 and 6 m below existing grades within all boreholes.

The silty clay was brown to grey in colour, damp to wet (below ~ 1.2 m), varved, soft to firm in consistency and of medium to high plasticity. The undrained shear of the material ranged from about 20 to 50 kPa, and increased in strength with depth in a portion of the boreholes. However, it is noted that the silty clay in the area is known to decrease in strength below about 4 to 5 m below grade. It is also noted that some of the higher undrained shear strengths could be a result of performing the field vane measurements in a material that has a higher silt content than observed in the previous soil sample.

The silty clay soil is susceptible to long-term consolidation settlements with an increase in effective stress due to installing earth/granular fill materials above the current grades.

The silt generally contained trace to some clay, was grey in colour, wet and loose to very loose.

Based on previous geotechnical information within the area, the silty clay and silt materials can be expected to extend to a sand soil deposit suspected to be encountered between about 60 to 70 m below grade and possibly more. The sand material is expected to overly glacial till, which overlays sandstone bedrock, which is expected to be encountered between about 80 to 90 m below grade.

3.2.3 Groundwater Observations – Measured and Inferred

2 weeks after the installation of the piezometers within boreholes BH9 and BH10, the natural groundwater was measured at about 1.2 below the ground surface, and is represented on the borehole logs with an inverted triangle

Based on field observations and laboratory testing, the natural groundwater was estimated and/or inferred to be located at approximately 1.2 m below grade in the remaining boreholes.

Upon completion of drilling, all boreholes were wet at the base.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall or in response to a particular precipitation event should be expected, and lower levels occurring during dry weather conditions.

4.0 GEOTECHNICAL GUIDELINES, DESIGN RECOMMENDATIONS, CONSIDERATIONS & COMMENTS

4.1 Residential Foundation Discussion & Recommendations

The recommendations presented in the following sections of this report are based on the information available regarding the proposed construction, the results obtained from our investigation, and our experience with similar projects. Because the investigation represents a small portion of the subsurface conditions, it is likely that conditions may be encountered during construction that are substantially different than those encountered during our investigation. If these situations are encountered, adjustments to the design may be necessary. A qualified geotechnical representative should be on Site during the foundation preparation and Site development to ensure the subsurface conditions are the same/similar to what was observed during the geotechnical field investigation.

Based on the information obtained from the geotechnical investigation, soil laboratory testing, and geotechnical engineering analysis, the proposed residential structures can be supported by conventional shallow strip and spread footings bearing directly on the undisturbed natural silty clay soil deposit, provided the recommendations outlined in this report are followed.

The natural soil deposits at this site are considered susceptible to frost heave movements during freezing conditions. As such, to mitigate potential foundation frost heave movements, it is typical building practice to establish shallow foundations with a minimum of 1.5 m of soil cover above the underside of the foundation. It is noted that the geotechnical exploratory borehole investigation indicates that the natural subgrade soils tend to become weaker with depth. As such, to support the proposed residential structures on conventional strip and spread footings, the following foundation considerations are provided:

- **Option 1** - Establish the foundations at 1.5 below the existing grade on undisturbed firm silty clay, with strip footing widths not exceeding 0.6 m wide and spread footings not exceeding 1.2 m by 1.2 m, in order to reduce the pressure (stress) on the underlying weaker soil deposit(s);
- **Option 2** - Install the foundations at a higher elevation on undisturbed firm silty clay to reduce the pressure on the underlying weaker soil deposits, and provide a combination of soil cover and rigid insulation to

mitigate possible soil frost heave movements. This option will allow for larger strip and spread footing dimensions; and/or

- **Option 3** - Install the foundations on either a compacted granular engineered fill pad and/or a granular engineered fill pad reinforced with a non-woven geotextile (Terrafix 360R or equivalent product).

For **Option 1**, an approximate unfactored allowable bearing reaction of 75 kPa at Serviceability Limit States (SLS) design may be used at the underside of the proposed foundations. The recommended maximum strip and spread footing widths are to keep the pressure (stress) on the underlying loose silt deposit to 50 kPa or less.

For **Option 2**, an approximate unfactored allowable bearing reaction of 75 kPa at SLS design may be used at the underside of the proposed foundations. However, provided the pressure on the underlying loose silt material is limited to 50 kPa or less, then the strip and spread footing dimensions may be increased accordingly. For example, if the foundations are established 1 m below the existing grade on the undisturbed firm silty clay soil deposit, then strip footing widths can be increased to 0.9 m and spread footings to 1.8 m by 1.8 m. All foundations are to have a minimum of 600 mm of soil cover above the underside of them, and not exceed the aforementioned foundation sizes.

Frost protection with rigid insulation will be a function of the foundation depth below the ground surface.

For **Option 3,** the unfactored allowable bearing reaction can be increased above 75 kPa with various foundation sizes (ex. smaller than outlined in Option 2). The allowable soil bearing reaction would be a function of the foundation sizes and the design of either a compacted granular engineered fill pad and/or a granular engineered fill pad reinforced with a non-woven geotextile (Terrafix 360R or equivalent product), as well as the final thickness of the engineered pad(s). The crux of the design is to keep the majority of the stresses within the engineered fill pad and reduce it on the underlying weaker soil deposits. Should this option is considered, then Down to Earth can provide appropriate design recommendations based on the loading/bearing pressure(s) and foundation sizes proposed by the structural engineer. General engineered fill material specifications and installation requirements are outlined in Section 4.3 of this report.

Any potential grade increases with granular fill materials are to be considered when evaluating the foundation bearing pressures, and the pressure at the underside of the foundation reduced accordingly. For example, should the grade be increased by 0.5 m, and assuming a unit weight of soil of 20 kN/m^3, then the bearing pressure should be reduced by 10 kPa from 75 to 65 kPa at SLS design. Grade increases are to limited to 600 mm of the original elevation of the surface of the natural silty clay soil deposit.

Since a relatively small quantity of boreholes were advanced at the Site compared to the size of the Site, it is noted that there could be pockets of weaker soils that were not encountered. As such, if observed during the excavation works for the foundation installation, then the unfactored allowable bearing reaction at SLS may have to be reduced accordingly. If it is determined that the soil bearing is to be reduced, then we would expect it to **not** be less than about 50 kPa at SLS design. However, the actual allowable soil bearing must be confirmed by a qualified representative at the time that the excavations take place.

The allowable bearing reactions provided also assumes that all footings will be constructed to the minimum sizes outlined in the latest edition of the Ontario Building Code, as well as this report.

The unfactored reaction at SLS is based on an estimated settlement of 25 mm or less with differential settlements of 19 mm or less.

Since the natural soils tend to vary in strength across the site, we recommend that the foundation walls be constructed of poured concrete reinforced with nominal reinforcing steel bars, to mitigate any potential foundation wall cracking versus a concrete block wall.

The recommended design bearing pressure assumes that all geotechnical recommendations outlined in this report are followed.

Depending on the subgrade conditions at the time of construction a 100 to 150 mm thick layer of Granular "A" (OPSS 1010) or a 19 mm diameter Clear Stone gravel (OPSS 1004) may be beneficial to protect the integrity of the natural subgrade soils during the installation and construction of the foundations.

Prior to the installation of the footings, the natural silty clay soil is to be inspected and approved by a certified building inspector or qualified geotechnical representative to ensure that the material conforms with the soil type and consistency observed during the subsurface investigation work. This will either consist of proof roll compaction with minimum 10 tonne non-vibratory steel drum roller, under the direction of geotechnical personnel and/or tactile inspection with a geotechnical probe rod.

4.2 General Shallow Foundation Subgrade Preparation

The natural subgrade soils are sensitive to change in moisture content and can become loose if the soils are subject to excessive precipitation prior to the installation of the foundations. As well, they could be easily disturbed if travelled on during construction. Once they become disturbed, they are no longer considered adequate for the support of shallow foundations. It is noted that the permeability of the silty clay soil is low to very low and should not require significant effort to remove the release of water from within it. To ensure and protect the integrity of the subgrade soil during construction operations, the following is recommended:

- The subgrade should be sloped to promote surface drainage and the collected water pumped out of the excavation. It is critical that water be controlled and the subgrade preparation work commence in the dry. Continuous groundwater control is critical to prevent the soils from becoming loose/soft;
- It is critical that 24 hour groundwater control be performed during the installation of the foundations and until all concrete for the proposed foundations is installed, set and backfilled;
- Construction equipment traffic on the subgrade soils should be avoided;
- The foundations should be installed as soon as practically possible after the excavation subgrade is exposed. The longer the excavated subgrade soil remains open to weather conditions and potential water seepage, the greater the chance for construction problems to occur, and increase compromising the integrity of the subgrade soils; and,
- Once the foundations are installed, they should be backfilled as soon as practically possible.

Should the subgrade soils become disturbed during construction or pockets of unstable or unsuitable areas be encountered, Down to Earth can provide appropriate recommendations at the time, which may include but not be limited to the following:

- Compaction of the subgrade soil;
- Removal of subgrade material and subsequent replacement with engineered fill;
- Placement of a non-woven geotextile;
- Placement of geogrid; and/or,
- Installation of a minimum 75 mm thick low strength (1 MPa) concrete mud slab immediately upon excavation of the exposed soils.

If construction proceeds during freezing weather conditions, the subgrade soils and any potential fill materials must be maintained above freezing or thawed prior to construction works and the installation of concrete.

Prior to installing the foundation form work and/or engineered fill for the foundations, the subgrade soils are to be inspected and approved by a certified building inspector or a qualified geotechnical engineering representative to ensure that the material conforms with the soil type and consistency observed during the subsurface investigation work. If the soils are not consistent with the observations made from within the boreholes or geological information in the area, Down to Earth can provide appropriate recommendations at that time.

4.3 General Engineered Fill Material Specifications and Installation Requirements

If required, the following outlines our general recommendations for the installation of granular engineered fill material, which must be reviewed prior to finalizing any potential foundation construction design.

Any potential granular engineered fill material installed below the foundations should consist of a Granular “A” Ontario Provincial Standard Specification 1010 (OPSS 1010) compacted in maximum 200 mm thick loose lifts to 100% Standard Proctor Maximum Dry Density (SPMDD). The Granular “A” should have a minimum thickness of 100 mm. Below the Granular “A” fill material, either a Granular “B” Type I or Type II can be used to increase the grade above the natural subgrade soils.

A Granular “B” Type I (OPSS 1010), should be placed in maximum 200 mm thick loose lifts and compacted to a minimum of 98% SPMDD.

Should surface or groundwater be an issue during construction, then a non-woven geotextile, such as a Terrafix 270R (or equivalent product) should be installed directly over the natural subgrade soils combined with the installation of 150 mm of 19 mm diameter Clear Stone gravel (OPSS 1004) for drainage purposes and controlling the water. The Clear Stone should contain a minimum of 50% crushed particles. The Clear Stone will help distribute footing pressures and protect the integrity of the subgrade soils during the construction. Water collected within the stone should be controlled through sumps and filtered pumps. The subgrade soils should be graded to drain to appropriate drainage areas and pumped away from the excavation if necessary.

The Clear Stone and the Granular “B” Type II should be vibratory compacted to a compact state, compacted in maximum 200 mm thick loose lifts. If Clear Stone is used to support foundations, then it should not exceed a thickness of 300 mm.

All engineered fill material installed below the underside of the foundations should extend a minimum horizontal distance of 300 mm beyond the outside face of the foundations and slope down at 1H:1V to ensure the foundation loads are properly transferred to the underlying undisturbed natural subgrade soils.

All individual spread footings are to bear entirely on natural soils or engineered fill, and not a combination of both.

Prior to the installation of a granular engineered fill pad, all deleterious materials and organics must be removed to a suitable undisturbed natural subgrade soil.

A qualified geotechnical engineering representative should be on site to observe fill placement operations and perform field density tests at select locations throughout each lift, to ensure the specified compaction is being achieved.

For Granular “A” and Granular “B” Type I material, a nuclear density gauge should be used for each lift to ensure that the material is compacted to the recommended SPMDD. For Granular “B” Type II and Clear Stone material, routine visual and tactile inspections should be performed during the placement of the material to ensure adequate compaction is achieved. Prior to the start of the project, a sample of each material type is required for laboratory testing to determine the materials’ SPMDD and/or grain size distribution for conformance with OPS Specifications.

Provided the engineered fill is prepared as outlined in this section, it should be capable of supporting a net allowable bearing reaction of 75 kPa or more at SLS design.

The recommended design bearing pressures assume that the groundwater is adequately controlled and the natural soil does not become loose during construction due to basal heave.

4.4 Vertical Transition of Strip Footings

Where strip footings are founded at different elevations, the subgrade soil is to have a maximum slope of 2H:1V, with a maximum rise of 600 mm and a minimum run of 600 mm between each step footing, as detailed in the latest edition of the Ontario Building Code.

4.5 Foundation Offsets

To avoid stress bulb interaction between footings, any potential parallel strip footings are to be spaced a minimum distance of one and half times the footing width apart from each other, and individual spread footings are to be spaced a minimum distance of one and a half times the largest footing width apart from one another. This assumes the footings are at the same elevation.

Foundations which are to be placed at different elevations in soils or near service trenches should be located such that the footings are separated by a minimum slope of 2H:1V with an imaginary line drawn from the underside of the lower foundation or bottom of the service trench to the outside bottom edge of the foundation facing each other.

4.6 Shallow Foundation Estimated Settlements

Foundations installed in accordance with the recommendations as outlined in the previous sections are not expected to exceed total settlements of 25 mm and differential settlements of 20 mm.

4.7 Soil Frost Susceptibility and Shallow Foundation Frost Protection

Where the interior of the building is heated to 18 degrees Celsius or more, perimeter shallow foundations are provided with a minimum of 1.5 m of soil cover frost protection above the underside of the foundation, and for unheated areas, 1.8 m of soil cover frost protection is typically provided.

Where the above cannot be achieved for perimeter foundations, an equivalent combination of soil cover and rigid insulation is installed above the underside of the foundation to mitigate possible soil frost heave movements.

For unheated foundations, a rigid insulation may be placed below the underside of the footing in combination with a frost free granular backfill material, provided the rigid insulation satisfies the required compressive strength requirements to withstand the foundation bearing pressure. All insulation material is to be installed in accordance with the manufactures recommendations.

4.8 Foundation Wall Backfill for Frost Protection & Drainage

To assist in maintaining the proposed residential buildings dry from surface water seepage, it is recommended that exterior grades around the building be sloped away at a 2% gradient or more, for a distance of at least 2.0 m. Roof drains should discharge a minimum of 1.5 m away from the buildings to a drainage swale or appropriate storm drainage system so that surface water is diverted away from the foundation to mitigate soil frost adhesion.

For residential buildings, exterior perimeter foundation drains are also to be installed. The foundation drains should consist of a minimum 100 mm diameter fabric wrapped perforated drainage tile surrounded by 19 mm diameter Clear Stone (OPSS 1004) with a minimum cover of 100 mm on top and sides and 50 mm below the drainage tile. The water collected from the weeping tile should be directed away from the building to appropriate drainage areas, either through gravity flow or interior sump pump systems. All subsurface walls should be damp proofed above the water table and water proofed below the water table.

To minimize potential frost movements from soil frost adhesion, the exterior foundation wall backfill should consist of a free-draining non-frost susceptible granular material, such as a Granular “B” Type I or a Granular “B” Type II (OPSS 1010). The backfill is to extend a minimum lateral distance of 600 mm beyond the outside face of the wall.

The backfill material used against the foundation must be placed so that the allowable lateral capacity is not exceeded. Ideally, during backfilling operations, all backfill material should be placed on each side of the foundation wall in equal lifts not exceeding 200 mm, compacted to a minimum of 97% SPMDD.

4.9 Concrete Floor Slab-on-Grade (Heated Areas Only)

The following recommendations assume that the residential floor slab is not connected to any load bearing walls or columns, and the floor slab is lightly loaded.

The concrete floor slab-on-grade is to be established on a minimum of 150 mm of engineered fill material, consisting of 19 mm Clear Stone (OPSS 1004), combined with an appropriate moisture barrier. The clear stone is to be compacted to a compact state with a vibratory plate tamper.

Prior to the installation of any engineering fill material, all deleterious and organic materials are to be removed down to the undisturbed natural subgrade soils.

Where subgrade soils are wet, it may be necessary to place a non-woven geotextile (Terrafix 270R or equivalent) prior to placing any fill material to act as a separation medium. The geotextile will also minimize the underlying fine grained natural soils from pumping up into the engineered fill due to construction traffic.

4.10 General Reuse of Excavated Material

The natural soils contain a significant amount of silt sized particles, which are considered highly frost susceptible and shouldn’t be used as engineered backfill material against any foundation walls.

They may be used for general landscaping purposes, provided they are deemed environmentally safe to do so by a qualified environmental engineering firm.

4.11 Underground Service Pipes

4.11.1 Bedding and Cover Materials for Flexible and Rigid Pipes

Service pipes require an adequate base to ensure proper pipe connection and positive flow is maintained post construction. As such, pipe bedding material is to be of uniform thickness, compactness and shaped to receive the bottom of the pipe. In general, the pipe bedding and backfilling materials are to conform to OPSD 802.010 specifications for flexible pipes.

The pipe bedding material should consist of a minimum thickness of 150 mm Granular A (OPSS 1010) below the pipe and extend up the sides to the spring line. In certain situations, the bedding thickness may have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered. The backfill material surrounding the pipe from the spring line up should consist of a stone free Granular B Type I (OPSS 1010) placed in maximum 200 mm thick loose lifts, at the same elevation on both sides of the pipe and extend to a minimum of 300 mm above the top of the pipe. The granular backfill should be compacted to 98% of SPMDD.

The bedding material, pipe, and cover material should be installed as soon as practically possible after the excavation subgrade is exposed. The longer the excavated subgrade soil remains open to weather conditions and groundwater seepage, the greater the chance for construction problems to occur.

Although not anticipated, where it is difficult to stabilize the subgrade due to groundwater or the material is at a higher than optimum moisture content, a Granular “B” Type II material may be required. Alternatively, if constant groundwater infiltration becomes an issue, then an approximate 150 mm thick granular pad consisting of 19 mm Clear Stone gravel (OPSS 1004) wrapped in a non-woven geotextile (Terrafix 270R or equivalent) should be considered to maintain the integrity of the natural subgrade soils. The clear stone should contain a minimum of 50% crushed particles. An additional 150 mm of Granular “A” installed over the clear stone may also be beneficial for unstable subgrade conditions. Water collected within the stone should be controlled through filtered sumps and pumps.

Provided the subgrade soils remain undisturbed, they will provide adequate support of buried services on conventional granular bedding as dictated by local good ground conditions.

Prior to the installation of any granular fill material, all organics and deleterious materials are to be removed down to the natural undisturbed subgrade soils.

4.11.2 Trench Backfill

Above the pipe cover material to the underside of the pavement structure, the trench can be backfilled by re-using the excavated fill and natural soils matching the materials exposed on the sides of the trenches, provided they are environmentally safe to do so. The soils should be placed to the underside of the granular subbase of the pavement structure, and be compacted in maximum 300 mm thick lifts to 95% SPMDD within 4% of optimum moisture content. This is recommended to provide soil compatibility and help minimize potential abrupt differential frost heave between the local soils and another type of backfill material.

The material must be free of organics or other deleterious material. If it contains deleterious material or it is not utilized, then it should be removed and properly disposed of in accordance with current environmental regulations if/as required.

All stockpiled material should be protected from deleterious materials, additional moisture and be kept from freezing.

Quality control will be of the utmost importance when selecting the material. The selection of the material should be done as early in the contract as possible to allow sufficient time for gradation and proctor testing on representative samples to ensure it meets the projects specifications.

Where the natural soils will be exposed, adequate compaction may prove difficult if the material becomes wet (i.e., above the optimum moisture content). Depending on the moisture content of the natural materials at the time of construction, they may either require moisture to be added or stockpiled and left to dry to achieve moisture content within 4% of optimum. This will be the case for soils excavated below the groundwater table.

Heavy construction equipment and truck traffic should not cross any pipe until at least 1 m of compacted soil is placed above the top of the pipe, or as recommended by the manufacture.

Post compaction settlement of finer grained soils can be expected, even when placed to compaction specifications. As such, fill material should be installed as far in advance as possible before finishing the roadway for best grade integrity.

4.11.3 Water Main Frost Protection

A frost penetration depth of up to 1.8 m can occur in open areas in the Sault Ste. Marie area without snow cover. The underlying natural subgrade soils are considered to have a high frost susceptibility. As such, there is a potential for the water pipes to freeze, heave and move due to frost action, should they be installed with inverts at or higher than about 1.8 m below grade(s). As such, Down to Earth recommends the following possible soil cover frost protection:

- 2.1 m to the spring line of the water main or lower, where the water main has continuous water flow, does not have service connections, and it is not dead-end; and,
- 2.1 m to the top of the pipe for all water mains that have service connections and are dead-end.

If the above cannot be achieved, then the pipe should be insulated with a rigid polystyrene insulation (DOW Styrofoam HI40, or equivalent) or a pre-insulated pipe be utilized.

The insulation design configuration may either consist of placing horizontal insulation to a specified design distance beyond the outside edge of the pipe or an inverted “U” surrounding the top and sides of the pipe. Any method chosen requires suitable design and installation in accordance with the manufactures recommendations. To accommodate the placement of horizontal insulation a wider excavation trench may be required.

4.12 Asphalt Pavement Structure Design

4.12.1 General

The following sections outline the recommended pavement structure design for an asphalt pavement structure.

An estimated functional Design Life of 20 years has been used for the pavement structure design. This is based on an estimated Service Life of 14 to 18 years, which represents the estimated number of years to the first major rehabilitation, e.g. asphalt overlay or resurfacing. The functional Design Life and Service Life assumes regular maintenance, such as, crack sealing, pothole repairs, and etcetera.

All design recommendations assume that no organics are present below the pavement structure. If organics are encountered during excavations, they should be removed to the underlying organic free natural subgrade soil to a maximum depth of about 1.5 m. Below this depth, it is likely cost prohibitive to remove the organics, unless it is at relatively small discrete locations or the majority of them are being removed during the installation of the sewer and water systems.

4.12.2 Asphalt Pavement Structure

The pavement structure design recommendations presented in the following table are based on the information obtained from our geotechnical investigation. The following table presents an asphalt pavement design structure for an Average Annual Daily Traffic (AADT) of 1000 to 2000, and 2000 to 3000 with 10% traffic comprising commercial.

[i] **Pavement Material Layer**	**Compaction Requirements**	**Pavement Design Thickness** **AADT 1000 to 2000**	**Pavement Design Thickness** **AADT 2000 to 3000**
Asphalt Surface Course: Hot Mix Asphalt HL-3 or HL4 (OPSS 1150)	92 to 97% MRD as per OPSS 310	50 mm	40 mm
Asphalt Base Course: Hot Mix Asphalt HL4 or HL-8 (OPSS 1150)	92 to 97% MRD as per OPSS 310	-	50 mm
Base Course: Granular A (OPSS 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Subbase Course: Granular B Type I (OPSS 1010)	100% Standard Proctor Maximum Dry Density (ASTM D698)	600 mm	600 mm
Non-woven geotextile (Terrafix 270R or equivalent) over subgrade soils			

Notes:

i) If a Granular B Type I (OPSS 1010) is replaced with the Granular B Type II (OPSS 1010), then the thickness of the subbase can be decreased by 100 mm for a crushed quarried bedrock product, or an air cooled blast furnace slag product (nut slag); and,

ii) Prior to placing the pavement structure, the fill and/or natural subgrade soils are to be proof rolled compacted with a minimum 10 tonne non-vibratory steel drum roller, under the direction of geotechnical personnel; and,

iii) If the subgrade soils are dry at the time of construction, a non-woven geotextile (Terrafix 270R or equivalent product) is not required to be installed over the subgrade soils prior to installing any granular fill material. This assumes good construction practices.

4.13.3 Granular B Type I (OPSS 1010) Specifications

Should a Granular B Type I be used within the pavement structure, it is recommended that it contain at least 25% material retained on the No. 4 (4.75 mm) sieve size. Of the 25% of the material retained, a minimum of 10% of the material should have particle sizes between 25 to 150 mm. The material passing the 4.75 mm sieve size is to conform to OPPSS 1010 for a Granular B Type I material.

The above, modified Granular B Type I (OPSS 1010) will provide better performance over a Granular B Type I, that is predominantly comprised of sand material, (i.e. passing the 4.75 mm sieve size).

4.13.4 Granular B Type II (OPSS 1010) Specifications

Should a Granular B Type II be used within the pavement structure, it is recommended that it be obtained from crushing quarried bedrock, or air-cooled blast furnace slag (nut slag). Steel slag and reclaimed materials shall not be used in the production of Granular B Type II.

4.13.5 Pavement Structure Existing Subbase and Subgrade Preparation

The proper placement of base and subbase fill materials becomes very important in addressing the proper load distribution to provide a durable pavement structure.

In general, the natural soils are sensitive to change in moisture content and can become loose/soft if they are subject to additional water exposure or precipitation. Furthermore, they could be easily disturbed if travelled on during construction. As such, where the natural soil will be exposed, it is recommended that the non-woven geotextile and engineered fill be placed immediately upon excavation to protect the integrity of the soil.

The first layer of granular fill should be placed at a minimum thickness of 300 mm (loose) prior to compaction to mitigate disturbance of the underlying natural subgrade soils.

If localized weaker (non-compacted) areas are encountered, these areas should be remediated under the guidance of a geotechnical engineering consultant to help ensure the longevity of the pavement structure.

Depending on the condition of the exposed natural subgrade soils, at the time of construction, Down to Earth can provide recommendations at the time, which may include but not be limited to the following:

- Compaction of the subgrade soil;
- Removal of subgrade material and subsequent replacement with engineered fill; and,
- Placement of geotextile and geogrid.

A geotechnical engineer should be on Site to review the subgrade material and to ensure fill specifications and compaction requirements are achieved. Once the subgrade is approved, it can then be backfilled with the recommended pavement structure materials.

Where underground services will be within the roadway granular fill materials, frost heave tapers as outlined in Section 4.13.7 of this report are to be constructed.

Post compaction settlement of fine-grained soils can be expected, even when placed to compaction specifications. As such, fill material should be installed as far in advance as possible before finishing the roadways for best grade integrity.

4.13.6 Compaction Requirements & Width of Granular Materials

The Granular "A" base and Granular "B" subbase material is to be compacted in maximum 200 mm thick lifts to 100% Standard Proctor Maximum Dry Density (SPMDD). All granular and asphalt materials are to conform to OPSS 1010, 1150 and the City of Sault Ste. Marie specifications.

All granular materials are to be placed full width unless otherwise specified.

4.13.7 Transition Treatment

Should the subgrade material types differ below the underside of the pavement structure, the transition between the materials should be sloped as per frost heave taper OPSD 205.060.

4.13.8 Drainage

Control of surface water is a critical factor in achieving good pavement structure life. The pavement thickness designs are based on a drained pavement subgrade via sub-drains or ditches.

Sub-drains should consist of 150 mm diameter fabric wrapped perforated drainage tile surrounded by 19 mm diameter clear stone (OPSS 1004) with a minimum cover of 150 mm on top and sides and 50 mm below the drainage tile. Since the in-situ soils contain a significant amount of silt sized particles, the clear stone gravel should be wrapped in a non-woven geotextile (Terrafix 270R or equivalent). Any potential ditching should have inverts of at least 500 mm below the underside of the subbase.

The surface of the roadway should be free of depressions. They should be sloped at a minimum grade of 1% in order to drain to appropriate drainage areas. Subgrade soils should slope a minimum grade of 3% toward subdrains or ditches. Positive slopes are very important for the proper performance of the drainage system. The granular base and subbase material should extend horizontally to subdrains and/or ditches.

In addition, routine maintenance of the drainage systems will assist with the longevity of the pavement structure, and should be regularly cleared of debris.

4.13.9 Pavement End Treatment & Tack Coat

The joints between any potential new and previously installed asphalt should be constructed in accordance to OPSS 310.07.11. Tack coating should be applied to the vertical joint surface. The tack coat should follow OPSS 308 and SSP 308S01.

4.14 Site Grade Increases

The natural silty clay soil deposits are susceptible to long-term consolidation settlements with net changes in effective stress caused by increasing the loads on the materials from installing earth/granular fill materials above the current grades.

Provided the existing site grades are not increased by more than 600 mm with earth/granular fill materials, then long-term excessive consolidation settlements of the soils are not expected to be an issue. Any proposed grade increases above the aforementioned will require specific design and potentially additional geotechnical investigation work via borehole drilling.

To keep the loading down, a polystyrene lightweight fill material may also be considered in lieu of earth/granular fill materials, which will also provide insulation frost protection for frost susceptible services should they happen to be in the area where grade increases are required. If this option is considered it would require additional geotechnical engineering review.

5.0 GEOTECHNICAL DESIGN CONSIDERATIONS FOR CONSTRUCTIBILITY

5.1 Open Cut Excavations

5.1.1 General

Where workers must enter trench excavations advanced within unconsolidated overburden soils cut deeper than 1.2 m, the trench excavations should be suitably sloped, braced and/or supported in accordance with the current Ontario Occupational Health and Safety Act (OHSA).

The OHSA recognizes four soil types, which are classified as Type 1, 2, 3 or 4 and associated safe side slopes for unsupported trench excavations cut 1.2 m or deeper, and to a maximum of 6 m:

The stability of the excavations may be affected by surcharge loads, stockpiles of material, as well as groundwater seepage conditions, and as such, must be considered when excavating and designing any potential lateral support systems.

5.1.2 Unconsolidated Soil

It is anticipated that open cut excavations will potentially extend up to approximately 3 to 4 m below the existing grades to accommodate the installation of the sewers.

Based on the subsurface information obtained from within the boreholes, it is anticipated that the excavated overburden material will predominantly consist of silty clay to silt soils.

Based on the OHSA, the in-situ soils may be classified as Type 3 soils above the groundwater table and Type 4 soils below the groundwater table. Temporary excavation side slopes in Type 3 soils should remain stable at a slope of 1H:1V and at 3H:1V in Type 4 soils.

If narrower excavation limits are required, then steel sheet piles, closed shoring, bracing or trench boxes can be used to support the excavations as dictated by ground conditions.

All excavated soils and surcharge loads should be kept a minimum horizontal distance away from the excavation equal to 2 times the depth of the excavation, unless a support system is designed to allow for surcharge loads.

In addition to compliance with the OHSA, the excavation procedures must also be in compliance to any potential other regulatory authorities, such as federal and municipal safety standards.

The in-situ soils can be excavated using conventional earthmoving equipment.

5.2 General Anticipated Groundwater Management (Temporary)

Prior to commencing excavations, it is critical that all existing surface water and potential surface water is controlled and diverted away from the work area to prevent infiltration and subgrade weakening. At no time should excavations be left open for a period of time that will expose them to precipitation and cause subgrade weakening.

It is noted that the permeability of the silty clay to silt material is low to very low and should not require significant effort to remove the release of water from within it.

Unless the groundwater level is controlled, excavations advanced below the water table will experience loosening and sloughing of the base and sides to 3H:1V or flatter. If this scenario occurs the soil bearing capacity will be significantly reduced.

Excavation side slopes and stability below the groundwater will be a function of the contractor's methodology and ability to effectively dewater the excavation.

It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. The method used should not adversely impact any nearby structures. The contractor should submit their proposal to the prime consultant for review and approval prior to construction. The use of steel sheet piles may be required, and should be considered by the contractor while developing an appropriate dewatering system. A permit to take water may be required from the Ministry of the Environment if the quantity of pumped water exceeds 50,000 L/day. It is the responsibility of the contractor to make this application as required. If required, Down to Earth can help with the application process.

To ensure a stable subgrade and adequate working conditions, it is recommended that the following conditions be fulfilled when dewatering excavations:

- The groundwater control should be maintained until services are installed and backfilled to at least 600 mm above the natural groundwater elevation;
- Until the backfilling is completed, the groundwater is to be kept under full control 24 hours a day, 7 days a week, to avoid base instability and compromised subgrade support soils;
- Effective filters are to be provided, as required to prevent loss of ground;
- Any potential precipitation or seepage entering the excavations should be pumped away immediately (not allowed to pond). It is critical that water be controlled and the subgrade preparation work commence in the dry;
- Additional sump pumps (i.e. backup pumps) and power supply(s) should be readily available to control the groundwater at all times;
- Pumping methods be adopted for groundwater lowering that will not lead to damage of adjacent structures, such as by settlement;
- All collected water is to discharge a sufficient distance away from the excavation to prevent re-entry; and,
- Sediment control measures, such as a silt fence should be installed at the discharge point of the dewatering system; and,
- The utmost care should be taken to avoid any potential impacts on the environment.

Fluctuations in the groundwater level due to seasonal variations or in response to a particular precipitation event should be anticipated. As such, depending on the groundwater at the time of the excavation works, a more involved dewatering system may be required.

The soil types should be assessed and confirmed in the field as the excavation works progress by a qualified representative.

The dewatering and excavations should only be performed by competent contractors, that are familiar with this type of construction, and dewatering challenges.

6.0 SITE SUPERVISION & QUALITY CONTROL

It is recommended that all geotechnical aspects of the project be reviewed and confirmed under the appropriate geotechnical supervision, to routinely check such items. This includes but is not limited to inspection and confirmation of the undisturbed natural subgrade soil prior to backfilling, subgrade preparation, engineered fill installation to ensure that the actual conditions are not markedly different than what was observed at the borehole locations and geotechnical components are constructed as per our recommendations. Compaction quality control of engineered fill material is recommended as standard practice, as well as sampling and testing of aggregates, to ensure it meets the physical characteristics for compliance during installation and satisfies all specifications presented within this report.

If appropriate routine geotechnical inspections and quality control are not provided by a Down to Earth representative, then Down to Earth accepts no responsibility for the performance or non-performance of geotechnical components, even if they are ostensibly constructed in accordance with the design recommendations within this report.

7.0 DESIGN REVIEW

Development or design plans and specifications should be reviewed by Down to Earth, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etcetera), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. The recommendations made in this report are in accordance with our present understanding of the project and are provided solely for the design team responsible for the project. Down to Earth should be retained to review our recommendations as the design nears completion to ensure that the final design is in general agreement with the assumptions on which our recommendations are based.

8.0 LIMITATIONS

This Geotechnical Investigation report was performed for our Client and their design consultants. The use of this report is subject to the Report Limitations and Guidelines for Use in Appendix E. It is the responsibility of the Client(s), and its agents to review the Report Limitations and Guidelines for Use within.

9.0 CLOSURE

We trust that the foregoing information is satisfactory for your present requirements. Should you have any questions about the report or require additional information, please contact the undersigned.

Yours truly,

Maurice Corriveau, P.Eng.
Principal Engineer
mcorriveau@downtoearthge.com

Steven Hoffman, Civil Eng. Technician
Geotechnical Specialist
shoffman@downtoearthge.com

APPENDIX A

FIGURES

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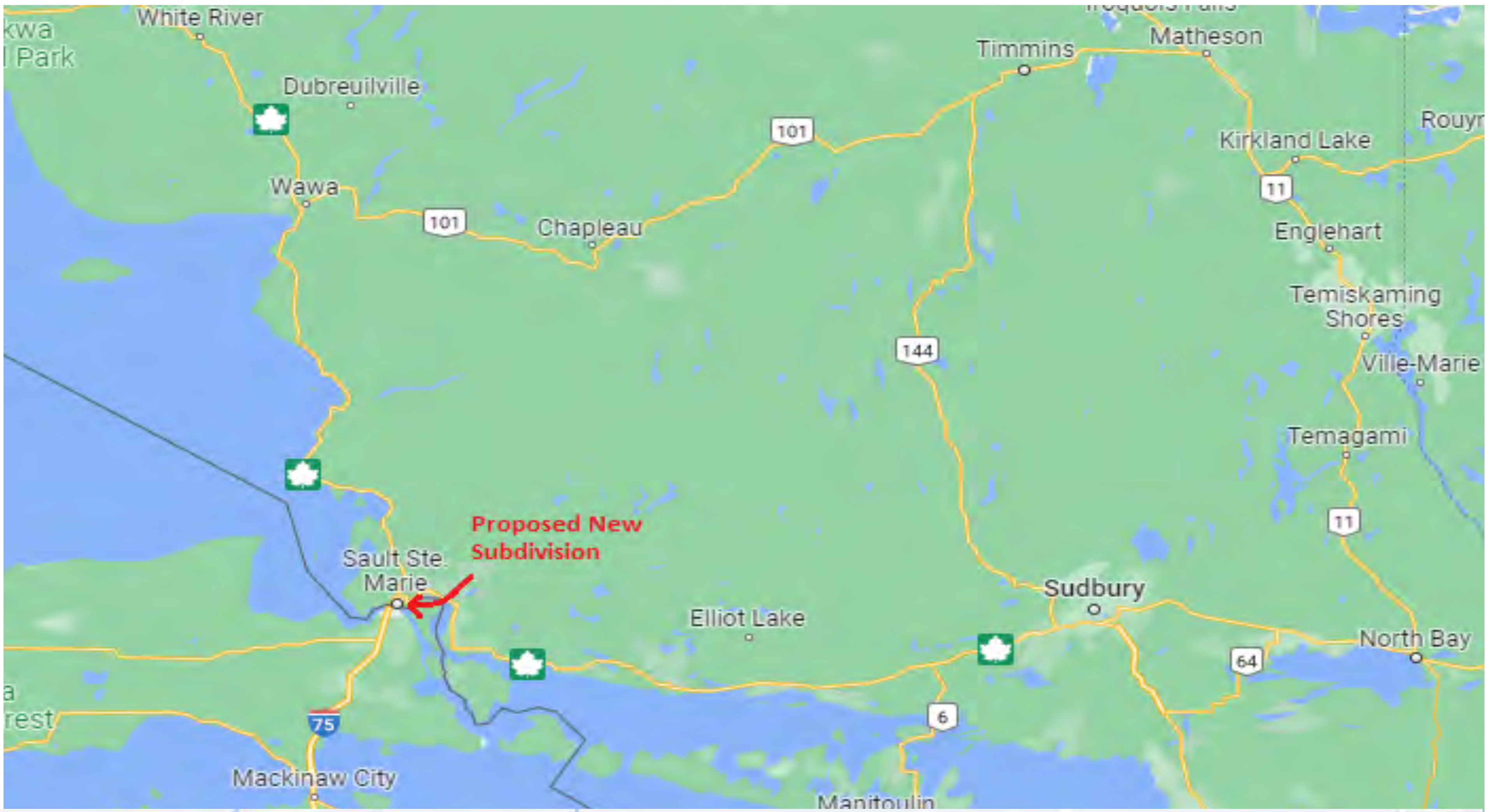

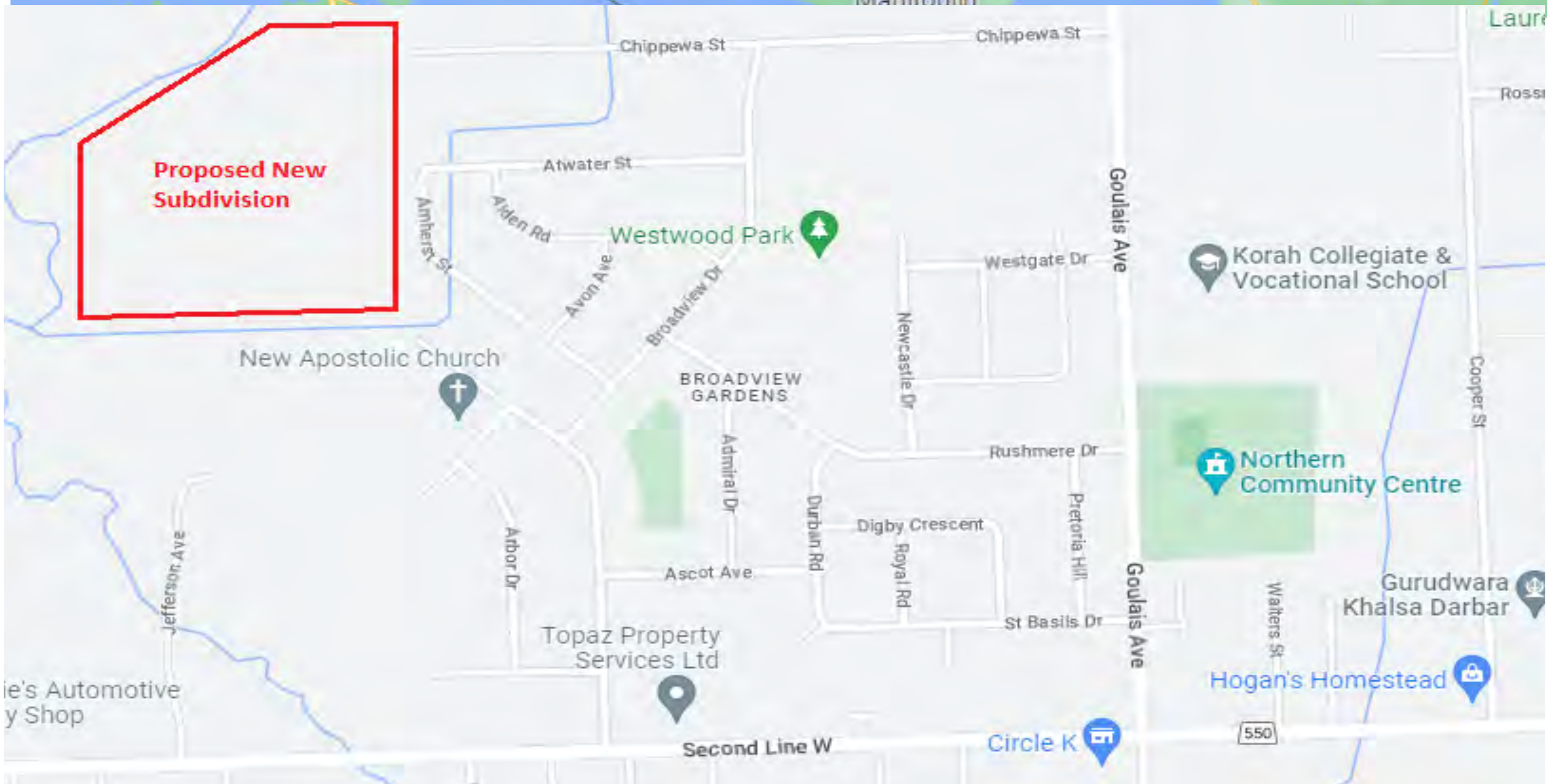

CLIENT Mamta Homes	FIGURE NAME General Location Plan	PROJECT NO. G22042	FIGURE NO. 1
PROJECT Proposed New Subdivision	PROJECT LOCATION Chippewa St. Sault Ste Marie, ON	DATE January, 2023	SCALE NTS

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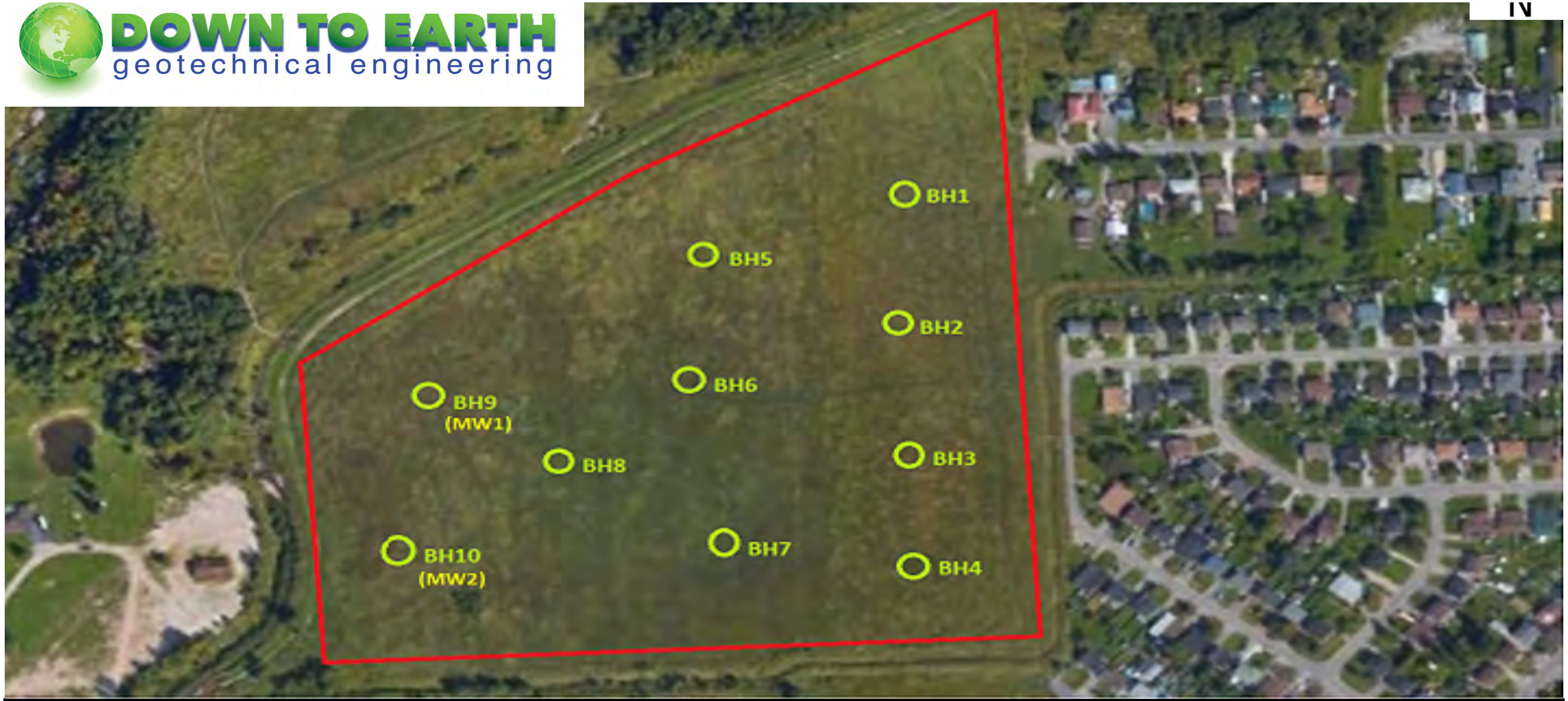


CLIENT Mamta Homes	**FIGURE NAME** Borehole Location Plan (BH 1 - 10)	**PROJECT NO.** G22042	**FIGURE NO.** 2
PROJECT Proposed New Subdivision	**PROJECT LOCATION** Chippewa St. Sault Ste Marie, ON	**DATE** January, 2023	**SCALE** NTS

APPENDIX B

SYMBOLS USED IN REPORT AND BOREHOLE LOGS

SYMBOLS & TERMS USED IN REPORT, BOREHOLE & TEST PIT LOGS

Soil Descriptions

The soil descriptions and classifications are based on the modified Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained, and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 76 mm.

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris, etc.) is based upon the proportion of these materials present:

Terminology	Proportion
Trace	Less than 10%
Some	10% to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And	35 to 50%

Notes:

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behavior over grain size fractions;
- With the exception of soil samples tested for particle size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The Standard Penetration Test SPT, N-value is used to interpret the compactness condition of cohesionless soils. A relationship between the compactness condition and N-Value is provided in the following table.

Cohesionless Soil	
Compactness Condition	**SPT N-Index (blows per 300 mm)**
Very Loose	<4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

The undrained shear strength as measured by in-situ vane tests, penetrometer tests, or unconfined compression tests, is used to describe the consistency of cohesive soils related to undrained shear strength. A relationship between the undrained shear strength and the SPT, N-value is provided in the following table.

Cohesive Soil		
Consistency	**Undrained Shear Strength (kPa)**	**SPT N-Index (blows per 300 mm)**
Very soft	<12	<2
Soft	12 to 25	2 to 4
Firm	25 to 50	5 to 8
Stiff	50 to 100	9 to 15
Very Stiff	100 to 200	16 to 30
Hard	>200	>30

Note: Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

Sampling Method

AS	Auger Sample
SS	Split Spoon Sample
ST	Thin Walled Shelby Tube
BS	Block Sample
w	Washed Sample
HQ	Rock Core (63.5 mm diam.)
NQ	Rock Core (47.5 mm diam.)
BQ	Rock Core (36.5 mm diam.)

Rock Coring

Rock Quality Designation (RQD) is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum.

The following is the Classification of Rock with Respect to RQD Value:

RQD Classification	RQD Value (%)
Very poor quality	<25
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100

APPENDIX C

BOREHOLE LOGS

BOREHOLE LOG BH1

(Page 1 of 1)

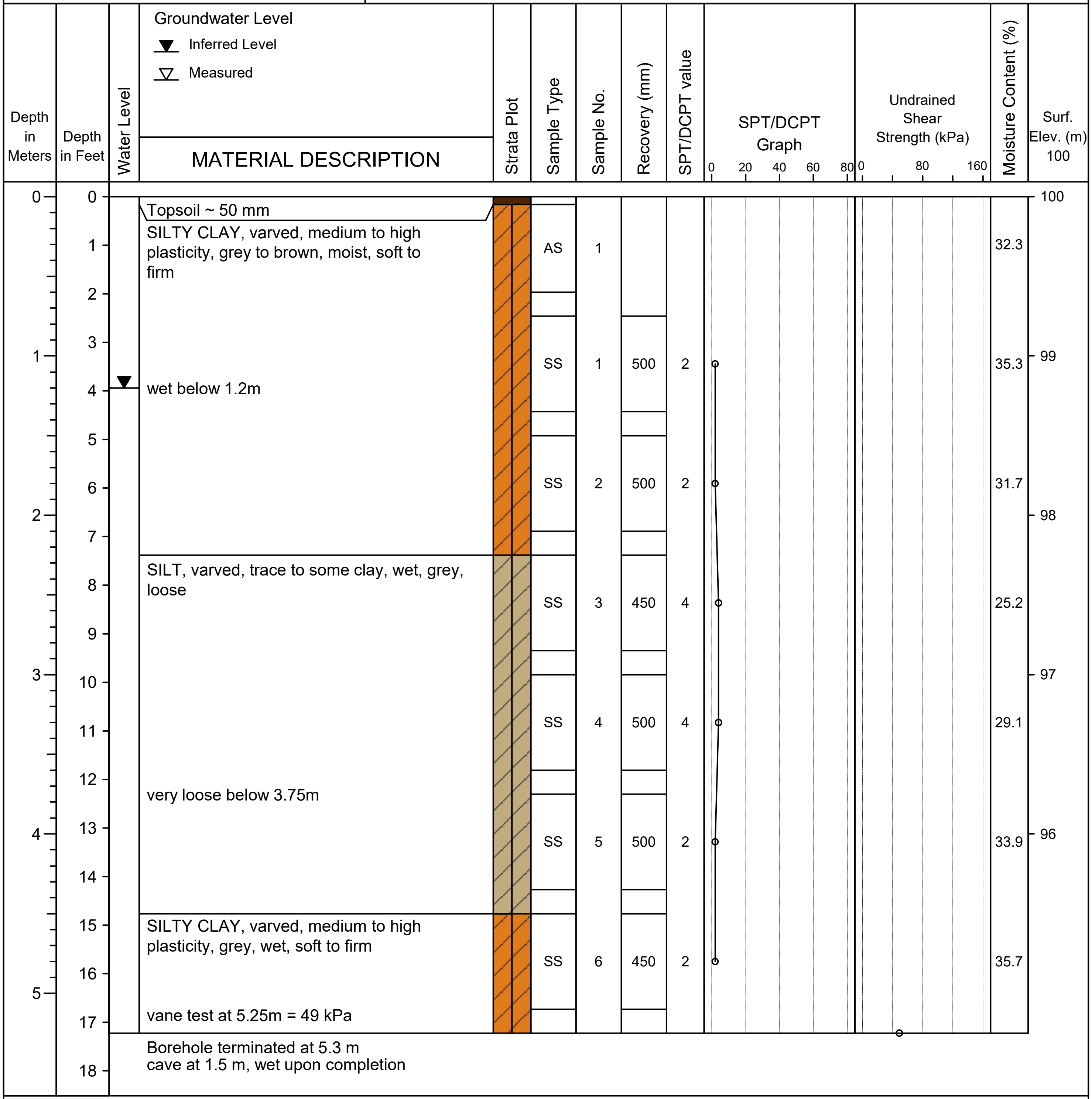
Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

PROJECT NO. G22042

PROJECT	: Proposed Subdivision		
Date Completed	: Jan. 19, 2023	Project Location	: Chippewa St.
Hole Diameter	: 150 mm	Borehole Location	: See Fig.2
Drilling Method	: Hollow Stem Auger	Company Rep.	: A. Waboose
Sampling Method	: Split Spoon	Surface Elev.	: Local

Groundwater Level
▼ Inferred Level
▽ Measured



Depth in Meters	Depth in Feet	Water Level	MATERIAL DESCRIPTION	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)
0	0		Topsoil ~ 50 mm					
			SILTY CLAY, varved, medium to high plasticity, grey to brown, moist, soft to firm	AS	1			32.3
1	3			SS	1	500	2	35.3
	4	▼	wet below 1.2m					
	6			SS	2	500	2	31.7
			SILT, varved, trace to some clay, wet, grey, loose	SS	3	450	4	25.2
	11			SS	4	500	4	29.1
	12		very loose below 3.75m					
4	13			SS	5	500	2	33.9
			SILTY CLAY, varved, medium to high plasticity, grey, wet, soft to firm	SS	6	450	2	35.7
	17		vane test at 5.25m = 49 kPa					
			Borehole terminated at 5.3 m cave at 1.5 m, wet upon completion					

This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

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BOREHOLE LOG BH2

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Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

PROJECT NO. G22042

PROJECT : Proposed Subdivision
Date Completed : Jan. 19, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon

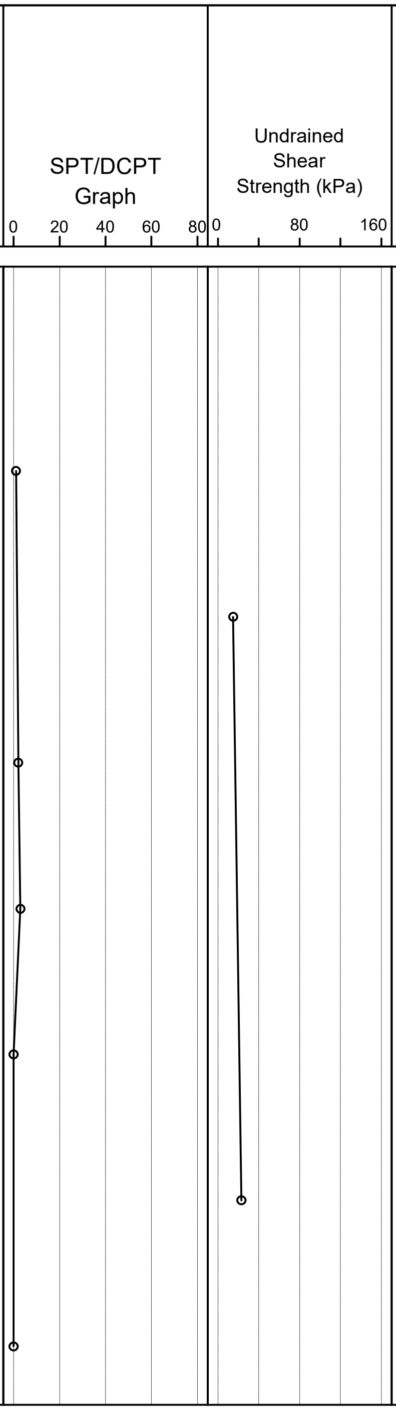
Project Location : Chippewa St.
Borehole Location : See Fig.2
Company Rep. : A. Waboose
Surf. Elev. : Local

Groundwater Level
▼ Inferred Level
▽ Measured

Water Level	MATERIAL DESCRIPTION	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)
	Topsoil ~ 50 mm					
	SILTY CLAY, varved, medium to high plasticity, brown, moist, soft	AS	1			32.7
		SS	1	450	1	40.6
▼	wet below 1.2m					
	vane test at 1.8m = 20 kPa					
	SILT, varved, trace to some clay, wet, grey, very loose	SS	2	450	2	34.9
		SS	3	500	3	28.9
	SILTY CLAY, varved medium to high plasticity, grey, wet, soft	SS	4	500	0	35.2
	vane test at 4.8m = 23 kPa					
		SS	5	450	0	38.3
	Borehole terminated at 5.9m cave at 1.3 m, wet upon completion					

Depth in Meters	Surf. Elev. (m) 100
0	100
1	99
2	98
3	97
4	96
5	95
6	

Depth in Feet: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20



This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

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BOREHOLE LOG BH3

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Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

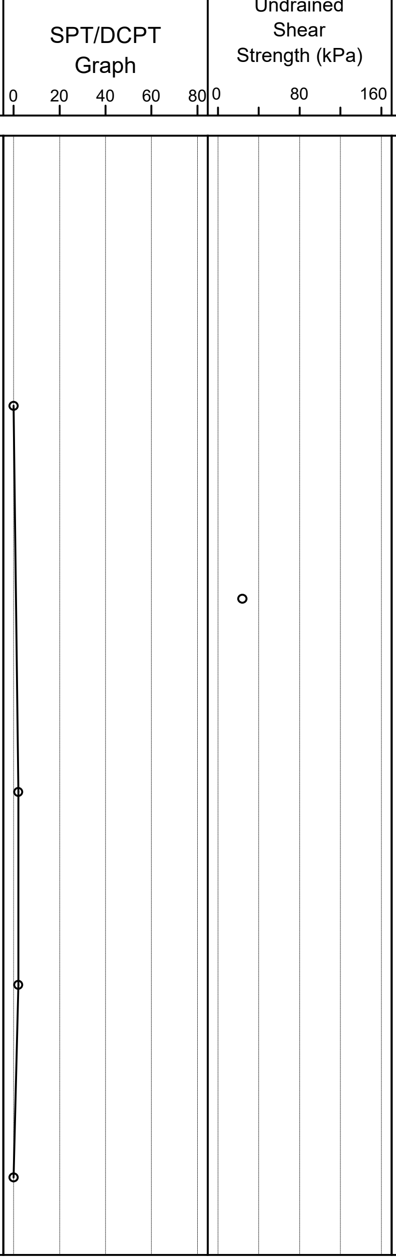
Geotechnical Investigation

PROJECT NO. G22042

PROJECT : Proposed New Subdivision
Date Completed : Jan. 19, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon
Project Location : Chippewa St.
Borehole Location : See Fig.2
Company Rep. : A. Waboose
Surface Elev. : Local

Groundwater Level
▼ Inferred Level
▽ Measured

Depth in Meters	Depth in Feet	Water Level	MATERIAL DESCRIPTION	Strata Plot	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)	Surf. Elev. (m) 100
0	0		Topsoil ~ 50 mm							100
	1		SILTY CLAY, varved, medium to high plasticity, brown, moist, soft	🟧	AS	1			37.2	
1	3			🟧	SS	1	400	0	36	99
	4	▼	wet below 1.2m	🟧						
2	6		vane test at 1.8m for 24 kPa	🟧						98
	8		SILT, varved, trace to some clay, grey, wet, very loose	🟫	SS	2	450	2	35.3	
3	11			🟫	SS	3	500	2	31.4	97
4	13		SILTY CLAY, varved, medium to high plasticity, brown, wet, soft	🟧	SS	4	500	0	35.7	
	15		Borehole terminated at 5.4m cave at 1.3 m, wet upon completion							



This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

DOWN TO EARTH
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BOREHOLE LOG BH4

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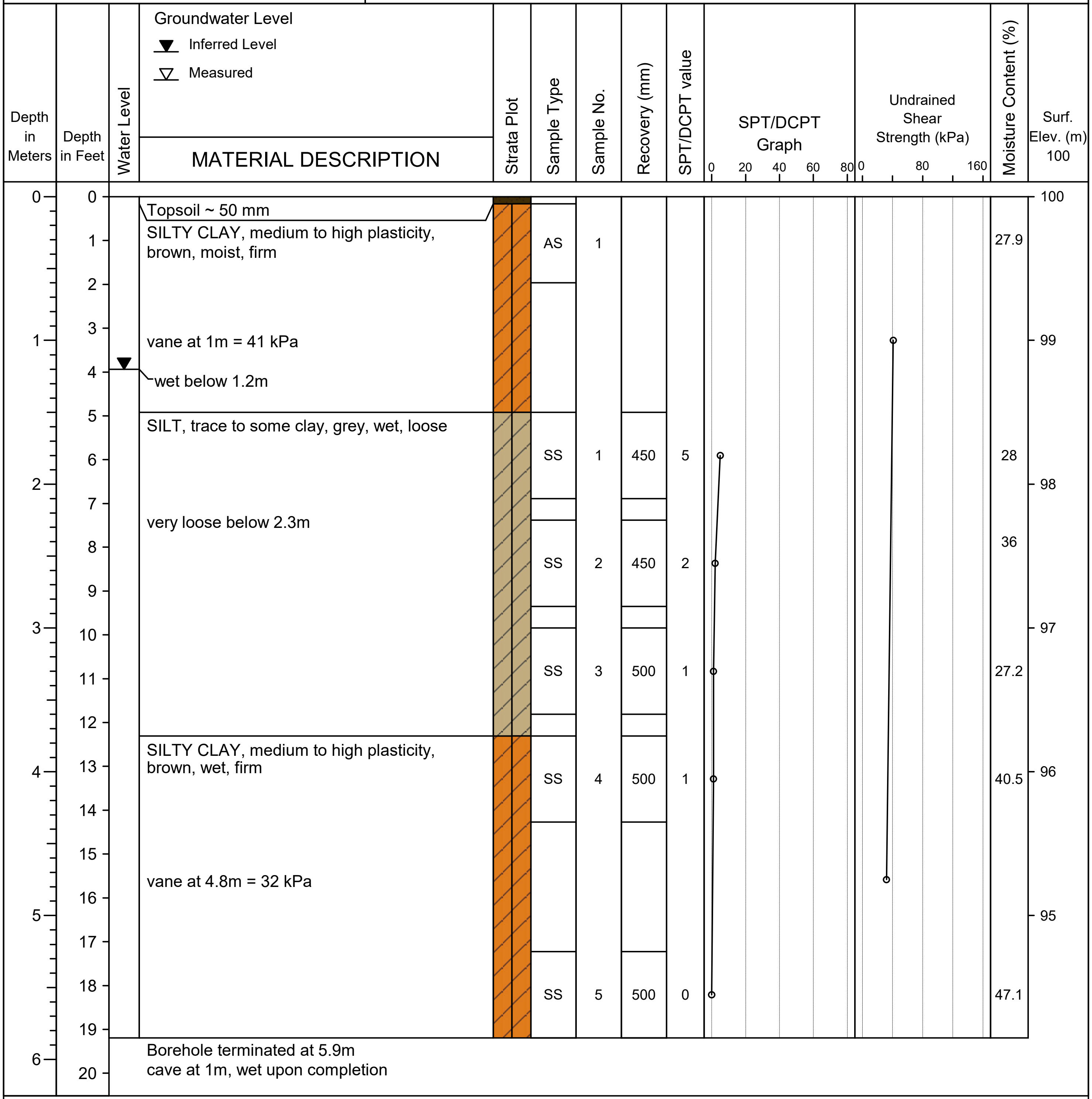
Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

PROJECT NO. G22042

PROJECT : Proposed New Subdivision
Date Completed : Jan. 20, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon
Project Location : Chippewa St.
Borehole Location : See Fig.2
Company Rep. : A. Waboose
Surf. Elev. : Local

Groundwater Level
▼ Inferred Level
▽ Measured



MATERIAL DESCRIPTION

Topsoil ~ 50 mm

SILTY CLAY, medium to high plasticity, brown, moist, firm

vane at 1m = 41 kPa

wet below 1.2m

SILT, trace to some clay, grey, wet, loose

very loose below 2.3m

SILTY CLAY, medium to high plasticity, brown, wet, firm

vane at 4.8m = 32 kPa

Borehole terminated at 5.9m
cave at 1m, wet upon completion

Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)
AS	1			27.9
SS	1	450	5	28
SS	2	450	2	36
SS	3	500	1	27.2
SS	4	500	1	40.5
SS	5	500	0	47.1

This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

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BOREHOLE LOG BH5

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Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

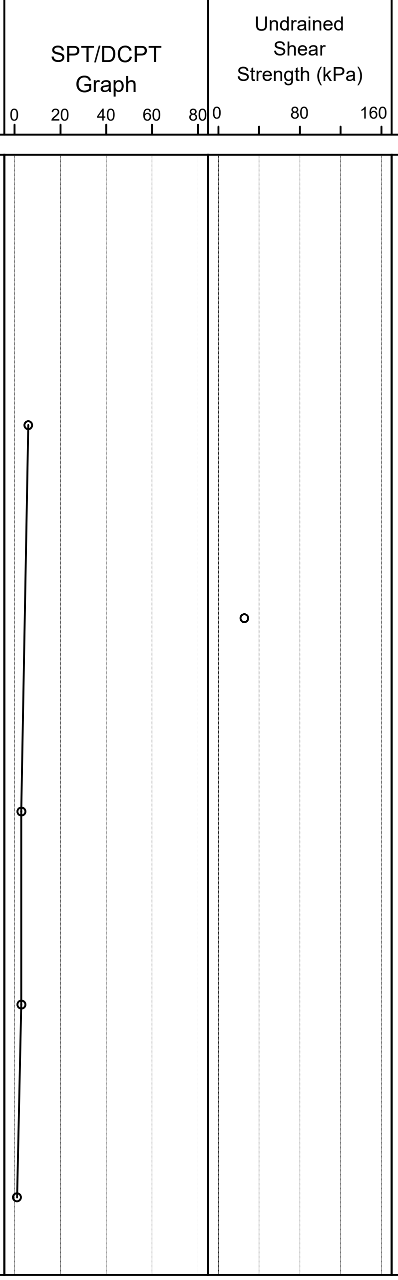
PROJECT NO. G22042

PROJECT : Proposed New Subdivision
Date Completed : Jan. 20, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon

Project Location : Chippewa St.
Borehole Location : See Fig.2
Company Rep. : A. Waboose
Surface Elev. : Local

Groundwater Level
▼ Inferred Level
▽ Measured

Depth in Meters	Depth in Feet	Water Level	MATERIAL DESCRIPTION	Strata Plot	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)	Surf. Elev. (m) 100
0	0		Topsoil ~ 50 mm							100
	1		SILTY CLAY, varved, medium to high plasticity, brown, moist, soft to firm		AS	1			39.2	
1	3				SS	1	400	6	34.9	99
	4	▼	wet below 1.2m							
	6		vane test at 1.8m = 25 kPa							
2	7									98
	8		SILT, varved, trace to some clay, grey, wet, very loose		SS	2	450	3	24.6	
3	10–11				SS	3	500	3	25.9	97
4	13		SILTY CLAY, varved, medium to high plasticity, brown, wet, soft		SS	4	500	1	36.9	
	15		Borehole terminated at 4.4m cave at 1.6m, wet upon completion							



This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

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BOREHOLE LOG BH6

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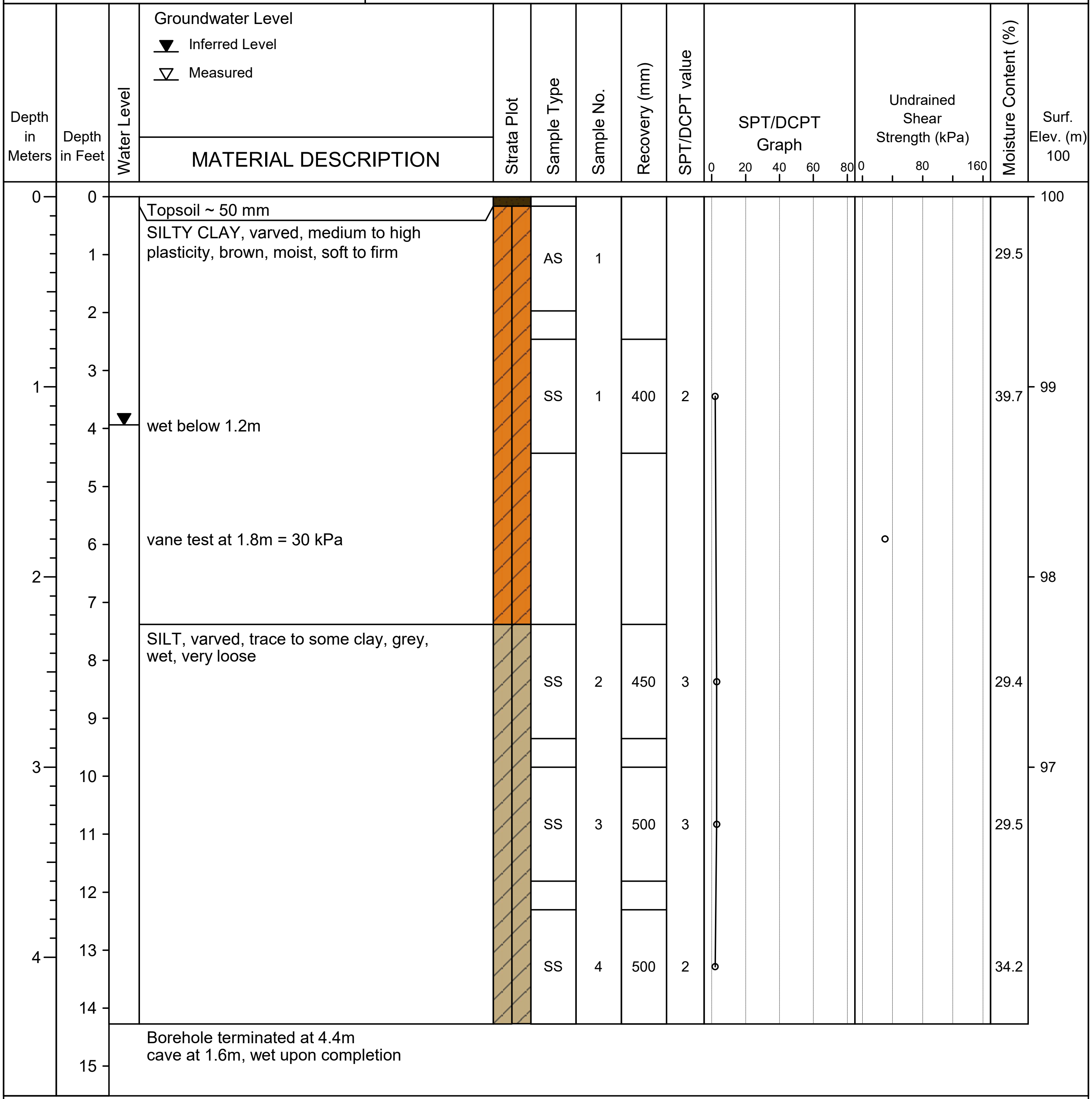
Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

PROJECT NO. G22042

PROJECT : Proposed New Subdivision
Date Completed : Jan. 20, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon
Project Location : Chippewa St.
Borehole Location : See Fig.2
Company Rep. : A. Waboose
Surface Elev. : Local

Groundwater Level
▼ Inferred Level
▽ Measured



Depth	Material Description	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)
0	Topsoil ~ 50 mm					
	SILTY CLAY, varved, medium to high plasticity, brown, moist, soft to firm	AS	1			29.5
		SS	1	400	2	39.7
	wet below 1.2m					
	vane test at 1.8m = 30 kPa					
	SILT, varved, trace to some clay, grey, wet, very loose	SS	2	450	3	29.4
		SS	3	500	3	29.5
		SS	4	500	2	34.2

Borehole terminated at 4.4m
cave at 1.6m, wet upon completion

This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

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BOREHOLE LOG BH7

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Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

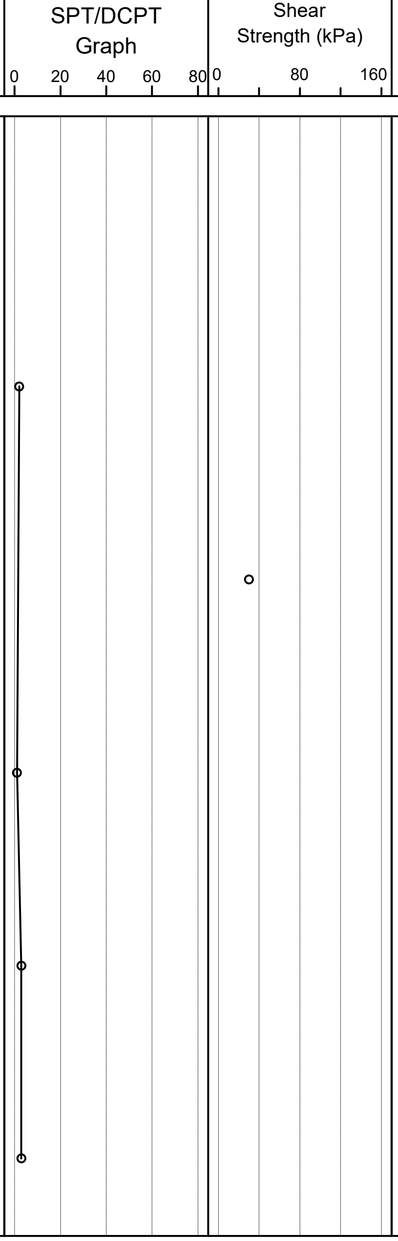
PROJECT NO. G22042

PROJECT : Proposed New Subdivision
Date Completed : Jan. 23, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon

Project Location : Chippewa St.
Borehole Location : See Fig.2
Company Rep. : A. Waboose
Surf. Elev. : Local

Groundwater Level
▼ Inferred Level
▽ Measured

Depth in Meters	Depth in Feet	Water Level	MATERIAL DESCRIPTION	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)	Surf. Elev. (m) 100
0	0		Topsoil ~ 50 mm						100
			SILTY CLAY, varved, medium to high plasticity, brown, moist, soft to firm						
	1			AS	1			25.7	
	2								
	3								
1				SS	1	400	2	39.9	99
	4	▼	wet below 1.2m						
	5								
	6		vane test at 1.8m = 30 kPa						
2									98
	7								
	8							42.8	
				SS	2	450	1		
	9							26.7	
3	10		SILT, varved, trace to some clay, grey, wet, very loose						97
	11			SS	3	500	3	34.9	
	12								
4	13			SS	4	500	3	32.1	
	14								
	15		Borehole terminated at 4.4m cave at 0.8m, wet upon completion						



This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

DOWN TO EARTH
geotechnical engineering

BOREHOLE LOG BH8

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Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

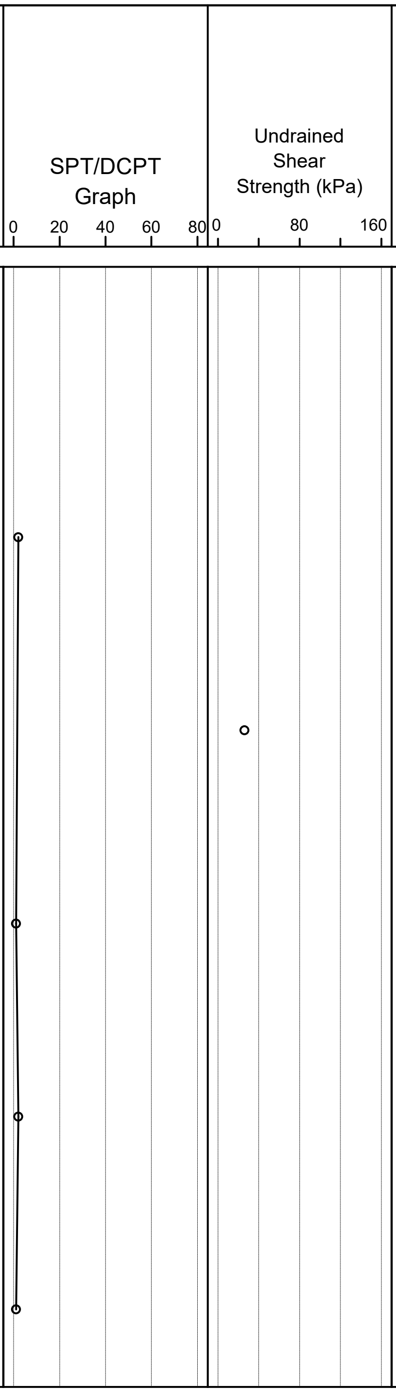
PROJECT NO. G22042

PROJECT : Proposed New Subdivision
Date Completed : Jan. 23, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon

Project Location : Chippewa St.
Borehole Location : See Fig.2
Company Rep. : A. Waboose
Surface Elev. : Local

Groundwater Level
▼ Inferred Level
▽ Measured

Depth in Meters	Depth in Feet	Water Level	MATERIAL DESCRIPTION	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)	Surf. Elev. (m) 100
0	0		Topsoil ~ 50 mm						100
	1		SILTY CLAY, varved, medium to high plasticity, brown, moist, soft to firm	AS	1			27.2	
	2								
1	3			SS	1	400	2	35.9	99
	4	▼	wet below 1.2m						
	5								
	6		vane test at 1.8m = 26 kPa						
2	7								98
	8							30.1	
			SILT, varved, trace to some clay, grey, wet, very loose	SS	2	450	1		
	9							24	
3	10								97
	11			SS	3	500	2	32.4	
	12								
4	13			SS	4	500	1	31.8	
	14								
	15		Borehole terminated at 4.4m cave at 0.8m, wet upon completion						



This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

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BOREHOLE LOG BH9 (MW1)

(Page 1 of 1)

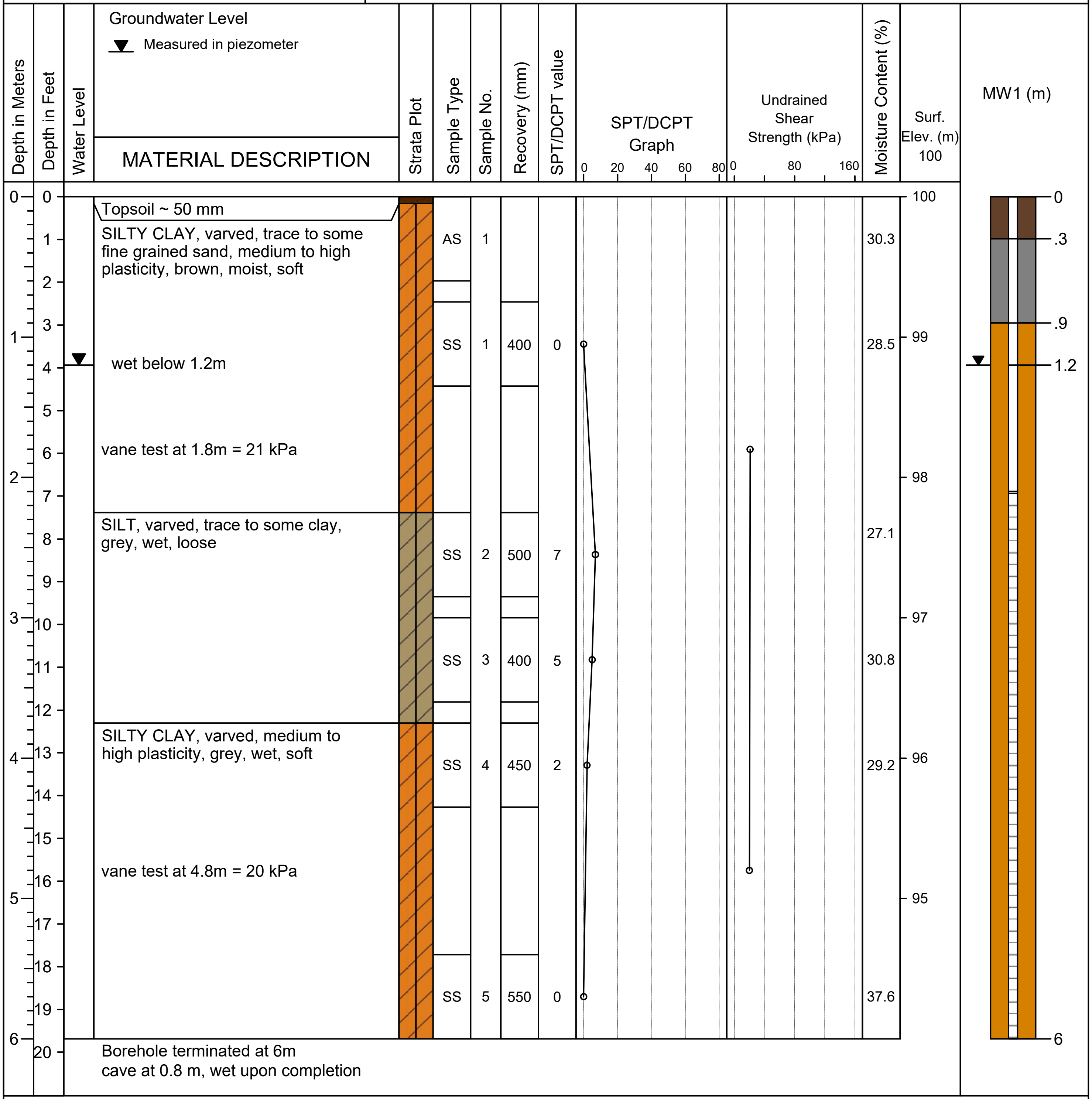
Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

PROJECT NO. G22042

PROJECT : Proposed New Subdivision
Date Completed : Jan, 24, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon
Project Location : Chippewa St.
Borehole Location : See Figure No.2
Company Rep. : A. Waboose
Surface Elev. : local

Groundwater Level
▼ Measured in piezometer



MATERIAL DESCRIPTION	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)
Topsoil ~ 50 mm					
SILTY CLAY, varved, trace to some fine grained sand, medium to high plasticity, brown, moist, soft	AS	1			30.3
	SS	1	400	0	28.5
wet below 1.2m					
vane test at 1.8m = 21 kPa					
SILT, varved, trace to some clay, grey, wet, loose	SS	2	500	7	27.1
	SS	3	400	5	30.8
SILTY CLAY, varved, medium to high plasticity, grey, wet, soft	SS	4	450	2	29.2
vane test at 4.8m = 20 kPa					
	SS	5	550	0	37.6

Borehole terminated at 6m
cave at 0.8 m, wet upon completion

This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

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BOREHOLE LOG BH10 (MW2)

(Page 1 of 1)

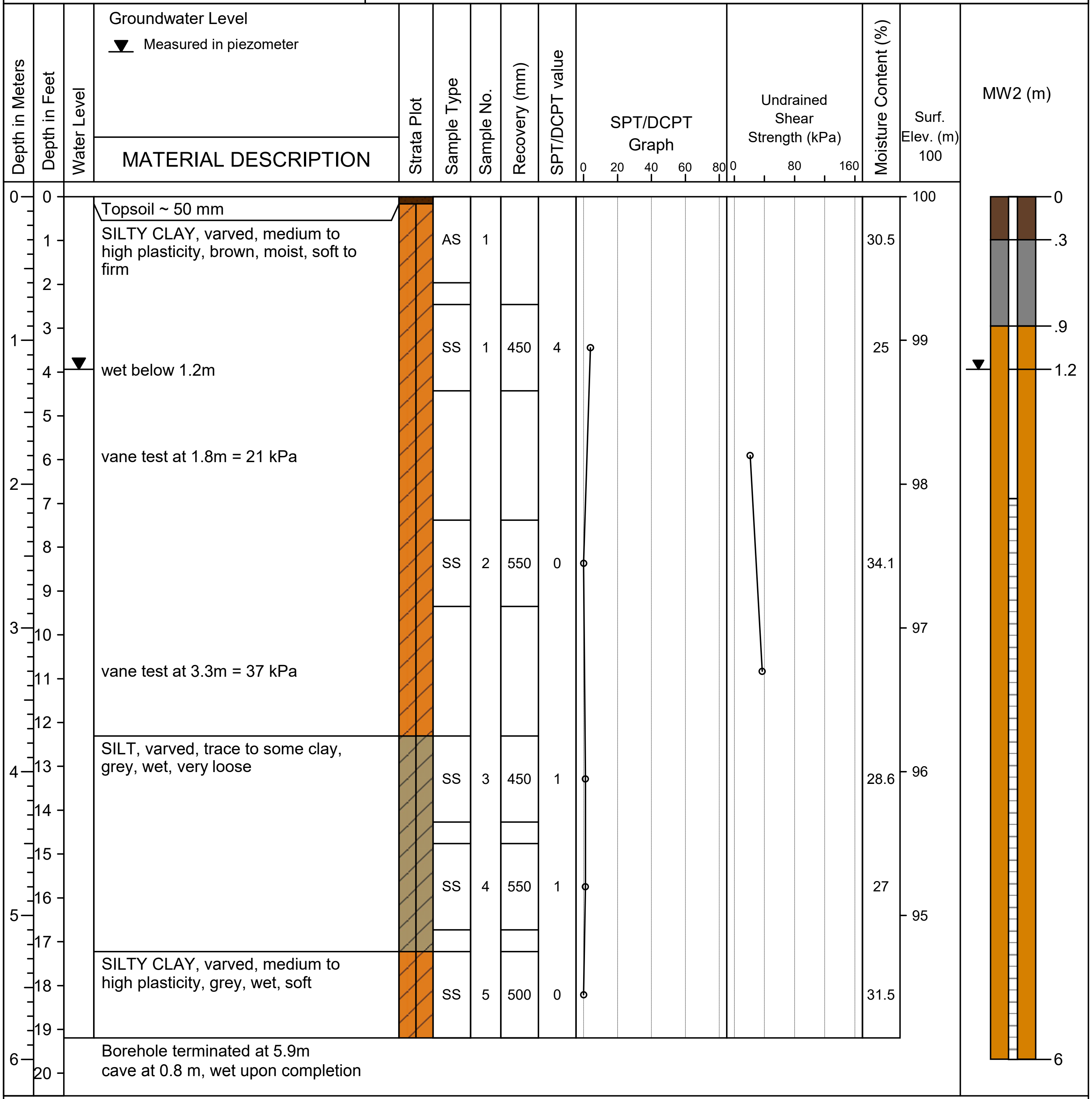
Proposed New Subdivision
0 Chippewa Street
Sault Ste. Marie, ON

Geotechnical Investigation

PROJECT NO. G22042

PROJECT : Proposed Subdivision
Date Completed : Jan, 24, 2023
Hole Diameter : 150 mm
Drilling Method : Hollow Stem Auger
Sampling Method : Split Spoon
Project Location : Chippewa St.
Borehole Location : See Figure No.2
Company Rep. : A. Waboose
Surface Elev. : local

Groundwater Level
▼ Measured in piezometer



Depth in Meters	Depth in Feet	MATERIAL DESCRIPTION	Sample Type	Sample No.	Recovery (mm)	SPT/DCPT value	Moisture Content (%)
0	0	Topsoil ~ 50 mm					
	1	SILTY CLAY, varved, medium to high plasticity, brown, moist, soft to firm	AS	1			30.5
1	3		SS	1	450	4	25
	4	wet below 1.2m					
	6	vane test at 1.8m = 21 kPa					
	8		SS	2	550	0	34.1
	11	vane test at 3.3m = 37 kPa					
4	13	SILT, varved, trace to some clay, grey, wet, very loose	SS	3	450	1	28.6
5	16		SS	4	550	1	27
	18	SILTY CLAY, varved, medium to high plasticity, grey, wet, soft	SS	5	500	0	31.5
6	20	Borehole terminated at 5.9m cave at 0.8 m, wet upon completion					

This information pertains to this boring only, and subsurface conditions may differ throughout the investigated area(s).

AS = Auger Sample, SS = Split Spoon Sample, ST = Shelby Tube, GS = Grab Sample, RC= Rock Core

APPENDIX D

LABORATORY SOIL TESTING REPORTS

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253 Old Garden River Road
Sault Ste. Marie, ON
P6B 5A7

MOISTURE CONTENTS

Tested in accordance with LS-701 (ASTM D 2216)

Project:	Proposed Subdivision
Location:	0 Chippewa Street
Date Sampled:	Monday, January 23, 2023
Date Tested:	Tuesday, January 31, 2023

Contract Number:	G22042
Client:	Mamta Homes
Sampled By:	A. Waboose
Tested By:	A. Waboose

BOREHOLE NUMBER	**BH 1**	**BH 1**	**BH 1**	**BH 1**	**BH1**	**BH1**	**BH1**	
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**	**SS6**	
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**1.8**	**2.6**	**3.3**	**4.1**	**4.8**	
MASS OF WET SOIL + TARE (g)	147.5	129.1	133.7	187.0	216.1	146.0	138.4	
MASS OF DRY SOIL + TARE (g)	134.2	120.3	124.8	168.1	189.2	132.4	126.3	
MASS OF TARE (g)	93.0	95.4	96.7	93.1	96.8	92.3	92.4	
WATER CONTENT (%)	**32.3%**	**35.3%**	**31.7%**	**25.2%**	**29.1%**	**33.9%**	**35.7%**	

BOREHOLE NUMBER	**BH 2**	**BH 2**	**BH 2**	**BH 2**	**BH2**	**BH2**		
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**		
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.6**	**3.3**	**4.1**	**5.6**		
MASS OF WET SOIL + TARE (g)	147.5	133.1	159.5	147.7	156.9	196.4		
MASS OF DRY SOIL + TARE (g)	134.4	121.6	142.1	135.5	139.9	168.1		
MASS OF TARE (g)	94.3	93.3	92.2	93.3	91.6	94.2		
WATER CONTENT (%)	**32.7%**	**40.6%**	**34.9%**	**28.9%**	**35.2%**	**38.3%**		

BOREHOLE NUMBER	**BH3**	**BH3**	**BH3**	**BH3**	**BH3**	**BH3**	**BH3**	**BH3**
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**			
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.6**	**3.3**	**4.1**			
MASS OF WET SOIL + TARE (g)	161.3	147.6	156.4	140.7	168.4			
MASS OF DRY SOIL + TARE (g)	142.9	133.0	140.2	129.0	148.9			
MASS OF TARE (g)	93.4	92.4	94.3	91.7	94.3			
WATER CONTENT (%)	**37.2%**	**36.0%**	**35.3%**	**31.4%**	**35.7%**			

BOREHOLE NUMBER	**BH4**	**BH4**	**BH4**	**BH4**	**BH4**	**BH4**		
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**		
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.8**	**2.4**	**3.3**	**4.1**	**5.6**		
MASS OF WET SOIL + TARE (g)	145.5	136.3	112.5	186.2	147.4	154.1		
MASS OF DRY SOIL + TARE (g)	134.1	126.7	107.5	166.0	132.1	133.8		
MASS OF TARE (g)	93.3	92.4	93.6	91.8	94.3	90.7		
WATER CONTENT (%)	**27.9%**	**28.0%**	**36.0%**	**27.2%**	**40.5%**	**47.1%**		

Comments:

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253 Old Garden River Road
Sault Ste. Marie, ON
P6B 5A7

MOISTURE CONTENTS

Tested in accordance with LS-701 (ASTM D 2216)

Project:	Proposed Subdivision
Location:	0 Chippewa Street
Date Sampled:	Monday, January 23, 2023
Date Tested:	Tuesday, January 31, 2023

Contract Number:	G22042
Client:	Mamta Homes
Sampled By:	A. Waboose
Tested By:	A. Waboose

BOREHOLE NUMBER	**BH5**	**BH5**	**BH5**	**BH5**	**BH5**			
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**			
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.6**	**3.3**	**4.1**			
MASS OF WET SOIL + TARE (g)	119.1	121.1	165.9	133.9	159.9			
MASS OF DRY SOIL + TARE (g)	111.1	112.7	151.4	124.3	143.2			
MASS OF TARE (g)	90.7	88.6	92.5	87.3	97.9			
WATER CONTENT (%)	**39.2%**	**34.9%**	**24.6%**	**25.9%**	**36.9%**			

BOREHOLE NUMBER	**BH6**	**BH6**	**BH6**	**BH6**	**BH6**			
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**			
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.6**	**3.3**	**4.1**			
MASS OF WET SOIL + TARE (g)	238.8	250.1	303.6	295.9	333.2			
MASS OF DRY SOIL + TARE (g)	229.1	236.3	282.4	282.7	309.0			
MASS OF TARE (g)	196.2	201.5	210.4	238.0	238.2			
WATER CONTENT (%)	**29.5%**	**39.7%**	**29.4%**	**29.5%**	**34.2%**			

BOREHOLE NUMBER	**BH7**	**BH7**	**BH7**	**BH7**	**BH7**	**BH7**		
SAMPLE NUMBER	**AS1**	**SS1**	**SS2a**	**SS2b**	**SS3**	**SS4**		
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.4**	**2.7**	**3.3**	**4.1**		
MASS OF WET SOIL + TARE (g)	197.6	151.3	164.9	106.5	160.8	164.5		
MASS OF DRY SOIL + TARE (g)	175.7	133.4	143.2	102.5	143.1	148.2		
MASS OF TARE (g)	90.6	88.5	92.5	87.5	92.4	97.4		
WATER CONTENT (%)	**25.7%**	**39.9%**	**42.8%**	**26.7%**	**34.9%**	**32.1%**		

BOREHOLE NUMBER	**BH8**	**BH8**	**BH8**	**BH8**	**BH8**	**BH8**		
SAMPLE NUMBER	**AS1**	**SS1**	**SS2a**	**SS2b**	**SS3**	**SS4**		
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.4**	**2.7**	**3.3**	**4.1**		
MASS OF WET SOIL + TARE (g)	166.4	260.6	274.6	275.9	324.5	340.6		
MASS OF DRY SOIL + TARE (g)	151.0	243.6	259.8	268.8	303.4	317.1		
MASS OF TARE (g)	94.3	196.2	210.7	239.2	238.3	243.3		
WATER CONTENT (%)	**27.2%**	**35.9%**	**30.1%**	**24.0%**	**32.4%**	**31.8%**		

Comments:

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MOISTURE CONTENTS

Tested in accordance with LS-701 (ASTM D 2216)

Project:	Proposed Subdivision
Location:	0 Chippewa Street
Date Sampled:	Monday, January 23, 2023
Date Tested:	Tuesday, January 31, 2023

Contract Number:	G22042
Client:	Mamta Homes
Sampled By:	A. Waboose
Tested By:	A. Waboose

BOREHOLE NUMBER	**BH9**	**BH9**	**BH9**	**BH9**	**BH9**	**BH9**		
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**		
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.4**	**3.3**	**4.1**	**5.7**		
MASS OF WET SOIL + TARE (g)	183.9	170.7	124.1	116.4	132.3	149.9		
MASS OF DRY SOIL + TARE (g)	162.8	154.0	118.4	111.2	123.3	136.1		
MASS OF TARE (g)	93.2	95.4	97.4	94.3	92.5	99.4		
WATER CONTENT (%)	**30.3%**	**28.5%**	**27.1%**	**30.8%**	**29.2%**	**37.6%**		

BOREHOLE NUMBER	**BH10**	**BH10**	**BH10**	**BH10**	**BH10**	**BH10**		
SAMPLE NUMBER	**AS1**	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**		
LAB NUMBER								
DEPTH OF SAMPLE (m)	**0.3**	**1.1**	**2.6**	**4.1**	**4.8**	**5.6**		
MASS OF WET SOIL + TARE (g)	155.0	276.3	179.0	170.0	170.7	152.2		
MASS OF DRY SOIL + TARE (g)	139.3	261.3	156.0	152.8	154.1	138.1		
MASS OF TARE (g)	87.8	201.4	88.6	92.7	92.6	93.3		
WATER CONTENT (%)	**30.5%**	**25.0%**	**34.1%**	**28.6%**	**27.0%**	**31.5%**		

BOREHOLE NUMBER								
SAMPLE NUMBER								
LAB NUMBER								
DEPTH OF SAMPLE (m)								
MASS OF WET SOIL + TARE (g)								
MASS OF DRY SOIL + TARE (g)								
MASS OF TARE (g)								
WATER CONTENT (%)								

BOREHOLE NUMBER								
SAMPLE NUMBER								
LAB NUMBER								
DEPTH OF SAMPLE (m)								
MASS OF WET SOIL + TARE (g)								
MASS OF DRY SOIL + TARE (g)								
MASS OF TARE (g)								
WATER CONTENT (%)								

Comments:

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ATTERBERG LIMITS

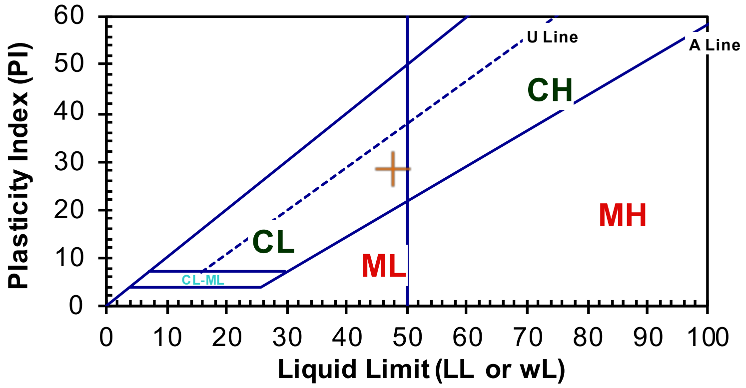
Tested in accordance with LS-703/704 (ASTM D4318)

Project:	Proposed Subdivision, 0 Chipewa St.
Sample Number:	BH1, SS1
Date Sampled:	19-Jan-23
Date Tested:	08-Feb-23

Contract Number:	G22042
Sample Depth:	0.8 m - 1.4 m
Sampled By:	S.Hoffman
Tested By:	S.Hoffman

TEST			**PLASTIC LIMIT**				**LIQUID LIMIT**			
Variable	**NO**		**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	Var.	**Units**								
Number of Blows	N	blows					16	20	31	
Can Number	---	---	A	B	C		E	G	J	
Mass of Empty Can	M_C	(g)	13.59	13.67	13.62		13.62	13.66	13.70	
Mass Can & Soil (Wet)	M_{CMS}	(g)	18.01	17.26	18.05		30.03	27.40	28.92	
Mass Can & Soil (Dry)	M_{CDS}	(g)	17.29	16.67	17.34		24.70	23.00	24.01	
Mass of Soil	M_S	(g)	3.70	3.00	3.72		11.08	9.34	10.31	
Mass of Water	M_W	(g)	0.72	0.59	0.71		5.33	4.40	4.91	
Water Content	w	(%)	19.5	19.7	19.1		48.1	47.1	47.6	

Liquid Limit (LL or w_L) (%):	47.6
Plastic Limit (PL or w_P) (%):	19.4
Plasticity Index (PI) (%):	28.2
USCS Classification:	



PI at "A" Line = 0.73(LL-20)

One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$

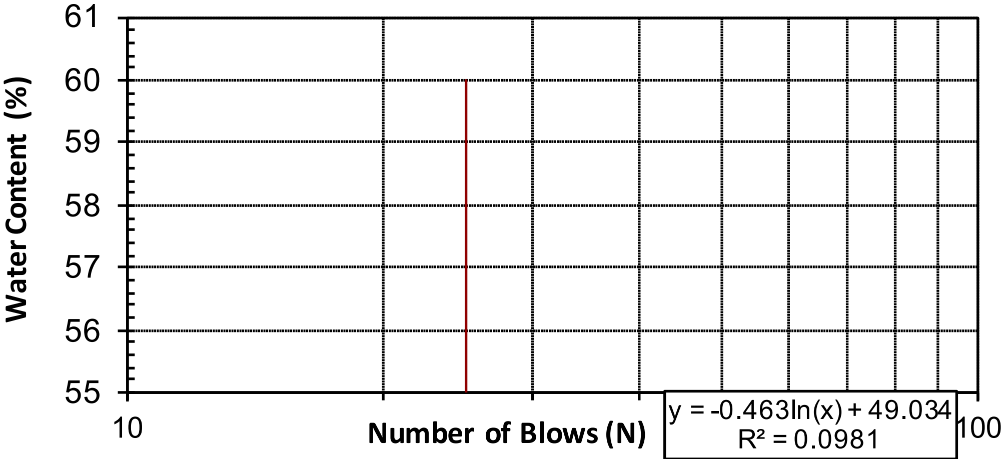
PROCEDURE USED

☐ **Wet Preperation**

☒ **Dry Preperation**

☐ **Procedure A Multipoint**

☐ **Procedure B One-Point**



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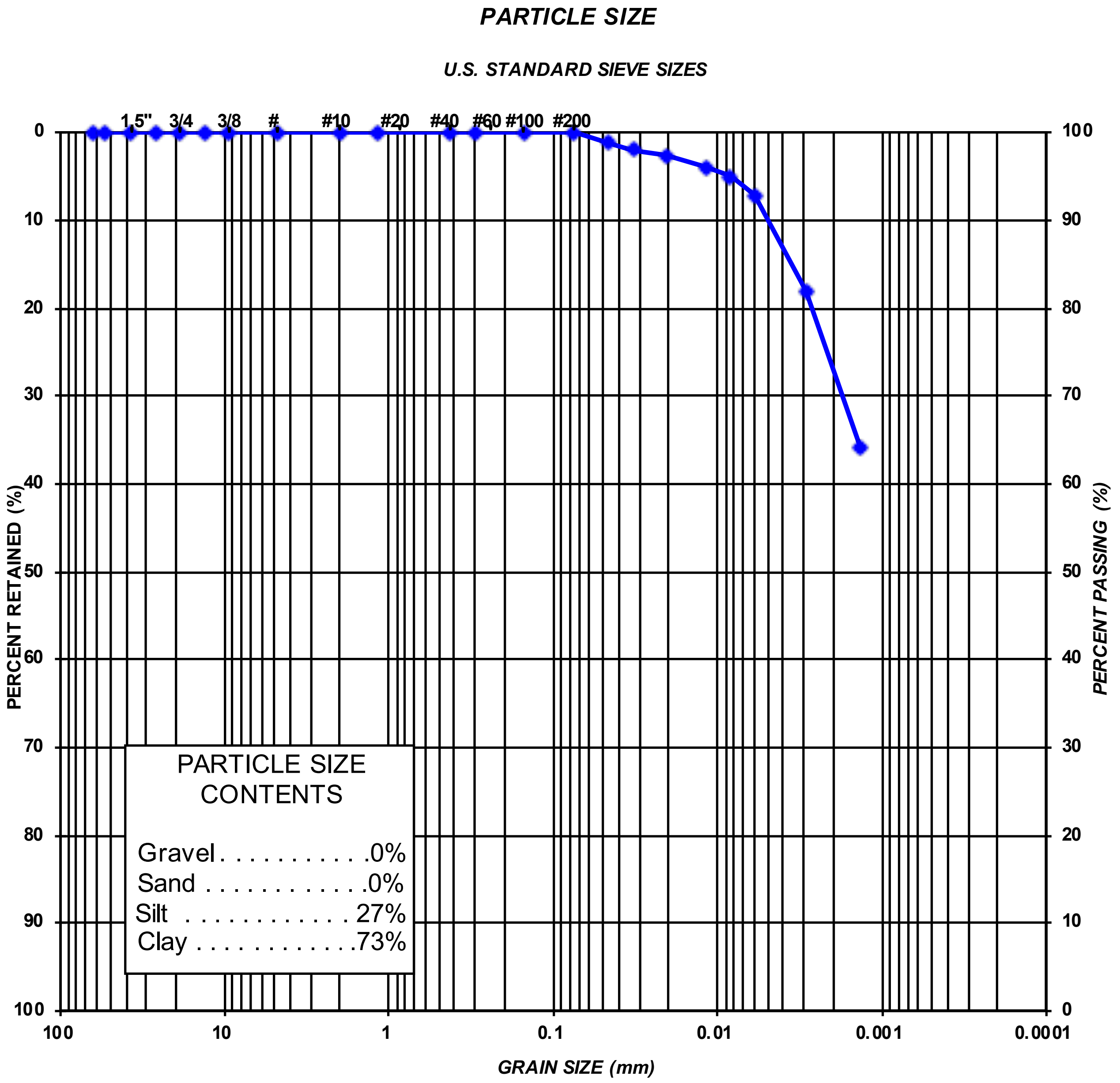
PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

Tested in accordance with LS-702

Project: Proposed Subdivision, 0 Chipewa St.
Lab Number:
Source: BH 1, SS2
Date Sampled: January 19, 2023
Date Tested: February 9, 2023

Contract Number: G22042
Material: Silty Clay
Sample Depth (m): 1.5 - 2.1
Sampled By: S. Hoffman
Tested By: S. Hoffman



UNIFIED SYSTEM	COARSE	FINE	COARS	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

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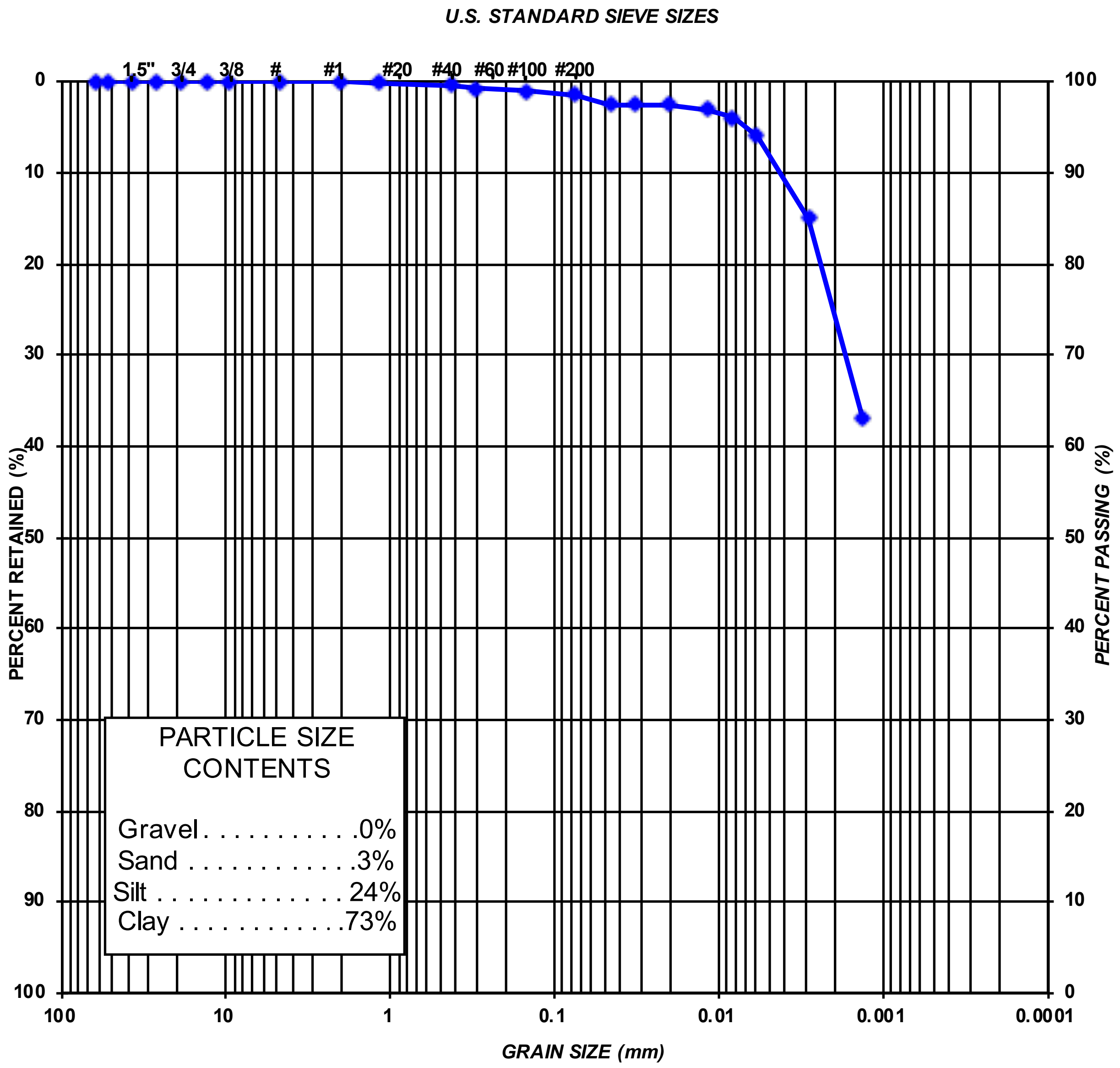
PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

Tested in accordance with LS-702

Project: Proposed Subdivision, 0 Chipewa St.
Lab Number:
Source: BH 2 - SS1
Date Sampled: January 24, 2023
Date Tested: February 10, 2023

Contract Number: G22042
Material: Silty Clay, trace fine sand
Sample Depth (m): 0.8 - 1.4
Sampled By: S. Hoffman
Tested By: S. Hoffman

PARTICLE SIZE



PARTICLE SIZE CONTENTS

Gravel 0%
Sand 3%
Silt 24%
Clay 73%

UNIFED SYSTEM	COARSE	FINE	COAR	MEDIUM	FINE	**SILT AND CLAY**
	GRAVEL		**SAND**			

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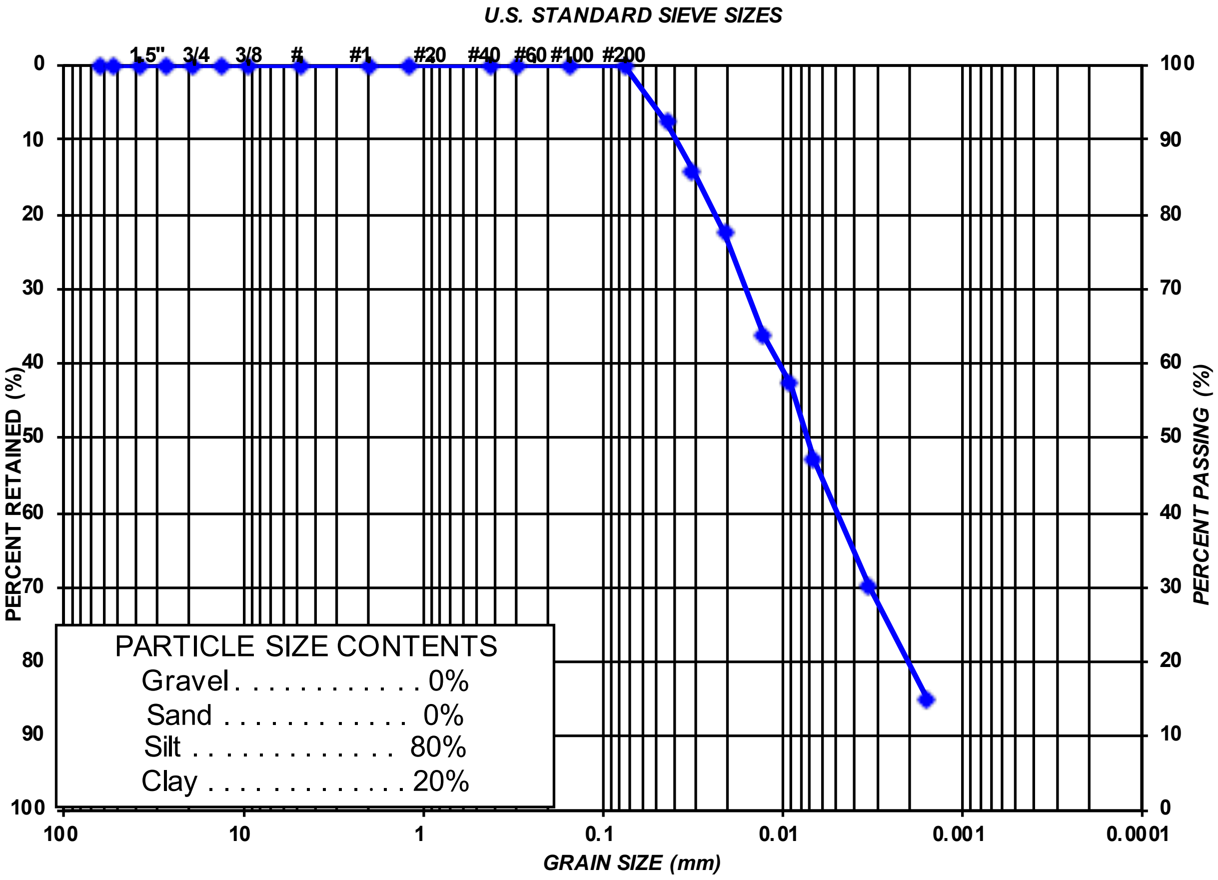
PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

Tested in accordance with LS-702

Project: Proposed Subdivision, 0 Chipewa St	Contract Number: G22042
Lab Number:	Material: Silt, some clay
Source: BH2, SS2	Sample Depth (m): 2.3 - 2.9
Date Sampled: January 19, 2023	Sampled By: S. Hoffman
Date Tested: February 9, 2023	Tested By: S. Hoffman

PARTICLE SIZE



PARTICLE SIZE CONTENTS
Gravel 0%
Sand 0%
Silt 80%
Clay 20%

UNIFIED SYSTEM	COARSE	FINE	COAR	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

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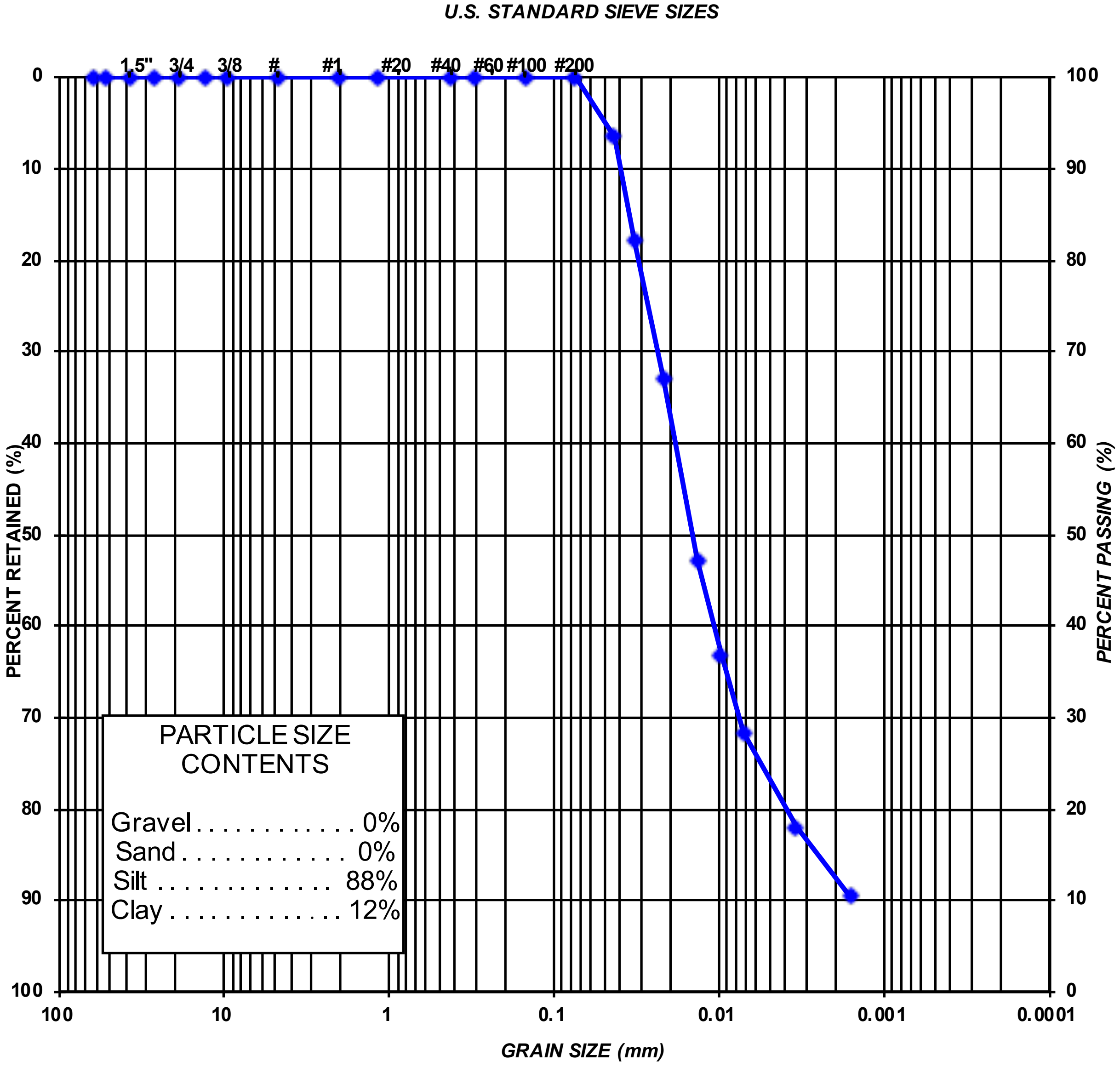
PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

Tested in accordance with LS-702

Project: Proposed Subdivision, 0 Chippewa St.	Contract Number: G22042
Lab Number:	Material: Silt, some Clay
Source: BH4, SS1	Sample Depth (m): 1.5 - 2.1
Date Sampled: January 20, 2023	Sampled By: S. Hoffman
Date Tested: February 9, 2023	Tested By: S. Hoffman

PARTICLE SIZE



UNIFIED SYSTE M	COARSE	FINE	COAR	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

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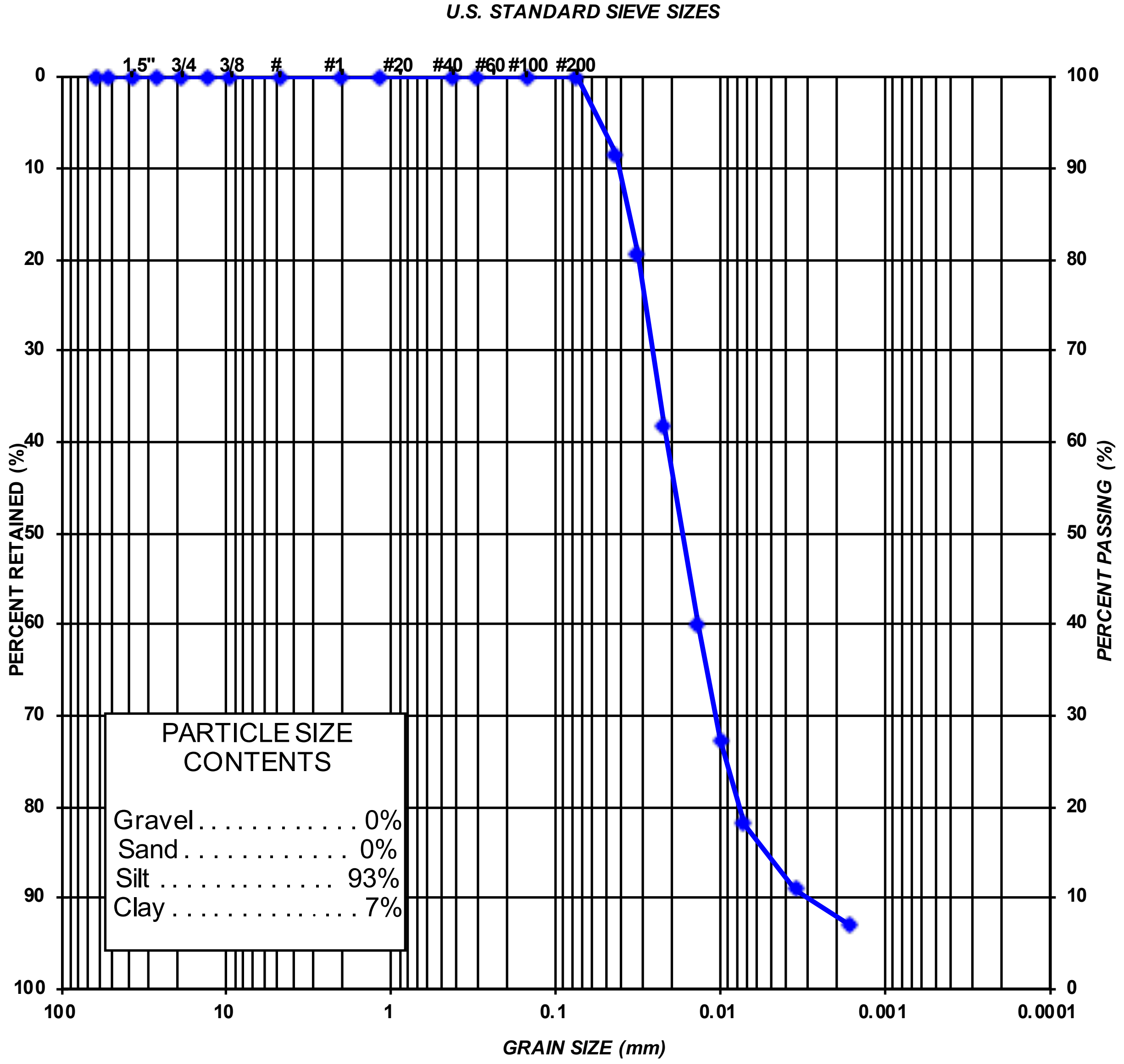
PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

Tested in accordance with LS-702

Project: Proposed Subdivision, 0 Chippewa St	Contract Number: G22042
Lab Number:	Material: Silt, trace Clay
Source: BH6, SS3	Sample Depth (m): 2.3 - 2.9
Date Sampled: January 20, 2023	Sampled By: S. Hoffman
Date Tested: February 9, 2023	Tested By: S. Hoffman

PARTICLE SIZE



PARTICLE SIZE CONTENTS

Gravel	0%
Sand	0%
Silt	93%
Clay	7%

<table>
<tr><td rowspan="2">UNIFIED SYSTEM</td><td>COARSE</td><td>FINE</td><td>COAR</td><td>MEDIUM</td><td>FINE</td><td rowspan="2">SILT AND CLAY</td></tr>
<tr><td colspan="2">GRAVEL</td><td colspan="3">SAND</td></tr>
</table>

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ATTERBERG LIMITS

Tested in accordance with LS-703/704 (ASTM D4318)

Project:	Proposed Subdivision, 0 Chipewa St.	Contract Number:	G22042
Sample Number:	BH10, SS2	Sample Depth:	2.3 m - 2.9 m
Date Sampled:	19-Jan-23	Sampled By:	S.Hoffman
Date Tested:	08-Feb-23	Tested By:	S.Hoffman

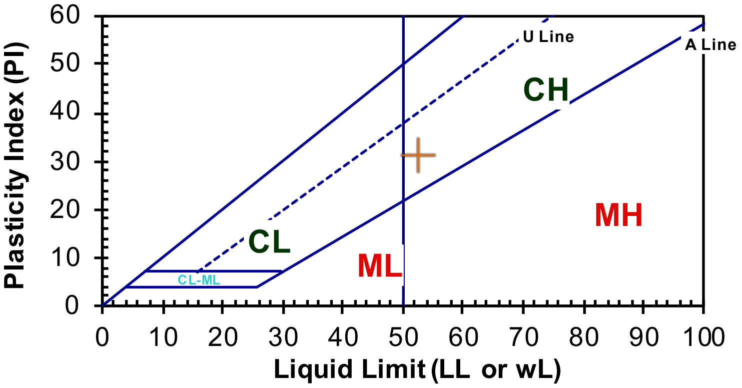
TEST			**PLASTIC LIMIT**				**LIQUID LIMIT**			
Variable	**NO**		**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	Var.	**Units**								
Number of Blows	N	blows					17	21	30	
Can Number	---	---	A	B	C		E	G	J	
Mass of Empty Can	M_C	(g)	13.64	13.65	13.75		13.65	13.64	13.69	
Mass Can & Soil (Wet)	M_{CMS}	(g)	18.03	17.33	18.05		30.60	28.18	29.40	
Mass Can & Soil (Dry)	M_{CDS}	(g)	17.24	16.69	17.29		24.82	23.20	23.89	
Mass of Soil	M_S	(g)	3.60	3.04	3.54		11.17	9.56	10.20	
Mass of Water	M_W	(g)	0.79	0.64	0.76		5.78	4.98	5.51	
Water Content	w	(%)	21.9	21.1	21.5		51.7	52.1	54.0	

Liquid Limit (LL or w_L) (%):	52.6
Plastic Limit (PL or w_P) (%):	21.5
Plasticity Index (PI) (%):	31.1
USCS Classification:	

PI at "A" Line = 0.73(LL-20)

One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



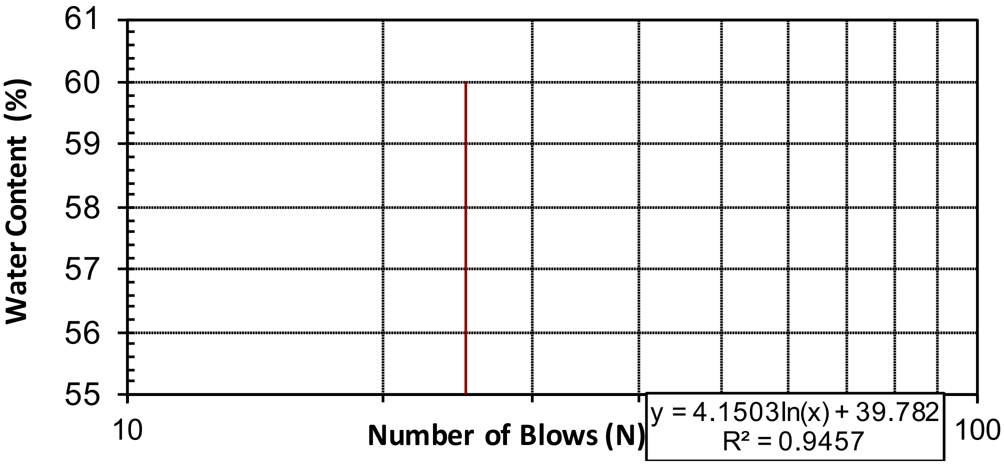
PROCEDURE USED

☐ **Wet Preperation**

☒ **Dry Preperation**

☐ **Procedure A Multipoint**

☐ **Procedure B One-Point**



DOWN TO EARTH
geotechnical engineering

253 Old Garden River Road
Sault Ste. Marie, ON
P6B 5A7
Ph. 705.257.0571

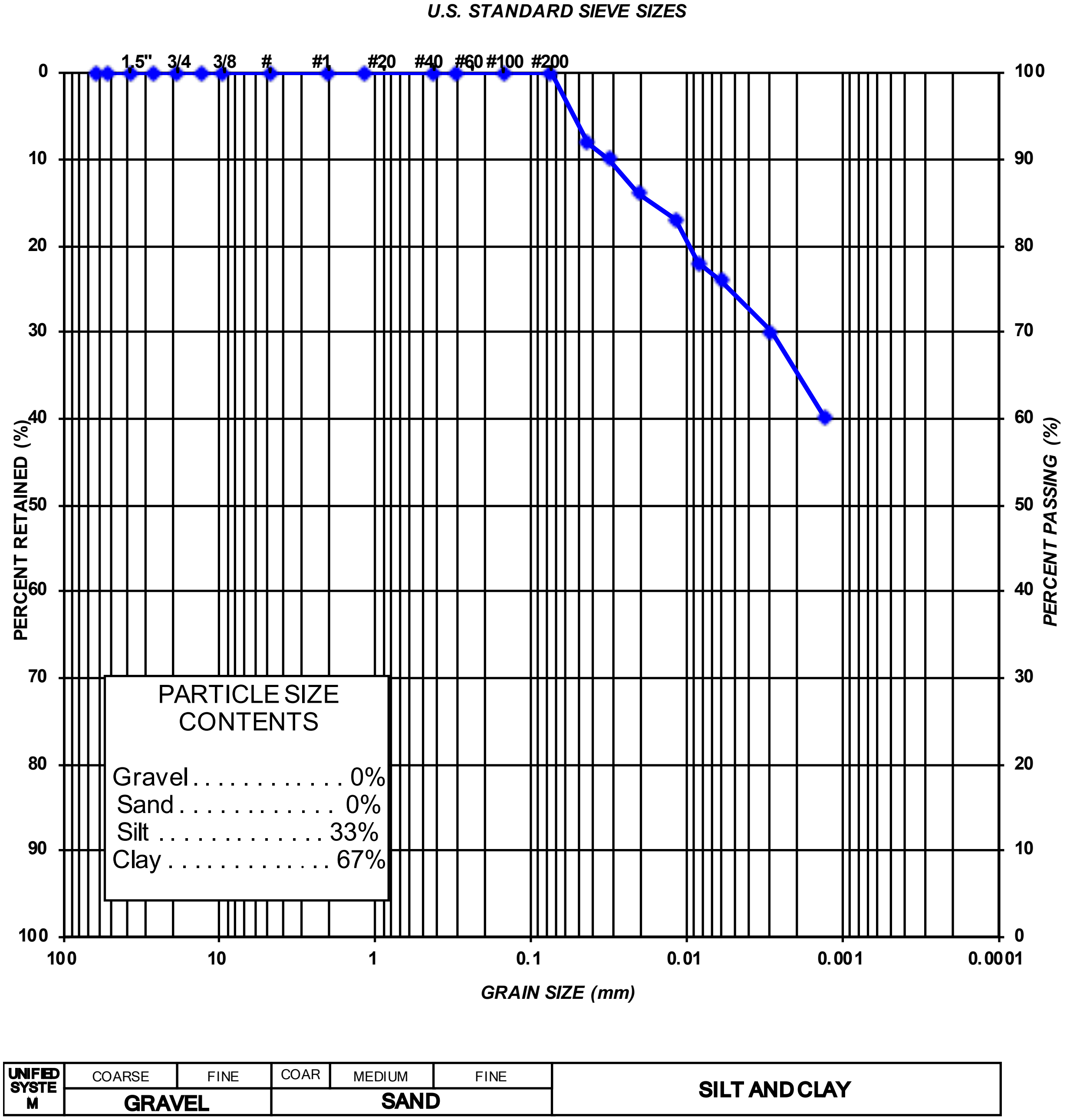
PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

Tested in accordance with LS-702

Project: Proposed Subdivision, 0 Chippewa St.
Lab Number:
Source: BH10, SS5
Date Sampled: January 24, 2023
Date Tested: February 10, 2023

Contract Number: G22042
Material: Silty Clay
Sample Depth (m): 5.3 - 5.9
Sampled By: S.Hoffman
Tested By: S. Hoffman

PARTICLE SIZE



PARTICLE SIZE CONTENTS

Gravel 0%
Sand 0%
Silt 33%
Clay 67%

APPENDIX E

REPORT LIMITATIONS AND GUIDELINES FOR USE

REPORT LIMITATIONS & GUIDELINES FOR USE

This report is intended to reduce, but not eliminate, uncertainty regarding the subsurface conditions at the Site(s), and recognizes reasonable limits on time and cost. There are risks associated with any and all subsurface investigation work, which must be reasonably recognized by the Client.

The following information has been provided to help manage and mitigate any potential risks that could arise with the misuse of this report.

USE OF THIS REPORT

This report has been prepared for the exclusive use and sole benefit of the Client or its authorized agent(s) and may not be used by any third party without the express written consent of Down to Earth Geotechnical Engineering and the Client. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of third parties. This report is not to be construed as legal advice. Down to Earth Geotechnical Engineering disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranty is expressed or implied.

Misinterpretation of this report by other design team members or contractors could result in significant financial and safety issues. Retaining Down to Earth Geotechnical Engineering to confer with the appropriate members of the design team can substantially lower those potential issues. To minimize those issues, Down to Earth Geotechnical Engineering should be retained to review pertinent elements of the design team's plans and specifications. Retaining Down to Earth Geotechnical Engineering to participate in prebid and preconstruction meetings can further reduce these issues. All retainer fees will be based on our professional engineering rates and disbursements at that time.

BASIS OF THE REPORT

The information, opinions, and/or recommendations made in this report are in accordance with Down to Earth Geotechnical Engineering’s present understanding of the Site specific project as described by the Client. The applicability of these is restricted to the Site conditions encountered at the time of the investigation or study. If the proposed Site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Down to Earth Geotechnical Engineering is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE

Based on the limitations of the scope of work, schedule, and budget, the preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care for the specific professional service provided to the Client. The geotechnical engineering discussions that have been presented are based on the factual data obtained from this investigation. No other warranty is expressed or implied.

INTERPRETATION OF SITE CONDITIONS

Soil, rock, groundwater or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Down to Earth Geotechnical Engineering at the time of the work, and at the specific testing and/or sampling locations. Classifications and statements of condition(s) have been made in accordance with commonly accepted practices, which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in-situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and Site use. No warranty or other conditions, expressed or implied, should be understood.

VARYING OR UNEXPECTED CONDITIONS:

Regardless how exhaustive a geotechnical investigation is performed, the investigation cannot identify all the subsurface conditions, which may differ from the conditions encountered at the test locations at the time of our investigation. Further, subsurface conditions can change with time due to natural and direct or indirect human impacts at or away from the Site. As such, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation, which may also change with time. Groundwater conditions are especially susceptible to variations with time and space, and as such, comments regarding the anticipated groundwater management procedures outlined within this report may not be applicable, and appropriated groundwater control should be based on the groundwater conditions at the time of construction.

Should any Site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Down to Earth Geotechnical Engineering must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Down to Earth Geotechnical Engineering will not be responsible to any party for damages incurred as a result of failing to notify Down to Earth Geotechnical Engineering that differing Site or subsurface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, AND CONSTRUCTION

If there are any changes in the project scope or development features, which may affect our assessment, the information obtained during the investigation may be inadequate. In this case, Down to Earth Geotechnical Engineering should be retained to review the project changes to evaluate if the changes will affect the conclusions and recommendations within our report, and if additional field investigation work, as well as reporting is required as part of the reassessment.

Development or design plans and specifications should be reviewed by Down to Earth Geotechnical Engineering, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etcetera), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer. Down to Earth Geotechnical Engineering cannot be responsible for site work carried out without being present.

This report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor's responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all other acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

Contractors bidding on or undertaking work on the project should be directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their own investigations and their own interpretations of the factual investigation results, cognizant of the risks implicit in the subsurface investigation activities, which may affect construction costs, techniques, equipment and scheduling.

This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

ENVIRONMENTAL DISCLAIMER

This report is geotechnical in nature and was not performed in accordance with any environmental sampling guidelines or procedures to identify any potential soil or groundwater contaminants. Any mention of visual or olfactory contamination evidence that may have been presented within this report is only to bring to the Client's attention that there could be possible issues with contaminants and/or environmental concerns. As such, any environmental comments are very preliminary in nature. Further, if contaminates or environmental concerns were not presented within the report it does not mean that they will not be encountered or observed during future Site developments or construction works. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. It is the responsibility of the Client to decide, if an appropriate environmental assessment of the Site should or should not be performed to further delineate any mentioned or potential contaminates.

The term "contamination/contaminates" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their byproducts.

FINANCIAL DISCLAIMER

Down to Earth will not be responsible for any consequential or indirect damages. Down to Earth will only be held liable for damages resulting from the negligence of Down to Earth. Down to Earth will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Down to Earth to recover such losses or damage. Any liability resulting from negligence of Down to Earth Geotechnical Engineering and its officers shall be limited to the lesser of fees paid and/or actual damages incurred by the Client.

LEGAL DISCLAIMER

Down to Earth Geotechnical Engineering makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters that could be construed within this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time.

Appendix 4

Stormwater Management Plan

Stormwater Management Report

Proposed Residential Subdivision,
0 Chippewa Avenue
Sault Ste. Marie, Ontario

Prepared for:
Mamta Homes

KRESIN
Engineering Corporation
www.kresinengineering.ca

June 2024
KEC Ref: 2278

TABLE OF CONTENTS

APPENDICES

1. Introduction

Kresin Engineering Corporation (“KEC”) has been retained by Mamta Homes Inc. (“Mamta”) to prepare a stormwater management plan (“SWMP”) for the planned subdivision at 0 Chippewa Avenue (the “site”). Mamta is proposing to develop the site for mixed density residential use, including single family homes, semi-detached homes, townhouses and apartment buildings.

2. Background

The site is a vacant 15.1 hectare parcel of land in the west end of Sault Ste. Marie, located north of Second Line and west of Goulais Avenue, adjacent to the existing Broadview Gardens neighbourhood. The site is bordered on the west by the West Davignon Creek, constructed ditches to the north and south and Broadview Gardens to the east..

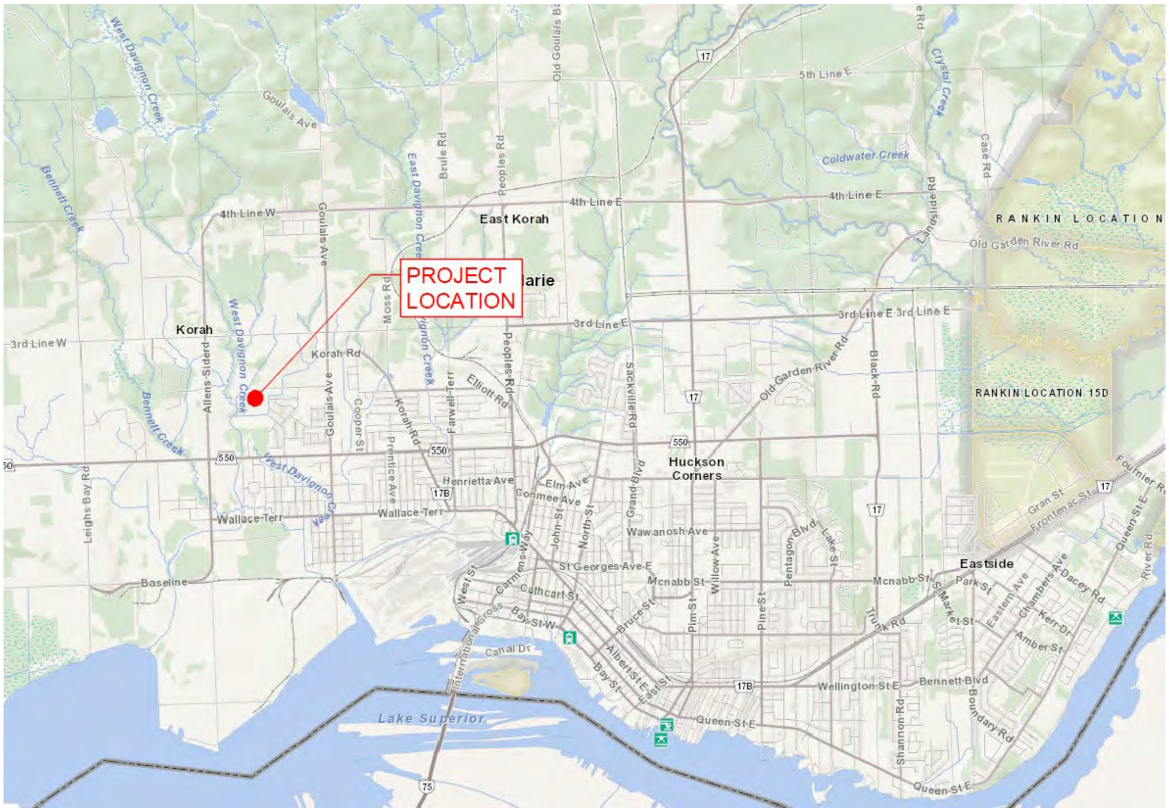


Figure 1: Project Location in Sault Ste. Marie, Ontario

It is our understanding that the property has historically been used for agricultural purposes, and it is currently zoned as Rural Area Zone in the City’s zoning by-law.

3. Proposed Subdivision

The proposed development consists of residential uses in a mix of densities including single family, semi-detached and multi-family as follows:

Table 1: Lot Count

Use	Number of Lots
Single Family Residential	66
Semi-Detached	16
Townhouse	104
Apartment	2

The proposed subdivision is divided into the following three parcels as shown in Figure 2:

- Parcel A: Freehold single family and semi-detached with municipal roads/services.
- Parcel B: Townhouse condominium with private roads (condo association).
- Parcel C: Apartment buildings.

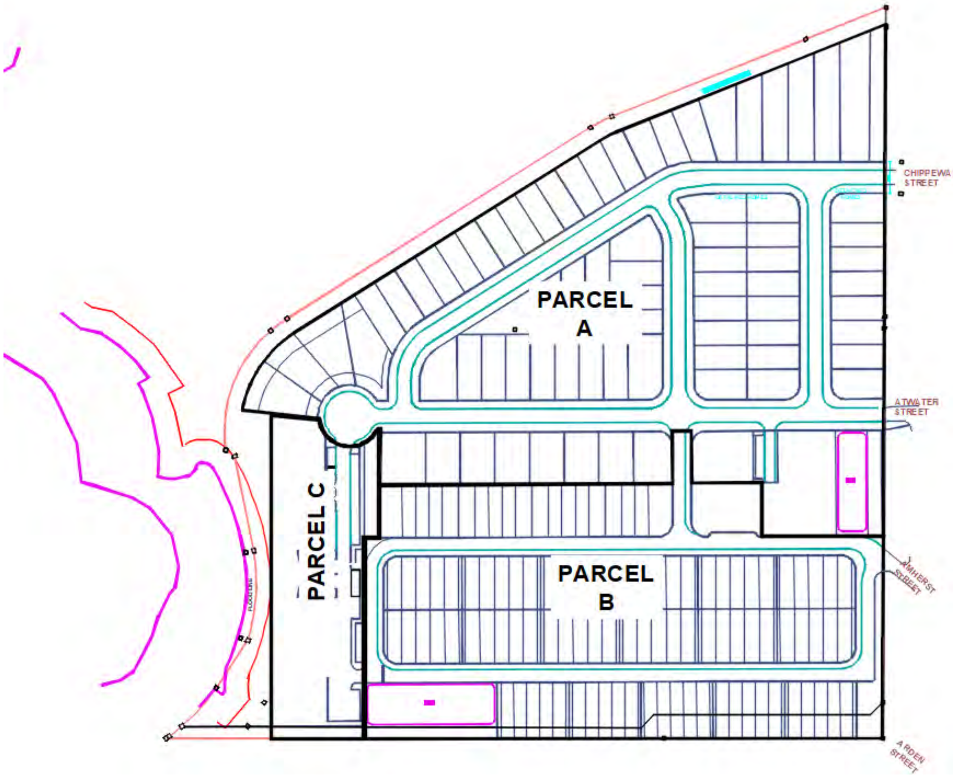


Figure 2: 0 Chippewa Avenue (the "Site")

This report is intended to address the SWMP for Parcel A only, as Parcel A servicing will be municipally owned. Stormwater management for Parcels B and C will be addressed during the site plan approval stage for those projects.

The development is to include construction of local roads, sewers, and water distribution, as well as electrical, natural gas and telecom infrastructure. The proposed roads are to be Class

"A" pavement including curbs and gutters with storm sewers. Storm water infrastructure will include yard drainage, road drainage and connections for foundation drains/sump pumps of individual buildings.

4. Stormwater Management

The City of Sault Ste. Marie ("City") Stormwater Management Guidelines (the "Guidelines") provides direction for the design of stormwater drainage systems serving developments within the City. As stated in the Guidelines, the goals of these drainage systems is to:

- Protect human health and safety;
- Protect property, structures and infrastructure from damage;
- Preserve natural water courses and wetlands; and,
- Minimize impacts on the quantity and quality of surface and groundwater.

The goals are to be addressed through the engineered design of stormwater collection, transmission and management systems. The collection and transmission components comprise catch basins and other inlets, as well as ditches, swales, culverts and other piped storm sewers. Stormwater management systems may include lot level, and/or a development scale approaches to control quantity, rate and quality of stormwater discharge.

Existing Conditions (Pre-Development)

Stormwater runoff for the pre-development conditions of Parcel A is projected using the airport method, with an estimated runoff coefficient of 0.35 (MTO Drainage Management Manual, Design Chart 1.07, flat woodland, clay soil). With the topographic characteristics described above and available rainfall IDF data for Sault Ste. Marie, the following runoff volumes are estimated:

Table 2: Existing runoff rates

Storm Return Period	Peak runoff (L/s)
10 year	281
100 year	467
Regional Storm	592

Calculation summary sheets are attached in Appendix A.

Post Development

It is proposed that Parcel A of the subdivision will discharge stormwater flows to a constructed dry pond of sufficient capacity to accommodate the required design storm. The pond will be equipped with flow control structure(s) designed to ensure that the peak outflow does not exceed the pre-development flows noted above.

Storm Sewer System

In accordance with the Guidelines, the storm sewer system (minor system) has been designed to accommodate flows from a 10 year return storm event without surcharging. Flows exceeding the capacity of the storm sewers will be accommodated via overland pathways and directed to avoid flooding of buildings.

Overland flow pathways are sized to accommodate flows up to and including the design major storm event (i.e. 100 year return event and the Regional Storm) without negative impacts to private property.

Storm sewer design plans and sheets are attached in Appendix B.

Storm Water Management Facility

The proposed Stormwater Management (SWM) Facility is designed to accommodate the required flow rates and quantities, and is in accordance with the City's design criteria, including:

- Quality control for enhanced level of protection;
- Municipal Stormwater Management Guidelines; and,
- Provincial Stormwater Management Standards.

Based on the design rainfall events, the SWM pond can accommodate a volume of approximately 2120m^3 of runoff with a maximum depth of 1.5m. In accordance with City guidelines, the pond will be constructed with 4:1 side slopes and will provide at least 0.3m of freeboard above the maximum operating level.

The outlet structure of the SWM pond has been designed to limit the rate of discharge to ensure pre-development rates are not exceeded; a summary is shown in Table 3. The discharge from the pond is directed to an existing municipal drainage ditch.

Table 3: SWM Pond Summary

Design Storm	Runoff rate (m^3/s)		SWM Pond	
	Pre	Post	Depth (m)	Volume (m^3)
10 year	0.281	0.562	1.03	1300
100 year	0.467	0.848	1.19	1575
Regional Storm	0.592	0.863	1.45	2040

In addition to managing the flow rate of runoff, the SWM facility will also provide the necessary enhanced level of protection for stormwater quality. Enhanced protection is defined as the long term average removal of 80% of total suspended solids (TSS) up to and including a 10 year return storm; this will be achieved utilizing Stormscepter oil/grit separator (OGS) at the pond inlet.

5. Maintenance and Operation

The storm sewer system will require maintenance in order to ensure proper function and long term performance. Routine maintenance may include catch-basin cleaning, vegetation management at the SWMP, pipeline inspections and maintenance hole cleaning. The timing of the maintenance should coincide with the City's standard procedures for storm sewer systems.

Stormceptor OGS unit(s) will require routine inspection and periodic sediment removal. Initially following installation and during the development build-out stage, annual inspection is recommended to confirm proper function and to observe sediment build-up. Once the development is built and landscaping has been established, the inspection interval may be extended pending observations.

Sediment removal, using a vacuum truck, will be required when the depth of sediment is approximately 15% of the unit's total storage capacity.

A copy of the Stormceptor manual is attached in Appendix C.

6. Closure

This stormwater management plan has been developed to provide the intended results in accordance with the Guidelines.

Runoff from the Site following storm events will be treated for minimum 80% TSS removal.

Flow rates from storm events will be tempered through the SWM facility so that the overall downstream peak flows will not increase when compared to pre-development discharge rate.

Thank you.

Yours Very Truly,
Kresin Engineering Corporation

Michael Kresin, P. Eng.
Consulting Engineer

2278 mk SWMP.docx

APPENDIX A

STORMWATER MODELLING

Storm Sewer Design Sheet

Project: **Chippewa Ave. Subdivision**
Client: **Mamta Homes**

KEC Project: **2278.03**
Date Updated: **March 8, 2023**

Bransby Williams Formula
Time of Concentration= 0.057xL/(Sw^0.2xA^0.1)
L= Watershed Length 571.00m
Sw= Watershed Slope 0.70%
A= Watershed Area 7.31ha
Time of Concentration= 10.00min

Design Parameters:

Storm Event Data: Sault Ste. Marie Airport AES IDF Curve (2010)
Use Rational Formula: Q=2.78CiA, for runoff generation.
Use Mannings Equation for sewer capacity determination.
Time of concentration: where C > 0.4 use Bransby Williams Formula (Tc= 0.057 x L / Sw0.2 x A0.1)
where C < 0.4 use Airport Formula (Tc= $(3.26*(1.1*C)*L^{0.5})/S_w^{0.33}$)

Pipe diameter are actual ID. From manufacturer's catalogs.
Pipe less then 600 nominal - PVC PROFILE PIPE
Pipe 600 nominal and larger - CONCRETE

Sewer Capacity:

Mannings Equation - $Q = 1/n * A * R^{2/3} * S^{1/2}$
Roughness Coefficient (n) - 0.013
Hydraulic Radius (R) - 0.25 * pipe diameter
Design Flow Velocity - $V= 1/n * R^{2/3} * S^{\wedge 1/2}$

LOCATION			DESIGN FLOWS										PIPE DESIGN							
			TRIBUTARY AREA										SEWER DATA							
from MH	**to MH**	**Area**	Roads C= 0.90 (ha)	Single Fam C= 0.35 (ha)	Grass C= 0.20 (ha)	Semis C= 0.50 (ha)	Commercial C= 0.85 (ha)	**Individual 2.78 CA**	**Cumulative 2.78 CA**	**Time of Concentration** (min)	**Rainfall Intensity** (mm/hr)	**Flow "Q_d" (L/s)**	**Trade Size**	**Average ID** (mm)	**Grade** (%)	**Length** (m)	**Capacity** "Q_{cap}" (L/s)	**Velocity** (m/s)	**Time** (min)	**Pipe Utilization** (Q_d/Q_{cap})
1	2	A1	0.05	0.15	0.23	0.00	0.00	0.399	0.399	10.0	116.1	46.3		375	0.15	33.9	67.91	0.62	10.0	68%
5	2	A2	0.10	0.36	0.20	0.00	0.00	0.712	1.111	10.9	109.2	121.3		525	0.13	79.8	155.06	0.72	10.9	78%
2	3	A3	0.08	0.52	0.00	0.00	0.00	0.706	1.817	12.8	97.8	177.7		750	0.06	81.9	272.70	0.62	12.8	65%
3	4	A4	0.13	0.61	0.00	0.00	0.00	0.919	2.736	15.0	87.5	239.3		750	0.05	74.9	248.94	0.56	15.0	96%
6	7	B1	0.09	0.46	0.00	0.00	0.00	0.673	0.673	10.0	116.1	78.1		450	0.08	82.8	80.64	0.51	10.0	97%
7	8	B2	0.13	0.78	0.00	0.00	0.00	1.084	1.757	12.7	98.1	172.4		600	0.08	100.7	173.67	0.61	12.7	99%
8	9	B3	0.04	0.17	0.00	0.00	0.00	0.273	2.030	15.5	85.6	173.8		675	0.07	40.8	222.40	0.62	15.5	78%
9	10	B4	0.14	0.59	0.00	0.00	0.00	0.924	2.954	16.5	81.6	241.1		750	0.06	109.7	272.70	0.62	16.5	88%
11	12	C1	0.18	0.50	0.00	0.12	0.00	1.109	1.109	10.0	116.1	128.7		450	0.23	56.5	136.73	0.86	10.0	94%
12	13	C2	0.07	0.24	0.00	0.23	0.00	0.728	1.837	11.1	108.0	198.3		600	0.12	61.0	212.70	0.75	11.1	93%
13	10	C3	0.14	0.46	0.00	0.31	0.00	1.229	3.066	12.4	99.6	305.4		825	0.07	96.8	379.78	0.71	12.4	80%
10	4	C4	0.06	0.00	0.00	0.00	0.15	0.505	6.525	14.7	88.6	578.1		900	0.09	87.0	543.09	0.85	14.7	106%
4	POND		0.00	0.00	0.00	0.00	0.00	0.000	9.260	16.4	82.1	760.0		900	0.16	25.0	724.12	1.14	16.4	105%
			0.18	0.35	0.00	0.30	0.00													
	TOTAL		1.40	5.19	0.43	0.96	0.15									930.8				

Stormwater modelling output

EPA SWMM/Autodesk SSA

O Chippewa Avenue Development – Municipal portion

10 year return event

```
  Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)
  -----------------------------------------------------------------------------------------

  *******************
  Project Description
  *******************
  File Name ................. CHIPPEWA WITH STORM IMPORT.SPF
  Description ............... S:\projects\2022\2278 Chippewa Ave Development\2278 Acad\Design\C3D-2278.03 P1 P2
P3 P4.dwg


  ****************
  Analysis Options
  ****************
  Flow Units ................ LPS
  Subbasin Hydrograph Method. EPA SWMM
  Infiltration Method ....... Horton
  Link Routing Method ....... Kinematic Wave
  Storage Node Exfiltration.. None
  Starting Date ............. JUN-09-2024 00:00:00
  Ending Date ............... JUN-10-2024 00:00:00
  Antecedent Dry Days ....... 0.0
  Report Time Step .......... 00:05:00
  Wet Time Step ............. 00:05:00
  Dry Time Step ............. 01:00:00
  Routing Time Step ......... 30.00 sec


  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subbasins ....... 14
  Number of nodes ........... 16
```

```
Number of links ........... 14
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
Gage                Data                Data       Recording
ID                  Source              Type       Interval
                                                              min
------------------------------------------------------------
100-yr storm        10-yr               INTENSITY       6.00
10-yr storm         10-yr               INTENSITY       6.00
timmins             10-yr               INTENSITY       6.00


****************
Subbasin Summary
****************
Subbasin                 Total    Equiv.   Imperv.   Average    Raingage
                          Area     Width      Area     Slope
ID                    hectares         m         %         %
------------------------------------------------------------------------
PRE DVLP                  7.31    100.00      0.00    1.2600    10-yr storm
Sub-05                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-06                    0.60     40.00     25.00    1.2600    10-yr storm
Sub-07                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-08                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-09                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-10                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-11                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-12                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-13                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-14                    0.60     60.00     25.00    1.2600    10-yr storm
```

```
Sub-15                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-16                    0.60     60.00     25.00    1.2600    10-yr storm
Sub-17                    0.60     60.00     25.00    1.2600    10-yr storm


************
Node Summary
************
Node                Element                Invert   Maximum    Ponded    External
ID                  Type                Elevation     Elev.      Area      Inflow
                                                m         m        m²
------------------------------------------------------------------------------
EndNullStruct0      JUNCTION              0.00      0.00      0.00
MH 1 (Proposed Storm)JUNCTION            193.79    195.60      0.00
MH 10 (Proposed Storm)JUNCTION            193.63    195.60      0.00
MH 11 (Proposed Storm)JUNCTION            193.85    195.64      0.00
MH 12 (Proposed Storm)JUNCTION            193.75    196.27      0.00
MH 13 (Proposed Storm)JUNCTION            193.68    196.11      0.00
MH 2 (Proposed Storm)JUNCTION            193.64    195.70      0.00
MH 3 (Proposed Storm)JUNCTION            193.56    195.26      0.00
MH 4 (Proposed Storm)JUNCTION            193.38    194.94      0.00
MH 5 (Proposed Storm)JUNCTION            193.84    196.27      0.00
MH 6 (Proposed Storm)JUNCTION            194.10    196.20      0.00
MH 7 (Proposed Storm)JUNCTION            193.95    196.68      0.00
MH 8 (Proposed Storm)JUNCTION            193.83    194.88      0.00
MH 9 (Proposed Storm)JUNCTION            193.74    196.10      0.00
Out-01              OUTFALL             192.50    192.50      0.00
POND                STORAGE             193.00    194.50      0.00


************
Link Summary
************
Link            From Node       To Node         Element         Length     Slope   Manning's
ID                                              Type                 m         %   Roughness
```

```
  --------------------------------------------------------------------------------------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm)MH 1 (Proposed Storm)MH 2 (Proposed Storm)CONDUIT           33.9
  0.2000      0.0120
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm)MH 10 (Proposed Storm)MH 4 (Proposed Storm)CONDUIT
87.0    0.2529      0.0130
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm)MH 11 (Proposed Storm)MH 12 (Proposed Storm)CONDUIT
53.5    0.2000      0.0130
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm)MH 12 (Proposed Storm)MH 13 (Proposed Storm)CONDUIT
64.0    0.2000      0.0130
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm)MH 13 (Proposed Storm)MH 10 (Proposed Storm)CONDUIT
96.8    0.2000      0.0120
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm)MH 2 (Proposed Storm)MH 3 (Proposed Storm)CONDUIT           81.9
  0.2000      0.0120
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm)MH 3 (Proposed Storm)MH 4 (Proposed Storm)CONDUIT           74.9
  0.2000      0.0120
  {Proposed Storm}.MH 4 - POND (Proposed Storm)MH 4 (Proposed Storm)POND            CONDUIT           25.0
0.2000      0.0120
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm)MH 5 (Proposed Storm)MH 2 (Proposed Storm)CONDUIT           79.8
  0.2000      0.0120
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm)MH 7 (Proposed Storm)MH 8 (Proposed Storm)CONDUIT           99.8
   0.2000      0.0120
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm)MH 8 (Proposed Storm)MH 9 (Proposed Storm)CONDUIT           40.6
  0.2000      0.0120
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm)MH 9 (Proposed Storm)MH 10 (Proposed Storm)CONDUIT
109.7    0.2000      0.0120
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm)MH 6 (Proposed Storm)MH 7 (Proposed Storm)CONDUIT           82.8
   0.2000      0.0120
  Orifice-01      POND            Out-01          ORIFICE


  *********************
  Cross Section Summary
  *********************
  Link             Shape            Depth/        Width        No. of        Cross    Full Flow       Design
  ID                              Diameter                    Barrels    Sectional    Hydraulic         Flow
```

```
                                                                               Area       Radius     Capacity
                                          m            m                         m²            m          LPS
  ------------------------------------------------------------------------------------------------------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm) CIRCULAR           0.45         0.45              1         0.16
       0.11       138.14
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) CIRCULAR           0.75         0.75              1         0.44
        0.19       559.91
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm) CIRCULAR           0.45         0.45              1
0.16         0.11       127.51
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm) CIRCULAR           0.60         0.60              1
0.28         0.15       274.61
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm) CIRCULAR           0.75         0.75              1
0.44         0.19       539.39
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm) CIRCULAR           0.75         0.75              1         0.44
       0.19       539.39
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm) CIRCULAR           0.75         0.75              1         0.44
       0.19       539.39
  {Proposed Storm}.MH 4 - POND (Proposed Storm) CIRCULAR           0.90         0.90              1         0.64
       0.23       877.11
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm) CIRCULAR           0.45         0.45              1         0.16
       0.11       138.14
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm) CIRCULAR           0.60         0.60              1         0.28
        0.15       297.50
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm) CIRCULAR           0.60         0.60              1         0.28
       0.15       297.50
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm) CIRCULAR           0.75         0.75              1         0.44
        0.19       539.39
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm) CIRCULAR           0.45         0.45              1         0.16
        0.11       138.14


  *************************         Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  *************************      ---------       -------
  Total Precipitation ......         1.086        71.563
```

```
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.102         6.717
Surface Runoff ...........         0.868        57.182
Final Surface Storage ....         0.117         7.699
Continuity Error (%) .....        -0.050


**************************        Volume        Volume
Flow Routing Continuity        hectare-m       Mliters
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.867         8.666
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.863         8.633
Surface Flooding .........         0.000         0.000
Evaporation Loss .........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.001         0.014
Continuity Error (%) .....         0.217



**************************************************
EPA SWMM Time of Concentration Computations Report
**************************************************

        Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

        Where:

        Tc = Time of Concentration (min)
        L  = Flow Length (ft)
        n  = Manning's Roughness
```

```
        i  = Rainfall Intensity (in/hr)
        S  = Slope (ft/ft)

--------------------
Subbasin PRE DVLP
--------------------

        Flow length (m):                            731.20
        Pervious Manning's Roughness:              0.10000
        Impervious Manning's Roughness:            0.40000
        Pervious Rainfall Intensity (mm/hr):       2.98180
        Impervious Rainfall Intensity (mm/hr):     2.98180
        Slope (%):                                 1.26000
        Computed TOC (minutes):                     220.48

------------------
Subbasin Sub-05
------------------

        Flow length (m):                            100.83
        Pervious Manning's Roughness:              0.10000
        Impervious Manning's Roughness:            0.01500
        Pervious Rainfall Intensity (mm/hr):       2.98180
        Impervious Rainfall Intensity (mm/hr):     2.98180
        Slope (%):                                 1.26000
        Computed TOC (minutes):                      56.51

------------------
Subbasin Sub-06
------------------

        Flow length (m):                            151.25
        Pervious Manning's Roughness:              0.10000
        Impervious Manning's Roughness:            0.01500
        Pervious Rainfall Intensity (mm/hr):       2.98180
```

```
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     72.08

------------------
Subbasin Sub-07
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-08
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-09
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
```

```
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-10
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-11
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-12
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
```

```
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-13
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-14
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      2.98180
        Impervious Rainfall Intensity (mm/hr):    2.98180
        Slope (%):                                1.26000
        Computed TOC (minutes):                     56.51

------------------
Subbasin Sub-15
------------------

        Flow length (m):                           100.83
```

```
        Pervious Manning's Roughness:            0.10000
        Impervious Manning's Roughness:          0.01500
        Pervious Rainfall Intensity (mm/hr):     2.98180
        Impervious Rainfall Intensity (mm/hr):   2.98180
        Slope (%):                               1.26000
        Computed TOC (minutes):                    56.51

------------------
Subbasin Sub-16
------------------

        Flow length (m):                          100.83
        Pervious Manning's Roughness:            0.10000
        Impervious Manning's Roughness:          0.01500
        Pervious Rainfall Intensity (mm/hr):     2.98180
        Impervious Rainfall Intensity (mm/hr):   2.98180
        Slope (%):                               1.26000
        Computed TOC (minutes):                    56.51

------------------
Subbasin Sub-17
------------------

        Flow length (m):                          100.83
        Pervious Manning's Roughness:            0.10000
        Impervious Manning's Roughness:          0.01500
        Pervious Rainfall Intensity (mm/hr):     2.98180
        Impervious Rainfall Intensity (mm/hr):   2.98180
        Slope (%):                               1.26000
        Computed TOC (minutes):                    56.51


***********************
Subbasin Runoff Summary
***********************
```

```
----------------------------------------------------------------------------------------------------------
Subbasin                     Total       Total       Total       Total       Total        Peak        Runoff        Time of
ID                        Rainfall       Runon       Evap.      Infil.      Runoff      Runoff   Coefficient  Concentration
                                mm          mm          mm          mm          mm         LPS                  days  hh:mm:ss
----------------------------------------------------------------------------------------------------------
PRE DVLP                     71.56        0.00        0.00        4.17       56.68      281.68         0.792     0  03:40:28
Sub-05                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-06                       71.56        0.00        0.00        9.08       57.45       41.05         0.803     0  01:12:04
Sub-07                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-08                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-09                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-10                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-11                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-12                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-13                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-14                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-15                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-16                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
Sub-17                       71.56        0.00        0.00        9.08       57.66       43.65         0.806     0  00:56:30
----------------------------------------------------------------------------------------------------------


******************
Node Depth Summary
******************

------------------------------------------------------------------------------------------
Node                Average   Maximum   Maximum   Time of Max      Total      Total   Retention
ID                    Depth     Depth       HGL    Occurrence    Flooded       Time        Time
                   Attained  Attained  Attained                   Volume    Flooded
                          m         m         m   days  hh:mm      ha-mm    minutes    hh:mm:ss
------------------------------------------------------------------------------------------
EndNullStruct0         0.00      0.00      0.00      0  00:00          0          0     0:00:00
MH 1 (Proposed Storm)   0.04      0.17    193.96      0  12:12          0          0     0:00:00
```

```
MH 10 (Proposed Storm)   0.10      0.43    194.06      0  12:14         0         0     0:00:00
MH 11 (Proposed Storm)   0.04      0.18    194.03      0  12:12         0         0     0:00:00
MH 12 (Proposed Storm)   0.09      0.23    193.98      0  12:12         0         0     0:00:00
MH 13 (Proposed Storm)   0.11      0.30    193.98      0  12:13         0         0     0:00:00
MH 2 (Proposed Storm)   0.14      0.27    193.91      0  12:12         0         0     0:00:00
MH 3 (Proposed Storm)   0.09      0.29    193.85      0  12:13         0         0     0:00:00
MH 4 (Proposed Storm)   0.24      0.52    193.90      0  12:14         0         0     0:00:00
MH 5 (Proposed Storm)   0.04      0.17    194.01      0  12:12         0         0     0:00:00
MH 6 (Proposed Storm)   0.04      0.17    194.27      0  12:12         0         0     0:00:00
MH 7 (Proposed Storm)   0.09      0.22    194.17      0  12:13         0         0     0:00:00
MH 8 (Proposed Storm)   0.08      0.28    194.11      0  12:13         0         0     0:00:00
MH 9 (Proposed Storm)   0.11      0.33    194.07      0  12:14         0         0     0:00:00
Out-01             0.00      0.00    192.50      0  00:00         0         0     0:00:00
POND               0.15      1.03    194.03      0  13:08         0         0     0:00:00


*****************
Node Flow Summary
*****************

------------------------------------------------------------------------------------
Node                Element     Maximum     Peak      Time of   Maximum Time of Peak
ID                     Type     Lateral   Inflow  Peak Inflow  Flooding     Flooding
                                 Inflow            Occurrence  Overflow   Occurrence
                                    LPS      LPS  days  hh:mm       LPS  days  hh:mm
------------------------------------------------------------------------------------
EndNullStruct0       JUNCTION      0.00     0.00     0  00:00      0.00
MH 1 (Proposed Storm) JUNCTION     43.65    43.65     0  12:12      0.00
MH 10 (Proposed Storm) JUNCTION     43.65   347.62     0  12:14      0.00
MH 11 (Proposed Storm) JUNCTION     43.65    43.65     0  12:12      0.00
MH 12 (Proposed Storm) JUNCTION     43.65    87.16     0  12:12      0.00
MH 13 (Proposed Storm) JUNCTION     43.65   130.60     0  12:13      0.00
MH 2 (Proposed Storm) JUNCTION     43.65   130.73     0  12:12      0.00
MH 3 (Proposed Storm) JUNCTION     41.05   171.66     0  12:13      0.00
MH 4 (Proposed Storm) JUNCTION     43.65   562.32     0  12:14      0.00
```

```
  MH 5 (Proposed Storm) JUNCTION     43.65    43.65     0  12:12      0.00
  MH 6 (Proposed Storm) JUNCTION     43.65    43.65     0  12:12      0.00
  MH 7 (Proposed Storm) JUNCTION     43.65    87.11     0  12:12      0.00
  MH 8 (Proposed Storm) JUNCTION     43.65   130.45     0  12:13      0.00
  MH 9 (Proposed Storm) JUNCTION     43.65   173.86     0  12:13      0.00
  Out-01               OUTFALL     281.68   541.77     0  12:54      0.00
  POND                 STORAGE       0.00   562.32     0  12:15      0.00


  ********************
  Storage Node Summary
  ********************


------------------------------------------------------------------------------------------------------------------
---------------------
  Storage Node ID        Maximum     Maximum    Time of Max    Average   Average       Maximum       Maximum
Time of Max.        Total
                          Ponded      Ponded         Ponded     Ponded    Ponded  Storage Node  Exfiltration
Exfiltration  Exfiltrated
                          Volume      Volume         Volume     Volume    Volume       Outflow          Rate
     Rate       Volume
                         1000 m³         (%)     days hh:mm    1000 m³       (%)           LPS           cmm
 hh:mm:ss      1000 m³

------------------------------------------------------------------------------------------------------------------
---------------------
  POND                     1.300          61       0  13:07      0.151         7        265.41          0.00
  0:00:00        0.000


  **********************
  Outfall Loading Summary
  **********************
```

```
  ----------------------------------------------
  Outfall Node ID        Flow   Average      Peak
                    Frequency      Flow    Inflow
                          (%)       LPS       LPS
  ----------------------------------------------
  Out-01                96.95    103.04    541.77
  ----------------------------------------------
  System                96.95    103.04    541.77


  *****************
  Link Flow Summary
  *****************


--------------------------------------------------------------------------------------------------------------------
----------------
  Link ID              Element       Time of   Maximum  Length   Peak Flow      Design  Ratio of  Ratio of
Total  Reported
                       Type        Peak Flow  Velocity  Factor      during        Flow   Maximum   Maximum
 Time  Condition
                                  Occurrence  Attained            Analysis    Capacity   /Design      Flow
Surcharged
                                  days hh:mm     m/sec                 LPS         LPS      Flow     Depth
minutes

--------------------------------------------------------------------------------------------------------------------
----------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm) CONDUIT      0  12:12      0.77    1.00       43.62      138.14
    0.32      0.39           0  Calculated
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) CONDUIT      0  12:15      1.33    1.00      347.53      559.91
     0.62      0.57           0  Calculated
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm) CONDUIT      0  12:13      0.73    1.00       43.59
127.51      0.34      0.40           0  Calculated
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm) CONDUIT      0  12:13      0.86    1.00       87.10
```

```
274.61      0.32      0.39           0  Calculated
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm) CONDUIT      0  12:14      1.01    1.00      130.53
539.39      0.24      0.34           0  Calculated
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm) CONDUIT      0  12:13      1.01    1.00      130.64      539.39
    0.24      0.34           0  Calculated
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm) CONDUIT      0  12:14      1.08    1.00      171.60      539.39
    0.32      0.39           0  Calculated
  {Proposed Storm}.MH 4 - POND (Proposed Storm) CONDUIT      0  12:15      1.46    1.00      562.32      877.11
    0.64      0.58           0  Calculated
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm) CONDUIT      0  12:13      0.77    1.00       43.57      138.14
    0.32      0.39           0  Calculated
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm) CONDUIT      0  12:14      0.91    1.00       87.03      297.50
    0.29      0.37           0  Calculated
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm) CONDUIT      0  12:14      1.02    1.00      130.44      297.50
    0.44      0.46           0  Calculated
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm) CONDUIT      0  12:14      1.09    1.00      173.79      539.39
    0.32      0.39           0  Calculated
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm) CONDUIT      0  12:13      0.77    1.00       43.57      138.14
    0.32      0.39           0  Calculated
  Orifice-01           ORIFICE      0  13:08                       265.41


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) (1)
  Link {Proposed Storm}.MH 4 - POND (Proposed Storm) (1)


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :    30.00 sec
  Average Time Step           :    30.00 sec
  Maximum Time Step           :    30.00 sec
```

```
Percent in Steady State     :     0.00
Average Iterations per Step :     1.39


Analysis began on:  Sun Jun 09 19:54:10 2024
Analysis ended on:  Sun Jun 09 19:54:10 2024
Total elapsed time: < 1 sec
```

Stormwater modelling output

EPA SWMM/Autodesk SSA

O Chippewa Avenue Development – Municipal portion

100 year return event

```
  Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)
  ----------------------------------------------------------------------------------------

  *******************
  Project Description
  *******************
  File Name ................. CHIPPEWA WITH STORM IMPORT.SPF
  Description ............... S:\projects\2022\2278 Chippewa Ave Development\2278 Acad\Design\C3D-2278.03 P1 P2
P3 P4.dwg


  ****************
  Analysis Options
  ****************
  Flow Units ................ LPS
  Subbasin Hydrograph Method. EPA SWMM
  Infiltration Method ....... Horton
  Link Routing Method ....... Kinematic Wave
  Storage Node Exfiltration.. None
  Starting Date ............. JUN-09-2024 00:00:00
  Ending Date ............... JUN-10-2024 00:00:00
  Antecedent Dry Days ....... 0.0
  Report Time Step .......... 00:05:00
  Wet Time Step ............. 00:05:00
  Dry Time Step ............. 01:00:00
  Routing Time Step ......... 30.00 sec


  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subbasins ....... 14
  Number of nodes ........... 16
```

```
Number of links ........... 14
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
Gage                Data                Data       Recording
ID                  Source              Type       Interval
                                                              min
------------------------------------------------------------
100-yr storm        100 YR              INTENSITY       6.00
10-yr storm         100 YR              INTENSITY       6.00
timmins             100 YR              INTENSITY       6.00


****************
Subbasin Summary
****************
Subbasin                 Total     Equiv.    Imperv.    Average    Raingage
                          Area      Width       Area      Slope
ID                    hectares          m          %          %
------------------------------------------------------------------------
PRE DVLP                  7.31     100.00       0.00     1.2600    100-yr storm
Sub-05                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-06                    0.60      40.00      25.00     1.2600    100-yr storm
Sub-07                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-08                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-09                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-10                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-11                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-12                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-13                    0.60      60.00      25.00     1.2600    100-yr storm
Sub-14                    0.60      60.00      25.00     1.2600    100-yr storm
```

```
Sub-15                    0.60     60.00     25.00    1.2600    100-yr storm
Sub-16                    0.60     60.00     25.00    1.2600    100-yr storm
Sub-17                    0.60     60.00     25.00    1.2600    100-yr storm


************
Node Summary
************
Node                 Element             Invert   Maximum    Ponded    External
ID                   Type             Elevation     Elev.      Area      Inflow
                                              m         m        m²
-------------------------------------------------------------------------------
EndNullStruct0       JUNCTION              0.00      0.00      0.00
MH 1 (Proposed Storm)JUNCTION            193.79    195.60      0.00
MH 10 (Proposed Storm)JUNCTION            193.63    195.60      0.00
MH 11 (Proposed Storm)JUNCTION            193.85    195.64      0.00
MH 12 (Proposed Storm)JUNCTION            193.75    196.27      0.00
MH 13 (Proposed Storm)JUNCTION            193.68    196.11      0.00
MH 2 (Proposed Storm)JUNCTION            193.64    195.70      0.00
MH 3 (Proposed Storm)JUNCTION            193.56    195.26      0.00
MH 4 (Proposed Storm)JUNCTION            193.38    194.94      0.00
MH 5 (Proposed Storm)JUNCTION            193.84    196.27      0.00
MH 6 (Proposed Storm)JUNCTION            194.10    196.20      0.00
MH 7 (Proposed Storm)JUNCTION            193.95    196.68      0.00
MH 8 (Proposed Storm)JUNCTION            193.83    194.88      0.00
MH 9 (Proposed Storm)JUNCTION            193.74    196.10      0.00
Out-01               OUTFALL           192.50    192.50      0.00
POND                 STORAGE           193.00    194.50      0.00


************
Link Summary
************
Link            From Node       To Node          Element          Length     Slope   Manning's
ID                                               Type                  m         %   Roughness
```

```
  --------------------------------------------------------------------------------------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm)MH 1 (Proposed Storm)MH 2 (Proposed Storm)CONDUIT           33.9
  0.2000      0.0120
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm)MH 10 (Proposed Storm)MH 4 (Proposed Storm)CONDUIT
87.0    0.2529      0.0130
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm)MH 11 (Proposed Storm)MH 12 (Proposed Storm)CONDUIT
53.5    0.2000      0.0130
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm)MH 12 (Proposed Storm)MH 13 (Proposed Storm)CONDUIT
64.0    0.2000      0.0130
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm)MH 13 (Proposed Storm)MH 10 (Proposed Storm)CONDUIT
96.8    0.2000      0.0120
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm)MH 2 (Proposed Storm)MH 3 (Proposed Storm)CONDUIT           81.9
  0.2000      0.0120
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm)MH 3 (Proposed Storm)MH 4 (Proposed Storm)CONDUIT           74.9
  0.2000      0.0120
  {Proposed Storm}.MH 4 - POND (Proposed Storm)MH 4 (Proposed Storm)POND            CONDUIT           25.0
0.2000      0.0120
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm)MH 5 (Proposed Storm)MH 2 (Proposed Storm)CONDUIT           79.8
  0.2000      0.0120
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm)MH 7 (Proposed Storm)MH 8 (Proposed Storm)CONDUIT           99.8
   0.2000      0.0120
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm)MH 8 (Proposed Storm)MH 9 (Proposed Storm)CONDUIT           40.6
  0.2000      0.0120
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm)MH 9 (Proposed Storm)MH 10 (Proposed Storm)CONDUIT
109.7    0.2000      0.0120
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm)MH 6 (Proposed Storm)MH 7 (Proposed Storm)CONDUIT           82.8
   0.2000      0.0120
  Orifice-01      POND            Out-01          ORIFICE


  ********************
  Cross Section Summary
  ********************
  Link              Shape              Depth/        Width        No. of        Cross    Full Flow       Design
  ID                                 Diameter                    Barrels    Sectional    Hydraulic         Flow
```

```
                                                                              Area       Radius     Capacity
                                         m            m                         m²            m          LPS
  ----------------------------------------------------------------------------------------------------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm) CIRCULAR           0.45         0.45             1         0.16
       0.11       138.14
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
        0.19       559.91
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm) CIRCULAR           0.45         0.45             1
0.16         0.11       127.51
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm) CIRCULAR           0.60         0.60             1
0.28         0.15       274.61
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm) CIRCULAR           0.75         0.75             1
0.44         0.19       539.39
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
       0.19       539.39
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
       0.19       539.39
  {Proposed Storm}.MH 4 - POND (Proposed Storm) CIRCULAR           0.90         0.90             1         0.64
       0.23       877.11
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm) CIRCULAR           0.45         0.45             1         0.16
       0.11       138.14
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm) CIRCULAR           0.60         0.60             1         0.28
        0.15       297.50
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm) CIRCULAR           0.60         0.60             1         0.28
       0.15       297.50
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
        0.19       539.39
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm) CIRCULAR           0.45         0.45             1         0.16
        0.11       138.14


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         1.584       104.363
```

```
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.103         6.793
Surface Runoff ...........         1.352        89.100
Final Surface Storage ....         0.129         8.524
Continuity Error (%) .....        -0.052


**************************        Volume        Volume
Flow Routing Continuity        hectare-m       Mliters
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         1.350        13.503
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         1.346        13.460
Surface Flooding .........         0.000         0.000
Evaporation Loss .........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.002         0.021
Continuity Error (%) .....         0.165



**************************************************
EPA SWMM Time of Concentration Computations Report
**************************************************

        Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

        Where:

        Tc = Time of Concentration (min)
        L  = Flow Length (ft)
        n  = Manning's Roughness
```

```
        i  = Rainfall Intensity (in/hr)
        S  = Slope (ft/ft)

--------------------
Subbasin PRE DVLP
--------------------

        Flow length (m):                           731.20
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.40000
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                    189.58

------------------
Subbasin Sub-05
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-06
------------------

        Flow length (m):                           151.25
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
```

```
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     61.98

------------------
Subbasin Sub-07
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-08
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-09
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
```

```
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-10
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-11
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-12
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
```

```
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-13
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-14
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-15
------------------

        Flow length (m):                           100.83
```

```
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-16
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59

------------------
Subbasin Sub-17
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):      4.34846
        Impervious Rainfall Intensity (mm/hr):    4.34846
        Slope (%):                                1.26000
        Computed TOC (minutes):                     48.59


***********************
Subbasin Runoff Summary
***********************
```

```
-------------------------------------------------------------------------------------------------------
Subbasin                  Total       Total       Total       Total       Total        Peak        Runoff        Time of
ID                     Rainfall       Runon       Evap.      Infil.      Runoff      Runoff   Coefficient  Concentration
                             mm          mm          mm          mm          mm         LPS                 days  hh:mm:ss
-------------------------------------------------------------------------------------------------------
PRE DVLP                 104.36        0.00        0.00        4.21       88.13      467.06         0.844    0  03:09:34
Sub-05                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-06                   104.36        0.00        0.00        9.19       89.72       62.78         0.860    0  01:01:58
Sub-07                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-08                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-09                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-10                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-11                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-12                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-13                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-14                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-15                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-16                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
Sub-17                   104.36        0.00        0.00        9.19       90.02       65.76         0.863    0  00:48:35
-------------------------------------------------------------------------------------------------------


******************
Node Depth Summary
******************

----------------------------------------------------------------------------------------------
Node               Average   Maximum   Maximum   Time of Max      Total      Total   Retention
ID                   Depth     Depth       HGL    Occurrence    Flooded       Time        Time
                  Attained  Attained  Attained                   Volume    Flooded
                         m         m         m   days  hh:mm      ha-mm    minutes    hh:mm:ss
----------------------------------------------------------------------------------------------
EndNullStruct0        0.00      0.00      0.00      0  00:00          0          0     0:00:00
MH 1 (Proposed Storm)   0.05      0.22    194.01      0  12:12          0          0     0:00:00
```

```
MH 10 (Proposed Storm)   0.13      0.58    194.21      0  12:13         0         0     0:00:00
MH 11 (Proposed Storm)   0.05      0.23    194.08      0  12:12         0         0     0:00:00
MH 12 (Proposed Storm)   0.10      0.29    194.04      0  12:12         0         0     0:00:00
MH 13 (Proposed Storm)   0.12      0.36    194.04      0  12:12         0         0     0:00:00
MH 2 (Proposed Storm)   0.15      0.32    193.96      0  12:12         0         0     0:00:00
MH 3 (Proposed Storm)   0.10      0.37    193.93      0  12:13         0         0     0:00:00
MH 4 (Proposed Storm)   0.26      0.71    194.09      0  12:13         0         0     0:00:00
MH 5 (Proposed Storm)   0.05      0.22    194.06      0  12:12         0         0     0:00:00
MH 6 (Proposed Storm)   0.05      0.22    194.32      0  12:12         0         0     0:00:00
MH 7 (Proposed Storm)   0.10      0.28    194.23      0  12:12         0         0     0:00:00
MH 8 (Proposed Storm)   0.10      0.36    194.19      0  12:12         0         0     0:00:00
MH 9 (Proposed Storm)   0.13      0.41    194.15      0  12:13         0         0     0:00:00
Out-01              0.00      0.00    192.50      0  00:00         0         0     0:00:00
POND                0.15      1.19    194.19      0  12:58         0         0     0:00:00


*****************
Node Flow Summary
*****************

------------------------------------------------------------------------------------
Node                 Element     Maximum     Peak      Time of   Maximum Time of Peak
ID                      Type     Lateral   Inflow  Peak Inflow  Flooding     Flooding
                                  Inflow            Occurrence  Overflow   Occurrence
                                     LPS      LPS  days  hh:mm       LPS  days  hh:mm
------------------------------------------------------------------------------------
EndNullStruct0        JUNCTION      0.00     0.00     0  00:00      0.00
MH 1 (Proposed Storm) JUNCTION     65.76    65.76     0  12:12      0.00
MH 10 (Proposed Storm) JUNCTION     65.76   524.10     0  12:13      0.00
MH 11 (Proposed Storm) JUNCTION     65.76    65.76     0  12:12      0.00
MH 12 (Proposed Storm) JUNCTION     65.76   131.33     0  12:12      0.00
MH 13 (Proposed Storm) JUNCTION     65.76   196.81     0  12:12      0.00
MH 2 (Proposed Storm) JUNCTION     65.76   196.97     0  12:12      0.00
MH 3 (Proposed Storm) JUNCTION     62.78   259.53     0  12:13      0.00
MH 4 (Proposed Storm) JUNCTION     65.76   848.50     0  12:13      0.00
```

```
  MH 5 (Proposed Storm) JUNCTION     65.76    65.76     0  12:12      0.00
  MH 6 (Proposed Storm) JUNCTION     65.76    65.76     0  12:12      0.00
  MH 7 (Proposed Storm) JUNCTION     65.76   131.27     0  12:12      0.00
  MH 8 (Proposed Storm) JUNCTION     65.76   196.65     0  12:12      0.00
  MH 9 (Proposed Storm) JUNCTION     65.76   262.18     0  12:12      0.00
  Out-01               OUTFALL     467.06   932.90     0  12:48      0.00
  POND                 STORAGE       0.00   848.51     0  12:14      0.00


  ********************
  Storage Node Summary
  ********************


  ----------------------------------------------------------------------------------------------------------------
---------------------
  Storage Node ID        Maximum     Maximum    Time of Max    Average   Average       Maximum       Maximum
Time of Max.        Total
                          Ponded      Ponded         Ponded     Ponded    Ponded  Storage Node  Exfiltration
Exfiltration  Exfiltrated
                          Volume      Volume         Volume     Volume    Volume       Outflow          Rate
     Rate       Volume
                         1000 m³         (%)     days hh:mm    1000 m³       (%)           LPS           cmm
 hh:mm:ss      1000 m³
  ----------------------------------------------------------------------------------------------------------------
---------------------
  POND                     1.575          74        0  12:58      0.151         7        472.43          0.00
  0:00:00        0.000


  **********************
  Outfall Loading Summary
  **********************
```

```
  -----------------------------------------------
  Outfall Node ID         Flow   Average      Peak
                     Frequency      Flow    Inflow
                           (%)       LPS       LPS
  -----------------------------------------------
  Out-01                 97.29    160.08    932.90
  -----------------------------------------------
  System                 97.29    160.08    932.90


  ****************
  Link Flow Summary
  ****************


----------------------------------------------------------------------------------------------------------------
----------------
  Link ID             Element       Time of   Maximum  Length   Peak Flow      Design  Ratio of  Ratio of
Total  Reported
                      Type        Peak Flow  Velocity  Factor      during        Flow   Maximum   Maximum
 Time  Condition
                                 Occurrence  Attained            Analysis    Capacity   /Design      Flow
Surcharged
                                 days hh:mm     m/sec                 LPS         LPS      Flow     Depth
minutes

----------------------------------------------------------------------------------------------------------------
----------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm) CONDUIT      0  12:12      0.86    1.00       65.71      138.14
    0.48      0.49           0  Calculated
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) CONDUIT      0  12:14      1.44    1.00      523.97      559.91
     0.94      0.77           0  Calculated
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm) CONDUIT      0  12:12      0.81    1.00       65.70
127.51      0.52      0.51           0  Calculated
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm) CONDUIT      0  12:13      0.96    1.00      131.27
```

```
274.61      0.48      0.49           0  Calculated
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm) CONDUIT      0  12:13      1.13    1.00      196.74
539.39      0.36      0.42           0  Calculated
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm) CONDUIT      0  12:13      1.13    1.00      196.89      539.39
    0.37      0.42           0  Calculated
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm) CONDUIT      0  12:13      1.21    1.00      259.45      539.39
    0.48      0.49           0  Calculated
  {Proposed Storm}.MH 4 - POND (Proposed Storm) CONDUIT      0  12:14      1.57    1.00      848.51      877.11
    0.97      0.79           0  Calculated
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm) CONDUIT      0  12:12      0.86    1.00       65.67      138.14
    0.48      0.49           0  Calculated
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm) CONDUIT      0  12:13      1.02    1.00      131.19      297.50
     0.44      0.46           0  Calculated
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm) CONDUIT      0  12:13      1.12    1.00      196.64      297.50
    0.66      0.59           0  Calculated
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm) CONDUIT      0  12:13      1.21    1.00      262.05      539.39
     0.49      0.49           0  Calculated
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm) CONDUIT      0  12:12      0.86    1.00       65.66      138.14
     0.48      0.49           0  Calculated
  Orifice-01           ORIFICE      0  12:58                        472.43


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) (1)


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :    30.00 sec
  Average Time Step           :    30.00 sec
  Maximum Time Step           :    30.00 sec
  Percent in Steady State     :     0.00
```

```
Average Iterations per Step :     1.46


Analysis began on:  Sun Jun 09 19:38:06 2024
Analysis ended on:  Sun Jun 09 19:38:06 2024
Total elapsed time: < 1 sec
```

Stormwater modelling output

EPA SWMM/Autodesk SSA

O Chippewa Avenue Development – Municipal portion

Regional Storm event

```
  Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)
  -----------------------------------------------------------------------------------------

  *******************
  Project Description
  *******************
  File Name ................. CHIPPEWA WITH STORM IMPORT.SPF
  Description ............... S:\projects\2022\2278 Chippewa Ave Development\2278 Acad\Design\C3D-2278.03 P1 P2
P3 P4.dwg


  ****************
  Analysis Options
  ****************
  Flow Units ................ LPS
  Subbasin Hydrograph Method. EPA SWMM
  Infiltration Method ....... Horton
  Link Routing Method ....... Kinematic Wave
  Storage Node Exfiltration.. None
  Starting Date ............. JUN-09-2024 00:00:00
  Ending Date ............... JUN-10-2024 00:00:00
  Antecedent Dry Days ....... 0.0
  Report Time Step .......... 00:05:00
  Wet Time Step ............. 00:05:00
  Dry Time Step ............. 01:00:00
  Routing Time Step ......... 30.00 sec


  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subbasins ....... 14
  Number of nodes ........... 16
```

```
Number of links ........... 14
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
Gage                Data                Data       Recording
ID                  Source              Type        Interval
                                                                 min
------------------------------------------------------------
100-yr storm        timmins             INTENSITY       6.00
10-yr storm         timmins             INTENSITY       6.00
timmins             timmins             INTENSITY       6.00


****************
Subbasin Summary
****************
Subbasin                 Total    Equiv.   Imperv.   Average    Raingage
                          Area     Width      Area     Slope
ID                    hectares         m         %         %
------------------------------------------------------------------------
PRE DVLP                  7.31    100.00      0.00    1.2600    timmins
Sub-05                    0.60     60.00     25.00    1.2600    timmins
Sub-06                    0.60     40.00     25.00    1.2600    timmins
Sub-07                    0.60     60.00     25.00    1.2600    timmins
Sub-08                    0.60     60.00     25.00    1.2600    timmins
Sub-09                    0.60     60.00     25.00    1.2600    timmins
Sub-10                    0.60     60.00     25.00    1.2600    timmins
Sub-11                    0.60     60.00     25.00    1.2600    timmins
Sub-12                    0.60     60.00     25.00    1.2600    timmins
Sub-13                    0.60     60.00     25.00    1.2600    timmins
Sub-14                    0.60     60.00     25.00    1.2600    timmins
```

```
Sub-15                    0.60     60.00     25.00    1.2600    timmins
Sub-16                    0.60     60.00     25.00    1.2600    timmins
Sub-17                    0.60     60.00     25.00    1.2600    timmins


************
Node Summary
************
Node                Element             Invert   Maximum    Ponded    External
ID                  Type             Elevation     Elev.      Area      Inflow
                                             m         m        m²
------------------------------------------------------------------------------
EndNullStruct0      JUNCTION              0.00      0.00      0.00
MH 1 (Proposed Storm)JUNCTION            193.79    195.60      0.00
MH 10 (Proposed Storm)JUNCTION            193.63    195.60      0.00
MH 11 (Proposed Storm)JUNCTION            193.85    195.64      0.00
MH 12 (Proposed Storm)JUNCTION            193.75    196.27      0.00
MH 13 (Proposed Storm)JUNCTION            193.68    196.11      0.00
MH 2 (Proposed Storm)JUNCTION            193.64    195.70      0.00
MH 3 (Proposed Storm)JUNCTION            193.56    195.26      0.00
MH 4 (Proposed Storm)JUNCTION            193.38    194.94      0.00
MH 5 (Proposed Storm)JUNCTION            193.84    196.27      0.00
MH 6 (Proposed Storm)JUNCTION            194.10    196.20      0.00
MH 7 (Proposed Storm)JUNCTION            193.95    196.68      0.00
MH 8 (Proposed Storm)JUNCTION            193.83    194.88      0.00
MH 9 (Proposed Storm)JUNCTION            193.74    196.10      0.00
Out-01              OUTFALL             192.50    192.50      0.00
POND                STORAGE             193.00    194.50      0.00


************
Link Summary
************
Link            From Node       To Node         Element         Length    Slope   Manning's
ID                                              Type                 m        %   Roughness
```

```
  --------------------------------------------------------------------------------------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm)MH 1 (Proposed Storm)MH 2 (Proposed Storm)CONDUIT           33.9
  0.2000      0.0120
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm)MH 10 (Proposed Storm)MH 4 (Proposed Storm)CONDUIT
87.0    0.2529      0.0130
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm)MH 11 (Proposed Storm)MH 12 (Proposed Storm)CONDUIT
53.5    0.2000      0.0130
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm)MH 12 (Proposed Storm)MH 13 (Proposed Storm)CONDUIT
64.0    0.2000      0.0130
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm)MH 13 (Proposed Storm)MH 10 (Proposed Storm)CONDUIT
96.8    0.2000      0.0120
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm)MH 2 (Proposed Storm)MH 3 (Proposed Storm)CONDUIT           81.9
  0.2000      0.0120
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm)MH 3 (Proposed Storm)MH 4 (Proposed Storm)CONDUIT           74.9
  0.2000      0.0120
  {Proposed Storm}.MH 4 - POND (Proposed Storm)MH 4 (Proposed Storm)POND            CONDUIT           25.0
0.2000      0.0120
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm)MH 5 (Proposed Storm)MH 2 (Proposed Storm)CONDUIT           79.8
  0.2000      0.0120
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm)MH 7 (Proposed Storm)MH 8 (Proposed Storm)CONDUIT           99.8
   0.2000      0.0120
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm)MH 8 (Proposed Storm)MH 9 (Proposed Storm)CONDUIT           40.6
  0.2000      0.0120
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm)MH 9 (Proposed Storm)MH 10 (Proposed Storm)CONDUIT
109.7    0.2000      0.0120
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm)MH 6 (Proposed Storm)MH 7 (Proposed Storm)CONDUIT           82.8
   0.2000      0.0120
  Orifice-01      POND            Out-01          ORIFICE


  *********************
  Cross Section Summary
  *********************
  Link             Shape              Depth/        Width        No. of        Cross    Full Flow       Design
  ID                              Diameter                      Barrels    Sectional    Hydraulic         Flow
```

```
                                                                              Area       Radius     Capacity
                                         m            m                         m²            m          LPS
  ----------------------------------------------------------------------------------------------------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm) CIRCULAR           0.45         0.45             1         0.16
       0.11       138.14
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
        0.19       559.91
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm) CIRCULAR           0.45         0.45             1
0.16         0.11       127.51
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm) CIRCULAR           0.60         0.60             1
0.28         0.15       274.61
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm) CIRCULAR           0.75         0.75             1
0.44         0.19       539.39
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
       0.19       539.39
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
       0.19       539.39
  {Proposed Storm}.MH 4 - POND (Proposed Storm) CIRCULAR           0.90         0.90             1         0.64
       0.23       877.11
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm) CIRCULAR           0.45         0.45             1         0.16
       0.11       138.14
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm) CIRCULAR           0.60         0.60             1         0.28
        0.15       297.50
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm) CIRCULAR           0.60         0.60             1         0.28
       0.15       297.50
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm) CIRCULAR           0.75         0.75             1         0.44
        0.19       539.39
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm) CIRCULAR           0.45         0.45             1         0.16
        0.11       138.14


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         2.875       189.404
```

```
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.105         6.950
Surface Runoff ...........         2.713       178.774
Final Surface Storage ....         0.055         3.649
Continuity Error (%) .....         0.016


**************************        Volume        Volume
Flow Routing Continuity        hectare-m       Mliters
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         2.714        27.142
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         2.709        27.094
Surface Flooding .........         0.000         0.000
Evaporation Loss .........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.178



**************************************************
EPA SWMM Time of Concentration Computations Report
**************************************************

        Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

        Where:

        Tc = Time of Concentration (min)
        L  = Flow Length (ft)
        n  = Manning's Roughness
```

```
        i  = Rainfall Intensity (in/hr)
        S  = Slope (ft/ft)

--------------------
Subbasin PRE DVLP
--------------------

        Flow length (m):                              731.20
        Pervious Manning's Roughness:                0.10000
        Impervious Manning's Roughness:              0.40000
        Pervious Rainfall Intensity (mm/hr):        15.78370
        Impervious Rainfall Intensity (mm/hr):      15.78370
        Slope (%):                                   1.26000
        Computed TOC (minutes):                       113.17

------------------
Subbasin Sub-05
------------------

        Flow length (m):                              100.83
        Pervious Manning's Roughness:                0.10000
        Impervious Manning's Roughness:              0.01500
        Pervious Rainfall Intensity (mm/hr):        15.78370
        Impervious Rainfall Intensity (mm/hr):      15.78370
        Slope (%):                                   1.26000
        Computed TOC (minutes):                        29.01

------------------
Subbasin Sub-06
------------------

        Flow length (m):                              151.25
        Pervious Manning's Roughness:                0.10000
        Impervious Manning's Roughness:              0.01500
        Pervious Rainfall Intensity (mm/hr):        15.78370
```

```
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     37.00

------------------
Subbasin Sub-07
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-08
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-09
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
```

```
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-10
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-11
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-12
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
```

```
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-13
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-14
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-15
------------------

        Flow length (m):                           100.83
```

```
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-16
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01

------------------
Subbasin Sub-17
------------------

        Flow length (m):                           100.83
        Pervious Manning's Roughness:             0.10000
        Impervious Manning's Roughness:           0.01500
        Pervious Rainfall Intensity (mm/hr):     15.78370
        Impervious Rainfall Intensity (mm/hr):   15.78370
        Slope (%):                                1.26000
        Computed TOC (minutes):                     29.01


***********************
Subbasin Runoff Summary
***********************
```

```
----------------------------------------------------------------------------------------------------------
Subbasin                 Total       Total       Total       Total       Total        Peak       Runoff        Time of
ID                    Rainfall       Runon       Evap.      Infil.      Runoff      Runoff  Coefficient  Concentration
                            mm          mm          mm          mm          mm         LPS                days  hh:mm:ss
----------------------------------------------------------------------------------------------------------
PRE DVLP                189.40        0.00        0.00        4.29      178.31      592.63        0.941     0  01:53:10
Sub-05                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-06                  189.40        0.00        0.00        9.42      178.91       65.14        0.945     0  00:36:59
Sub-07                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-08                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-09                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-10                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-11                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-12                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-13                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-14                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-15                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-16                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
Sub-17                  189.40        0.00        0.00        9.42      179.23       66.69        0.946     0  00:29:00
----------------------------------------------------------------------------------------------------------


******************
Node Depth Summary
******************

-----------------------------------------------------------------------------------------
Node               Average   Maximum   Maximum   Time of Max      Total      Total   Retention
ID                   Depth     Depth       HGL    Occurrence    Flooded       Time        Time
                  Attained  Attained  Attained                   Volume    Flooded
                         m         m         m   days  hh:mm      ha-mm    minutes    hh:mm:ss
-----------------------------------------------------------------------------------------
EndNullStruct0        0.00      0.00      0.00      0  00:00          0          0     0:00:00
MH 1 (Proposed Storm)   0.06      0.22    194.01      0  07:06          0          0     0:00:00
```

```
MH 10 (Proposed Storm)   0.17      0.58    194.21      0  07:12         0         0     0:00:00
MH 11 (Proposed Storm)   0.07      0.23    194.08      0  07:06         0         0     0:00:00
MH 12 (Proposed Storm)   0.12      0.29    194.04      0  07:07         0         0     0:00:00
MH 13 (Proposed Storm)   0.14      0.37    194.05      0  07:08         0         0     0:00:00
MH 2 (Proposed Storm)   0.16      0.32    193.96      0  07:07         0         0     0:00:00
MH 3 (Proposed Storm)   0.13      0.37    193.93      0  07:12         0         0     0:00:00
MH 4 (Proposed Storm)   0.29      0.73    194.11      0  07:12         0         0     0:00:00
MH 5 (Proposed Storm)   0.06      0.22    194.06      0  07:06         0         0     0:00:00
MH 6 (Proposed Storm)   0.06      0.22    194.32      0  07:06         0         0     0:00:00
MH 7 (Proposed Storm)   0.11      0.28    194.23      0  07:08         0         0     0:00:00
MH 8 (Proposed Storm)   0.12      0.36    194.19      0  07:09         0         0     0:00:00
MH 9 (Proposed Storm)   0.15      0.41    194.15      0  07:10         0         0     0:00:00
Out-01             0.00      0.00    192.50      0  00:00         0         0     0:00:00
POND               0.34      1.45    194.45      0  08:06         0         0     0:00:00


*****************
Node Flow Summary
*****************

------------------------------------------------------------------------------------
Node                Element     Maximum     Peak      Time of   Maximum Time of Peak
ID                     Type     Lateral   Inflow  Peak Inflow  Flooding     Flooding
                                 Inflow            Occurrence  Overflow   Occurrence
                                    LPS      LPS  days  hh:mm       LPS  days  hh:mm
------------------------------------------------------------------------------------
EndNullStruct0       JUNCTION      0.00     0.00     0  00:00      0.00
MH 1 (Proposed Storm) JUNCTION     66.69    66.69     0  07:06      0.00
MH 10 (Proposed Storm) JUNCTION     66.69   532.45     0  07:12      0.00
MH 11 (Proposed Storm) JUNCTION     66.69    66.69     0  07:06      0.00
MH 12 (Proposed Storm) JUNCTION     66.69   133.28     0  07:07      0.00
MH 13 (Proposed Storm) JUNCTION     66.69   199.85     0  07:08      0.00
MH 2 (Proposed Storm) JUNCTION     66.69   199.88     0  07:07      0.00
MH 3 (Proposed Storm) JUNCTION     65.14   264.76     0  07:12      0.00
MH 4 (Proposed Storm) JUNCTION     66.69   863.67     0  07:12      0.00
```

```
  MH 5 (Proposed Storm) JUNCTION     66.69    66.69     0  07:06      0.00
  MH 6 (Proposed Storm) JUNCTION     66.69    66.69     0  07:06      0.00
  MH 7 (Proposed Storm) JUNCTION     66.69   133.24     0  07:08      0.00
  MH 8 (Proposed Storm) JUNCTION     66.69   199.72     0  07:09      0.00
  MH 9 (Proposed Storm) JUNCTION     66.69   266.26     0  07:12      0.00
  Out-01               OUTFALL     592.63  1100.65     0  07:48      0.00
  POND                 STORAGE       0.00   863.65     0  07:12      0.00


  ********************
  Storage Node Summary
  ********************


--------------------------------------------------------------------------------------------------------------------
---------------------
  Storage Node ID        Maximum     Maximum    Time of Max    Average   Average       Maximum       Maximum
Time of Max.        Total
                          Ponded      Ponded         Ponded     Ponded    Ponded  Storage Node  Exfiltration
Exfiltration  Exfiltrated
                          Volume      Volume         Volume     Volume    Volume       Outflow          Rate
     Rate       Volume
                        1000 m³         (%)     days hh:mm    1000 m³       (%)           LPS           cmm
 hh:mm:ss      1000 m³

--------------------------------------------------------------------------------------------------------------------
---------------------
  POND                     2.040          95        0  08:05      0.411        19        520.62          0.00
  0:00:00        0.000


  ***********************
  Outfall Loading Summary
  ***********************
```

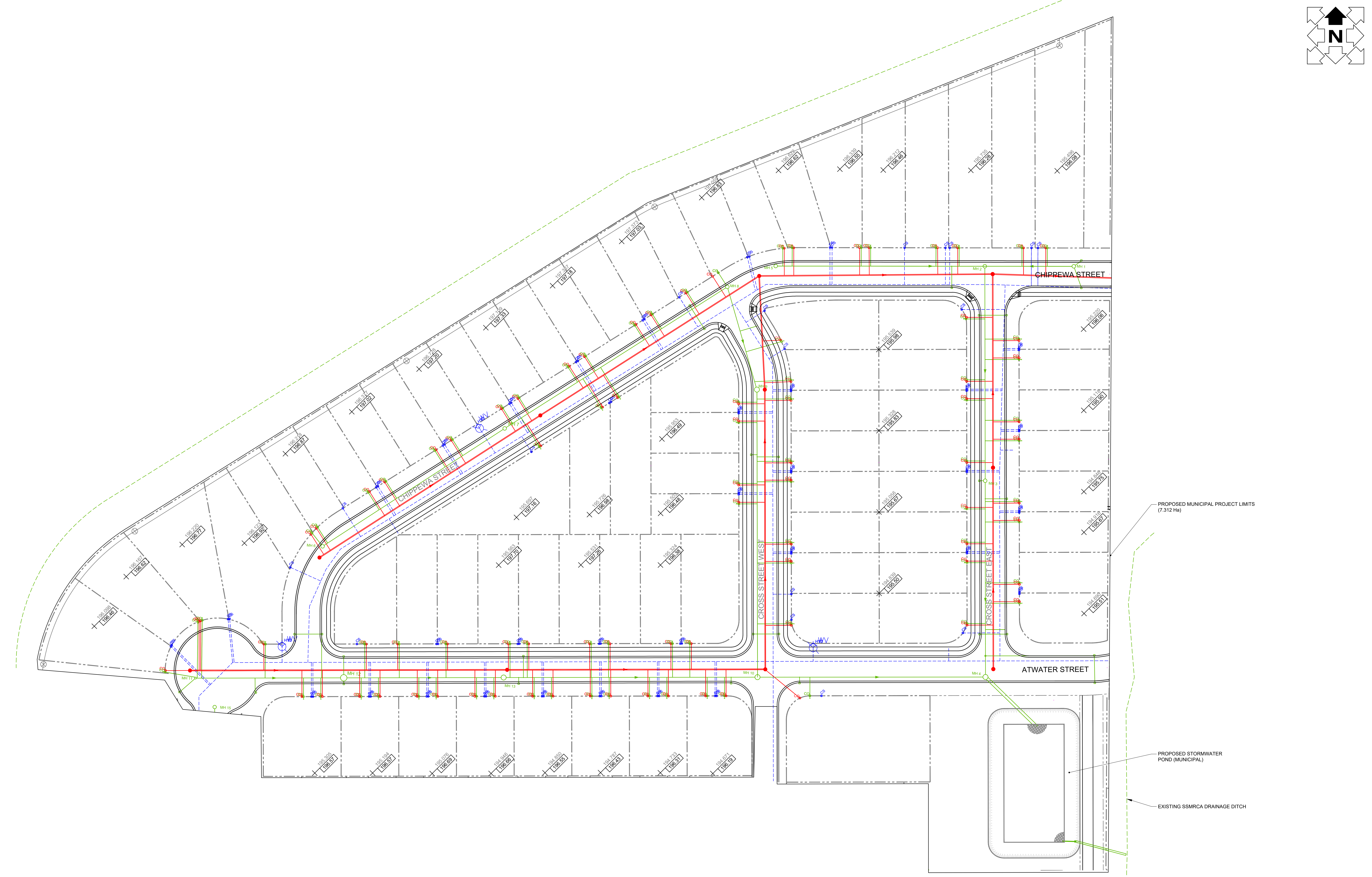
```
  -----------------------------------------------
  Outfall Node ID         Flow   Average      Peak
                     Frequency      Flow    Inflow
                           (%)       LPS       LPS
  -----------------------------------------------
  Out-01                 98.99    316.66   1100.65
  -----------------------------------------------
  System                 98.99    316.66   1100.65


  *****************
  Link Flow Summary
  *****************


----------------------------------------------------------------------------------------------------------------
----------------
  Link ID              Element       Time of   Maximum  Length   Peak Flow      Design  Ratio of  Ratio of
Total  Reported
                       Type        Peak Flow  Velocity  Factor      during        Flow   Maximum   Maximum
 Time  Condition
                                  Occurrence  Attained            Analysis    Capacity   /Design      Flow
Surcharged
                                  days hh:mm     m/sec                 LPS         LPS      Flow     Depth
minutes

----------------------------------------------------------------------------------------------------------------
----------------
  {Proposed Storm}.MH 1 - MH 2 (Proposed Storm) CONDUIT      0  07:07      0.86    1.00       66.65      138.14
    0.48      0.49           0  Calculated
  {Proposed Storm}.MH 10 - MH 4 (Proposed Storm) CONDUIT      0  07:12      1.44    1.00      532.42      559.91
     0.95      0.78           0  Calculated
  {Proposed Storm}.MH 11 - MH 12 (Proposed Storm) CONDUIT      0  07:07      0.81    1.00       66.64
127.51      0.52      0.51           0  Calculated
  {Proposed Storm}.MH 12 - MH 13 (Proposed Storm) CONDUIT      0  07:08      0.96    1.00      133.25
```

```
274.61      0.49      0.49           0  Calculated
  {Proposed Storm}.MH 13 - MH 10 (Proposed Storm) CONDUIT      0  07:09      1.13    1.00      199.80
539.39      0.37      0.42           0  Calculated
  {Proposed Storm}.MH 2 - MH 3 (Proposed Storm) CONDUIT      0  07:09      1.13    1.00      199.84      539.39
    0.37      0.42           0  Calculated
  {Proposed Storm}.MH 3 - MH 4 (Proposed Storm) CONDUIT      0  07:12      1.22    1.00      264.74      539.39
    0.49      0.49           0  Calculated
  {Proposed Storm}.MH 4 - POND (Proposed Storm) CONDUIT      0  07:12      1.57    1.00      863.65      877.11
    0.98      0.81           0  Calculated
  {Proposed Storm}.MH 5 - MH 2 (Proposed Storm) CONDUIT      0  07:08      0.86    1.00       66.62      138.14
    0.48      0.49           0  Calculated
  {Proposed Storm}.MH 7 - MH 88 (Proposed Storm) CONDUIT      0  07:10      1.02    1.00      133.17      297.50
     0.45      0.47           0  Calculated
  {Proposed Storm}.MH 8 - MH 9 (Proposed Storm) CONDUIT      0  07:10      1.13    1.00      199.71      297.50
    0.67      0.60           0  Calculated
  {Proposed Storm}.MH 9 - MH 10 (Proposed Storm) CONDUIT      0  07:12      1.22    1.00      266.26      539.39
     0.49      0.50           0  Calculated
  {Proposed Storm}.MH 9 - MH 11 (Proposed Storm) CONDUIT      0  07:08      0.86    1.00       66.62      138.14
     0.48      0.49           0  Calculated
  Orifice-01           ORIFICE      0  08:06                       520.62


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link Orifice-01 (1)


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :    30.00 sec
  Average Time Step           :    30.00 sec
  Maximum Time Step           :    30.00 sec
  Percent in Steady State     :     0.00
```

```
Average Iterations per Step :     1.94


Analysis began on:  Sun Jun 09 19:50:06 2024
Analysis ended on:  Sun Jun 09 19:50:06 2024
Total elapsed time: < 1 sec
```

APPENDIX B

ENGINEERING DRAWINGS



NOTES:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. DO NOT SCALE DRAWING.
3. DRAWING SHOWS PROPOSED CONSTRUCTION EMPHASIZED.
4. EXISTING CONDITIONS APPEAR SCREENED IN BACKGROUND.
5. LOCATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE ONLY AND MUST BE VERIFIED BY CONTRACTOR.
6. FOR BOREHOLE INFORMATION, REFER TO GEOTECHNICAL REPORT.

No	DESCRIPTION	DATE	INITIAL

REVISIONS

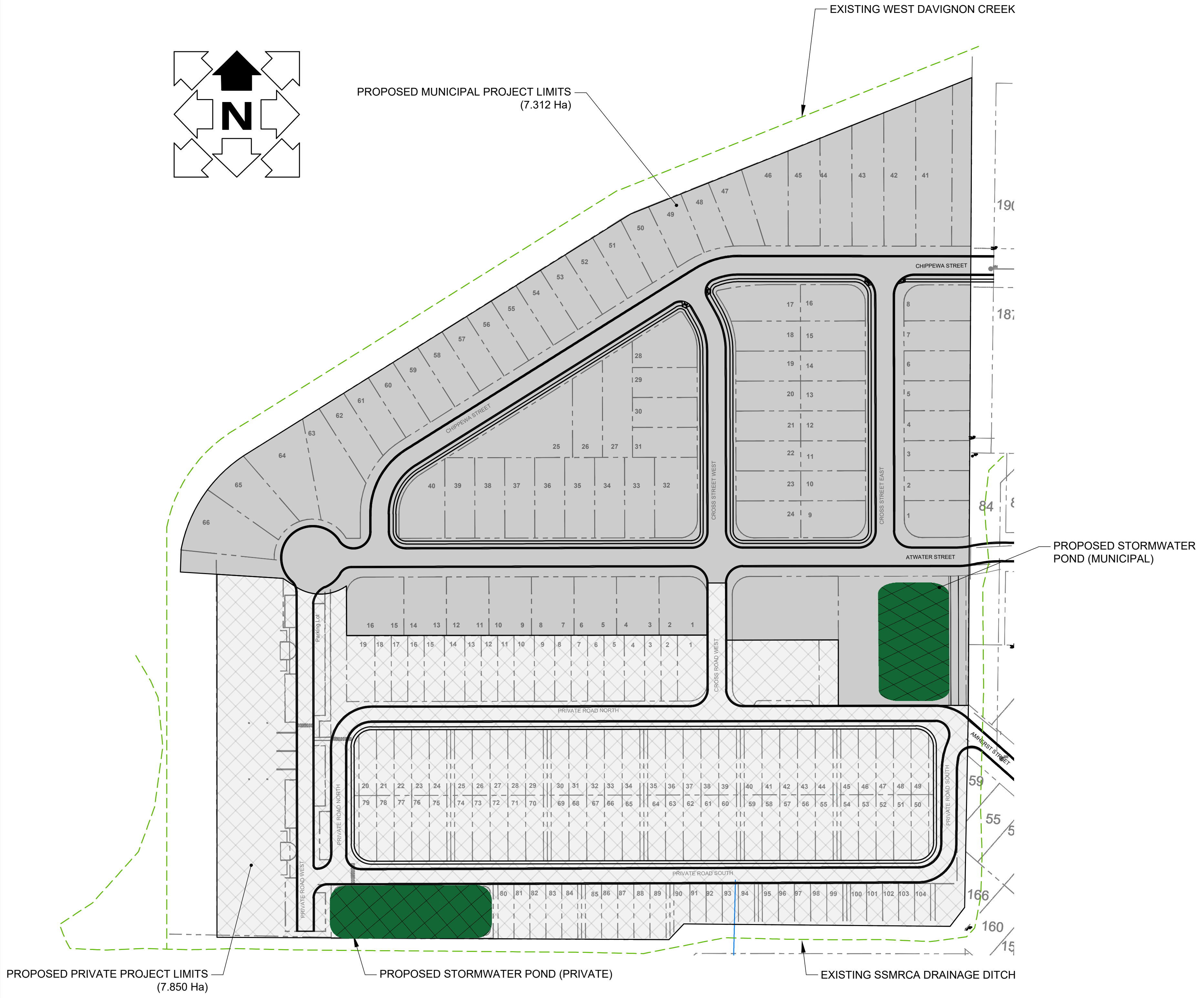
KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949–4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

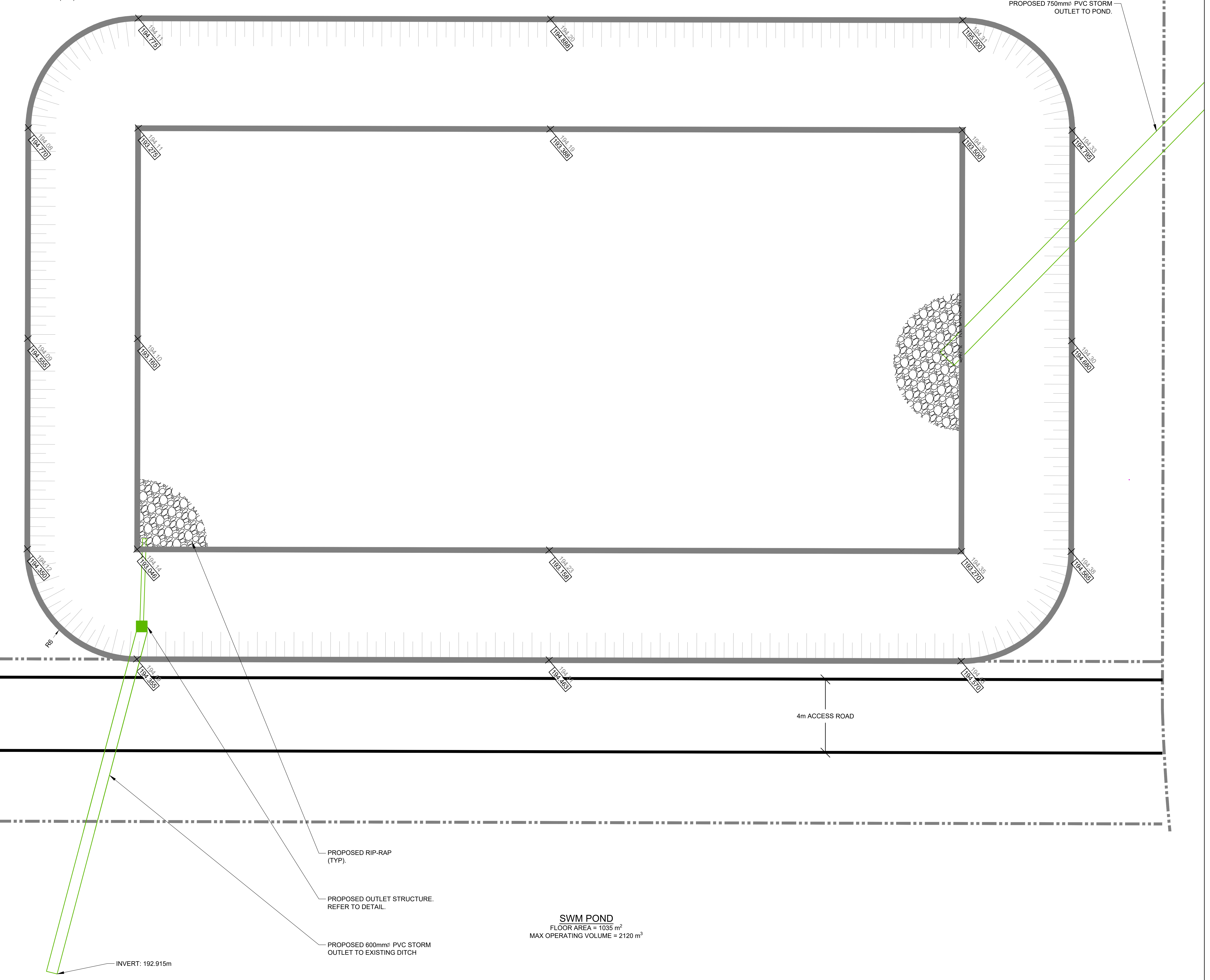
MAMTA HOMES
0 CHIPPEWA STREET
SITE GRADING

DRAWING NO.
G2

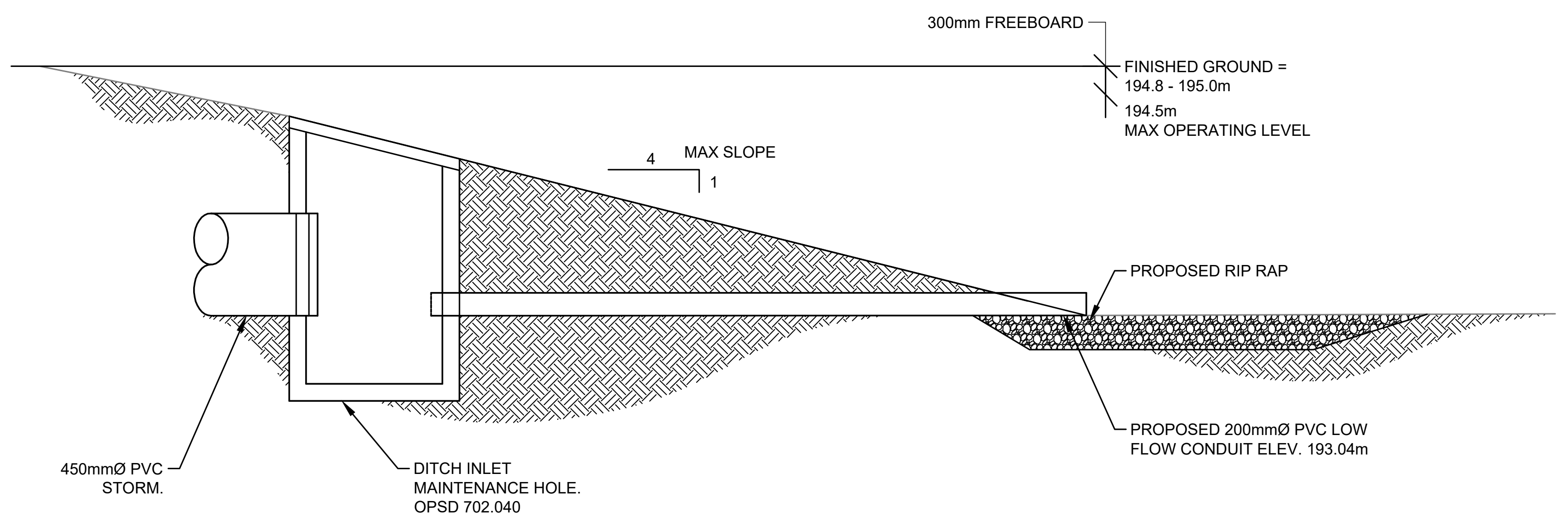


LOCATION PLAN
SCALE 1:2000

NOTES:
1. ALL SIDE SLOPES TO BE COMPLETED WITH 75mm TOPSOIL SEED AND MULCH.
2. RIP RAP SHALL BE 300mmØ (MIN) C/W GEOTEXTILE AS PER OPSD 810.01



SWM POND
FLOOR AREA = 1035 m^2
MAX OPERATING VOLUME = 2120 m^3



OUTLET STRUCTURE DETAIL
SCALE 1:25

NOTES:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. DO NOT SCALE DRAWING.
3. DRAWING SHOWS PROPOSED CONSTRUCTION EMPHASIZED.
4. EXISTING CONDITIONS APPEAR SCREENED IN BACKGROUND.
5. LOCATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE ONLY AND MUST BE VERIFIED BY CONTRACTOR.
6. FOR BOREHOLE INFORMATION, REFER TO GEOTECHNICAL REPORT.

No	DESCRIPTION	DATE	INITIAL

REVISIONS

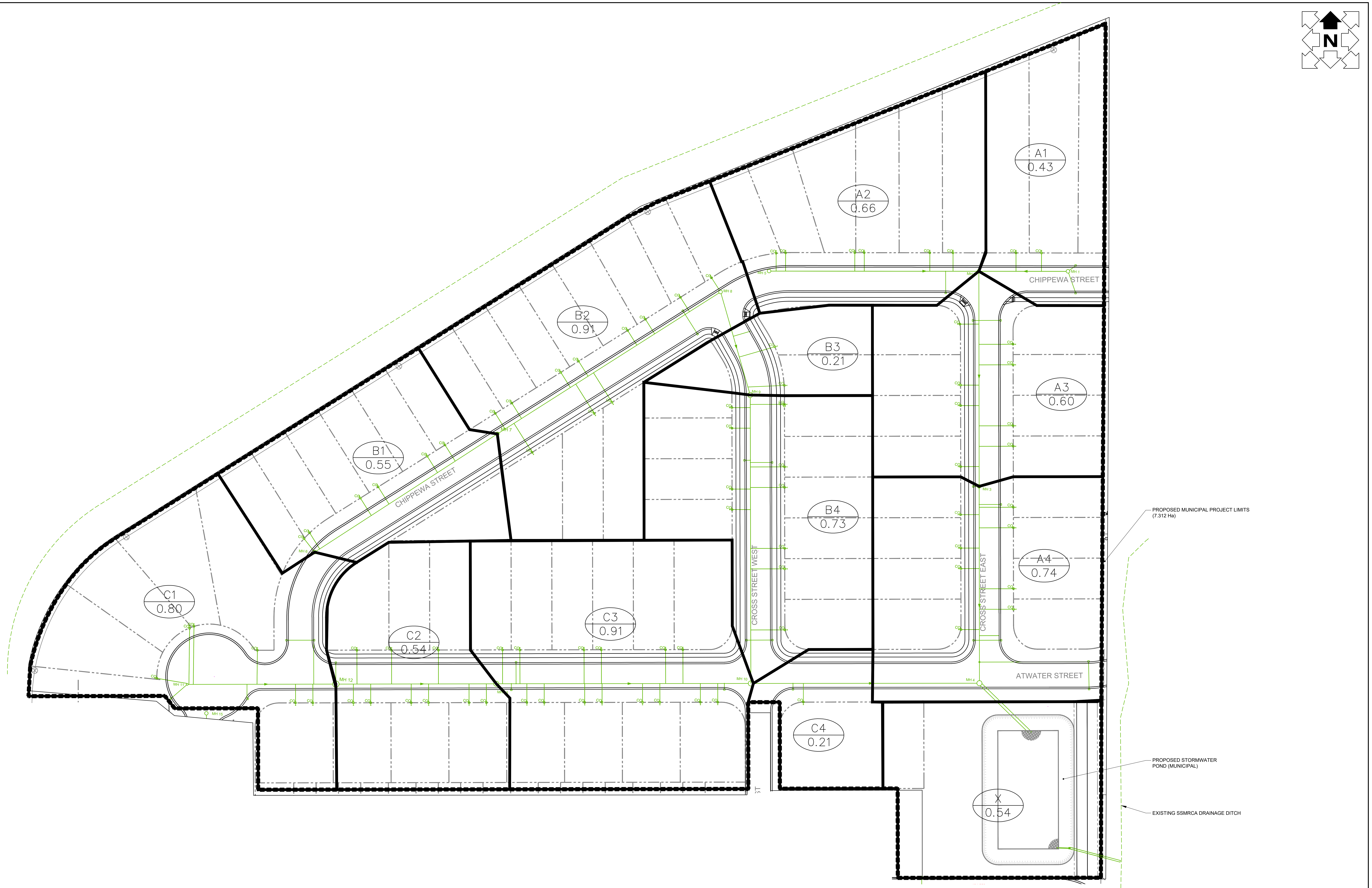
KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
STORMWATER POND

DRAWING NO.
G3



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DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
STORM DRAINAGE AREAS

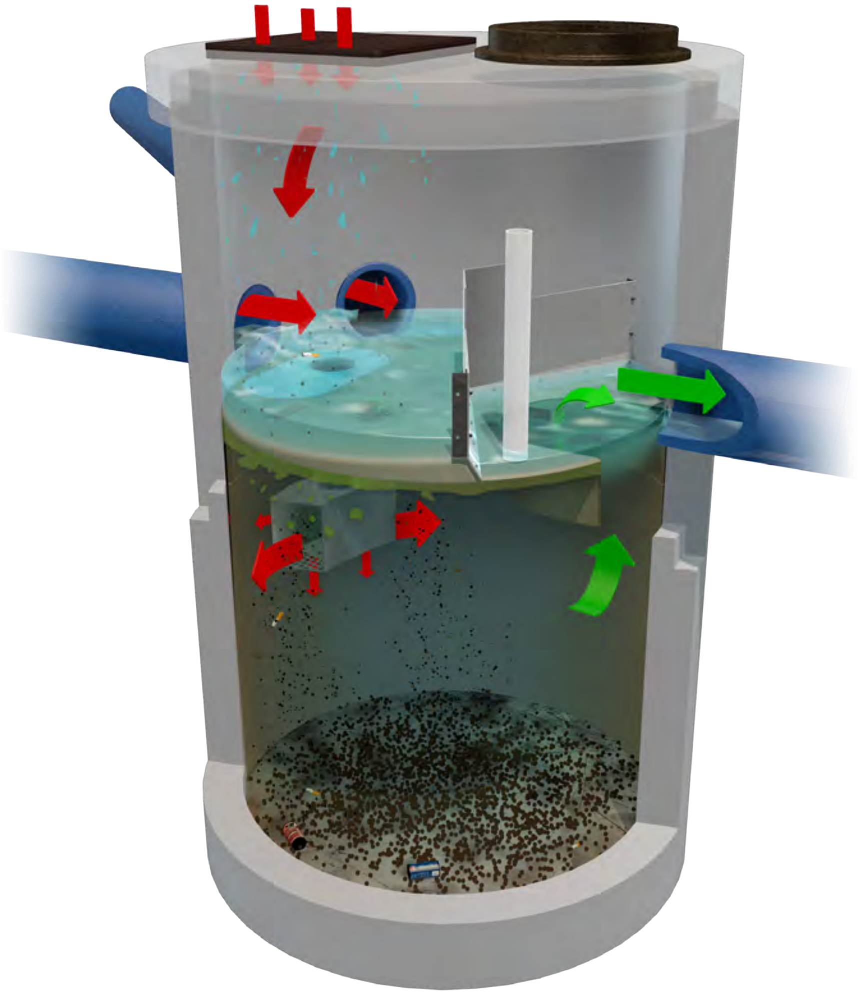
DRAWING NO.
G4

APPENDIX C

STORMCEPTOR MANUAL

Stormceptor® EF

Owner's Manual



STORMCEPTOR® EF IS PATENT-PENDING.

TABLE OF CONTENTS

OVERVIEW

The **Stormceptor® EF** is a continuation and evolution of the most globally recognized oil-grit separator (OGS) stormwater treatment technology - ***Stormceptor®***. Also known as a hydrodynamic separator,
fectively removes a
wide variety of pollutants from stormwater and snowmelt runof
original Stormceptor. Stormceptor EF captures and retains sediment (TSS), free oils, gross pollutants and other pollutants that attach to particles, such as nutrients and metals. Stormceptor EF's patent-pending treatment and scour prevention technology and internal bypass ensures sediment is retained during all rainfall events..

Stormceptor EF of
inlet pipe, multiple inlet pipes, and/or from the surface through an inlet grate. Stormceptor EF can also

ensure performance in submerged conditions. With its scour prevention technology and internal bypass, Stormceptor EF can be installed online, eliminating the need for costly additional bypass structures.

OPERATION

- Stormwater enters the Stormceptor upper chamber through the inlet pipe(s) or a surface inlet grate.
  A
  s
  weir
  , sediment, and

  strong vortex draws water, sediment, oil, and debris down the drop pipe cone.
- The duct has two large rectangular outlet openings
  fused through these
  various opening in multiple directions and at low velocity into the lower chamber.
-
  sump. Pollutants are retained for later removal during maintenance cleaning.
- T
  , moves upward, and discharges to the top side of the insert
  downstream of the weir
-
  of the weir may exceed the height of the weir
  to the downstream side of the insert, and exits through the outlet pipe. This internal bypass feature allows for online installation, avoiding the cost of additional bypass structures. During bypass,
- Stormceptor EF'

  intensity storms.

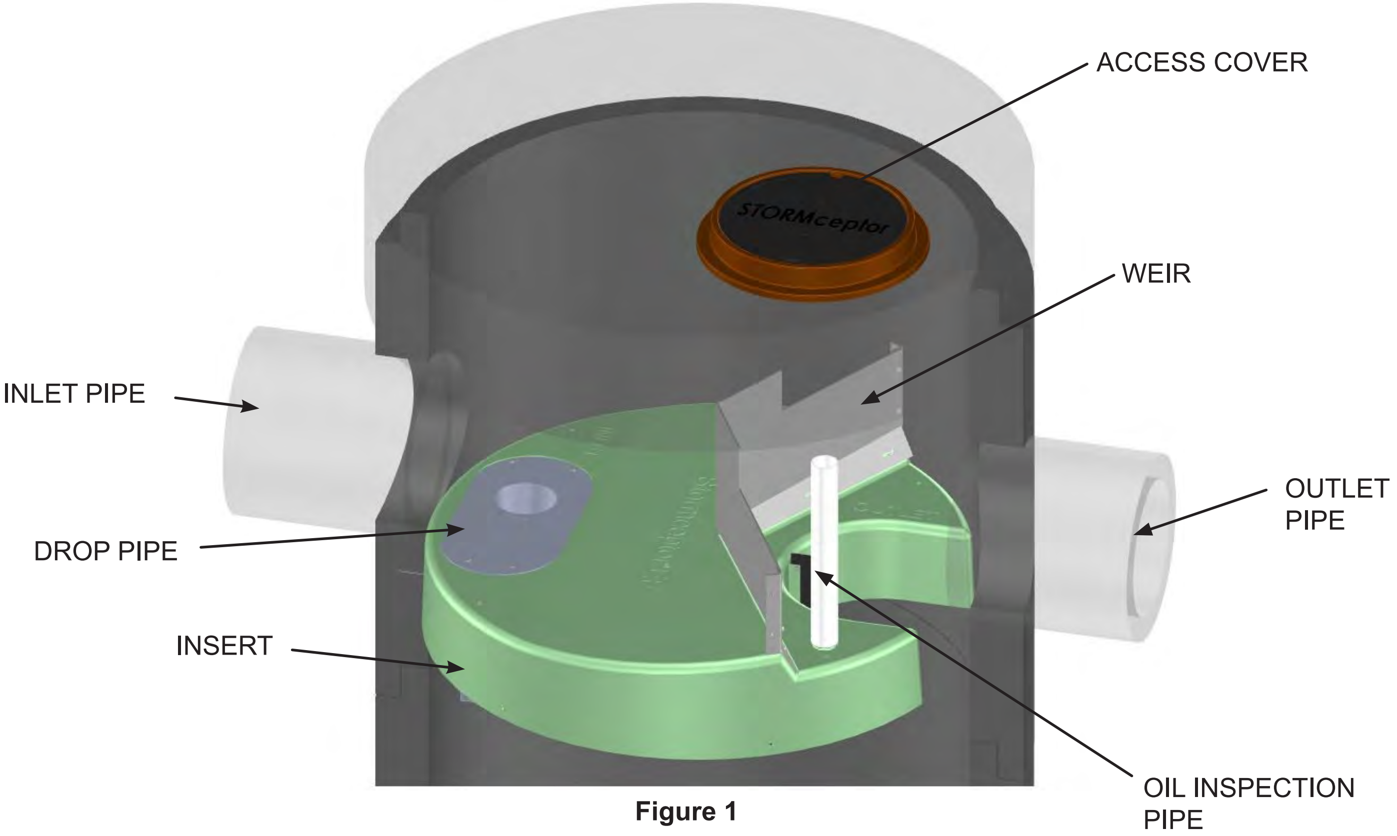


Figure 1

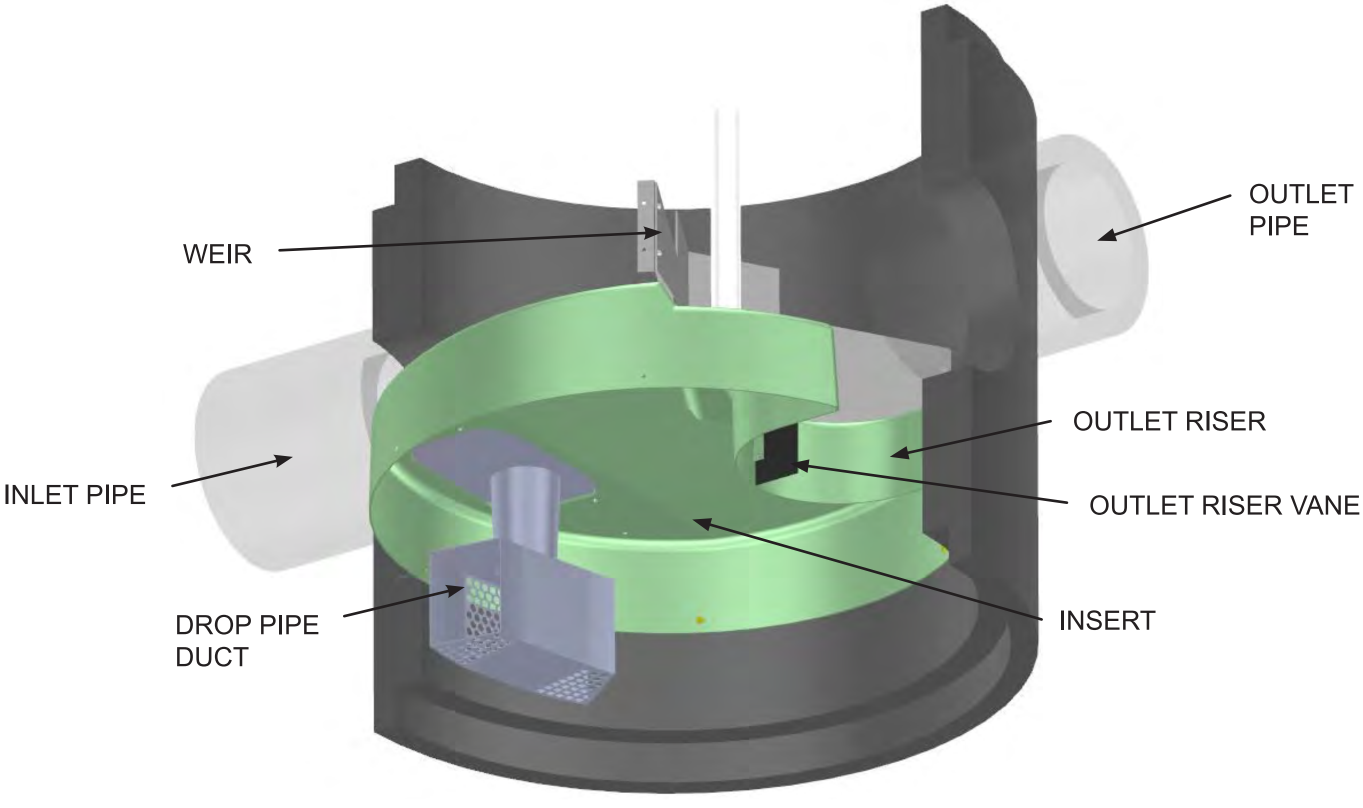


Figure 2

- Insert – separates vessel into upper and lower chambers, and provides double-wall containment of hydrocarbons
- Weir – creates stormwater ponding and driving head on top side of insert
- Drop pipe – conveys stormwater and pollutants into the lower chamber
- Outlet riser – conveys treated stormwater from the lower chamber to the outlet pipe, and provides primary inspection and maintenance access into the lower chamber
-
- Oil inspection pipe – primary access for measuring oil depth, and oil removal

IDENTIFICATION

trade name ***Stormceptor***® embossed on the access cover at grade as shown in **Figure 3**. The tradename ***Stormceptor***® is also embossed on the top of the insert upstream of the weir as shown in **Figure 3**.

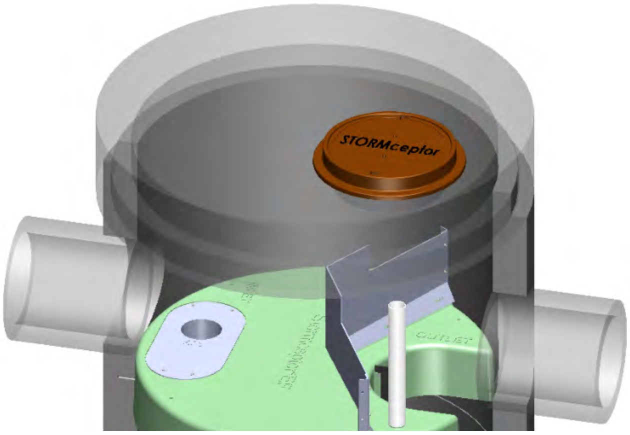


Figure 3

Figure 4.

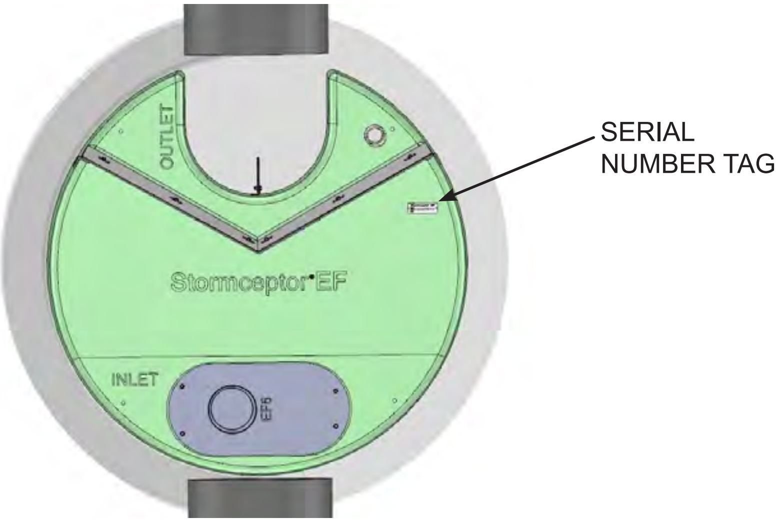


Figure 4

MODEL DETAILS

TABLE 1. METRIC DIMENSIONS AND CAPACITIES

Stormceptor Model	Inside Diameter	Minimum Surface to Outlet Invert Depth	Depth Below Outlet Pipe Invert	Wet Volume	Sediment Capacity[1]	Hydrocarbon Storage Capacity[2]	Maximum Flow Rate into Lower Chamber[3]	Peak Conveyance Flow Rate[4]
	(m)	(mm)	(mm)	(L)	(m^3)	(L)	(L/s)	(L/s)
EF4 / EFO4	1.22	915	1524	1780	1.19	265	22.1 / 10.4	425
EF6 / EFO6	1.83	915	1930	5070	3.47	610	49.6 / 23.4	990
EF8 / EFO8	2.44	1219	2591	12090	8.78	1070	88.3 / 41.6	1700
EF10 / EFO10	3.05	1219	3251	23700	17.79	1670	138 / 65	2830
EF12 / EFO12	3.66	1524	3886	40800	31.22	2475	198.7 / 93.7	2830

TABLE 2. U.S. DIMENSIONS AND CAPACITIES

Stormceptor Model	Inside Diameter	Minimum Surface to Outlet Invert Depth	Depth Below Outlet Pipe Invert	Wet Volume	Sediment Capacity[1]	Hydrocarbon Storage Capacity[2]	Maximum Flow Rate into Lower Chamber[3]	Peak Conveyance Flow Rate[4]
	(ft)	(in)	(in)	(gal)	(ft^3)	(gal)	(cfs)	(cfs)
EF4 / EFO4	4	36	60	471	42	70	0.78 / 0.37	15
EF6 / EFO6	6	36	76	1339	123	160	1.75 / 0.83	35
EF8 / EFO8	8	48	102	3194	310	280	3.12 / 1.47	60
EF10 / EFO10	10	48	128	6261	628	440	4.87 / 2.30	100
EF12 / EFO12	12	60	153	10779	1103	655	7.02 / 3.31	100

1.

2. Hydrocarbon Storage Capacity is measured from the bottom of the outlet riser to the underside of the insert. Hydrocarbon Storage Capacity

3. EF Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 1135 L/min/m^2 (27.9 gpm/ft^2). EFO Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 535 L/min/m^2 (13.1 gpm/ft^2).

4. Peak Conveyance Flow Rate is limited by a maximum velocity of 1. m/s (5 fps).

INSPECTION AND MAINTENANCE

It is important to perform regular inspection and maintenance. Regular inspection and maintenance
, keeps maintenance costs low, and provides continued protection of natural waterways.

Quick Reference

- Typical inspection and maintenance is performed from grade
- Remove manhole cover(s) or inlet grate to access insert and lower chamber

  beneath inlet grate
- Use Sludge Judge® or similar sediment probe to check sediment depth through the outlet riser
- Oil dipstick can be inserted through the oil inspection pipe
- Visually inspect the insert for debris, remove debris if present
- Visually inspect the drop pipe opening for blockage, remove blockage if present
- Visually inspect insert and weir for damage, schedule repair if needed
-
-

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
-
  pollutant accumulation.
-
  year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

What equipment is typically required for inspection?

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

When is maintenance cleaning needed?

- If the post-construction inspection indicates presence of construction sediment of a depth greater than a few inches, maintenance is recommended at that time. For optimum performance and normal operation the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, see **Table 3**.
- Maintain immediately after an oil, fuel, or other chemical spill.

TABLE 3

RECOMMENDED SEDIMENT DEPTHS FOR MAINTENANCE SERVICE*

MODEL	Sediment Depth	
	in	mm
EF4 / EFO4	8	203
EF6 / EFO6	12	305
EF8 / EFO8	24	610
EF10 / EFO10	24	610
EF12 / EFO12	24	610

* Based on a minimum distance of 40 inches (1,016 mm) from bottom of outlet riser to top of sediment bed

The frequency of inspection and maintenance may need to be adjusted based on site conditions to ensure the unit is operating and performing as intended. Maintenance costs will vary based on the size of the unit, site conditions, local requirements, disposal costs, and transportation distance.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear
  entry is required (adhere to all OSHA / CCOSH standards)

What conditions can compromise Stormceptor performance?

- Presence of construction sediment and debris in the unit prior to activation
- Excessive sediment depth beyond the recommended maintenance depth
- Oil spill in excess of the oil storage capacity
- Clogging or restriction of the drop pipe inlet opening with debris
- Downstream blockage that results in a backwater condition

MAINTENANCE PROCEDURES

-
- Stormceptor is maintained from grade through a standard surface manhole access cover or inlet grate.
- In the case of submerged or tailwater conditions, extra measures are likely required, such as plugging the inlet and outlet pipes prior to conducting maintenance.
- Inspection and maintenance of upstream catch basins and other stormwater conveyance structures is also recommended to extend the time between future maintenance cycles.
- Sediment depth inspections are performed through the **Outlet Riser** and oil presence can be determined through the **Oil Inspection Pipe** (**see Figures 6 and 7**).
- Oil presence and sediment depth are determined by inserting a Sludge Judge® or measuring stick to quantify the pollutant depths.
- Visually inspect the insert, weir, and drop pipe inlet opening to ensure there is no damage or blockage.

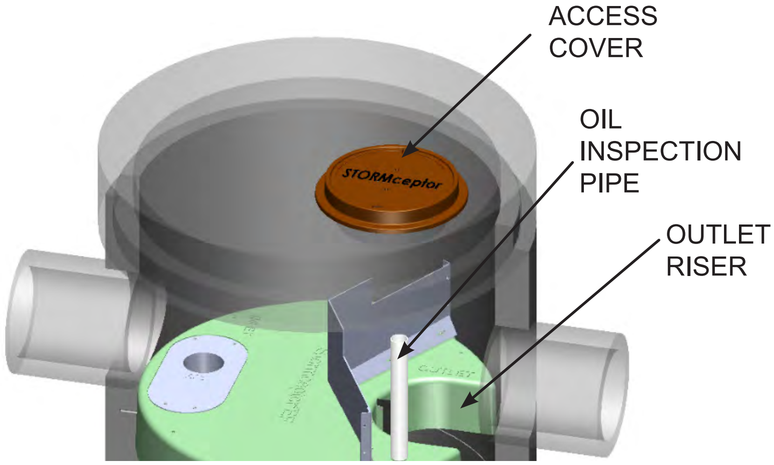


Figure 5

Figure 6

- When maintenance is required, a standard vacuum truck is used to remove the pollutants from the lower chamber of the unit through the **Outlet Riser** (**see Figure 7**).

Figure 7

- The Outlet Riser V
  minimal, if any, interference (**see Figure 8**).

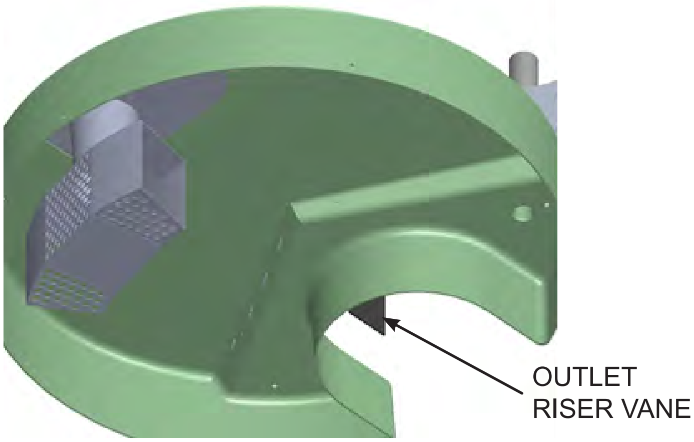


Figure 8

REMOVABLE FLOW DEFLECTOR

-

grade **(See Figure 9).** .

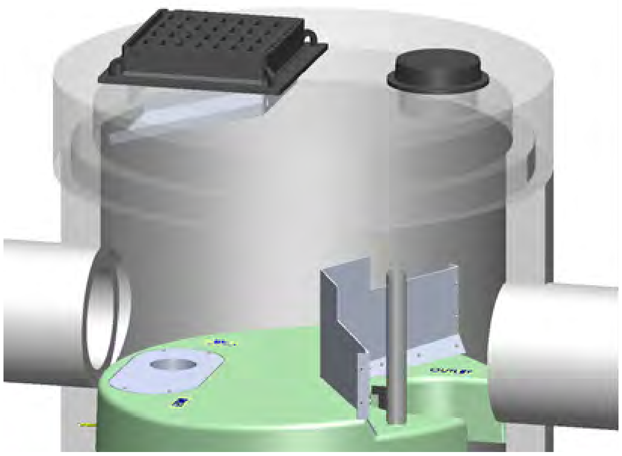
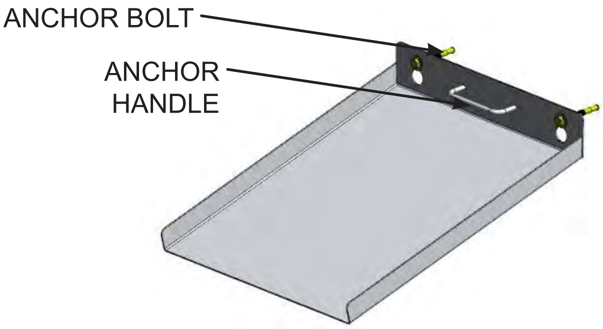


Figure 9



Removable Flow Detector

HYDROCARBON SPILLS

spill potential exists. Should a spill occur
unit should be cleaned immediately by a licensed liquid waste hauler.

Disposal

Maintenance providers are to follow all federal, state/ provincial, and local requirements for disposal of material.

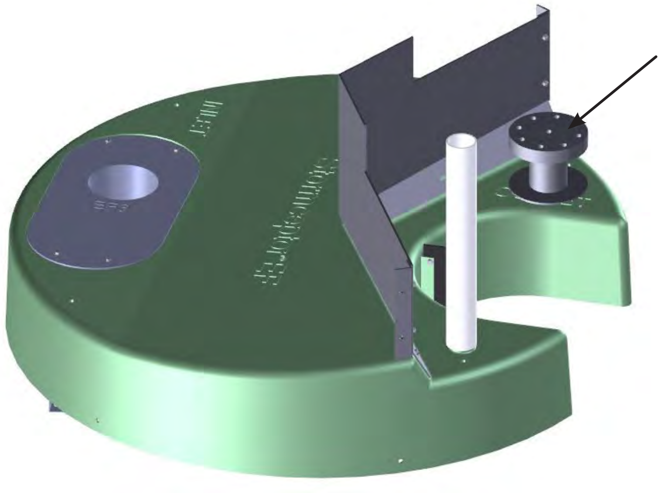
Oil Sheens

When oil is present in stormwater runoff, a sheen may be noticeable at the Stormceptor outlet. An oil rainbow or sheen can be noticeable at very low oil concentrations (< 10 mg/L). Despite the appearance of a sheen, Stormceptor EF/EFO may still be functioning as intended.

Oil Level Alarm

To mitigate spill liability with 24/7 detection, an electronic Oil Level Alarm monitoring system can be employed to trigger a visual and audible alarm when a pre-set level of oil is captured within the lower chamber or when an oil spill occurs. The oil level alarm is available as an optional feature to include with Stormceptor EF/EFO as shown in **Figure 10**.

For additional details about the Oil Level Alarm, please visit
www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-systems.



OIL ALARM PROBE
INSTALLED ON
DOWNSTREAM SIDE
OF WEIR

Figure 10

Optional Oil Alarm

REPLACEMENT PARTS

Stormceptor has no moving parts. Therefore, inspection and maintenance activities are generally focused on pollutant removal. Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. However, if replacement parts are necessary, they may be purchased by contacting your local Stormceptor representative.

STORMCEPTOR INSPECTION AND MAINTENANCE LOG

Stormceptor Model No: ______________________________

Serial Number: ______________________________

Installation Date: ______________________________

Location Description of Unit: ______________________________

Recommended Sediment Maintenance Depth: ______________________________

DATE	SEDIMENT DEPTH	OIL DEPTH (inches or mm)	SERVICE REQUIRED (Y/N)	MAINTENANCE PERFORMED	MAINTENANCE PROVIDER	COMMENTS

Other Comments: ______________________________

CONTACT INFORMATION

Questions regarding Stormceptor EF/EFO can be addressed by contacting your local Stormceptor representative.

Imbrium Systems Inc.
1-416-960-9900 / 1-800-565-4801 / 888-279-8826

www.imbriumsystems.com
www.stormceptor.com
info@imbriumsystems.com

APPENDIX D

STATEMENT OF LIMITATIONS

Statement of Limitations

This report has been prepared by Kresin Engineering Corporation (KEC) at the request of the Owner for use in support of the development of the Site (as defined in the report). KEC expressly excludes liability to any party for any use or reliance of the information contained in this report for any other purpose.

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The report shall be considered in its entirety. Portions of the report shall not be used out of context.

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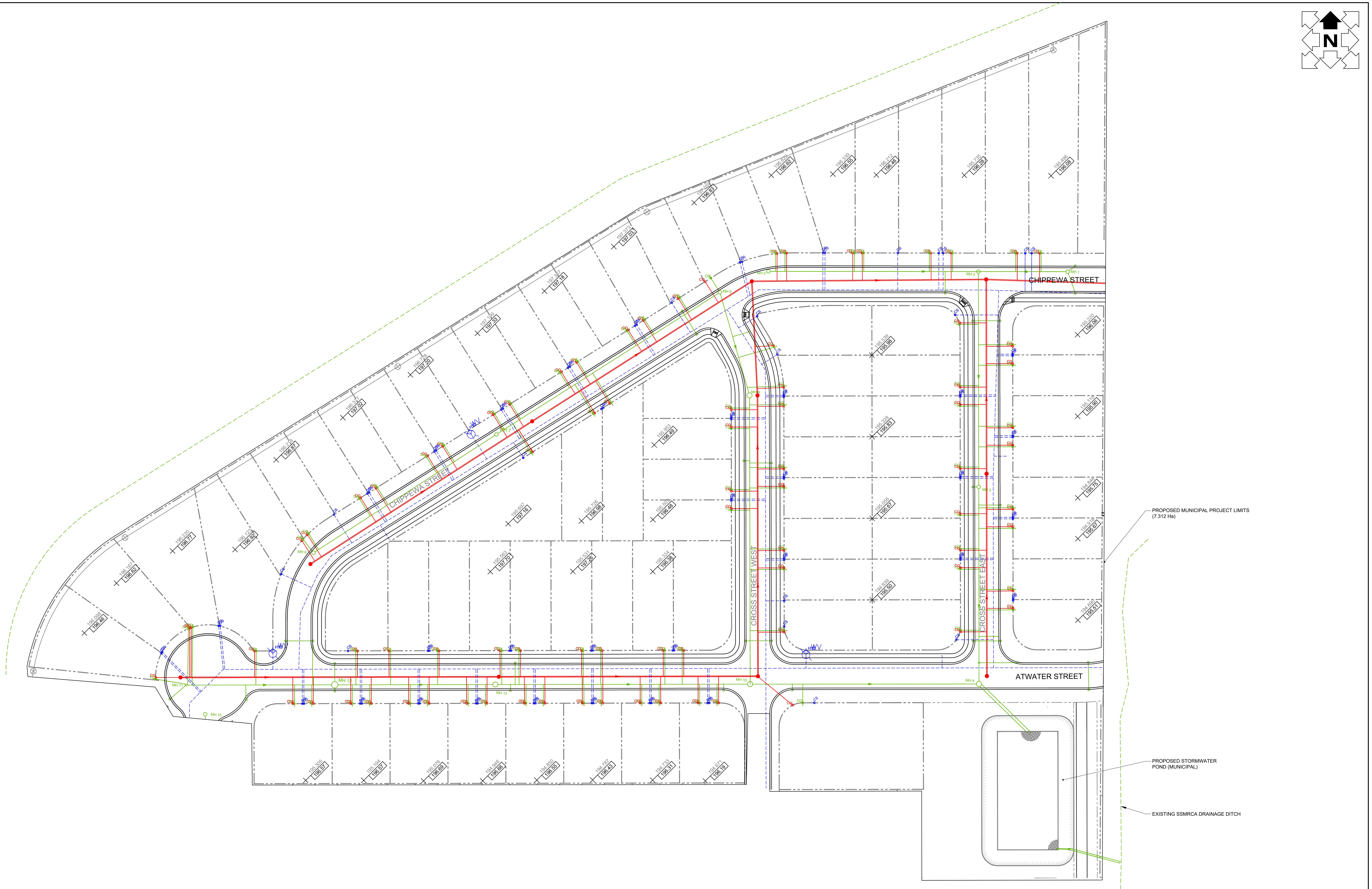
This statement of limitations shall be considered a part of the report.

Appendix 5

Preliminary Site Grading Plan



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No	DESCRIPTION	DATE	INITIAL

REVISIONS

KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
SITE GRADING

DRAWING NO.
G2

Appendix 6

Traffic Impact Study

Kresin Engineering Corporation

Traffic Impact Study

0 Chippewa Avenue Development

B001618

CIMA+ file number: B001618
04 01 2024 – Review 1.0

Kresin Engineering Corporation

Traffic Impact Study

0 Chippewa Avenue Development

B001618

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Burington, ON L7N 3G7

CIMA+ file number: B001618
04 01 2024 – Review 1.0

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1. Introduction and Background

CIMA+ was retained by Kresin Engineering to undertake a Traffic Impact Study (TIS) as part of a development application for a 363-unit mixed use development at 0 Chippewa Street with direct access to Chippewa Street, Atwater Street, and Amherst Street as shown in **Figure 1**. The proposed development is located on the northwest corner of the City of Sault Ste. Marie (the City) and is planned to include mostly residential homes and a retail store.

The study objective is to determine the expected traffic volumes to be generated by the proposed development during the AM, and PM peak hours, and to assess the impact of development traffic on the surrounding transportation network. Finally, mitigation measures will be recommended to accommodate the projected development traffic if the operational analysis indicates they are necessary.

The content of this TIS follows the approach and methodology presented in the Terms of Reference (TOR) submitted to the City for review on March 27th, 2023. **Appendix A** contains the TOR documentation.

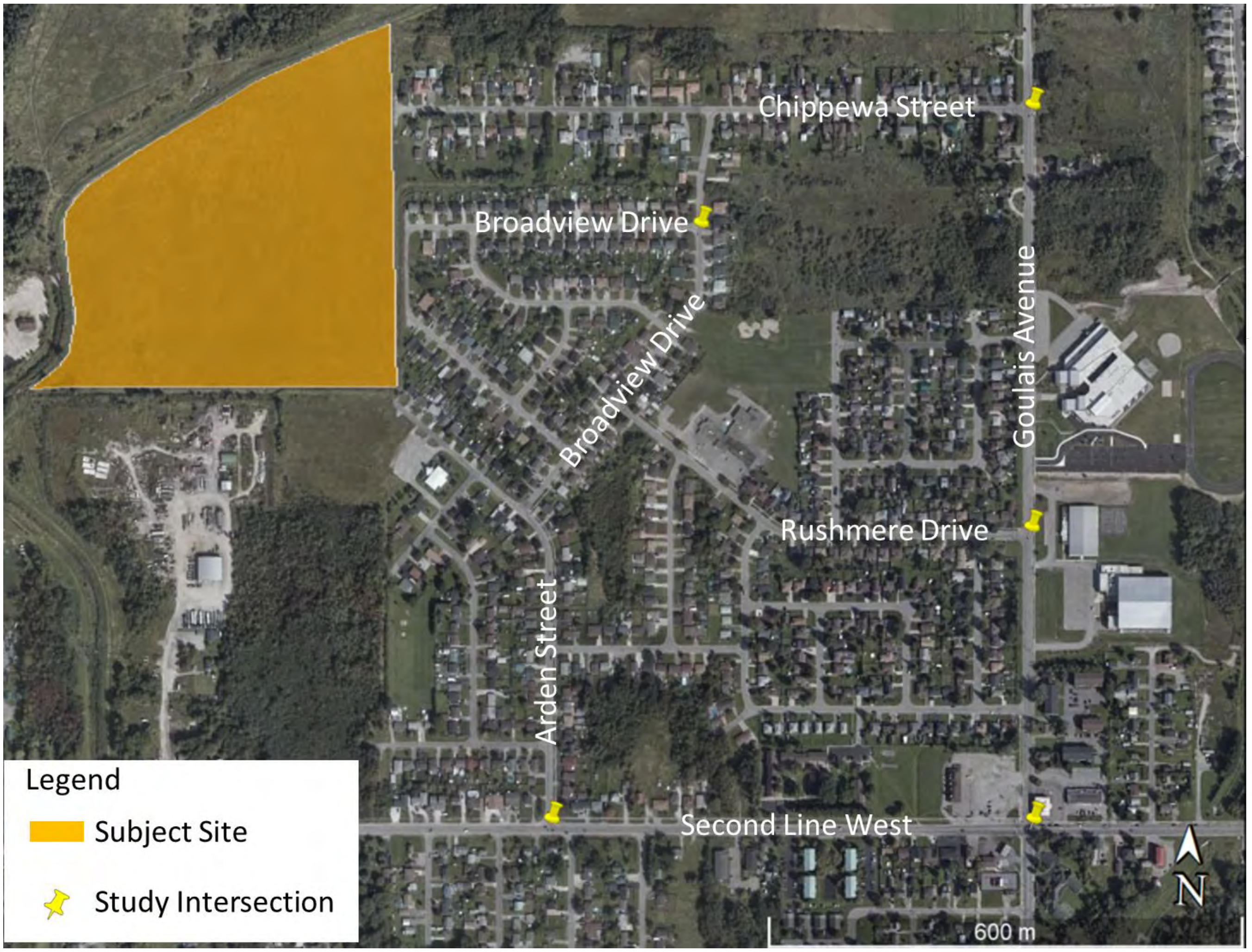


Figure 1: Proposed Development Area Map

1.1 Study Area

Figure 1 illustrates the subject site along with the surroundings lands, which together, represents the study area. The subject site is located adjacent to residential neighbourhoods.

Second Line West is classified as a major urban arterial in the City's Transportation Master Plan, with a posted speed limit of 60 km/h. Within the study area Second Line West is a two-lane road (one lane per direction) oriented in an east-west direction. The only other non-local road in the study area is Goulais Avenue, which is classified as an urban collector road with posted speed of 50 km/h. Goulais Avenue is currently a 4-lane road (two lanes per direction) however, we are aware that the City is currently investigating the implementation of a road diet. At the time of this TIS, there is no formal standing for the road diet and for this reason Goulais Avenue will maintain its current configuration for all future scenarios.

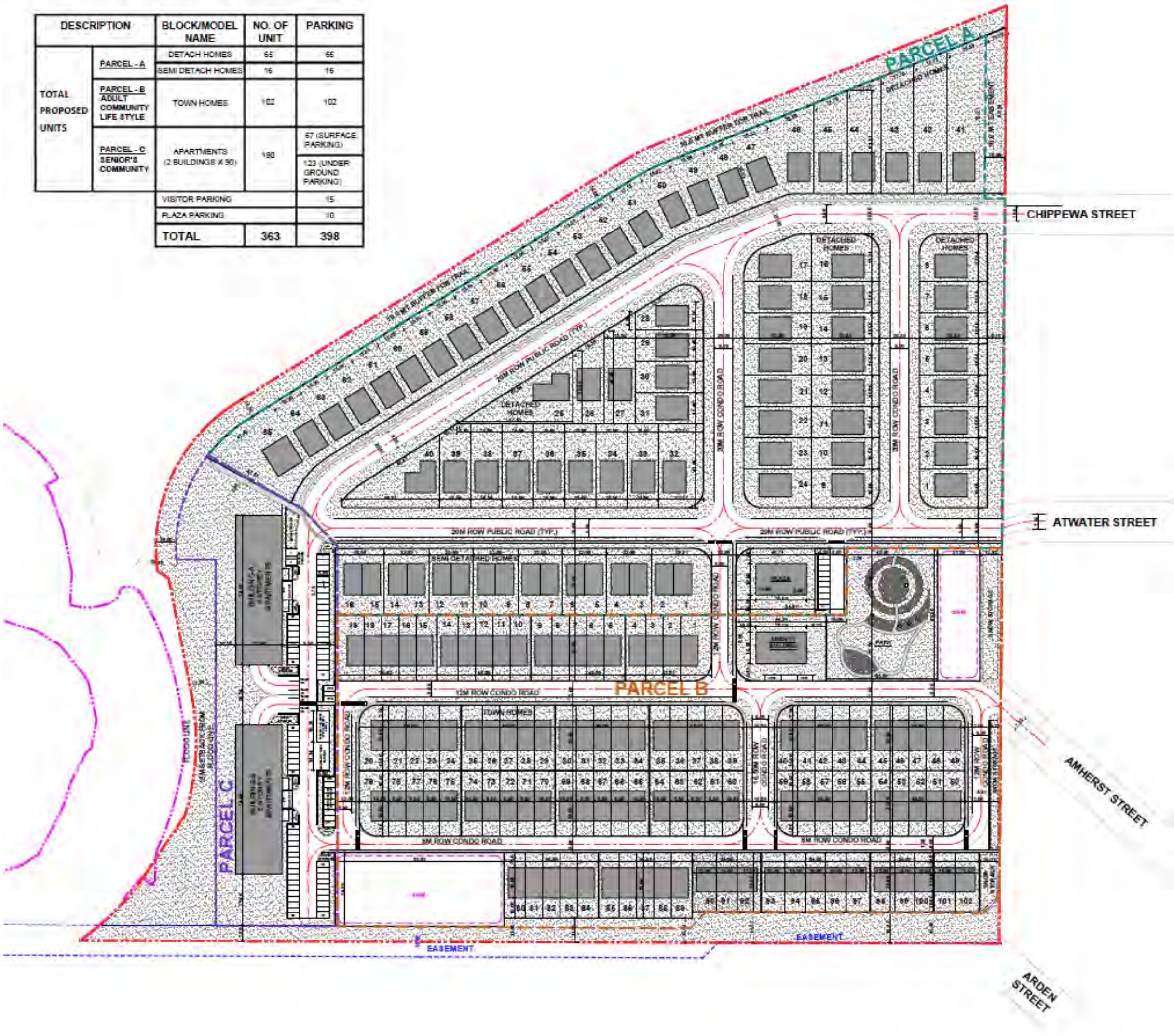
The following intersections were analyzed as part of the road network impacted by the proposed development:

- Chippewa Street and Goulais Avenue (Unsignalized)
- Atwater Street and Broadview Drive (Unsignalized)
- Rushmere Drive and Goulais Avenue (Unsignalized)
- Arden Street and Second Line West (Unsignalized), and
- Goulais Avenue and Second Line West (Signalized).

The turning movement count (TMC) provided by the City, for Goulais Avenue and Second Line West was conducted in October 2022. TMCs for the other four intersections were provided by Kresin Engineering and conducted on December 14th, 2023. It should be noted that for another CIMA assignment, a TMC was provided for Goulais Avenue and Second Line West. The TMC was conducted by the City on December 15th 2023and its volumes were found to have greater similarity to the Kresin TMCs compared to the TMC conducted in October 2022. For this study, the December 2023 TMC at Goulais Avenue and Second Line West was used. The existing traffic counts are provided in **Appendix B**.

1.2 Development Context

The proposed mixed used development is bounded by Chippewa Street and Broadview Street to the east, a construction yard to the south and a creek to the north and west. Accesses are provided via Chippewa Street, Atwater Street, and Amherst Street. **Figure 2** and **Appendix C** showcase the site plan. Through consultations with Kresin Engineering, Parcel A, comprising of detached homes, semi-detached homes and a plaza, is expected to be fully built out by 2035 while Parcel B and C comprising of town homes, apartments, an amenity building, and a park are expected to be fully built out by 2032.



DESCRIPTION		BLOCK/MODEL NAME	NO. OF UNIT	PARKING
TOTAL PROPOSED UNITS	PARCEL - A	DETACH HOMES	65	65
		SEMI DETACH HOMES	16	16
	PARCEL - B ADULT COMMUNITY LIFE STYLE	TOWN HOMES	102	102
	PARCEL - C SENIOR'S COMMUNITY	APARTMENTS (2 BUILDINGS X 90)	180	67 (SURFACE PARKING)
				123 (UNDER GROUND PARKING)
		VISITOR PARKING		15
		PLAZA PARKING		10
		TOTAL	363	398

Figure 2: Site Plan

2. Study Methodology

2.1 Horizon Years

This study evaluates existing and future traffic operations at study area intersections for the weekday AM peak hour, and weekday PM peak hour. The development is expected to be built in phases. The horizon year for the completion of each phase was selected to fully evaluate the effects of the development on the transportation network.

The study assessed traffic operations under existing (2023) conditions and the following future horizon years:

- Opening Year for Parcels B and C (2032) Background Conditions;
- Full Build-Out (2035) Background Conditions;
- Opening Year for Parcels B and C Future (2032) Total Conditions; and,
- Full Build-Out Future (2035) Total Conditions.

2.2 Traffic Operational Analysis

Intersection operations were assessed using the Synchro 11 software which utilizes the Highway Capacity Manual (HCM) 2000 methodology published by the Transportation Research Board National Research Council. Synchro 11 can analyze both signalized and unsignalized intersections in a road corridor or network considering the spacing, interaction, queues, and operations between intersections. Intersection operations performance metrics are reported in terms of Level of Service (LOS), volume to capacity (v/c) ratios.

Level of Service is based on the average control delay per vehicle for a given movement. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay.

Table 1 summarizes the LOS criteria for signalized and unsignalized intersections.

Table 1: Intersection Level of Service Criteria

Level of Service	Average Control Delay per Vehicle (second/vehicle)	
	Signalized Intersection	Unsignalized Intersection
A	≤10	≤10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

SimTraffic software was used to calculate the 95th percentile queue length to analyze and assess the available storage capacity and whether queue spillback or lane blockages occur due to long queues. The available storage capacity was based on the best available data collected from aerial imagery.

The City does not have a Traffic Impact Study Guidelines. Therefore, for this study, critical movements are established based on the following criteria:

- Level of Service of E or F;
- Volume to Capacity ratio of 1.00 or greater; and
- 95%th percentile queue exceeds the available storage length.

It should be noted that the peak hour factor (PHF) was calculated from the provided turning movement counts (TMC's) and was used for all existing and future scenarios.

3. Existing Conditions

3.1 Collision Data

A collision analysis was conducted to identify any potential safety issues within the study area. The most recent five years' worth of historical collision data was provided by the city. The data provided is dated between January 2018 and May 2023 for the three busiest study area intersections, which are Second Line West & Goulais Avenue, Second Line West & Arden Street and Chippewa Street & Goulais Avenue. This section summarizes the results of the collision data analysis.

Second Line West & Arden Street

The unsignalized T-intersection had only one reported collision. It was a rear-end collision that occurred in June of 2019, during a rain event and one of the drivers was found to be following too close. No collision patterns or safety issues identified.

Chippewa Street & Goulais Avenue

The unsignalized T-intersection had only three reported collisions where two occurred in 2018 and one in 2021. The two 2018 collisions occurred while the roads were snow covered and involved a driver going too fast for road conditions. No collision patterns or safety issues identified.

Second Line West & Goulais Avenue

A total of 42 collisions were reported at Goulais Avenue and Second Line West intersection. The collision data was further examined for patterns that might point to underlying safety issues. The collision summary by severity, prevailing driver action and impact type is shown below in **Table 2**. The following collision characteristics were reviewed to find possible collision patterns:

- Classification
- Prevailing Driver Action
- Prevailing Impact Type
- Lighting
- Environment Conditions
- Road Surface Conditions
- Direction

Table 2: Collision Summary

Intersection	Total	Severity		

		Fatal	Non-Fatal	PDO	Prevailing Driver Action	Prevailing Impact Type
Second Line West and Goulais Avenue	**42 (1 reported as intentional)**	**0**	**3**	**38**	**43% (18/42) Following Too Close**	**52% (22/42) Rear End**

Table 3: Environmental Conditions

Intersection	Lighting		Environment Condition		Road Surface Condition	
	Daylight	Non-daylight	Clear	Other	Dry	Other
Second Line West and Goulais Avenue	**86% (36/42)**	**14% (6/42)**	**88% (37/42)**	**12% (5/42)**	**62% (26/42)**	**52% (22/42) Rear End**

The following collision trends were observed:

- All 18 instances where drivers were following too close resulted in a rear end collision.
- 68% (15/22) of rear end collisions occurred during dry road conditions.
- Westbound vehicles were involved in 59% (13/22) of rear end collisions followed by 27% (6/22) for southbound vehicles and only 9% (2/22) for eastbound vehicles and 5% northbound vehicles.
  - Of the 13 westbound vehicles involved in rear end collisions 85% (11/13) occurred during the afternoon between 12:00 and 7:00 PM.

There is a pattern of vehicle heading westbound in the afternoon being involved in rear end collisions.

3.2 Sightline Assessment

Kresin Engineering conducted a sightline analysis for the proposed site access located at Amherst Street. The sightline assessment aimed to determine if the curve of Amherst Street, where a proposed access to the development will be located, may cause any sightline issues as illustrated in **Figure 3**. It should be noted that the sightline analysis was conducted during the winter, and it was difficult to know where the proposed condo road would be located.

Based on the Transportation Association of Canada Geometric Design Guide for Canadian Road (TAC-2017), the required stopping sight distance is 85 metres (based on 60 km/h design speed). The design speed is based on the posted speed plus 10 km/h, where in this case a 50 km/h posted speed is assumed. Additionally, the TAC-2017 manual outlines a recommended 110 metre intersection sight distance based on the design speed.

The sightline assessment results (pictures provided in **Appendix D)**, showcases the minimum sight distance can be achieved based on the existing road profile and configuration. No sightline obstructions were found during the assessment. The pictures show a clear sightline for well over 110 metres looking down Amherst Street.

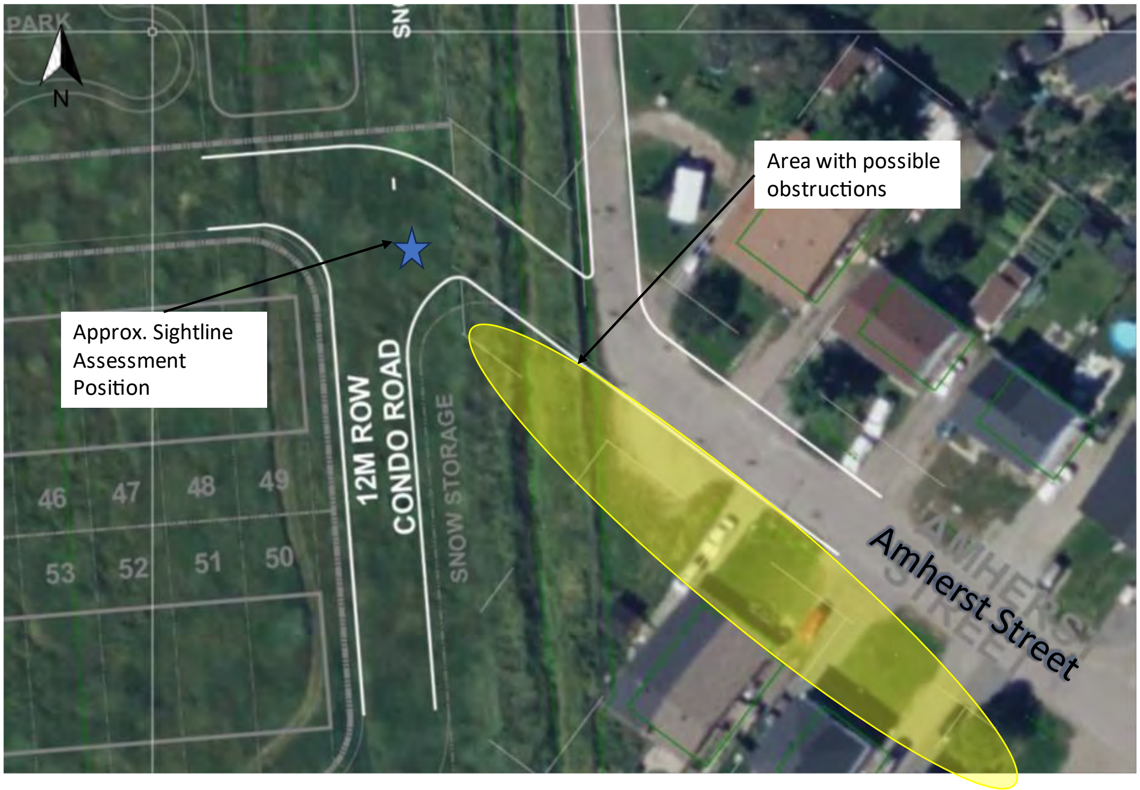


Figure 3: Sightline Assessment

3.3 Traffic Operations

The following section outlines existing conditions. Existing intersection operations were analyzed using the lane configurations illustrated in **Figure 4**.

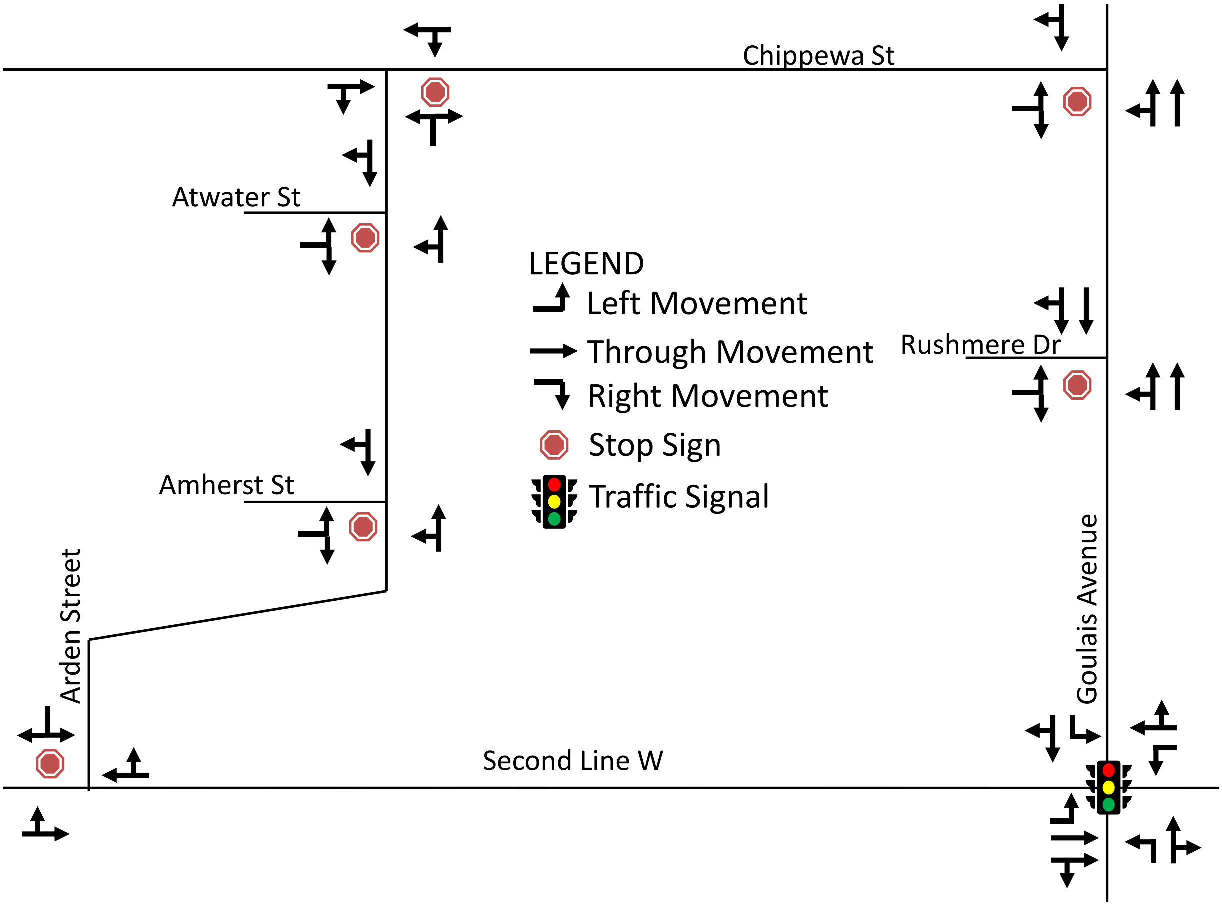


Figure 4: Existing Lane Configuration

As previously mentioned in Section 1.1, CIMA+ received the collection of turning movement counts (TMC) for the study area network from the City and Kresin Engineering.

Volume balancing was conducted due to the TMCs being conducted on different days. As a conservative approach, the balancing resulted in additional volume to be place on the through movements along Goulais Avenue. Volume balancing was only necessary for the PM peak hour with the goal of maintaining a similar ratio of leaving and departing volumes between the three study area intersections along Goulais Avenue. This resulted in vehicles being added to the northbound and southbound through movements for Chippewa Street & Goulais Avenue and Rushmere Drive & Goulais Avenue intersections. The resulting volume balanced existing traffic volumes are shown in **Figure 5**.

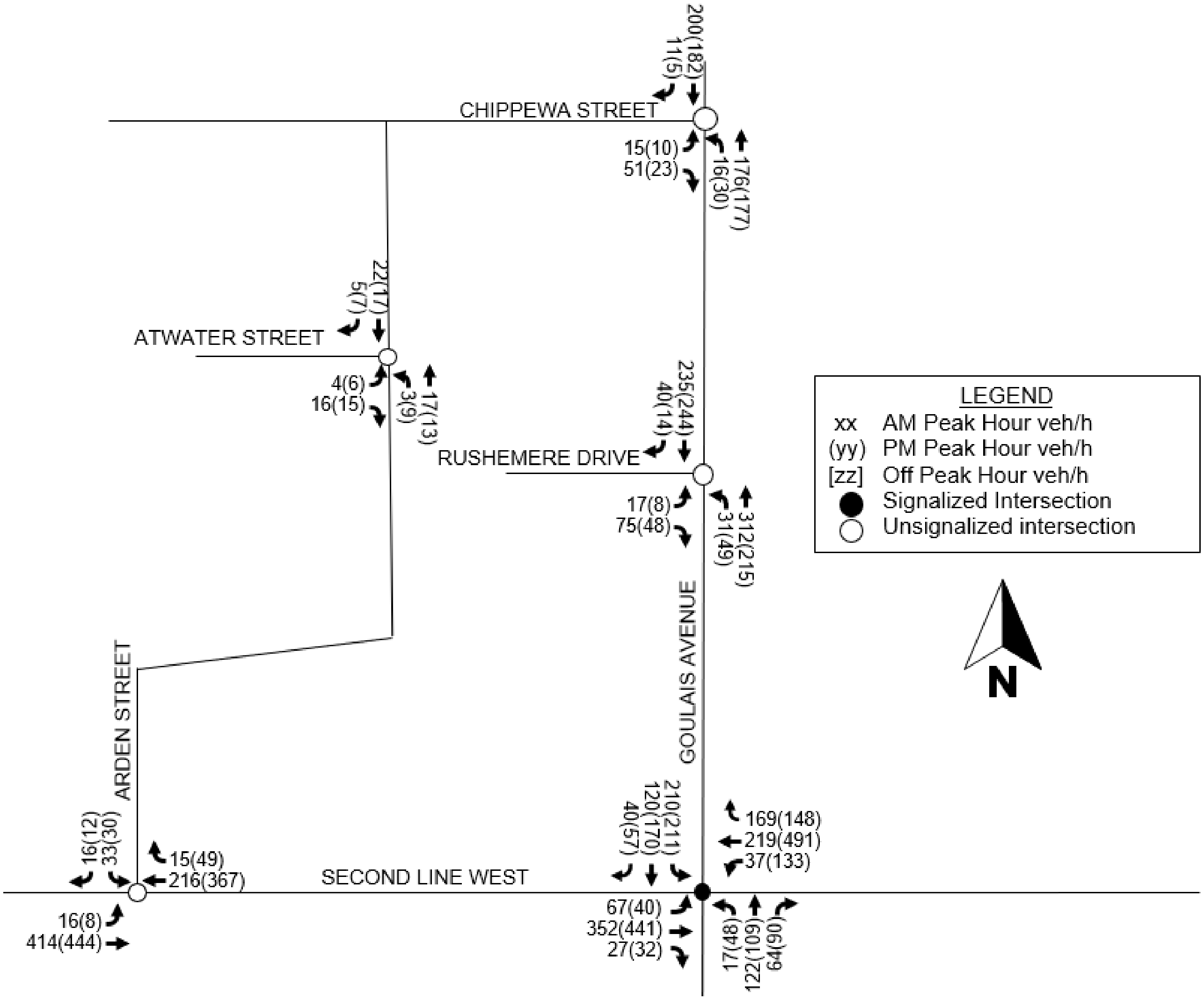


Figure 5: Existing 2023 Volume

Traffic operations were analyzed using Synchro 11 and SimTraffic software. Volume to capacity ratio (v/c), level of service (LOS) and delay, and 95th percentile queues were reviewed. The results are summarized in **Table 4**. It should be noted that the available storage capacity is based on aerial imagery to measure storage lane length. Synchro and SimTraffic outputs are available in **Appendix E**.

Table 4: Existing 2023 Traffic Operations

Direction / Movement		Storage (m)	v/c	Delay	LOS	95%^{ile} Queue (m)
Goulais Avenue at Second Line W (Signalized)						
EB	L	75	0.17 (0.20)	11 (14)	B (B)	23 (21)
	TR	>500	0.22 (0.28)	11 (11)	B (B)	33 (44)
WB	L	>950	0.09 (0.37)	15 (19)	B (B)	13 (62)
	TR	>950	0.53 (0.86)	21 (34)	C (C)	67 (163)
NB	L	45	0.08 (0.26)	31 (32)	C (C)	16 (27)
	TR	>250	0.56 (0.57)	36 (36)	D (D)	51 (48)
SB	L	>250	0.74 (0.77)	36 (39)	D (D)	52 (49)
	TR	>250	0.29 (0.43)	24 (26)	C (C)	38 (48)
Intersection Summary			**0.62 (0.83)**	**22 (27)**	**C (C)**	**-**
Broadview Drive at Atwater Street (Unsignalized)						
EB	LR	>250	0.02 (0.02)	9 (9)	A (A)	13 (15)
NB	LT	>100	0.00 (0.00)	1 (3)	A (A)	<7 (<7)
SB	TR	>100	0.02 (0.02)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Chippewa Street (Unsignalized)						
EB	LR	>300	0.11 (0.08)	11 (11)	B (B)	15 (13)
NB	LT	>500	0.08 (0.10)	2 (3)	A (A)	<7 (12)
SB	TR	>500	0.14 (0.16)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Rushmere Drive (Unsignalized)						
EB	LR	>200	0.15 (0.10)	11 (10)	B (B)	17 (16)
NB	LT	>200	0.14 (0.10)	2 (4)	A (A)	9 (10)
SB	TR	>300	0.10 (0.11)	0 (0)	A (A)	<7 (<7)
Arden Street at Second Line W (Unsignalized)						
EB	TR	>500	0.02 (0.01)	1 (0)	A (A)	9 (12)
WB	TR	>500	0.19 (0.27)	0 (0)	A (A)	<7 (15)
SB	LR	>200	0.16 (0.18)	16 (20)	C (C)	18 (17)

Legend: AM (PM)

The results indicate that all movements are operating at an acceptable level of service. All 95th percentile queues can be accommodated within existing storage capacity.

4. Future Background Conditions

Future background traffic volumes were estimated using a 1% compound annual growth rate for the opening year for Parcel B and Parcel C (2032) and the Full Build-Out (2035). It is assumed background developments are accounted for by the growth rate.

4.1 Future Road Improvements

The City does not have any planned road improvements within the study area. However, as previously mentioned in Section 1.1, the City is planning a possible road diet on Goulais Avenue between Second Line West and Chippewa Street. At the time of this TIS, there is no formal standing for the road diet and for this reason Goulais Avenue will maintain its current configuration for all future scenarios.

4.2 2032 Traffic Volume and Operations

The 2032 future background traffic volumes are shown in **Figure 6**.

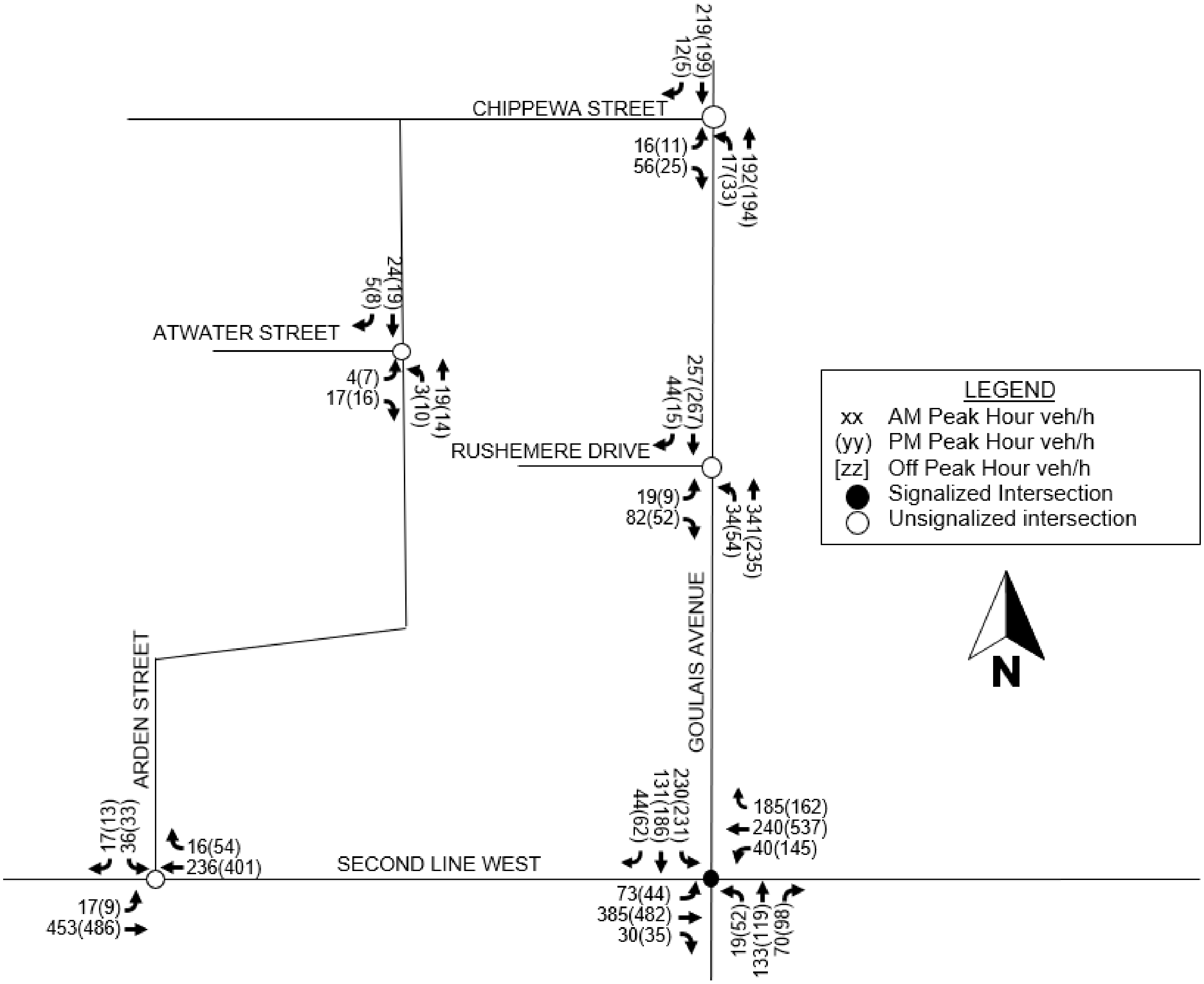


Figure 6: 2032 Future Background Volume

The 2032 future background traffic operations results are summarized in **Table 5**. Synchro and SimTraffic outputs are available in **Appendix G**.

Table 5: 2032 Future Background Traffic Operations

Direction / Movement		Storage (m)	v/c	Delay	LOS	95%^{ile} Queue (m)
Goulais Avenue at Second Line W (Signalized)						
EB	L	75	0.20 (0.29)	11 (17)	B (B)	27 (21)
	TR	>500	0.24 (0.31)	11 (12)	B (B)	40 (46)
WB	L	>950	0.11 (0.43)	16 (20)	B (C)	15 (71)
	TR	>950	0.59 (0.96)	23 (47)	C (D)	72 (206)
NB	L	45	0.10 (0.28)	30 (32)	C (C)	16 (28)
	TR	>250	0.60 (0.61)	36 (37)	D (D)	63 (62)
SB	L	>250	0.83 (0.86)	45 (51)	D (D)	56 (53)
	TR	>250	0.32 (0.46)	24 (25)	C (C)	42 (59)
Intersection Summary			**0.69 (0.93)**	**24 (33)**	**C (C)**	**-**
Broadview Drive at Atwater Street (Unsignalized)						
EB	LR	>250	0.03 (0.03)	9 (9)	A (A)	13 (14)
NB	LT	>100	0.00 (0.01)	1 (3)	A (A)	<7 (<7)
SB	TR	>100	0.02 (0.02)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Chippewa Street (Unsignalized)						
EB	LR	>300	0.12 (0.10)	11 (12)	B (B)	14 (12)
NB	LT	>500	0.08 (0.11)	2 (3)	A (A)	8 (12)
SB	TR	>500	0.15 (0.17)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Rushmere Drive (Unsignalized)						
EB	LR	>200	0.17 (0.11)	11 (11)	B (B)	17 (16)
NB	LT	>200	0.15 (0.10)	2 (4)	A (A)	11 (11)
SB	TR	>300	0.11 (0.12)	0 (0)	A (A)	<7 (<7)
Arden Street at Second Line W (Unsignalized)						
EB	TR	>500	0.02 (0.01)	1 (0)	A (A)	8 (24)
WB	TR	>500	0.20 (0.30)	0 (0)	A (A)	<7 (18)
SB	LR	>200	0.18 (0.22)	18 (23)	C (C)	18 (18)

Legend: AM (PM)

The results indicate that all study area intersections are expected to operate well. The individual movements are also expected to operate at an acceptable LOS D or better. All 95th percentile turning movement queues are expected to be able to be accommodated within the existing storage capacity. However, 95th percentile westbound through/right queue at Goulais Avenue and Second Line West is expected to extend to the Walters Street intersection, 200 metres upstream during the PM peak hour.

4.3 2035 Traffic Volume and Operations

The 2035 future background traffic volumes are shown in **Figure 7**.

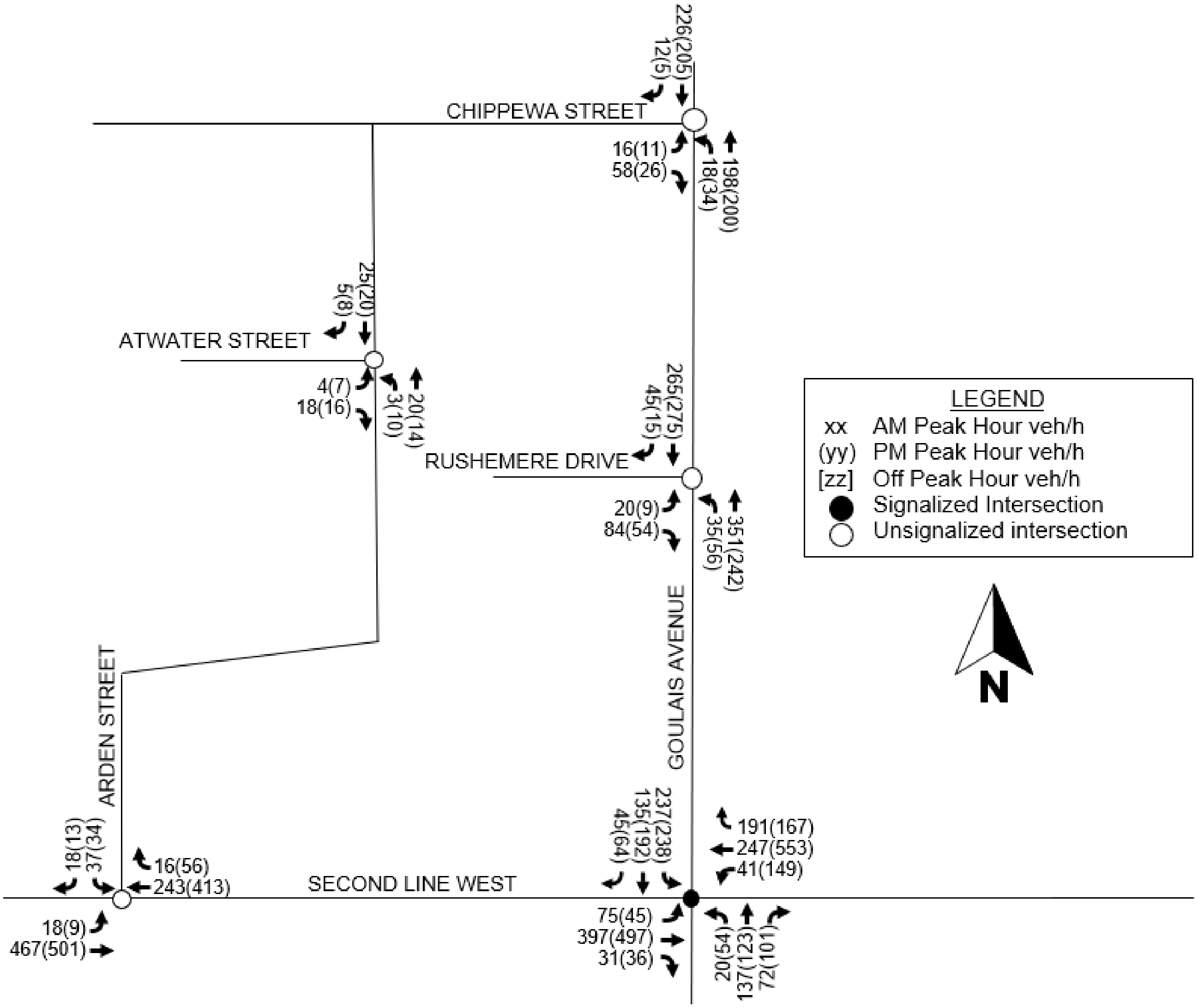


Figure 7: 2035 Future Background Volume

The 2035 future background traffic operations results are summarized in **Table 6**. Synchro and SimTraffic outputs are available in **Appendix H**.

Table 6: 2035 Future Background Traffic Operations

Direction / Movement		Storage (m)	v/c	Delay	LOS	95%^{ile} Queue (m)
Goulais Avenue at Second Line W (Signalized)						
EB	L	75	0.22 (0.31)	12 (18)	B (B)	26 (22)
	TR	>500	0.25 (0.32)	11 (12)	B (B)	41 (48)
WB	L	>950	0.11 (0.45)	16 (21)	B (C)	17 (138)
	TR	>950	0.61 (0.99)	23 (55)	C (D)	70 (320)
NB	L	45	0.10 (0.29)	30 (32)	C (C)	20 (30)
	TR	>250	0.61 (0.63)	37 (37)	D (D)	61 (61)
SB	L	>250	0.86 (0.90)	50 (57)	D (E)	62 (50)
	TR	>250	0.33 (0.48)	24 (25)	C (C)	44 (56)

Intersection Summary			**0.72 (0.96)**	**25 (36)**	**C (D)**	**-**
Broadview Drive at Atwater Street (Unsignalized)						
EB	LR	>250	0.03 (0.03)	9 (9)	A (A)	14 (15)
NB	LT	>100	0.00 (0.01)	1 (3)	A (A)	<7 (<7)
SB	TR	>100	0.02 (0.02)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Chippewa Street (Unsignalized)						
EB	LR	>300	0.13 (0.10)	11 (12)	B (B)	17 (13)
NB	LT	>500	0.09 (0.11)	2 (3)	A (A)	11 (11)
SB	TR	>500	0.16 (0.18)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Rushmere Drive (Unsignalized)						
EB	LR	>200	0.18 (0.11)	11 (11)	B (B)	18 (18)
NB	LT	>200	0.16 (0.11)	2 (4)	A (A)	10 (12)
SB	TR	>300	0.12 (0.13)	0 (0)	A (A)	<7 (<7)
Arden Street at Second Line W (Unsignalized)						
EB	TR	>500	0.02 (0.01)	1 (0)	A (A)	10 (17)
WB	TR	>500	0.21 (0.31)	0 (0)	A (A)	<7 (14)
SB	LR	>200	0.20 (0.23)	18 (24)	C (C)	18 (17)

Legend: AM (PM)

The results indicate that all study area intersections are expected to operate well. The individual movements are also expected to operate at an acceptable LOS D or better except for the southbound left-turn movement at Goulais Avenue and Second Line West during the PM peak hour, which is expected to operate at LOS E.

All 95th percentile turning movement queues are expected to be able to be accommodated within the existing storage capacity. However, 95th percentile westbound through/right queue at Goulais Avenue and Second Line West is expected to extend well past the Walters Street intersection during the PM peak hour.

5. Future Total Conditions

5.1 Trip Generation

As previously mentioned in Section 1.2, Parcels B and C are expected to be built out by 2032 and Parcel A is expected to be built out by 2035.

The trip generation estimates for Parcel A are based on the Single Family Detached Housing land use code (LUC 210), Single Family Attached Housing (LUC 215), and Variety Store (LUC 814) from the Institute of Transportation Engineers (ITE), Trip Generation Manual (11th Edition).

The trip generation estimates for Parcels B and C are based on the Multifamily Housing (Low-Rise) land use code (LUC 220), Multifamily Housing (Mid-Rise) (LUC 221), Public Park (LUC 411), and Utility Building (LUC 170) from the ITE, Manual.

The projected trip generation for the proposed development during the weekday AM and PM peak hours is summarized in **Table 7** for Parcel A and **Table 8** Parcel B.

Table 7: Parcel A Trip Generation Summary

ITE Land Use	Units/GFA	Parameter	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single Family Detached Housing (ITE LU Code 210)	65	Equation	T=0.71(x)+7.23			Ln(T)=0.93 Ln(x)+0.36		
		Gross Trips	14	39	53	45	25	70
Single Family Attached Housing (ITE LU Code 215)	16	Equation	Ln(T)=0.92 Ln(x)-0.26			Ln(T)=0.88 Ln(x)+0.06		
		Gross Trips	3	7	10	7	5	12
Variety Store (ITE LU Code 814)	4,036.46 ft^2	Equation	Average Rate=4.51			Average Rate=7.42		
		Gross Trips	9	9	18	15	15	30
Total Trips			**26**	**55**	**81**	**67**	**45**	**112**

As detailed in **Table 7**, Parcel A is expected to generate 81 two-way trips during the weekday AM peak hour (26 trips in / 55 trips out) and 112 two-way trips during the weekday PM peak hour (67 trips in / 45 trips out).

Table 8: Parcel B and Parcel C Trip Generation Summary

ITE Land Use	Units/GFA	Parameter	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (Low-Rise) (ITE LU Code 220)	102	Equation	T=0.35(x)+28.13			T=0.42(x)+34.78		
		Gross Trips	15	49	64	48	30	78
Multifamily Housing (Mid-Rise) (ITE LU Code 221)	180	Equation	T=0.32(x)+5.84			T=0.32(x)+15.57		
		Gross Trips	16	47	63	44	29	73
Public Park (ITE LU Code 411)	35,224.86 ft^2	Equation	T=0.05(x)+12.67			T=0.08(x)+15.36		
		Gross Trips	9	5	14	7	11	18
Utility (ITE LU Code 170)	4,171.011 ft^2	Equation	Ln(T)=0.67 Ln(x)+1.44			T=2.00(x)+3.49		
		Gross Trips	9	2	11	2	10	12
Total Trips			**49**	**103**	**152**	**101**	**80**	**181**

As detailed in **Table 8**, Parcels B and C are expected to generate 152 two-way trips during the weekday AM peak hour (49 trips in / 103 trips out) and 181 two-way trips during the weekday PM peak hour (101 trips in / 80 trips out).

5.2 Trip Distribution

The trip distribution for the proposed development is based on the existing travel patterns. The resulting trip distribution is summarized in **Table 9**.

Table 9: Trip Distribution Summary

From/To	Via	AM	PM
North	Goulais Avenue	16%	12%
South	Goulais Avenue	27%	15%
East	Second Line West	27%	44%
West	Second Line West	30%	29%
Total		100%	100%

The resulting site generated trips and distribution is illustrated in **Figure 8** and **Figure 9**.

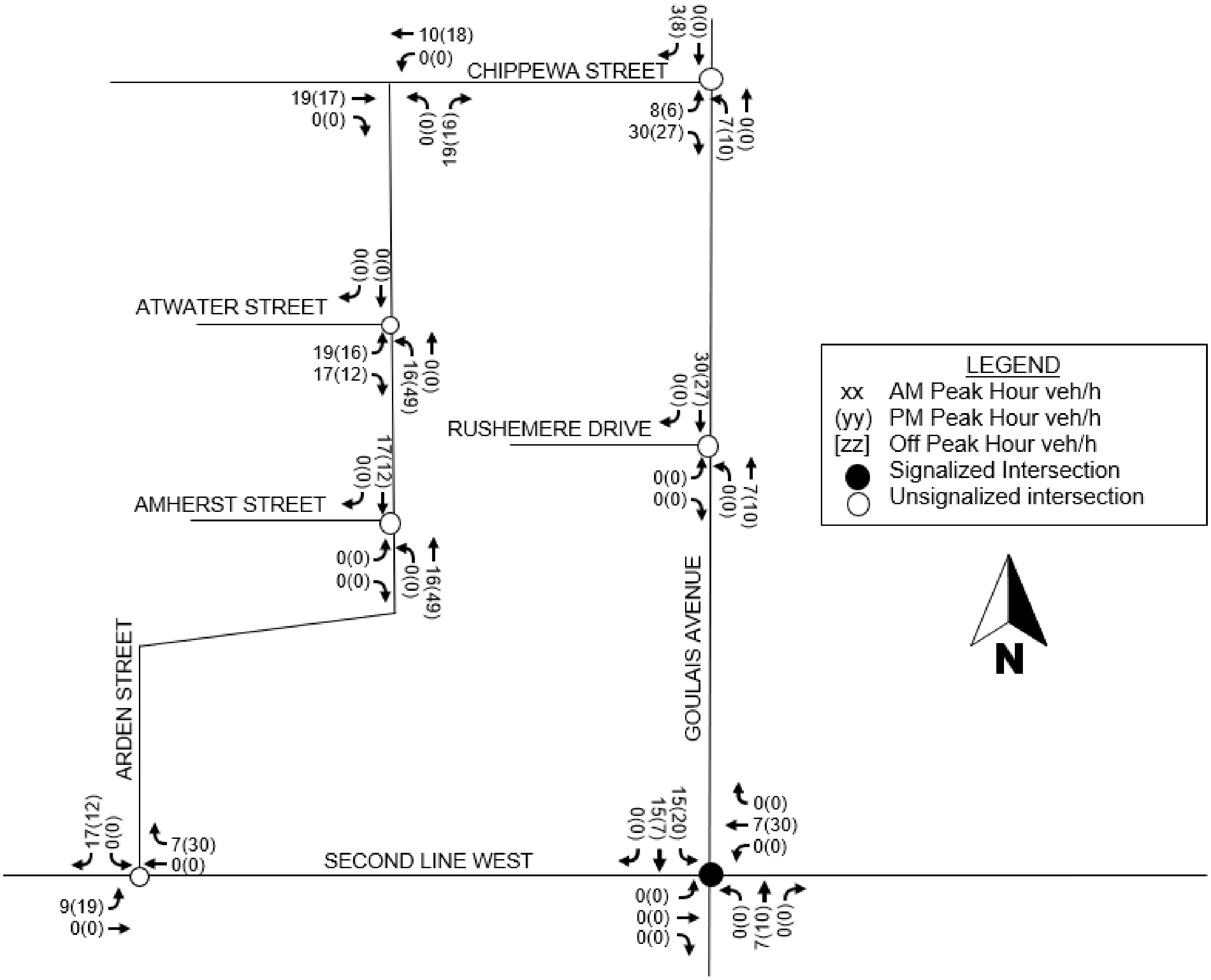


Figure 8: Parcel A Site Traffic

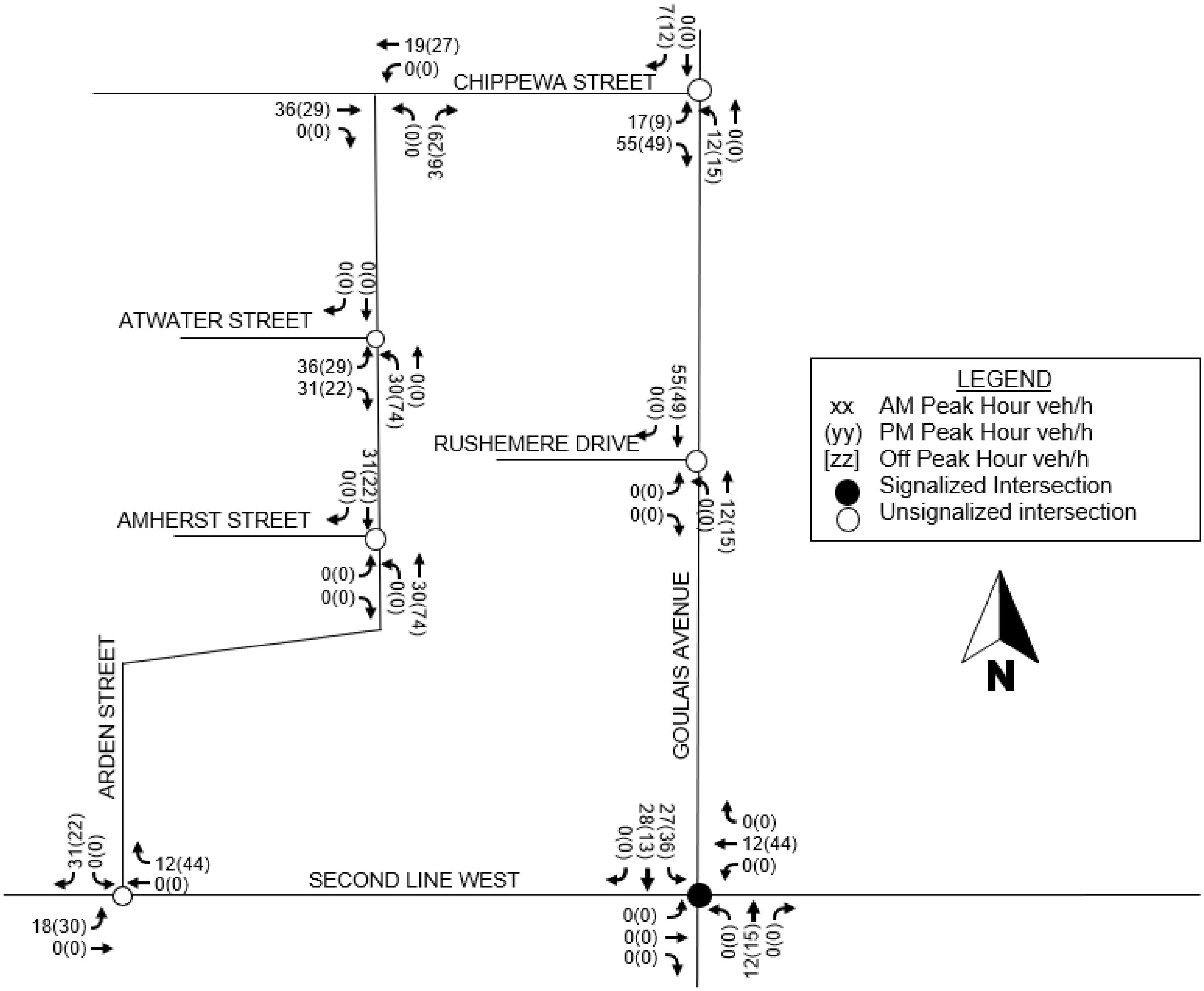


Figure 9: Parcel B and Parcel C Site Traffic

5.3 2032 Future Total Conditions

Traffic operations under future 2032 total conditions were analyzed for the weekday AM and PM peak hours. The traffic operational analysis and results for the future total conditions are discussed in this section.

2032 future total intersection operations were assessed using the existing lane configurations shown in **Figure 4**. The 2032 future total traffic volumes were estimated by adding the Parcel B and Parcel C site traffic (**Figure 9**) to 2032 future background volumes (**Figure 6**) and the resulting 2032 future total traffic volumes are illustrated in **Figure 10**. The operational analysis results are provided in **Table 10** and the Synchro and SimTraffic outputs are provided in **Appendix I**.

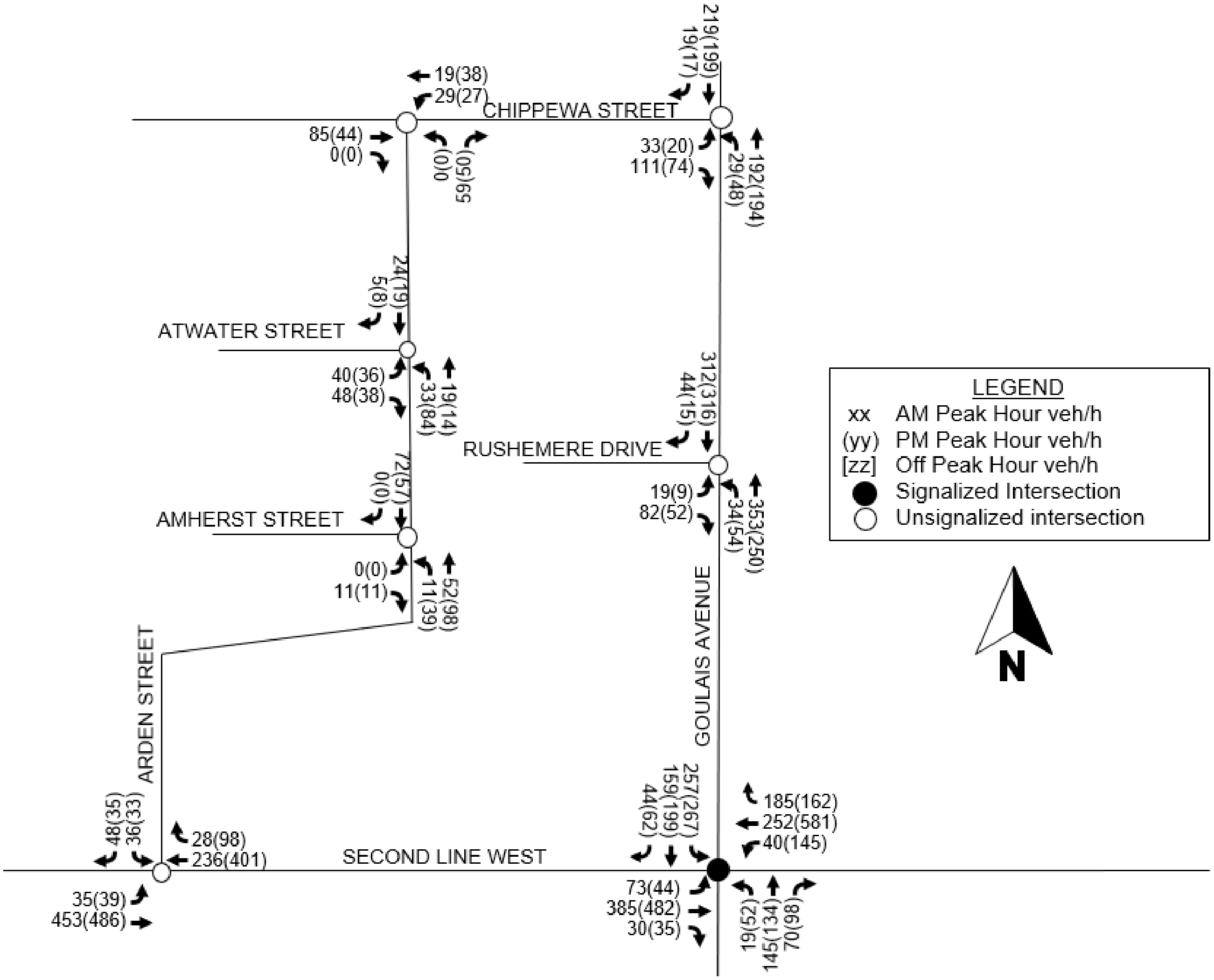


Figure 10: 2032 Future Total Traffic Volumes

Table 10: 2032 Future Total Traffic Operations

Direction / Movement		Storage (m)	v/c	Delay	LOS	95%^{ile} Queue (m)
Goulais Avenue at Second Line W (Signalized)						
EB	L	75	0.21 (0.31)	12 (19)	B (B)	26 (22)
	TR	>500	0.25 (0.31)	11 (12)	B (B)	42 (47)
WB	L	>950	0.11 (0.44)	16 (21)	B (C)	16 (189)
	TR	>950	0.62 (**1.03**)	24 (66)	C (E)	74 (366)
NB	L	45	0.10 (0.27)	30 (31)	C (C)	16 (33)
	TR	>250	0.63 (0.65)	37 (38)	D (D)	61 (65)
SB	L	>250	0.94 (**1.01**)	66 (87)	E (F)	57 (58)
	TR	>250	0.37 (0.48)	24 (25)	C (C)	49 (56)
Intersection Summary			**0.75 (1.03)**	**28 (44)**	**C (D)**	**-**
Broadview Drive at Atwater Street (Unsignalized)						
EB	LR	>250	0.11 (0.13)	10 (10)	A (B)	19 (20)
NB	LT	>100	0.03 (0.07)	5 (7)	A (A)	<7 (8)

SB	TR	>100	0.02 (0.02)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Chippewa Street (Unsignalized)						
EB	LR	>300	0.25 (0.25)	12 (13)	B (B)	19 (15)
NB	LT	>500	0.08 (0.11)	3 (4)	A (A)	10 (13)
SB	TR	>500	0.16 (0.19)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Rushmere Drive (Unsignalized)						
EB	LR	>200	0.18 (0.11)	12 (11)	B (B)	17 (17)
NB	LT	>200	0.16 (0.11)	2 (4)	A (A)	11 (14)
SB	TR	>300	0.14 (0.14)	0 (0)	A (A)	<7 (<7)
Arden Street at Second Line W (Unsignalized)						
EB	TR	>500	0.04 (0.04)	1 (1)	A (A)	17 (36)
WB	TR	>500	0.21 (0.33)	0 (0)	A (A)	<7 (19)
SB	LR	>200	0.26 (0.31)	17 (24)	C (C)	22 (20)
Broadview Drive at Amherst Street (Unsignalized)						
EB	LR	>250	0.01 (0.01)	9 (9)	A (A)	8 (8)
NB	LT	>75	0.01 (0.03)	1 (2)	A (A)	<7 (<7)
SB	TR	>450	0.05 (0.04)	0 (0)	A (A)	<7 (<7)
Broadview Drive at Chippewa Street (Unsignalized)						
EB	TR	350	0.05 (0.03)	0 (0)	A (A)	<7 (<7)
WB	LT	350	0.02 (0.02)	5 (3)	A (A)	<7 (<7)
NB	LR	>500	0.07 (0.05)	9 (9)	A (A)	13 (13)

Legend: AM (PM)

During the PM peak hour, Goulais Avenue and Second Line West intersection is expected to operate slightly over capacity. The results indicate that all movements are expected to operate at an acceptable level of service except for the following movements at Goulais Avenue and Second Line West:

- Westbound Through-Right (v/c ratio of 1.03 and LOS E during PM peak hour).
- Southbound Left (v/c ratio of 0.94 & 1.01 and LOS E & F during AM & PM peak hours respectively).

All 95th percentile turning movement queues are expected to be able to be accommodated within the existing storage capacity. However, 95th percentile westbound through/right queue at Goulais Avenue and Second Line West is expected to extend well past the Walters Street intersection during the PM peak hour.

5.3.1 2032 Total Traffic Mitigation Measures

Goulais Avenue at Second Line West intersection is expected to experience long delays and capacity issues that occur during the PM peak hour. To address these issues, the cycle length was increased to 110 seconds. The traffic operational results for the 2032 future total scenario with updated signal timings and cycle length is summarized in **Table 11** . Synchro and SimTraffic outputs are available in **Appendix I**.

Table 11: 2032 Future Total Traffic Operations – Updated Signal Timing

Direction /		Storage	v/c	Delay	LOS	95%^{ile} Queue

Movement		**(m)**				**(m)**
Goulais Avenue at Second Line W (Signalized)						
EB	L	75	0.32	22	C	22
	TR	>500	0.30	13	B	51
WB	L	>950	0.41	22	C	70
	TR	>950	0.98	55	E	219
NB	L	45	0.30	40	D	36
	TR	>250	0.75	52	D	69
SB	L	>250	0.96	73	E	73
	TR	>250	0.48	30	C	65
Intersection Summary			**0.96**	**42**	**D**	**-**

Legend: PM

The results indicate that the intersection is projected to operate slightly below capacity. Delays for both critical movements have improved by over 10 seconds and v/c ratios are now below capacity. The 95th percentile queues for the westbound movements have also been significantly reduced with the updated signal timing plan.

5.4 2035 Future Total Conditions (Full Build-Out)

2035 future total intersection operations were assessed using the existing lane configurations. The 2035 future total traffic volumes were estimated by adding the Parcel A site traffic (**Figure 8**) and Parcel's B and C site traffic (**Figure 9**) to 2035 future background volumes (**Figure 7**). The resulting 2035 future total traffic volumes are illustrated in **Figure 11**. The operational analysis results are provided in **Table 12** and the Synchro and SimTraffic outputs are provided in **Appendix J**.

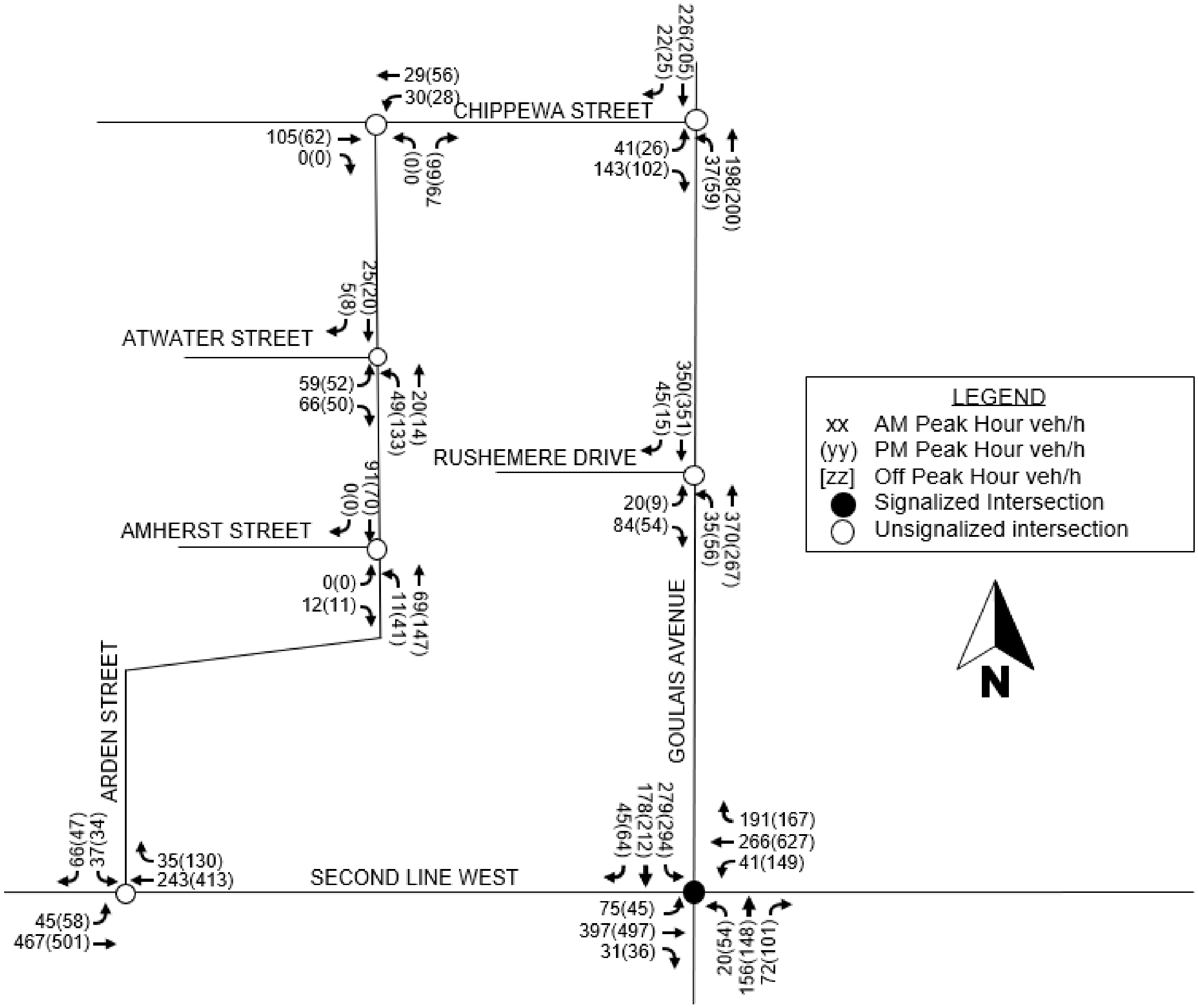


Figure 11: 2035 Future Total Traffic Volumes

Table 12: 2035 Future Total Traffic Operations

Direction / Movement		Storage (m)	v/c	Delay	LOS	95%^{ile} Queue (m)
Goulais Avenue at Second Line W (Signalized)						
EB	L	75	0.23 (0.31)	12 (20)	B (C)	25 (24)
	TR	>500	0.26 (0.32)	12 (13)	B (B)	44 (50)
WB	L	>950	0.12 (0.46)	16 (22)	B (C)	16 (492)
	TR	>950	0.65 (**1.12**)	25 (98)	C (**F**)	81 (677)
NB	L	45	0.10 (0.27)	30 (31)	C (C)	25 (33)
	TR	>250	0.65 (0.68)	38 (39)	D (D)	65 (65)
SB	L	>250	**1.04** (**1.14**)	93 (126)	**F** (**F**)	61 (77)
	TR	>250	0.40 (0.49)	24 (25)	C (C)	51 (60)
Intersection Summary			**0.81 (1.14)**	**33 (60)**	**C (E)**	-
Broadview Drive at Atwater Street (Unsignalized)						
EB	LR	>250	0.17 (0.21)	10 (12)	B (B)	22 (20)

NB	LT	>100	0.04 (0.11)	6 (7)	A (A)	<7 (7)
SB	TR	>100	0.02 (0.02)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Chippewa Street (Unsignalized)						
EB	LR	>300	0.33 (0.35)	13 (15)	B (B)	20 (19)
NB	LT	>500	0.09 (0.11)	3 (5)	A (A)	11 (19)
SB	TR	>500	0.17 (0.20)	0 (0)	A (A)	<7 (<7)
Goulais Avenue at Rushmere Drive (Unsignalized)						
EB	LR	>200	0.20 (0.12)	12 (11)	B (B)	18 (17)
NB	LT	>200	0.16 (0.12)	2 (4)	A (A)	12 (13)
SB	TR	>300	0.15 (0.16)	0 (0)	A (A)	<7 (<7)
Arden Street at Second Line W (Unsignalized)						
EB	TR	>500	0.05 (0.06)	1 (2)	A (A)	19 (41)
WB	TR	>500	0.22 (0.36)	0 (0)	A (A)	7 (22)
SB	LR	>200	0.32 (0.39)	18 (27)	C (D)	23 (26)
Broadview Drive at Amherst Street (Unsignalized)						
EB	LR	>250	0.01 (0.01)	9 (9)	A (A)	9 (9)
NB	LT	>75	0.01 (0.03)	1 (2)	A (A)	<7 (7)
SB	TR	>450	0.06 (0.04)	0 (0)	A (A)	<7 (<7)
Broadview Drive at Chippewa Street (Unsignalized)						
EB	TR	350	0.07 (0.04)	0 (0)	A (A)	<7 (<7)
WB	LT	350	0.02 (0.02)	4 (3)	A (A)	<7 (<7)
NB	LR	>500	0.09 (0.07)	9 (9)	A (A)	14 (13)

Legend: AM (PM)

During the PM peak hour, Goulais Avenue and Second Line West intersection is expected to operate over capacity. The results indicate that all movements are expected to operate at an acceptable level of service except for the following movements at Goulais Avenue and Second Line West:

- Westbound Through-Right (v/c ratio of 1.12 and LOS F during PM peak hour).
- Southbound Left (v/c ratio of 1.04 & 1.14 and LOS F during AM & PM peak hours respectively).

All 95th percentile turning movement queues are expected to be able to be accommodated within the existing storage capacity. However, 95th percentile westbound through/right queue at Goulais Avenue and Second Line West is expected to extend well past the Edison Avenue intersection during the PM peak hour.

5.4.1 2035 Total Traffic Mitigation Measures

Goulais Avenue at Second Line West intersection is expected to experience long delays and capacity issues that occur during the AM and PM peak hours. To address these issues, the cycle length was increased to 110 seconds for the AM peak hour, 140 seconds for the PM peak hour. The traffic operational results for the 2035 future total scenario with updated signal timings and cycle length is summarized in **Table 13**. Synchro and SimTraffic outputs are available in **Appendix J**.

Table 13: 2035 Future Total Traffic Operations – Updated Signal Timing

Direction / Movement		Storage (m)	v/c	Delay	LOS	95%^{ile} Queue (m)
Goulais Avenue at Second Line W (Signalized)						
EB	L	75	0.24 (0.42)	15 (32)	B (C)	31 (24)
	TR	>500	0.26 (0.31)	14 (17)	B (B)	44 (52)
WB	L	>950	0.11 (0.42)	19 (26)	B (C)	17 (106)
	TR	>950	0.64 (**1.01**)	28 (70)	C (E)	93 (284)
NB	L	45	0.11 (0.33)	38 (52)	D (D)	26 (57)
	TR	>250	0.74 (0.86)	51 (78)	D (E)	68 (122)
SB	L	>250	0.85 (0.94)	46 (71)	D (E)	71 (93)
	TR	>250	0.37 (0.47)	27 (36)	C (D)	56 (81)
Intersection Summary			**0.73 (0.98)**	**30 (51)**	**C (D)**	**-**

Legend: AM (PM)

The results indicate that all movements are operating at an acceptable level of service for the AM peak hour. During the PM peak hour, the intersection is projected to operate slightly below capacity. Delays for both critical movements have greatly improved, and v/c ratios are now at or below capacity. The 95th percentile queues for the westbound movements have also been significantly reduced with the updated signal timing plan.

6. Auxiliary Lanes Review

To help address long PM peak hour at Goulais Avenue and Second Line West, westbound through/right queues that were shown to begin in the 2032 future background scenario and extend over 200 metres to the Walters Street intersection, a westbound right auxiliary lane may be considered. However, it should be noted that the City is expected to implement a road diet on Goulais Avenue. The results from the traffic impacts from the road diet should be analyzed before considering any auxiliary lanes to address the background traffic volume queues.

7. Conclusion

Based on the analysis results, the following conclusions can be made:

Existing Conditions

- The analysis results indicate that all movements at study intersections are operating with acceptable level of service and residual capacity during the weekday AM and PM peak hours.
- A pattern of westbound vehicles in the afternoon involved in rear end collisions was identified. This may be attributed to long queues and delay for the existing westbound traffic. Recommend the City monitor volumes and optimize the signal timing plan to reduce queues and delays.
- The sightline assessment did not reveal any obstructions. Sight distance meets recommended intersection sight distance.

Future Background Conditions

- The analysis results indicate that all movements at study intersections are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under both future 2032 and 2035 background conditions.
- The 95th percentile westbound through/right queue (320 metres) at Goulais Avenue and Second Line West is expected to extend well past the Walters Street intersection during the PM peak hour.

Trip Generation

- Parcel A of the subject site is expected to generate 81 new auto trips during the weekday AM peak hour and 112 new auto trips during the weekday PM peak hour.
- Parcel B and Parcel of the subject site is expected to generate 152 new auto trips during the weekday AM peak hour and 181 new auto trips during the weekday PM peak hour.

Future Total Conditions

- Under future 2032, 2035 total conditions, the traffic operational analysis results indicate that all movements at study intersections are expected to operate with an acceptable LOS D or better with updated signal timing plan; and
- At Goulais Avenue and Second Line West, the 95th percentile queue lengths during the weekday AM can be accommodated by existing storage capacity.
- At Goulais Avenue and Second Line West, the 95th percentile queue lengths during the weekday PM peak hour is expected to extend past Walters Avenue. However, by updating the signal timing plan queue length were reduced from 320 metres for 2035 future background, to 284 metres for 2035 future total.

A

Appendix A
Terms of Reference Document

March 27, 2023

Maggie McAuley, P.Eng.
Municipal Services Engineer
City of Sault Ste. Marie
99 Foster Drive, Sault Ste. Marie

Attention: **Maggie McAuley, P.Eng.**

RE: **Terms of Reference for the Preparation of a Traffic Impact Study – 0 Chippewa Avenue**

Dear Maggie

As part our collaboration with Kresin Engineering Corp. we would like to present for your consideration the following Terms of Reference for the completion of a Traffic Impact Study supporting the development of 0 Chippewa Avenue. The outline of this document follows standard practices for the preparation of Traffic Impact Studies, but please let us know if an outline specific to the City should be followed.

Background and Understanding

We were advised that Kresin Engineering's client is planning the development of a 374-unit mixed use development at Chippewa Street with a direct access to Chippewa Street, Atwater Street, and Amherst Street (**Figure 1**).

Based on the information provided we understand that the developer already engaged the City of Sault Ste. Marie and due to the location of the proposed development the preparation of a Traffic Impact Study that complies with the requirements of the City needs to be completed.

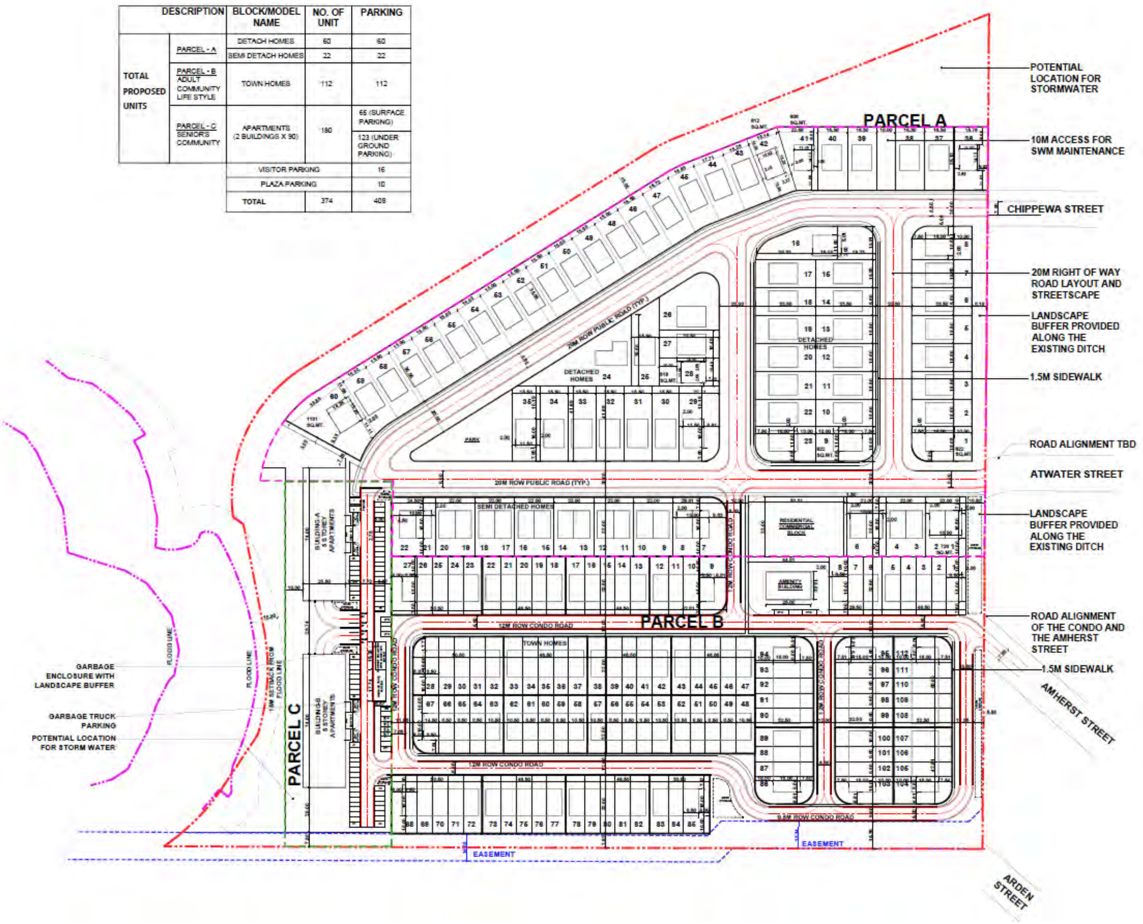
We also understand that the City does not have a formal Traffic Impact Study Guidelines and as such, we are presenting for your consideration this Terms of Reference to ensure that all concerns are identified in advance of the preparation of the Traffic Impact Study.

Based on the location of the proposed development and the information provided by our client it is our understanding that the TIS will not be circulated to any other road authority aside of the City for review.

Terms of Reference

Task 1: Pre-Consultation Teleconference Meeting with MTO

CIMA+ will attend a pre-submission consultation (virtual) meeting with the City to review and approve the scope of work and discuss any project-specific concerns, as well as verify the availability of data required to complete the review.



DESCRIPTION		BLOCK/MODEL NAME	NO. OF UNIT	PARKING
TOTAL PROPOSED UNITS	PARCEL - A	DETACH HOMES	60	60
		SEMI DETACH HOMES	22	22
	PARCEL - B ADULT COMMUNITY LIFE STYLE	TOWN HOMES	112	112
	PARCEL - C SENIOR'S COMMUNITY	APARTMENTS (2 BUILDINGS X 90)	180	65 (SURFACE PARKING) 123 (UNDER GROUND PARKING)
		VISITOR PARKING		16
		PLAZA PARKING		10
		TOTAL	374	408

Figure 1 Proposed Development – 0 Chippewa Avenue

Task 2: Review of Background Information and Estimation of Volumes

CIMA+ will review all relevant background information related to the proposed development and estimated traffic volumes at the proposed accesses. In order to complete this task, it is expected that availability of the following information will be discussed/confirmed as part of the pre-consultation teleconference with the City.

- Turning movement counts (TMC), signal timing data, historical and recent AADT volume information for the following roads:
  - Chippewa Street and Goulais Avenue
  - Atwater Street and Broadview Drive
  - Rushmere Drive and Goulais Avenue
  - Arden Street and Second Line West, and
  - Goulais Avenue and Second Line West
- Collision records for the past 5 years;
- Lot area and type of development (number, type and size of units, GFA of commercial development, etc.).
- Opening year (if multiple phases, opening year of each phase); and

Task 3: Sight Distance Assessment and Field Review

Although the proposed accesses are assumed to front existing roadways (Chippewa Street, Atwater Street and Amherst Street) – CIMA+ will rely on information collected by Kresin Engineering during a site visit to assess sight distances at the proposed site accesses.

Task 4: Trip Generation, Distribution, Assignment & Traffic Control Assessment

CIMA+ will undertake trip generation calculations, distribution and assignment for the proposed development based on the information to be provided by the developer. Trip generation will be conducted using the Institute of Transportation (ITE) Trip Generation manual, 10th edition.

CIMA+ will evaluate necessary changes to the existing control at the aforementioned intersections of Goulais Avenue and Second Line West. Similarly, the potential effects on the existing traffic control, auxiliary lanes, and tapers at the aforementioned intersections will be identified. The traffic control assessment will consider the increased volume of traffic associated with the proposed development and the surrounding area for the future horizon of 5 years from the date of the TIS. A growth rate for future background traffic of 1% is expected to be confirmed during our discussion with the City.

Considerations for other modes of transportation as well as the use of Traffic Demand Management will be included as part of our analysis.

Task 5: Review for Additional Roadway Improvements

CIMA+ will evaluate the need for any improvements at the aforementioned intersections in accordance with the TAC Road Design Guide, and other applicable City design standards.

Task 6: Prepare Draft and Final TIS Report

CIMA+ will prepare a draft report summarizing Tasks 2 through 5 that will be submitted to the City for formal approval. Any comments provided by the City will be addressed as part of the Final TIS Report.

It is assumed that the design of any necessary improvements to support the City's approval will be conducted as part of the next phase of the development approval process.

Closing

Should you have any questions or concerns regarding this Terms of Reference, do not hesitate to contact the undersigned.

Sincerely,

CIMA Canada Inc.

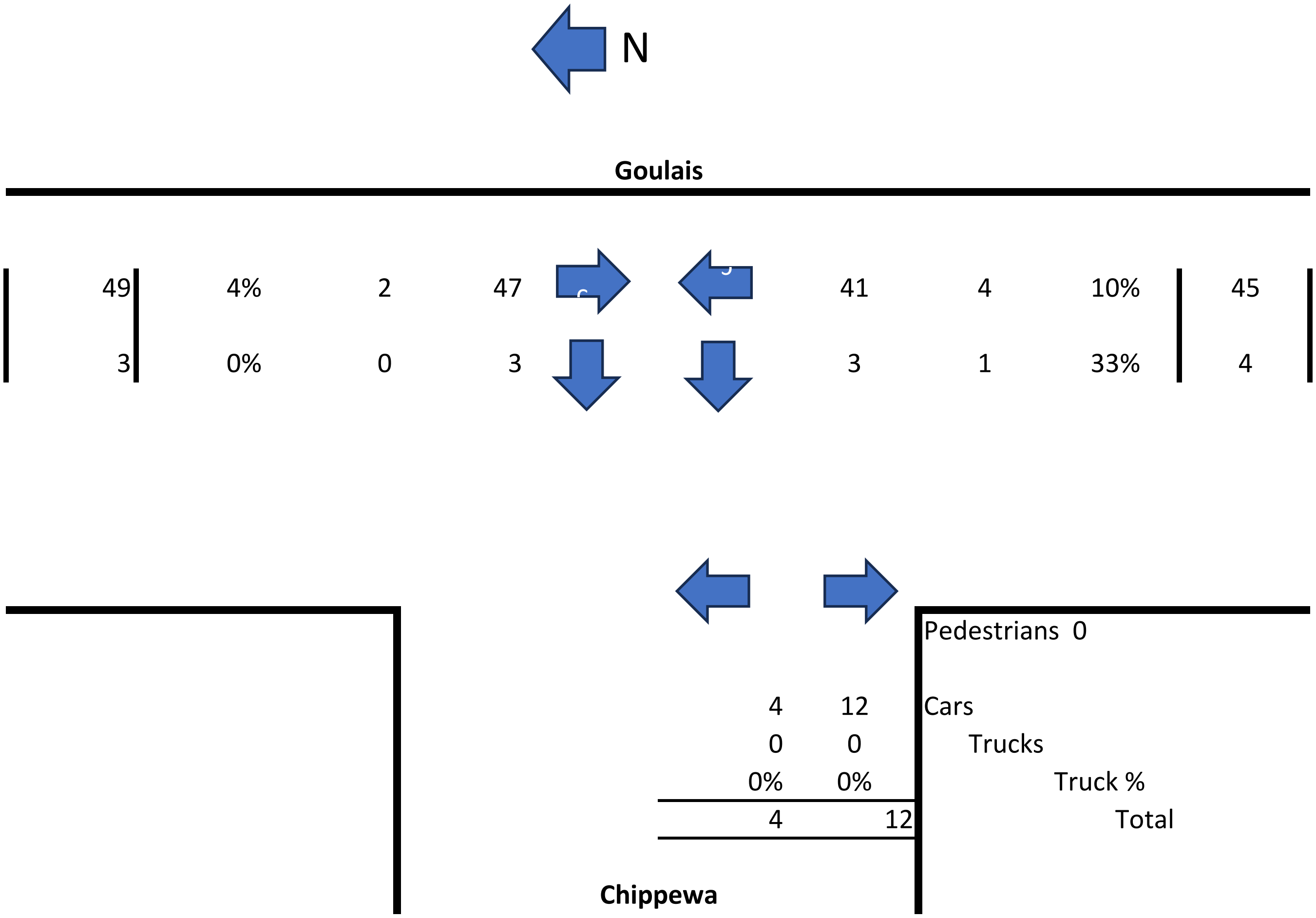
Jaime Garcia, P.Eng., Ph.D.
Senior Project Manager, Transportation
jaime.garcia@cima.ca

B

Appendix B
Turning Movement Counts

Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 8:00am - 8:15am



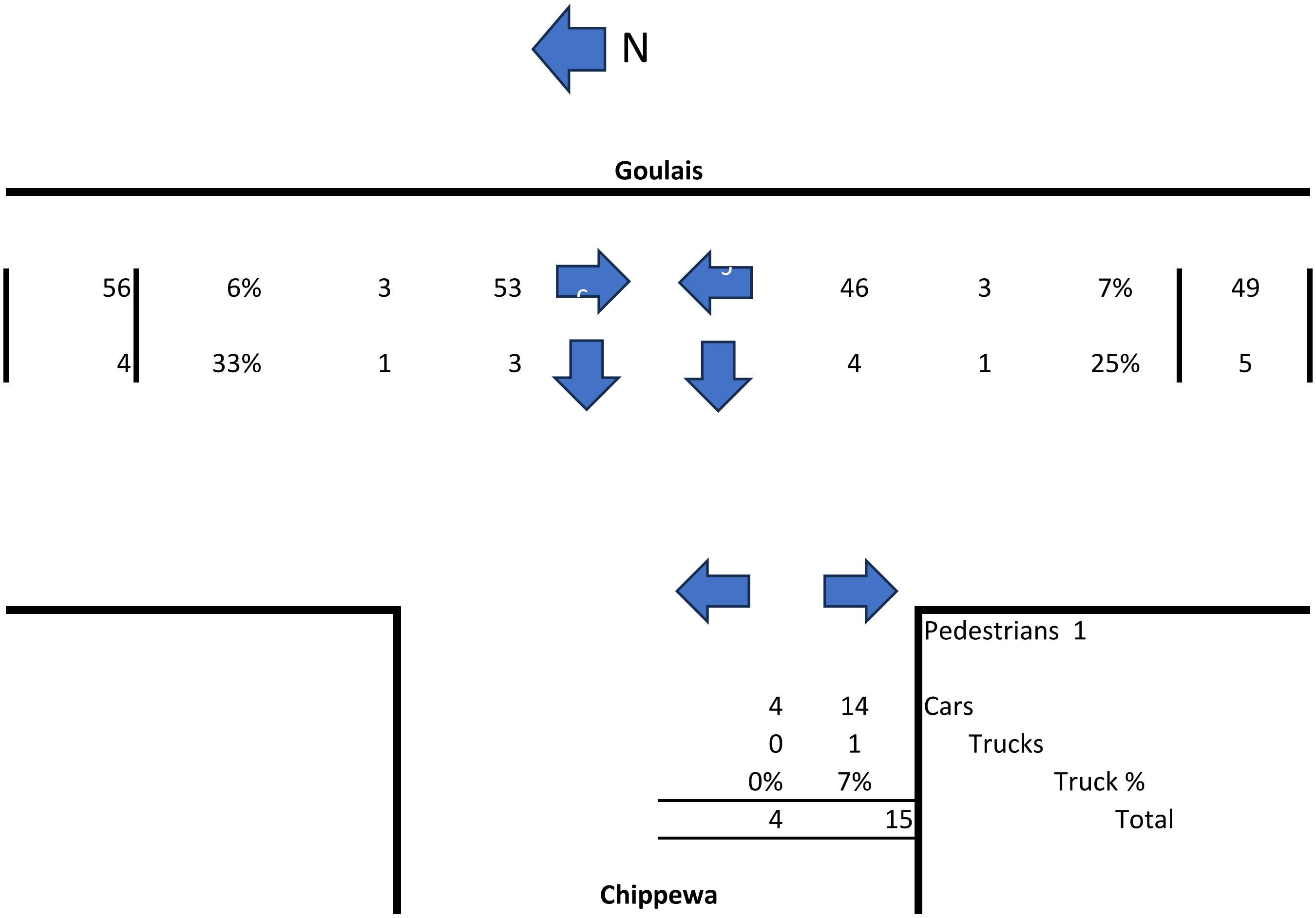
49	4%	2	47	41	4	10%	45
3	0%	0	3	3	1	33%	4

Pedestrians 0

4	12	Cars
0	0	Trucks
0%	0%	Truck %
4	12	Total

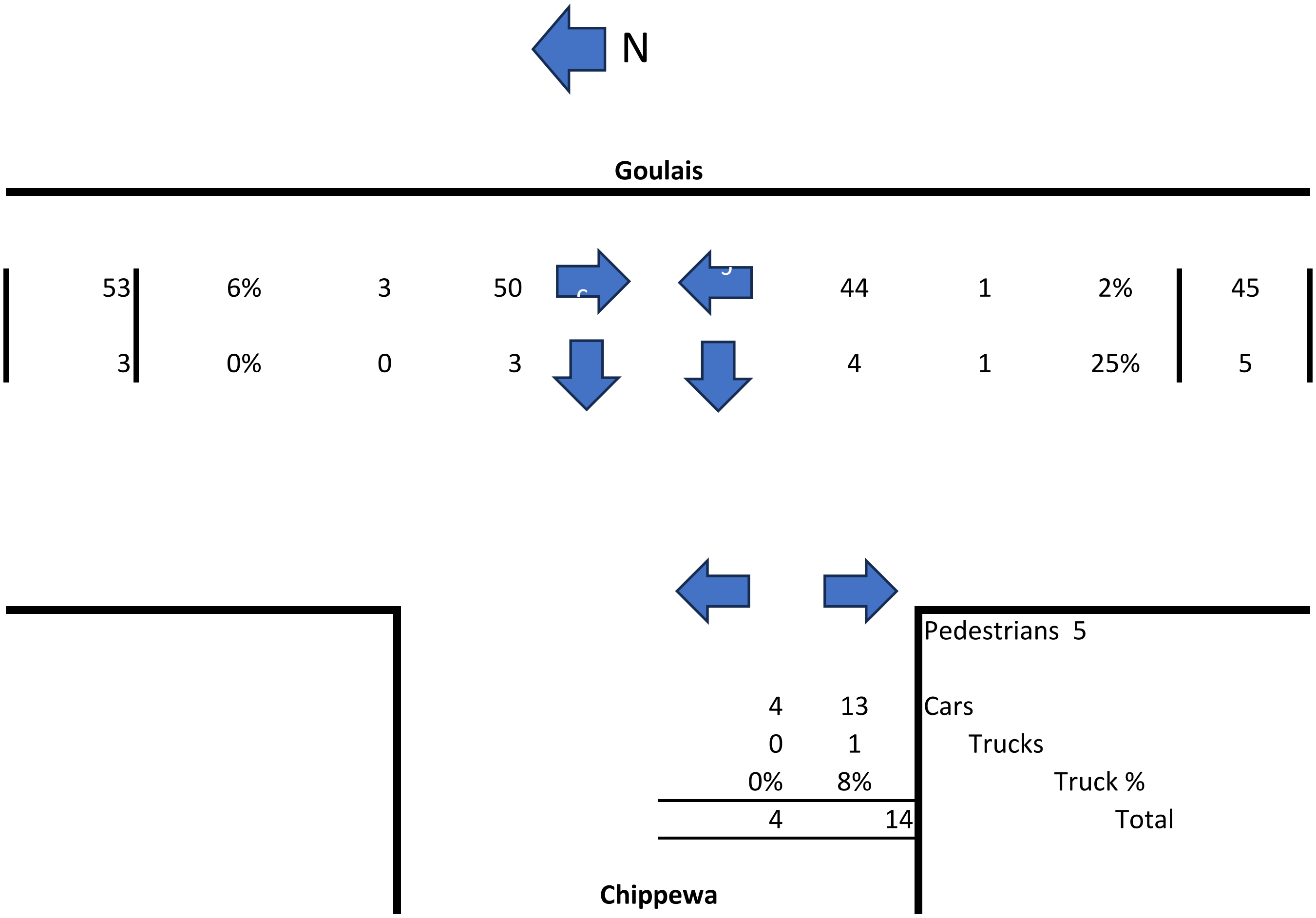
Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 8:15am - 8:30am



Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 8:30am - 8:45am



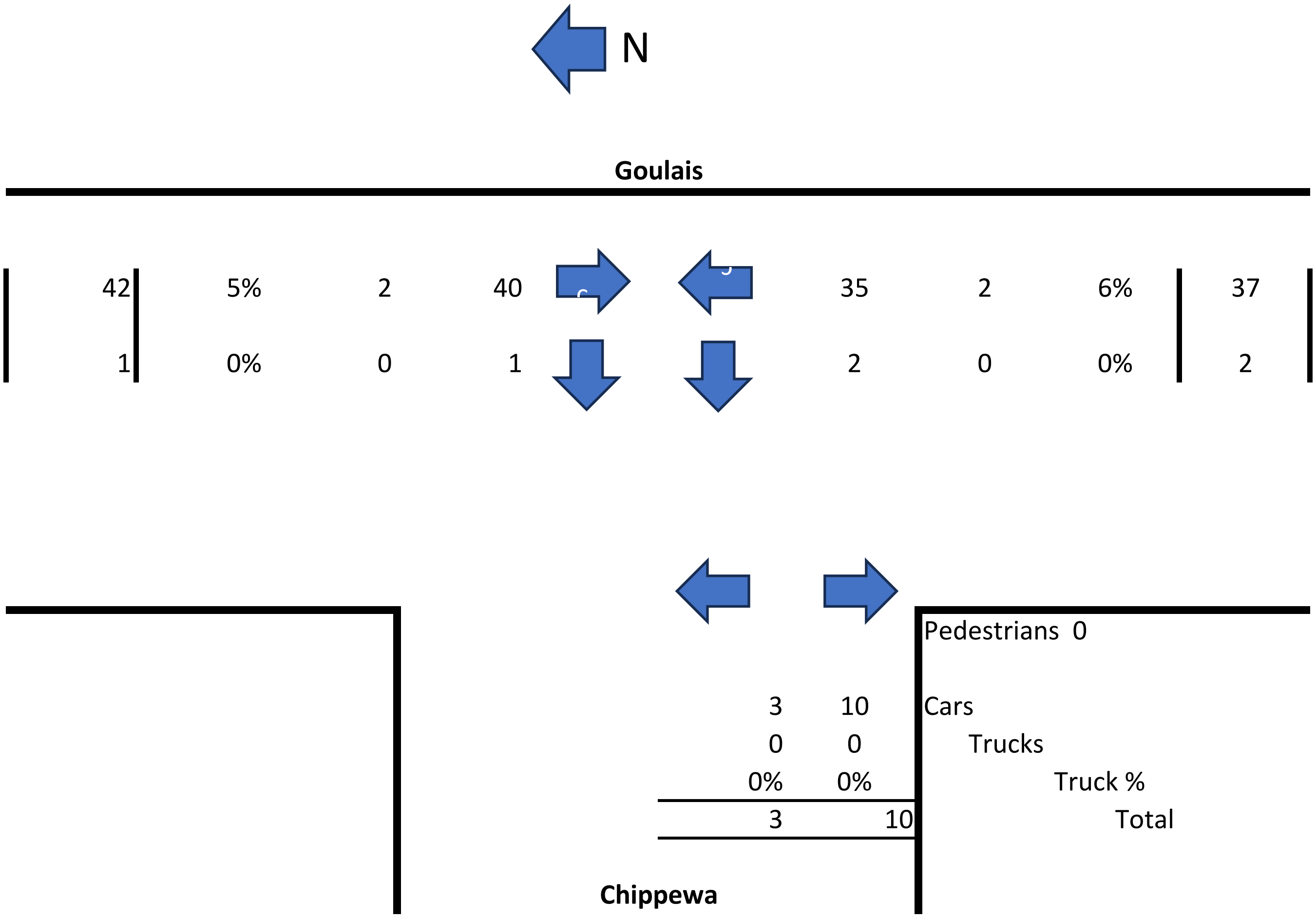
53	6%	3	50	44	1	2%	45
3	0%	0	3	4	1	25%	5

Pedestrians 5

4	13	Cars
0	1	Trucks
0%	8%	Truck %
4	14	Total

Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 8:45am - 9:00am



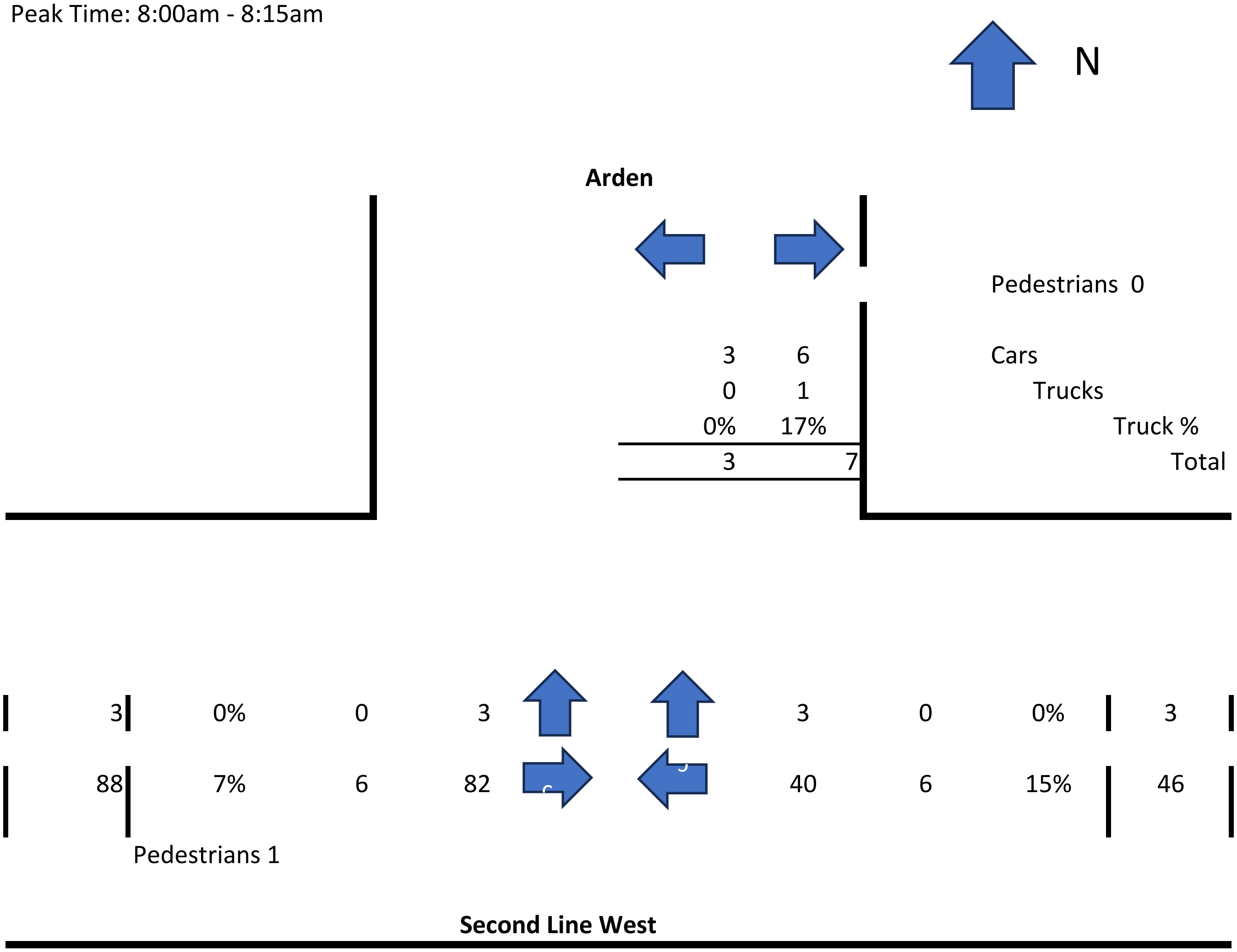
42	5%	2	40	→ ←	35	2	6%	37
1	0%	0	1	↓ ↓	2	0	0%	2

Pedestrians 0

3	10	Cars
0	0	Trucks
0%	0%	Truck %
3	10	Total

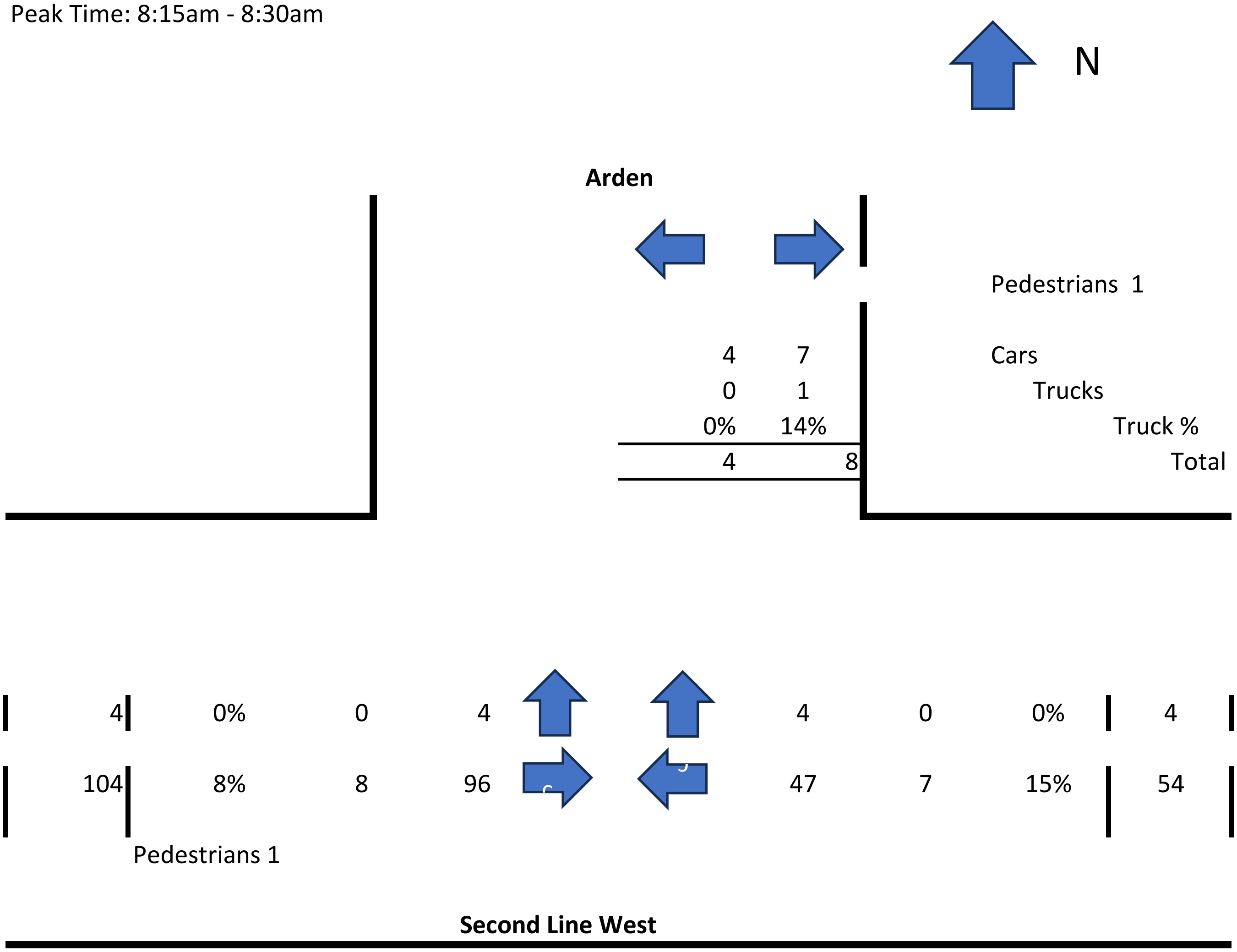
Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 8:00am - 8:15am



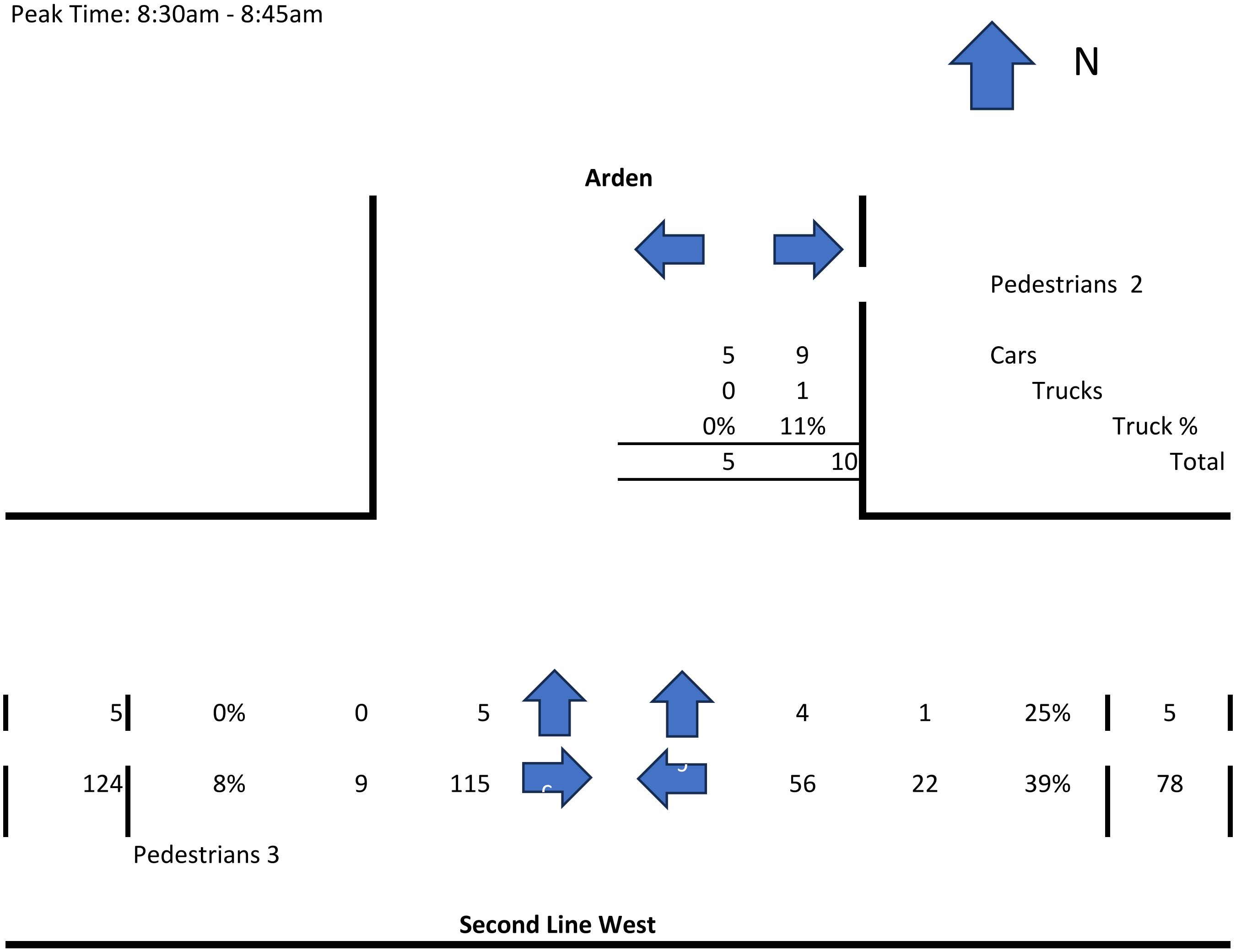
Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 8:15am - 8:30am



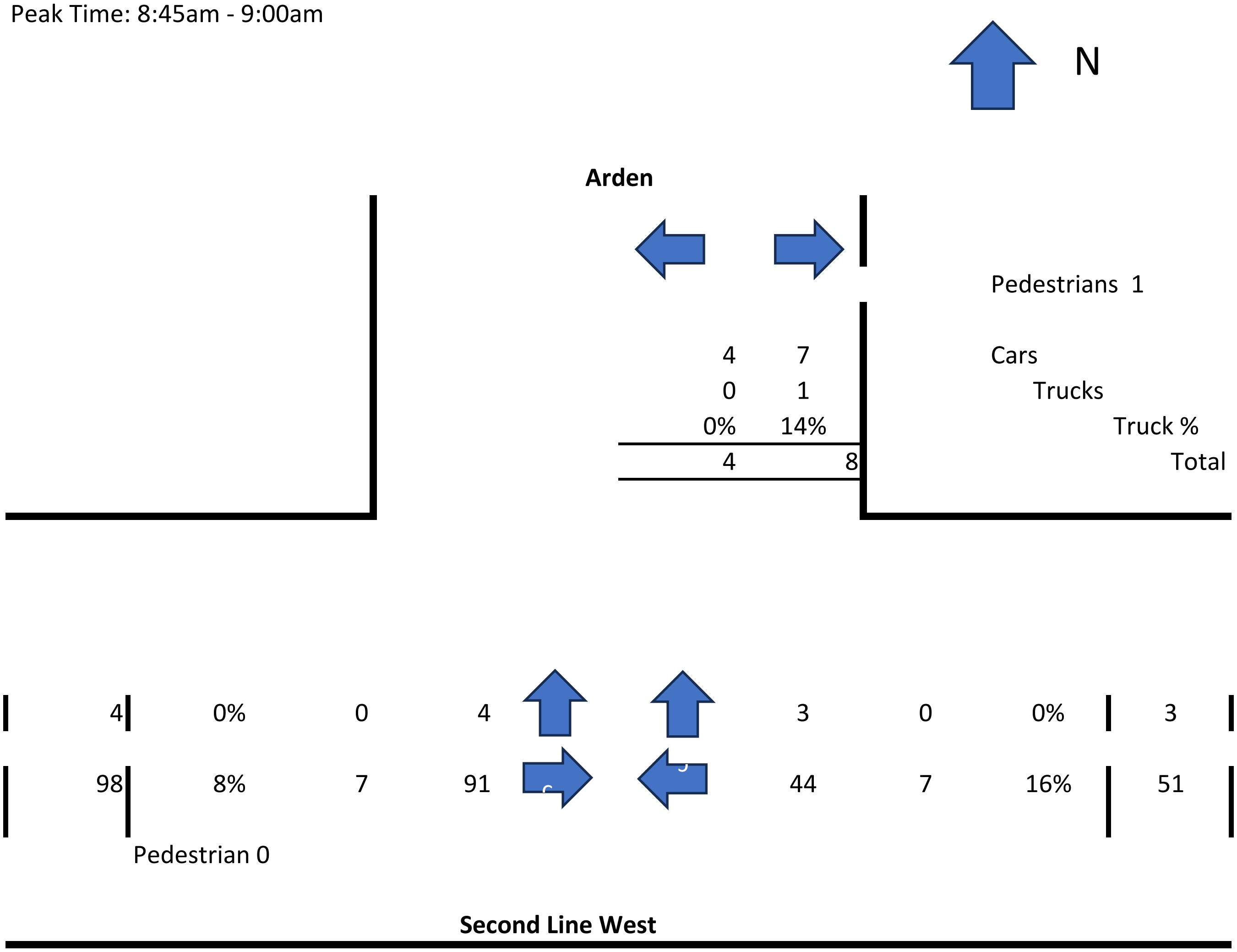
Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 8:30am - 8:45am



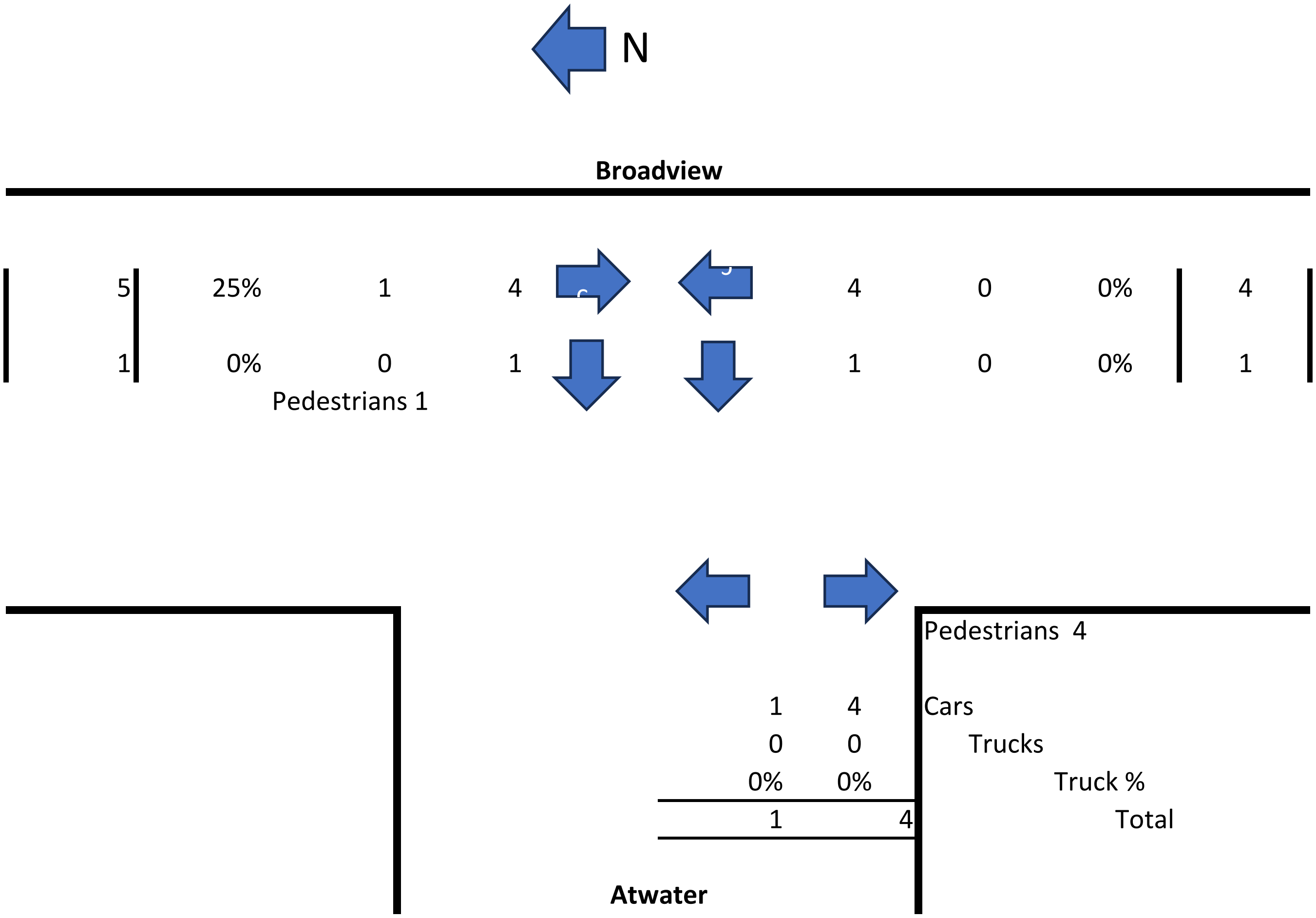
Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 8:45am - 9:00am



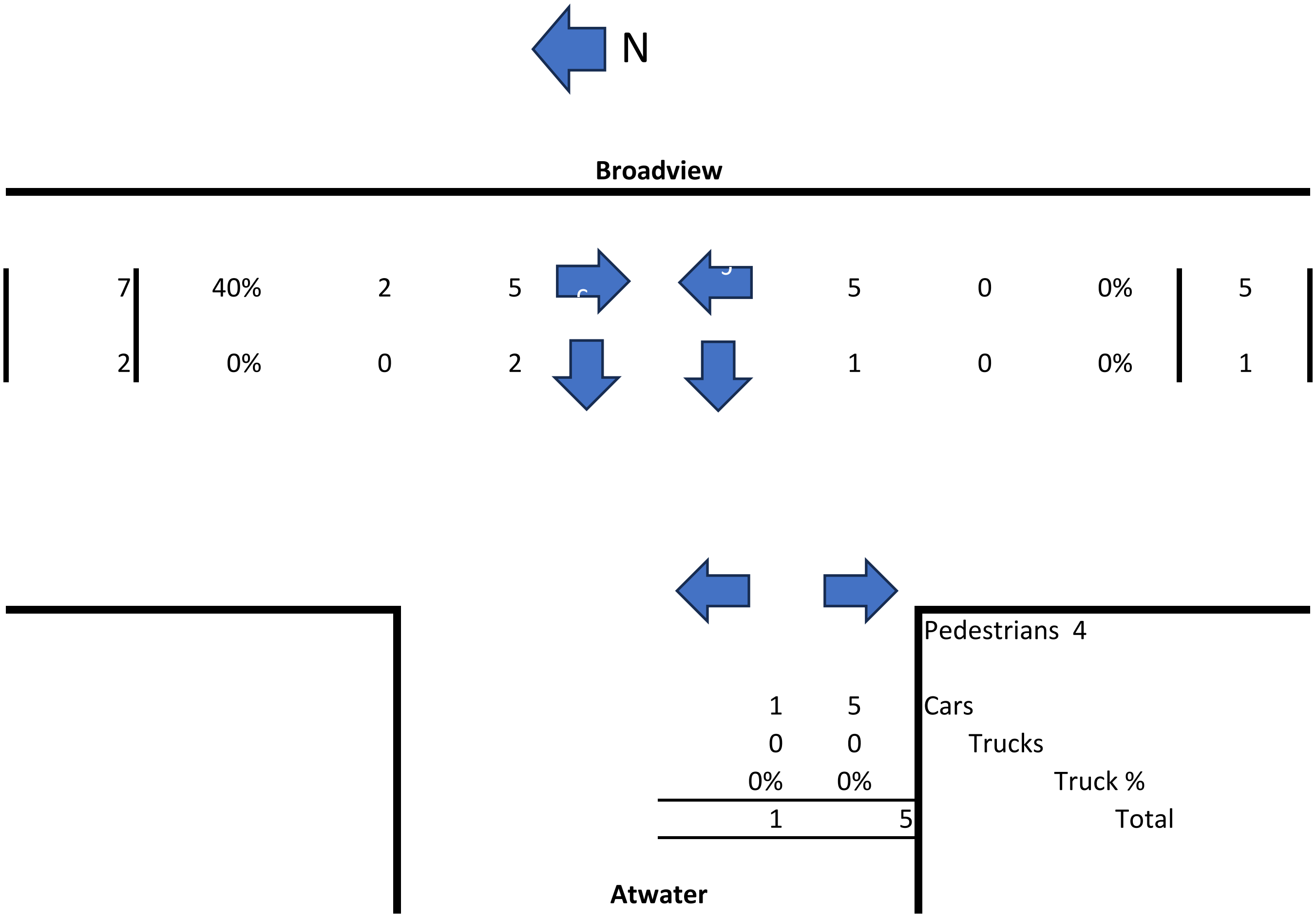
Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 8:00am - 8:15am



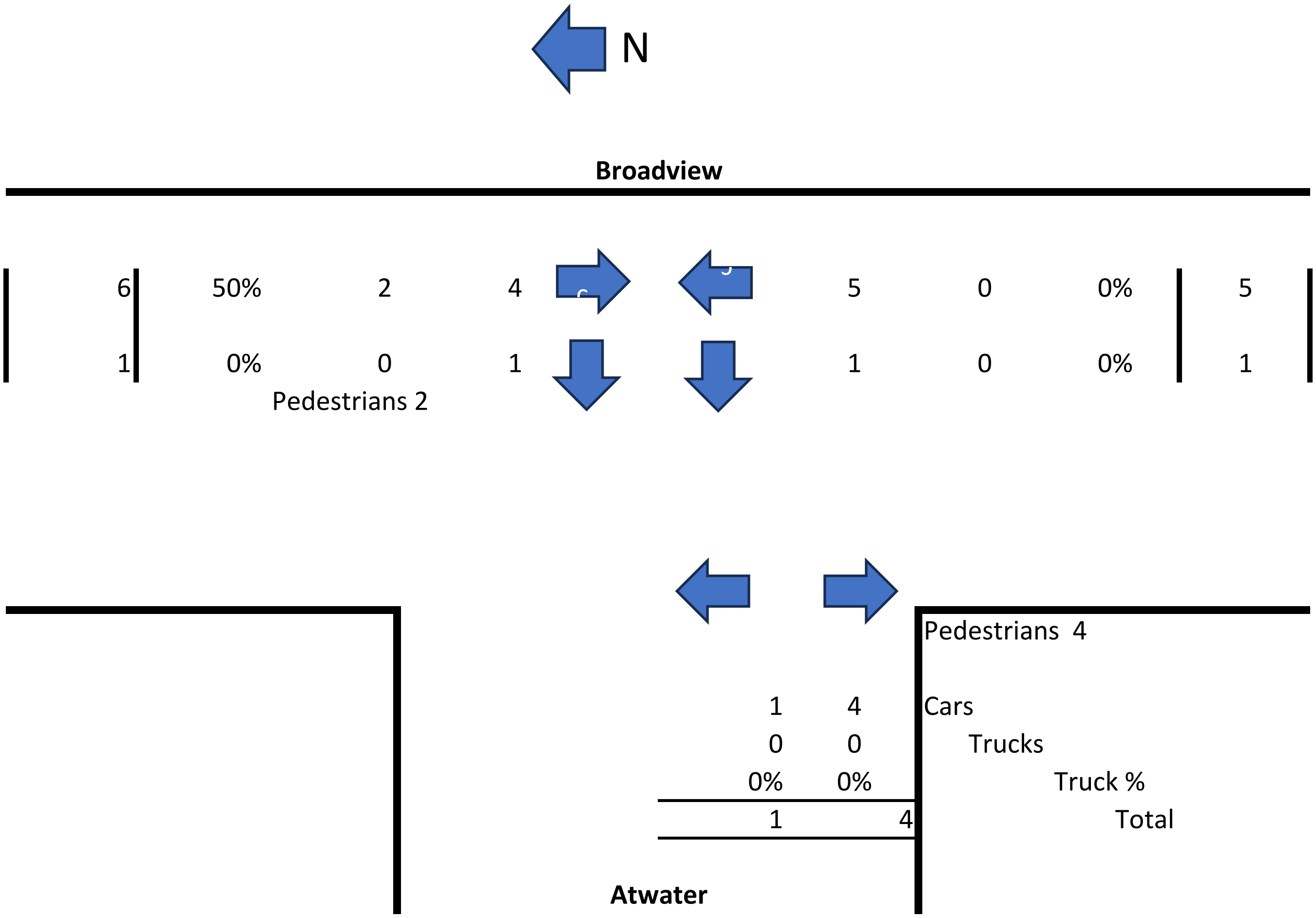
Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 8:15am - 8:30am



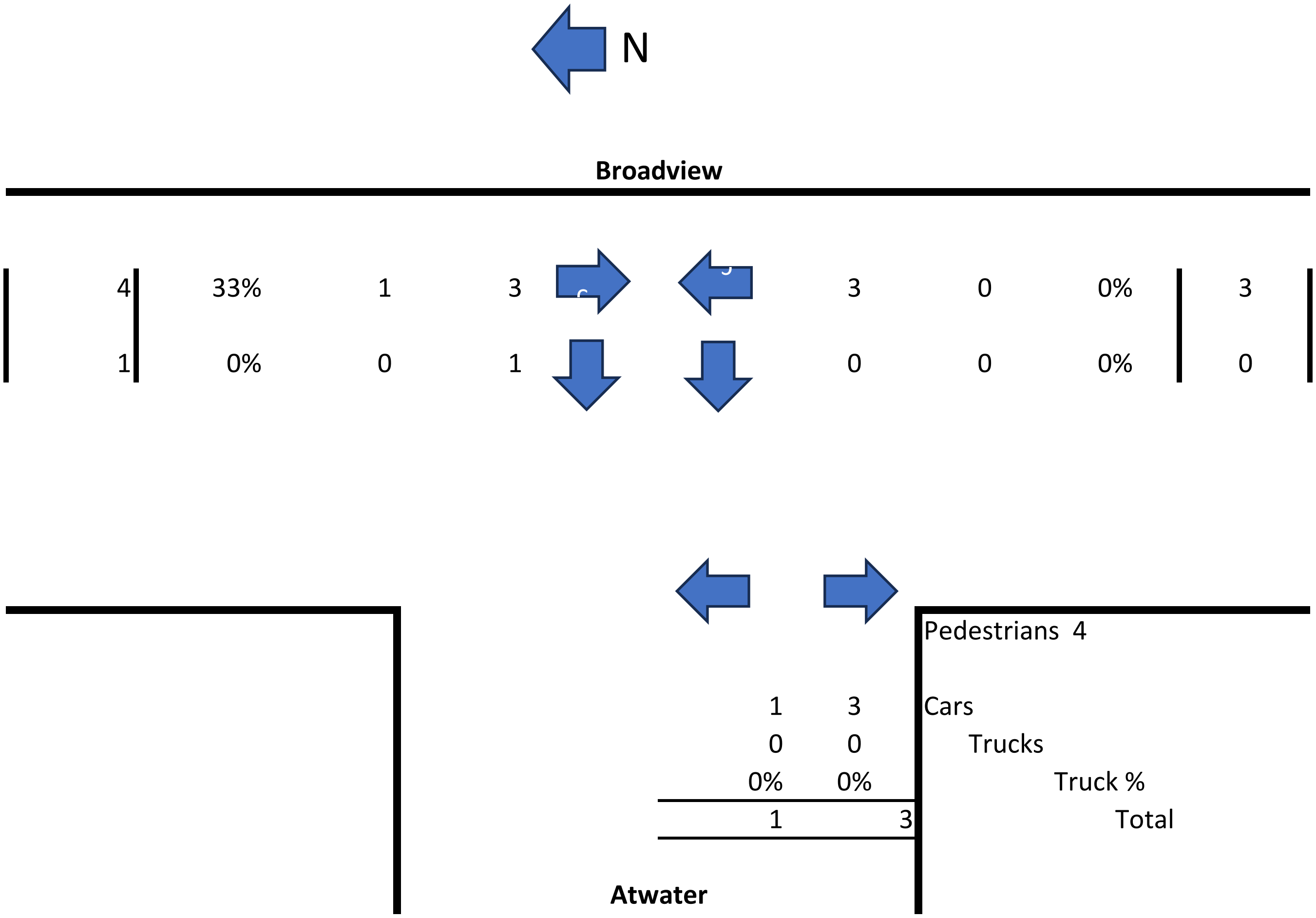
Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 8:30am - 8:45am



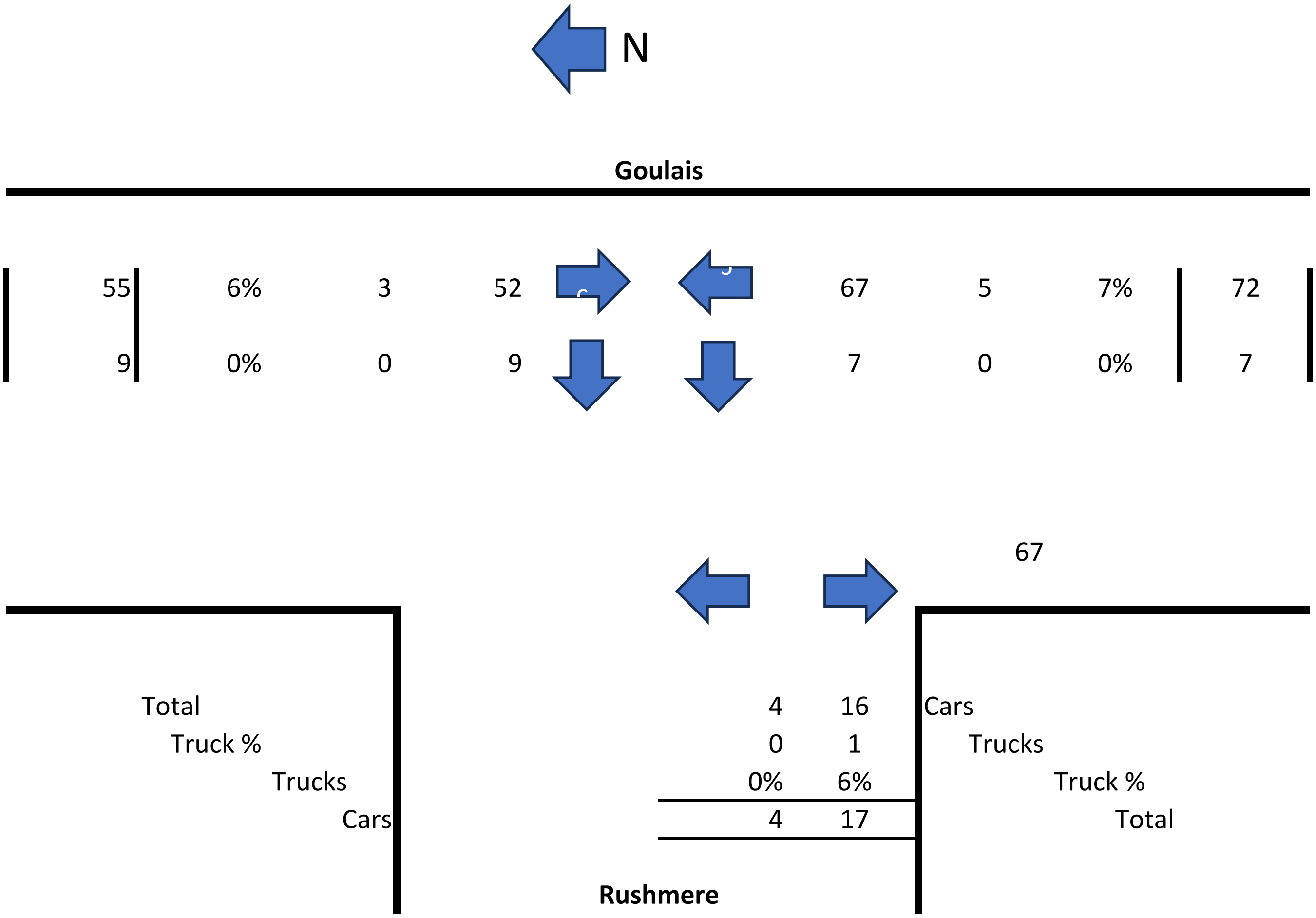
Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 8:45am - 9:00am



Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 8:00am - 8:15am



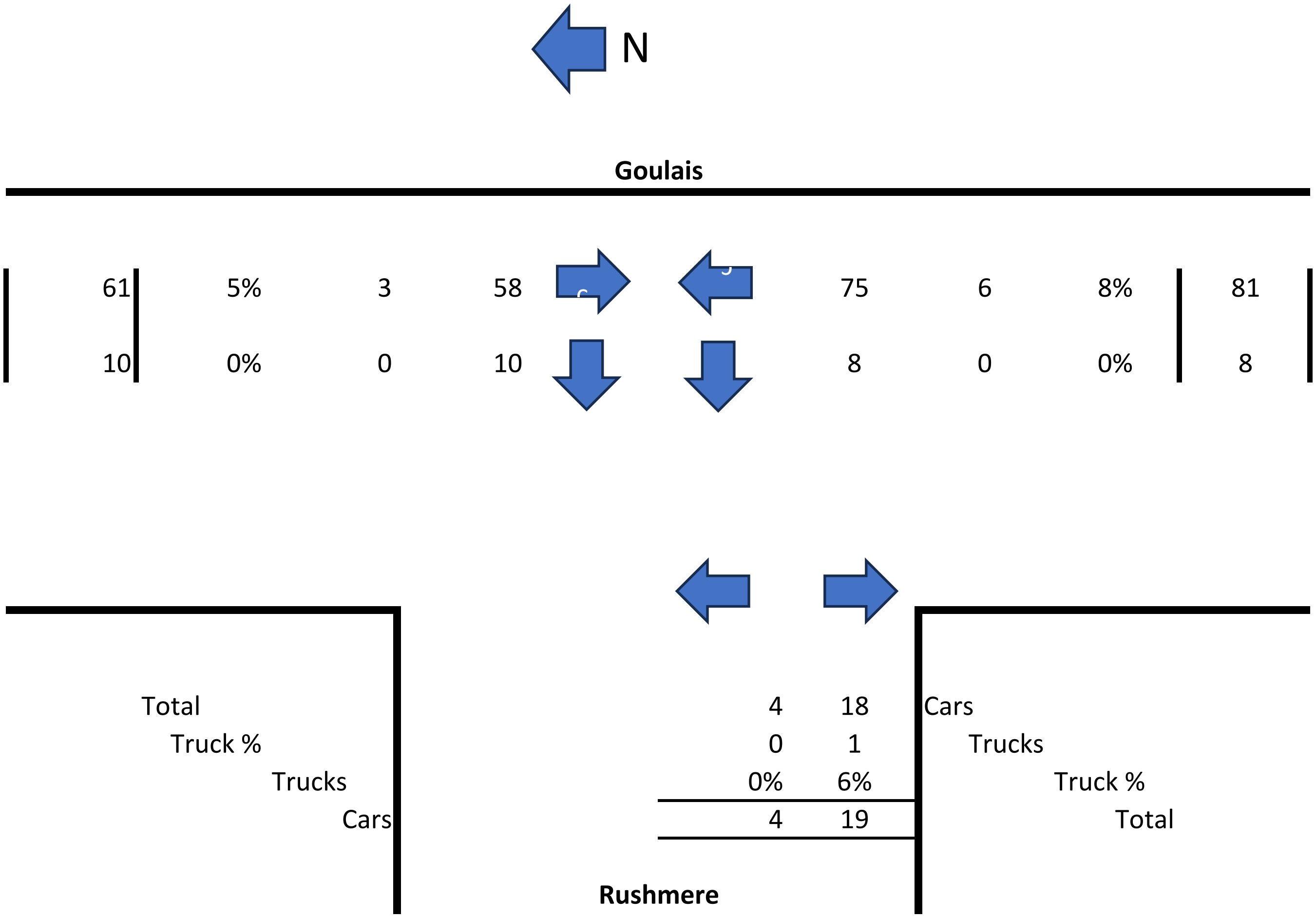
55	6%	3	52	67	5	7%	72
9	0%	0	9	7	0	0%	7

67

Total		4	16	Cars	
Truck %		0	1	Trucks	
Trucks		0%	6%	Truck %	
Cars		4	17	Total	

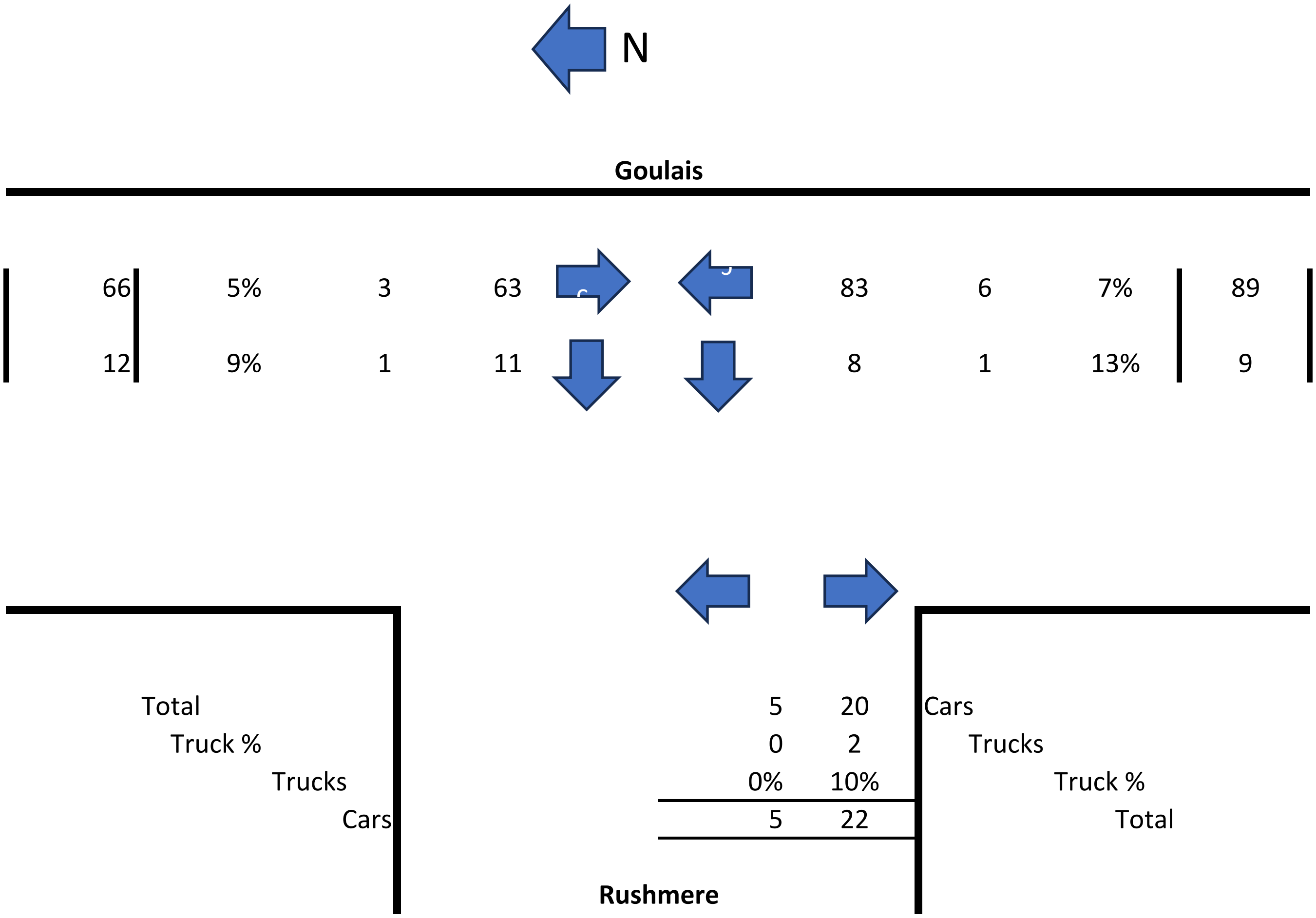
Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 8:15am - 8:30am



Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 8:30am - 8:45am

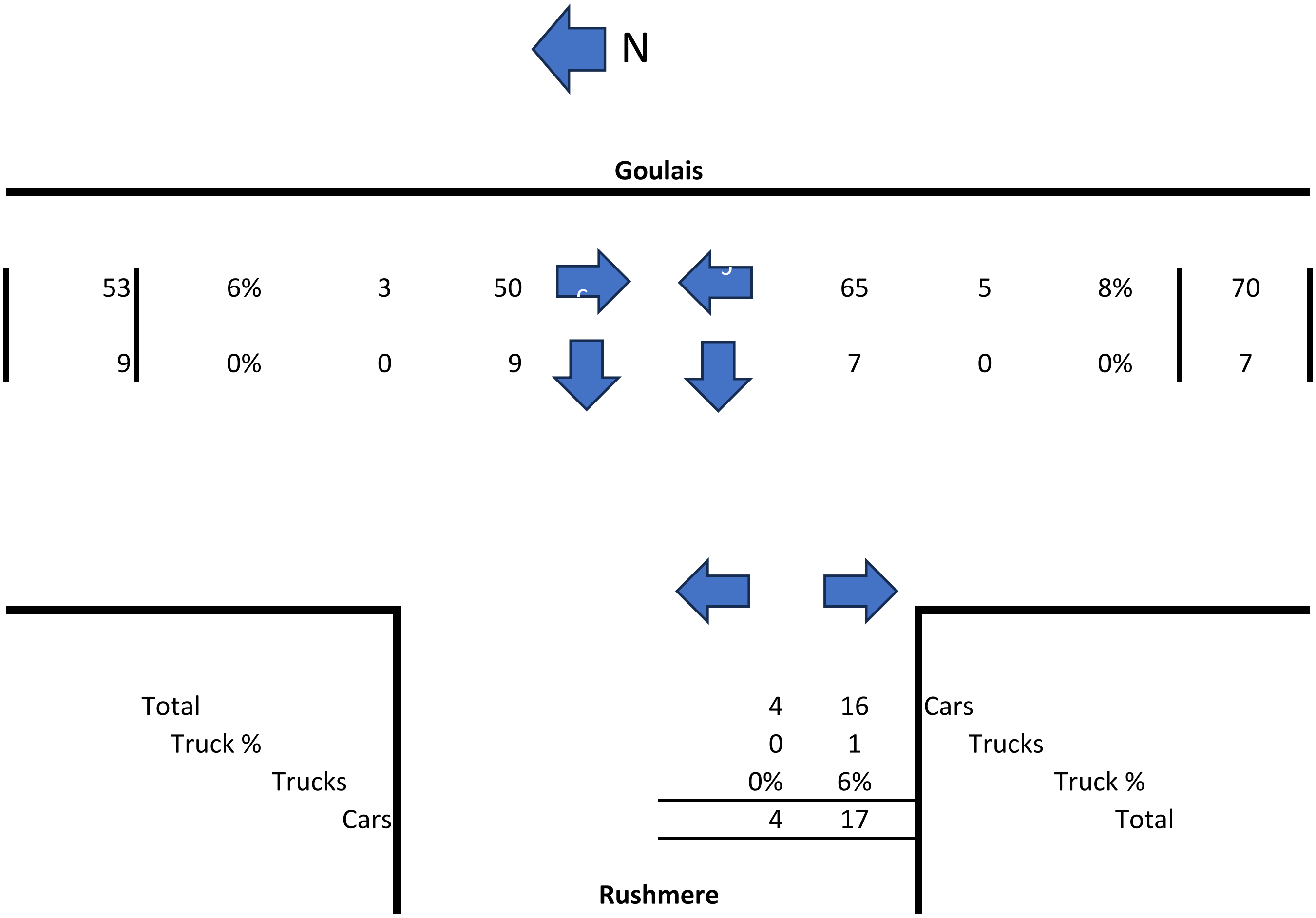


66	5%	3	63	83	6	7%	89
12	9%	1	11	8	1	13%	9

Total	5	20	Cars
Truck %	0	2	Trucks
Trucks	0%	10%	Truck %
Cars	5	22	Total

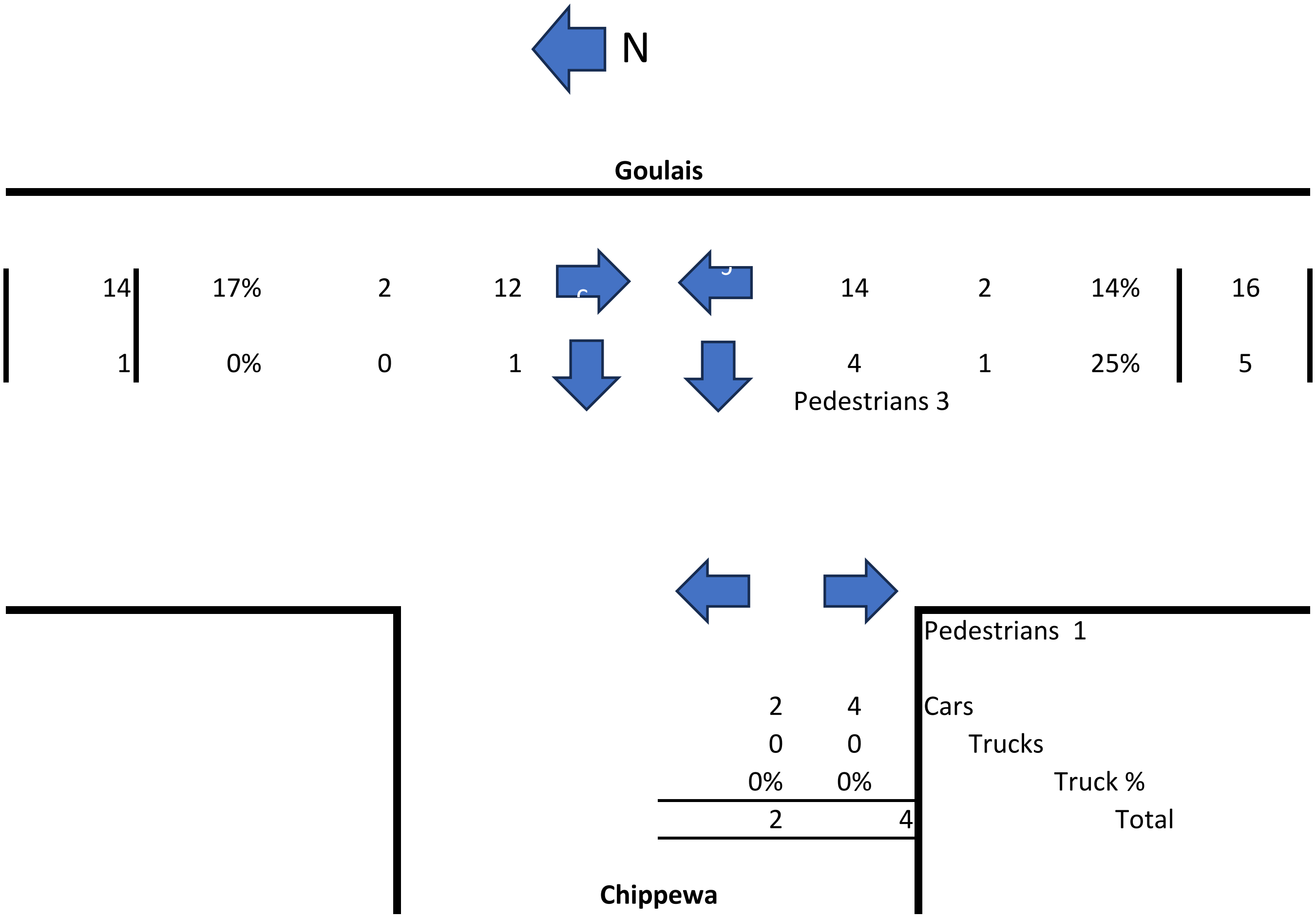
Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 8:45am - 9:00am



Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 4:15pm - 4:30pm



14	17%	2	12	14	2	14%	16
1	0%	0	1	4	1	25%	5

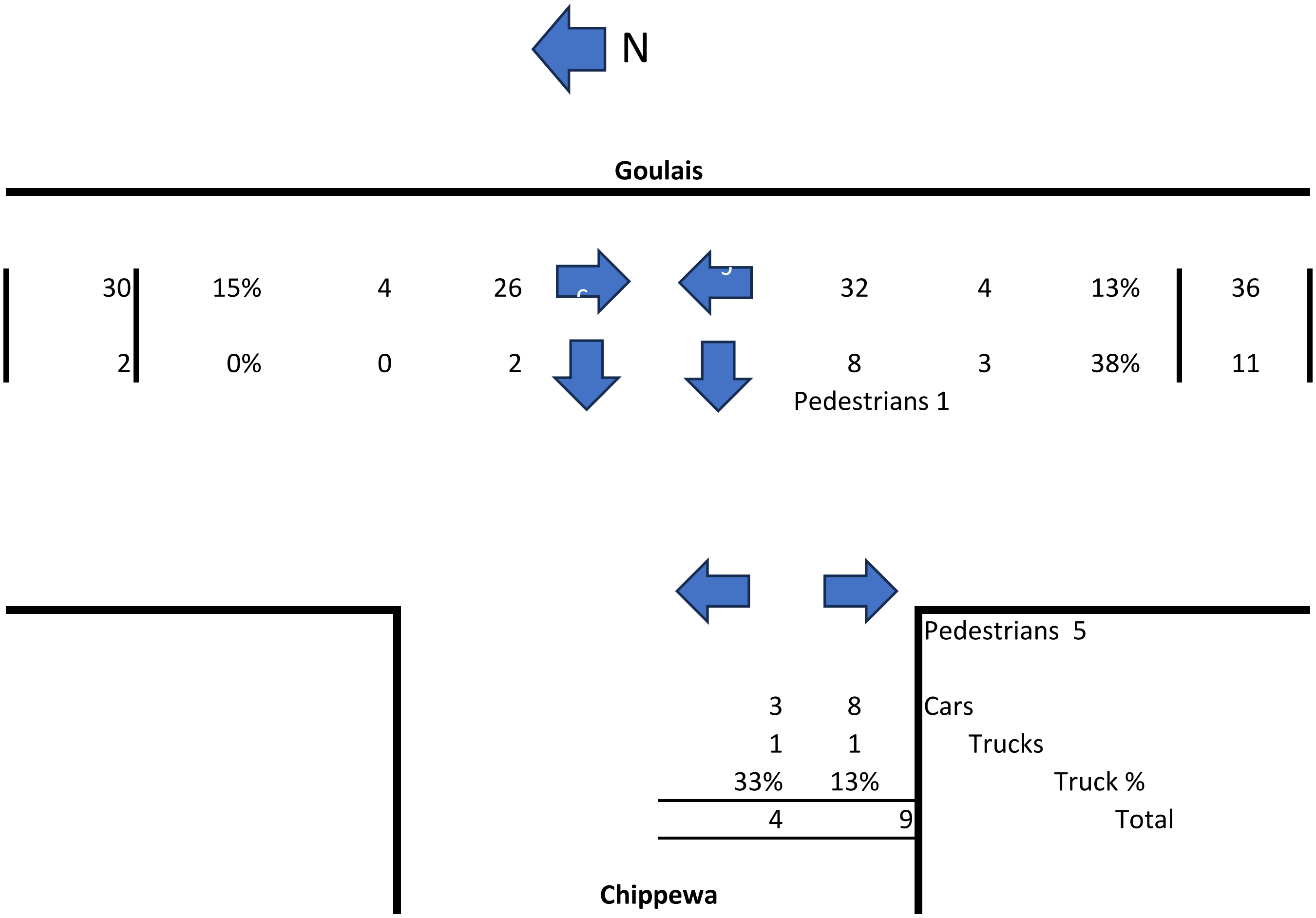
Pedestrians 3

Pedestrians 1

2	4	Cars
0	0	Trucks
0%	0%	Truck %
2	4	Total

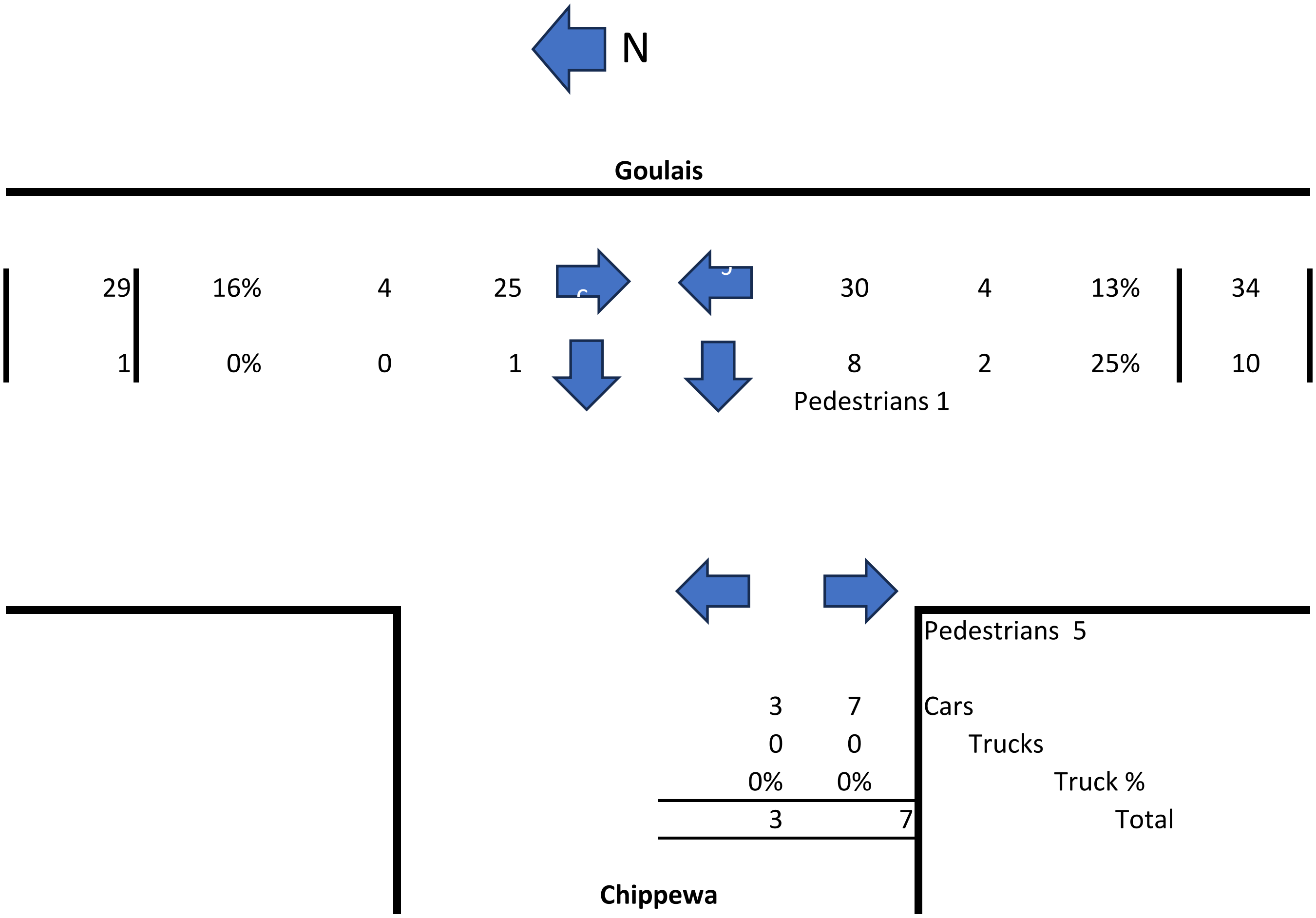
Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 4:30pm - 4:45pm



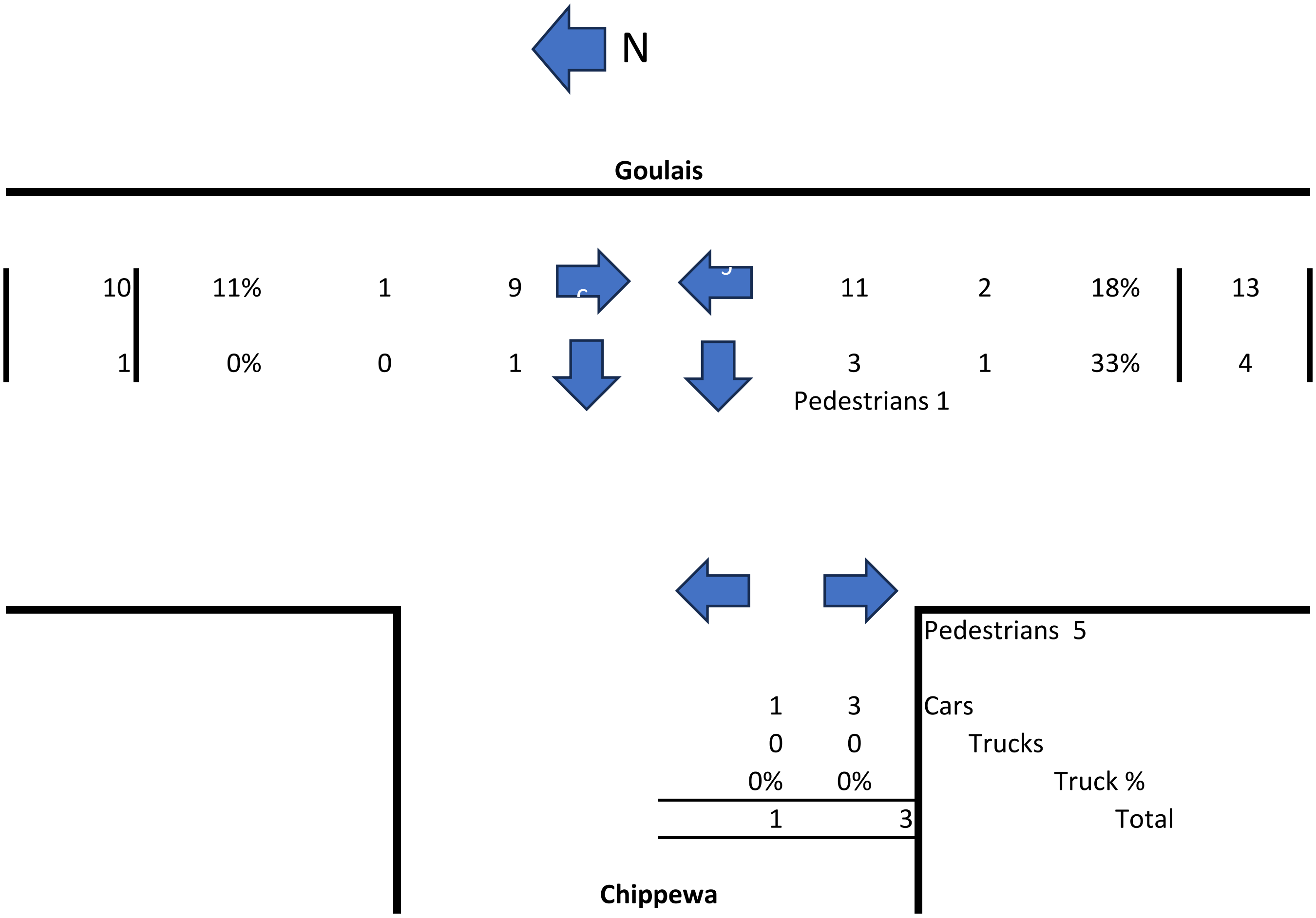
Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 4:45pm - 5:00pm



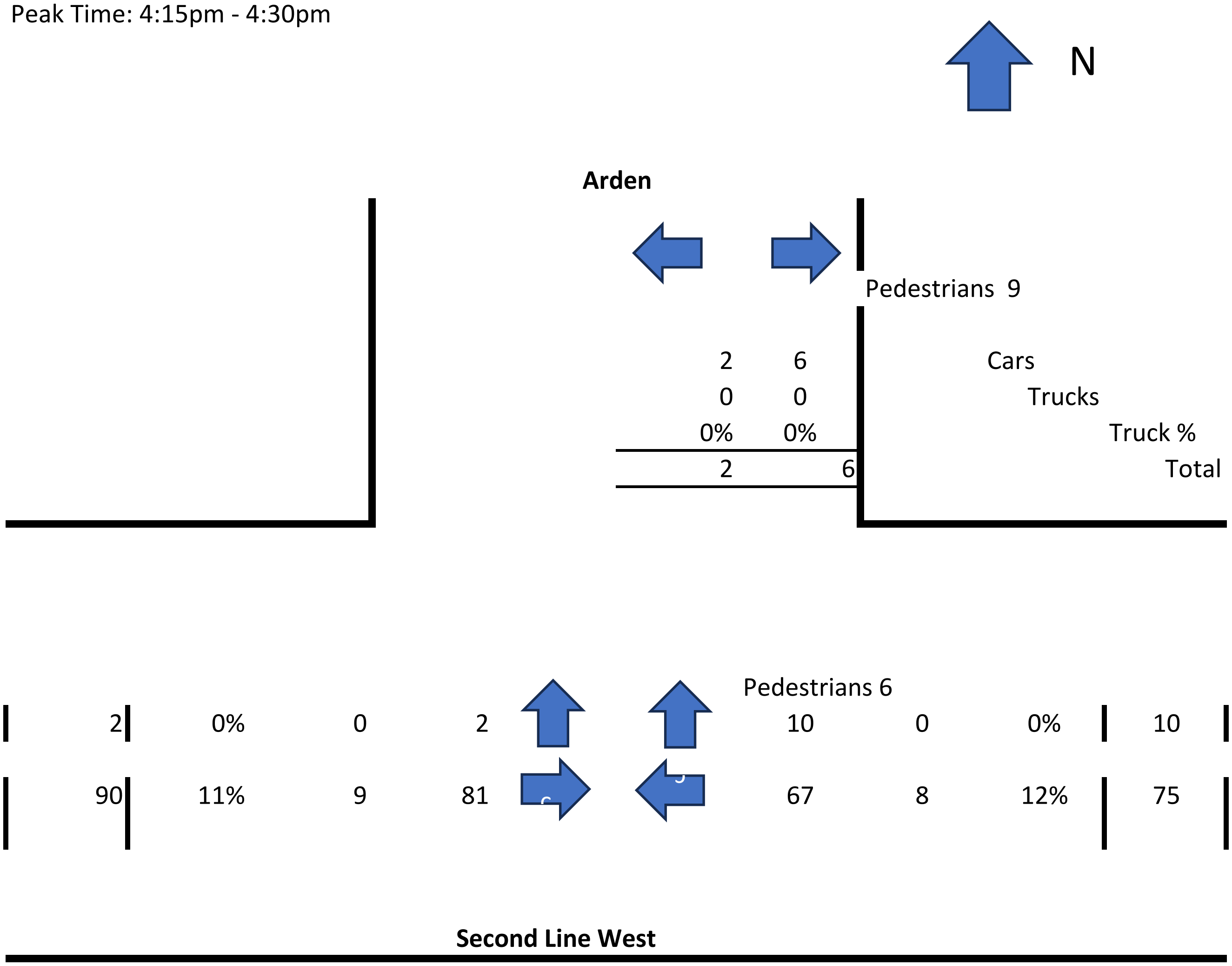
Turning Movements Report

Location: Goulais @ Chippewa
Municipality: Sault Ste. Marie
Count Date: Thursday December 14, 2023
Time: 5:00pm - 5:15pm



Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 4:15pm - 4:30pm



Pedestrians 9

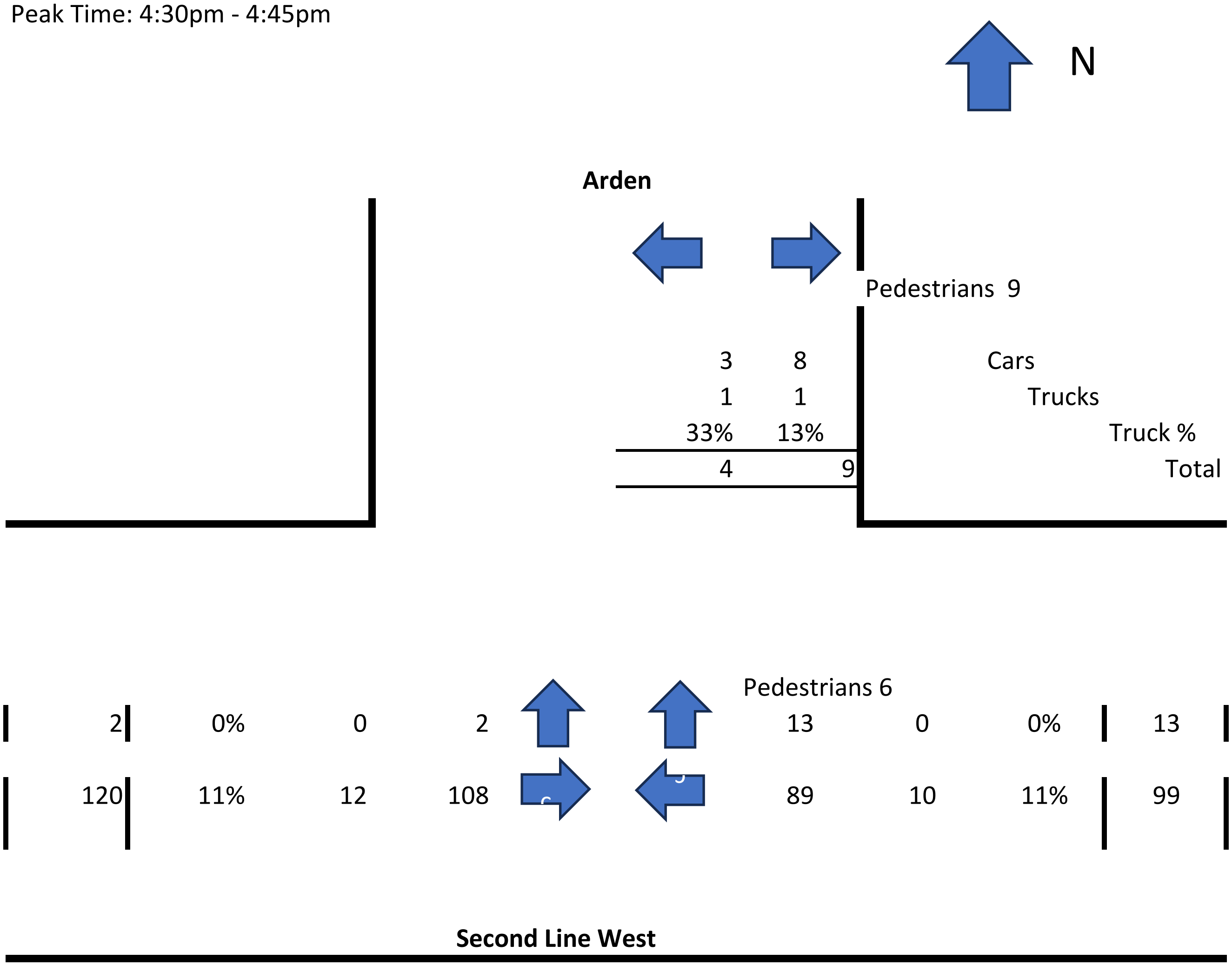
2	6	Cars
0	0	Trucks
0%	0%	Truck %
2	6	Total

Pedestrians 6

2	0%	0	2	10	0	0%	10
90	11%	9	81	67	8	12%	75

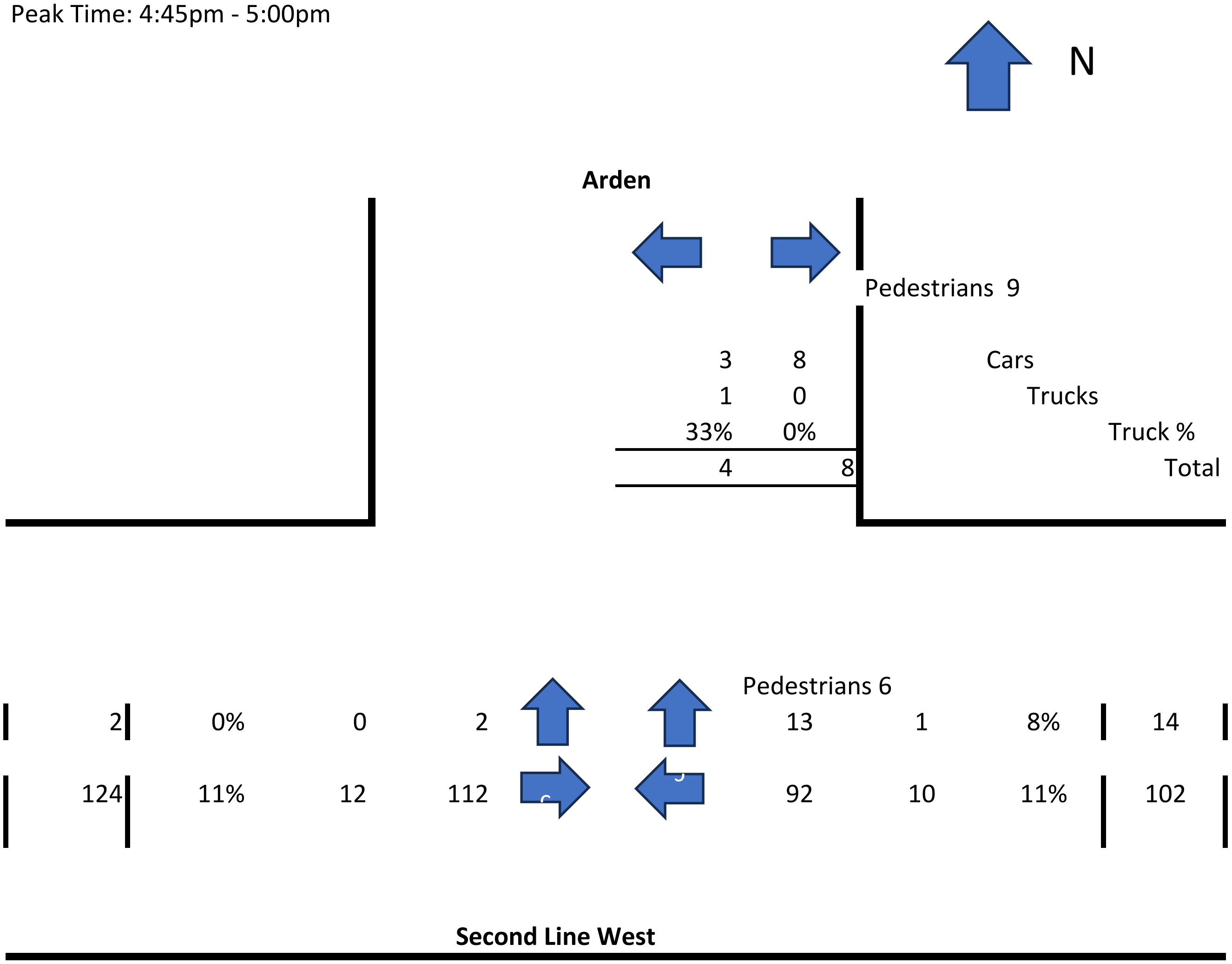
Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 4:30pm - 4:45pm



Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 4:45pm - 5:00pm

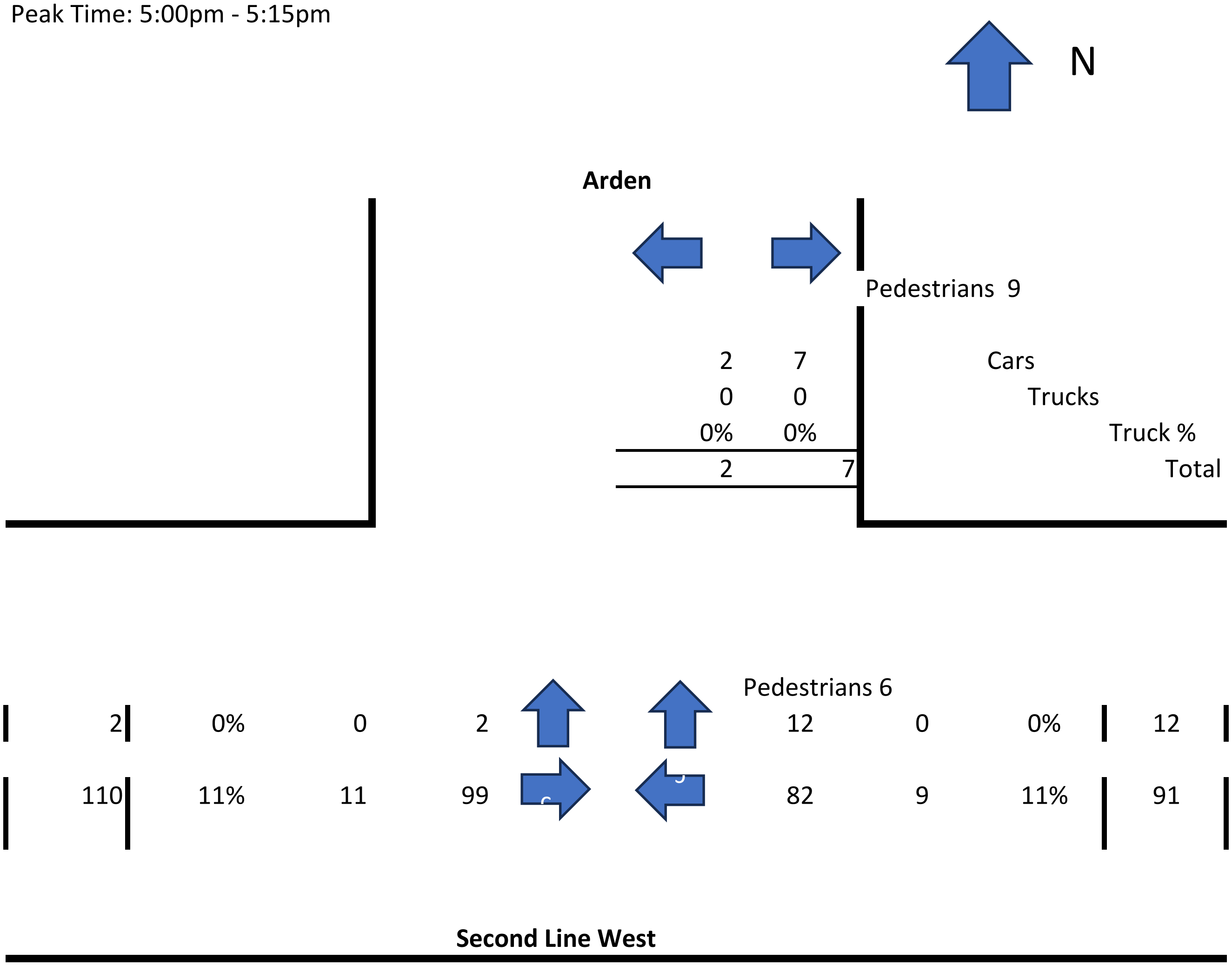


3	8	Cars
1	0	Trucks
33%	0%	Truck %
4	8	Total

2	0%	0	2	↑	↑	13	1	8%	14
124	11%	12	112	→	←	92	10	11%	102

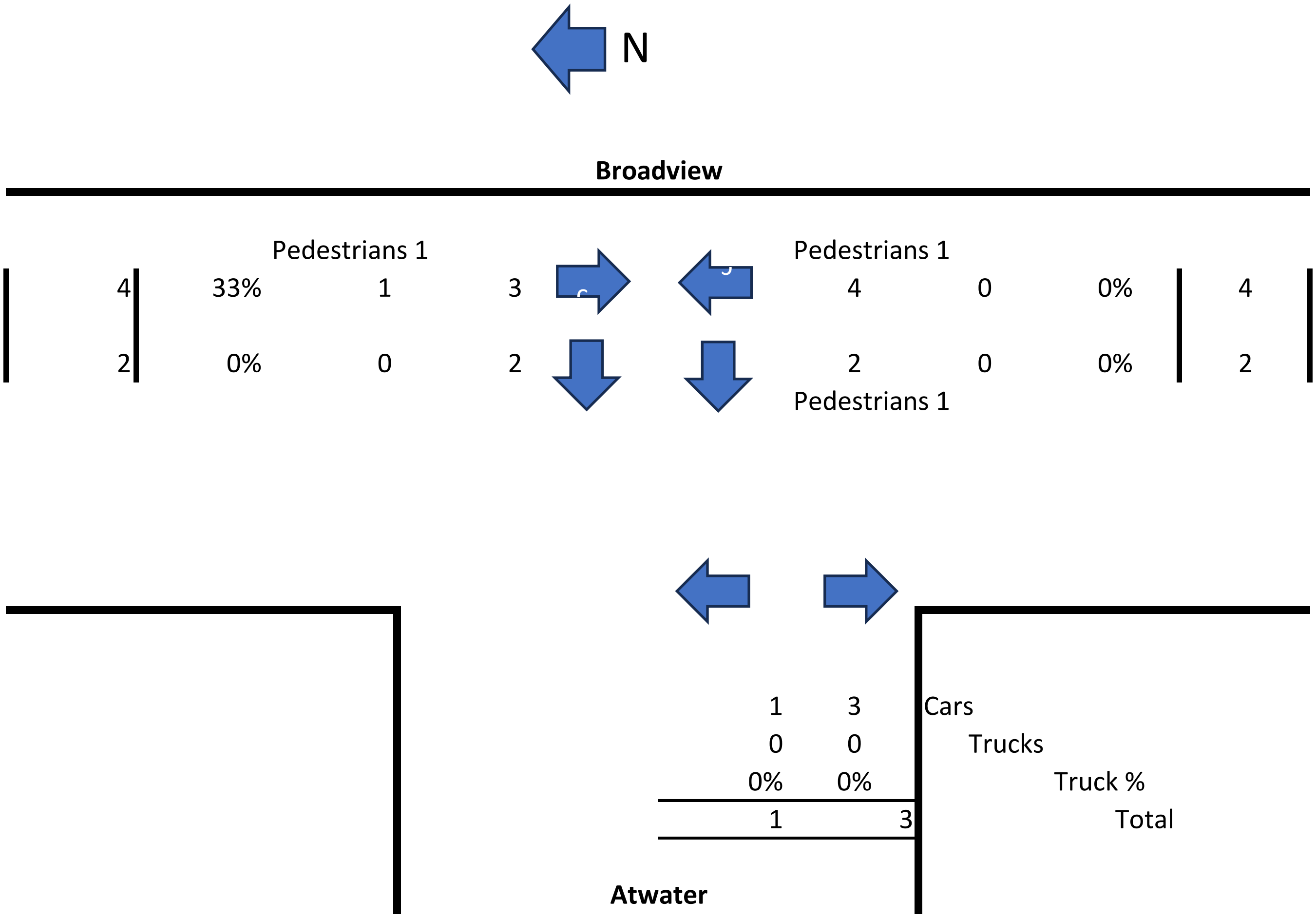
Turning Movements Report

Location: Second Line W @ Arden
Municipality: Sault Ste. Marie
Count Date: Friday December 15, 2023
Peak Time: 5:00pm - 5:15pm



Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 2:00pm - 2:15pm



Broadview

Pedestrians 1

Pedestrians 1

4	33%	1	3	4	0	0%	4
2	0%	0	2	2	0	0%	2

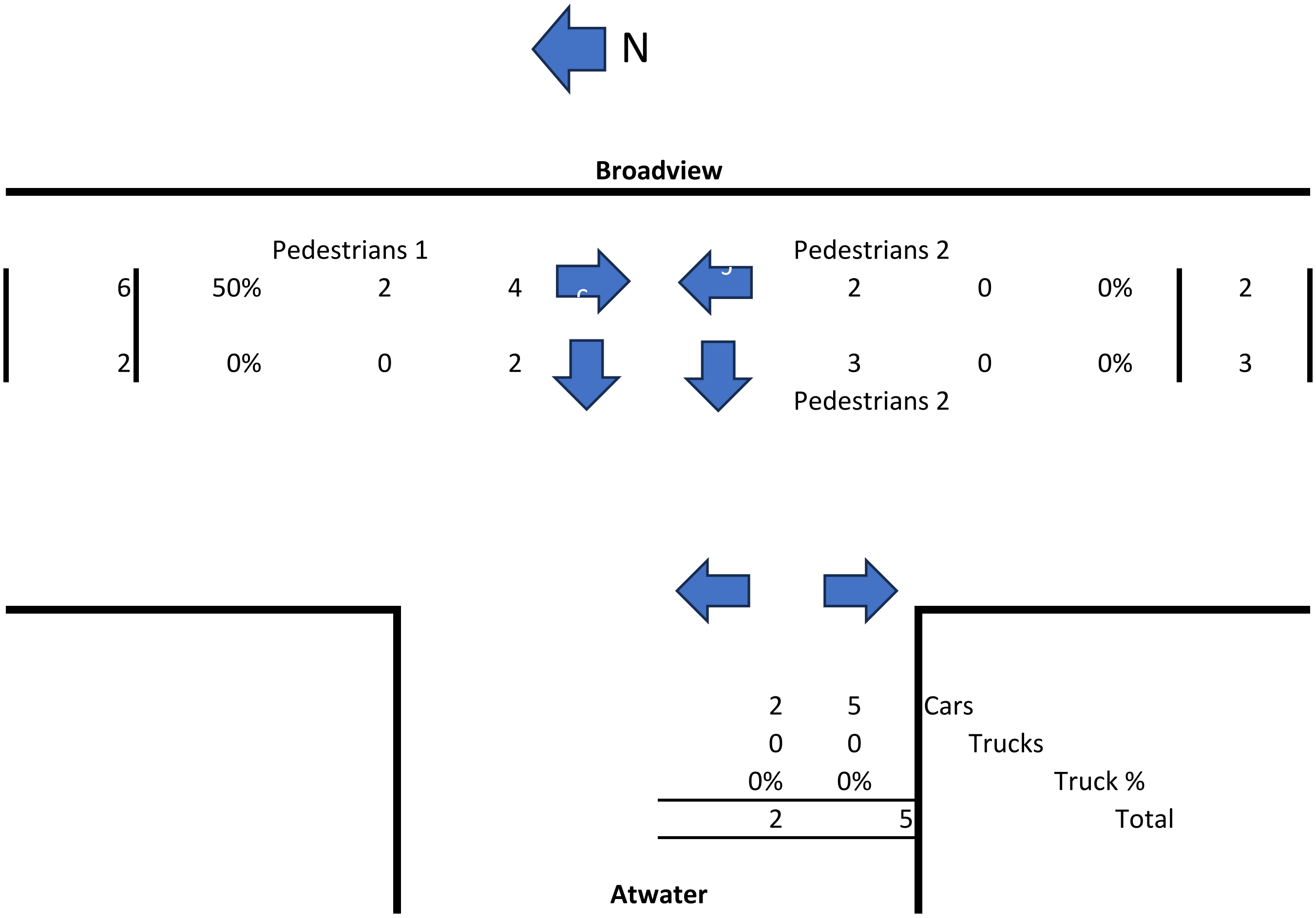
Pedestrians 1

1	3	Cars
0	0	Trucks
0%	0%	Truck %
1	3	Total

Atwater

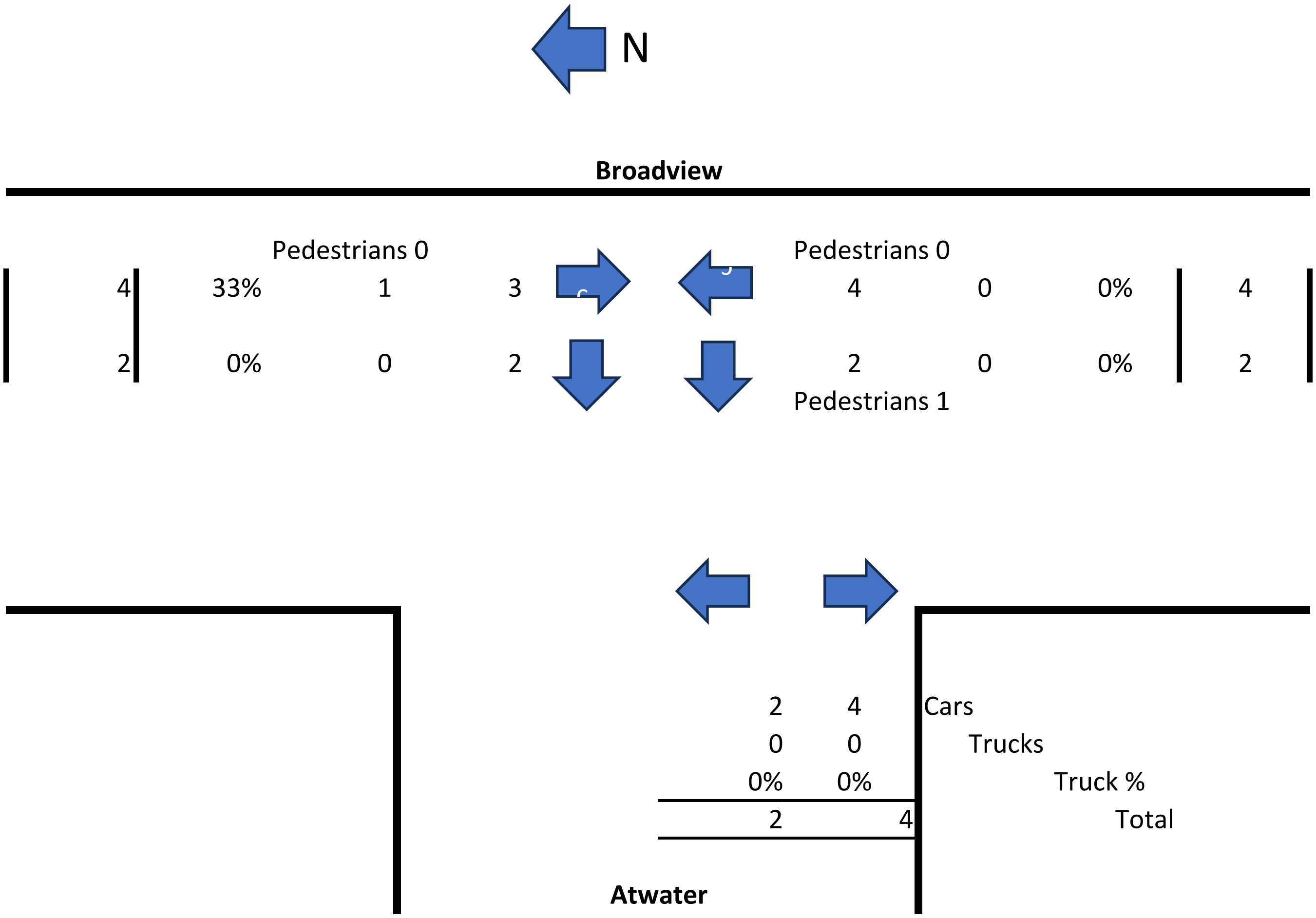
Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 2:15pm - 2:30pm



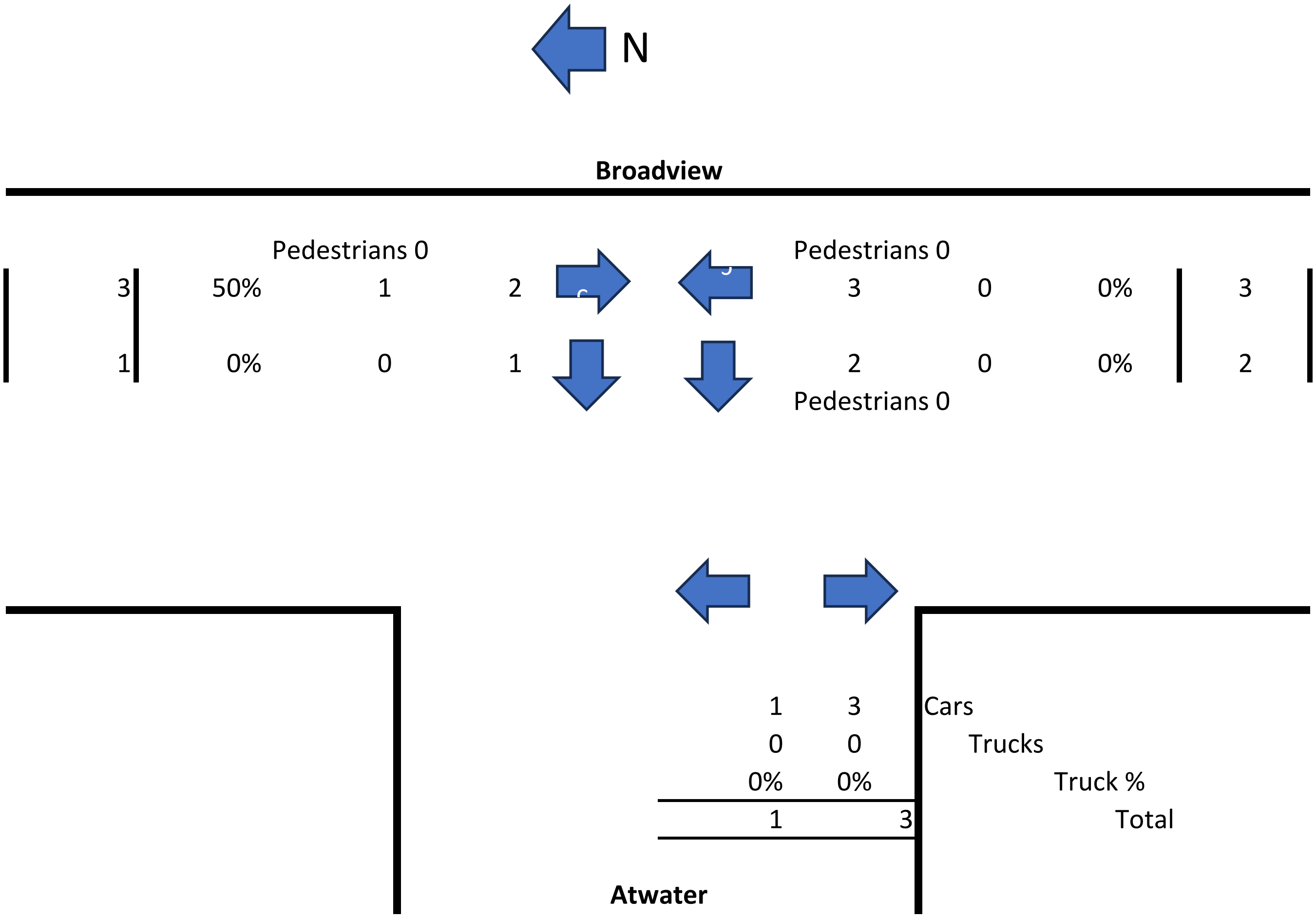
Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 2:30pm - 2:45pm



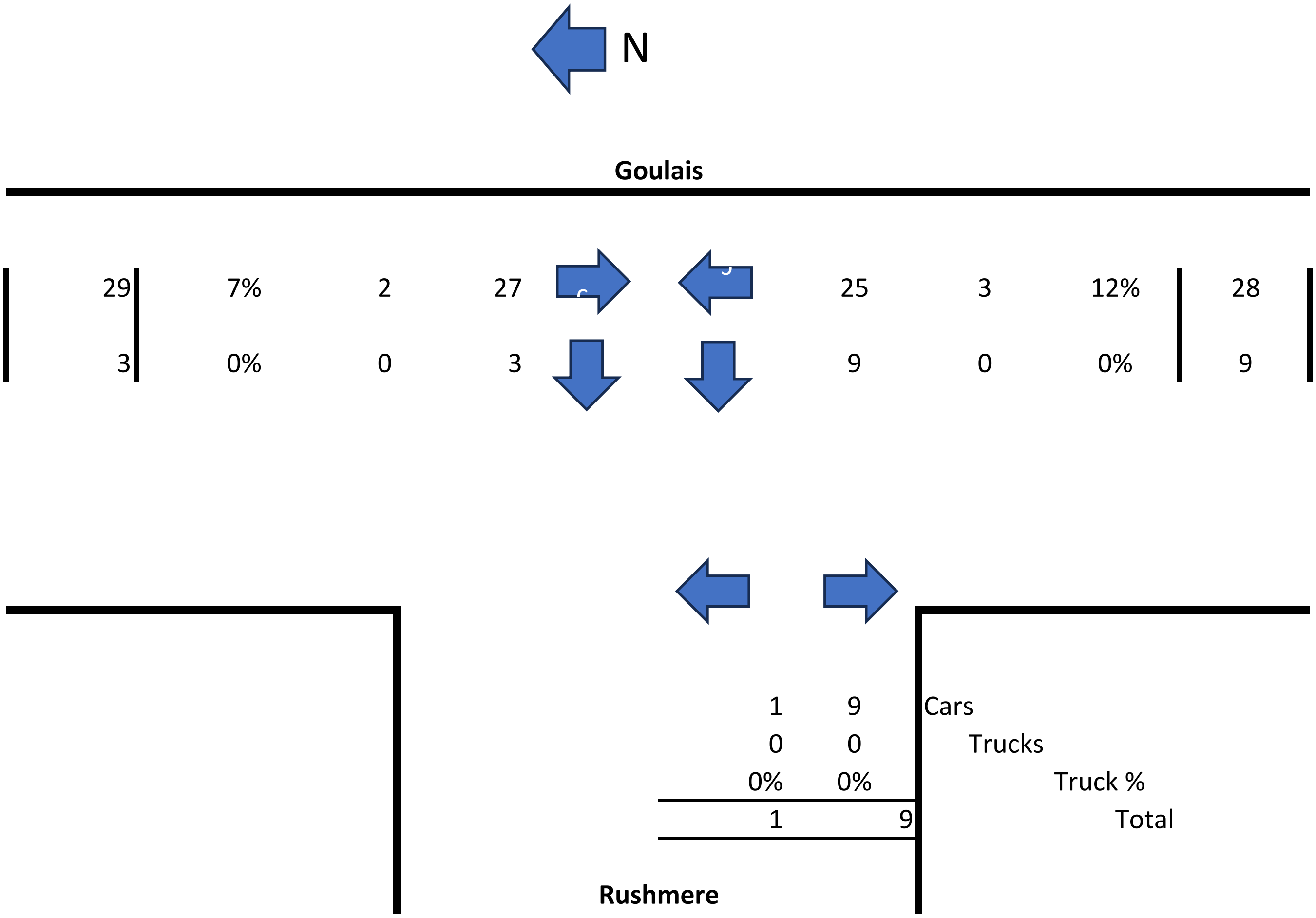
Turning Movements Report

Location: Broadview @ Atwater
Municipality: Sault Ste. Marie
Count Date: Monday December 19, 2023
Time: 2:45pm - 3:00pm



Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 4:15pm -4:30pm

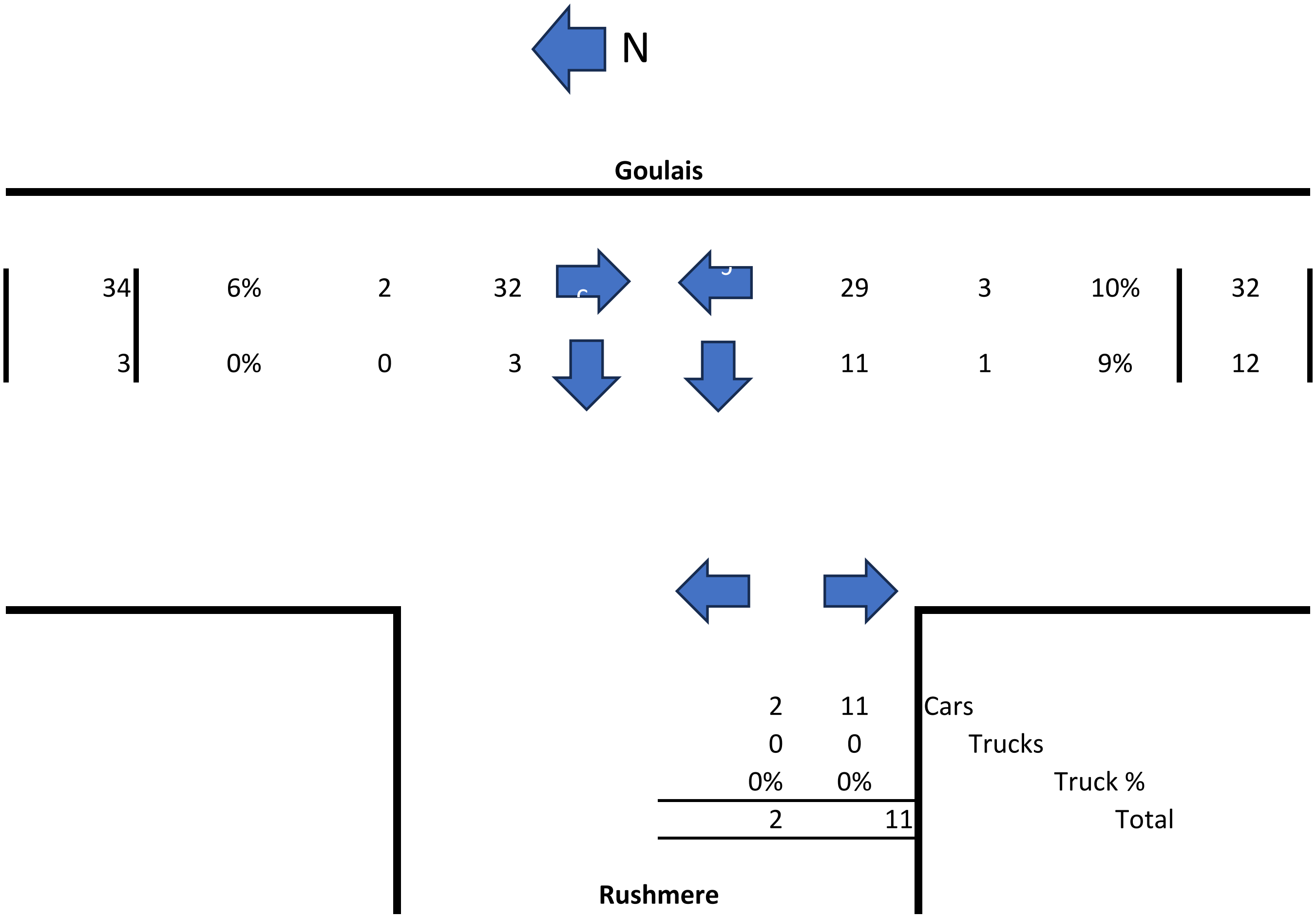


29	7%	2	27	25	3	12%	28
3	0%	0	3	9	0	0%	9

1	9	Cars
0	0	Trucks
0%	0%	Truck %
1	9	Total

Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 4:30pm -4:45pm

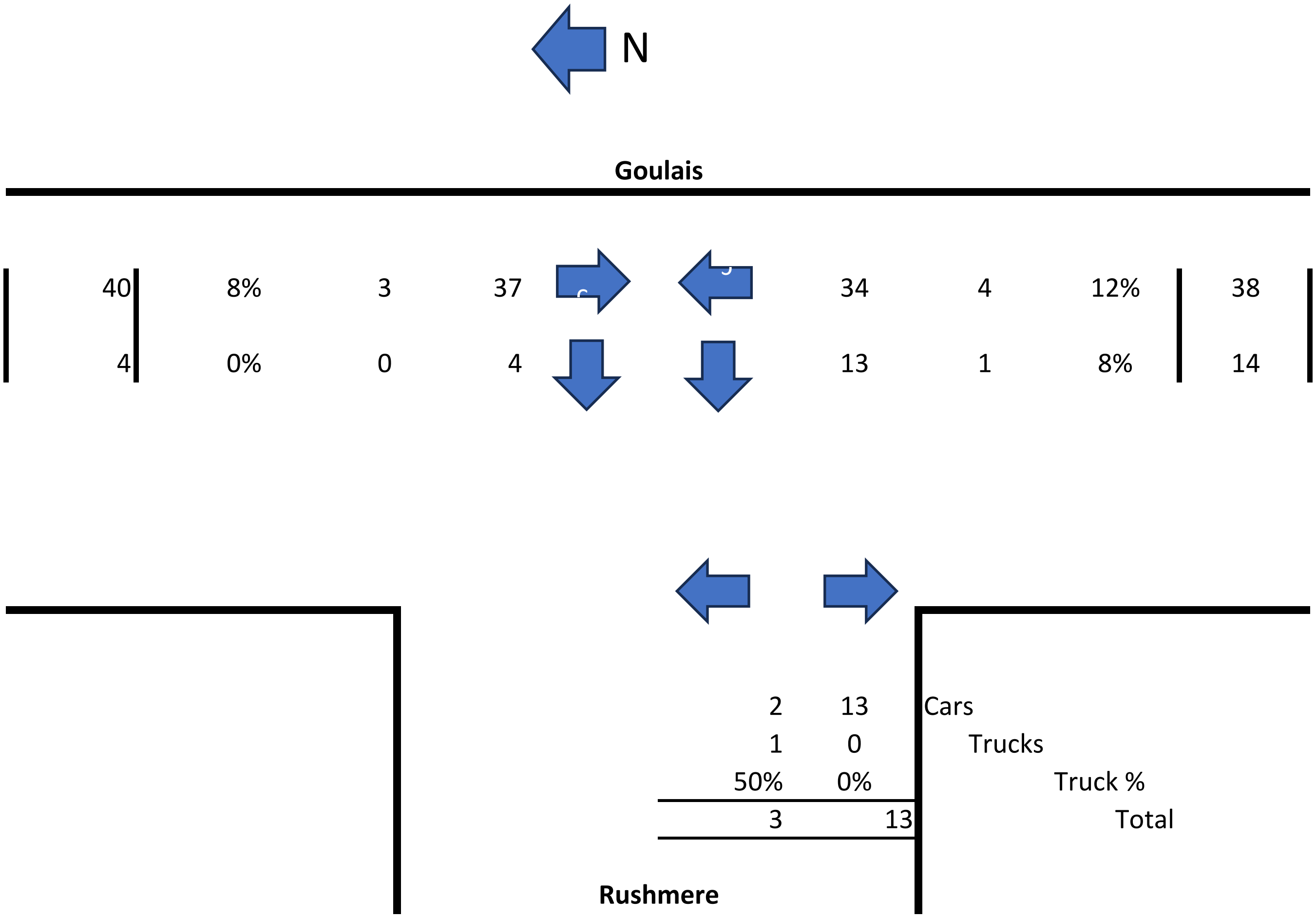


34	6%	2	32	→	←	29	3	10%	32
3	0%	0	3	↓	↓	11	1	9%	12

←	→	
2	11	Cars
0	0	Trucks
0%	0%	Truck %
2	11	Total

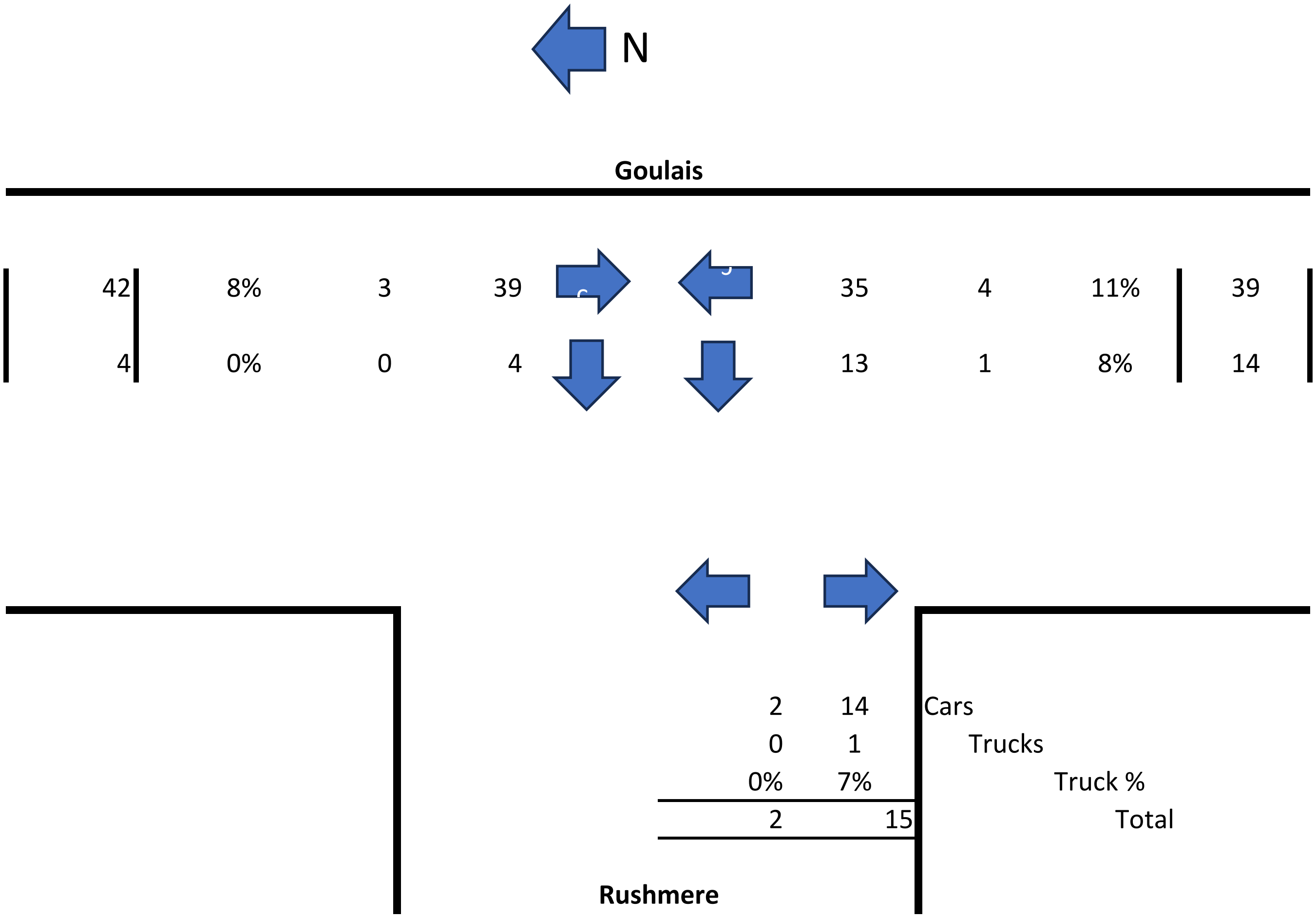
Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 4:45pm -5:00pm



Turning Movements Report

Location: Goulais @ Rushmere
Municipality: Sault Ste. Marie
Count Date: Monday December 18, 2023
Time: 5:00pm -5:15pm



42	8%	3	39	35	4	11%	39
4	0%	0	4	13	1	8%	14

2	14	Cars
0	1	Trucks
0%	7%	Truck %
2	15	Total

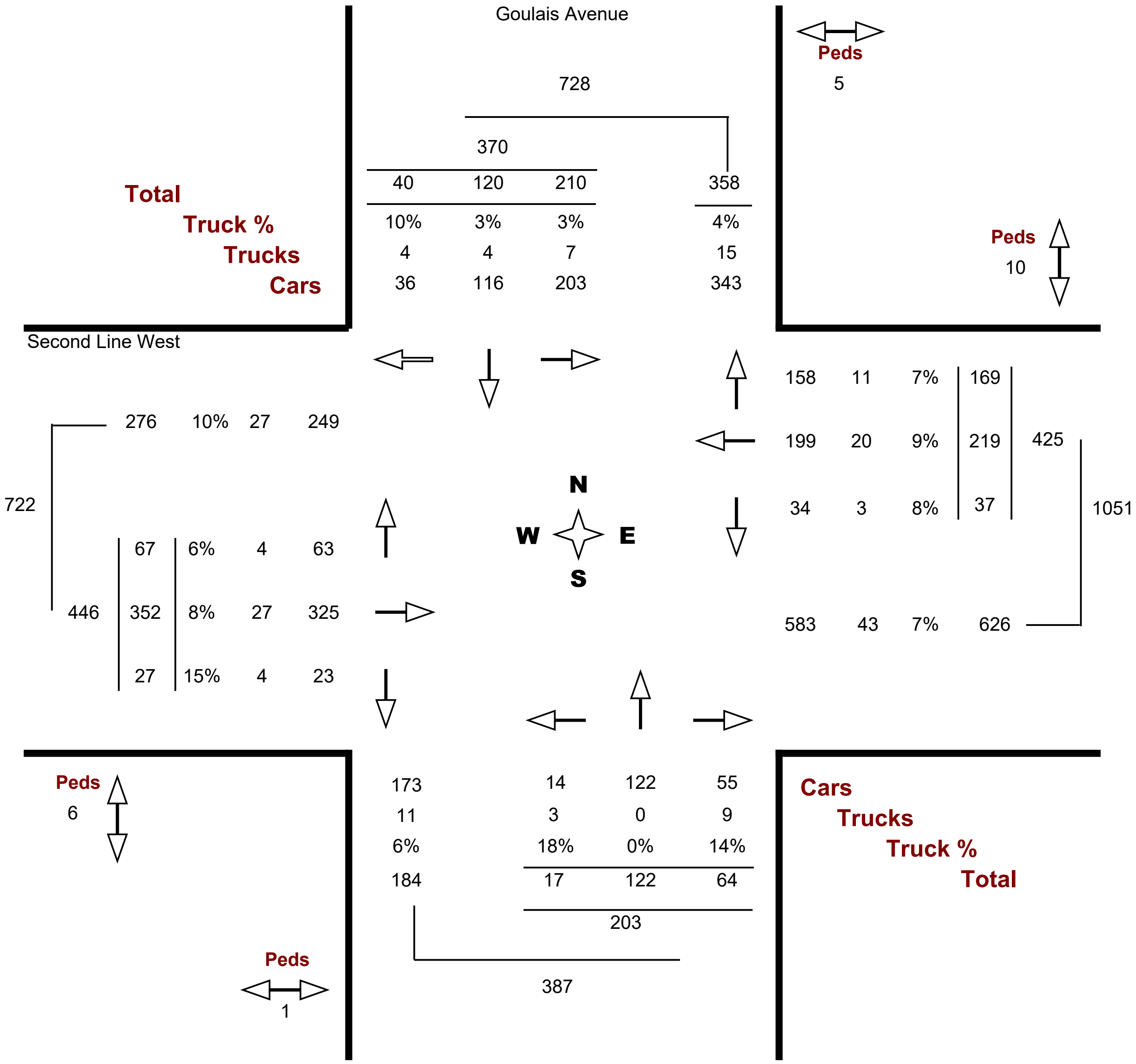
Turning Movements Report - AM Period

Location............. Goulais Avenue @ Second Line West

Municipality....... Sault Ste. Marie

GeoID....... 16339

Count Date....... Friday, 15 December, 2023 **Peak Hour......** 08:00 AM —— 09:00 AM



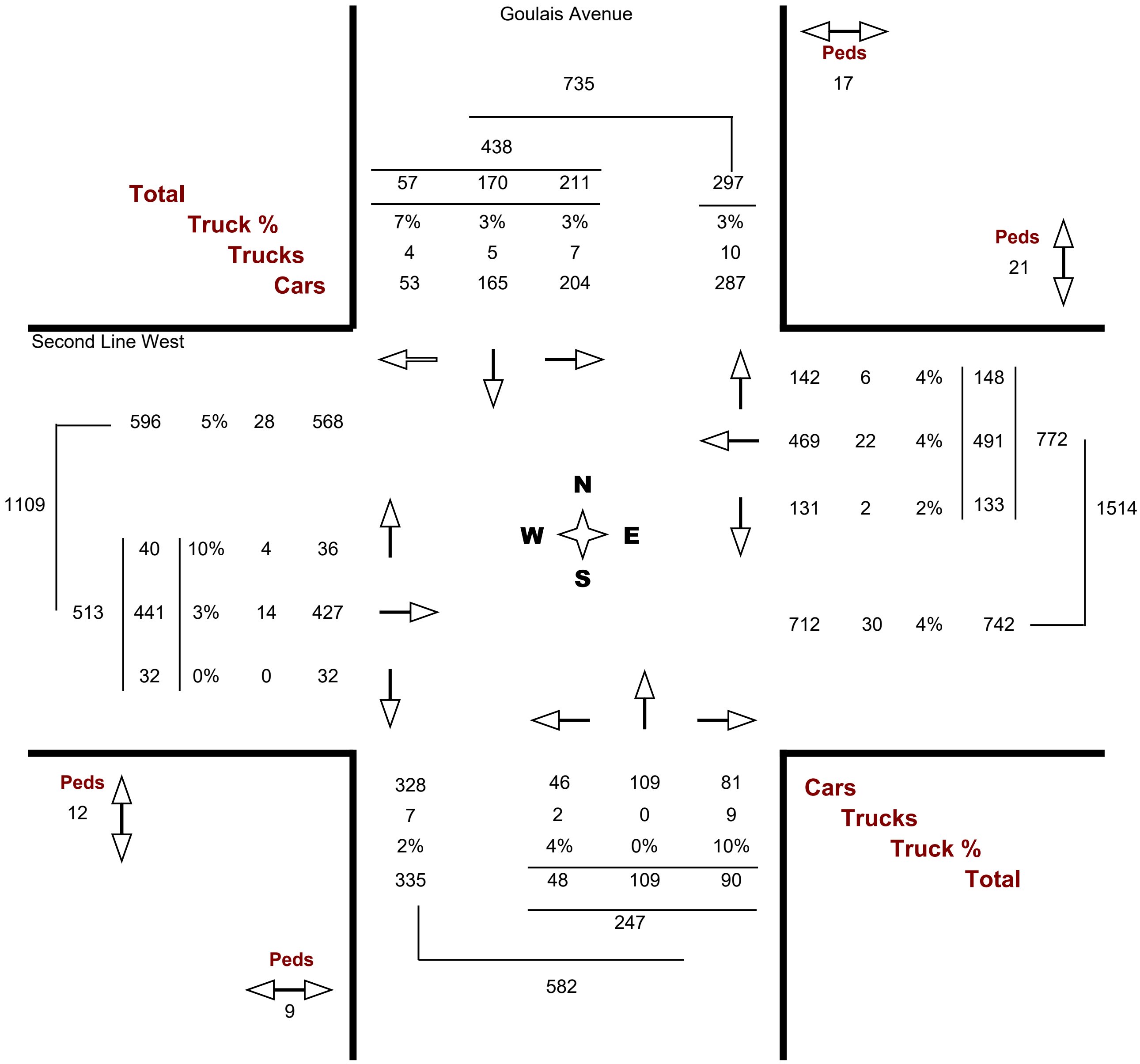
Turning Movements Report - PM Period

Location............. Goulais Avenue @ Second Line West

Municipality....... Sault Ste. Marie

GeoID....... 16339

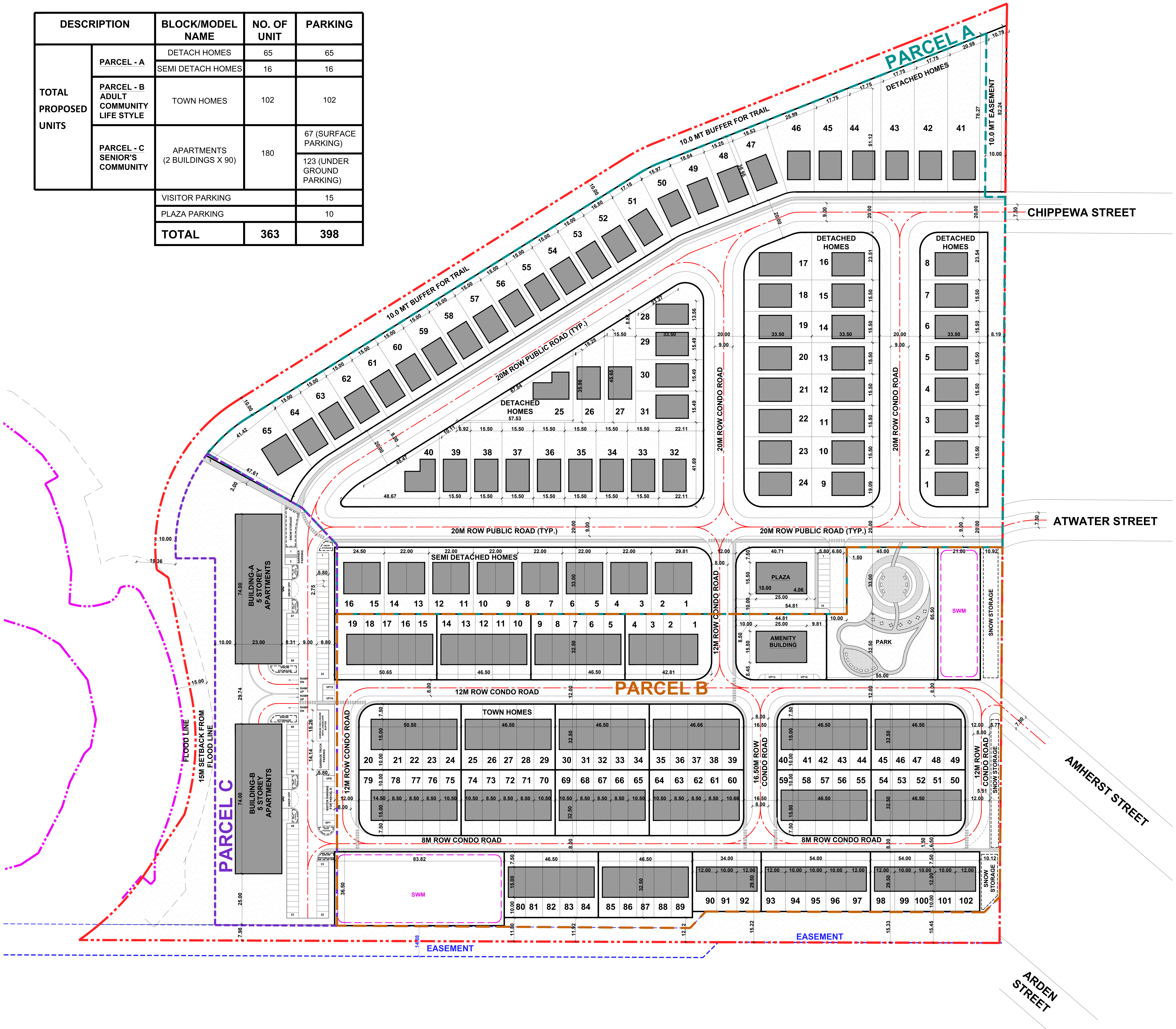
Count Date....... Friday, 15 December, 2023 **Peak Hour......** 02:30 PM —— 03:30 PM



C

Appendix C
Site Plan

DESCRIPTION		BLOCK/MODEL NAME	NO. OF UNIT	PARKING
TOTAL PROPOSED UNITS	**PARCEL - A**	DETACH HOMES	65	65
		SEMI DETACH HOMES	16	16
	PARCEL - B ADULT COMMUNITY LIFE STYLE	TOWN HOMES	102	102
	PARCEL - C SENIOR'S COMMUNITY	APARTMENTS (2 BUILDINGS X 90)	180	67 (SURFACE PARKING)
				123 (UNDER GROUND PARKING)
		VISITOR PARKING		15
		PLAZA PARKING		10
		TOTAL	**363**	**398**



NO.	DATE	REVISION

*** NOT FOR SITE PLAN APPROVAL**
*** NOT FOR CONSTRUCTION**
*** ONLY FOR PRELIMINARY DISCUSSION**

DEVELOPED BY:

MAMTA HOMES

CONSULTING ENGINEER :

KRESIN
Engineering Corporation

RPDS
INTEGRATED DESIGN FIRM
SUITE 203, 7895 TRANMERE DR., MISSISSAUGA, ON L5S 1V9
MAIL: PROJECT@RPDSTUDIO.CA, CALL: 647-556-2596
WEBSITE: WWW.RPDSTUDIO.CA

PROJECT & CLIENT

0 CHIPPEWA STREET

CITY OF SAULT STE. MARIE
DISTRICT OF ALGOMA

DRAWING TITLE

CONCEPT
MASTER PLAN

DRAWING NO.

N

SCALE :- 1:900

D

Appendix D
Sightline Assessment

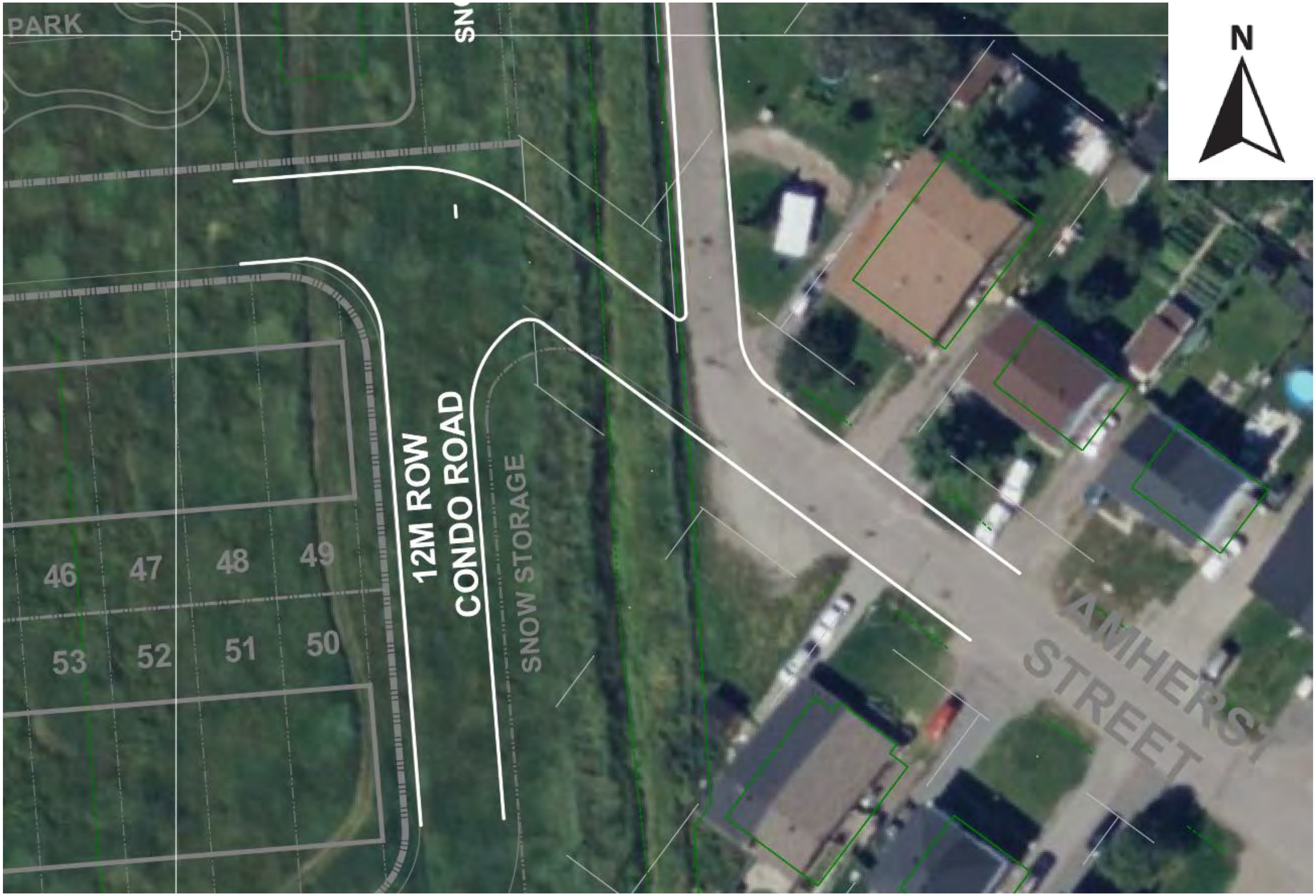

PARK
N
12M ROW
CONDO ROAD
SNOW STORAGE
46
47
48
49
53
52
51
50
AMHERST
STREET

Photo Looking East

Photo Looking West

Photo Looking South

Photo Looking South from Lane

E

Appendix E
Existing Synchro and SimTraffic Outputs

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-20-2024

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	67	352	27	37	219	169	17	122	64	210	120	40
Future Volume (vph)	67	352	27	37	219	169	17	122	64	210	120	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.93		1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1686	3367		1768	1686		1739	1746		1765	1763	
Flt Permitted	0.37	1.00		0.51	1.00		0.65	1.00		0.40	1.00	
Satd. Flow (perm)	659	3367		950	1686		1186	1746		749	1763	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	383	29	40	238	184	18	133	70	228	130	43
RTOR Reduction (vph)	0	5	0	0	25	0	0	25	0	0	16	0
Lane Group Flow (vph)	73	407	0	40	397	0	18	178	0	228	157	0
Confl. Peds. (#/hr)	5		1	1		5	6		10	10		6
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	49.6	49.6		40.0	40.0		16.4	16.4		27.4	27.4	
Effective Green, g (s)	49.6	49.6		40.0	40.0		16.4	16.4		27.4	27.4	
Actuated g/C Ratio	0.55	0.55		0.44	0.44		0.18	0.18		0.30	0.30	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	427	1855		422	749		216	318		307	536	
v/s Ratio Prot	0.01	c0.12			c0.24			0.10		c0.06	0.09	
v/s Ratio Perm	0.08			0.04			0.02			c0.17		
v/c Ratio	0.17	0.22		0.09	0.53		0.08	0.56		0.74	0.29	
Uniform Delay, d1	10.4	10.3		14.5	18.2		30.6	33.5		27.1	23.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.3		0.4	2.7		0.2	2.3		9.3	0.3	
Delay (s)	10.6	10.6		14.9	20.8		30.7	35.8		36.4	24.2	
Level of Service	B	B		B	C		C	D		D	C	
Approach Delay (s)		10.6			20.3			35.4			31.1	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖↗			↰	↱	
Traffic Volume (veh/h)	4	16	3	17	22	5
Future Volume (Veh/h)	4	16	3	17	22	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	0.80	0.75	0.85	0.79	0.63
Hourly flow rate (vph)	4	20	4	20	28	8
Pedestrians	3			16	16	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	79	51	39			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	79	51	39			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	100	98	100			
cM capacity (veh/h)	854	1007	1580			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	24	24	36
Volume Left	4	4	0
Volume Right	20	0	8
cSH	977	1580	1700
Volume to Capacity	0.02	0.00	0.02
Queue Length 95th (m)	0.6	0.1	0.0
Control Delay (s)	8.8	1.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	1.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	18.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Goulais Ave & Chippewa St

02-20-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↳	
Traffic Volume (veh/h)	15	51	16	176	200	11
Future Volume (Veh/h)	15	51	16	176	200	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.85	0.80	0.90	0.89	0.69
Hourly flow rate (vph)	16	60	20	196	225	16
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	383	245	247			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	383	245	247			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	97	92	98			
cM capacity (veh/h)	582	742	1170			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	76	85	131	241
Volume Left	16	20	0	0
Volume Right	60	0	0	16
cSH	701	1170	1700	1700
Volume to Capacity	0.11	0.02	0.08	0.14
Queue Length 95th (m)	2.9	0.4	0.0	0.0
Control Delay (s)	10.8	2.0	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	10.8	0.8		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	29.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

02-20-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Traffic Volume (veh/h)	17	75	31	312	235	40
Future Volume (Veh/h)	17	75	31	312	235	40
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.86	0.88	0.89	0.83
Hourly flow rate (vph)	20	88	36	355	264	48
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	538	156	312			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	538	156	312			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	96	90	97			
cM capacity (veh/h)	465	846	1238			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	108	154	237	176	136
Volume Left	20	36	0	0	0
Volume Right	88	0	0	0	48
cSH	735	1238	1700	1700	1700
Volume to Capacity	0.15	0.03	0.14	0.10	0.08
Queue Length 95th (m)	4.1	0.7	0.0	0.0	0.0
Control Delay (s)	10.7	2.1	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	10.7	0.8		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	32.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

02-20-2024

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		↲↳	
Traffic Volume (veh/h)	16	414	216	15	33	16
Future Volume (Veh/h)	16	414	216	15	33	16
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.83	0.73	0.75	0.83	0.80
Hourly flow rate (vph)	20	499	296	20	40	20
Pedestrians		4	4		5	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	321				854	315
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	321				854	315
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	98				87	97
cM capacity (veh/h)	1245				311	711

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	519	316	60
Volume Left	20	0	40
Volume Right	0	20	20
cSH	1245	1700	383
Volume to Capacity	0.02	0.19	0.16
Queue Length 95th (m)	0.4	0.0	4.4
Control Delay (s)	0.5	0.0	16.1
Lane LOS	A		C
Approach Delay (s)	0.5	0.0	16.1
Approach LOS			C

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	29.8	34.1	35.6	15.6	87.1	24.1	56.6	57.3	44.8
Average Queue (m)	9.4	14.3	18.7	4.9	36.1	4.7	30.1	31.2	20.9
95th Queue (m)	23.2	27.7	32.9	12.8	67.0	15.8	50.5	51.9	37.9
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							1		
Queuing Penalty (veh)							0		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB
Directions Served	LR
Maximum Queue (m)	15.8
Average Queue (m)	4.6
95th Queue (m)	12.7
Link Distance (m)	339.8
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	19.0	9.1	1.8	1.7
Average Queue (m)	8.3	0.8	0.1	0.1
95th Queue (m)	14.3	4.9	1.3	1.2
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	23.0	12.1
Average Queue (m)	10.2	1.8
95th Queue (m)	16.9	8.2
Link Distance (m)	304.9	354.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	15.8	7.8	22.6
Average Queue (m)	1.2	0.4	8.7
95th Queue (m)	8.1	3.7	17.2
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 0

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-20-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	40	441	32	133	491	148	48	109	90	211	170	57
Future Volume (vph)	40	441	32	133	491	148	48	109	90	211	170	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.93		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3365		1756	1739		1728	1691		1761	1757	
Flt Permitted	0.16	1.00		0.46	1.00		0.61	1.00		0.38	1.00	
Satd. Flow (perm)	276	3365		855	1739		1101	1691		706	1757	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	479	35	145	534	161	52	118	98	229	185	62
RTOR Reduction (vph)	0	5	0	0	10	0	0	38	0	0	16	0
Lane Group Flow (vph)	43	509	0	145	685	0	52	178	0	229	231	0
Confl. Peds. (#/hr)	17		9	9		17	12		21	21		12
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	49.4	49.4		41.2	41.2		16.6	16.6		27.6	27.6	
Effective Green, g (s)	49.4	49.4		41.2	41.2		16.6	16.6		27.6	27.6	
Actuated g/C Ratio	0.55	0.55		0.46	0.46		0.18	0.18		0.31	0.31	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	217	1847		391	796		203	311		298	538	
v/s Ratio Prot	0.01	c0.15			c0.39			0.11		c0.06	0.13	
v/s Ratio Perm	0.10			0.17			0.05			c0.18		
v/c Ratio	0.20	0.28		0.37	0.86		0.26	0.57		0.77	0.43	
Uniform Delay, d1	13.9	10.8		15.9	21.8		31.4	33.5		27.2	24.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.4		2.7	11.8		0.7	2.5		11.3	0.6	
Delay (s)	14.4	11.2		18.6	33.6		32.1	36.0		38.5	25.5	
Level of Service	B	B		B	C		C	D		D	C	
Approach Delay (s)		11.4			31.0			35.2			31.7	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	26.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-20-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Traffic Volume (veh/h)	6	15	9	13	17	7
Future Volume (Veh/h)	6	15	9	13	17	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.81	0.71	0.88
Hourly flow rate (vph)	8	20	12	16	24	8
Pedestrians	4			3	2	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	74	35	36			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	74	35	36			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	99	98	99			
cM capacity (veh/h)	865	1038	1583			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	28	28	32
Volume Left	8	12	0
Volume Right	20	0	8
cSH	982	1583	1700
Volume to Capacity	0.03	0.01	0.02
Queue Length 95th (m)	0.7	0.2	0.0
Control Delay (s)	8.8	3.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	3.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	18.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Goulais Ave & Chippewa St

02-20-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↳	
Traffic Volume (veh/h)	10	23	30	177	182	5
Future Volume (Veh/h)	10	23	30	177	182	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.63	0.64	0.68	0.69	0.69	0.63
Hourly flow rate (vph)	16	36	44	257	264	8
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	496	280	278			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	496	280	278			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	97	95	96			
cM capacity (veh/h)	483	704	1137			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	52	130	171	272
Volume Left	16	44	0	0
Volume Right	36	0	0	8
cSH	617	1137	1700	1700
Volume to Capacity	0.08	0.04	0.10	0.16
Queue Length 95th (m)	2.2	1.0	0.0	0.0
Control Delay (s)	11.4	3.0	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	11.4	1.3		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

02-20-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Traffic Volume (veh/h)	8	48	49	215	244	14
Future Volume (Veh/h)	8	48	49	215	244	14
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.67	0.80	0.88	0.88	0.86	0.88
Hourly flow rate (vph)	12	60	56	244	284	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	526	150	300			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	526	150	300			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	97	93	96			
cM capacity (veh/h)	465	854	1251			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	72	137	163	189	111
Volume Left	12	56	0	0	0
Volume Right	60	0	0	0	16
cSH	749	1251	1700	1700	1700
Volume to Capacity	0.10	0.04	0.10	0.11	0.07
Queue Length 95th (m)	2.5	1.1	0.0	0.0	0.0
Control Delay (s)	10.3	3.5	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	10.3	1.6		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	28.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

02-20-2024

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		↲↳	
Traffic Volume (veh/h)	8	444	367	49	30	12
Future Volume (Veh/h)	8	444	367	49	30	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	0.90	0.90	0.88	0.83	0.75
Hourly flow rate (vph)	8	493	408	56	36	16
Pedestrians		24	24		36	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		2	2		3	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	500				1005	496
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	500				1005	496
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				85	97
cM capacity (veh/h)	1042				244	538

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	501	464	52
Volume Left	8	0	36
Volume Right	0	56	16
cSH	1042	1700	293
Volume to Capacity	0.01	0.27	0.18
Queue Length 95th (m)	0.2	0.0	5.1
Control Delay (s)	0.2	0.0	19.9
Lane LOS	A		C
Approach Delay (s)	0.2	0.0	19.9
Approach LOS			C

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	26.7	41.1	46.9	77.2	178.0	38.1	54.8	59.2	59.4
Average Queue (m)	8.8	20.7	26.2	21.9	87.5	11.4	28.2	29.7	28.1
95th Queue (m)	20.2	35.6	44.0	61.9	162.2	26.4	47.3	49.0	48.0
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)						0	1		
Queuing Penalty (veh)						0	0		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	20.6	1.7
Average Queue (m)	5.7	0.1
95th Queue (m)	14.8	1.2
Link Distance (m)	339.8	424.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	12.3	20.1	4.8	1.9
Average Queue (m)	5.8	2.4	0.2	0.1
95th Queue (m)	12.2	11.5	2.8	1.3
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	17.7	12.8
Average Queue (m)	8.7	2.7
95th Queue (m)	16.0	10.0
Link Distance (m)	304.9	354.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	18.5	27.5	19.0
Average Queue (m)	2.8	3.2	7.7
95th Queue (m)	11.6	14.7	16.4
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 0

F

Appendix F
Signal Timing Plans

Intersection Location:	Second Line @ Sackville Rd
Control Type:	Coordianted and Actuated
Signal Timing Plan Effect Day:	Monday to Friday
If Coordianted	
Coordinate Street:	Second Line
Offset (s):	19
Cycle Length (s):	90
Signal Timing effect Time period :	6:45 am - 8:15 am & 9:30 am - 11:30 am & 1 pm - 2:40 pm & 5:40 pm - 10 pm
Northbound Direction Street Name:	Sackville Rd
Total Split (s):	43
Arrow Green	
Minimum(s):	7
Extension (s):	4
Maximum(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	15
Extension (s):	4
Maximum(s):	35-40
Through Amber (s):	4.3
Through All Red (s):	1.7
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8
Southbound Direction Street Name:	Sackville Rd
Total Split (s)	43
Arrow Green	
Minimum Green Time (s):	7
Extension (s):	4
Max Green Time(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	15
Extension (s):	4
Maximum(s):	35-40
Through Amber (s):	4.3
Through All Red (s):	1.7
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8
Eastbound Direction Street Name:	Second Line
Total Split (s)	47
Arrow Green	
Minimum Green Time (s):	7

Extension (s):	4
Max Green Time(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	20
Extension (s):	4
Maximum(s):	40-50
Through Amber (s):	5.4
Through All Red (s):	1.6
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8
Westbound Direction Street Name:	Second Line
Total Split (s)	47
ArrowGreen	
Minimum Green Time (s):	7
Extension (s):	4
Max Green Time(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	20
Extension (s):	4
Maximum(s):	40-50
Through Amber (s):	5.4
Through All Red (s):	1.6
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8

Intersection Location:	Second Line @ Sackville Rd
Control Type:	Coordianted and Actuated
Signal Timing Plan Effect Day:	Monday to Friday
If Coordianted	
Coordinate Street:	Second Line
Offset (s):	9
Cycle Length (s):	100
Signal Timing effect Time period :	8:15 am - 9:30 am & 11:30 an - 1:00 pm
Northbound Direction Street Name:	Sackville Rd
Total Split (s):	46
Arrow Green	
Minimum(s):	14
Extension (s):	4
Maximum(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1.7
Through Green	
Minimum (s):	15
Extension (s):	4
Maximum(s):	35-40
Through Amber (s):	4.3
Through All Red (s):	1.7
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8
Southbound Direction Street Name:	Sackville Rd
Total Split (s)	46
Arrow Green	
Minimum Green Time (s):	14
Extension (s):	4
Max Green Time(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	15
Extension (s):	4
Maximum(s):	35-40
Through Amber (s):	4.3
Through All Red (s):	1.7
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8
Eastbound Direction Street Name:	Second Line
Total Split (s)	54
Arrow Green	
Minimum Green Time (s):	13

Extension (s):	4
Max Green Time(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	20
Extension (s):	4
Maximum(s):	40-50
Through Amber (s):	5.4
Through All Red (s):	1.6
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8
Westbound Direction Street Name:	Second LIne
Total Split (s)	54
ArrowGreen	
Minimum Green Time (s):	13
Extension (s):	4
Max Green Time(s):	35-40
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	20
Extension (s):	4
Maximum(s):	40-50
Through Amber (s):	5.4
Through All Red (s):	1.6
Pedestrian Walk (s)	13
Pedestrian Flash-Do Not Walk (s)	8

Intersection Location:	Second Line @ Goulais Ave
Control Type:	Coordianted and Actuated
Signal Timing Plan Effect Day:	Sunday to Saturday
If Coordianted	
Coordinate Street:	Second Line
Offset (s):	15
Cycle Length (s):	90
Signal Timing effect Time period :	6:45 - 22:00
Northbound Direction Street Name:	Goulais Ave
Total Split (s):	45
Arrow Green	
Minimum(s):	0
Extension (s):	0
Maximum(s):	0
Arrow Amber Time (s):	0
Arrow All-Red Time (s)	0
Through Green	
Minimum (s):	12
Extension (s):	3
Maximum(s):	45-55
Through Amber (s):	4.3
Through All Red (s):	1.7
Pedestrian Walk (s)	7
Pedestrian Flash-Do Not Walk (s)	20
Southbound Direction Street Name:	Goulais Ave
Total Split (s)	45
Arrow Green	
Minimum Green Time (s):	7
Extension (s):	3
Max Green Time(s):	35-45
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	12
Extension (s):	3
Maximum(s):	45-55
Through Amber (s):	4.3
Through All Red (s):	1.7
Pedestrian Walk (s)	7
Pedestrian Flash-Do Not Walk (s)	20
Eastbound Direction Street Name:	Second Line
Total Split (s)	45
Arrow Green	
Minimum Green Time (s):	7

Extension (s):	3
Max Green Time(s):	35-45
Arrow Amber Time (s):	3
Arrow All-Red Time (s)	1
Through Green	
Minimum (s):	12
Extension (s):	3
Maximum(s):	45-55
Through Amber (s):	5.4
Through All Red (s):	1.6
Pedestrian Walk (s)	7
Pedestrian Flash-Do Not Walk (s)	19
Westbound Direction Street Name:	Second LIne
Total Split (s)	45
ArrowGreen	
Minimum Green Time (s):	0
Extension (s):	0
Max Green Time(s):	0
Arrow Amber Time (s):	0
Arrow All-Red Time (s)	0
Through Green	
Minimum (s):	12
Extension (s):	3
Maximum(s):	45-55
Through Amber (s):	5.4
Through All Red (s):	1.6
Pedestrian Walk (s)	7
Pedestrian Flash-Do Not Walk (s)	19

Intersection Location:	
Control Type:	
Signal Timing Plan Effect Day:	
If Coordianted	
Coordinate Street:	
Offset (s):	
Cycle Length (s):	
Signal Timing effect Time period :	
Northbound Direction Street Name:	
Total Split (s):	
Arrow Green	
Minimum(s):	
Extension (s):	
Maximum(s):	
Arrow Amber Time (s):	
Arrow All-Red Time (s)	
Through Green	
Minimum (s):	
Extension (s):	
Maximum(s):	
Through Amber (s):	
Through All Red (s):	
Pedestrian Walk (s)	
Pedestrian Flash-Do Not Walk (s)	
Southbound Direction Street Name:	
Total Split (s)	
Arrow Green	
Minimum Green Time (s):	
Extension (s):	
Max Green Time(s):	
Arrow Amber Time (s):	
Arrow All-Red Time (s)	
Through Green	
Minimum (s):	
Extension (s):	
Maximum(s):	
Through Amber (s):	
Through All Red (s):	
Pedestrian Walk (s)	
Pedestrian Flash-Do Not Walk (s)	
Eastbound Direction Street Name:	
Total Split (s)	
Arrow Green	
Minimum Green Time (s):	

Extension (s):	
Max Green Time(s):	
Arrow Amber Time (s):	
Arrow All-Red Time (s)	
Through Green	
Minimum (s):	
Extension (s):	
Maximum(s):	
Through Amber (s):	
Through All Red (s):	
Pedestrian Walk (s)	
Pedestrian Flash-Do Not Walk (s)	
Westbound Direction Street Name:	
Total Split (s)	
ArrowGreen	
Minimum Green Time (s):	
Extension (s):	
Max Green Time(s):	
Arrow Amber Time (s):	
Arrow All-Red Time (s)	
Through Green	
Minimum (s):	
Extension (s):	
Maximum(s):	
Through Amber (s):	
Through All Red (s):	
Pedestrian Walk (s)	
Pedestrian Flash-Do Not Walk (s)	

G

Appendix G
2032 Future Background Synchro and SimTraffic Outputs

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-21-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	73	385	30	40	240	185	19	133	70	230	131	44
Future Volume (vph)	73	385	30	40	240	185	19	133	70	230	131	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.93		1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1686	3365		1768	1686		1739	1746		1766	1761	
Flt Permitted	0.33	1.00		0.49	1.00		0.64	1.00		0.38	1.00	
Satd. Flow (perm)	588	3365		915	1686		1168	1746		702	1761	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	418	33	43	261	201	21	145	76	250	142	48
RTOR Reduction (vph)	0	5	0	0	25	0	0	24	0	0	16	0
Lane Group Flow (vph)	79	446	0	43	437	0	21	197	0	250	174	0
Confl. Peds. (#/hr)	5		1	1		5	6		10	10		6
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	49.0	49.0		39.4	39.4		17.0	17.0		28.0	28.0	
Effective Green, g (s)	49.0	49.0		39.4	39.4		17.0	17.0		28.0	28.0	
Actuated g/C Ratio	0.54	0.54		0.44	0.44		0.19	0.19		0.31	0.31	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	388	1832		400	738		220	329		301	547	
v/s Ratio Prot	0.01	c0.13			c0.26			0.11		c0.06	0.10	
v/s Ratio Perm	0.10			0.05			0.02			c0.19		
v/c Ratio	0.20	0.24		0.11	0.59		0.10	0.60		0.83	0.32	
Uniform Delay, d1	11.1	10.8		14.9	19.2		30.1	33.4		27.9	23.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		0.5	3.5		0.2	2.9		17.4	0.3	
Delay (s)	11.3	11.1		15.5	22.7		30.3	36.3		45.3	24.0	
Level of Service	B	B		B	C		C	D		D	C	
Approach Delay (s)		11.1			22.1			35.8			36.1	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-21-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	4	17	3	19	24	5
Future Volume (Veh/h)	4	17	3	19	24	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	0.80	0.75	0.85	0.79	0.63
Hourly flow rate (vph)	4	21	4	22	30	8
Pedestrians	3			16	16	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	83	53	41			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	83	53	41			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	100	98	100			
cM capacity (veh/h)	849	1004	1577			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	25	26	38
Volume Left	4	4	0
Volume Right	21	0	8
cSH	976	1577	1700
Volume to Capacity	0.03	0.00	0.02
Queue Length 95th (m)	0.6	0.1	0.0
Control Delay (s)	8.8	1.1	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	1.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	18.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Goulais Ave & Chippewa St

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↱	
Traffic Volume (veh/h)	16	56	17	192	219	12
Future Volume (Veh/h)	16	56	17	192	219	12
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.85	0.80	0.90	0.89	0.69
Hourly flow rate (vph)	17	66	21	213	246	17
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	415	266	269			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	415	266	269			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	97	91	98			
cM capacity (veh/h)	555	718	1146			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	83	92	142	263
Volume Left	17	21	0	0
Volume Right	66	0	0	17
cSH	677	1146	1700	1700
Volume to Capacity	0.12	0.02	0.08	0.15
Queue Length 95th (m)	3.3	0.4	0.0	0.0
Control Delay (s)	11.1	2.0	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	11.1	0.8		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

02-21-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Traffic Volume (veh/h)	19	82	34	341	257	44
Future Volume (Veh/h)	19	82	34	341	257	44
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.86	0.88	0.89	0.83
Hourly flow rate (vph)	22	96	40	388	289	53
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	590	171	342			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	590	171	342			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	95	88	97			
cM capacity (veh/h)	429	827	1207			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	118	169	259	193	149
Volume Left	22	40	0	0	0
Volume Right	96	0	0	0	53
cSH	705	1207	1700	1700	1700
Volume to Capacity	0.17	0.03	0.15	0.11	0.09
Queue Length 95th (m)	4.8	0.8	0.0	0.0	0.0
Control Delay (s)	11.1	2.1	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.1	0.8		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

02-21-2024

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Volume (veh/h)	17	453	236	16	36	17
Future Volume (Veh/h)	17	453	236	16	36	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.83	0.73	0.75	0.83	0.80
Hourly flow rate (vph)	21	546	323	21	43	21
Pedestrians		4	4		5	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	349				930	342
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	349				930	342
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	98				85	97
cM capacity (veh/h)	1216				280	686

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	567	344	64
Volume Left	21	0	43
Volume Right	0	21	21
cSH	1216	1700	347
Volume to Capacity	0.02	0.20	0.18
Queue Length 95th (m)	0.4	0.0	5.3
Control Delay (s)	0.5	0.0	17.7
Lane LOS	A		C
Approach Delay (s)	0.5	0.0	17.7
Approach LOS			C

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	34.5	39.0	42.1	20.5	84.8	23.5	78.2	62.2	50.9
Average Queue (m)	12.2	18.0	21.9	6.0	41.0	4.7	35.6	33.6	22.5
95th Queue (m)	26.3	32.7	39.3	14.1	71.8	15.3	62.3	55.5	41.5
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							3		
Queuing Penalty (veh)							1		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB
Directions Served	LR
Maximum Queue (m)	12.9
Average Queue (m)	4.9
95th Queue (m)	12.9
Link Distance (m)	339.8
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	17.0	14.0	1.7	9.4
Average Queue (m)	8.2	1.4	0.1	0.5
95th Queue (m)	13.9	7.9	1.2	4.6
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	19.0	12.9	1.3
Average Queue (m)	10.5	2.9	0.0
95th Queue (m)	16.7	10.2	0.9
Link Distance (m)	304.9	354.3	515.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	17.0	6.0	22.8
Average Queue (m)	1.2	0.2	8.8
95th Queue (m)	8.0	3.0	17.9
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 1

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	44	482	35	145	537	162	52	119	98	231	186	62
Future Volume (vph)	44	482	35	145	537	162	52	119	98	231	186	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.93		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3365		1757	1739		1728	1691		1763	1758	
Flt Permitted	0.10	1.00		0.44	1.00		0.59	1.00		0.35	1.00	
Satd. Flow (perm)	173	3365		816	1739		1080	1691		654	1758	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	524	38	158	584	176	57	129	107	251	202	67
RTOR Reduction (vph)	0	5	0	0	9	0	0	38	0	0	16	0
Lane Group Flow (vph)	48	557	0	158	751	0	57	198	0	251	253	0
Confl. Peds. (#/hr)	17		9	9		17	12		21	21		12
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	48.8	48.8		40.6	40.6		17.2	17.2		28.2	28.2	
Effective Green, g (s)	48.8	48.8		40.6	40.6		17.2	17.2		28.2	28.2	
Actuated g/C Ratio	0.54	0.54		0.45	0.45		0.19	0.19		0.31	0.31	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	164	1824		368	784		206	323		291	550	
v/s Ratio Prot	0.01	c0.17			c0.43			0.12		c0.07	0.14	
v/s Ratio Perm	0.14			0.19			0.05			c0.20		
v/c Ratio	0.29	0.31		0.43	0.96		0.28	0.61		0.86	0.46	
Uniform Delay, d1	16.3	11.3		16.8	23.9		31.1	33.4		28.1	24.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.4		3.6	23.3		0.7	3.4		22.2	0.6	
Delay (s)	17.3	11.7		20.4	47.2		31.8	36.8		50.3	25.4	
Level of Service	B	B		C	D		C	D		D	C	
Approach Delay (s)		12.2			42.6			35.8			37.4	
Approach LOS		B			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-21-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	7	16	10	14	19	8
Future Volume (Veh/h)	7	16	10	14	19	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.81	0.71	0.88
Hourly flow rate (vph)	9	21	13	17	27	9
Pedestrians	4			3	2	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	80	38	40			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	80	38	40			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	99	98	99			
cM capacity (veh/h)	857	1033	1577			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	30	30	36
Volume Left	9	13	0
Volume Right	21	0	9
cSH	973	1577	1700
Volume to Capacity	0.03	0.01	0.02
Queue Length 95th (m)	0.8	0.2	0.0
Control Delay (s)	8.8	3.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	3.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	18.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑↑	↱	
Traffic Volume (veh/h)	11	25	33	194	199	5
Future Volume (Veh/h)	11	25	33	194	199	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.63	0.64	0.68	0.69	0.69	0.63
Hourly flow rate (vph)	17	39	49	281	288	8
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	542	304	302			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	542	304	302			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	96	94	96			
cM capacity (veh/h)	450	679	1111			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	56	143	187	296
Volume Left	17	49	0	0
Volume Right	39	0	0	8
cSH	588	1111	1700	1700
Volume to Capacity	0.10	0.04	0.11	0.17
Queue Length 95th (m)	2.5	1.1	0.0	0.0
Control Delay (s)	11.8	3.1	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	11.8	1.4		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

02-21-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Traffic Volume (veh/h)	9	52	54	235	267	15
Future Volume (Veh/h)	9	52	54	235	267	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.67	0.80	0.88	0.88	0.86	0.88
Hourly flow rate (vph)	13	65	61	267	310	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	574	164	327			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	574	164	327			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	97	92	95			
cM capacity (veh/h)	431	837	1222			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	78	150	178	207	120
Volume Left	13	61	0	0	0
Volume Right	65	0	0	0	17
cSH	723	1222	1700	1700	1700
Volume to Capacity	0.11	0.05	0.10	0.12	0.07
Queue Length 95th (m)	2.9	1.3	0.0	0.0	0.0
Control Delay (s)	10.6	3.5	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	10.6	1.6		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

	↗	→	←	↖	↘	↙
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰↑	↑↱		↙↘	
Traffic Volume (veh/h)	9	486	401	54	33	13
Future Volume (Veh/h)	9	486	401	54	33	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	0.90	0.90	0.88	0.83	0.75
Hourly flow rate (vph)	9	540	446	61	40	17
Pedestrians		24	24		36	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		2	2		3	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	543				1094	536
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	543				1094	536
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				81	97
cM capacity (veh/h)	1005				215	510

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	549	507	57
Volume Left	9	0	40
Volume Right	0	61	17
cSH	1005	1700	260
Volume to Capacity	0.01	0.30	0.22
Queue Length 95th (m)	0.2	0.0	6.5
Control Delay (s)	0.3	0.0	22.7
Lane LOS	A		C
Approach Delay (s)	0.3	0.0	22.7
Approach LOS			C

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	26.1	44.4	48.9	122.5	228.6	49.0	80.1	60.7	72.8
Average Queue (m)	9.4	23.1	28.0	25.4	108.4	11.7	34.1	31.9	31.7
95th Queue (m)	20.6	38.6	45.4	70.2	205.6	27.6	61.8	52.1	58.9
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							3		
Queuing Penalty (veh)							1		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	16.7	1.8
Average Queue (m)	4.9	0.1
95th Queue (m)	13.4	1.3
Link Distance (m)	339.8	424.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	10.8	18.2	5.3	3.7
Average Queue (m)	5.7	3.0	0.2	0.1
95th Queue (m)	11.9	11.8	2.2	1.9
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	17.0	13.1
Average Queue (m)	8.3	3.2
95th Queue (m)	15.2	10.9
Link Distance (m)	304.9	354.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	40.8	32.8	22.6
Average Queue (m)	6.0	4.0	8.5
95th Queue (m)	23.7	17.7	18.0
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 1

H

Appendix H
2035 Future Background Synchro and SimTraffic Outputs

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-21-2024

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	75	397	31	41	247	191	20	137	72	237	135	45
Future Volume (vph)	75	397	31	41	247	191	20	137	72	237	135	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.93		1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1686	3365		1768	1685		1739	1747		1766	1762	
Flt Permitted	0.32	1.00		0.48	1.00		0.63	1.00		0.37	1.00	
Satd. Flow (perm)	563	3365		901	1685		1162	1747		687	1762	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	432	34	45	268	208	22	149	78	258	147	49
RTOR Reduction (vph)	0	5	0	0	25	0	0	24	0	0	16	0
Lane Group Flow (vph)	82	461	0	45	451	0	22	203	0	258	180	0
Confl. Peds. (#/hr)	5		1	1		5	6		10	10		6
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	48.8	48.8		39.2	39.2		17.2	17.2		28.2	28.2	
Effective Green, g (s)	48.8	48.8		39.2	39.2		17.2	17.2		28.2	28.2	
Actuated g/C Ratio	0.54	0.54		0.44	0.44		0.19	0.19		0.31	0.31	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	375	1824		392	733		222	333		299	552	
v/s Ratio Prot	0.01	c0.14			c0.27			0.12		c0.07	0.10	
v/s Ratio Perm	0.10			0.05			0.02			c0.20		
v/c Ratio	0.22	0.25		0.11	0.61		0.10	0.61		0.86	0.33	
Uniform Delay, d1	11.3	10.9		15.1	19.6		30.0	33.3		28.2	23.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		0.6	3.8		0.2	3.1		21.7	0.3	
Delay (s)	11.6	11.3		15.7	23.4		30.2	36.5		49.9	24.0	
Level of Service	B	B		B	C		C	D		D	C	
Approach Delay (s)		11.3			22.7			35.9			38.7	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Traffic Volume (veh/h)	4	18	3	20	25	5
Future Volume (Veh/h)	4	18	3	20	25	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	0.80	0.75	0.85	0.79	0.63
Hourly flow rate (vph)	4	22	4	24	32	8
Pedestrians	3			16	16	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	87	55	43			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	87	55	43			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	100	98	100			
cM capacity (veh/h)	845	1001	1575			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	26	28	40
Volume Left	4	4	0
Volume Right	22	0	8
cSH	974	1575	1700
Volume to Capacity	0.03	0.00	0.02
Queue Length 95th (m)	0.7	0.1	0.0
Control Delay (s)	8.8	1.1	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	1.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	18.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Goulais Ave & Chippewa St

02-21-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↱	
Traffic Volume (veh/h)	16	58	18	198	226	12
Future Volume (Veh/h)	16	58	18	198	226	12
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.85	0.80	0.90	0.89	0.69
Hourly flow rate (vph)	17	68	22	220	254	17
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	428	274	277			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	428	274	277			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	97	90	98			
cM capacity (veh/h)	544	710	1138			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	85	95	147	271
Volume Left	17	22	0	0
Volume Right	68	0	0	17
cSH	669	1138	1700	1700
Volume to Capacity	0.13	0.02	0.09	0.16
Queue Length 95th (m)	3.5	0.5	0.0	0.0
Control Delay (s)	11.2	2.0	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	11.2	0.8		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	32.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

02-21-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Traffic Volume (veh/h)	20	84	35	351	265	45
Future Volume (Veh/h)	20	84	35	351	265	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.86	0.88	0.89	0.83
Hourly flow rate (vph)	24	99	41	399	298	54
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	606	176	352			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	606	176	352			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	94	88	97			
cM capacity (veh/h)	418	821	1196			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	123	174	266	199	153
Volume Left	24	41	0	0	0
Volume Right	99	0	0	0	54
cSH	691	1196	1700	1700	1700
Volume to Capacity	0.18	0.03	0.16	0.12	0.09
Queue Length 95th (m)	5.1	0.9	0.0	0.0	0.0
Control Delay (s)	11.3	2.1	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.3	0.8		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	35.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

02-21-2024

	↗	→	←	↖	↘	↙
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰↑	↑↱		↲↳	
Traffic Volume (veh/h)	18	467	243	16	37	18
Future Volume (Veh/h)	18	467	243	16	37	18
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.83	0.73	0.75	0.83	0.80
Hourly flow rate (vph)	22	563	333	21	45	22
Pedestrians		4	4		5	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	359				960	352
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	359				960	352
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	98				83	97
cM capacity (veh/h)	1206				268	677

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	585	354	67
Volume Left	22	0	45
Volume Right	0	21	22
cSH	1206	1700	335
Volume to Capacity	0.02	0.21	0.20
Queue Length 95th (m)	0.4	0.0	5.9
Control Delay (s)	0.5	0.0	18.4
Lane LOS	A		C
Approach Delay (s)	0.5	0.0	18.4
Approach LOS			C

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	33.1	41.7	47.6	22.7	84.8	34.7	81.0	70.8	52.3
Average Queue (m)	12.1	18.2	23.1	6.8	40.8	6.0	33.8	34.6	23.2
95th Queue (m)	25.6	33.5	40.1	16.3	69.9	19.2	60.6	61.8	43.3
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							2		
Queuing Penalty (veh)							0		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB
Directions Served	LR
Maximum Queue (m)	17.7
Average Queue (m)	4.9
95th Queue (m)	13.3
Link Distance (m)	339.8
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	20.5	19.7	1.8	2.9
Average Queue (m)	8.6	2.1	0.1	0.1
95th Queue (m)	16.2	10.7	1.3	1.5
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	22.6	10.8	1.2
Average Queue (m)	11.1	2.5	0.0
95th Queue (m)	17.9	9.2	0.9
Link Distance (m)	304.9	354.3	515.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	16.4	5.4	22.6
Average Queue (m)	1.4	0.2	9.5
95th Queue (m)	9.2	2.2	17.7
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 0

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-21-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	45	497	36	149	553	167	54	123	101	238	192	64
Future Volume (vph)	45	497	36	149	553	167	54	123	101	238	192	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.93		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3365		1757	1738		1729	1692		1763	1758	
Flt Permitted	0.09	1.00		0.43	1.00		0.59	1.00		0.34	1.00	
Satd. Flow (perm)	160	3365		803	1738		1070	1692		633	1758	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	540	39	162	601	182	59	134	110	259	209	70
RTOR Reduction (vph)	0	5	0	0	10	0	0	38	0	0	16	0
Lane Group Flow (vph)	49	574	0	162	773	0	59	206	0	259	263	0
Confl. Peds. (#/hr)	17		9	9		17	12		21	21		12
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	48.6	48.6		40.4	40.4		17.4	17.4		28.4	28.4	
Effective Green, g (s)	48.6	48.6		40.4	40.4		17.4	17.4		28.4	28.4	
Actuated g/C Ratio	0.54	0.54		0.45	0.45		0.19	0.19		0.32	0.32	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	157	1817		360	780		206	327		287	554	
v/s Ratio Prot	0.01	c0.17			c0.44			0.12		c0.07	0.15	
v/s Ratio Perm	0.15			0.20			0.06			c0.21		
v/c Ratio	0.31	0.32		0.45	0.99		0.29	0.63		0.90	0.48	
Uniform Delay, d1	17.2	11.5		17.1	24.6		31.0	33.3		28.5	24.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.5		4.0	30.1		0.8	3.9		29.2	0.6	
Delay (s)	18.3	11.9		21.2	54.8		31.8	37.3		57.7	25.4	
Level of Service	B	B		C	D		C	D		E	C	
Approach Delay (s)		12.4			49.0			36.2			41.0	
Approach LOS		B			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	36.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-21-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	7	16	10	14	20	8
Future Volume (Veh/h)	7	16	10	14	20	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.81	0.71	0.88
Hourly flow rate (vph)	9	21	13	17	28	9
Pedestrians	4			3	2	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	82	40	41			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	82	40	41			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	99	98	99			
cM capacity (veh/h)	855	1032	1576			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	30	30	37
Volume Left	9	13	0
Volume Right	21	0	9
cSH	972	1576	1700
Volume to Capacity	0.03	0.01	0.02
Queue Length 95th (m)	0.8	0.2	0.0
Control Delay (s)	8.8	3.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	3.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	18.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Goulais Ave & Chippewa St

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↱	
Traffic Volume (veh/h)	11	26	34	200	205	5
Future Volume (Veh/h)	11	26	34	200	205	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.63	0.64	0.68	0.69	0.69	0.63
Hourly flow rate (vph)	17	41	50	290	297	8
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	558	313	311			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	558	313	311			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	96	94	95			
cM capacity (veh/h)	439	670	1102			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	58	147	193	305
Volume Left	17	50	0	0
Volume Right	41	0	0	8
cSH	581	1102	1700	1700
Volume to Capacity	0.10	0.05	0.11	0.18
Queue Length 95th (m)	2.7	1.1	0.0	0.0
Control Delay (s)	11.9	3.1	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	11.9	1.4		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	33.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

02-21-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Traffic Volume (veh/h)	9	54	56	242	275	15
Future Volume (Veh/h)	9	54	56	242	275	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.67	0.80	0.88	0.88	0.86	0.88
Hourly flow rate (vph)	13	68	64	275	320	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	594	168	337			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	594	168	337			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	97	92	95			
cM capacity (veh/h)	418	831	1212			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	81	156	183	213	124
Volume Left	13	64	0	0	0
Volume Right	68	0	0	0	17
cSH	717	1212	1700	1700	1700
Volume to Capacity	0.11	0.05	0.11	0.13	0.07
Queue Length 95th (m)	3.0	1.3	0.0	0.0	0.0
Control Delay (s)	10.7	3.6	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	10.7	1.7		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

02-21-2024

Movement	EBL	EBT	WBT	WBR	SBL	SBR
	↗	→	←	↖	↘	↙
Lane Configurations		↰↑	↑↱		↰↱	
Traffic Volume (veh/h)	9	501	413	56	34	13
Future Volume (Veh/h)	9	501	413	56	34	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	0.90	0.90	0.88	0.83	0.75
Hourly flow rate (vph)	9	557	459	64	41	17
Pedestrians		24	24		36	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		2	2		3	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	559				1126	551
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	559				1126	551
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				80	97
cM capacity (veh/h)	991				206	500

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	566	523	58
Volume Left	9	0	41
Volume Right	0	64	17
cSH	991	1700	249
Volume to Capacity	0.01	0.31	0.23
Queue Length 95th (m)	0.2	0.0	7.0
Control Delay (s)	0.3	0.0	23.8
Lane LOS	A		C
Approach Delay (s)	0.3	0.0	23.8
Approach LOS			C

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	23.2	47.3	53.5	137.5	275.7	37.4	76.8	58.2	67.9
Average Queue (m)	9.8	24.9	28.6	43.8	156.5	12.8	33.7	30.4	31.4
95th Queue (m)	21.4	41.2	47.8	138.0	319.6	29.7	60.6	49.6	55.8
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							3		
Queuing Penalty (veh)							1		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	18.8	3.7
Average Queue (m)	5.5	0.2
95th Queue (m)	14.8	2.3
Link Distance (m)	339.8	424.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	13.7	13.6	3.7	4.4
Average Queue (m)	5.5	2.3	0.1	0.1
95th Queue (m)	12.3	10.3	1.9	1.8
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	20.3	14.6
Average Queue (m)	9.0	3.8
95th Queue (m)	17.1	11.9
Link Distance (m)	304.9	354.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	27.3	25.6	18.6
Average Queue (m)	4.0	2.8	7.9
95th Queue (m)	16.4	13.1	16.7
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 1

Appendix I
2032 Future Total Synchro and SimTraffic Outputs

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-22-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	73	385	30	40	252	185	19	145	70	257	159	44
Future Volume (vph)	73	385	30	40	252	185	19	145	70	257	159	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1686	3365		1768	1689		1740	1755		1766	1775	
Flt Permitted	0.32	1.00		0.49	1.00		0.62	1.00		0.36	1.00	
Satd. Flow (perm)	562	3365		915	1689		1136	1755		668	1775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	418	33	43	274	201	21	158	76	279	173	48
RTOR Reduction (vph)	0	5	0	0	24	0	0	22	0	0	13	0
Lane Group Flow (vph)	79	446	0	43	451	0	21	212	0	279	208	0
Confl. Peds. (#/hr)	5		1	1		5	6		10	10		6
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	48.6	48.6		39.0	39.0		17.4	17.4		28.4	28.4	
Effective Green, g (s)	48.6	48.6		39.0	39.0		17.4	17.4		28.4	28.4	
Actuated g/C Ratio	0.54	0.54		0.43	0.43		0.19	0.19		0.32	0.32	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	373	1817		396	731		219	339		296	560	
v/s Ratio Prot	0.01	c0.13			c0.27			0.12		c0.07	0.12	
v/s Ratio Perm	0.10			0.05			0.02			c0.22		
v/c Ratio	0.21	0.25		0.11	0.62		0.10	0.63		0.94	0.37	
Uniform Delay, d1	11.4	11.0		15.2	19.7		29.8	33.3		29.2	23.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		0.6	3.9		0.2	3.6		37.1	0.4	
Delay (s)	11.7	11.3		15.7	23.6		30.0	36.9		66.3	24.3	
Level of Service	B	B		B	C		C	D		E	C	
Approach Delay (s)		11.4			22.9			36.3			47.7	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	28.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	81.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-22-2024

	↗	↘	↖	↑	↓	↙
Movement	**EBL**	**EBR**	**NBL**	**NBT**	**SBT**	**SBR**
Lane Configurations	Y			↰	↳	
Traffic Volume (veh/h)	40	48	33	19	24	5
Future Volume (Veh/h)	40	48	33	19	24	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	0.80	0.75	0.85	0.79	0.63
Hourly flow rate (vph)	40	60	44	22	30	8
Pedestrians	3			16	16	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	163	53	41			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	163	53	41			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	95	94	97			
cM capacity (veh/h)	744	1004	1577			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	100	66	38
Volume Left	40	44	0
Volume Right	60	0	8
cSH	881	1577	1700
Volume to Capacity	0.11	0.03	0.02
Queue Length 95th (m)	3.1	0.7	0.0
Control Delay (s)	9.6	5.0	0.0
Lane LOS	A	A	
Approach Delay (s)	9.6	5.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	6.3		
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)	15		

7: Goulais Ave & Chippewa St

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↱	
Traffic Volume (veh/h)	33	111	29	192	219	19
Future Volume (Veh/h)	33	111	29	192	219	19
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.85	0.80	0.90	0.89	0.69
Hourly flow rate (vph)	35	131	36	213	246	28
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	450	272	280			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	450	272	280			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	93	82	97			
cM capacity (veh/h)	520	713	1135			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	166	107	142	274
Volume Left	35	36	0	0
Volume Right	131	0	0	28
cSH	661	1135	1700	1700
Volume to Capacity	0.25	0.03	0.08	0.16
Queue Length 95th (m)	7.9	0.8	0.0	0.0
Control Delay (s)	12.3	3.0	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	12.3	1.3		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

8: Goulais Ave & Rushmere Dr

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	19	82	34	353	312	44
Future Volume (Veh/h)	19	82	34	353	312	44
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.86	0.88	0.89	0.83
Hourly flow rate (vph)	22	96	40	401	351	53
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	658	202	404			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	658	202	404			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	94	88	97			
cM capacity (veh/h)	388	790	1144			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	118	174	267	234	170
Volume Left	22	40	0	0	0
Volume Right	96	0	0	0	53
cSH	662	1144	1700	1700	1700
Volume to Capacity	0.18	0.03	0.16	0.14	0.10
Queue Length 95th (m)	5.2	0.9	0.0	0.0	0.0
Control Delay (s)	11.6	2.1	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.6	0.8		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

02-22-2024

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		↲↳	
Traffic Volume (veh/h)	35	453	236	28	36	48
Future Volume (Veh/h)	35	453	236	28	36	48
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.83	0.73	0.75	0.83	0.80
Hourly flow rate (vph)	44	546	323	37	43	60
Pedestrians		4	4		5	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	365				984	350
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	365				984	350
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	96				83	91
cM capacity (veh/h)	1200				254	679

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	590	360	103
Volume Left	44	0	43
Volume Right	0	37	60
cSH	1200	1700	400
Volume to Capacity	0.04	0.21	0.26
Queue Length 95th (m)	0.9	0.0	8.1
Control Delay (s)	1.0	0.0	17.1
Lane LOS	A		C
Approach Delay (s)	1.0	0.0	17.1
Approach LOS			C

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

15: Broadview Dr & Amherst St

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Traffic Volume (veh/h)	0	11	11	52	72	0
Future Volume (Veh/h)	0	11	11	52	72	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	12	12	57	78	0
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	159	78	78			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	159	78	78			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	99			
cM capacity (veh/h)	826	983	1520			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	12	69	78
Volume Left	0	12	0
Volume Right	12	0	0
cSH	983	1520	1700
Volume to Capacity	0.01	0.01	0.05
Queue Length 95th (m)	0.3	0.2	0.0
Control Delay (s)	8.7	1.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	1.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	20.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: Broadview Dr & Chippewa St

02-22-2024

Movement	EBT	EBR	WBL	WBT	NBL	NBR
	→	↘	↙	←	↖	↗
Lane Configurations	↱			↰	Y	
Traffic Volume (veh/h)	85	0	29	19	0	59
Future Volume (Veh/h)	85	0	29	19	0	59
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)	92	0	32	21	0	64
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			92		177	92
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			92		177	92
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	93
cM capacity (veh/h)			1503		795	965

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	92	53	64
Volume Left	0	32	0
Volume Right	0	0	64
cSH	1700	1503	965
Volume to Capacity	0.05	0.02	0.07
Queue Length 95th (m)	0.0	0.5	1.7
Control Delay (s)	0.0	4.6	9.0
Lane LOS		A	A
Approach Delay (s)	0.0	4.6	9.0
Approach LOS			A

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	28.6	37.8	51.8	23.0	86.3	19.0	67.5	64.4	57.2
Average Queue (m)	12.2	17.7	22.8	6.1	42.1	5.5	34.3	34.8	26.2
95th Queue (m)	25.1	32.3	41.1	15.8	73.7	15.3	60.5	56.7	48.7
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							3		
Queuing Penalty (veh)							1		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	22.8	7.2
Average Queue (m)	10.8	0.4
95th Queue (m)	18.5	3.6
Link Distance (m)	339.7	330.1
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	25.9	17.6	4.8	4.6
Average Queue (m)	10.8	2.2	0.2	0.2
95th Queue (m)	18.7	10.3	2.5	2.4
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	19.7	12.0	1.3
Average Queue (m)	10.7	2.9	0.0
95th Queue (m)	16.6	10.4	0.9
Link Distance (m)	304.9	354.3	515.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	26.2	5.1	25.1
Average Queue (m)	4.3	0.2	11.9
95th Queue (m)	16.8	3.0	21.1
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Broadview Dr

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	8.1	9.0
Average Queue (m)	2.1	0.5
95th Queue (m)	7.7	3.8
Link Distance (m)	270.7	77.1
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 17: Broadview Dr & Chippewa St

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	7.3	14.5
Average Queue (m)	0.3	6.8
95th Queue (m)	3.0	12.8
Link Distance (m)	380.6	125.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Zone Summary

Zone wide Queuing Penalty: 1

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-22-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	44	482	35	145	581	162	52	134	98	267	199	62
Future Volume (vph)	44	482	35	145	581	162	52	134	98	267	199	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3365		1757	1743		1729	1704		1763	1763	
Flt Permitted	0.09	1.00		0.44	1.00		0.59	1.00		0.33	1.00	
Satd. Flow (perm)	161	3365		816	1743		1067	1704		615	1763	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	524	38	158	632	176	57	146	107	290	216	67
RTOR Reduction (vph)	0	5	0	0	9	0	0	34	0	0	14	0
Lane Group Flow (vph)	48	557	0	158	799	0	57	219	0	290	269	0
Confl. Peds. (#/hr)	17		9	9		17	12		21	21		12
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	48.2	48.2		40.0	40.0		17.8	17.8		28.8	28.8	
Effective Green, g (s)	48.2	48.2		40.0	40.0		17.8	17.8		28.8	28.8	
Actuated g/C Ratio	0.54	0.54		0.44	0.44		0.20	0.20		0.32	0.32	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	157	1802		362	774		211	337		286	564	
v/s Ratio Prot	0.01	c0.17			c0.46			0.13		c0.08	0.15	
v/s Ratio Perm	0.15			0.19			0.05			c0.25		
v/c Ratio	0.31	0.31		0.44	1.03		0.27	0.65		1.01	0.48	
Uniform Delay, d1	18.2	11.6		17.2	25.0		30.6	33.2		29.7	24.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.4		3.8	41.0		0.7	4.5		56.8	0.6	
Delay (s)	19.4	12.1		21.0	66.0		31.3	37.7		86.6	25.2	
Level of Service	B	B		C	E		C	D		F	C	
Approach Delay (s)		12.7			58.6			36.5			56.3	
Approach LOS		B			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	43.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-22-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	36	38	84	14	19	8
Future Volume (Veh/h)	36	38	84	14	19	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.81	0.71	0.88
Hourly flow rate (vph)	48	51	112	17	27	9
Pedestrians	4			3	2	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	278	38	40			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	278	38	40			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	92	95	93			
cM capacity (veh/h)	615	1033	1577			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	99	129	36
Volume Left	48	112	0
Volume Right	51	0	9
cSH	777	1577	1700
Volume to Capacity	0.13	0.07	0.02
Queue Length 95th (m)	3.5	1.8	0.0
Control Delay (s)	10.3	6.5	0.0
Lane LOS	B	A	
Approach Delay (s)	10.3	6.5	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	24.1%	ICU Level of Service	A
Analysis Period (min)	15		

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑↑	↱	
Traffic Volume (veh/h)	20	74	48	194	199	17
Future Volume (Veh/h)	20	74	48	194	199	17
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.63	0.64	0.68	0.69	0.69	0.63
Hourly flow rate (vph)	32	116	71	281	288	27
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	596	314	321			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	596	314	321			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	92	83	93			
cM capacity (veh/h)	407	670	1092			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	148	165	187	315
Volume Left	32	71	0	0
Volume Right	116	0	0	27
cSH	588	1092	1700	1700
Volume to Capacity	0.25	0.07	0.11	0.19
Queue Length 95th (m)	7.9	1.7	0.0	0.0
Control Delay (s)	13.2	4.0	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	13.2	1.9		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	9	52	54	250	316	15
Future Volume (Veh/h)	9	52	54	250	316	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.67	0.80	0.88	0.88	0.86	0.88
Hourly flow rate (vph)	13	65	61	284	367	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	640	192	384			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	640	192	384			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	97	92	95			
cM capacity (veh/h)	391	802	1164			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	78	156	189	245	139
Volume Left	13	61	0	0	0
Volume Right	65	0	0	0	17
cSH	682	1164	1700	1700	1700
Volume to Capacity	0.11	0.05	0.11	0.14	0.08
Queue Length 95th (m)	3.1	1.3	0.0	0.0	0.0
Control Delay (s)	11.0	3.5	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.0	1.6		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

02-22-2024

Movement	EBL	EBT	WBT	WBR	SBL	SBR
	↗	→	←	↖	↘	↙
Lane Configurations		↰	↱		Y	
Traffic Volume (veh/h)	39	486	401	98	33	35
Future Volume (Veh/h)	39	486	401	98	33	35
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	0.90	0.90	0.88	0.83	0.75
Hourly flow rate (vph)	39	540	446	111	40	47
Pedestrians		24	24		36	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		2	2		3	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	593				1180	562
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	593				1180	562
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	96				78	90
cM capacity (veh/h)	963				185	494

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	579	557	87
Volume Left	39	0	40
Volume Right	0	111	47
cSH	963	1700	279
Volume to Capacity	0.04	0.33	0.31
Queue Length 95th (m)	1.0	0.0	10.3
Control Delay (s)	1.1	0.0	23.6
Lane LOS	A		C
Approach Delay (s)	1.1	0.0	23.6
Approach LOS			C

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Broadview Dr & Amherst St

02-22-2024

	↗	↘	↖	↑	↓	↙
Movement	**EBL**	**EBR**	**NBL**	**NBT**	**SBT**	**SBR**
Lane Configurations	↖↗			↰	↱	
Traffic Volume (veh/h)	0	11	39	98	57	0
Future Volume (Veh/h)	0	11	39	98	57	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	12	42	107	62	0
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	253	62	62			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	253	62	62			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	97			
cM capacity (veh/h)	716	1003	1541			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	12	149	62
Volume Left	0	42	0
Volume Right	12	0	0
cSH	1003	1541	1700
Volume to Capacity	0.01	0.03	0.04
Queue Length 95th (m)	0.3	0.7	0.0
Control Delay (s)	8.6	2.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.6	2.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	24.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: Broadview Dr & Chippewa St

02-22-2024

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰↱	
Traffic Volume (veh/h)	44	0	27	38	0	50
Future Volume (Veh/h)	44	0	27	38	0	50
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)	48	0	29	41	0	54
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			48		147	48
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			48		147	48
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	95
cM capacity (veh/h)			1559		830	1021

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	48	70	54
Volume Left	0	29	0
Volume Right	0	0	54
cSH	1700	1559	1021
Volume to Capacity	0.03	0.02	0.05
Queue Length 95th (m)	0.0	0.5	1.3
Control Delay (s)	0.0	3.1	8.7
Lane LOS		A	A
Approach Delay (s)	0.0	3.1	8.7
Approach LOS			A

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	20.2%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	28.2	48.5	54.9	190.0	304.1	51.5	77.2	66.0	66.4
Average Queue (m)	9.7	23.6	28.4	51.6	181.9	13.0	37.3	35.8	31.8
95th Queue (m)	21.7	40.7	46.4	188.7	365.1	32.3	64.4	58.0	55.1
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)						0	3		
Queuing Penalty (veh)						0	2		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	22.8	12.0
Average Queue (m)	10.8	1.4
95th Queue (m)	19.5	7.6
Link Distance (m)	339.7	333.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	19.4	20.1	3.0	3.7
Average Queue (m)	8.9	3.4	0.2	0.1
95th Queue (m)	14.7	12.9	2.5	1.9
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	18.7	18.4
Average Queue (m)	8.1	3.9
95th Queue (m)	16.3	13.2
Link Distance (m)	304.9	354.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	48.8	30.7	27.0
Average Queue (m)	13.4	4.5	10.3
95th Queue (m)	35.6	18.3	19.5
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Broadview Dr & Amherst St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	8.5	5.4
Average Queue (m)	2.1	0.2
95th Queue (m)	7.9	2.7
Link Distance (m)	269.7	75.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 17: Broadview Dr & Chippewa St

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	5.4	12.4
Average Queue (m)	0.3	6.8
95th Queue (m)	3.0	12.6
Link Distance (m)	380.6	125.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

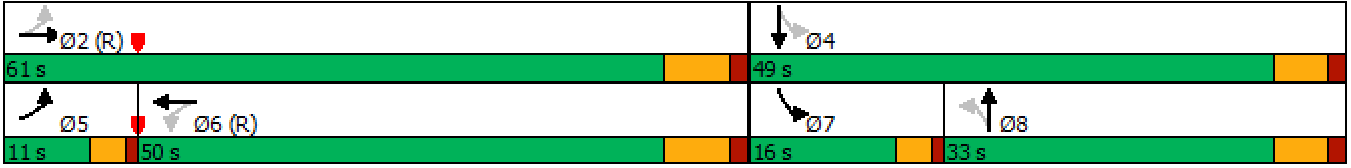
Zone Summary

Zone wide Queuing Penalty: 2

	↗	→	↙	←	↖	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↑↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	44	482	145	581	52	134	267	199
Future Volume (vph)	44	482	145	581	52	134	267	199
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases	5	2		6		8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	7	4
Switch Phase								
Minimum Initial (s)	7.0	12.0	12.0	12.0	12.0	12.0	7.0	12.0
Minimum Split (s)	11.0	37.0	33.0	33.0	33.0	33.0	11.0	37.0
Total Split (s)	11.0	61.0	50.0	50.0	33.0	33.0	16.0	49.0
Total Split (%)	10.0%	55.5%	45.5%	45.5%	30.0%	30.0%	14.5%	44.5%
Yellow Time (s)	3.0	5.4	5.4	5.4	4.3	4.3	3.0	4.3
All-Red Time (s)	1.0	1.6	1.6	1.6	1.7	1.7	1.0	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0	7.0	7.0	6.0	6.0	4.0	6.0
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lead	
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated

Splits and Phases: 3: Goulais Ave & Second Line W



HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-22-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	44	482	35	145	581	162	52	134	98	267	199	62
Future Volume (vph)	44	482	35	145	581	162	52	134	98	267	199	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.98		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.98	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3364		1754	1741		1724	1701		1764	1762	
Flt Permitted	0.07	1.00		0.44	1.00		0.59	1.00		0.28	1.00	
Satd. Flow (perm)	129	3364		815	1741		1063	1701		516	1762	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	524	38	158	632	176	57	146	107	290	216	67
RTOR Reduction (vph)	0	4	0	0	8	0	0	26	0	0	11	0
Lane Group Flow (vph)	48	558	0	158	800	0	57	227	0	290	272	0
Confl. Peds. (#/hr)	17		9	9		17	12		21	21		12
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	61.3	61.3		51.7	51.7		19.7	19.7		35.7	35.7	
Effective Green, g (s)	61.3	61.3		51.7	51.7		19.7	19.7		35.7	35.7	
Actuated g/C Ratio	0.56	0.56		0.47	0.47		0.18	0.18		0.32	0.32	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	151	1874		383	818		190	304		303	571	
v/s Ratio Prot	0.02	c0.17			c0.46			0.13		c0.10	0.15	
v/s Ratio Perm	0.16			0.19			0.05			c0.21		
v/c Ratio	0.32	0.30		0.41	0.98		0.30	0.75		0.96	0.48	
Uniform Delay, d1	20.8	12.9		19.2	28.6		39.2	42.8		33.2	29.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.4		3.3	26.6		0.9	9.6		39.8	0.6	
Delay (s)	22.0	13.3		22.4	55.2		40.1	52.3		73.1	30.3	
Level of Service	C	B		C	E		D	D		E	C	
Approach Delay (s)		14.0			49.8			50.1			51.9	
Approach LOS		B			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	28.4	54.0	59.8	122.7	242.3	57.2	78.6	82.4	77.1
Average Queue (m)	10.4	26.0	29.1	26.4	123.9	13.7	39.5	43.4	36.8
95th Queue (m)	21.4	44.8	50.6	69.6	219.2	35.2	68.5	72.6	64.5
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)						0	6		
Queuing Penalty (veh)						0	3		

J

Appendix J
2035 Future Total Synchro and SimTraffic Outputs

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-22-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	75	397	31	41	266	191	20	156	72	279	178	45
Future Volume (vph)	75	397	31	41	266	191	20	156	72	279	178	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1686	3365		1768	1691		1740	1759		1766	1781	
Flt Permitted	0.29	1.00		0.48	1.00		0.61	1.00		0.34	1.00	
Satd. Flow (perm)	520	3365		901	1691		1114	1759		636	1781	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	432	34	45	289	208	22	170	78	303	193	49
RTOR Reduction (vph)	0	5	0	0	24	0	0	21	0	0	12	0
Lane Group Flow (vph)	82	461	0	45	473	0	22	227	0	303	230	0
Confl. Peds. (#/hr)	5		1	1		5	6		10	10		6
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	48.1	48.1		38.5	38.5		17.9	17.9		28.9	28.9	
Effective Green, g (s)	48.1	48.1		38.5	38.5		17.9	17.9		28.9	28.9	
Actuated g/C Ratio	0.53	0.53		0.43	0.43		0.20	0.20		0.32	0.32	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	350	1798		385	723		221	349		292	571	
v/s Ratio Prot	0.01	c0.14			c0.28			0.13		c0.08	0.13	
v/s Ratio Perm	0.11			0.05			0.02			c0.25		
v/c Ratio	0.23	0.26		0.12	0.65		0.10	0.65		1.04	0.40	
Uniform Delay, d1	12.0	11.3		15.5	20.5		29.5	33.2		29.8	23.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		0.6	4.6		0.2	4.3		62.8	0.5	
Delay (s)	12.3	11.6		16.1	25.0		29.7	37.5		92.6	24.3	
Level of Service	B	B		B	C		C	D		F	C	
Approach Delay (s)		11.7			24.3			36.8			62.2	
Approach LOS		B			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-22-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	59	66	49	20	25	5
Future Volume (Veh/h)	59	66	49	20	25	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	0.80	0.75	0.85	0.79	0.63
Hourly flow rate (vph)	59	82	65	24	32	8
Pedestrians	3			16	16	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	209	55	43			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	209	55	43			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	91	92	96			
cM capacity (veh/h)	689	1001	1575			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	141	89	40
Volume Left	59	65	0
Volume Right	82	0	8
cSH	842	1575	1700
Volume to Capacity	0.17	0.04	0.02
Queue Length 95th (m)	4.8	1.0	0.0
Control Delay (s)	10.1	5.5	0.0
Lane LOS	B	A	
Approach Delay (s)	10.1	5.5	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		

7: Goulais Ave & Chippewa St

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↱	
Traffic Volume (veh/h)	41	143	37	198	226	22
Future Volume (Veh/h)	41	143	37	198	226	22
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.85	0.80	0.90	0.89	0.69
Hourly flow rate (vph)	44	168	46	220	254	32
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	484	282	292			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	484	282	292			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	91	76	96			
cM capacity (veh/h)	491	702	1122			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	212	119	147	286
Volume Left	44	46	0	0
Volume Right	168	0	0	32
cSH	644	1122	1700	1700
Volume to Capacity	0.33	0.04	0.09	0.17
Queue Length 95th (m)	11.5	1.0	0.0	0.0
Control Delay (s)	13.3	3.4	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	13.3	1.5		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

8: Goulais Ave & Rushmere Dr

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↑↱	
Traffic Volume (veh/h)	20	84	35	370	350	45
Future Volume (Veh/h)	20	84	35	370	350	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.86	0.88	0.89	0.83
Hourly flow rate (vph)	24	99	41	420	393	54
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	712	224	447			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	712	224	447			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	93	87	96			
cM capacity (veh/h)	358	765	1103			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	123	181	280	262	185
Volume Left	24	41	0	0	0
Volume Right	99	0	0	0	54
cSH	626	1103	1700	1700	1700
Volume to Capacity	0.20	0.04	0.16	0.15	0.11
Queue Length 95th (m)	5.8	0.9	0.0	0.0	0.0
Control Delay (s)	12.2	2.2	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	12.2	0.8		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Second Line W & Arden St

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		↲↳	
Traffic Volume (veh/h)	45	467	243	35	37	66
Future Volume (Veh/h)	45	467	243	35	37	66
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.83	0.73	0.75	0.83	0.80
Hourly flow rate (vph)	56	563	333	47	45	82
Pedestrians		4	4		5	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	385				1040	366
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	385				1040	366
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	95				81	88
cM capacity (veh/h)	1180				233	666

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	619	380	127
Volume Left	56	0	45
Volume Right	0	47	82
cSH	1180	1700	401
Volume to Capacity	0.05	0.22	0.32
Queue Length 95th (m)	1.2	0.0	10.7
Control Delay (s)	1.3	0.0	18.1
Lane LOS	A		C
Approach Delay (s)	1.3	0.0	18.1
Approach LOS			C

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑	↑↱	
Traffic Volume (veh/h)	0	12	11	69	91	0
Future Volume (Veh/h)	0	12	11	69	91	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	13	12	75	99	0
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	198	99	99			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	198	99	99			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	99			
cM capacity (veh/h)	784	957	1494			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	13	87	99
Volume Left	0	12	0
Volume Right	13	0	0
cSH	957	1494	1700
Volume to Capacity	0.01	0.01	0.06
Queue Length 95th (m)	0.3	0.2	0.0
Control Delay (s)	8.8	1.1	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	1.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	20.9%	ICU Level of Service	A
Analysis Period (min)	15		

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	Y	
Traffic Volume (veh/h)	105	0	30	29	0	79
Future Volume (Veh/h)	105	0	30	29	0	79
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)	114	0	33	32	0	86
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			114		212	114
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			114		212	114
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	91
cM capacity (veh/h)			1475		759	939

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	114	65	86
Volume Left	0	33	0
Volume Right	0	0	86
cSH	1700	1475	939
Volume to Capacity	0.07	0.02	0.09
Queue Length 95th (m)	0.0	0.5	2.4
Control Delay (s)	0.0	3.9	9.2
Lane LOS		A	A
Approach Delay (s)	0.0	3.9	9.2
Approach LOS			A

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	30.4	39.0	45.3	19.3	95.8	42.5	72.6	73.1	58.9
Average Queue (m)	11.7	18.9	24.3	6.5	44.9	7.0	37.1	38.0	28.3
95th Queue (m)	24.2	34.2	43.6	15.3	80.3	24.6	64.6	60.9	50.1
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)						0	4		
Queuing Penalty (veh)						0	1		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	25.0	7.3
Average Queue (m)	13.3	0.5
95th Queue (m)	22.0	4.0
Link Distance (m)	339.7	330.1
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	22.0	13.2	4.8
Average Queue (m)	12.0	2.6	0.3
95th Queue (m)	19.1	10.4	3.4
Link Distance (m)	380.6	515.6	423.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	21.7	14.7	1.3
Average Queue (m)	11.1	3.2	0.0
95th Queue (m)	18.0	11.1	0.9
Link Distance (m)	304.9	354.3	515.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	29.0	12.9	29.3
Average Queue (m)	5.5	0.6	12.9
95th Queue (m)	18.6	6.3	22.7
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Broadview Dr & Amherst St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	8.3	9.1
Average Queue (m)	2.7	0.4
95th Queue (m)	8.8	3.6
Link Distance (m)	270.7	77.1
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 17: Broadview Dr & Chippewa St

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	10.6	18.4
Average Queue (m)	0.9	8.3
95th Queue (m)	5.5	13.2
Link Distance (m)	380.6	125.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Zone Summary

Zone wide Queuing Penalty: 1

HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-22-2024

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	45	497	36	149	627	167	54	148	101	294	212	64
Future Volume (vph)	45	497	36	149	627	167	54	148	101	294	212	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3365		1757	1745		1729	1712		1764	1765	
Flt Permitted	0.09	1.00		0.43	1.00		0.58	1.00		0.31	1.00	
Satd. Flow (perm)	164	3365		803	1745		1050	1712		578	1765	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	540	39	162	682	182	59	161	110	320	230	70
RTOR Reduction (vph)	0	5	0	0	8	0	0	31	0	0	14	0
Lane Group Flow (vph)	49	574	0	162	856	0	59	240	0	320	286	0
Confl. Peds. (#/hr)	17		9	9		17	12		21	21		12
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	47.5	47.5		39.3	39.3		18.5	18.5		29.5	29.5	
Effective Green, g (s)	47.5	47.5		39.3	39.3		18.5	18.5		29.5	29.5	
Actuated g/C Ratio	0.53	0.53		0.44	0.44		0.21	0.21		0.33	0.33	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	157	1775		350	761		215	351		281	578	
v/s Ratio Prot	0.01	c0.17			c0.49			0.14		c0.09	0.16	
v/s Ratio Perm	0.15			0.20			0.06			c0.28		
v/c Ratio	0.31	0.32		0.46	1.12		0.27	0.68		1.14	0.49	
Uniform Delay, d1	19.2	12.1		17.9	25.4		30.1	33.0		29.3	24.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.5		4.4	72.4		0.7	5.4		96.5	0.7	
Delay (s)	20.3	12.6		22.3	97.8		30.8	38.5		125.7	24.9	
Level of Service	C	B		C	F		C	D		F	C	
Approach Delay (s)		13.2			85.9			37.1			77.0	
Approach LOS		B			F			D			E	

Intersection Summary			
HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Broadview Dr & Atwater St

02-22-2024

	⤴	⤵	↰	↑	↓	↲
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Traffic Volume (veh/h)	52	50	133	14	20	8
Future Volume (Veh/h)	52	50	133	14	20	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.75	0.81	0.71	0.88
Hourly flow rate (vph)	69	67	177	17	28	9
Pedestrians	4			3	2	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	410	40	41			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	410	40	41			
tC, single (s)	6.6	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.2			
p0 queue free %	86	94	89			
cM capacity (veh/h)	491	1032	1576			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	136	194	37
Volume Left	69	177	0
Volume Right	67	0	9
cSH	662	1576	1700
Volume to Capacity	0.21	0.11	0.02
Queue Length 95th (m)	6.1	3.0	0.0
Control Delay (s)	11.8	7.0	0.0
Lane LOS	B	A	
Approach Delay (s)	11.8	7.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	8.1		
Intersection Capacity Utilization	28.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Goulais Ave & Chippewa St

02-22-2024

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰↑	↱	
Traffic Volume (veh/h)	26	102	59	200	205	25
Future Volume (Veh/h)	26	102	59	200	205	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.63	0.64	0.68	0.69	0.69	0.63
Hourly flow rate (vph)	41	159	87	290	297	40
Pedestrians	6			6	6	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	648	329	343			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	648	329	343			
tC, single (s)	6.8	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.4			
p0 queue free %	89	76	92			
cM capacity (veh/h)	371	654	1069			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	200	184	193	337
Volume Left	41	87	0	0
Volume Right	159	0	0	40
cSH	566	1069	1700	1700
Volume to Capacity	0.35	0.08	0.11	0.20
Queue Length 95th (m)	12.7	2.1	0.0	0.0
Control Delay (s)	14.8	4.5	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	14.8	2.2		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Goulais Ave & Rushmere Dr

02-22-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰↑ ↑	↑ ↑↱	
Traffic Volume (veh/h)	9	54	56	267	351	15
Future Volume (Veh/h)	9	54	56	267	351	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.67	0.80	0.88	0.88	0.86	0.88
Hourly flow rate (vph)	13	68	64	303	408	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				371		
pX, platoon unblocked						
vC, conflicting volume	696	212	425			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	696	212	425			
tC, single (s)	6.8	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	96	91	94			
cM capacity (veh/h)	359	777	1124			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	81	165	202	272	153
Volume Left	13	64	0	0	0
Volume Right	68	0	0	0	17
cSH	655	1124	1700	1700	1700
Volume to Capacity	0.12	0.06	0.12	0.16	0.09
Queue Length 95th (m)	3.4	1.4	0.0	0.0	0.0
Control Delay (s)	11.3	3.6	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.3	1.6		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	33.0%	ICU Level of Service	A
Analysis Period (min)	15		

	↗	→	←	↖	↘	↙
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Volume (veh/h)	58	501	413	130	34	47
Future Volume (Veh/h)	58	501	413	130	34	47
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	0.90	0.90	0.88	0.83	0.75
Hourly flow rate (vph)	58	557	459	148	41	63
Pedestrians		24	24		36	
Lane Width (m)		3.6	3.6		3.6	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		2	2		3	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	643				1266	593
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	643				1266	593
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	94				74	87
cM capacity (veh/h)	923				160	474

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	615	607	104
Volume Left	58	0	41
Volume Right	0	148	63
cSH	923	1700	267
Volume to Capacity	0.06	0.36	0.39
Queue Length 95th (m)	1.6	0.0	14.1
Control Delay (s)	1.6	0.0	26.8
Lane LOS	A		D
Approach Delay (s)	1.6	0.0	26.8
Approach LOS			D

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Broadview Dr & Amherst St

02-22-2024

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Traffic Volume (veh/h)	0	11	41	147	70	0
Future Volume (Veh/h)	0	11	41	147	70	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	12	45	160	76	0
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	326	76	76			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	326	76	76			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	97			
cM capacity (veh/h)	648	985	1523			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	12	205	76
Volume Left	0	45	0
Volume Right	12	0	0
cSH	985	1523	1700
Volume to Capacity	0.01	0.03	0.04
Queue Length 95th (m)	0.3	0.7	0.0
Control Delay (s)	8.7	1.8	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	1.8	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: Broadview Dr & Chippewa St

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	Y	
Traffic Volume (veh/h)	62	0	28	56	0	66
Future Volume (Veh/h)	62	0	28	56	0	66
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)	67	0	30	61	0	72
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			67		188	67
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			67		188	67
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	93
cM capacity (veh/h)			1535		785	997

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	67	91	72
Volume Left	0	30	0
Volume Right	0	0	72
cSH	1700	1535	997
Volume to Capacity	0.04	0.02	0.07
Queue Length 95th (m)	0.0	0.5	1.9
Control Delay (s)	0.0	2.5	8.9
Lane LOS		A	A
Approach Delay (s)	0.0	2.5	8.9
Approach LOS			A

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	28.4	46.3	54.2	538.9	629.7	56.9	80.8	85.3	77.8
Average Queue (m)	11.1	26.1	31.0	218.3	402.6	13.0	38.1	44.5	33.8
95th Queue (m)	23.7	43.6	49.6	491.8	676.3	33.0	64.2	76.7	59.4
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							4		
Queuing Penalty (veh)							2		

Intersection: 6: Broadview Dr & Atwater St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	23.2	12.0
Average Queue (m)	11.6	1.2
95th Queue (m)	20.0	6.8
Link Distance (m)	339.7	333.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: Goulais Ave & Chippewa St

Movement	EB	NB	NB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (m)	23.9	24.5	8.2	8.9
Average Queue (m)	10.7	6.1	0.3	0.3
95th Queue (m)	18.4	18.1	3.4	4.2
Link Distance (m)	380.6	515.6	515.6	423.6
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: Goulais Ave & Rushmere Dr

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	20.7	14.7
Average Queue (m)	9.3	4.0
95th Queue (m)	17.0	12.5
Link Distance (m)	304.9	354.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Second Line W & Arden St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (m)	58.1	32.9	32.2
Average Queue (m)	16.1	5.7	12.7
95th Queue (m)	40.9	21.2	25.3
Link Distance (m)	978.1	588.4	347.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Broadview Dr & Amherst St

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	8.6	10.5
Average Queue (m)	2.5	1.0
95th Queue (m)	8.6	6.4
Link Distance (m)	269.7	75.3
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 17: Broadview Dr & Chippewa St

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	3.6	14.8
Average Queue (m)	0.2	7.5
95th Queue (m)	2.2	12.5
Link Distance (m)	380.6	125.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Zone Summary

Zone wide Queuing Penalty: 2

Timings

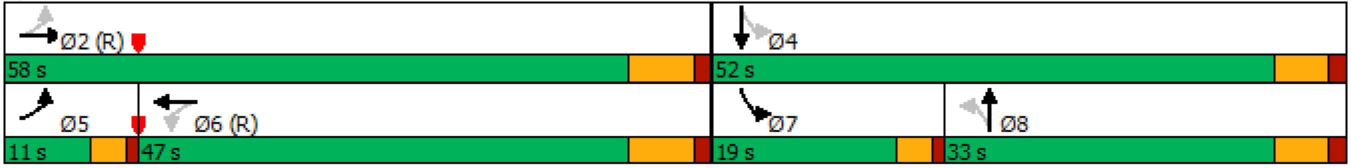
3: Goulais Ave & Second Line W

02-26-2024

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↑↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	75	397	41	266	20	156	279	178
Future Volume (vph)	75	397	41	266	20	156	279	178
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases	5	2		6		8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	7	4
Switch Phase								
Minimum Initial (s)	7.0	12.0	12.0	12.0	12.0	12.0	7.0	12.0
Minimum Split (s)	11.0	37.0	33.0	33.0	33.0	33.0	11.0	33.0
Total Split (s)	11.0	58.0	47.0	47.0	33.0	33.0	19.0	52.0
Total Split (%)	10.0%	52.7%	42.7%	42.7%	30.0%	30.0%	17.3%	47.3%
Yellow Time (s)	3.0	5.4	5.4	5.4	4.3	4.3	3.0	4.3
All-Red Time (s)	1.0	1.6	1.6	1.6	1.7	1.7	1.0	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0	7.0	7.0	6.0	6.0	4.0	6.0
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lead	
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 3: Goulais Ave & Second Line W



HCM Signalized Intersection Capacity Analysis
3: Goulais Ave & Second Line W

02-22-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	75	397	31	41	266	191	20	156	72	279	178	45
Future Volume (vph)	75	397	31	41	266	191	20	156	72	279	178	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1686	3365		1768	1690		1737	1758		1767	1780	
Flt Permitted	0.30	1.00		0.48	1.00		0.61	1.00		0.29	1.00	
Satd. Flow (perm)	524	3365		901	1690		1113	1758		535	1780	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	432	34	45	289	208	22	170	78	303	193	49
RTOR Reduction (vph)	0	5	0	0	21	0	0	16	0	0	9	0
Lane Group Flow (vph)	82	461	0	45	476	0	22	232	0	303	233	0
Confl. Peds. (#/hr)	5		1	1		5	6		10	10		6
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	58.3	58.3		48.7	48.7		19.7	19.7		38.7	38.7	
Effective Green, g (s)	58.3	58.3		48.7	48.7		19.7	19.7		38.7	38.7	
Actuated g/C Ratio	0.53	0.53		0.44	0.44		0.18	0.18		0.35	0.35	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	336	1783		398	748		199	314		356	626	
v/s Ratio Prot	0.01	c0.14			c0.28			0.13		c0.12	0.13	
v/s Ratio Perm	0.12			0.05			0.02			c0.18		
v/c Ratio	0.24	0.26		0.11	0.64		0.11	0.74		0.85	0.37	
Uniform Delay, d1	14.9	14.1		18.0	23.8		37.8	42.7		28.9	26.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.4		0.6	4.1		0.2	8.7		17.4	0.4	
Delay (s)	15.2	14.4		18.6	27.9		38.1	51.4		46.3	27.0	
Level of Service	B	B		B	C		D	D		D	C	
Approach Delay (s)		14.6			27.1			50.3			37.7	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	38.0	42.3	47.8	23.2	108.4	50.1	78.3	76.0	62.8
Average Queue (m)	14.6	20.6	26.2	5.9	49.8	6.7	41.1	44.6	32.5
95th Queue (m)	30.3	36.9	43.4	16.5	92.5	25.8	67.3	70.9	56.0
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)							6		
Queuing Penalty (veh)							1		

Timings
3: Goulais Ave & Second Line W

02-26-2024

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↑↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	45	497	149	627	54	148	294	212
Future Volume (vph)	45	497	149	627	54	148	294	212
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases	5	2		6		8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	7	4
Switch Phase								
Minimum Initial (s)	7.0	12.0	12.0	12.0	12.0	12.0	7.0	12.0
Minimum Split (s)	11.0	37.0	33.0	33.0	33.0	33.0	11.0	37.0
Total Split (s)	11.0	82.0	71.0	71.0	33.0	33.0	25.0	58.0
Total Split (%)	7.9%	58.6%	50.7%	50.7%	23.6%	23.6%	17.9%	41.4%
Yellow Time (s)	3.0	5.4	5.4	5.4	4.3	4.3	3.0	4.3
All-Red Time (s)	1.0	1.6	1.6	1.6	1.7	1.7	1.0	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0	7.0	7.0	6.0	6.0	4.0	6.0
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lead	
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None

Intersection Summary

Cycle Length: 140

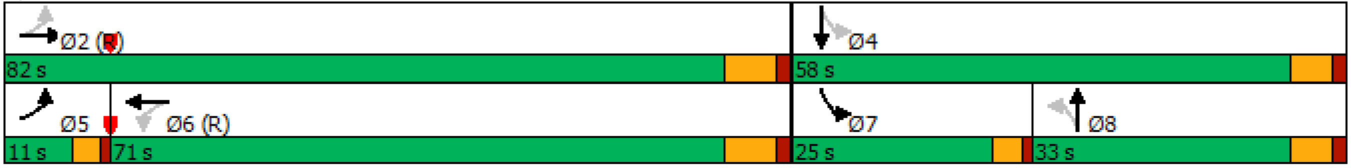
Actuated Cycle Length: 140

Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Splits and Phases: 3: Goulais Ave & Second Line W



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	45	497	36	149	627	167	54	148	101	294	212	64
Future Volume (vph)	45	497	36	149	627	167	54	148	101	294	212	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.98		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.98	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.97		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	3363		1750	1741		1716	1704		1765	1760	
Flt Permitted	0.06	1.00		0.43	1.00		0.58	1.00		0.20	1.00	
Satd. Flow (perm)	98	3363		800	1741		1043	1704		378	1760	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	540	39	162	682	182	59	161	110	320	230	70
RTOR Reduction (vph)	0	4	0	0	7	0	0	18	0	0	8	0
Lane Group Flow (vph)	49	575	0	162	857	0	59	253	0	320	292	0
Confl. Peds. (#/hr)	17		9	9		17	12		21	21		12
Heavy Vehicles (%)	7%	6%	5%	2%	5%	4%	3%	0%	7%	2%	2%	6%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	77.8	77.8		68.2	68.2		24.2	24.2		49.2	49.2	
Effective Green, g (s)	77.8	77.8		68.2	68.2		24.2	24.2		49.2	49.2	
Actuated g/C Ratio	0.56	0.56		0.49	0.49		0.17	0.17		0.35	0.35	
Clearance Time (s)	4.0	7.0		7.0	7.0		6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	118	1868		389	848		180	294		340	618	
v/s Ratio Prot	c0.02	0.17			c0.49			0.15		c0.14	0.17	
v/s Ratio Perm	0.21			0.20			0.06			c0.19		
v/c Ratio	0.42	0.31		0.42	1.01		0.33	0.86		0.94	0.47	
Uniform Delay, d1	29.5	16.7		23.1	35.9		50.8	56.3		37.7	35.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.4	0.4		3.3	33.7		1.1	21.3		33.7	0.6	
Delay (s)	31.8	17.1		26.4	69.6		51.8	77.6		71.4	35.9	
Level of Service	C	B		C	E		D	E		E	D	
Approach Delay (s)		18.2			62.7			73.0			54.2	
Approach LOS		B			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	51.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 3: Goulais Ave & Second Line W

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	30.3	53.3	60.2	152.8	312.8	57.3	144.6	101.1	93.4
Average Queue (m)	10.6	27.0	30.7	35.9	159.4	23.9	67.0	56.0	48.0
95th Queue (m)	23.2	47.5	51.6	106.0	283.7	56.7	121.4	92.3	80.1
Link Distance (m)		588.4		792.4	792.4		392.5	354.3	354.3
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)	90.0		124.0			50.0			
Storage Blk Time (%)						0	26		
Queuing Penalty (veh)						0	14		

Appendix 7

Sanitary Sewer Design

Sanitary Sewer Design Sheet

Project: **Chippewa Avenue Subdivision**
Client: Mamta Homes

KEC Project: **2278.02**
Date Updated: **March 1, 2023**

Chippewa Ave Capacity Review

Area Types:

LD	3.5	low density domestic
MD	2	medium density domestic
HD		high density domestic (P - actual based on survey)
IND		industrial
SCHOOL		school (P - actual based on school population)
MALL		shopping centres
COM		commercial areas
HOTEL		hotel/motel (P - actual based on 5 bed spaces per room)

Design Flow Rates:

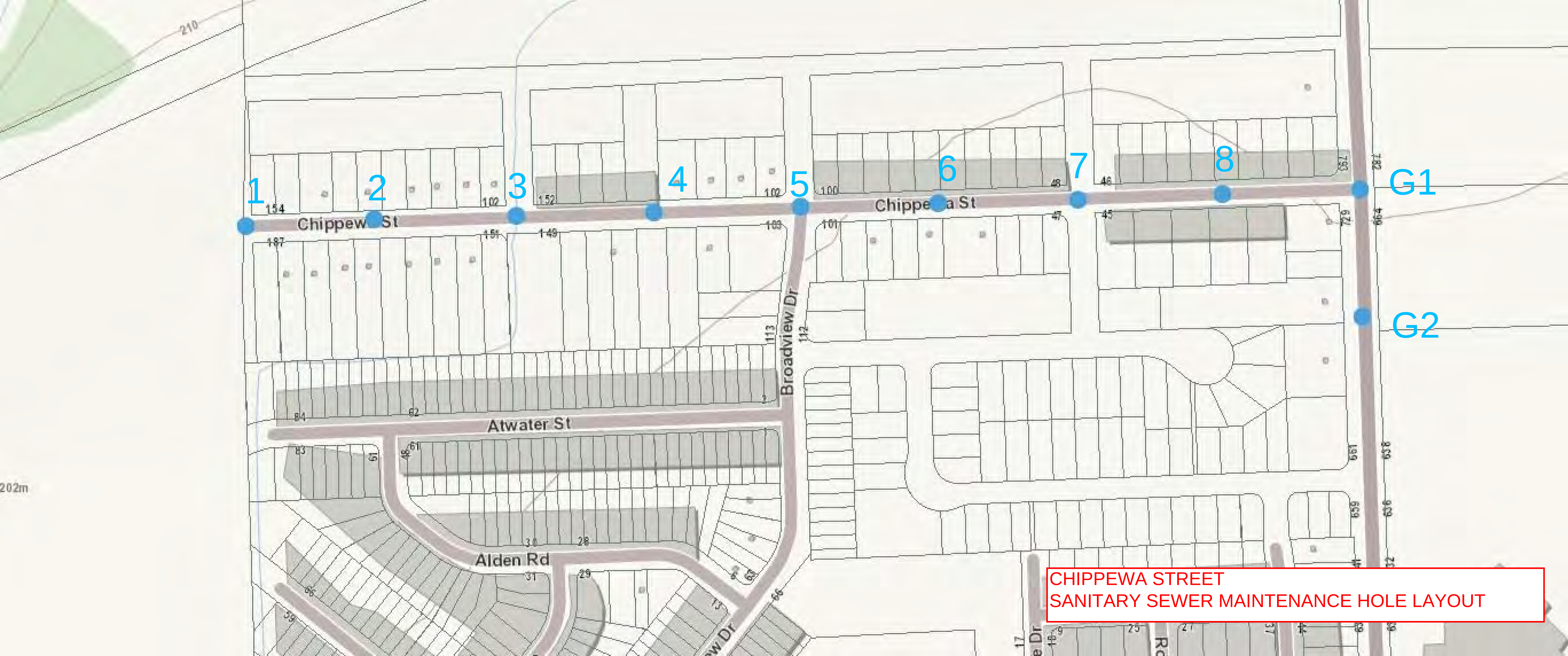
Domestic Sewage Flow Rate =	400	L/c/d
MALL flow rate =	5	L/m^2/d
IND flow rate =	35	m^3/ha/d
COM flow rate =	28	m^3/ha/d
SCHOOL flow rate =	140	L/student/d
HOTEL flow rate =	225	L/bedspace/d
Unit of peak extraneous flow (I) =	0.15	L/ha/s

Design Calculations:

Peaking Factor (Harmon) - M = 1 + 14 / (4 + SQRT (0.001p))
Peak Flow - Q_p = P * q * M / 86400 (L/s)
Peak Extraneous Flow - Q_i = I*A (L/s)
Foundation Drain Flow - Q_f = H * a (L/s)
Peak Design Flow - Q_d = Q_p + Q_i + Q_f (L/s)

Mannings Equation - $Q = 1/n * A * R^{2/3} * S^{1/2}$
Roughness Coefficient (n) - 0.013
Hydraulic Radius (R) - 0.25 * pipe diameter
Design Flow Velocity - Hydraulic elements

LOCATION			DESIGN FLOWS													PIPE DESIGN								
			Tributary Area							Sewage Flows														
from MH	to MH	Street	Area ID	Number of Lots	Size (ha)	Type	Description	Flow Rate "q" (L/c/d)	Population, Students, or Area "P"		Average Flow (P*q / 86400) (L/s)	Peaking Factor "M"	Peak "Q_p" (L/s)	Peak Extraneous "Q_i" (L/s)	Flow (L/s)	Design Flow "Q_d" (L/s)	Length (m)	Pipe I.D. (mm)	Type of Pipe	Grade (%)	Full Capacity "Q_{cap}" (L/s)	Full flow Velocity (m/s)	Design Flow Velocity (m/s)	Pipe Utilization Q_d / Q_{cap}
Parcel A	Chippewa	Subdivision	RES	82	8.10	LD	Parcel A	400	287	persons	1.33	4.087	5.44	1.22	6.66	**6.66**								
1	2	Chippewa	1	10	1.47	LD	1	400	35	persons	0.16	4.344	0.69	0.22	0.91	**7.57**	94.8	250	CONC	0.32	33.64	0.69	0.46	**23%**
2	3	Chippewa	2	10	1.47	LD	2	400	35	persons	0.16	4.344	0.69	0.22	0.91	**8.48**	98.0	250	CONC	0.31	33.11	0.67	0.49	**26%**
3	4	Chippewa	3	10	1.47	LD	3	400	35	persons	0.16	4.344	0.69	0.22	0.91	**9.39**	101.8	250	CONC	0.27	30.90	0.63	0.51	**30%**
4	5	Chippewa	4	10	1.47	LD	4	400	35	persons	0.16	4.344	0.69	0.22	0.91	**10.30**	99.4	250	CONC	0.27	30.90	0.63	0.54	**33%**
5	6	Chippewa	5	10	1.47	LD	5	400	35	persons	0.16	4.344	0.69	0.22	0.91	**11.21**	102.7	250	CONC	0.22	27.89	0.57	0.54	**40%**
6	7	Chippewa	5	10	1.47	LD	6	400	35	persons	0.16	4.344	0.69	0.22	0.91	**12.12**	99.1	250	CONC	0.24	29.13	0.59	0.57	**42%**
7	8	Chippewa	6	10	1.47	LD	7	400	35	persons	0.16	4.344	0.69	0.22	0.91	**13.03**	100.0	250	CONC	0.28	31.47	0.64	0.62	**41%**
8	Goulais 1	Chippewa	7	10	1.47	LD	8	400	35	persons	0.16	4.344	0.69	0.22	0.91	**13.94**	101.5	250	CONC	0.37	36.17	0.74	0.69	**39%**
Goulais 1	2	Goulais	8	3	1.47	LD	9	400	11	persons	0.05	4.413	0.22	0.22	0.44	**14.38**	91.3	350	CONC	0.46	98.93	1.03	0.50	**15%**
					21.33				578						14.38									



CHIPPEWA STREET
SANITARY SEWER MAINTENANCE HOLE LAYOUT

Sanitary Sewer Design Sheet

Project: **Chippewa Avenue Subdivision**
Client: Mamta Homes

KEC Project: **2278.02**
Date Updated: **March 17, 2023**

Arden St. Capacity Review

KRESIN
Engineering Corporation

Area Types:

LD	3.5	low density domestic
MD	2	medium density domestic
HD		high density domestic (P - actual based on survey)
IND		industrial
SCHOOL		school (P - actual based on school population)
MALL		shopping centres
COM		commercial areas
HOTEL		hotel/motel (P - actual based on 5 bed spaces per room)

Design Flow Rates:

Domestic Sewage Flow Rate =	400	L/c/d
MALL flow rate =	5	L/m^2/d
IND flow rate =	35	m^3/ha/d
COM flow rate =	28	m^3/ha/d
SCHOOL flow rate =	140	L/student/d
HOTEL flow rate =	225	L/bedspace/d
Unit of peak extraneous flow (I) =	0.15	L/ha/s

Design Calculations:

Peaking Factor (Harmon) - $M = 1 + 14 / (4 + SQRT(0.001p))$
Peak Flow - $Q_p = P * q * M / 86400$ (L/s)
Peak Extraneous Flow - $Q_i = I*A$ (L/s)
Foundation Drain Flow - $Q_f = H * a$ (L/s)
Peak Design Flow - $Q_d = Q_p + Q_i + Q_f$ (L/s)

Mannings Equation - $Q = 1/n * A * R^{2/3} * S^{1/2}$
Roughness Coefficient (n) - 0.013
Hydraulic Radius (R) - 0.25 * pipe diameter
Design Flow Velocity - Hydraulic elements

LOCATION			DESIGN FLOWS													PIPE DESIGN								
			Tributary Area								Sewage Flows												
from MH	to MH	Downstream MH Location	Area ID	Number of Lots	Size (ha)	Type	Description	Flow Rate "q" (L/c/d)	Population, Students, or Area "P"		Average Flow (P*q / 86400) (L/s)	Peaking Factor "M"	Peak "Q_p" (L/s)	Peak Extraneous "Q_i" (L/s)	Flow (L/s)	Design Flow "Q_d" (L/s)	Length (m)	Pipe I.D. (mm)	Type of Pipe	Grade (%)	Full Capacity "Q_{cap}" (L/s)	Full flow Velocity (m/s)	Design Flow Velocity (m/s)	Pipe Utilization Q_d / Q_{cap}
PROP	J	160 Arden	PROP	180	1.48	MD	Parcel C	400	360	persons	1.67	4.043	6.75	0.22	6.97									
PROP	J	160 Arden	PROP	112	5.52	LD	Parcel B	400	392	persons	1.81	4.026	7.29	0.83	8.12									
J	I	144 Arden	9	8	1.38	LD		400	28	persons	0.13	4.359	0.57	0.21	0.78	**15.87**	72.0	300	AC	0.33	55.55	0.79	0.62	**29%**
I	H	Alpine Street	8	9	0.69	LD		400	32	persons	0.15	4.351	0.65	0.10	0.75	**16.62**	68.0	300	AC	0.30	52.97	0.75	0.62	**31%**
H	G	Broadview	7	16	1.38	LD		400	56	persons	0.26	4.305	1.12	0.21	1.33	**17.95**	75.0	300	AC	0.35	57.21	0.81	0.67	**31%**
G	F	84 Arden	Broadview	259	13.30	LD		400	907	persons	4.20	3.827	16.07	2.00	18.07	**36.02**	26.0	300	AC	0.70	80.91	1.15	1.14	**45%**
F	E	70 Arden	6	8	0.73	LD		400	28	persons	0.13	4.359	0.57	0.11	0.68	**36.70**	53.0	300	AC	0.32	54.70	0.77	0.86	**67%**
E	D	Ascot Ave	5	9	0.74	LD		400	32	persons	0.15	4.351	0.65	0.11	0.76	**37.46**	107.0	300	AC	0.37	58.82	0.83	0.92	**64%**
D	C	36 Arden	4	40	3.87	LD		400	140	persons	0.65	4.201	2.73	0.58	3.31	**40.77**	61.0	300	PVC	0.15	37.45	0.53	0.43	**109%**
C	B	Winfield Drive	3	7	0.67	LD		400	25	persons	0.11	4.368	0.48	0.10	0.58	**41.35**	61.0	300	AC	0.15	37.45	0.53	0.41	**110%**
B	A	2nd Line	1+2	44	4.08	LD		400	154	persons	0.71	4.187	2.97	0.61	3.58	**44.93**	91.0	375	AC	0.18	74.39	0.67	0.73	**60%**
					33.84				2152						44.93									

I.D.	LOTS	AREA (ha)
1	4	0.46
2	40	3.62
3	7	0.67
4	40	3.87
5	9	0.74
6	8	0.73

I.D.	LOTS	AREA (ha)
BROADVIEW	(FROM	AMHERST DESIGN SHEET)
7	16	1.38
8	9	0.69
9	8	0.43

Sanitary Sewer Design Sheet

KRESIN Engineering Corporation

Project: **Chippewa Avenue Subdivision**
Client: Mamta Homes

KEC Project: **2278.02**
Date Updated: **March 1, 2023**

Area Types:

LD	low density domestic LD persons per lot = 4
MD	medium density domestic (P - actual based on survey) = 3
HD	high density domestic (P - actual based on survey)
IND	industrial
SCHOOL	school (P - actual based on school population)
MALL	shopping centres
COM	commercial areas = 2
HOTEL	hotel/motel (P - actual based on 5 bed spaces per room)
	Amenity Space Capacity= 200

Design Flow Rates:

Domestic Sewage Flow Rate =	450	L/c/d
MALL flow rate =	5	L/m²/d
Amenity Building flow rate=	36	L/c/d
COM flow rate =	650	L/station/d
SCHOOL flow rate =	140	L/student/d
HOTEL flow rate =	225	L/bedspace/d
Unit of peak extraneous flow (I) =	0.15	L/ha/s
Foundation Drain Allowance (a) =	0	L/s/house (from MEA - 0.071)

Design Calculations:

Peaking Factor (Harmon) - M = 1 + 14 / (4 + SQRT (0.001p))
Peak Flow - Q_p = P * q * M / 86400 (L/s)
Peak Extraneous Flow - Q_i = I*A (L/s)
Foundation Drain Flow - Q_f = H * a (L/s)
Peak Design Flow - Q_d = Q_p + Q_i + Q_f (L/s)

Mannings Equation - $Q = 1/n * A * R^{2/3} * S^{1/2}$
Roughness Coefficient (n) - 0.013
Hydraulic Radius (R) - 0.25 * pipe diameter
Design Flow Velocity - Hydraulic elements

LOCATION			DESIGN FLOWS														PIPE DESIGN								
			Tributary Area								Sewage Flows													
from MH	to MH	Street	Area ID	Number of Lots	Size (ha)	Type	Description	Flow Rate "q" (L/d)	Population, Students, or Area "P"		Average Flow (P*q / 86400) (L/s)	Peaking Factor "M"	Peak "Q_p" (L/s)	Peak Extraneous "Q_i" (L/s)	Foundation Drain "Q_f" (L/s)	Flow (L/s)	Design Flow "Q_d" (L/s)	Length (m)	Pipe I.D. (mm)	Type of Pipe	Grade (%)	Full Capacity "Q_{cap}" (L/s)	Full flow Velocity (m/s)	Design Flow Velocity (m/s)	Pipe Utilization Q_d / Q_{cap}
D	C	Parcel A		7	0.39	LD	Residential	450	28	persons	0.15	4.359	0.65	0.06	0.00	0.71	**0.71**	91.2	300	Sanitite HP	0.22	45.36	0.64	0.08	**2%**
C	B	Parcel A		11	0.74	LD	Residential	450	44	persons	0.23	4.326	0.99	0.11	0.00	1.10	**1.81**	111.6	300	Sanitite HP	0.22	45.36	0.64	0.13	**4%**
B	A	Parcel A		5	0.44	LD	Residential	450	20	persons	0.10	4.380	0.44	0.07	0.00	0.51	**2.32**	83.3	300	Sanitite HP	0.22	45.36	0.64	0.15	**5%**
E	F	Parcel A Street 2		6	0.36	LD	Residential	450	24	persons	0.13	4.369	0.57	0.05	0.00	0.62	**0.62**	46.9	300	Sanitite HP	0.22	45.36	0.64	0.08	**1%**
F	G	Parcel A Street 2		6	0.32	LD	Residential	450	24	persons	0.13	4.369	0.57	0.05	0.00	0.62	**1.24**	77.3	300	Sanitite HP	0.22	45.36	0.64	0.10	**3%**
K		Atwater		9	0.76	LD	Residential	450	36	persons	0.19	4.341	0.82	0.11	0.00	0.93	**1.69**	114.2	300	Sanitite HP	0.22	45.36	0.64	0.12	**4%**
	L	Atwater		10	0.39	MD	Residential	450	30	persons	0.16	4.355	0.70	0.06	0.00	0.76									
L		Atwater		4	0.51	LD	Residential	450	16	persons	0.08	4.393	0.35	0.08	0.00	0.43	**2.68**	81.0	300	Sanitite HP	0.22	45.36	0.64	0.17	**6%**
	G	Atwater		6	1.15	MD	Residential	450	18	persons	0.09	4.386	0.39	0.17	0.00	0.56									
G	H	Atwater		4	0.26	COM	Residential	650	8	persons	0.06	4.423	0.27	0.04	0.00	0.31	**2.99**	85.5	300	Sanitite HP	0.22	45.36	0.64	0.18	**7%**
H	J	Parcel A Street 1		8	0.44	LD	Residential	450	32	persons	0.17	4.350	0.74	0.07	0.00	0.81	**3.80**	75.4	300	Sanitite HP	0.22	45.36	0.64	0.21	**8%**
J	A	Parcel A Street 1		8	0.44	LD	Residential	450	32	persons	0.17	4.350	0.74	0.07	0.00	0.81	**4.61**	72.3	300	Sanitite HP	0.22	45.36	0.64	0.24	**10%**
A	Existing	Chippewa		2	0.27	LD	Residential	450	8	persons	0.04	4.423	0.18	0.04	0.00	0.22	**7.15**	53.5	300	Sanitite HP	0.22	45.36	0.64	0.33	**16%**
				51.00	4.21											4.83									

Sanitary Sewer Design Sheet

KRESIN
Engineering Corporation

Project: **Chippewa Avenue Subdivision**
Client: Mamta Homes

KEC Project: **2278.02**
Date Updated: **March 1, 2023**

Area Types:

LD	low density domestic LD persons per lot = 4
MD	medium density domestic (P - actual based on survey) = 3
HD	high density domestic (P - actual based on survey)
IND	industrial
SCHOOL	school (P - actual based on school population)
MALL	shopping centres
COM	commercial areas = 2
HOTEL	hotel/motel (P - actual based on 5 bed spaces per room)
	Amenity Space Capacity= 200

Design Flow Rates:

Domestic Sewage Flow Rate =	400	L/c/d
MALL flow rate =	5	L/m²/d
Amenity Building flow rate=	36	L/c/d
COM flow rate =	650	L/station/d
SCHOOL flow rate =	140	L/student/d
HOTEL flow rate =	225	L/bedspace/d
Unit of peak extraneous flow (I) =	0.15	L/ha/s
Foundation Drain Allowance (a) =	0	L/s/house (from MEA - 0.071)

Design Calculations:

Peaking Factor (Harmon) - $M = 1 + 14 / (4 + SQRT (0.001p))$
Peak Flow - $Q_p = P * q * M / 86400$ (L/s)
Peak Extraneous Flow - $Q_i = I*A$ (L/s)
Foundation Drain Flow - $Q_f = H * a$ (L/s)
Peak Design Flow - $Q_d = Q_p + Q_i + Q_f$ (L/s)

Mannings Equation - $Q = 1/n * A * R^{2/3} * S^{1/2}$
Roughness Coefficient (n) - 0.013
Hydraulic Radius (R) - 0.25 * pipe diameter
Design Flow Velocity - Hydraulic elements

LOCATION			DESIGN FLOWS														PIPE DESIGN							
			Tributary Area								Sewage Flows													
from MH	to MH	Street	Area ID	Number of Lots	Size (ha)	Type	Description	Flow Rate "q" (L/d)	Population, Students, or Area "P"		Average Flow (P*q / 86400) (L/s)	Peaking Factor "M"	Peak "Q_p" (L/s)	Peak Extraneous "Q_i" (L/s)	Foundation Drain "Q_f" (L/s)	Flow (L/s)	Design Flow "Q_d" (L/s)	Length (m)	Pipe I.D. (mm)	Type of Pipe	Grade (%)	Full Capacity "Q_{cap}" (L/s)	Full flow Velocity (m/s)	Design Flow Velocity (m/s)	Pipe Utilization Q_d / Q_{cap}
U	V	Parcel B	m	13	0.67	MD	Residential	400	39	persons	0.18	4.335	0.78	0.10	0.00	0.88	**0.88**	72.0	300	Sanitite HP	0.22	45.36	0.64	0.09	**2%**
V	W	Parcel B	m	25	0.60	MD	Residential	400	75	persons	0.35	4.276	1.50	0.09	0.00	1.59	**2.47**	118.0	300	Sanitite HP	0.22	45.36	0.64	0.16	**5%**
W		Parcel B	m	8	0.277	MD	Residential	400	24	persons	0.11	4.369	0.48	0.04	0.00	0.52	**0.87**	81.0	300	Sanitite HP	0.22	45.36	0.64	0.09	**2%**
	Y	Parcel B	m	1	0.151	Amenity	Residential	36	200	persons	0.08	4.148	0.33	0.02	0.00	0.35									
Y	Z	Parcel B	m	19	0.75	MD	Residential	400	57	persons	0.26	4.303	1.12	0.11	0.00	1.23	**2.10**	99.0	300	Sanitite HP	0.22	45.36	0.64	0.14	**5%**
Z	T	Parcel B	m	19	0.70	MD	Residential	400	57	persons	0.26	4.303	1.12	0.11	0.00	1.23	**3.33**	87.0	300	Sanitite HP	0.22	45.36	0.64	0.19	**7%**
M	N	Parcel C	f	90	0.41	MD	Residential	400	270	persons	1.25	4.098	5.12	0.06	0.00	5.18	**5.18**	92.0	300	Sanitite HP	0.22	45.36	0.64	0.26	**11%**
N	P	Parcel C	e	90	0.40	MD	Residential	450	270	persons	1.41	4.098	5.78	0.06	0.00	5.84	**11.02**	41.0	300	Sanitite HP	0.22	45.36	0.64	0.45	**24%**
P	Q	Parcel B	d	6	0.21	MD	Residential	400	18	persons	0.08	4.386	0.35	0.03	0.00	0.38	**11.40**	117.0	300	Sanitite HP	0.22	45.36	0.64	0.46	**25%**
Q	R	Parcel B	c	17	0.56	MD	Residential	450	51	persons	0.27	4.313	1.16	0.08	0.00	1.24	**12.64**	99.0	300	Sanitite HP	0.22	45.36	0.64	0.50	**28%**
R	S	Parcel B	c	18	0.60	MD	Residential	450	54	persons	0.28	4.308	1.21	0.09	0.00	1.30	**13.94**	73.0	300	Sanitite HP	0.22	45.36	0.64	0.53	**31%**
S	T	Parcel B	c	14	0.47	MD	Residential	450	42	persons	0.22	4.329	0.95	0.07	0.00	1.02	**14.96**	66.0	300	Sanitite HP	0.22	45.36	0.64	0.55	**33%**
T	Existing	Arden	m	3	0.28	MD	Residential	400	9	persons	0.04	4.419	0.18	0.04	0.00	0.22	**18.51**	62.0	300	PVC DR 35	0.22	45.36	0.64	0.62	**41%**
				238.00	2.93											15.18									

Appendix 8

Fire Flow Design

Domestic

S.F lots	66	3.5	231
S.D. lots	16	3.5	56
Townhouse lots	104	2	208
Apartment units	180	2	360
			855

Population	855	persons
Design Demand	400	L/capita/day
Development Demand	3.96	L/s
Maximum Day Factor	2.75	
Maximum daily demand	10.89	L/s
Peak Rate Factor (hour)	4.13	
Maximum hourly demand	16.35	L/s

Design fire

Fire (UL)

RFF = 220CvA

C	1	Common Construction		
A	3000	Based on Fire Area of one townhouse block		
			1500	sq. m per floor
			2	floors
RFF	12049.9	L/m		
	12000	L/m		rounded to nearest 1000

Content Adjustment

factor	-15%	Group C - Limited combustible contents
adjusdment	-1800	L/m

Exposure Adjustment

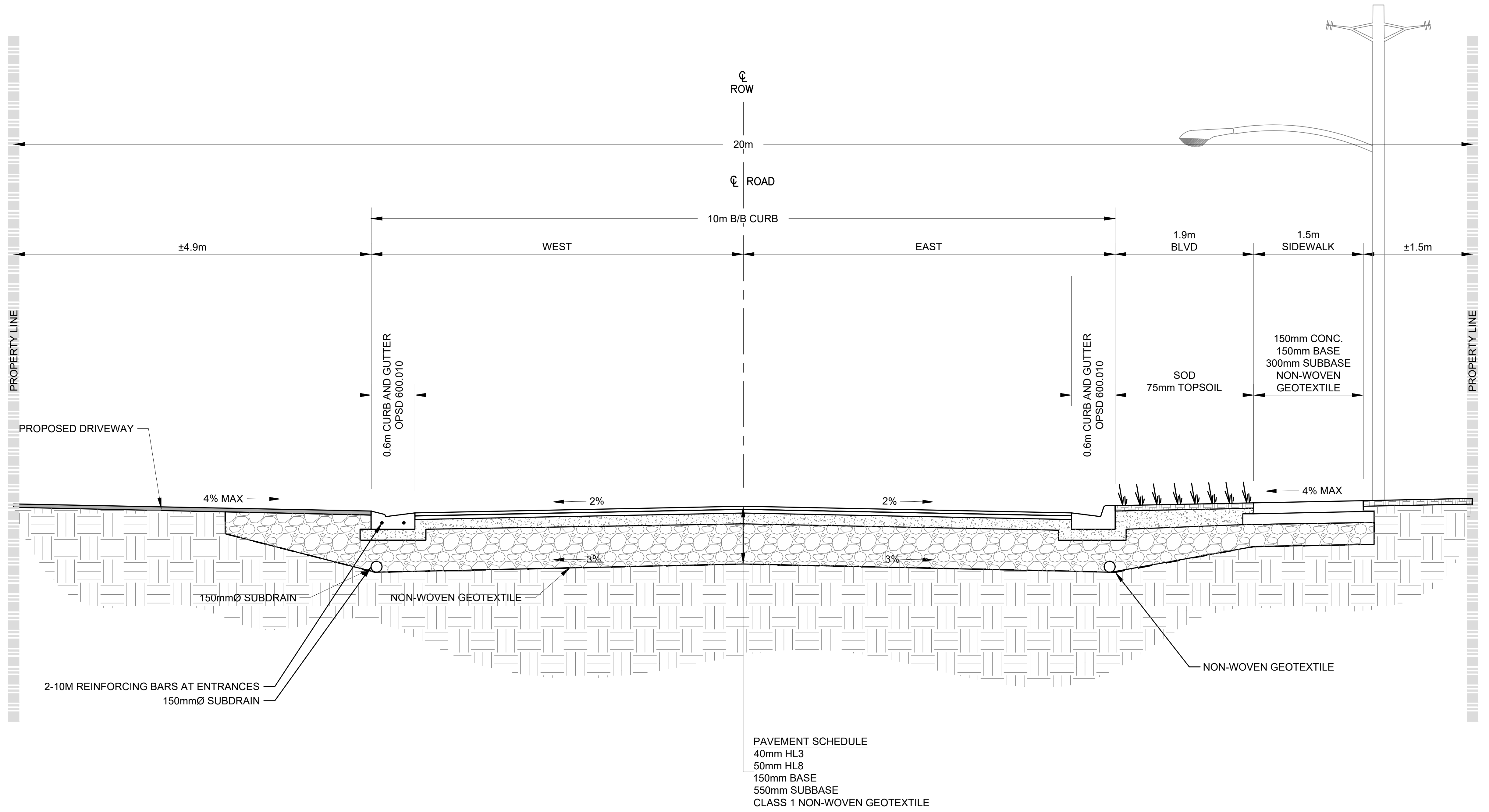
	20%	side yard 1
	20%	side yard 2
	10%	rear yard
	50%	
adjusdment	6000	L/m

Adjusted RFF

RFF	16000	L/m	(Note OBC max rate is 9,000 L/m)
	265	L/s	rounded

Appendix 9

Engineering Drawings



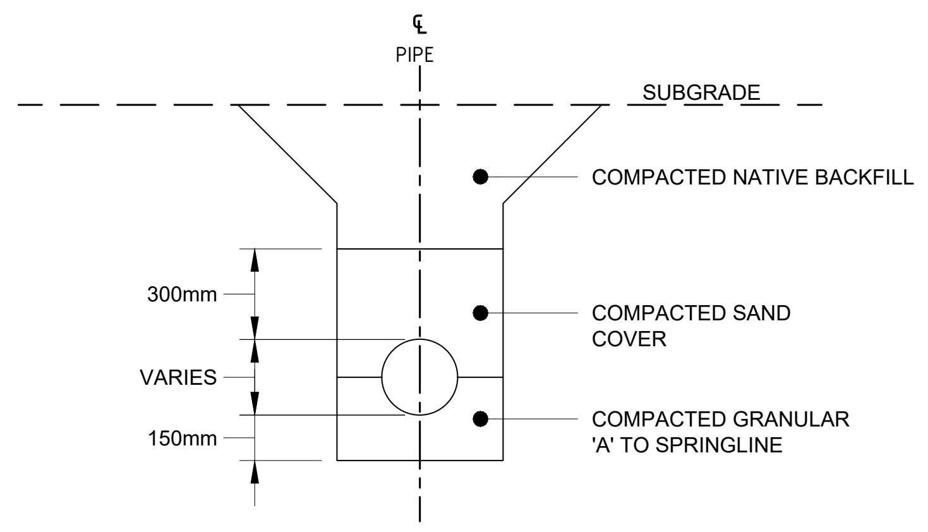
TYPICAL CROSS SECTION
SCALE 1:50

GENERAL:

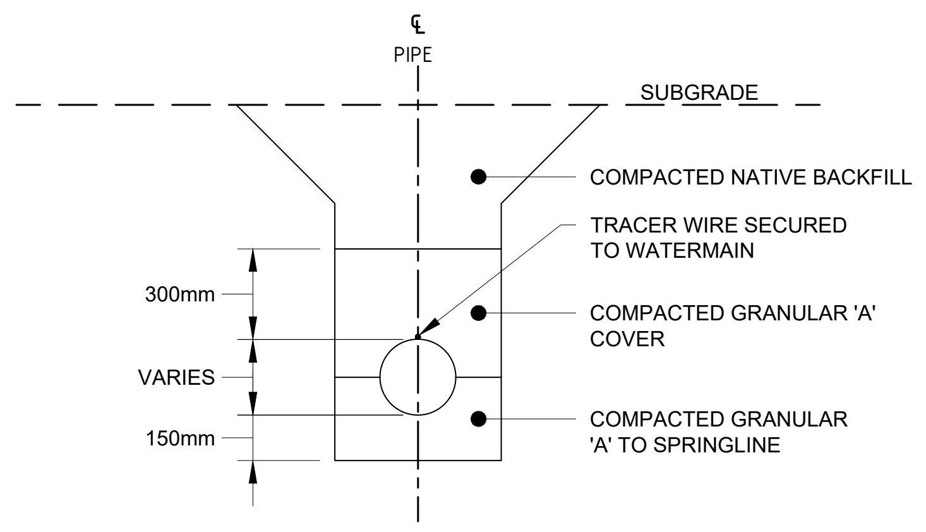
1. ALL SERVICES ARE TO REMAIN UNINTERRUPTED FOR THE DURATION OF THE CONTRACT.
2. THE CONTRACTOR SHALL RESTORE ALL DISTURBED AREAS TO PRE-CONSTRUCTION CONDITION,OR BETTER AND TO THE SATISFACTION OF THE ENGINEER.
3. CONCRETE SIDEWALK CONSTRUCTION SHALL BE AS PER OPSD 310.010 WITH RAMPS AT INTERSECTIONS CONFORMING TO CITY OF SAULT STE. MARIE STANDARDS.
4. ALL ENTRANCE RESTORATION SHALL ENSURE WIDTHS, SURFACE, CURB AND FINISHED GRADE MATCH EXISTING AT LIMITS AS DIRECTED BY THE ENGINEER ON-SITE. ENSURE POSITIVE SURFACE DRAINAGE TO STORM WATER COLLECTION SYSTEM.
5. GRADE TO MATCH EXISTING ASPHALT AND CURB AT INTERSECTIONS. ENSURE POSITIVE SURFACE DRAINAGE TO STORM WATER COLLECTION SYSTEM.
6. THE POSITION AND SIZE OF POLE LINES, CONDUITS, DUCTS, WATER MAINS, SEWERS AND OTHER UNDER GROUND AND ABOVE GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. THE CONTRACTOR SHALL BE RESPONSIBLE TO DETERMINE THE EXACT LOCATION AND SIZE OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME LIABILITY FOR DAMAGE TO THEM.

SANITARY AND STORM SEWERS:

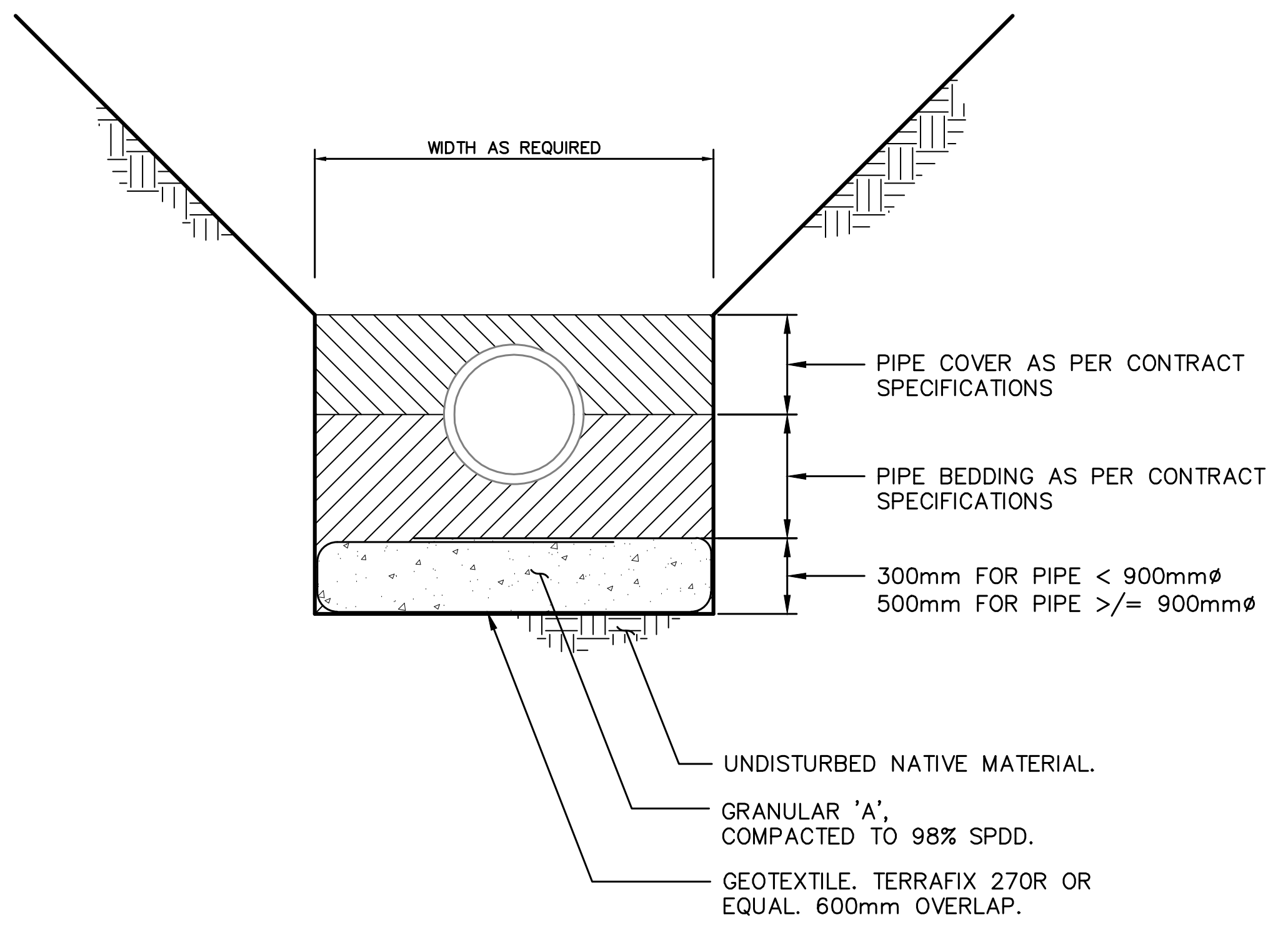
1. ALL SANITARY SEWER PIPE TO BE CSA 182.2 PVC SDR 35, SIZED AS NOTED ON DRAWINGS. ALL FITTINGS AND APPURTENANCES TO BE 100% COMPATIBLE.
2. ALL STORM SEWER PIPE TO BE CSA 182.2 PVC SDR35, OR CSA A257.2 REINFORCED CONCRETE PIPE,SIZED AS NOTED ON DRAWINGS. ALL FITTINGS & APPURTENANCES TO BE 100% COMPATIBLE.
3. ALL SANITARY AND STORM MAINTENANCE HOLES TO BE SIZED AS NOTED ON THE PROFILE DRAWING(S) AND SHALL CONFORM TO THE RELEVANT OPSD UNLESS OTHERWISE NOTED.
4. ALL CATCH BASIN LEADS SHALL BE CSA 182.2 PVC SDR 35 250mmØ UNLESS NOTED.
5. ALL SUBDRAINS TO BE CSA 182.8 PERFORATED HIGH DENSITY POLYETHYLENE PIPE OR APPROVED ALTERNATIVE; WRAPPED IN FILTER FABRIC CONFORMING TO OPSS 1840; 150mmØ.



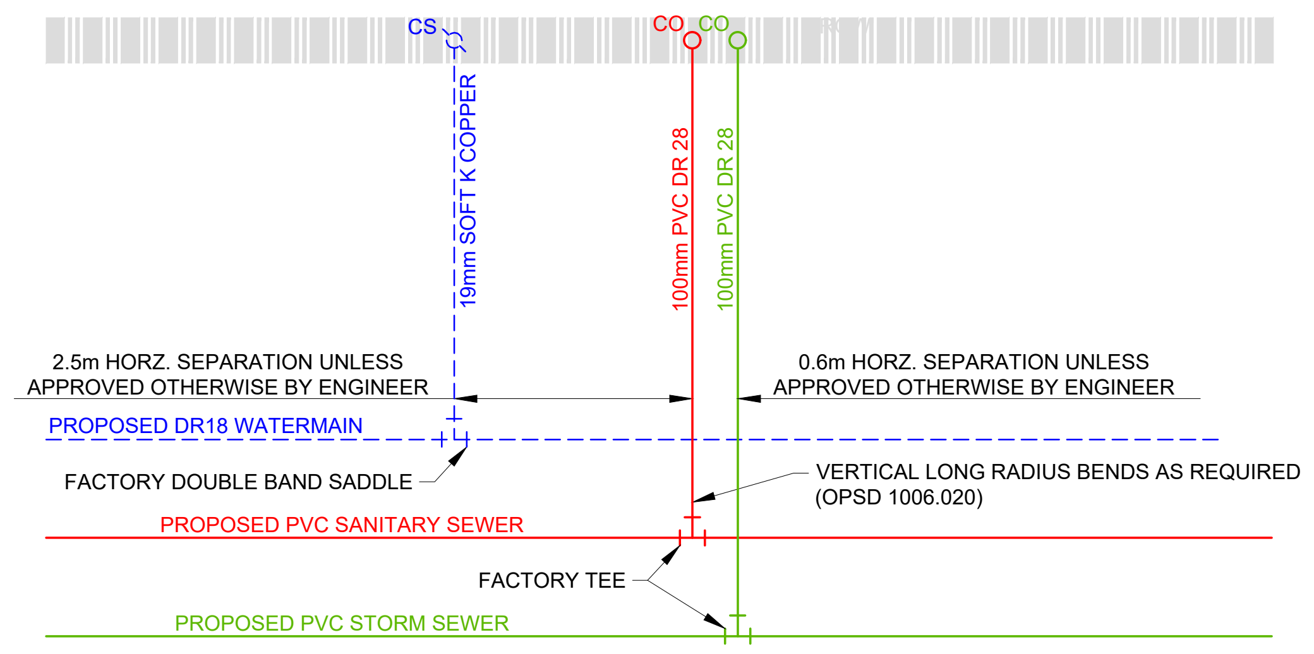
BEDDING DETAIL - SEWERS AND SERVICES
SCALE 1:25



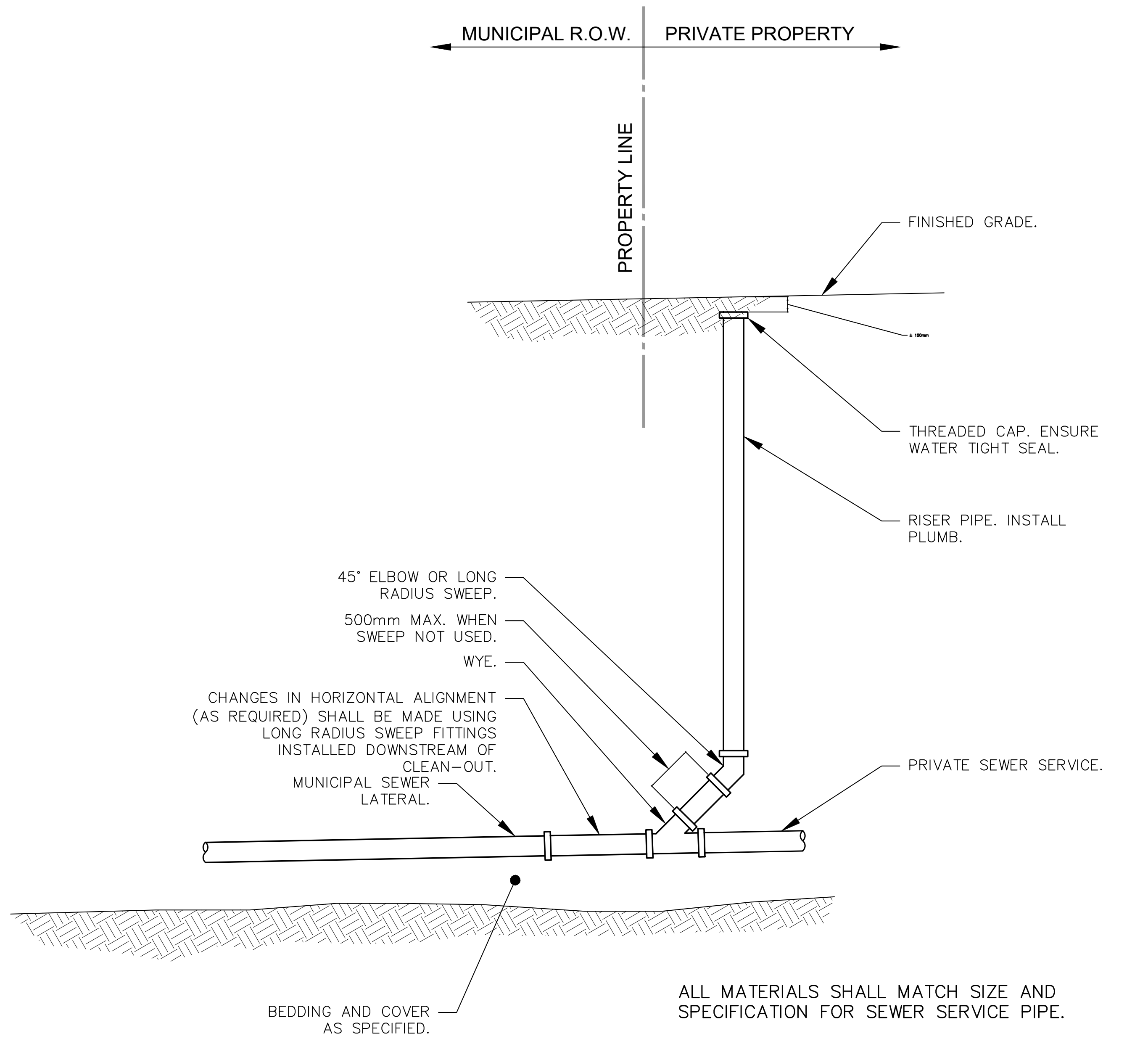
BEDDING DETAIL - WATERMAIN AND SERVICES
SCALE 1:25



REINFORCED PIPE BEDDING
SCALE NTS



TYPICAL SANITARY AND WATER SERVICE DETAIL
N.T.S.



SEWER SERVICE CLEAN-OUT
SCALE NTS

NOTES:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. DO NOT SCALE DRAWING.
3. DRAWING SHOWS PROPOSED CONSTRUCTION EMPHASIZED.
4. EXISTING CONDITIONS APPEAR SCREENED IN BACKGROUND.
5. LOCATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE ONLY AND MUST BE VERIFIED BY CONTRACTOR.
6. FOR BOREHOLE INFORMATION, REFER TO GEOTECHNICAL REPORT.

No	DESCRIPTION	DATE	INITIAL

REVISIONS

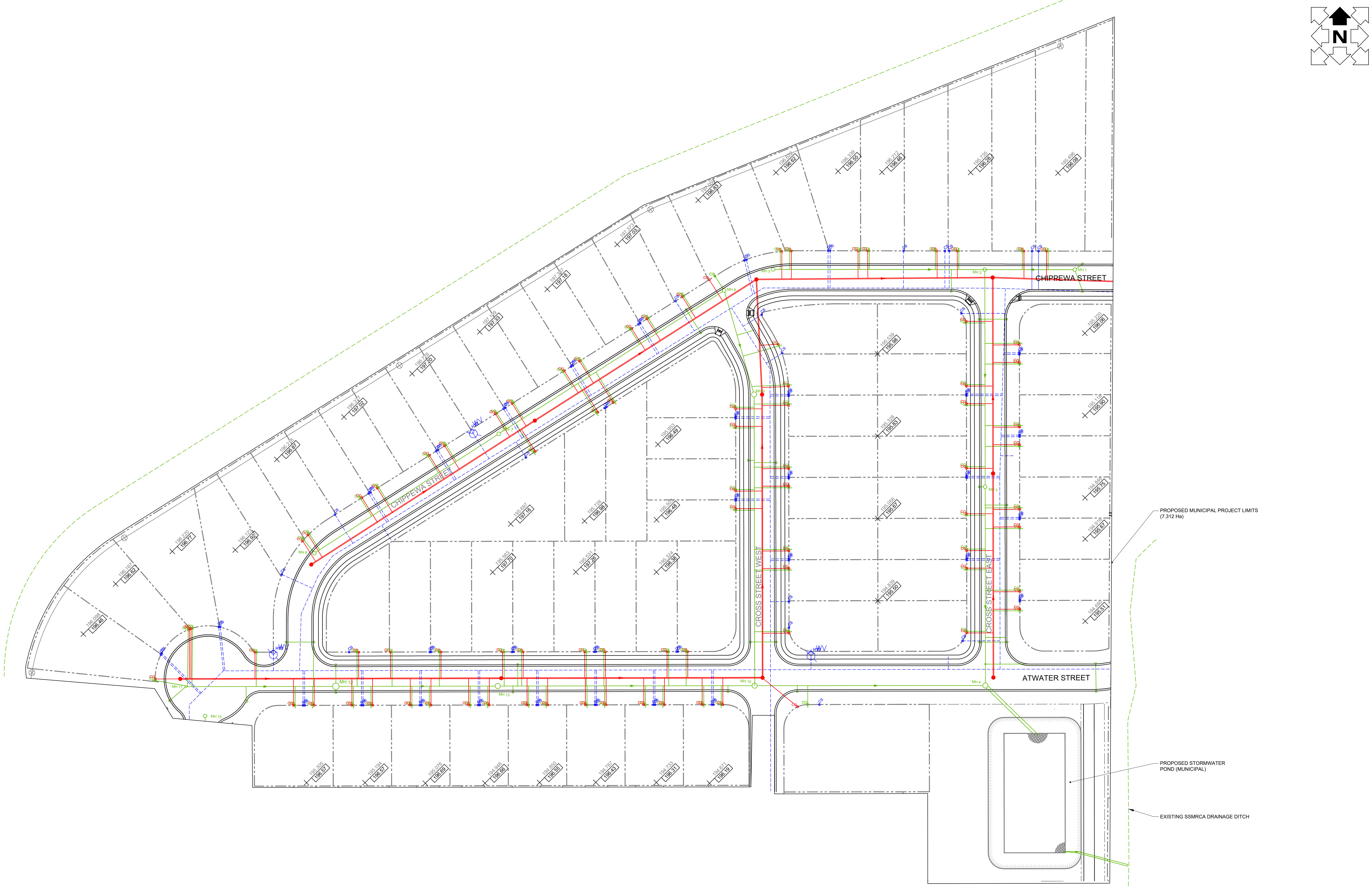
KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
DETAILS AND NOTES

DRAWING NO.
G1



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REVISIONS

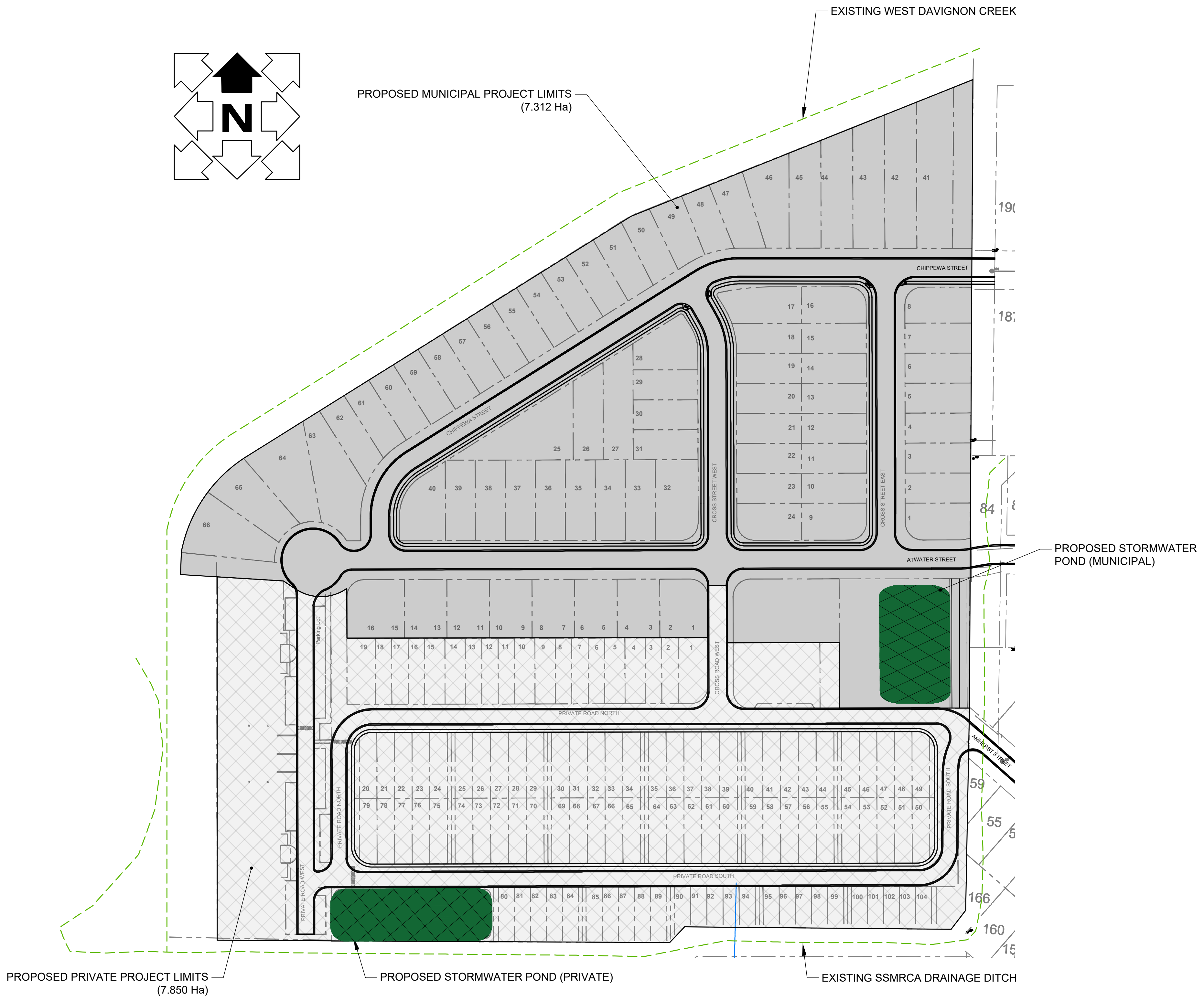
KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

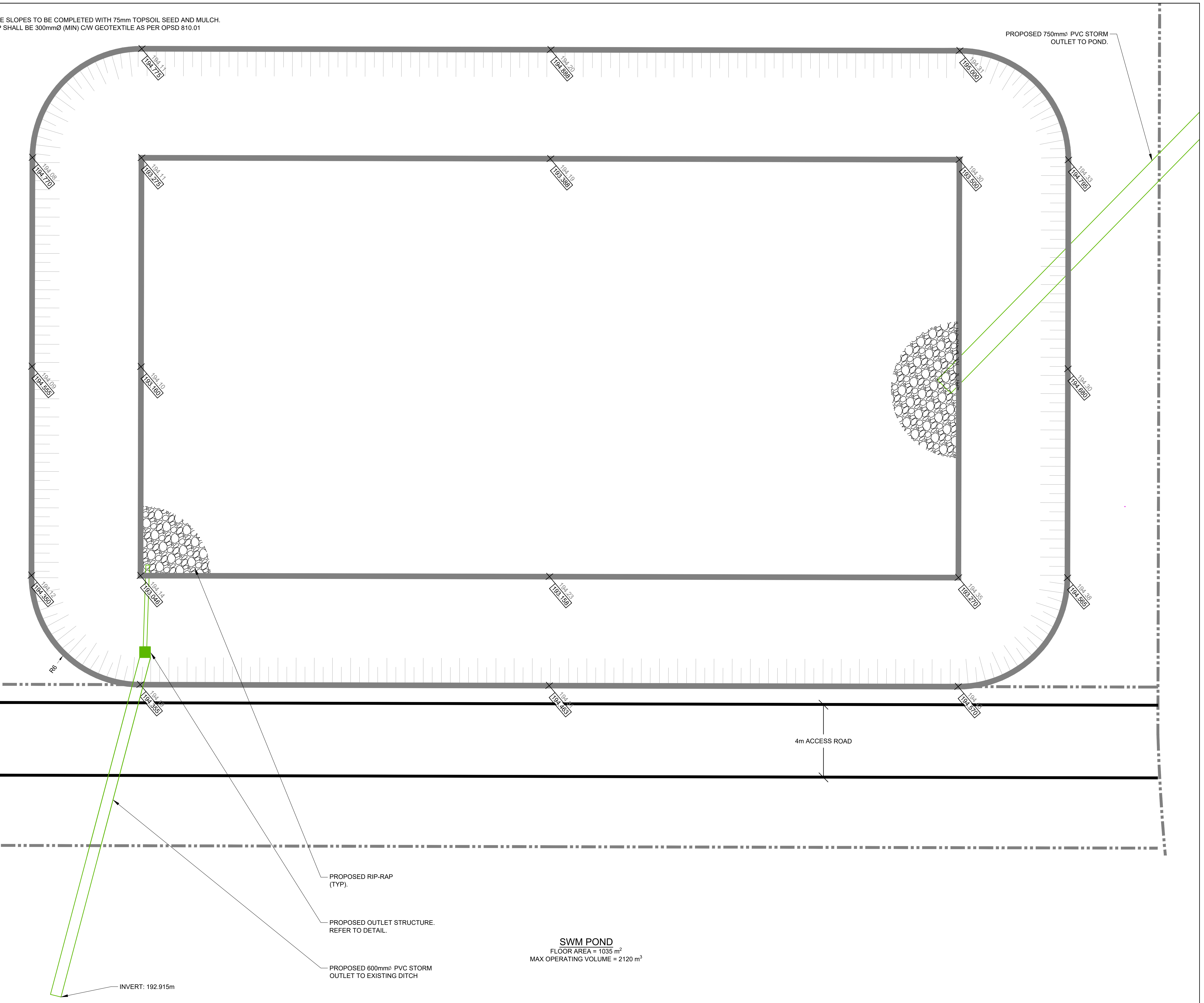
MAMTA HOMES
0 CHIPPEWA STREET
SITE GRADING

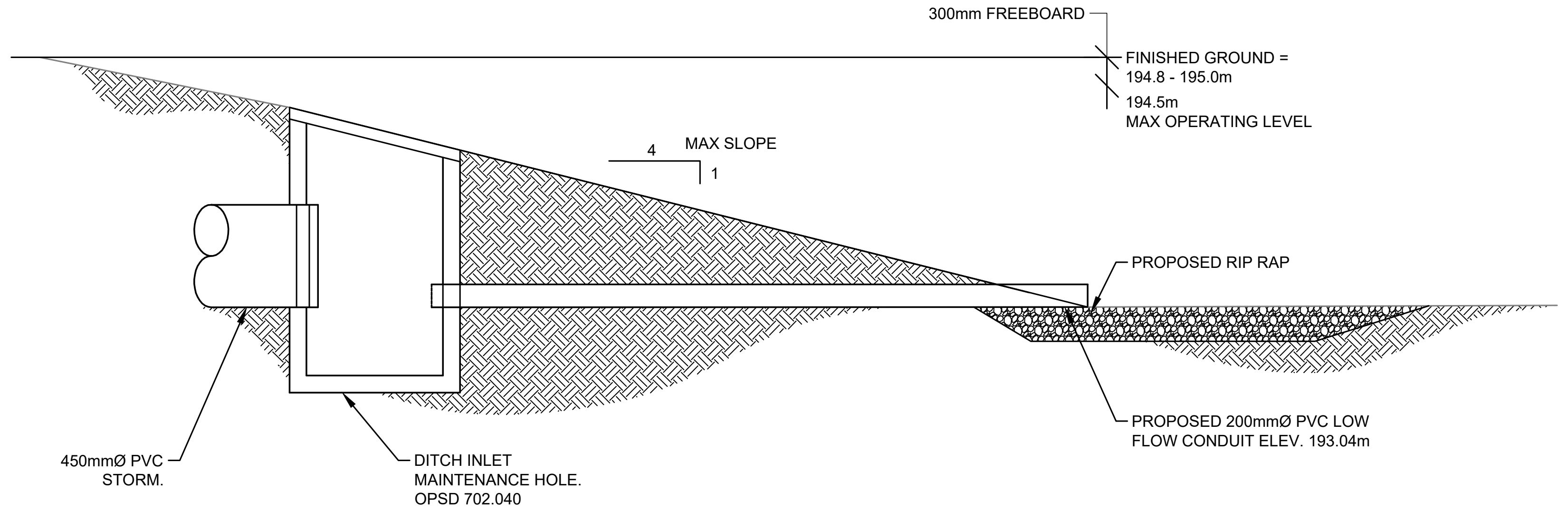
DRAWING NO.
G2



LOCATION PLAN
SCALE 1:2000

NOTES:
1. ALL SIDE SLOPES TO BE COMPLETED WITH 75mm TOPSOIL SEED AND MULCH.
2. RIP RAP SHALL BE 300mmØ (MIN) C/W GEOTEXTILE AS PER OPSD 810.01





OUTLET STRUCTURE DETAIL
SCALE 1:25

NOTES:
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No	DESCRIPTION	DATE	INITIAL
REVISIONS			

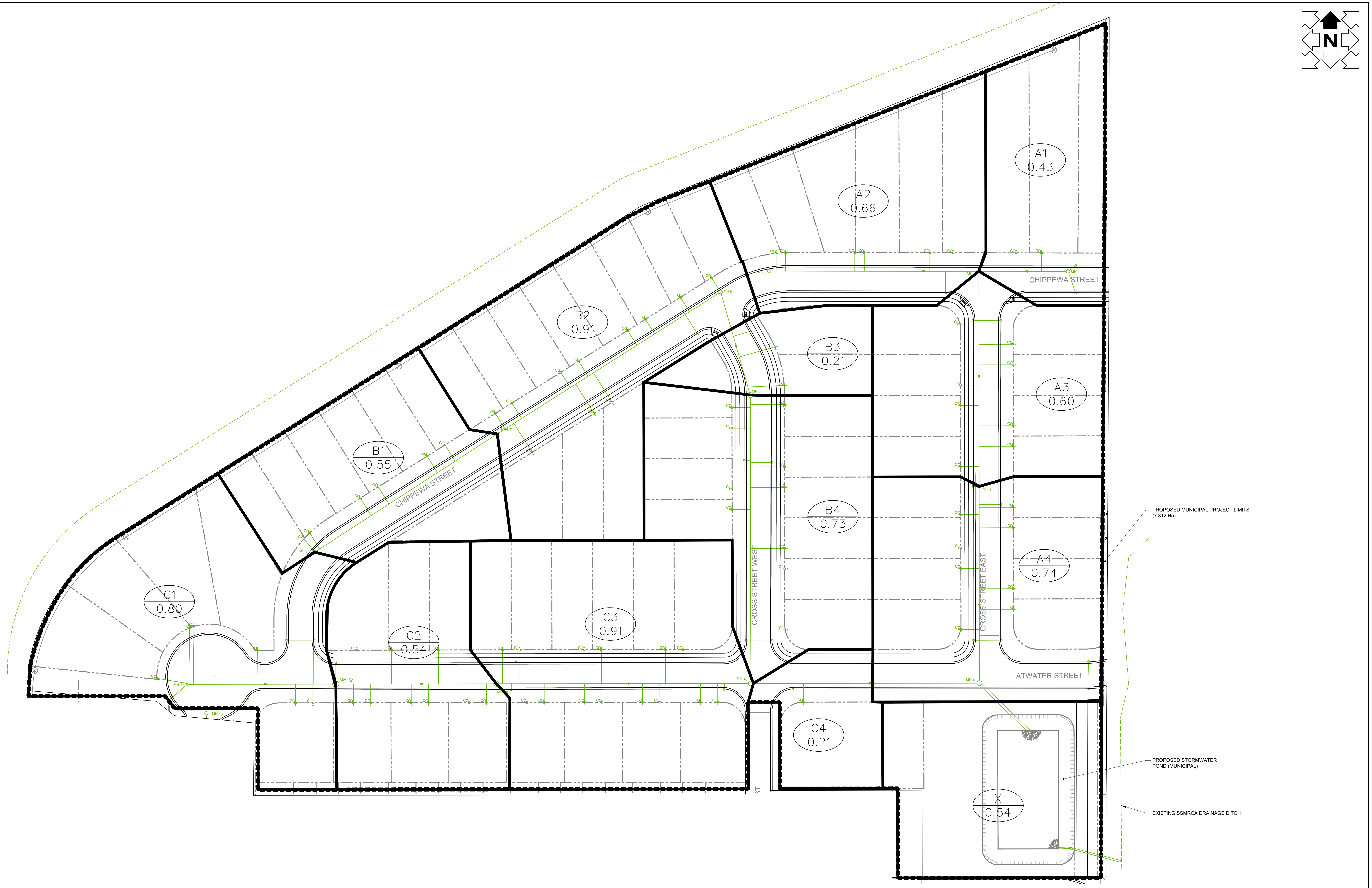
KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
STORMWATER POND

DRAWING NO.
G3



NOTES:
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No	DESCRIPTION	DATE	INITIAL

REVISIONS

KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 G1 G2 G3.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
STORM DRAINAGE AREAS

DRAWING NO.

G4

CL ELEV.	195.943	196.000	196.057	196.114	196.171	196.228	196.286	196.343	196.400	196.457	196.514	196.571	196.629	196.686	196.743	196.800	196.749	196.699	196.648	196.598
STA.		10+010	10+020	10+030	10+040	10+050	10+060	10+070	10+080	10+090	10+100	10+110	10+120	10+130	10+140	10+150	10+160	10+170	10+180	10+190

CL ELEV.	196.547	196.497	196.446	196.395	196.344	196.290	196.236	196.182	196.127	196.073	196.019	195.965	195.911	195.857	195.803	195.740	195.676	195.612	195.549	195.485	195.437
STA.	10+200	10+210	10+220	10+230	10+240	10+250	10+260	10+270	10+280	10+290	10+300	10+310	10+320	10+330	10+340	10+350	10+360	10+370	10+380	10+390	10+400

NOTES:
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No	DESCRIPTION	DATE	INITIAL

REVISIONS

KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 DESIGN.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
CHIPPEWA STREET

DRAWING NO.
P1

REFER TO DRAWING G1 FOR STRUCTURE SCHEDULE

PAVEMENT SCHEDULE
40mm HL3
50mm HL8
150mm BASE
550mm SUBBASE
CLASS 1 NON-WOVEN GEOTEXTILE

LOT SERVICING
-100mm DIAMETER PVC DR 28 SANITARY
-100mm DIAMETER PVC DR28 STORM
-19 mm DIAMETER COPPER WATER

REFER TO DRAWING G1 FOR STANDARD SERVICING DETAIL

NOTES:

No	DESCRIPTION	DATE	INITIAL

REVISIONS

KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

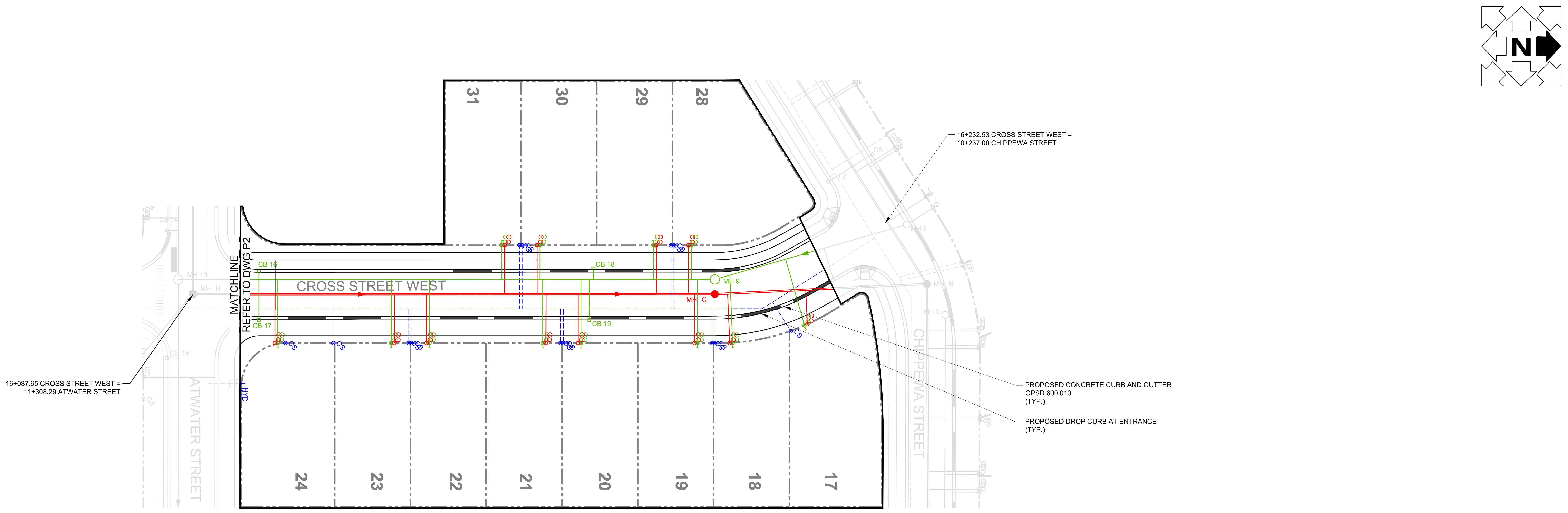
SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 DESIGN.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
ATWATER STREET

DRAWING NO.

P2



NOTES:

No	DESCRIPTION	DATE	INITIAL

REVISIONS

KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	06/10/2024
DWG.	KS
GEO BM	
FILE	2278.03 DESIGN.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
CROSS ROAD WEST

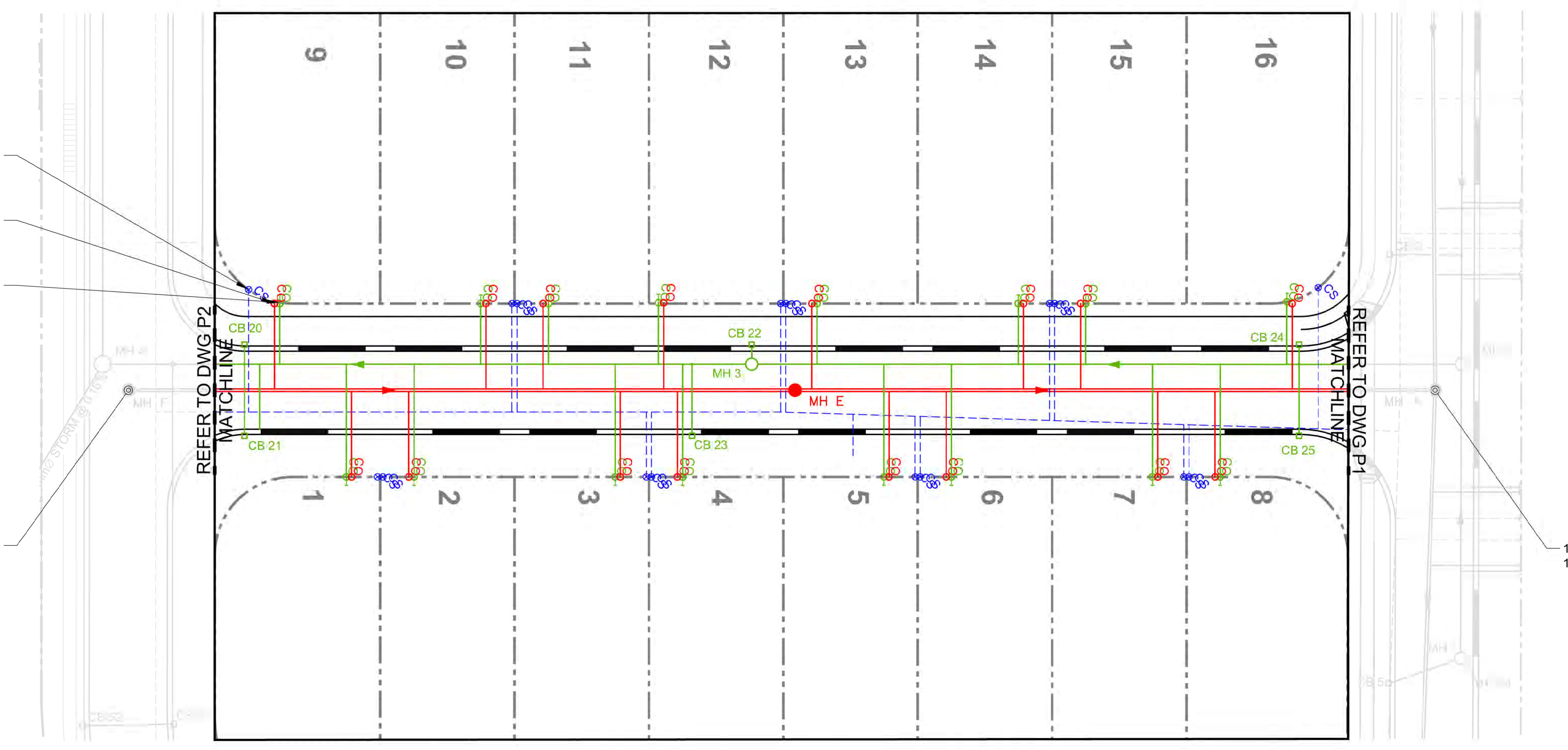
DRAWING NO.

P3

PROPOSED 19mmØ SOFT K COPPER WATER SERVICE (TYP.)
UNLESS OTHERWISE NOTED

PROPOSED 100mmØ SANITARY SERVICE PVC DR-28
C/W CLEAN-OUT AT PROPERTY LINE(TYP.)

PROPOSED 100mmØ STM SERVICE PVC DR-28(TYP.)
C/W CLEAN-OUT AT PROPERTY LINE



12+010.048 CROSS STREET EAST =
11+395.30 ATWATER STREET

12+010.05 CROSS STREET EAST =
10+340.56 CHIPPEWA STREET

REFER TO DRAWING G1 FOR
STRUCTURE SCHEDULE

PAVEMENT SCHEDULE
40mm HL3
50mm HL8
150mm BASE
550mm SUBBASE
CLASS 1 NON-WOVEN GEOTEXTILE

LOT SERVICING
-100mm DIAMETER PVC DR 28 SANITARY
-100mm DIAMETER PVC DR28 STORM
-19 mm DIAMETER COPPER WATER

REFER TO DRAWING G1 FOR STANDARD
SERVICING DETAIL

NOTES:

No	DESCRIPTION	DATE	INITIAL

REVISIONS

KRESIN
Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

SCALE	1:500
CHK	M. KRESIN
DATE	05/2024
DWG.	BM KS
GEO BM	
FILE	2278.03 DESIGN.DWG

FOR APPROVAL

MAMTA HOMES
0 CHIPPEWA STREET
CROSS STREET EAST

DRAWING NO.
P4