



Master Environmental Servicing Plan

Clair-Maltby

Guelph, ON

Project # TPB168050

Prepared for:

City of Guelph

1 Carden Street, Guelph, Ontario N1H 3A1

6/18/2021



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6/18/2021

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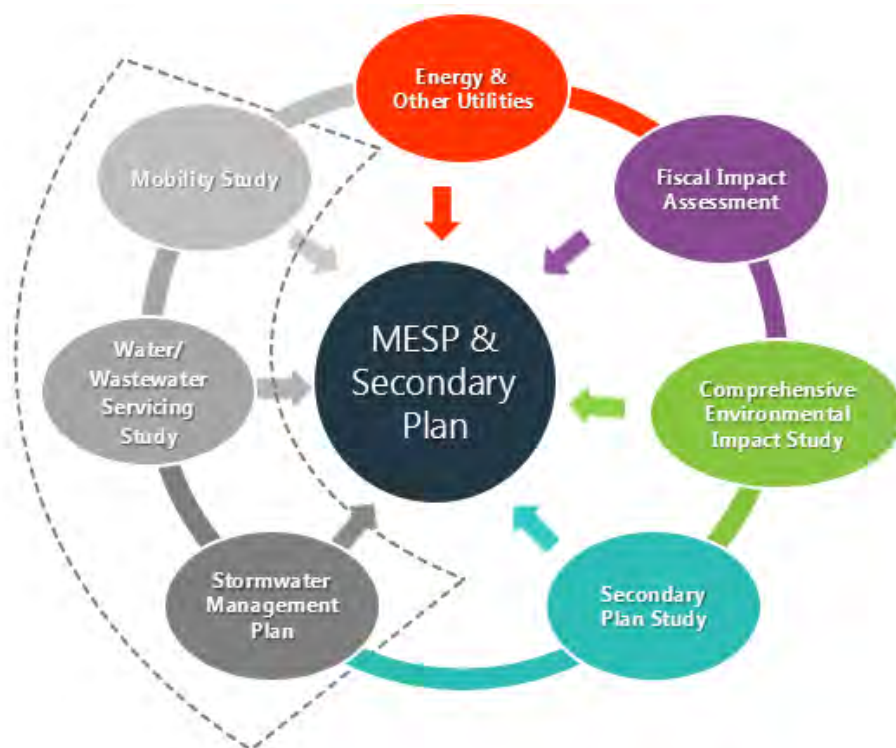
Executive Summary

1. Introduction

The City of Guelph initiated the process of preparing the Clair-Maltby Secondary Plan in 2016. As part of this process, the City is also preparing a Comprehensive Environmental Impact Study (CEIS), which establishes the existing environmental conditions within the Secondary Plan Area (SPA), determines the environmental impacts from the proposed land use (Community Structure) and then recommends mitigative and management measures to prevent and / or manage impacts (ref. Figure EX 1). The CEIS is being conducted by the Wood Team, comprised of Wood Environment & Infrastructure Solutions, Matrix Solutions, Beacon Environmental and Daryl Cowell.

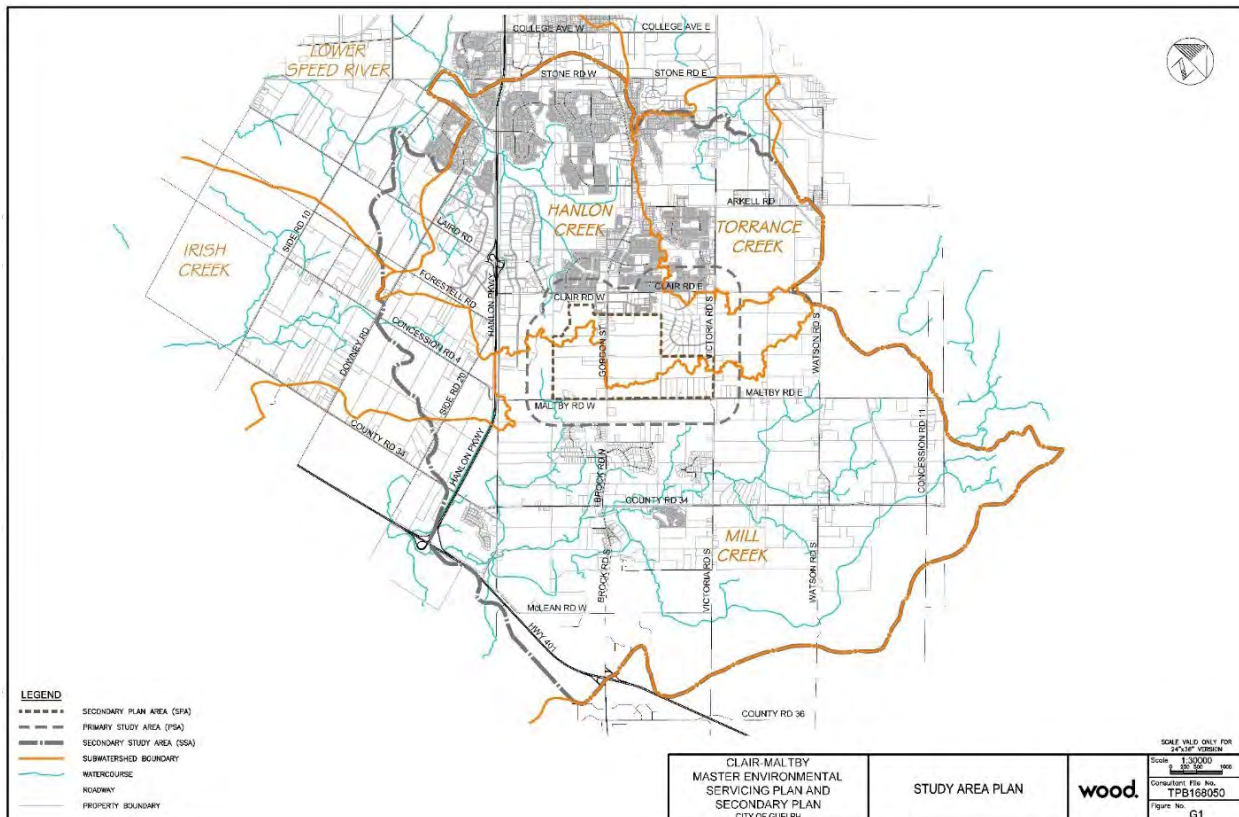
The Master Environmental Servicing Plan (MESP) is also being prepared concurrently with the Secondary Plan. The MESP is intended to satisfy the requirements of the Environmental Assessment Act and the Planning Act. The MESP will determine the preferred servicing strategies (water, wastewater, stormwater and mobility) required for the Clair-Maltby Secondary Plan Area (SPA). The Secondary Plan, CEIS and MESP along with the Energy & Other Utilities study as well as the Fiscal Impact Assessment are all integrated components as part of this study (ref. Figure EX 1).

Figure EX.1. Clair-Maltby Study Components



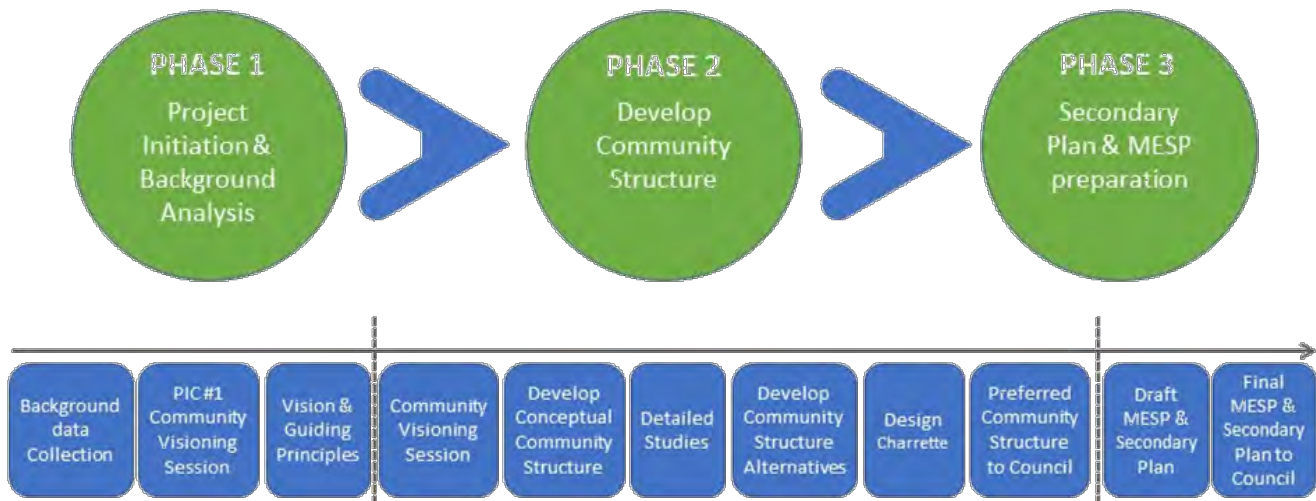
The Secondary Plan Area (SPA): (ref. Figure EX.2) constitutes the lands within which land use change is proposed to occur in accordance with an approved Secondary Plan. The SPA includes the lands south of Clair Road East, north of Maltby Road East, approximately 1 km east of the Hanlon Expressway and west of Victoria Road South, excluding the Rolling Hills Community at the corner of Victoria Road and Clair Road East. Notably, the Rolling Hills Community was originally included in the SPA for this project at its outset, and was considered under the Phase 1 and 2 Characterization reporting. However, based on feedback from the community and other planning considerations, it was removed by decision of Council in June 2018 (ref. Figure Ex.2). The Secondary Study Area (SSA) refers to the assessment area being considered either partially or in its entirety (e.g. Regional groundwater movement).

Figure EX.2. Study Area Plan



The purpose of the CEIS is to serve as a comprehensive and strategic document to address natural heritage and water resource protection and management based on a subwatershed scale assessment to inform environmental, land use and infrastructure planning and associated decision-making, as part of a broader integrated development framework for informing the Secondary Plan and its policies. The process and timing for developing the Secondary Plan is outlined in Figure EX.3.

Figure EX.3. Clair-Maltby Secondary Plan Process



1.1 Process

The process and timing for developing the Secondary Plan is outlined in Figure 1.2. As part of the overall land use planning process, a preferred Conceptual Community Structure for the Clair-Maltby SPA has been developed by the City through a highly consultative process, with input from government agencies, stakeholder groups, the public and the CEIS/MESP Team. The process for developing the initial Community is discussed further in Section 1.3.

The MESP has been conducted in accordance with the Master Plan requirements of the Municipal Engineers Association Class Environmental Assessment (EA) process (Section A.2.7 of the Municipal Class EA document, October 2000, as amended in 2007, 2011 and 2015). The MESP has followed Phases 1 and 2 of the Class EA process and identifies a series of servicing projects that will be required to service the Clair-Maltby SPA.

1.2 Problem and Opportunity Statement

The conversion of the Clair-Maltby SPA to urban uses, from its current largely natural and agricultural state, brings forward the need for municipal services including potable water, wastewater collection/treatment, stormwater management and transportation facilities.

The Class EA master planning process adopted for the MESP, with support from the CEIS, ultimately establishes the preferred servicing and transportation solutions for the preferred Community Structure Plan (land use plan), which are to be compatible, and integrate with, the existing and recommended natural systems, existing adjacent urban land uses and associated transportation and municipal servicing infrastructure.

1.3 Development of Preferred Community Structure/Public Consultation

The process of establishing the preferred land use for Clair-Maltby involved a number of concurrent studies and investigations. The initial preferred Conceptual Community Structure (urban land use plan) for Clair-Maltby was developed by the City through a highly consultative process, with input from government agencies, stakeholder groups, the public and the CEIS Team. Through the consultative process and the CEIS Impact Assessment results, the Updated Preferred Community Structure Plan was developed (ref. Figure EX.3). Subsequently the City finalized the location of the Community Park within the context of the updated Preferred Community Structure Plan in May 2020. In May 2021, a Final Preferred Community Structure Plan was provided by the City. Assessment has been conducted using the May 2021 Final Preferred Community Structure Plan, but do timing of the plan being provided, figures and drawings indicate the Updated Preferred Community Structure from May 2019.

Figure EX.3. Updated Preferred Community Structure, May 13, 2019

PREFERRED COMMUNITY STRUCTURE: Council Endorsed May 13, 2019

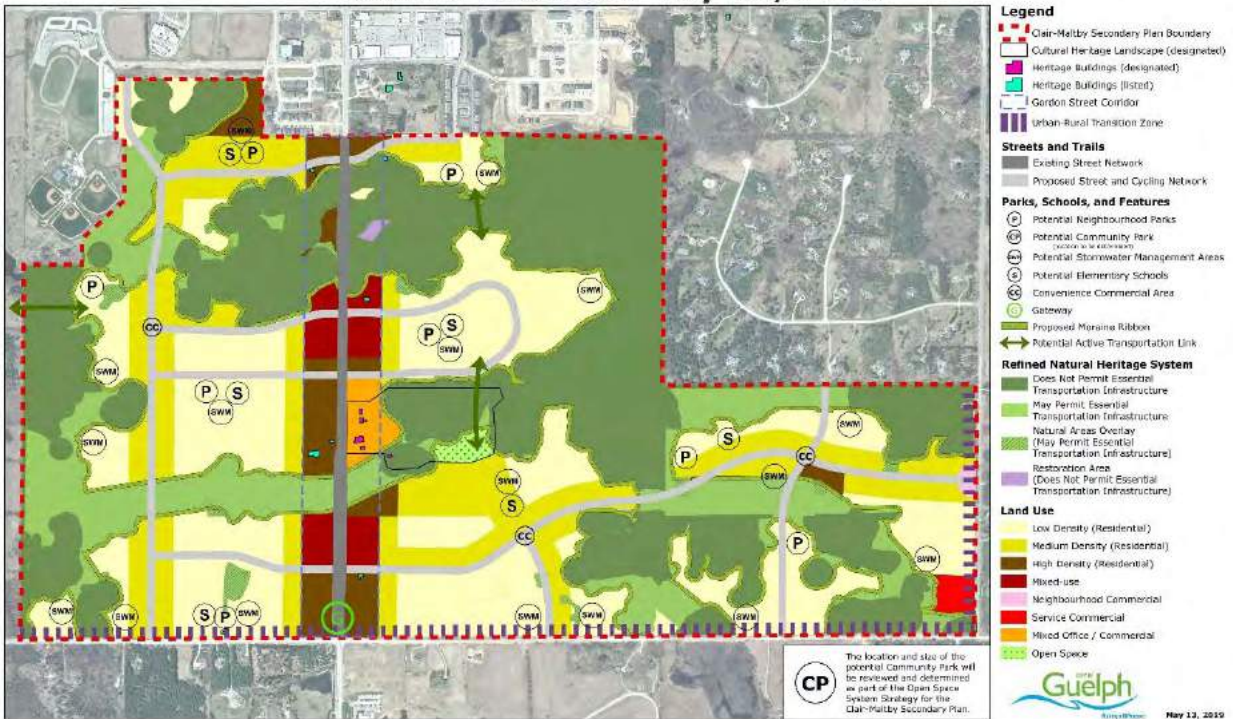
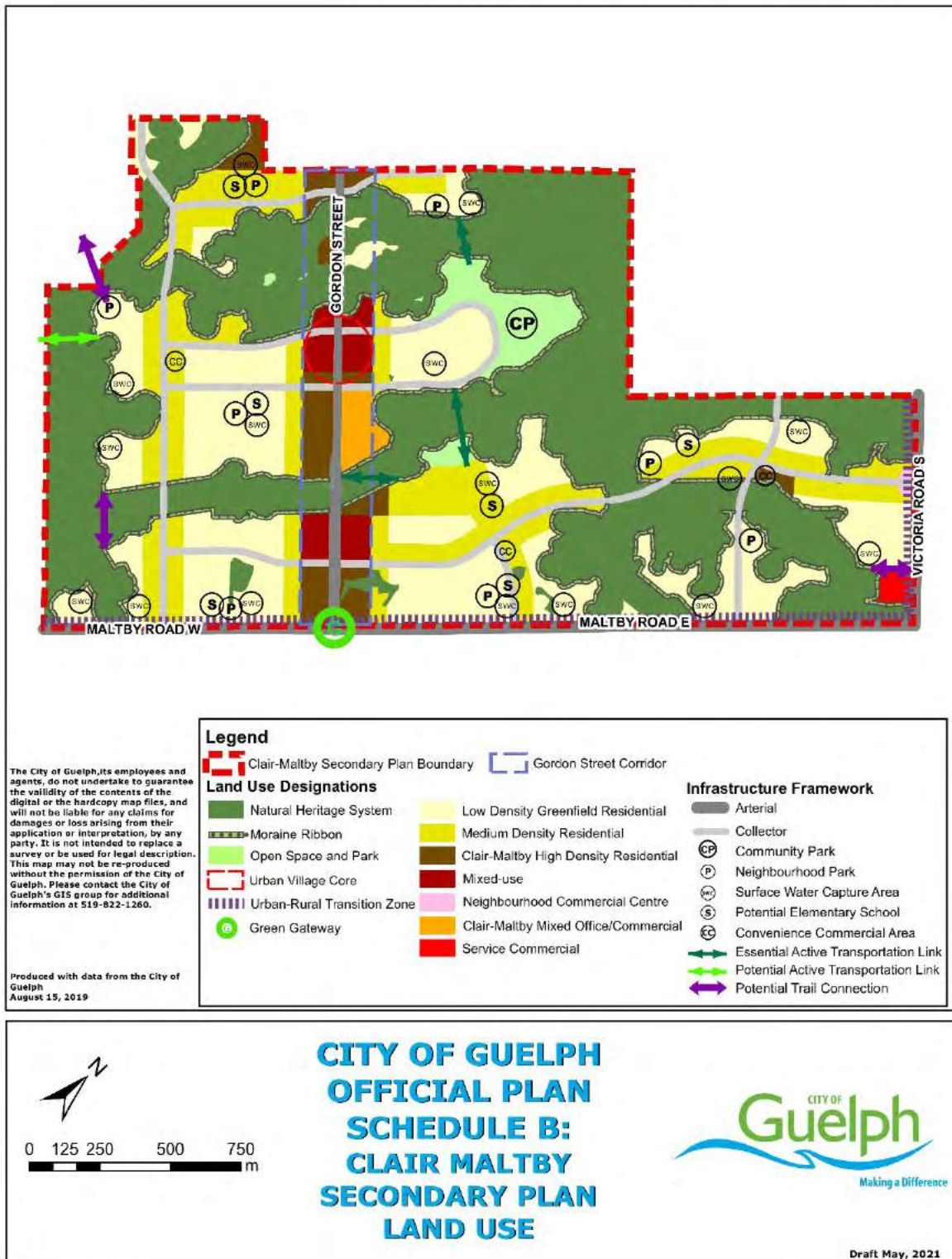


Figure EX.4. Final Preferred Community Structure, May 2021



The Clair-Maltby SPA is approximately 415 ha and will have various residential land uses schools, parks and office and commercial areas. The Clair-Maltby SPA would have a population of approximately 16,300 people and provide 1,250 jobs.

2. Natural Environment

The CEIS provides the details associated with the natural systems in the Clair-Maltby SPA and surrounding areas based on existing conditions. Key information from the CEIS Characterization assessment of the natural environment serves as a basis for evaluating the respective servicing alternatives related to the water, wastewater, stormwater and mobility servicing.

The Clair-Maltby SPA includes portions of the Hanlon Creek, Mill Creek and Torrance Creek watersheds. It contains a well-defined natural heritage system (NHS). The Hanlon Creek Watershed and the Mill Creek Watershed each cover almost half of the SPA, with the northeastern corner captured by the Torrance Creek Watershed. The SPA contains a mix of cultural vegetation communities, natural forests and wetlands that support a range of significant species. This diversity of natural features and areas sits above the generally well-drained, hummocky topography of the Paris Moraine, which lacks open watercourse features, and instead drains to depressional features including Significant Wetlands, other Wetlands, Significant Woodlands and Cultural Woodlands.

3. Servicing

The objective of the MESP, as outlined in the earlier Problem Statement is to establish water, wastewater and storm servicing and transportation solutions for the preferred Community Structure Plan, with consideration to the existing and recommended NHS, existing adjacent urban land uses and associated existing transportation and municipal servicing infrastructure. The following sections provide details of the respective water, wastewater and storm servicing and transportation assessments conducted in accordance with the provisions of the MEA Class EA process (ref. Municipal Engineers Association Municipal Class Environmental Assessment document October 2000, as amended 2007, 2011 and 2015). Each section has been largely structured in a common approach providing details of the existing system, governing policies and criteria, outlining future needs and demands, per the Clair-Maltby Community Structure and offering a suite of alternatives, assessment criteria and ultimately the preferred solutions.

3.1 Water

The City's water distribution system is currently being expanded in the southern portion of Guelph through a new pressure zone (Zone 3) that will operate at pressures that are suitable to supply the water demands for the CMSP Lands. Zone 3 is now live with pumping into the zone from the Clair Road Booster Pumping Station, however as demand increases in its service area, Zone 3 will require storage to meet mandated operating requirements.

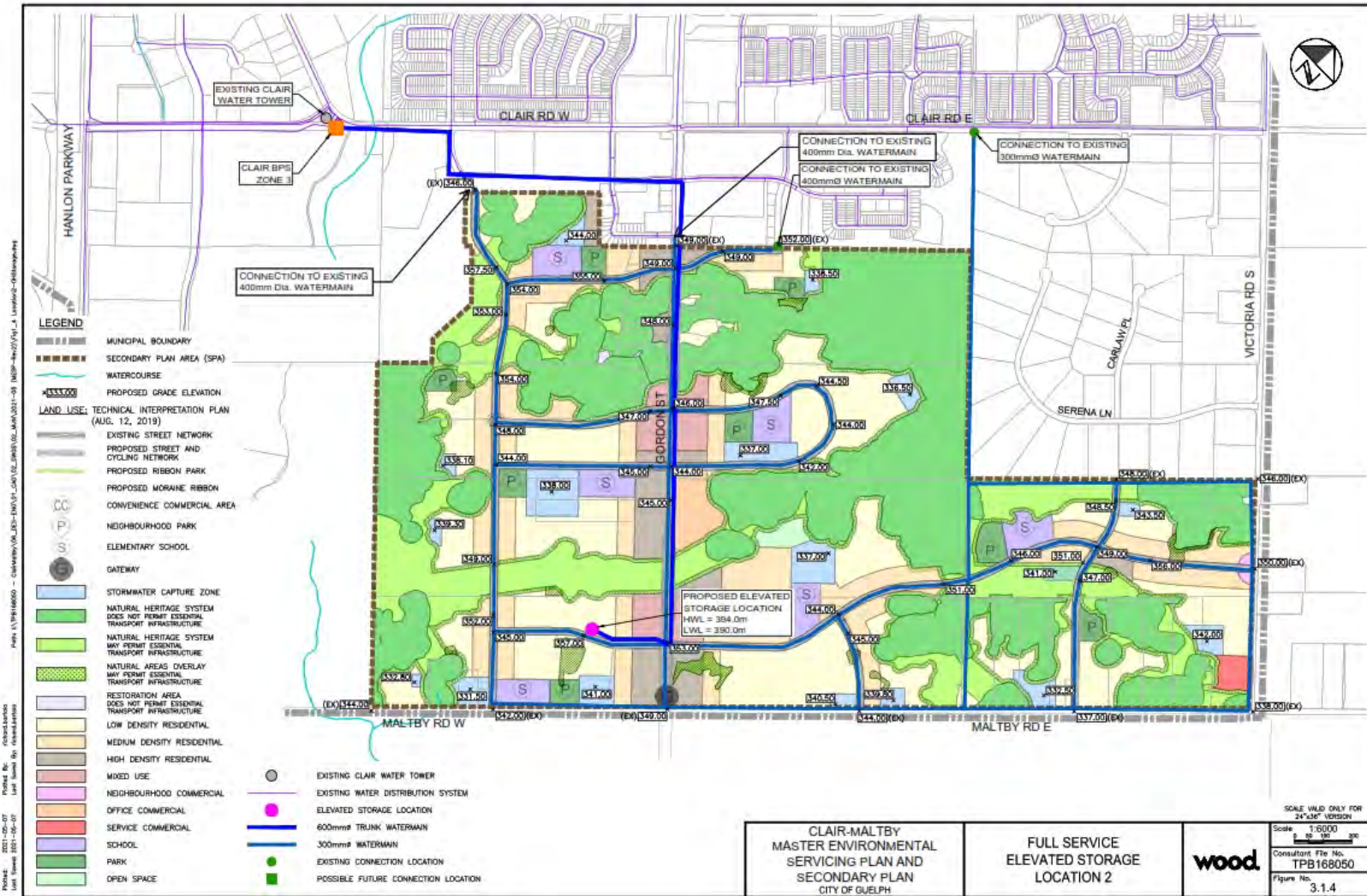
A 5ML storage reservoir will be required at one of the high points within the CMSP Lands. Three potential locations were selected for the water storage reservoir, Location 1 in the northern portion of the lands near Gordon Street, Location 2 in the

Southwest portion of the lands near Maltby Road, and Location 3 in the eastern portion of the lands adjacent Victoria Road.

Water storage options examined consisted of elevated storage which will be operated by gravity, and subsurface storage which will require a suitably sized pumping station. Elevated storage and underground storage with a pumping station were assessed for all three geographic locations including the water transmission mains and distribution piping required for each scenario. All scenarios were evaluated on a variety of Social/Cultural Environment, Economic Environment, Natural Environment and Functional (Technical) Environment criteria.

The preferred alternative (ref. Figure EX.5) utilizes an elevated 5ML Storage reservoir at location 2, near the corner of Gordon Street and Maltby Roads, and requires approximately 17.35km of 300mm diameter watermain and 3.3km of 600mm watermain.

Figure EX.5 Water System Preferred Alternative



3.2 Wastewater

Wastewater flows will be conveyed to the Guelph Wastewater Treatment Plant (WWTP). Four main receiving branches were considered potentially available to receive all or part of the wastewater flow from the CMSP area and convey it to the WWTP. The receiving branches evaluated were the Clair Gordon Branch, the Southgate Hanlon Branch, Victoria Road Branch and the Valleyland Trunk. Up to three connection points along each branch were considered and evaluated. The topography of the CMSP Lands is such that flow by gravity alone is not possible and the use of sewage pumping stations is required. In all wastewater servicing scenarios, three sewage pumping stations are required to service the lands. Between each scenario the length, size and routing of the collection and conveyance piping and the size of the sewage pumping station differed.

The Clair Gordon Trunk alternative discharge immediately north of the lands and will require significant upgrades/twinning of existing sewers to provide capacity in the Clair Gordon Trunk system to accommodate CMSP wastewater flows.

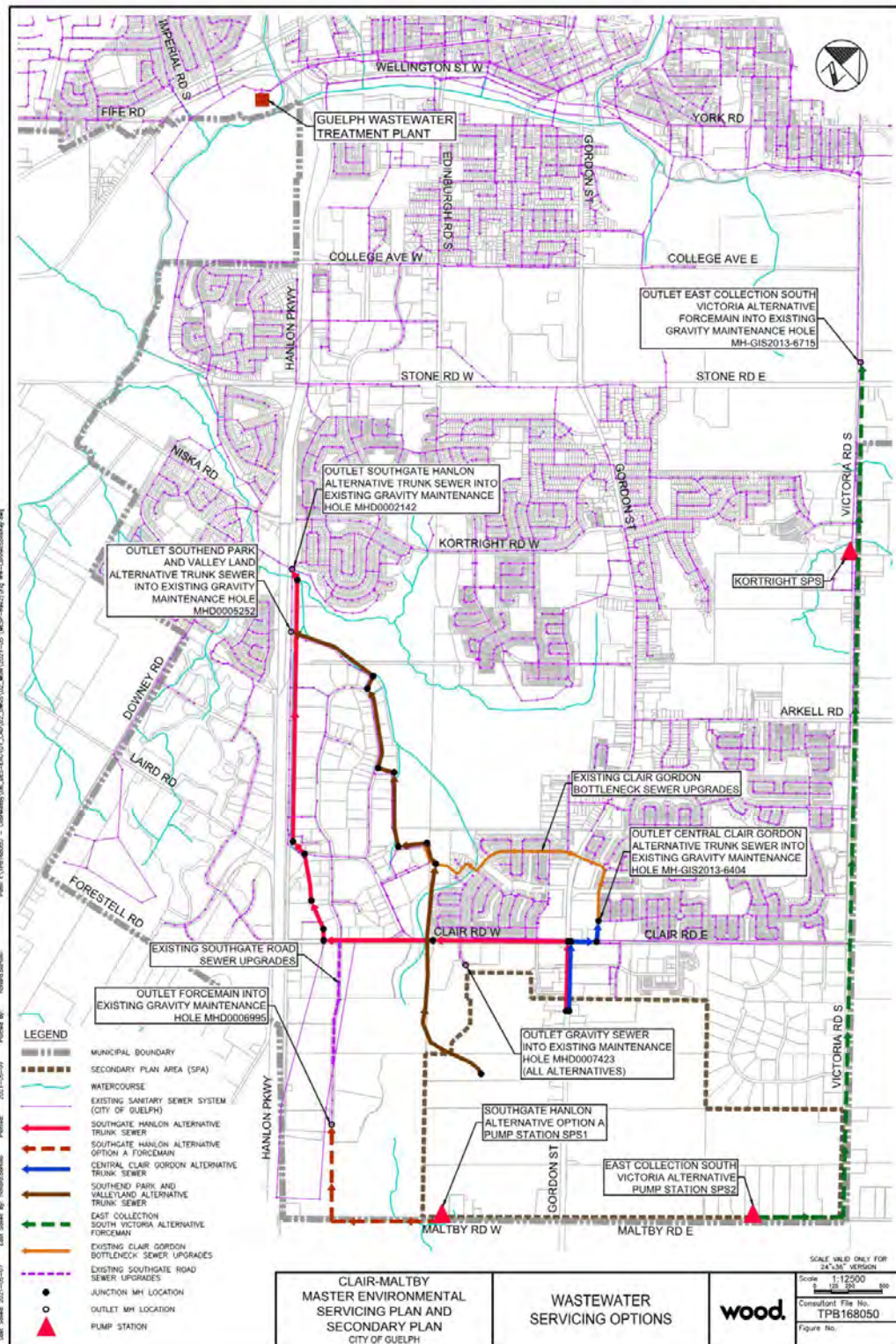
The Southgate Hanlon alternative discharges to the west side of the development and provides a connection point which will not require upgrading of the existing sewer infrastructure. The Southgate Hanlon Alternative is the preferred alternative. It offers the lowest capital cost, reasonable operating costs and limited impact to businesses and communities, as well as limited impact to the natural environment.

The Victoria Street alternative discharges to the east of the lands and requires an exceptionally long forcemain to avoid upgrading of an existing downstream sewage pumping station, due to its lack of capacity to support the Clair Maltby Lands.

The Southend Park and Valleyland Trunk alternative discharges to the west side of the lands. The advantage of this option is its heavy reliance on gravity flows resulting in smaller sewage pumping stations within the CMSP Lands. The disadvantage of this option is that the sewer depths are in excess of 10 m, going as deep as 15 m to 18 m in some locations. As well, extensive sewer easements will be required for this option.

The Wastewater Servicing alternatives considered are shown in Figure EX 6.

Figure EX.6. Wastewater Servicing Alternatives



All scenarios were evaluated on a variety of Social/Cultural Environment, Economic Environment, Natural Environment and Functional (Technical) Environment criteria.

The preferred alternative is the Southgate Hanlon Trunk Alternative (ref. Figure EX.7). It is believed this alternative offers the best combinations of economics (capital and operating costs), respect for the natural environment, and functionality in terms of operating and maintaining the system.

Figure EX.7. Preferred Wastewater Servicing Alternative



3.3 Stormwater

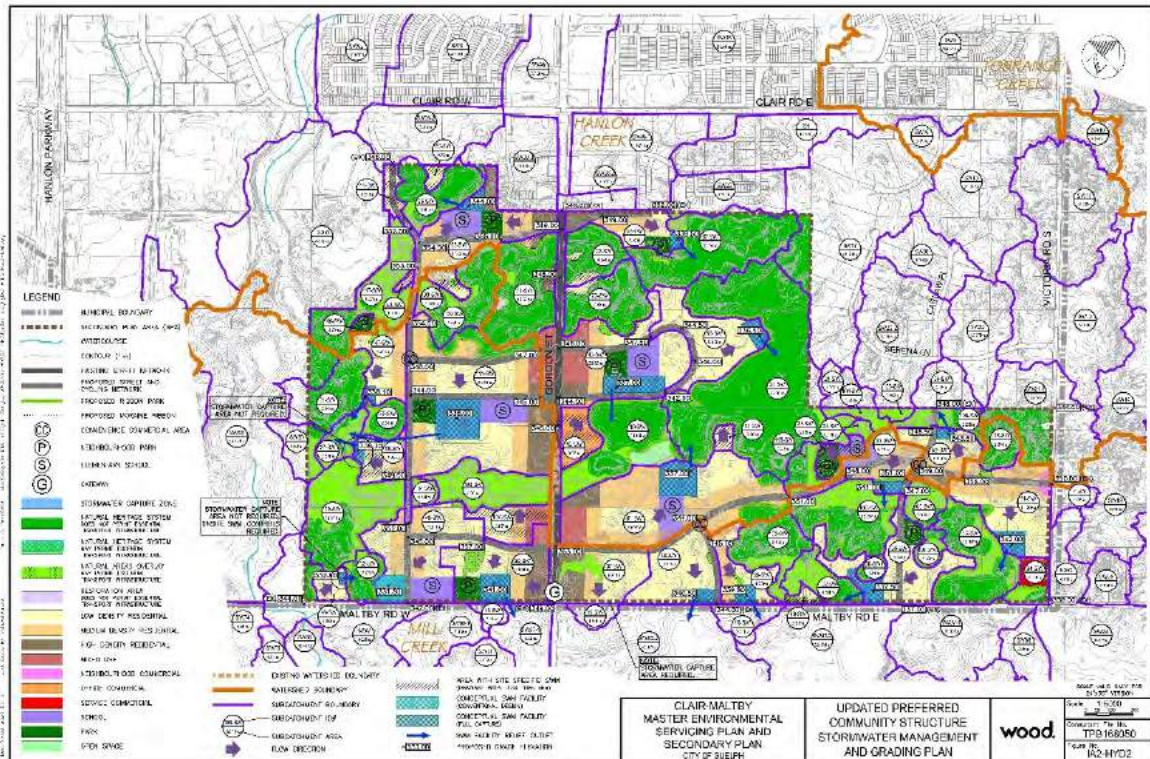
Stormwater management will need to address the drainage impacts resulting from the Final Preferred Community Structure (ref. Figure Ex-4). Based on the proposed land use, without mitigation, impacts to peak flows, runoff volumes and surface water and ground water quality would occur. The CEIS developed preliminary targets for surface water and ground water based on existing drainage conditions and the goals and objectives documented in Section 3.3.2. Given hummocky terrain exhibited in the SPA, most surface water will infiltrate to the groundwater system, therefore groundwater targets are fully integrated and linked to surface water targets.

As part of Phase 2 of the Municipal Class EA process, a wide range, and types, of alternatives are typically developed and assessed to address the Problem Statement. Alternative stormwater management (SWM) solutions for Clair-Maltby have been advanced to consider all aspects of the environment - natural, social/cultural, and economic (also referred to as the "Triple Bottom Line"). The approach to identifying alternative SWM quantity and quality solutions to address the goals, objectives and targets cited in Section 3.3.3, has considered the Subwatershed level protection strategies derived through the CEIS, based on the area's natural and water-based resources. Based on the stormwater management alternatives assessed, the following recommendations have been prepared (ref. Figure EX.8)

1. To provide stormwater management for the Clair-Maltby SPA, it is recommended that distributed low impact development best management measures capturing 20 mm runoff be provided within both public and private lands, with the remaining drainage being conveyed to stormwater capture areas, sized to capture the Regional Storm, with 10 per cent buffer to allow for maintenance access, trails, sediment removal and other detailed design requirements. . Stormwater capture areas are to have an overflow to existing depression areas, should the stormwater capture area storage capacity be fully used.
2. For small development areas (typically less than 5 ha), unless draining to Maltby Road, 20 mm capture will be required to provide water quality treatment and maintain water balance.
3. For small development areas (typically less than 5 ha), draining to Maltby Road, Regional Storm (285 mm) capture and control will be required, to mitigate impacts to properties located south of Maltby Road.
4. For the Community Park, located adjacent to Halls Pond, distributed LID BMPs are to capture the 100 year storm event. The distributed LID BMPs are to replace a 100 year stormwater capture area, which would have been required for the park draining to Hall's Pond. The rationale for using LID BMPs versus a SWCA is to prevent groundwater mounding and increases in the average Halls Pond water level.
5. The SWCA's for Subcatchments SW-42 and SW-61 should be located as per the recommendations of the Halls Pond Assessment (ref. Appendix F).

6. Infiltrative LID BMPs that receive runoff from paved surfaces will require pretreatment to prevent groundwater contamination.
7. A treatment train approach should be used to protect the stormwater capture areas' function of infiltration and to protect groundwater quality.
8. Surface and groundwater quality monitoring as determined within the finalized CEIS, will be required to protect existing surface water and groundwater resources.
9. The City of Guelph should consider salt reduction and management measures per the following:
 - i. The City of Guelph should consider any outstanding recommendations from the 2017 SMP,
 - ii. The City of Guelph should consider options for salt alternatives such as different types of chemical de-icers and agricultural by-products.
 - iii. Implement salt alternatives through financial incentives for independent contractors conducting snow removal and de-icing.
 - iv. Implement recommendations of the Snow and Ice Control for Parking Lots Platforms and Sidewalks (SICOPS) program as developed by the iTSS Lab at the University of Waterloo, to reduce salt application and improve salt management. The SICOPS program sets out various guidelines for salt management and anti-icing as outlined at <http://www.sicops.ca/>
 - v. Consider removal of snow in areas with low traffic loadings and the transportation/storage of this snow to established snow storage/ melt areas that provide treatment prior to discharge to the Speed River.
 - vi. Seasonally closed or partially closed City owned parking lots could be considered by the City of Guelph. Closed parking lots could be used for snow storage and piling, to facilitate reduced salt use for paved areas.
 - vii. To control salt laden runoff from entering groundwater during the winter months, the City could consider bypasses of infiltrative LID BMPs that receive drainage from paved surfaces.

Figure EX.8. Stormwater Management Plan



3.4 Mobility

An assessment of background material including existing transportation conditions, design guidelines, policies and standards, and opportunities/challenges for the study area was prepared to inform the Preferred Conceptual Community Structure Plan, which was further appraised through a series of community and stakeholder engagements.

Community Structure options were assessed, and a “Preferred Community Structure” was developed as a planning objective for the future development of the Clair-Maltby Secondary Plan. The Preferred Community Structure Plan provides a general layout of land use, transportation linkages, community facilities, storm water management facilities, cultural heritage resources, and the NHS; and was utilized as a basis for technical multi-modal transportation analysis.

A system of connected arterial and collector streets are envisioned as part of the Preferred Community Structure Plan, to support development of the Secondary Plan area, while respecting the Natural Heritage System and existing topography. As part of the Preferred Community Structure Plan the Gordon Street corridor is a central element in the local transportation network, and is intended to accommodate all street users through the delivery of multi-modal infrastructure. Limiting direct vehicular access to individual properties is recommended along Gordon Street. Street design throughout the Clair-Maltby Secondary Plan have been designed to be inclusive of bicycle and pedestrian amenities throughout the community.

Travel demands for the Secondary Plan were developed based on the most conservative (highest density) assumptions outlined in the "Land Development Budget", and assumed a total of 10,125 residential units and 333 jobs¹. Given the applicable "Land Development Budget", development within the Clair-Maltby Secondary Plan is anticipated to result in approximately 5,150 and 6,950 two-way person trips (all travel modes) during the weekday morning and weekday afternoon peak hours, respectively.

A future conditions traffic operations analysis was undertaken to understand impacts of Secondary Plan development traffic on the planned road network (ref. Figure EX.9) with the following key findings:

- Overall, traffic operations within the Secondary Plan area are anticipated to be acceptable under future conditions given planned and recommended intersection traffic control measures and roadway improvements.
- Future traffic demands are anticipated to be accommodated by the Preferred Community Structure street network plan.
- A macro-model analysis undertaken in consultation with the City of Guelph and supported through the traffic analysis, supports the implementation of a 4-lane Gordon Street section within the Clair-Maltby Secondary Plan area. A typical 4-lane street section is anticipated to sufficiently accommodate forecast traffic demands along the Gordon Street corridor, understanding the need for ancillary turn lanes where appropriate.
- The transportation modelling undertaken indicates that a second north-south oriented street is required to connect to Clair Road to accommodate anticipated future traffic demands.
- The transportation modelling undertaken indicates that a third north-south oriented street connecting to Clair Road, initially considered during the planning process, is not required to accommodate anticipated future traffic demands.

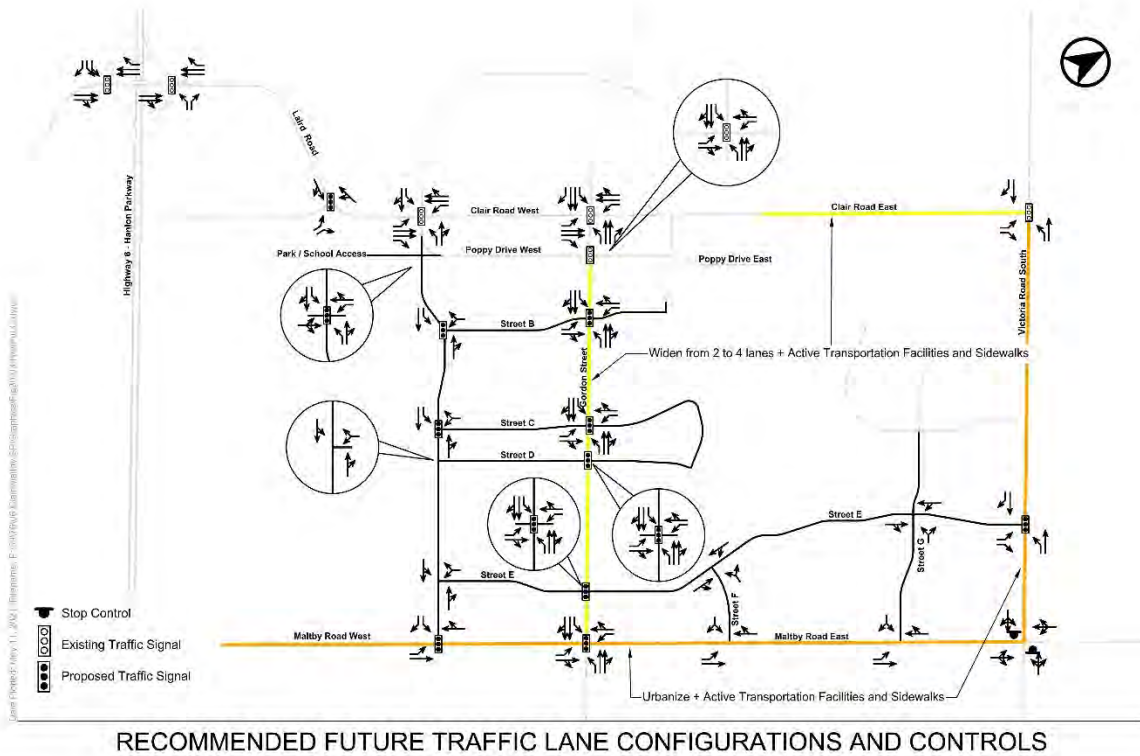
A future conditions transit assessment was also undertaken considering expected transit ridership demands. Development contemplated as part of the Clair-Maltby Secondary Plan is anticipated to be accommodated by the introduction of new transit routes or the expansion of existing services.

Parking demands and supply can be managed through a combination of strategies implemented to guide overall development through the Clair-Maltby Secondary Plan area. A number of policies can be implemented in support of reducing parking demands, and would provide a positive contribution towards the City's approach to parking management.

¹ Based on August 2018 Area Population and Employment of 24,495 population and 564 jobs. 333 jobs related to commercial and office uses. Remaining jobs related to Service Commercial and Neighbourhood assumed to be small, dispersed, and partly off-peak.

A Transportation Demand Management (TDM) framework can be pursued to establish a foundation for managing future travel demands upon development of the secondary plan area. It is recommended that the Secondary Plan incorporate a robust TDM framework requiring future development to pursue TDM measures.

Figure EX.9. Proposed Road and Existing Road Network



4. Implementation and Costing

Implementation of water, wastewater, stormwater and mobility infrastructure has to consider phasing / staging considerations and costing. The following outlines phasing considerations and preliminary costing for each of the infrastructure components, with Figures EX.10-EX. 14 indicating the recommended four (4) implementation phases.

4.1 Water

Order of magnitude cost estimates were developed for the various water supply, storage and distribution elements for each of the alternatives. Cost Estimates include the local distribution system (watermains, valves hydrants, etc.), transmission main from the Clair Road Booster Pumping Station, a 5ML water storage reservoir, and the pumping systems required for the subsurface storage alternatives. The capital costs for all alternatives are relatively closely grouped and range from \$31.0 M to \$35.8M. The Preferred Alternative, Elevated 5ML Storage Reservoir at Location 2, is on the lower end of the range at \$31.8M. Phasing of the

Transmission Main from the Clair Road Booster Pumping Station to new Water Storage reservoir will proceed with partial construction of the transmission main in phases 1 and 2 and completion of the Transmission Main and Water Storage Reservoir in Phase 3.

4.2 Wastewater

Order of magnitude cost estimates were developed for the various wastewater collection, pumping and conveyance alternatives. Cost Estimates include the local gravity sewers, sewage pumping stations (3 in all scenarios), forcemains (3), and upgrades to existing downstream infrastructure. Service easement costs were not evaluated.

The capital costs for all alternatives range from \$29.1M to \$33.7M. The Preferred Alternative, Southgate Hanlon Trunk, has the lowest capital cost at \$29.1M and is expected to have reasonable operating and maintenance costs.

Phasing is heavily driven by the sanitary catchment areas and must proceed from downstream to upstream (North to South) to ensure infrastructure is in place to support upstream development. Phase 1 can be constructed and connected to the existing wastewater system by gravity. Development of Phase 2 will require the construction on the Trunk sewer to the receiving branch as well as construction of Sewage Pumping Station 3 (SPS3). Phases 3 and 4 will each require pumping stations which will discharge to SPS3 and then to the new trunk sewer.

4.3 Stormwater

Stormwater management measures are typically constructed for the contributing development area, as development precedes, with stormwater management measures implemented at various stages of construction. End-of-pipe stormwater management facilities, in the case of Clair-Maltby, stormwater capture areas (SWCA), are proposed to be constructed near the commencement of construction of each development phase tributary to that SWCA, therefore providing runoff capture from the disturbed lands. At public source and conveyance stormwater management measures would be constructed during right-of-way construction and for LID BMPs located on private lands, during the finishing construction of private lot grading and sodding.

Preliminary cost estimates for stormwater management measures have been determined for the 15 SWCA and for low impact development best management measures (ref. Appendix C). SWCA have been estimated at approximately \$26,607,705, with the SWCA costs to be covered through development agreements, based on the contributing development impervious area to each SWCA. Costing for low impact development best management measures located has been estimated at a cost of \$4,324,419, of which \$1,226,018 would be for collector and arterial roadways, which would be covered by development charges as part of the road work, as stormwater management measures with the remaining cost to be distributed between various land uses, including local roads; the volume of public versus private LID BMPs, would be based on land use impervious coverages. As per the City of Guelph's DC Local Service Policy, storm sewers up to and including 900 mm diameter are a direct developer responsibility. For the

purpose of the MESP preliminary stormwater costing, storm sewers are assumed to be covered by the City's DC Local Service Policy. The LID capture of 20 mm will provide climate change resiliency for sizing of the storm sewer system, as long as the benefit of the LID capture is not considered in the sizing of the pipes.

4.4 Mobility

It is anticipated that new streets and transportation infrastructure will be pursued through development of the Secondary Plan area, either through direct development contributions and / or development charges. New collector streets will be required to undergo detailed design through an Environmental Assessment phases 3 / 4, or in support of prospective Draft Plan processes.

Transportation infrastructure costs have been estimated for the Clair-Maltby Preferred Community Structure land use plan. General cost estimates, where available, are derived from the February 2019 Development Charges Background Study – Consolidated Report, prepared by Watson and Associates Economists Ltd. for the City of Guelph. This document provides the basis for understanding the unit cost of identified infrastructure. General costs account for the extent of new collector streets reflected in the "Preferred Community Structure Plan", as identified in the City of Guelph Official Plan Schedule C: Clair-Maltby Secondary Plan Mobility Plan.

Mobility infrastructure preliminary costs are forecast in the order of \$45,000,000 to \$50,000,000. Estimated transportation infrastructure costs are not exhaustive, and generally reflect the extent of details derived from the Secondary Plan structure.

As is typically the case, a contingency is often included. A contingency of 20 per cent may be appropriate given the early stages of planning.

The following recommended roads projects are anticipated to be required to support the Preferred Community Structure. These improvements are also illustrated in Section 3.4 Mobility:

- Widening of Clair Road from 2 to 4 lanes (east of Beaver Meadows Road to Victoria Road) including active transportation and sidewalks
- Widening of Gordon Road from 2 to 4 lanes (south of Poppy Drive to Maltby Road) and urbanizing to include cycle tracks and sidewalks
- Urbanizing of Maltby Road (from Highway 6 to Victoria Road), including introduction of active transportation facilities
- Urbanizing of Victoria Road (from Clair Road to Maltby Road), including introduction of active transportation facilities
- A new Collector Road network that establishes an additional N-S link between Clair and Maltby and an east-west link from west of Gordon (Street A) and Victoria Road.
- 11 new traffic signals (1 on Laird/Clair, 1 on Victoria Road, 2 on Maltby, 4 on Gordon internal to SP, and 3 internal to Collector Road network)
- Intersections Improvements (additional turning lanes) across the Secondary Plan area.

The following roads projects are anticipated to require Schedule C EAs as part of Phases 3&4 of the MCEA:

- Widening of Clair Road from 2 to 4 lanes (east of Beaver Meadows Road to Victoria Road)
- Widening of Gordon Road from 2 to 4 lanes (south of Poppy Drive to Maltby Road) – EA Update
- Street A (north-south) Collector Road (from Clair Road to Maltby Road) that will exceed Schedule B requirements (>\$2.4m) and have crossings within the NHS.
- Street E (east-west) Collector Road (from Gordon Road to Victoria Road) that will exceed Schedule B requirements (>\$2.4m) and have a crossing within the NHS.

As we understand, there are also numerous ways the roads could be phased and built out within the Clair-Maltby SP, given:

- there are a number of land owners in the SP area;
- phasing of development can happen in a number of ways; and
- we understand there are a number of amendments in progress for the MCEA process that can influence whether roads >\$2.4m proceed to Schedule C or instead to schedule A.

Given the above, we note that each road project's classification under the MCEA process should be discussed between the City and developers as draft plans of subdivision come forward.

Figure EX.10. Phase 1

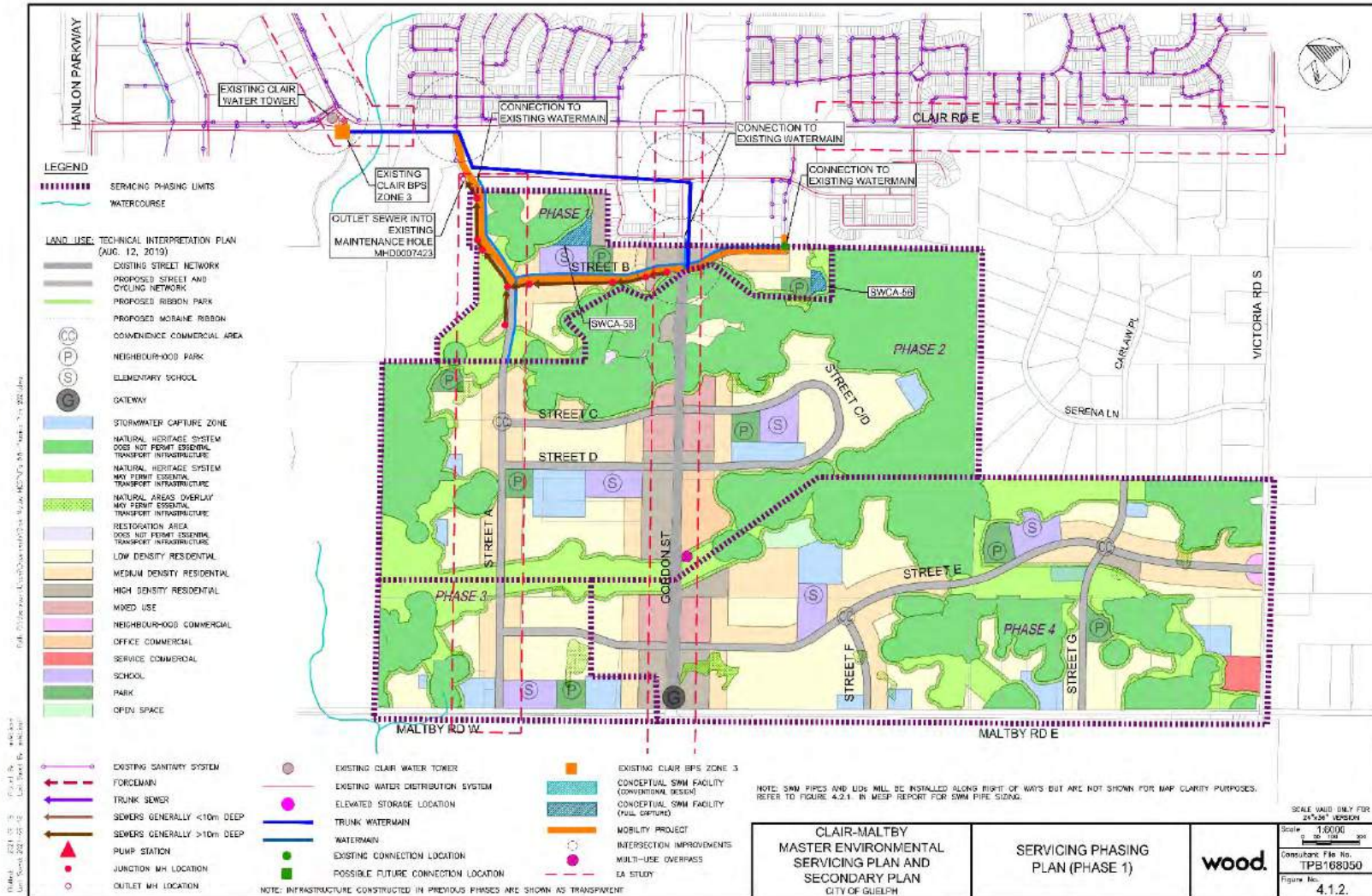


Figure EX.11. Phase 2

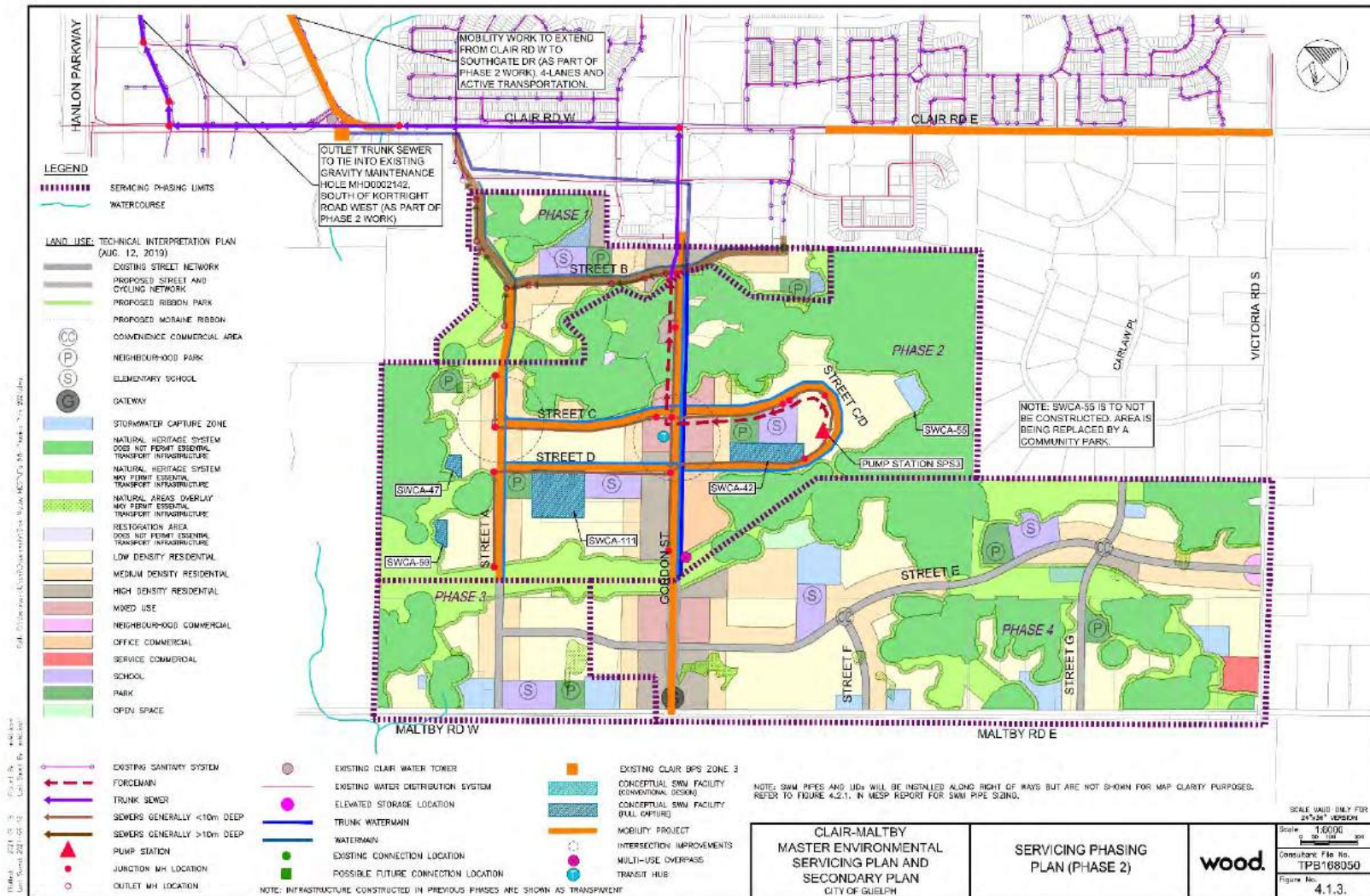


Figure EX.12. Phase 3

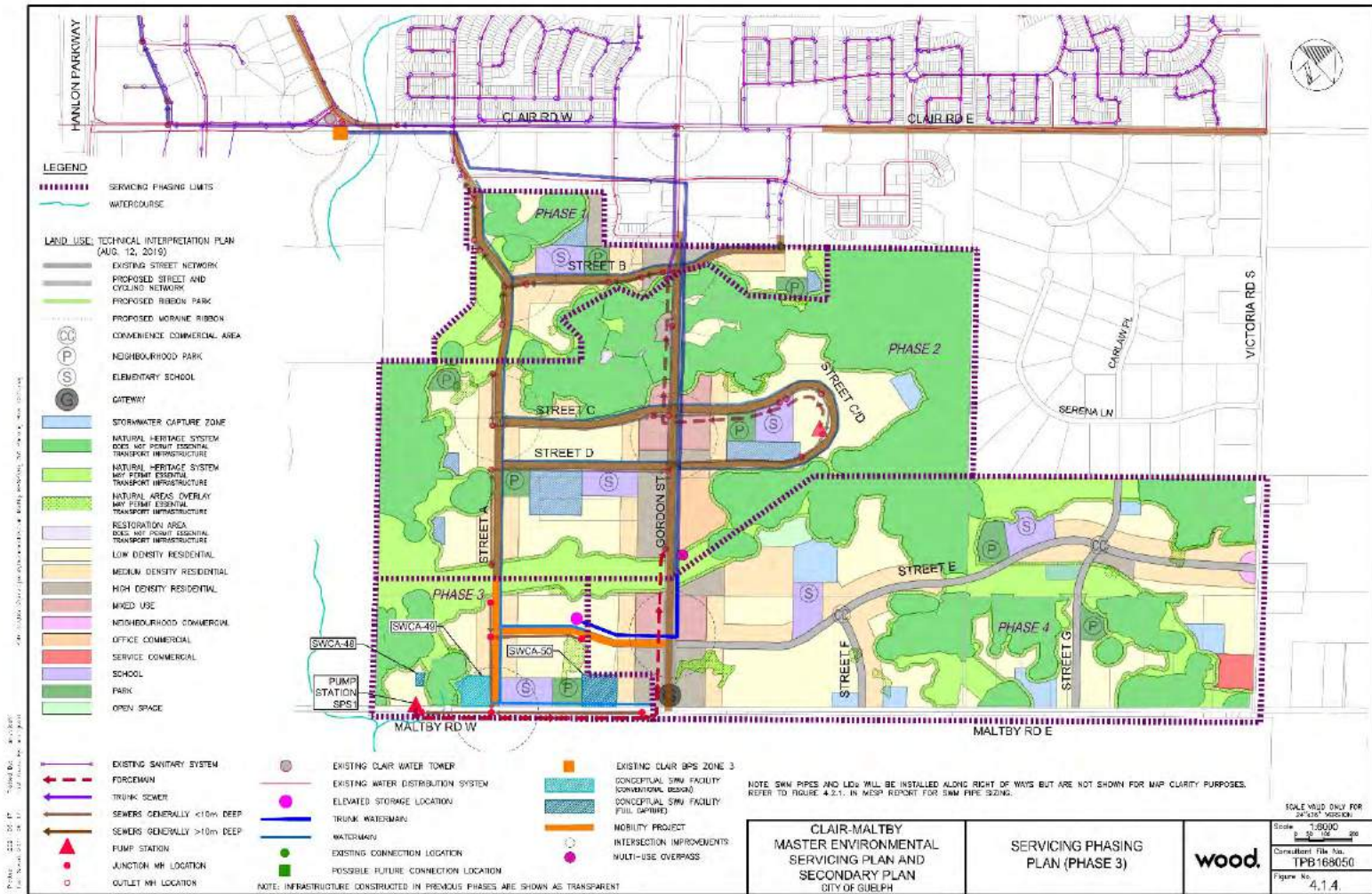


Figure EX.13. Phase 4

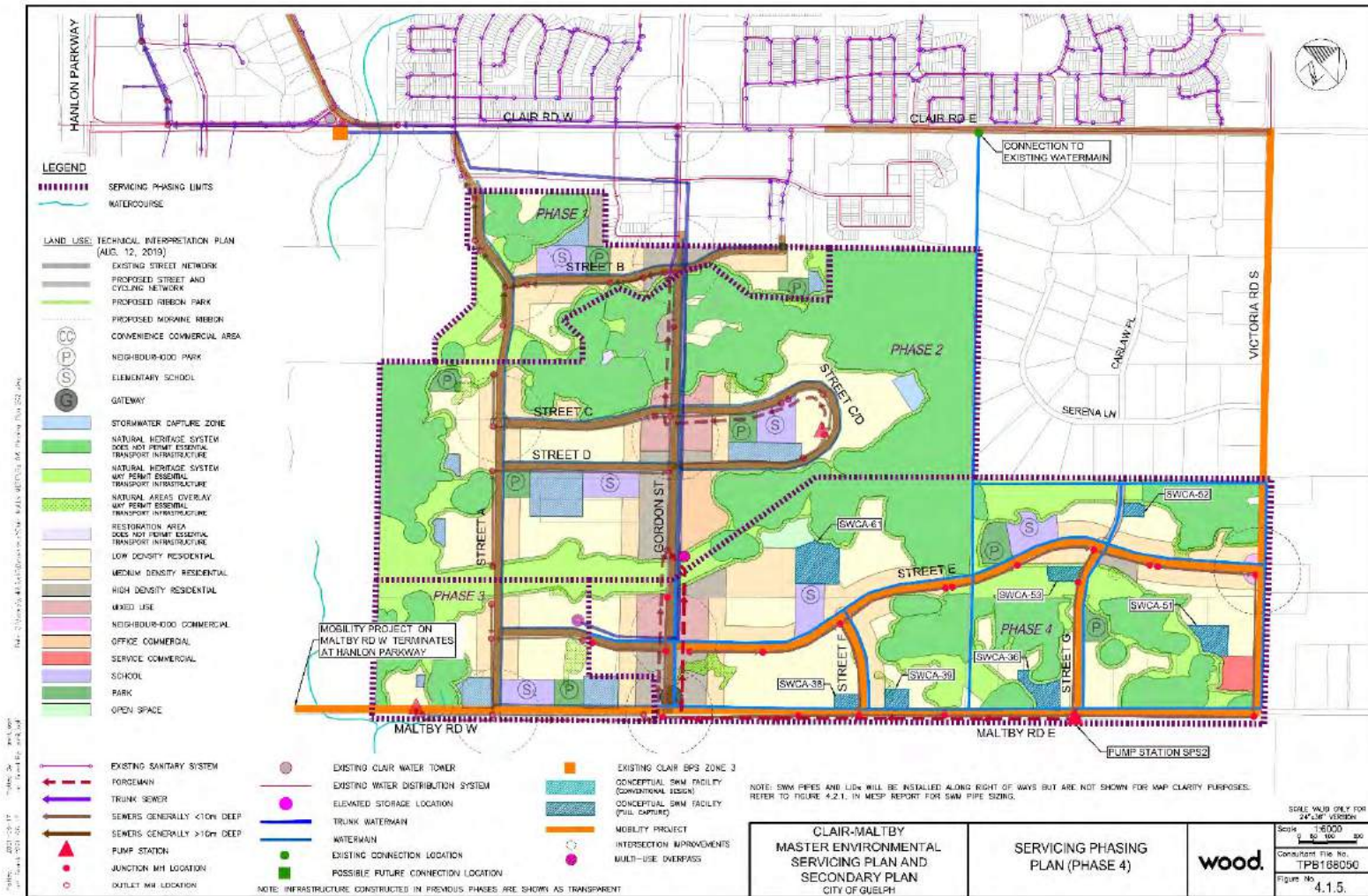


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- Appendix E Public Consultation
- Appendix F Halls Pond Assessment

1 Introduction

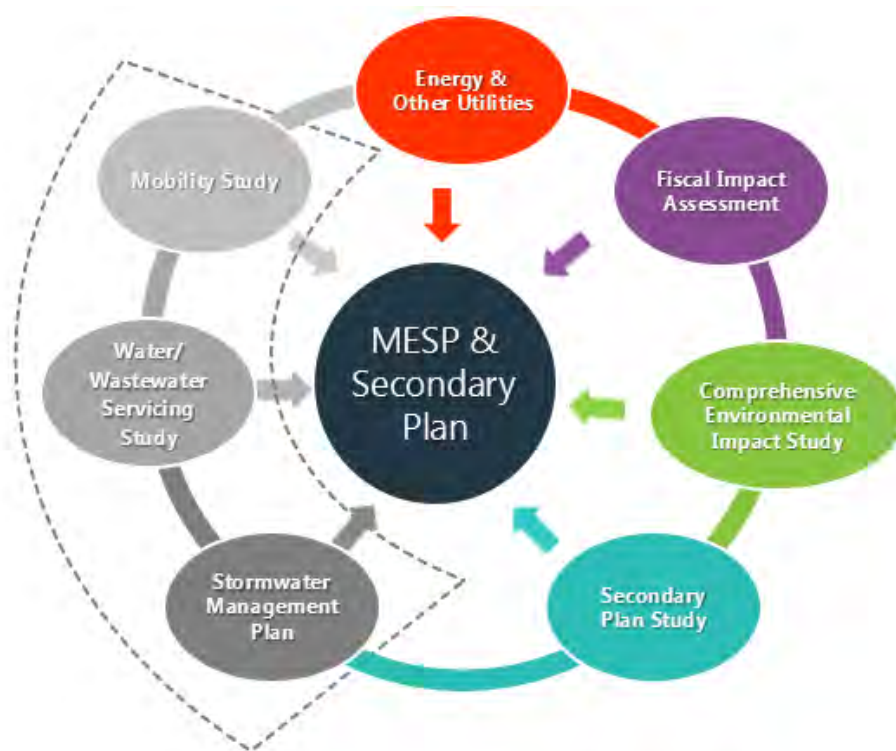
The City of Guelph initiated preparation of the Clair-Maltby Secondary Plan in 2015 to establish preferred land uses and servicing for this new community in the City's south-central area. As part of this process, the City conducted an integrated process for the Clair-Maltby Secondary Plan which included a Master Environmental Servicing Plan (MESP) building from the Comprehensive Environmental Impact Study (CEIS), specifically the Phase 3 Impact Assessment – Second Iteration, March 31, 2020. The CEIS established the existing environmental conditions within the Secondary Plan Area (SPA) and surrounding lands, and assessed the environmental impacts from the proposed land use (Community Structure) and ultimately recommended mitigative/management measures to prevent and / or manage potential impacts associated with urbanization of the SPA. The CEIS has been prepared by the Wood Team, comprised of Wood Environment & Infrastructure Solutions (Wood), Matrix Solutions (Matrix), Beacon Environmental (Beacon), BA Group, and Daryl Cowell (Cowell). The CEIS was prepared in a multi-phased approach including:

Phase 1 and 2: Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (CMSP / MESP) Comprehensive Environmental Impact Study (CEIS) Phase 1 and Phase 2: Characterization Report, September 5, 2018.

Phase 3: Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (CMSP/ MESP) Comprehensive Environmental Impact Study (CEIS) Phase 3 Impact Assessment – First Iteration, March 6, 2019 and Second Iteration, March 31, 2020.

The CEIS sets the environmental framework for the assessment of land use in the SPA and servicing alternatives (MESP), by providing guidance specific to the protection and enhancement of the natural heritage system and the water resource system (surface and ground), and their associated functions. As noted, in addition to the CEIS, in order to properly service this new urban community, the City requires that a Master Environmental Servicing Plan (MESP) be prepared to support the Clair-Maltby Secondary Plan. As a Master Plan, the MESP is intended to satisfy the requirements of the Provincial Environmental Assessment Act through the Municipal Engineers Association (MEA) Environmental Assessment process (ref. Municipal Engineers Association Municipal Class Environmental Assessment document October 2000, as amended 2007, 2011 and 2015) and the Planning Act. The MESP sets out the preferred servicing strategies for water, wastewater, stormwater and mobility required for the Clair-Maltby Secondary Plan Area. The integrated process is depicted on Figure 1.1.

Figure 1.1. Clair-Maltby Study Components



1.1 Process

The process and timing for developing the Secondary Plan is outlined in Figure 1.3. As part of the overall land use planning process, a preferred Conceptual Community Structure for the Clair-Maltby SPA has been developed by the City through a highly consultative process, with input from government agencies, stakeholder groups, the public and the CEIS/MESP Team. The process for developing the initial Community Structure is discussed further in Section 1.3.

The MESP has been conducted in accordance with the Master Plan Approach 2 requirements of the Municipal Engineers Association Class Environmental Assessment (EA) process (Section A.2.7 of the Municipal Class EA document, October 2000, as amended in 2007, 2011 and 2015). The MESP has followed Phases 1 and 2 of the Class EA Schedule B process and identifies a series of servicing projects that will be required to service the Clair-Maltby SPA. The MESP addresses Phases 1 and 2 of the MEA Class EA Process (ref. Figure 1.2), with the servicing needs for the Preferred Community Structure determined in Phase 1 and servicing alternatives identified and selected in Phase 2.

Figure 1.2. MEA Class EA Process

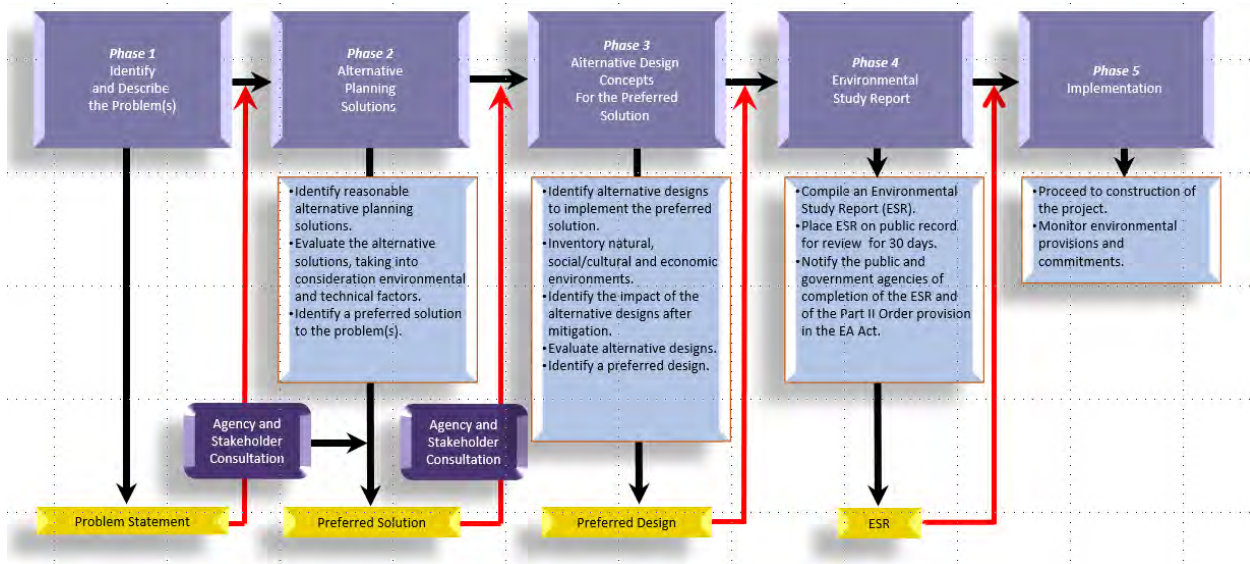
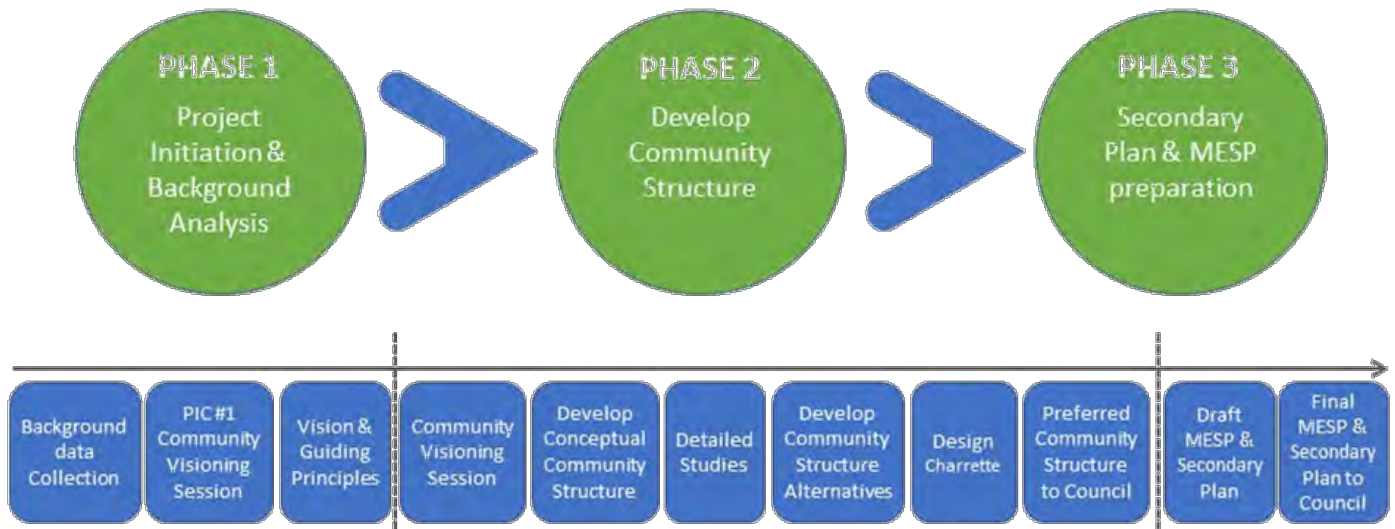


Figure 1.3. Clair-Maltby Secondary Plan Process

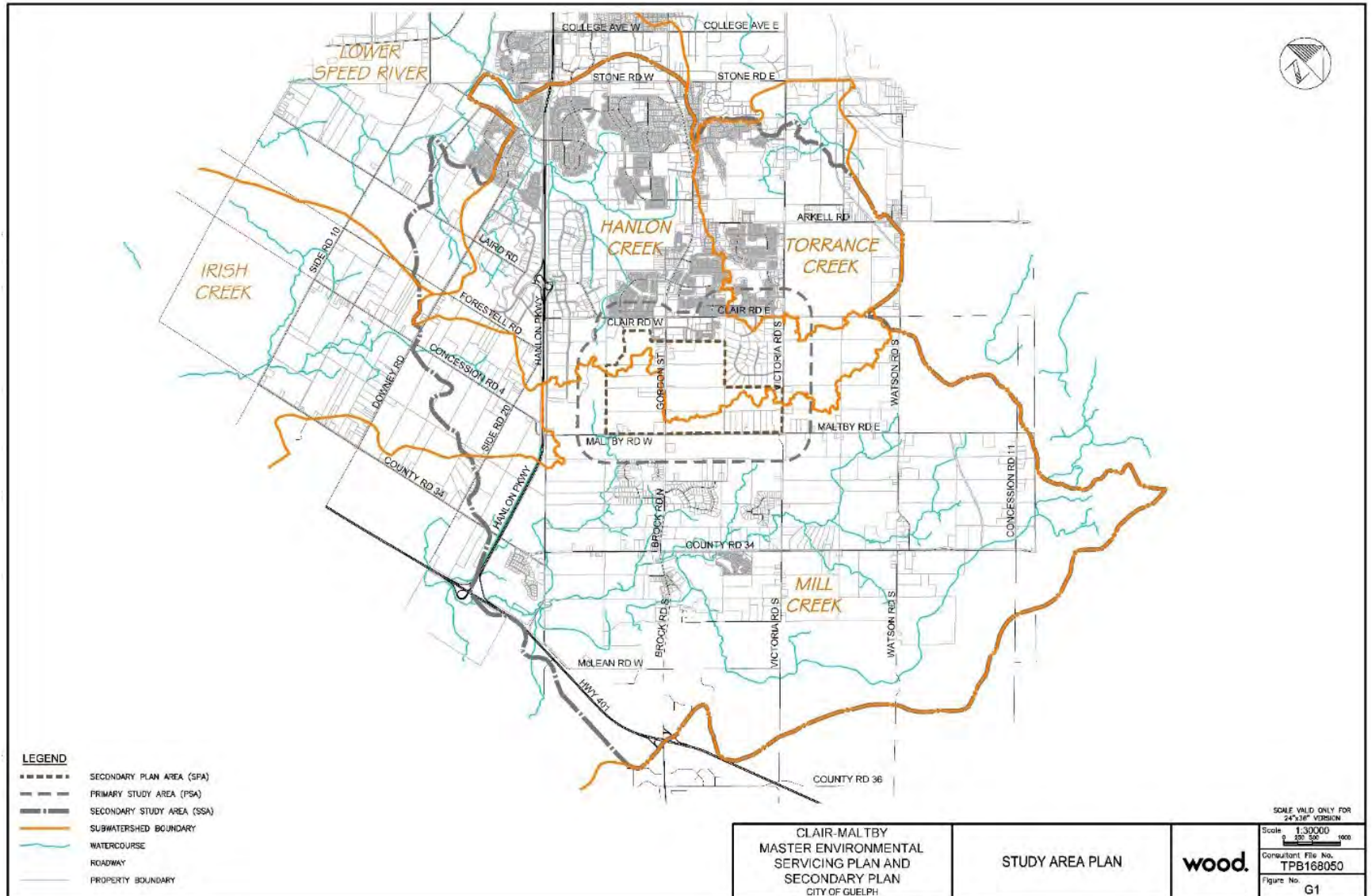


1.2 Study Area

Three scales of study area (ref. Figure 1.4) have been identified for the CEIS which inherently consider the core area (direct land base proposed to be urbanized – SPA), and the immediate surrounding area (Primary Study Area-PSA) and the broader watershed areas (Secondary Study Area-SSA) given the environmental focus of the CEIS. Notably, given that the MESP also needs to consider the existing system of infrastructure associated with water, wastewater, mobility and to a lesser degree stormwater, each infrastructure system has its own spatial domain which is described under each servicing section. The following describes the study limits for the environment as outlined in the CEIS:

- i. The Secondary Plan Area (SPA): The SPA is the area within which land use change will occur in accordance with an approved Secondary Plan. The SPA includes the lands south of Clair Road East, north of Maltby Road East, west of Victoria Road South, and approximately 1 km east of the Hanlon Expressway in the City of Guelph.
- ii. The Primary Study Area (PSA): The PSA includes the SPA plus a 500 m (+/-) zone beyond this boundary to allow for consideration of natural heritage and water resource functions and connectivity in the landscape.
- iii. The Secondary Study Area (SSA): The SSA includes the PSA plus the surface water / groundwater receiving systems beyond the Clair-Maltby SPA. This area has been defined based on the area’s hydrology and hydrogeology to ensure that landscape scale connectivity is considered from a groundwater and surface water perspective. The SSA is based on appropriate groundwater and surface water model boundaries, which inherently consider subwatershed boundaries (Mill Creek, Hanlon Creek, Torrance Creek, Irish Creek and Lower Speed River), as well as groundwater flow divides.

Figure 1.4. Study Plan



1.3 Problem and Opportunity Statement

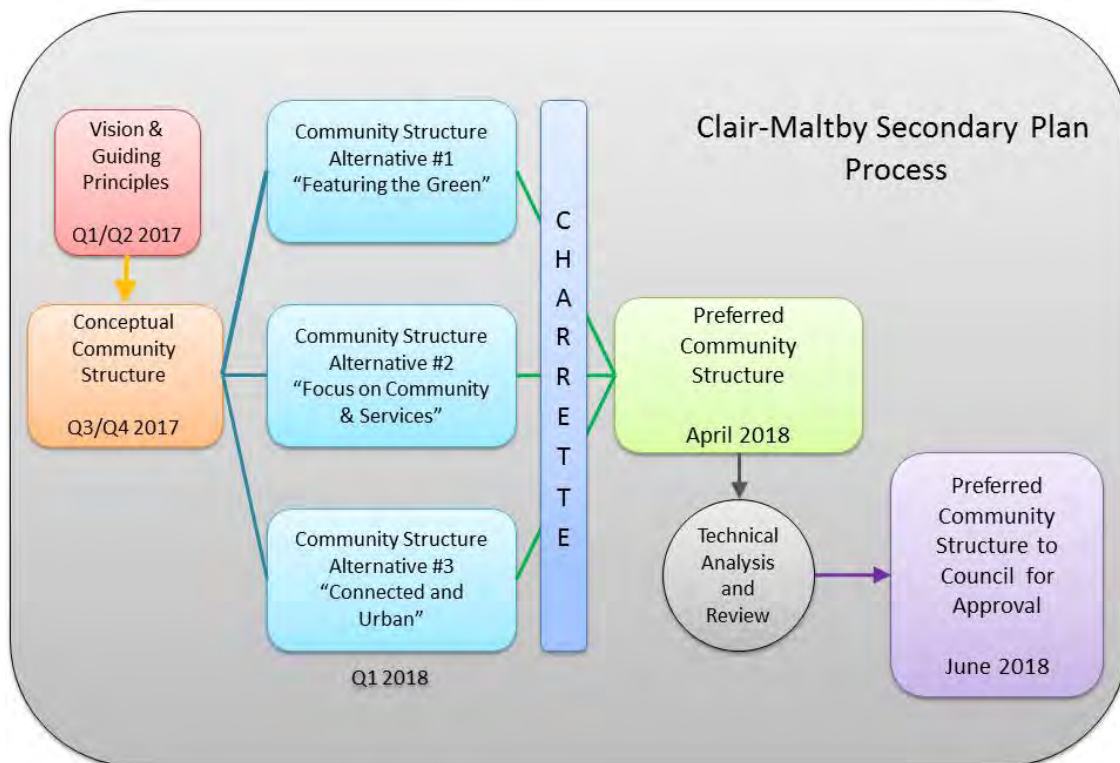
The conversion of the Clair-Maltby SPA to urban uses, from its current largely natural and agricultural state, brings forward the need for municipal services including potable water, wastewater collection/treatment, stormwater management and transportation facilities.

The Class EA master planning process adopted for the MESP, with support from the CEIS, ultimately establishes the preferred servicing and transportation solutions for the preferred Community Structure Plan (land use plan), which are to be compatible, and integrate with, the existing and refined natural heritage system, existing adjacent urban land uses and associated transportation and municipal servicing infrastructure.

1.4 Development of Preferred Community Structure/Public Consultation

As outlined in Figure 1.1, the process of establishing the preferred land uses for Clair-Maltby involved a number of concurrent studies and investigations. The initial preferred Conceptual Community Structure (urban land use plan) for Clair-Maltby was developed by the City through a highly consultative process, with input from government agencies, stakeholder groups, the public and the CEIS Team (ref. Figure 1.5). The following provides an overview of the steps taken to prepare the initial preferred Community Structure Plan.

Figure 1.5. Clair-Maltby Preferred Community Structure Development Process



In July 2017 the City established a *vision* and *guiding principles* for the Clair-Maltby community, as per the following:

Vision

Clair-Maltby will be a vibrant, urban community that is integrated with Guelph's southern neighbourhoods, as well as having strong connections to Downtown, employment areas and the rest of the City. The NHS and the Paris Moraine provide the framework for the balanced development of interconnected and sustainable neighbourhoods. This area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents. A system of parks, open spaces and trails will be interwoven throughout to provide opportunities for active and passive recreation.

Guiding Principles

Vibrant and Urban: Create identifiable urban neighbourhoods that are pedestrian oriented and human-scaled. Promote forward-thinking and innovative design that integrates new development into the rolling topography, while conserving significant cultural heritage resources.

Green and Resilient: Protect, maintain, restore, and where possible, improve water resources and the Natural Heritage System. Support resiliency and environmental sustainability through measures such as energy efficiency, water conservation and green infrastructure.

Healthy and Sustainable: Design the community for healthy, active living. Provide a mix of land uses including a diversity of housing choices at appropriate densities with appropriate municipal services to ensure long-term sustainable development which is fiscally responsible.

Interconnected and Interwoven: Establish a multi-modal mobility network that provides choice and connects neighbourhoods to each other and the rest of the City. Create a network of parks, open spaces and trails to provide opportunities for active and passive recreation, as well as active transportation choices.

Balanced and Liveable: A valued and livable community which reflects the right balance between protecting the environment and fostering a healthy, equitable and complete community.

Conceptual Community Structure and Community Alternative Plans

The Conceptual Community Structure was developed and approved by Council December 2017 based on the Vision and Guiding Principles and was further developed into three Alternative Plans in early 2018 based on a focus of various community aspects and themes.

The first land use alternative (Featuring the Green), generally reflected the land uses with the high density and mixed uses focused on Gordon Street, medium density located along proposed collector and/or arterial roads and low density in the interior parts of the neighbourhoods. The roads were to be located beside the NHS in some locations with the right-of-way boulevard providing additional buffer to the NHS, and fewer connections through the NHS.

The second land use alternative (Focus on Community and Services) increased the area of medium density residential by reducing the areas of lower density residential and moved the southern east/west collector roadway to the south to allow for development on each side of the right-of-way. The Proposed Trail Network, east of Gordon Street was replaced with a Potential Active Transportation Link, increasing the width of the link through the NHS. The land use along the Gordon Street corridor was revised compared to the first Alternative to include additional mixed use.

The third land use alternative (Connected and Urban) provided additional connectivity by using south/north roadways through the NHS in two locations east of Gordon Street. In addition, high density residential land uses, replaced medium density in select locations compared to the second Alternative. The Gordon Street corridor land use was also revised to provide mixed use land uses centred around roadway intersections. The three initial land use alternatives are depicted in Figures 1.6 to 1.8.

Figure 1.6. Alternative 1: Feature the Green

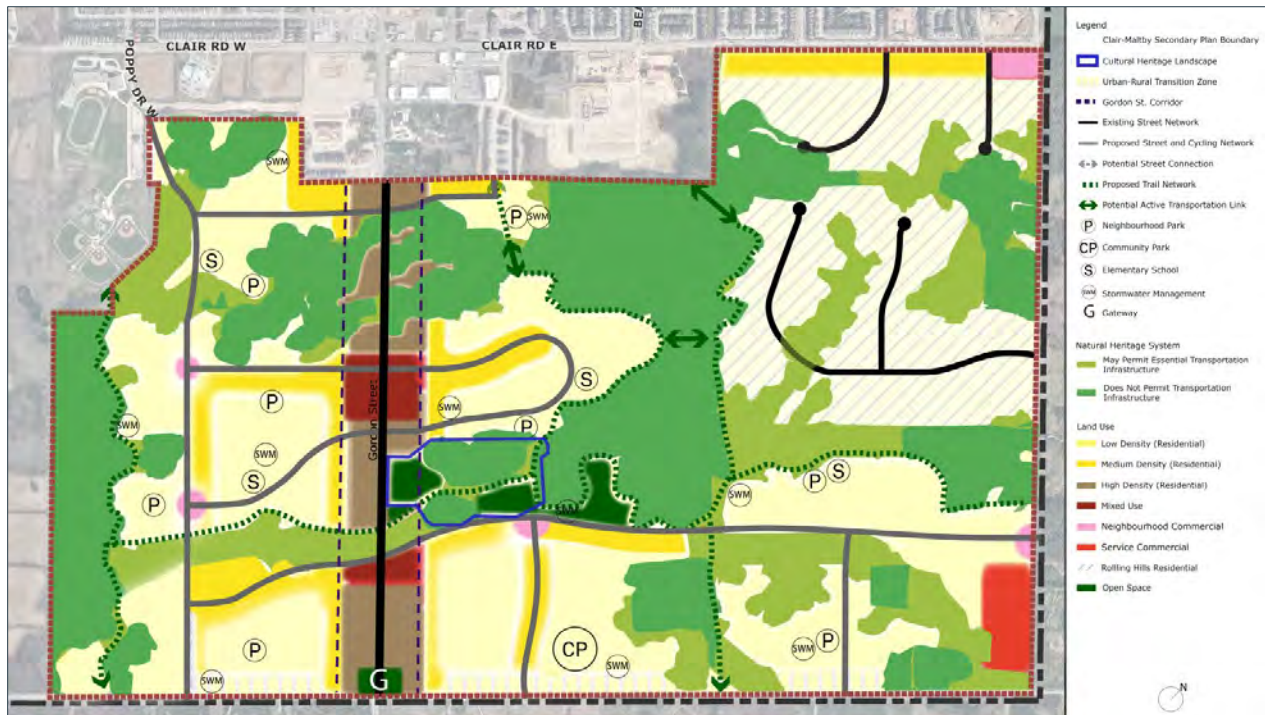


Figure 1.7. Alternative 2: Focus on Community and Services

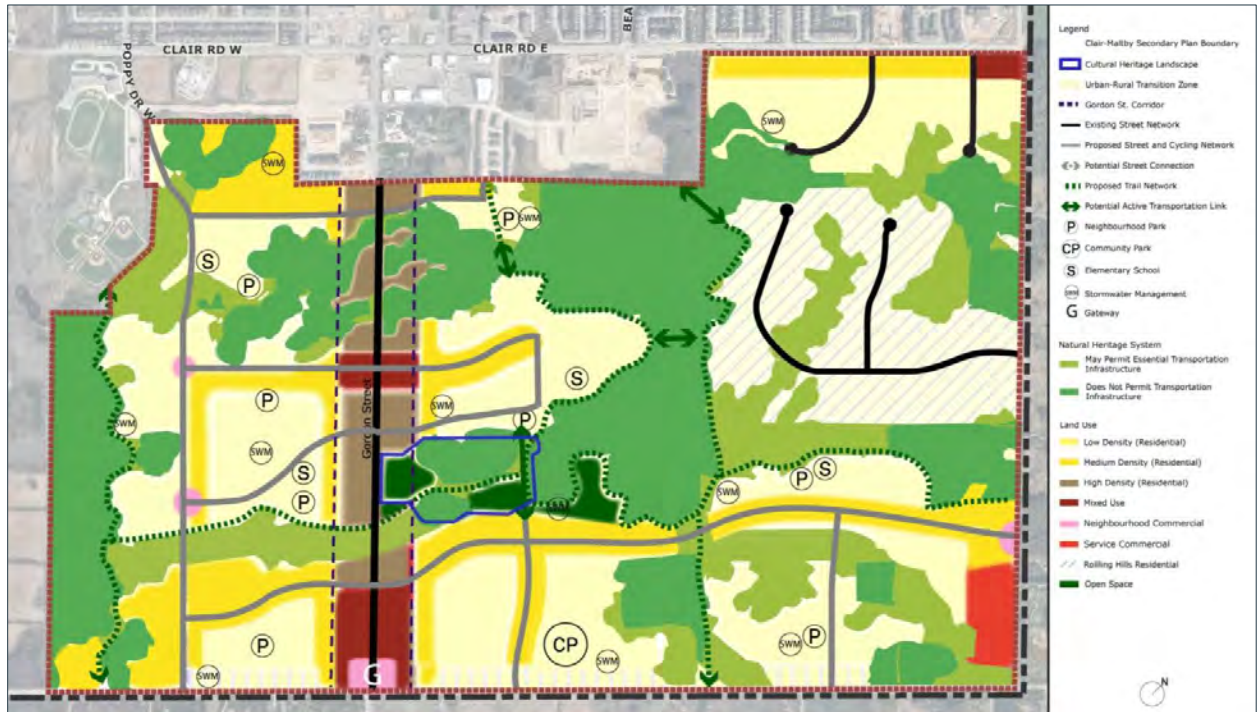
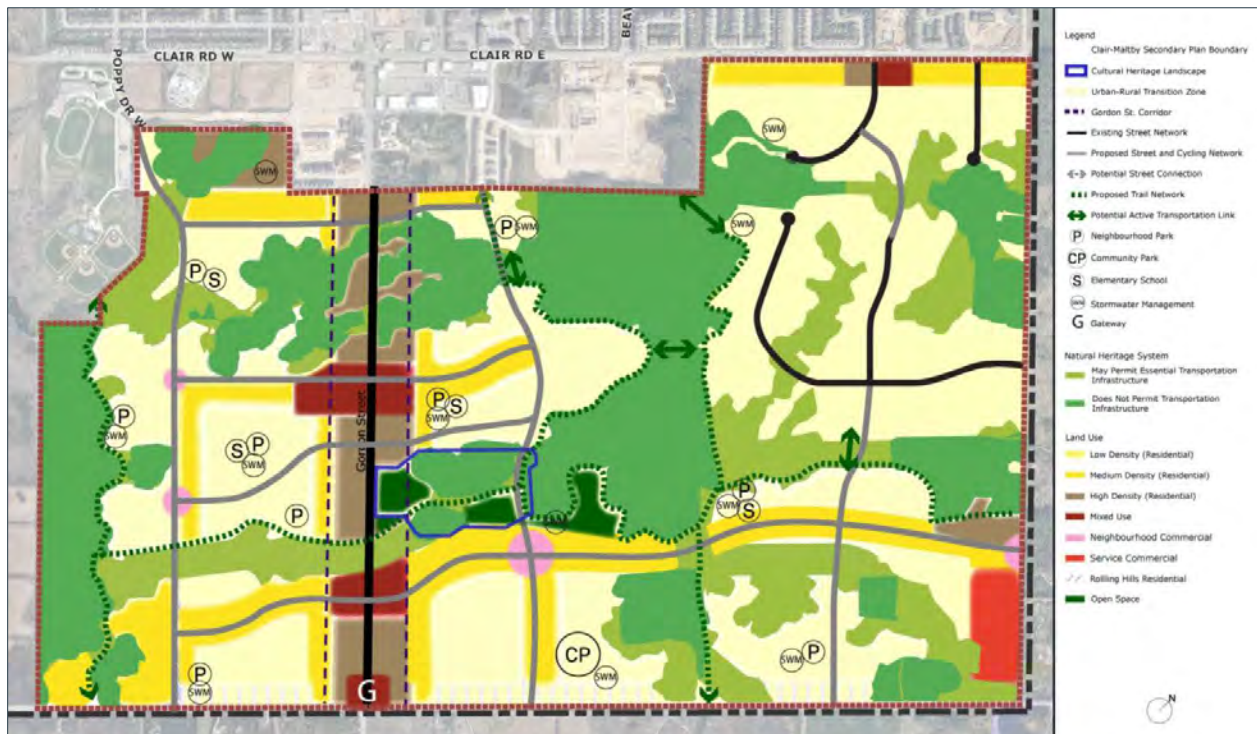


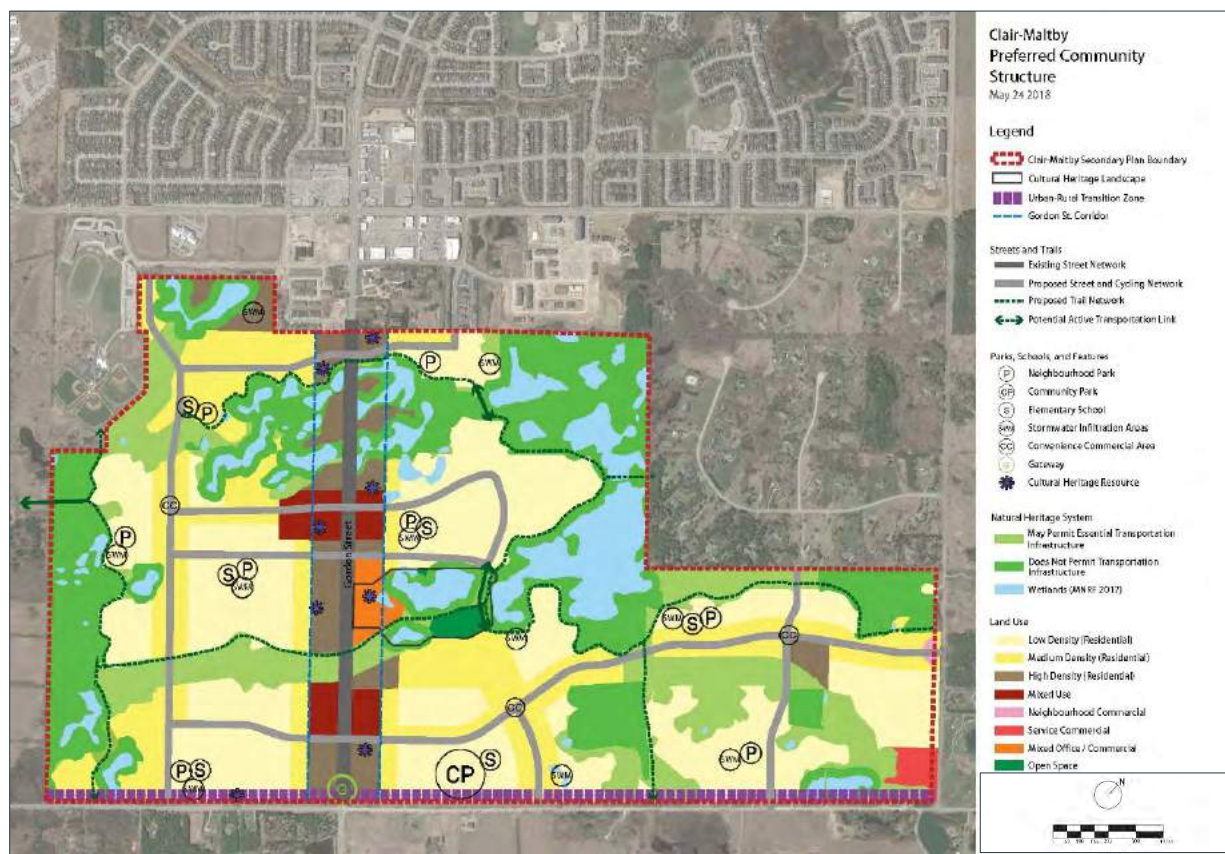
Figure 1.8. Alternative 3: Connected and Urban



Public Consultation

In April 2018, the City held a five day planning and design charrette, which used collaborative design and planning workshops with stakeholders and the public to evaluate the three initial land use alternatives, known as the Community Structure Alternatives, leading to the Preliminary Preferred Community Structure for the SPA. At these sessions, the Wood Team provided information from the CEIS on the environmental systems and also outlined preliminary concepts and principles for servicing, while the BA Group added insights associated with transportation needs. Subsequent to the design charrette, modifications were made to the Preliminary Preferred Community Structure, including removal of the Rolling Hills area from the SPA and other land use revisions, resulting in an initial Preferred Community Structure approved by Council in June 2018. The initial Preferred Community Structure which resulted from that process is depicted in Figure 1.9.

Figure 1.9. Initial Preferred Community Structure



Refinement of Preferred Community Structure

The initial Preferred Community Structure plan was then assessed at a high level in terms of its potential impacts on the social, natural and economic environments. Based on the technical feedback from this integrated assessment (ref. March 2019 Preferred Community Structure Impact Assessment), and in response to comments from the public and stakeholders the City updated the initial Preferred Clair-Maltby

Community Structure. The Policy Directions Document, May 2019, provided several high-level directions for the revised Community Structure, which included the notable addition of the Moraine Ribbon.

The Updated Preferred Community Structure approved by Council in May 2019 conforms to the approved Vision and Guiding Principles for the Clair-Maltby Secondary Plan (CMSP) project; the updated plan is considered:

- Green and Resilient
- Healthy and Sustainable
- Vibrant and Urban
- Interconnected and Interwoven
- Balanced and Liveable

The Updated Preferred Community Structure continues to be primarily residential in character, with the ability to accommodate a full range and mix of housing types, as well as a mix of uses at key locations. A multi-modal mobility network, including major roads, bicycle infrastructure and trails, is planned to provide strong connectivity throughout the Clair-Maltby area and to the rest of the city. A connected system of parks, open spaces and trails are proposed to provide both active and passive recreation opportunities. The updated Preferred Community Structure creates a framework to enable carbon neutral policies to be developed for this area in line with the City's goal of being a Net Zero Carbon Community by 2050.

The Updated Preferred Community Structure also continues to put protection of the Paris Moraine and the city's natural heritage and water resources first.

As noted above, the updates to the Preferred Community Structure have been informed by detailed technical work, including data analysis and numerical modelling. The technical work and modelling completed as part of the CEIS has concluded that urban development, with appropriate and contemporary management practices in place, can occur in this area without negatively impacting the moraine, the NHS or water resources. Further, the modelling confirms the City's previous understanding that the Paris Moraine is not a significant recharge area for the City's drinking water supply; however, it is an important recharge area for the local wetlands and headwaters of Hanlon Creek and Mill Creek, as noted in the Comprehensive Environmental Impact Study (CEIS) Phase 1 and Phase 2: Characterization Report, September 5, 2018.

The Updated Preferred Community Structure illustrates the conceptual location of the proposed Moraine Ribbon as part of the Open Space System in the CMSP area.

It was proposed that the Community Park be moved so that it nestles beside the southerly edge of Halls Pond and the surrounding NHS, although this location was again revised through the Open Space System Strategy (refer to Components of the Recommended Open Space System map approved by Council in May 2020). . Figure 1.11 represents the Final Preferred Community Structure Plan.

In addition, the amount of medium density residential has been decreased in order to increase the amount of low density residential areas. This has been done to improve the balanced mix of unit types to be provided within the CMSP area. The

low density residential land use is proposed to accommodate a range of 20 to 60 units per hectare. This range allows for most low-rise housing types and, therefore creates flexibility for development to respond to the changing needs of the community over the next 20 years and beyond. Notably, as it relates to water management, low density residential areas will have more pervious areas, allowing for more balanced opportunities for source infiltration, which will further assist in ensuring that development in this area will not impact the moraine, natural heritage or water resources.

The other changes within the Updated and Final Preferred Community Structures (ref. Figure 1.10 and Figure 1.11) include the following:

- The urban-rural transition zone has been extended along both Maltby Road and Victoria Road. The urban-rural transition will ensure that low-rise buildings are located in proximity to the surrounding rural area including the area shown as high density along Gordon Street at the entrance to the City;
- A high density residential area just south of Poppy Drive has been changed to low density residential in order to assist with the mitigation of potential impacts to the wetland in that area;
- Stormwater management areas have been shifted and modified as a result of more detailed analysis being completed in the CEIS. The stormwater management areas are still largely co-located with parks and schools in most instances;
- Potential school and park locations have been shifted to remain co-located with stormwater management areas; and,
- Conceptual road alignments have been modified in response to refinements to the NHS and stormwater management area locations.

Assessment of each service has been conducted using the Final Preferred Community Structure, with plans indicating the updated Preferred Community Structure, based on the Final Community Structure plan being prepared in short duration prior to this report.

Figure 1.10. Updated Preferred Community Structure, May 2019

PREFERRED COMMUNITY STRUCTURE: Council Endorsed May 13, 2019

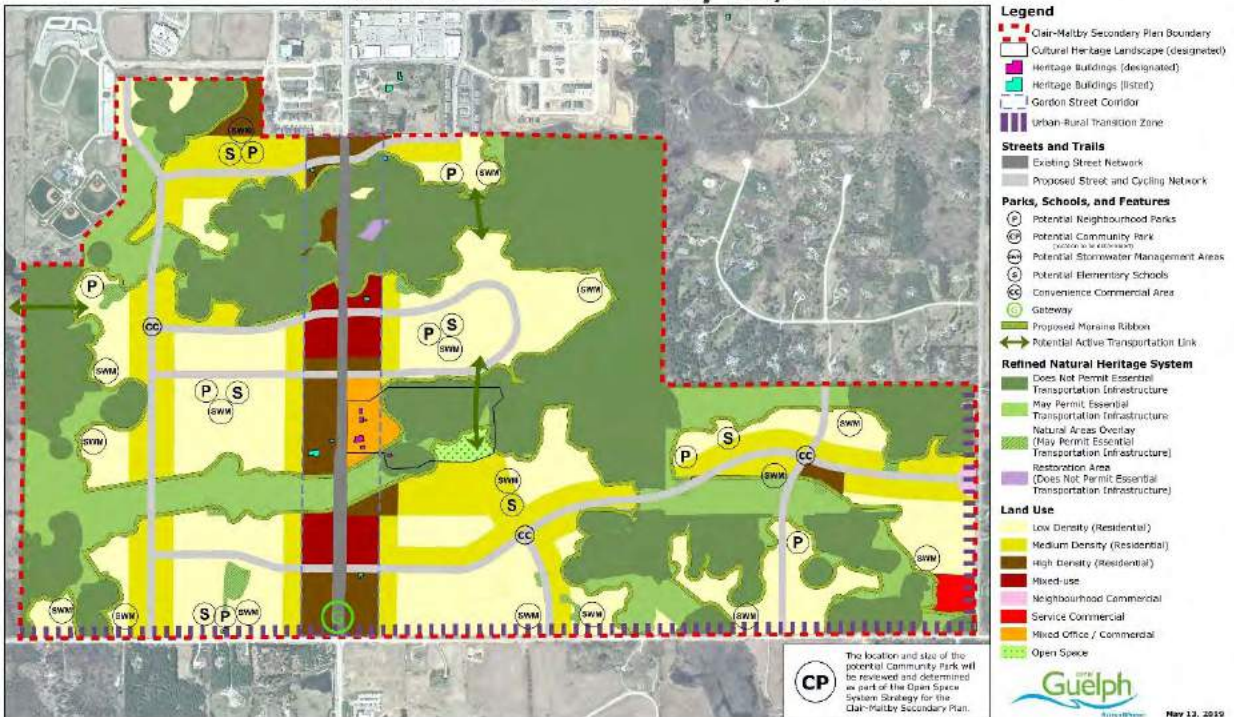
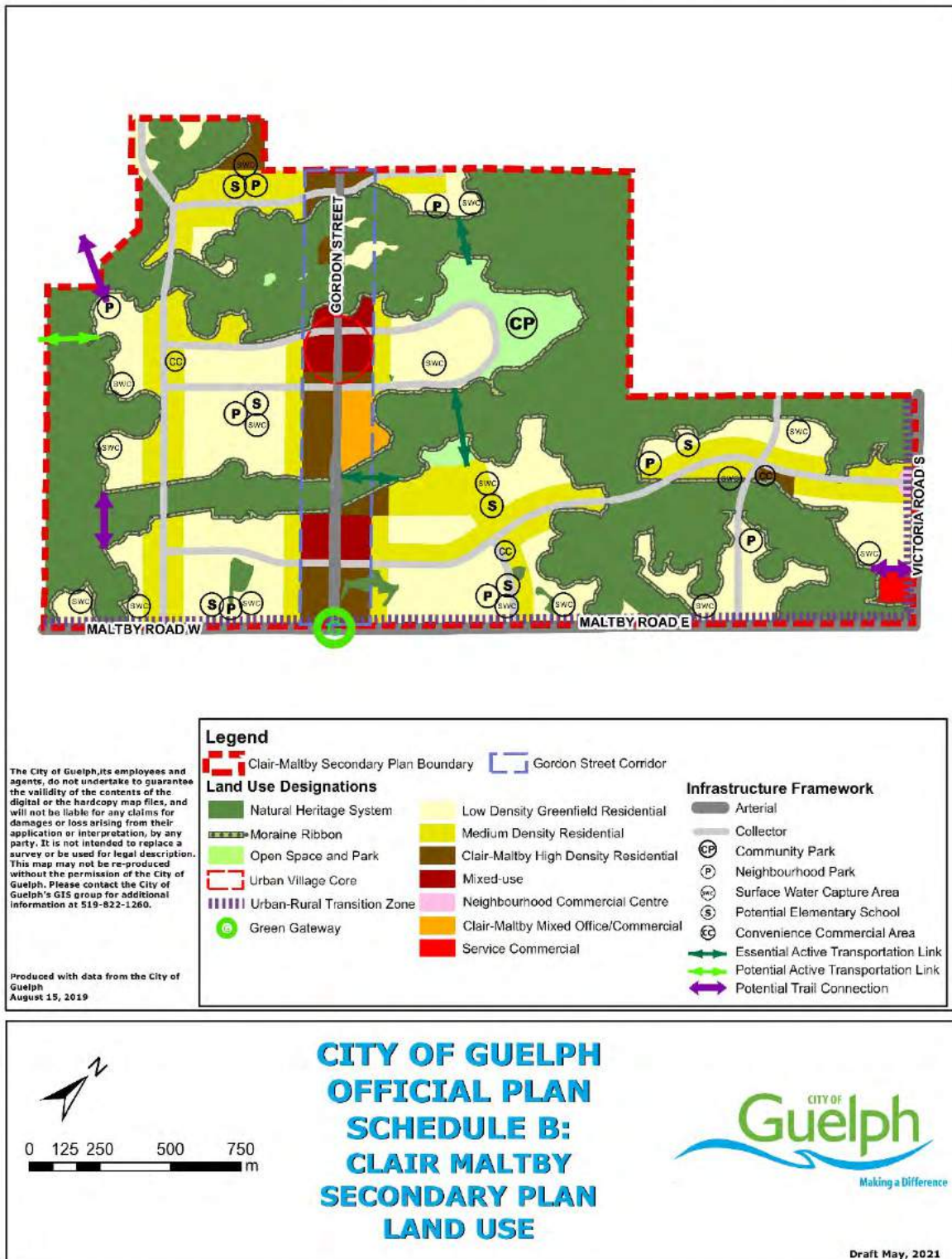


Figure 1.11. Final Preferred Community Structure, May 2021



1.5 Public Consultation Process

The City of Guelph has conducted a comprehensive public consultation process for the CMSP, which went beyond the April 2018, design charrette process, as outlined in Section 1.4 and with consultation materials in Appendix E. The following provides a summary of the public engagement conducted thus far for the future Clair-Maltby Community.

- August 2015: Open House held providing the process for developing and assessing the Clair-Maltby Secondary Plan. The open house also provided a high level summary of existing conditions.
- May 2016: Meeting with property owners to establish access for monitoring and field work. Wood provided an overview of the CEIS Team, scope, including field monitoring requirements that could require property owner's permission.
- April 2017: Notice of Study Commencement and Public Information Centre (PIC) No.1 held to present initial existing condition findings of the CEIS and the MESP, Secondary Planning Process, and future Visioning Workshop. The Wood Team presented material to public regarding the CEIS scope including assessments of the NHS, stormwater management alternatives and water and wastewater alternatives.
- April 2018: Community Structure Design Charrette held with the public. The Wood Team assisted the City during the Charette to provide insight into constraints and opportunities of each land use specifically related to the NHS, surface and groundwater systems and servicing requirements.
- September 2018: CEIS Characterization Report released. The Wood Team provided the existing conditions characterization of the Clair-Maltby SPA including surface water, groundwater and the NHS.
- September 2018: CEIS Characterization Presentation: A presentation was made to the public providing the findings of the Clair-Maltby SPA characterization.
- November 2018: Draft Direction Consultation Report released
- December 2018: Public Workshop held to discuss Secondary Plan Policy Directions
- March 2019: Public Information Session held to discuss protection of the moraine, water resources, and natural heritage resources
- May 2019: Policy Directions : Framework for Clair-Maltby Secondary Plan approved by Council
- September 2019: Workshop held to discuss parks and open spaces
- November 2019: Second workshop held to discuss parks and open spaces
- May 2020 Council approved the Parks and Open Space Strategy

2 Natural Environment

The CEIS provides a detailed description of the NHS and water resources in the Clair-Maltby SPA and surrounding areas based on existing conditions. Key information from the CEIS Characterization assessment of the natural environment is summarized as follows to serve as a basis for evaluating the respective servicing alternatives related to the water, wastewater, stormwater and mobility servicing.

2.1 General

The Clair-Maltby SPA includes portions of the Hanlon Creek, Mill Creek and Torrance Creek watersheds. The Hanlon Creek Watershed and the Mill Creek Watershed each cover almost half of the SPA, with the northeastern corner captured by the Torrance Creek Watershed. The SPA contains a mix of cultural vegetation communities, natural forests and wetlands that support a range of significant species. This diversity of natural features and areas sits above the generally well-drained, hummocky topography of the Paris Moraine, which lacks open watercourse features, and instead drains to depressional features including Significant Wetlands, other Wetlands, Significant Woodlands and Cultural Woodlands.

2.2 Natural Heritage System

As part of Guelph's Natural Heritage Strategy, NHS mapping and policies were developed for the entire city, including the Clair-Maltby SPA. These NHS policies and maps were included in the City's updated Official Plan in 2010, refined through the Ontario Municipal Board process, and finalized in June 2014.

From a natural heritage perspective, the Clair-Maltby SPA is unique in the City because it is dominated by the Paris Moraine which has no watercourses and has highly hummocky topography that supports woodlands, wetlands and transitional habitats scattered amongst lands that are currently being farmed, as well as a few scattered residences and commercial buildings.

As part of the natural heritage work for the CEIS (as documented in annual Monitoring Reports (2016, 2017, 2018 and 2019) a Refined NHS has been determined consisting of the following components:

Significant Natural Areas (including Significant habitat for Provincially Endangered and Threatened species; Surface Water Features and Fish Habitat (warm water) plus a 15 m minimum buffer; Provincially Significant Wetlands (PSWs) plus minimum 30 m buffer); Significant Woodlands plus minimum 10 m buffers; Significant Landform; Ecological Linkages; Confirmed Significant Wildlife Habitat (SWH); Restoration Areas; and

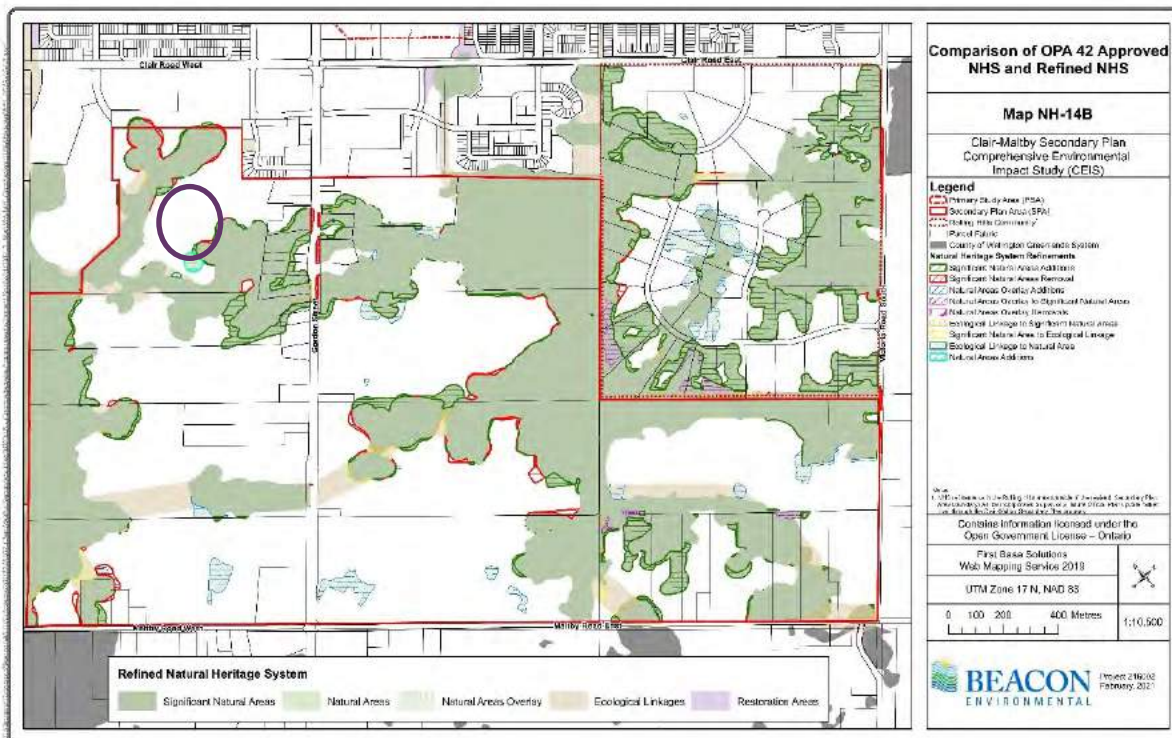
- i. Natural Areas (mapped as an Overlay) (including Other Wetlands plus a 15 m buffer; Candidate SWH; Cultural Woodlands plus minimum 10 m buffers; and Habitat of Significant Species)

The Phase 1 and 2 Characterization Reports prepared as part of the overall CEIS included a "Draft 1" refined NHS based on information collected through to the end of 2017 which was presented to the stakeholders in the spring of 2018. The first iteration of the Phase 3 CEIS reporting included the "Draft 2" refined NHS based on information collected through to the end of 2018. The Phase 3 CEIS included the final refined NHS being used as the primary development constraint for the Secondary Plan. The final refined NHS builds on the two Draft versions and includes some additional minor modifications based on input on the Draft 2 mapping from the City, GRCA, Technical Advisory Group, Technical Steering Committee, local landowners, and the community. The refined NHS for the Clair-Maltby SPA is indicated in Figure 2.1, with a comparison of the refined NHS to the OPA 42 Approved NHS in Figure 2.2.

Figure 2.1. Refined Natural Heritage System for Secondary Plan Area



Figure 2.2. Comparison of OPA 42 to Refined Natural Heritage System for Secondary Plan Area



2.3 Water Resource System

The Secondary Plan Area (SPA) is predominantly within the Horseshoe Moraine physiographic region and transitions into the Guelph Drumlin Field to the north in proximity to Clair Road (Chapman and Putnam 1984). The physiographic region consists of rough, hummocky terrain and often steep, irregular slopes. Therefore as noted earlier, streams and creeks are largely absent in the SPA reflecting the high infiltration capacity of the area (ref. Figure 2.3). The headwaters of Hanlon, Mill and Torrance Creek form on the north and south slopes of the moraine.

Surface Water:

Surface runoff is predominantly infiltrated or evaporated. The permeable nature of the surficial sediments, as well as the interconnected permeable properties of the overburden, allows for significant infiltration, subsequent recharge to the water table (overburden aquifer) and shallow and deep bedrock aquifers. Groundwater flow tends to radiate out from the SPA to contribute groundwater to the Mill Creek and Hanlon Creek subwatersheds (ref. Figure 2.4). In the broader SSA, each creek system annually infiltrates and evaporates 93 per cent to 98 per cent of the total precipitation, with Torrance Creek infiltrating the least, due to some existing development within its limits. The remaining surface water (not infiltrated or evaporated) ends up as limited discharge/ runoff from the system to each creek system.

Figure 2.3. Existing Drainage Boundaries

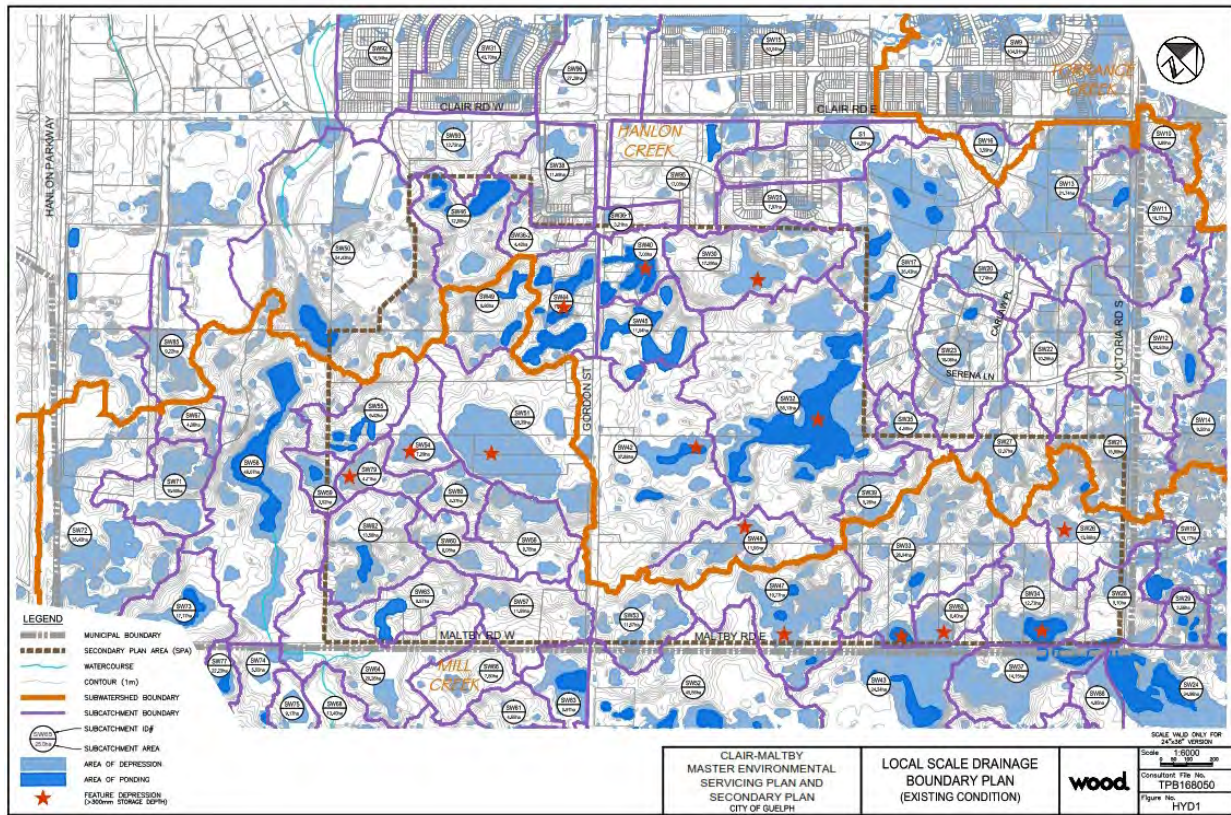
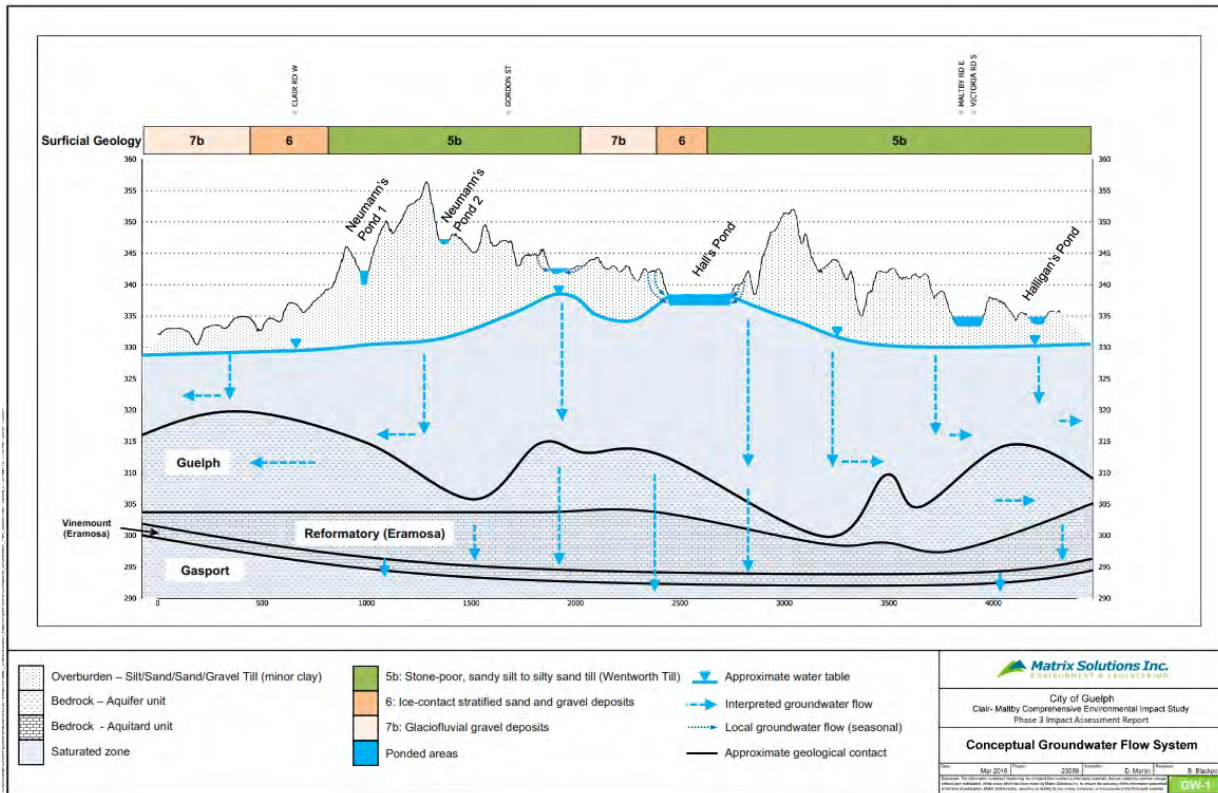


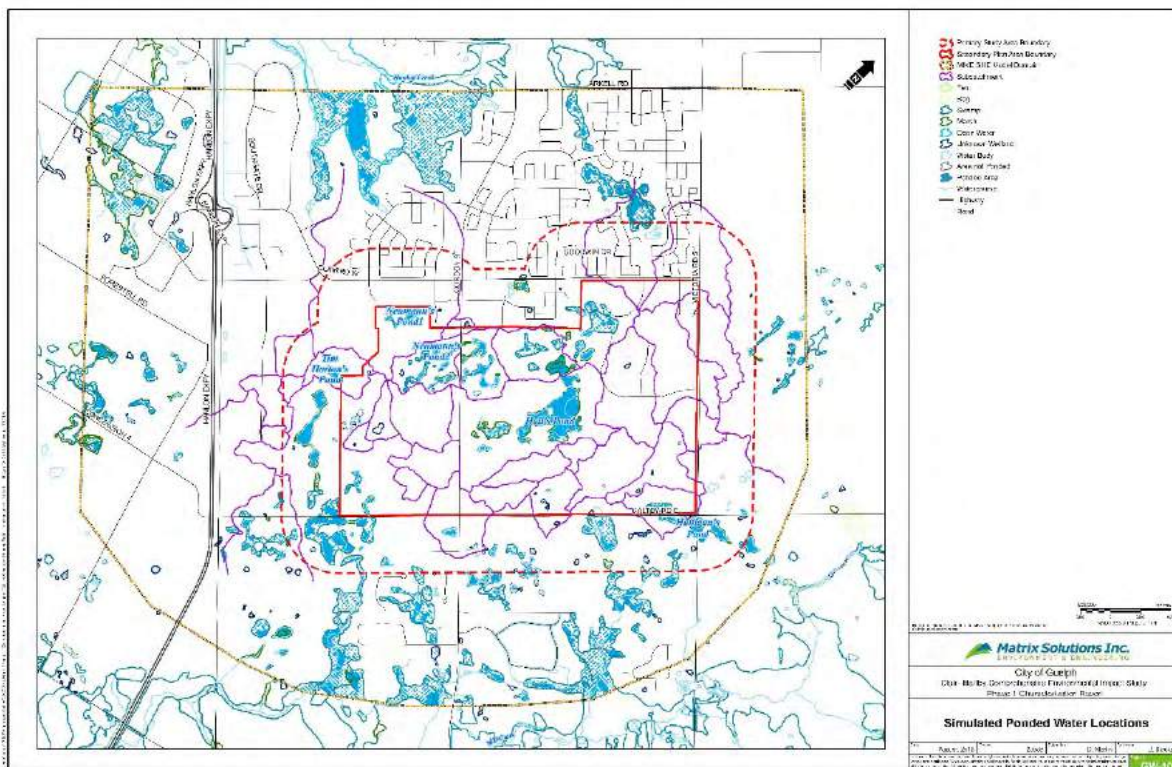
Figure 2.4. Existing Groundwater Flow System



Groundwater:

Water budget analyses of Neumann’s Pond, Halls Pond and Halligan’s Pond (ref. Figure 2.5) indicate that these features are predominantly maintained by direct precipitation and minor overland flow contributions which reflect the lower groundwater levels near these wetland features. Other perennial ponds in the area are typically perched and are predominantly surface run-off fed. Groundwater discharge appears to be derived locally and during spring melt or longer-term precipitation events. Per Figure 2.4, wetlands within the SPA can exhibit perched conditions such as Neumann’s Pond (i.e. unsaturated zone beneath the pond) or be connected to the water table such as Halls Pond, Halligan’s Pond (i.e. saturated zone beneath the pond) and other wetland/pond features within the SPA (i.e. northwestern portion of SPA).

Figure 2.5. Existing Poned Locations



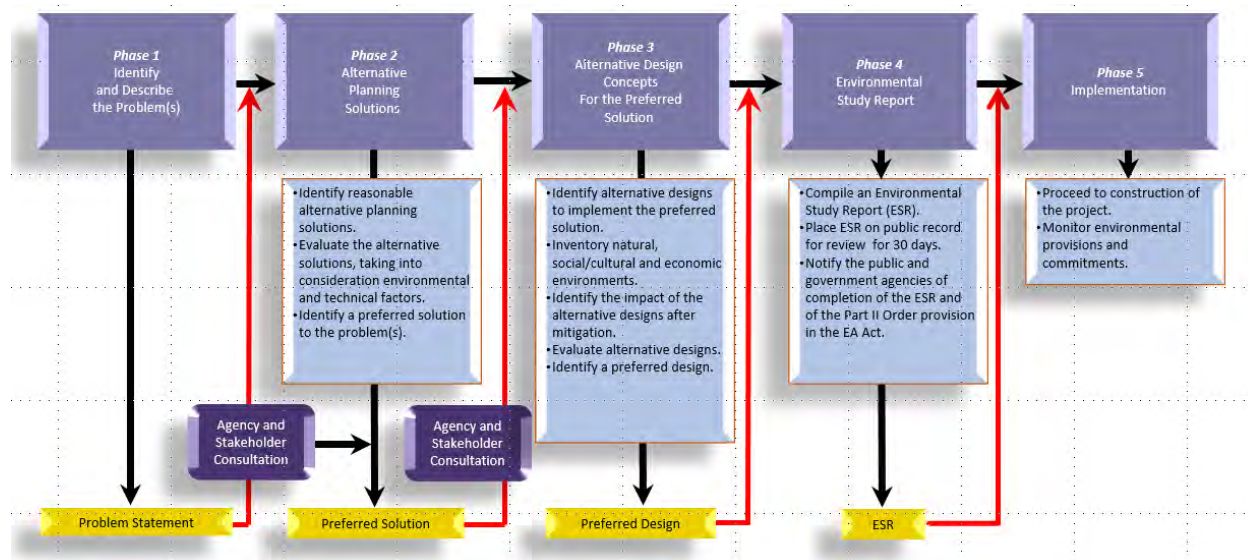
Groundwater quality analysis indicates the overburden water consistently represents a calcium-magnesium carbonate system with no significant difference in most basic anions and cations between the shallow and deeper groundwater in the overburden monitoring wells. In addition, the basic anions and cations within the two Provincial Groundwater Monitoring Network (PGMN) bedrock wells appear to be like the overburden monitoring wells. Localized elevated levels of chloride and nitrate reflect potential quality degradation related to winter de-icing or agricultural applications.

There is limited groundwater quality protection within the overburden and shallow bedrock aquifers from potential contaminant sources, particularly related to those elements that are considered conservative (i.e. those that do not biodegrade or are not adsorbed such as chloride). The thick overburden and Vinemount bedrock aquitard provides greater protection for the deep bedrock aquifer (main source of municipal groundwater) by limiting the flux from the shallow to deep bedrock aquifer in the SPA).

3 Servicing

The objective of the MESP, as outlined in the earlier Problem Statement is to establish water, wastewater and storm servicing and transportation solutions for the preferred Community Structure Plan, with consideration to the existing and recommended natural heritage systems, existing adjacent urban land uses and associated existing transportation and municipal servicing infrastructure. The following sections provide details of the respective water, wastewater and storm servicing and transportation assessments conducted in accordance with the provisions of the MEA Class EA process (ref. Municipal Engineers Association Municipal Class Environmental Assessment document October 2000, as amended 2007, 2011 and 2015). The MESP addresses Phases 1 and 2 of the MEA Class EA Process (ref. Figure 3.1), with the servicing needs for the Preferred Community Structure determined in Phase 1 and servicing alternatives identified and selected in Phase 2.

Figure 3.1. MEA Class EA Process



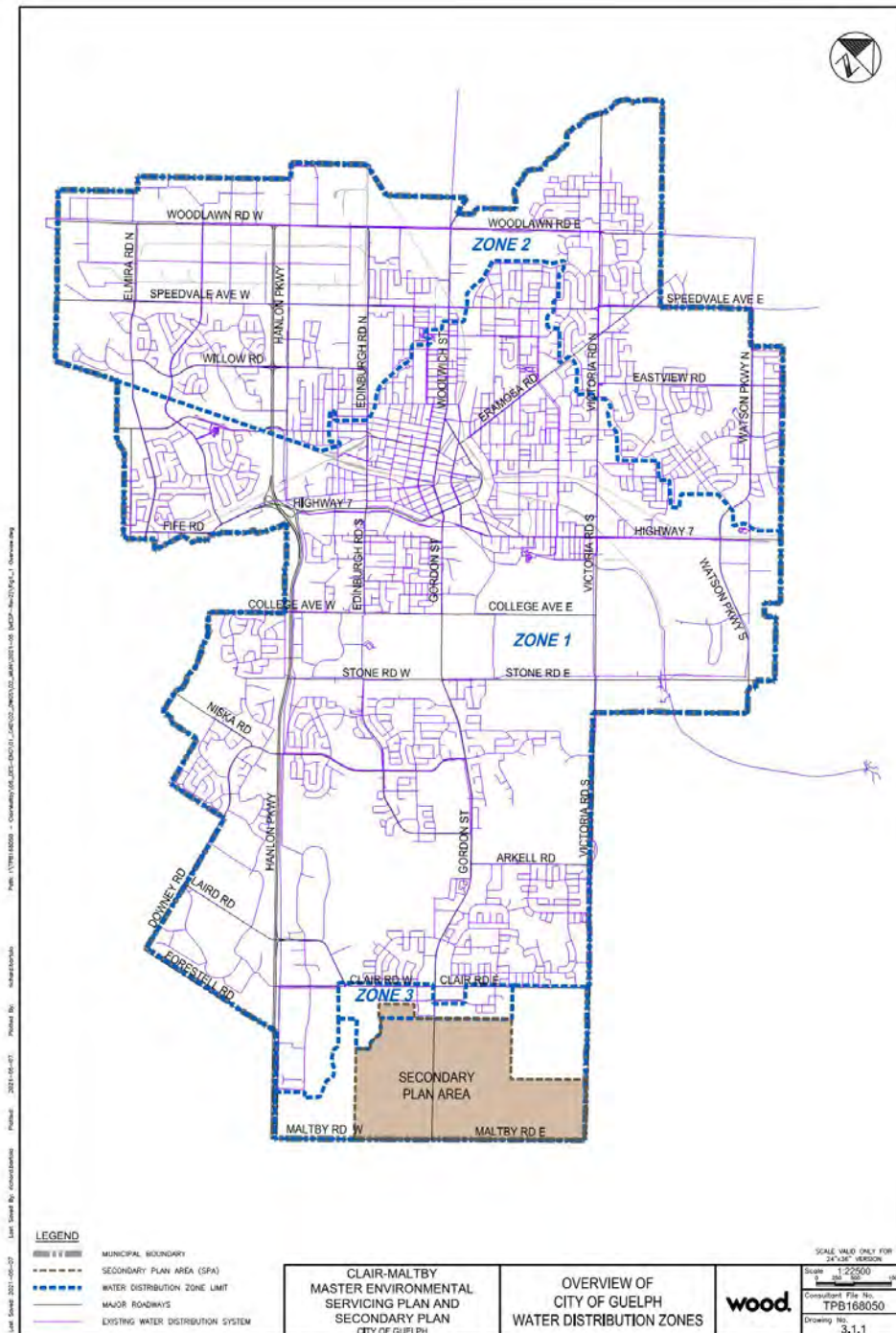
Each servicing section has been largely structured in a common approach providing details of the existing system, governing policies and criteria, outlining future needs and demands, per the Clair-Maltby Community Structure and offering a suite of alternatives, assessment criteria and ultimately the preferred solutions.

3.1 Water

3.1.1 Existing Conditions

The City of Guelph’s water distribution system is shown in Figure 3.1.1.

Figure 3.1.1. Overview of City of Guelph Water Distribution System



To establish the preliminary servicing requirements for the CMSP lands, and to aid with the hydraulic analysis and the City provided a working water model for the

entire City. This water model was utilized by Wood to size the servicing infrastructure at a planning level and establish the pressures for various servicing scenarios. The City's water model was also utilized to estimate available fire flows at various locations. The City's hydraulic water model is deemed to be sufficiently calibrated to determine the boundary conditions for the existing and baseline network.

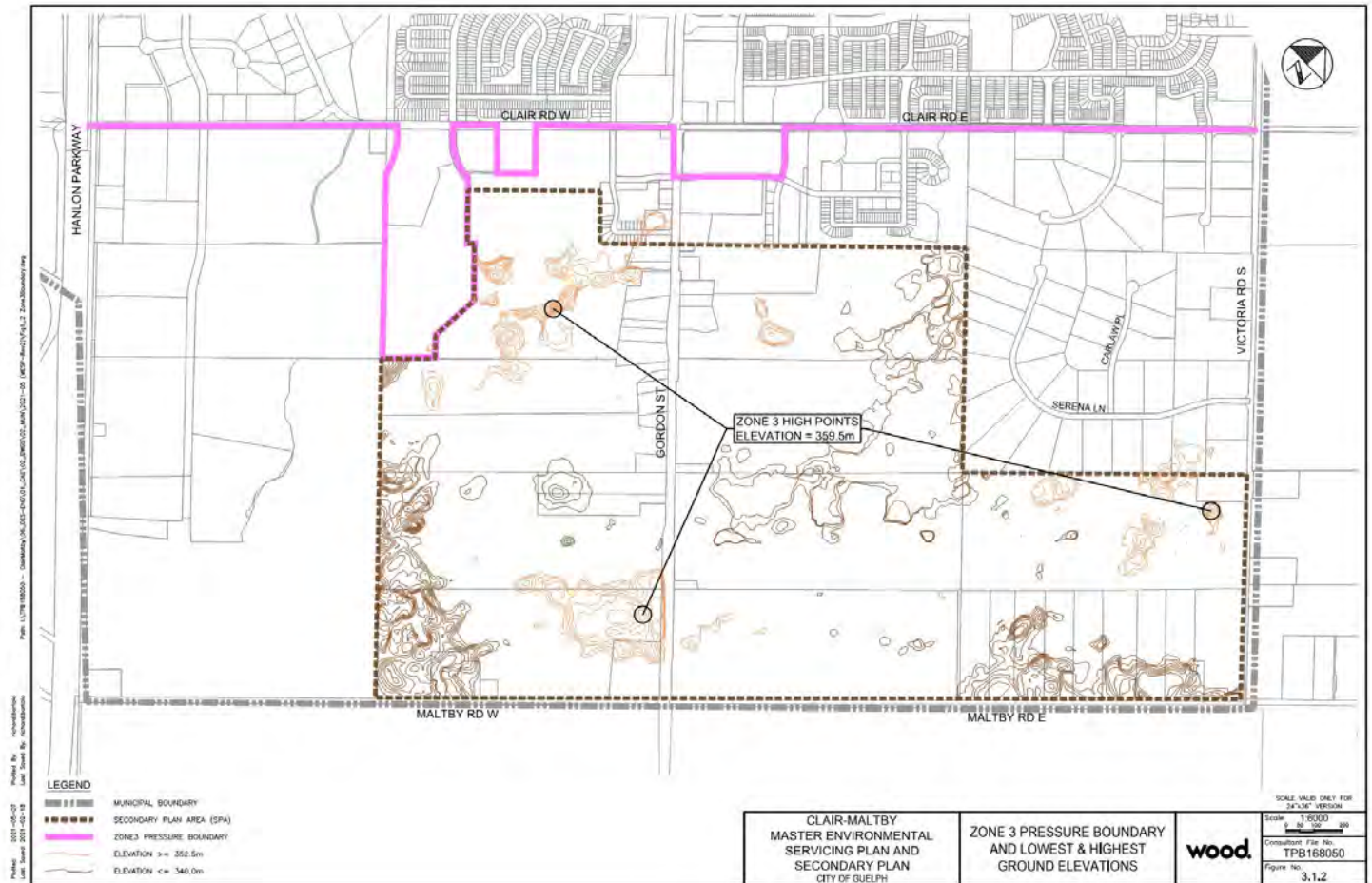
The CMSP lands are primarily rural and agricultural in nature and according to Ministry of Environment Well Records, the lands contain in excess of 60 private water wells.

The CMSP lands are higher in elevation than much of the rest of the City. The City's water distribution system is currently being expanded in the south side of Guelph through a new pressure zone (Zone 3) that will operate at elevations that are suitable for the CMSP Lands. Zone 3 is now live with pumping into the zone, however as demand increases in its service area, it will require storage to meet mandated operating requirements. As such, a new storage tank must be considered to meet the water distribution demands for Zone 3. Evaluation of the pros and cons of an elevated tank versus an in-ground storage tank must be also carried out in order to make a recommendation on the most suitable storage system to meet the needs of the CMSP lands.

The Clair Road Booster Pumping Station (BPS) was constructed in 2012 to service new development areas consistent with the CMSP lands, as a part of Zone 3 development. The Clair Road BPS increases water pressures from a Zone 1 Hydraulic Grade Line (HGL) of approximately 377 m to the proposed Zone 3 HGL of approximately 400 m (Zone 3 Commissioning Plan). The Zone 3 boundary is shown in Figure 3.1.2. This proposed HGL for Zone 3 will provide customers in that area with pressures between 40 - 100 psi (275 - 690 KPa) consistent with Ministry of the Environment, Conservation and Parks (MECP) guidelines.

As the CMSP lands are expected to have planned growth in phases and over a period of time, consideration should be provided to adjusting the hydraulic grade line (HGL) as the growth progresses. During the initial stages of development, when the hydraulic head loss is relatively low, a Top Water Level (TWL) of the elevated Zone 3 Reservoir can be less than 400 m to provide adequate residual pressure to the area's residents. The TWL of the Zone 3 reservoir could be brought up as development in CMSP lands progresses to account for additional hydraulic head loss, over time. This approach could result in savings in pumping costs until full buildout, as presented in the energy efficiency study as part of the Clair Booster Pumping Station and Zone 3 Commissioning Plan carried out by the City through another consultant in 2016. See Appendix A- Water, for Water Model output.

Figure 3.1.2. Zone 3 Pressure Boundary and Highest Ground Elevations



Based on current planning level information, the proposed CMSP developable lands are expected to be graded between 331.5 to 357.5 m, which is considered suitable for this area. These grades are consistent with the proposed grading to provide stormwater servicing (ref. Section 3.3). Note that low areas below 340 mASL may require pressure reducing components and associated plumbing systems. An assessment of the pressures and elevations within Zone 3 is presented in Table 3.1.1.

Table 3.1.1. Zone 3 Pressures/Elevations

Descriptor	Required (MECP)	Preferred
Minimum Operating Pressure	40 psi / 275 kPa / 28.0 m	50 psi / 340 kPa / 35.0 m
Maximum Operating Pressure	100 psi / 690 kPa / 70.0 m	80 psi / 550 kPa / 56.0 m
Minimum Suitable Ground Service Elevation	330.0 mASL	344.0 mASL
Maximum Suitable Ground Service Elevation	360.0 mASL	353.0 mASL
Minimum HGL	388 mASL	388 mASL
Maximum HGL	400 mASL	400 mASL

3.1.2 Criteria/Standards/Policy

A review of the policies, standards and criteria as it relates to the water supply and distribution systems was undertaken. This would serve as the basis for further analysis, hydraulic modelling and preliminary sizing of the water infrastructure for the CMSP lands.

3.1.2.1 Water Demand Estimates

The water demands in this planning process are described as “Average Day Demand”, “Maximum Day Demand”, “Peak Hour Demand”, and “Fire Demand”.

Average Day Demand (ADD): refers to the average daily demand observed in a system in a given year. The City of Guelph has a modelled average day demand for an existing condition (2018 scenario) and a projected future 2032 scenario. The 2032 average day demand scenario has been modified in Section 3.1.3 to reflect the planning framework for the Clair-Maltby Secondary Plan Lands as described in Section 1.

Maximum Day Demand (MDD): refers to the highest daily demand observed in a system in a given year. City of Guelph has a modelled max day demand for an existing condition (2018 scenario) and a projected future 2032 scenario. The 2032 Max Day Demand scenario has been modified in Section 3.1.3 to reflect the planning framework for the Clair-Maltby Secondary Plan Lands as described in Section 1. In the previous studies undertaken by the City, specifically, the 2016 Water Efficiency Study and the 2014 Water Supply Master Plan update, a Max Day Demand (MDD) factor of 1.5 was utilized. In order to be consistent and as discussed with the City, a MDD factor of 1.5 has been utilized in the current analysis.

Peak Hour Demand (PHD): refers to the highest hourly demand observed in a system in a given day. The City of Guelph has a modelled peak hour demand for an existing condition (2018 scenario) and a projected future 2032 scenario. The

2032 Peak Hour Demand scenario has been modified in Section 3.1.3 to reflect the planning framework for the Clair-Maltby Secondary Plan Lands as described in Section 1.

Fire Demand and Available Fire Flow: The fire demand criterion can be described in two ways, *building-specific* fire demand criterion, and *urban network* fire demand criterion. In the building specific context, the fire demand typically refers to the protection needs of a given building, as estimated by the Fire Underwriters' Survey (FUS) method. In the urban network context, fire demand is typically estimated based on the service population of a given distribution system or pressure zone. The MECP guidelines (ref. MECP Design Guidelines for Drinking-Water Systems, Chapter 8) have a population-based fire demand. Available fire flow refers to the amount of flow a network can deliver to a single point in the network without going below 140 KPa (X psi). The available fire flow typically does not consider the restrictions through a hydrant, (i.e. in order to draw the available fire flow at a given point), as there may need to be multiple hydrants.

3.1.2.2 Water Operating Pressures

Normal Operating Pressures

The MECP guidelines require water distribution systems to operate, under normal operating conditions (Peak Hourly, Average Day, and Max Day), within the following pressure range:

- 275 - 690 KPa (40 -100 psi)

Typically, municipalities operate pressure zones within a preferred operating range per the following:

- 350 - 550 KPa (50 - 80 psi)

Fire Flow Conditions

Under fire flow conditions, the MECP guidelines require system pressure to be greater than 140 KPa (20 psi) in the vicinity of the point in the network where fire flow is drawn. Fire flow conditions are evaluated with Max Day Demand background demands in the system.

3.1.2.3 Pipe Network

Head losses in the piped system are a function of the network conditions, specifically related to pipe inside diameters, pipe lengths, inside wall smoothness, network configuration, valving, bends, and restrictions. The Hazen Williams friction loss method is the basis commonly used for determining and solving pressure conditions within the network.

For the new water servicing to represent the future Clair-Maltby area, the pipe servicing will be connected to the City model. For these new pipes, it has been assumed that nominal diameter is equal to inside diameter, Hazen-Williams C factors used were dependent on diameters as stipulated in MECP guidelines as indicated below:

Diameter – Nominal	C-Factor
150 mm (6 in)	100
200 mm 250 mm (8 to 10 in)	110
300 mm 600 mm (12 to 24 in)	120
Over 600 mm (over 24 in)	130

Pumping Stations

Water pumping systems are designed with multiple pumps and are designed to meet a firm capacity. The firm capacity of a pumping station which supplies a pressure zone with adequate floating² storage available for fire protection and balancing, is defined as the system flow rate with the largest capacity pump out-of-service. For a pump station which serves a pressure zone that does not have adequate floating storage, the firm capacity is defined by two of the largest capacity pumps out-of-service.

The use of firm capacity introduces a safety/redundancy factor in the case of a pump needing to be taken out for maintenance or if a pump breaks down.

3.1.2.4 Zone Storage Requirements

Every city and town needs a ready source of water and a means to store this water for future use. Water supply flow rates never exactly match water usage rates. During periods of excess inflow, unused water needs to be conveniently and safely stored for use during peak demand times or for emergencies such as fires. Storage tanks and reservoirs are used to provide potable water storage capacity to meet fluctuations in demand, to provide reserve supply for firefighting use and emergency needs, to stabilize pressures in the distribution system, to increase operating convenience and provide flexibility in pumping, to provide water during source or pump failures, and to blend different water sources.

Water storage planning needs to consider the MECP’s Design Guidelines for Drinking Water Systems (Section 8.4.2), where:

Total Treated Water Storage Requirement = A + B + C, where:

- A = Fire Storage:
 - Evaluated as the volume from MECP Table 8-1: Fire Flow Requirements via suggested flow rate x duration.
- B = Equalization Storage (25 per cent of maximum day demand):
 - Max Day Demand, per capita consumption rates, and Max Day demand factors will be evaluated based on historical demands and updated on an annual basis to determine system requirements. Growth will be evaluated based on per capita unit consumption rates observed in the Clair-Maltby distribution system.
- C = Emergency Storage (25 per cent of A + B):
 - Emergency storage is evaluated as a function of the needs identified in A and B.

² Floating Storage refers to water that is stored at an elevation range that coincides with the pressure requirements of a distribution zone and does not require pumping to be distributed to the zone

The fire flow requirements can be based on:

- the MECP guidelines, which are based on a combination of the equivalent population, as well as suggested fire flow requirements;
- Fire Underwriters Survey (FUS);
- City's specific guidelines in the Guelph Master Servicing Plan, 2008, mentioned below.

Fire flow guidelines are provided in the Guelph Master Servicing Plan, 2008. This document is understood (based on consultation with City staff) to be approved as a guideline for planning the water infrastructure within the City. Based on the proposed development within the CMSP lands, the maximum fire flow is to be determined based on the commercial building guideline, which is 267 L/s for 3.5 hours. While will be primarily residential in nature, the highest fire flow demand will be the commercial development.

3.1.2.5 Demand Estimation

Based on the land use information provided by Brook McIllroy, August, 2019, the total CMSP population is estimated to be 23,759. This includes a projected residential population of 23,135, and an employment equivalent of 624. This population projection is exclusively for the CMSP lands and does not include any additional lands outside the CMSP boundary, which may develop or intensify.

Typically, storage needs are calculated to meet the requirements of the entire distribution zone, rather than for a single development area. At this time, the ultimate planning population for entire Zone 3, is not known. Based on conversation with the City, it is also understood that the Zone 3 requirements can be met in part by the Zone 1 pumps, at Clair Rd if required. Currently, the spare capacity of Zone 1 pumps to meet Zone 3 requirements is not known. As such, to account for the potential for development outside of the CMSP lands, 15 per cent of the projected population for CMSP lands, (i.e., a total population equivalent of 3,565) has been included for planning purposes, over and above the estimated population of 23,759. A similar ratio between residential and non-residential population has been assumed for the additional population of 3,565 (Residential population = 3,471, and non-residential population equivalent =94). This would provide a total planning population of 27,324, for the servicing assessment.

The per capital demand factors utilized in this study are as follows:

- Residential 180 L/ca/d
- Non-residential 286 L/ca/d
- Non-revenue Water 43 L/ca/d

In addition, a Max Day Demand (MDD) factor of 1.5 has been utilized. These are based on the 2016 Water Efficiency Study and the 2014 Water Supply Master Plan update.

For the Clair-Maltby SPA, the total projected population equivalent of 27,324, includes a residential population of 26,606 persons and a non-res population equivalent of 718 persons, the average day and max day demands are therefore as follows:

- Average Day Demand (ADD) 6.2 ML/d
 - $(180 \text{ L/ca/d} \times 26,606 + 286 \text{ L/ca/d} \times 718 + 43 \text{ L/ca/d} \times 27,324) / 10^6$
- Max Day Demand (MDD) 9.3 ML/d
 - $\text{ADD} \times \text{PF} (1.5)$

3.1.2.6 Zone 3 Fire Flow and Storage Requirements

The MECP fire flow guidelines reference the latest edition of the “Water Supply for Public Fire Protection” published by the Fire Underwriters Survey and provide a suggested fire flow requirement for small municipalities of 318L/s for 5 hours for an equivalent population of 27,000.

Application of the suggested requirements result in higher volumes than are typically implemented, especially when a zone relies on elevated tank storage. The reduced storage can be rationalized in combination with often redundant supply elements, including multiple supply sources, backup power, and pump capacities.

Fire flow guidelines are provided in the Guelph Master Servicing Plan, 2008. As noted earlier, this document is approved as a guideline for planning the water infrastructure within the City. Based on the proposed development within the CMSP lands, the maximum fire flow is determined based on the commercial building guideline, which is 267 L/s for 3.5 hours.

Based on an assumed Zone 3 total population of 27,324 (Residential and Non-Residential), and an elevated storage component sized for a fire flow of 267 L/s for 3.5 hours, the elevated storage requirement is established as approximately 7.1 ML. This calculation assumes that 100 per cent of the volume would be supplied by the distribution system feeding Zone 3. However as previously discussed, based on conversation with the City, Zone 3 demands can be provided in part by Zone 1. It is understood from City staff that 50 percent of the fire flows for Zone 3 can be met by Zone 1. This will be further verified in the subsequent City-wide modelling and studies. Therefore, if 50 percent of the Zone 3 demands are assumed to be provided by Zone 1, the elevated storage requirement for Zone 3 would be approximately 5.0 ML.

Table 3.1.2. Estimated Storage Requirements

Descriptor	Storage (50 per cent Q_{fireMECP})	Storage (100 per cent Q_{fireMECP})
Residential Population	26,606	26,606
Non-residential Population Equivalent	718	718
Average Day Demand Factor (Residential)	180 L/ca/d	180 L/ca/d
Average Day Demand Factor (Non- Residential)	286 L/ca/d	286 L/ca/d
Non-Revenue Water	43 L/ca/d	43 L/ca/d
Average Day Demand (ADD)	6.2 ML/day	6.2 ML/day

Descriptor	Storage (50 per cent $Q_{fireMECP}$)	Storage (100 per cent $Q_{fireMECP}$)
Maximum Day Demand (MDD) Peaking Factor	1.5	1.5
Maximum Day Demand (MDD)	9.3 ML/day	9.3 ML/day
Fire Storage	1.7 ML	3.4 ML
Equalization Storage	2.3 ML	2.3 ML
Emergency Storage	1.0 ML	1.4 ML
Total	5.0 ML	7.1 ML

In the 50 per cent storage scenario, it has been assumed that all of equalization storage for Zone 3 will be provided by its own reservoir. However, 50 per cent of the fire storage and corresponding emergency storage will be provided by Zone 1.

Table 3.1.2a. Existing Storage Capacities

Storage	Type	Zone	Volume (m ³)
F.M. Woods	Reservoir	1	29,270
University	Reservoir	1	2,287
Clair	Elevated Tank	1/3	4,500
Verney	Elevated Tank	1	3,790
Paisley	Reservoir	2	11,750
Clythe	Reservoir	2	650
Speedvale	Elevated Tank	2	2,258
Zone 1 Total			39,847
Zone 2 Total			14,658
System Total			54,505

3.1.3 Alternatives

The following general servicing approach has been considered to service the proposed development. This approach is a practical method of ensuring that the pipe network is not a limiting factor in achieving the required levels of service (pressure, flow etc.) while facilitating operations from a water quality / aging / chlorination perspective. It is also expected that further opportunities for refining/optimizing the pipe sizing for the transmission, as well distribution mains will present themselves during the subsequent stages of the planning and design process, as land use details are established including local roads and lotting.

1. All new collector and arterial roads shown in the land use plan will be serviced with 300 mm distribution mains;
2. Distribution mains will be looped, and where there are any dead-ends a looped solution will be envisaged (via easement or other opportunity);

3. Transmission mains will be constructed along major system connections (Pump to Storage) and distribution mains will be connected to the transmission mains at suitable locations. Transmission mains will be distributed sufficiently around the pressure zone to provide sufficient boundary pressure for the distribution mains.

It is also acknowledged that the City's Development Engineering Manual provides a minimum pipe size of 150 mm for local roads, and pipe diameters on local roads could be as small as 150 mm. For the level of resolution of this study (planning-level), local roads are not included in the analysis as the local road patterns and alignments, and associated lotting, are not yet established.

3.1.3.1 Alternative 1 - Do Nothing

This alternative would not implement any infrastructure to service the CMSP lands. As such there would be no municipal water services for the planned growth. This alternative does not present a viable solution to service the CMSP lands, nor does it address the problem/opportunity statement. The alternative is listed here, only for the purpose of benchmarking against the other alternatives being considered.

3.1.3.2 Alternative 2 - Limit Community Growth

This alternative will generally involve limiting growth to below the levels identified in the current Secondary Plan. The limitation in growth could be due to limiting the geographical area of development, reduction in population density, or both. Limiting community growth would result in not achieving the growth targets identified in the secondary plan and Provincial Forecasts and would therefore not meet the planned growth targets. As such, limiting community growth to minimize/eliminate infrastructure upgrades, is not considered a viable solution to service the CMSP lands.

3.1.3.3 Alternative 3 - Elevated Storage

This alternative addresses the storage and transmission requirements for the projected growth in land use. As noted, the total projected population equivalent for pressure Zone 3 includes an additional 27,324.

The primary system components required are:

1. Zone 3 Functional Storage: Storage volume requirements are a function of the overall needs in Zone 3, (i.e. not simply the CMSP lands). Functional Storage will support a normal operating HGL of 382-394 masl.
2. Transmission Main to Storage: A 600 mm transmission main from the Clair Road Booster Pumping Station to the new storage facility will be required at the same time as the storage is implemented.
3. Internal Distribution System: A 300 mm looped distribution system will be implemented.

This alternative is subdivided into two sub alternatives based on the approach to functional storage. Specific storage facility design configurations will need to be determined through detailed design.

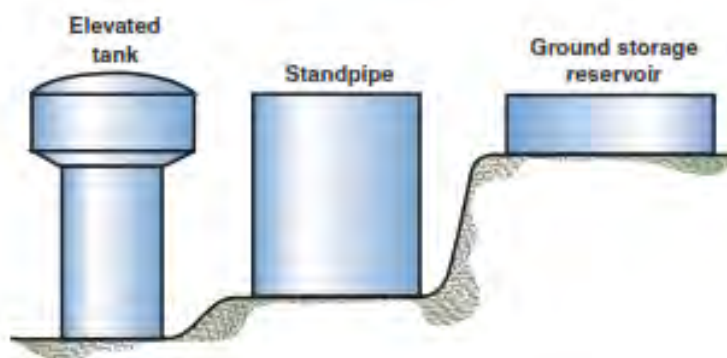
Alternative 3 - Zone 3 Storage and Transmission using Elevated Storage

The Elevated Storage option for Zone 3 has the specific advantage of being configured as floating storage, where the free surface of the water in the storage facility establishes the HGL in the pressure zone. Where ground elevations permit, it is desirable to locate storage facilities on higher ground and use ground level storage tanks or standpipes. Water storage can be most economically provided by constructing ground storage reservoirs on high ground. Floating storage from an operational, economic, and practical perspective, is a much simpler option to implement than a system which relies on pumping, to utilize the storage to its full potential.

Instrumentation is required in in storage facilities to control water levels. Level indicating devices will provide readings at a central location and overflow and low-level alarms sent to locations which will be monitored 24 hours a day. For subsurface storage, level indicators would be provided by a pressure gauge on the tank piping, a level indicating transmitter or other means. For elevated tanks, level control instrumentation should be sufficiently precise to prevent wasting storage or tank overflows. Subsurface storage is designed with two or more cells which can be operated independently. Through valving it is possible to isolate one of the two cells without affecting the operation of the other cell. This is imperative for routine inspection, maintenance and cleaning of the tank.

Elevated Storage eliminates the need for electrical systems and backup power and makes the entire storage potential available to the pressure zone in an emergency situation. Figure 3.1.3 illustrates the typical configurations for floating storage.

Figure 3.1.3. Types of Floating Storage



This alternative has also considered three sub-options (a), (b) and (c), based on three possible locations for the elevated storage. The locations were selected based on elevation; the three locations represent the three highest elevations within the CMSP, as illustrated in Figure 3.1.2. Elevated storage volume requirements have been estimated as 5.0 ML, assuming that 50 per cent of the Zone 3 storage requirement for fire and the corresponding emergency storage will be provided from Zone 1. The storage elevation has been assumed to be 12 m, resulting in a total required storage area of approximately 419 m². On this basis the tank diameter has been estimated to be 23.1 m. The facility footprint, including the

elevated tank, parking, and roadways would result in a conservative value of 50 m x 50 m for the total facility area.

The diameters, elevations, and lengths of new and existing watermains and transmission mains for Alternatives 3 (a), 3 (b), and 3 (c) are based on the demand estimation and per capita factors discussed in the foregoing, premised on the conceptual grading for stormwater servicing, and the hydraulic modelling carried out for the CMSP lands.

Elevated Storage Location 1

Alternative 3 (a) Elevated Storage – Location 1

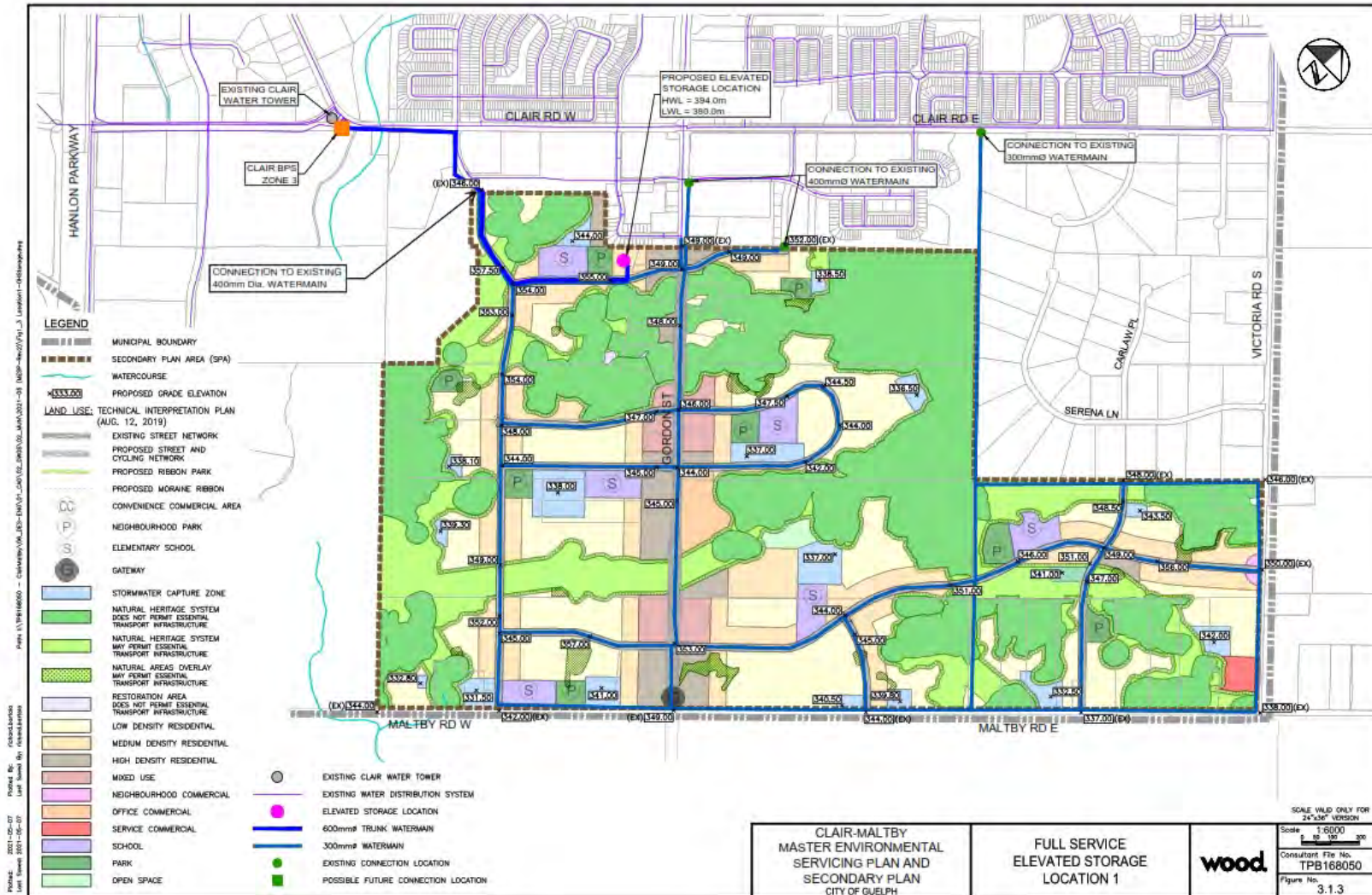
Figure 3.1.4 shows the location of the Elevated Storage within the northwest portion of the CMSP lands. This location is closest to the Clair Booster Pump Station as well as the Zone 1 Clair Rd elevated storage tank and therefore, will require the shortest length of the transmission main from the Clair Booster Pump Station to the Elevated Reservoir. Its proposed location is close to existing and proposed residences and proposed schools. As such, the visual appearance and acceptability may pose an issue.

Table 3.1.3 presents a summary of the infrastructure required for this alternative.

Table 3.1.3. Watermain and Storage Information for Reservoir Location 1

Infrastructure Required	Amount
Length of 200 mm Diameter Watermain	300 m
Length of 300 mm Diameter Watermain	17,800 m
Length of 400 mm Diameter Watermain	540 m
Length of 600 mm Diameter Watermain	2,200 m
Capacity of Above Ground Storage Reservoir	5 ML

Figure 3.1.4. Elevated Storage – Location 1



Elevated Storage Location 2

Alternative 3 (b) Elevated Storage – Location 2

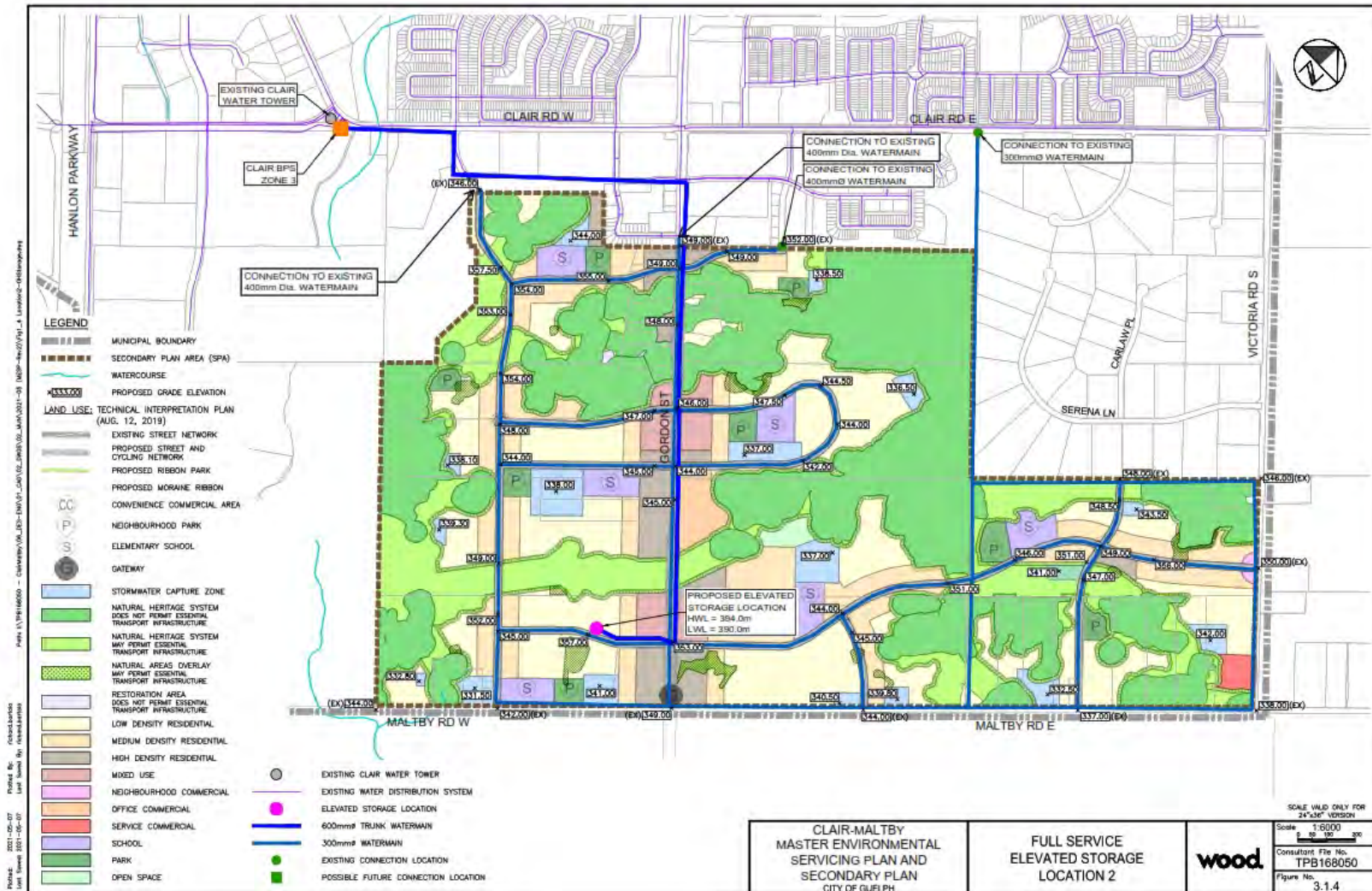
Figure 3.1.5 shows the location of the Elevated Storage within the southern portion of the CMSP lands. This location is in a more centralized location than the other two proposed locations, which is generally considered a better location than to one side/corner of the service area. Another advantage of this location is that it is close to a proposed commercial building, which is associated with the largest fire flow demand for the CMSP lands. As such, it has the potential to provide more reliable fire flow to the largest fire flow demand area.

Table 3.1.4 presents a summary of the infrastructure required for this alternative.

Table 3.1.4. Watermain and Storage Information for Reservoir Location 2

Infrastructure Required	Amount
Length of 300 mm Diameter Watermain	17,550 m
Length of 600 mm Diameter Watermain	3,300 m
Capacity of Above Ground Storage Reservoir	5 ML

Figure 3.1.5. Elevated Storage – Location 2



Elevated Storage Location 3 for Projected Future Community Growth

Alternative 3 (c) Elevated Storage – Location 3

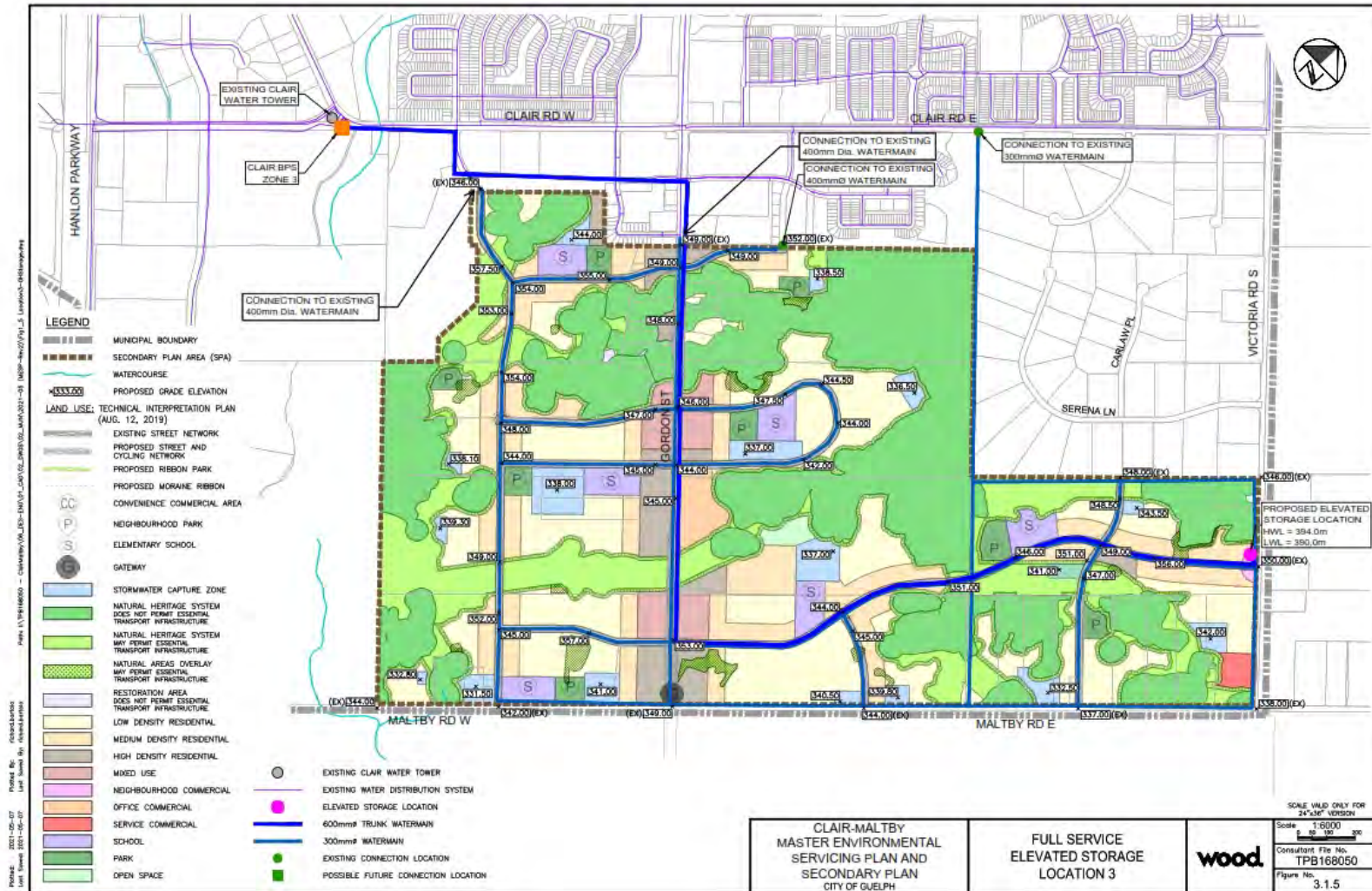
Figure 3.1.6 shows the location of the Elevated Storage within the southeastern portion of the CMSP lands. This location will require the longest transmission main from the Clair Booster Pump Station to the Elevated Storage Tank. It is toward the southeast corner of the subject lands and is close to proposed residential areas, where it will impact the visual appearance/skyline of the neighbourhood.

Table 3.1.5 presents a summary of the infrastructure required for this alternative.

Table 3.1.5. Watermain and Storage Information for Reservoir Location 3

Infrastructure Required	Amount
Length of 300 mm Diameter Watermain	17,550 m
Length of 600 mm Diameter Watermain	5,200 m
Capacity of Above Ground Storage Reservoir	5 ML

Figure 3.1.6. Elevated Storage – Location 3



3.1.3.4 Alternative 4 – Zone 3 Storage and Transmission using Below Ground Storage and Pumping

“Floating” underground storage is commonly used in Ontario Systems in areas where topography is suitable. Integrated Urban Systems with multiple zones, progressing in elevation, tend to lend themselves to the use of underground floating storage. In such situations, underground floating storage reservoirs are located in ground that is higher than the pressure zone they service, connected via transmission mains, and often used as the launch point for pumping into the next zone.

The CMSP lands are located at a topographic high point, as such, there is no nearby ground that is at a suitable elevation for providing floating underground storage. Underground storage in this case will need to be combined with a pumping system located at the storage reservoir to simulate what a floating storage reservoir would achieve. This pumping system will need to be equipped with back-up power generation, typically natural gas or diesel generator, to ensure the ability to use the storage in the event of an emergency.

The storage is configured with a pumping station that pressurizes water to Zone 3 operating levels. The pumping station will thereby be able to meet max day demands and max day plus fire flow demands in combination with other booster pumping stations (i.e. Clair Road BPS). The pumping station will need to have a firm capacity of 160 L/s, as well as backup power.

This alternative similarly has three sub-options (i – iii) based on three possible locations for the underground storage. Underground storage volume requirements are the same as above ground storage requirements. The storage requirements were established in Section 3.1.2.7. A subsurface storage of 5.0 ML has been considered. The estimated total storage area required is approximately 1,100 m² for this amount of storage. Based on preliminary sizing, the area would be divided into 3 cells, and assuming a 1:1 grading slope of 5 m, as well as space for the pumping facility, parking, and roadways, resulting in a conservative foot print of 100 m x 60 m (6000 m²) for facility sizing.

Underground Storage Location 1

Alternative 4 (a) Underground Storage – Location 1

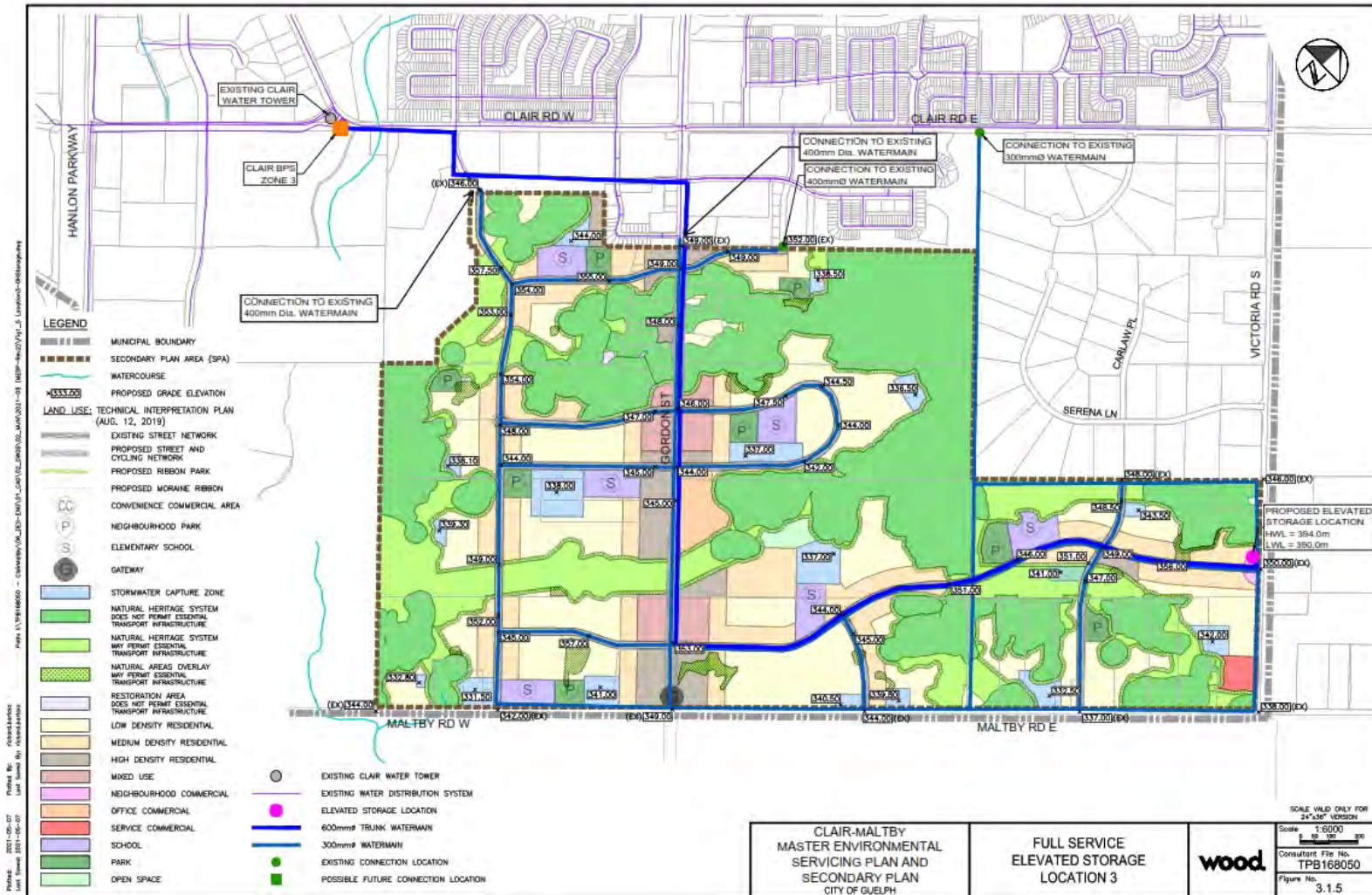
Alternative 4 (a) (i) (Figure 3.1.7) shows the location of the underground storage reservoir within the northwest portion of the CMSP lands. The approximate mean elevation the underground storage reservoir at this location is 355.5 masl (meters above sea level).

Table 3.1.6 presents a summary of the infrastructure required for this alternative.

Table 3.1.6. Watermain, Storage and Pumping Information for Reservoir Location 1

Infrastructure Required	Amount
Length of 150 mm Diameter Watermain	11 m
Length of 200 mm Diameter Watermain	300 m
Length of 300 mm Diameter Watermain	17,800 m
Length of 400 mm Diameter Watermain	540 m
Length of 600 mm Diameter Watermain	2,200 m
Capacity of Below Ground Storage Reservoir	5 ML
Capacity of the Booster Pumping Station	160 L/s

Figure 3.1.7. Underground Storage – Location 1



Underground Storage Location 2

Alternative 2 (b) Underground Storage – Location 2

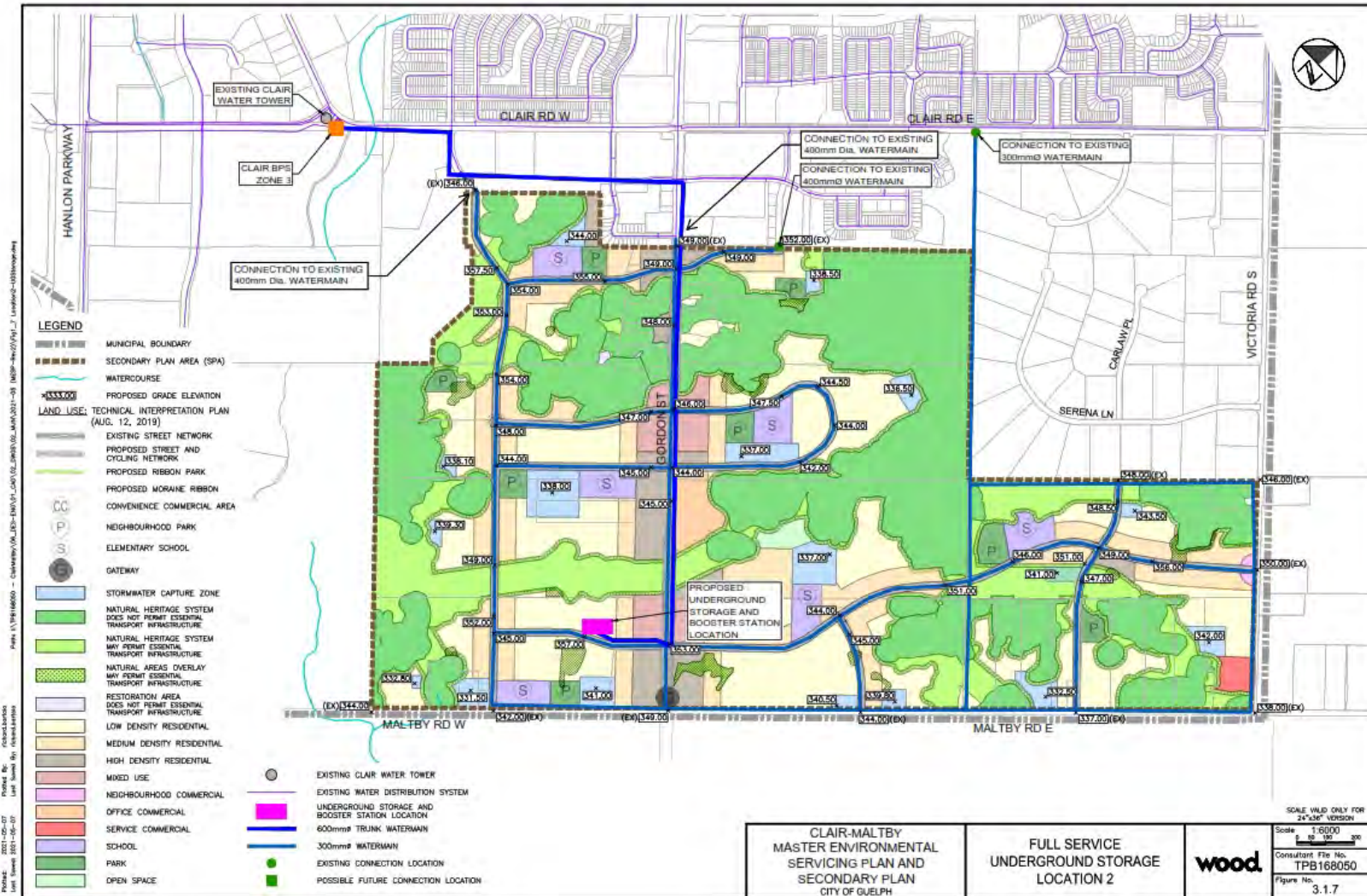
Alternative 2 (a) (ii) (Figure 3.1.8.) shows the location of the underground storage reservoir within the southern portion of the CMSP lands. The approximate mean elevation of the underground storage reservoir at this location is 359.5 masl.

Table 3.1.7 presents a summary of the infrastructure required for this alternative.

Table 3.1.7. Watermain, Storage and Pumping Information for Reservoir Location 2

Infrastructure Required	Amount
Length of 300 mm Diameter Watermain	17,550 m
Length of 600 mm Diameter Watermain	3,300 m
Capacity of Above Ground Storage Reservoir	5 ML
Capacity of the Booster Pumping Station	160 L/s

Figure 3.1.8. Underground Storage – Location 2



Underground Storage Location 3 for 100 per cent Community Growth

Alternative 2 (c) Underground Storage – Location 3

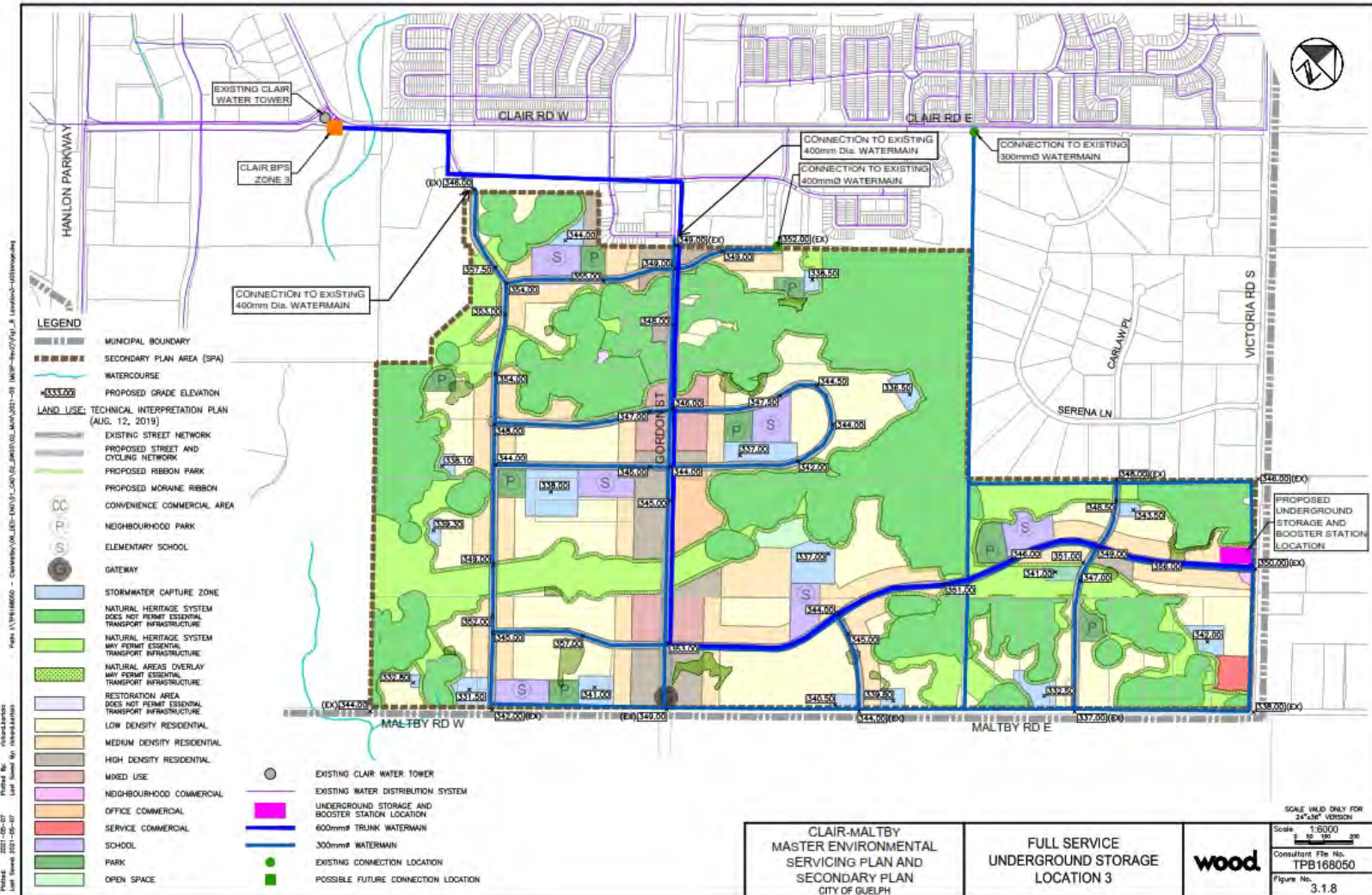
Alternative 2 (a) (iii) (ref. Figure 3.1.9) shows the location of the underground storage reservoir within the southeastern portion of the CMSP lands. The approximate mean elevation the underground storage reservoir at this location is 352 masl.

Table 3.1.8 presents a summary of the infrastructure required for this alternative.

Table 3.1.8. Watermain, Storage and Pumping Information for Reservoir Location 3

Infrastructure Required	Amount
Length of 300 mm Diameter Watermain	17,550 m
Length of 600 mm Diameter Watermain	5,200 m
Capacity of Above Ground Storage Reservoir	5 ML
Capacity of the Booster Pumping Station	160 L/s

Figure 3.1.9. Underground Storage – Location 3



3.1.4 Economics of Water Servicing Alternatives

This section discusses the economics of the different water servicing alternatives. Order of magnitude cost estimates were developed for the various water storage and distribution for each of the alternatives. These are based on information extracted from recent tenders for the City of Guelph (provided by the City), as well as the technical publications of the American Water Works Association (AWWA) and United States Environmental Protection Agency (US EPA). The cost numbers were suitably interpolated to reflect the current servicing sizes and capacities. Property costs have been based on estimated local market conditions.

Annual Operating and Maintenance costs have been estimated based on a percentage of capital costs as follows:

Watermains:	0.5% of Capital Cost
Reservoirs (Above-ground)	2.0% of Capital Cost
Reservoirs (In -ground)	0.5% of Capital Cost
Booster Pumping station (including energy costs)	5.0% of Capital Cost

Property costs have been assessed at an estimated \$800,000 per acre, or \$198/m². Easements costs have not been included as they are considered incidental (\$0.5/m²).

3.1.4.1 Elevated Storage for Projected Future Community Growth

Location 1

The approximate capital cost for a water distribution network including an Elevated Storage in Location 1 is \$31.0 million, with the cost breakdown shown in

Table 3.1.9.

Table 3.1.9. Estimated Cost – Alternative 1 (a) –Elevated Storage – Location 1

Distribution	Cost
Local Distribution Systems (150, 200, 300, 400 mm WMs, Valves, Hydrants)	\$23.3 M
Elevated Storage (5 ML)	\$ 3.3 M
600 mm Transmission Main from Clair Gordon BPS (with Valve Chamber Connections)	\$ 3.9 M
Property Costs	\$ 0.5 M
Total Capital Cost Option 1 (a)	\$31.0 M
Estimated Annual O&M Costs	\$202 K /year

Location 2

The approximate capital cost for a water distribution network including an Elevated Storage in Location 2 is \$31.6 million, with the cost breakdown shown in **Table 3.1.10.**

Table 3.1.10. Estimated Cost – Alternative 1 (b) – Elevated Storage – Location 2

Distribution	Cost
Local Distribution Systems (300 mm WMs, Valves, Hydrants)	\$ 21.9 M
Elevated Storage (5 ML)	\$ 3.3 M
600 mm Transmission Main from Clair Gordon BPS (with Valve Chamber Connections)	\$ 5.9 M
Property Costs	\$ 0.5 M
Total Cost Option 1 (b)	\$ 31.6 M
Estimated Annual O&M Costs	\$205 K /year

Location 3

The approximate capital cost for a water distribution system including an Elevated Storage in this location is \$35.0 million, with the cost breakdown shown in **Table 3.1.11.**

Table 3.1.11. Estimated Cost – Alternative 1 (c) –Elevated Storage – Location 3

Distribution	Cost
Local Distribution Systems (300 mm WMs, Valves, Hydrants)	\$ 21.9 M
Elevated Storage (5 ML)	\$ 3.3 M
600 mm Transmission Main from Clair Gordon BPS (with Valve Chamber Connections)	\$ 9.3 M
Property Costs	\$0.5 M
Total Cost Option 1 (c)	\$ 35.0 M
Estimated Annual O&M Costs	\$222 K /year

3.1.4.2 Below Ground Storage for Projected Future Community Growth

Location 1

The approximate capital cost for a water distribution system including an underground storage reservoir in this location is \$31.8 million, with the cost breakdown shown in **Table 3.1.12**.

Table 3.1.12. Estimated Cost – Alternative 2 (a) – Underground Storage – Location 1

Distribution	Cost
Local Distribution Systems (300 mm WMs, Valves, Hydrants)	\$23.3 M
Underground Storage (5 ML) including Pumping Systems (160 L/s)	\$3.4 M
600 mm Transmission Main from Clair Gordon BPS (with Valve Chamber Connections)	\$3.9 M
Property Costs	\$1.2 M
Total Cost Option 2 (a)	\$31.8 M
Estimated Annual O&M Costs	\$243 K /year

Location 2

The approximate capital cost for a water distribution system including an underground storage reservoir in this location is \$32.4 million, with the cost breakdown shown in **Table 3.1.13**. The key difference in cost for this alternative is primarily due to a longer 600 mm transmission main connecting the Clair Gordon BPS Zone 3 and the proposed below ground storage reservoir.

Table 3.1.13. Estimated Cost – Alternative 2 (b) – Underground Storage – Location 2

Distribution	Cost
Local Distribution Systems (300 mm WMs, Valves, Hydrants)	\$ 21.9 M
Underground Storage (5 ML) including Pumping Systems (160 L/s)	\$ 3.4 M
600 mm Transmission Main from Clair Gordon BPS (with Valve Chamber Connections)	\$ 5.9 M
Property Costs	\$ 1.2 M
Total Cost Option 2 (b)	\$ 32.4 M
Estimated Annual O&M Costs	\$246 K /year

Location 3

The approximate capital cost for an underground storage reservoir in this location is \$35.8 million, with the cost breakdown shown in **Table 3.1.4**.

Table 3.1.14. Estimated Cost – Alternative 2 (c) – Underground Storage – Location 3

Distribution	Cost
Local Distribution Systems (300 mm WMs, Valves, Hydrants)	\$ 21.9 M
Underground Storage (5 ML) including Pumping Systems (160 L/s)	\$ 3.4 M
600 mm Transmission Main from Clair Gordon BPS (with Valve Chamber Connections)	\$ 9.3 M
Property Costs	\$ 1.2 M
Local Distribution Systems (300 mm WMs, Valves, Total Cost Option 2 (c))	\$ 35.8 M
Estimated Annual O&M Costs	\$263 K /year

3.1.5 Assessment Criteria

As part of Phase 2 of the Municipal Class Environmental Assessment process, the water servicing alternatives noted above need to be evaluated methodically comparing the pros and cons of each alternative such that the servicing alternative that best meets the requirements of the subject lands could be put forth as the preferred alternative.

In order to perform a meaningful comparison, detailed evaluation criteria need to be developed to ascertain the potential impacts of the various alternatives on the natural environment, social and cultural impacts, cost impacts etc. The next section details the various evaluation criteria that were selected to carry out the comparative analysis of the various servicing alternatives.

3.1.5.1 Evaluation Criteria

The following evaluation criteria has been prepared in order to carry out the comparative evaluation of the different water servicing alternatives for the CMSP lands. The water servicing alternatives have been compared with respect to the evaluation criteria presented below. As per the Municipal Environmental Assessment process, the selected criteria relate to the consideration of potential impacts and opportunities generated by the alternatives within four distinct environments:

Table 3.1.15. Water Servicing Evaluation Criteria

Evaluation	Criteria
Social/Cultural Environment	Impacts or opportunities created by the alternative as related to the people and their current or historic relationship with the study area.
Economic Environment	Capital, operation and maintenance costs associated with an alternative.
Natural Environment	Impacts or opportunities that an alternative may have related to the natural environment (i.e., fisheries, wildlife, water quality, etc.).
Functional (Technical) Environment	Considers the ability of the alternative to address the Problem Statement and how it may impact existing physical systems. These include ease of maintenance, impact to existing infrastructure, ability to utilize available capacity in the existing infrastructure, capability of phased implementation, and ability to be implemented in concert with wastewater servicing, stormwater servicing and mobility

Within each environment, relevant and representative criteria have been considered for the evaluation. Each evaluation criterion has been assessed to ensure it results in a meaningful comparison between the water servicing alternatives.

Table 3.1.16. Water Servicing Alternatives Evaluation Factors

Component	Category	Evaluation Criteria	Criteria Indicator	Potential Measure
Natural Environment	Terrestrial/Aquatic Environment Resources	Impact to Terrestrial/Aquatic Environment Resources	Potential adverse effects on ecological sensitive lands, impacts to water bodies and aquatic species.	Extent of impact
Social/Cultural	Impact on Local Residents and Businesses	Archaeological Resources ¹ .	Potential adverse effects on archaeological resources	Extent of impact
Social/Cultural	Impact on Local Residents and Businesses	Cultural Heritage Resources ² .	Potential adverse effects on cultural heritage resources	Extent of impact
Social/Cultural	Sustainable Growth	Impacts on Adjacent Properties	Potential adverse impacts to adjacent properties due to construction of solutions etc.	Number of private or public properties

Component	Category	Evaluation Criteria	Criteria Indicator	Potential Measure
Social/ Cultural	Reliability	Impact to adjacent properties.	Potential adverse impact in the event of failure of system.	Extent of impact
Social/ Cultural	Regulatory Environment	Compliance with provincial/municipal regulations and standards	Potential adverse impact due to inadequate infrastructure.	Extent of impact
Social/ Cultural	Landuse	Impact on surrounding landuse.	Potential aesthetic impact, disruption to public life during construction/operation.	Noise, odour
Economic	Cost benefit over infrastructure lifecycle	Capital Cost	Design and construction costs	Estimated cost (\$)
Economic	Cost benefit over infrastructure lifecycle	Maintenance Cost	Asset management costs (lifecycle)	Estimated cost (\$)
Economic	Cost benefit over infrastructure lifecycle	Property Acquisition	Amount of private property required to achieve solution	Area in ha
Functional (Technical)	Ease of Maintenance	Maintainability	Adverse impact on system performance	Extent of impact
Functional (Technical)	Impact to Existing Infrastructure	Impact of new infrastructure on the existing infrastructure to meet its assigned/allocated function	Surcharges, pressure reductions, lack of water storage	Extent of impact
Functional (Technical)	Ability to Utilize Capacity in Existing Infrastructure	Ability of new infrastructure to utilize spare capacity within the existing infrastructure	Eliminating/minimizing requirement for upgrade/expansion to existing infrastructure	Extent of impact
Functional (Technical)	Capability of Phased	Ability of proposed scheme to be	Modularity/flexibility of the proposed servicing	Extent of flexibility in phasing

Component	Category	Evaluation Criteria	Criteria Indicator	Potential Measure
	Implementation	implemented in a phased manner over a period of time		
Functional (Technical)	Ability to be implemented in Concert with the Wastewater and stormwater servicing and mobility infrastructure	Ability to be implemented within proximity of the wastewater/ stormwater servicing and mobility infrastructure	Physical proximity with wastewater/storm water servicing and mobility infrastructure	Extent of proximity
Functional (Technical)	Construction Difficulty	Ability to be implemented utilizing traditional Construction Techniques	Eliminating/ Minimizing locations of difficult construction	Extent of proximity

1. Combined into a single criterion due to common potential for impacts (spatially).
2. More related to detailed design versus planning stages thus removed from assessment.

Each of the water servicing alternatives has been assessed using the evaluation categories, criteria and factors provided within Table 3.3.7. The following has been noted regarding the various alternatives under consideration:

3.1.5.2 Evaluation of Servicing Alternatives

Each of the alternatives is evaluated against the criteria provided in the previous section as well as in its capacity to address the original Problem/Opportunity statement that triggered the study.

Alternative 1: Do-Nothing: The Do-Nothing alternative for water servicing wouldn't cause disruption to the natural, social and cultural environment. Neither would it provide any servicing in terms of infrastructure such as pipes, valves, appurtenances, storage reservoir and/or booster pumping. As a result, the CMSP development would be left without a water distribution system. Therefore, this alternative does not address the problem/opportunity statement nor does it meet the objective of development within the subject lands and is therefore not considered a viable alternative.

Alternative 2: Limit Community Development: Limiting community development potentially would reduce the adverse impact on the natural, social and cultural environment. It also would cost less to design, construct, operate and maintain the water supply and distribution infrastructure to meet the reduced demand. However, this alternative also does not meet the objective of full development within the subject lands and is therefore, not considered a viable alternative.

Alternatives 3 a, b, c: Elevated Tank, Locations – 1, 2, 3: These alternatives are essentially similar in the water distribution infrastructure have similar water distribution network configurations and meet the water regulatory and service requirements for the entire subject lands. The water transmission and distribution mains are generally located on proposed roads, except where recommended for system looping. The different locations of above ground elevated tank are similar except in capital and operating cost. All three locations offer similar operation performance. It is anticipated that the operational and capital cost will be very similar between Locations 1 and 2. Operational costs are based on the length and size of linear infrastructure installed and Locations 1 and 2 offer the most efficient use of linear infrastructure. Location 1 and 2 are therefore associated with the least operational cost. The capital cost would also be very similar to Location 1, which would have the least capital cost. Location 2 is also considered to be in the vicinity of a major commercial centre associated with the largest fire flow demand.

Alternatives 4a, b, c: Below Ground and Pump Station, Locations – 1, 2, 3: These alternatives are also have similar water distribution network configurations very similar in the water distribution infrastructure and meet the water regulatory and service requirements for the entire subject lands. The locations 1, 2, and 3 of the below ground/subsurface storage tanks are identical to the locations 1, 2, and 3 of the above ground storage tanks. Similar to the elevated storage tank alternatives, the main difference in the comparative evaluation is the capital and operating costs associated with the storage option.

























As compared to the above ground storage options, these will need additional land due to the pump station and below-ground reservoir. Although, visually, a below-ground reservoir would be more acceptable than an above ground, the reliability of such an arrangement is lower than an above-ground tank, as the distribution is dependent on the operation of the pumps and the pump station is an additional point of failure that could impact water distribution. Additionally, below-ground reservoir arrangements are more energy intensive than above-ground reservoirs due to the requirement to operate pumps to draw water from the reservoir.

3.1.5.3 Comparative Evaluation Matrix

The different alternatives were compared against each other with respect to the various criteria established in Section 3.1.5.1. The comparative evaluation matrix is presented in the tables below.

Table 3.1.17. Comparative Evaluation Matrix – Above Ground Tank

Category	Criteria	Criteria Indicator	Do Nothing	Limit Community Growth	Above Ground Tank – Location 1 – Location 1 Cost Option 1(a)	Above Ground Tank – Location 2 – Location 2 Cost Option 1(b)	Above Ground Tank – Location 3 – Location 3 Cost Option (c)
Natural Environment	Terrestrial/Aquatic Environment Resources	Potential adverse effects on ecological sensitive lands, impacts to water bodies and aquatic species.	No impact as no new lands will have to be developed or utilized.	Minimal impact as watermains would be aligned along proposed road network. Overall smaller network and therefore less impact.	Minimal impact as watermains would be aligned along proposed road network.	Minimal impact as watermains would be aligned along proposed road network.	Minimal impact as watermains would be aligned along proposed road network.
Social, Cultural Environment	Impact on Local Residents and Businesses	Cultural Heritage and Archaeology	No impact as no servicing will be provided.	Moderate impact for connection to the existing Clair Booster Pump Station.	Moderate impact for connection to the existing Clair Booster Pump Station.	Moderate impact for connection to the existing Clair Booster Pump Station.	Moderate impact for connection to the existing Clair Booster Pump Station.
Social, Cultural Environment	Sustainable Growth	Impacts on Adjacent Properties	No impact to adjacent properties as no servicing will be provided.	Limited impact to adjacent properties due to limited growth and greenfield development.	Limited impact as most of the development is expected to be greenfield development.	Limited impact as most of the development is expected to be greenfield development.	Limited impact as most of the development is expected to be greenfield development.
Social, Cultural Environment	Reliability	Impact to adjacent properties.	Not applicable	Dependent on whether storage would be above or below ground.	Reasonably reliable due to above ground tank.	Reasonably reliable due to above ground tank.	Reasonably reliable due to above ground tank.
Social, Cultural Environment	Regulatory Environment	Compliance with provincial/municipal regulations and standards	Not applicable	Complies with guidelines.	Complies with guidelines.	Complies with guidelines.	Complies with guidelines.
Social, Cultural Environment	Land use	Impact on surrounding land use.	No impact on surrounding land use	Construction Impacts, Visual Impact of aboveground storage tank	Construction Impacts, Visual Impact of aboveground storage tank adjacent to park, school and existing residential.	Construction Impacts, Visual Impact of aboveground storage tank. Location 2 is adjacent to large demand non-residential user compared to Location 1 which is next to a park and school.	Construction Impacts, Visual Impact of aboveground storage tank




























Category	Criteria	Criteria Indicator	Do Nothing	Limit Community Growth	Above Ground Tank – Location 1 Cost Option 1(a)	Above Ground Tank – Location 2 Cost Option 1(b)	Above Ground Tank – Location 3 Cost Option (c)
Economic	Capital	Design and construction costs	No capital costs, as there is no servicing	Capital costs will be less than the full servicing. However, it won't be proportionally less in accordance with the extent of servicing 	Estimated Capital Cost \$31.0 Million. 	Estimated Capital Cost \$31.6 Million 	Estimated Capital Cost 35.0 Million 
Economics	Maintenance	Asset management costs (lifecycle)	No maintenance cost, as there is no servicing	Maintenance cost similar to providing full service alternative. Operating cost less than providing full service alternatives. 	Reasonable maintenance cost and similar to other above ground tank alternatives. Average operating cost. 	Reasonable maintenance cost and similar to other above ground tank alternatives. Least operating cost due to centralized location of the above ground tank. 	Reasonable maintenance cost and similar to other above ground tank alternatives. Highest operating cost as the location of the above ground elevated tank is furthest from the Clair Booster Pump Station 
Economics	Property Acquisition	Amount of private property required to achieve solution	No property required.	Property requirement similar to the full-service alternatives. 	Property requirement similar for all above ground tank alternatives. 	Property requirement similar for all above ground tank alternatives. 	Property requirement similar for all above ground tank alternatives. 
Functional (Technical)	Ease of Maintenance	Adverse impact on system performance	No maintenance required as there is not infrastructure.	Infrastructure provided will be similar to full growth except for smaller size. Similar maintenance is expected. 	The maintenance is expected to be similar for all above ground tank alternatives. 	The maintenance is expected to be similar for all above ground tank alternatives. 	The maintenance is expected to be similar for all above ground tank alternatives. 
Functional (Technical)	Impact to Existing Infrastructure	Surcharges, pressure reductions, lack of water storage	No impact to existing infrastructure.	Impacted to existing infrastructure is reduced as growth is limited. 	Medium impact to existing infrastructure. 	Medium impact to existing infrastructure. 	Medium impact to existing infrastructure. 
Functional (Technical)	Ability to Utilize Capacity in Existing Infrastructure	Eliminating/minimizing requirement for upgrade/expansion to existing infrastructure	No ability to utilize existing infrastructure	Limited ability to utilize existing infrastructure due to limited growth. 	Existing Zone 1 storage will be utilized to augment Zone 3 storage. 	Existing Zone 1 storage will be utilized to augment Zone 3 storage 	Existing Zone 1 storage will be utilized to augment Zone 3 storage 

Category	Criteria	Criteria Indicator	Do Nothing	Limit Community Growth	Above Ground Tank – Location 1 Cost Option 1(a)	Above Ground Tank – Location 2 Cost Option 1(b)	Above Ground Tank – Location 3 Cost Option (c)
Functional (Technical)	Capability of Phased Implementation	Modularity/flexibility of the proposed servicing	No capability of being implemented in phases.	No capability of being implemented in phases.	Good capability for phased implementation	Good capability for phased implementation	Good capability for phased implementation
Functional (Technical)	Ability to be implemented in Concert with the Wastewater Servicing Alternatives	Physical proximity with wastewater servicing	No servicing provided, therefore, no ability to for water and wastewater servicing to be implemented together.	Limited servicing, therefore, limited opportunity to implement along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	Most services are along road right of ways, however, this is likely the last area to be developed under the wastewater servicing preferred alternative
Functional (Technical)	Construction Difficulty	Eliminating/Minimizing locations of difficult construction	No construction	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades

Preferred → Least Preferred



Table 3.1.18. Comparative Evaluation Matrix – Below Ground Reservoir

Category	Criteria	Criteria Indicator	Subsurface Reservoir and Booster Pump Station – Location 1 Cost Option 2(a)	Subsurface Reservoir and Booster Pump Station – Location 2 Cost Option 2(b)	Subsurface Reservoir and Booster Pump Station – Location 3 Cost Option 2(c)
Natural Environment	Terrestrial/Aquatic Environment Resources	Potential adverse effects on ecological sensitive lands, impacts to water bodies and aquatic species.	Larger facility footprint than aboveground 	Larger facility footprint than aboveground 	Larger facility footprint than aboveground 
Social, Cultural Environment	Impact on Local Residents and Businesses	Cultural Heritage and Archaeology	Moderate impact for connection to the existing Clair Booster Pump Station. 	Moderate impact for connection to the existing Clair Booster Pump Station. 	Moderate impact for connection to the existing Clair Booster Pump Station. 
Social, Cultural Environment	Sustainable Growth	Impacts on Adjacent Properties	Limited impact as most of the development is expected to be greenfield development. 	Limited impact as most of the development is expected to be greenfield development. 	Limited impact as most of the development is expected to be greenfield development. 
Social, Cultural Environment	Reliability	Impact to adjacent properties.	Inherently less reliable compared to above ground tank option, as supplies will be affected if pump station breaks down. 	Inherently less reliable compared to above ground tank option, as supplies will be affected if pump station breaks down. 	Inherently less reliable compared to above ground tank option, as supplies will be affected if pump station breaks down. 
Social, Cultural Environment	Regulatory Environment	Compliance with provincial/municipal regulations and standards	Complies with guidelines. 	Complies with guidelines. 	Complies with guidelines. 
Social, Cultural Environment	Land use	Impact on surrounding land use.	Less adverse visual impact than above ground storage tank. Similar construction impact. 	Less adverse visual impact than above ground storage tank. Similar construction impact. 	Less adverse visual impact than above ground storage tank. Similar construction impact. 
Economic	Capital	Design and construction costs	Estimated Capital Cost \$30.6 Million. 	Estimated Capital Cost \$31.2 Million 	Estimated Capital Cost 34.6 Million 
Economic	Maintenance	Asset management costs (lifecycle)	Increased maintenance cost anticipated due to the pump station. 	Increased maintenance cost anticipated due to the pump station. 	Increased maintenance cost anticipated due to the pump station. 
Economic	Property Acquisition	Amount of private property required to achieve solution	Property requirement greater than above ground alternative. It would be similar for all below ground tank alternatives. 	Property requirement greater than above ground alternative. It would be similar for all below ground tank alternatives. 	Property requirement greater than above ground alternative. It would be similar for all below ground tank alternatives. 

Category	Criteria	Criteria Indicator	Subsurface Reservoir and Booster Pump Station – Location 1 Cost Option 2(a)	Subsurface Reservoir and Booster Pump Station – Location 2 Cost Option 2(b)	Subsurface Reservoir and Booster Pump Station – Location 3 Cost Option 2(c)
Functional (Technical)	Ease of Maintenance	Adverse impact on system performance	The maintenance is expected to be similar for all below ground tank alternatives. Maintenance however is expected to be greater than the above ground alternatives due to addition of the pump station.	The maintenance is expected to be similar for all below ground tank alternatives. Maintenance however is expected to be greater than the above ground alternatives due to addition of the pump station.	The maintenance is expected to be similar for all below ground tank alternatives. Maintenance however is expected to be greater than the above ground alternatives due to addition of the pump station.
Functional (Technical)	Impact to Existing Infrastructure	Surcharges, pressure reductions, lack of water storage	Medium impact to existing infrastructure.	Medium impact to existing infrastructure.	Medium impact to existing infrastructure.
Functional (Technical)	Ability to Utilize Capacity in Existing Infrastructure	Eliminating/minimizing requirement for upgrade/expansion to existing infrastructure	Existing Zone 2 storage will be utilized to augment Zone 3 storage.	Existing Zone 2 storage will be utilized to augment Zone 3 storage	Existing Zone 2 storage will be utilized to augment Zone 3 storage
Functional (Technical)	Capability of Phased Implementation	Modularity/flexibility of the proposed servicing	Good capability for phased implementation	Good capability for phased implementation	Good capability for phased implementation
Functional (Technical)	Ability to be implemented in Concert with the Wastewater Servicing Alternatives	Physical proximity with wastewater servicing	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.
Functional (Technical)	Construction Difficulty	Eliminating/ Minimizing locations of difficult construction	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades

Most Preferred → Least Preferred



3.1.6 Preferred Solution

The preferred water servicing alternative is Alternative 3b, the above ground storage location 2.

Consideration was given to above-ground vs below ground storage complete with booster pumping station. In this application the above-ground ground storage offers significant advantages in reliability (gravity versus mechanical equipment), capital cost and operating costs, as well as impact to the environment due to the smaller footprint of the facility. As a result, above-ground storage was preferred over below-ground storage.

For the locations of the above-ground storage site, Location 3 is the most expensive in terms of both capital and operating costs. Location 1 and Location 2 both offer similar system reliability, performance, as well as similar capital and operating costs. Location 1 offers the disadvantage of its visual proximity to a park and school, while Location 2 offers the advantage of amore central locations to the CMSP development as compared with the other two locations identified.

Additionally, Location 2 for the reservoir would be close to a large non-residential commercial center and would facilitate in meeting the higher fire flow requirements or this land-use.

As a result, Location 2 was deemed to be the preferential location for above-ground storage

3.1.6.1 Discussion of the Preferred Alternative

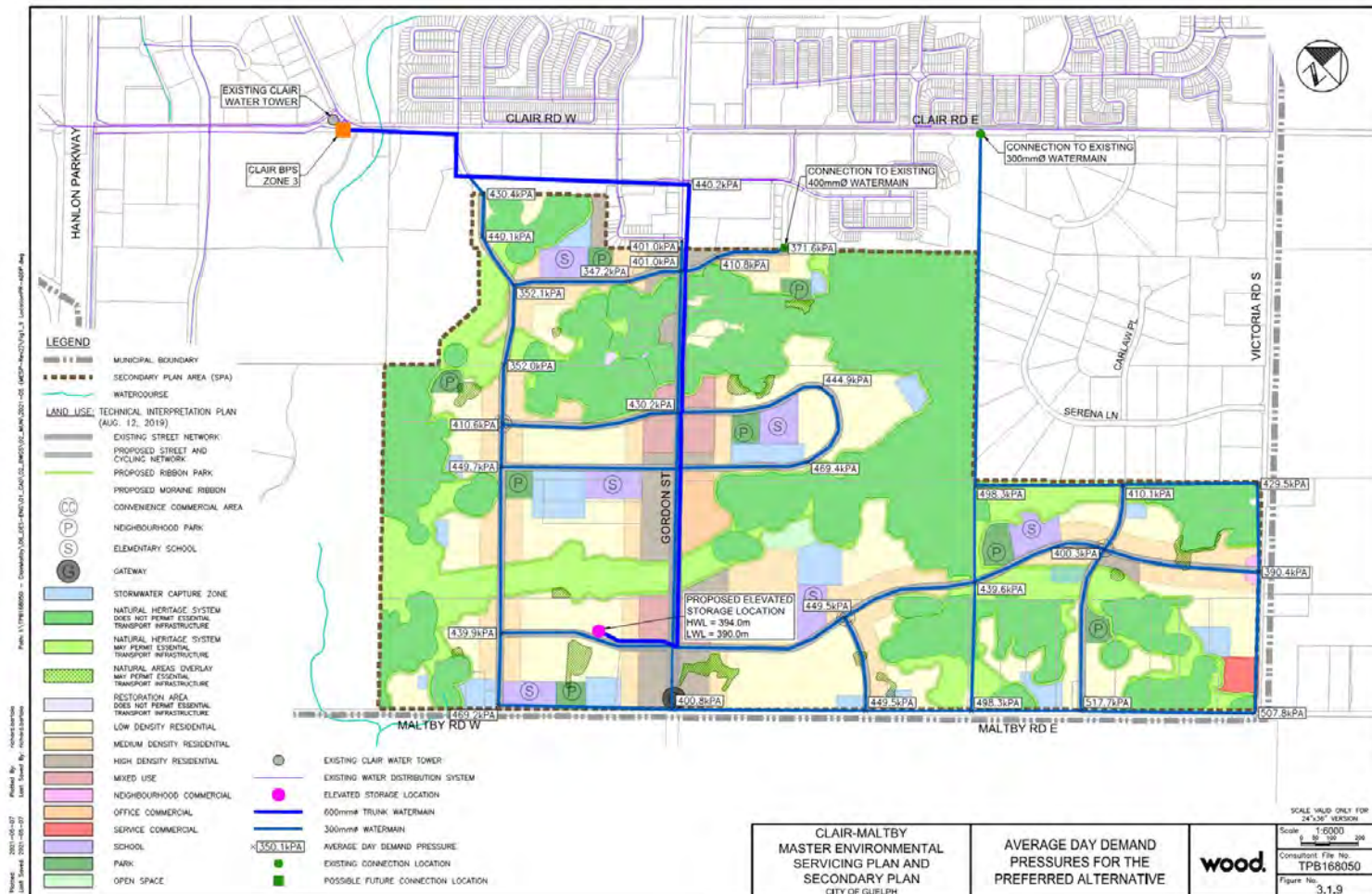
The following scenarios were modelled for the preferred alternative:

- Average Day Demand (ADD);
- Max Day Demand plus Fire (MDD + Fire); and,
- Peak Hour Demand (PHD)

Average Day Demand (ADD)

The average day demand scenario is presented in Figure 3.1.9. The pressures range from a maximum of 517 kPa (75 psi) to a minimum of 347 kPa (50 psi), which are within acceptable range.

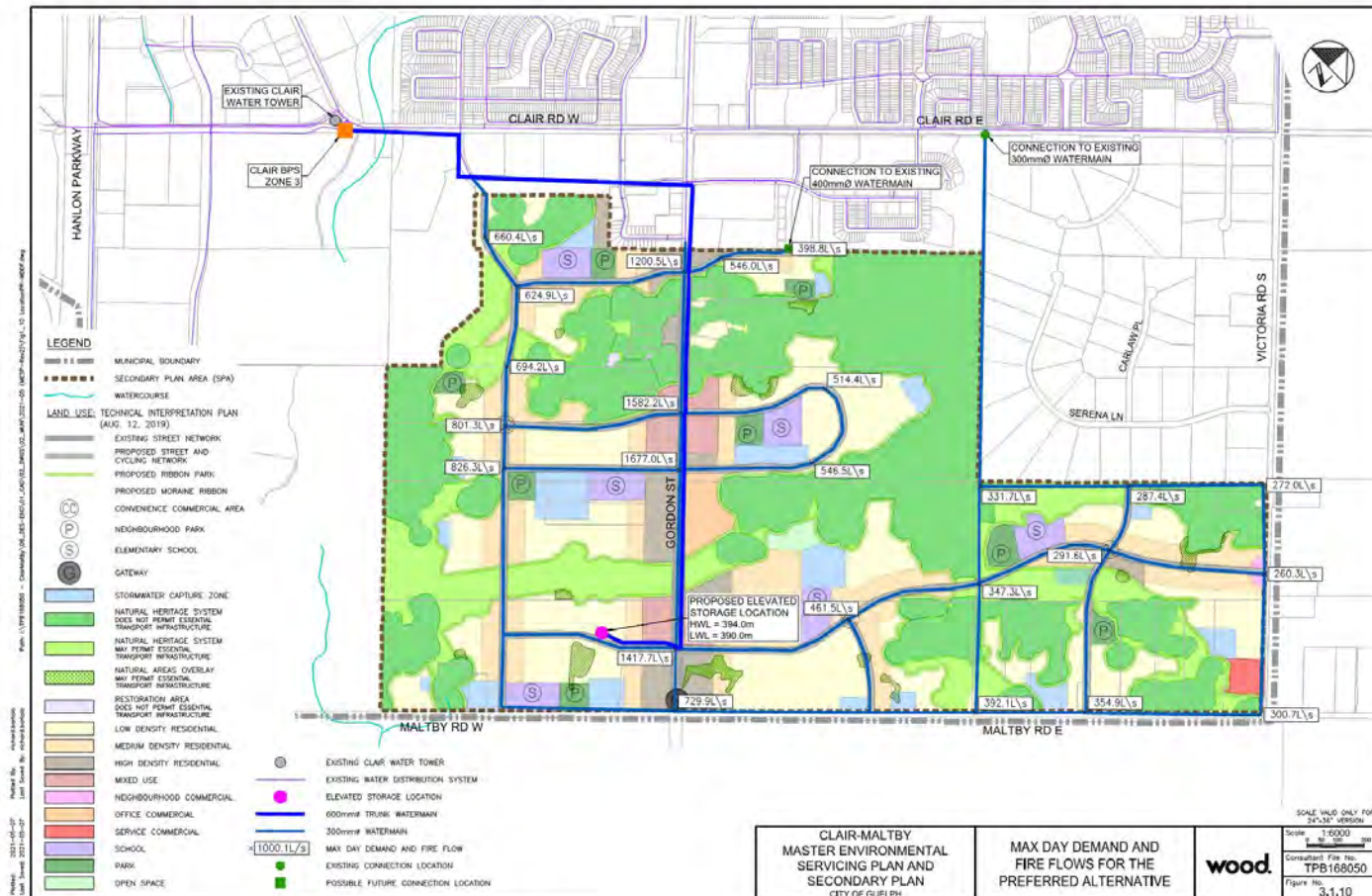
Figure 3.1.10. Average Day Demand – Pressures for the Preferred Alternative



Max Day Demand plus Fire (MDD + Fire)

The max day demand + fire flow scenario is presented in Figure 3.1.10. This figure presents the fire flows available at various junctions while max day demand is exercised at all the junctions in the backdrop. All this was modelled while keeping the pressures within the acceptable range. The fire flows predicted by the model meet the fire flow requirements established in section 3.1.2.7 of this report.

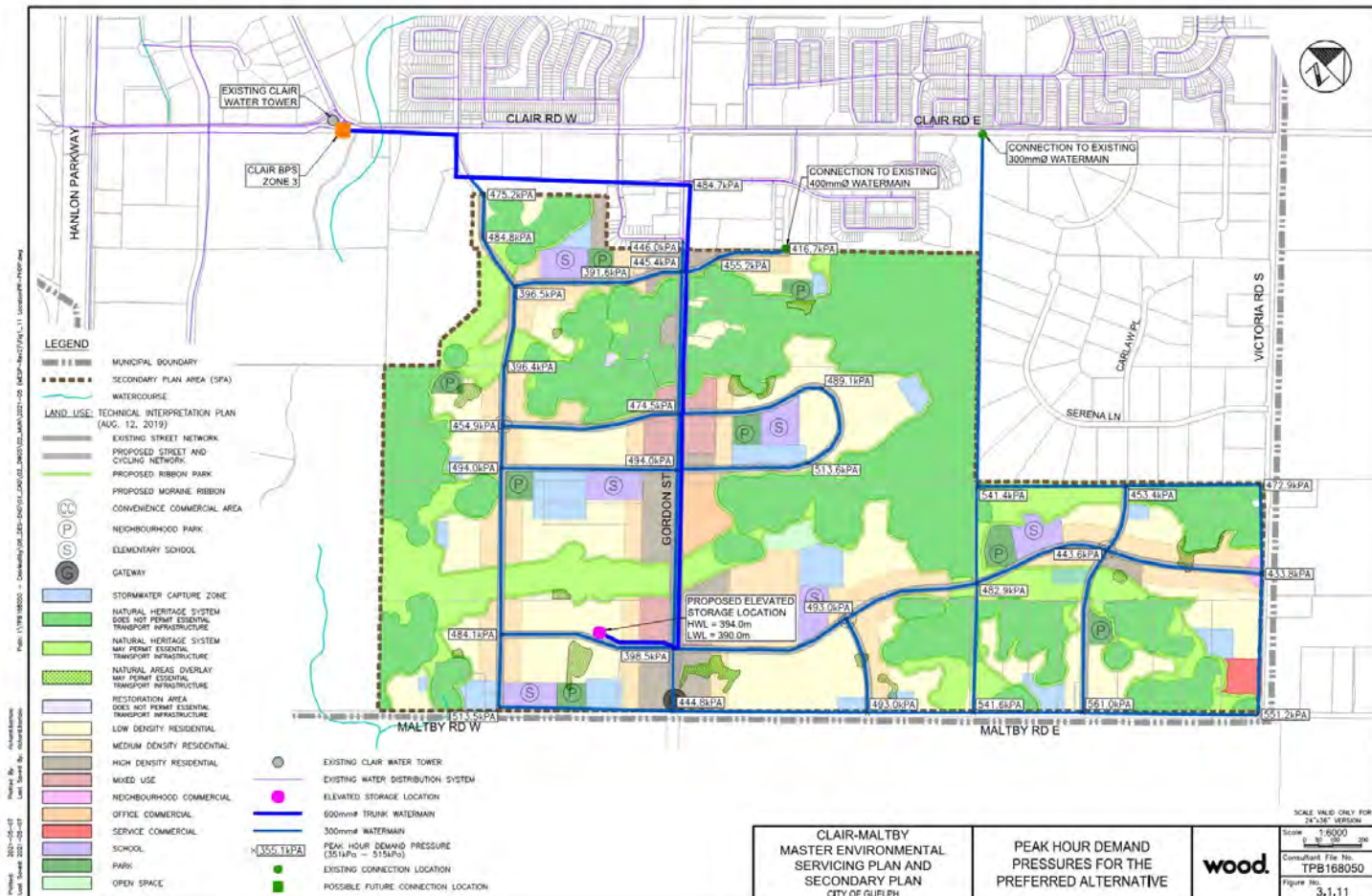
Figure 3.1.11. Max Day Demand + Fire – Fire Flows for the Preferred Alternative



Peak Hour Demand (PHD)

The peak hour demand scenario is presented in Figure 3.1.11. The pressures range from a maximum of 561 kPa (81psi) to a minimum of 391 kPa (56 psi), which are within acceptable range.

Figure 3.1.12. Peak Hour Demand – Pressures for the Preferred Alternative



Preferred Alternative Summary

During all scenarios examined, the preferred alternative provides pressures and flows within the acceptable range in accordance with MECP guidelines.

During the Average day demand pressures range from a minimum of 347 kPa (50 psi) to a maximum of 517 kPa (75 psi). These pressures are within the preferred operating range of 350 - 550 KPa (50 - 80 psi).

Similarly the pressure reading in the system under the Peak Hour demand, range a minimum of 391 kPa (56 psi) to a maximum of 561 kPa (81psi).

Trunk watermains and distribution piping have been sized in accordance with MECP standards to minimize head loss in the system and providing pipe velocities within acceptable ranges.

Finally the Available fire flows meet the requirements of the MECP, the latest edition of the "Water Supply for Public Fire Protection" published by the Fire Underwriters Survey and are in accordance with the Fire flow guidelines provided in the Guelph Master Servicing Plan, 2008.

Fire Flow Conditions

Under fire flow conditions, the MECP guidelines require system pressure to be greater than 140 KPa (20 psi) in the vicinity of the point in the network where fire flow is drawn. Fire flow conditions are evaluated with Max Day Demand background demands in the system. For water modling output, see Appendix A – Water.

3.2 Wastewater

This section presents the wastewater servicing alternatives, flow allocations, comparative evaluation and the relative economics for various alternatives. A preferred alternative is presented based on the detailed evaluation.

3.2.1 Existing Conditions

Before evaluating the internal servicing alternatives for the CMSP lands, opportunities and constraints for routing the wastewater flows generated from the CMSP lands were evaluated. For this evaluation, the City provided their existing wastewater model. This model was utilized to identify key sanitary trunk sewers that could receive and convey flows to the Guelph Wastewater Treatment Plant (WWTP). These were termed as receiving branches. The wastewater model was utilized to ascertain the spare capacity within these receiving branches to find out spare capacities in the receiving branches. There are currently no wastewater services within the secondary plan area; it is therefore assumed majority of properties are on septic systems.

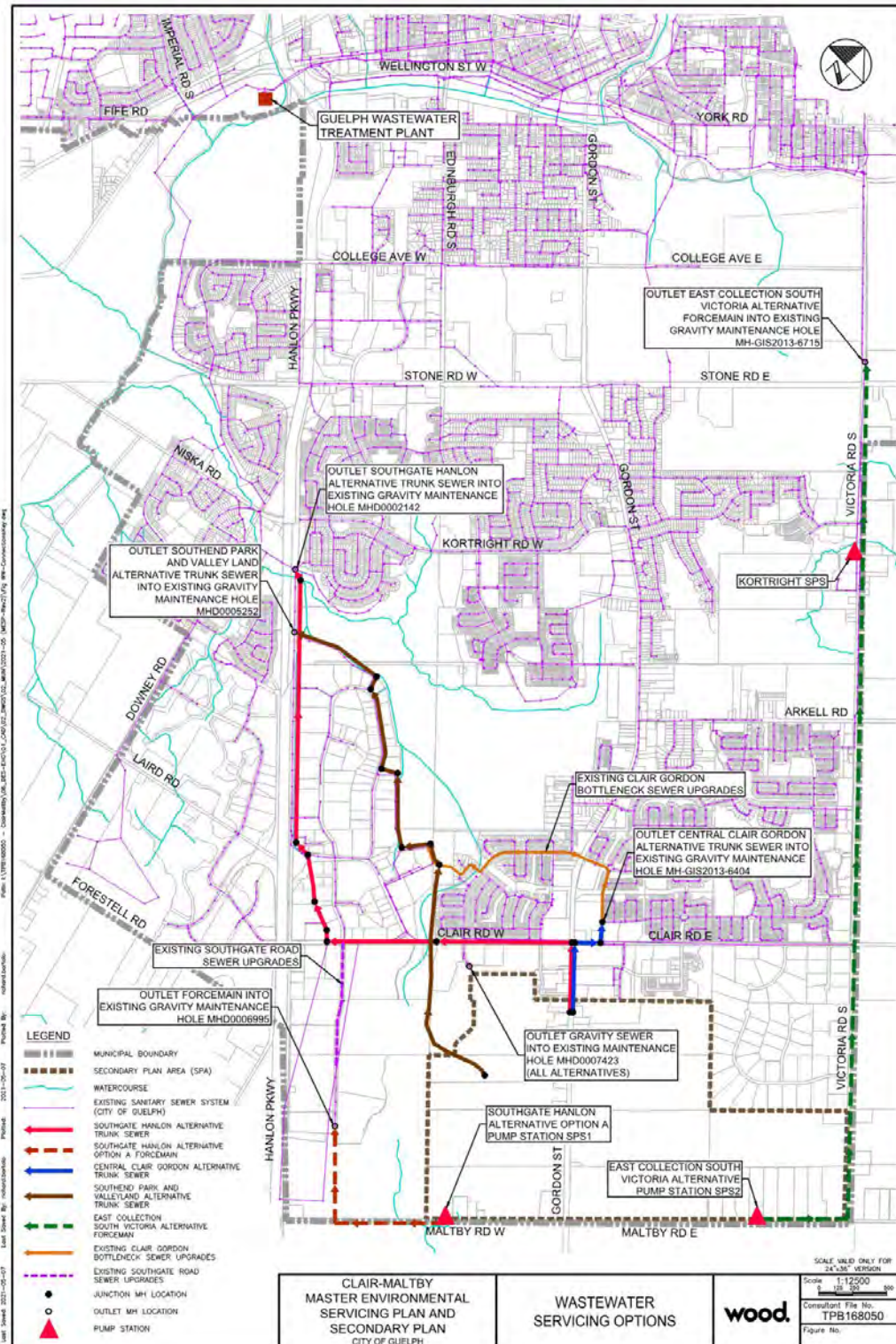
3.2.1.1 Receiving Branches

Three main receiving branches are considered potentially available to receive all or part of the wastewater flow from the CMSP area. Up to three connection points/maintenance hole have been identified per these receiving sewers with spare capacity within the sewer trunk system as it drains to the Guelph Wastewater Treatment Plant (WWTP), accommodating flows generated by the subject lands.

The City's wastewater model (ref. InfoSWMM Model received in 2018) has been used as the basis for understanding the available capacity in each of the potential systems. For planning purposes, the flow capacity has been converted to show the equivalent population and serviceable land area. The available capacity represents the amount, over and above the 2031 baseline flows, that can be added to the receiving system without surcharging. A comprehensive Wastewater Model Review is included in Appendix B of this report.

The three connection points and their estimated available capacity to accommodate the CMSP are shown in Figure 3.2.0 and described on the following pages:

Figure 3.2.0. Wastewater Servicing Options



Clair Gordon Receiving Branch

Three connection points were evaluated along the Clair Gordon trunk system to ascertain available capacity in the system.

- Clair Gordon connection point (MH-GIS2013-6404), which equates to a total population equivalent of 8,667 (for dry weather flow), an area of 98.4 ha for Infiltration and Inflow (I and I), and a resulting peak I and I flow of 27.54 L/s). This equates to approximately 40 per cent of the CMSP lands;
- Clair Gordon connection point (MHD0005955), which equates to a total population equivalent of 13,000 (for dry weather flow), an area of 159.8 ha for Infiltration and Inflow, and a resulting peak I and I flow of 44.75 L/s). This equates to approximately 60 per cent of the CMSP lands;
- Clair Gordon connection point (MHD0004348), which can accommodate 100 per cent of the subject lands without the need for upgrades.

Southgate-Hanlon Connection Point

- Southgate-Hanlon Connection Point (MH- D0006995), which equates to a total population equivalent of 2,167 (for dry weather flow), and area of 24.6 ha for Infiltration and Inflow, and a resulting peak I and I flow of 6.9 L/s). This equates to 10 per cent of the CMSP lands;
- Southgate-Hanlon Connection Point (MH0000214), which can accommodate 100 per cent of the subject lands without the need for upgrades.

Victoria Road Connection Point

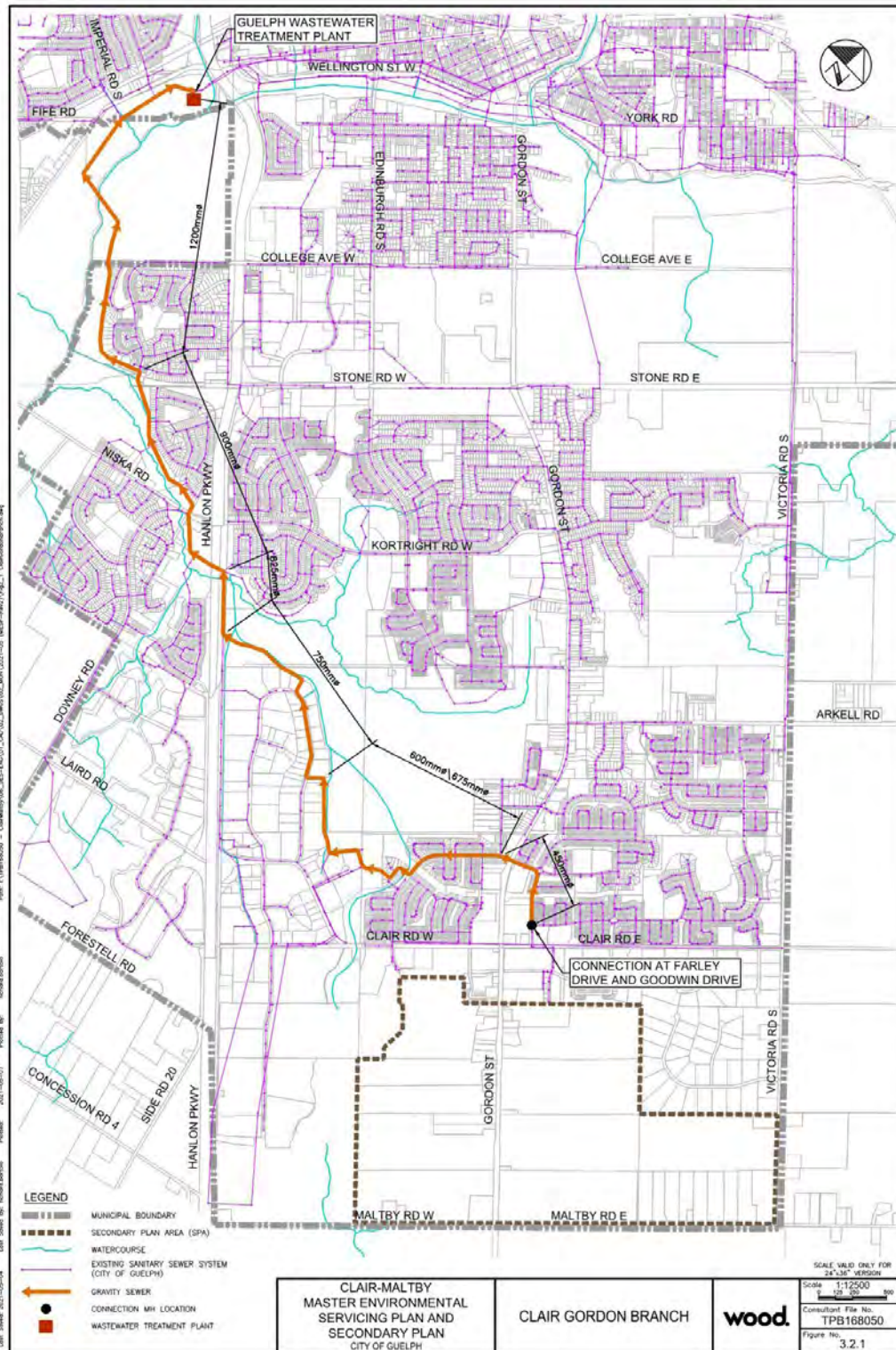
- Victoria Road connection point (MH-GIS2013-6775), which equates to a total population equivalent of 2,167 (for dry weather flow), and area of 24.6 ha for Infiltration and Inflow, and a resulting peak I and I flow of 6.9 L/s). This equates to 10 per cent of the subject lands;
- Victoria Road connection point (MH-GIS2013-6770), which equates to a total population equivalent of 8,667 (for dry weather flow), an area of 98.4 ha for Infiltration and Inflow, and a resulting peak I and I flow of 27.54 L/s). This equates to approximately 40 per cent of the subject lands;
- Victoria Road connection point (MH-GIS2013-6715), which can accommodate 100 per cent of the subject lands without the need for upgrades;
- The first two connection points will need expansion of the Kortright East Sewage Pumping Station and Forcemain, whereas the third connection point would eliminate the need to expand the Pumping Station.

Clair-Gordon Connection Branch

The Clair-Gordon Connection Branch sewer is a collection system which begins at the Farley Drive and Goodwin Drive intersection and runs north to Clairfields Drive and west to the industrial park near Kirkby Court, eventually connecting to the trunk sewer at the Hanlon Road, north of the industrial park. The collection system is shown in Figure 3.2.1.

1. Local sewers at the connection point on Farley Drive are 450 mm in size and increase to 600 mm at Dawn Avenue and Clairfields Road West. The Farley Drive connection point can accommodate 40 per cent and the 600 mm pipe segment can accommodate 60 per cent of the Clair-Maltby demands without causing surcharging downstream.
2. The section of the system between Dawn Avenue and Kirkby Court is 600 mm in size and increases to 675mm north of Kirkby Court. North of Kirkby Court the branch can accommodate 100 per cent of the Clair-Maltby demands without causing surcharging downstream.

Figure 3.2.1. Clair Gordon Branch

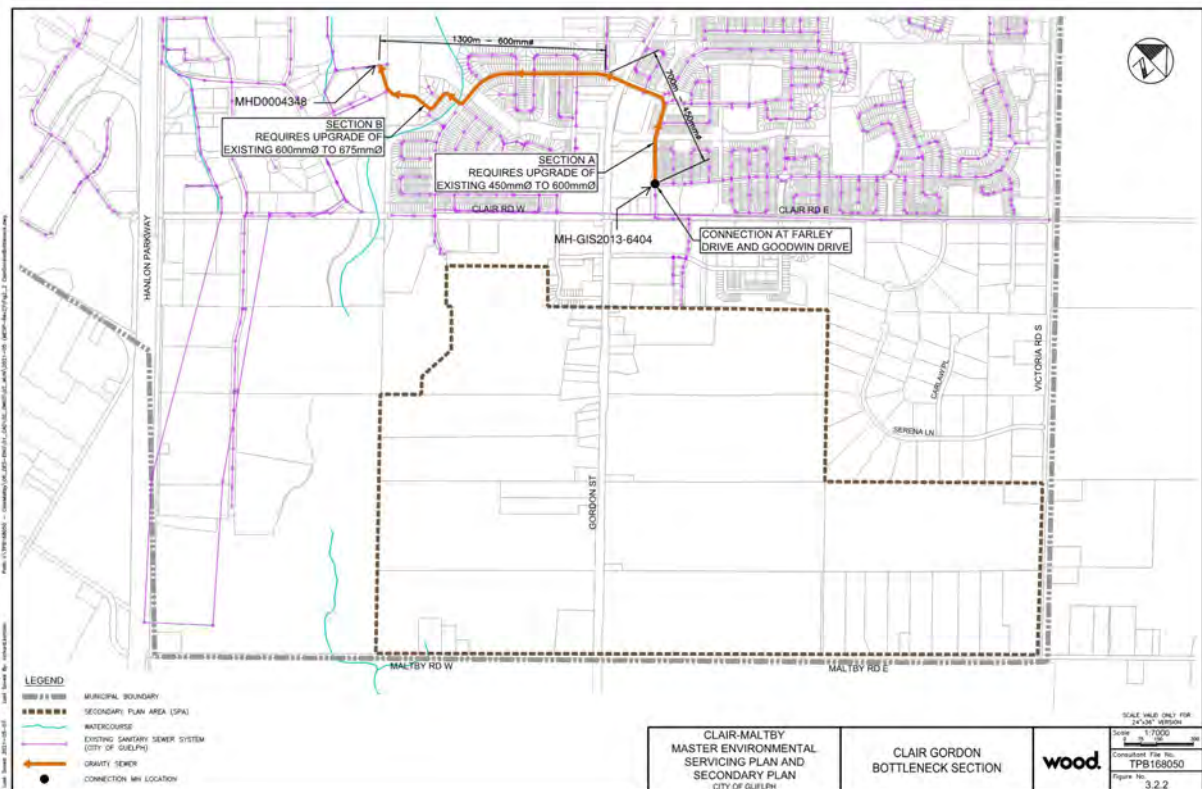


System Upgrades:

The Clair Gordon Branch has a bottleneck through a 2.0 km section as shown in **Figure 3.2.2**.

1. Analysis confirms that sending 100 per cent of Clair-Maltby flows to Goodwin Drive and Farley Drive would require an upsize of the existing sewer down to the Trunk Sewer at Kirby Court. The 700 m x 450 mm section requires upgrading to a 600 mm pipe and the 1.3 km x 600 mm pipe requires upgrading to a 675 mm pipe at a total estimated cost of \$2,700,000.

Figure 3.2.2. Clair Gordon Bottleneck Section



Victoria Road Connection

The Victoria Road Branch is a collection system located South-East of Victoria Road South and Arkell Road. The collection system discharges to the York Trunk through the following segments as shown in **Figure 3.2.3**.

1. Local sewers along Victoria Road range in size from 200 mm diameter at the connection point and increase to 375mm diameter prior to the Kortright East Sewage Pumping Station. This 375 mm pipe segment can accept 40 per cent of the Clair-Maltby demands without causing surcharging downstream.
2. The Kortright East Pumping Station and Forcemain has a firm capacity of 130.6 L/s of which is 100 per cent dedicated to existing land uses and baseline growth to 2031, excluding Clair-Maltby. There is insufficient capacity in the Kortright East Pumping station and forcemain to accommodate additional demand beyond the 2031 baseline demand.

A 750 mm diameter sewer on Victoria Road, north of Stone Road East can accommodate 100 per cent of the Clair-Maltby flows without causing any downstream surcharging. This connection point is approximately 6.2 km to the north of the Victoria Road / Maltby Road intersection.

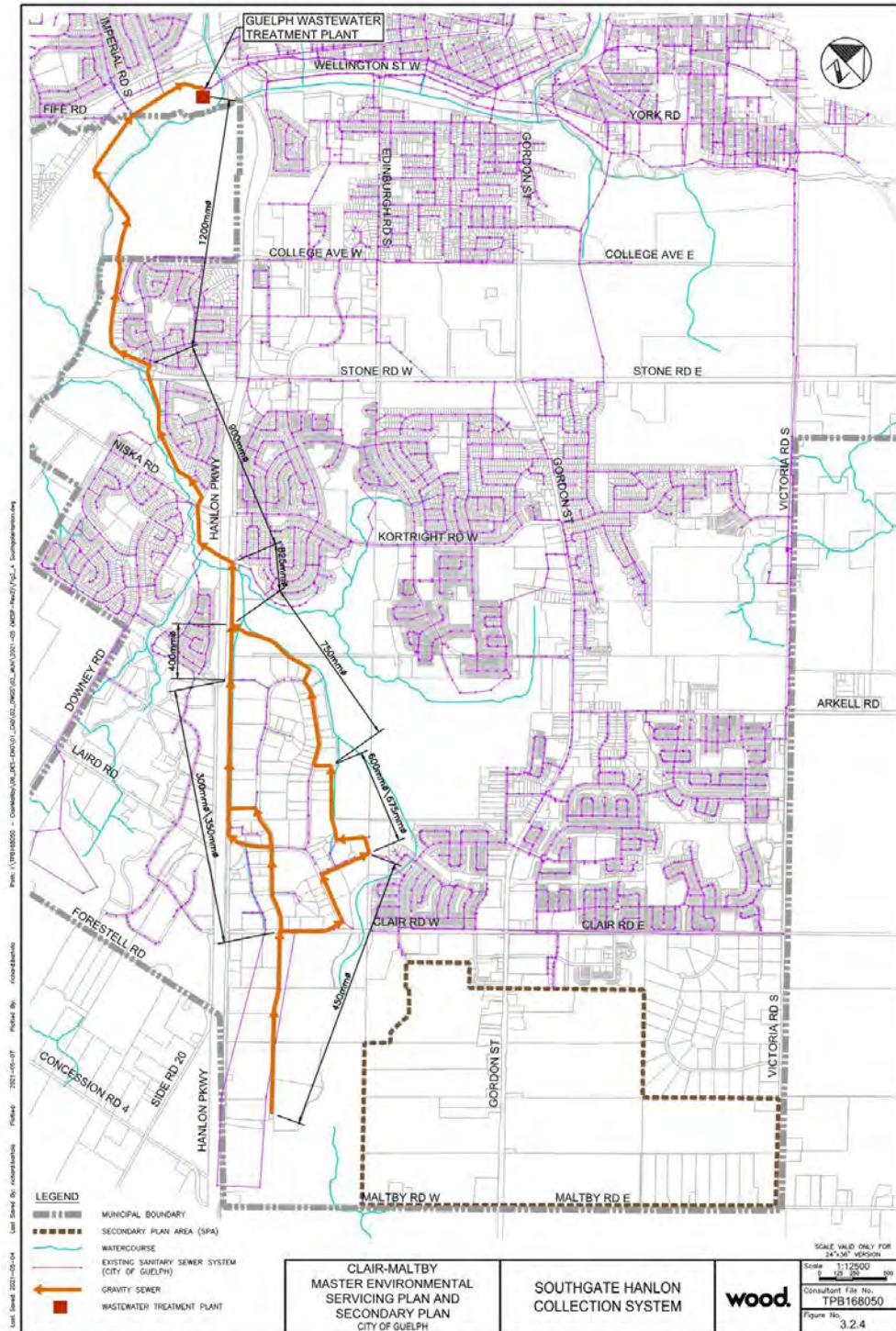
Figure 3.2.3. Victoria Road Collection System



South-Gate Hanlon Connection

The Southgate Hanlon Branch is a collection system located South-East of Southgate Drive and Clair Road W. The collection system discharges to the same trunk as the Clair-Gordon collection system. The collection system is shown in Figure 3.2.4.

Figure 3.2.4. Southgate – Hanlon



Local sewers along Southgate Drive are 450 mm diameter. This 450 mm pipe segment can accept 10 per cent of the Clair-Maltby demands without causing surcharging downstream. This analysis is based on the future baseline flows connecting to the system without any upgrades

3.2.2 Criteria/Standards/Policy

3.2.2.1 Dry Weather Flow

A review of the policies, standards and criteria as it relates to the wastewater collection and pumping systems was undertaken. This would serve as the basis for further analysis, hydraulic modelling and preliminary sizing of the wastewater infrastructure for the CMSP lands

The wastewater model provided by the City of Guelph contains the per capita dry weather flow allocation, for the existing system. In addition, the dynamic model includes a diurnal pattern, which was utilized for the current study as well.

For the Clair-Maltby planned development a per capita allocation of 300 L/day has been utilized in the modelling; this included residential population, as well as non-residential population equivalents. The diurnal pattern previously utilized within the wastewater model has been applied at each maintenance hole/node where dry weather flow has been allocated. Modelling Criteria and assumptions are in accordance with the Water and Wastewater Master Plan, 2008.

3.2.2.2 Infiltration/Inflow

Estimation of Inflow and Infiltration for the planned development in Clair-Maltby area has been established as for existing Areas, per the estimates in the baseline model by the City of Guelph. Inflow and infiltration for new areas assumed at a factor of 0.28 L/s-/ha.

3.2.2.3 Gravity Sewers

Design Slopes for new sanitary sewers

New sewers in the CMSP Lands, have been designed conceptually with a minimum full-pipe flow velocity of 0.8 m/s. This exceeds the City's minimum of 0.6 m/s and provides flexibility to ensure that other criteria, such as higher slopes for pipes running at 1/3 of the depth, can be met and that changes can be accommodated in the detailed design stage.

The minimum design slope is a function of the full pipe velocity and the pipe size.

Sewer Capacity Evaluation

The City of Guelph has adopted a no-surcharge approach regarding sewer capacity evaluation. The capacity is thus defined as the full flowing capacity of the pipe with hydraulic grade line at the pipe obvert. Upgrades to the sewer system are triggered when demand exceeds capacity.

Other conventional approaches to this problem include the hydraulic grade line risk evaluation. With this approach, sewers can be loaded beyond the full pipe-capacity and function at a higher flow rate under partially pressurized conditions, in which

case the flooding risk of nearby buildings and infrastructure is evaluated with respect to the hydraulic grade line.

3.2.2.4 Pumping Stations and Forcemains

If a pumping station is required, multiple pumps are designed to meet a firm capacity. The firm capacity is defined as the system flow rate with the largest pump out-of-service. If the pumps do not have equal capacity the highest capacity pump is assumed out of service for the purpose of determining firm capacity.

The use of firm capacity introduces a safety/redundancy factor as the system flow rate can exceed the firm capacity when all pumps are running.

The forcemains are sized to have velocities in the range of 0.8 m/s to 2.5 m/s in accordance with the MECP design guidelines.

A lot size of 30m x 30m has been assumed for each Sewage Pumping Station.

The MECP design guidelines for sewage works also indicate a controlled high-level wet well overflow to supplement alarm systems and emergency power generation should be considered. The need for emergency overflow shall be identified by the designer on a project specific basis.

Sewage overflows should discharge into a water body, municipal drain, storm sewer, or lined stormwater detention ponds. Overflow lines shall be equipped with instruments to record overflow discharge volume and duration of the overflow event to meet MECP reporting requirements.

The alternatives reviewed for this application included:

- Pump to wetlands or existing depressional areas in NHS
- Underground tanks
- Stormwater Capture Areas (SWCAs)
- SWCA lined forebays

It was determined that pumping to wetlands is the least preferred. Underground storage tanks are expensive and could entail purchasing additional land. SWCAs utilize infiltration into the soil strata so it's not practical. SWCA forebays appear to offer the best solution. The SWCA forebays would be lined and would not be allowed to discharge to the main cells, therefore the overflow volume would not exceed the forebay volume. The forebays would have bypasses to allow drainage to the main cell, in the event of an emergency pump station overflow.

3.2.3 Future Requirements

3.2.3.1 Approach

The variation in the ground elevations for the subject lands is highly complex due to the hummocky ground; the ground elevations vary from a maximum of 357.5 m above average sea level (asl) to 331.5 m above asl. The two competing constraints in a typical sanitary sewer planning strategy are to minimize pumping to conserve energy, at the same time, minimize the sewer depths to provide ease of construction and subsequent maintenance. Due to the large variation in topography of the subject lands, optimizing these two competing constraints is an important criterion.

Due to the undulating land base, the subject lands have been delineated into three distinct catchment areas; north service area, southeast service area and southwest service area. Internal servicing concepts have been developed individually for these three distinct catchment areas. The southeast and southwest service areas individually would be expected to drain to new sanitary pumping stations, which are proposed at the lowest elevations within their catchments. The north service area can on this basis be serviced either by a new pumping station or completely by gravity depending on the different servicing alternatives developed.

Additionally, the City has requested the investigation of two alternative solutions:

Southgate Industrial is a variation of one of the alternatives prepared by Wood proposed by consulting engineers GM Blueplan. The internal servicing for this alternative is presented in Figure 3.2.8a as a separate alternative.

Southend Park and Valley Land is a variation of one of the alternatives prepared by Wood proposed by Consulting Engineer, MTE. The City independently carried out hydraulic modelling for this alternative through another consultant and shared the hydraulic modelling results with Wood. These results have been used by Wood to present and evaluate this alternative vis-à-vis the other servicing alternatives.

3.2.3.2 Updated Wastewater Model

The City has an ongoing flow measurement program for collecting data at the sanitary sewer system and including them in the model for calibration purposes. In 2020, the City carried out further calibration of the wastewater model to reflect the flow measurement information collected. This model also included capacity allocations for part of the Clairfields Subdivision, which were not included previously. As a result, the updated model showed lesser capacities in the receiving trunks previously identified under section 3.2.1.1.

As part of generating the internal servicing alternatives discussed in the sections to follow, connection points were altered within the receiving branches to eliminate surcharging of receiving sewers where possible. The additional infrastructure upgrades required to eliminate surcharging has been captured in the modelling and the resulting costing exercise for the various servicing alternatives.

3.2.3.3 Wastewater Flow Estimation for CMSP Lands

The total CMSP population is estimated to be 23,759. This includes a projected residential population of 23,135, and an employment equivalent of 624. This population projection is exclusively for the CMSP lands and does not include additional lands outside the CMSP boundary (ref. Landuse information obtained from Brook McIlroy in August of 2019).

In order to estimate the total wastewater flows for the major infrastructure such as pump stations, it is important to give consideration to additional adjacent lands that could potentially be serviced by the wastewater infrastructure provided within the subject lands. At this time, the nature and extent of this development is not available nor has it been provided through this study.

As such, to account for the potential for development outside of the CMSP lands, 15 per cent of the projected population for CMSP lands, (i.e., a total population equivalent of 3,565) has been included for planning purposes, over and above the estimated population of 23,759. A similar ratio between residential and non-residential population is assumed for the additional population of 3,565 (Residential population = 3,471, and non-residential population equivalent = 94). This would provide a total population of 27,324.

The wastewater flow generation factors utilized in this study are as follows:

- Dry Weather Flow (Res and Non-res) 300 L/ca/d
- Infiltration and Inflow (I and I) 0.28 L/ha/s
- Harmon Peaking Factor (K) 2.52

For the Clair-Maltby total projected population equivalent of 27,324, which includes a residential population of 26,606 persons and a non-res population equivalent of 718 persons. The total wastewater flow for the CMSP lands is estimated as follows:

- Average Dry Weather Flow 94.9 L/s
- Peak Dry Weather Flow 238.9 L/s
- Infiltration and Inflow (I and I) 77 L/s
- Peak Wet Weather Flow 315.9 L/s

3.2.3.4 Topography of CMSP Lands and Internal Servicing Concept

The preliminary grading along the roads developed to provide stormwater servicing has been utilized to evaluate the internal sanitary servicing within the CMSP lands. These elevations vary from a maximum of 357.5 m to 331.5 m above sea level. In general, the topography of the lands is very undulating making it a challenge to optimize wastewater servicing within the subject lands.

Based on a review of the revised elevations, a sanitary servicing scheme has been developed based on the road elevations available. In general it has been Wood's endeavour to keep the sewer depths relatively low and generally follow the topography of the land. Based on a careful review of the topography of the subject lands, it is observed that the area could be generally demarcated into three distinct catchments; with each having its low spot. These three low spots are good candidate locations for building sewage lift stations.

In addition, there is an opportunity to connect the subject lands immediately south of Clair Road to existing sewers. This would allow development of these lands to proceed first without dependence on any of the pumping stations.

For the subject lands, three main catchment areas have been identified, each draining to a pumping station. In addition to the three main catchment areas, areas on either side of Gordon Street immediately south of Clair Road have been classified as two separate catchments, each draining to existing sewers. These are classified as Catchments 4 and 5. The areas west of Gordon Street (Catchment 4) were allocated to the Poppy Drive sewer, and those to the east of Gordon Street (Catchment 5) were allocated to the Hawkins Drive sewer. Based on the updated wastewater modelling, these existing sewer stretches have adequate available capacity to accommodate wastewater flows generated from these two catchments. The internal servicing concept/sewersheds are provided in Figure 3.2.5. In addition

to the general gravity servicing, the figure also shows the three pumping stations; SPS-1, SPS-2 and SPS-3.

3.2.3.5 Water Reuse – Purple Pipe Option

In several jurisdictions, including the Southern United States, the implementation of water reuse systems, referred to as the purple pipe systems, have been proposed due to water scarcity. These areas have thereby introduced detailed legislation governing its implementation. As most are aware, most areas in Canada do not have a shortage of water, and as such, there is minimal legislation governing the implementation of water reuse systems such as the “Purple” Pipe scenario.

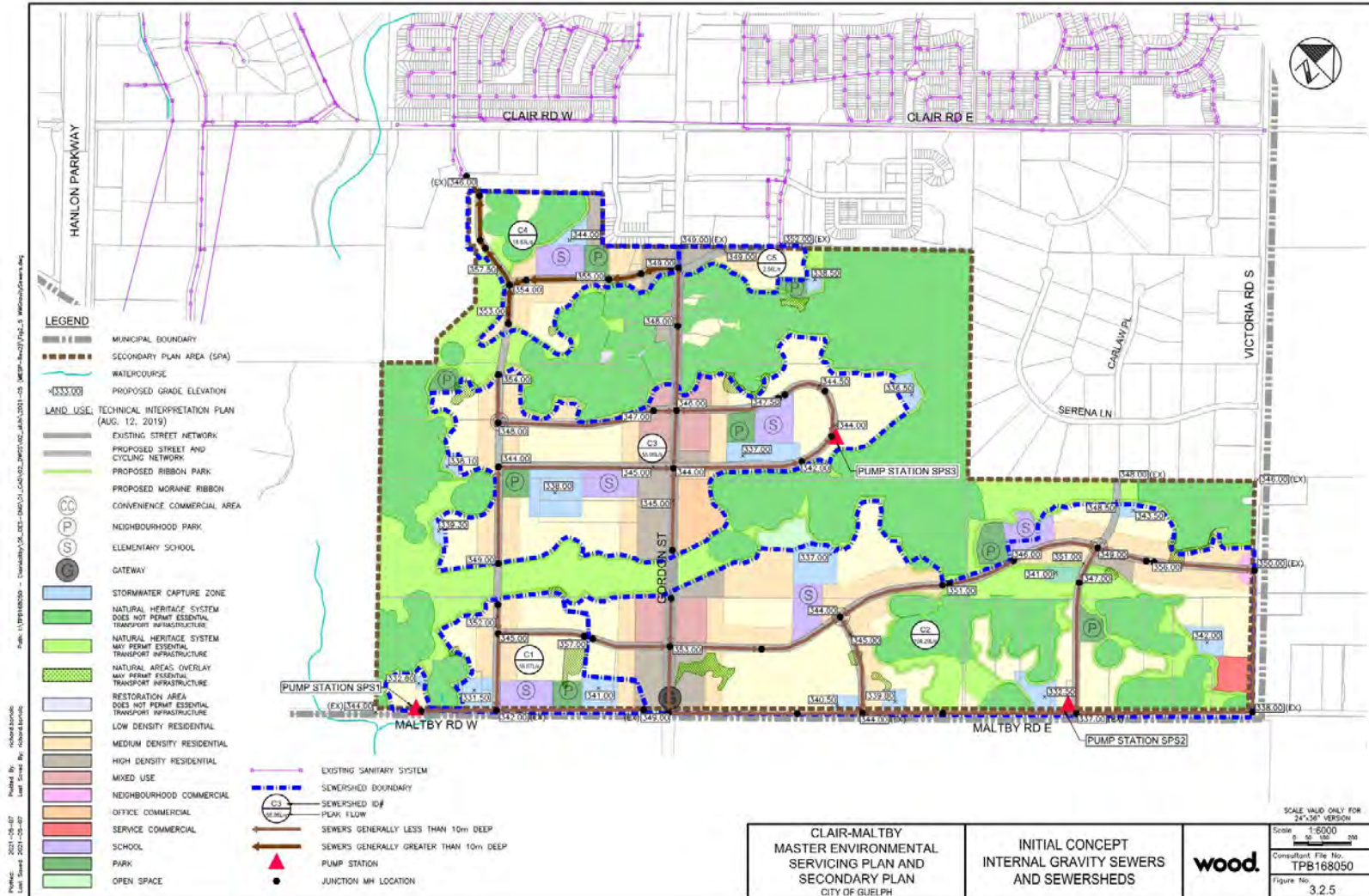
Per the United States Environmental Protection Agency (EPA), treated wastewater effluent of different quality can find beneficial use as follows:

- Unrestricted Urban Reuse and Recreational Use such as irrigation of parks, decorative fountains, fire protection etc.;
- Restricted Urban Reuse such as street cleaning, sewer flushing etc., where no contact with general public is there;
- Industrial Reuse such as boiler feed, cooling towers etc.; and,
- Groundwater Recharge.

In order to obtain maximum utilization of treated water for reuse, effluent must be treated to achieve unrestricted urban reuse and recreational use, where the general public could have contact with this water. Additionally, City-wide infrastructure would be required, which would include further treatment and storage, conveyance and pumping infrastructure in the form of either bulk reuse water dispensing stations, or an infrastructure of pipes and pumps. Standard operating procedures and protocols will need to be written for utilizing this resource.

It is believed that a City-wide study is best suited to evaluate the pros and cons of this alternative and establish the cost vs benefit of implementing this alternative. It would not be cost-effective to design and construct infrastructure to treat, store, pump and convey reuse water solely for the CMSP lands. As the current study focuses on CMSP lands only, this alternative is not considered for further analysis at this time.

Figure 3.2.5. Initial Concept – Internal Gravity Sewers and Sewersheds Water Reuse – Purple Pipe Option



3.2.4 Alternatives

The wastewater servicing alternatives have been developed giving due consideration to the available capacity within the existing trunk sewers. Internal gravity servicing within the CMSP lands has been largely kept similar for the different servicing alternatives. The forcemains from the three pumping stations have been routed differently for the various servicing alternatives. Servicing strategies for Catchments 4 and 5 are consistent across servicing all servicing alternatives. The wastewater servicing alternatives are presented below:

3.2.4.1 Alternative 1: Do-Nothing

This alternative would not implement any infrastructure to service the CMSP lands for wastewater. As such there would be no municipal wastewater services for the planned growth. This alternative does not present a viable solution to service the CMSP lands nor does it address the Problem/Opportunity Statement.

3.2.4.2 Alternative 2: Limit Community Growth

This alternative will generally involve limiting growth to below the levels identified in the planning Secondary Plan. The limitation in growth could limit the geographical area of development, reduce population density, or both. Limiting community growth would result in not achieving the growth targets identified in the planning studies and would therefore, not meet the planned growth targets. As such, limiting community growth to minimize/eliminate infrastructure upgrades is not a viable solution to service the CMSP lands.

3.2.4.3 Alternative 3: East Connection – Victoria Road Trunk

In the Victoria Road trunk alternative, wastewater would be conveyed from the CMSP lands to the Victoria Road trunk sewer system. In this alternative, wastewater flows collected at SPS-1 and SPS-3 are pumped to the sewer along Maltby Road to be conveyed to SPS-2. SPS-2 would collect flows for Catchments 1, 2, and 3 and will pump these wastewater flows to the existing sewer on Victoria Road, at a point north of Stone Road (MH-GIS2013-6715), which is downstream of the Kortright Pumping Station. Wastewater collected from catchments 4 and 5 would be conveyed to the City's existing sewer system as described in Section 2.8.

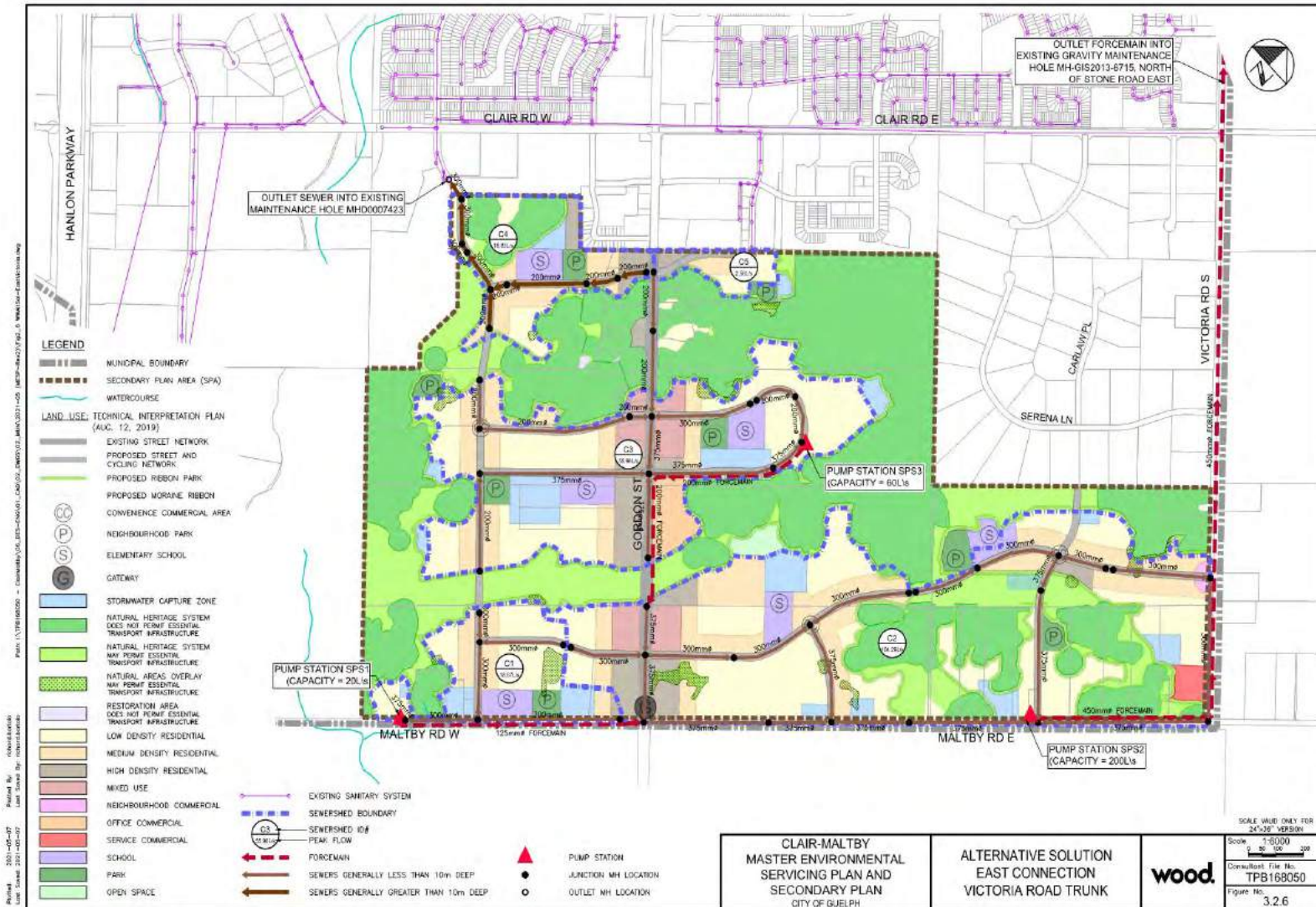
According to the wastewater modelling analysis carried out in the updated model received in 2020 it has been concluded that infrastructure downstream of the proposed maintenance hole MH-GIS2013-6715 would have adequate capacity to convey 100 per cent of the flows from the CMSP lands without the need for upgrades. As this connection point is downstream of the Kortright Pumping Station, its expansion will also not be required.

As discussed previously, the gravity infrastructure schematic and sizing is consistent across the servicing alternatives. However, depending upon the connection points, the pumping station capacities, forcemain diameters and lengths will be different depending on the alternative. This information for the Victoria Road Trunk alternative is presented in **Table 3.2.1**.

Table 3.2.1. Sanitary Sewer, Pump and Forcemain Information for the Victoria Road Trunk Alternative

Total Length of 200 mm Sewers	2.7 km
Total Length of 300 mm Sewers	5.2 km
Total Length of 375 mm Sewers	5.2 km
SPS-1 Capacity	20 L/s
SPS-2 Capacity	200 L/s
SPS-3 Capacity	60 L/s
FM-1 Diameter, Length	125 mm, 0.9 km
FM-1 Diameter, Length	450 mm, 7.0 km
FM-1 Diameter, Length	200 mm, 1.0 km

Figure 3.2.6. Alternative Solution – East Connection - Victoria Road Trunk



3.2.4.4 Alternative 4: Central Connection – Clair Gordon Trunk

In the Clair Gordon trunk alternative, wastewater would be conveyed from the CMSP lands to the Clair Gordon trunk sewer system. In this alternative, wastewater flows collected at SPS-1 and SPS-2 are pumped to Gordon Street and conveyed by gravity to SPS-3. SPS-3 will collect flows for Catchments 1, 2, and 3 and will pump these wastewater flows to the existing Clair Gordon trunk sewer. According to the wastewater modelling analysis carried out on the updated model received in 2020, surcharges surcharged sewers were observed downstream of existing maintenance hole MH-GIS2013-6404 at the intersection of Farley Drive and Goodwin Drive.

The hydraulic model did not show surcharges surcharging downstream of MHD0004348 all the way to the Guelph Wastewater Treatment Plant and would be able to accommodate flow from the CMSP lands.

Maintenance hole MH-GIS2013-6404 is at the intersection of Farley Drive and Goodwin Drive, and MHD0004348 is located on an easement close to the Hanlon Park Mini Storage on Kirkby Court.

The sewer sections indicating surcharging within the modelling are within built up areas and replacing/twinning these sections of sewer will cause disruption to the public. The Forcemain from SPS-3 could be aligned along Clair Road, Laird Road and Kirkby Court to connect directly to MHD0004348 near Hanlon Park Mini Storage on Kirkby Court to avoid sanitary upgrades. However, this alternative would be very similar to the Southgate Hanlon Trunk alternative, discussed in the next section. Therefore, this option is not considered for further evaluation under this alternative.

For the purpose of this alternative, it has been assumed that the forcemain from SPS-3 would connect to MHD-GIS2013-6404, and the sewer sections showing surcharges (the Clair Gordon Bottleneck) will be replaced/twinning.

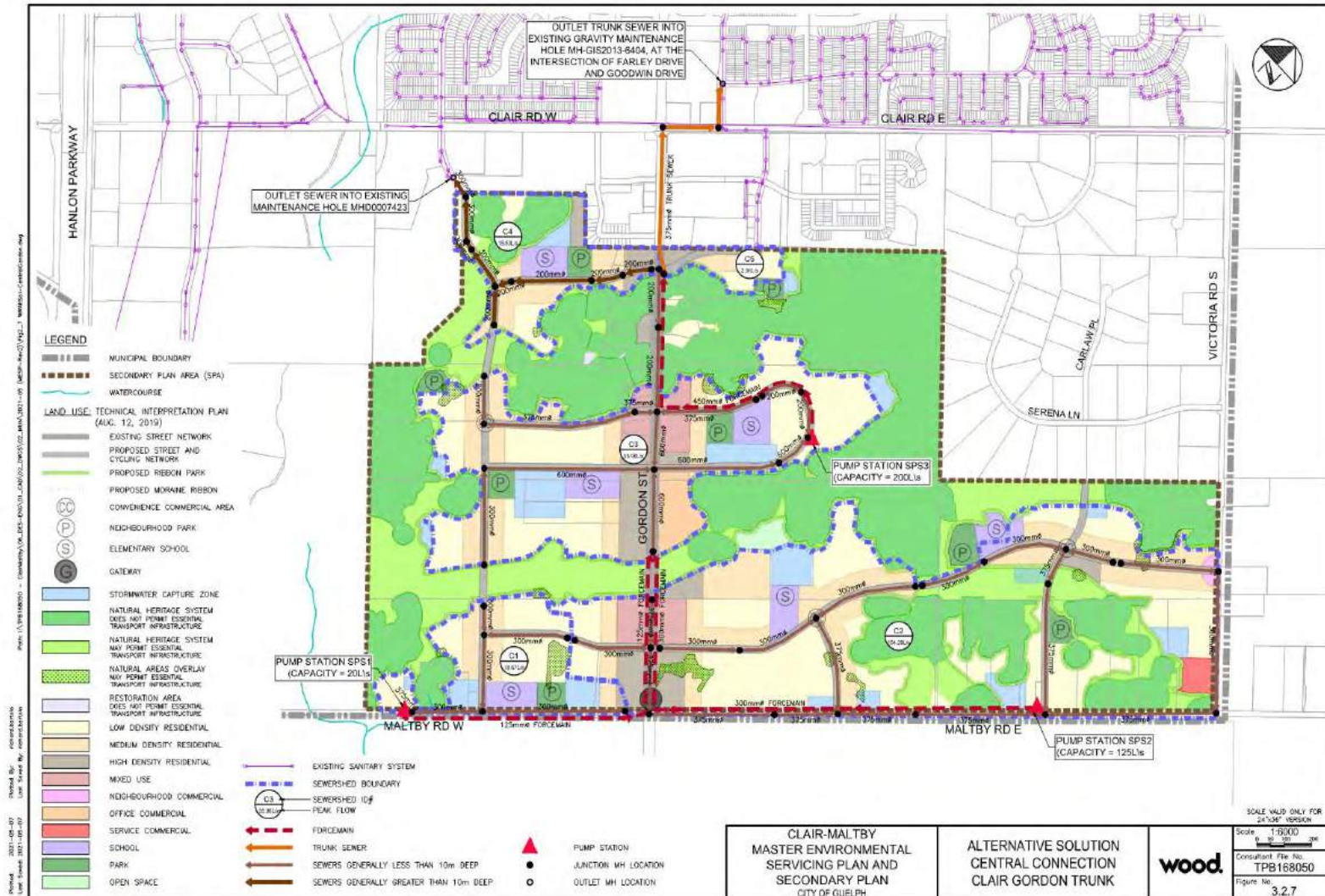
As discussed previously, the gravity infrastructure schematic and sizing will be generally consistent across the servicing alternatives except the sewers receiving forcemain discharge from another pumping station. However, depending upon the connection points, the pumping station capacities, forcemain diameters and lengths will be different depending on the alternative. This information for the Clair Gordon Trunk alternative is presented in **Table 3.2.2**.

Table 3.2.2. Pump and Forcemain Information for the Clair Gordon Trunk Alternative

Total Length of 200 mm Sewers (New Sewers)	1.7 km
Total Length of 300 mm Sewers (New Sewers)	5.2 km
Total Length of 375 mm Sewers (New Sewers)	4.4 km
Total Length of 600 mm Sewers (New Sewers)	1.7 km
Total Length of 200 mm Sewers (Twin Existing Sewers)	0.4 km
Total Length of 300 mm Sewers (Twin Existing Sewers)	0.8 km
Total Length of 375 mm Sewers (Twin Existing Sewers)	0.6 km
Total Length of 450 mm Sewers (Twin Existing Sewers)	1.0 km

Total Length of 600 mm Sewers (Twin Existing Sewers)	1.3 km
Total Length of 675 mm Sewers (Twin Existing Sewers)	0.7 km
SPS-1 Capacity	20 L/s
SPS-2 Capacity	125 L/s
SPS-3 Capacity	200 L/s
FM-1 Diameter, Length	125 mm, 1.5 km
FM-1 Diameter, Length	300 mm, 1.9 km
FM-1 Diameter, Length	450 mm, 1.2 km

Figure 3.2.7. Alternative Solution – Central Connection – Clair Gordon Trunk



3.2.4.5 Alternative 5: West Connection – Southgate Hanlon Trunk

In the Southgate Hanlon trunk alternative, wastewater would be conveyed from the CMSP lands to a new trunk sewer system on Gordon Street and Clair Road, eventually flowing into the Hanlon Trunk system. In this alternative, wastewater flows collected at SPS-1 and SPS-2 are pumped to be conveyed to SPS-3. SPS-3 will collect flows for Catchments 1, 2, and 3 and will pump these wastewater flows to a new 525mm Trunk Sewer. The new trunk sewer will convey flows along Gordon Street and Clair Road and north along the east side of Hanlon Parkway to connect directly to Maintenance Hole MHD0002142.

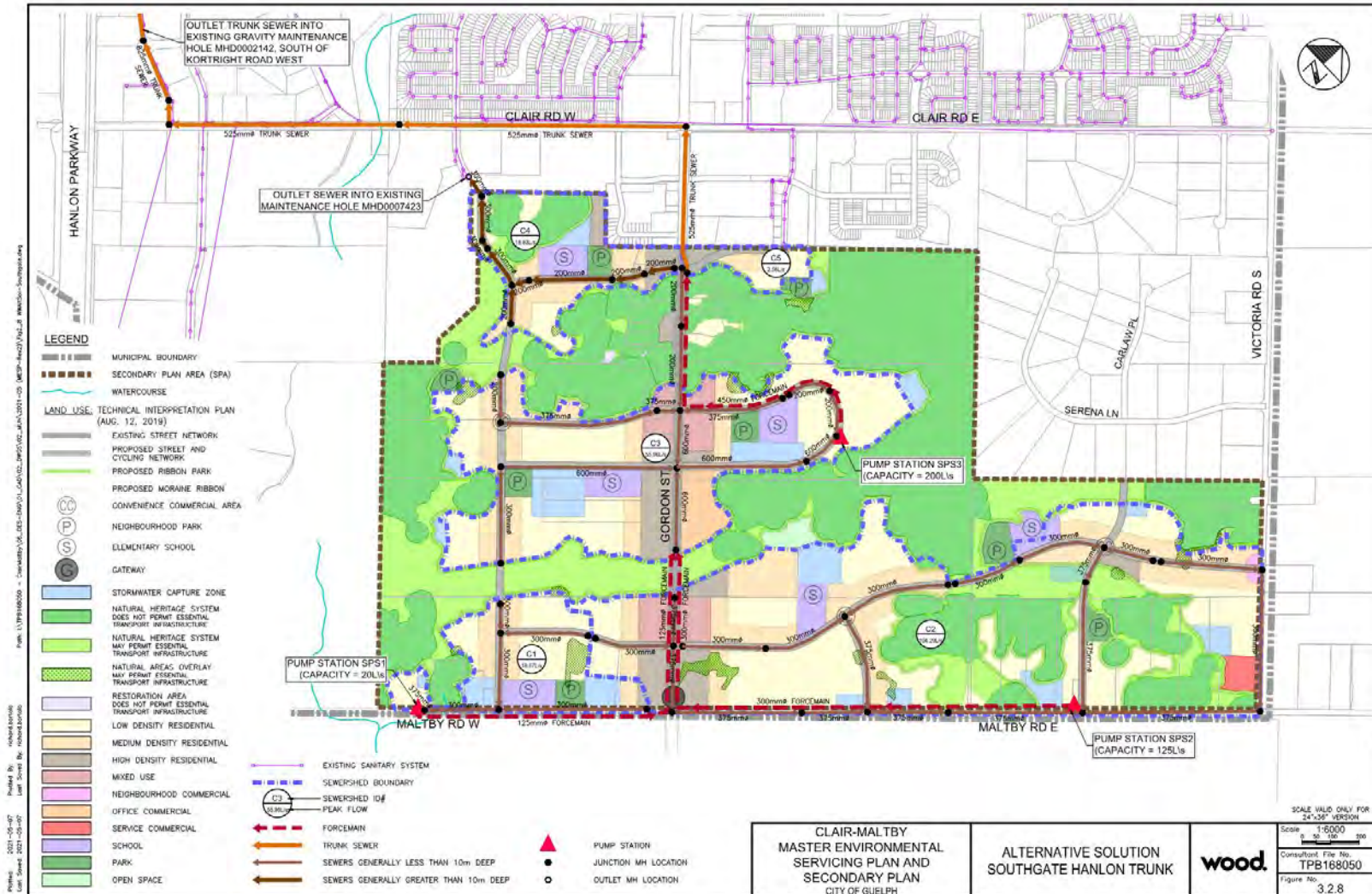
According to the wastewater modelling analysis carried out on the updated model received in 2020, the hydraulic model did not show surcharges downstream of MHD0002142 all the way to the Guelph Wastewater Treatment Plant and will be able to accommodate flow from the CMSP lands

As discussed previously, the gravity infrastructure schematic and sizing will be generally consistent across the servicing alternatives except the sewers receiving forcemain discharge from another pumping station. However, depending upon the connection points, the pumping station capacities, forcemain diameters and lengths will be different depending on the alternative. This information for the Southgate Hanlon Trunk alternative is presented in the Table 3.2.3.

Table 3.2.3. Pump and Forcemain Information for the Southgate Hanlon Trunk Alternative

Total Length of 200 mm Sewers	1.7 km
Total Length of 300 mm Sewers	5.2 km
Total Length of 375 mm Sewers	4.5 km
Total Length of 525 mm Sewers	2.4 km
Total Length of 600 mm Sewers	1.7 km
Total Length of 825 mm Sewers	2.8 km
SPS-1 Capacity	20 L/s
SPS-2 Capacity	125 L/s
SPS-3 Capacity	200 L/s
FM-1 Diameter, Length	125 mm, 1.5 km
FM-2 Diameter, Length	300 mm, 1.9 km
FM-3 Diameter, Length	450 mm, 1.2 km

Figure 3.2.8. Alternative Solution –West Connection – Southgate Hanlon Trunk



3.2.4.6 Alternative 6: West Connection – Southgate Industrial

In the Southgate Industrial alternative is a variation of the Southgate Hanlon Alternative Solution presented in the previous section. This Alternative gives consideration to the servicing required for the extension of Southgate Road to Maltby Road for the extensions of the Southgate Business Park.

Based on the topography, it is expected that the servicing for the Southgate Road extension will require a sewage pumping station for the collection of wastewater from the lands serviced by the extension. The servicing alternative was based on Southgate Phase 2 Draft Plan(2006) which has since expired but which provides sufficient detail for an initial assessment of the alternative.

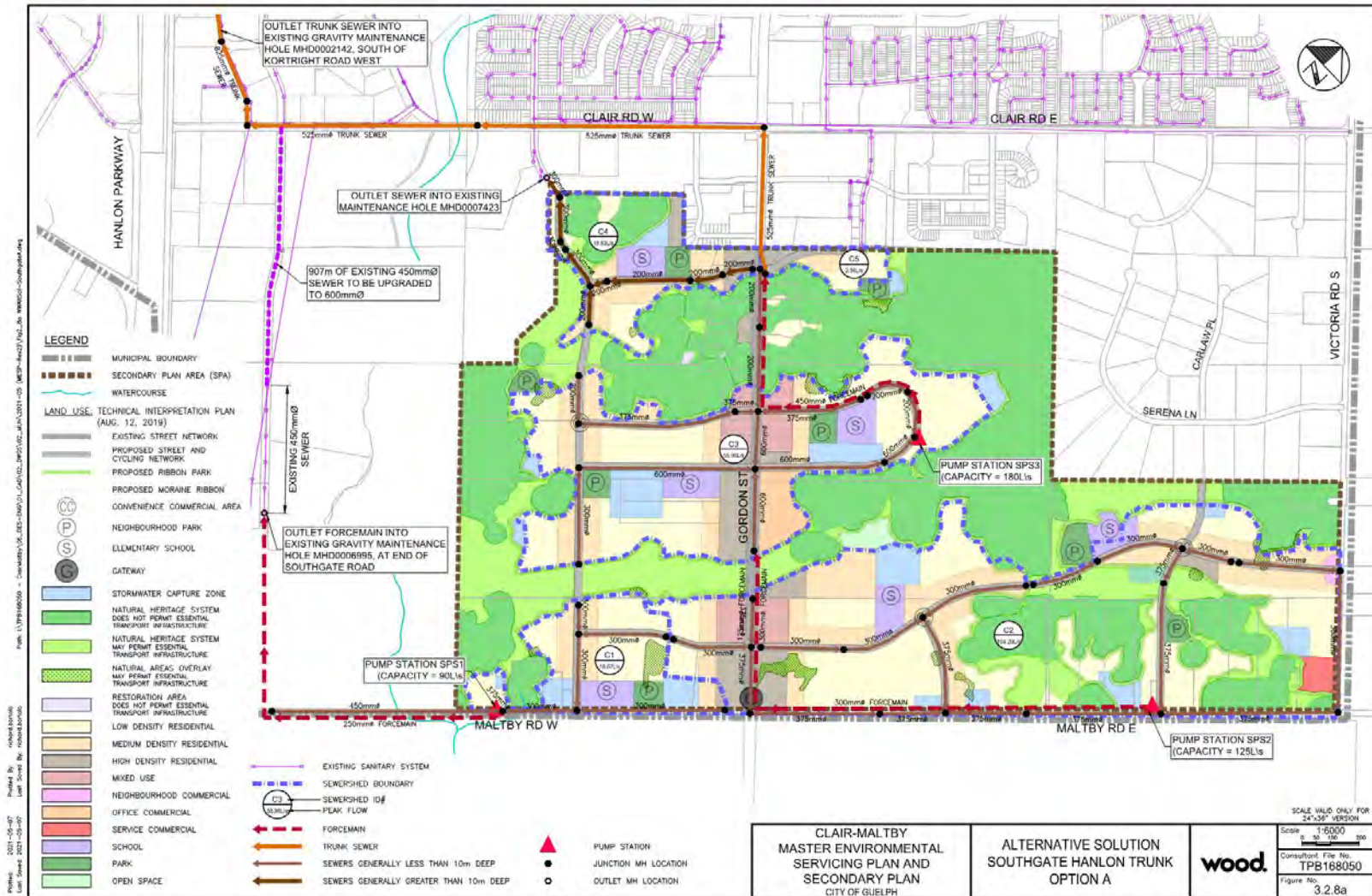
The primary difference between this alternative and the Southgate Hanlon alternative is SPS-1 receives from the Southgate Industrial Park in addition to the flow from the CMSP lands and the forcemain from SPS-1 is directed to Southgate Drive. The additional flow from lands outside the CSMPS lands results in an increase in size for SPS-1, from 20 l/s to 90 l/s to accommodate the additional flow. As SPS-1 no longer directs flow to SPS-1, the size of SPS-1 reduces slightly from 200 l/s to 180 l/s. Additionally, approximately 900m of existing 450mm diameter wastewater line on Southgate Drive will need to be upsized to 600mm diameter to accommodate the flows

The remainder of the collection systems is essentially unchanged from the Southgate Hanlon Alternative. This information for the Southgate Hanlon Trunk alternative is presented in the Table 3.2.4.

Table 3.2.4. Pump and Forcemain Information for the Southgate Industrial Alternative

Total Length of 200 mm Sewers	1.7 km
Total Length of 300 mm Sewers	5.2 km
Total Length of 375 mm Sewers	4.5 km
Total Length of 450 mm Sewers	1.7 km
Total Length of 525 mm Sewers	2.4 km
Total Length of 600 mm Sewers	1.7 km
Total Length of 825 mm Sewers	2.8 km
SPS-1 Capacity	90 L/s
SPS-2 Capacity	125 L/s
SPS-3 Capacity	180 L/s
FM-1 Diameter, Length	250 mm, 1.5 km
FM-2 Diameter, Length	300 mm, 1.9 km
FM-3 Diameter, Length	450 mm, 1.2 km

Figure 3.2.9. Alternative Solution – West Connection – Southgate Industrial



3.2.4.7 Alternative 7: West Connection – Southend Park and Valley Land Trunk

In the Southend Park and Valley Land trunk alternative, wastewater is conveyed from the CMSP lands to the trunk sewer system on Southgate Drive, eventually flowing into the Hanlon Trunk system. The alternative presents the connection point, which is very close to the connection point in the Southgate Hanlon Trunk alternative. However, the internal servicing as well the alignment of a new trunk sewer to convey wastewater flows is different from the Southgate Hanlon Trunk alternative.

In this alternative, the internal servicing is configured differently from the previously discussed servicing alternatives. Catchment 1 covers a much smaller area, and drains towards its lowest point, from where, wastewater gets pumped north to a gravity sewer. Wastewater flow on the south and east sides of Catchment 2 is collected and conveyed through sewers along Maltby Road and Victoria Road respectively and is conveyed to a pump station within Catchment 2, from where, it is pumped to a sewer along the north side of Catchment 2, which conveys wastewater westwards.

Along its route travelling northwards, the gravity sewer also picks up wastewater flows from catchment 3, and conveys collected wastewater through an easement through Valley Land and eventually connects to the existing trunk sewer leading to the Guelph WWTP at an easement close to Kirkby Road. As there is a low point in the east side of Catchment 3, wastewater is collected to a sewage pumping station, from where, it is lifted pumped and conveyed to a sewer connecting to the sewer conveying flows from Catchments 1 and 2. Catchment 4 is a small catchment and conveys wastewater flows to the existing sanitary sewer on Poppy Drive. As the wastewater flows from this catchment are relatively small, the existing downstream sewer would be capable of conveying the collected flow without surcharging the existing sewer. Catchment 5 is east of Gordon Street, and collects and conveys wastewater flows to an existing sewer along Hawkins Drive. This sewer and downstream infrastructure is also capable of conveying the flows collected from Catchment 5 to the Guelph WWTP without causing surcharge in the sewer system.

In this alternative, wastewater flows collected at SPS-1, SPS-2 and SPS-3 would be pumped to a gravity sewer. Each SPS will operate independently of each other. According to the wastewater modelling carried out on the updated wastewater model provided in 2020, the connection point downstream of which, there would not be any surcharges to the Guelph WWTP is identified as MHD0005252, which is south of Kortright Road West and east of Berry Drive. This connection point is further downstream of that identified in the modelling exercise carried out with the earlier version of the model provided in 2018. This is illustrated on Figure 3.2.0 earlier in this section.

While the benefits are apparent, this alternative does have significant challenges. As the majority of the gravity route for the Southend Park Valley Land Trunk Alternative is not within a ROW, it is expected that maintenance access for this alternative will be very challenging. It is understood that roadways though natural habitat will not be supported. It should also be noted that the alignment will impact the Hanlon Creek Swamp, a Provincially Significant Wetland. Lastly, it is

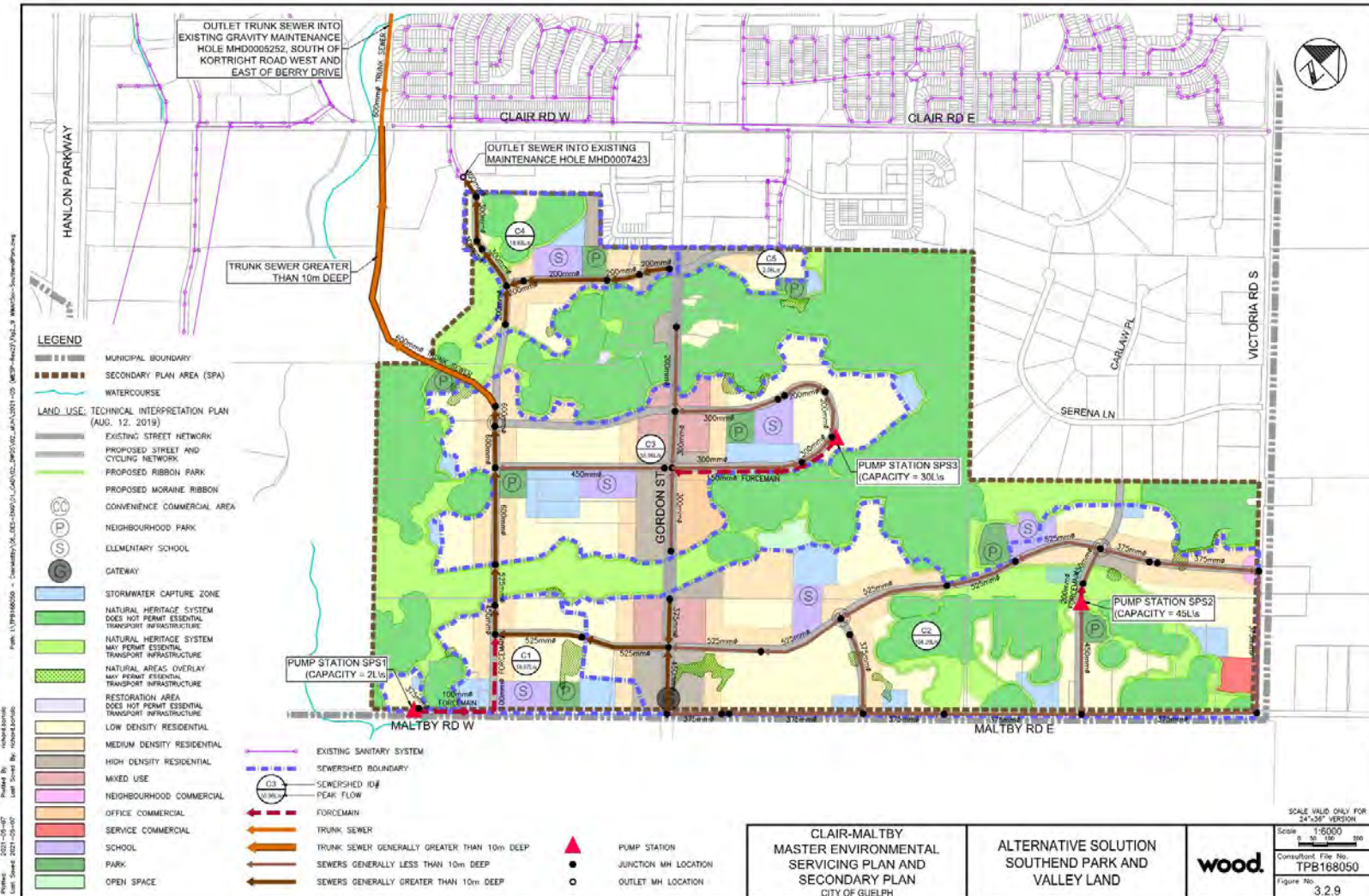
expected that open cut construction will be very challenging given the depth of water table in the area.

The information for the pump station capacity and forcemain diameter and length for the Southend Park and Valley Land alignment alternative is presented in Table 3.2.5.

Table 3.2.5. Pump and Forcemain Information for the Southend Park Valley Land Trunk Alternative

Total Length of 200 mm Sewers	1.3 km
Total Length of 300 mm Sewers	1.9 km
Total Length of 375 mm Sewers	5.3 km
Total Length of 450 mm Sewers	1.5 km
Total Length of 525 mm Sewers	2.4 km
Total Length of 600 mm Sewers	0.6 km
Total Length of Trunk Sewer (Average 10 m Depth)	4.1 km
SPS-1 Capacity	2 L/s
SPS-2 Capacity	45 L/s
SPS-3 Capacity	30 L/s
FM-1 Diameter, Length	100 mm, 0.6 km
FM-2 Diameter, Length	200 mm, 0.02 km
FM-3 Diameter, Length	150 mm, 0.6 km

Figure 3.2.10. Alternative Solution – West Connection – Southend Park and Valley Land Trunk



3.2.5 Economics of Wastewater Servicing Alternatives

This section discusses the economics of the different wastewater servicing alternatives. Order of magnitude cost estimates were developed for the various water supply, storage and distribution for each of the alternatives. These are based on information extracted from recent tenders for the City of Guelph (provided by the City), Pump Station Design by R. Sanks (2006), and Engineering News Record (ENR) cost data prorated for greater depths and indexed to 2020. The cost numbers were suitably interpolated to reflect the current servicing sizes and capacities.

Annual Operating and Maintenance costs have been estimated based on a percentage of capital costs as follows:

Wastewater Piping <10m Depth:	1.0% of Capital Cost
Wastewater Piping >10m depth:	2.5% of Capital Cost
Sewage Pumping Station (including energy costs)	5.0% of Capital Cost

Property costs have been assessed at an estimated \$800,000 per acre, or \$198/m². Easements costs have not been included as they are considered incidental (\$0.5/m²).

Pump Station Emergency overflows (assuming overflow to lined SWCA Forebays) have been estimated at \$100,000 inclusive of piping, valving, controls and forebay lining.

3.2.5.1 Alternative 3: East Connection – Victoria Road Trunk

The Victoria Road Trunk alternative proposes the second smallest pump station capacity as compared to the other three alternatives and as such, the pump station costs are a relatively minor component of the overall cost. The forcemains, however also longest of all the other alternatives and as such are relatively expensive compared to the other alternatives. The major cost component for this alternative are the sanitary forcemains. FM-2 is almost 7km long and is the single most expensive element in the alternative.

The estimated capital cost for implementing this solution is \$30.6 Million as given in **Table 3.2.6**.

Table 3.2.6. Estimated Cost – East Connection Alternative – Victoria Road Trunk

Internal Sewers	\$10.2 Million
Sewage Pump Station (SPS) - 1	\$0.7 Million
Sewage Pump Station (SPS) – 2	\$4.7 Million
Sewage Pump Station (SPS) - 3	\$1.6 Million
Forcemain - 1	\$0.6 Million
Forcemain - 2	\$10.4 Million
Forcemain - 3	\$0.8 Million
Property Costs	\$1.6 Million

Total Cost for East Connection Alternative – Victoria Road Trunk	\$30.6 Million
Estimated Annual O&M Costs	\$506 K per year

3.2.5.2 Alternative 4: Central Connection – Clair Gordon Trunk

The Clair Gordon Trunk alternative proposes to upgrade the section of sanitary sewer termed the Clair-Maltby bottleneck by twinning the existing sewers and as such, the sewer twinning costs are unique to this alternative. The forcemains, are much shorter in length than the Victoria Road alternative and are similar in length and cost to the Southgate Hanlon and South Industrial options. The major cost additional cost component for this alternative is the twinning of existing sewers, which is not present in any other alternative.

The estimated capital cost for implementing this solution is \$33.7 Million as given in Table 3.2.7.

Table 3.2.7. Estimated Cost – Central Connection Alternative – Clair Gordon Trunk

Internal Sewers	\$10.2 Million
Twinning of Existing Sewers	\$8.1 Million
Sewage Pump Station (SPS) - 1	\$0.7 Million
Sewage Pump Station (SPS) – 2	\$3.1 Million
Sewage Pump Station (SPS) - 3	\$4.8 Million
Forcemain - 1	\$1.0 Million
Forcemain - 2	\$2.4 Million
Forcemain - 3	\$1.8 Million
Property Costs	\$1.6 Million
Total Cost for Central Connection Alternative – Clair Gordon Trunk	\$33.7 Million
Estimated Annual O&M Costs	\$787 K per year

3.2.5.3 Alternative 5: West Connection – Southgate Hanlon Trunk

This alternative is associated with the lowest capital costs of all the alternatives examined. The major cost component is the internal sewers. The pumping stations and forcemains are similar to the Clair Gordon Alternative. This alternative provides a balance of all wastewater collection elements. There aren't exceptionally long forcemains, or an exceptional amount of deep sewers, there aren't significant property or easement requirements and it doesn't require significant twinning of services through residential areas.

The estimated capital cost for implementing this solution is \$29.1 Million as given in Table 3.2.8.

Table 3.2.8. Estimated Cost – West Connection Alternative – South Hanlon Trunk

Gravity Sewers	\$13.7 Million
Sewage Pump Station (SPS) - 1	\$0.7 Million
Sewage Pump Station (SPS) – 2	\$3.1 Million
Sewage Pump Station (SPS) - 3	\$4.8 Million
Forcemain - 1	\$1.0 Million
Forcemain - 2	\$2.4 Million
Forcemain - 3	\$1.8 Million
Property Costs	\$1.6 Million
Total Cost for West Connection – Southgate Hanlon Trunk	\$29.1 M
Estimated Annual O&M Costs	\$720 K per year

3.2.5.4 Alternative 6: West Connection – Southgate Industrial

The Southgate Industrial alternative is a variation on the Southgate Hanlon Alternative which proposes an increased capacity for SPS -1 in order to accommodate the future flows from the extension to the industrial park. In this option flows are diverted from SPS-3 to Southgate Drive.

Additionally, some gravity piping has been included in this option to collect flows from the industrial park to SPS-1. This option will see some upsizing of existing infrastructure along Southgate Drive and Clair Rd.

The estimated capital cost for implementing this solution is \$31.9 Million as given in **Table 3.2.9.**

Table 3.2.9. Estimated Cost – West Connection Alternative – Southgate Industrial

Gravity Sewers	\$14.6 Million
Sewage Pump Station (SPS) - 1 *	\$2.4 Million
Sewage Pump Station (SPS) – 2	\$3.2 Million
Sewage Pump Station (SPS) - 3	\$4.4 Million
Forcemain - 1	\$1.5 Million
Forcemain - 2	\$2.4 Million
Forcemain - 3	\$1.8 Million
Property Costs	\$1.6 Million
Total Cost for West Connection – Southgate Hanlon Trunk	\$31.9 M
Estimated Annual O&M Costs*	\$1.9M per year

*Capital and O&M Costs include increased pumping station size to accommodate Industrial Park expansion

3.2.5.5 Alternative 7: West Connection – Southend Park and Valley Land Trunk

The Southend Park and Valley Land alignment alternative proposes smaller capacity pump stations as compared to the other three alternatives and as such, the pump station costs are a relatively minor component of the overall cost. The forcemains also are short in length and smaller in diameter and as such would cost relatively lesser than the other three alternatives. The major cost component for this alternative is the sanitary gravity sewers, as this is the only alternative which collects all flows into a gravity line withing the CMSP Lands. As such, the sewer diameters are larger.

This alternative differs from the others as the City will need to acquire an easement for the Southend Park Valley Land trunk sewer. Easement acquisition costs are negotiated with each affected landowner and as such, have not been included in the cost estimates. Notwithstanding the easement acquisition cost, this alternative is associated with the least capital cost.

The estimated capital cost for implementing this solution is \$33.0 Million as given in Table 3.2.10.

Table 3.2.10. Estimated Cost – West Connection Alternative – Southend Park and Valley Land Route to South Hanlon Trunk

Gravity Sewers	\$16.5 Million
Trunk Sewer (average 10 m Depth)	\$11.7 Million
Sewage Pump Station (SPS) - 1	\$0.2 Million
Sewage Pump Station (SPS) – 2	\$1.3 Million
Sewage Pump Station (SPS) - 3	\$0.8 Million
Forcemain - 1	\$0.4 Million
Forcemain - 2	\$0.1 Million
Forcemain - 3	\$0.4 Million
Property Costs	\$1.6 Million
Total Cost for West Connection Alternative – Southend park and Valley Land Route to South Hanlon Trunk	\$33.0 Million
Estimated Annual O&M Costs	\$575 K per year

3.2.6 Assessment Criteria

The wastewater servicing alternatives noted above need to be evaluated methodically comparing the pros and cons of each alternative such that the servicing alternative that best meets the requirements of the subject lands could be put forth as the preferred alternative. In order to perform a meaningful comparison, detailed evaluation criteria need to be developed to ascertain the potential impacts of the various alternatives on the natural environment, social and cultural impacts,

cost impacts etc. The next section details the various evaluation criteria that were selected to carry out the comparative analysis of the various servicing alternatives.

3.2.6.1 Evaluation Criteria

The following evaluation criteria has been prepared in order to carry out the comparative evaluation of the different wastewater servicing alternatives for the CMSP lands. The wastewater servicing alternatives have been compared with respect to the evaluation criteria presented below. As per the Municipal Environmental Assessment process, the selected criteria relate to the consideration of potential impacts and opportunities generated by the alternatives within four distinct categories:

Table 3.2.11. Wastewater Servicing Alternatives Evaluation Criteria

Environment	Criteria
Social/Cultural Environment	Impacts or opportunities created by the alternative as related to the people and their current or historic relationship with the study area.
Economic Environment	Capital, operation, and maintenance costs associated with an alternative.
Natural Environment	Impacts or opportunities that an alternative may have related to the natural environment (i.e., fisheries, wildlife, water quality, etc.).
Functional (Technical) Environment	Considers the ability of the alternative to address the Problem Statement and how it may impact existing physical systems. These include ease of maintenance, impact to existing infrastructure, ability to utilize available capacity in the existing infrastructure, capability of phased implementation, and ability to be implemented in concert with wastewater servicing.

Within each environment, relevant and representative criteria have been considered for the evaluation. Each evaluation criterion has been assessed to ensure it results in a meaningful comparison between the wastewater servicing alternatives.

Table 3.2.12. Wastewater Servicing Alternatives Evaluation Factors

Component	Category	Evaluation Criteria	Criteria Indicator	Potential Measure
Natural Environment	Terrestrial/ Aquatic Environment Resources	Impact to Terrestrial/ Aquatic Environment Resources	Potential adverse effects on ecological sensitive lands, impacts to water bodies and aquatic species.	Extent of impact
Social/ Cultural	Impact on Local Residents and Businesses	Archaeological Resources ¹ .	Potential adverse effects on archaeological resources	Extent of impact
Social/ Cultural	Impact on Local Residents and Businesses	Cultural Heritage Resources ² .	Potential adverse effects on cultural heritage resources	Extent of impact
Social/ Cultural	Sustainable Growth	Impacts on Adjacent Properties	Potential adverse impacts to adjacent properties due to construction of solutions etc.	Number of private or public properties
Social/ Cultural	Reliability	Prone to failure/breakdown	Potential adverse impact in the event of failure of system.	Extent of impact
Social/ Cultural	Regulatory Environment	Compliance with provincial/ municipal regulations and standards	Potential adverse impact due to inadequate infrastructure.	Extent of impact
Social/ Cultural	Land use	Impact on surrounding land use.	Potential aesthetic impact, disruption to public life during construction/operation.	Noise, odour
Economic	Cost benefit over infrastructure lifecycle	Capital Cost	Design and construction costs	Estimated cost (\$)

Component	Category	Evaluation Criteria	Criteria Indicator	Potential Measure
Economic	Cost benefit over infrastructure lifecycle	Maintenance Cost	Asset management costs (lifecycle)	Estimated cost (\$)
Economic	Cost benefit over infrastructure lifecycle	Property Acquisition	Amount of private property required to achieve solution	Area in ha
Functional (Technical)	Ease of Maintenance	Maintainability	Adverse impact on system performance	Extent of impact
Functional (Technical)	Impact to Existing Infrastructure	Impact of new infrastructure on the existing infrastructure to meet its assigned/ allocated function	Sewer surcharges, Capacity exceedances at pumping stations and forcemains	Extent of impact
Functional (Technical)	Ability to Utilize Capacity in Existing Infrastructure	Ability of new infrastructure to utilize spare capacity within the existing infrastructure	Eliminating/minimizing requirement for upgrade/expansion to existing infrastructure	Extent of impact
Functional (Technical)	Capability of Phased Implementation	Ability of proposed scheme to be implemented in a phased manner over a period of time	Modularity/flexibility of the proposed servicing	Extent of flexibility in phasing
Functional (Technical)	Ability to be implemented in Concert with the Water Servicing Alternatives	Ability to be implemented within proximity of the water servicing	Physical proximity with water servicing	Extent of proximity
Functional (Technical)	Construction Difficulty	Ability to be implemented utilizing traditional Construction Techniques	Eliminating/ Minimizing locations of difficult construction	Extent of proximity

1. Combined into a single criterion due to common potential for impacts (spatially).
2. More related to detailed design versus planning stages thus removed from assessment.

Each of the wastewater servicing alternatives has been assessed using the evaluation categories, criteria and factors provided within Table 3.2.2. Alternatives 3, 4 and 5 are very similar to each other in terms of internal servicing of the CMSP lands. The key difference is that different forcemains convey to different receiving sewers within the CMSP lands. The other fundamental difference is that each of these three alternatives convey collected wastewater to different branches of the existing City of Guelph wastewater network. The following has been noted regarding the various alternatives under consideration:

3.2.6.2 Evaluation of Servicing Alternatives Against Each Criteria

Alternative 1: Do-Nothing: The Do-Nothing alternative for wastewater servicing would not cause disruption to the natural, social and cultural environment. Neither would it provide any servicing in terms of infrastructure such as sewer pipes, maintenance holes, forcemains, valves, appurtenances, sanitary pumping stations. As a result, the CMSP development would be left without a piped sanitary collection system to convey collected wastewater to the Guelph Wastewater Treatment Plant. Therefore, this alternative does not meet the objective of development within the subject lands nor does it address the problem/opportunity statement and is not considered a viable alternative.

Alternative 2: Limit Community Development: Limiting community development potentially would reduce the adverse impact on the natural, social and cultural environment. It also would cost less to design, construct, operate and maintain the wastewater collection and pumping infrastructure to meet the reduced flows. However, this alternative also does not meet the objective of full development within the subject lands and is therefore, not considered a viable alternative.

Alternative 3: East Connection – Victoria Road Trunk: This alternative is anticipated to have the least impact on the local residents, as no sewer upgrades are required within the built-up areas. However, this alternative scores the lowest relative to other alternatives when it comes to operation and maintenance. This is primarily due to a long forcemain, which would be associated with the highest pumping cost. Odour issues associated with long forcemains may also be an issue.

Alternative 4: Central Connection – Clair Gordon Trunk: This alternative will include significant upgrades/twinning of existing sewers (more than other servicing alternatives) to provide capacity in the Clair Gordon Trunk system to accommodate CMSP wastewater flows. As such, this alternative will have the largest social/cultural impact in terms of disruption to daily life. This alternative is associated with the highest cost primarily due to a significant part of the existing sewer through the Clairfields Subdivision requiring upgrades.

Alternative 5: West Connection – Southgate Hanlon Trunk: This alternative is among the more favourable alternatives as compared to alternatives 3 and 4. As this alternative relies on three pump stations to service the entire subject lands, similar to alternatives 3 and 4, the reliability is a notch lower as compared to alternative 7 as a larger catchment area is dependent on the pump stations. Similarly, the operational cost for this alternative is expected to be higher than that for alternative 6 due to larger capacity pump stations.

Alternative 6: West Connection – Southgate Industrial: This alternative provides the benefit of acknowledging pending development outside the CMSP lands and implementing infrastructure which can support both developments. The operational cost for this alternative is expected to be significantly higher than that for the other alternatives due to larger capacity pump stations required to accept flow from outside the CMSP Lands.































Alternative 7: West Connection – Southend Park and Valleyland Trunk: This alternative presents the most reliable solution as not all the catchment areas are drained to sanitary pump stations and a significant part is captured directly by the gravity sewer system reducing the reliability on pumping. This arrangement also has the potential for lesser operating costs. However, the gravity solution would result in deeper sewers. Given the difficult topography of the CMSP lands, Wood’s modelling work has indicated that certain stretches will have sewer depths in excess of 10 m, going as deep as 15 m to 18 m at some stretches. This would result in difficult and expensive construction and subsequent maintenance of sewers. Service easements across existing parcels will need to be acquired for the Valley Land Trunk sewer, whereas no external (outside CMSP) service easement is anticipated for sewer/forcemain installation under the other alternatives. Land requirements for the pumping stations is expected to be very similar between the alternatives as the number of pump stations remain the same. The only exception is SPS-1, which is expected to require less land for Alternative 6 due to significantly lesser flows. This alternative is associated with the one of the highest capital costs, even excluding the costs of the easement acquisition for the trunk sewer easement.

3.2.6.3 Comparative Evaluation Matrix

The different alternatives were compared against each other with respect to the various criteria established in section 3.2.6.1. The comparative evaluation matrix is presented in the tables below.

Table 3.2.13. Wastewater Alternatives Evaluation Matrix

Category	Criteria	Criteria Indicator	Do Nothing	Limit Community Growth	East Connection – Victoria Road Trunk	Central Connection – Clair Gordon Trunk	West Connection – Southgate Hanlon Trunk	West Connection – Southgate Industrial	West Connection – Southend Valleylands Trunk
Natural Environment	Terrestrial/Aquatic Environment Resources	Potential adverse effects on ecological sensitive lands, impacts to water bodies and aquatic species.	No impact as no new lands will have to be developed or utilized.	Minimal impact anticipated, depending on the location and extent of services.	Limited impact anticipated as internal servicing would be along proposed roads. The Victoria Road Forcemain would also be along an existing Road.	Limited impact anticipated as internal servicing would be along proposed roads. Forcemain along Gordon Street.	Limited impact anticipated as internal servicing would be along proposed roads. Forcemain along Gordon Street, and Trunk Sewer along Clair Road.	Limited impact anticipated as internal servicing would be along proposed roads. Forcemain along Gordon Street, and Trunk Sewer along Clair Road.	Moderate impact anticipated as internal servicing would be along proposed roads. The trunk sewer is not aligned along a proposed road, while the alignment does not encroach on environmentally sensitive areas.
Social, Cultural Environment	Impact on Local Residents and Businesses	Cultural Heritage and Archaeology	No impact as no servicing will be provided.	No impact anticipated	While no upgrades of existing sewers are required, 7 km forcemain may cause odour issues.	Sewers along built up areas will need to be twinned/ upgraded causing disruption to local residents and businesses.	Sewers along built up areas will need to be twinned/ upgraded. The extent of upgrades is less than that of the Clair Gordon Trunk alternative.	Sewers along built up areas will need to be twinned/ upgraded. The extent of upgrades is less than that of the Clair Gordon Trunk alternative.	Sewers along built up areas will need to be twinned/ upgraded. The extent of upgrades is less than that of the Clair Gordon Trunk alternative.
Social, Cultural Environment	Sustainable Growth	Impacts on Adjacent Properties	No impact to adjacent properties as no servicing will be provided.	Limited impact to adjacent properties due to limited growth and greenfield development.	Limited impact as most of the development is expected to be greenfield development.	Limited impact as most of the development is expected to be greenfield development.	Limited impact as most of the development is expected to be greenfield development.	Limited impact as most of the development is expected to be greenfield development.	Limited impact as most of the development is expected to be greenfield development.
Social, Cultural Environment	Reliability	Prone to failure/breakdown	Not applicable	Dependent on the system configuration.	Reasonable reliability.	Reasonable reliability.	Reasonable reliability.	Reasonable reliability.	Most reliable option as large area is served through gravity servicing reducing the chances of breakdown

Category	Criteria	Criteria Indicator	Do Nothing	Limit Community Growth	East Connection – Victoria Road Trunk	Central Connection – Clair Gordon Trunk	West Connection – Southgate Hanlon Trunk	West Connection – Southgate Industrial	West Connection – Southend Valleylands Trunk
Social, Cultural Environment	Regulatory Environment	Compliance with provincial/municipal regulations and standards	Not applicable	Complies with guidelines. 	Complies with guidelines. 	Complies with guidelines. 	Complies with guidelines. 	Complies with guidelines. 	Complies with guidelines. 
Social, Cultural Environment	Land use	Impact on surrounding land use.	No impact on surrounding land use	Construction Impacts. 	Construction Impacts. 	Construction Impacts. 	Construction Impacts. 	Construction Impacts. 	Construction Impacts. 
Economic	Capital	Design and construction costs	No capital costs, as there is no servicing	Capital costs will be less than the full servicing. However, it won't be proportionally less in accordance with the extent of servicing. 	Estimated Capital Cost \$30.6 Million. 	Estimated Capital Cost \$33.7 Million 	Estimated Capital Cost 29.1 Million 	Estimated Capital Cost 31.9 Million 	Estimated Capital Cost \$33.0 Million 
Economics	Maintenance	Asset management costs (lifecycle)	No maintenance cost, as there is no servicing	Maintenance cost similar to full service alternative. Operating cost less than full service alternatives. 	Estimated Operation and maintenance cost. \$506K 	Estimated Operation and maintenance cost. \$787K 	Estimated Operation and maintenance cost. \$720K 	Estimated Operation and maintenance cost. \$1.9M inclusive of Industrial Park expansion 	Estimated Operation and maintenance cost. \$575K 
Economics	Property/Easement Acquisition	Amount of private property required to achieve solution	No property required.	Property requirement similar to the full-service alternatives. 	Property requirement for pump stations similar to the Clair Gordon Trunk and Southgate Hanlon Trunk alternatives. 	Property requirement for pump stations similar to Victoria Road Trunk and Southgate Hanlon Trunk alternatives. 	Property requirement for pump stations similar to the Clair Gordon Trunk and Victoria Road Trunk alternatives. 	Property requirement for pump stations similar to the Clair Gordon Trunk and Victoria Road Trunk alternatives 	Property requirement for pump stations is less due to smaller size of PS-1. Service easement will be required for construction and subsequent maintenance of Valley Land Trunk. 

Category	Criteria	Criteria Indicator	Do Nothing	Limit Community Growth	East Connection – Victoria Road Trunk	Central Connection – Clair Gordon Trunk	West Connection – Southgate Hanlon Trunk	West Connection – Southgate Industrial	West Connection – Southend Valleylands Trunk
Functional (Technical)	Ease of Maintenance	Adverse impact on system performance	No maintenance required as there is not infrastructure.	Infrastructure provided will be similar to full growth except for smaller size. Similar maintenance is expected.	Maintenance is expected to be primarily at the lift stations and occasionally for forcemain swabbing/sewer flushing. 7 km forcemain may cause odour issues.	Maintenance is expected to be primarily at the lift stations and occasionally for forcemain swabbing/sewer flushing.	Maintenance is expected to be primarily at the lift stations and occasionally for forcemain swabbing/sewer flushing.	Maintenance is expected to be primarily at the lift stations and occasionally for forcemain swabbing/sewer flushing.	Maintenance is expected to be primarily at the lift stations and occasionally for forcemain swabbing/sewer flushing. Due to deeper sewer stretches, requirement for maintenance will be onerous.
Functional (Technical)	Impact to Existing Infrastructure	Sewer surcharges, Capacity exceedances at pumping stations and forcemains	No impact to existing infrastructure.	Impacted to existing infrastructure is reduced as growth is limited. Impact also dependent on the connection point.	No impact to existing infrastructure based on the chosen connection point.	The identified connection point identified surcharges in the existing sewers, therefore, upgrades will be required.	No impact to existing infrastructure based on the chosen connection point.	Minor impact to existing infrastructure based on the chosen connection	No impact to existing infrastructure based on the chosen connection point.
Functional (Technical)	Ability to Utilize Capacity on Existing Infrastructure	Eliminating/minimizing requirement for upgrade/expansion to existing infrastructure	No ability to utilize existing infrastructure	Limited ability to utilize existing infrastructure due to limited growth.	Existing Victoria Road Trunk downstream of Stone Road will be utilized.	Existing Clair-Maltby Road Sewer will be utilized.	Existing Hanlon Gate Trunk will be utilized.	Existing Hanlon Gate Trunk will be utilized.	Existing Hanlon Gate Trunk will be utilized.
Functional (Technical)	Capability of Phased Implementation	Modularity/flexibility of the proposed servicing	No capability of being implemented in phases.	No capability of being implemented in phases.	Good capability for phased implementation	Good capability for phased implementation	Good capability for phased implementation	Good capability for phased implementation	Better capability for phased implementation due to larger trunk sewer accommodating a large part of CMSP lands.

Category	Criteria	Criteria Indicator	Do Nothing	Limit Community Growth	East Connection – Victoria Road Trunk	Central Connection – Clair Gordon Trunk	West Connection – Southgate Hanlon Trunk	West Connection – Southgate Industrial	West Connection – Southend Valleylands Trunk
Functional (Technical)	Ability to be implemented in Concert with the Water Servicing Alternatives	Physical proximity with water servicing	No servicing provided, therefore, no ability for water and water servicing to be implemented together.	Limited servicing, therefore, limited opportunity to implement along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	Most services are along road right of ways, therefore, good ability of being implemented along with wastewater servicing.	The main wastewater trunk is aligned along Valley Lands, where there is no proposal for a watermain. Limited ability for implementation with water servicing.
Functional (Technical)	Construction Difficulty	Eliminating/Minimizing locations of difficult construction	No servicing provided	Limited servicing	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades	Standard Construction Techniques and Trades	Extended section of Deep Excavations

Most Preferred → Least Preferred



Preferred Alternative

3.2.7 Preferred Solution(s)

The preferred wastewater servicing alternative is the West Connection – Southgate Hanlon Trunk. This alternative will see pumped flow enter a new maintenance hole just inside of the northern CMSP boundary, from where it flows by gravity to Clair Road, Laird Road and Kirkby Court to connect directly to MHD0002142. Upsizing of existing sanitary infrastructure is not required with this option.

This alternative is also associated with the lowest capital cost as compared to the other sanitary servicing alternatives and provides reasonable operating costs. In addition the maintenance issues associated with deep sewers are limited with this option (approximately 1km). The long forcemain associated with the Victoria Road alternative are not present so odor issues are not anticipated. This options appears to offer the best balance of costs, operational expectations, and impact to adjacent residences and businesses.

3.2.7.1 Discussion of the Preferred Alternative

This alternative proposes three sewage pumping stations as with the other alternatives. The capacity of each pump station and consequently, the forcemain diameter is similar to the Clair Gordon Trunk Alternative. In general, the forcemain lengths and sizes are the same as the Clair Gordon Trunk Alternative. However it has the distinct advantage of avoiding the bottle neck section through approximately 2 km of primarily residential area.

Resultant gravity sewers depths will be within the typical range of depths at all locations. The sewers will be readily accessible for maintenance operations, and will avoid the maintenance issues associated with deep sewers. Additional easements for construction of the sewers is not anticipated

This preferred alternative avoids the maintenance issues and easement requirements associated with the Southend Park Valley Lands Trunk alternative; and avoids the requirement to upgrade the bottlenecked area of the Clair Gordon Trunk Alternative.

3.3 Stormwater

Stormwater management measures are required to mitigate the potential impacts to the quantity and quality of runoff resulting from the urbanization of the Clair-Maltby SPA in accordance with the updated Preferred Community Structure. As noted, the SPA is predominantly located within the headwaters of Hanlon, Mill and Torrance Creek and the Paris Moraine. The SPA consists of hummocky terrain, with streams and creeks largely absent, resulting in surface runoff predominantly being infiltrated and evaporated under existing conditions. To the extent feasible and practical, stormwater management measures will be required to mimic the existing surface water/groundwater conditions, which largely infiltrate precipitation through numerous depressional features (ref, Figure 2.3).

As part of the overall Secondary Planning study through the CEIS, a four year monitoring program was undertaken (2016, 2017, 2018 and 2019). As part of the program, surface water quality monitoring was conducted at key locations within the Clair-Maltby SPA and beyond to characterize the surface water chemistry for

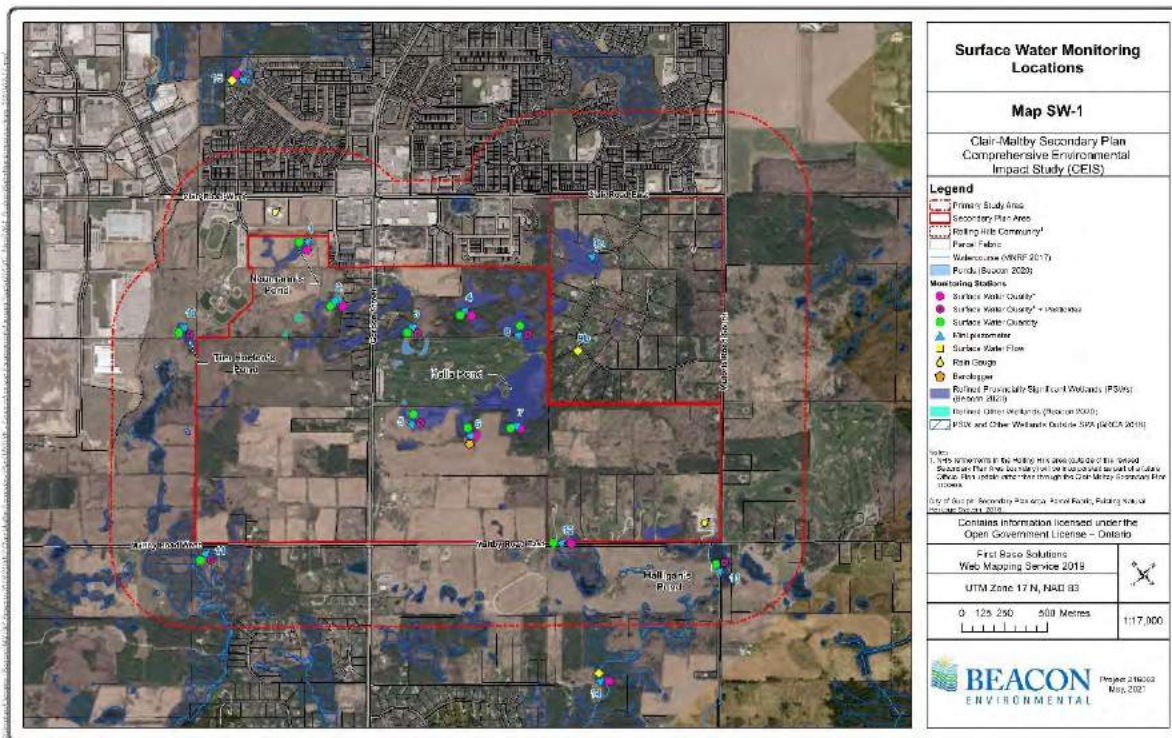
existing land use conditions. Based on the monitoring results, existing surface water quality within the Clair-Maltby SPA and immediately downstream is generally of reasonable quality, with some exceedances to provincial and federal water quality guidelines in those parameters linked primarily to agricultural and golf course land uses and roadway runoff. To protect both surface water quality and ground water quality, stormwater quality controls will be required.

3.3.1 Existing Conditions

Surface Water Monitoring Program

As noted, a four year monitoring program (2016-2019) has been conducted as part of the Comprehensive Environmental Impact Study (CEIS), to understand and assess the Clair-Maltby study area's unique surface water / ground water system and associated natural heritage character. The monitoring program supplemented the available data from existing studies and reports. For the purpose of validating the hydrologic model, rainfall and flow monitoring (Stations 9A, 9B, 14 and 15) were conducted in addition to spot flow measurements at other locations (ref. Figure 3.3.1). Stations 14 and 15 in Mill Creek and Hanlon Creek respectively were the only two stations where flow was observed during the monitoring period.

Figure 3.3.1. Surface Water Monitoring Locations



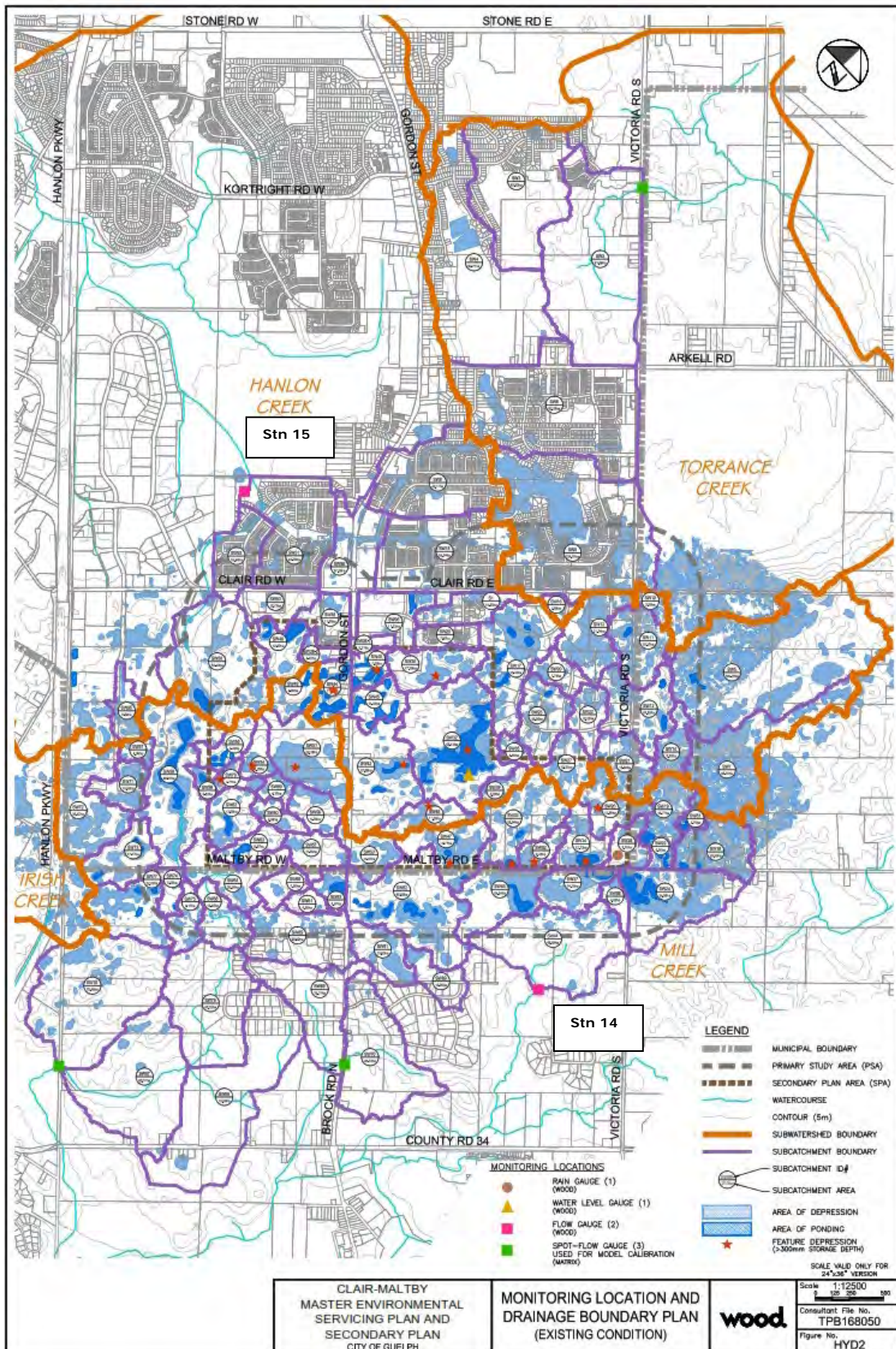
Based on the significant number of depressional features, most storm events did not result in a surface water response at the flow monitoring locations. The observed runoff response at the monitoring locations is considered largely a result of the local catchments immediately upstream of the monitoring locations. In addition, both flow monitoring locations, Hanlon Creek (Station 15) and Mill Creek (also known as Hammersly) (Station 14) are located downstream of groundwater discharge locations, which after certain storm events exhibited groundwater discharge conditions above the normal baseflow, therefore adding to the surface water response.

Hydrologic Modelling

The hydrologic analysis for the Clair-Maltby SPA was conducted using the PCSWMM modelling platform based on the US-EPA SWMM program. The PCSWMM modelling completed for the Clair-Maltby SPA has been developed using the 2012 Digital Elevation Model (DEM); the subcatchment boundary plan for the overall PCSWMM hydrologic model is presented in Figures 3.3.2 and 2.3. Subcatchments have been discretized to represent the drainage areas within each primary subwatershed, Hanlon Creek, Mill Creek and Torrance Creek to specific monitoring locations, which are located outside/downstream of the SPA. The natural depressional features located within, and adjacent to, the Clair-Maltby SPA have been assessed to determine their cumulative storage volume for the contributing area, resulting in a depth (mm) of storage for each depressional feature. The intent of this effort has been to quantify the capture/storage potential of the respective depressional features.

The PCSWMM hydrologic model parameterization for existing conditions has been validated using the flow data collected for the Hanlon Creek monitoring site (Station 15) and the Mill Creek/ Hammersly (Station 14) monitoring site for the 2016 to 2017 monitoring period.

Figure 3.3.2. Existing Drainage Plan

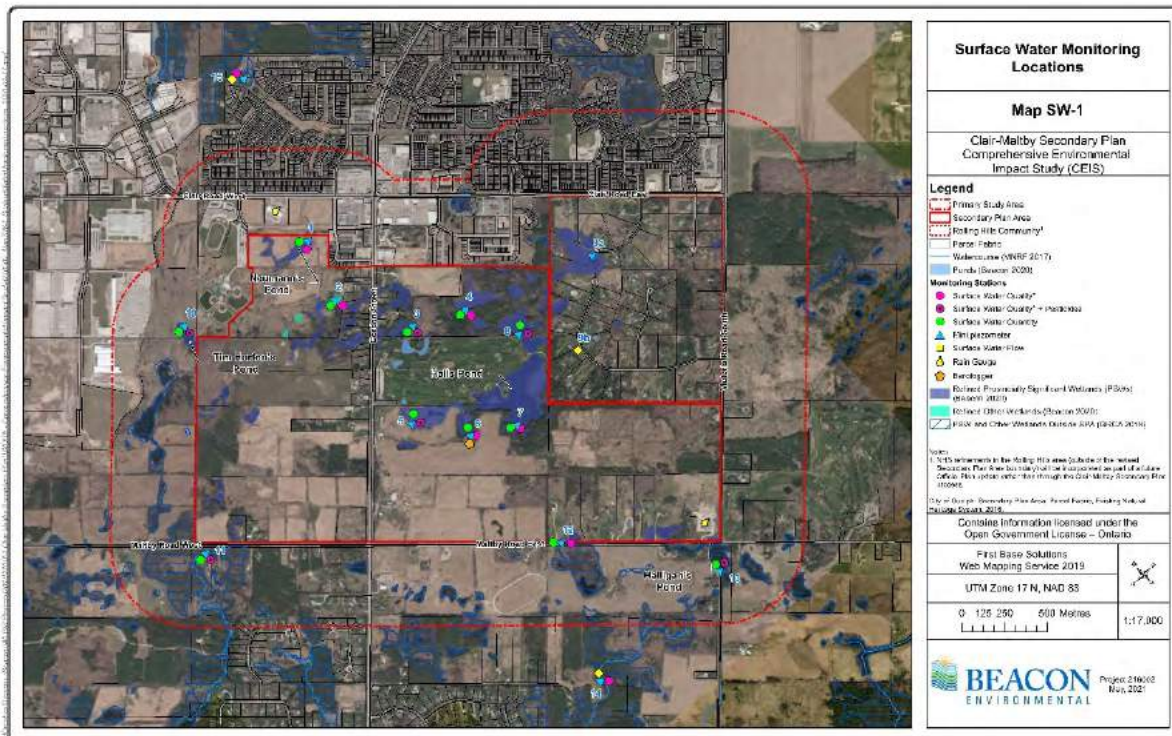


The validated PCSWMM hydrologic model for existing conditions has been executed for a continuous simulation period of 1950 to 2017 (67 years). Frequency flows have been determined using the Log Pearson Type III Distribution for both flow monitoring locations (ref. Table 3.3.1). Frequency flows for the Mill Creek and Hanlon Creek are considered low (<1.5 m³/s for the 100 year), due to the significant influence of depressional features (capture and storage) and the existing urban area greenway stormwater management systems within the Clairfield area, which infiltrate most storm runoff.

In addition to the continuous simulation, peak flows have also been determined using design storms (City of Guelph 3 hour Chicago design storms) for the 2 to 100 year storm events, along with the Regional Storm (Hurricane Hazel), with peak flows provided within Table 3.3.2.

In addition, the 1950-2017 climate data set has been used to determine an annual water budget (premised on surface based water modelling) within the Clair-Maltby SPA and to the monitoring locations (flow and spot flow) within the Clair-Maltby Secondary Study Area (SSA) (ref. Figure 3.3.2). The annual water budget assessment has been conducted for each subwatershed based on the subcatchments contributing to the monitoring locations within Hanlon Creek, Torrance Creek and Mill Creek.

Figure 3.3.3. Surface Water Monitoring Locations



As noted, the Clair-Maltby SPA is located at the headwaters of the Hanlon Creek, Torrance Creek and Mill Creek and with the significant number of the depressional features and lack of overland drainage routes and watercourses, surface runoff is predominantly infiltrated or evaporated. Each creek system annually infiltrates and evaporates 93 per cent to 98 per cent of the total precipitation, with Torrance Creek infiltrating the least, due to some existing development. The remaining surface water (not infiltrated or evaporated) ends up as discharge/ runoff from the system. Each creek system exhibits high annual infiltration, due to the depressional features and the urban area greenway stormwater management systems within the Clairfield area (greenways), the function of which will have to be replicated within the Clair-Maltby SPA. Based on a review of the area’s topography using GIS techniques, there are forty-seven (47) major depressional features that have over 300 mm storage (i.e. runoff volume of 300 mm precipitation over contributing drainage area, with runoff coefficient value of 1), of which only seven features based on the modelling results, have been identified to discharge (Overflow) during the 67 year continuous modelling period. The water balance results for Hanlon Creek and Mill Creek are in Tables 3.3.3 and 3.3.4. Torrance Creek (with Rolling Hills not part of the Conceptual Community Structure) would not exhibit a change in water balance and as such has not been depicted. The existing water budget for Hanlon Creek and Mill Creek provides guidance for associated targets for stormwater management for the future land use condition.

Table 3.3.1. Frequency Peak Flows (m³/s) - Existing Conditions

Location (Map SW-1, Appendix D)	1.003	1.050	1.25	2	5	10	20	50	100
Hanlon Creek Monitoring Site (Station 15)	0.008	0.036	0.100	0.250	0.530	0.760	0.990	1.310	1.550
Mill Creek Monitoring Site (Station 14)	0.035	0.038	0.039	0.045	0.069	0.100	0.160	0.290	0.480

Table 3.3.2. Design Storm Event Peak Flows (m³/s) – Existing Conditions

Location (Map SW-1, Appendix D)	2	5	10	25	50	100	Regional
Hanlon Creek Monitoring Site (Station 15)	0.50	0.67	0.70	0.71	0.72	0.74	0.82
Mill Creek Monitoring Site (Station 14)	0.04	0.06	0.08	0.32	1.37	2.81	4.75

Table 3.3.3. Hanlon Subwatershed Annual Water Balance Summary

	Precipitation (mm)	Infiltration/Transpiration (mm)	Evaporation (mm)	Discharge/Runoff (mm)
Mean	856.46	842.98	26.94	0.42
Median	846.34	828.41	26.34	0.01
Min	543.18	532.00	19.26	0.00
Max	1137.70	1127.13	38.38	5.74
Std Dev.	126.26	124.58	4.10	1.00

Table 3.3.4. Mill Creek Subwatershed Annual Water Balance Summary

	Precipitation (mm)	Infiltration/Transpiration (mm)	Evaporation (mm)	Discharge/Runoff (mm)
Mean	856.46	843.18	11.95	9.69
Median	846.34	830.49	11.70	8.91
Min	543.18	537.71	8.44	4.39
Max	1137.70	1125.45	17.35	21.10
Std Dev.	126.26	122.88	1.87	2.94

Water Quality

In addition to understanding the existing surface water movement and annual water balance within the Clair-Maltby SPA, water quality has also been assessed as part of the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (CMSP / MESP) based on data collected and interpreted as part of the Comprehensive Environmental Impact Study (CEIS) (ref. Phase 1 and Phase 2: Characterization Report, September 5, 2018). The assessment of existing water quality conditions, provides the context and baseline condition for recommending stormwater quality measures to meet local, provincial and federal water quality guidelines and policies. This section discusses the existing water quality conditions and outlines the water quality requirements from local studies in consideration of federal and provincial policies that are in place requiring stormwater quality controls to mitigate water quality impacts from the Updated Preferred Community Structure land use.

As part of the four year monitoring program, surface water quality monitoring has been conducted at targeted locations within the Clair-Maltby SPA and beyond to characterize the surface water temperatures and chemistry under existing land use conditions. The water quality monitoring locations are illustrated in Figure 3.3.1 and include two flow stations outside the SPA (i.e., Stations 14 and 15) and an additional 11 stations (i.e., Stations 1 to 8, and 10 to 13) established in the internally draining wetlands within the PSA (with no surface water connections to any watercourses or other open water systems).

The water quality monitoring conducted in all stations over 2016 and 2017 indicated that the existing surface water quality within the Clair-Maltby SPA and immediately downstream is generally of reasonable quality. Repeat sampling conducted over 2018 and 2019 confirmed these results as being generally consistent from year to year under different weather conditions.

At the two flow stations, water temperatures remained largely below 20°C throughout the summer months at the Mill Creek station and below 24°C at the Hanlon Creek station. The instream water temperatures for the Mill Creek Flow Station 14 (south of the SPA) remained below 20°C and daily maximums of between 13.82°C and 19.47°C were recorded in the summer months (i.e., June through September) over the four years of monitoring between 2016 to 2019. The Hanlon Creek flow Station 15 (north of the SPA) was generally warmer with daily maximums in the summer months ranging between 19.85°C and 23.24°C between 2017 and 2019, considered to be impacted by runoff from existing residential development and the potential thermal impacts resulting from the permanent pool within the nearby stormwater management facility located immediately upstream of the Hanlon Creek flow gauge (ref. Figure 3.3.2).

At the 11 wetland stations, surface water temperatures in 2017, 2018 and 2019 displayed a relatively consistent seasonal rise from spring into summer, as air temperatures increased and wetland water elevations fell, followed by a drop in the fall although this trend was more pronounced in some wetlands than others. Not surprisingly, temperatures were much more variable than at the flow stations, as these wetlands are relatively isolated depressional features in which surface water temperatures will vary depending on a variety of factors including their size and depth, the extent to which the water levels in them vary over the year, air temperatures, the extent and type of natural cover, and the source(s) of their water (i.e., surface water, groundwater or both).

The larger wetlands sampled in the Halls Pond subwatershed have variable sources of water inputs other than direct precipitation depending on their location and the time of year. For example, Neumann's Pond (Station 1) and Halligan's Pond (Station 13) (ref. Figure 3.3.2) appear to be largely surface water fed, while Halls Pond (Stations 6, 7 and 8) is being sustained by both groundwater and surface water contributions with the relative importance of each fluctuating depending on the time of year. In the Mill Creek Subwatershed, the "Tim Hortons Pond" (Station 10) is being sustained by both groundwater and surface water contributions and the relatively cool temperatures documented in the remaining wetlands assessed in both Halls Pond Subwatershed (i.e., Stations 3, 4 and 5) and Mill Creek Subwatershed (i.e., Stations 11 and 12) suggest that these smaller wetlands are also being sustained to some extent by a direct connection to the groundwater table.

With respect to water chemistry, Provincial Water Quality Objectives (PWQO), Canadian Environmental Quality Guidelines (CEQG) and Canadian Drinking Water Quality Guidelines (CDWQ) repeated exceedances were documented at several stations and at different times of the year under existing conditions at both the 2 flow and the 11 wetland stations. During wet weather conditions exceedances for Total Phosphorus, Aluminum, Alum, Calcium, Cadmium, Iron, Manganese, Zinc and

Ammonia were documented across many sampling stations and multiple sampling events.

Exceedances can occur for various reasons, such as untreated runoff from roadways, application of fertilizers on agricultural and the golf course lands within the study area and, in some cases (such as Zinc in Mill Creek Subwatershed) due to naturally high occurrences. These exceedances and their potential causes are not being studied as part of the CMSP, as this can be very complex and is not necessary to support decision-making with respect to land use planning and impact management. Moreover, exceedances are being documented in order to contribute to a more complete understanding of existing baseline conditions in the SPA to: (a) guide management directions and objectives with respect to water quality in the SPA, and (b) provide generalized baseline information against which to assess site-specific findings, as part of future development applications and related technical studies. In addition, exceedances specifically related to Sodium and Chloride will need to be addressed in accordance with the applicable source water protection policies at both the Secondary Plan and the site-specific level.

Detailed results from the four year water quality monitoring program are provided in the Clair-Maltby CEIS Year 4 Monitoring Report (2016 – 2019).

3.3.2 Criteria/Standards/Policy

In order to establish a preferred stormwater management plan for the Clair-Maltby Secondary Plan area, it is important to consider the various planning objectives and the current policy framework, to direct and manage future growth in the area. There are several levels of requirements related to drainage, including from previous studies' goals, objectives and criteria, local municipal criteria, standards and policies and provincial and federal requirements. The following provides a summary of relevant stormwater/drainage related criteria, standards and policy considered applicable to the Clair-Maltby SPA.

Previous Studies

i. Hanlon Creek Watershed Plan, 1993 Goals:

- To minimize the threat to life and the destruction of property and natural resources from flooding and preserve or re-establish natural flood plain hydrologic functions
- To restore, protect and enhance water quality and associated aquatic resources and water supplies

ii. Hanlon Creek Watershed Plan, 1993 Objectives:

- To ensure that runoff from developing and urbanizing areas is controlled such that it does not unnecessarily increase the frequency and intensity of flooding at the risk of threatening life and property
- To minimize erosion and prevent sedimentation of waterways
- To prevent the accelerated nutrient enrichment of streams and contamination of waterways from runoff containing nutrients, pathogenic organisms, organic substances, and heavy metals and toxic substances

- To maintain or restore a natural vegetative canopy along streams where required to ensure that mid-summer stream temperatures do not exceed tolerance limits of desirable aquatic organisms
- To maintain the stream or waterway free from litter, trash, and other debris
- To minimize the disturbance of streambed and prevent streambank erosion and, where practical, to restore eroding streambanks to a natural or stable condition
- To restore, rehabilitate, or enhance water quality and associated resources through the implementation of an appropriate Best Management Practices on the land
- To take full advantage of stream baseflow enhancement opportunities
- To enhance the fishery habitat, specifically to increase the quantity and quality of Brook Trout in the headwaters area and to extend their range downstream of the Hanlon Parkway to the Speed River
- To maintain or enhance the buffers provided by wetlands
- To minimize disturbance of wetlands, preserving or enhancing the habitat they provide
- To provide buffers to wetlands to maintain or enhance their biological health
- To ensure that environmental resource constraints are fully considered in establishing land use patterns in the watershed
- To retain and preserve open space and visual amenities in urban and rural areas by establishing and maintaining greenbelts along stream corridors and adjacent natural areas

iii. Mill Creek Subwatershed Plan 1996 Goals:

- To restore, protect, and enhance water quality and associated aquatic resources and water supplies
- To conserve, protect and restore natural land, water, forest and wildlife resources
- To protect restore and enhance groundwater quantity and quality
- To minimize the threat to life and the destruction of property and natural resources from flooding and preserve or re-establish natural flood plain hydrologic functions

iv. Mill Creek Subwatershed Plan 1996 Objectives:

- Maintain existing recharge and discharge characteristics
- Control sediment discharges and provide erosion control during development
- Ensure appropriate water quality control measures are in place following development
- Maintain/reduce existing erosion rates following development
- Maintain/enhance cold-water fisheries' potential as subwatershed creeks
- Protect natural area functions/features from development
- Enhance natural area features and functions in long term
- Maintain infiltration, baseflow and discharge to natural features
- Minimize risk to life and property with future development
- Protect natural area functions/features from development
- Enhance natural area features and functions in long term

Governing Acts, Policies and Guidelines

As a complement to the overall process of establishing Secondary Plan Area scale goals, objectives, and targets, there also needs to be recognition/understanding of the context of the governing legislation with respect to resource management. Various acts, guidelines, and policies exist at a federal, provincial and municipal level to provide a framework for managing the impacts associated with land use change.

The following table provides a summary of the key legislative and policy documents that provide direction on drainage related matters applicable to subwatershed and secondary planning studies in the City of Guelph. In addition, there are supporting guidelines and decision-making systems to help implement a number of these Acts and policies, which are also included in the table.

Table 3.3.5. Summary of Acts, Guidelines, Policy Related to Drainage

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
Federal	Federal Fisheries Act	Act	Purpose is to manage threats to the sustainability and ongoing productivity of Canada’s commercial, recreational and Aboriginal fisheries.
Federal	Canadian Environmental Protection Act (CEPA)(1999)	Act	The goal of the Canadian Environmental Protection Act (CEPA) is to contribute to sustainable development through pollution prevention and to protect the environment, human life and health from the risks associated with toxic substances.
Federal	Canadian Environmental Assessment Act	Act	The Act requires federal departments, including Environment Canada, agencies, and crown corporations to conduct environmental assessments for proposed projects where the federal government is the proponent.
Federal	Canadian Water Quality Guidelines for the Protection of Aquatic Life	Guideline	The Canadian Water Quality Guidelines consist of a set of recommended “safe limits” for various polluting substances in raw (untreated) drinking water, recreational water, water used for agricultural and industrial purposes, and water supporting aquatic life. They are designed to protect and enhance the quality of water in Canada. The guidelines apply only to inland surface waters and groundwater and not to estuarine and marine waters.

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
Federal	Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses	Guideline	The Canadian Water Quality Guidelines consist of a set of recommended “safe limits” for various polluting substances in raw (untreated) drinking water, recreational water, water used for agricultural and industrial purposes, and water supporting aquatic life. They are designed to protect and enhance the quality of water in Canada. The guidelines apply only to inland surface waters and groundwater and not to estuarine and marine waters.
Federal	Guidelines for Canadian Drinking Water Quality	Guideline	To provide a national guideline for the protection of drinking water.
Federal	Guidelines for Canadian Recreational Water	Guideline	To provide a national guideline for the protection of recreational waters used for primary contact recreation such as swimming, windsurfing and water skiing and for secondary contact recreation activities including boating and fishing.
Federal	How Much Habitat is Enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern (2013, EC/CWS, OMNR, OME) (D)	Guideline	Initiated in 1990 as part of the federal Great Lakes Action Plan, the Cleanup Fund represents a significant part of Canada’s commitment to restore the Great Lakes Basin Ecosystem as outlined in the 1987 Protocol to the Great Lakes Water Quality Agreement between Canada and the United States (GLWQA).

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
Provincial	Endangered Species Act (2007)	Act	The purpose of this Act is to identify and protect species that are at risk and their habitat, and to promote recovery of the species, including stewardship activities to facilitate protection and recovery of the species.
Provincial	Nutrient Management Act (OMAF) (2002)	Act	As part of the Ontario government's Clean Water Strategy, the Nutrient Management Act provides for province-wide standards to address the effects of agricultural practices on the environment, especially as they relate to land-applied materials containing nutrients.
Provincial	Lakes and Rivers Improvement Act (1990)	Act	The Lakes and Rivers Improvement Act gives the Ministry of Natural Resources the mandate to manage water-related activities, particularly in the areas outside the jurisdiction of Conservation Authorities.
Provincial	Provincial Planning Act (1990)	Act	The purpose of this Act is to promote sustainable economic development in a healthy natural environment, as well as to provide a land use planning system led by Provincial Policy. The Act is intended to be interpreted according to the Provincial Policy Statement, which was last updated in 2020.

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
Provincial	Ontario Water Resources Act	Act	<p>The Ontario Water Resource Act deals with the powers and obligations of the Ontario Clean Water Agency, as well as an assigned provincial officer, who monitors and investigates any potential problems with regards to water quality or supply. There are also extensive sections on Wells, Water Works, and Sewage works involving their operation, creation and other aspects.</p>
Provincial	Clean Water Act, 2006		<p>The provincial Clean Water Act, 2006, established the need to protect Ontario’s existing and future drinking water sources as part of an overall commitment to safeguard human health and the environment. A key focus of the legislation is the preparation of locally-developed Source Protection Plans (SPP). The goal of each SPP is to eliminate and/or manage existing significant threats and to ensure no future drinking water threats become significant.</p> <p>According to the Act, Source Protection Plans must include:</p> <ul style="list-style-type: none"> - Policies and programs to eliminate and/or manage existing significant threats - Policies and programs to ensure no future activities become significant drinking water threats <p>These policies might include:</p>

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
			<ul style="list-style-type: none"> - Rules for activities in wellhead protection areas and intake protection zones, e.g., activities that will be allowed, with conditions (e.g., risk management plans) - Public education programs - Programs to promote best management practices for voluntary action
Provincial	Environmental Protection Act	Act	The purpose of this Act is to provide for the protection and conservation of the natural environment. R.S.O.1990, c.E.19, s.3.
Provincial	Fish and Wildlife Conservation Act (1997)	Act	Fish and Wildlife Conservation Act enables the Ministry of Natural Resources (MNR) to provide sound management of the province’s fish and wildlife.
Provincial	Safe Drinking Water Act (MOE) (2002)	Act	Its purpose is the protection of human health through the control and regulation of drinking-water systems and drinking-water testing.
Provincial	Threats Assessment	Regulation	(Section 1.1 of Ontario Regulation 287/07 Province identified 21 activities that are prescribed as drinking water threat activities. For water quantity vulnerable areas with a significant risk level, all existing and new water takings (prescribed drinking water threat #19) located within the areas that draw water from the municipal aquifers or Eramosa River or activities that reduce groundwater recharge (prescribed

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
			<p>drinking water threat #20) are classified as Significant Drinking Water Quantity Threats (significant threats)</p> <p>Recharge reduction is or would be a significant drinking water threat in WHPA-Qs and IPZ-Qs that are assigned a significant risk level.</p>
Provincial	Municipal Act	Act	The Municipal Act sets forth regulations in regard to the structuring of municipalities in Ontario.
Provincial	Ontario's New Drinking Water Protection Regulation for Smaller Waterworks Serving Designated Facilities O. Reg. 505/01	Regulation	The Regulation is Part of the New Drinking Water Regulations administered through the Ministry of the Environment.
Provincial	Ontario Drinking Water Protection Regulation	Regulation	In August 2000, the Government of Ontario announced a new Drinking Water Protection Regulation (Ontario Regulation 459/00) to ensure the safety of Ontario's drinking water. The regulation issued under the Ontario Water Resources Act was a part of the comprehensive Operation Clean Water action plan. This regulation put the Ontario Drinking Water Standards into law, updating and strengthening the Ontario Drinking Water Objectives.
Provincial	Bill 127, Ontario Water Resources Amendment Act	Act	The Bill amends the Ontario Water Resources Act in regard to the availability and conservation of Ontario

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
	(Water Source Protection), 2002		water resources. Specifically, the Bill requires the Director to consider the Ministry of Environment’s statement of environmental values when making any decision under the Act. The Bill also requires that municipalities and conservation authorities are notified of applications to take water that, if granted, may affect their water sources or supplies.
Provincial	Provincial Water Quality Objectives (MOE) (1994)	Guideline	To provide objectives for the protection of aquatic life.
Provincial	Natural Heritage Reference Manual for the Natural Heritage Policies of the Provincial Policy Statement (2010)	Guideline	Provides guidelines for the implementation of the natural heritage components of the PPS by planning authorities.
Provincial	Protection and Management of Aquatic Sediment Quality in Ontario (MOE 1993)	Guideline	The purpose of the sediment quality guideline is to protect the aquatic environment by setting safe levels for metals, nutrients and organic compounds.
Provincial	Guidelines for Evaluating Construction Activities Impacting on Water Resources (MOE 1995)	Guideline	These guidelines were developed to protect the receiving environment according to the physical, the chemical and the biological quality of the material being dredged.
Provincial	Incorporation of the Reasonable Use concept into MOE Groundwater	Guideline	This guideline establishes the basis for the reasonable use of groundwater on property adjacent

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
	Management Activities (1994)		to sources of contaminants and for determining the levels of contaminants acceptable to the ministry.
Provincial	Ontario Drinking Water Standards (MOE 2001)	Guideline	The purpose of the standards is to protect public health through the provision of safe drinking water.
Provincial	Technical Guideline for Private Wells: Water Supply Assessment (MOE 1996)	Guideline	Guidance manual for the development of private wells.
Provincial	Technical Guideline for On-site Sewage Systems (MOE)	Guideline	Guidance manual for assessing the proposed impacts on on-site sewage systems on groundwater.
Provincial	Subwatershed Planning (MOE 1993)	Guideline	Technical manual on conducting subwatershed planning in Ontario.
Provincial	Integrating Water Management Objectives into Municipal Planning Documents (MOE 1993)	Policy	Policy manual on the integration of watershed management practices into municipal planning documents.
Provincial	Watershed Management on a Watershed Basis (MOE 1993)	Guideline	Guideline manual on watershed management practices.
Provincial	Provincial Policy Statement (2014)	Policy	Provincial Policy Statement was issued under Section 3 of the Planning Act, came into effect on May 22, 1996 and was last updated in February 2020.

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
Provincial	Drainage Act	Act	Provides for the regulation of drainage practices in Ontario.
Provincial	Public Lands Act	Act	
Provincial	Environmental Bill of Rights (EBR)	Bill of Rights	On February 15, 1994, the Environmental Bill of Rights (EBR) took effect and the people of Ontario received an important new tool to help them protect and restore the natural environment. While the Government of Ontario retains the primary responsibility for environmental protection, the EBR provides every resident with formal rights to play a more effective role.
Provincial	Conservation Authorities Act (1990)	Act	Originally developed in 1946 in response to Hurricane Hazel flooding, the purpose of this Act is “to provide for the organization and delivery of programs and services that further the conservation, restoration, development and management of natural resources in watersheds in Ontario”. As stated in the legislation, “the objects of an authority are to provide, in the area over which it has jurisdiction, programs and services designed to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals”.

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
Municipal	City of Guelph Official Plan (1994, updated through OPA 39, 42 and 48)	Policy	The Official Plan is a statutory document under the Ontario Planning Act that sets out land use policy to guide future development and to manage growth. It provides a policy framework for Council decisions regarding the use of land, the provision of municipal services required to support growth, and the phasing of development.
Water Quantity Policy Development Study (In Progress)	Grand River Conservation Authority, City of Guelph, Guelph/Eramosa Township, Wellington Source Water Protection, Wellington County, Ministry of the Environment and Climate Change	Policies	For areas in WHPA-Q or IPZ-Q recharge reduction; lay out policy tools; Clean water policy tools include: education and outreach and incentive programs, to land use planning, prescribed instruments, and Part IV approaches, such as risk management plans, and prohibition.
Stormwater Management Master Plan 2012 (currently being updated) / Stormwater Management policy	City of Guelph	Policies	The SWM Master Plan explores, evaluates and identifies innovative approaches to manage stormwater runoff using low impact development and water sensitive urban design for both new construction and existing developed areas.

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
	City of Guelph Private Tree Protection By-law (2010-19058)	Regulation	Regulates the damage or destruction of any tree measuring at least 10 centimetres in diameter at 1.4 metres above the ground on lots larger than 0.2 hectares (0.5 acres). Some trees are exempt from the bylaw and can be removed without a permit including dead or dying trees, trees posing danger to life or property, or trees impacted by unforeseen causes or natural events. Please refer to the full list of exemptions in the by-law.
Conservation Authority	Ontario Regulation 150/06: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (last amended Feb. 8, 2013)	Regulation	Under the Conservation Authorities Act, Ontario Regulation 150/06 allows Conservation Authorities including the GRCA to prevent the loss of life, minimize property damage, prohibit or regulate development in or adjacent to shorelines, wetlands, floodplains, watercourses, valleys, dynamic beaches and hazard lands.
Conservation Authority	GRCA's Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (approved and effective Oct. 23, 2015)	Policy	In valleys and/or valley systems and stream corridors, to further its objectives relating to flooding and erosion, and the maintenance of <u>natural environmental integrity</u> , including the <u>conservation of land</u> . These are the policies, procedures and guidelines the GRCA uses for permit applications under Ontario Regulation 150/06. This document outlines the policies to be followed by the GRCA in making decisions regarding the outcome of all applications made under O. Reg. 150/06.

Level of Government	Name of Management Tool: Act/Regulation/Policy/ Guideline/Program	Type of Tool	Purpose
Conservation Authority	GRCA's Wetland Policy, 2003		The policy provides a comprehensive planning process to allow for appropriate studies to identify natural heritage form and functions and determine methods to minimize negative environmental impacts.

3.3.3 Future Requirements

Stormwater management will need to address the drainage impacts resulting from the updated Preferred Community Structure (ref. Figure 1.10). Based on the proposed land use, without mitigation, impacts to peak flows, runoff volumes and surface water and ground water quality would occur. The CEIS developed targets for surface water and ground water (ref. Table 3.3.6), based on existing drainage conditions and the goals and objectives documented in Section 3.3.2. Given hummocky terrain exhibited in the SPA, most surface water will infiltrate to the groundwater system, therefore groundwater targets are fully integrated and linked to surface water targets. Targets related to discharge, recharge and water budget with 'Work toward' indicated, are still to be achieved. Approval for not meeting a target, will only be provided when it has been adequately demonstrated that all efforts have been applied in trying to obtain the target, but for technical reasons the target has not been exactly met.

Table 3.3.6. Groundwater and Surface Water Goals, Objectives and Targets

System	Goals	Objectives	Targets
Groundwater	Groundwater of sufficient quantity and quality to support ecological functions, aquatic habitats, native fish communities and sustainable human needs, including drinking water, agricultural, industrial, and commercial uses.	<ol style="list-style-type: none"> 1. Protect, Restore and enhance groundwater recharge and discharge. 2. Protect, restore and enhance groundwater quality. 3. Ensure sustainable rates of groundwater use. 	<ol style="list-style-type: none"> 1. Work toward maintaining pre-development groundwater recharge and groundwater discharge. 2. Provide stormwater quality treatment for infiltrated surface water. 3. Work toward maintaining pre-development groundwater recharge to support groundwater supply function of local aquifers.
Surface Water	<p>Surface waters of a quality, volume and naturally variable rate of flow to:</p> <ul style="list-style-type: none"> • Protect aquatic and terrestrial life and ecological functions; • Protect human life and property from risks due to flooding; • Protect and contribute to the local groundwater system within Guelph, and the domestic drinking water source; • Support sustainable agricultural, industrial, 	<ol style="list-style-type: none"> 1. Protect and restore the natural variability of infiltration to significant depressional features (or surrogates). 2. Maintain and restore natural levels of baseflow 3. Maintain surface and groundwater flows to terrestrial features. 4. Eliminate or minimize risks to human life and property due to flooding and erosion. 5. Protect and restore surface water quality, with respect to toxic contaminants and other 	<ol style="list-style-type: none"> 1. Work toward maintaining pre-development water budget. 2. Work toward maintaining pre-development water budget 3. Work toward maintaining pre-development water budget 4. Provide post-to-pre-development flood control for all events up to the Regional Storm event. 5. Meet or exceed stormwater quality control for future development in accordance with provincial (MECP – TSS based or updates to MECP Guidelines) standards, with the following

System	Goals	Objectives	Targets
	<p>and commercial water supply needs</p>	<p>pollutants, to ensure protection of aquatic life, ecological functions, human health, and water supply needs.</p>	<p>targets as per the Hanlon Creek Subwatershed Study:</p> <ul style="list-style-type: none"> - Chloride levels to average below 100 mg/l during non-runoff (dry weather) conditions. - Zinc levels to average at or below 0.7 mg/l - Total Phosphorus levels to average up to 0.1 mg/l during non-runoff (dry weather) conditions, - Nitrate levels of 5 mg/l (Tributary E) and 3 mg/l elsewhere. As the Clair-Maltby SPA is internally draining, 3 mg/l should apply - Dissolved Oxygen of 6 mg/l - Stream Temperature (downstream of Clair-Maltby) for Mill Creek to be below 20 °C and for Hanlon Creek to be below 24°C (based on monitoring stations temperature data), as such this temperature should be considered in developing the drainage and stormwater management systems.

3.3.4 Stormwater Management Alternatives

As part of Phase 2 of the Municipal Class EA process, a wide range, and types, of alternatives are typically developed and assessed to address the Problem Statement. Alternative stormwater management (SWM) solutions for Clair-Maltby have been advanced to consider all aspects of the environment - natural, social/cultural, and economic (also referred to as the "Triple Bottom Line"). The approach to identifying alternative SWM quantity and quality solutions to address the goals, objectives and targets cited in Section 3.3.3, has considered the Subwatershed level protection strategies derived through the CEIS, based on the areas natural and water-based resources. Stormwater management alternatives are listed in the following, including the "Do-Nothing" alternative which is required to be considered as per the Municipal Class EA process.

Alternative 1: Do-Nothing: No stormwater management would be implemented and any impacts resulting from the updated Preferred Community Structure would not be addressed.

Alternative 2: Source/ Conveyance Controls (Public lands): Stormwater management quantity and quality measures, comprised of low impact development (LID) best management practices (BMPs) would be implemented within public lands, including road right-of-ways and park lands.

Alternative 3: Source/ Conveyance Controls (Private lands): Stormwater management quantity and quality measures, comprised of low impact development (LID) best management practices (BMPs) would be implemented within privately owned lands (at-source, in predominantly residential land uses).

Alternative 4: Stormwater Capture Areas: End of pipe, dry detention areas, that capture and infiltrate the runoff volume associated with a Regional Storm – Hurricane Hazel, with potential overflow from the capture areas being conveyed either overland or piped to adjacent depression areas or public overland drainage routes.

Alternative 5: Combinations: Combinations of Alternatives 1-4.

3.3.5 Stormwater Management Assessment Criteria

In order to systematically evaluate the advantages and disadvantages of the alternatives cited above, it is necessary to develop meaningful criteria which reflect the considerations related to each of the potentially affected environments namely: natural, social/cultural, and economic environmental categories, with consideration of functional effectiveness (ref. Section 3.3.6). Direct and indirect impacts related to the specific criteria associated with each of these categories, have been further examined as part of the evaluation of alternatives.

Evaluation Criteria

The evaluation criteria have been used to assess each proposed alternative solution. The stormwater management alternatives have been assessed on the basis of evaluation criteria established specifically for the current study. As per the Municipal Environmental Assessment process, the selected criteria relate to the

consideration of potential impacts and opportunities generated by the alternatives within four distinct environments:

Table 3.3.7. Stormwater Management Alternatives Evaluation Criteria

Environment	Criteria
Natural Environment	Impacts or opportunities that an alternative may have related to the natural environment (i.e., fisheries, wildlife, water quality, etc.).
Social/Cultural Environment	Impacts or opportunities created by the alternative as related to the people and their current or historic relationship with the study area.
Economic Environment	Capital, operation and maintenance costs associated with an alternative, both in the short-term and long-term.
Functional (Technical) Environment	Considers the ability of the alternative to address the Problem Statement and how it may impact existing physical systems.

Within each environment, relevant and representative criteria have been considered for the evaluation. Each evaluation criterion has been assessed to ensure it is quantifiable and results in a meaningful comparison between the SWM alternatives. The detailed evaluation categories, criteria, factors and measures have been established to inherently encompass the Clair-Maltby Vision, Guiding Principles and objectives.

Table 3.3.8. Stormwater Management Alternatives Evaluation Factors

Component	Category	Evaluation Criteria	Factor	Potential Measure
Natural Environment	Water Quality	Water Chemistry and Temperature	Quality of water for fish and wildlife, recreation, or human use	Provincial Stormwater Guidelines and Water Quality Objectives (PWQO) and Stream Management Objectives
Natural Environment	Hydrology and Stormwater Management	Water Quantity	Environmental flows for recreation or wildlife	Flow rate (m ³ /s)
Natural Environment	Natural Heritage	Wildlife Habitat	Potential effects on wildlife due to changes in habitat	Area of impacted habitat in m ²
Natural Environment	Natural Heritage	Wetland Impacts ¹	Impacts to identified wetland areas	Area of impacted wetland in m ²
Natural Environment	Geology, Hydrogeology and Groundwater	Groundwater/Source Protection	Potential adverse effect on groundwater including groundwater discharge and recharge	Change in Annual Water Balance, Depth to Ground Water
Social/Cultural	Cultural Heritage and Archaeology	Archaeological Resources ¹	Potential adverse effects on archaeological resources	Extent of impact
Social/Cultural	Cultural Heritage and Archaeology	Cultural Heritage Resources ²	Potential adverse effects on cultural heritage resources	Extent of impact
Social/Cultural	Future Land Use and Growth Impacts	Impacts on Adjacent Properties	Potential adverse impacts to adjacent properties due to changes in water levels, construction of solutions etc.	Number of private or public properties

Component	Category	Evaluation Criteria	Factor	Potential Measure
Social/ Cultural	Hydraulics	Flooding - off-site	Impacts on flooding potential	Peak flows
Economic	NA	Capital Cost	Design and construction costs	Estimated cost (\$)
Economic	NA	Operation and Maintenance Cost	Asset management costs (lifecycle)	Estimated cost (\$)
Economic	NA	Utilities ^{2.}	Ability to minimize effects on existing and proposed utilities	Number and extent of potential impacts on utilities
Economic	NA	Property Acquisition	Amount of private property required to achieve solution	Area in ha
Technical	NA	Stormwater Management	Ability to achieve SWM standards	Stormwater quantity, quality and water balance measure requirements
Technical	NA	Hydrology	Control of runoff	Stormwater quantity measures
Technical	NA	Constructability	The degree of ability to construct the improvements in a simple and cost-effective manner	Duration/ cost
Technical	NA	Community Resilience and Sustainability	Ability of the solution to have resilience for climate change impacts	Excess Capacity beyond standard design requirements

1. Combined into a single criterion due to common potential for impacts (spatially).

2. More related to detailed design versus planning stages thus removed from assessment.

Each of the stormwater management alternatives has been assessed using the evaluation categories, criteria and factors provided within Table 3.3.7. The following has been noted regarding the various alternatives under consideration:

Alternative 1: Do-Nothing: The Do-Nothing alternative for stormwater management would provide no mitigation of urban development impacts to the natural heritage system and water cycle/budget and offer no overall environmental benefits. The minor and major drainage systems would be expected to require more substantial designs given the lack of at source and/or conveyance controls (i.e. Low Impact Development Best Management Practices – LID BMPs). Although there would be no “direct” capital costs for stand-alone SWM infrastructure associated with this alternative, there would ultimately be costs related to addressing the impacts that would be expected to occur to the natural heritage system and surface/groundwater system. Furthermore, development in the Province of Ontario would be non-compliant if it proceeded without any form of stormwater management (ref. Clean Water Act, PPS and Growth Plan).

Alternative 2: Source/ Conveyance Controls (Public lands): LID BMPs implemented within public lands, including road right-of-ways and park lands (approximately 55% of the total LID BMPs, considering LID BMPs for both public and private lands), would provide low to moderate water quantity benefits and moderate to high water quality benefits, but would not be expected to address all development-related hydrologic and water quality impacts. LID BMPs within public lands would be more easily maintained due to ownership and accessibility.


























Alternative 3: Source/ Conveyance Controls (Private lands): This alternative is similar to Alternative 2 in the levels of attainable water quantity and water quality benefits, it could provide. LID BMPs located on private lands (approximately 45% of the total LID BMPs, considering LID BMPs for both public and private lands) would need to be maintained from time to time hence accessibility and landowner awareness will be required elements of an effective system-based design. Specifically, to maintain the function of the various LID BMPs, land title agreements (or equivalents) would require landowners to preserve the LID BMPs and would either require the landowner to be responsible for maintenance or the City would be responsible through a third party (agreed to by the City) to observe the state of the LID BMP and maintain the feature accordingly.































Alternative 4: Stormwater Capture Areas: These end of pipe, dry detention areas, would be designed to capture and infiltrate the runoff from the Regional Storm for both public and private lands. The facilities would require water quality pretreatment to preserve/enhance the infiltrative properties, which could be provided by various measures including CB Shields™ and/ or oil/grit chambers.

Alternative 5: Combinations: Strategic Combinations of Alternatives 2-4, can potentially offer improved performance when compared to the singular application of any of the other Alternatives considered.

The foregoing alternatives have been assessed using the criteria noted in Table 3.3.8 by applying positive, positive-neutral, negative-neutral and negative scores. Based on this assessment the preferred stormwater management alternative is a combination of source/ conveyance controls for both public and private lands and stormwater water capture areas (i.e. Alt 5).

Table 3.3.9. Assessment of Alternative Design Concepts - Stormwater Management

Component	Category	Evaluation Criteria	Factor	Measure	Alt 1 Score	Alternative 1: Do Nothing	Alt 2 Score	Alternative 2: Source / Conveyance Controls (Public Roads)	Alt 3 Score	Alternative 3: Source / Conveyance Controls (Private)	Alt 4 Score	Alternative 4: Stormwater Capture Areas	Alt 5 Score	Alternative 5: Combinations
Natural Environment	Water Quality	Water Quality and Temperature	Quality of Water for Fish and Wildlife, Recreation, or Human Use	Provincial Stormwater Guidelines and Water Quality Objectives (PWOQ) and stream management objectives		Moderate impacts to local area		Potential for recovered capacity		Potential for recovered capacity		Potential for recovered capacity		Potential for recovered capacity
Natural Environment	Hydrology and Stormwater Management	Water Quantity	Environmental flows for recreation or wildlife	Flow rate (cubic metres per second, m ³ /s)		Moderate impacts to local area		Minor benefit potential		Minor benefit potential		Moderate benefit potential		Moderate benefit potential
Natural Environment	Natural Heritage	Wildlife Habitat	Potential effects on wildlife due to changes in habitat	Area of impacted habitat (square metres, m ²)		Moderate impacts to local area		No direct change		No direct change		No direct change		No direct change
Natural Environment	Natural Heritage	Wetland Impacts	Impacts to identified wetland areas	Area of impacted wetland m ²		Moderate impacts to local area		Minor benefit potential		Minor benefit potential		Moderate benefit potential		Moderate benefit potential
Natural Environment	Geology, Hydrogeology and Groundwater	Groundwater / Source Protection	Potential adverse effect on groundwater and wells including groundwater discharge and recharge	Change in Annual Water Balance, Depth to Ground Water		Moderate impacts to local area		Minor water balance benefit		Minor water balance benefit		Moderate benefit potential		Moderate benefit potential

Component	Category	Evaluation Criteria	Factor	Measure	Alt 1 Score	Alternative 1: Do Nothing	Alt 2 Score	Alternative 2: Source / Conveyance Controls (Public Roads)	Alt 3 Score	Alternative 3: Source / Conveyance Controls (Private)	Alt 4 Score	Alternative 4: Stormwater Capture Areas	Alt 5 Score	Alternative 5: Combinations
Social/Cultural	Cultural Heritage and Archaeology	Archaeological and Cultural Heritage Resources	Potential adverse effects on archaeological and cultural heritage resources	Extent of impact		No direct impact		No direct impact (right-of-way)		No direct impact (developing land base)		Minor potential		Minor potential
Social/Cultural	Future Land Use and Growth Impacts	Impacts on Adjacent Properties	Changes to properties resulting from changes to water levels, construction of alternatives, etc.	Private and public properties (number of)		Moderate impacts to local area		None will occur in road right-of-ways		Minor impacts to private property		Minor impacts to local area		Minor impacts to private property
Social/Cultural	Hydraulics	Flooding - off-site	Impacts on flood potential	Peak Flows		No potential to address off-site flood risk		Potentially addresses off-site flood risk		Potentially addresses off-site flood risk		Potentially addresses off-site flood risk		Addresses off-site flood risk
Economic		Capital Cost	Design and construction costs	Estimated cost (\$)		No capital cost		Public cost at time of road works		Private cost at time of redevelopment		Standalone capital cost		Public, Private and Standalone capital cost
Economic		Maintenance Cost	Asset management costs (Lifecycle)	Estimated cost (\$)		No capital cost		City responsibility		Private responsibility		City responsibility		Private and City Responsibility
Economic		Property Acquisition	Amount of private property required to achieve solution	Area (hectares, ha)		No property acquisition		Within road right-of-way. Land costs for right-of-way		Within institutional lands. Cost for developers.		Land dedicated as part of SWM Block. Cost for developers		Combination of land provisions

Component	Category	Evaluation Criteria	Factor	Measure	Alt 1 Score	Alternative 1: Do Nothing	Alt 2 Score	Alternative 2: Source / Conveyance Controls (Public Roads)	Alt 3 Score	Alternative 3: Source / Conveyance Controls (Private)	Alt 4 Score	Alternative 4: Stormwater Capture Areas	Alt 5 Score	Alternative 5: Combinations
Technical		Stormwater Management	Ability to achieve stormwater management standards	To be determined		No potential to address stormwater management		Likely only partially effective. Requires other stormwater management measures		Likely only partially effective. Requires other stormwater management measures		Likely only partially effective. Requires other stormwater management measures		Meets Provincial Guidelines
Technical		Constructability	The ability to construct the improvements in a simple and cost effective manner	Duration / cost		No construction		Integrated into proposed roads and infrastructure		Constructed as part of new development		Constructed as part of new development		Constructed as part of new development
Technical		Community Resilience and Sustainability	Ability of the solution to mitigate climate change impacts	To be determined		No ability to mitigate climate change impacts		Recovers system capacity		Recovers system capacity		Recovers system capacity		Maximum ability to mitigate climate change impacts
Summary						Not Preferred		Preferred		Preferred		Preferred		Preferred and Selected

Score Legend

	Negative
	Negative-Neutral
	Positive-Neutral
	Positive

3.3.6 Preferred Stormwater Management Solution(s)

The preferred stormwater management alternative based on an assessment of the various criteria associated with the respective environments considered is Alternative 5: Combination of Alternatives, including at source/ conveyance controls located on both public and private property and Stormwater capture Stormwater capture Areas (SWCA) that will receive the residual drainage after source and conveyance controls to provide at-source infiltration of either clean drainage or pre-treated drainage. Alternative 5 provides a sustainable approach by using a distributed approach for LID BMPs within the land use fabric, with the objective of providing water quality control, contributing to the water balance requirement and reducing frequent discharge to the SWCAs. Innovation can be applied through a collective suite of LID BMPs, that will be determined through the design process. The following sections provide further details on the technical assessment of the preferred stormwater management alternatives.

3.3.6.1 Grading

To develop the preferred stormwater management alternative, a conceptual grading plan (ref. Figures 3.3.2 and 3.3.5) has been developed with the objective of largely maintaining and preserving existing drainage areas and patterns. The proposed conceptual grading has considered the existing subwatershed boundaries, drainage areas to NHS features, significant depressional features and the limitations of development grading (e.g. road slopes).

3.3.6.2 Hydrology

The validated PCSWMM existing condition hydrologic model prepared for the Phase 1 and 2 Characterization Report as part of the CEIS and the future condition hydrologic model provide the base models from which to assess the Preferred Community Structure. In order to develop a preliminary drainage area plan, the existing land use drainage boundaries and depressional features have been overlaid on the Preferred Community Structure (ref. Figure 3.3.1) and then proposed drainage boundaries have been established premised on the conceptual grading (ref. Figure 3.3.2).

The SWCAs have been located and sized to capture the Regional Storm, Hurricane Hazel, hence the initial sizing or area of each of the proposed SWCA's has been approximated using 10 per cent of the contributing drainage area, which is within the industry's typical range of areas for stormwater management facilities capable of controlling the Regional Storm, based on Hurricane Hazel. Each SWCA has also been sized to provide a buffer of approximately 5 per cent to 10 per cent area to allow for consideration of maintenance and operation requirements and potential trails. The location for overflow relief systems for each SWCA and the associated outlet locations have been set, with the objective of maintaining the existing drainage patterns. It is important to emphasize that the relief systems would not be operative until extreme conditions, above the Regional Storm – Hurricane Hazel (285 mm).

The foregoing drainage details were used as a basis to revise the existing condition PCSWMM hydrologic model. The parameterization for the PCSWMM modelling impervious coverages for the proposed land uses within the SPA have been set as per Table 3.3.8 which reflects land use values for similar forms of development across Southern Ontario and Guelph. Notably, City staff and the Study Planning lead for the Secondary Plan were also engaged in a discussion regarding these coverages to ensure that they are supportive of industry values. Impervious coverages outside of the SPA have been maintained as per the values used in the CEIS - Phases 1 and 2 Characterization assessment. The impervious coverages represent the total impervious coverages and the percentage of the impervious coverages (indirect impervious coverage) routed over pervious areas such as landscaped lands. Indirect impervious coverages such as roof areas draining to grass areas result in less runoff as the grassed areas or landscaped areas are able to infiltrate some of the runoff from the impervious surface. The indirect impervious coverages have been determined through assessing various land uses within southern Ontario and typically drainage connections for impervious surfaces. The directly connected impervious coverages are the difference of the total impervious coverage minus the routed impervious coverage (indirect impervious coverage).

Soil parameterization, as per the existing conditions in the PCSWMM model, has also been maintained within and outside of the SPA. The depressional areas located within the NHS have been maintained, while the depressional areas partially within the NHS and the developing area have been adjusted accordingly, based on the future land use and conceptual grading plan. Drainage catchment slopes range from 1 per cent to 5 per cent based on existing and proposed grades within the SPA while respecting significant landform policies associated with the Natural Heritage System.

Table 3.3.10. Proposed Land Use Impervious Coverages

Land Use Type	Total Imperviousness (%)	Routing Over Pervious (%)
Mixed Use	88	0
Office Commercial	85	0
Neighborhood Commercial	85	0
Service Commercial	85	0
School	65	40
High-density Residential	80	0
Medium density Residential	70	30
Low-density Residential	65	40
ROW (Local/Collector)	65	0
ROW(Arterial)	75	0

Land Use Type	Total Imperviousness (%)	Routing Over Pervious (%)
Park (neighborhood)	20	25
Open Space	10	100
Natural Heritage	5	100
SWM	10	100

The PCSWMM hydrologic model, based on the foregoing parameter assumptions, has been developed accordingly for the impact assessment.

Stormwater Capture Areas (SWCA) and Low Impact Development Best Management Practices (LID BMPs) Sizing

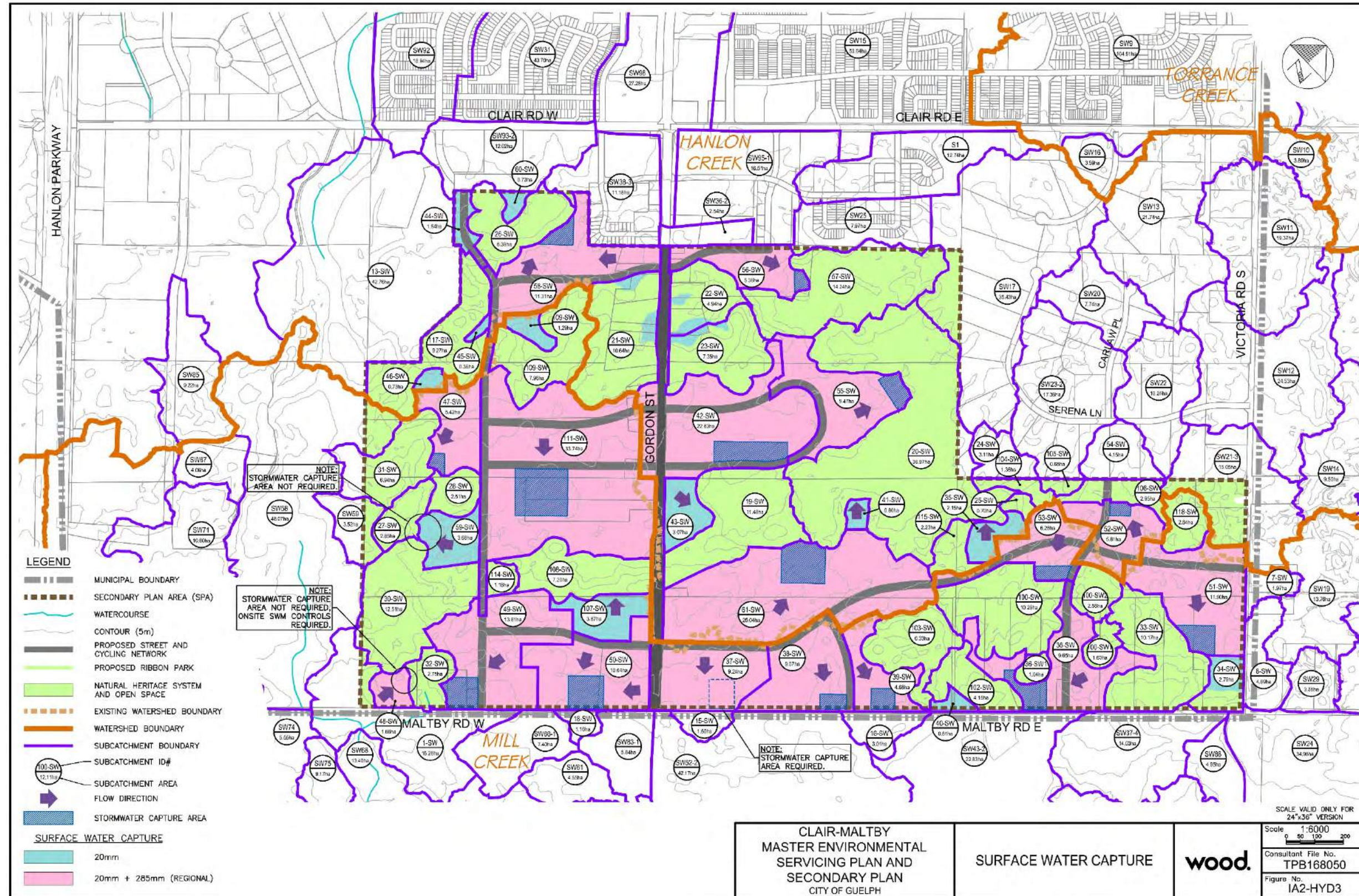
In establishing stormwater capture stormwater capture areas and low impact development (LID) best management practices (BMPs), replication of the function of significant number of existing depressional features on the landscape had to be considered. The most significant of these depressional areas (i.e., those with 300 mm + of runoff capture) became the primary focus to replicate existing drainage patterns and water balance conditions within the Clair-Maltby SPA, since the smaller features tended to overflow more frequently into the adjacent larger systems noted. The resulting stormwater management approach has considered the following:

- 20 mm capture via LID BMPs to replicate the function of the numerous small depressional areas within the SPA and to provide for stormwater quality management, contribute to the water balance target and provide quantity control prior to drainage being conveyed to the SWCAs.. The 20 mm capture would apply to all new development areas, including public, private properties and roads based on total impervious coverage (ref. Figure 3.3.4). Note: the CEIS reporting discusses the iterative approach to establishing the optimum capture.
- For small development areas (typically less than 5 ha), drainage catchments which are either internally draining within Clair-Maltby to other larger depressional features or are draining directly to significant depressional (>300 mm capture) features immediately next to the Clair-Maltby boundary, capture of 20 mm would be required for water quality treatment and water budget objectives. For development areas less than 5 ha, that are discharging to Maltby Road providing capture and storage up to the Regional Storm (Regulatory) event is required to maintain peak flows to external private lands.
- For all other remaining development areas (typically more than 5 ha), full capture of the Regional Storm (285 mm) will be required in addition to the 20 mm capture through distributed LID BMPs.
- The stormwater capture stormwater capture areas (SWCA) are proposed to have a 10 per cent buffer to allow for opration and maintenance requirements, trails and modifications during the design stage. allow . An overflow relief system will be required for each SWCA and it will be designed to function after the volumetric buffer has been used, Depending on location of the SWCA it would

discharge drainage to the adjacent NHS and be sited to maintain existing drainage patterns. Adding 10 per cent volume to the Regional Storm, will ensure extreme events resulting from climate change would be managed.

- For the Community Park, located adjacent to Halls Pond, distributed LID BMPs are to capture the 100 year storm event. The distributed LID BMPs are to replace a 100 year stormwater capture area, which would have been required for the park draining to Halls Pond. The rationale for using LID BMPs versus a SWCA is to prevent groundwater mounding and increases in the average Halls Pond water level. The detailed Halls Pond Assessment has been provided in Appendix F. Stormwater management requirements for drainage in Subcatchments S-42, S-55, and S-61 have been updated as per the recommendations and requirements of Appendix F. Figure 3.3.4 indicates SWCAs in the Community Park area prior to the Community Park being approved, as such reference Appendix F for the revised SWCAs locations in this area.

Figure 3.3.4. Proposed Stormwater captureStormwater capture Criteria



Each of the stormwater capture stormwater capture areas (SWCAs) has been modelled using PCSWMM applying a depth/area/discharge rating curve based on a maximum operating depth of 2.5 m to the invert of the relief system. The relief system elevations have been established by matching grades at the receiving drainage system (i.e. depressional feature) to allow for positive drainage.

The distributed 20 mm capture for impervious surfaces for each drainage catchment has been modelled using a storage element that uses the existing soil conditions and allows for evaporation, thus replicating at surface LID BMPs.

Table 3.3.11 provides a summary of the stormwater capture stormwater capture areas for Regional Storm capture. Drainage areas (catchments) are depicted on Figure 3.3.4. The SWCA Top Area / Drainage Area ratio ranges from 8 per cent to 11 per cent, which is within the industry upper range for stormwater management facility sizing. Table 3.3.12 provides the unitary volumetric storage (m³/impervious hectare) for the SWCAs for the 25 year, 100 year and Regional Storm events. Volumetric requirements for each storm event are within typical industry expected ranges.

Table 3.3.11. Summary of Stormwater capture Stormwater capture Areas

Drainage Catchment	Drainage Area (ha)	Imperviousness Coverage (%)	Top Area (ha)	Top Area / Drainage Area	Volume Provided (m ³)	Sizing Event
38_SW	9.07	62.5	0.80	9 per cent	13160	Regional
48_SW	1.66	65.0	Onsite Control	NA	3309	Regional
36_SW	9.65	54.9	1.08	11%	14966	Regional
39_SW	4.68	60.2	0.51	11%	6951	Regional
42_SW	22.53	65.9	2.01	9%	35594	Regional
47_SW	5.42	63.3	0.58	11%	7940	Regional
49_SW	13.81	61.4	1.20	9%	21109	Regional
50_SW	10.64	58.8	1.05	10%	17294	Regional
51_SW	11.90	61.5	1.13	10%	17757	Regional
52_SW	5.81	64.3	0.60	10%	8789	Regional
53_SW	6.28	55.5	0.66	11%	8729	Regional
55_SW ₁	9.47	60.2	1.01	11%	14896	Regional
56_SW	5.45	58.9	0.60	11%	7728	Regional

Drainage Catchment	Drainage Area (ha)	Imperviousness Coverage (%)	Top Area (ha)	Top Area / Drainage Area	Volume Provided (m ³)	Sizing Event
58_SW	11.31	61.8	1.14	10%	17525	Regional
61_SW	25.04	60.4	2.27	9%	41287	Regional
111_SW	33.74	57.1	3.02	9%	53383	Regional
37_SW	9.24	65.0	0.92	10%	14727	Regional

1. SWCA 55-SW has been removed based on the Final Preferred Community Structure Plan (ref. Appendix F)

Figure 3.3.5. Preliminary Stormwater Management and Conceptual Grading Plan

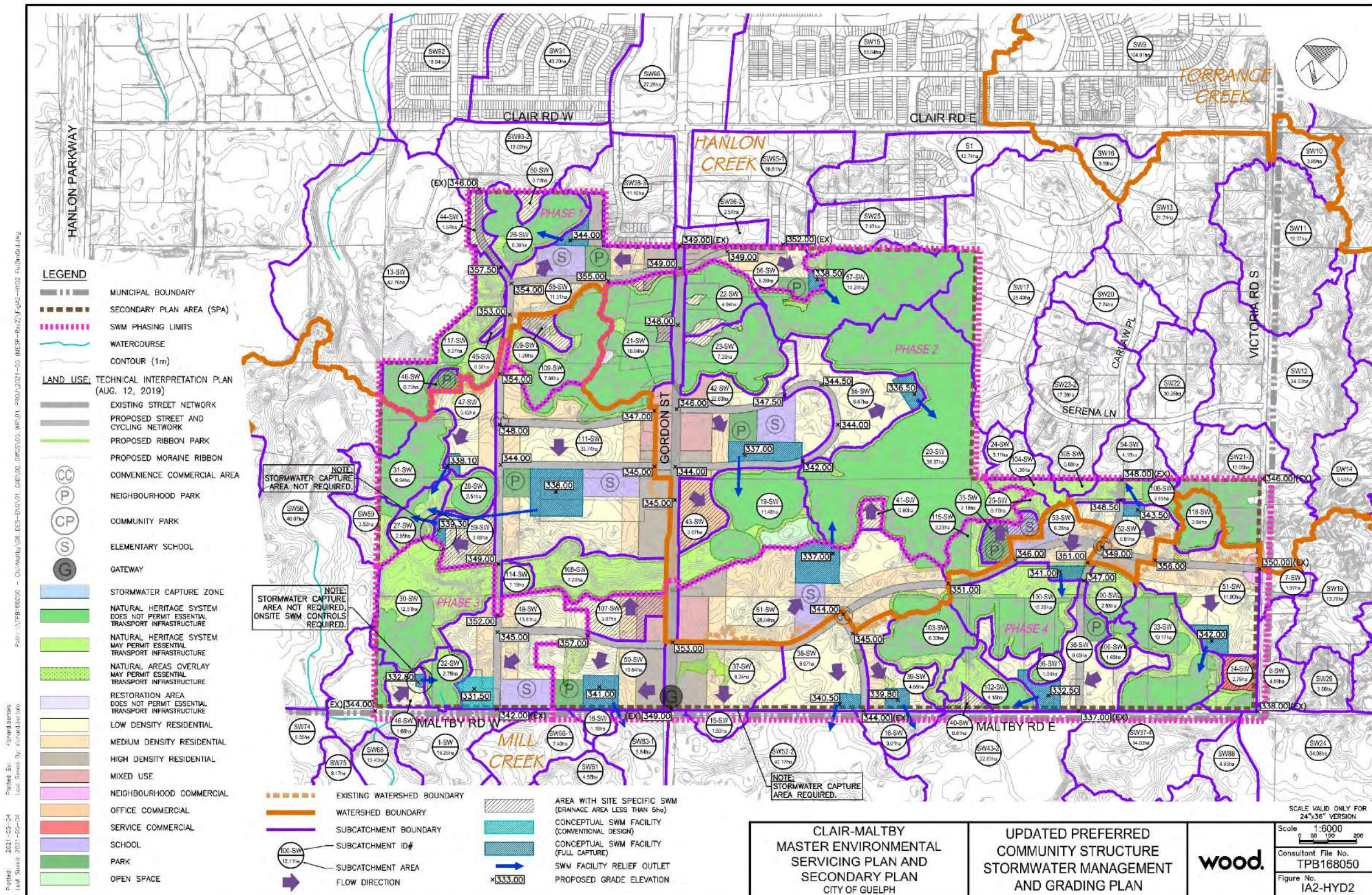


Table 3.3.12. Stormwater captureStormwater capture Areas Volumetric Requirements

Drainage Catchment	Drainage Area (ha)	Sizing Event	Volume Provided (m ³)	25 Year Maximum Vol. (m ³)	25 Year Unitary Vol (m ³ /imp.ha)	100 Year Maximum Vol. (m ³)	100 Year Unitary Vol (m ³ /imp.ha)	Regional Storm Maximum Vol. (m ³)	Regional Storm Unitary Vol (m ³ /imp.ha)
38_SW	9.07	Regional	13,160	2,726	481	4,265	752	11,640	2,053
48_SW	1.66	Regional	3,309	635.8	590	946.8	879	2,962	2,748
36_SW	9.65	Regional	14,966	2,794	528	4,395	830	11,370	2,147
39_SW	4.68	Regional	6,951	1,389	493	2,171	771	5,754	2,043
42_SW	22.53	Regional	35,594	7,003	472	10,820	729	30,960	2,085
47_SW	5.42	Regional	7,940	1,641	478	2,552	744	6,889	2,007
49_SW	13.81	Regional	21,109	4,113	485	6,448	760	17,330	2,044
50_SW	10.64	Regional	17,294	3,149	504	4,926	788	13,290	2,126
51_SW	11.90	Regional	17,757	3,545	484	5,560	760	14,940	2,042
52_SW	5.81	Regional	8,789	1,790	479	2,766	741	7,705	2,063
53_SW	6.28	Regional	8,729	1,857	532	2,898	831	7,567	2,170
55_SW	9.47	Regional	14,896	2,803	492	4,398	771	11,680	2,049
56_SW	5.45	Regional	7,728	1,604	499	2,501	779	6,838	2,129
58_SW	11.31	Regional	17,525	3,421	489	5,322	761	14,800	2,117
61_SW	25.04	Regional	41,287	7,267	480	11,500	760	30,740	2,031
111_SW	33.74	Regional	53,383	9,738	505	15,360	797	40,710	2,111
37_SW	9.24	Regional	14,727	2,835	472	4,393	732	12,390	2,064

1. SWCA 55_SW has been removed based on the Final Preferred Community Structure Plan

Frequency and Design Event Peak Flows

The PCSWMM hydrologic model representative of the updated Preferred Community Structure and the recommended 20 mm source capture and stormwater capture stormwater capture areas, has been executed for the 67 year continuous period (1950-2017) as per the CEIS. The hydrologic model has been used to determine frequency flows at the Hanlon Creek and Mill Creek flow monitoring sites.

Frequency analyses using Consolidated Frequency Analysis (CFA) have been completed using the Log Pearson Type III Distribution providing the best fit to the annual maximum peak flows. Frequency flows for both flow monitoring locations have been provided in Tables 3.3.13 and 3.3.14. Frequency flows for the proposed future land use condition are comparable to those for the existing land use condition.

In addition to frequency flows calculated with continuous simulation, peak flows for the proposed future land use condition have also been determined using the City of Guelph 3 hour Chicago design storms for the 2 to 100 year storm events, along with the Regional Storm (Hurricane Hazel), with peak flows provided within Tables 3.1.15 and 3.1.16. The future land use condition design event peak flows are also comparable to those of the existing land use condition, similarly calculated using design storm methodology. Both the future frequency and design event peak flows are comparable to the existing land use condition and are considered to be acceptable, based on little to no impact compared to existing conditions, thus demonstrating the effectiveness of the proposed SWM system. Frequency and peak flows are representative of the Updated Preferred Community Structure and Final Preferred Community Structure. Frequency flows are based on historical rainfall data and determining peak flows based on the frequency of occurrence. Frequency flows are considered to be more accurate than flows determined using synthetic storm equations (design storms) based on using actual rainfall data. Peak flows resulting from using design storms are considered to be conservative and are used for storm infrastructure design

Table 3.3.13. Hanlon Creek Monitoring Site (Station 15) Frequency Flows for Existing and Proposed Land Use Conditions (m³/s)

Land Use Condition	Return Period 1.003	Return Period 1.05	Return Period 1.25	Return Period 2	Return Period 5	Return Period 10	Return Period 20	Return Period 50	Return Period 100
Existing	0.008	0.036	0.100	0.250	0.530	0.760	0.990	1.310	1.550
Future	0.009	0.036	0.095	0.230	0.490	0.710	0.940	1.260	1.520
Difference	0.001	0.000	-0.005	-0.020	-0.040	-0.050	-0.050	-0.050	-0.030

Table 3.3.14. Mill Creek Monitoring Site (Station 14) Frequency Flows for Existing and Proposed Land Use Conditions (m³/s)

Land Use Condition	Return Period 1.003	Return Period 1.05	Return Period 1.25	Return Period 2	Return Period 5	Return Period 10	Return Period 20	Return Period 50	Return Period 100
Existing	0.035	0.038	0.039	0.045	0.069	0.100	0.160	0.290	0.480
Future	0.035	0.038	0.039	0.045	0.069	0.100	0.160	0.290	0.480
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 3.3.15. Hanlon Creek Monitoring Site (Station 15) Design Event Peak Flows for Existing and Proposed Land Use Conditions (m³/s)

Land Use Condition	Return Period 2	Return Period 5	Return Period 10	Return Period 25	Return Period 50	Return Period 100	Return Period Regional
Existing	0.501	0.667	0.697	0.714	0.723	0.740	0.819
Future	0.453	0.662	0.693	0.710	0.722	0.739	0.811
Difference	-0.048	-0.005	-0.004	-0.004	-0.001	-0.001	-0.008

Table 3.3.16. Mill Creek Monitoring Site (Station 14) Design Event Peak Flows for Existing and Proposed Land Use Conditions (m³/s)

Land Use Condition	Return Period 2	Return Period 5	Return Period 10	Return Period 25	Return Period 50	Return Period 100	Return Period Regional
Existing	0.039	0.060	0.076	0.324	1.371	2.801	4.747
Future	0.039	0.060	0.076	0.324	1.369	2.798	4.747
Difference	0.000	0.000	0.000	0.000	0.002	0.003	0.000

Water Balance

In addition to determining frequency flows and design event peak flows at the two monitoring locations, the 1950-2017 climate data set has been used to establish an annual water balance (surface water-based modelling) within the Clair-Maltby SPA and to the monitoring locations (flow and spot flow) within the Clair-Maltby Secondary Study Area (SSA) (ref. Figure 3.3.2). An annual water balance assessment has been conducted for each subwatershed based on the subcatchments contributing to the monitoring locations within Mill Creek, and Hanlon Creek for the Preferred Community Structure, with the results compared to the existing land use condition. To provide flexibility in the stormwater management capture area designs and to facilitate infiltration to maintain water balance, pervious land uses (i.e. parks, schools and stormwater capture areas) have been planned to be grouped together (ref. Appendix C). The mean values for the annual water balance are provided in Tables 3.3.17 to 3.3.18, with detailed results provided in Appendix C.

As noted earlier, the PCSWMM hydrologic modelling methodology determines annual evaporation conditions using pan-evaporation and temperature data series sets. The evaporation does not include transpiration from vegetation, as such the transpiration is inherently included with infiltration, as the drainage that is infiltrated within the vegetation root zone would also be available for transpiration.

Baseflow within the PCSWMM hydrologic model is a continuous discharge in Clair-Maltby, and it represents groundwater discharge. Outflow represents baseflow and any other overland runoff response.

Based on a comparison of the water balance for the existing and future land use conditions, on a subwatershed basis, the total amount of drainage available for infiltration and transpiration is primarily maintained (i.e. no let loss) using the proposed stormwater management approach, including a distributed 20 mm capture and the proposed stormwater capture stormwater capture areas. For Hanlon Creek with a drainage area of 821.37 ha, the 0.36 mm annual infiltration/transpiration deficit is equivalent to 2957m³ or 0.04 per cent of the annual infiltration/transpiration volume. For Mills Creek with a drainage area of 1019.87 ha the 1.26 mm annual infiltration/ transpiration deficit is equivalent to 12,850 m³ or 0.15 per cent of the annual infiltration/transpiration volume.

Table 3.3.17. Hanlon Subwatershed Annual Water Balance Summary for Existing and Future Land Use Conditions (mm)

Land Use Condition	Precipitation	Infiltration/ Transpiration	Evaporation	Discharge/ Runoff
Existing	856.46	842.98	26.94	0.39
Proposed	856.46	840.62	31.38	0.31

Table 3.3.18. Mill Creek Subwatershed Annual Water Balance Summary for Existing and Future Land Use Conditions (mm)

Land Use Condition	Precipitation	Infiltration/ Transpiration	Evaporation	Discharge/ Runoff
Existing	856.46	843.18	11.95	9.69
Proposed	856.46	841.92	16.86	8.72

Notably, the locations of the SWCAs and the source control rate (20 mm), has been further assessed as input to the groundwater modelling (MIKE-SHE) to validate the movement of water through the system. The impacts of the future conditions’ scenario and effectiveness of the LID BMPs and other SWM measures has been assessed by comparison to the existing conditions for the period of 2003-2017 for the revised Community Structure (land use iteration 2). The 15-year simulation period employed (for iteration 2) provides additional insights on long term impacts compared to the shorter simulation used in iteration 1 (initial Community Structure).

The Secondary Study Area (SSA) simulated water budget provides an indication of potential impacts to regional surface water and groundwater flow systems and receptors in the Secondary Plan Area (SPA) and the Primary Study Area (PSA) (ref. Figure 1.3) in Hanlon, Mill and Torrance Creeks subcatchment areas. Existing conditions groundwater flow is simulated to be maintained in PCS future conditions, indicating that there is no simulated impact to regional groundwater flow in the bedrock or overburden. The predicted impacts of development when using 20 mm and 27 mm of depression storage were compared following the second iteration of the updated PCS. This comparison indicated that the predicted impacts were similar and that 20 mm of depression storage was similarly protective of groundwater function as 27 mm.

Within the SSA, evapotranspiration is reduced from simulated existing conditions by approximately 1 per cent. The reduction in evapotranspiration may contribute to the negligible increase in runoff (overland flow) in the SSA, and the 1 per cent increase in recharge observed for the SSA. The pre- and post-development SSA water balance (ref. Tables 3.3.19-3.3.20) is a basic indicator that future conditions are simulated to be protective of regional groundwater functions, for areas in the SSA.

The SPA simulated water budget (ref. Tables 3.3.21-3.3.24) provides an indication of changes in local surface and groundwater flow systems and potential impacts to receptors within the SPA and highlights. The most notable changes in the future conditions water budget are in evapotranspiration, overland flow and changes in groundwater flows out of the SPA into the PSA and SSA which demonstrate the dynamic response of the system to local changes.

Evapotranspiration in the SPA is reduced by 4 per cent overall representing the change from undeveloped or agricultural conditions that exist at present to predominantly residential land uses. When evaporation and transpiration losses

occurring in the subsurface are considered, neglecting ponded water evaporation at surface, the reduction of evapotranspiration is approximately 18 per cent. This reduction in evapotranspiration balances with the use of infiltration based LID BMPs and SWCAs to provide capture, results in an increase in recharge in the SPA (28 mm/year), (ref. Figures GW-7 to GW-9, Appendix C).

The increased recharge from the application of distributed LID BMPs results in small decreases in lateral groundwater inflow to the SPA from the east through the overburden and bedrock. While lateral groundwater outflow from the SPA increases by approximately 5 mm/year as a result of increased recharge. In contrast there are decreases in runoff/overland flow components into and out of the SPA. The decrease in runoff into and out of the SPA occurs across wetland areas that are cross-cut by the SPA boundary (a non-physical boundary). The net change in overland flow is a reduction of outflow of 3 mm/year from the SPA. The reduction of outflow predicted for the SPA is associated with the application of distributed LID BMPs and the routing of runoff in excess of LID BMPs capacity to the SWCAs for infiltration and recharge. These features serve to cause a small decrease of runoff from the SPA relative to existing conditions.

Seasonal analysis of the SPA water budget indicates that the transient behaviour of groundwater recharge in the area is maintained in future conditions, (ref. Figure 3.3.5). Peak groundwater recharge is predicted to occur in late winter/early spring in both existing and future conditions. An increase in recharge relative to existing conditions is predicted during the summer months and is associated with the LID BMPs promoting infiltration and recharge of precipitation events during this time. Evapotranspiration rates within the SPA are predicted to be reduced in future conditions relative to existing due to reductions in vegetation associated with development, (ref. Figure 3.3.6).

The water budgets for Halls, Halligan's and Neumann's Ponds subcatchments were simulated to maintain existing conditions under updated PCS Future conditions within the catchments local to these features. However, there are potentially increases in overland flow (runoff) to Halls and Neumann's ponds, as well as local increases in local water table elevation in proximity to Halls Pond (ref. Table 3.3.27).

The impact to ponded water levels was not identified in iteration 1 due to:

1. Focus on water balance (at the scale of SPA, subwatersheds and wetland catchments) and recharge as the metrics of impact and management
2. Shorter model simulation time (5 years vs current 15 year period) – i.e. change less evident
3. More generalized representation of SWCA in first iteration which has been refined in second iteration
4. Modelling Community Park Lands conservatively as urban/residential as per land use plan

The increased run-off and groundwater elevation changes for the Halls Pond Subcatchment results in a long term pond level increase of approximately 2 cm/year or 26 cm over the 2003-2017 period. Analysis of water budget data and predicted groundwater elevation change indicates that this change is primarily the

result of an increased local groundwater elevation resulting from concentrated recharge and increased soil saturation near the SWCAs which are in the vicinity of the Halls Pond Subcatchment. The localized increase in the water table reduces the rate of recharge (leakage) from the pond to the subsurface and thereby induces more lateral flow into the pond from subsurface. Additional overland runoff from adjacent development areas, which allows runoff to the NHS areas when LID BMPs capacity is exceeded, are thought to also contribute to local groundwater elevation increases, however their contribution is limited relative to the SWCA related changes.

For the Neumann's Pond subcatchment an increase in runoff to the subcatchment, results in pond levels increasing approximately 1 cm/year or 16 cm over the 2003-2017 period. Analysis of the water budget and groundwater elevation data indicates this is the result of overland runoff primarily. Increases in runoff are attributed to development grading near the catchments associated with these features where runoff has been directed to NHS features.

The possible management scenarios related to mitigating potential increases in ponded elevation include:

1. Move SWCAs to locations of thicker Unsaturated Zones; there are locations further south of Halls pond which would be less impactful however this would require a change to grading and the overall drainage plan for this area.
2. Reduce urban drainage areas contributing the SWCAs around Halls Pond. This should reduce the groundwater elevation increases associated with the SWCAs.
3. Adjust LID source control capture to greater than 20 mm. This will allow more water to recharge and or evapotranspire relative to the considered scenarios and reduce runoff to the SWCAs. This should also provide more diffuse recharge across the development areas which should reduce groundwater elevation increases around the SWCAs.
4. Increased evapotranspiration (street trees and plantings including Ribbon Park) in Halls Pond catchment areas. Increased evapotranspiration will mitigate some of the increases in recharge predicted which will in turn reduce groundwater elevation rise.
5. Model the Community Park explicitly in its currently proposed location. The replacing of developed areas with the Community Park would serve to reduce impervious areas and increase evapotranspiration. This in turn should reduce predicted groundwater elevations increases in this area.

No one mitigation alternative listed above is considered to be able to fully mitigate the predicted impact however it is considered likely that a strategic combination would be effective. To mitigate the impact to Halls Pond a detailed assessment has been conducted as per Appendix F. The results of the detailed assessment indicate that the predicted impact can be mitigated through a series of measures including the location of the community park, relocation of SWCAs and increased vegetation within a buffer strip adjacent to Halls Pond. The water balance results in Tables 3.3.25 and 3.3.26 reflect the modelling conducted for both the Updated and Final Community Structure Plans and the Halls Pond Assessment (ref. Appendix F).

Table 3.3.19. Water Budget for MIKE SHE Model Domain within Secondary Study Area (SSA) (Pre- and Post-Development); (2003-2017 in mm/year);

a) Existing Conditions

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow Overburden - Inflow	Lateral Groundwater Flow Overburden - Outflow	Lateral Groundwater Flow Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SSA	794	461	0	135	17	40	34	118	3	98	2	6

Explanation of Water budget terms:

Area – This is the region or catchment within which the inflows, outflows and change in storage of water are assessed for the period of the water budget.

Precipitation – This term represents rainfall or snowfall which falls within the catchment. Precipitation is an inflow of water to the catchment.

Evapotranspiration – This term represents water lost to evaporation and vegetation associated transpiration. Evapotranspiration is an outflow of water from the catchment.

Overland Flow In – This term represents water flowing as runoff or in channels which enters the catchment. This is an inflow of water to the catchment.

Overland Flow Out – This represents water flowing overland as runoff or in channels which exits catchment. This is an outflow of water from the catchment

Lateral groundwater Flow – These terms represent water flowing laterally through the overburden and bedrock units in the subsurface. Inflows represent water flowing into the catchment and outflows represent water flowing out of the catchment.

Vertical Groundwater Flow – These terms represent water flowing vertically across the regional bedrock aquifer unit in the subsurface. Inflows represent water flowing into catchment and outflows represent water flowing out of the catchment.

Pumping – This term represents water extracted from the catchment through groundwater pumping. Pumping represents an outflow of water from the catchment.

Change in storage – Throughout the catchment water is stored in various locations through time. Storage areas for water include storage on vegetation canopy, storage on the land surface (e.g. as ponds, lakes or wetlands) as water, and storage on the land surface as snow and finally storage in the subsurface material pores as groundwater.

**Table 3.3.20. Water Budget for MIKE SHE Model Domain within Secondary Study Area (SSA)
(Pre- and Post-Development); (2003-2017 in mm/year)**

b) Future Conditions

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow – Overburden - Inflow	Lateral Groundwater Flow – Overburden - Outflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SSA	794	458	0	135	17	40	34	119	3	100	2	6

*overland flow includes amounts discharging to Mill Creek at headwaters and is not strictly runoff but includes runoff and stream flow in the headwaters.

**Table 3.3.21. Water Budget for MIKE SHE Model Domain within Secondary Study Area (SSA) (Pre- and Post-Development)
(2003-2017 in mm/year);**

Recharge Summary

Area	Scenario	Recharge (mm/year)	Recharge Volume (m ³ /year)	Change (%)
SSA Model Domain	Existing Conditions	303	8.50E+06	N/A
SSA Model Domain	Future Conditions	306	8.59E+06	1%

*Recharge volume accounts for differing numbers of recharging cell locations in the model domain between scenarios.

**Table 3.3.22. Water Budget for MIKE SHE Model Domain within Secondary Plan Area (SPA)
(Pre- and Post-Development); (2003–2017 in mm/year)**

a) Existing Conditions

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow – Overburden - Inflow	Lateral Groundwater Flow – Overburden - Outflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SPA	794	493	5	9	5	28	42	197	2	132	2	12
Mill Creek in SPA	794	499	16	17	38	50	286	476	2	105	2	10
Hanlon Creek in SPA	794	491	1	5	6	34	39	179	2	143	2	13

**Table 3.3.23. Water Budget for MIKE SHE Model Domain within Secondary Plan Area (SPA)
(Pre- and Post-Development); (2003-2017 in mm/year)**

b) Future Conditions

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow – Overburden - Inflow	Lateral Groundwater Flow – Overburden - Outflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SPA	794	472	3	4	5	33	39	209	2	137	0	11
Mill Creek in SPA	794	465	18	9	37	65	283	499	2	109	0	12
Hanlon Creek in SPA	794	474	1	6	6	34	37	186	2	149	0	10

*overland flow includes amounts discharging to Mill Creek at headwaters and is not strictly runoff but includes runoff and stream flow in the headwaters.

**Table 3.3.24. Water Budget for MIKE SHE Model Domain within Secondary Plan Area (SPA) (Pre- and Post-Development)
(2003-2017 in mm/year);**

c) Recharge Summary

Area	Scenario	Recharge (mm/year)	Recharge Volume (m ³ /year)	Change (per cent)
SPA Model Domain	Existing Conditions	308	1.26E+06	N/A
SPA Model Domain	Future Conditions	336	1.37E+06	8 per cent

Table 3.3.25. Monthly Water Budget for MIKE SHE Model within Secondary Plan Area (SPA) – Existing Conditions (2003-2017 in mm/month)

Month	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Subsurface Inflow	Subsurface Outflow	Pumping	Change in Storage
1	49	2	0	0	4	32	0	18
2	43	3	0	0	4	28	0	15
3	47	7	0	1	4	30	0	14
4	70	33	-1	1	4	29	0	11
5	81	58	-1	1	4	30	0	-3
6	65	94	0	1	4	27	0	-53
7	81	103	-1	1	4	29	0	-47
8	81	96	-1	1	4	30	0	-42
9	69	60	0	1	4	28	0	-16
10	84	26	-1	1	4	31	0	30
11	68	7	0	1	4	31	0	34
12	57	3	0	0	4	31	0	27

**Table 3.3.26. Monthly Water Budget for MIKE SHE Model within Secondary Plan Area (SPA) –
Future Conditions
(2003-2017 in mm/month);**

Month	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Subsurface Inflow	Subsurface Outflow	Pumping	Change in Storage
1	49	3	0	0	4	34	0	15
2	43	3	0	0	4	30	0	13
3	47	9	0	0	4	32	0	11
4	70	37	0	1	4	30	0	7
5	81	59	0	0	4	31	0	-4
6	65	86	0	0	4	29	0	-45
7	81	90	0	0	4	31	0	-35
8	81	83	0	0	4	32	0	-31
9	69	57	0	0	3	31	0	-16
10	84	29	0	0	3	33	0	24
11	68	10	0	0	3	33	0	29
12	57	4	0	0	3	33	0	23

Figure 3.3.6. Mean Monthly Groundwater Recharge – Existing vs Future Conditions (2003-2017)

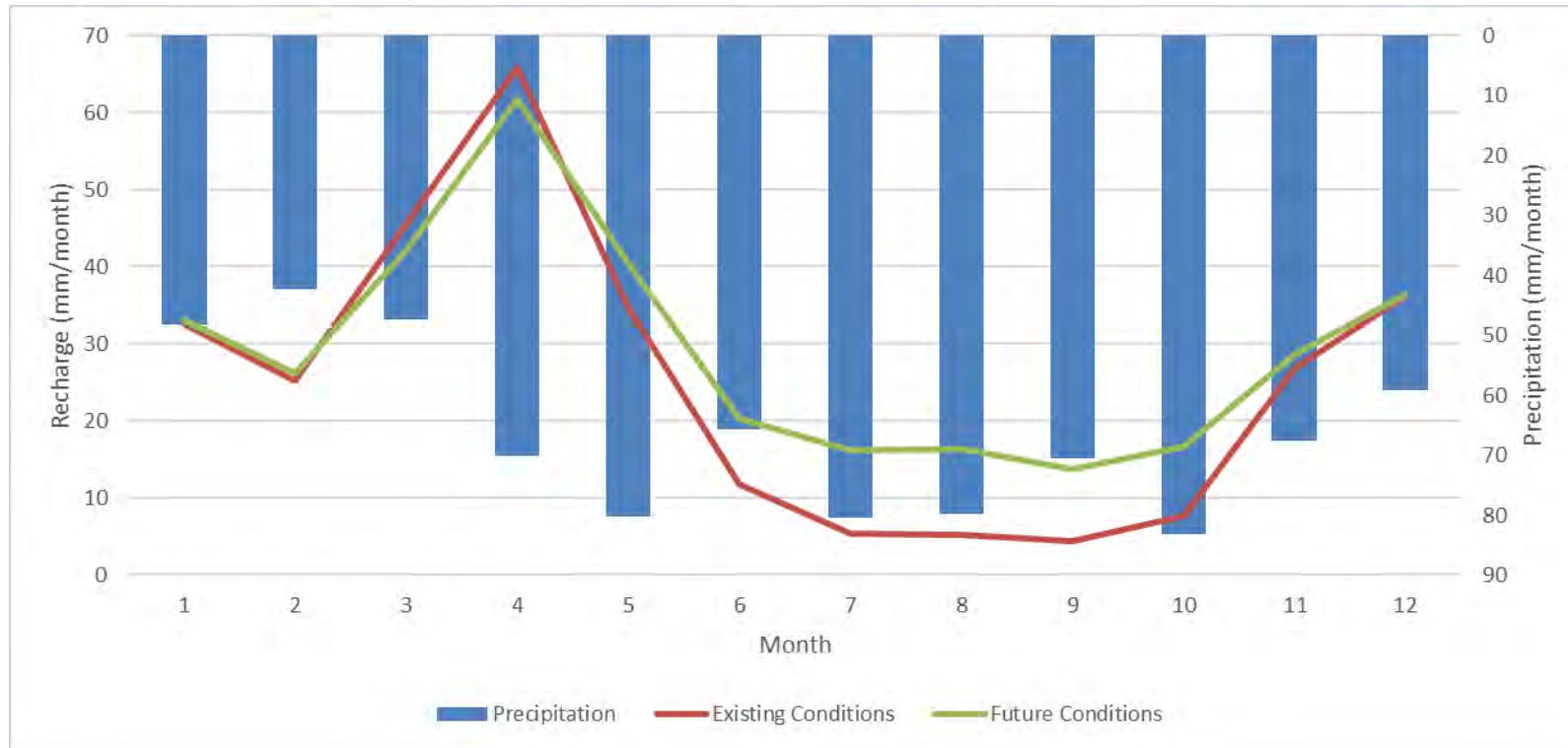


Figure 3.3.7. Mean Monthly Evapotranspiration – Existing vs Future Conditions (2003-2017)

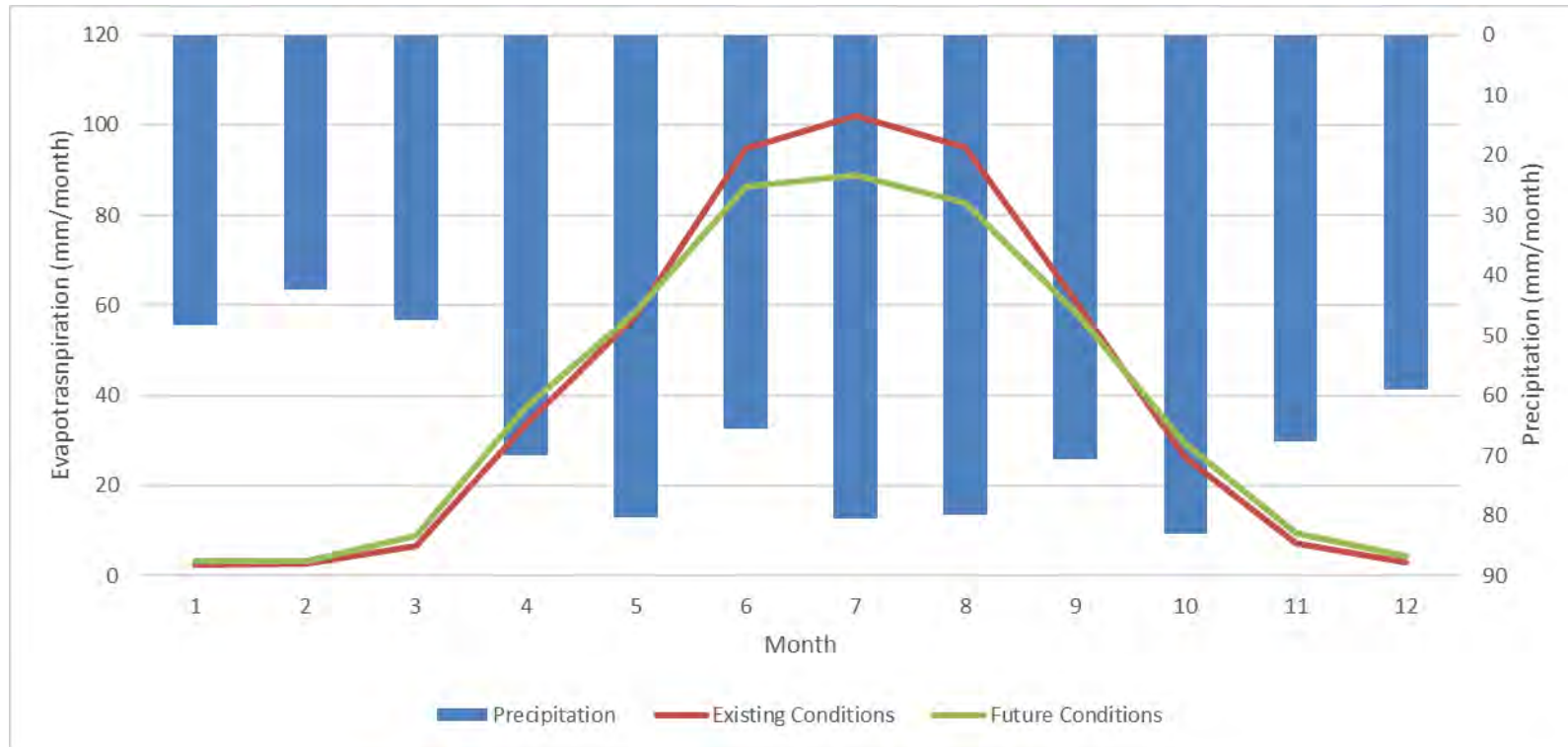


Table 3.3.27. Water Budget for MIKE SHE Model Domain for Halls, Halligan's and Neumann's Ponds (Pre- and Post-Development)

NHS Feature Water Balances – 2003-2017 (mm-year) - Subcatchment	Scenario	Precipitation	Evapotranspiration	Overland Net	Shallow GW (Layer 1) Net	Recharge	Storage Change
Halls Pond	Existing Conditions	794	-511	0	-1	-296	-14
Halls Pond	Future Land Use	794	-512	1	-1	-291	-9
Halls Pond	Future vs Existing	0	0	0	0	-5	5
Halligan's Pond	Existing Conditions	794	-493	21	-1	-281	40
Halligan's Pond	Future Land Use	794	-495	20	-1	-280	38
Halligan's Pond	Future vs Existing	0	2	-1	0	-1	-2
Neumann's Pond	Existing Conditions	794	-541	0	2	-266	-11
Neumann's Pond	Future Land Use	794	-547	11	3	-267	-7
Neumann's Pond	Future vs Existing	0	7	11	-1	1	4

Phase 3 Third Iteration Impact Assessment And Management

A third iteration of the Impact Assessment was conducted as part of the Halls Pond Water Level Uncertainty Analysis and Mitigation Measures assessment. Initially the PCS was revised to represent the newly approved Community Park, March 2020, and determine its effects on predicted water level increase at Halls Pond. A two phase assessment was then conducted to evaluate uncertainty in factors contributing to the pond level increases and to develop a management approach to mitigate these impacts and maintain the hydroperiod of Halls Pond. A revised PCS which implements a combination of mitigation and management measures developed through the second phase of the assessment and evaluated using the MIKE SHE model. The effectiveness of the revised PCS at mitigating impacts assessed by comparison to the existing conditions for the period of 2003-2017. The impacts of the revised PCS scenario were evaluated based on simulated changes to:

- Water budgets in the SSA, SPA and key NHS features in, and adjacent to, the SPA,
- Groundwater flow directions and depth to water table,
- Recharge to the water table, shallow and deep bedrock aquifers,
- Groundwater discharge to streams and wetlands,
- Average annual ponded water elevation in wetlands.

Water budgets for these comparisons are found in the following section and figures are found within the Groundwater Appendix of the Phase 3 CEIS Impact Assessment Report in the figures for these comparisons are included Appendix F:Halls Pond Assessment .

The revised PCS LID BMPs and SWCAs in combination with reductions in evapotranspiration due to decreased vegetation in future land uses, are predicted to result in maintenance or enhancement of recharge within the SPA. While localized increases and decreases in groundwater recharge to the water table are predicted within the SPA, the distributed detention storage in development areas and the additional capture capacity provided by the SWCAs are predicted to maintain or enhance recharge and maintain overall groundwater flow directions and recharge to shallow and deep bedrock aquifers, by infiltrating water as close to source as possible. By maintaining groundwater flow, gradients and linkages between recharge and discharge areas the revised PCS is predicted to maintain groundwater function within most of the study area. Further this revised PCS adequately mitigates the predicted water level increases at Halls Pond supporting the maintenance of existing pond hydroperiod and aquatic and terrestrial habitat in the vicinity of Halls Pond.

A management strategy identifying recommended measures to help avoid, minimize, and manage potential negative impacts to the NHS at the Secondary Plan is provided in detail in Appendix F. i. The principal elements of the management strategy are:

- Site specific studies: Impacts will need to be addressed as part of area or site specific studies undertaken as part of the implementation of the Secondary Plan. These studies should consider the functional insights provided in this report when designing site specific SWCA and source controls after confirming site specific conditions (e.g., infiltration capacities).
- Ongoing observation: Observation of surface water levels in key wetlands within the SPA (e.g., Halls Pond), and groundwater levels in the SPA and monitoring of ponding extent (using aerial imagery) is recommended to provide data to avoid, manage, or minimize potential impacts to the NHS.
- Implementation of the Revised PCS: Implementation of the revised PCS which relocates SWCAs to increase distance from Halls Pond, increases depth to groundwater at the SWCA locations and implements an enhanced vegetative buffer around Halls Pond.

Tables 3.3.28 to 3.3.35 represent results for the third iteration Impact Assessment.

Table 3.3.28. Water Budget for MIKE SHE Model Domain within Secondary Study Area (SSA) (Pre-Development); (2003-2017 in mm/year);

a) Existing Conditions (revised)

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow – Overburden - Inflow	Lateral Groundwater Flow – Overburden - Outflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SSA	794	460	0	135	17	40	34	118	3	99	2	7

Explanation of Water budget terms:

Area – This is the region or catchment within which the inflows, outflows and change in storage of water are assessed for the period of the water budget.

Precipitation – This term represents rainfall or snowfall which falls within the catchment. Precipitation is an inflow of water to the catchment.

Evapotranspiration – This term represents water lost to evaporation and vegetation associated transpiration. Evapotranspiration is an outflow of water from the catchment.

Overland Flow In – This term represents water flowing as runoff or in channels which enters the catchment. This is an inflow of water to the catchment.

Overland Flow Out – This represents water flowing overland as runoff or in channels which exits catchment. This is an outflow of water from the catchment

Lateral groundwater Flow – These terms represent water flowing laterally through the overburden and bedrock units in the subsurface. Inflows represent water flowing into the catchment and outflows represent water flowing out of the catchment.

Vertical Groundwater Flow – These terms represent water flowing vertically across the regional bedrock aquifer unit in the subsurface. Inflows represent water flowing into catchment and outflows represent water flowing out of the catchment.

Pumping – This term represents water extracted from the catchment through groundwater pumping. Pumping represents an outflow of water from the catchment.

Change in storage – Throughout the catchment water is stored in various locations through time. Storage areas for water include storage on vegetation canopy, storage on the land surface (e.g. as ponds, lakes or wetlands) as water, and storage on the land surface as snow and finally storage in the subsurface material pores as groundwater.

**Table 3.3.29. Water Budget for MIKE SHE Model Domain within Secondary Study Area (SSA)
(Post-Development); (2003-2017 in mm/year);**

a) Future Conditions

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow – Overburden - Inflow	Lateral Groundwater Flow – Overburden - Outflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SSA	794	454	0	136	17	40	33	120	3	102	2	6

*overland flow includes amounts discharging to Mill Creek at headwaters and is not strictly runoff but includes runoff and stream flow in the headwaters.

**Table 3.3.30. Water Budget for MIKE SHE Model Domain within Secondary Study Area (SSA)
(Pre- and Post-Development); (2003-2017 in mm/year);**

b) Recharge Summary

Area	Scenario	Recharge (mm/year)	Recharge Volume (m ³ /year) *	Change (per cent)
SSA Model Domain	Existing Conditions (revised)	309	8.50E+06	N/A
SSA Model Doman	Future Conditions (Final PCS)	319	8.70+06	3

*Recharge volume accounts for differing numbers of recharging cell locations in the model domain between scenarios.

**Table 3.3.31. Water Budget for MIKE SHE Model Domain within Secondary Plan Area (SPA)
(Pre- and Post-Development); (2003-2017 in mm/year);**

b) Existing Conditions (revised)

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow – Overburden - Inflow	Lateral Groundwater Flow – Overburden - Outflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SPA	794	492	5	9	5	41	28	198	2	132	2	12
Mill Creek in SPA	794	499	16	17	38	50	287	477	2	106	0	10
Hanlon Creek in SPA	794	490	1	5	6	34	39	180	2	144	2	13

**Table 3.3.31 Water Budget for MIKE SHE Model Domain within Secondary Plan Area (SPA) (Pre- and Post-Development)
(2003-2017 in mm/year);**

Future Conditions (Final PCS)

Area / Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow – Overburden - Inflow	Lateral Groundwater Flow – Overburden - Outflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Inflow	Lateral Groundwater Flow – Bedrock Above Vinemount - Outflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Inflow	Vertical Groundwater Flow Across Regional Bedrock Aquifer - Outflow	Pumping	Change in Storage
SPA	794	444	4	4	5	41	36	221	2	145	0	13
Mill Creek in SPA	794	437	24	9	42	85	289	522	2	115	0	15
Hanlon Creek in SPA	794	447	1	9	7	39	34	198	2	158	0	11

*overland flow includes amounts discharging to Mill Creek at headwaters and is not strictly runoff but includes runoff and stream flow in the headwaters.

**Table 3.3.32 Water Budget for MIKE SHE Model Domain within Secondary Plan Area (SPA) (Pre- and Post-Development)
(2003-2017 in mm/year);**

a) Recharge Summary

Area	Scenario	Recharge (mm/year)	Recharge Volume (m3/year)*	Change (%)
SPA Model Domain	Existing Conditions (revised)	311	1.26E+06	N/A
SPA Model Domain	Future Conditions (Final PCS)	394	1.49E+06	18

*Recharge volume accounts for differing numbers of recharging cell locations in the model domain between scenarios.

**3.3.33 Monthly Water Budget for MIKE SHE Model within Secondary Plan Area (SPA) (Pre- and Post-Development)
(2003-2017 in mm/month);**

Month	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Subsurface Inflow	Subsurface Outflow	Pumping	Change in Storage
1	49	2	0	0	4	32	0	18
2	43	3	0	0	4	29	0	15
3	47	7	0	0	4	30	0	14
4	70	33	1	1	4	29	0	11
5	81	58	1	1	4	30	0	-3
6	65	94	0	0	4	27	0	-53

Month	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Subsurface Inflow	Subsurface Outflow	Pumping	Change in Storage
7	81	103	1	1	4	29	0	-47
8	81	96	1	1	4	30	0	-42
9	69	60	0	0	4	29	0	-16
10	84	26	1	1	4	31	0	30
11	68	7	0	1	4	31	0	33
12	57	3	0	0	4	31	0	26

Table 3.3.34 Monthly Water Budget for MIKE SHE Model within Secondary Plan Area (SPA) – Future Conditions (Final PCS) (2003-2017 in mm/month);

Month	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Subsurface Inflow	Subsurface Outflow	Pumping	Change in Storage
1	49	3	0	0	4	36	0	13
2	43	3	0	0	4	32	0	11
3	47	8	0	0	4	34	0	9
4	70	35	0	1	4	32	0	7
5	81	55	0	1	4	33	0	-3
6	65	82	0	0	4	31	0	-44
7	81	86	0	1	4	33	0	-35
8	81	80	0	0	3	35	0	-30
9	69	54	0	0	3	33	0	-15
10	84	26	0	0	3	36	0	25
11	68	8	0	0	3	36	0	27
12	57	3	0	0	3	35	0	21

Figure 3.3.8. Mean Monthly Groundwater Recharge – Existing (revised) vs. Future Conditions (Final PCS) (2003-2017)

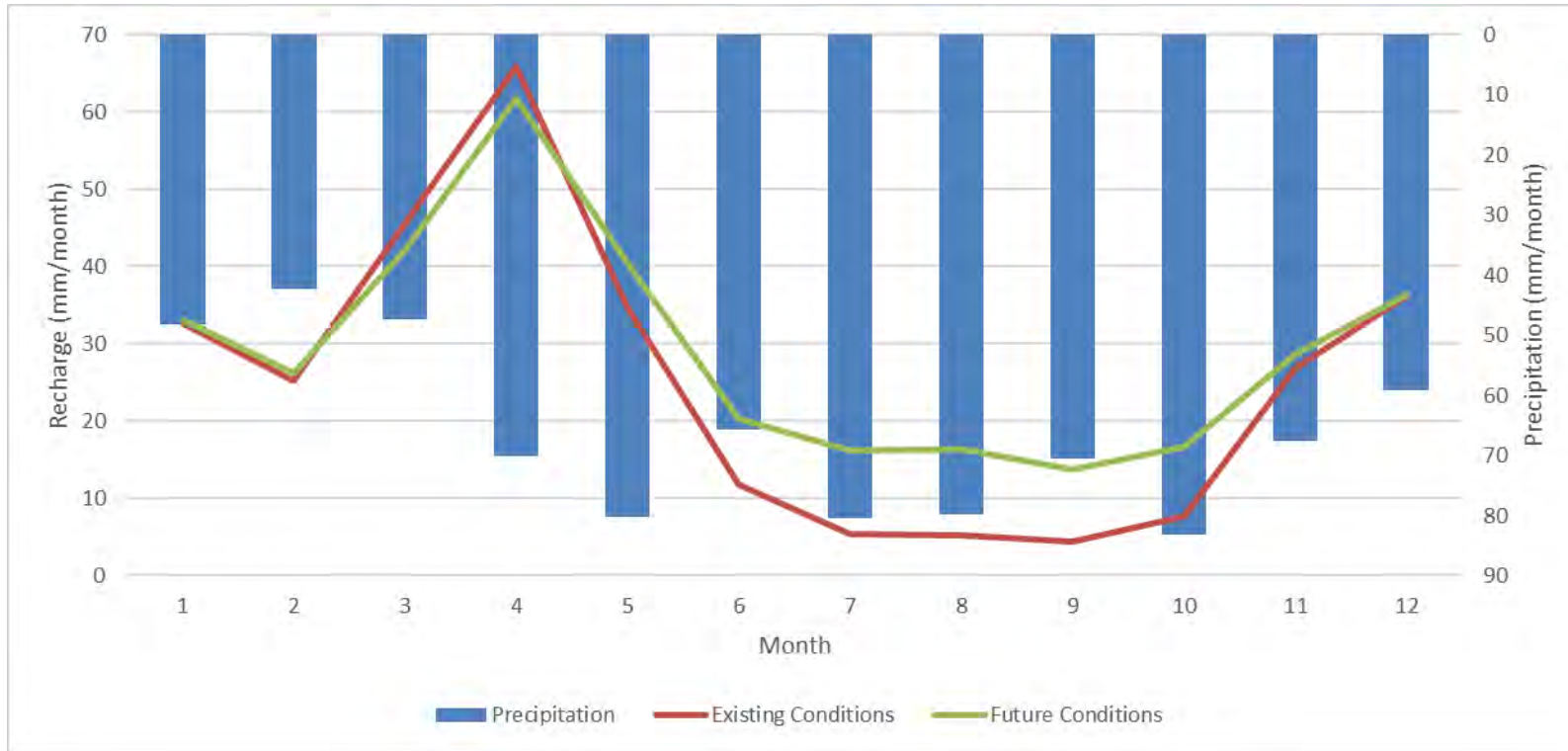


Figure 3.3.9. Mean Monthly Evapotranspiration – Existing (revised) vs. Future Conditions (Final PCS) (2003-2017)

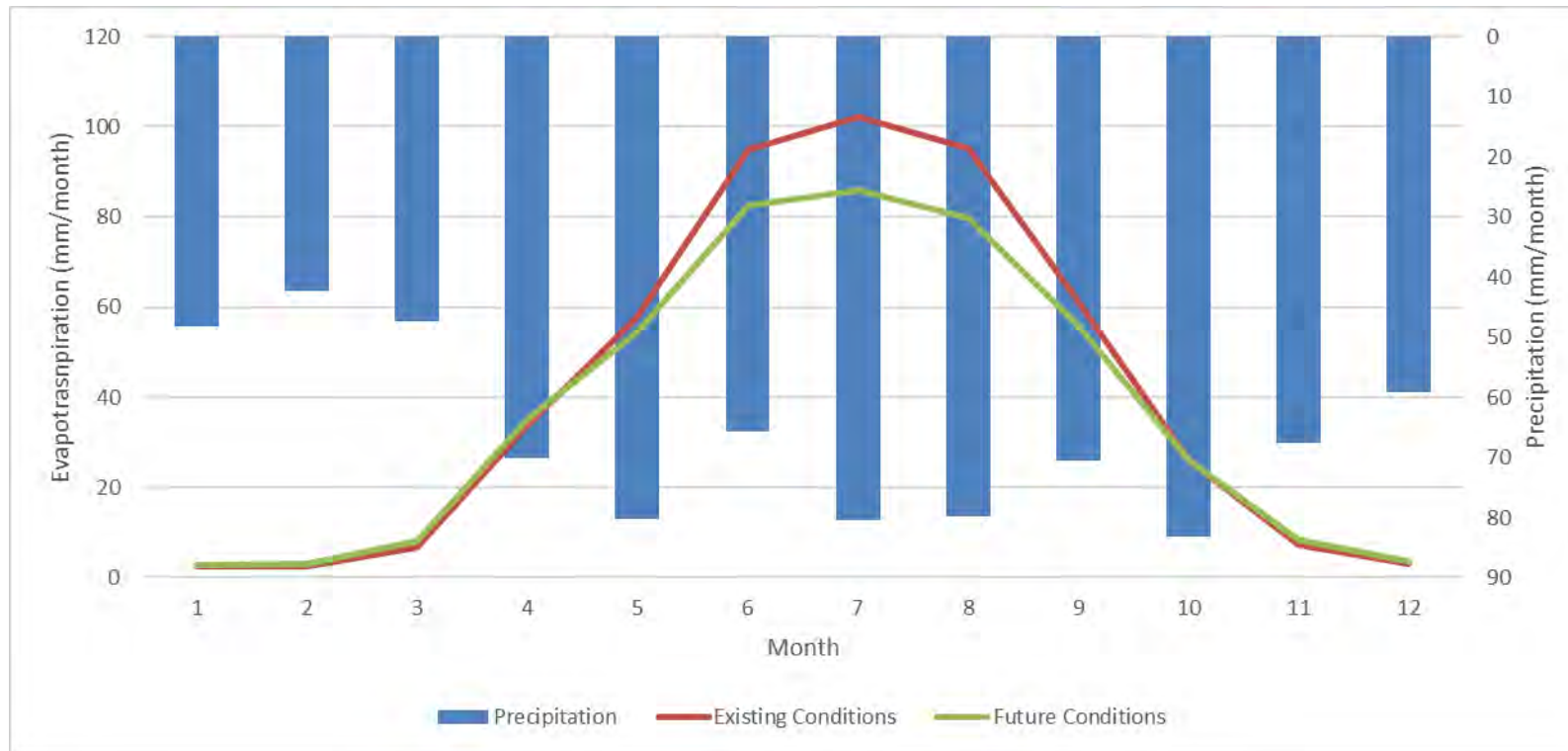


Table 3.3.35. Water Budget for MIKE SHE Domain for Halls, Halligan’s and Neumann’s Ponds (Pre- and Post-Development)

NHS Feature Water Balances – 2003-2017 (mm-year) Subcatchment	NHS Feature Water Balances – 2003-2017 (mm-year) Scenario*	NHS Feature Water Balances – 2003-2017 (mm-year) Precipitation	NHS Feature Water Balances – 2003-2017 (mm-year) Evapotranspiration	Overland Net	Shallow GW (Layer 1) Net	Recharge	Storage Change
Halls Pond	Existing Conditions	794	-497	1	0	-302	-5
Halls Pond	Future Land Use	794	-501	10	1	-308	-4
Halls Pond	Future vs Existing	0	4	9	1	6	1
Halligan's Pond	Existing Conditions	794	-486	-27	-1	-282	-2
Halligan's Pond	Future Land Use	794	-495	-23	-1	-277	-2
Halligan's Pond	Future vs Existing	0	9	-4	0	-5	0
Neumann's Pond	Existing Conditions	794	-541	0	4	-264	-7
Neumann's Pond	Future Land Use	794	-545	5	6	-267	-7
Neumann's Pond	Future vs Existing	0	4	5	2	3	0

*Existing Conditions refers to the revised Existing Conditions simulation completed as part of iteration 3. Future Land Use and Future refers the Future Conditions Simulation based on Iteration 3 - Final Preferred Community Structure (PCS)

Water Quality

The Preferred Community Structure includes various densities of residential land uses, commercial, institutional (schools), mixed uses and parks that will be required to drain through a series of LID BMPs towards stormwater capturestormwater capture areas, with the objective of maintaining the existing water balance within the SPA replicating the significant levels of infiltration under current conditions. The Ammonia and Total Phosphorous exceedances from agriculture lands and the golf course which were observed in the monitoring data would be expected to reduce after the land use has been changed, however the proposed land use would typically result in other urban surface water quality concerns and need to be mitigated accordingly.

Water quality from urban land uses generally has been widely characterized by various studies including the 2007 Credit River Water Management Study Update (CRWMSU) by Credit Valley Conservation which documented water quality event mean concentrations (EMCs) for various contaminants by land use as per Table 3.3.36, with the highest EMCs resulting from runoff from roads, agricultural areas and golf courses.

Table 3.3.32. Event Mean Concentration by Contaminant and Land Use as per CRWMSU (mg/L unless otherwise noted)

Land Use	Contaminant Total P	Contaminant Nitrate + Nitrite	Contaminant TKN	Contaminant Copper	Contaminant Zinc	Contaminant E.Coli (#/100 ml)	Contaminant TSS
Residential	0.36	1.75	1.92	0.025	0.123	25,000	91
Commercial	0.25	0.67	0.71	0.022	0.127	5,000	70
Industrial	0.30	1.16	1.06	0.027	0.220	1,138	67
Educational / Institutional	0.36	1.75	1.92	0.025	0.123	8,360	63
Open Space	0.12	0.54	0.97	0.016	0.098	4,100	70
City Parks	0.36	1.75	1.92	0.025	0.123	10,000	63
Golf/Cemetery	0.70	1.75	3.30	0.025	0.123	4,100	63
Agricultural	0.45	4.00	1.90	0.014	0.039	100,000	132
Highway	0.39	0.76	2.00	0.052	0.302	3,070	331

It is well known within the industry that most of the surface water contaminants that occur from urban runoff occur from paved surfaces, such as parking lots and roadways and from fertilizers applied to landscaped areas. Contaminants can include metals, TSS, *E. Coli*, nitrates and nitrites, phosphates, salt and others. Contaminants from the landscaped areas within residential, commercial and institutional land uses, are often sourced from the use of fertilizers.

Future land use drainage to the existing natural features within the Clair-Maltby SPA, whether overland or via a storm sewer drainage system, would be required to undergo various forms of water quality treatment (i.e. "Treatment Train") in accordance with Provincial guidance to maintain and/or improve water quality within surface and groundwater receiving systems.

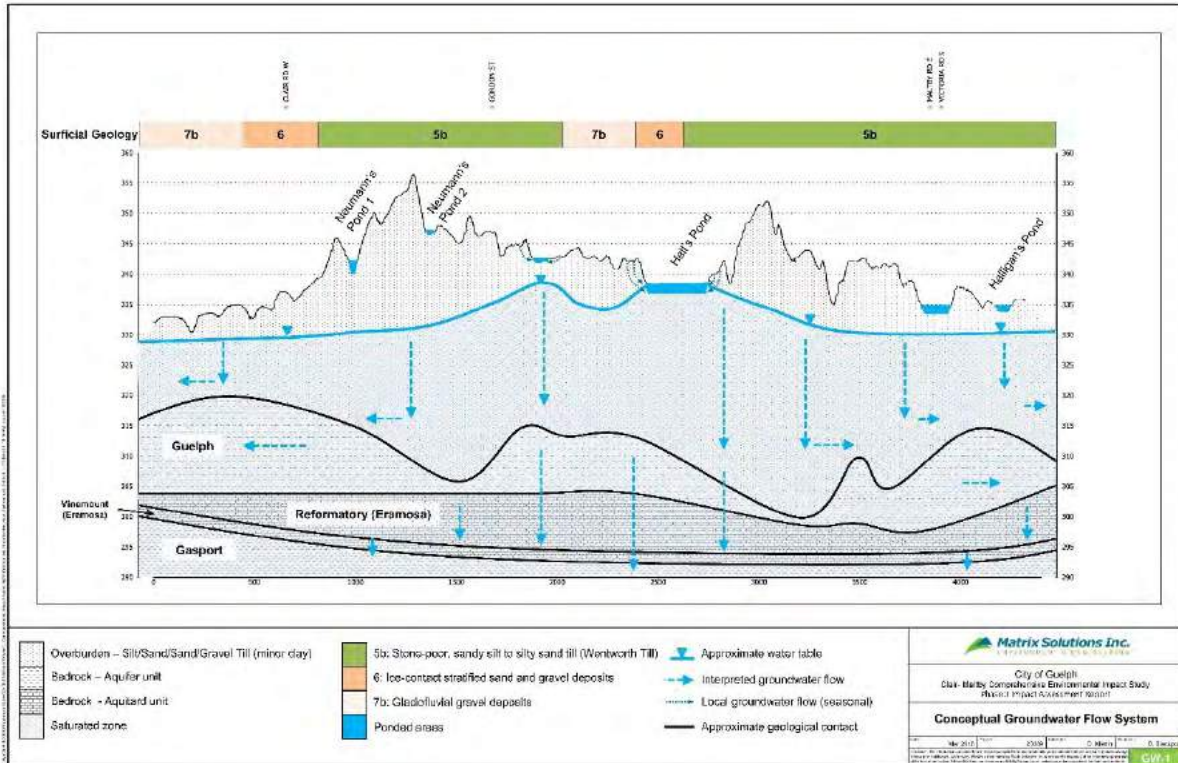
To mitigate potential surface water and ground water quality impacts from the proposed urban form within the Clair-Maltby SPA, a formal water quality management strategy is required.

3.3.7 Water Quality Management Alternatives and Assessment

To replicate the function of the significant number of depressional features currently within the Clair-Maltby SPA with the objective of maintaining the water balance for both Hanlon and Mill Creeks, a distributed approach of low impact development (LID) best management measures (BMPs) to capture the 20 mm storm runoff response is proposed. The LID BMPs would receive surface runoff prior to the excess runoff (i.e., greater than 20 mm) flowing to the proposed stormwater capturestormwater capture areas, which support the local water balance.

The application of LID BMPs and associated function of infiltration within Clair-Maltby without pre-treatment of contaminated runoff would potentially lead to impacts to the NHS wetland features and groundwater quality. The Gasport/Goat Island and Guelph Formation bedrock aquifers underlie the study area and the entire City. The Gasport/Goat Island aquifer provides the majority of groundwater for the City. The Vinemount Bedrock aquitard and thick overburden that overlie the aquifer in the SSA provide a degree of protection to the main aquifer. The Guelph Aquifer overlies the bedrock aquitard but is afforded a degree of protection from the thick overburden on the moraine. The Burke Wells that are part of the City supply wells, extract some of their supply from the Guelph aquifer but most from the deeper Gasport/Goat Island aquifer. Based on the Tier 3 modelling work (Matrix 2017) most of the water supplying the well is recharge from areas outside the Clair-Maltby SPA (regional flow). SPA Groundwater Flow System (ref. Figure 3.3.10). Simulated recharge to the Gasport/Goat Island aquifer in the SPA is less than X per cent of the average annual groundwater demand or X per cent of total recharge in the city.

Figure 3.3.10. Conceptual Groundwater Flow System



Based on the foregoing, the following general approach to protecting these systems and functions to manage surface water quality in the SPA has been proposed:

1. Apply a distributed approach for 20 mm capture within LID BMPs
2. Separate 'clean' water (rooftop and landscaped areas runoff) from dirty water, with dirty water typically resulting from roadways and parking areas
3. Apply a treatment train approach to dirty water and protect the stormwater capturestormwater capture area's function of infiltration
4. LID BMP type selection and locations to be determined based on land ownership, land use, development form and grading (public realm and private realm)
5. Reduce the use of salt through the City of Guelph Salt Management Plan and MESP recommendations. Recommendations include:
 - i. The City of Guelph should consider any outstanding recommendations from the 2017 SMP, particularly the construction and implementation of a snow storage facility using TAC best practices, such as non-permeable storage areas, OGS separators, and settling/dilution ponds to dilute salts and reduce particles entering the water system.
 - ii. The City of Guelph should consider options for salt alternatives such as different types of chemical de-icers and agricultural by-products such as sugar beet juice. Having a variety of salt alternatives available for use, would reduce salt application by the City.

- iii. As per the SMP recommendations, the City should consider implementing technologies for liquid pre-wetting agents or sprayers for salt alternatives onto their existing truck fleet, therefore potentially reducing the amount of salt used in Clair-Maltby and across the City.
 - iv. Implementing salt alternatives through financial incentives for snow removal and de-icing by independent contractors, would help facilitate alternatives other than standard road salt, and will help reduce overall dependence on road salt.
 - v. Implement recommendations of the Snow and Ice Control for Parking Lots, Platform and Sidewalks (SICOPS) program, as it develops further, in an effort to reduce salt application and to streamline salt management for the City, including in the Clair-Maltby SPA.
 - vi. Consider removal of snow in areas with low traffic loadings (e.g. local residential roads/ Road Classes 3-5), and the transportation/storage of this snow to established snow storage/ melt areas that provide treatment prior to discharge to the Speed River.
 - vii. Seasonally closed or partially closed City owned parking lots could be considered by the City of Guelph. While heavily trafficked areas should be maintained with respect to snow and ice control, the City of Guelph could identify parking lots which are less trafficked during winter months, and reduce or not apply salt or other de-icing materials to sections of the parking lots or the entire parking lots should it be closed. Closed parking lots could be used for snow storage and piling, to facilitate reduced salt use for paved areas.
 - viii. To control salt laden runoff from entering groundwater during the winter months, the City could consider bypasses of infiltrative LID BMPs that receive drainage from paved surfaces. The bypass systems are used on other infrastructure within southern Ontario. The City of Toronto requires automated bypass systems on new splash pads, which divert drainage away from the wastewater system, during rainfall events and during non-operational periods. Similar bypass systems could be applied to underground infiltrative LID BMPs. For above ground infiltrative LID BMPs that would receive drainage from paved surfaces, pretreatment water quality measures should already be in place, that said salt cannot be removed once in solution, as such above ground infiltrative LID BMPs, could be designed with winter bypasses (e.g. gated bioretention systems).
6. In establishing a list of available low impact development BMPs and other stormwater quality management measures, the following have been considered, with further discussion provided thereafter:
- a. **Oil and Grit Separators (OGS):**

These end-of-pipe systems tend to most effectively service smaller drainage areas (2 ha +\-) and provide varying levels of stormwater quality treatment depending on the model selected. OGS units are typically encouraged as part of a "treatment train" approach; many municipalities and regulators will not credit

the full TSS removal function of OGS units accordingly (i.e. typical maximum credit of 50 per cent to 70 per cent TSS removal). The Environmental Technology Verification (ETV) Program as established by Toronto Region Conservation Authority (TRCA) has established an OGS testing approach that once completed by OGS manufactures results in an ETV certification. ETV OGS units typically provide up to 70 per cent TSS removal and as such do not provide the required Enhanced level (80 per cent TSS removal) as per the 2003 MOECC Stormwater Management Planning and Design Manual. ETV certified OGS units are required by the GRCA. GRCA typically will only credit a maximum of 50 per cent TSS Removal for ETV certified OGS units, based on the particle size distribution that is being used to test the unit. The combination of water quality treatment measures should be demonstrated to provide 80 per cent TSS removal. The disadvantages of OGS units include the need for frequent maintenance, as well as relatively high capital costs and the ability to only service smaller drainage areas. As a pre-treatment approach for other stormwater quality measures, or for providing water quality treatment for smaller pavement areas, oil grit separators should be considered within the Clair-Maltby SPA.

b. Catch Basin Shields (or equivalent):

Catch Basin (CB) Shields (or equivalent) have been tested by the ETV Program. A (CB) Shield is an insert into a CB that prevents sediment within the CB sump from being discharged from the CB. CB Shields are able to service an area up to 0.60 ha and provide up to 56 per cent TSS removal and would be considered a pre-treatment to other stormwater management quality measures and LID BMPs.

c. Enhanced Grassed Swales:

Grassed swales designed with a trapezoidal geometry and flat longitudinal profiles with largely un-maintained turf can provide excellent filtration and treatment for storm runoff from roadways, when adequate space is provided to implement the swales. It is generally conceded that treatment levels are at a minimum, Normal (formerly Level 2) water quality treatment, and combined with other practices can provide Enhanced (Level 1) stormwater quality treatment. Their application in linear corridors is also particularly appropriate and can be further enhanced through the introduction of check dams to provide additional on-line storage. Their application in urbanized roadway cross-sections (i.e. curb and gutter) often requires alternative grading and roadway configurations which can compromise the function of the roadway itself, and are therefore typically not preferred in those cases. Notwithstanding, gutter outlets along outside lanes have been demonstrated to function effectively where the right-of-way can accommodate the design.

d. Filter Strips:

Filter strips are typically designed for small drainage areas (less than 2 ha), and are applied as part of a treatment train. Filter strips require flat areas with slopes ranging from 1 to 5 per cent and are usually in the range of 10 to 20 m in length in the direction of flow. Flow leaving filter strips should be a maximum of

0.10 m depth, based on a 10 mm storm event. Based on the limited space within the typical urban form, filter strips would only be considered to be a practical stormwater quality solution for more porous land uses such as schools and parks.

e. Bioretention Systems:

Bioretention systems provide effective removal of pollutants by sedimentation, filtering, soil adsorption, microbial processes and plant uptake. Bioretention systems should be approximately 10 to 20 per cent in size of the contributing drainage area, with typical drainage areas of 0.50 ha and a maximum drainage area of 0.80 ha. Slopes within bio-retention systems are typically 1 per cent to 5 per cent. Bioretention systems are preferred in areas that have reasonable infiltration properties (15 mm/ hr., 1×10^{-6} cm/s), but can be implemented in all soil types as long as the water quality event can be temporarily stored (typical depths 0.15 m to 0.25 m) before infiltrating and an underdrain is provided. The selection of filter and mulch material can impact the water quality discharging from the bio-retention system, as such the practitioner should review current LID guidelines (e.g. Low Impact Development Stormwater Management Planning and Design Guide, Version 1.0, 2011, prepared by CVC and TRCA).

Bioretention systems should have forebays for a form of surface water pre-treatment, however for the Clair-Maltby SPA, surface runoff from roads and parking areas that has not received any pre-treatment before entering a bio-retention area, should require the bio-retention area to be lined and therefore act as a water quality filtration measure. Bioretention areas that receive drainage from pre-treatment would not need to be lined.

f. Infiltration Trenches:

Infiltration Trenches are similar to bio-retention systems but would require pre-treatment of road and parking lot runoff, unless the trenches are lined, and then would act only as a filtration system. Infiltration trenches could also provide thermal mitigation of surface runoff.

g. Soakaway Pits:

Soakaway Pits may be implemented within Clair-Maltby for residential land uses, where space allows. Soakaway pits provide a method of increasing infiltration of clean water from roof areas in particular. With residential roof drainage being directed underground, thermal mitigation could be an additional benefit of soakaway pits.

h. Permeable Pavers/ Pavement:

Permeable pavement could be used within the Clair-Maltby SPA as long as a sand bed is provided for water quality filtration for areas where vehicular movements occur. As a standalone LID BMP, a permeable paved multiuse path would not provide a stormwater quality benefit, however it would reduce the runoff volume from the paved surface. Permeable pavers/pavement could reduce the amount runoff and the duration of runoff remaining on paved surfaces, as such this LID BMP could provide thermal mitigation.

i. Pervious Pipes:

Pervious pipes could be used in combination with either bio-retention systems or infiltration trenches. As a standalone stormwater quality measure, pervious pipes can be a cost-effective and relatively simple method to accomplish infiltration requirements, while eliminating the need for surface space within the right-of-way. That said, pervious pipes within the Clair-Maltby SPA would require pre-treatment which can be provided vis-à-vis a hybrid roadway cross-section (urban / rural) and / or with catchbasin controls. Pervious pipes, with the surrounding stone media, could provide for thermal mitigation of drainage based on the contact with the cool stone media.

j. Increased Topsoil Depth. Soil Amendments:

Increasing topsoil depth from 0.10 m +/- to 0.25 m to 0.30 m within landscaped areas for residential and non-residential land uses provides a simple non-structural method of reducing runoff and increasing infiltration at source. Amending topsoil with compost can achieve further reductions in runoff and has the added benefit of creating a more drought tolerant landscaped area.

Providing 20 mm of capture for clean water from roofs, landscaped areas and non-vehicle trafficked areas could be conducted by various combinations of the foregoing listed LID BMPs from Bioretention Systems to Increased Topsoil Depth. Notwithstanding, any LID BMPs receiving drainage from paved areas will require pre-treatment such as CB Shields™, oil/grit separators, primary treatment cells for underground infiltration systems, lined forebays for above ground bioretention systems and other forms of pre-treatment as required. Pre-treatment water quality measures receiving runoff from paved surfaces and in a treatment train, should be able to provide a minimum of 60 per cent TSS removal (former Basic Level of water quality treatment) prior to discharging to infiltrative LID BMPs. The combination of pre-treatment water quality measures, at source and conveyance LID BMPs, should be able to meet or exceed an Enhanced Level of Water Quality Treatment of 80 per cent TSS removal.

Based on the foregoing, it is known that CB Shields™ are able to provide up to 56 per cent TSS removal for areas that are 100 per cent paved. As such to obtain a minimum of 60 per cent TSS removal prior to any infiltration, other stormwater quality measures will be required, in addition to, or instead of CB Shields™, and would then provide TSS removal.

Soil cells such as Silva Cells™ provide water quality treatment levels similar to that of bioretention systems, but have the added benefit of providing additional interception and evapotranspiration through large trees. Silva cells would receive pre-treated drainage from CB Shields™ and would then provide additional TSS removal, as a minimum equivalent to a standard bioretention cell, with the Silva Cell lined if there is concern of groundwater contamination. Silva Cells have received approval from TRCA, Credit Valley Conservation (CVC) and Lower Simcoe Region Conservation Authority (LSRCA) for TSS removal equivalent to bioretention.

A bioretention system with forebay that provides 60 per cent TSS removal based on the 2003 SWM Planning and Design Manual dry pond storage requirements, receiving drainage from a single 3.75 m wide lane of road 50 m length, would need

to have a storage volume of over 5m³. This storage volume is considered significant for implementing within a typical boulevard (ref. ongoing Road Right-of-way Cross-section Assessment, March 13, 2020, Appendix C), but could be implemented in landscaped areas in parking lots. That said a standard bioretention cell with a forebay could provide adequate water quality control should a CB Shield™ or equivalent measure be provided as a pretreatment measure.

Additional assessment will be required at the next stages of planning and design to support subdivision planning to determine groundwater and bedrock elevations and the potential areas within a development site which may restrict the form of LID BMPs to be constructed. The stormwater quality control strategy will necessarily need to be flexible in order to account for on-site local constraints, while still remaining consistent with the specified approach and required quality control targets.

Staging and costing for stormwater management is discussed within Implementation Section 4. In general it is expected that onsite and conveyance stormwater quality measures will have to be implemented as development precedes, with LID BMPs to be constructed within the municipal right-of-ways prior to LID BMPs being constructed on private development lots. Construction staging of LID BMPs should incorporate LID BMP construction guidance from CVC's 2012 LID Construction Guide Manual and construction approval guidance as per CVC's LID Stormwater Management Certification Protocols for Low Impact Development.

Costing of LID BMPs has been provided within the Implementation Section 4.

3.4 Mobility

As part of the input into the City's Secondary Plan process and Phases 1 and 2 of the Master Environmental Servicing Plan (MESP), BA Group prepared a Mobility Study dated March 6, 2019 (revised February 2021 and incorporated into this MESP document) entitled, "Clair-Maltby Secondary Plan – Transportation Master Plan Study".

The content of these reports are provided in the following Mobility section. These reports firstly comprises Phase 1 Mobility Study documentation, including a review of existing transportation conditions and planning context for the Clair-Maltby study area. The remaining sections are comprised of the review of the Preferred Community Structure Plan, supportive transportation policies and objectives, and future conditions transportation analysis to inform potential transportation network improvements and high-level transportation infrastructure requirements and options.

The Mobility Study specifically includes:

1. an introduction and overview of the transportation study, including the objective of the Phase 1 study (June 2018), and subsequent transportation direction and analysis included herein;
2. an overview of the existing Secondary Plan area context and transportation elements;

3. a review of existing travel patterns, traffic operations, and collision history based on available data within the study area;
4. a review of relevant standards, active development applications, policies, and general planning framework based on available planning and transportation studies and reports;
5. a summary of key challenges and opportunities for the Secondary Plan, from a transportation perspective, which highlights key objectives sought through directive policies;
6. an overview of the planning processes and events undertaken over the course of the MESP study to review community structure options and achieve a Preferred Community Structure plan;
7. a review of the Clair-Maltby Secondary Plan Preferred Community Structure and associated transportation network elements and attributes, including cross-sections developed by Wood in consultation with City departments;
8. an overview of general parking standards and best practice policies;
9. an overview of general transportation demand management (TDM) standards, policy objectives, and best practices;
10. a discussion of potential traffic calming measures most applicable to local streets planned as part of Secondary Plan development;
11. multi-modal travel demand forecasting for development associated with the Clair-Maltby Secondary Plan, based on the highest (most dense) land use budget developed in support of the MESP;
12. an assessment of forecast transit rider demands associated with development of the Secondary Plan; and
13. an assessment of forecast traffic resulting from development of the Secondary Plan, and summary of potential transportation improvements to accommodate anticipated traffic demands.

The findings of the Clair-Maltby Secondary Plan – Transportation Master Plan Study report (updated in February 2021) are provided herein along with its related technical appendices in Appendix D. The Mobility section of this MESP doc outlines the background analysis, policy and standards, a review of community consultation, alternatives, criteria, evaluation, and the preferred transportation network as it relates to Phase 3 of the Clair-Maltby Secondary Plan and MESP process.

3.4.1 Existing Conditions

The Secondary Planning Area is located in the south end of the City of Guelph. It is bounded by Clair Road to the north, Victoria Road (City Boundary) to the east, Maltby Road (City Boundary) to the south and the eastern limits of the Southgate Business Park to the west. It has an area of more than 520 hectares, which is currently primarily rural and agricultural in nature. The study area and existing road context is illustrated in Figure 3.4.1.

3.4.1.1 Existing Road Network

The Clair-Maltby Secondary Plan area is served by a series of rural and urbanized roads. The area road system, under existing conditions is generally defined by:

- Three north-south routes: Gordon Street, Victoria Road, and Southgate Drive; and,
- Two east-west routes: Clair Road and Maltby Road.

Additionally, Highway 6 (the Hanlon Parkway) operates in a north-south direction west of the secondary plan area.

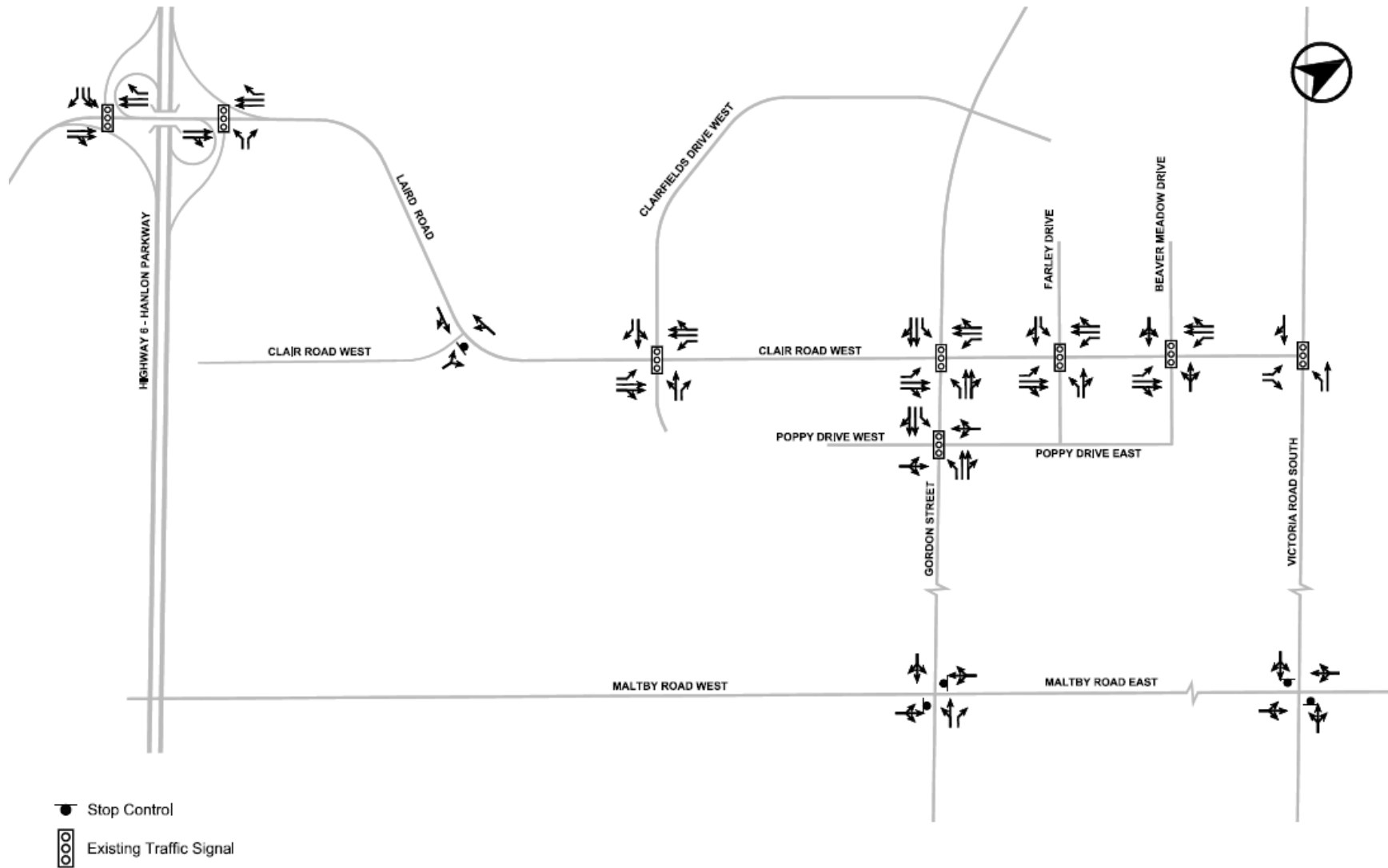
An overview of the surrounding municipal street network highways and key roadways is provided below.

The existing local street network, including intersection lane configuration and traffic controls, is illustrated in Figure 3.4.2.

Figure 3.4.1. Study Scope Location and Context



Figure 3.4.2. Existing Traffic Lane Configuration and Controls



Highway 6 (Hanlon Parkway) is a provincially-owned and maintained limited access highway (in the Guelph area) operating in a north-south direction west of the Secondary Plan area. Although the highway has limited access, and operates with a fully grade-separated interchange at Laird Road, it intersects with Maltby Road at an unsignalized intersection (east-west STOP-control). The highway operates with an 80 km/h. posted speed limit and two travel lanes in both the northbound and southbound directions. Northbound and southbound travel lanes are generally separated by a grassed median.

Highway 6 is a major traffic route linking the City of Guelph with the wider region and specifically with Highway 401 in the south. The highway begins at Highway 403 in the City of Hamilton (Dundurn) in the south and extends north through the City of Guelph to Tobermory at the northern end of the Bruce Peninsula.

Highway 6 includes a full interchange at its crossing with Laird Drive, which becomes Clair Road through the study area. The highway also intersects at an unsignalized intersection with Maltby Road, whereby eastbound / westbound traffic movements on Maltby Road operate under STOP-control.

Gordon Street is a two-way arterial road running north-south through the City of Guelph. Gordon Street becomes Brock Road south of the City Boundary at Maltby Road. The street extends south of Highway 401 as Highway 6, and north of Waterloo Avenue in Downtown Guelph as Norfolk Street, Woolwich Street, and then Highway 6 north of Woodlawn Road.

In the site vicinity, it has a 4-lane urban cross-section north of Poppy Drive and a 2-lane rural cross-section south of Poppy Drive. The roadway includes separate left-turn lanes at signalized intersections and bicycle lanes in both directions within the City limits. The street has an existing speed limit of 60 km/h. in its urban section, and a 70 km/h. speed limit in its rural section south of Poppy Drive.

Victoria Road is a north-south direction roadway stretching through the City of Guelph from Wellington County Road 36 in the south (at Highway 401) to Highway 6 in the north. In the site vicinity, Victoria Road has a basic 2-lane rural cross section, with a separate north left-turn lane at Clair Road. Victoria Road intersects with Maltby Road in two separate T-intersections, with the section of Victoria Road north of Maltby Road extends from a point approximately 55 metres east of where the section of Victoria Road south of Maltby Road

terminates. **Southgate Drive** services industrial and employment areas in the southwest area of Guelph east of Highway 6 and north and south of Laird Road. Southgate Drive is a two-way roadway with a 50 km/h. speed limit and a basic 2-lane cross section and auxiliary left-turn lanes at its intersections with Laird Road and Clair Road. The street loops north of Laird Road, intersecting with Laird Road at two points, and extends south of Laird Road (at its western intersection) before terminating in a cul-de-sac approximately 1.4 kilometres south of Clair Road.

Clair Road is a two-way road running east-west between Hanlon Road / Crawley Road in the west (just east of Highway 6) and Victoria Road in the east. It generally operates with a 2-lane cross section except for the "urbanized" portion of the street which extends from 225 metres east of Laird Road to approximately 140 metres east of Beaver Meadow Drive – where the street generally has a 4-lane urban cross

section. Within the street's urban portion, auxiliary left-turn lanes are provided at all intersections, as well as bicycle lanes in both directions adjacent to the curb. Clair Road has a speed limit of 60 km/h.

Laird Road is a two-way road oriented generally in an east-west direction between Clair Road in the east and the street's termination approximately 175 metres west of Quaterman Road. It generally operates with a 4-lane cross section west of the street's signalized intersection with Southgate Drive, and a 2-lane cross section between this point and Clair Road in the east. West of the street's signalized intersection with Southgate Drive to Cooper Drive, bicycle lanes are also provided in both directions adjacent to the curb. The street intersects with Highway 6 as a grade-separated interchange, providing a high-capacity traffic connection to Highway 6 in the Secondary Plan area. Laird Road has a speed limit of 50 km/h.

Maltby Road is a two-way rural road oriented generally in an east-west direction between Nassagaweya-Puslinch Townline in the east and Highway 6 in the west. West of Highway 6, Maltby Road continues as Concession Road 4 to Roszell Road near the Town of Hespeler. It operates with a 2-lane cross section and has a speed limit of 50 km/h.

3.4.1.2 Existing Transit Facilities

Guelph Transit is responsible for transit service in the vicinity of the Secondary Plan area, and provides services within the City of Guelph generally. Guelph Transit also connects the City of Guelph with major transit terminals in the Downtown area, including the University of Guelph and Guelph Central Station which provide connections to regional and inter-city transit services – including GO Transit, Greyhound and VIA Rail.

Existing transit routes do not serve the Secondary Plan area except along a section of Clair Road west of Gordon Street. There are currently no transit services along Gordon Street (south of Clair Road), Victoria Road, Maltby Road, or Clair Road (east of Gordon Street). A number of transit routes located just north Clair Road provide connections to Guelph Central Station, which is located approximately 7 kilometres north of the subject lands. These routes operate north of Clair Road serving Hanlon Industrial Park (Route 16), the University of Guelph (Routes 5 and 99), and the Guelph Central Station (Route 99) – which is located approximately 7.2 kilometres north of the subject lands. These routes may be revised to extend or reroute to the subject site area. Frequency of buses along these routes varies from two to four vehicles per hour during peak morning activity.

3.4.1.3 Existing Active Transportation Facilities

Cycling and pedestrian facilities in the Secondary Plan area are limited under existing conditions, owing to the rural character of existing lands.

Pedestrian sidewalks and bicycle lanes are currently provided along sections of Clair Road and Gordon Street within the Secondary Plan area. Sidewalks are also provided along sections of new streets southeast of the Gordon Street / Clair Road intersection.

3.4.1.4 Existing Travel Behaviour

The Secondary Plan area is located in the south portion of the City of Guelph in a largely rural area with few existing transit and cycling / pedestrian facilities. A review of the travel characteristics information provided by the Transportation Tomorrow Survey (TTS) for trips made in the areas immediately north of the Secondary Plan area (herein referred to as the “South Guelph Area”) confirms that a majority of trips are undertaken in a private automobile either as a driver or passenger. However, a proportion of travel is undertaken using non-auto means, specifically for peak direction travel during peak travel periods.

Travel behaviour characteristics for trips to from the South Guelph Area during the weekday morning and afternoon peak periods are summarized in Table 3.4.1. Detailed TTS data calculations are included in Appendix D.

Table 3.4.1. Existing Mode Split (TTS – 2016, South Guelph Area)

Mode	Morning Peak Period Inbound	Morning Peak Period Outbound	Afternoon Peak Period Inbound	Afternoon Peak Period Outbound	Total Peak Period Travel
Auto Driver 4	67%	67%	76%	76%	72%
Auto Passenger 5	7%	8%	9%	21%	10%
Transit	2%	8%	9%	2%	6%
Walk	17%	6%	1%	1%	5%
Cycle	3%	2%	2%	0%	2%
Other 6	4%	9%	3%	0%	5%
Total	100%	100%	100%	100%	100%

Notes:

1. Based on 2016 TTS results for morning (7:00 a.m. – 9:00 a.m.) and afternoon (4:00 p.m. – 6:00 p.m.) peak traffic periods.
2. Statistics specific to 2006 GTA Zones 8062, 8064, 8067-8076, and 8078-8081.
3. Trips represent an expanded value based on a sample of persons surveyed in the study area.
4. Auto driver trips (includes auto drivers and motorcycles).
5. Auto passenger trips (includes auto passenger trips only).
6. Other trips include school bus and taxi trips, consistent with The City’s model document.

The proportion of people in the South Guelph Area who chose to drive a car during the morning and afternoon peak weekday periods is in the order of 70% to 75%. The balance of travel is undertaken, significantly, as a vehicle passenger (10%), while a small portion of travel is undertaken using transit or by walking / cycling (approximately 2% to 6%).

It should be noted that "other" trips during the weekday peak periods comprise of school bus trips – and that these represent approximately 4% to 9% of trips during the morning peak period. School bus trips comprise a smaller proportion of weekday afternoon peak period trips as they tend to occur before the afternoon peak travel period (before 4:00 p.m.).

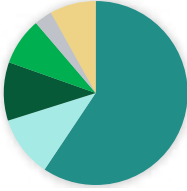
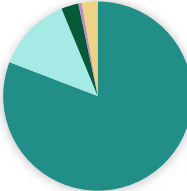
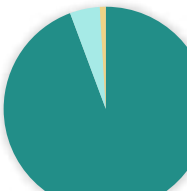
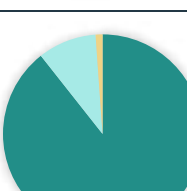
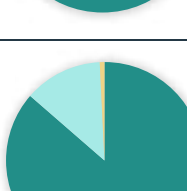
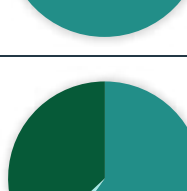
The proportion of travel undertaken as a pedestrian, using a bicycle and by transit generally represents 7% of all trips, which is a small proportion of all trips and should be improved as part of new development planned within the Secondary Plan area.

A summary of existing resident travel characteristics including travel mode by certain areas of distribution is provided in Table 3.4.1.

Trips made "local" to the South Guelph Area are more likely to be undertaken by sustainable transportation means (transit, walking, cycling) relative to trips made within the City of Guelph generally, or to trips made between the South Guelph Area and neighbouring Waterloo, Halton, and Peel Regions. During weekday peak travel periods, approximately 11 per cent of "local" trips are made by walking or cycling, while another 10 per cent is made by transit.

During weekday peak travel periods, trips oriented within the City of Guelph (outside of the "local" area) and to neighbouring regions (Halton, Peel, Waterloo, Wellington County) are predominately undertaken in a private vehicle (see Table 3.4.2). During weekday peak travel periods, trips to / from the City of Toronto comprise a small proportion of overall travel (1 per cent). Although trips to / from Toronto are still predominately undertaken by car, the transit mode share is greater than trips between the South Guelph Area and other areas analyzed herein.

Table 3.4.2. South Guelph Area: Peak Period Trip Distribution by Travel Mode

Destination Area	Proportion of All Trips	Mode Split	Colour	Travel Mode
Local Area ¹	54%			Auto Driver
Rest of Guelph	20% (5 per cent Downtown)			Auto Passenger
Waterloo Region	10%			Transit
Halton / Peel Regions	7%			Walk
Wellington County	4%			Cycle
City of Toronto	1%			Other

Note: 1. "Local area" consists of areas within the City of Guelph south of the Eramosa and Speed Rivers.

2. Another 4 per cent of trips are oriented to "other" areas in the region.

3.4.1.5 Collision Data Summary

A total of 134 collisions were reported at the existing intersections scoped for the Mobility Study (63 month period from 2012 to 2017). Of the total volume of collisions, 21 (16 per cent) resulted in a non-fatal injury, while 42 collisions (31 per cent) report property damage only (no injury). All other collisions were non-reported or "non-reportable". No "fatal" collisions were reported.

Within the collision data scope, approximately 51 per cent of the collisions recorded have occurred at the Gordon Street and Clair Road intersection. Most (greater than half) of these collisions were either "rear-end" collisions often resulting from following too closely or improper speed for road conditions, or "turning movement" collisions often resulting from left-turn traffic not yielding to on-coming traffic. Measures to reduce rear-end collisions include safety campaigns targeted at poor-weather vehicle operation, and greater enforcement. The introduction of protected left-turn phases at this intersection may have an impact on reducing turning movement collisions.

A total of 3 collisions involving vulnerable road users were recorded – in all instances involving cyclists. Two of this collisions occurred at the Gordon Street and Clair Road intersection, and one other at the Clair Road and Farley Drive intersection. Cycling facilities and pavement markings (including pedestrian crossings) should be highly visible and well-marked. Consideration may be made to reducing vehicle speeds and/or providing physical separation (bollards / buffers) between cycling facilities and vehicle travel lanes. It is noted that Gordon Street is planned to be upgraded to accommodate fully protected cycling infrastructure.

It should be noted that a total of 15 collisions were recorded at the Victoria Road South and Maltby Road intersection. This intersection is currently configured as two separate intersections (back to back T-intersections). This unusual configuration, which requires northbound / southbound traffic to conduct a right-turn then left-turn in short succession to continue in the same direction, may explain the rate of rear-end collisions at this intersection.

A detailed collision data summary table and detailed collision reports are included in Appendix D.

3.4.1.6 Existing Traffic Operations

Existing Traffic Volumes

Existing traffic volume data was obtained for all study area intersections from the City of Guelph and / or traffic counts collected by Spectrum Traffic Data Inc. on behalf of BA Group.

Traffic volume data was collected for the period 2012 to 2017 for key intersections in the study area, as well as older traffic volume data for use as reference. Traffic volumes were reviewed against historical data (TMCs and ATRs) to verify general trends and understand potential inconsistencies. Generally, the most recent intersection counts (those from 2015 to 2017) were selected at key study area intersections, and utilized as the basis for analysis.

Traffic signal timing plans were provided by the Ministry of Transportation and the City of Guelph for signalized intersection included as part of the analysis.

Existing area traffic volumes utilized in assessing current traffic operations are illustrated in Figure 3.4.3.

Intersection Capacity Analysis Methodology

Traffic operations analyses have been undertaken at study area intersections using standard capacity analysis procedures as follows.

The traffic operations analysis for signalized and unsignalized intersections was undertaken using Synchro Version 10 software, adhering to the analysis methodology outlined in the Highway Capacity Manual 2000. Key performance indicators utilized for the signalized and unsignalized analyses are volume-to-capacity (v/c) ratios, delay times, and level-of-service (LOS).

Input parameters for the analyses are based on data acquired from traffic surveys. Peak hour factors and heavy traffic percentage parameters were calculated based on the traffic data acquired where appropriate. Bus blockages were estimated based on transit service frequency during prevailing traffic volume peak hours.

Calibration

Vehicle delay surveys were undertaken for the eastbound and westbound traffic movements at the Gordon Street and Maltby Road intersection so as to ensure that the traffic model appropriately reflects existing traffic delays for the eastbound and westbound movements. The existing traffic analysis herein is calibrated to reflect existing delay results observed during updated data collection and traffic delay surveys. Parameters calibrated under existing traffic conditions is carried forward as part of future analysis traffic scenarios.

A summary of existing signalized and unsignalized traffic operations at key existing study area intersections is provided in Figure 3.4.4.³

³ The free traffic movements associated with the existing Highway 6 access ramps to / from Laird Road East are not analyzed as part of the traffic analysis herein.

Existing Operations

The signalized intersection traffic analysis indicates that all study area intersections perform acceptably, and without any traffic capacity constraints for any individual traffic movements. During the weekday afternoon peak hour, overall intersection v/c ratios are shown to be 0.70 or less, while individual traffic movements are shown to all operate with a v/c ratio of 0.73 or less.

Overall signalized intersection traffic operations are good under existing conditions, and are generally reflective of new infrastructure (updated and widened roads) and limited area development. Existing delay and capacity results are acceptable.

The key Gordon Street and Clair Road gateway intersection operates acceptably under existing traffic conditions, with an overall intersection v/c ratio of 0.63 during the weekday afternoon peak hour. Traffic volumes and resulting traffic operations are reflective of the commercial land uses prevalent in each of the intersection's four quadrants.

The intersection of Clair Road East and Victoria Road was recently signalized. The signalized intersection analysis indicates that this intersection generally operates acceptably.

The existing conditions traffic analysis indicates that eastbound and westbound STOP-control movements at the Gordon Street and Maltby Road intersection operate with longer delays and fewer gap opportunities.

The unsignalized traffic analysis indicates that the eastbound movement operates with LOS C during the weekday afternoon peak hour, while the westbound movement operates with LOS D during the weekday afternoon peak hour. Signalization of this intersection may be considered in the longer-term given anticipated traffic growth along both streets.

All other movements at unsignalized intersections within the study area are shown to operate at LOS C or better during the weekday afternoon peak hour, which is acceptable.

Individual movement and overall volume-to-capacity ratios for each of the signalized intersections within the study area are summarized in Appendix D.

Detailed results of the Synchro analysis are included in Appendix D.

Figure 3.4.3. Existing Weekday Afternoon Peak Hour Traffic Volumes

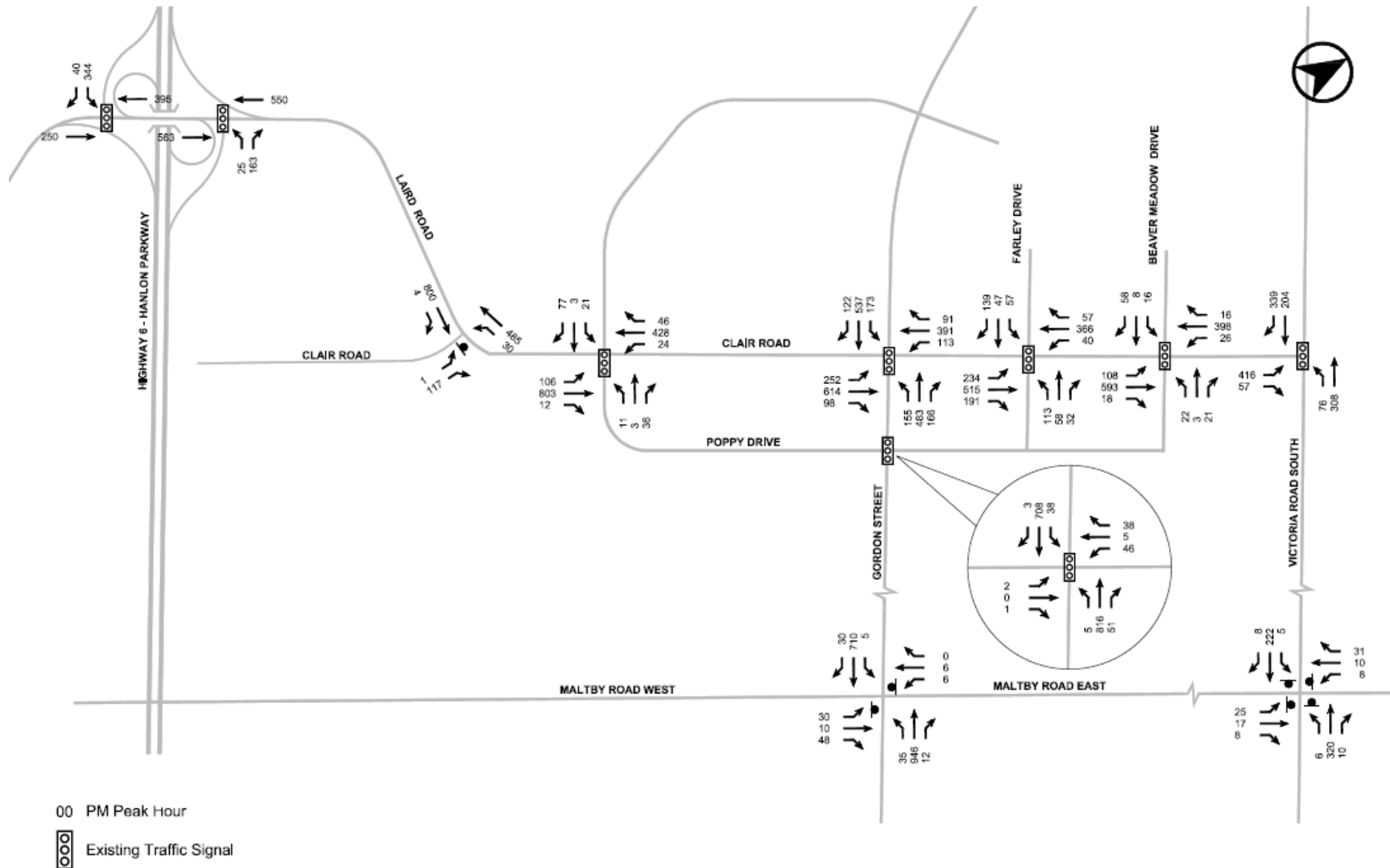
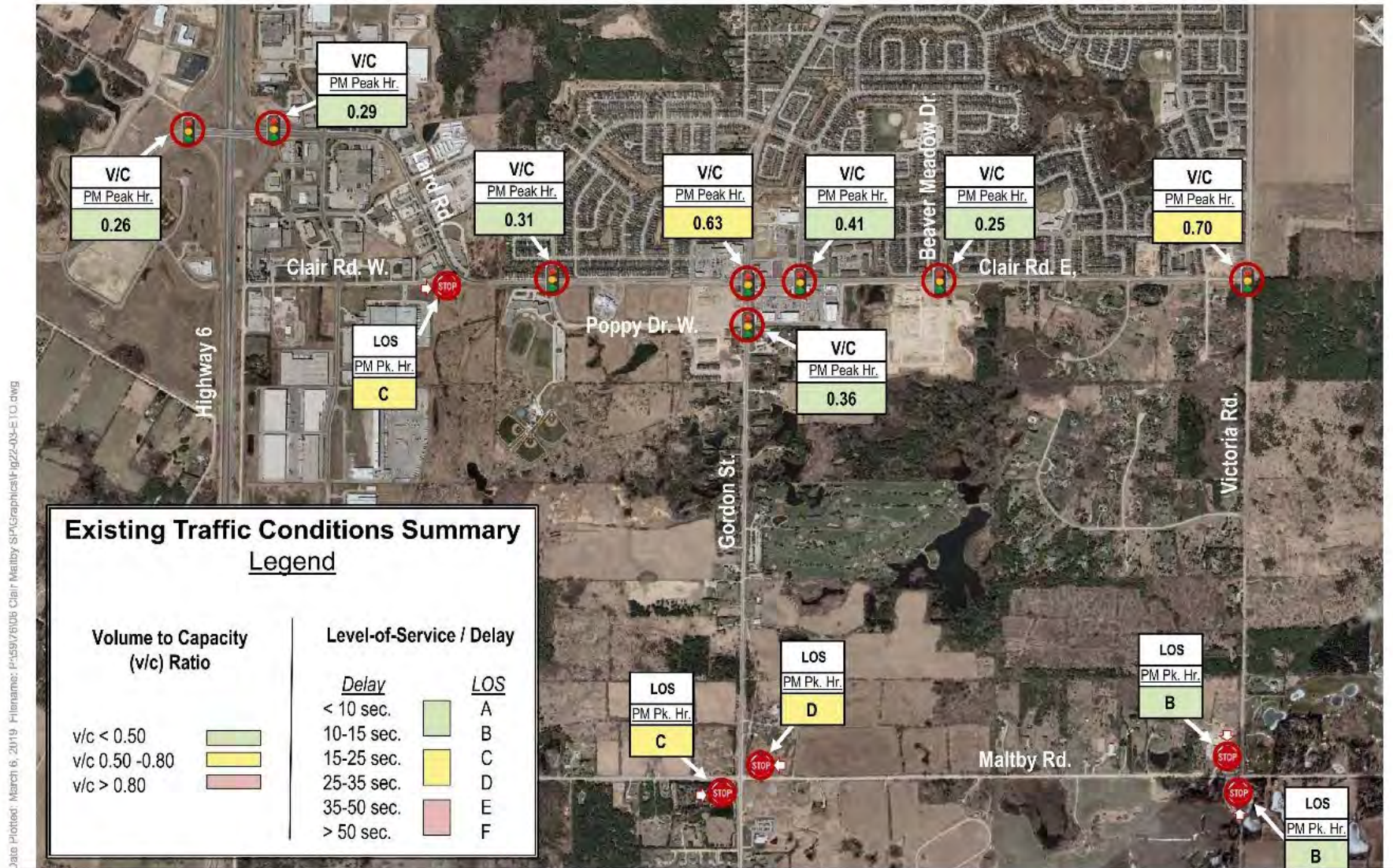


Figure 3.4.4. Summary of Existing Traffic Operations Analysis



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3.4.1.7 Background Development and Area Growth Assumptions

Future background traffic operations were forecast and assessed considering:

- review of and application of general corridor growth – growth observations are summarized in Table 3.4.3; and,
- area site-specific background developments – which are summarized in Table 3.4.4.

Corridor Growth

A review of traffic patterns in the study area was undertaken over 10 years (2008 to 2018) to provide an understanding of overall traffic growth trends on key street segments within the Secondary Plan area.

Traffic volumes were reviewed for the following street segments to provide an indication of prevailing trends in vehicle activity along the arterial road corridors of Gordon Street, Clair Road, and Victoria Road within this period.

- Gordon Street south of Clair Road,
- Gordon Street north of Maltby Road,
- Clair Road east of Gordon Street,
- Clair Road west of Gordon Street, and
- Victoria Road south of Clair Road.

Traffic volumes were also reviewed for segments of Maltby Road east of Gordon Street. However, the infrequency of historical data and generally small traffic volumes could not produce a reflective traffic growth rate. Traffic volumes on Maltby Road were shown to be relatively small, and variable from count to count.

Traffic corridor review observations are outlined in the following and are summarized in Appendix D.

Table 3.4.3 Corridor Traffic Growth Summary

Street	Direction	Observed Annual Growth Rate
Gordon Street Two-way Traffic	Northbound / Southbound	+0.4% to +0.7%
Clair Road Two-way Traffic	Eastbound / Westbound	+3.7% to +4.7%
Victoria Street Two-way Traffic	Northbound / Southbound	+18%

Understanding the prevailing traffic growth trends associated with key arterial roads within the Secondary Plan area (Gordon Street, Victoria Road and Clair Road), traffic growth was assumed for these corridors. Corridor traffic growth was carried through the study area, and in the case of Clair Road, assigned to terminal ramps at the Highway 6 / Laird Road interchange based on existing turning movement proportions. Corridor growth rates were applied over a 14-year period to the 2031

planning horizon year, to account for the 2017 date of traffic data collection associated with this project.

An average annual corridor growth rate of 0.5% was applied to Gordon Street during the weekday afternoon peak hour.

Higher traffic growth rates along Victoria Road and Clair Road are expected to result from recent development along these corridors; however, this growth would not be expected to be maintained over the long-term without the introduction of new site-specific developments (accounted for in the following section). As such, a corridor growth rate of 1.5% per annum was applied to these corridors, which is generally consistent with growth rates applied by the City in traffic planning modelling exercises.

Traffic volumes resulting from the application of corridor growth rates outlined herein, are summarized in Appendix D.

Site Specific Background Developments

Area background developments (which are summarized in Table 3.4.4) provide an understanding of current changes within the vicinity of the Clair-Maltby Secondary Plan area, and the existing development context that will be considered as part of future planning for the subject lands.

Traffic related to the proposed development comprising the Dallan Residential Subdivision (161, 205, and 253 Clair Road East) is partially captured as part of existing traffic volumes given the initial occupancy of this development. For the purposes of the traffic analysis herein, traffic volumes associated with this development are reduced by 25% to account for existing occupancy.

Traffic volumes related to the Dallan, Neumann and Bird Subdivisions were also adjusted as part of the analysis herein to account for the introduction of Poppy Road, which was not utilized in the assignment of site specific trips within Transportation Studies prepared for the background developments.

Background Road Network Assumptions

Future lane configurations on the area street network reflect the following planned improvements that are assumed as part of the future traffic analysis scenarios:

- Widening of Gordon Street from 2 to 4 lanes (approved 2001 EA) from Kortright Road to Wellington Road 34;
- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA) – COMPLETE; and
- Southerly extension of Southgate Drive to Maltby Road.

Table 3.4.4. Area Development Applications

Development	Residential Units	Non-Residential GFA	Two-Way Site Traffic¹ AM (PM)	Transportation Study / Analysis
1888 Gordon Street (Tricar Developments Inc.)	460 Apartment Units	6,350 sq. ft. non- residential GFA	297 (329)	1888 Gordon Street TIS, September 22, 2017, Stantec.
Neumann Subdivision (Coldwell Banker Neumann REB Ltd.)	Stacked townhouses and apartments (permitted use). Number of units unspecified.	3.22 ha Corporate Business Park <u>0.98 ha Commercial</u> 4.2 ha	205 (203)	Neumann Subdivision Guelph, ON TIS, October 2014, Paradigm Transportation Solutions Ltd.
Bird Subdivision (Thomasfield Homes Ltd.)	21 Single Family Units 36 Townhouse Units <u>249 Apartment Units</u> 306 Total Units	0.04 ha Future Development	107 (137)	Bird Residential Subdivision TIS, October 2010, Paradigm Transportation Solutions Ltd.
Southwest Corner of Gordon Street / Clair Road (Fieldgate)	-	7,408 sq. m. Retail	515 ²	Gordon Street and Clair Road October 2015, LEA Consulting Ltd.
Hanlon Creek Business Park	--	--	--	--
Dallan Residential Subdivision 161, 205 and 253 Clair Road East	409 residential units (Mix of densities)	--	--	1888 Gordon TIS assumed 105 units. ~400 units were previously proposed.

Development	Residential Units	Non-Residential GFA	Two-Way Site Traffic ¹ AM (PM)	Transportation Study / Analysis
South End Centre	-	13,935 sq.m. (150,000 sq.ft.) Recreation Centre	308 (411)	No TIS. Traffic referenced from 1888 Gordon TIS.
Westminster Woods Victoria Road South and Clair Road East	101 residential apartment units	745 sq. m. Commercial	70 (149)	Kingsbury C Westminster Woods TIS. March 2015, Stantec.

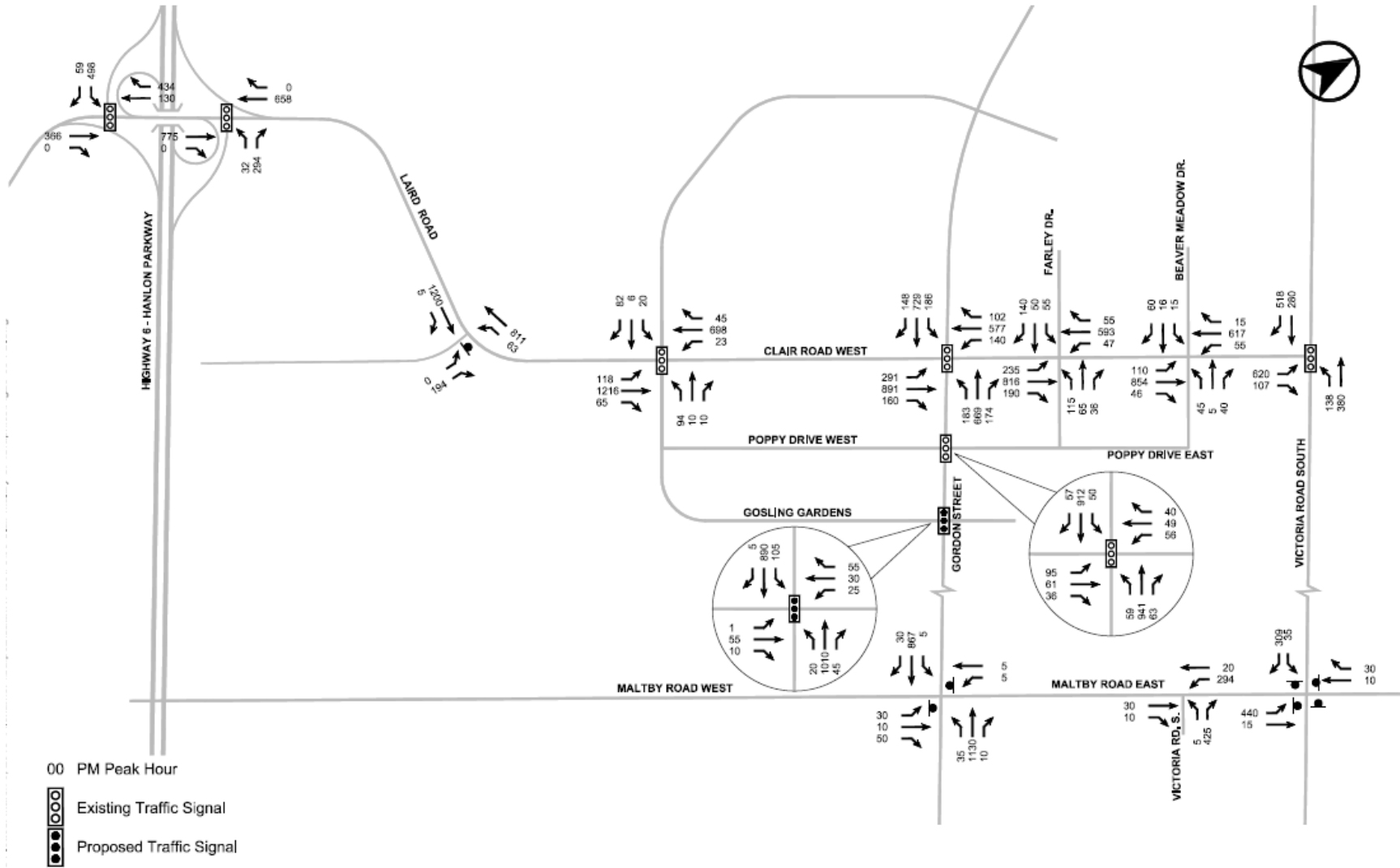
Notes:

1. Two-Way Site Traffic based on individual TIS reports.
2. 515 total PM trips, 340 net new PM trip
3. TIS = Traffic (or Transportation) Impact Study

In addition to the background developments noted in the above table, traffic allowances are made for lands previously comprising the Southgate Business Park.

Future Background traffic volumes, which are the sum of existing traffic volumes, corridor growth traffic volumes, and site-specific background development traffic volumes, are illustrated in Figure 3.4.5.

Figure 3.4.5. Future Background Traffic Volumes



3.4.1.8 Background Traffic Operations

Overall signalized intersection traffic operations are generally acceptable under future background traffic conditions and are similar to those observed under existing traffic conditions, although longer delays and higher volume-to-capacity ratios are observed at the key Gordon Street / Clair Road and Victoria Road / Clair Road intersections relative to the existing conditions.

The key Gordon Street / Clair Road intersection is anticipated to operate acceptably under future background traffic conditions, with an overall intersection v/c ratio 0.87 during the weekday afternoon peak hour. Relative to the existing condition, overall intersection v/c ratios increase by 32 per cent during the weekday afternoon peak hour, which is generally the result of anticipated increases in through traffic volumes along Gordon Street and Clair Road, site-specific development traffic, and an increase in eastbound left-turn traffic volumes resulting from specific area developments.

The future background traffic analysis indicates that the Victoria Road / Clair Road intersection generally operates acceptably, despite an increase in traffic delay and volume-to-capacity ratios. Relative to the existing condition, overall intersection v/c ratios increase by 25 per cent during the weekday afternoon peak hour, which is generally the result of anticipated increases in southbound right-turn and eastbound left-turn traffic volumes resulting from area-specific background developments.

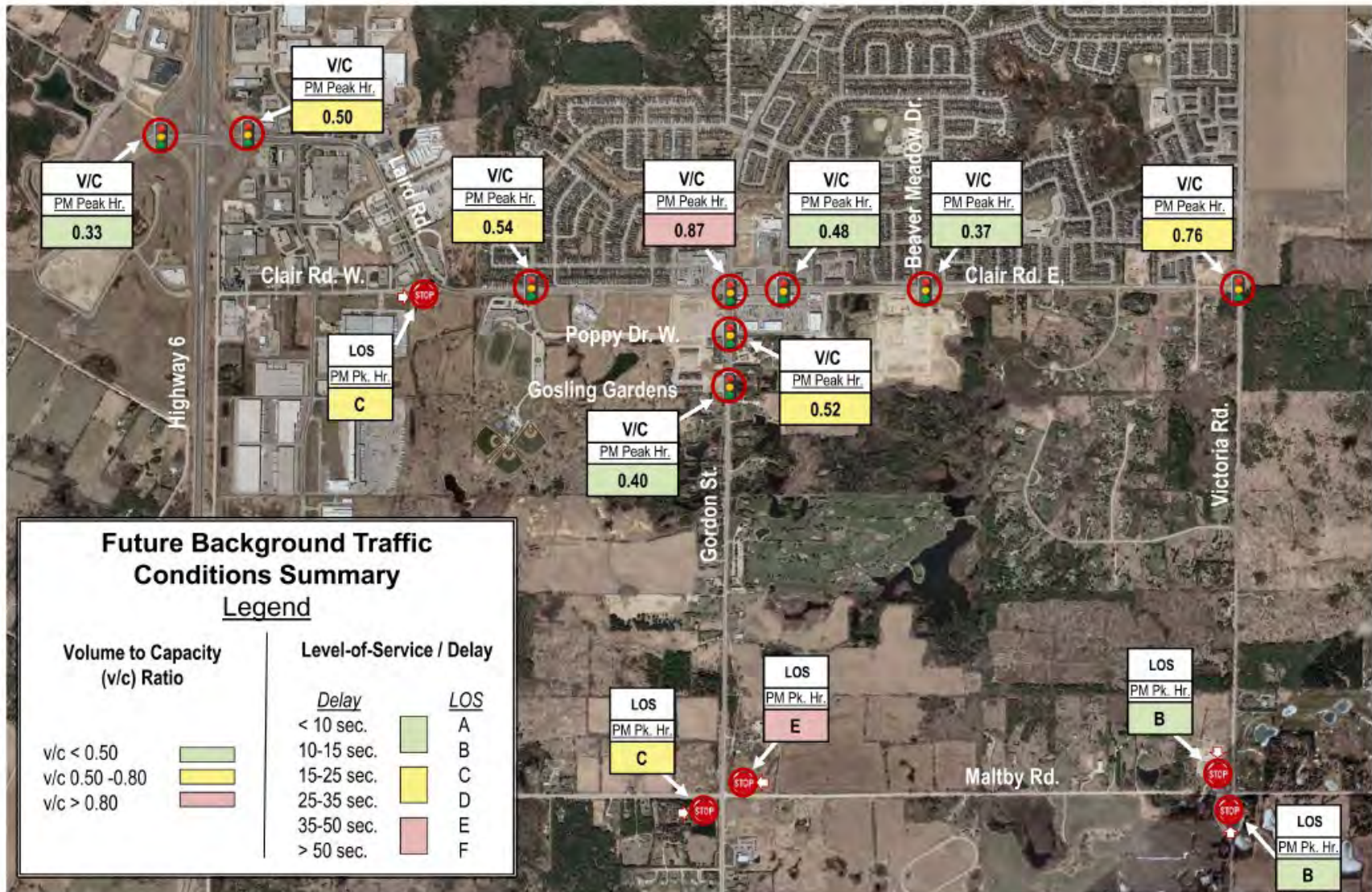
Traffic operations at unsignalized intersections within the study area are anticipated to continue to operate similar to existing conditions.

A summary of future background signalized and unsignalized traffic operations at key existing study area intersections is provided in Figure 3.4.6.

Individual movement and overall volume-to-capacity ratios for each of the signalized intersections within the study area are summarized in Appendix D.

Detailed results of the Synchro analysis are included in Appendix D.

Figure 3.4.6. Summary of Future Background Traffic Operations Analysis



3.4.2 Criteria/Standards/Policy

The Clair-Maltby Secondary Plan transportation elements are guided by the policies and plans set out in the policies outlined below.

3.4.2.1 The Provincial Policy Statement (PPS)

The Provincial Policy Statement (PPS) was enacted in 2005 and the most recent version came into effect on May 1, 2020. The PPS provides policy direction on land use planning, development and transportation matters. All planning decisions must be consistent with the PPS. The PPS is based on the principles of “maintaining strong communities, a clean and healthy environment and a strong economy” (Part IV Vision).

The PPS supports:

- connectivity within and among multimodal transportation systems, including across jurisdictional boundaries;
- safe and efficient movement of people and goods, appropriately addressing projected needs;
- density and a mix of uses to support the planning and development of alternative transportation modes and limit the length and need of vehicle trips and support current and future use of transit and
- active transportation;
- public streets that meet the needs of pedestrians and facilitate active transportation and community connectivity;
- efficient use of existing and planned infrastructure, including through Transportation Demand Management (TDM) strategies, where feasible;
- protection of rights-of-way for infrastructure including transportation and transit to meet current and project needs; and,
- protecting for long term goods movement facilities and corridors.

In addition, the PPS promotes planning decisions including intensification, redevelopment, accounting for existing building stock, promoting various types of housings, making efficient use of existing infrastructure, etc.

3.4.2.2 A Place to Grow

“A Place to Grow” - the Growth Plan for the Greater Golden Horseshoe was initially prepared by the Provincial government in 2006 and should be read in conjunction with the PPS.

All decisions made by municipalities with respect to planning matters must conform to the Growth Plan. The Places to Grow Growth Plan has been recently updated. In May 2019, the Government of Ontario released A Place to Grow: Growth Plan for the Greater Golden Horseshoe (APTG), and Amendment 1 to APTG was approved with an effective date of August 28, 2020. APTG and Amendment 1 replace the Growth Plan for the Greater Golden Horseshoe, 2006 that initially took effect on

June 16, 2006 and guides growth and development within the Greater Golden Horseshoe over the next 30 years.

The Growth Plan provides a vision and a framework for managing growth. It requires all municipalities to implement policies to achieve intensification and higher-densities to make efficient use of land and infrastructure and support transit viability, and directs growth to urban growth centres and transit corridors and stations areas. The plan also calls for the consideration of climate change in planning for future growth that supports moving towards low-carbon communities and approaches to reduce greenhouse gas emissions.

In these areas, the Growth Plan demands increased residential and employment densities to support existing and planned transit services, a mix of land uses, and designed access for various transportation modes to the transit facility including pedestrian and cycling infrastructure.

The Growth Plan requires land use planning to be coordinated with transportation planning and investment. The Plan states that transportation investments and the wider transportation system:

1. provide connectivity among transportation modes for moving people and for moving goods;
2. offer a balance of transportation choices that reduces reliance upon the automobile and promotes transit and *active transportation*;
3. be sustainable and reduce greenhouse gas emissions by encouraging the most financially and environmentally appropriate mode for trip-making and supporting the use of zero- and low-emission vehicles;
4. offer multimodal access to jobs, housing, schools, cultural and recreational opportunities, and goods and services;
5. accommodate agricultural vehicles and equipment, as appropriate; and
6. provide for the safety of system users.

The Growth Plan indicates that the design of new facilities and redesign of existing streets will adopt a complete-streets approach that will ensure the needs of all street users are accommodated; however, public transit will be the first priority for transportation infrastructure planning and major transportation investments.

Supported by the implementation of complete street policies, municipalities will ensure that active transportation networks are comprehensive and integrated into transportation planning. The Growth Plan states that Municipalities will develop and implement transportation demand management policies in official plans or other planning documents or programs to:

1. reduce trip distance and time;
2. increase the modal share of alternatives to the automobile, which may include setting modal share targets;
3. prioritize active transportation, transit, and goods movement over single-occupant automobiles;

4. expand infrastructure to support active transportation; and
5. consider the needs of major trip generators.

The Growth Plan also speaks to accommodating goods movement, through linking international gateways and employment areas by appropriate transportation facilities / infrastructure, and that municipalities establish priority routes for goods movement.

3.4.2.3 City of Guelph Official Plan

The City of Guelph Official Plan is a statement of goals, objectives and policies that guide Guelph's growth and development in the years leading up to 2031. The most recent statutory five year review was completed in three phases with Official Plan Amendment (OPA) 48 being the third and final phase. OPA 48 was approved by Council in June 2012 and approved by the Ontario Municipal Board, with some exceptions, in October 2017.

The City of Guelph Official Plan follows the policies laid out in the PPS and Growth Plan, and the Official Plan:

- a) establishes a vision, guiding principles, strategic goals, objectives and policies to manage future land use patterns that have a positive effect on the social, economic, cultural and natural environment of the city.
- b) Promotes long-term community sustainability and embodies policies and actions that aim to simultaneously achieve social well-being, economic vitality, cultural conservation and enhancement, environmental integrity and energy sustainability.
- c) Promotes the public interest in the future development of the city and provides a comprehensive land use policy basis which will be implemented through the Zoning By-law and other land use controls.
- d) Guides decision making and community building to the year 2031..

The Official Plan identifies in Figure 3.4.7, the Clair-Maltby Secondary Plan area as a "greenfield area", while the Clair Road / Gordon Street junction is identified as a "community mixed-use node" (OP Schedule 1). Lands within the Clair-Maltby Secondary Plan area are designated as Reserve Lands, Significant Natural Area, Corporate Business Park, Industrial and Low Density Greenfield Residential on Schedule 2 of the Official Plan. These areas are further noted as "reserve", "industrial" and "commercial" (ref. Figure 3.4.8).

In regards to development in new "greenfield" areas, the Official Pan directs new development to provide for a diverse mix of land uses at transit supportive densities (minimum 50 residents / jobs per hectare) that supports a multi-modal transportation network and efficient public transit that links to the City's Urban Growth Centre and surrounding communities.

Transit, along with walking and cycling, are to be supported by new development for everyday travel. The identified community mixed-use node at Clair Road / Gordon Street, is an area identified for higher density and mixed-use development that serve the wider community. The node is intended to be well served by transit and facilitate pedestrian and cycling travel.

Transportation policies are established within the Official Plan, which plans and manages the City's transportation system to accommodate the following:

- a) provide connectivity among transportation modes for moving people and goods;
- b) offer a balance of transportation choices that reduces reliance upon any single mode and promotes transit, cycling and walking;
- c) be sustainable, by encouraging the most financially and environmentally appropriate mode for trip-making;
- d) offer *multi-modal* access to jobs, housing, schools, cultural and recreational opportunities, and goods and services;
- e) provide for the safety of system users; and
- f) ensure coordination between transportation system planning, land use planning, and transportation investment.

Figure 3.4.7. Schedule 1, City of Guelph Official Plan – Growth Plan Elements

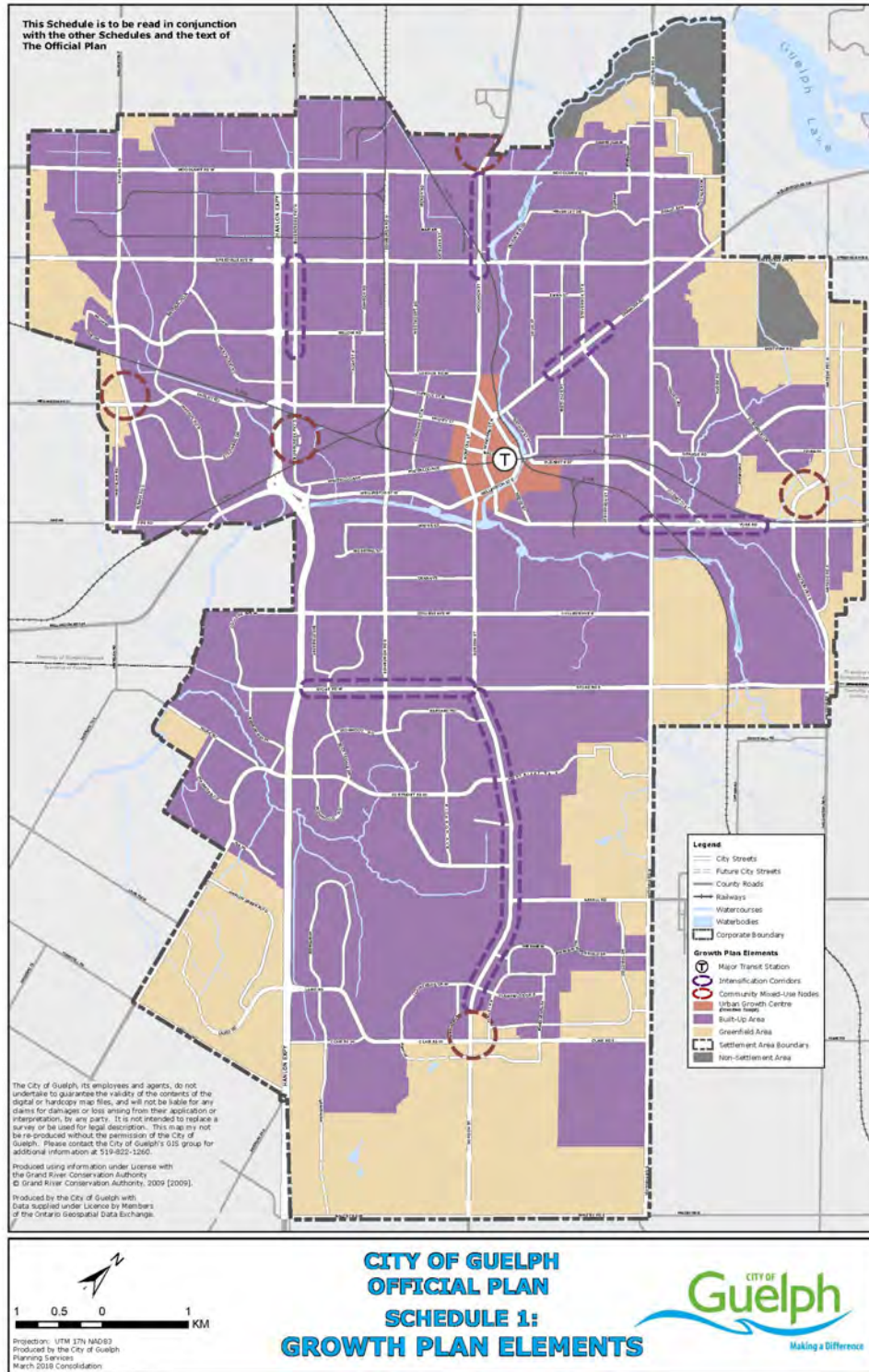
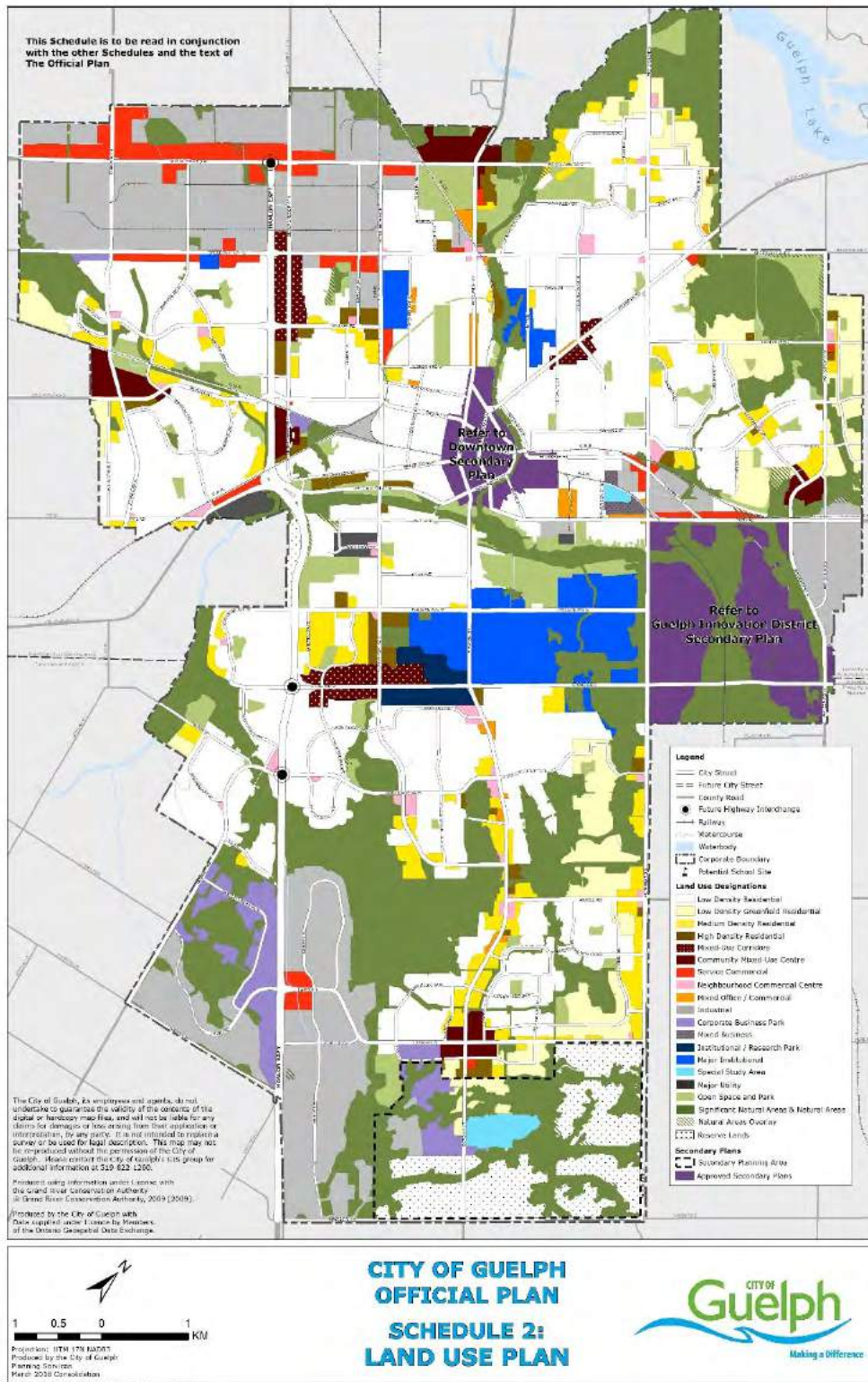


Figure 3.4.8. Schedule 2, City of Guelph Official Plan Amendment 48 - Land Use Plan



In planning for new - or reconfiguring existing - transportation infrastructure, the Official Plan states that proponents consider separation of travel modes within transportation corridors, use transit infrastructure to shape growth, place priority on increasing the capacity of existing transit systems, expand transit services to areas that are planned to achieved transit supportive densities, facilitate improved linages to / from Downtown Guelph and other intensification areas, and increase mode share of transit. In all cases, and consistent with provincial directives, public transit will be the first priority for transportation infrastructure planning.

In addition to prioritizing transit, the City is directed to develop transportation demand management (TDM) policies, and pedestrian and cycling networks to be utilized by planned new development.

The Movement of People and Goods section of the Official Plan generally defines the transportation policy for the City. The planning and design of the City Transportation system should meet the following objectives:

- a) To provide a transportation system, involving all transport modes, to move people and goods safely, efficiently and economically while contributing positively to the social, cultural and natural environments of the city.
- b) To ensure that the transportation system is accessible and meets the needs of all members of the community.
- c) To ensure that the transportation system is planned, implemented and maintained in a financially sustainable manner.
- d) To encourage and support walking and cycling as healthy, safe and convenient modes of transportation all year round and ensure that the design of pedestrian and cycling networks are integrated with other modes of transportation.
- e) To place a priority on increasing the capacity of the existing transit system and facilitate its efficient expansion, where necessary and feasible, to areas that have achieved, or are planned to achieve, transit-supportive residential and employment densities.
- f) To aim to increase non-auto mode shares.
- g) To develop and maintain an appropriate hierarchy of roads to ensure the desired movement of people and goods within and through the city.
- h) To work in co-operation with Federal, Provincial and other local governments, to create a transportation system that accommodates current and anticipated regional transportation movements.
- i) To reduce the amount of energy used for transportation.

Furthermore, the Official Plan establishes plans and objectives related to pedestrian and bicycle movement, public transport, roads, new / reconfigured road design, transportation and related urban environment, railways, and parking.

The City's policies also identify they will plan, implement and maintain a transportation system to facilitate increasing non-auto mode shares for average daily trips to 15% for transit, 15% for walking and 3% for cycling.

Key Pedestrian and Bicycle Policies

The City, through policies and standards, will ensure that bikeways and pedestrian walkways are integrated into and designed as part of new road and other infrastructure projects in the City. They will also support the creation of programs and facilities that will encourage walking and greater use of bicycles, through the integration of safe and convenient bike and pedestrian components into the design of new streets including shade trees, street furniture, lighting, street crossing and other traffic control. Policies also support the ongoing enhancement of a pedestrian and bicycle system that is convenient, safe and pleasant, serves both commuter and recreational purposes and provides access throughout the City. Additionally, new development will provide for bicycle / pedestrian linkages and street sidewalks, and quality (i.e. conveniently located, sheltered integrated into built form) bicycle parking facilities for uses such as employment/commercial, schools, and medium to high density residential..

The City, through policies established in the Official Plan, developed a Trail Network Plan that directs expansion of trail facilities in Guelph, including within the Clair-Maltby Secondary Plan area. This trail network plan is illustrated in Figure 3.4.9, and is complemented by the City of Guelph Active Transportation Network Plan, 2017 (ref. Figure 3.4.10).

Figure 3.4.9. Schedule 7, City of Guelph Official Plan Amendment 48 – Trail Network Plan

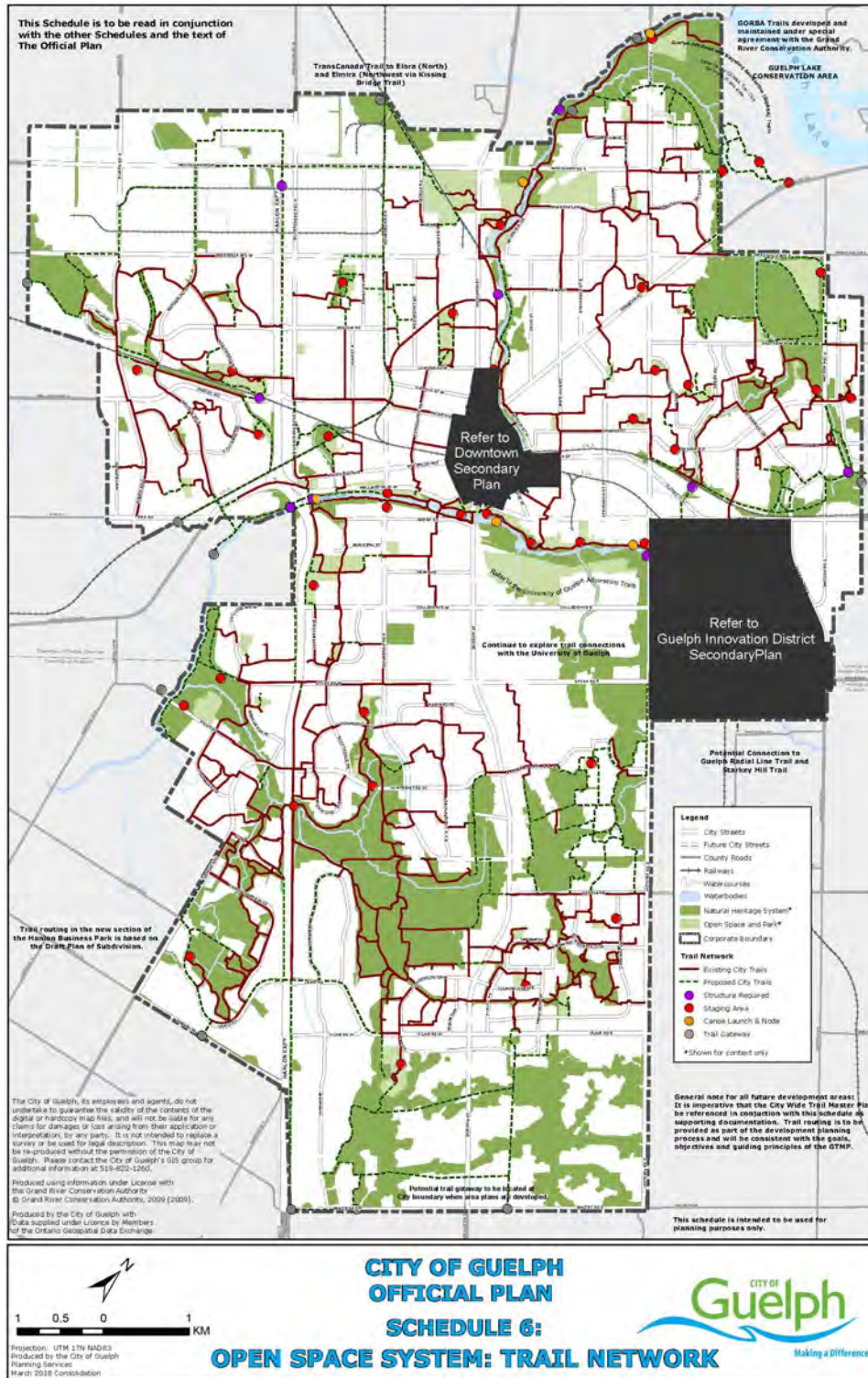
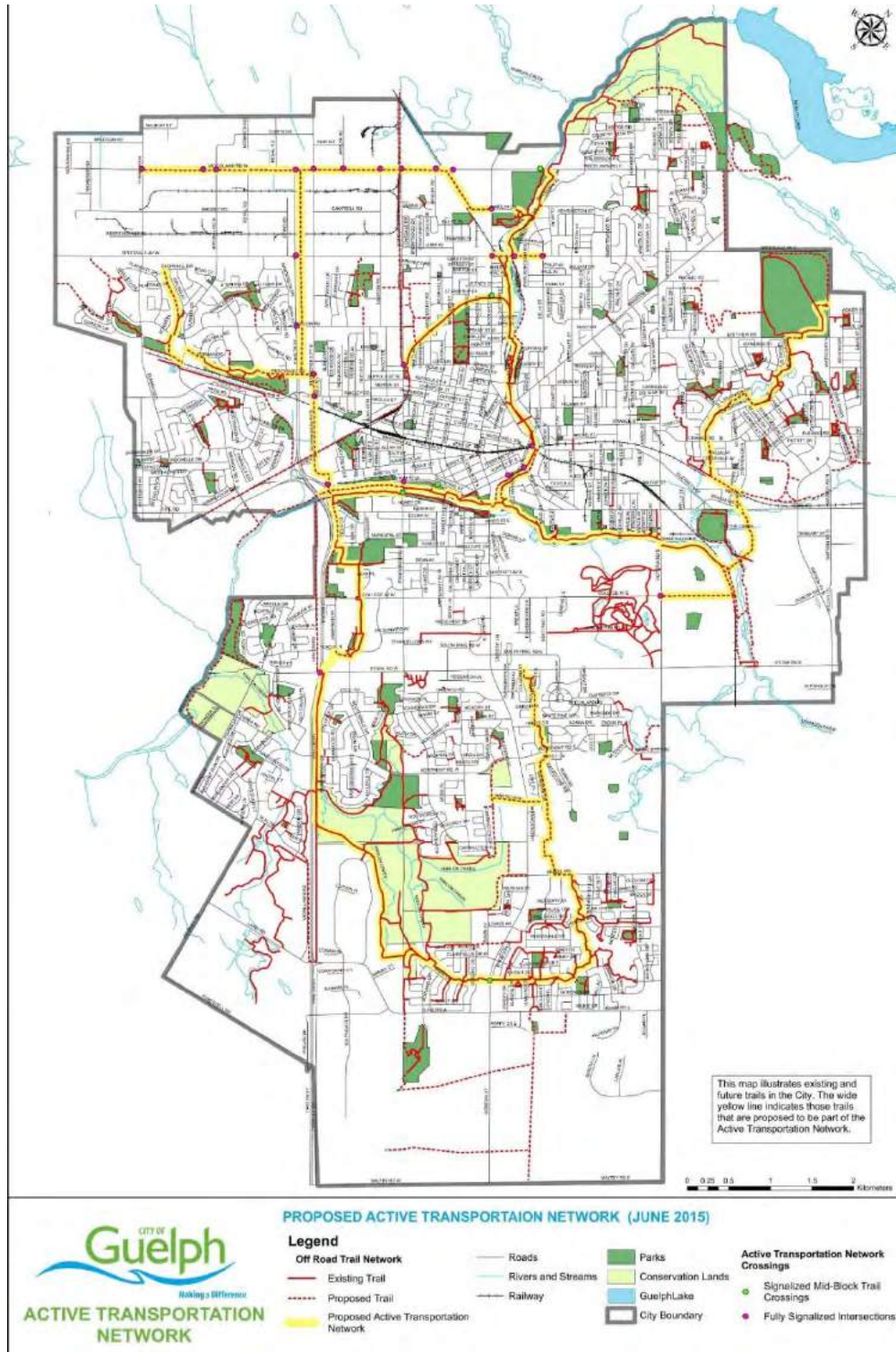


Figure 3.4.10. City of Guelph Proposed Active Transportation Network, 2017



Key Transit Policies

Important in maintaining and expanding transit services in the City of Guelph, the Official Plan cites developing a compact urban form with a mix of land uses, ensuring the creation of a street network that permits the location of transit stops within a reasonable walking distance of a significant majority of residents, jobs and other activities, and staging urban expansion to include the provision of transit service.

Within new development, transit facilities should be detailed in land use / development plans, and bus stops should be provided at regular intervals.

Roads and Road Design

The City of Guelph Official Plan recognizes that private automobiles will continue to represent the primary mode in meeting the travel needs of residents and businesses in the City, and lays out a hierarchy of public street facilities and their intended purposes / permissions: expressways, arterials, collects and locals.

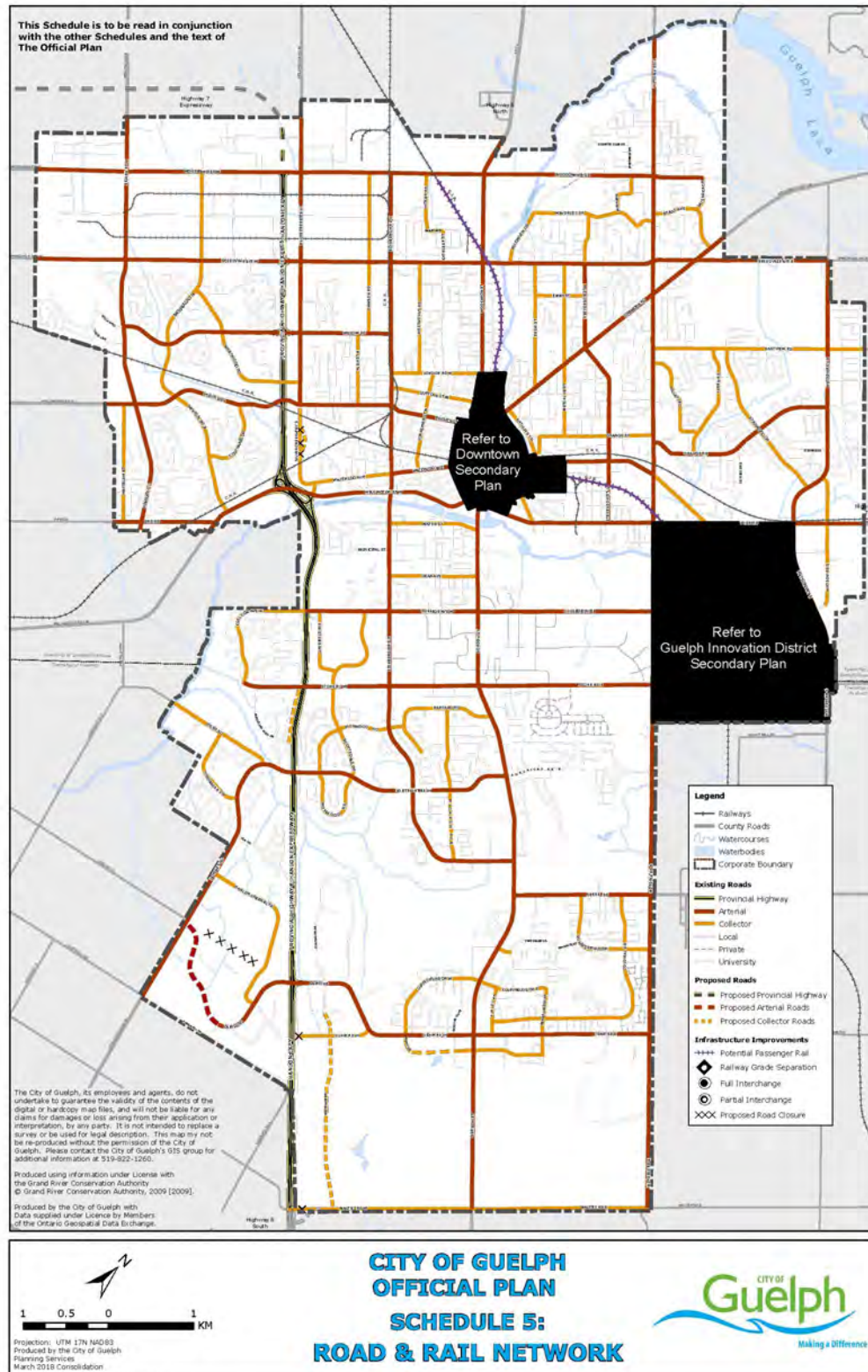
The main elements of the road network are identified in Schedule 5 of the Official Plan, which is included in Figure 3.4.11. In regard to new public streets and street design, the Official Plan promotes the creation of an arterial – collector grid system in new development areas to assist in the dispersion of traffic and to provide a reasonable walking distance to transit services. The Official Plan identifies that Arterial roads are meant to accommodate a high level of transit service and direct access from local roads / individual properties to an arterial shall be limited to avoid interference with the primary function of the roadway.

A series of public street widenings and "Ultimate Widths" are also identified in the Official Plan (Tables 5.1 and 5.2).

Key street widenings as they related to the Clair-Maltby Secondary Plan area include:

- Clair Road – 30 metre "ultimate width" (5 metre widening on both sides)
- Gordon Street - 30 metre "ultimate width" between Clair Road and Maltby Road (5 metre widening on both sides)
- Maltby Road – 30 metre "ultimate width" (5 metre widening on both sides)
- Victoria Road - 36 metre "ultimate width" between Stone Road and South City Limit (8 metre widening on both sides)
- Clair Road and Laird Road (potential widening to accommodate intersections improvements)
- Clair Road and Crawley Road (potential widening to accommodate intersections improvements)
- Gordon Street and Maltby Road (potential widening to accommodate intersections improvements)
- Maltby Road and Crawley Road (potential widening to accommodate intersections improvements)
- Victoria Road and Clair Road (potential widening to accommodate intersections improvements)
- Victoria Road and Maltby Road (potential widening to accommodate intersections improvements)

Figure 3.4.11. Schedule 6, City of Guelph Official Plan Amendment 48 – Road and Rail Network



Urban Environment

The City of Guelph Official Plan establishes policies as they relate to the impact of transportation facilities on urban neighbourhoods and design. These policies include minimizing the impact of trucks upon residential areas, maintain and enhance the streetscape (tree planting), minimize land use conflicts between major transportation routes and residential areas, and noise and vibration mitigation.

Railways

The City recognizes the importance of rail facilities to support freight service and passenger rail service, and to minimize road / rail conflicts through a program of grade-separated under / over passes.

Parking

The City of Guelph, through the application of the City Zoning By-law, establishes parking requirements for all types of land uses to ensure parking demands are met off-street. However, the City may, where the property owner enters into an agreement with the City to ensure continued availability of an off-street parking area, permit the provision of requirement parking spaces on another site that is within convenient and reasonable walking distance.

Key Transportation Demand Management (TDM) Policies

The City has established, within the Official Plan, that transportation demand management (TDM) is an essential part of an integrated and sustainable transportation system. TDM policies will be developed and implemented to reduce trip distance and time, and to increase the modal share of alternatives to the automobile. Suggested TDM measures include the following:

- including provisions for active transportation in association with development and capital projects including secure bicycle storage facilities and pedestrian and cycling access to the road network;
- supporting transit through reduced parking standards for some land uses or locations, where appropriate, and making provisions for parking spaces for car share vehicles through the development approval process where appropriate; and
- encouraging carpooling programs, preferential parking for carpoolers, transit pass initiatives and flexible working hours.

In addition, a Transportation Demand Management Plan is listed among the type of transportation studies that the City may require as part of a development application.

3.4.2.4 Guelph – Wellington Transportation Study (Transportation Master Plan)

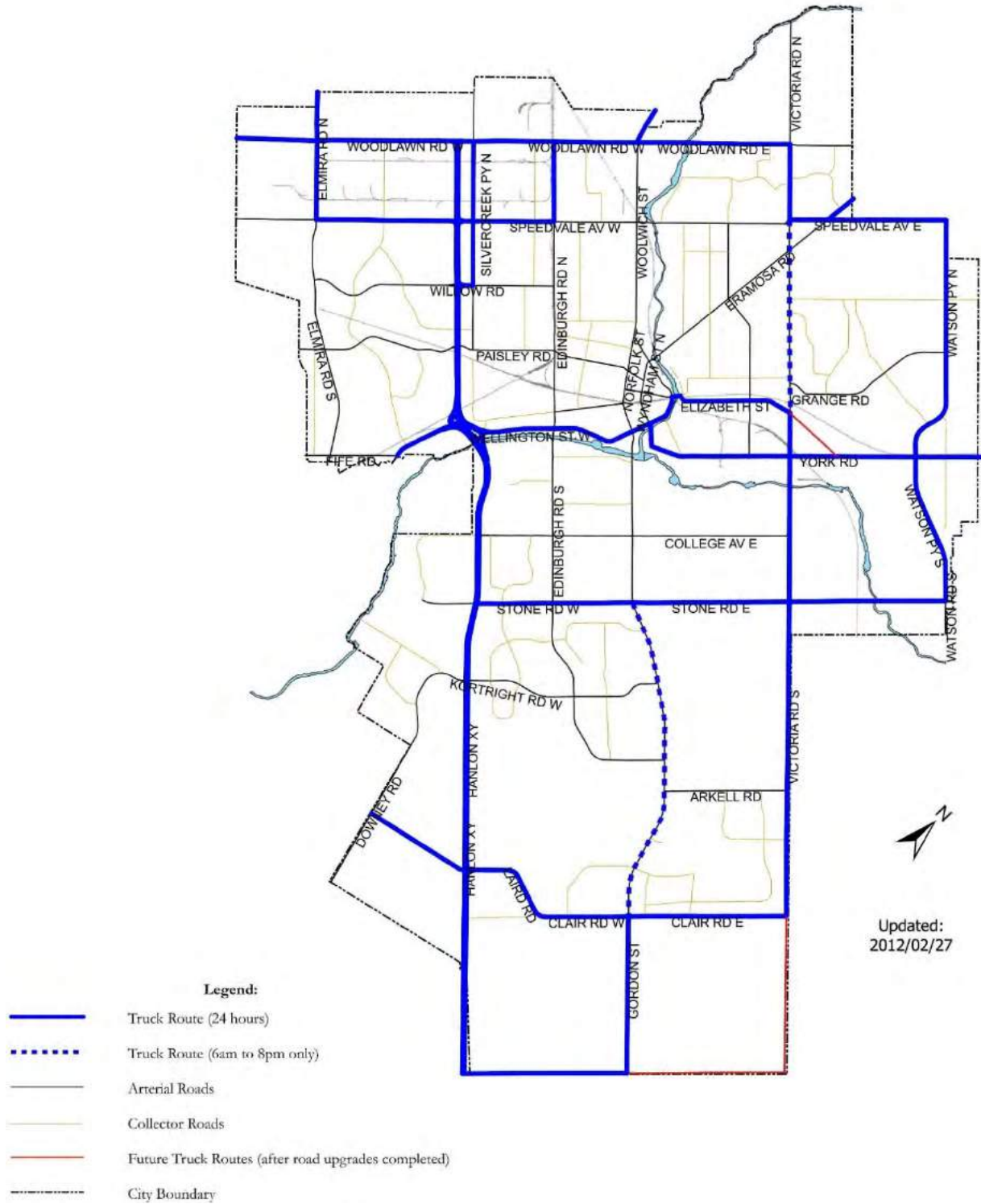
The City is in the process of updating their Transportation Master Plan (TMP), with prospective completion of the study by the end of 2021.

The Guelph – Wellington Transportation Study was undertaken by a consortium of planning and engineering consultants on behalf of the City of Guelph and finalized in July 2005, in an effort to address long-term transportation needs and improvements in accordance with the Official Plan policies and City’s Transportation Strategy and SmartGuelph Principles. The study has 5 main objectives:

1. Identify transportation needs and recommend practical improvements;
2. Recommend Transportation Demand Management (TDM) measures;
3. Identify improvements to City and County roadways;
4. Review Provincial highway initiatives affecting Guelph and Wellington County;
and
5. Review inter-regional travel between Guelph, the Region of Waterloo, and the GTA and identify opportunities for transit initiatives to serve this need.

The Master Plan provides direction on the City’s existing and planned cycling network, truck route network (Figure 3.4.12), and transit node and corridor framework which is intended to support transit routes and the potential removal of reduced / removed parking standards. These planned networks include components related to existing road facilities in the Clair-Maltby Secondary Plan area.

Figure 3.4.12. Truck Route Network



The Guelph – Wellington Transportation Study also reviews existing transportation behavior and forecasts future travel demands based on existing travel and demographic trends. The study concludes that travel demands are 2 to 3 times higher during weekday peak periods than typical weekday midday periods and that 83 per cent of trips within the study area are undertaken in a private automobile, and since the mid-1990s - travel demands have generally increased and average persons per vehicle have reduced. It is also important to note that a significant and increase amount of work travel is occurring between the Waterloo Region and Guelph areas.

Given the aforementioned trends, there is anticipated to be considerable road network deficiencies and traffic congestion in the long term, assuming no new infrastructure improvements, particularly in the South Guelph area. To accommodate increased traffic demand in the South Guelph area, the study identifies a number of improvements, including:

- Widening of Gordon Street from 2 to 4 lanes (approved 2001 EA) from Kortright Road to Wellington Road 34;
- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA) - COMPLETE
- Southerly extension of Southgate Drive to Maltby Road; and
- Development of an internal collector road system within the Clair-Maltby Secondary Plan area connecting to Gordon Street and Maltby Road.

Of note, the forecasting model does not indicate the need to widen Victoria Road south of Clair Road, or widen Maltby Road between Victoria Road and the Hanlon Express to be widened; however, both roads require upgrading.

The recommendation of TDM measures to reduce automobile use and increase use of alternative modes of transportation is identified as one of five primary study objectives in the Guelph-Wellington Transportation Study. The Study makes a connection between land use, urban form, density, neighbourhood design, and the transportation choices made by people making use of the network.

Ultimately, the document assesses an assortment of TDM measures and their practicality in Guelph; the Table 3.4.5 (Table 4.1 in the Guelph-Wellington Transportation Study) is included identifying TDM measures that either encourage alternative transportation modes or discourage automobile use:

Table 3.4.5. Guelph-Wellington Transportation Study TDM Measures

	Strategy	Practical	Limitations/Barriers
Encourage Walking, Cycling, Transit and Ridesharing	Urban Form	Yes	Long term effectiveness, market barriers
	Increased Density	Yes	Community acceptance, political commitment
	Mixed Uses	Yes	Development specialization, economics
	Neighbourhood Design	Yes	Some increase in private and public cost
	Car Pool/Van Pool Programs	Yes	Large employers, longer distance trips
	Guaranteed Ride Home	Yes	Part of a TDM program - not stand alone
	Parking Supply Management	Yes	Large employers and downtown
	HOV Lanes	No	Road right of way restrictions
	Cycling Routes and Facilities	Yes	Climate, fitness level, cost, trip length
	Pedestrian Trails and Walkways	Yes	Climate, fitness level, cost, trip length
	Increased Transit Service and Routes	Yes	Budget constraints, bus shelters, traffic congestion
	Transit Fare Strategies	Yes	Lack of tax incentives, cost
	Preferential Transit Facilities	Yes	Right of way constraints, traffic congestion
Improved Inter-City Transit	Yes	Inter-city licensing, reduced fare	
Programs to Discourage Auto Use	Telecommuting	Yes	Type of work, lack of supervision, security issues
	Alternative Work Schedules	Yes	Many in use - benefits may be minimal
	Vehicle Use Restrictions	No	Public acceptance and economic development issues
	Increasing Traffic Congestion	No	Emissions, emergency service, neighbourhood infiltration
	Congestion Pricing	No	Public acceptance and economic development issues
	Increase Driving Cost	No	Legislation changes, economic development issues
	Parking Pricing and Supply Management	Yes	Limited to downtown and University, economic development issues

Additional Guelph Transportation Demand Management Policy

Additional policy documents in the City of Guelph TMP provide a basis for the advancement of Transportation Demand Management (TDM).

The Downtown Guelph Secondary Plan includes TDM policy in support of the promotion of alternatives to automobile use. Policy tools that are mandated or suggested include working with transit providers, developers, and businesses to promote TDM, requiring large-scale developments to complete a TDM plan describing facilities and programs intended to reduce single occupancy vehicle trips, minimize parking and promote alternative travel modes, and finally, suggests the City may permit reduced parking supplies if a TDM plan proves that reduced parking is appropriate.

The Guelph Innovation District Secondary Plan promoted the implementation of TDM measures, through working with developers and businesses to reduce vehicular trips and to promote alternative travel modes.

The City of Guelph Community Energy Plan makes the connection between environmental and energy related goals and the need to reduce energy use and greenhouse gas emissions generated by transportation. A stated goal is to reduce transportation energy use by 25 per cent (while accommodating Guelph’s growing transport requirements) using sensitive urban design, effective alternative transport options (i.e. through TDM and a focused attention on competitive mass transit), and encouraging vehicle efficiencies.

3.4.2.5 Transit Framework

Transit Growth Strategy and Plan

The “Guelph Transit Growth Strategy and Plan and Mobility Service Review” was prepared in 2010, and was prepared to assess the transit market, estimate future travel demand (ridership forecasts), outline mobility service and higher-order transit opportunities, and detail associated capital and revenue implications associated with service recommendations. It should be noted that the plan is now seven years old and, at the time of the study, did not forecast any substantial development within the Clair-Maltby Secondary Plan area within the 2031 horizon year period.

Of the report’s key recommendations, that includes development of the South Guelph area, include:

1. Establish the Gordon / Norfolk / Woolwich spine as a Bus Rapid Transit priority corridor, starting with the implementation of queue jump lanes, traffic signal priority, and express bus services, and additional infrastructure as demand increases (dedicated bus / HOV lanes). Specifically, the report recommends that as transit demand increases, a dedicated transit / HOV lane be provided in each direction of Gordon Street, firstly between Stone Road and Clair Road, and eventually on Gordon Street south of Clair Road. Many of these improvements have been implemented along Gordon Street north of Clair Road. Transit service improvements along the Gordon Street corridor should include improved passenger amenities at transit stops.
2. Introduction of train service on the Guelph Junction Railway, including the introduction of up to 4 stations including a station servicing the Guelph Innovation District (northeast of the Clair-Maltby area) and the downtown.
3. Establish new inter-city / inter-regional bus and rail transit connections, most notably to Kitchener, Waterloo, Cambridge, and potentially, Georgetown, Brampton, Milton, Mississauga, and Hamilton.
4. Work with property owners to establish a 4 to 6 bay bus terminal within the South End Node (Gordon Street and Clair Road).

Recommendations 1 and 2 in the foregoing list establish a transit structure for the City by connecting key existing and emerging nodes via priority corridors.

Moving Guelph Forward: Guelph Transit Growth Opportunities

This report identifies immediate and recommended route service changes while highlighting potential long-term areas of growth related to service enhancements and infrastructure. The report was released in 2016 and outlines existing trends and service standards, and potential opportunities to make transit more attractive and increase ridership.

The report includes a summary of rider survey data, which indicates among other items, that transit riders are evenly satisfied / dissatisfied with service frequency and on-time arrival, and generally dissatisfied with local service connections to GO (regional service) facilities.

Moving Guelph Forward also describes recommended service changes and future measures that are intended to increase ridership and achieve a 15 per cent transit mode share – consistent with policy objectives of OPA 48 and the Guelph – Wellington Transportation Study. Recommended service changes, in the vicinity of the Clair-Maltby Secondary Plan area include minor alterations to the #5 Clair and #56 Victoria Express bus routes, which will potentially be altered again given the development of the Clair-Maltby precinct. Transit priority measures, to be potentially integrated within the Maltby Secondary Plan area to increase ridership, include:

- Queue jump lanes,
- Reversible lanes,
- Roundabouts,
- Transit signal priority, and
- Reserved bus lanes.

3.4.2.6 Cycling and Trails Framework

Cycling Master Plan – Bicycle Friendly Guelph (2012)

The City's Cycling Master Plan (February 2012), is directed by the City's Official Plan, and provides recommendations and strategies that aim to operationalize the visions of the Bicycle-Friendly Guelph Initiative formed by the City.

The City's vision for becoming one of Canada's most bicycle-friendly communities includes 1) more people cycling, 2) a safer and more connected network, 3) strong culture of cycling, and 4) measured improvements.

Engineering Principles

The Cycling Master Plan's recommendations for Safe and Continuous Infrastructure (Engineering) outlines tools for selecting types of bikeways relative to vehicular volume, vehicular speed, and local context that influence cyclist safety and comfort levels relative to other on-street facilities and vehicles.

Bikeway Treatments

The Cycling Master Plan identifies several types of bikeway treatments for consideration by the City of Guelph:

- Signed Routes
- Bicycle Boulevards
- Shared-Use Lanes (Sharrows)
- Advisory or Suggested Lanes
- Bike Lanes and Paved Shoulders
- Multi-Use Boulevard Trails, and,
- Cycle Tracks / Physically-Separated Bike Lanes

Intersection Treatments

The plan also recommends that the design of intersections should also take into account the many possible movements of cyclists at intersections including:

- General intersection guidelines to address visibility where there is a higher presence of conflicts between cyclists, motorists, and pedestrians;
- Accommodating Left Turns at signalized and unsignalized intersections; and,
- Specific cases where two arterial roads intersect and all intersections with multi-use boulevard trails.

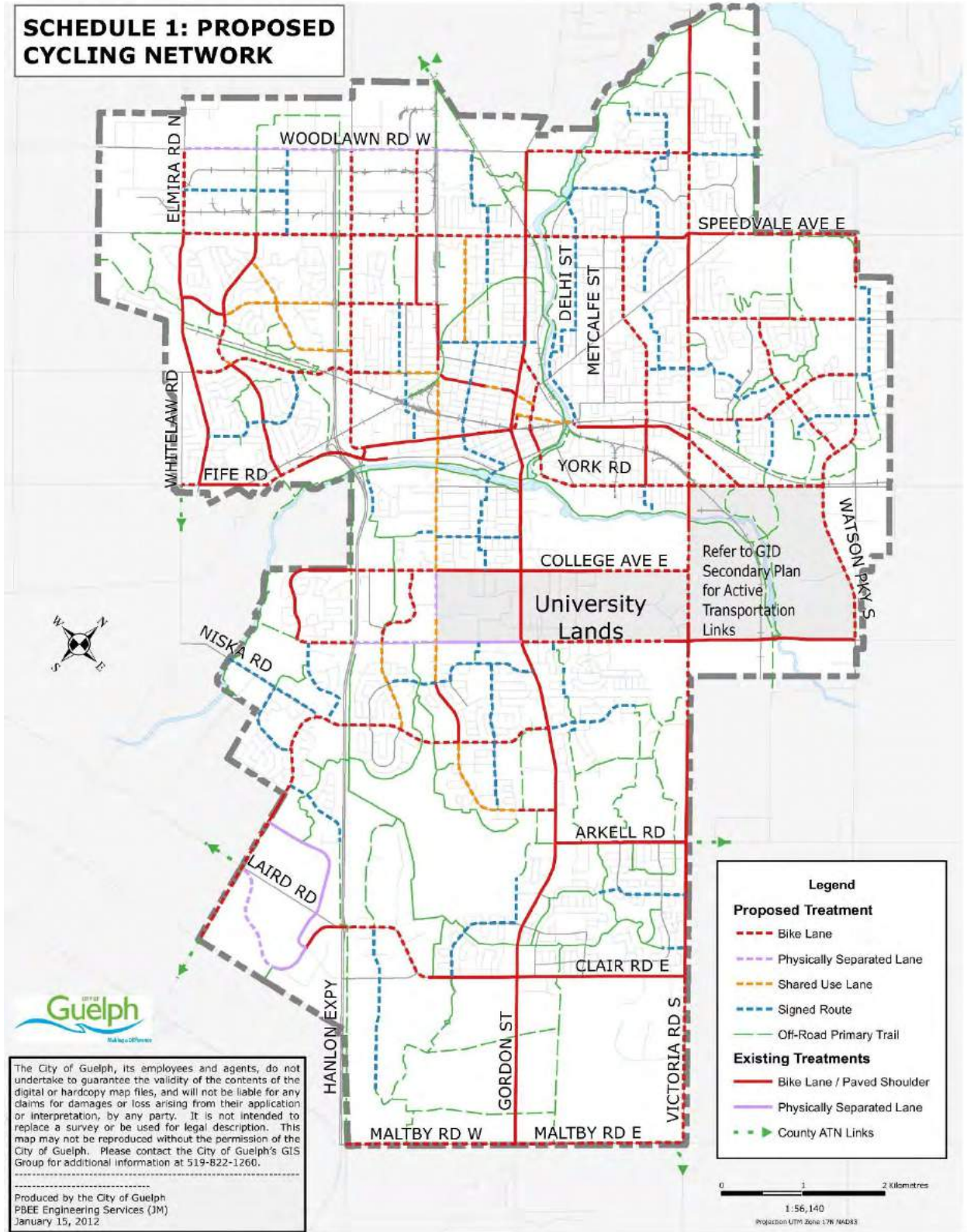
Cycling Network Plan

The recommended Cycling Network Plan from the Cycling Master Plan is provided in Figure 3.4.13.

This Cycling Network Plan identifies several existing and proposed surface treatments for the Clair-Maltby study area. Existing and proposed cycling treatments within the study area include:

- **Existing Bike Lanes / Paved Shoulder** are identified along both Clair Road East and Gordon Street within the study area.
- **Proposed 1 metre Paved Shoulder** is proposed along east-west Maltby Road and along north-south Victoria Road South (between Clair Road and Maltby Road)
- **Off-Road Primary Trails** are proposed at two locations running east-west across Gordon Street that will make connections to the proposed north-south signed routes along Southgate Drive. North-south off-road trails are also proposed within the study area that will connect to proposed signed routes along Clairfields Drive West, existing trails north of Clair Road, as well as at two locations potentially crossing Maltby Road to the south.
- **County ATN Links** are proposed at the southeast corner of the study area at the intersection of Maltby Road East and Victoria Road South.

Figure 3.4.13. Proposed Cycling Network – 2013 Guelph Cycling Master Plan



End-of-Trip Facilities Recommendations

The Cycling Master Plan outlines guidelines for providing end-of-trip facilities (bike parking facilities). They have identified two classes of bicycle parking as follows:

- Class One: Long-term bicycle parking
- Class Two: Short-term bicycle parking
- Additional Class: Artistic bicycle parking

The Cycling Master Plan outlines recommended Bicycles Parking Requirements for each Class of parking, by type of land use. Recommendations for General Rack Spacing and Rack Spacing within the Public Right-of-Way are also recommended as part of this section of the Cycling Master Plan.

Education and Encouragement

The Cycling Master Plan recommends complementing the guidelines for providing a safe cycling environment with complementary encouragement and education with a set of recommended objectives and actions.

Enforcement

The Cycling Master Plan recommends continued and improved actions to cycling enforcement as a means to reduce incidents and provide front-line education to both drivers and cyclists.

Evaluation

The Cycling Master Plan recommends actions to monitor and measure success in order to guide future planning and policy decisions.

Guelph Trails Master Plan (2005)

The Guelph Trails Master Plan is currently in the process of being updated and is currently in Phase 4 of the update, where a final draft master plan will be prepared.

The Guelph Trail Master Plan (GTMP, Fall 2005) was established to provide an overall vision to the developing trail system. The Goal of the GTMP is to:

“develop a cohesive city wide trail system that will connect people and places through a network that is off-road wherever possible and supported by on-road links where necessary”

The GTMP outlines the following areas of recommendations:

- Establishing the Need for Trails;
- Understanding the Resources;
- Planning for Trails;
- Building Trails; and,
- Supporting Trails.

The GTMP outlines a hierarchy of trail types: Primary, Secondary, Tertiary, and Water Routes for canoeists and kayakers.

The Trail Network

The GTMP Trail Network, outlining the hierarchy of trail routes including desire lines for the Clair-Maltby study area is presented in Figure 3.4.14.

The GTMP Trail Network identifies conceptual connections through the Clair-Maltby study area that are generally consistent with the Open Space Corridors outlined in the City's Official Plan. There are two north-south Primary conceptual connections through the Clair-Maltby study area and one east-west Primary conceptual connection crossing Gordon Street midblock between Clair Road and Maltby Road. The north-south connections provide an opportunity to connect to the primary trail network north of Clair Road and also to connect with potential Trail Gateways at the Maltby Road City Boundary. Conceptual secondary connections are shown at regular intervals south of Clair Road.

On and Off-Road

The GTMP Trail Network, outlining the On and Off-Road Breakdown of trails, is presented in Figure 3.4.15. The primary trails identified in the Clair-Maltby study area are largely intended to be off-road routes, with some local connections secondary connections intended to be on and off-road and located at regular intervals.

Figure 3.4.14. City Wide Trail Master Plan Trail Network

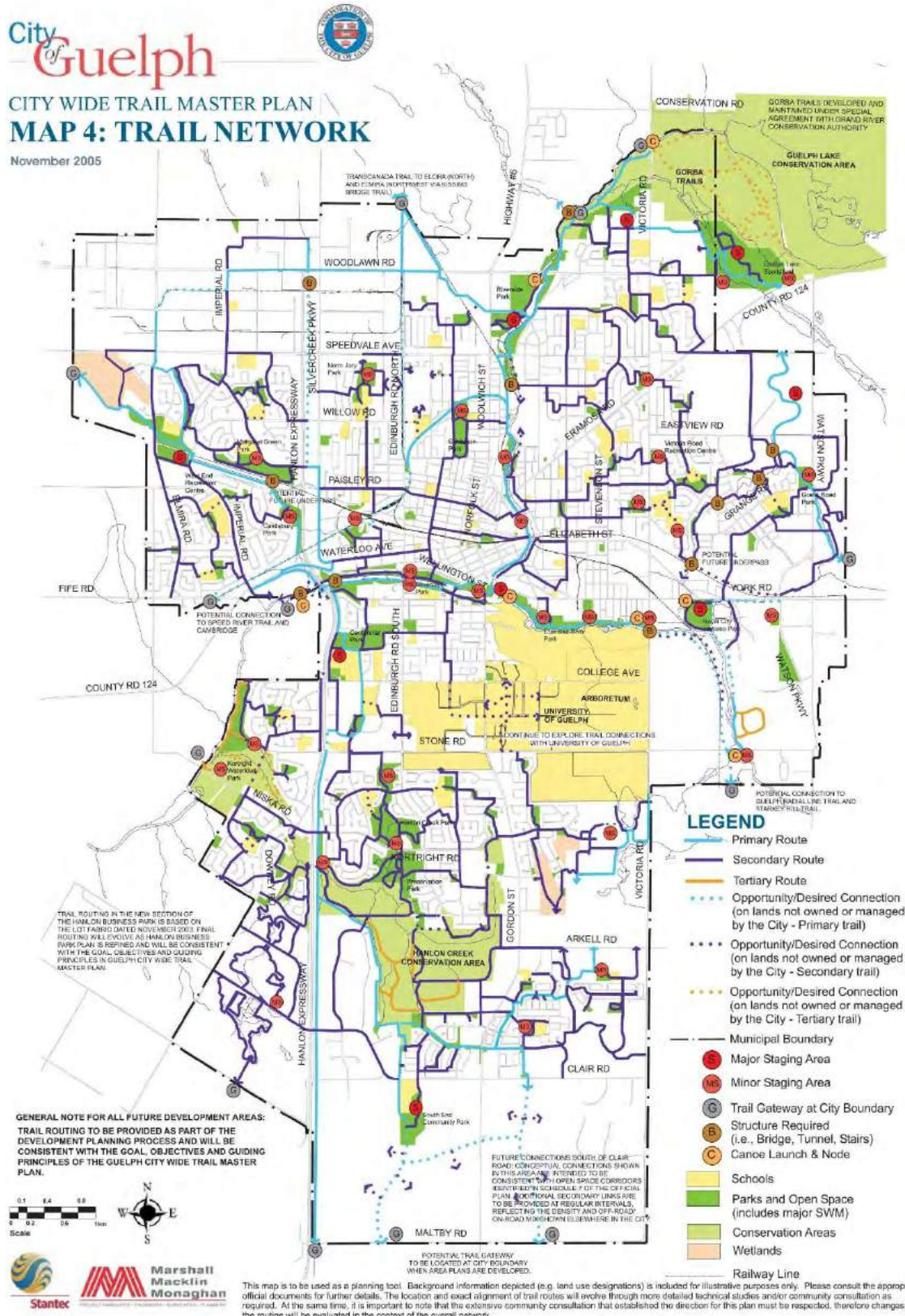
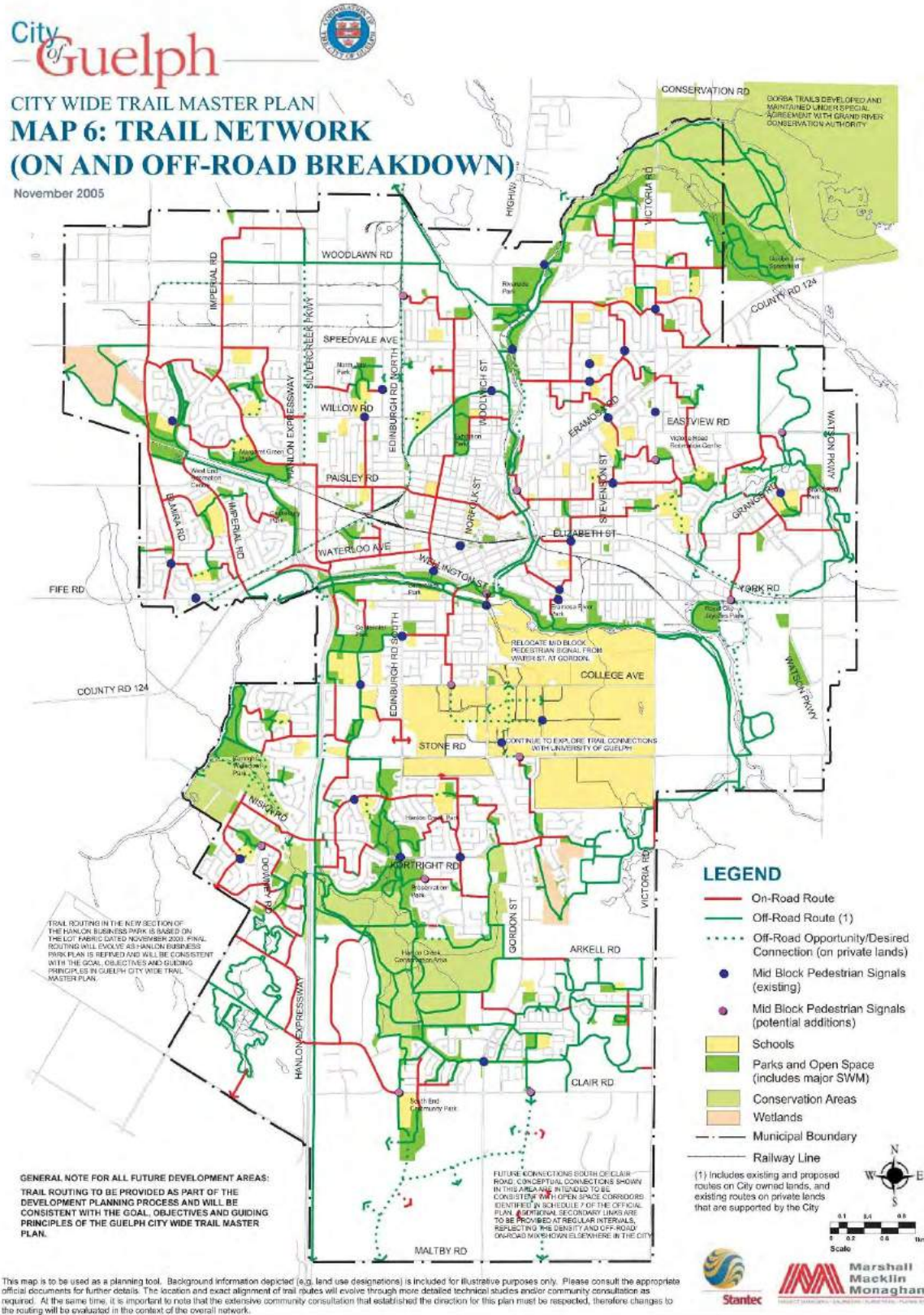


Figure 3.4.15. City Wide Trail Master Plan: Trail Network (On and Off-Road Breakdown)



On-Road Cycling Linkages

The GTMP Trail Network, outlining the potential On -Road Cycling Linkages, is presented in Figure 3.4.16. The arterial roadways in the Clair-Maltby study area, including Clair Road, Maltby Road, Gordon Street, and Victoria Road are all identified as On-Road Bicycle Network linkages. A potential connection south of the City is also identified on this figure at Maltby Road / Victoria Road.

Timing of Priorities

The current GTMP Trail Network recommends three timeline phases:

- Short Term (0 to 5 years - 2005-2010)
- Medium Term (5 to 15 years – 2011 to 2021)
- Long Term (beyond year 15 – beyond 2021)

The trail network proposed for the Clair-Maltby study area is identified as a “Medium Term” priority, as illustrated in Figure 3.4.17.

Building and Supporting Trails

The GTMP outlines available resources for design guidelines and construction details applicable to the trail network. Recommendations are also made for promoting, encouraging trail use, educating users, maintaining, managing, and monitoring trails.

Figure 3.4.16. City Wide Trail Master Plan: Potential On-Road Cycling Linkages

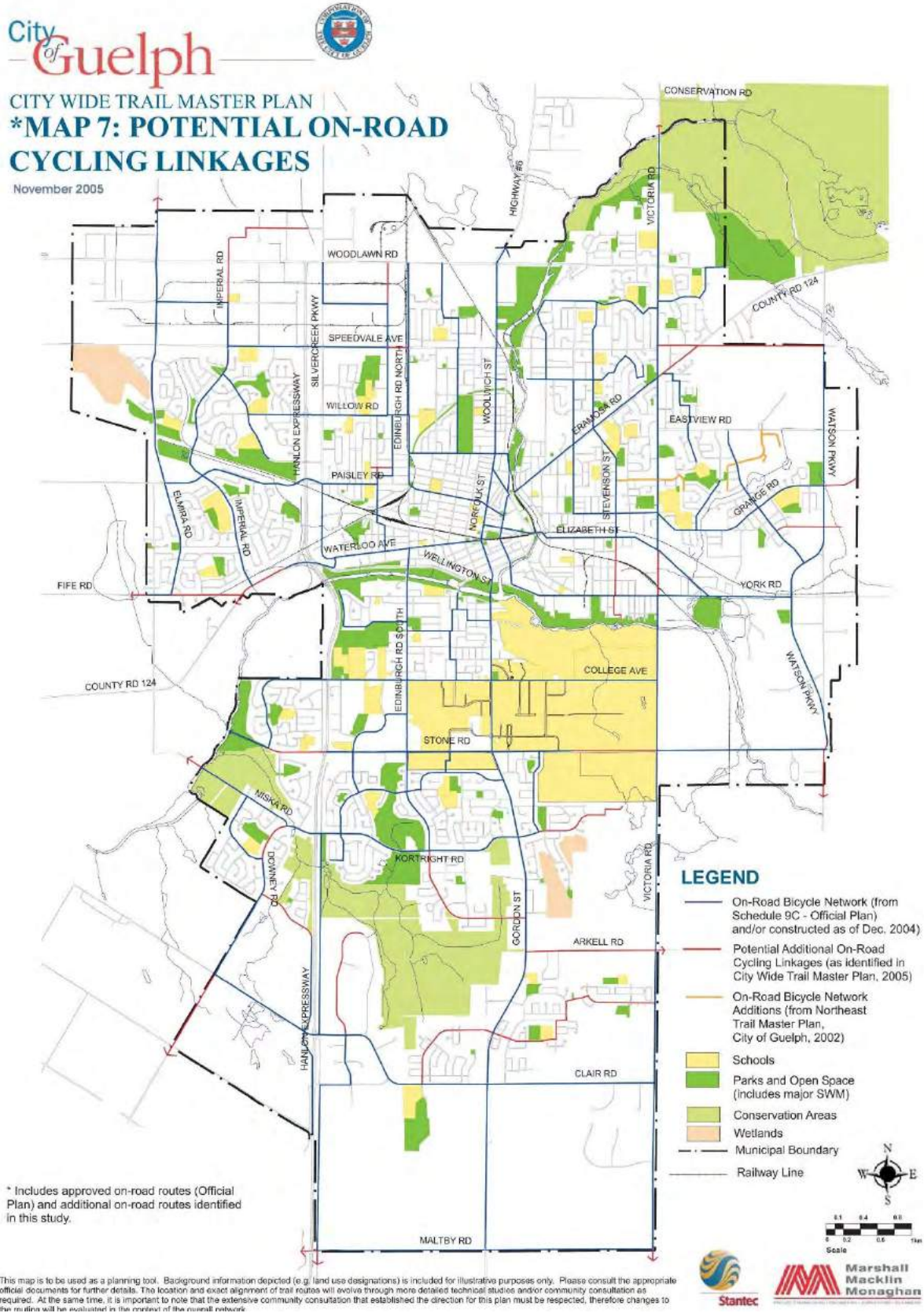
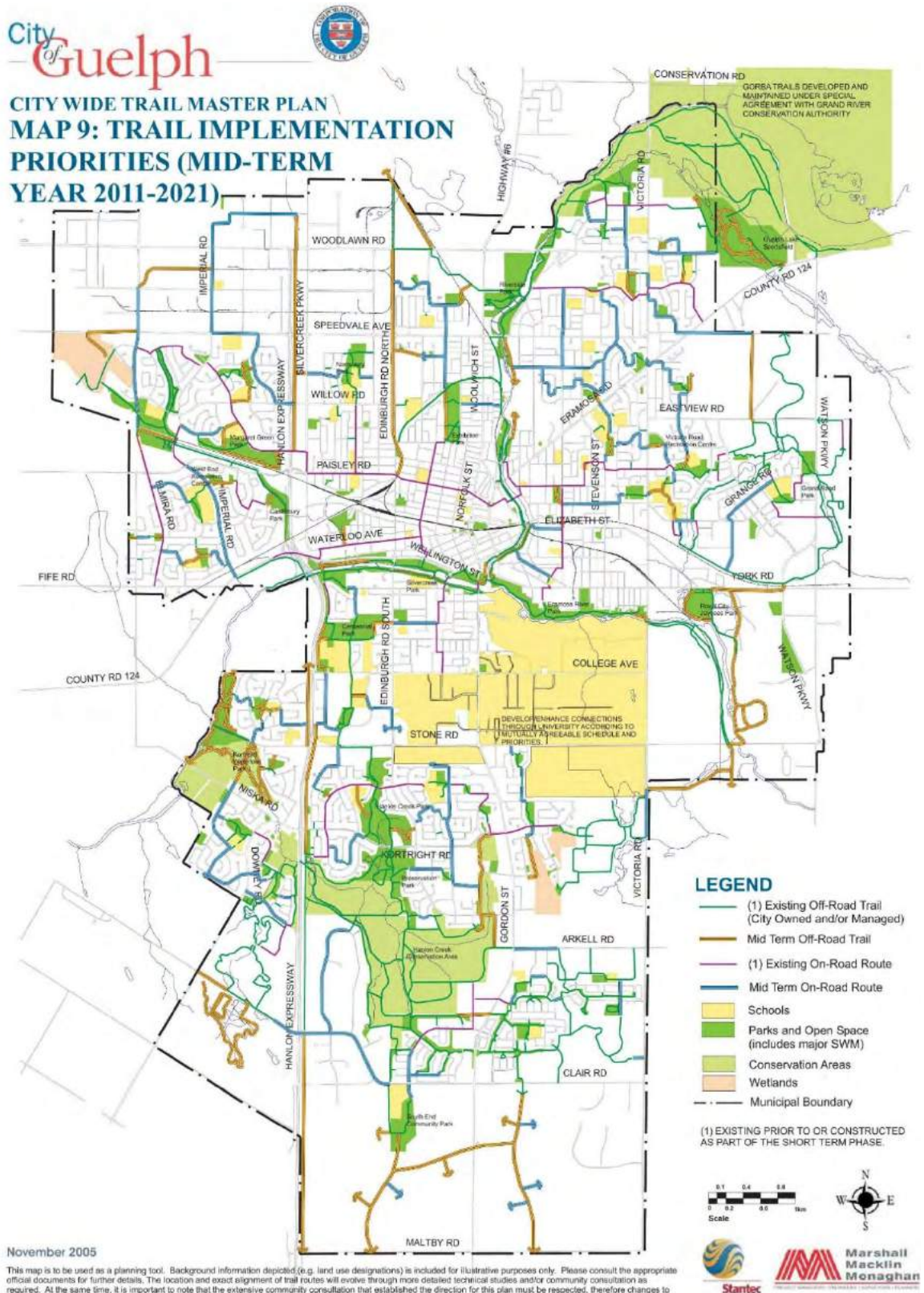


Figure 3.4.17. City Wide Trail Master Plan: Trail Implementation Priorities (Mid-Term Year 2011-2021)



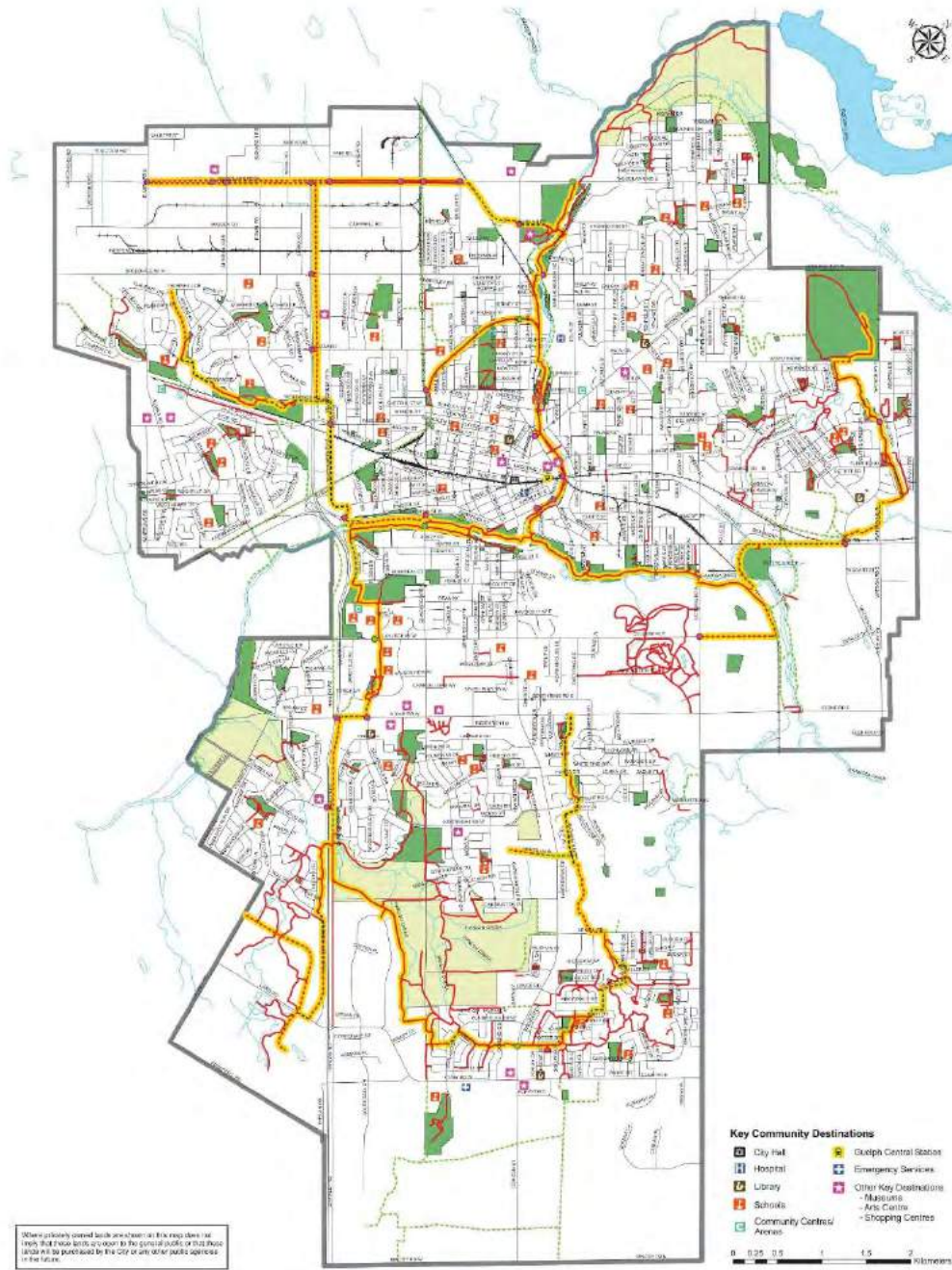
Active Transportation Network Study (2017)

The Active Transportation Network Study (ATN Study, January 2017) builds on the Primary Trails system of the Guelph Trails Master Plan (2005) and the infrastructure (Engineering) objectives of the Cycling Master Plan (2012).

The ATN Study was prepared by MMM Group / Paradigm Transportation Solutions on behalf of the City of Guelph to assess the feasibility of upgrading and maintaining existing and proposed Primary Trails in Guelph – notably the trail network identified in the City’s Draft Proposed Active Transportation Network (ATN).

The ATN’s Recommended Active Transportation Network is presented in Figure 3.4.18. However, given that the ATN largely reviewed the primary trail system identified by the Trail Master Plan and Cycling Master Plan, the planned trails identified in the Clair-Maltby study were outside of the scope of the ATN.

Figure 3.4.18. Recommended Active Transportation Network



Where privately owned lands are shown as blue areas, it is not intended that these lands are open to the general public or that these lands will be purchased by the City or any other public agency in the future.

4.1 RECOMMENDED ACTIVE TRANSPORTATION NETWORK



- Off-Road Trail Network**
- Existing Trail
 - Proposed Trail (from previously approved plans, alignment to be confirmed in the next Guelph Trail Master Plan Update)
 - Proposed trail route identified during the ATN Study
 - Recommended Active Transportation Network
 - Proposed trail identified in the Guelph Trail Master Plan (2015) or other approved City plan / planning approval analysis. Shown for illustrative purposes.

- On-Road Links**
- On-road link, critical to connectivity of the Active Transportation Network. Route also identified in the Guelph Cycling Master Plan (2019)
 - On-road link, critical to connectivity of the Active Transportation Network. Route identified during the ATN Study
- Existing Active Transportation Network Crossings**
- Existing Mid-block Pedestrian Signal located on the ATN Study Route
 - Existing Signalized Road Intersection

- Roads
- Rivers and Streams
- Railway
- City-owned Park or Open Space
- Conservation Authority Lands
- Guelph Lake
- City Boundary

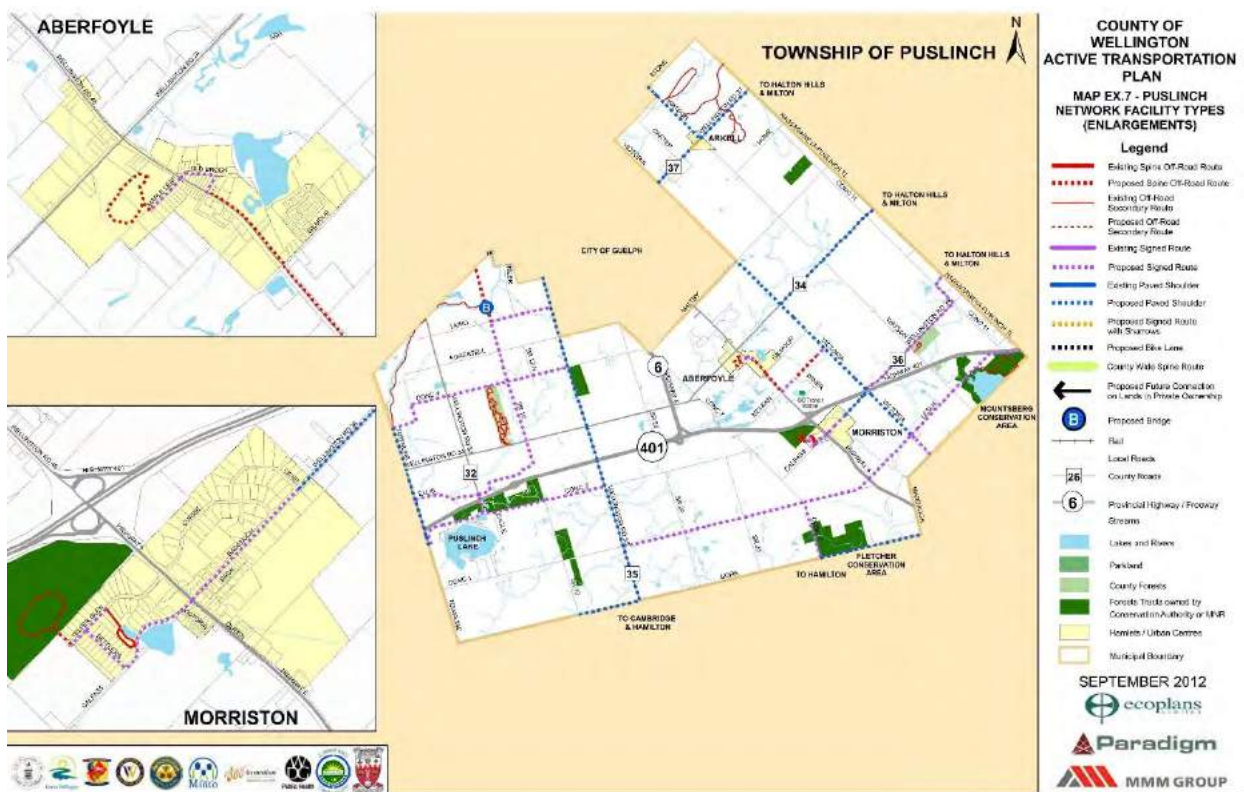
Wellington County Active Transportation Plan

The Wellington County Active Transportation Plan (ATP, September 2012) provides guidelines and strategies that aim to meet the County’s goals in fostering a healthy and more sustainably community, notably including an Active Transportation Network (ATN) that connects the County’s communities.

The Township of Puslinch, within Wellington County, is directly adjacent to the Clair-Maltby study area.

The County of Wellington Active Transportation Plan for Puslinch is illustrated in Figure 3.4.19. A proposed paved shoulder condition is recommended along Victoria Road, connecting with the southeast corner of the Clair-Maltby study area.

Figure 3.4.19. County of Wellington Active Transportation Plan: Map Ex.7 Puslinch Network Facility Types (enlargements)



3.4.2.7 Engineering Design Criteria and Standards

Development Engineering Manual, Version 2.0 (2019)

City of Guelph Engineering and Transportation Services prepared their Development Engineering Manual (DEM, January 2019) to guide engineering related aspects of development related work, including established Engineering Design Criteria and Standards intended to be used by developers, residents and the City to inform engineering design and related review and discussion. The DEM recognizes that the outlined standards may not be compatible to all scenarios, and engineering judgement should be used in such cases.

The key objectives of the DEM are to:

- Document existing process information related to the engineering submission of a development application;
- Outline requirements and standards for the engineering design of new developments within the City;
- Provide guidance and framework for applicants submitting engineering designs and reports in support of development applications;
- Provide guidance to City staff when reviewing and commenting on engineering aspects of a development application; and
- Identify the role and involvement of City departments and external agencies as part of the development engineering review and approval process.

The DEM is complemented by Part B Specs (Linear Infrastructure Standards, 2017) that provides, in detail the City’s standard specifications.

Road Standards

The DEM, outlines a range of pavement widths, typical AADT volumes, right-of-way widths, and maximum allowable grades for local and collector roadways. Subdivision Geometric Design Criteria for local and collector roadways are presented in Table 3.4.6 and Table 3.4.7.

Table 3.4.6. Subdivision Geometric Design Criteria, Part 1

Road Classification	AADT	Pavement Width (m)	Allowable Grade	Minimum Centreline Radius	Minimum SSSD	Minimum Tangent Intersection
Local	<1,000	8.4, 8.8, 10	0.5 – 8.0	18	65	10
Collector	<12,000	10	0.5 – 6.0	140	85	25

Table 3.4.7. Subdivision Geometric Design Criteria, Part 2

Road Classification	Minimum Tangent Between Curves	Property Line Radius @ Intersection	R.O.W. Width
Local	15	8	17,18,20
Collector	30	8	20

Sight Triangles

The use of Transportation Association of Canada (TAC) Stopping Sight Distance (3-second rule) for evaluation of sight triangles at intersections and access points for new developments is adopted by the City of Guelph. The DEM notes that reduction of a sight triangle may be considered for areas located in an "Urban Growth Centre" and the specific locations identified in the Clair-Maltby study area below. Reductions to sight triangles still need to be reviewed by a professional engineer for the recommended design and should not create a condition prone to collisions. Adequate space should also continue to be provided for utility/traffic signal equipment and the final dimensions are also subject to minimum requirements set out in the City's bylaw.

Intersections subject to further consideration for sight triangle in the Secondary Plan area include:

- Victoria Road and Clair Road
- Gordon Street and Clair Road
- Gordon Street and Poppy Drive

Parking

Off-street parking is outlined in the City's comprehensive bylaw and repeated in the DEM for surface parking.

According to the DEM, on-street parallel parking should have a minimum of 15 m setback from the near side of an intersection, and a minimum of 9 m setback from the far side of the intersection (measured from the end of curb return), unless the minimum setback needs to be increased to address sight distance or operating speed.

Access Design

The DEM outlines design guidelines for throat width, lane width, radius, and spacing for access to/from residential/commercial/institutional areas and the public road network as summarized in Table 3.4.8 and Table 3.4.9.

Table 3.4.8. Layout of Accesses

Access Classification	Roadway Classification	Throat Width, W or Land Width, LW (m)	Radius, R (m)	Distance Between Accesses, S (m)
Multi-Residential	Local/Collector	6.0	6.0	7
Multi-Residential	Arterial	7.5	6.0	25
Low Volume Commercial and Institutional	Local/Collector	7.5	9.0	23-30
Low Volume Commercial and Institutional	Arterial	8.0	9.0	60
High Volume Commercial and Institutional	Collector	8.0	12.0	60
High Volume Commercial and Institutional	Collector (divided access)	3.0 m left 3.6 m through 3.6 m right 1.2 m island	12.0	60
High Volume Commercial and Institutional	Arterial	9.0	12.0	100
High Volume Commercial and Institutional	Arterial (divided access)	3.0 m left 3.6 m through 3.6 m right 1.2 m island	12.0	100
Industrial	Collector	9.0 (max 15.0)	12.0	40-60
Industrial	Arterial	9.0 (max 15.0)	12.0	40-60

Table 3.4.9. Number and Location of Accesses

Access Classification	Roadway Classification	Distance from Non-Signalized Intersection (m)	Distance from Signalized Intersection (m)
Multi-Residential	Local / Collector	15	30 ¹
Multi-Residential	Arterial	30	60 ²
Low Volume Commercial and Institutional (2-way access)	Local / Collector	30	30
Low Volume Commercial and Institutional (2-way access)	Arterial	60	60 ³
High Volume Commercial and Institutional	Collector / Arterial	60	60 ³
Industrial	Collector / Arterial	30	60 ³

Notes:

1. Multi-Residential of up to 30 units
2. Multi-Residential of over 30 units
3. Full movement accesses will not be allowed within 100 m of a signalized intersection on arterial roadways. Site specific turning movement restrictions will be determined by City staff upon application.
4. Should a site require a right in/out access, the layout shall be approved by traffic engineering staff and conform to the most current TAC specifications.

3.4.2.8 Area Road Environmental Assessments

Gordon Street (Wellington Road 46) Class EA Environmental Study Report

The Gordon Street Class EA was undertaken by the City of Guelph and County of Wellington in December 2000 for the section of Gordon Street between Wellington Road 34 in the south and Lansdown Drive in the north.

The EA study utilizes three other previous transportation reports to judge the transportation impacts of new residential and commercial development along the Gordon Street corridor, and reconfirms the need for traffic capacity within this section of the street. In addition to traffic capacity and operation issues, the EA also identified other public concerns related to truck traffic volumes and roadway deficiencies, including a lack of sidewalks, bicycle lanes, and transit-related infrastructure.

At the time of the study, Gordon Street had a basic two-lane cross-section within the study area. The resulting EA concluded that Alternative 4 (basic improvements plus the widening of Gordon Street) was the preferred solution, and that widening of Gordon Street north of Clair Road would begin by 2002, while widening between Clair Road and Maltby Road would be dependent on the occurrence of development activity.

Upon the adoption of the Gordon Street EA, road widening has been undertaken from just south of Clair Road to just south of Poppy Drive. Gordon Street has not been widened from just south of Poppy Drive to Wellington Road 34 under existing conditions. This section is planned to be widened symmetrically from the road centreline except for a 500 metre section in the vicinity of the Mill Creek crossing where widening will occur on the west side only. The EA specified that rural drainage (ditches) be provided on both sides of the road, but did not specify sidewalk / bicycle lane provisions.

Clair Road Class EA Environmental Study Report

The Clair Road Class EA was undertaken on behalf of the City of Guelph in September 2003 for the section of Clair Road and Laird Road between Southgate Drive in the west and Victoria Road in the east.

The EA concluded that Clair Road (at the time of study) will not provide the level of service necessary to avoid traffic congestion, frequent delays, and unsafe driving conditions, given the predicated traffic volumes, and that the road itself is in poor physical condition and lacks sidewalk and bicycle facilities to accommodate these travel modes. Given the prevailing conditions, the EA advanced four alternative planning solutions:

1. Do nothing.
2. Non-structural solutions (increase use of alternative modes; traffic diversion).
3. Construct a new road.
4. Improve the existing road.

In summary, from transportation, natural, social and physical environment perspective, the preferred alternative was the improvement of Clair Road from Victoria Road in the east to the Hanlon Business Park in the west. Improvements include the introduction of an “urban” cross-section with curbs and sidewalks, a landscaped median in the South Guelph District and adjacent to Bishop Macdonell High School and South End Community Park, provision of sidewalks on both sides of the street, and bicycle lanes within the road surface area.

The EA considered 2 and 4 traffic lane cross-sections, and determined that the western portion of the street (west of Beaver Meadow Drive) would include 4 travel lanes, while the eastern section (east of Beaver Meadow Drive) would include 2 travel lanes – one in either direction. This lane configuration has been implemented from Victoria Road in the east to approximately 200 metres west of Poppy Drive in the west. Bicycle lanes have also been introduced along this section of the street. Sidewalks are provided on both sides of the street west of Hawkins Drive, but are often interrupted (discontinuous) in sections east of this point.

Victoria Road (Clair Road to York Road) Class EA Study

The Victoria Road Class EA was undertaken on behalf of the City of Guelph in December 2005 for the section of Victoria Road between York Road in the north and Clair Road in the south. The extent of the study area is generally north of Clair Road and does not include the section of Victoria Road adjacent to the Clair-Maltby Secondary Plan area (south of Clair Road).

The outcomes of the EA provided cross-section alignments of the street within the study area, including for Victoria Road immediately north of Clair Road. In this location, the EA identified a 3-lane cross-section with one travel lane in either direction and a continuous left-turn / median lane, bicycle lanes, and improvements at the Clair Road / Victoria Road intersection. These intersection improvements include installing traffic signal control and separate eastbound turn lanes and a northbound left-turn lane that have already been implemented.

3.4.3 Future Requirements

The Clair-Maltby Secondary Plan – Transportation Master Plan Study tested and reviewed a system of connected arterial and collector streets that was advanced as part of initial Community Structure Alternatives to support development of the Secondary Plan area. The mobility study looked at most conservative land budget requirements (i.e. most capacity constrained) and conservative street network assessed.

A key priority of the preferred transportation network is to prioritize the needs of active transportation and transit users so as to create a transportation network that accommodates and promotes these alternative modes.

Analysis in the Clair-Maltby Secondary Plan – Transportation Master Plan Study report provided in Appendix D focussed on establishing estimates and capacity considerations of separate modes of travel in order to establish the key road, transit and trail network requirements for the Secondary Plan area.

Other consideration to support the preferred transportation network include:

- **Transportation Demand Management:** An essential part to prioritizing alternatives to auto-oriented travel is the support for and implementation of Transportation Demand Management (TDM) measures. BA Group identified a number of Transportation Demand Management (TDM) measures in the Transportation Master Plan Study that are recommended for inclusion or in greater detail than current city-wide measures as part of the Clair-Maltby Secondary Plan.
- **Natural Heritage System (NHS)** Also integral to the success of the Clair-Maltby Secondary Plan is a system of connected arterial and collector streets that support development of the Secondary Plan area, while respecting the Natural Heritage System and existing topography. The Natural Heritage system therefore plays an important role in the evaluation matrix of alternative concepts.

The following section focusses on the travel demand forecasts for auto-based and non-auto-based trips for the Secondary Plan area that identify key road network, transit and trail requirements. Detailed analysis and findings are provided in the Clair-Maltby Secondary Plan – Transportation Master Plan Study report provided in Appendix D.

3.4.3.1 Land Development Scenario Assumptions and Approach

Travel demands and assessment of future conditions for development anticipated within the Clair-Maltby Secondary Plan area are summarized in the following sections, and have been developed based on the most conservative (highest density) assumptions outlined in the “Land Development Budget” prepared by the project team – dated August 27, 2018. For the purposes of the analysis herein, a total of 10,125 residential units and 333 jobs were assessed.

3.4.3.2 Traffic Zones

Travel demands were developed for nine individual “Traffic Zones” that comprise the Secondary Plan area, to provide appropriately-sized areas to assign travel demands on the area transportation network and assess the overall transportation impacts of Secondary Plan development.

Traffic zones were established for segmented areas within the overall community, and generally comprise zones east and west of Gordon Street. Travel demands for each zone are forecast and assigned individually on the area transportation network.

The nine identified Clair-Maltby Secondary Plan Traffic Zones are illustrated in Figure 3.4.20.

Figure 3.4.20. Secondary Plan Area Traffic Zones⁴



3.4.3.3 Multimodal Travel Forecasting

Travel demand forecasts for the Clair-Maltby Secondary Plan area development have been developed to reflect pedestrian, cycling and transit usage that is reflective of the existing travel characteristics of the area, and to the extent that transit services and active transportation infrastructure is pursued as part of the Secondary Plan. The addition of mixed-use zones within the Clair-Maltby Secondary Plan area further supports sustainable and short trip making, particular during weekday peak travel periods, and is considered in travel demand forecasting in mixed-use development zones.

Travel Mode Split

For the purpose of this analysis, travel demands to and from the Clair-Maltby Secondary Plan area have been developed for residential and office land uses by applying modal share information, which is based on a review of data retrieved from the 2016 Transportation Tomorrow Survey (TTS). A combination of study area travel information, and proxy development information was utilized in selecting an appropriate travel mode split for Secondary Plan residential development.

The “selected” travel mode split for new development associated with the Clair-Maltby Secondary Plan, for resident-related and employee-related travel during weekday morning and afternoon peak hours, is summarized in Table 3.4.10. The selected travel mode splits generally reflect a higher degree of transit use and

⁴ Note: traffic zones were developed prior to final selection of Preferred Community Plan. Base plan beneath zones areas does not reflect latest land use plan and is meant to be illustrative.

active transportation travel relative to what is currently observed in the south portions of the City of Guelph, and results in a lower degree of automobile use relative to other areas of the City.

Table 3.4.10. Selected Clair-Maltby Secondary Plan Travel Mode Splits

Travel Mode	Weekday Morning Peak Hour - Inbound	Weekday Morning Peak Hour - Outbound	Weekday Afternoon Peak Hour - Inbound	Weekday Afternoon Peak Hour - Outbound
Resident Travel - Auto Driver ¹	85%	60%	72%	65%
Resident Travel - Auto Passenger ²	2%	10%	10%	25%
Resident Travel - Transit	5%	10%	10%	5%
Resident Travel - Walk	8%	10%	3%	3%
Resident Travel - Cycle	0%	3%	2%	2%
Resident Travel - Other ³	0%	7%	3%	0%
Employee Travel - Auto Driver ¹	90%	90%	90%	90%
Employee Travel - Auto Passenger ²	2%	2%	2%	2%
Employee Travel - Transit	4%	4%	4%	4%
Employee Travel - Walk	2%	2%	2%	2%
Employee Travel - Cycle	2%	2%	2%	5%

Notes:

1. Auto driver trips (includes auto drivers and motorcycles).
2. Auto passenger trips (includes auto passenger trips only).
3. Other trips include school bus and taxi trips.
4. Employee-based mode share is summarized for the key inbound movement during the weekday morning peak period, and the key outbound movement during the weekday afternoon peak hour.

Multimodal Forecasts

Residential and office employee traffic forecasts for the Clair-Maltby Secondary Plan have been developed using Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition) traffic generation rates, combined with TTS data on residential and employee travel characteristics in the vicinity of the Secondary Plan area⁵.

ITE Trip Generation Manual traffic generation rates are factored for the selected travel mode splits. Traffic generation rates are factored from an assumed 95 per cent auto mode share to a more appropriate level of automobile use for residential trips: 75 per cent during the weekday morning peak hour, and 85 per cent during the weekday afternoon peak hour. Given that employee-related trips currently are in the order of 90 per cent to 95 per cent undertaken by automobile, traffic generation rates are not factored for greater non-auto use for work-related trips (ref. Table 3.4.11).

⁵ 2016 TTS data was used to determine existing mode split for home-based trips during the morning and afternoon peak hours in the vicinity of the Secondary Plan area. The selected study area (proxy zone) is bounded generally by Kortright Road to the north, Clair Road to the south, Victoria Road to the east and Preservation Park to the west).

Table 3.4.11. Clair-Maltby Secondary Plan, Maximum Density Travel Demands

Development Density	Travel Mode	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour 2-Way	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour 2-Way
10,125 units; 333 employees	Auto Driver Trips (Traffic)	925	2,440	3,350	2,935	1,860	4,700
10,125 units; 333 employees	Auto Passenger Trips	20	400	420	405	680	1,085
10,125 units; 333 employees	Transit Trips	55	400	455	405	150	555
10,125 units; 333 employees	Active Trips	90	525	615	200	145	345
10,125 units; 333 employees	Total Trips:	1,090	4,065	5,155	4,075	2,860	6,935

Assuming the most conservative land use budget comprising 10,125 residential units and 333 employee positions⁶, provided for the purposes of this analysis, the Clair-Maltby Secondary Plan would be anticipated to result in the order of 5,150 and 6,950 two-way person trips during the weekday morning and weekday afternoon peak hours, respectively. Total trips include those trips that utilize “other” travel modes, including those using school buses, taxis, or ride-share services, despite these travel modes not being explicitly identified in the above summary.

Overall, approximately 3,770 and 5,785 two-way person trips are anticipated to be undertaken in a personal vehicle (as a driver or passenger), comprising approximately 73 per cent to 83 per cent of all trips during weekday morning and afternoon peak hours. In the order of 455 and 555 two-way person trips are anticipated to be undertaken as a transit rider, comprising approximately 8 per cent of all trips during weekday peak hours. Comparatively, in the order of 615 and 345 two-way person trips are anticipated to be undertaken as a pedestrian or cyclist during the weekday morning and afternoon peak hours, respectively, comprising approximately 12 per cent and 5 per cent of all trips during the respective weekday peak hours.

⁶ Based on August 2018 Area Population and Employment of 24,495 population and 564 jobs. 333 jobs related to commercial and office uses. Remaining jobs related to Service Commercial and Neighbourhood assumed to be small, dispersed, and partly off-peak.

Trip generation, by zone and mode, is provided in detail in Appendix D. Traffic volumes generated by the existing buildings within the Secondary Plan area are expected to be small, and generally represent individual households, small businesses, an existing golf course, and general rural activities.

A marginal volume of traffic results from existing operations and activities within the Secondary Plan area relative to the planned redevelopment of these lands. For the purposes of the traffic analysis conducted herein, existing Secondary Plan area traffic was conservatively retained on the area street network. Reductions to future forecast Clair-Maltby Secondary Plan traffic were not made to account for existing traffic resulting from current development within the subject lands.

Vehicle Traffic Assignment

Base Road Network

Future total traffic scenario lane configurations on the area street network reflect the following planned improvements that are assumed as part of the future traffic analysis scenarios:

- Widening of Gordon Street from 2 to 4 lanes (approved 2001 EA) from Kortright Road to Wellington Road 34;
- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA);
- Southerly extension of Southgate Drive to Maltby Road; and
- Clair-Maltby Secondary Plan collector road network as outlined in the preferred "Community Structure".

Future Total traffic volumes have been forecast for existing study area intersections, as well as future collector road intersections as outlined within the community plan. The base future traffic lane configurations and traffic controls are illustrated in Figure 3.4.21. , as are general street names for reference purposes.

Traffic Assignment

Travel patterns for traffic generated by the residential and employments uses planned within the Secondary Plan area are based upon a review of the following:

- Travel destination information provided in the 2016 Transportation Tomorrow Survey (TTS). A comprehensive series of surveys were conducted in the development of the TTS database that describes, among other information, the travel behaviour of motorists of a specific area during the street peak periods;
- Capacity constraints on turning movements at area intersections that would, because of the extent of the delays that may be experienced, influence motorists to choose alternate routes while travelling to and from the proposed building; and
- The introduction of planned new roads and road improvements within the vicinity of the Secondary Plan, advanced through City and County transportation planning and / or site-specific development.

For destinations within the City of Guelph, forecast site traffic is routed along both local (collector) and regional transportation corridors depending on their distance to / from the Secondary Plan area. At the regional level, a greater reliance on regional corridors such as Highway 6 - the Hanlon Parkway and Gordon Street is expected as many drivers would take advantage of highway and higher-order roads to travel greater distances across the region and connect with Highway 401 to the south.

Overall traffic distribution assumptions are applied to individual Traffic Zones, identified within the Secondary Plan area, to appropriately assign traffic volumes related to specific development areas within the overall Plan.

Forecast new Secondary Plan traffic volumes on the area street network are illustrated in Figure 3.4.22 and provided in Appendix D.

Clair-Maltby Secondary Plan forecast traffic volumes are assigned based on the Traffic Zones identified in Figure 3.4.20. Understanding that local streets have not been identified within the Preferred Community Structure, forecast traffic volumes have been assigned generally to collector roads. As such, collector road traffic volumes will not balance along collector street corridors

Future Total traffic volumes, which is the sum of future background traffic volumes and traffic volumes resulting from development of the Clair-Maltby Secondary Plan area, are illustrated in Figure 3.4.23. Future total traffic volumes also include minor adjustments to existing traffic volumes associated with Bishop Macdonell Catholic Secondary School and South End Community Park, which would be anticipated to utilize Poppy Drive upon completion of this street between Gordon Street and Clair Road West rather than being required to route through the Poppy Drive West / Clair Road West intersection.

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Figure 3.4.21. Future Base Traffic Lanes Configurations and Controls

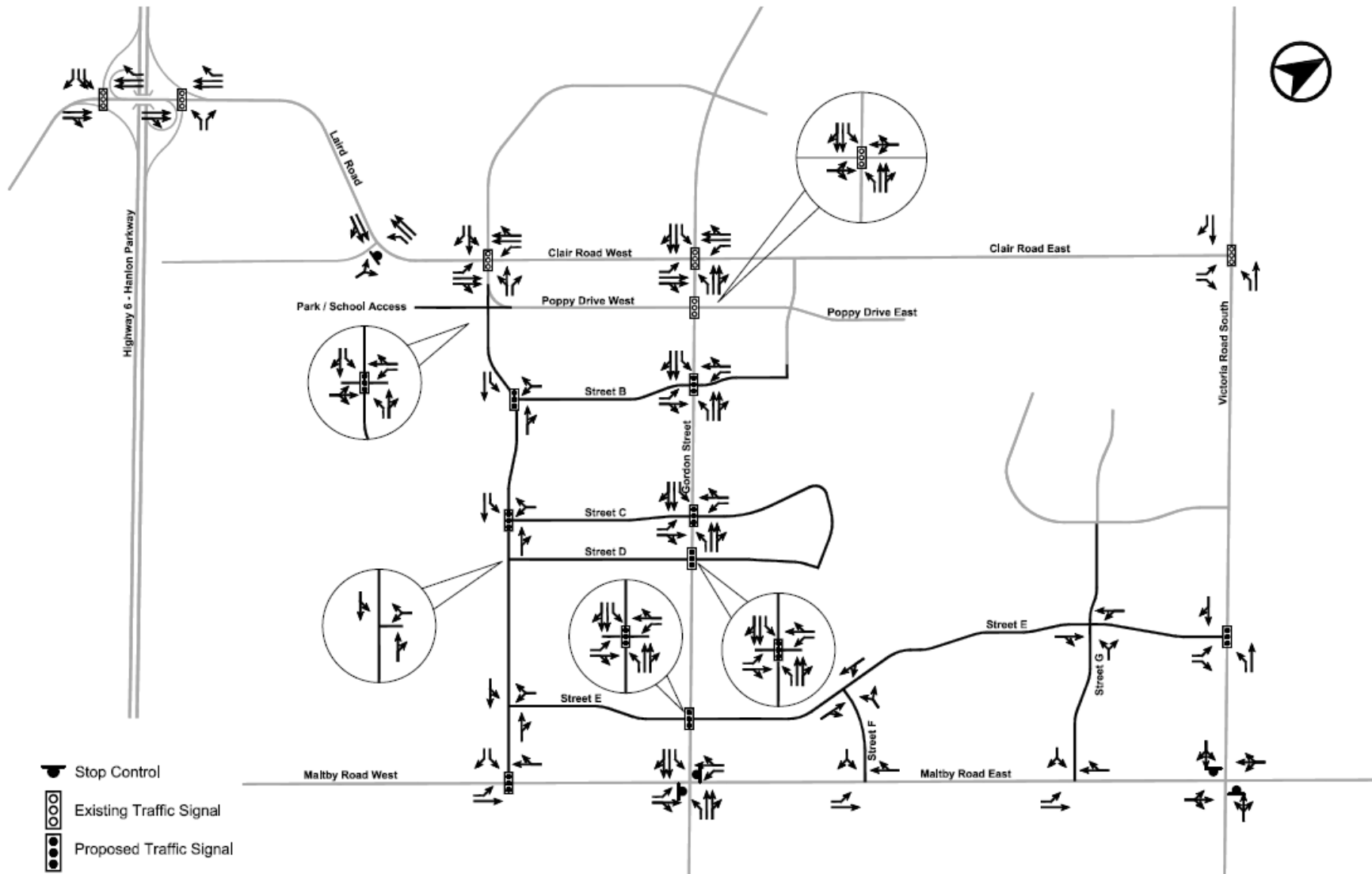


Figure 3.4.22. Forecast New Secondary Plan Traffic Volumes

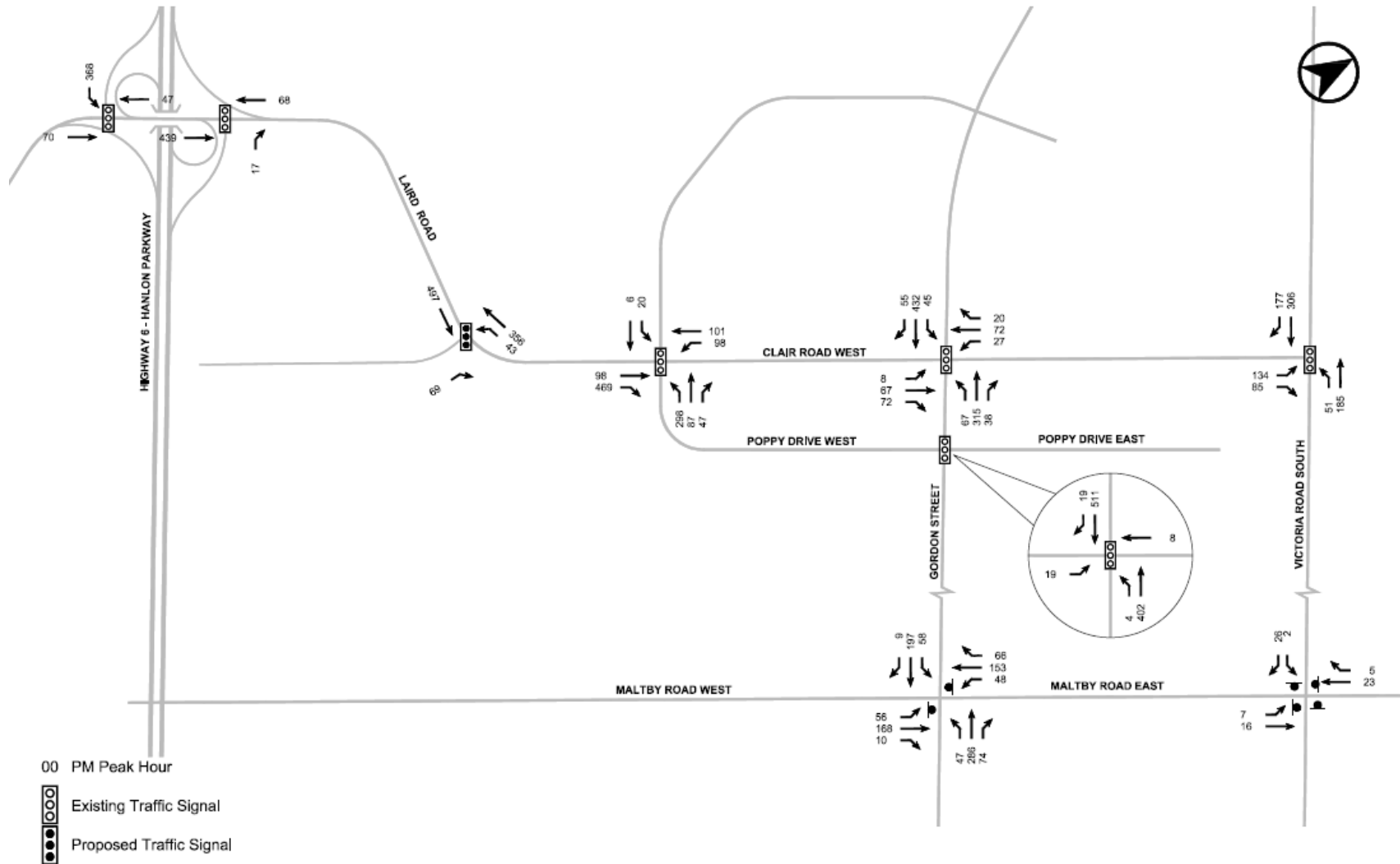
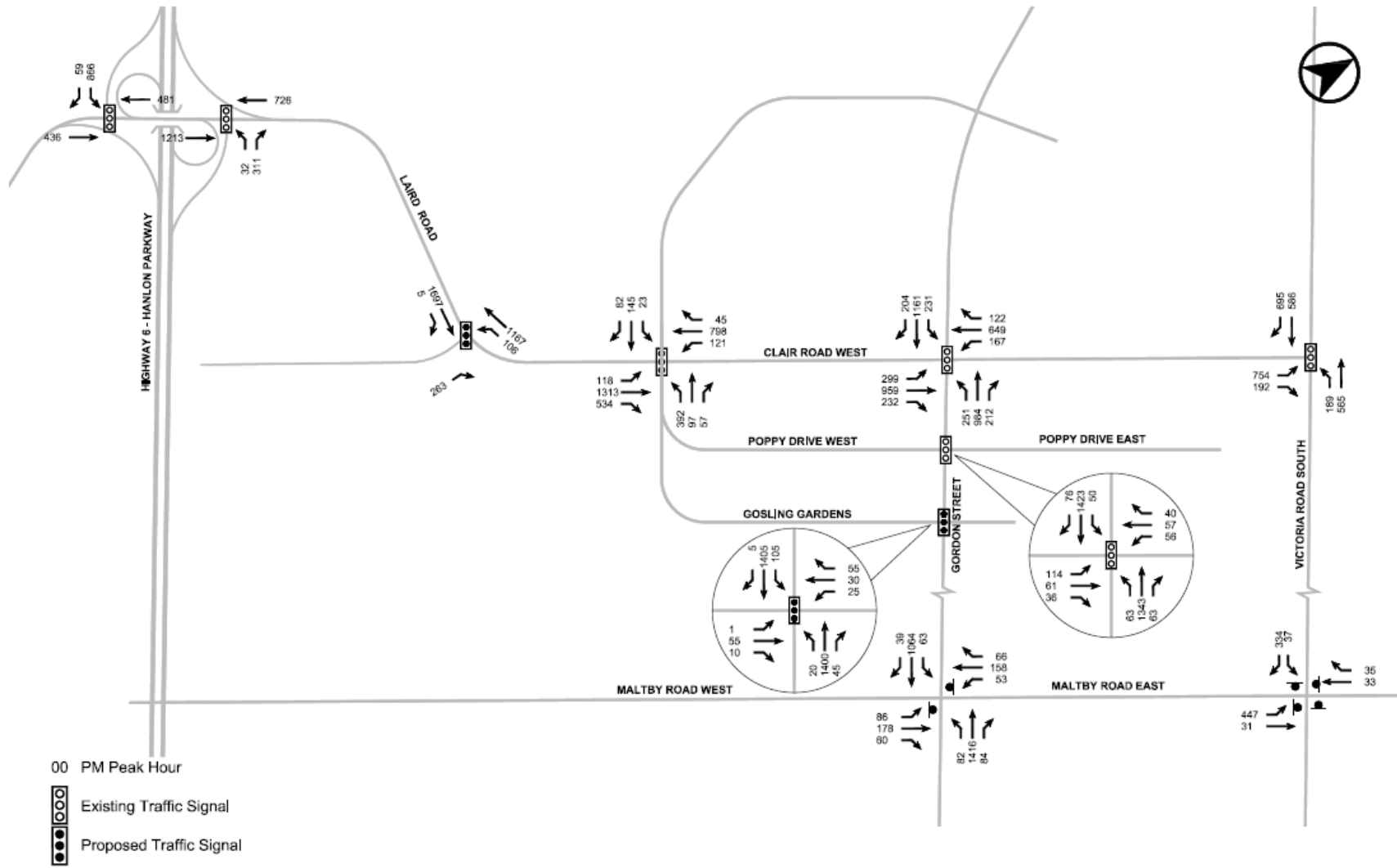


Figure 3.4.23. Future Total Traffic Volumes



Intersection Analysis Results and Road Network Requirements

Detailed results of the Synchro analysis of signalized and unsignalized intersections within the study area under future total traffic conditions are provided in Appendix D. A discussion of the traffic analysis findings follows.

Base Future Total Street Network

A summary of future total signalized and unsignalized traffic operations at key study area intersections under base future total street network conditions is provided in Figure 3.4.24.

Recommended Future Total Street Network

Assuming the introduction of the recommended intersection improvements traffic operations at signalized and unsignalized intersections are anticipated to be acceptable, except for certain capacity constraints expected for specific traffic movements at key study area intersections.

Additional analysis was undertaken with recommended intersection improvements at certain intersections within the study area. Recommended improvements specifically imply physical improvements to existing intersection configurations (additional traffic lanes), or traffic control (signalization). The improvements are illustrated in Figure 3.4.25 (and associated traffic operations are illustrated in Figure 3.4.26) and the following individual improvements are described in detail in Appendix D:

- Traffic signal optimization
- New Traffic Signal Controls
- Intersection Traffic Capacity Improvements

Additional North-South Collector Road West of Gordon Street

The transportation modelling undertaken herein indicates that a second north-south oriented street is required to connect to Clair Road to accommodate the land budget considered as part of the planning process (approximately 10,125 units). In absence of a second street connection between the Secondary Plan area and Clair Road, Gordon Street would operate over its capacity even with a 4-lane cross-section. In addition, considerable improvements are required to the Gordon Street / Clair Road and Victoria Road / Clair Road intersections, beyond those already recommended herein.

This collector street (west of Gordon Street) also provides important connectivity between Secondary Plan development and recreational and institutional uses in the area of Clair Road / Poppy Drive West. A more robust, resilient street network is also provided that can better distribute traffic, accommodate transit vehicle routing, and provide more direct access to Secondary Plan area development (including for emergency vehicles).

Additional North-South Collector Road East of Gordon Street

The transportation modelling undertaken as part of this study demonstrates that traffic volumes resulting from background traffic and traffic related to the development of the Clair-Maltby Secondary Plan area, can be accommodated by

Gordon Street as planned (i.e. with four through-traffic lanes), understanding that certain traffic movements at the Gordon Street / Clair Road intersection will operate under busy conditions during the prevailing weekday afternoon peak hour. Specifically, southbound through movements and left-turn movements in the weekday afternoon peak hour are anticipated to operate near theoretical capacity, with v/c ratios between 0.90 and 1.00, assuming the highest density Land Budget development scenario tested herein.

Traffic analysis forecasts undertaken herein, support the implementation of 4 through-traffic lanes along Gordon Street within the Clair-Maltby Secondary Plan area. Traffic capacity constraints, should they develop during prevailing weekday peak travel periods, may be anticipated at the key Gordon Street / Clair Road intersection, but are otherwise not anticipated for link segments of Gordon Street. Improvements, by way of ancillary turn lanes, are recommended herein to mitigate traffic capacity constraints at the Gordon Street / Clair Road intersection.

A typical 4-lane street section is anticipated to sufficiently accommodate forecast traffic demands along the Gordon Street corridor, understanding the need for ancillary turn lanes – specifically separate left-turn lanes at all intersections where left-turns are permitted. Pending the frequency of separate left-turn lanes, a continuous left-turn / centre median lane along the extent, or portions of, Gordon Street within the Secondary Plan area may be warranted.

Gordon / Maltby Roundabout

The intersection of Gordon Street and Maltby Road is considered for the introduction of a roundabout, as an alternative to recommended signalization. A roundabout, at this junction, may be appropriate considering:

- its location as a gateway to / from the City of Guelph,
- its boundary character between urban Guelph and rural Wellington County, and
- as this intersection would likely be the end-of-line for any transit service routing along Gordon Street, a roundabout would accommodate transit vehicle turnaround.

With regards to the first two points noted above, a roundabout may be appropriate as an option to reduce vehicle speeds on approach to the City of Guelph in transition from rural highway to urban arterial.

Understanding the opportunity for a roundabout at the junction of Gordon Street and Maltby Road, roundabout traffic analysis was completed for the future total traffic scenario.

ARCADY 9 traffic analysis results for the analyzed roundabout under future traffic conditions are summarized in Table 3.4.12. Detailed results analysis outputs are included in the Clair-Maltby Secondary Plan – Transportation Master Plan Study report provided in Appendix D.

Table 3.4.12. Roundabout Analysis Summary

Intersection	Approach Leg	Future Total Traffic Conditions - V/C Ratio	Future Total Traffic Conditions - Average Delay (sec)	Future Total Traffic Conditions - LOS
Gordon Street and Maltby Road	WB	0.56	17.12	C
Gordon Street and Maltby Road	SB	0.60	4.13	A
Gordon Street and Maltby Road	EB	0.39	6.53	A
Gordon Street and Maltby Road	NB	0.81	9.01	A
Gordon Street and Maltby Road	Overall	--	7.74	A

Notes:

1. Overall intersection capacity indicated as “residual” capacity.

Should a traffic roundabout be pursued for the junction of Gordon Street and Maltby Road, traffic operations are anticipated to be acceptable. Further consideration would be required as to its functional design and ability to appropriately accommodate pedestrian crossings, cyclists, transit vehicles and articulated trucks.

Figure 3.4.24. Summary of Future Total Traffic Operations Analysis – Base Future – Traffic Network

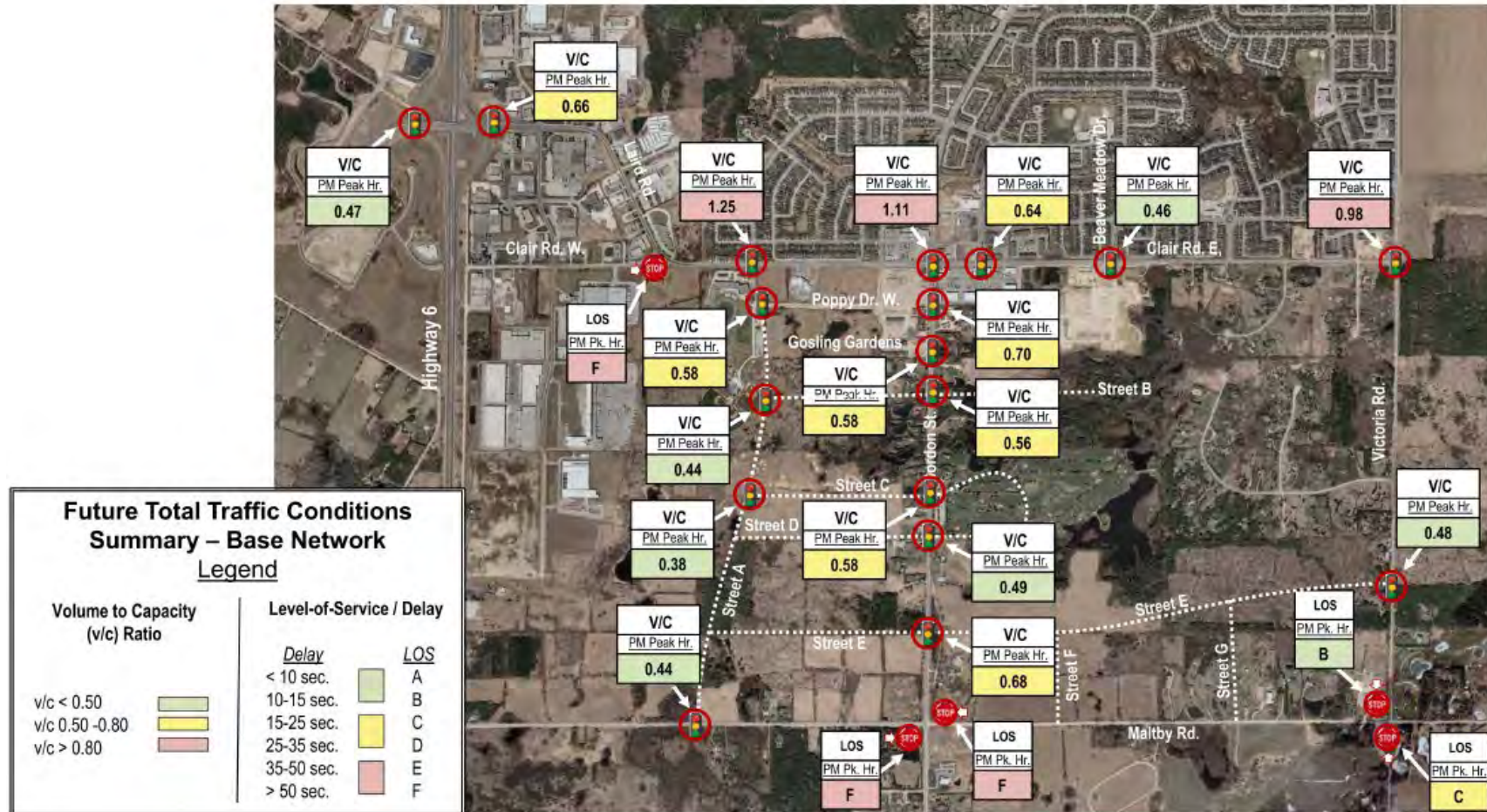
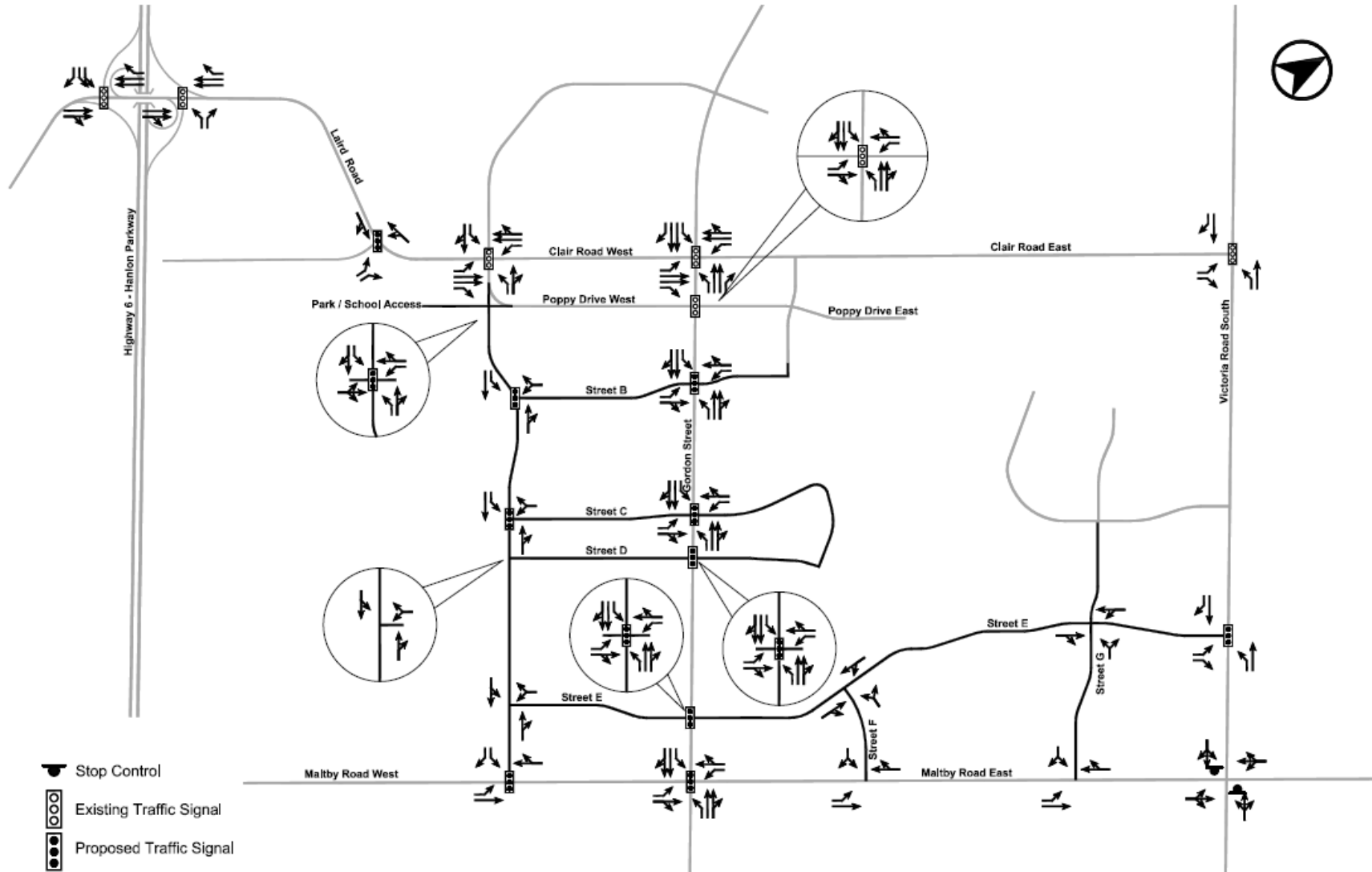


Figure 3.4.25. Recommended Future Traffic Lane Configurations and Controls



Summary of Road Improvements

Road improvements for the Clair-Maltby Secondary Plan area have been itemized in Table 3.4.13

Table 3.4.13. Summary of Road Improvements

Road	Improvement	From	To
Clair Road East	Widen from 2 to 4 lanes with active transportation and sidewalks	Beaver Meadows Drive	Victoria Road South
Victoria Road South	Urbanize and add active transportation and sidewalks	Clair Road East	Maltby Road
Maltby Road East	Urbanize and add active transportation and sidewalks	Hanlon Parkway	Victoria Road South
Gordon Street	Widen from 2 to 4 lanes, Urbanize to include cycle tracks and sidewalks	Clair Road	Maltby Road
Street A Collector	New Road	Poppy Drive	Maltby Road
Street B Collector	New Road	Street A	Gordon Street
Street B Collector	New Road	Gordon Street	Hawkins Drive
Street C Collector	New Road	Street A	Gordon Street
Street D Collector	New Road	Street A	Gordon Street
Street C/D ¹	New Road	East of Gordon Street	East of Gordon Street
Street E Collector	New Road	Street A	Victoria Road
Street F Collector	New Road	Street E	Maltby Road
Street G Collector	New Road	Street E	Maltby Road
New Signals identified in Figure 3.4.45			
Lane configurations identified in Figure 3.4.45			

Notes:

1. Street C/D is a loop road that effectively operates as two local connections.
2. Street G (north of Street E) operates as a local connection.

Transit Service Assignment

Assignment of transit trips is based on a review of origin and destination data collected as part of the 2016 Transportation Tomorrow Survey (TTS) for the southern parts of the City of Guelph. A total of 455 and 555 new transit trips are forecast during the weekday morning and weekday afternoon peak hours, respectively.

Clair-Maltby Secondary Plan transit trips are assigned to general directions, and would be captured by local transit services. Additional opportunities to explore regional transit connectivity and demands are discussed in the later portions of this chapter.

The majority of transit trips are anticipated to route outbound during the weekday morning peak hour, and inbound during the weekday afternoon peak hour given the prevailing residential-related travel demands associated with the Secondary Plan.

The review of resident-based area transit trips indicated that the majority of transit trips were undertaken exclusively by local transit services - in the order of 85 per cent to 90 per cent, while a smaller proportion of trips utilized regional GO Transit services to access other parts of the region.

It is expected that most transit trips to the Clair-Maltby Secondary Plan area will be captured by local transit services, which is anticipated to continue to evolve in sequence with development of the Secondary Plan area, and as part of on-going service reviews conducted by Guelph Transit.

The anticipated distribution of transit trips and resulting number transit trips, based on the TTS transit distribution and forecast transit rider volumes, are summarized in the table below. Forecast transit rider volumes are summarized based on the type of service riders would be anticipated to utilize (local or regional), and general directional orientation those riders would travel.

Table 3.4.14. Resulting New Transit Trips by Orientation and Service

Orientation	Orientation of Transit Trips	Two-way Transit Trips Distribution	Two-way Transit Trips AM	Two-way Transit Trips PM
Regional Transit Services (GO Transit) East	Kitchener GO Line (Guelph Station); Aberfoyle GO Park and Ride Bus Stop	14%	65	75
Local Transit Services (Guelph Transit): North	Old Guelph (Downtown) Area	81%	370	450
Local Transit Services (Guelph Transit): North	University of Guelph Area	81%	370	450

Orientation	Orientation of Transit Trips	Two-way Transit Trips Distribution	Two-way Transit Trips AM	Two-way Transit Trips PM
Local Transit Services (Guelph Transit): Northeast	Northeast areas of Guelph	2%	10	15
Local Transit Services (Guelph Transit): Northwest	Northwest and West areas of Guelph	3%	10	15

Notes:

1. Trips Rounded to the Nearest 5.

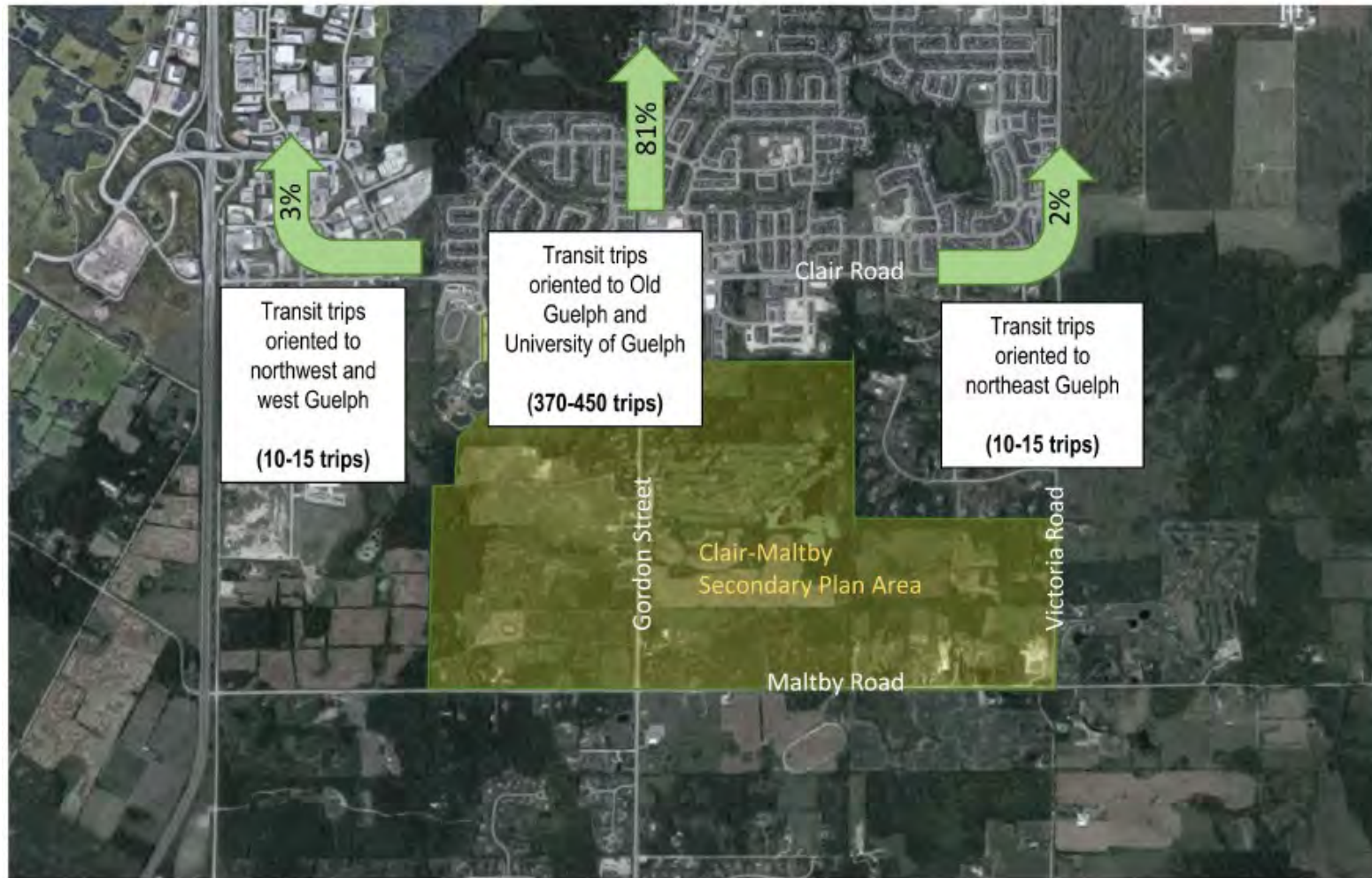
Clair-Maltby Secondary Plan area transit trips are predominantly anticipated to be oriented north of the Secondary Plan area, as transit riders tend to route to / from the downtown area, the University area, and central GO Transit Station. In the order of 370 and 450 two-way transit trips are anticipated to route to / from these areas during the weekday morning and weekday afternoon peak hours respectively.

In the order of 65 and 75 two-way transit trips are anticipated to route to / from GO Transit service stops during the weekday morning and weekday afternoon peak hours respectively, including the Guelph GO Station, as well as the existing GO Transit Bus Services routing through Aberfoyle GO Park and Ride.

A small number of transit trips are expected to route to other employment areas in the east and west portions of the City. However, as employment growth is anticipated in the Laird / Highway 6 area, opportunity to capture more trips via transit may exist given the proximity of this employment area to the Clair-Maltby Secondary Plan area, and relative direct options for transit routing.

Transit rider volumes related to development anticipated with the Clair-Maltby Secondary Plan are illustrated by general direction in Figure 3.4.26.

Figure 3.4.26. Weekday Peak Hour Forecast Transit Rider Trips



* Remaining percentage of transit rider trips (approx. 14%) are anticipated to utilize regional transit services (GO Transit) only via Guelph Station or Aberfoyle GO Park and Ride.

Transit Capacity Considerations and Network Requirements

Transit trips associated with development of the Clair-Maltby Secondary Plan area are analyzed for the prevailing directions in each of the key weekday morning and afternoon peak hours. Given that most new transit trips are resident-based, prevailing transit impacts are outbound during the weekday morning peak hour, and inbound during the weekday afternoon peak hour.

Understanding transit rider forecasts are based on the most conservative (highest density) "Land Use Budget" circulated in support of planning for Secondary Plan development, up to 400 outbound transit trips can be anticipated during the weekday morning peak hour, and 405 inbound trips can be anticipated during the weekday afternoon peak hour. In the order of 90 per cent to 95 per cent of these trips can be expected (conservatively) to be oriented north of the Secondary Plan area to / from the University and Downtown areas. Therefore, up to 385 peak direction transit trips can be expected between the Secondary Plan area and central areas of the City during weekday peak hours.

Guelph Transit currently utilizes Nova Bus LFS 40-foot buses, which have a total passenger capacity of 50-60 persons per vehicle (per Guelph Transit). As such, a total of 6 to 8 buses would be required to accommodate peak direction, peak time transit ridership demands associated with travel between the Clair-Maltby Secondary Plan area and central Guelph areas. However, transit service provisions would also have to accommodate for existing (and future) down-stream transit rider demands associated with existing developed areas north of the Secondary Plan.

The requirement for a minimum of 6 to 8 new buses (per hour) in excess of existing services, operating between the Secondary Plan area and the central areas of the City to accommodate development associated with the Secondary Plan area, can be accommodated through the provision of various routes, express-only services, or frequent services routing along the Gordon Street spine and supporting collector roads.

Guelph Transit anticipates operating bus services (new or extended) along all arterial and collector streets within the Secondary Plan area.

Transit service provisions can be further supported through measures outlined in transit supportive City policies, including:

- Queue jump lanes;
- Priority traffic signal timing; and
- Bus / Taxi / HOV curbside lane designations (Gordon Street) during weekday peak travel periods.

Transit Hub Considerations

Guelph Transit supports the concept of a "Transit Hub" within the Secondary Plan to support future transit operations in the area, and have identified a central location along the Gordon Street corridor within a designated mixed-use zoning area as being a preferred site for such a facility. A Transit Hub facility would require an

approximate 65m by 65m area to facilitate 6 bus bays to accommodate 3 new bus routes and 2 to 3 extended (existing) routes;

Active Transportation Assignment

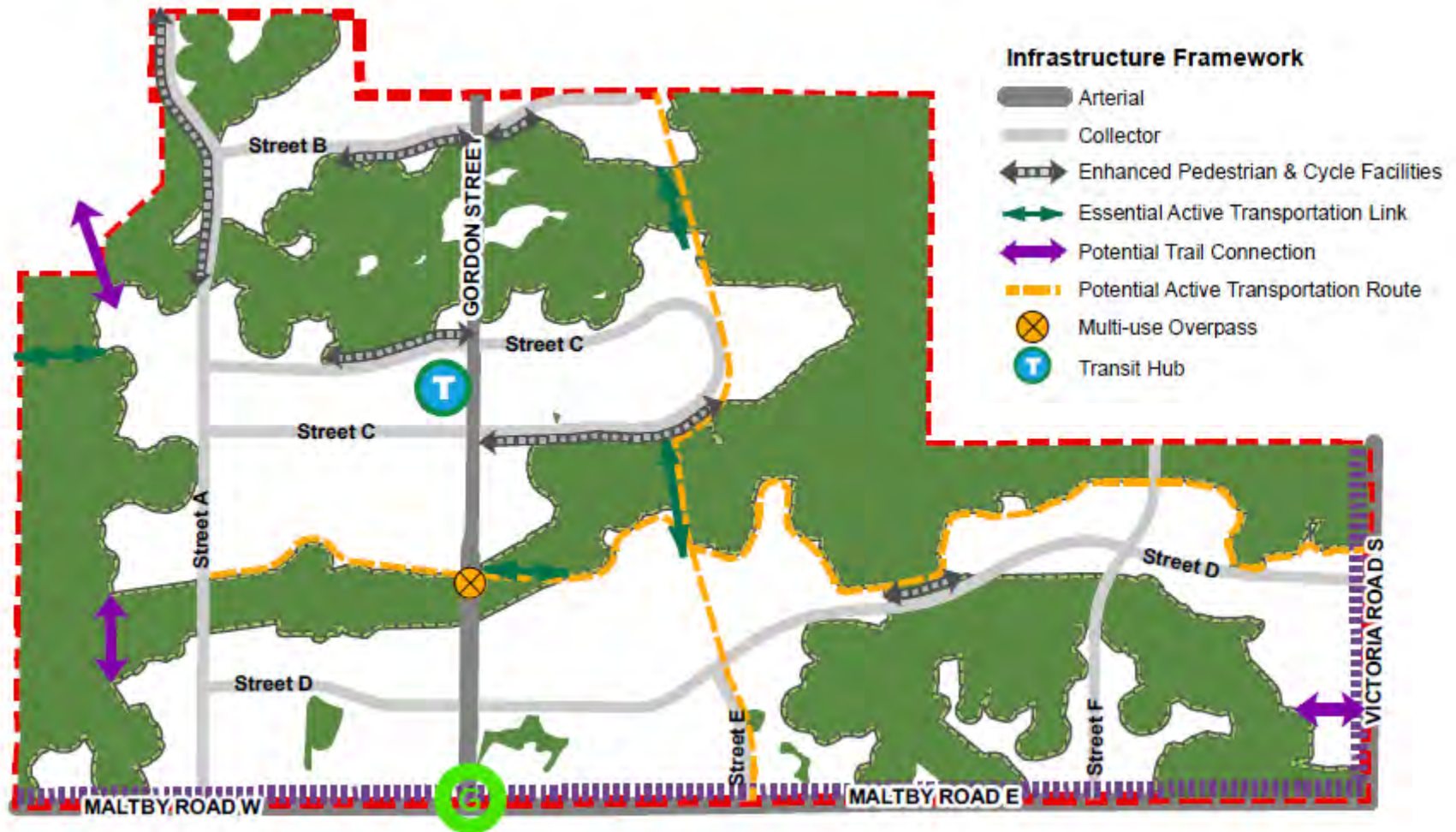
Active trips (walking and cycling) resulting from development contemplated within the Clair-Maltby Secondary Plan area are forecast for planned residential and office land uses, based on the trip forecasting methods outlined under Section 3.4.4.3 based on the most conservative (highest density) "Land Use Budget". A total of 615 and 345 active two-way trips are forecast during the weekday morning and weekday afternoon peak hours, respectively. Both Arterial and Collector Road networks are contemplating cycling facilities within their cross-sections to facilitate the Secondary Plan Active Transportation Network. Additional active and recreational trips are anticipated during the off-peak periods on both the Active Transportation Network and the Trail Network. The function of the Trail Network is to provide pedestrian and cycling facilities throughout the Secondary Plan area in addition to those already contemplated for the arterial and collector road network, in order to:

- Further accommodate commuter and practical pedestrian and cycling circulation and connectivity;
- provide recreational amenity and active transportation use;
- augment the wider trail network in the southern parts of the City of Guelph; and,
- augment the collector street network prepared as part of the Preferred Community Structure plan.

The Clair-Maltby Secondary Plan must create a robust linked trail system with direct and convenient connections for both recreational and utilitarian users that accommodates and prioritizes active transportation travel modes. An illustration of the proposed Secondary Plan Active Transportation and Trail system is provided in Figure 3.4.28. These networks must be integrated in a manner with the surrounding street network that facilitates safe and direct crossings between both sides of Gordon Street. The Active Transportation Network must also facilitate safe and direct access between transit stops on both sides of Gordon Street. An overpass (or pedestrian signal) may be considered at the key street crossing of Gordon Street, between Streets D and E, given the distance to either Street would be considered too long.

East of Gordon Street, important elements of the Trail Network are proposed to cross the Natural Heritage System to continue to allow for pedestrian and cycling connectivity. Future studies will be required to demonstrate that the Trail Network can be accommodated without a negative impact to the NHS or the cultural heritage attributes located in these areas.

Figure 3.4.27. Clair-Maltby Secondary Plan Mobility Plan



3.4.3.4 Community Consultation

The City of Guelph has engaged with local residents, landowners, technical advisors, a community working group, key stakeholders, and the general public over the course of four years to develop a Preferred Community Structure to guide development of the Clair-Maltby Secondary Plan area.

Before the start of any formal study process, the City hosted a public house, focus group, and engaged with area property owners in 2015 and 2016. Early engagement with interested parties outlined existing conditions including the extent of municipal transportation infrastructure in the vicinity of Clair-Maltby, works related to retaining a study team, and outlined the pending study process. The study structure identified the need for a Mobility Study, to support a comprehensive review of background planning and engineering material and inform a formal Secondary Plan and Master Environmental Service Plan.

Following commencement of the Clair-Maltby Secondary Plan and Master Environmental Service Plan study, the City hosted a series of formal meetings to engage with the public, land owners, and technical advisors. In April 2018, the City held a five day planning and design charrette, which used collaborative design and planning workshops with stakeholders and the public to evaluate the three initial land use alternatives, leading to the Preliminary Preferred Community Structure for the SPA. At these sessions, the Wood Team provided information from the CEIS on the environmental systems and also outlined preliminary concepts and principles for servicing, while the BA Group added insights associated with transportation needs. Subsequent to the design charrette, modifications were made to the Preliminary Preferred Community Structure, including removal of the Rolling Hills area from the SPA and other land use revisions, resulting in an initial Preferred Community Structure

The Clair-Maltby Secondary Plan community engagement process has included two Public Information Centres (April 2017 and April 2018). A third Public Information Centre is planned in 2021.

Key community engagement sessions, which informed and shaped a "Preferred Community Structure Plan", are summarized in the following.

Community Visioning Sessions (April 2017, September 2017)

Community Visioning Sessions were undertaken to help establish a vision, goals and guiding principles for the study.

The planning objectives of the Secondary Plan included a vision for a complete and healthy community with an integrated transportation network to promote transit, walking and cycling.

A Community Visioning Workshop undertaken in September 2017 assisted in establishing a Conceptual Community Structure, which was carried-forward as part of meetings with a Community Working Group and Technical Advisory Group. This initial concept included prospective street alignments, new road connections to the existing street work, and considerations for active transportation that were intended to establish a modified street grid to support future development, robust

transit routing options, and active transportation connectivity and mobility, while noting key natural heritage attributes.

The Conceptual Community Structure was further used in the development of three Community Structure Alternatives, which formed the discussion of a 5-day planning and design charrette held in April 2018.

Planning and Design Charrette (April 2018)

The planning and design charrette was a multi-disciplinary, intensive, and collaborative design and planning workshop, and was undertaken in order to develop a Preliminary Preferred Community Structure with input from stakeholders, community members, City departments and the project team.

The charrette evaluated three Community Structure Alternatives in order to develop a Preliminary Preferred Community Structure. The alternative structures included different transportation network elements intended to support the creation of an *interconnected and interwoven* community given the multi-disciplinary considerations of the Secondary Plan. Transportation network options are intended to provide mobility choice, connect neighbourhoods to each other and the rest of the City, and to utilize networks of parks, open spaces, and trails to accommodate active / passive recreation and more utilitarian active transportation use.

Transportation-related considerations made of the Community Structure Alternatives included:

- Suggestions for a more connected, 'grid' network of collector streets;
- General support for as few street crossings of the Natural Heritage System (NHS) as possible;
- Concerns of single-loaded roads adjacent to NHS;
- Consideration of grading, landform and topography;
- Discussion of municipal street right-of-way widths, and cross-section elements;
- Suggestions to incorporate additional trails, including those to employment lands;
- General concerns related to a conceptual new collector street (east of Gordon Street) through a Cultural Heritage landscape and the NHS, and that the need for this street be further studied and analyzed; and
- Additional trail connections be provided in consultation with parks staff.

The planning and design charrette resulted in a Preliminary Preferred Community Structure to advance planning for the future development of the Clair-Maltby Secondary Plan, and utilized as a basis for detailed technical analysis – including transportation modelling analysis.

Following the planning and design charrette, a transportation modelling assessment was conducted of the anticipated future traffic conditions within the Secondary Plan area pending the introduction of the aforementioned north-south oriented collector street extending between Clair Road and Maltby Road (located east of Gordon

Street). This assessment demonstrated that Gordon Street would be able to accommodate future traffic demands without this collector street on the easterly side of Gordon Street. This modelling allowed a general understanding of the potential impacts that a collector street would have on the existing NHS in two locations, as well as on an identified Cultural Heritage Landscape, and resulted in the removal of this collector road where it crosses these features as part of the Secondary Plan. Further analysis has also subsequently been conducted on the Preferred Community Plan to confirm the need for a north-south oriented street, west of Gordon Road.

Public Workshop: Secondary Plan Policy Directions (December 2018)

This workshop included focused conversations and discussion to help establish and refine the policy directions that will inform the creation of the Clair-Maltby Secondary Plan. The workshop addressed mobility and trails in addition to other topics.

These discussions helped inform, and are included within, the *Plan Policy Directions: Framework for the Clair-Maltby Secondary Plan* report (May, 2019). Key transportation considerations are cited therein, including sustainable transportation, transit, trails, design standards, parking, and general transportation networks.

A summary of transportation-related comments received from workshop attendees is provided in the following:

- Support for mobility choice and accommodating sustainable transportation modes, including active transportation routes to schools;
- A need to accommodate transit service and discussion of a transit hub;
- Discussion of the overall trail network and design standards to address environmental and safety concerns;
- Support appropriate amounts of vehicle parking, consider parking for electric vehicles, and encourage underground or rear laneway parking;
- Consider traffic impacts, vehicle congestion, reliance on automobiles to connect to employment areas, and traffic level-of-service metrics;
- Ideas for buffering / protecting the NHS from transportation infrastructure; and
- Various transportation design considerations related to street crossings of the NHS, low-impact (environmental) street designs, accommodating species migration, sidewalk provisions, cycling facility design, traffic calming measures, and grading impacts on existing landscapes.

3.4.3.5 Evolution of Community Structure

The Community Structure was advanced through modifications to alternative Community Structures developed as part of the April 2018 design and planning workshop and subsequent advisory group meetings.

These modifications to the community structure plan included adjustments to the Secondary Plan boundary, the removal of a conceptual north-south direction collector street aligned east of Gordon Street, changes to the location of high-density residential development, and the identification of cultural heritage resources and existing wetlands.

3.4.4 Alternatives

3.4.4.1 Do Nothing and Community Structure Alternatives (4)

The Clair-Maltby Secondary Plan has been evaluated from a transportation lens based on four primary alternatives to the land use plan that were presented as part of a 2018 Design Charette:

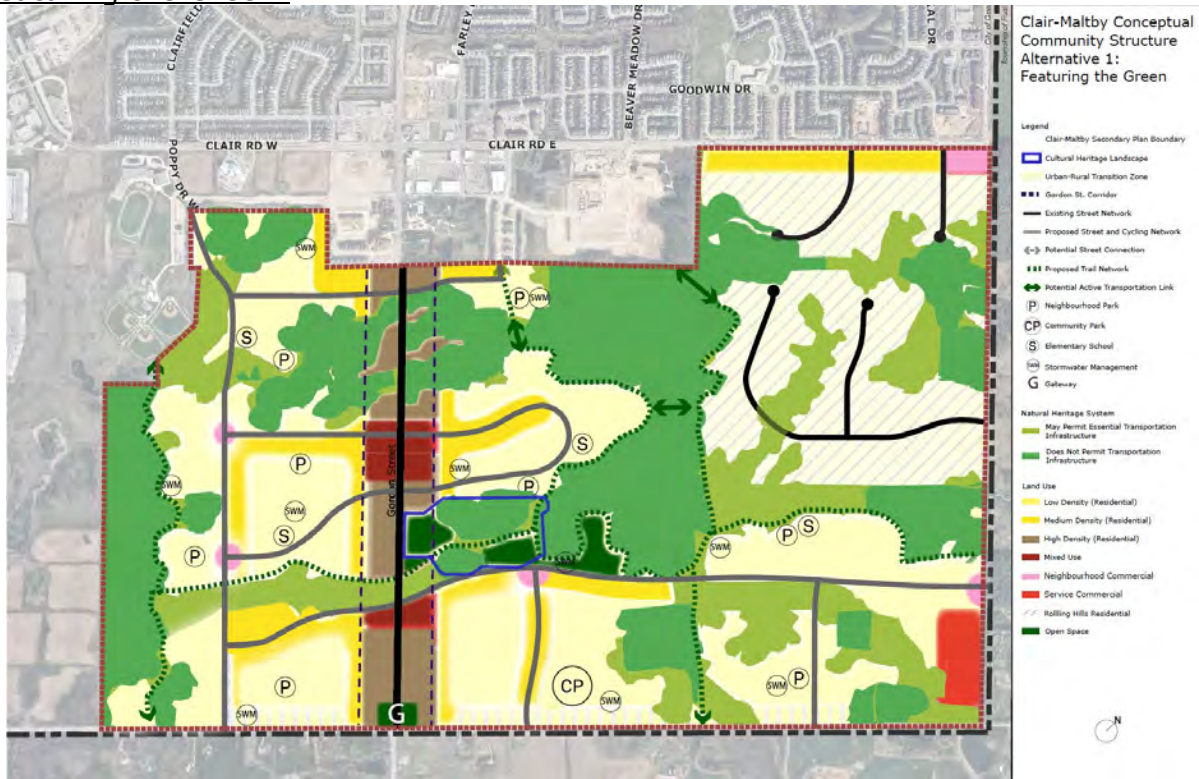
1. Do Nothing – No new roads
2. Featuring the Green– 2 continuous collectors (one N-S, one E-W)
3. Focus on Community Services– 2 continuous collectors (one N-S, one E-W)
4. Urban and Connected – 3 continuous collectors (two N-S, one E-W)
5. Preferred Community Structure Plan – 2 continuous collectors (3rd continuous collector replaced by continuous active transportation link)

Alternatives 2 to 5 are illustrated in Figure 3.4.30. Note, the land use alternatives pre-date a modification to the Secondary Plan that removes the Rolling Hills neighbourhood from the Secondary Plan study area.

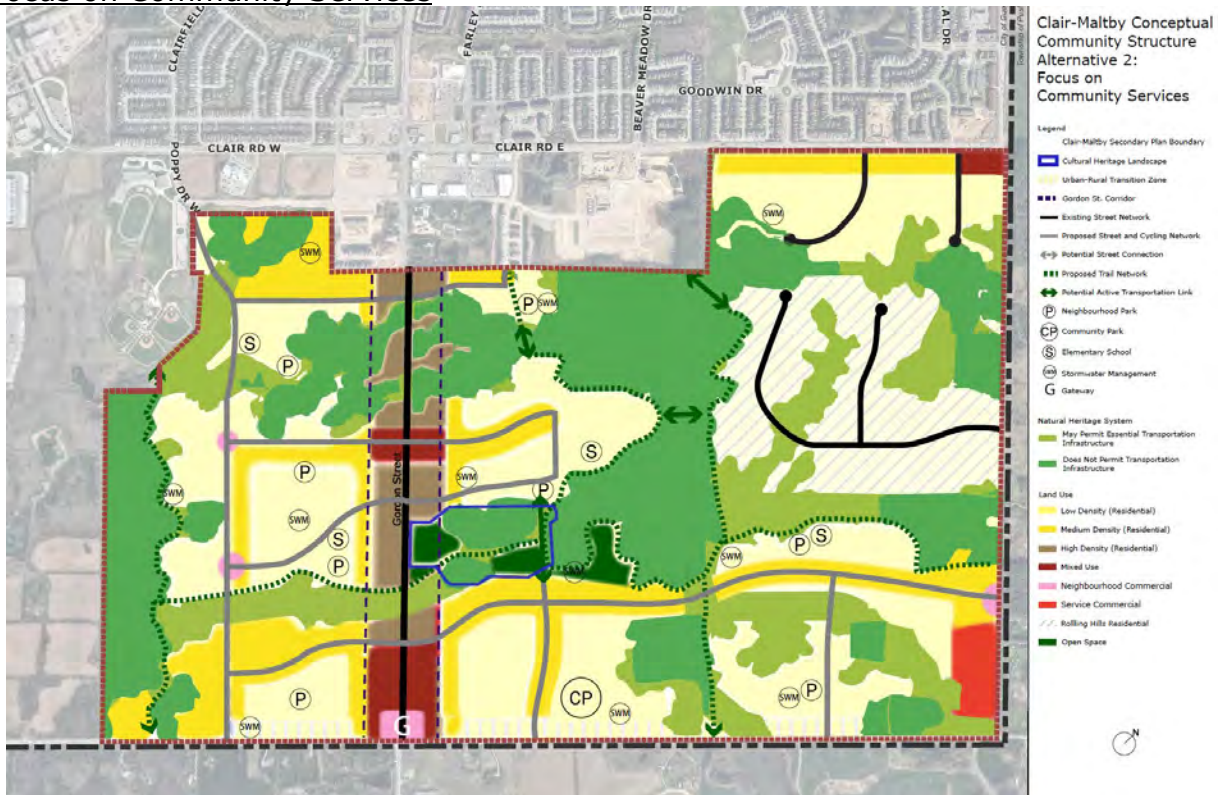
A total of five alternative land use scenarios with differing transportation network were considered based on the criteria noted below, including a “Do Nothing” option. Three alternatives reviewed as part of the Clair-Maltby Secondary Plan Charette (March 2018), and the final “Preferred Community Structure Plan” transportation network that resulted from direction provided as part of the March 2018 Charette, public consultation, and internal analysis and multi-disciplinary consultation. “Featuring the Green” and “Focus on Community Services” (aside from location and walkability of land uses) have similar mobility networks, with one notable difference in the north-south active transportation links east of Gordon Street.

Figure 3.4.28. Community Structure Alternatives Reviewed- 2018

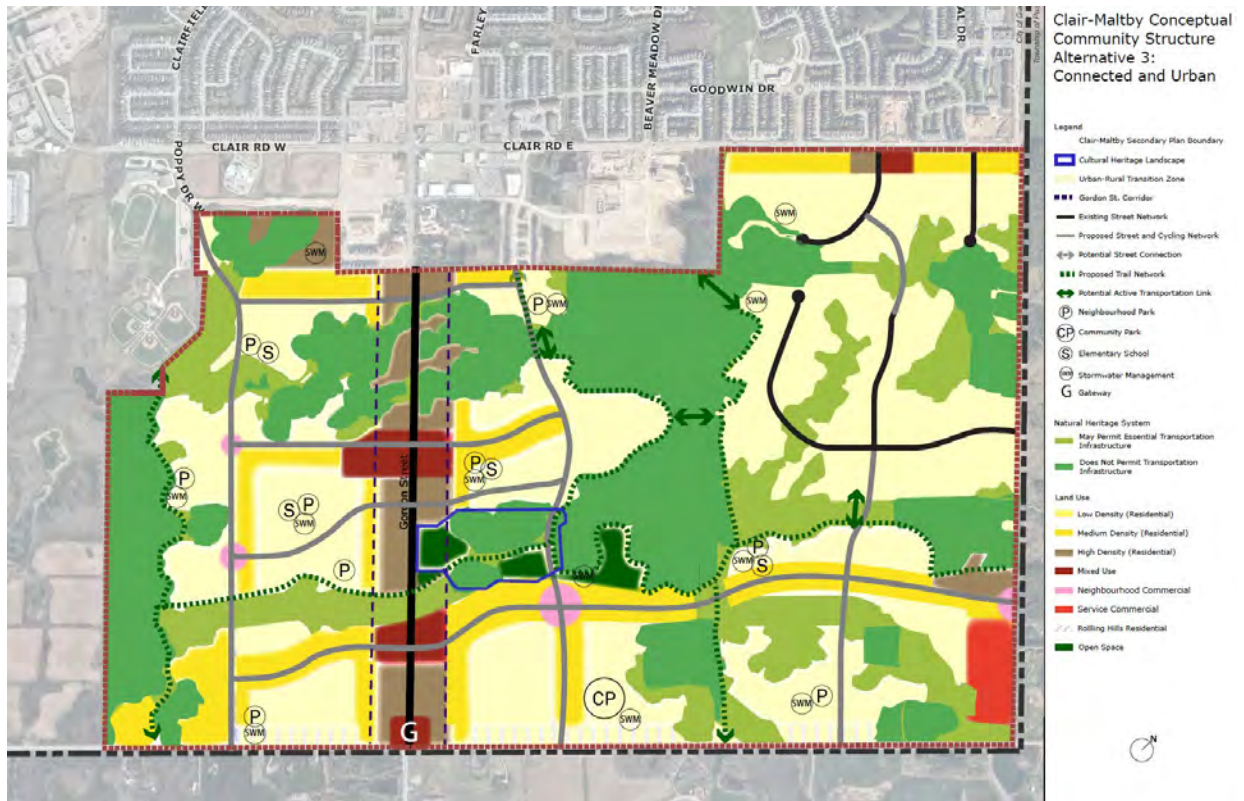
Featuring the Green:



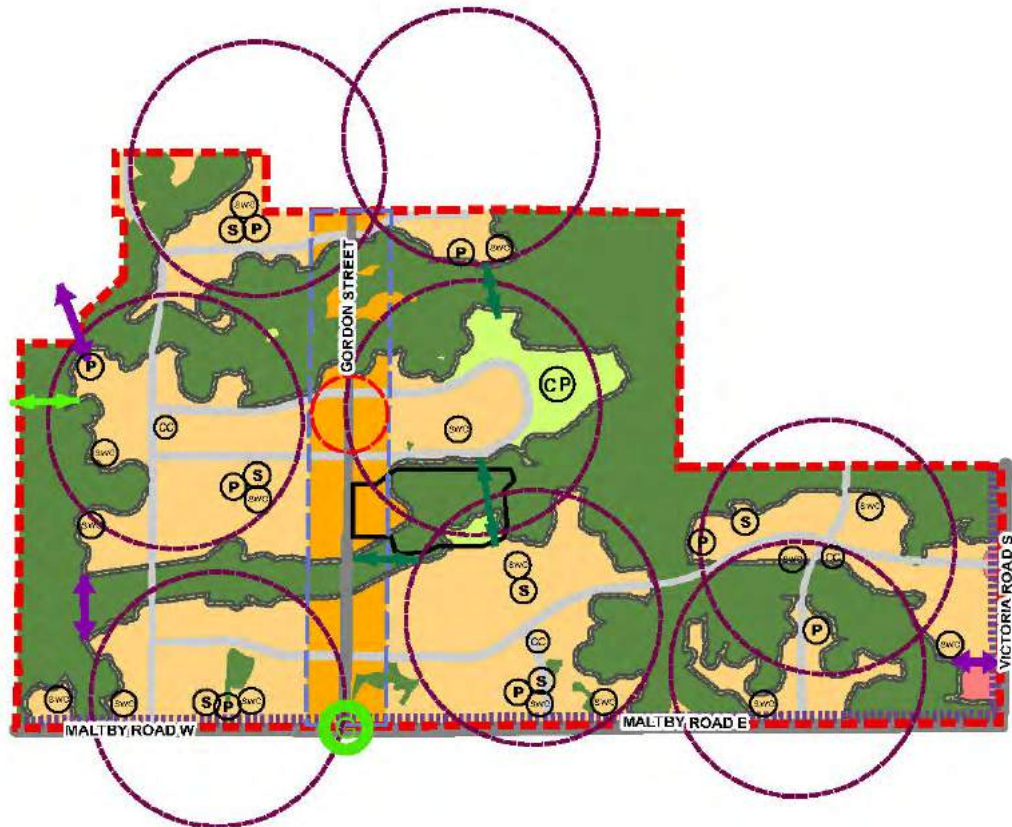
Focus on Community Services



Urban and Connected:



Preferred Community Structure Plan:



3.4.5 Assessment Criteria

The transportation criteria used to evaluate each alternative are described below:

Street Network:

- Modified grid collector street system with a fine-grained block structure to disperse traffic and encourage walking and cycling.
- Cost of implementing street network.
- Ability to provide property access.
- Potential to service future travel demands.

- New street network continuity and connectivity internal to Secondary Plan area.
- Multiple vehicular connections with local, regional and provincial roads to connect with the existing street network and distribute traffic.
- Impact to Natural Heritage System and natural / environmental

Active Transportation:

- Provide facilities within the public and private realm which encourage cycling, and includes off-road cycling facilities.
- Active transportation links to the Clair-Gordon mixed use node, South End Community Park, and other community facilities (schools, parks, community centres).
- Safety

Transit:

- Extends and connects to existing transit routes and facilities within the City of Guelph
- Transit hub along Gordon Street in a location that connects riders with high density residential, commercial and mixed use areas.
- Bus stops are provided at regular intervals, generally within 400m of 90 per cent of residence and business.
- Opportunity to provide efficient transit routing options.

Trails:

- Facilities for recreational trail use.
- Facilitates for day-to-day travel demand.
- Connections to City-wide trail network
- Local connections between residential areas and community facilities / commercial areas

Alignment with Objectives of the Secondary Plan (Interconnected & Interwoven):

- Green and Resilient
- Healthy and Sustainable
- Vibrant and Urban
- Interconnected and Interwoven
- Balanced and Livable

3.4.5.1 Ranking

Alternative Community Structure Plans and the evaluation matrix for mobility is provided below.
















The network alternatives were ranked for each criteria to provide an understanding of overall network performance.





















The ranking system is outlined in the following:

































Table 3.4.15. Mobility Alternative Evaluation Matrix

Transportation Network Elements	Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
Street Network	Modified grid collector street system with a fine-grained block structure to disperse traffic and encourage walking and cycling.	Does not advance a collector street network to accommodate traffic from future development. Does not establish a fine-grain network of collector streets to accommodate traffic movement or multi-modal travel connectivity.	East-west and north-south oriented collector streets provide a fine-grained grid of streets west of Gordon Street. East-west oriented parallel collector streets provide traffic routing alternatives and supports efficient dispersal of traffic. Limited provision of north-south oriented parallel collector streets east of Gordon Street. Proposed collector streets, in addition to existing road network, provides connectivity and access to planned development. Gaps in collector street grid network east of Gordon Street.	East-west and north-south oriented collector streets provide a fine-grained grid of streets west of Gordon Street. East-west oriented parallel collector streets provide traffic routing alternatives and supports efficient dispersal of traffic. Limited provision of north-south oriented parallel collector streets east of Gordon Street. Proposed collector streets, in addition to existing road network, provides connectivity and access to planned development. Gaps in collector street grid network east of Gordon Street.	East-west and north-south oriented collector streets provide a fine-grained grid of streets west and east of Gordon Street. East-west oriented and north-south parallel collector streets provide traffic routing alternatives and supports efficient dispersal of traffic. Direct north-south collector connections to Clair Road east of Gordon Street.	East-west and north-south oriented collector streets provide a fine-grained grid of streets west of Gordon Street. East-west oriented parallel collector streets provide traffic routing alternatives and supports efficient dispersal of traffic. Limited provision of north-south oriented parallel collector streets east of Gordon Street. Proposed collector streets, in addition to existing road network, provides connectivity and access to planned development. Gaps in collector street grid network east of Gordon Street.
Street Network	Cost of implementing street network.	Does not advance a collector street network. Minimal cost implications.	Approximately 9 km of collector streets. Limited roadworks through ecologically sensitive areas. Fifteen (15) new or reconstructed collector / arterial street intersections within the study area. Some grading challenges to more considerable grading challenges for Street E alignment west of Gordon Street.	Approximately 9 km of collector streets. Limited roadworks through ecologically sensitive areas. Fifteen (15) new or reconstructed collector / arterial street intersections within the study area. Some grading challenges to more considerable grading challenges for Street E alignment west of Gordon Street.	Additional 11.5 km of collector streets. Additional costs associated with roadworks through ecologically sensitive areas. Eighteen (18) new or reconstructed collector / arterial street intersections within the study area. Some grading challenges to more considerable grading challenges for Street E alignment west of Gordon Street.	Approximately 9 km of collector streets. Limited roadworks through ecologically sensitive areas. Fifteen (15) new or reconstructed collector / arterial street intersections within the study area. Some grading challenges including challenges for Street E alignment west of Gordon Street; however to a lesser degree than other concepts.

Transportation Network Elements	Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
Street Network	Ability to provide property access.	Property access provided from existing arterial / collector streets. 	Collector network adequately services development areas. 	Collector network adequately services development areas. 	Collector network adequately and most directly services development areas. 	Collector network adequately services development areas. 
Street Network	Potential to service future travel demands.	Limited opportunities to effectively distribute future development traffic. Reliance on existing arterial / collector streets to accommodate future development. Existing arterial / collector streets included limited active transportation facilities to accommodate multi-modal travel. 	Collector street network adequately services anticipated development contemplated in land budget. Intersection improvements may be required to appropriately accommodate traffic demands at certain existing intersections north of the area. A macro-level traffic analysis conducted by a City consultant, supported a 4-lane Gordon Street cross-section without introduction on a new north-south oriented collector street between Clair Road and Maltby Road east of Gordon St. 	Collector street network adequately services anticipated development contemplated in land budget. Intersection improvements may be required to appropriately accommodate traffic demands at certain existing intersections north of the area. A macro-level traffic analysis conducted by a City consultant, supported a 4-lane Gordon Street cross-section without introduction on a new north-south oriented collector street between Clair Road and Maltby Road east of Gordon St. 	Collector street network adequately services anticipated development contemplated in land budget. Provides additional north-south direction vehicular capacity. Provides additional vehicle routing to / from Clair Road and neighbourhoods north of Clair Road. Fewer intersection improvements may be required to appropriately accommodate traffic demands at certain existing intersections north of the area. 	Collector street network adequately services anticipated development contemplated in land budget. Intersection improvements may be required to appropriately accommodate traffic demands at certain existing intersections north of the area. A macro-level traffic analysis conducted by a City consultant, supported a 4-lane Gordon Street cross-section without introduction on a new north-south oriented collector street between Clair Road and Maltby Road east of Gordon St. 
Street Network	New street network continuity and connectivity internal to Secondary Plan area.	Does not advance a collector street network to provide to support development. 	West of Gordon Street: good collector street connectivity and continuity. East of Gordon Street: discontinuity in north-south collector street network. 	West of Gordon Street: good collector street connectivity and continuity. East of Gordon Street: discontinuity in north-south collector street network. 	Good collector street connectivity and continuity east and west of Gordon Street. 	West of Gordon Street: good collector street connectivity and continuity. East of Gordon Street: discontinuity in north-south collector street network. 
Street Network	Multiple vehicular connections with local, regional and provincial roads to connect with the existing street	No new street connection with local, regional or provincial roads.	Provides connectivity to planned collector street network and existing arterial street network.	Provides connectivity to planned collector street network and existing arterial street network.	Provides connectivity to planned collector street network and existing arterial street network.	Provides connectivity to planned collector street network and existing arterial street network.

Transportation Network Elements	Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
	network and distribute traffic.		No connectivity to planned Southgate Drive extension or Rolling Hills neighbourhood. 	No connectivity to planned Southgate Drive extension or Rolling Hills neighbourhood. 	Additional collector street connectivity to Clair Road, and north-south collector street connectivity internal to the area. 	No connectivity to planned Southgate Drive extension or Rolling Hills neighbourhood. 
Street Network	Impact to Natural Heritage System and natural / environmental elements.	No provision of new transportation infrastructure. No substantive impacts to existing physical environment. 	Construction of new collector street network. Five (5) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is permitted. Trail connections provided within Natural Heritage System. 	Construction of new collector street network. Five (5) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is permitted. Trail connections provided within Natural Heritage System. 	Construction of new collector street network. Eight (8) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is and is not permitted. Trail connections provided within Natural Heritage System. 	Construction of new collector street network. Five (5) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is permitted. Trail connections provided within Natural Heritage System. 
Active Transportation	Provide facilities within the public and private realm which encourage cycling, and includes off-road cycling facilities.	New cycling facilities not provided. 	Pedestrian and cycling facilities to be incorporated in all municipal street right-of-ways. Potential active transportation links considered to connect proposed north-south oriented collector streets east of Gordon Street. 	Pedestrian and cycling facilities to be incorporated in all municipal street right-of-ways. Potential active transportation links considered to connect proposed north-south oriented collector streets east of Gordon Street. 	Pedestrian and cycling facilities to be incorporated in all municipal street right-of-ways. Active transportation links provided within / adjacent to municipal right-of-ways across Natural Heritage System corridors. 	Pedestrian and cycling facilities to be incorporated in all municipal street right-of-ways. Potential active transportation links considered to connect proposed north-south oriented collector streets east of Gordon Street and west to Stonegate Drive industrial area. 
Active Transportation	Active transportation links to the Clair-Gordon mixed use node, South End Community Park, and other community facilities (schools, parks, community centres).	New cycling and pedestrian facilities not provided. 	Collector street network, and potential active transportation links provide direct connectivity to most community facilities. 	Collector street network, and potential active transportation links provide direct connectivity to all community facilities. 	Collector street network, and potential active transportation links provide direct connectivity to all community facilities. 	Collector street network, and potential active transportation links provide direct connectivity to all community facilities. 

Transportation Network Elements	Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
Active Transportation	Safety	<p>Existing streets will be upgraded consistent with the Transportation Master Plan, according to best practices and engineering standards to prioritize safety.</p> <p>New cycling infrastructure limited to improvements already identified in current plans and studies.</p> <p>New pedestrian infrastructure limited to improvements already identified in current plans and studies.</p> <p>No new pedestrian facilities, pedestrian crossing infrastructure, or cycling facilities, other than those identified in current plans and studies, to support new development.</p> 	<p>Streets will be designed according to best practices and engineering standards to prioritize safety.</p> <p>Separate cycling facilities are proposed for arterial and collector street segments. Off-street trails will complement the planned cycling network.</p> <p>Sidewalks will be provided on both sides of all arterial and collector streets, and provide connections to properties, amenities and transit. Appropriate street crossing facilities will be incorporated to complement the pedestrian network.</p> 	<p>Streets will be designed according to best practices and engineering standards to prioritize safety.</p> <p>Separate cycling facilities are proposed for arterial and collector street segments. Off-street trails will complement the planned cycling network.</p> <p>Sidewalks will be provided on both sides of all arterial and collector streets, and provide connections to properties, amenities and transit. Appropriate street crossing facilities will be incorporated to complement the pedestrian network.</p> 	<p>Streets will be designed according to best practices and engineering standards to prioritize safety.</p> <p>Separate cycling facilities are proposed for arterial and collector street segments. Off-street trails will complement the planned cycling network.</p> <p>Sidewalks will be provided on both sides of all arterial and collector streets, and provide connections to properties, amenities and transit. Appropriate street crossing facilities will be incorporated to complement the pedestrian network.</p> 	<p>Streets will be designed according to best practices and engineering standards to prioritize safety.</p> <p>Separate cycling facilities are proposed for arterial and collector street segments. Off-street trails will complement the planned cycling network.</p> <p>Sidewalks will be provided on both sides of all arterial and collector streets, and provide connections to properties, amenities and transit. Appropriate street crossing facilities will be incorporated to complement the pedestrian network.</p> 
Transit	Extends and connects to existing transit routes and facilities within the City of Guelph	<p>Existing area bus routes do not service the area.</p> 	<p>Provides opportunity for existing area bus routes to connect to, and circulate within, the area.</p> 	<p>Provides opportunity for existing area bus routes to connect to, and circulate within, the area.</p> 	<p>Provides opportunity for existing area bus routes to connect to, and circulate within, the area.</p> <p>Provides additional opportunity to route existing bus services to / from Clair Road east of Gordon Street</p> 	<p>Provides opportunity for existing area bus routes to connect to, and circulate within, the area.</p> 
Transit	Transit hub along Gordon Street in a location that connects riders with high density residential,	<p>Opportunity to appropriately locate a transit terminal along a mixed-use / high-density section of Gordon Street.</p> <p>Limited opportunity to accommodate high-density</p>	<p>Opportunity to appropriately locate a transit terminal along a mixed-use / high-density section of Gordon Street.</p> <p>Opportunity to utilize east-west oriented collector</p>	<p>Opportunity to appropriately locate a transit terminal along a mixed-use / high-density section of Gordon Street.</p> <p>Opportunity to utilize east-west oriented collector</p>	<p>Opportunity to appropriately locate a transit terminal along a mixed-use / high-density section of Gordon Street.</p> <p>Opportunity to utilize east-west oriented collector streets to provide flexibility and</p>	<p>Opportunity to appropriately locate a transit terminal along a mixed-use / high-density section of Gordon Street.</p> <p>Opportunity to utilize east-west oriented collector</p>

Transportation Network Elements	Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
	commercial and mixed use areas.	and / or commercial retail development without new collector road network and improvements to the existing road network. 	streets to provide flexibility and efficient bus routing to transit terminal. 	streets to provide flexibility and efficient bus routing to transit terminal. 	efficient bus routing to transit terminal. 	streets to provide flexibility and efficient bus routing to transit terminal. 
Transit	Bus stops are provided at regular intervals, generally within 400m of every residence and business.	Existing area bus routes do not service the area. Bus routing and stops limited to existing roads and unable to provide service within 400m of all development areas. 	Collector street network established to accommodate bus routing and stops within 400m of all development areas. 	Collector street network established to accommodate bus routing and stops within 400m of all development areas. 	Collector street network established to accommodate bus routing and stops within 400m of all development areas. 	Collector street network established to accommodate bus routing and stops within 400m of all development areas. 
Transit	Opportunity to provide efficient transit routing options.	Existing area bus routes do not service the area. Few opportunities to efficiently provide turnaround or "end-of-route" facilities. 	Continuity in collector streets provides opportunity to efficiently route bus services north-south / east-west through the area. 	Continuity in collector streets provides opportunity to efficiently route bus services north-south / east-west through the area. 	Continuity in collector streets provides opportunity to efficiently route bus services north-south / east-west through the area. Additional north-south collector street east of Gordon Streets provides additional opportunity for efficient routing of bus services east of Gordon Street. 	Continuity in collector streets provides opportunity to efficiently route bus services north-south / east-west through the area. 
Trails	Facilities for recreational trail use.	New recreation trails not provided. 	Opportunities for trail facilities adjacent to natural heritage system. Limit trail crossing of collector / arterial street network. 	Opportunities for trail facilities adjacent to natural heritage system. Limit trail crossing of collector / arterial street network. 	Opportunities for trail facilities adjacent to natural heritage system. Additional trail crossing of collector streets required. 	Opportunities for trail facilities adjacent to natural heritage system. Limit trail crossing of collector / arterial street network. 
Trails	Facilitates for day-to-day travel demand.	New recreation trails, multi-use trails, and other cycling and pedestrian facilities not provided.	Provides opportunities to connect with planned / existing on-street cycling facilities.	Provides opportunities to connect with planned / existing on-street cycling facilities.	Provides opportunities to connect with planned / existing on-street cycling facilities. Supplements on-street cycling facilities within the area.	Provides opportunities to connect with planned / existing on-street cycling facilities.


























Transportation Network Elements	Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
			Supplements on-street cycling facilities within the area.	Supplements on-street cycling facilities within the area.		Supplements on-street cycling facilities within the area.
Trails	Connections to City-wide trail network	New recreation trails not provided.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan. Potential active transportation link considered to connect with Southgate Drive.
Trails	Local connections between residential areas and community facilities / commercial areas	New recreation trails, multi-use trails, and other cycling and pedestrian facilities not provided.	Trails supplement collector street network to provide direct connectivity to most community facilities and Gordon Street corridor.	Trails supplement collector street network to provide direct connectivity to all community facilities and Gordon Street corridor.	Trails supplement collector street network to provide direct connectivity to all community facilities and Gordon Street corridor.	Trails supplement collector street network to provide direct connectivity to all community facilities and Gordon Street corridor.
Alignment with Objectives of the Secondary Plan	Green and Resilient	No provision of new transportation infrastructure. No substantive impacts to existing physical environment.	Construction of new collector street network. Five (5) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is permitted.	Construction of new collector street network. Five (5) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is permitted.	Construction of new collector street network. Eight (8) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is and is not permitted. Trail connections provided within Natural Heritage System.	Construction of new collector street network. Five (5) new collector street crossings of the Natural Heritage System within areas where transportation infrastructure is permitted. Trail connections provided within Natural Heritage System.
Alignment with Objectives of the Secondary Plan	Healthy and Sustainable	No provision of new transportation infrastructure, recreation trails, multi-use trails, and other cycling and pedestrian facilities.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan.	Provides opportunities to connect City Cycling Master Plan, Active Transportation Network Plan, and Trail Network Plan. Potential active transportation link

Transportation Network Elements	Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
Alignment with Objectives of the Secondary Plan	Vibrant and Urban	No provision of new transportation infrastructure, recreation trails, multi-use trails, and other cycling and pedestrian facilities.	Gordon Street is central spine with connectivity Village Core / Main	Gordon Street is central spine with connectivity Village Core / Main	Gordon Street is central spine with connectivity Village Core / Main. N-S Collector connection on either side of Gordon Street.	Gordon Street is central spine with connectivity Village Core / Main. N-S Active Transportation connection on either side of Gordon Street.
Alignment with Objectives of the Secondary Plan	Interconnected and Interwoven	No provision of new transportation infrastructure, recreation trails, multi-use trails, and other cycling and pedestrian facilities.	Efficient transit service. Provide connections to parks, open spaces and trails from the Moraine Ribbon and the road network to promote active transportation and passive recreation	Efficient transit service. Provide connections to parks, open spaces and trails from the Moraine Ribbon and the road network to promote active transportation and passive recreation	Continuous multi-modal travel throughout Clair-Maltby with connections to city-wide travel networks. Efficient transit service. Provide connections to parks, open spaces and trails from the Moraine Ribbon and the road network to promote active transportation and passive recreation	Continuous multi-modal travel throughout Clair-Maltby with connections to city-wide travel networks. Efficient transit service. Provide connections to parks, open spaces and trails from the Moraine Ribbon and the road network to promote active transportation and passive recreation. Priority on walking, cycling, and transit.
Alignment with Objectives of the Secondary Plan	Balanced and Livable	No provision of new transportation infrastructure, recreation trails, multi-use trails, and other cycling and pedestrian facilities.	Adequately served by trails, walkable areas, access to Natural Heritage System.	Adequately served by trails, walkable areas, access to Natural Heritage System.	Adequately served by trails, walkable areas, access to Natural Heritage System.	Adequately served by trails, walkable areas, access to Natural Heritage System.

3.4.6 Preferred Solution(s)

A summary of the Evaluation Matrix (by criteria) is provide below.

Table 3.4.16. Mobility Evaluation Summary

Criteria	Alternative 1: "Do Nothing"	Alternative 2: "Featuring the Green"	Alternative 3: "Focus on Community Services"	Alternative 4: "Urban and Connected"	Alternative 5: "Preferred Community Structure Plan"
Street Network					
Active Transportation					
Transit					
Trails					
Alignment with Objectives of the Secondary Plan					

3.4.6.1 Preferred Solution

Alternative 4 "Urban and Connected" provides the most robust transportation network to adequately accommodate development of the Secondary Plan area, but it is also the most expensive alternative and most extensively impacts the Natural Heritage System and existing physical environment.

Alternative 5, the "Preferred Community Structure Plan" street network provides equivalent / better active transportation and trail connectivity relative to the Alternative 4 concept, adequately accommodates future development and transit services, is less costly, and, importantly, results in less impact to the Natural Heritage System.

The Preferred Community Structure has built upon the road network, active transportation network, and trail network in the preferred Mobility alternative (Alternative 5).

The street network represents a modified grid system, which is intended to allow for frequent and robust routing for all street users, while respecting the important environmental features of the area.

A total of four east-west oriented collector streets are proposed to cross Gordon Street between Gosling Gardens in the north and Maltby Road in the south. One north-south oriented collector street is proposed to extend between Poppy Road in

the north and Maltby Road in the south, and will be located in the western portion of the Secondary Plan area (west of Gordon Street). This second north-south oriented street is required to connect to Clair Road to accommodate the land budget considered as part of the planning process (approximately 10,125 units). In absence of a second street connection between the Secondary Plan area and Clair Road, considerable improvements are required to the Gordon Street / Clair Road and Victoria Road / Clair Road intersections, beyond those already recommended herein.

Two additional north-south collector streets are illustrated in the south-eastern portions of the Secondary Plan area in order to establish a robust street-network grid in this location. All collector streets, as well as existing arterial streets, are intended to appropriately integrate cycling and pedestrian facilities to ensure multi-modal mobility and accessibility.

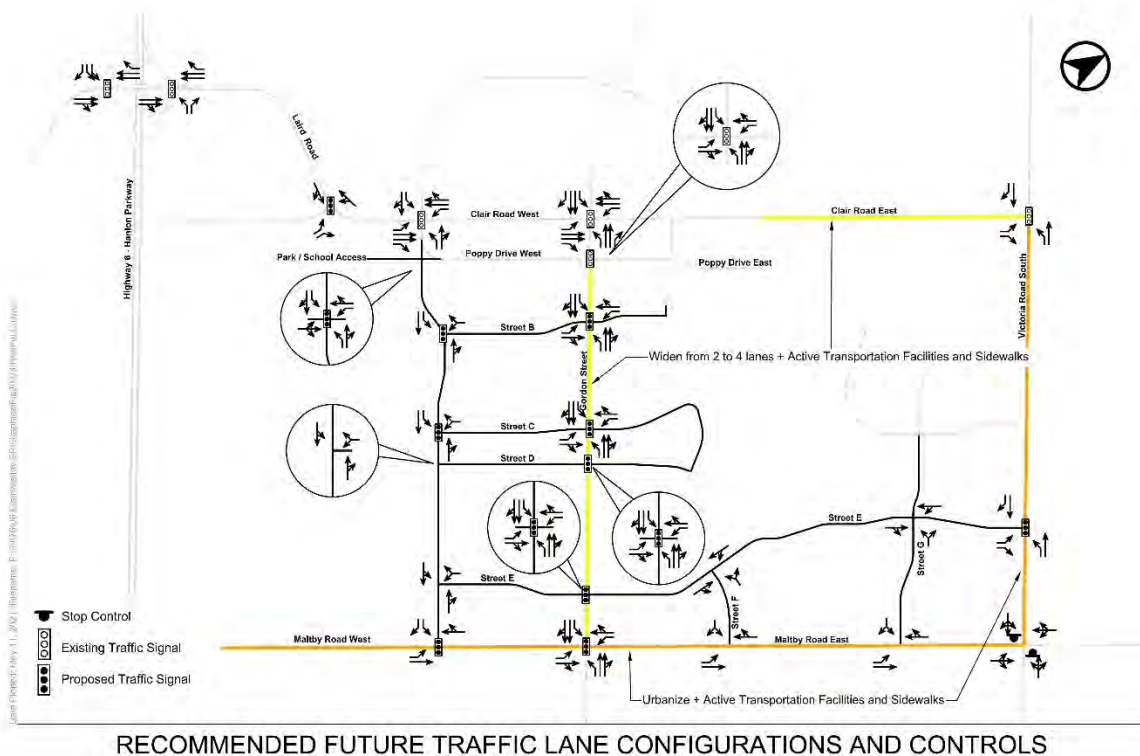
The design of all collector streets and existing arterial streets is intended to allow for the operation of buses, to provide several opportunities and flexibility for transit vehicle routing throughout the Clair-Maltby Secondary Plan. Transit services are intended to route throughout the Secondary Plan area, allowing for bus stops to be provided at regular intervals within 400 metres of 90 per cent of residents and businesses. Additional transit provisions may also be made along the Gordon Street corridor to allow for convenient service transfers, and infrastructure to support the efficient and reliable routing of transit vehicles.

The planned network of streets (and trails) are intended to achieve safe, convenient and comfortable travel and access for all street-users, with priority given to pedestrians, cyclists, and transit operations, to provide mobility choice and support city policy and modal-split objectives. Vehicular movement will be accommodated, but is not prioritized, and will be subject to levels-of-service which are more constrained than typical in new-build areas within the City.

The Preferred Community Structure provides a general layout of land use, connective elements (arterial / collector streets and trails), community facilities, potential locations for storm water management facilities, existing cultural heritage resources, and wetlands.

The Clair-Maltby Secondary Plan Preferred Community Structure advances an urban village concept comprised of the Gordon Street Corridor, surrounding neighbourhoods and the Natural Heritage System. The Plan indicates that the area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents. The Natural Heritage System and the Paris Moraine, together with a system of parks and open spaces, provide a framework for the balanced development of interconnected and sustainable neighbourhoods. The Natural Heritage System further informs the opportunities for transportation infrastructure including a network of development-supportive collector streets.

Figure 3.4.29. Preferred Road Network



Road Cross-Sections

The City of Guelph has a set of standard road cross-sections that guides design of the right-of-way, boulevard, and pavement width standards for municipal roadways. There is potential to update the road / design standards specifically for the Clair-Maltby Secondary Plan area to permit further programming within the pavement or boulevard spaces to include multi-modal uses where appropriate or to account for variations in natural landscape where a context sensitive standard may be most suitable.

A Cross-Section study was conducted by Wood specifically for the Clair-Maltby Secondary Plan area. Excerpts of the latest cross-sections are provided in Figures 3.4.30, 3.4.31, and 3.4.32

Gordon Street Corridor

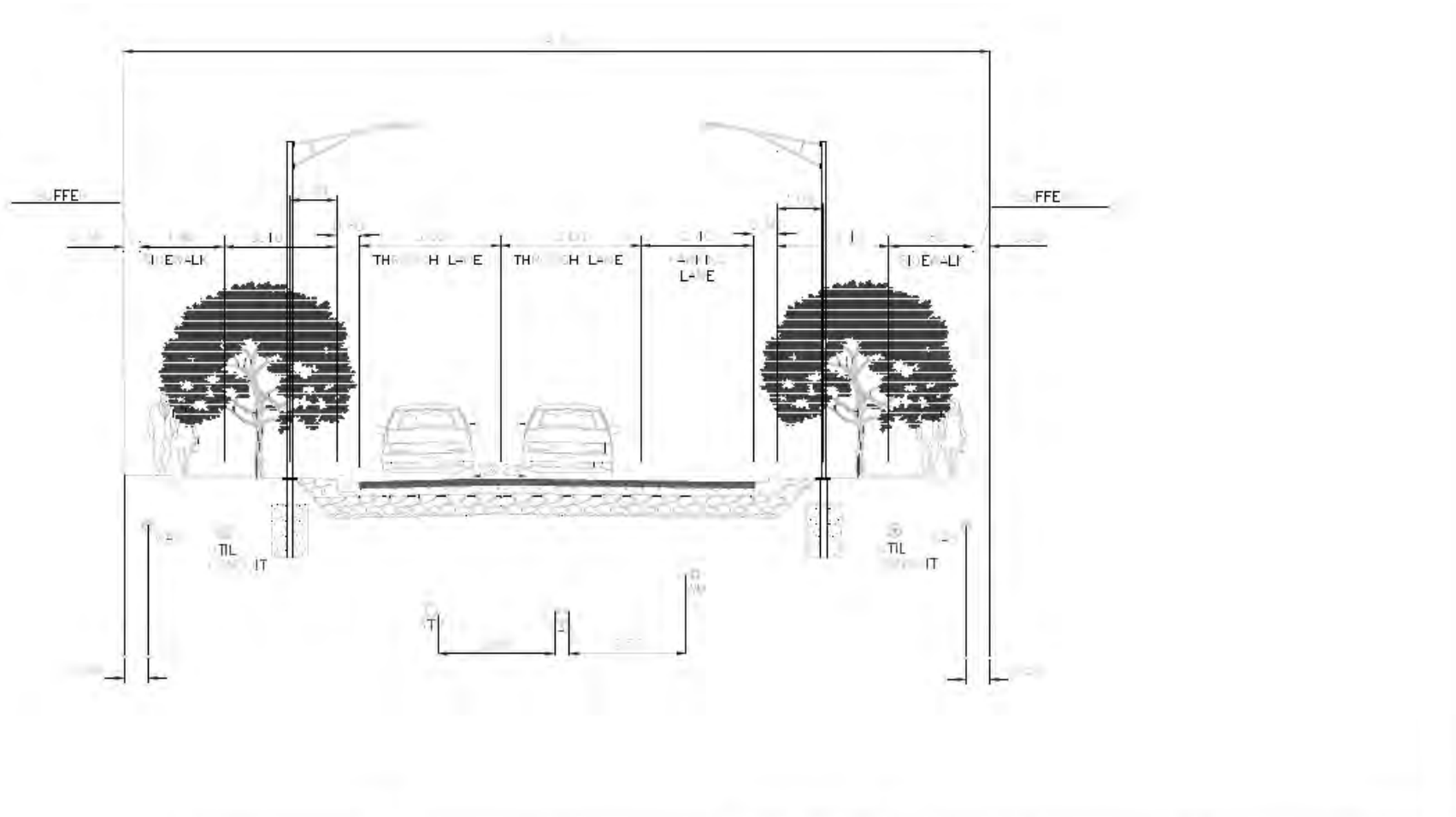
The Gordon Street corridor is a central element in the local transportation network, connects the area with the wider City and County, provides an opportunity for transit priority, and is envisioned as a main street / village core destination.

The Gordon Street right-of-way is intended to accommodate all street users through the delivery of multimodal infrastructure. Its design will support the efficient and effective routing of transit services, the comfortable movement of cyclists and pedestrians, and accommodate for automobile travel.

A 4-lane Gordon Street cross-section is anticipated to appropriately accommodate traffic demands along the corridor given optimized signal timing and coordination, and the inclusion of ancillary turn lanes where necessary. Separate left-turn lanes should be provided at all junctions where left-turns are permitted, which may further support the introduction of a continuous left-turn / centre median lane along the extent of Gordon Street within the Secondary Plan area.

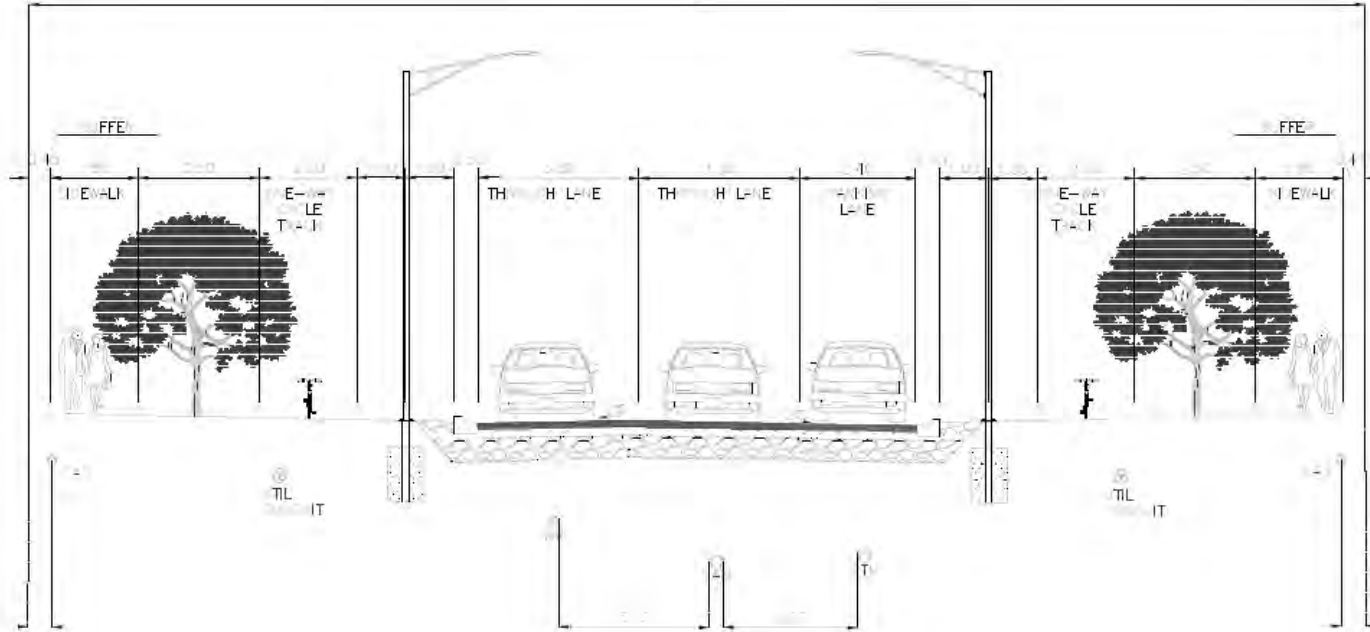
The Clair-Maltby Secondary Plan encourages dense, mixed-use development along the Gordon Street corridor to support the deployment of transit services. Transit priority measures can be potentially introduced along the Gordon Street corridor to increase the proportional uptake of transit use, and can include physical design elements to reduce transit vehicle delays and provide amenity and convenience to perspective riders, and policy measures to make transit more appealing, affordable and competitive with other travel modes.

Figure 3.4.30. Local Roadway



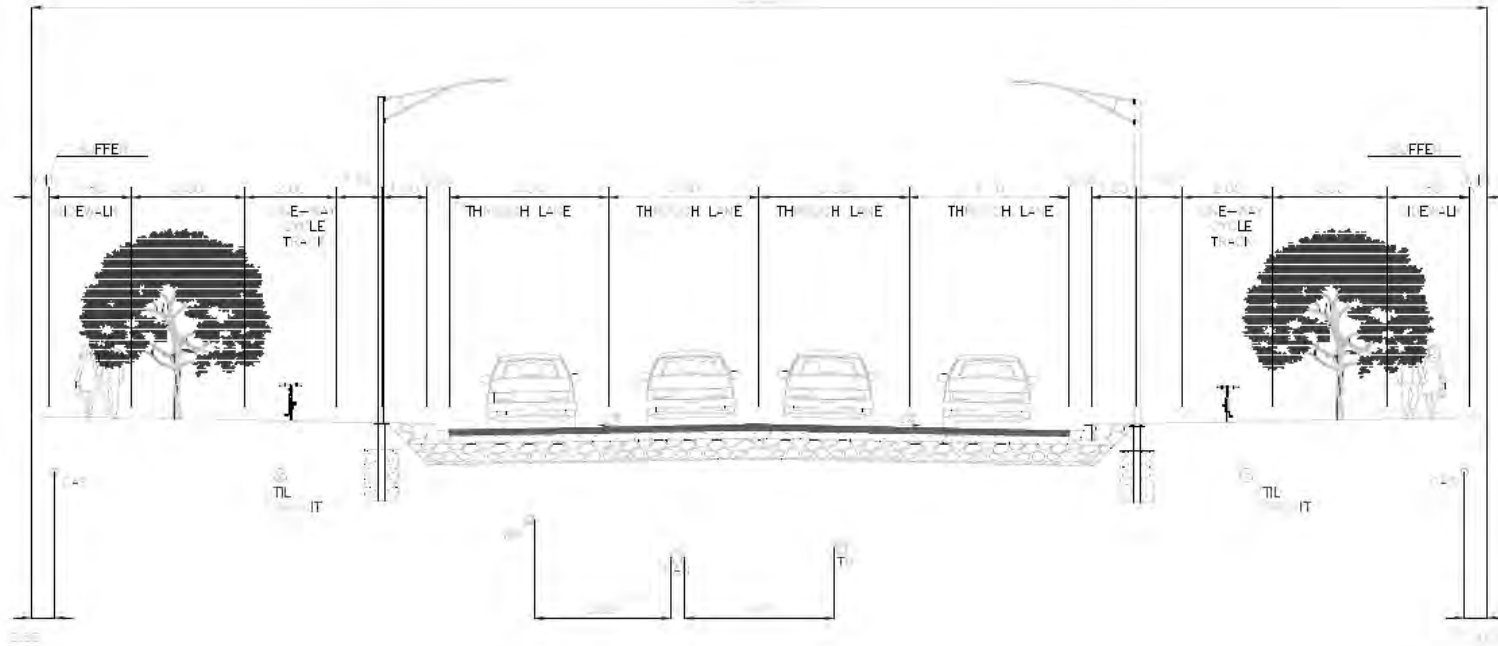
<p>NOTES</p> <p>Tree species to be selected in per- mit. Technical manual and standards may be date-coded to aid with performance visibility. For vertical clearance of pipes and utility structures, see EIR section 3.4.30.</p>	<p>CLAIR MALTBY CROSS-SECTION STUDY CITY OF GUELPH SHORTLIST DESIGN LOCAL ROADWAY</p>	<p>wood.</p>	Project # TPB168050
			Date JUNE, 2020
			Scale 1:100
			Sheet # 3

Figure 3.4.29. Collector Roadway



<p>NOTES</p> <p>Tree Species to be selected in per Tree Technical Manual Light standards may be determined to go with pedestrian visibility For vertical clearance of pipes and utilities refer to the EM report</p>	<p>CLAIR MALTBY CROSS-SECTION STUDY CITY OF GUELPH SHORTLIST DESIGN COLLECTOR ROADWAY</p>	<p>wood.</p>	PROJECT # TPB168050
			DATE JUNE, 2020
			SCALE 1:100
			FIGURE # 2

Figure 3.4.30. Arterial Roadway



<p>NOTES</p> <p>Tree species to be selected on per the Tree Technical Manual.</p> <p>Grade standards may be state-adopted or per local jurisdiction.</p> <p>For vertical clearance of pipes and utilities, refer to 2015 EIR Section 3.4.10.</p>	<p>CLAIR MALTBY CROSS-SECTION STUDY CITY OF GUELPH SHORTLIST DESIGN ARTERIAL ROADWAY</p>		Project No. TPB168050
			Date: JUNE, 2020
			Scale: 1:100
			Revision: 1

Clair-Maltby Secondary Plan Cross-Sections

Right-of-way cross-sections have been developed for collector streets contemplated as part of the Clair- Maltby Secondary Plan, as well as existing arterial streets and concept future local streets within the area.

A series of cross-sections are developed for different types of streets, which are appropriately designed to accommodate a diverse mix of users and respond to the urban design, land use, and public realm contexts. Cross-sections are intended to be understood in conjunction with City of Guelph construction standards and guidelines, and should be flexible enough to meet context specific limitations and servicing / utility requirements and will be designed in detailed plan and section view as part of future area development.

Cross sections prepared in support of the Clair-Maltby Secondary Plan intend the design and delivery of complete streets, which include pedestrian and cycling infrastructure, support transit service routing, street trees and landscaping, and utility / service delivery. Vehicle travel lanes are reduced to an appropriate level, to accommodate vehicle movement while not prioritizing vehicles over other street users.

In the design of public right-of-ways, the City will balance the provision of safe, functional and attractive pedestrian-oriented, cyclist friendly and transit-supportive environments while accommodating for an acceptable level of vehicular traffic and operation.

Different public right-of-way cross-sections have been developed for unique circumstances that accommodate for differences in adjacent land uses and the types of demands these uses can place on a typical street. For example, three-lane collector street cross-sections may be more appropriate for corridors with frequent transit service, larger (heavy) turning vehicles, intended to accommodate a greater number of "through" traffic, or frequent driveway connections. Wider pavement areas, or off-centre median lane designs, may also be pursued in instances where on-street parking will be accommodated. It is noted that Guelph Transit does not support vehicle parking on streets where transit services operate, as there is concern about motorists blocking or parking adjacent to transit stops. Similarly, wider right-of-ways may be pursued in instances where other infrastructure are required such as major trunk utilities, municipal service corridors, or overland flow routes.

The narrowest public right-of-ways are typically reserved for local streets intended to provide property access, accommodate local traffic and relatively low volumes of street users, and serve low and medium density development.

4 Implementation

Implementation of water, wastewater, stormwater and mobility infrastructure has to consider phasing / staging considerations and costing. The following outlines phasing considerations and preliminary costing for each of the infrastructure components.

4.1 Phasing

The following outlines phasing considerations for each of the infrastructure components.

4.1.1 Water

As there is available capacity in Zone 1 to supply the demands of Zone 3 in part, development in the subject lands can begin before the Zone 3 storage reservoir and the transmission ground is constructed. In general, it would be advantageous for the development to progress from north to south. It appears that this would be the most economic sequencing of development from the perspective of infrastructure costs vs return on investment. Additionally, the transmission main could be extended southwards with the development.

A Conceptual Servicing Phasing is shown in Figures 1 on the following page which indicates the general recommended sequencing of phasing areas and developments, with detailed phasing figures provided in Section 4.1.5. The relative proximity of Phase 1 to the Clair Booster Pump Station would ensure that the transmission main conveying water to the new development would minimize the length to service this initial Phase. It is estimated that approximately 20%-25% of the total demand could be met by the existing infrastructure. It is expected that a Phase 1 and Phase 2 could be developed before the Water Storage from Zone 1 is no longer sufficient and the new Zone 3 storage reservoir will be required. Exact timing of this requirement will depend on the sequencing of development within each phase and will need to be determined/confirmed by updated modelling.

4.1.2 Wastewater

A Conceptual Servicing Phasing is shown in Figure 4.1.1 on the following page which indicates the general recommended sequencing of developments. Phasing of the development will be sequential from downstream to upstream. Catchments 4 and 5 in Phase 1 can discharge to existing services. In order to develop Phase 2 pumping infrastructure and trunk sewers for the SPS3 catchment area from Gordon St to the receiving branch connection at MHD00002142 will be required. Once that infrastructure is in place, development of the catchment areas associated with either SPS1 (Phase 3) or SPS2 (Phase 4) could proceed in a logical manner.

Figure 4.1.1. Conceptual Servicing Phasing Areas



4.1.3 Stormwater

Stormwater management measures are typically constructed for the contributing development area, as development precedes, with stormwater management measures implemented at various stages of construction. End-of-pipe stormwater management facilities, in the case of Clair-Maltby, stormwater capture stormwater capture areas (SWCA), are proposed to be constructed near the commencement of construction of each development phase tributary to that SWCA, therefore providing runoff capture from the disturbed lands. At-source public and conveyance stormwater management measures would be constructed during right-of-way construction and for LID BMPs located on private lands, during the finishing construction of private lot grading and sodding. High level staging for stormwater management has been demonstrated in Figure 3.3.5 and Figure 4.1.2 based on the staging required for water and wastewater servicing.

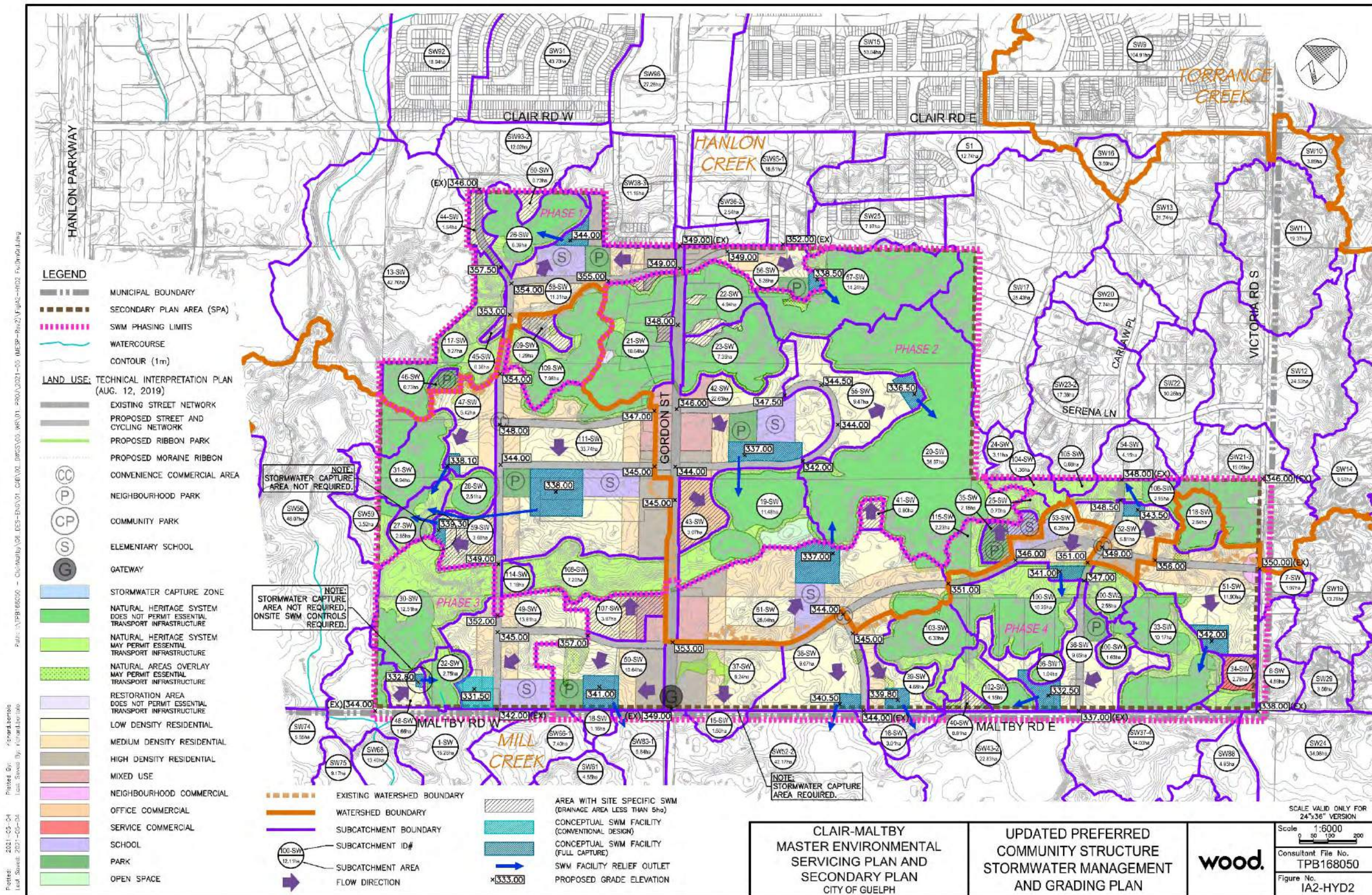
For SWCAs that could receive drainage from multiple developments/ developers, agreements will have to be in place between the developers and the City, that provide staging and financial arrangements to facilitate construction of the respective SWCAs. The agreement will need to outline if the SWCA is to be constructed partially (in stages) or in its entirety, should the contributing developments be staged at different times. Any staging of associated stormwater management measures will have to be detailed in the subdivision Stormwater Management Reports prepared by development representatives and agreed to by the City, GRCA and the MECP.

Individual development applications will have to demonstrate, as part of a stormwater management study, that there is sufficient capacity within the receiving drainage systems and SWCA(s) to support their development.

Stormwater management measures will have to be maintained during the various construction stages and if required, cleaned-out prior to assumption by the City. Stormwater management measures will be required to be monitored to ensure, performance is as per the detailed design criteria and that water quantity and quality targets are being met or exceeded. Stormwater monitoring durations and targets will be determined during the last stage of the CEIS.

In developing development plans, investigation is required to determine the possibility of tile drainage systems onsite or on adjacent lands that may contribute tile drainage either in tiles or overland via tile system outlets. Assessment of tile drainage systems and potential connected ponds and/or wetlands is required to demonstrate no negative impacts to the ultimate receiving drainage system(s) and to the upstream tile drainage system and connecting pond and/or wetlands.

Figure 4.1.2. Stormwater Management Staging Plan



4.14. Mobility

The timing of development applications and their associated road network is unknown at this time for lands within the Secondary Plan area. Individual development applications will have to demonstrate, as part of a traffic impact study or driveway operations review, that there is sufficient capacity on the existing/background road network and what, if any specific improvements would be required to support their development including new road connections. As part of the development application, they would also be required to provide the planned rights-of-way for the Secondary Plan collector and arterials road system that would be DC eligible and construct/pay for local roads serving the development. Depending on the location of a specific development and its associated impact, a developer may be required to construct a segment of DC eligible collector/arterial road network.

The recommended road network improvements for the Secondary Plan study area are identified in Table 4.2.1, along with the anticipated EA Schedule for roads projects within and surrounding the Secondary Plan area.

As we understand, there are also a number of amendments in progress for the MCEA process that can influence whether roads >\$2.4m proceed to Schedule C or instead to Schedule A.

Table 4.1.1. Summary of Road Improvements and Anticipated EA Schedules

Road	Improvement	From	To	Anticipated EA Schedule Required	Anticipated Cost Relative to MCEA Limit	MCEA Schedule Reference ^{2,3,4}
Clair Road East	Widen from 2 to 4 lanes with active transportation and sidewalks	Beaver Meadows Drive	Victoria Road South	Schedule C EA	>\$2.4	20
Victoria Road South	Urbanize and add active transportation and sidewalks	Clair Road East	Maltby Road	Schedule A+ ⁶	NL ¹	19
Maltby Road East	Urbanize and add active transportation and sidewalks	Hanlon Parkway	Victoria Road South	Schedule A+ ⁶	NL ¹	19
Gordon Street	Widen from 2 to 4 lanes, Urbanize to include cycle tracks and sidewalks	Clair Road	Maltby Road	EA Update to former study	>\$2.4m	20
Street A Collector	New Road	Poppy Drive	Maltby Road	Schedule C	>\$2.4m	20
Street B Collector	New Road	Street A	Gordon Street	Schedule B	<\$2.4m	20
Street B Collector	New Road	Gordon Street	Hawkins Drive	Schedule B	<\$2.4m	20

Road	Improvement	From	To	Anticipated EA Schedule Required	Anticipated Cost Relative to MCEA Limit	MCEA Schedule Reference ^{2,3,4}
Street C Collector	New Road	Street A	Gordon Street	Schedule B	<\$2.4m	20
Street D Collector	New Road	Street A	Gordon Street	Schedule B	<\$2.4m	20
Street C/D ⁵	New Road	East of Gordon Street	East of Gordon Street	Schedule B	<\$2.4m	20, 23
Street E Collector	New Road	Street A	Victoria Road	Schedule C	>\$2.4m	20
Street F Collector	New Road	Street E	Maltby Road	Schedule B	<\$2.4m	20
Street G Collector	New Road	Street E	Maltby Road	Schedule B	<\$2.4m	20

Notes:

1. NL = No financial limit in MCEA Schedule
2. Ref 20 = Reconstruction or widening where the reconstructed road or other linear paved facilities (e.g. HOV lanes) will not be for the same purpose, use, capacity or at the same location (e.g. additional motor vehicle lanes, continuous centre turn lane)
3. Ref 19 = Reconstruction where the reconstructed road or other linear paved facilities (e.g. HOV lanes) will be for the same purpose, use, capacity and at the same location (e.g. addition or reduction of cycling lanes/facilities or parking lanes, provided no change in the number of motor vehicle lanes)
4. Ref 23. Construction of local roads which are required as condition of approval on a site plan, consent, plan of subdivision or plan of condominium which will come into effect under the Planning Act prior to the construction of the road. [Note – Reference to “local” roads refers to roadway function not municipal jurisdiction.
5. Street C/D is a loop road that effectively operates as a local connection.
6. Widening or change in number of lanes would modify this to a Schedule C.

4.1.5 Integrated Phasing

The following provides a summary of each of the four (4) phases for each of the four (4) servicing components, water, wastewater, stormwater and mobility as per Tables 4.1.2 to 4.1.5. Each table indicates the project (item) that would be constructed, capital cost (see Section 4.2 for further costing details) and anticipated municipal class environmental assessment schedule required. Figures 4.1.3 to 4.1.6 depict infrastructure requirements for Phases 1-4. The capital projects listed below are required to be in place to support the growth in each phase (i.e. must build this before the full build-out of each phase).

Table 4.1.2. Summary of Phase 1 Infrastructure Projects

Item	Item Details	Capital Cost (\$)	Anticipated EA Schedule Required
Water			
1	Partial 600mm Transmission Main from Clair Gordon BPS	\$2,982,600	Schedule B ₁
2	Local Distribution System (300mm diameter, Valves, Hydrants, etc.)	\$2,257,500	Schedule B ₁
Wastewater			
1	Local Gravity Sewers	\$1,062,343	Schedule B ₁
Stormwater			
1	Stormwater Capture Area 56	\$1,915,930	Schedule B ₁
2	Stormwater Capture Area 58	\$2759,998	Schedule B ₁
Mobility			
1	Commence EA Study for Laird Road (Southgate Drive to west of Poppy Drive): widening to 4-lanes plus Active Transportation		Schedule C
2	Commence EA Study for Clair Road (Dallan Drive to Victoria Road): widening to 4-lanes plus Active Transportation		Schedule C
3	Commence EA Study for Street A Collector Road (Poppy Drive to Maltby Road)		Schedule C
4	Commence EA Study Update for Gordon Road (Gosling Gardens to south of Maltby Road)		Schedule C EA Update

Item	Item Details	Capital Cost (\$)	Anticipated EA Schedule Required
5	Intersection Improvements ^{2,3} at: - Clair Road / Laird Road - Clair Road / Poppy Drive - Clair Road / Gordon Street - Gordon Street / Poppy Drive - Gordon Street / Street B - Gordon Street / Maltby Road	\$1,404,300	NL ₄
6	Street B (west of Gordon) – 615 m	\$2,054,285	Schedule B ₁
7	Street B (east of Gordon) – 375 m	\$1,252,613	Schedule B ₁
8	Street A (Stage 1: Poppy to Street B) – 355 m + NHS Crossing	\$4,745,807	Schedule C
TOTAL PHASE 1 COSTING		\$20,515,671	

1. MCEA Schedule requirements have been fulfilled by MESP
2. Phase 1 assumes the buildout of background development and units north of the Phase 1 Servicing/SWM phasing boundary. Timing of intersection improvements noted above should be monitored through Plan of Subdivision and development applications, recognizing the short time period (0-2 years) and variability in development buildout that could occur.
3. Collector costs based on per intersection costs outlined in April 2020 Cost Estimate Memorandum: \$3,340,300 / km for 2-3 lane plus AT
4. NL = No Financial Limit for MCEA Requirement 12. a) Construction of localized operational improvements at specific locations and <\$9.5m MCEA Requirement 13 Installation, construction or reconstruction of traffic control devices (e.g. signing, signalization)

Table 4.1.3. Summary of Phase 2 Infrastructure Projects

Item	Item Details	Capital Cost (\$)	Anticipated EA Schedule Required
Water			
1	600mm Transmission Main from Clair Gordon BPS	\$1,915,200	Schedule B ₁
2	Local Distribution System (300mm diameter, Valves, Hydrants, etc.)	\$5,483,750	Schedule B ₁
Wastewater			
1	Local Gravity Sewers	\$2,342,144	Schedule B ₁
2	Sewage Pumping Station SPS-3	\$4,729,868	Schedule B ₁
3	Forcemain FM-3	\$1,762,500	Schedule B ₁
4	Property Costs	\$540,000	Schedule B ₁
5	Trunk Sewer	\$4,555,120	Schedule B ₁
Stormwater			
1	Stormwater Capture Area 42	\$4,030,640	Schedule B ₁
2	Stormwater Capture Area 47	\$1,911,477	Schedule B ₁
3	Stormwater Capture Area 55	\$2,491,353	Schedule B ₁
4	Stormwater Capture Area 111	\$6,149,941	Schedule B ₁
Mobility			
1	Widen Laird Road (Southgate Drive to west of Poppy Drive) to 4-lanes plus Active Transportation (approx. 950 m)	\$5,149,760 ²	Schedule C
2	Widen Clair Road Road (Dallan Drive to Victoria Road) to 4-lanes plus Active Transportation (approx. 1.2 km)	\$6,504,960 ²	Schedule C
3	Street A (Stage 2: Street B to south of Street D) – 908 m + NHS Crossing	\$6,504,960	Schedule C
4	Street C (Street A to Gordon Street) – 638 m	\$2,131,111	Schedule B ₁
5	Street D (Street A to Gordon Street) – 633 m	\$2,114,409	Schedule B ₁
6	Street C/D (East of Gordon) – 1,232 m	\$4,115,249	NL ₃

Item	Item Details	Capital Cost (\$)	Anticipated EA Schedule Required
7	Widen Gordon Street to 4-lanes plus Active Transportation (approx. 1.7 km)	\$9,215,360 ²	EA Update
8	Intersection Improvements ^{2,3} at: <ul style="list-style-type: none"> - Street A / Street B - Street A / Street C - Street C / Gordon Street - Street D / Gordon Street 	\$882,400	Schedule A ₁ , NL ₄
TOTAL PHASE 2 COSTING		\$75,206,231	

1. MCEA Schedule requirements have been fulfilled by MESP
2. Arterial Roads Widening to 4-lanes with AT (Clair Road, Laird Road, Gordon Street) based on \$5,420,800 per km.
3. NL = No Financial Limit for MCEA Requirement 23. Construction of local roads which are required as condition of approval on a site plan, consent, plan of subdivision or plan of condominium which will come into effect under the Planning Act prior to the construction of the road. Note – Reference to “local” roads refers to roadway function not municipal jurisdiction.
4. NL = No Financial Limit for MCEA Requirement 12. a) Construction of localized operational improvements at specific locations and <\$9.5m MCEA Requirement 13 Installation, construction or reconstruction of traffic control devices (e.g. signing, signalization)

Table 4.1.4. Summary of Phase 3 Infrastructure Projects

Item	Item Details	Capital Cost (\$)	Anticipated EA Schedule Required
Water			
1	600mm Transmission Main from Clair Gordon BPS	\$995,400	Schedule B ₁
2	Local Distribution System (300mm diameter, Valves, Hydrants, etc)	\$1,660,000	Schedule B ₁
3	Elevated Storage	\$3.3 M	Schedule B ₁
4	Property Costs	\$0.5M	Schedule B ₁
Wastewater			
1	Local Gravity Sewers	\$949,518	Schedule B ₁
2	Sewage Pumping Station SPS-1	\$663,929	Schedule B ₁
3	Forcemain FM-1	\$1,036,000	Schedule B ₁
4	Property Costs	\$540,000	Schedule B ₁
Stormwater			
1	Stormwater Capture Area 49	\$2,669,583	Schedule B ₁
Mobility			
1	Street A (Stage 3: North of Street E to Maltby Road) – 535 m + NHS Crossing	\$5,348,730	Schedule C
2	Commence EA Study for Street E Collector Road (Street A to Victoria Road)		Schedule C
3	Street E (Stage 1: Street A to Gordon Street) – 633 m	\$2,114,409	Schedule C
4	Intersection Improvements ^{2,3} at: Street A / Maltby Road Street E / Gordon Street	\$441,200	Schedule A ₁ , NL ₂
TOTAL PHASE 3 COSTING		\$19,777,569	

1. MCEA Schedule requirements have been fulfilled by MESP
2. NL = No Financial Limit for MCEA Requirement 12. a) Construction of localized operational improvements at specific locations and <\$9.5m MCEA Requirement 13 Installation, construction or reconstruction of traffic control devices (e.g. signing, signalization)

Table 4.1.5. Summary of Phase 4 Infrastructure Projects

Item	Item Details	Capital Cost (\$)	Anticipated EA Schedule Required
Water			
1	300mm Diameter Distribution System	\$12,471,121	Schedule B ₁
Wastewater			
1	Local Gravity Sewers	\$4,813,697	Schedule B ₁
2	Sewage Pumping Station SPS-2	\$3,129,861	Schedule B ₁
3	Forcemain FM-2	\$2,431,250	Schedule B ₁
4	Property Costs	\$540,000	Schedule B ₁
Stormwater			
1	Stormwater Capture Area 36	\$2,512,704	Schedule B ₁
2	Stormwater Capture Area 38	\$2,096,632	Schedule B ₁
3	Stormwater Capture Area 39	\$1,556,036	Schedule B ₁
4	Stormwater Capture Area 50	\$2,436,047	Schedule B ₁
5	Stormwater Capture Area 51	\$2,749,138	Schedule B ₁
7	Stormwater Capture Area 52	\$1,880,932	Schedule B ₁
8	Stormwater Capture Area 53	\$1,954,733	Schedule B ₁
9	Stormwater Capture Area 61	\$4,345,800	Schedule B ₁
Mobility			
1	Street E (Stage 2: Gordon Street to Victoria Road) – 2,138 m + NHS Crossing	\$10,701,561	Schedule C
2	Street F (Street E to Maltby Road) – 343 m	\$1,145,722	Schedule B ₁
3	Street G (Street E to Maltby Road) – 588 m	\$1,964,096	Schedule B ₁
4	Intersection Improvements ^{2,3} at: - Street E / Victoria Street	\$138,100	Schedule A ₁ , NL ₄
5	Urbanize Victoria Road and add active transportation and sidewalks	\$6,660,780 ₃	Schedule A+ ₁
6	Urbanize Maltby Road and add active transportation and sidewalks (approx. 4,200 m)	\$13,321,560 ₃	Schedule A+ ₁
7	Multi-use Overpass of Gordon Street	\$2,200,000 ₄	Schedule C EA Updates ₅
TOTAL PHASE 4 COSTING		\$95,189,339	

1. MCEA Schedule requirements have been fulfilled by MESP

2. NL = No Financial Limit for MCEA Requirement 12. a) Construction of localized operational improvements at specific locations and <\$9.5m MCEA Requirement 13 Installation, construction or reconstruction of traffic control devices (e.g. signing, signalization)
3. Arterial Roads Urbanizing with AT (Victoria Road, Maltby Road) based on \$3,171,800 per km
4. \$2,200,000 based on DC costing for GID-GJR Pedestrian Bridge & Trail.
5. Assumed to be studied as part of the Gordon Street EA Update.

Figure 4.1.3. Phase 1 Plan

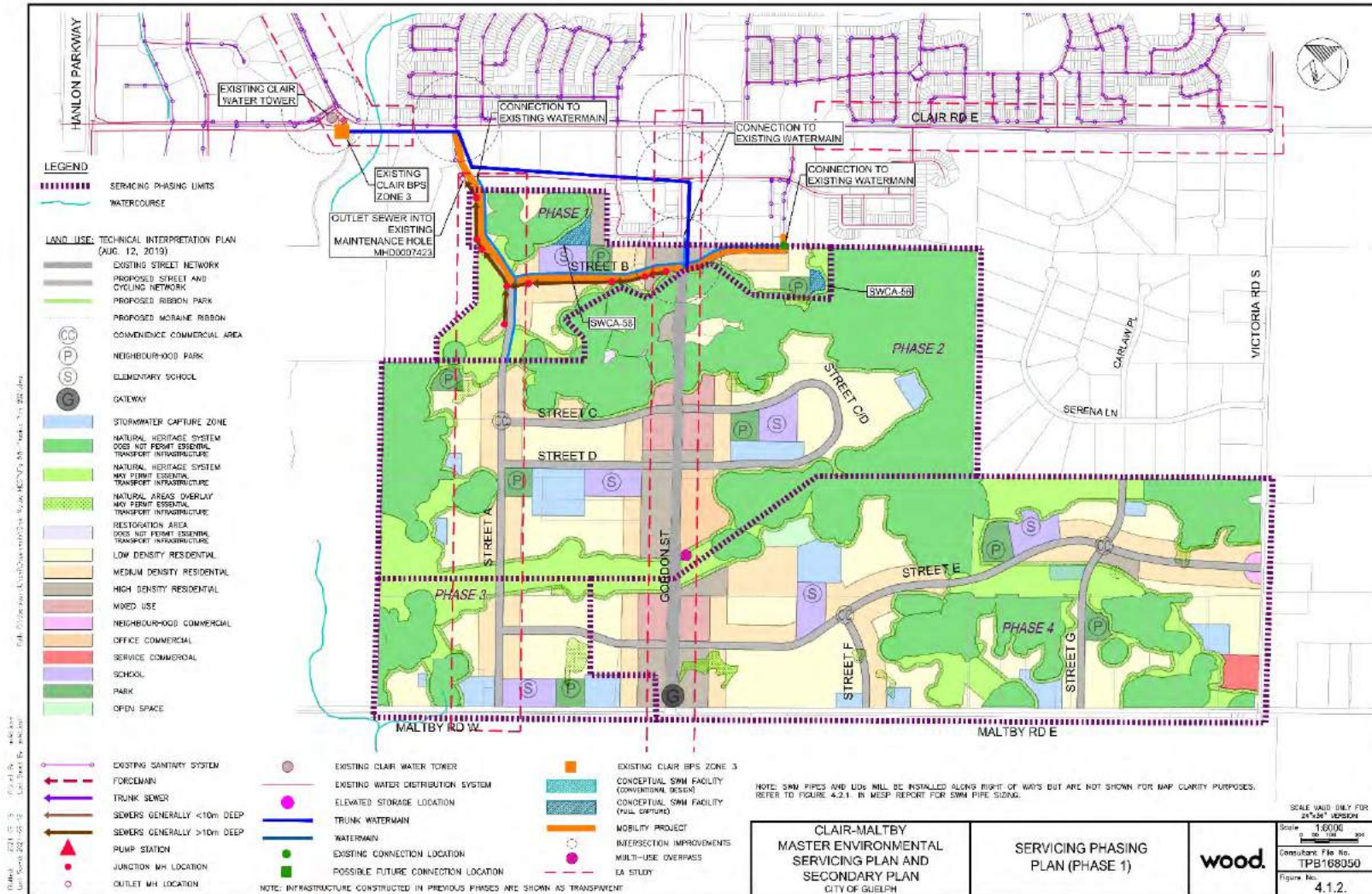


Figure 4.1.4. Phase 2 Plan

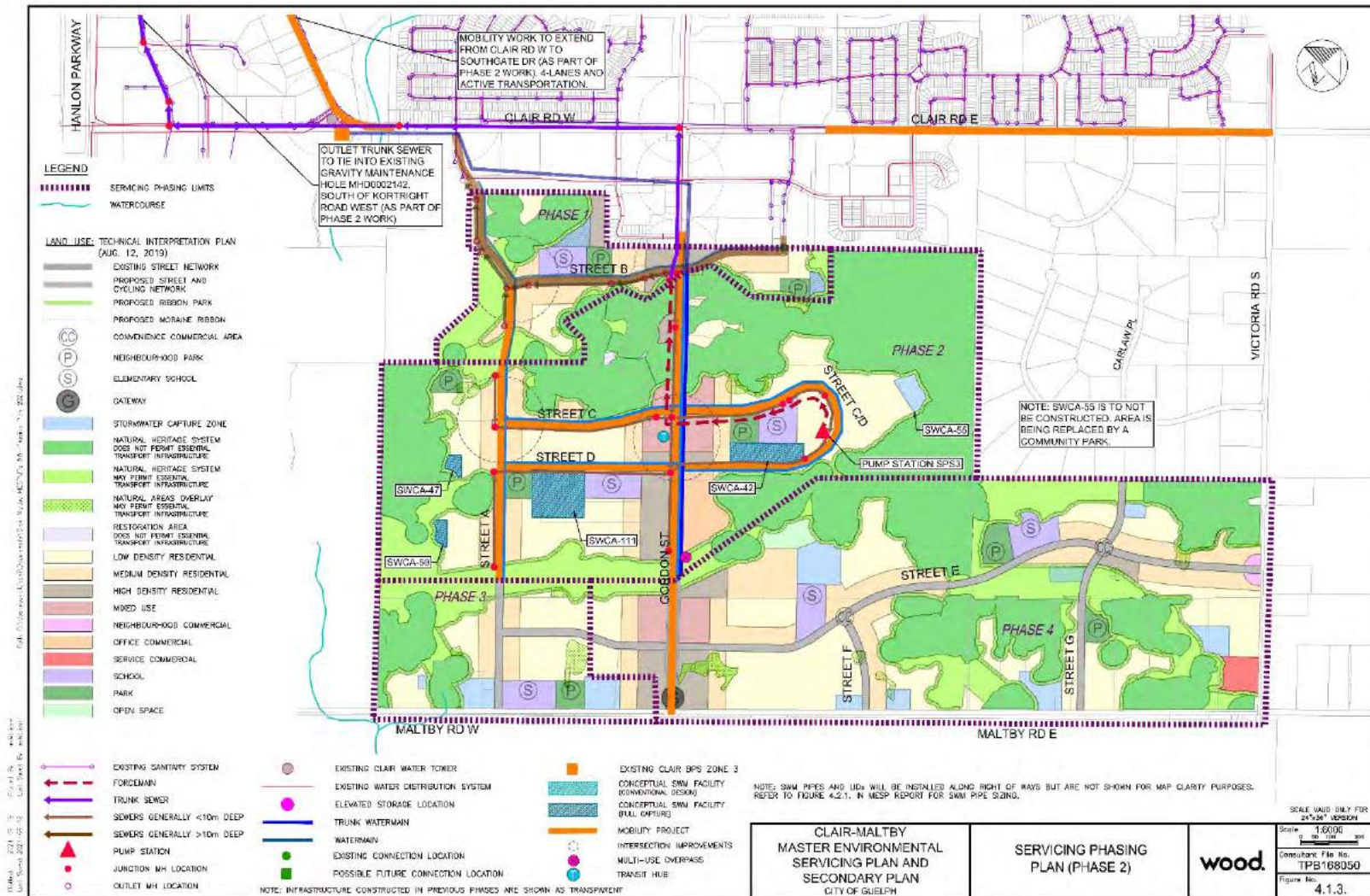


Figure 4.1.5. Phase 3 Plan

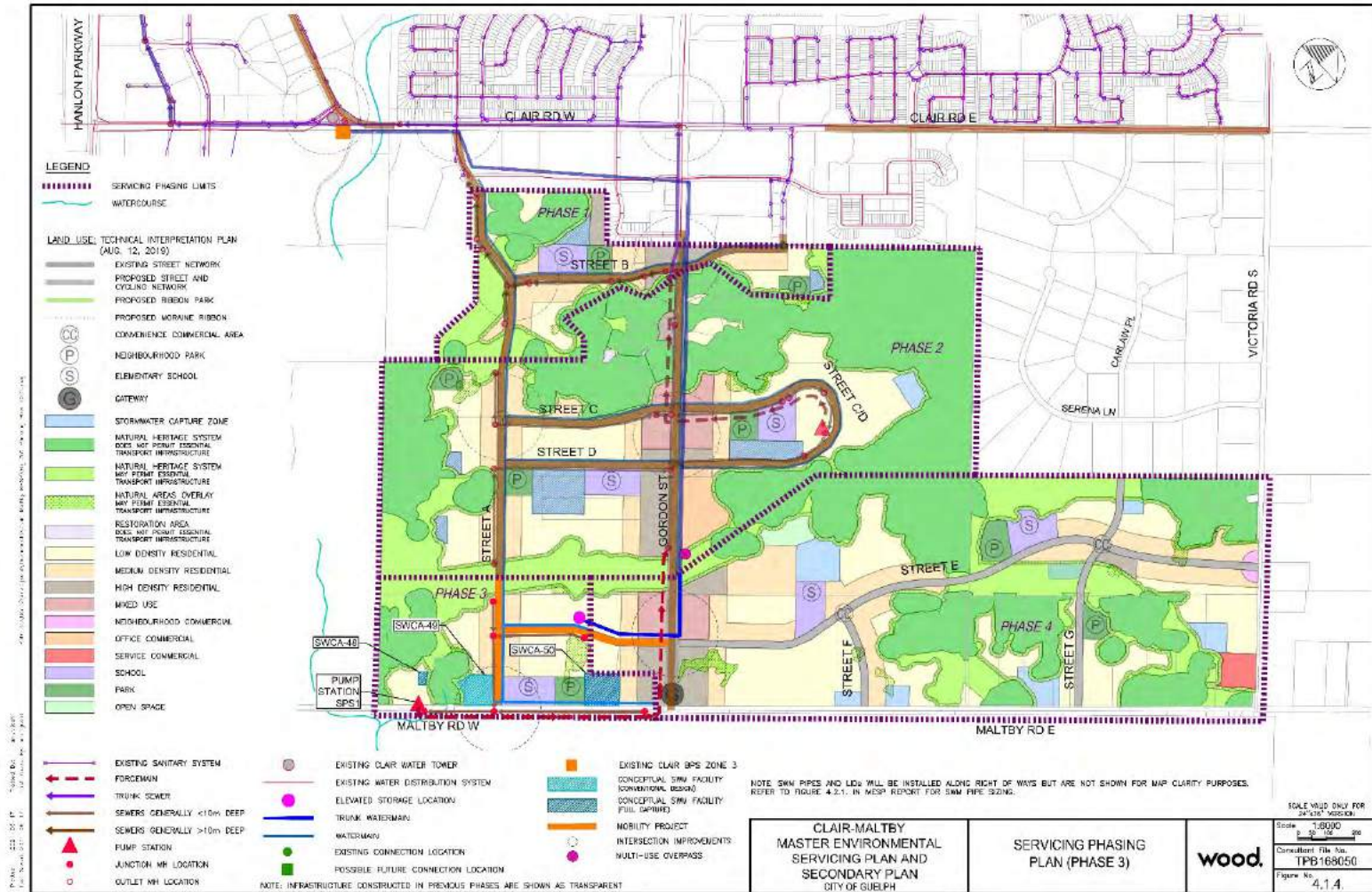
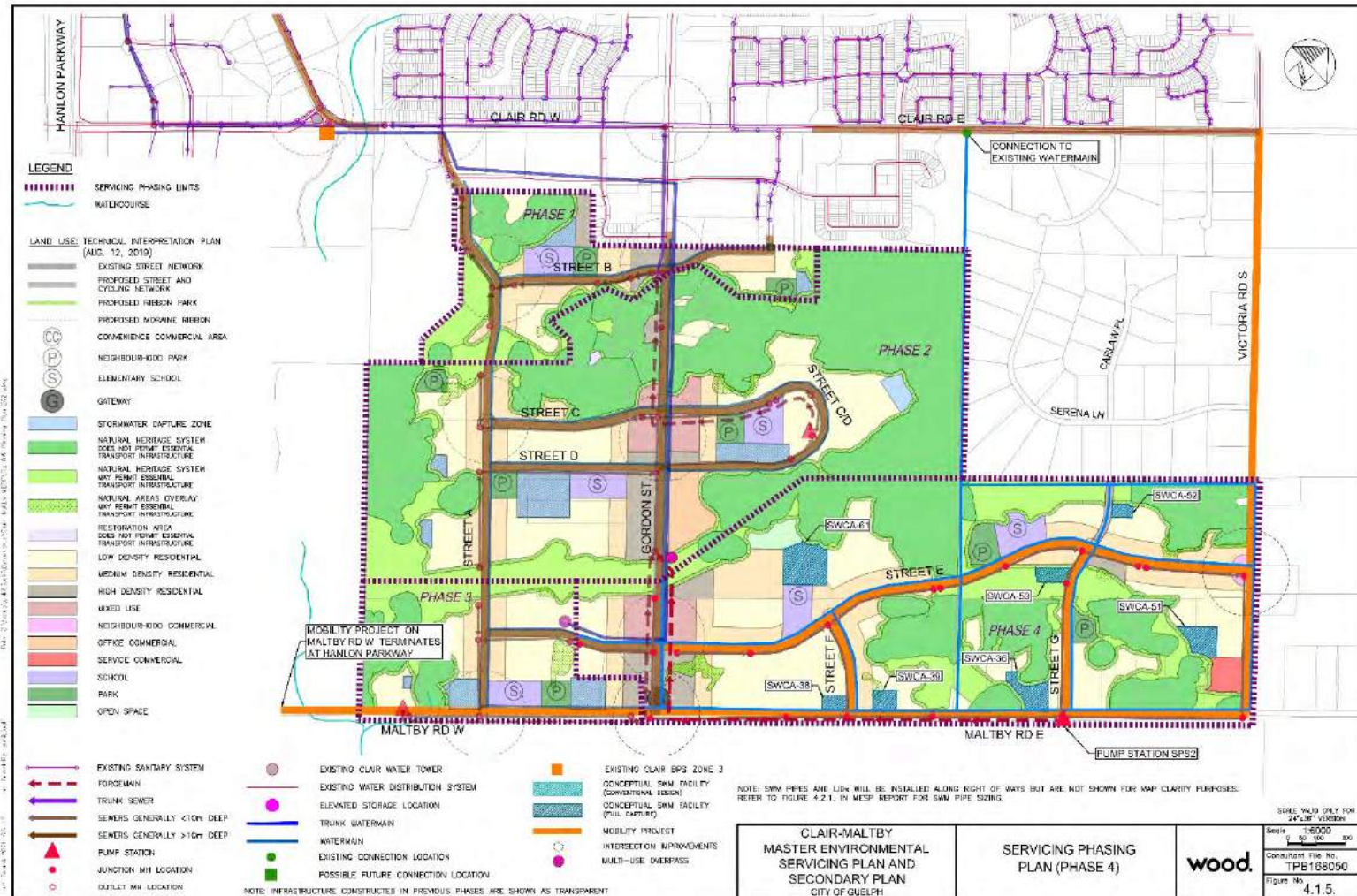


Figure 4.1.6. Phase 4 Plan



4.2 Costing

The following outlines costing considerations for each of the infrastructure components.

4.2.1 Water

The cost estimates (ref. Appendix A) for the various above ground and below ground storage alternatives have been summarized below for easy comparison. In general, the cost estimates are within a reasonable range from each other. There is no major difference between the capital costs of the elevated tank vs. the in-ground reservoir and booster pump station as any cost savings for an in-ground reservoir would be made up by the booster pump station. However, underground storage does have higher operating and maintenance costs. The preferred alternative, aboveground storage at Location 2, has one of the lowest capital and operating costs.

Table 4.2.1. Summary of Estimated Costs

Alternative	Capital Cost	Annual O&M Cost
Aboveground Storage		
Location 1	\$ 31.0 M	\$ 202 K
Location 2 (Preferred Alternative)	\$ 31.6 M	\$ 205 K
Location 3	\$ 35.0 M	\$ 222 K
Underground Storage		
Location 1	\$ 31.8 M	\$ 243 K
Location 2	\$ 32.4 M	\$ 246 K
Location 3	\$ 35.8 M	\$ 263 K

In addition to costing for water infrastructure, costs will also be incurred by the City retaining engineering consulting firms to review proposed water distribution modelling, an approximate cost of \$15,000 should be allocated by the City for each update, but will be the responsibility of the developer.

4.2.2 Wastewater

The cost estimates for the various wastewater servicing alternatives (ref. Appendix B) have been summarized below for easy comparison. The cost estimates are within a reasonable range of each other. The preferred alternative is the West Connection – Southgate Hanlon Trunk. This alternative is associated with the lowest Capital Cost and reasonable operating costs. The resultant gravity sewers depths will be within the typical range of depths at all locations. The sewers will be readily accessible for maintenance operations, and will avoid the maintenance issues associated with deep sewers.

In addition to costing for wastewater infrastructure, costs will also be incurred by the City retaining engineering consulting firms to review proposed wastewater modelling, an approximate cost of \$15,000 should be allocated by the City for each update, but will be the responsibility of the developer.

Table 4.2.2. Summary of Estimated Costs

Alternative	Capital Cost	Annual O&M Cost
East Connection Alternative – Victoria Road Trunk Sewer	\$30.6 Million	\$506 K
Central Connection Alternative – Clair Gordon Trunk	\$ 33.7 Million	\$787 K
West Connection Alternative – Southgate Hanlon Trunk (Preferred Alternative)	\$ 29.1 Million	\$720 K
West Connection Alternative – Southgate Industrial *	\$ 31.9 Million	\$1.9 M
West Connection Alternative – Southend Park Valley Land Trunk	\$ 33.0 Million	\$575 K

*Capital and O&M Costs include pumping station costs inclusive of Industrial Park expansion

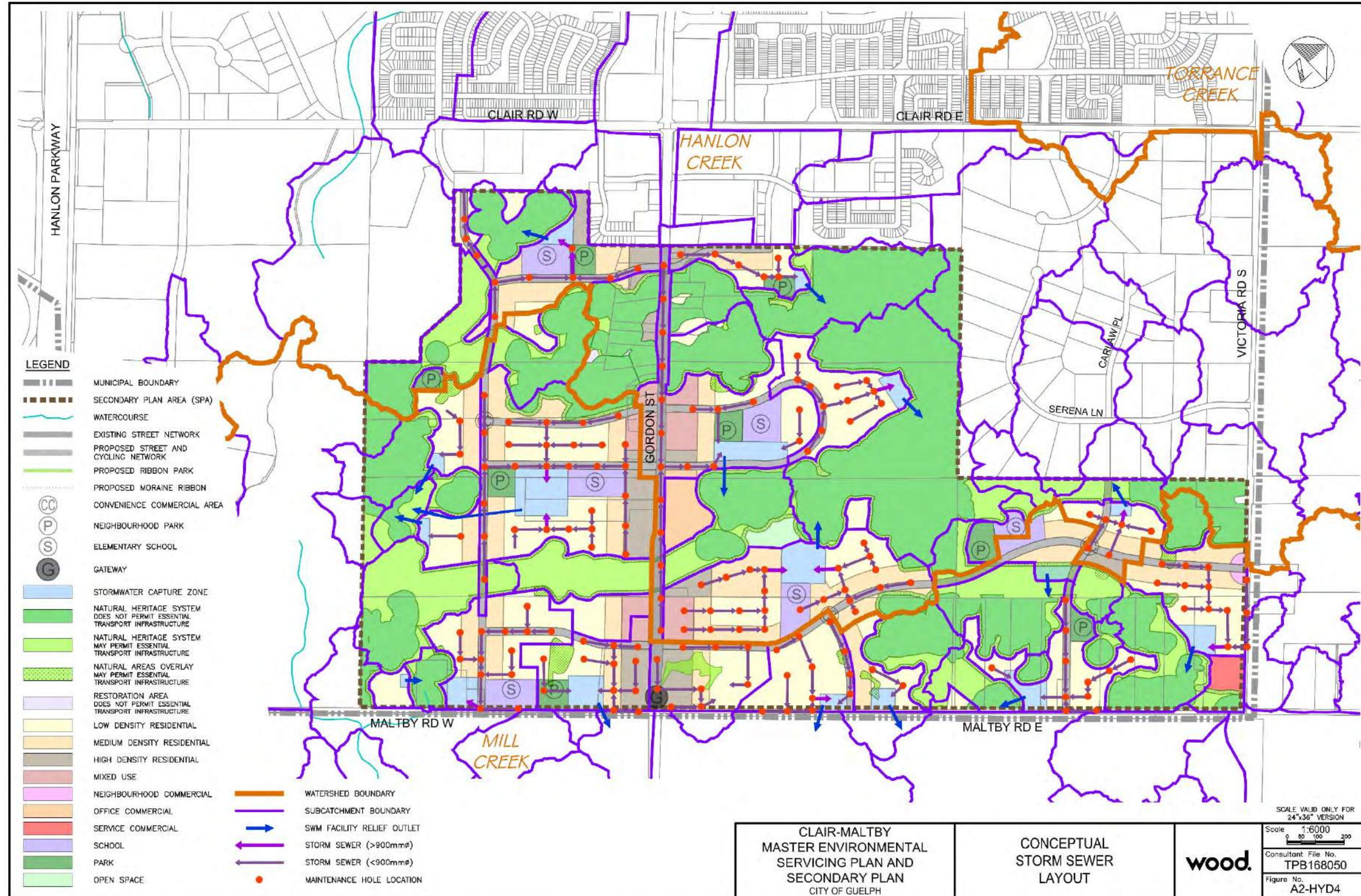
4.2.3 Stormwater

Preliminary cost estimates for stormwater management measures have been determined for the fifteen (15) SWCA and for low impact development best management measures (ref. Appendix C). SWCA have been estimated at approximately \$26,607,075, with an average cost of storage of \$105/m³, which would be covered through development agreements between the Clair-Maltby developers. Costing for low impact development best management measures with a runoff capture volume of 20mm or 14,106 m³ (apart from the community park which captures the 100 year storm), for the overall area has been determined using a unit rate of \$307/m³ for a total estimated cost of \$4,324,419, which would be covered by development charges as part of the road work, as stormwater management measures. The volume of public versus private LID BMPs will be determined during the detailed design stage based on runoff from public versus private lands, that said, the split in sizing would be approximately based on the impervious areas for public lands versus private lands.

As per the City of Guelph's DC Local Service Policy, storm sewers up to and including 900 mm diameter are a direct developer responsibility. Development Charges are responsible for storm sewers exceeding 900 mm provided that the oversizing is required to service existing external upstream lands and provided that the contribution towards 'over-sizing' through development charges for pipe sizes over 900 mm diameter for storm sewers shall be the cost less the cost of a 900 mm pipe. Due to the internally draining nature of the study area and the comparatively small drainage areas, it is not anticipated that storm sewers greater than 900 mm will be required, although development areas draining to SWCA 111 (44.81 ha), 55 (9.47 ha) 61 (25.04 ha), 38 (9.07 ha), 52 (5.8 ha), 51 (11.90 ha) and 49 (13.81 ha) may require short lengths of storm sewer above 900 mm diameter in size; this would be determined at the time of subdivision design (ref. Figure 4.2.1). For the purpose of the MESP preliminary stormwater costing, storm sewers are assumed to be covered by the City's DC Local Service Policy. Storm sewers should be sized without the size reduction benefit from the 20 mm LID capture, to account for climate change resiliency, which depending upon the climate change representative concentration pathway (RCP) could result in storm sewers being upsized by one (1) pipe size; the LID 20 mm capture offsets the potential increase in storm sewer sizing.

In addition to costing for storm infrastructure and stormwater management measures, costs will also be incurred by the City retaining engineering consulting firms to review proposed stormwater management measures and LID BMP sizing within both the MIKE SHE modelling and PCSWMM modelling. For each model update and associated technical assessment, an approximate cost of \$10,000 should be allocated by the City.

Figure 4.2.1. Conceptual Storm Sewer Layout



4.2.4 Mobility

Estimated transportation infrastructure costs have been determined for the Clair-Maltby Updated Preferred Community Structure land use plan and reflect the March 2019 Transportation Master Plan Study.

General cost estimates, where available, are derived from the February 2019 Development Charges Background Study – Consolidated Report, prepared by Watson and Associates Economists Ltd. for the City of Guelph. This document provides the basis for understanding the unit cost of identified infrastructure. General costs account for the extent of new collector streets reflected in the “Preferred Community Structure” Plan, as identified in the City of Guelph Official Plan Schedule C: Clair-Maltby Secondary Plan Mobility Plan. A summary of key transportation infrastructure, assumed unit costs, and estimated overall costs are included in Table 4.2.3.

Table 4.2.3. Mobility Infrastructure Preliminary Costs

Item	Volume	Unit Cost	Cost
Widened Arterial Streets <ul style="list-style-type: none"> • Laird Road • Clair Road • Gordon Street 	Approximately 3.85km	\$5,420,800/km ¹	\$20,870,000
Urbanized Arterial Streets <ul style="list-style-type: none"> • Victoria Road • Maltby Road 	Approximately 6.3km	\$3,171,800/km ¹	\$19,982,000
New Collector Streets Includes: 4 lane pavement (2-3 traffic lanes and bicycle lanes) Sidewalks Trees Basic Signage Lighting Basic Storm	Approximately 9.354km of new collector roads.	\$3,340,300/km ^{1 2}	\$31,245,000
Traffic Signals (excluding bike signals)	Assumed 11 traffic signals. Assumed traffic signal for all collector / collector and collector / Arterial intersections	\$138,100 per intersection	\$1,519,100

Item	Volume	Unit Cost	Cost
Improvements to existing intersections. Turn lanes, taper and storage, medians, etc. along sections of existing road that will intersect with new collector streets. It is anticipated that the Gordon Street EA does not include costs associated with the improvements at new intersections.	Assumed 9 intersections requiring improvements along Gordon Street, and Clair Road.	\$165,000 per intersection ⁴	\$1,485,000
New bridges / culverts along new collector streets	Assumed 4 crossing structures along new collector streets (not including new, replaced, or refurbished structures along Gordon Street) ⁶	\$3,560,000 per bridge	\$14,240,000
Off-street paved bicycle paths	n/a	\$200,000 per kilometer + potential culverts / bridges in NHS (pedestrian bridge = \$1,680,000 per item). ³	n/a
Multi-use Overpass of Gordon Street	Each	\$2,200,000 ⁷	\$2,200,000
TOTAL:			Approx. \$91,541,100

Notes:

- Road costs are based on consultation with Wood on Clair-Maltby section costs and review of comparable 'per km' rates in Guelph DC and comparable Brampton DC study rates.

2. Collector street costs averaged between 2-lane and 3-lane sections, plus on-street cycling infrastructure.
3. Culverts not included cost considerations. Culverts greater than 3m = \$830,000 per item.
4. Bus infrastructure not included. Bus signage, pad and shelter = approximately \$9,000 per stop.
5. Cost of intersection improvements extracted from City of Brampton DC By-law, less the cost of traffic signal infrastructure.
6. Bridge structure assumed for each instance where a new collector street crosses the NHS
7. \$2,200,000 based on DC costing for GID-GJR Pedestrian Bridge & Trail. Assumed to be studied as part of the Gordon Street EA Update.

The above-outlined costs are not exhaustive, and generally reflect the extent of details derived from the Secondary Plan structure. A summary of included and excluded costs from Table 4.1 are provided in the following.

Costs include:

- New collector streets and basic components within the municipal right of way (sidewalks, bicycle lanes, trees, signage, lighting and basic storm);
- Traffic control signals;
- Improvements for existing intersections; and
- New collector street bridges and culverts.

The costs do not include:

- Arterial Road urbanization, widening, and resurfacing
- Land acquisition;
- New local streets;
- Potential improvements to the Victoria Road / Maltby Road intersection;
- New off-street paved bicycle paths (estimated cost: \$268,700 per kilometre), new pedestrian / bicycle bridges (estimated cost: \$1,680,000 per item), and new trail culverts (estimated cost: \$830,000 per item);
- Servicing (sanitary, sewer) within the right-of-way;
- Engineering / planning and Environmental Assessments (estimated 15 per cent to 18 per cent of total cost);
- Transit facilities (queue jump lanes, posts, signs, shelters); and
- Street furniture.

As is typically the case, a contingency is often included. A contingency of 20 per cent may be appropriate given the early stages of planning that would be in addition to other costs not included in the table above.

5 Conclusions and Recommendations

The following conclusions and recommendations have been determined based on the water, wastewater, stormwater and mobility assessments. The recommendation section includes Table 5.1 which summarizes the project for each infrastructure category and provides the MEA Class EA Schedule requirements.

5.1 Conclusions

5.1.1 Water

1. Water Pressure Zone 1 is unable to meet the entire storage requirements (Equalization + Fire + Emergency). As such, a separate above ground reservoir is proposed for Zone 3, which includes CMSP lands, to meet the full equalization storage and part fire and corresponding emergency storage.
2. A looped water distribution system is proposed to eliminate dead ends, reduce water age and mitigate low residual chlorine issues.
3. All watermains would be installed along proposed roads.
4. The proposed water distribution system will be able to meet the demands of the full buildout of CMSP lands while maintaining adequate pressures for various demand scenarios.
5. As Zone 3 may extend beyond the CMSP lands, an allowance of 15 per cent population over and above the CMSP lands has been made and the system has been sized accordingly.

5.1.2 Wastewater

1. Due to the undulating nature of the CMSP lands, and to keep the sewer depths shallow as much as possible, three pump stations are proposed to lift collected wastewater.
2. The two southernmost pump stations (SPS1 And SPS2) both pump north to the catchment area of the northernmost pump station (SPS3). SPS3 pumps to a new gravity sewer on Gordon Street from where, it would flow by gravity to Clair Road, Laird Road and Kirkby Ct to connect into the Hanlon Trunk system at MHD0002142.
3. By making the connection into the Hanlon Trunk sewer at MHD0002142, all sewer upgrades are avoided and the existing trunk sewer system is capable of conveying the flow from the CMSP lands all the way to the Guelph Wastewater Treatment Plant without surcharge.

5.1.3 Stormwater

1. The Clair-Maltby SPA is mostly inwardly draining to either dry depressional features, ponds and wetlands, with few overland drainage outlets, as such most drainage infiltrates to the groundwater system. The drainage and stormwater management strategy for the Clair-Maltby SPA has considered the existing drainage system and has tried to replicate existing conditions through at source infiltration and stormwater capture areas.

2. For the Phase 3 CEIS Impact Assessment (third iteration), representing the Final Preferred Community Structure land use and the revised location of the Community Park next to Halls Pond has determined that groundwater impacts resulting from the land use plan can be mostly mitigated, without significant water level impacts Halls Pond and Neumann's Pond and hydroperiod will be maintained.
3. The Final Preferred Community Structure land use plan will result in both surface water and ground water quality impacts, requiring various water quality measures to mitigate the impacts.

5.1.4 Mobility

1. The Final updated Preferred Community Structure land use plan will result in urbanization of non-natural heritage system lands, with a different suite of potential water quality contaminants.
2. The Final Preferred Community Structure Plan street network would provide active transportation and trail connectivity that will adequately accommodate future development and transit services. The street network represents a modified grid system, which is intended to allow for frequent and robust routing for all street users, while respecting the important environmental features of the area.
3. The planned network of streets (and trails) are intended to achieve safe, convenient and comfortable travel and access for all street-users, with priority given to pedestrians, cyclists, and transit operations, to provide mobility choice and support city policy and modal-split objectives. Vehicular movement will be accommodated, but is not prioritized, and will be subject to levels-of-service which are more constrained than typical in new-build areas within the City.
4. Road cross sections prepared in support of the Clair-Maltby Secondary Plan intend the design and delivery of complete streets, which include pedestrian and cycling infrastructure, support transit service routing, street trees and landscaping, and utility / service delivery. Vehicle travel lanes are reduced to an appropriate level, to accommodate vehicle movement while not prioritizing vehicles over other street users.

5.2 Recommendations

5.2.1 Water

1. The Water servicing for the updated land use within CMSP lands (Zone 3) will be provided with a system of water distribution mains, an above-ground reservoir, and a transmission main bringing water from the Clair Booster Pump Station to the overhead reservoir, with associated hydrants, valves and appurtenances as required.
2. The new 5 ML overhead reservoir would be capable of meeting the equalization demands of 100 per cent of the CMSP development, and part of the fire flow and the corresponding emergency demands. The remainder of the demands will be provided by the Zone 1 system.

3. The preferred location of the overhead reservoir is identified in Figure 3.1.4 and will be able to provide adequate pressures during various scenarios and fire flows during a max day demand period while keeping the pressures within acceptable range.
4. Provision has been made to accommodate 15 per cent additional population over and above the updated land use plan recommendations to allow Pressure Zone 3 lands outside of the CMSP area.

5.2.2 Wastewater

1. The wastewater servicing for the updated landuse within CMSP lands will be provided with a system of wastewater mains, sanitary pump stations and sanitary forcemains.
2. The study area was delineated into five independent catchments based on topography, preliminary grading plan for stormwater servicing, and proximity to the City's existing sanitary system.
3. A new trunk sewer routed along Gordon Street to Clair Road, Laird Road and Kirkby Ct will connect into the Hanlon Trunk system .
4. At this time, 15 per cent additional population over and above the updated landuse plan recommendations has been considered to be serviced by the CMSP wastewater system.

5.2.3 Stormwater

1. To provide stormwater management for the Clair-Maltby SPA, it is recommended that distributed low impact development best management measures capturing 20 mm runoff be provided within both public and private lands, with the remaining drainage being conveyed to stormwater capture areas, sized to capture the Regional Storm. . Stormwater capture areas are to have an overflow to existing depression areas, should the stormwater capture area storage capacity be fully used.
2. For small development areas (typically less than 5 ha), unless draining to Maltby Road, 20 mm capture will be required to provide water quality treatment and water balance.
3. For small development areas (typically less than 5 ha), draining to Maltby Road, Regional Storm (285 mm) capture and control will be required, to mitigate impacts to properties located south of Maltby Road.
4. For the Community Park, located adjacent to Hall's Pond, distributed LID BMPs are to capture the 100 year storm event. The distributed LID BMPs are to replace a 100 year stormwater capture area, which would have been required for the park draining to Halls Pond. The rationale for using LID BMPs versus a SWCA is to prevent groundwater mounding and increases in the average Halls Pond water level.
5. The SWCA's for Subcatchments SW-42 and SW-61 should be located as per the recommendations of the Halls Pond Assessment (ref. Appendix F).

6. Infiltrative low impact development best management measures that receive runoff from paved surfaces will require pretreatment to prevent groundwater contamination.
7. A treatment train approach should be used to protect the stormwater capture areas' function of infiltration and to protect groundwater quality.
8. Surface and groundwater quality monitoring as to be determined within the finalized CEIS, will be required to protect existing surface water and groundwater resources.
9. The City of Guelph should consider salt reduction and management measures per the following prior to subdivision approval:
 - i. The City of Guelph should consider any outstanding recommendations from the 2017 SMP.
 - ii. The City of Guelph should consider options for salt alternatives such as different types of chemical de-icers and agricultural by-products.
 - iii. Implement salt alternatives through financial incentives for independent contractors conducting snow removal and de-icing.
 - iv. Implement recommendations of the SICOPS program, to reduce salt application and improve salt management.
 - v. Consider removal of snow in areas with low traffic loadings and the transportation/storage of this snow to established snow storage/ melt areas that provide treatment prior to discharge to the Speed River.
 - vi. Seasonally closed or partially closed City owned parking lots could be considered by the City of Guelph. Closed parking lots could be used for snow storage and piling, to facilitate reduced salt use for paved areas.
 - vii. To control salt laden runoff from entering groundwater during the winter months, the City could consider bypasses of infiltrative LID BMPs that receive drainage from paved surfaces.

5.2.4 Mobility

1. Cross sections have been developed by Wood in consultation with the City of Guelph as part of the Clair-Maltby Secondary Plan, to permit further programming within the pavement or boulevard spaces to include multi-modal uses where appropriate or to account for variations in natural landscape where a context sensitive standard may be most suitable.
2. Road sections should be flexible enough to meet context specific limitations and servicing / utility requirements and should be designed in detailed plan and section view as part of future area development.
3. Wider pavement areas, or off-centre median lane designs, should be pursued in instances where on-street parking will be accommodated. Similarly, wider right-of-ways should be pursued in instances where other infrastructure are required such as major trunk utilities, municipal service corridors, or overland flow routes.

4. The following roads projects are anticipated to require Schedule C EAs as part of Phases 3&4 of the MCEA:
 - Widening of Clair Road from 2 to 4 lanes (east of Beaver Meadows Road to Victoria Road)
 - Widening of Gordon Road from 2 to 4 lanes (south of Poppy Drive to Maltby Road) – EA Update
 - Street A (north-south) Collector Road (from Clair Road to Maltby Road) that will exceed Schedule B requirements (>\$2.4m) and have crossings within the NHS.
 - Street E (east-west) Collector Road (from Gordon Road to Victoria Road) that will exceed Schedule B requirements (>\$2.4m) and have a crossing within the NHS.
5. As we understand, there are also numerous ways the roads could be phased and built out within the Clair-Maltby SP, given:
 - a) there are a number of land owners in the SP area;
 - b) phasing of development can happen in a number of ways; and
 - c) we understand there are a number of amendments in progress for the MCEA process that can influence whether roads >\$2.4m proceed to Schedule C or instead to schedule A.

Given the above, we note that each road project’s classification under the MCEA process should be reviewed by the City and developers as draft plans of subdivision come forward.

5.2.5 Project Summary and Schedule Requirements

The MESP has been conducted in accordance with the Master Plan Approach 2 requirements of the Municipal Engineers Association Class Environmental Assessment (EA) process (Section A.2.7 of the Municipal Class EA document, October 2000, as amended in 2007, 2011 and 2015). The MESP has followed Phases 1 and 2 of the Class EA Schedule B process and identifies a series of servicing projects that will be required to service the Clair-Maltby SPA. The MESP addresses Phases 1 and 2 of the MEA Class EA Process with the servicing needs for the Final Preferred Community Structure determined in Phase 1 and servicing alternatives identified and selected in Phase 2.

The Projects have been determined for each infrastructure category/ type consisting of water, wastewater, stormwater and mobility. The Municipal Class Environmental Assessment (MCEA) process classifies projects according to their level of complexity and potential environmental impacts. These are termed “Schedules” and are summarized as follows:

- **Schedule ‘A’ and ‘A+’** include projects that involve minor modifications to existing facilities. Environmental effects of these projects are generally small; therefore, the projects are considered pre-approved. The difference between a Schedule ‘A’ and ‘A+’ project is the latter requires a mechanism to inform the public.

- **Schedule 'B'** includes projects that involve improvements and minor expansion to existing facilities. There is a potential for some adverse environmental impacts and, therefore, the proponent is required to proceed through a screening process, including consultation with those affected. Schedule 'B' projects are required to proceed through Phases 1, 2 and 5 of the Class EA process.
- **Schedule 'C'** includes projects that involve construction of new facilities and major expansion of existing facilities. These projects proceed through the environmental assessment planning process outlined in the Class EA document, and are required to fulfill the requirements of all five phases of the Class EA process.
- The projects in Table 5.1 are categorized as of Schedule A, A+, B and C. Schedule 'C' undertakings, would have to satisfy Phases 3 and 4 of the MCEA Class EA process, requiring consultation with stakeholders, agencies, public and Indigenous Communities. It would also require the need for alternative design evaluation, and the preparation of preliminary (30 per cent) design drawings and an Environmental Study Report (ESR). The only projects indicated as Class C, would be the collector streets (>\$2.4 million).

Table 5.1 provides a summary of the recommended projects emanating from MESP and the associated MCEA requirements.

Table 5.1. Summary of MCEA Project Requirements

Project Description	Municipal Class Environmental Assessment (MCEA) Schedule Determination
Water: Watermains	Schedule B Establish, extend or enlarge a water distribution system and all works necessary to connect the system to an existing system or water source, where such facilities are not in either an existing road allowance or an existing utility corridor.
Water: Above Ground Storage Tank	Schedule B Establish new or expand/replace existing water storage facilities.
Wastewater: Wastewater Pumping Stations	Schedule B Construct new pumping station or increase pumping station capacity by adding or replacing equipment and appurtenances, where new equipment is located in a new building or structure.
Stormwater: Storm sewer system	Schedule A #10 - Establish, extend, or enlarge a sewage collection system and all necessary works to connect the system to an existing sewage outlet, where it is required as a condition of approval on a site plan, consent plan of subdivision or plan of condominium which will come into effect under

Project Description	Municipal Class Environmental Assessment (MCEA) Schedule Determination
	<p>the Planning Act prior to the construction of the collection system.</p> <p>Schedule A + #1- Establish, extend, or enlarge a sewage collection system and all necessary works to connect the system to an existing sewage or natural drainage outlet, provided all such facilities are in either an existing road allowance or an existing utility corridor, including the use of Trenchless Technology for water crossings.</p> <p>Schedule B # 1 - Establish, extend or enlarge a sewage collection system and all works necessary to connect the system to an existing sewage outlet where such facilities are not in an existing road allowance or an existing utility corridor.</p>
<p>Stormwater: Low Impact Development Best Management Measures</p>	<p>Schedule A – #11. Establish new or replace or expand existing stormwater detention/retention ponds or tanks and appurtenances including outfall to receiving water body provided all such facilities are in either an existing utility corridor or an existing road allowance where no additional property is required.</p> <p>Schedule B – #2- Establish new stormwater retention/detention ponds and appurtenances or infiltration systems including outfall to receiving water body where additional property is required.</p>
<p>Stormwater: Stormwater capture area (s)</p>	<p>Schedule B #2- Establish new stormwater retention/detention ponds and appurtenances or infiltration systems including outfall to receiving water body where additional property is required.</p>
<p>Mobility: New collector streets</p>	<p>Schedule B: (<\$2.4m), Schedule C: (>\$2.4m) #21 – Construction of new roads</p>
<p>Mobility: Intersection Improvement</p>	<p>Schedule A+ #12 a) - Construction of localized operational improvements at specific locations.</p>
<p>Mobility: Traffic Signals</p>	<p>Schedule A: (<\$9.5m), Schedule B :(>\$9.5m) #13 - Installation, construction or reconstruction of traffic control devices (e.g. signing, signalization).</p>

Project Description	Municipal Class Environmental Assessment (MCEA) Schedule Determination
Mobility: New bridges/ culvert along collector streets	Schedule A+ – #18 – Construction of a new culvert or increase culvert size due to change in the drainage area.
Mobility: Off-street paved bicycle paths	Schedule A+ – #22 - New Construction or removal of sidewalks, multi-purpose paths or cycling crossings outside existing right-of-way

6 References

Comprehensive Environmental Impact Study (CEIS) Phase 1

Phase 2: Characterization Report, September 5, 2018

CEIS Characterization Report, September 2018

Draft Direction Consultation Report, November, 2018

Policy Directions : Framework for Clair-Maltby Secondary Plan, May 2019

Torrance Creek Subwatershed Study, Totten Sims Hubicki Associates et al.,
November 1998

Mill Creek Subwatershed Plan, CH2M Gore & Storrie Limited, June 1996

Hanlon Creek Watershed Plan, Marshall Macklin Monaghan Limited et al., October
1993

Preferred Community Structure Impact Assessment, March 2019

The Policy Directions Document, May 2019

Appendix A
Water



CONTENTS

Cost Estimates – Water System

Memo - Clair Maltby Servicing - Water Model Setup and Preferred Alternative June 10, 2020

WATER MAINS, RESERVOIRS AND BOOSTER STATIONS

RESERVOIR LOCATION 1 - NORTHWEST		UNIT COST (\$/m)	INSTALLED COST (\$)	Annual O&M
<i>Diameter</i>	<i>Total Length (m)</i>			
150 mm	11.2	\$800	\$8,920	\$ 44.60
200 mm	299.7	\$1,130	\$338,606	\$ 1,693.03
300 mm	17770.9	\$1,250	\$22,213,617	\$ 111,068.09
400 mm	537.1	\$1,400	\$751,968	\$ 3,759.84
600 mm	2191.9	\$1,800	\$3,945,393	\$ 19,726.97
	20,810.70	Total Cost	\$27,258,505	\$136,293
RESERVOIR LOCATION 3 - EAST				
<i>Diameter</i>	<i>Total Length (m)</i>			
300 mm	17549.6	\$1,250	\$21,937,013	\$ 109,685.07
600 mm	5168.4	\$1,800	\$9,303,124	\$ 46,515.62
	22718.0	Total Cost	\$31,240,137	\$156,201
RESERVOIR LOCATION 2 - CENTRAL (PREFERRED)				
<i>Diameter</i>	<i>Total Length (m)</i>			
300 mm	17497.9	\$1,250	\$21,872,371	\$ 109,361.86
600 mm	3274.1	\$1,800	\$5,893,348	\$ 29,466.74
	20772.0	Total Cost	\$27,765,719	\$138,829

Property Costs

Water (Assume 5m easement required when outside of public ROW):				
All alternatives:	m2	Unit rate per m2	Cost	
Watermain Easement: 3,000m length x 5m easement =	15000	0.2	\$ 3,000	
Elevated Storage: (property purchase)				
Location 1, 2, 3, : 50x50m lot = 2500m2	2500	198	\$ 495,000	
Underground Tank:				
Location 1, 2, 3 :100m x 60m = 6000m2	6000	198	\$ 1,188,000	

Source: Tendered Costs for City of Guelph Projects. Please refer to the "Benchmarking" Tab. The tendered costs are for 150 and 200 mm diameter pipes. Other pipe unit costs were estimated taking the 150 mm and 200 mm pipes as reference.

Property Costs =	\$ 800,000	per acre	=	\$ 197.68	per m2	Source: Watson & Associates
Easement costs =	\$ 2,000.00	per hectare (10,000 sq.m.)		\$ 0.20	per m2	

Watermain O&M	0.50% of Capital
---------------	------------------

Water Summary by Reservoir Location

	1A	1B	1C	2A	2B	2C
Property Costs	\$495,000	\$495,000	\$495,000	\$1,188,000	\$1,188,000	\$1,188,000
O&M Costs	\$202,293	\$204,829	\$222,201	\$243,293	\$245,829	\$263,201
Distribution Cost (\$M)	23.3	21.9	21.9	23.3	21.9	21.9
Storage Cost (\$M)	3.3	3.3	3.3	3.4	3.4	3.4
Transmission Cost (\$M)	3.9	5.9	9.3	3.9	5.9	9.3
Property Costs - From above (\$M)	0.5	0.5	0.5	1.2	1.2	1.2
Total (\$M)	31.0	31.6	35.0	31.8	32.4	35.8

WATER STORAGE RESERVOIRS

Volume of Storage Reservoir - 5ML		
	Estimated Cost (\$)	Annual O&M
In-ground Reservoir	1.4 Million	\$ 7,000.00
Booster PS for In-ground Reservoir	2.0 Million	\$ 100,000
Overhead Service Reservoir	3.3 Million	\$ 66,000

Ref. AWWA M42, 2013, Chapter 5
ELEVATED TANK
Estimated cost for a 1.9 ML Elevated Tank is \$1 Million (2013) Therefore, estimated cost for a 5 ML Elevated Tank is \$2.6 Million (2013) Assuming Inflation of 3.5%, estimated cost for a 5 ML Elevated Tank is 3.3 Million (2020)
IN-GROUND RESERVOIR
Estimated cost for a 1.9 ML Elevated Tank is \$0.4 Million (2013) Therefore, estimated cost for a 5 ML In-ground Reservoir is \$1.1.6 Million (2013) Assuming Inflation of 3.5%, estimated cost for a 5 ML In-ground Reservoir is 1.4 Million (2020)

Ref. USEPA, 1999
BOOSTER-PUMP STATION
Unit cost per m3/d is \$68 (1999) Assuming Inflation of 3.5%, unit cost per m3/d is \$140 (2020) Cost for a Booster Pump Station Capacity of 170 L/s is \$2 Million (2020)

O&M Costs - Water	
In ground reservoir	0.50% of Capital Cost
Booster pumping station	5% of Capital Cost
Overhead reservoir	2% of Capital Cost

Memo

To: Rajan Sawhney (Wood)
From: Ali Aamir (Wood)
Date: June 10, 2020
File: N/A
cc: Steve Chipps, Ron Scheckenberger (Wood)
Re: **Clair Maltby Servicing - Water Model Setup and Preferred Alternative**

1.0 Introduction

The Clair Maltby Secondary Plan (CMSP) Lands water modelling has been developed using the existing City hydraulic modelling as a base, with revised modelling as developed by Wood representing the proposed servicing for the Clair Maltby Secondary Plan Lands. Three alternatives have been proposed, each at different locations, considering above ground storage via elevated tanks. The hydraulic modelling assessment consisted of assessing these locations while being connected to City servicing, as supplied by the Clair Gordon booster pump station. This memorandum provides a brief overview of the development of the water modelling for the preferred alternative.

2.0 Model Development

The hydraulic model has been created using InfoWater, and has been built upon the existing City of Guelph hydraulic model, with the connection point at Clair Gordon booster pumping station. A 600 mm diameter transmission main has been proposed to be connected to the Clair Gordon booster pumping station, which will provide a supply to the proposed elevated tank in the preferred alternative. Internal servicing of watermains within the CMSP lands consist of 300 mm diameter supply mains which will follow proposed grading within CMSP.

The proposed elevated tank will have a capacity of 5 ML, and will be situated at an elevation of 382 m, consisting of a low water level (LWL) at an elevation of 390 m, and a high water level (HWL) at an elevation of 394 m, which will be sufficient to supply an adequate amount of water for future developments within the CMSP area, while meeting necessary pressure and flow requirements.

Flow allocation has been based upon a predicted population of approximately 27,324, which consists of the total CMSP population of 23,759, and an additional population loading of 3,471 (consisting of 15% of the primary CMSP population) from potential additional Zone 3 lands outside of the CMSP area. This population has been used to estimate the required demands for the CMSP lands.

The population has been distributed based upon the land use plan information provided by Brook McIlroy in August, 2019. Demands have been split between several land use types, including residential, commercial, and mixed use. While the land use is not expected to drastically change over the course of development, it should be noted that the demand allocation will have to be revised should there be any



City of Guelph

June 10, 2020

change in either the overall population, or the land use within CMSP lands. This will also include the population estimates attributed to any potential additional Zone 3 lands outside of the CMSP area.

The C3W memorandum outlining potential changes to the water model have been assessed within this iteration of the model as well, with updated peaking factors applied, in addition to other adjustments within the model (addition of check valves etc.). It should be noted that within the existing City water modelling, a City node (valve V8056) prevented the ADD and PHD scenarios from running to completion for a 24-hour duration. Based upon Wood's communication with Innovyze Support, extending the trial time, increasing the error tolerance, and allowing pumps to run in parallel allowed the model to run through the full 24 hour duration. However, should a steady state model be used instead, there is minimal change expected within overall pressures and flows.

3.0 Preferred Alternative

The preferred water servicing alternative is the above ground storage (via an elevated tank), at location 2. This location would be more central to the CMSP development as compared with the other two locations identified. Additionally, this location for the reservoir would be close to a large commercial centre and would facilitate in meeting the fire flow requirements.

3.1 Discussion of the Preferred Alternative

The following scenarios were modelled for the preferred alternative:

- Average Day Demand (ADD);
- Max Day Demand plus Fire (MDD + Fire); and,
- Peak Hour Demand (PHD).

Figure 1 through 3 show the pressure and flow breakdown at certain locations across the CMSP area.

Average Day Demand (ADD)

The average day demand scenario is presented in **Figure 1**. The pressures range from a maximum of 517 kPa to a minimum of 347 kPa, which are within the acceptable range.

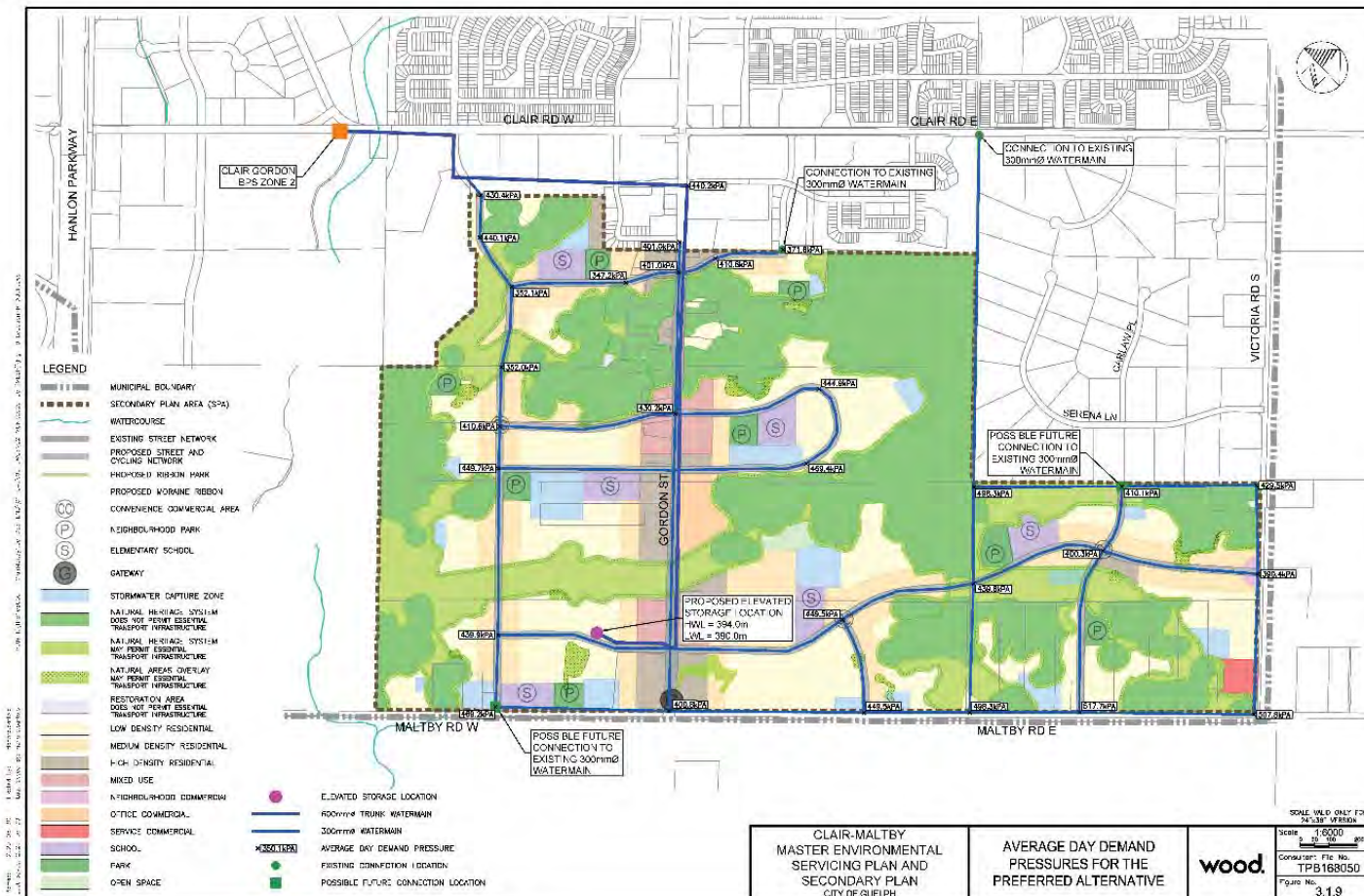


Figure 1 Average Day Demand – Pressures for the Preferred Alternative



Max Day Demand plus Fire (MDD + Fire)

The max day demand + fire flow scenario is presented in **Figure 2**. This figure presents the fire flows available at various junctions while max day demand is exercised at all the junctions in the backdrop. All this was modelled while keeping the pressures within the acceptable range. The fire flows predicted by the model meet the fire flow requirements established in section 3.1.3.2 of this report.

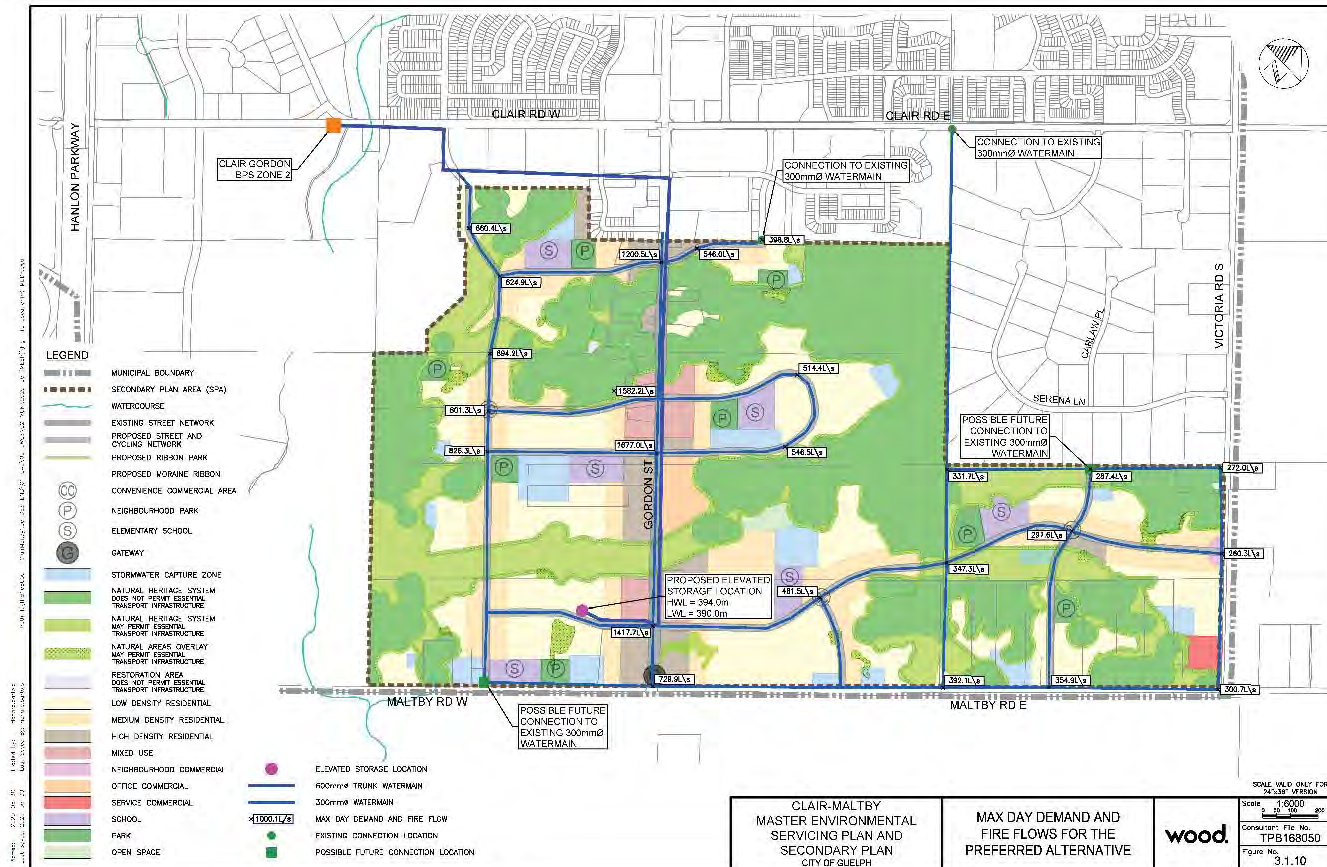


Figure 2 Max Day Demand + Fire – Fire Flows for the Preferred Alternative

City of Guelph
 June 10, 2020

Peak Hour Demand (PHD)

The peak hour demand scenario is presented in **Figure 3**. The pressures range from a maximum of 561 kPa to a minimum of 391 kPa, which are within acceptable range.

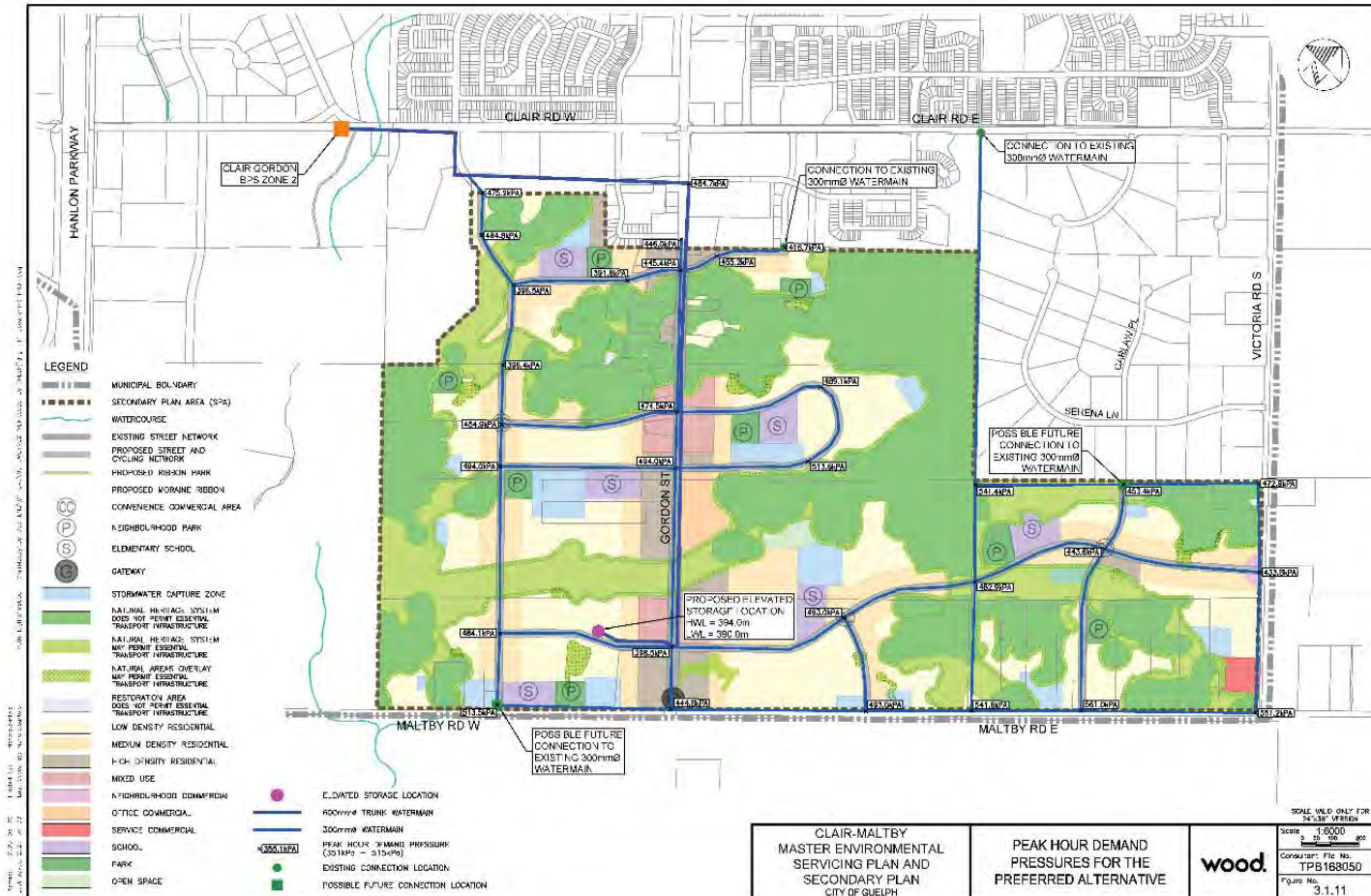


Figure 3 Peak Hour Demand – Pressures for the Preferred Alternative

Appendix B
Wastewater

CONTENTS

Cost Estimates – Wastewater System

Technical Note: Clair Maltby Wastewater Modelling – Sept 2018

Memo - Clair Maltby Servicing – Wastewater Model Setup – June 24, 2020

Wastewater Model Outputs

Southgate Hanlon

Depth (m)	200	Unit Cost (\$/m)	Cost (\$)	300	Unit Cost (\$/m)	Cost (\$)	375	Unit Cost (\$/m)	Cost (\$)	525	Unit Cost (\$/m)	Cost (\$)	600	Unit Cost (\$/m)	Cost (\$)	825	Unit Cost (\$/m)	Cost (\$)
2.25	184.537	\$ 231.81	\$ 42,776.89															
2.75													144.822	\$ 561.74	\$ 81,352.78			
3	295.459	\$ 303.77	\$ 89,752.75							1432	511.08773	\$ 731,877.63						
3.25							481.208	\$ 492.88	\$ 237,176.45				458.319	\$ 595.30	\$ 272,837.99			
3.5	177.651	\$ 387.11	\$ 68,771.01	1801.873	\$ 434.19	\$ 782,355.20	555.609	\$ 540.43	\$ 300,268.52									
3.75				518.575	\$ 481.11	\$ 249,490.55	694.724	\$ 594.27	\$ 412,852.05				904.733	\$ 722.54	\$ 653,702.76			
4							382.408	\$ 594.27	\$ 227,252.73	917	717.92439	\$ 658,336.66	201.668	\$ 780.99	\$ 157,499.75	1406	\$ 1,026.00	\$ 1,442,556.00
4.25	166.016	\$ 482.70	\$ 80,135.66															
4.75	269.011	\$ 590.69	\$ 158,901.90	320.404	\$ 644.53	\$ 206,508.58	354.988	\$ 767.39	\$ 272,413.20							1406	1225	\$ 1,722,350.00
5				267.878	\$ 702.97	\$ 188,311.34	283.203	\$ 767.39	\$ 217,326.32									
5.15				278.187	\$ 702.97	\$ 195,558.30												
5.25				967.545	\$ 767.78	\$ 742,866.21												
5.5				100.948	\$ 832.60	\$ 84,048.81	170.502	\$ 1,042.93	\$ 177,821.77									
6.25				324.549	\$ 974.14	\$ 316,157.52	456.948	\$ 1,042.93	\$ 476,565.10									
6.3							25	\$ 1,042.93	\$ 26,073.27									
6.35							230.408	\$ 1,199.08	\$ 276,278.37									
6.85							458.678	\$ 1,199.08	\$ 549,993.10									
7							232.112	\$ 1,455.12	\$ 337,750.11									
7.6335				82.709	\$ 1,381.37	\$ 114,251.92												
7.75	126.18																	
8				180.285	\$ 1,471.77	\$ 265,338.13												
8.75							141.468											
9	138.184																	
9.45				155.312	\$ 1,969.16	\$ 305,834.26												
11	286.616																	
11.5	56.006																	
12.65				165.696	\$ 3,190.94	\$ 528,725.35												
12.85				34.096	\$ 3,329.76	\$ 113,531.50												
Grand Total	1699.66		\$ 397,561.31	5198.057		\$ 4,092,977.68	4467.256		\$ 3,511,770.96	1709.542		\$ 1,390,214.29	1709.542		\$ 1,165,393.27	1709.542		\$ 3,164,906.00

TOTAL COST FOR SOUTHGATE HANLON SEWERS \$ 13,722,823.51

Southgate Industrial

Depth (m)	200	Unit Cost (\$/m)	Cost (\$)	300	Unit Cost (\$/m)	Cost (\$)	375	Unit Cost (\$/m)	Cost (\$)	525	Unit Cost (\$)	Cost (\$)	450	Unit Cost (\$)	Cost (\$)	600	Unit Cost (\$)	Cost (\$)	825	Unit Cost (\$/n)	Cost (\$)	
2.25	184.537	\$ 231.81	\$ 42,776.89																			
2.75																144.822	\$ 561.74	\$ 81,352.78				
3	295.459	\$ 303.77	\$ 89,752.75							1432	511.08773	\$ 731,877.63										
3.25							481.208	\$ 492.88	\$ 237,176.45													
3.5	177.651	\$ 387.11	\$ 68,771.01	1801.873	\$ 434.19	\$ 782,355.20	555.609	\$ 540.43	\$ 300,268.52				360	675.93678	\$ 243,337.24							
3.75				518.575	\$ 481.11	\$ 249,490.55	694.724	\$ 594.27	\$ 412,852.05													
4							382.408	\$ 594.27	\$ 227,252.73	917	717.92439	\$ 658,336.66										
4.25	166.016	\$ 482.70	\$ 80,135.66																			
4.75	269.011	\$ 590.69	\$ 158,901.90	320.404	\$ 644.53	\$ 206,508.58	354.988	\$ 767.39	\$ 272,413.20													
5				267.878	\$ 702.97	\$ 188,311.34	283.203	\$ 767.39	\$ 217,326.32													
5.15				278.187	\$ 702.97	\$ 195,558.30																
5.25				967.545	\$ 767.78	\$ 742,866.21																
5.5				100.948	\$ 832.60	\$ 84,048.81	170.502	\$ 1,042.93	\$ 177,821.77													
6.25				324.549	\$ 974.14	\$ 316,157.52	456.948	\$ 1,042.93	\$ 476,565.10													
6.3							25	\$ 1,042.93	\$ 26,073.27													
6.35							230.408	\$ 1,199.08	\$ 276,278.37													
6.85							458.678	\$ 1,199.08	\$ 549,993.10													
7							232.112	\$ 1,455.12	\$ 337,750.11													
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7.75	126.18																					
8				180.285	\$ 1,471.77	\$ 265,338.13																
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11.5	56.006																					
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12.85				34.096	\$ 3,329.76	\$ 113,531.50																
Grand Total	1699.66		\$ 397,561.31	5198.057		\$ 4,092,977.68	4467.256		\$ 3,511,770.96	1709.542		\$ 1,390,214.29	1709.542		\$ 243,337.24	1709.542		\$ 1,820,734.03	1709.542		\$ 3,164,906.00	

TOTAL COST FOR SOUTHGATE INDUSTRIAL SEWERS \$ 14,621,501.51

Clain Gordon

Depth (m)	200 Unit Cost (\$/m)	Cost (\$)	250 Unit Cost (\$/m)	Cost (\$)	300 Unit Cost (\$/m)	Cost (\$)	375 Unit Cost (\$/m)	Cost (\$)	450 Unit Cost (\$/m)	Cost (\$)	600 Unit Cost (\$/m)	Cost (\$)	675 Unit Cost (\$/m)	Cost (\$)							
3.448				23262.56																	
3.483	51.00	\$ 503.61	\$	25,684.25																	
3.7855	14.50	\$ 555.06	\$	8,048.42																	
3.789	41.30	\$ 555.06	\$	22,924.12																	
3.942																					
4.2175	68.10	\$ 612.32	\$	41,698.94																	
4.779																					
4.813				36.06	\$ 766.35	\$	27,634.70														
5.1965	54.20	\$ 875.54	\$	47,454.10																	
5.235									6.50	\$ 1,071.16	\$	6,962.55									
5.434				14.20	\$ 905.60	\$	12,859.47														
5.575									35.50	\$ 1,006.75	\$	35,739.56									
5.5795										76.00	\$ 1,144.32	\$	86,968.41								
5.6175										19.30	\$ 1,144.32	\$	22,085.40								
5.641										95.50	\$ 1,144.32	\$	109,282.68								
5.6475											39.50	\$ 1,291.52	\$	51,014.90							
5.7125										83.60	\$ 1,144.32	\$	95,665.25								
5.7625										95.30	\$ 1,144.32	\$	109,053.81								
5.795						18.10	\$ 1,084.28	\$	19,625.51												
5.865								47.00	\$ 1,154.26	\$	54,250.29										
5.905						28.00	\$ 1,084.28	\$	30,359.90												
5.9775											97.70	\$ 1,374.06	\$	134,245.68							
6.16								50.70	\$ 1,232.99	\$	62,512.50										
6.255													226.70	\$ 1,533.02 \$ 347,536.68							
6.283													76.80	\$ 1,533.02 \$ 117,736.29							
6.29													6.20	\$ 1,533.02 \$ 9,504.75							
6.3505										95.00	\$ 1,304.16	\$	123,895.24								
6.501													90.80	\$ 1,622.00 \$ 147,277.25							
6.598													120.90	\$ 1,622.00 \$ 196,099.34							
6.7175													97.20	\$ 1,712.69 \$ 166,473.64							
6.7525						57.90	\$ 1,329.31	\$	76,966.96												
6.7625											12.10	\$ 1,635.33	\$	19,787.49							
6.795								32.80	\$ 1,402.30	\$	45,995.55										
6.8585													81.90	\$ 1,712.69 \$ 140,269.46							
7.083										90.00	\$ 1,564.98	\$	140,848.25								
7.205								83.50	\$ 1,490.72	\$	124,474.77										
7.331								39.00	\$ 1,581.89	\$	61,693.56										
7.395											45.60	\$ 1,823.95	\$	83,172.17							
7.5325											43.50	\$ 1,823.95	\$	79,341.87							
7.542								67.70	\$ 1,581.89	\$	107,093.69										
7.675						21.40	\$ 1,599.92	\$	34,238.26												
7.765						19.80	\$ 1,599.92	\$	31,678.39												
7.77						59.40	\$ 1,599.92	\$	95,035.16												
7.8305											51.90	\$ 1,922.44	\$	99,774.83							
7.95											108.10	\$ 2,023.72	\$	218,764.62							
8.1155								80.40	\$ 1,772.50	\$	142,509.02										
8.13						81.50	\$ 1,695.67	\$	138,197.31												
8.1575									46.60	\$ 1,849.90	\$	86,205.22									
8.1655									48.50	\$ 1,849.90	\$	89,720.03									
8.2105											42.00	\$ 2,023.72	\$	84,996.43							
8.235									48.40	\$ 1,950.37	\$	94,397.88									
8.377									68.10	\$ 1,950.37	\$	132,820.16									
8.4045											72.10	\$ 2,127.79	\$	153,413.90							
8.4175						82.40	\$ 1,794.20	\$	147,842.23												
8.4225	86.30	\$ 1,717.87	\$	148,252.07																	
8.537										84.50	\$ 2,053.59	\$	173,528.47								
8.566											41.40	\$ 2,234.65	\$	92,514.52							
8.601								30.10	\$ 1,974.15	\$	59,421.79										
8.6865									42.00	\$ 2,053.59	\$	86,250.84									
8.7755						84.00	\$ 1,895.51	\$	159,222.54												
8.82											88.70	\$ 2,234.65	\$	198,213.47							
8.8915	20.70	\$ 1,919.89	\$	39,741.81																	
8.898						20.00	\$ 1,999.59	\$	39,991.73												
8.9745								50.70	\$ 2,079.11	\$	105,410.63										
8.992											45.00	\$ 2,344.30	\$	105,493.28							
9.0545											81.40	\$ 2,344.30	\$	190,825.62							
9.19											83.60	\$ 2,456.73	\$	205,382.46							
9.1955						97.60	\$ 2,106.44	\$	205,588.71												
9.3865											118.00	\$ 2,456.73	\$	289,893.91							
9.4945											17.90	\$ 2,571.95	\$	46,037.89							
9.6275								84.70	\$ 2,297.30	\$	194,581.11										
9.667	21.30	\$ 2,133.00	\$	45,432.81																	
9.679											17.10	\$ 2,571.95	\$	43,980.33							
9.692										85.30	\$ 2,379.76	\$	202,993.21								
9.6955											75.60	\$ 2,571.95	\$	194,439.34							
9.745											30.90	\$ 2,571.95	\$	79,473.22							
10.016											57.40	\$ 2,689.96	\$	154,403.59							
10.056									20.60	\$ 2,493.98	\$	51,375.94									
10.12											9.10	\$ 2,810.76	\$	25,577.87							
10.16											89.40	\$ 2,810.76	\$	251,281.50							
10.294									20.20	\$ 2,610.95	\$	52,741.17									
Grand Total	357.40	\$	402,499.07	50.26	\$	40,494.17	795.70	\$	1,145,985.89	566.60	\$	957,942.90	1025.40	\$	1,664,794.51	1268.00	\$	2,802,028.89	700.50	\$	1,124,897.42

TOTAL COST FOR CLAIR GORDON TWINNING OF EXISTING SEWERS \$ 8,138,642.85

Southend Valleyland

Depth (m)	200	Unit Cost (\$/m)	Cost (\$)	300	Unit Cost (\$/m)	Cost (\$)	375	Unit Cost (\$/m)	Cost (\$)	450	Unit Cost (\$/m)	Cost (\$)	525	Unit Cost (\$/m)	Cost (\$)	600	Unit Cost (\$/m)	Cost (\$)
2.75				144.822	\$ 347.11	\$ 50,269.66				141.468	\$ 460.43	\$ 65,136.43						
3	295.459	\$ 303.77	\$ 89,752.75										324.549	\$ 511.09	\$ 165,873.01			
3.25				458.319	\$ 387.27	\$ 177,494.12												
3.5							1886.76	\$ 492.88	\$ 929,940.98									
3.65							701.708	\$ 492.88	\$ 345,855.87									
3.75				286.758	\$ 481.11	\$ 137,961.55	574.427	\$ 540.43	\$ 310,438.35									
4				584.076	\$ 533.59	\$ 311,658.54	361.467	\$ 594.27	\$ 214,808.17									
4.15							197.018	\$ 594.27	\$ 117,081.44									
4.25	166.016	\$ 482.70	\$ 80,135.66				489.502	\$ 594.27	\$ 290,895.24									
4.75	268.181	\$ 590.69	\$ 158,411.63															
5													258.298	\$ 1,007.23	\$ 260,164.29			
5.5										607.943	\$ 965.40	\$ 586,906.21	714.518	\$ 1,036.57	\$ 740,647.17			
7							30.013	\$ 1,199.08	\$ 35,988.08									
7.6335				82.709	\$ 1,381.37	\$ 114,251.92												
7.75	126.18	\$ 1,309.53	\$ 165,236.36															
8.5							170.502	\$ 1,640.87	\$ 279,771.20									
8.75							865.006	\$ 1,738.26	\$ 1,503,606.46	456.948	\$ 1,812.49	\$ 828,214.54						
9	138.184	\$ 1,681.08	\$ 232,298.06							232.112	\$ 1,913.58	\$ 444,164.93						
9.25																482.951	\$ 2,239.66	\$ 1,081,644.54
9.45				155.312	\$ 1,969.16	\$ 305,834.26												\$ -
10.5													317.071	\$ 2,553.97	\$ 809,789.07	4100	\$ 2,849.50	\$ 11,682,929.55
11	286.616	\$ 2,446.77	\$ 701,283.97															
11.5	56.006	\$ 2,568.16	\$ 143,832.09															
12.65				165.696	\$ 3,190.94	\$ 528,725.35												
12.75													143.534	\$ 3,429.27	\$ 492,217.34			
12.85				34.096	\$ 3,329.76	\$ 113,531.50												
13.75										100.948	\$ 3,937.20	\$ 397,452.92						
14.75																69.333	\$ 4,816.17	\$ 333,919.44
15.5													295.101	\$ 4,750.49	\$ 1,401,874.09			
15.75													323.768	\$ 4,910.89	\$ 1,589,988.92			
Grand Total	1336.642		\$ 1,570,950.51	1911.788		\$ 1,739,726.90	5276.403		\$ 4,028,385.79	1539.419		\$ 2,321,875.03	2376.839		\$ 5,460,553.89	552.284		\$ 13,098,493.53

TOTAL COST FOR SOUTHEND VALLEYLAND SEWERS

\$ 28,219,985.65

Victoria Road

Depth (m)	200 mm	Unit Cost (\$/m)	Cost (\$)	300 mm	Unit Cost (\$/m)	Cost (\$)	375 mm	Unit Cost (\$/m)	Cost (\$)
2.25	184.537	\$ 231.81	\$ 42,777.52						
2.75							144.822	\$ 403.81	\$ 58,480.57
3	295.459	\$ 348.70	\$ 103,026.55						
3.25							939.527	\$ 470.00	\$ 441,577.69
3.5	1071.179	\$ 387.11	\$ 414,664.10	1463.954	\$ 434.19	\$ 635,634.19			
3.75	82.083	\$ 431.80	\$ 35,443.44	518.575	\$ 481.11	\$ 249,491.62	1517.374	\$ 540.43	\$ 820,034.43
4				382.408	\$ 533.59	\$ 204,049.08	201.668	\$ 594.27	\$ 119,845.24
4.25	166.016	\$ 533.59	\$ 88,584.48						
4.75	269.011	\$ 590.69	\$ 158,902.11	323.768	\$ 702.97	\$ 227,599.19	354.988	\$ 707.75	\$ 251,242.76
5				267.878	\$ 767.78	\$ 205,671.37	283.203	\$ 767.39	\$ 217,327.15
5.15				278.187	\$ 767.78	\$ 213,586.41			
5.25				967.545	\$ 767.78	\$ 742,861.70			
5.5				100.948	\$ 832.60	\$ 84,049.30	170.502	\$ 899.00	\$ 153,281.30
6.25				324.549	\$ 1,020.00	\$ 331,039.98	456.948	\$ 1,042.93	\$ 476,564.78
6.3							25	\$ 1,042.93	\$ 26,073.25
6.35							230.408	\$ 1,119.76	\$ 258,001.66
6.85							458.678	\$ 1,199.08	\$ 549,991.62
7							232.112	\$ 1,281.42	\$ 297,432.96
7.63				82.709	\$ 1,381.37	\$ 114,251.73			
7.75	126.18	1309.53	\$ 165,236.50						
8				180.285	\$ 1,471.77	\$ 265,338.05			
8.75							141.468	\$ 1,738.26	\$ 245,908.17
9	138.184	1781.46	\$ 246,169.27						
9.45				155.312	\$ 1,969.16	\$ 305,834.18			
11	286.616	2446.77	\$ 701,283.43						
11.5	56.006	2692.54	\$ 150,798.40						
12.65				165.696	\$ 3,190.94	\$ 528,725.99			
12.85				34.096	\$ 3,329.76	\$ 113,531.50			
Grand Total	2675.271		\$ 2,106,885.79	5245.91		\$ 4,221,664.31	5156.698		\$ 3,915,761.57

TOTAL COST FOR VICTORIA ROAD AND CLAIR GORDON SEWERS \$ 10,244,311.67

Sanitary Force mains

EAST CONNECTION - VICTORIA ROAD TRUNK ALTERNATIVE			UNIT COST	INSTALLED
			(\$/m)	COST (\$)
<i>Name</i>	<i>Diameter (mm)</i>	<i>Total Length (m)</i>		
Forcemain 1	125	915	\$700	\$640,500
Forcemain 2	450	6975	\$1,500	\$10,462,500
Forcemain 3	200	1035	\$800	\$828,000
			Total Cost	\$11,931,000
CENTRAL CONNECTION - CLAIR GORDON TRUNK ALTERNATIVE				
<i>Name</i>	<i>Diameter (mm)</i>	<i>Total Length (m)</i>		
Forcemain 1	125	1480	\$700	\$1,036,000
Forcemain 2	300	1945	\$1,250	\$2,431,250
Forcemain 3	450	1175	\$1,500	\$1,762,500
			Total Cost	\$5,229,750
WEST CONNECTION - SOUTHGATE HANLON TRUNK ALTERNATIVE				
<i>Name</i>	<i>Diameter (mm)</i>	<i>Total Length (m)</i>		
Forcemain 1	125	1480	\$700	\$1,036,000
Forcemain 2	300	1945	\$1,250	\$2,431,250
Forcemain 3	450	1175	\$1,500	\$1,762,500
			Total Cost	\$5,229,750
WEST CONNECTION - SOUTHEND PARK AND VALLEY LAND TRUNK ALTERNATIVE				
<i>Name</i>	<i>Diameter (mm)</i>	<i>Total Length (m)</i>		
Forcemain 1	100	555	\$650	\$360,750
Forcemain 2	200	17	\$800	\$13,600
Forcemain 3	150	635	\$700	\$444,500
			Total Cost	\$818,850
WEST CONNECTION - SOUTHGATE INDUSTRIAL ALTERNATIVE				
<i>Name</i>	<i>Diameter (mm)</i>	<i>Total Length (m)</i>		
Forcemain 1	250	1525	\$1,000	\$1,525,000
Forcemain 2	300	1945	\$1,250	\$2,431,250
Forcemain 3	450	1175	\$1,500	\$1,762,500
			Total Cost	\$5,718,750

Sanitary Pump Stations

EAST CONNECTION - VICTORIA ROAD TRUNK ALTERNATIVE			Capacity in MGD	Cost in \$ (2008)	Cost in \$ (2020) Assuming 3.5% Annual Inflation	Including Emergency Overflow
Pump Station	Capacity in L/s	Estimated Cost (\$) in 2020				
SPS-1	19	\$ 0.7 Million	0.43	\$373,198	\$563,929	\$663,929
SPS-2	195	\$ 4.7 Million	4.38	\$3,035,953	\$4,587,533	\$4,687,533
SPS-3	56	\$ 1.6 Million	1.26	\$987,472	\$1,492,138	\$1,592,138
CENTRAL CONNECTION - CLAIR GORDON TRUNK ALTERNATIVE						
Pump Station	Capacity in L/s	Estimated Cost (\$) in 2020				
SPS-1	19	\$ 0.7 Million	0.43	\$373,198	\$563,929	\$663,929
SPS-2	123	\$ 3.1 Million	2.76	\$2,005,111	\$3,029,861	\$3,129,861
SPS-3	198	\$ 4.8 Million	4.45	\$3,077,966	\$4,651,019	\$4,751,019
WEST CONNECTION - SOUTHGATE HANLON TRUNK ALTERNATIVE						
Pump Station	Capacity in L/s	Estimated Cost (\$) in 2020				
SPS-1	19	\$ 0.7 Million	0.43	\$373,198	\$563,929	\$663,929
SPS-2	123	\$ 3.1 Million	2.76	\$2,005,111	\$3,029,861	\$3,129,861
SPS-3	197	\$ 4.7 Million	4.43	\$3,063,969	\$4,629,868	\$4,729,868
WEST CONNECTION - SOUTHGATE INDUSTRIAL						
Pump Station	Capacity in L/s	Estimated Cost (\$) in 2020				
SPS-1	90	\$ 2.4 Million	2.02	\$1,513,613	\$2,287,174	\$2,387,174
SPS-2	123	\$ 3.1 Million	2.76	\$2,005,111	\$3,029,861	\$3,129,861
SPS-3	180	\$ 4.4 Million	4.04	\$2,824,894	\$4,268,609	\$4,368,609
WEST CONNECTION - SOUTHEND PARK AND VALLEYLAND TRUNK ALTERNATIVE						
Pump Station	Capacity in L/s	Estimated Cost (\$) in 2020				
SPS-1	1.5	\$ 0.2 Million	0.03	\$37,960	\$57,360	\$157,360
SPS-2	42	\$ 1.3 Million	0.94	\$762,175	\$1,151,699	\$1,251,699
SPS-3	26	\$ 0.8 Million	0.58	\$494,954	\$747,910	\$847,910

SOURCE OF COST CURVES: Pumping Station Design (Third Edition, 2006) - R. Sanks

Emergency Overflows				
	Unit rate	Unit	Quantity	
Shallow Bury piping	\$ 400.00	m	150	\$ 60,000.00
Valving and controls	\$ 7,500.00	each	2	\$ 15,000.00
Forebay lining	\$ 25,000.00	ls	1	\$ 25,000.00
				\$ 100,000.00

Property Costs			
30mx30m lot for each (3) pump station: 2700m2			
2700	\$ 198.00	\$ 534,600.00	

Summary of Costs - Wastewater

	Victoria Road \$ M	Clair Gordon \$ M	Southgate Hanlon \$ M	Southgate Industrial* \$ M	Southend Park Valley Land \$ M
Internal Sewers	\$ 10.20	\$ 10.20	\$ 13.72	\$ 14.60	\$ 16.50
Twinning/Trunk	\$ -	\$ 8.10	\$ -	\$ -	\$ 11.70
SPS1	\$ 0.70	\$ 0.70	\$ 0.70	\$ 2.40	\$ 0.20
SPS2	\$ 4.70	\$ 3.10	\$ 3.10	\$ 3.20	\$ 1.30
SPS3	\$ 1.60	\$ 4.80	\$ 4.80	\$ 4.40	\$ 0.80
FM1	\$ 0.60	\$ 1.00	\$ 1.00	\$ 1.50	\$ 0.40
FM2	\$ 10.40	\$ 2.40	\$ 2.40	\$ 2.40	\$ 0.10
FM3	\$ 0.80	\$ 1.80	\$ 1.80	\$ 1.80	\$ 0.40
Property	\$ -	\$ -	\$ -	\$ -	\$ -
Total in \$M	\$ 29.0	\$ 32.1	\$ 27.5	\$ 30.3	\$ 31.4
O&M	\$ 0.506	\$ 0.787	\$ 0.720	\$ 1.903	\$ 0.575

*Capital and O&M Costs include increased pumping station size to accommodate Industrial Park expansion

Technical note:

Clair Maltby Wastewater Modelling

1. Introduction

Wood Environment & Infrastructure Solutions Canada (Wood Canada) is to develop a Water and Wastewater Servicing Plan for the Clair Maltby Master Environmental Servicing Plan and Secondary Plan for the City of Guelph, Ontario. This will provide a long-term strategy for the servicing of the Clair Maltby Secondary Plan. The Servicing Plan will support the long-term growth scenarios envisioned by the City.

As part of this, Wood Canada have requested modelling support associated with the sanitary system from Wood Environment & Infrastructure Solutions UK (Wood UK) to enable the assessment of existing and future sanitary system capacity and the impact on the future sanitary system from the Clair Maltby Lands.

The basis of all modelling undertaken is the existing Guelph InfoSWMM sanitary model which has been converted to an InfoWorks ICM model.

The scope of this report involves the following:

- Review of Existing InfoSWMM Model;
- Model Conversion to InfoWorks ICM & comparison with InfoSWMM outputs for confidence;
- Baseline constraint analysis for current and future time horizons to identify existing capacity constraints;
- Modelling of the Clair Maltby Lands to three potential connection points;
- Constraint analysis to identify capacity issues introduced by the inclusion of the Clair Maltby Lands; and,
- Development phasing analysis to identify the percentage of the Clair Maltby Lands that can connect to the existing sanitary sewer system without causing capacity constraints and the need for sewer upgrades.

1.1 Model Background

In 2013, AECOM utilised an existing wastewater model, which was calibrated as part of the "2008 W/WW Master Plan" in 2008, to carry out extensive model upgrades. This incorporated the following:

- New sewers;
- Inspection manholes;
- Pipe invert elevations; and
- Ground elevations.

The work undertaken by AECOM is detailed in "Hydraulic Modeling Update for the 2013 Guelph DC Study (Final)" report. The updated AECOM 2013 model reflects the City of Guelph's current sanitary system. It is

noted that although the current 2013 model was calibrated in 2008; with updates implemented for the 2013 study, the model is considered to be acceptable for master planning purposes by the City of Guelph.

The Wastewater model database which has been used for this study was named "2013-11-21-Guelph_Sanitary_Model-60298422". This was provided by the City of Guelph in InfoSWMM (Innovyze) format.

1.2 Existing InfoSWMM Model

The "2013-11-21- Guelph_Sanitary_Model-60298422" InfoSWMM model was converted by AMECFW Canada to EPA SWMM5 text files for import into InfoWorks ICM (Innovyze). Each scenario in the InfoSWMM model was then converted as a separate SWMM5 text file. The baseline model for this analysis (representing 2013) is based on the InfoSWMM scenario "2012_WEXISTING". This model is deemed to be correct for use as the "Baseline Model" and is an accurate representation of the City's current sewer system. Wood do not provide any warranty for the model.

2. InfoWorks ICM Model

This section details the conversion of the InfoSWMM model to InfoWorks ICM, the model review and connectivity check undertaken, and the setting up of the baseline 2013 and 2031 model scenarios.

Table 2.1 highlights the files provided by Wood Canada which have been used to produce the InfoWorks ICM model scenarios for use in the baseline constraint analysis:

Table 2.1 Baseline ICM Model and Ancillary Files

	File Name	Comments
SWMM5 Network File	2012_WExisting.inp	SWMM 5 .inp file imported into a blank InfoWorks ICM model network named "Guelph Wastewater Model".
Subcatchments	N/A	Due to differences in application of flows to model nodes in InfoSWMM and InfoWorks ICM, dummy subcatchments were created in ICM to allow application of dry weather and II flows. The subcatchments were sized based on a dummy area of 0.1ha where no RDII flows were applied, or the corresponding RDII Sewershed Area (hc).
2012 Dry Weather Flows	2012_WEXISTING.xlsx	DWF's were imported to relevant InfoWorks ICM Sanitary Subcatchments. Baseflow allocations were applied as ICM "Baseflow". Allocations for SOUTH, SOUTH, Fut_Res, Fut_ICI, Fut_II, RES, ICI and ROCKWOOD were combined per junction/subcatchment and applied as ICM "Additional Foul Flow". Relevant Time Pattern ID was applied to each subcatchment as a corresponding "Wastewater Profile" (See Time Patterns below)
2031 Dry Weather Flows	2031_175K_EXPIPE_2013UPD.xlsx	Applied as 2012 DWFs above.
Rainfall Derived Inflows and Infiltration (RDII)	Node RDII - 2012 WExisting.xlsx	RDII flows imported to relevant InfoWorks ICM Subcatchments as contributing areas (Sewershed Area (hc)) and associated RDII Hydrograph profiles.
Time Patterns	Time Patters for 2012 WExisting.xlsx	Time Patterns applied to a InfoWorks ICM "WasteWater" ancillary file named "2012_WEXISTING Waste water". Time Patter ID 1 from the InfoSWMM model was applied as a Weekday profile and Time Pattern ID 2 as a weekend profile. The following ICM Wastewater profiles were created:

File Name	Comments
	1: FM_1
	2: FM_2
	3: FM_3
	4: FM_4
	5: FM_5
	6: FM_6
	7: FM_7
	8: FM_8
	9: FM_B
	10: PEAK2
	11: PEAK2.8

2.1 Connectivity and Model Review

The following steps were completed as part of the model review and connectivity check:

- Imported existing InfoSWMM model "2012_Wexisting.inp" to InfoWorks ICM v8.5.7.
- InfoWorks ICM Model Network named "Guelph Wastewater Model".
- Connectivity in ICM model was reviewed and compared with InfoSWMM and found to be comparable.
- The model was "flagged" in ICM to identify data which has come from the original InfoSWMM model. The data flag used for this was "SWMM - Value imported from InfoSWMM model".
- The imported InfoSWMM model was subject to an engineering validation in InfoWorks ICM. Several errors were noted which were resolved. A number of "warnings" also identified locations in the model where pipes had "invert levels above ground level" or "soffit above ground level". No changes were made to the model with regards to these warnings, apart from where these caused an instability in the InfoWorks ICM model. Details of changes made to the ICM model to gain successful model validation and resolve model instabilities can be found in the document "Guelph_Wastewater_Model_Validation_Log.pdf", located in **Appendix A**. Any changes to the model to obtain engineering validation have been flagged "WOOD - Value adjusted by Wood Environmental & Infrastructure Solutions".

2.2 InfoWorks ICM 2012 Baseline Model

- Dummy subcatchments were created in the InfoWorks ICM model to allow application of DWF's and RDII. These were set to 0.1ha in size for junctions with DWF only, or to the relevant "Sewershed area" for nodes with RDII. The subcatchments were also set to apply inflows to associated junctions in the model.
- DWF & RDII were applied to relevant subcatchments based on files provided from the InfoSWMM model (see table 2.1).
- Time patterns were set up within an InfoWorks ICM Wastewater file and associated time patterns applied to relevant subcatchments (see table 2.1).
- "Base" scenario within the model network represents the 2013 wastewater network and flows.

- The resulting ICM flow/depths from key locations from 1 in 25-year design storm were reviewed with InfoSWMM outputs to ensure that results were comparable. Flows were found to be generally within $\pm 10\%$ at all locations throughout the catchment, apart from in locations with level errors in the InfoSWMM model which had been rectified in ICM.

2.3 InfoWorks ICM 2031 Baseline Model

- Additional Dummy subcatchments were created in the InfoWorks ICM model to allow application of future 2031 DWF's and RDII. These were set to 0.1ha in size for junctions with DWF only, or to the relevant "Sewershed area" for nodes with RDII. The subcatchments were also set to apply inflows to associated junctions in the model.
- 2031 DWF & RDII were applied to relevant subcatchments based on files provided from the InfoSWMM model (see table 2.1).
- Time patterns were set up within an InfoWorks ICM Wastewater file and associated time patterns applied to relevant subcatchments (see table 2.1).
- Future infrastructure associated with two planned projects included in the Master Plan framework of the City of Guelph have been added to the 2031 model after confirmation from the City of Guelph that these are partially constructed and will be completed by 2020. The infrastructure projects are "WW-I-1 Twinning and replacement of existing York Trunk from east of Hanlon to Victoria" & "WW-I-1A Add parallel pipe on Wellington St W" as detailed in Appendix H of "Hydraulic Modeling Update for the 2013 Guelph DC Study (Final)" report. Details of the new infrastructure were taken from InfoSWMM network "2031_175k_EXPIPE_2013UPD" and can be seen highlighted in green in Figure 2.1 below.
- "2031 Network 2031 Flows" scenario within the model network represents the 2031 wastewater network and flows.

Figure 2.1 2031 Additional Assets Associated with Infrastructure Projects WW-I-1 & WW-I-1A



3. Baseline Constraints Analysis

3.1 Introduction

There are 3 potential connection points for flows from the proposed Clair Maltby Lands to discharge to the existing sewer system. The connection points and associated downstream network (highlighted green) are detailed in figures 3.2 to 3.4 below:

Figure 3.1 Clair Maltby Lands Connection Point – Clair Gordon



Figure 3.2 Clair Maltby Lands Connection Point – Southgate-Hanlon

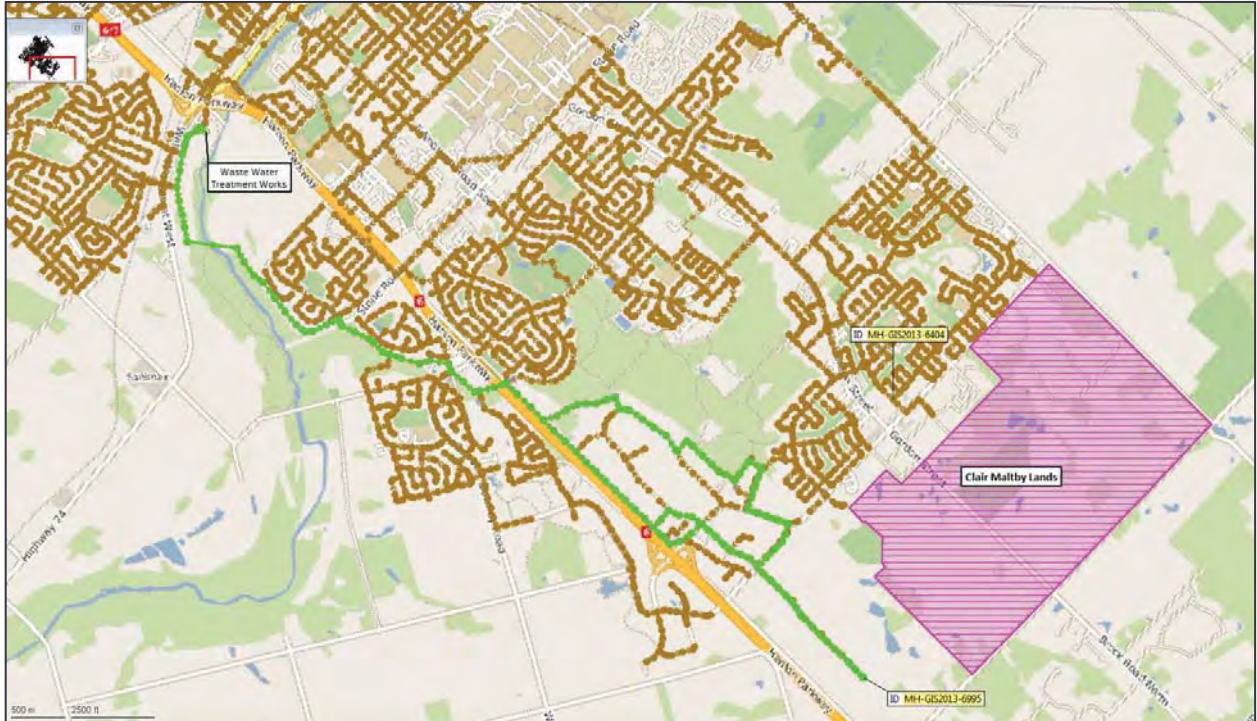


Figure 3.3 Clair Maltby Lands Connection Point – Victoria Road



Model simulations were carried out with a 1 in 25yr design storm to gain an understanding of existing capacity constraints within the sewer network downstream of the potential connection points of the Clair Maltby Lands. This exercise was carried out for two flow time horizons, 2012 & 2031, on the corresponding baseline model scenarios. For the baseline constraints analysis, no flows from the Clair Maltby Lands are included in the model.

A constraint is defined as a surcharged pipe with a “Max Surcharge State” of ≥ 1.0 from the ICM simulation results as described in figure 3.5:

Figure 3.4 Surcharge State Definition

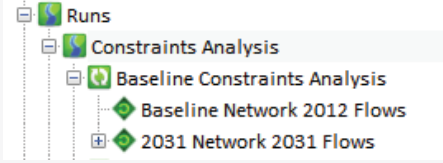
Max surcharge state	Indicates whether the flow rate in the system exceeded the capacity of the drainage network to the extent that levels rose within manholes at any time during the simulation. Maximum surcharge state can be one of the following values:	
	Value	Description
	<1	Not surcharged Where the ratio of water depth (max_depth) to pipe height (conduit_height) is 0 or less than 1
	1	Surcharged by depth
	2	Surcharged by flow
See Surcharge Rate for more details.		

Table 3.1 below details the simulation parameters and input files used for this analysis:

Table 3.1 Baseline Constraints Analysis – Model Simulation Parameters

	Details	Comments
ICM Model Scenario	Base 2031 Network 2031 Flows	Base scenario represents 2012 network and flows (see section 2.2) Represents 2031 network with 2031 flows (see section 2.3)
Rainfall	M25 Design storm (25YRCHICDES)	25-year return period design storm taken directly from InfoSWMM model.



WasteWater	2012_WEXISTING Waste water	See "Time Patterns" in table 2.1 above.
Simulation Start Date/Time	01/05/2007 @ 00:00	As per InfoSWMM simulations
Simulation Finish Date/Time	03/05/2007 @ 23:45	As per InfoSWMM simulations
Simulation Timestep	20 seconds	As per InfoSWMM simulations
Results Timestep	900 seconds	As per InfoSWMM simulations
Simulation Name	Baseline Constraints Analysis	

Model results from the baseline constraints analysis are presented below and have also been provided for the entire catchment in ArcGIS shape file format in **Appendix B & C**.

3.2 2012 Baseline Scenario Constraints

From the corresponding model simulation, Tables 3.2 to 3.4 identifies the existing downstream constraints from each of the potential three connection points of the Clair Maltby Lands with 2012 flows applied to the baseline sewerage network. The model results for all pipes from the connection points downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix B** alongside model longsections and plans showing the location of identified constraints.

Table 3.2 2012 Baseline Constraints – Clair Gordon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.3 2012 Baseline Constraints – Southgate-Hanlon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.4 2012 Baseline Constraints – Victoria Road Connection Point

Asset ID	Max Surcharge State	Comments
SED0001845	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 781.68l/s against PFC of 605l/s.
SED0001897	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 859.02l/s against PFC of 476l/s.
SED0001999	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 784.79l/s against PFC of 617l/s.
SED0002949	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 860.17l/s against PFC of 694l/s.
SED0002950	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 861.48l/s against PFC of 565l/s.
SED0005877	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 866.96l/s against PFC of 769l/s.
SED01960-2	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 778.13l/s against PFC of 593l/s.
SED0004477	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 426.69l/s against PFC of 330l/s.
SED0004259	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 277.36l/s against PFC of 197l/s.
SED0004292	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 271.87l/s against PFC of 118l/s.
SED0004392	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 518.47l/s against PFC of 338l/s.
SED0004412	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 428.16l/s against PFC of 227l/s.
SED0004413	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 427.91l/s against PFC of 401l/s.
SED0004414	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 427.92l/s against PFC of 218l/s.
SED0004426	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 427.85l/s against PFC of 216l/s.
CN-GIS2013-7436	1	Pipe has capacity but is surcharged by depth. This is the Force Main for Kortright East Sewage Pumping Station so is designed to be surcharged.
CN-GIS2013-7416	1	Pipes have capacity but are surcharge by depth due to downstream trunk sewer incapacity (see above pipes).
SED0001960	1	
SED0004285	1	
SED0004312	1	
SED0004415	1	
SED0004420	1	

3.3 2031 Baseline Scenario Constraints

From the corresponding model simulations, Tables 3.5 to 3.7 identifies the downstream constraints from each of the 3 potential connection points of the Clair Maltby Lands with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection points downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix C** alongside model longsections and plans showing the location of identified constraints.

Table 3.5 2031 Baseline Constraints – Clair Gordon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.6 2031 Baseline Constraints – Southgate-Hanlon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.7 2031 Baseline Constraints – Victoria Road Connection Point

Asset ID	Max Surcharge State	Comments
CN-GIS2013-7436	1	Pipe has capacity but is surcharged by depth. This is the Force Main for Kortright East Sewage Pumping Station so is designed to be surcharged.

3.4 Baseline Constraint Analysis Conclusions

The baseline constraints analysis has identified that in general the existing sewer system has capacity for both 2012 and 2031 flows with few pipes in the downstream network from the potential connection points showing a capacity constraint.

The Clair Gordon and Southgate-Hanlon connection points have no downstream capacity constraints identified by the analysis apart from the triple inverted syphon pipes under the Speed River which are designed to be surcharged.

The Victoria Road connection point has a number of existing downstream capacity constraints for the baseline 2012 scenario (see table 3.4). The model simulation has identified under capacity and surcharging in the main trunk sewer running along the North bank of the Speed River to the WwTW. However, the inclusion of infrastructure projects WW-I-1 & WW-I-1A in the 2031 baseline scenario (see section 2.3 above) resolves the identified constraints (see table 3.7). Upgrade of the existing Kortright East Sewage Pumping Station (model node PS-KRSPS-1) may however be required if flows were to be connected to Victoria Road.

4. Clair Maltby Lands Constraints Analysis

4.1 Introduction

Model simulations were carried out to gain an understanding of capacity constraints within the sewer network downstream of the 3 potential connection points with the Clair Maltby Lands and associated flows included. This exercise was carried out using the 2031-time horizon network and flows.

A constraint is defined as a surcharged pipe with a “Max Surcharge State” of ≥ 1.0 from the ICM simulation results as described in Figure 3.4 above.

4.2 Clair Maltby Lands – Model Input

The model was updated by adding an additional subcatchment to represent the Clair Maltby Lands and the associated population and II flows. This has applied to the three connection points using three separate modelled scenarios.

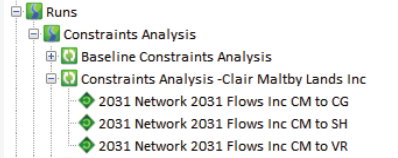
Details of the modelled subcatchment can be found in Table 4.1. All population and flow figures were provided by Wood Canada.

Table 4.1 Clair Maltby Lands - Modelled Subcatchment Details

	Clair Gordon Connection Point	Southgate-Hanlon Connection Point	Victoria Road Connection Point	Comments
Subcatchment ID	Clair Maltby Lands	Clair Maltby Lands	Clair Maltby Lands	
System Type	Sanitary	Sanitary	Sanitary	
Drains to Node ID	MH-GIS2013-6404	MH-GIS2013-6995	MH-GIS2013-6775	Most appropriate existing connection manhole for each scenario.
Total Area (ha)	538.105	538.105	538.105	
Developable Area (ha)	245.9	245.9	245.9	
Wastewater Profile	PEAK2	PEAK2	PEAK2	Uses consumption rate of 300l/h/d with an associated diurnal profile with a maximum multiplier of 2xDWF
Population	21,668	21,668	21,668	
Baseflow II (l/s)	68.852	68.852	68.852	Infiltration & Inflow has been applied as a constant baseflow based on the total developable lands area of 245.9ha @ 0.28l/s/ha
RDII	N/A	N/A	N/A	No RDII has been applied to the Clair Maltby Lands subcatchment.

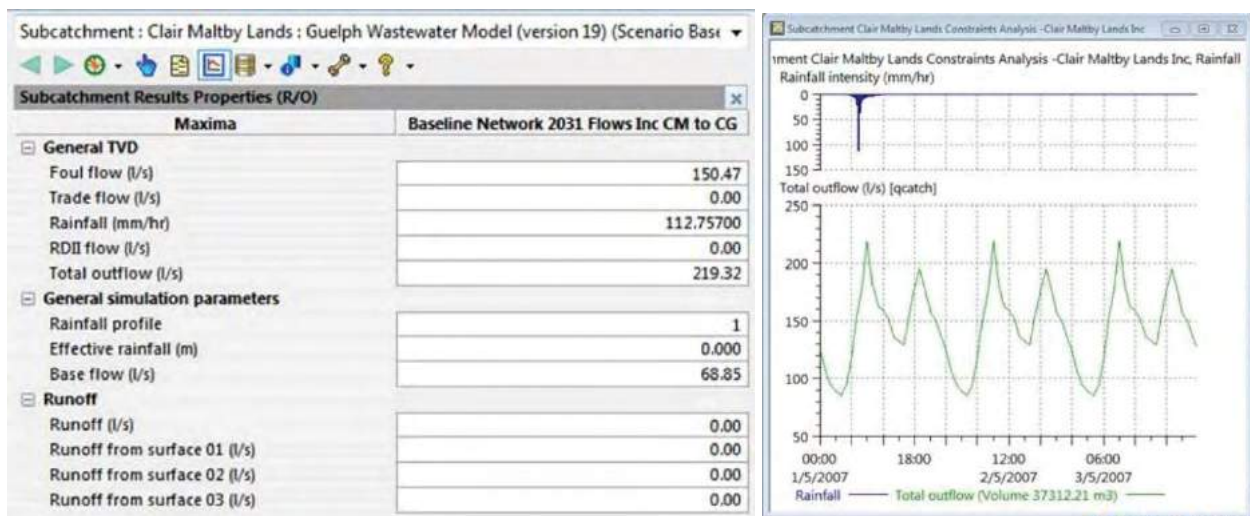
Table 4.2 below details the simulation parameters and input files used for the Clair Maltby Lands constraints analysis:

Table 4.2 Clair Maltby Lands Constraints Analysis – Model Simulation Parameters

	Details	Comments
ICM Model Scenario	- 2031 Network 2031 Flows Inc CM to CG - 2031 Network 2031 Flows Inc CM to SH - 2031 Network 2031 Flows Inc CM to VR	Three model scenarios representing different connection points for Clair Maltby Lands flows.
Rainfall	M25 Design storm (25YRCHICDES)	25-year return period design storm taken directly from InfoSWMM model.
WasteWater	Clair Maltby Lands Waste Water	As "2012_WEXISTING Waste water" wastewater file put with 300l/h/d consumption rate added to profile 10 "PEAK2" so Clair Maltby Lands could be modelled as a population rather than a flow rate.
Simulation Start Date/Time	01/05/2007 @ 00:00	As per InfoSWMM & Baseline Constraints Analysis simulations
Simulation Finish Date/Time	03/05/2007 @ 23:45	As per InfoSWMM & Baseline Constraints Analysis simulations
Simulation Timestep	20 seconds	As per InfoSWMM & Baseline Constraints Analysis simulations
Results Timestep	900 seconds	As per InfoSWMM & Baseline Constraints Analysis simulations
Simulation Name	Constraints Analysis -Clair Maltby Lands Inc	

When running the model with the above simulation parameters and inputs associated with the Clair Maltby Lands, the model subcatchment representing the development generates a peak total flow rate of circa 220l/s. Figure 4.1 below gives more detailed breakdown of flow rates predicted by the model:

Figure 4.1 Clair Maltby Lands – Predicted Model Flows



4.3 Clair Maltby Lands Constraints – Clair Gordon Connection Point

From the corresponding model simulation, Figure 4.2 and Table 4.3 identifies the downstream constraints from the modelled Clair Gordon connection point with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection point downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix D** alongside model longsections and plans showing the location of identified constraints.

Figure 4.2 Clair Maltby Lands Constraints – Clair Gordon Connection Point

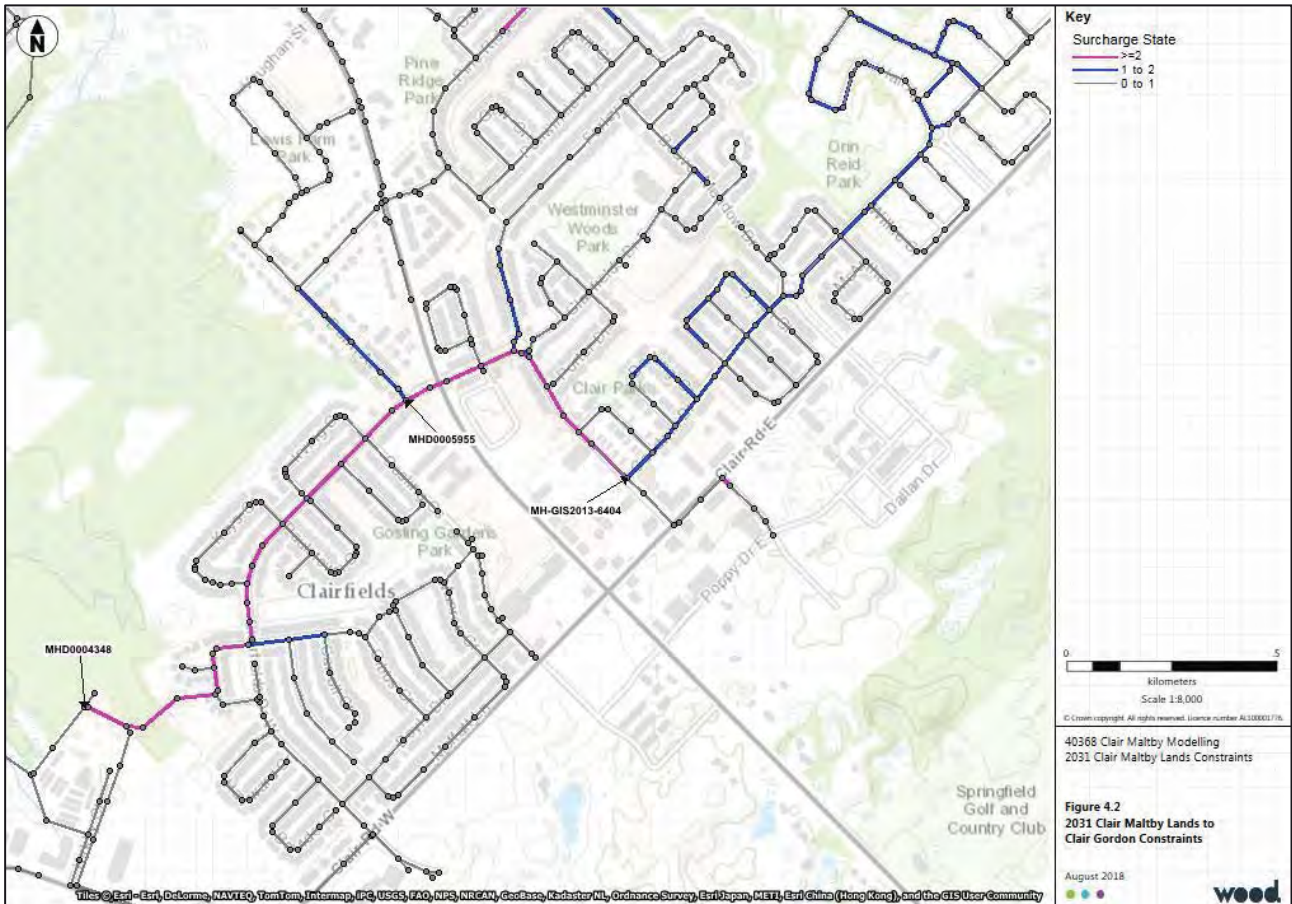


Table 4.3 Clair Maltby Lands Constraints – Clair Gordon Connection Point

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7027	2.0	254.87	116	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7028	2.0	254.29	173	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7029	2.0	253.98	139	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005977	2.0	344.02	290	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0005979	2.0	343.96	275	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005980	2.0	355.98	300	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005981	2.0	356.07	297	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005982	2.0	356.17	296	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005984	2.0	356.68	325	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005985	2.0	356.72	322	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005986	2.0	389.98	305	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005990	2.0	390.32	310	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005991	2.0	390.46	207	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005992	2.0	392.25	323	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005993	2.0	392.28	330	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006515	2.0	335.76	300	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006516	2.0	343.66	327	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006517	2.0	343.81	314	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006518	2.0	331.48	323	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006519	2.0	333.51	309	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006520	2.0	335.31	315	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006521	2.0	327.45	305	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006522	2.0	327.83	303	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0006523	2.0	330.34	304	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006532	2.0	264.92	144	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006533	2.0	266.96	128	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006534	2.0	266.98	150	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006535	2.0	267.09	117	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006553	2.0	260.54	218	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006554	2.0	255.03	133	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006555	2.0	255.04	150	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006556	2.0	254.94	114	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006621	2.0	335.56	300	Sewer downstream of development connection point. Pipe is now under capacity.
SIP0000017	1.0	271.83	1309	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	64.61	114	
SIP0000019	1.0	585.82	1850	

From the above figure and table, the addition of the flows from the Clair Maltby Lands to the proposed Clair Gordon connection point has resulted in several downstream constraints. With the Clair Maltby Lands flows applied to MH MH-GIS2013-6404, a section of sewer between the connection point and MH MHD0004348, approximately 1,950m downstream, becomes under capacity resulting in surcharge to the system (top water level above pipe soffit/overt). The capacity restraint caused by the additional flows also results in backing up and surcharge to the upstream system (see dark blue pipes on figure 4.2). Downstream of MH MHD0004348 no further surcharge is predicted by the model and the existing sewers have sufficient capacity to accommodate the additional flows.

Although the additional flows from the Clair Maltby Lands produce significant surcharge in the existing sewer system, no flooding is predicted by the model in the vicinity of the Claire Gordon or at any point downstream to the treatment works, i.e. top water levels do not exceed ground level.

4.4 Clair Maltby Lands Constraint – Southgate-Hanlon Connection Point

From the corresponding model simulation, Figure 4.3 and Table 4.4 identifies the downstream constraints from the modelled Southgate-Hanlon connection point with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection point downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix E** alongside model longsections and plans showing the location of identified constraints.

Figure 4.3 Clair Maltby Lands Constraints– Southgate-Hanlon Connection Point

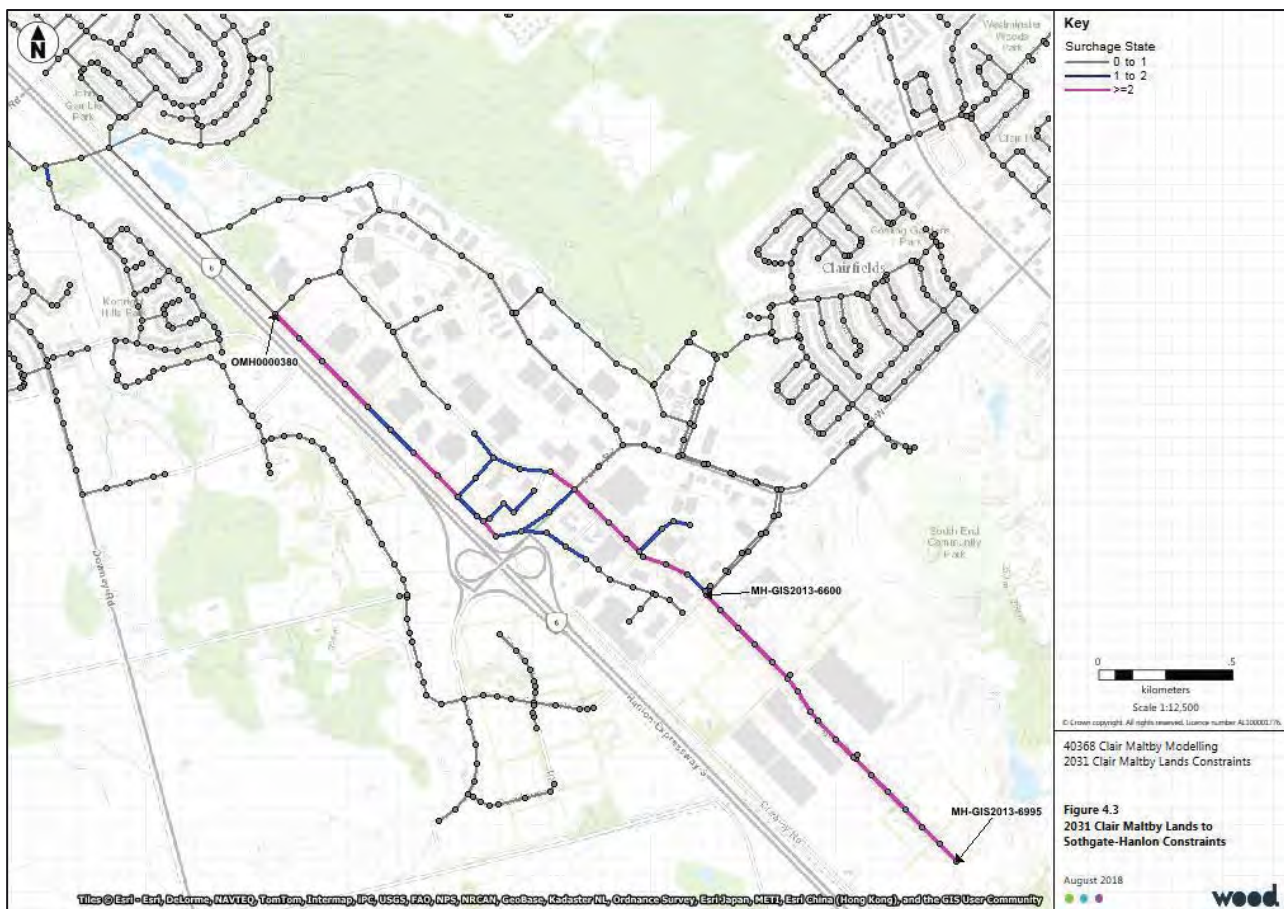


Table 4.4 Clair Maltby Lands Constraints– Clair Gordon Connection Point

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7275	2.0	246.39	188	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7027	2.0	244.55	170	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7028	2.0	243.19	174	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7029	2.0	241.81	172	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005977	2.0	240.77	165	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005979	2.0	238.63	178	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005980	2.0	237.97	172	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005981	2.0	237.06	186	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005982	2.0	236.18	172	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005984	2.0	235.26	181	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005985	2.0	232.89	163	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005986	2.0	233.12	162	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005990	2.0	232.92	155	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005991	2.0	232.11	180	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005992	2.0	231.3	168	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005993	2.0	230.74	169	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006515	2.0	230.43	171	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006516	2.0	54.41	37	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006517	2.0	121.78	83	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006518	2.0	122.22	84	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006519	2.0	123.67	123	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006520	2.0	124.11	112	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0006521	2.0	125.66	110	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006522	2.0	70	67	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006523	2.0	96.91	71	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006532	2.0	98.58	60	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006533	2.0	99.79	89	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006534	2.0	94.39	71	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006535	2.0	94.54	61	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006553	2.0	94.57	84	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006554	2.0	95.85	57	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006555	2.0	126.11	113	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7274	1.0	93.96	318	Pipes have capacity but are surcharge by depth due to downstream sewer incapacity (see above pipes).
CN-GIS2013-7495	1.0	70.16	104	
SED0004677	1.0	55	82	
SED0004679	1.0	55.36	83	
SED0004683	1.0	56.47	95	
SED0004684	1.0	56.84	98	
SED0004702	1.0	56.44	88	
SED0004704	1.0	57.29	80	
SED0004727	1.0	122.71	132	
SED0004728	1.0	123.18	124	
SED0004732	1.0	69.87	93	
SED0004734	1.0	70.29	84	

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0004742	1.0	94.25	171	
SIP0000017	1.0	277.65	1309	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	64.62	114	
SIP0000019	1.0	597.91	1850	

From the above figure and table, the addition of the flows from the Clair Maltby Lands to the proposed Southgate-Hanlon connection point has resulted in several downstream constraints. With the Clair Maltby Lands flows applied to MH MH-GIS2013-6995, sections of sewer between the connection point and MH OMH0000380, approximately 3,500m downstream, become under capacity resulting in surcharge to the system (top water level above pipe soffit/overt). Downstream of MH OMH0000380 no further surcharge is predicted by the model and the existing sewers have sufficient capacity to accommodate the additional flows.

Although the additional flows from the Clair Maltby Lands produce significant surcharge in the existing sewer system, no flooding is predicted by the model in the vicinity of the Southgate-Hanlon or at any point downstream to the treatment works, i.e. top water levels do not exceed ground level.

4.5 Clair Maltby Lands Constraint – Victoria Road Connection Point

From the corresponding model simulation, Figure 4.4 and Table 4.5 identifies the downstream constraints from the modelled Victoria Road connection point with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection point downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix F** alongside model longsections and plans showing the location of identified constraints.

Figure 4.4 Clair Maltby Lands Constraints– Victoria Road Connection Point

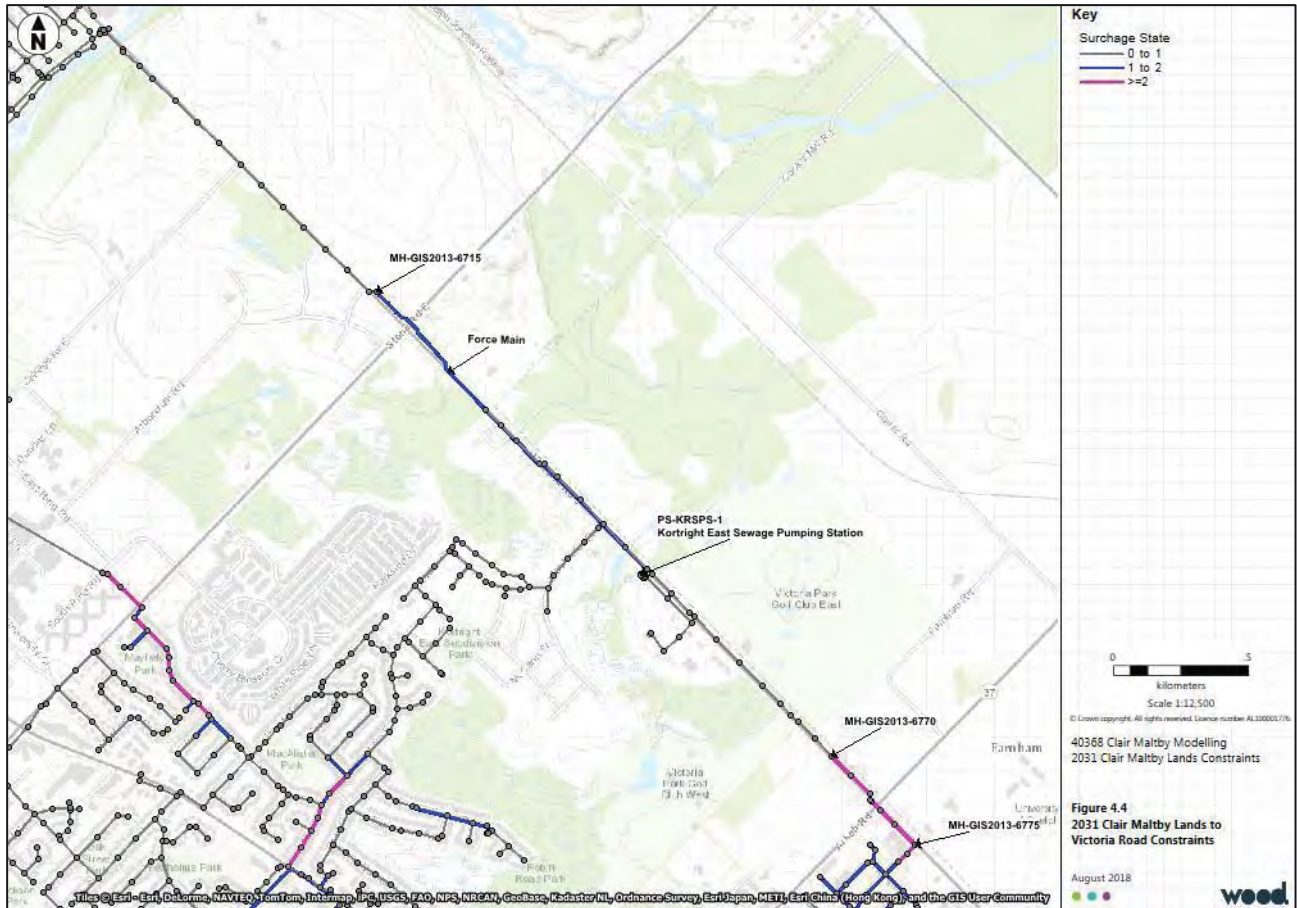


Table 4.5 Clair Maltby Lands Constraints– Victoria Road Connection Point

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7459	2.0	76.68	67	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7461	2.0	73.33	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7462	2.0	76.68	27	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7463	2.0	76.68	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7464	2.0	73.19	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7465	2.0	73.21	32	Sewer downstream of development connection point. Pipe is now under capacity.

CN-GIS2013-7466	2.0	73.26	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7436	1.0	196.39	161	Pipe has capacity but is surcharged by depth. This is the Force Main for Kortright East Sewage Pumping Station so is designed to be surcharged.

From the above figure and table, the addition of the flows from the Clair Maltby Lands to the proposed Victoria Road connection point has resulted in downstream constraints close to the connection point itself. With the Clair Maltby Lands flows applied to MH MH-GIS2013-6775 the section of sewer between the connection point and MH MH-GIS2013-6770, approximately 450m downstream, becomes significantly under capacity resulting in surcharge to the system (top water level above pipe soffit/overt). Downstream of MH MH-GIS2013-6770 no further surcharge is predicted by the model and the existing sewers have sufficient capacity to accommodate the additional flows. However, the additional flows from the Clair Maltby Lands to MH MH-GIS2013-6775 are likely to have an impact on the capacity and operation of Kortright East Sewage Pumping Station (model node PS-KRSPS-1) which may need to be investigated further if this connection point is taken forward.

In addition to surcharge, top water levels are also exceeding ground level at points on the network in the vicinity of the Victoria Road connection point. The model predicts significant new flooding in a number of locations as a direct impact of the inclusion of the developments flows to MH MH-GIS2013-6775. Figure 4.5 and Table 4.6 below highlight the locations of the sewer flooding predicted by the model:

Figure 4.5 Clair Maltby Lands Constraints Analysis 2031 Flows – Victoria Road Flooding

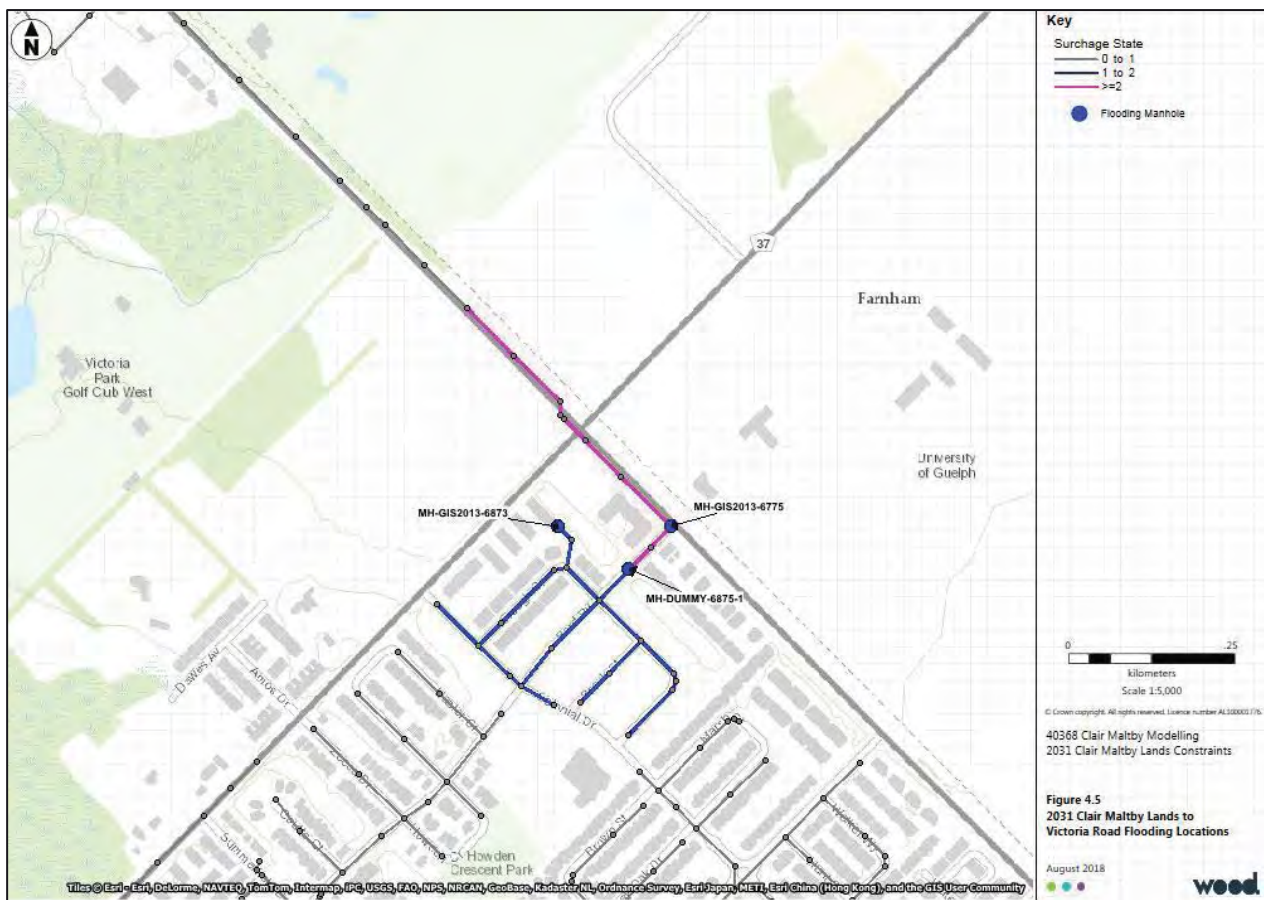


Table 4.6 Clair Maltby Lands Constraints Analysis 2031 Flows – Victoria Road Flooding

Manhole ID	2031 Network 2031 Flows Flood/Lost Volume (m ³)	2031 Network 2031 Flows – Clair Maltby to Victoria Road Flood/Lost Volume (m ³)
MH-DUMMY-6875-1	0	9076.5
MH-GIS2013-6775	0	7936.8
MH-GIS2013-6873	0	2351.3

5. Development Phasing

The constraints analysis for all three potential connection points for the entire Clair Maltby Lands resulted in the identification of significant capacity constraints in the downstream system. Further model analysis was therefore undertaken to identify the percentage of the lands (population and II flows) that could be connected to each point without causing downstream surcharge. This therefore provides an indication of the amount of the lands that can be developed without the need to upgrade the existing sewer system. Alternative connection points for the remaining phases of development, as well as a connection point for the full development, have also been identified.

5.1 Development Phasing - Clair Gordon Connection Point

Model analysis showed that 40% of the Clair Maltby Lands can be accommodated without any detrimental effect on the downstream system. This equates to a population of 8,667 and II of 27.54l/s.

Further analysis showed that if an alternative connection point at MH MHD0005955 is utilised, the system can accommodate 60% of the Clair Maltby Lands. This equates to 13,000 population and 44.75l/s II. There is no predicted downstream surcharge due to an increase in pipe size at this point from 450mm to 600mm diameter.

Alternatively, 100% of the developable lands could be connected to MH MHD0004348 as the system downstream of this point is able to accommodate all of the development flows. There are no predicted constraints in the system downstream to the treatment works.

Figure 4.2 above identifies the three potential connection points on the Clair Gordon system.

5.2 Development Phasing – Southgate-Hanlon Connection Point

Model analysis showed that only 10% of the Clair Maltby Lands can be accommodated without any detrimental effect on the downstream system. This equates to a population of 2,167 and II of 6.88l/s.

Further analysis showed that 100% of the developable lands could be connected to an alternative location, MH OMH0000380, where the downstream system is able to accommodate the development flows.

Figure 4.3 above identifies the two potential connection points on the Southgate-Hanlon system.

5.3 Development Phasing – Victoria Road Connection Point

Model analysis showed that only 10% of the Clair Maltby Lands can be accommodated without any detrimental effect on the downstream system. This equates to a population of 2,167 and II of 6.88l/s.

Further analysis showed that if an alternative connection point at MH MH-GIS2013-6770 is used, the model predicts that 40% of the Clair Maltby Lands can be accommodated. This is due to the increase in pipe diameter from 250mm to 375mm resulting in an increased pipe full capacity at this point. The 40% equates to a population of 8,867 and a II flow of 27.54l/s.

Alternatively, 100% of the developable lands could be connected to MH MH-GIS2013-6715 which is situated at the discharge location of the Kortright East Sewage Pumping Station Force Main. The model predicts no detriment to the system. In addition, this would remove the need to upgrade the pumping station to accommodate the additional flows from the Clair Maltby Lands.

Figure 4.4 above identifies the three potential connection points on the Victoria Road system.

Author

Reviewer

.....
Alistair Dalton

.....
Iris Isaksen

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Appendix A

Model Validation log

Refer to digital folder "Appendix A - Model Validation log"



Appendix B

Constraints Analysis 2012 Network 2012 Flows

Refer to digital folder "Appendix B - Constraints Analysis 2012 Network 2012 Flows"

Appendix C

Constraints Analysis 2031 Network 2031 Flows

Refer to digital folder "Appendix C - Constraints Analysis 2031 Network 2031 Flows"

Appendix D

Constraints Analysis Clair Gordon Connection Point

Refer to digital folder "Appendix D - Constraints Analysis Clair Gordon Connection Point"

Appendix E

Constraints Analysis Southgate-Hanlon Connection Point

Refer to digital folder "Appendix E - Constraints Analysis Southgate-Hanlon Connection Point"

Appendix F

Constraints Analysis Victoria Road Connection Point

Refer to digital folder "Appendix F - Constraints Analysis Victoria Road Connection Point"

Appendix G

Clair Maltby InfoWorks ICM Model

Refer to digital folder "Appendix G - InfoWorks ICM Model"

Memo

To: Rajan Sawhney (Wood)
From: Ali Aamir (Wood)
Date: June 24, 2020
File: N/A
cc: Steve Chipps, Ron Scheckenberger (Wood)
Re: **Clair Maltby Servicing - Wastewater Model Setup**

1.0 Introduction:

The Clair Maltby Secondary Plan (CMSP) Lands wastewater modelling has been developed using Civica Infrastructure's sanitary model as a base, with revised modelling as developed by Wood representing the proposed wastewater servicing for the Clair Maltby Secondary Plan Lands.

Four alternatives have been assessed for the sanitary modelling, each with different proposed outlet locations for the sanitary sewer connection to the City of Guelph from CMSP lands. Wood produced alternatives consist of the Victoria Trunk connection, the Clair Gordon Trunk connection, and the Southgate Hanlon Trunk connection. Wood also assessed an additional alternative as proposed by MTE Consultants (the Southend Park and Valleyland Trunk connection), to determine its veracity. Based upon Wood's assessment, the Southend Park and Valleyland Trunk sewer connection as proposed by MTE Consultants is currently the preferred alternative.

This memorandum provides a brief overview of the development of the wastewater modelling for the CMSP lands by providing an outline of all alternatives.

2.0 Model Development

The sanitary models for CMSP lands have been generated using PCSWMM 7.2 (running on SWM engine 5.1.013), and are an extension of the sanitary model as provided by Civica Infrastructure, which has been calibrated based upon the latest flow monitoring information for the lands immediately north of CMSP (Clairfield Subdivision).

Wood was also provided with the City of Guelph sanitary model which consisted of the entirety of the City of Guelph's wastewater infrastructure. This model was used to provide additional information for certain nodes within Wood's sanitary modelling.

Flow allocation has been based upon a predicted population of approximately 27,324, which consists of the total CMSP population of 23,759, and an additional population loading of 3,471 (consisting of 15% of the primary CMSP population) from potential additional Zone 3 lands outside of the CMSP area. This population has been used to estimate the required demands for the CMSP lands.



City of Guelph

June 24, 2020

The population has been distributed based upon the land use plan information provided by Brook McIlroy in August, 2019. Demands have been split between several land use types, including residential, commercial, and mixed use. While the land use is not expected to drastically change over the course of development, it should be noted that the demand allocation will have to be revised should there be any change in either the overall population, or the land use within CMSP lands. This will also include the population estimates attributed to any potential additional Zone 3 lands outside of the CMSP area.

The dry weather flow (DWF) has been based upon an average demand of 300 L/s, which has been split based upon the aforementioned population and land use types. Infiltration and inflow (I/I) have also been addressed within the modelling and form the baseline demand at each demand node within the sanitary model. The I/I values are based upon a factor of 0.28 L/s-ha, and have been split based upon the contributing sanitary drainage area as per the land use plan and available contours.

The CMSP lands have been split into five (5) catchments which will have flow generation from a combination of DWF and I/I. These catchments have been further subdivided based upon the land use plan and available contours to provide some granularity in terms of flow allocation, which subsequently allowed further refinement for the modelling in terms of sewer sizing and pumping capacities.

To maintain consistency with the Civica model, the most conservative time pattern (FM02Q) has been borrowed from the Civica model and applied to all DWF nodes in the CMSP lands. This allows similar peaking times and values for CMSP lands as it does for the area already modelled by Civica. In a similar fashion, hydrograph FM-02_1 has also been applied throughout the CMSP lands as well.

As Wood's initial wastewater modelling consisted of the base City model, this revised model is based on Civica Infrastructure's calibrated model for the Clairfields Subdivision. As the calibrated model is more conservative compared to the existing City model, the alternatives presented in Wood's sanitary analysis result in a different set of results compared to the pre-existing modelling as performed by Wood's UK group. This is discussed within the main reporting.

3.0 Alternatives

Four alternatives have been developed by Wood, as follows:

- Victoria Road Trunk – East Connection

Under this alternative, the wastewater from CMSP will be conveyed to the Victoria Road trunk sewer system. As the outlet for this alternative was outside the limits of Civica Infrastructure's modelling, Wood used the provided City model to add in appropriate elevations for the outlet point in an effort to assess this alternative.

- Clair Gordon Trunk – Central Connection

Under this alternative, the wastewater from CMSP will be conveyed to the Clair Gordon trunk sewer system.

- Southgate Hanlon Trunk – West Connection

Under this alternative, the wastewater from CMSP will be conveyed to the Southgate Drive trunk sewer system.

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- Southend Park and Valley Land – West Connection (based upon MTE Consulting's planning)

Under this alternative, the wastewater from CMSP will be conveyed to the Southgate Drive trunk sewer system and will eventually flow into the Hanlon trunk system. Wood matched MTE's layout for the outletting gravity sewer to its connection point. Based upon Wood's assessment, this is the preferred alternative.

The following figures (1 through 4) show the junction locations used for each alternative, as well as overall sanitary sewer (conduits), forcemains, and gravity main servicing. These points have been extracted from the sanitary PCSWMM model and overlaid on a GIS mapping base to show proximate junction locations and overall servicing for each alternative.

Figure 1 - Victoria Trunk Alternative

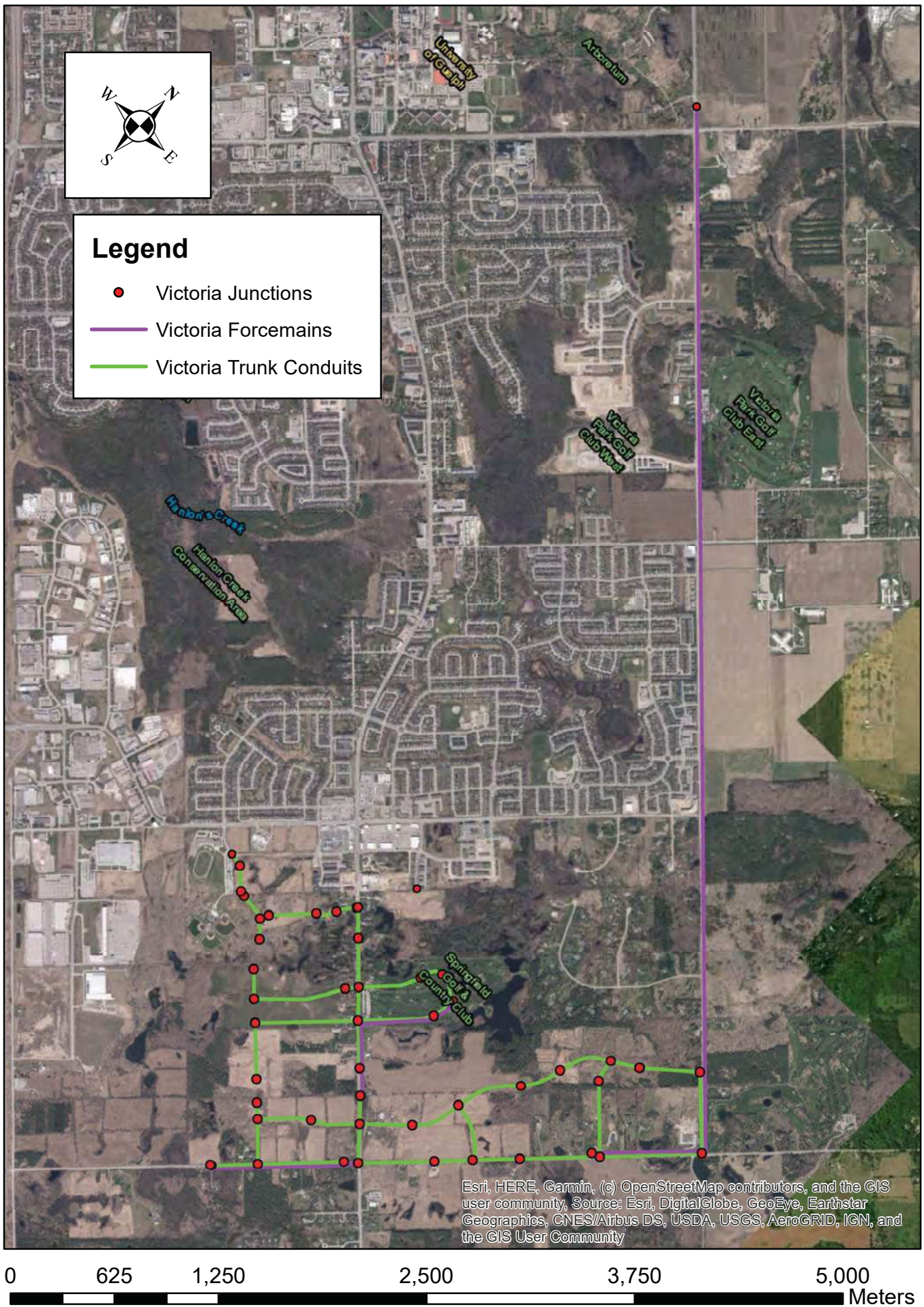


Figure 2 - Clair Gordon Trunk Alternative

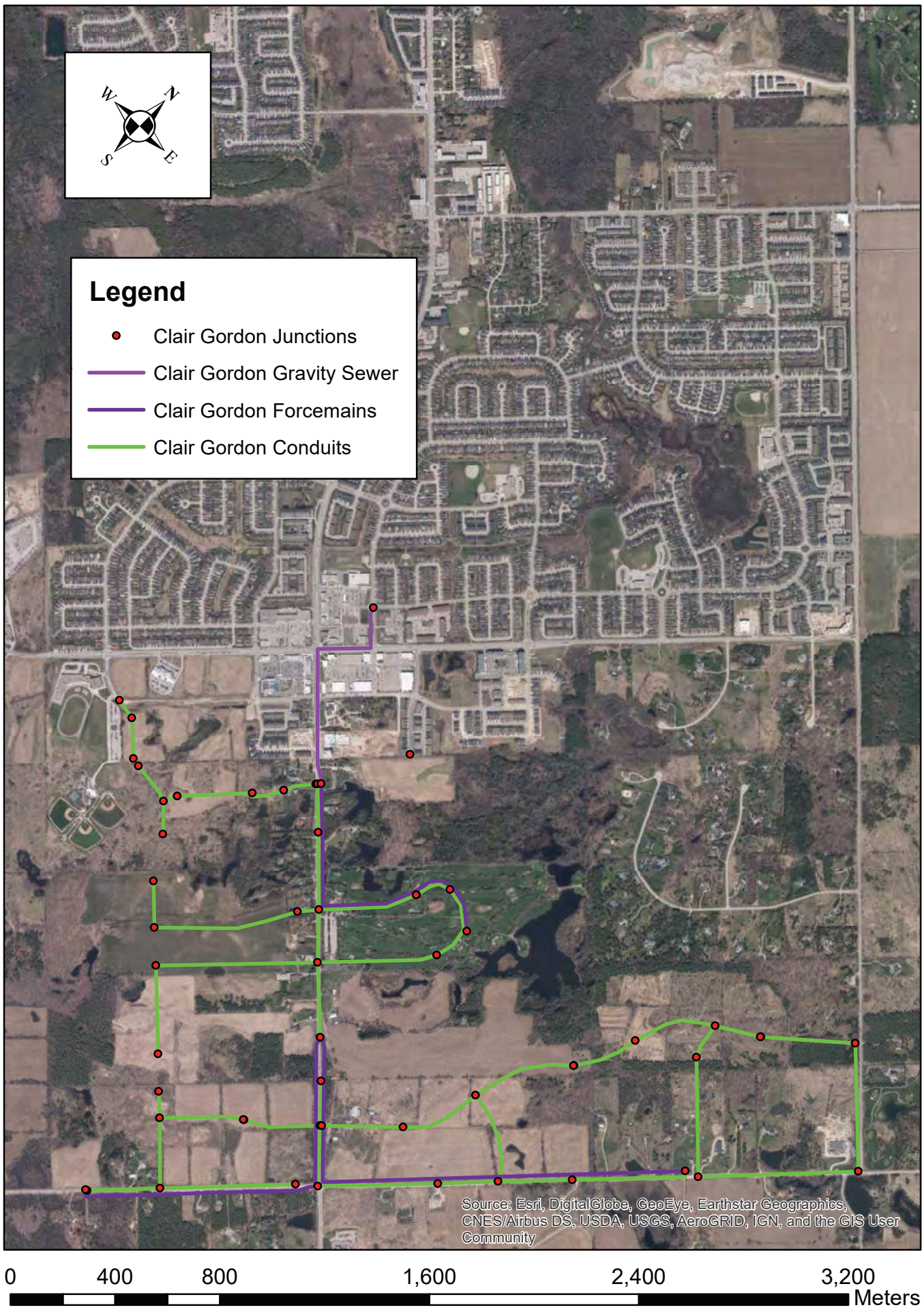


Figure 3 - Southgate Hanlon Trunk Alternative

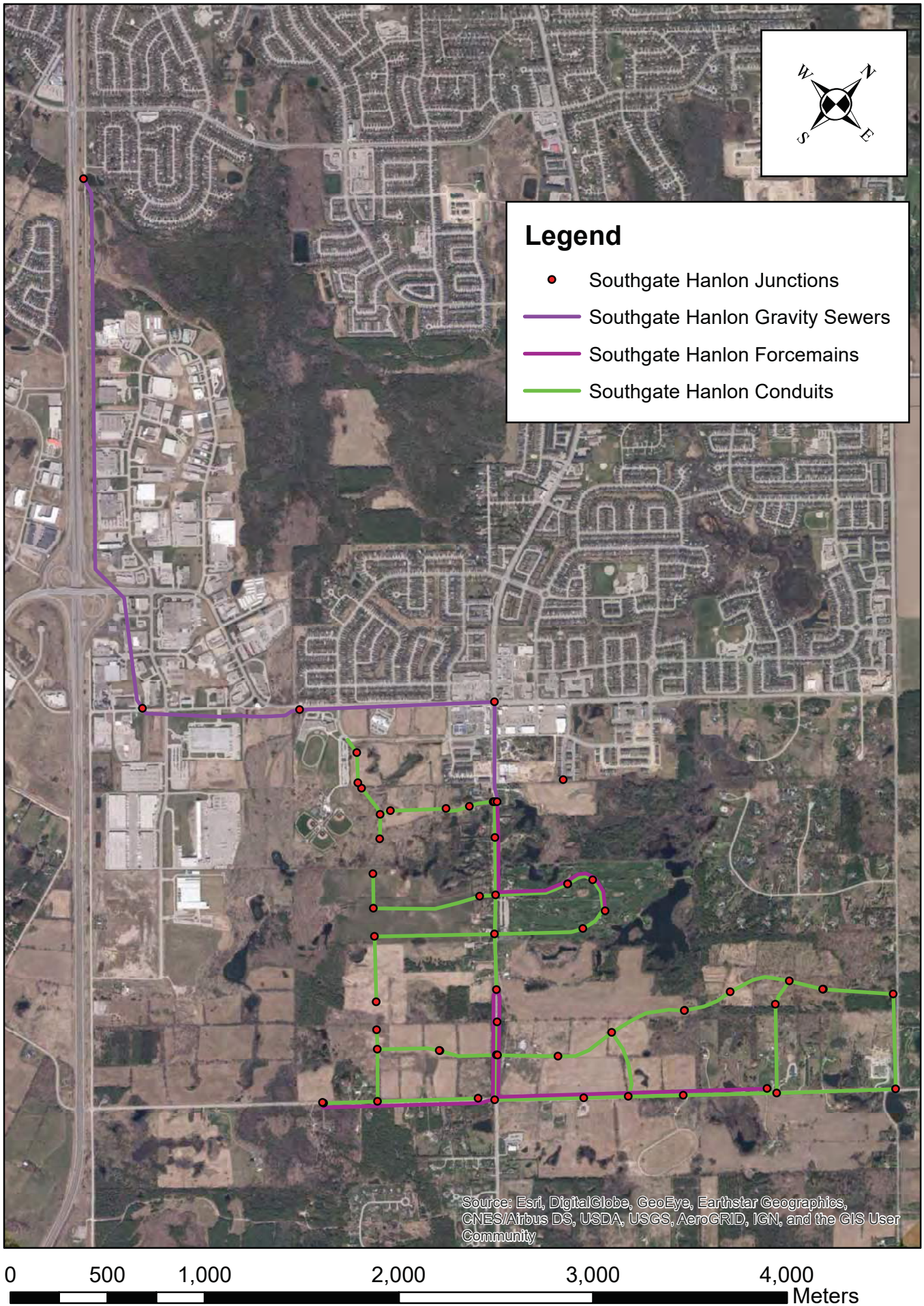
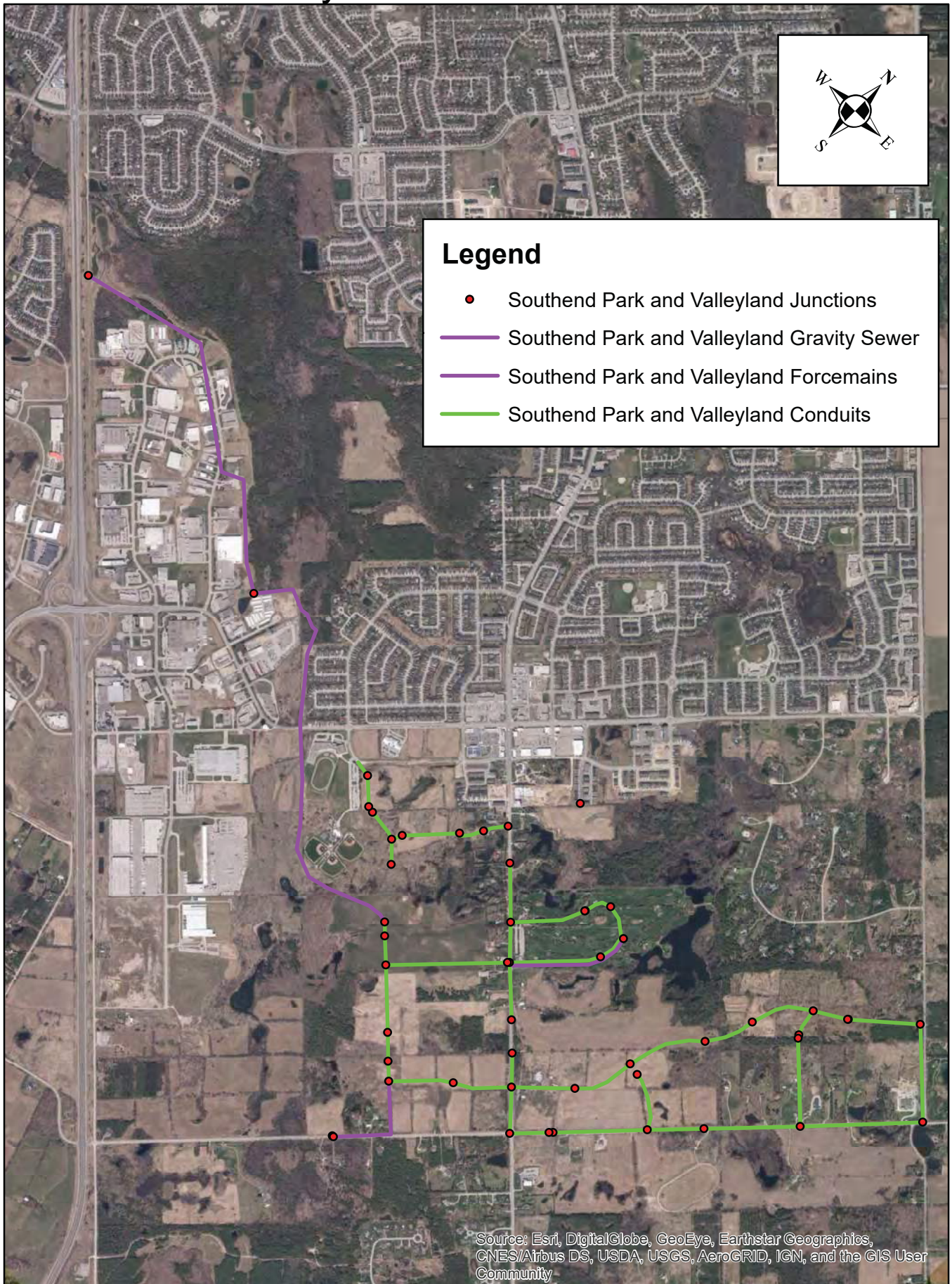


Figure 4 - Southend Park and Valleyland Trunk Alternative

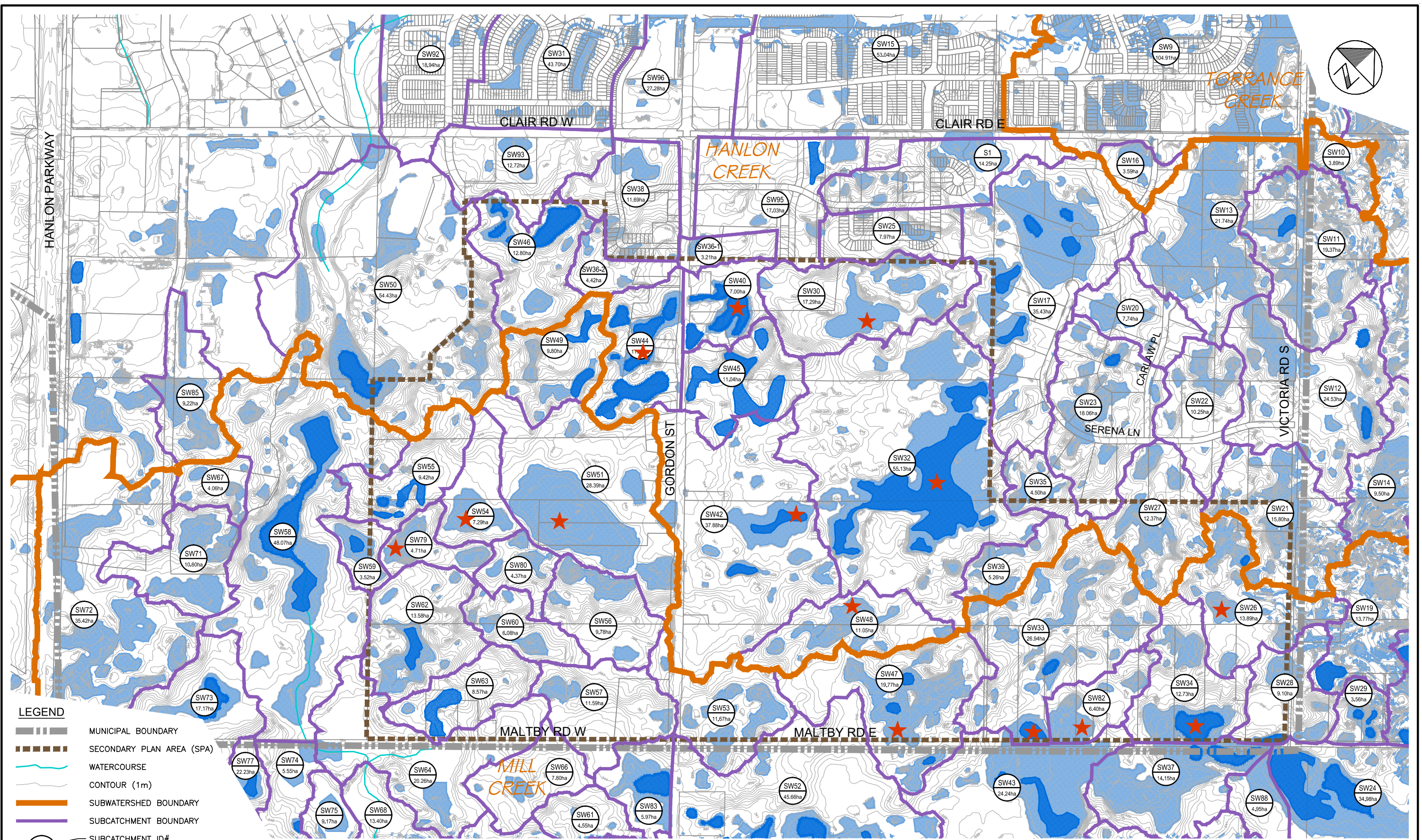


0 500 1,000 2,000 3,000 4,000 Meters

Appendix C
Stormwater



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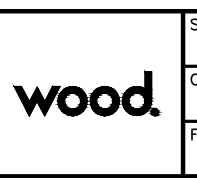


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- SECONDARY PLAN AREA (SPA)
- WATERCOURSE
- CONTOUR (1m)
- SUBWATERSHED BOUNDARY
- SUBCATCHMENT BOUNDARY
- SUBCATCHMENT ID#
- SUBCATCHMENT AREA
- AREA OF DEPRESSION
- AREA OF PONDING
- FEATURE DEPRESSION (>300mm STORAGE DEPTH)

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 SECONDARY PLAN
 CITY OF GUELPH

LOCAL SCALE DRAINAGE
 BOUNDARY PLAN
 (EXISTING CONDITION)



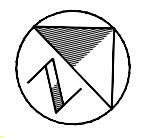
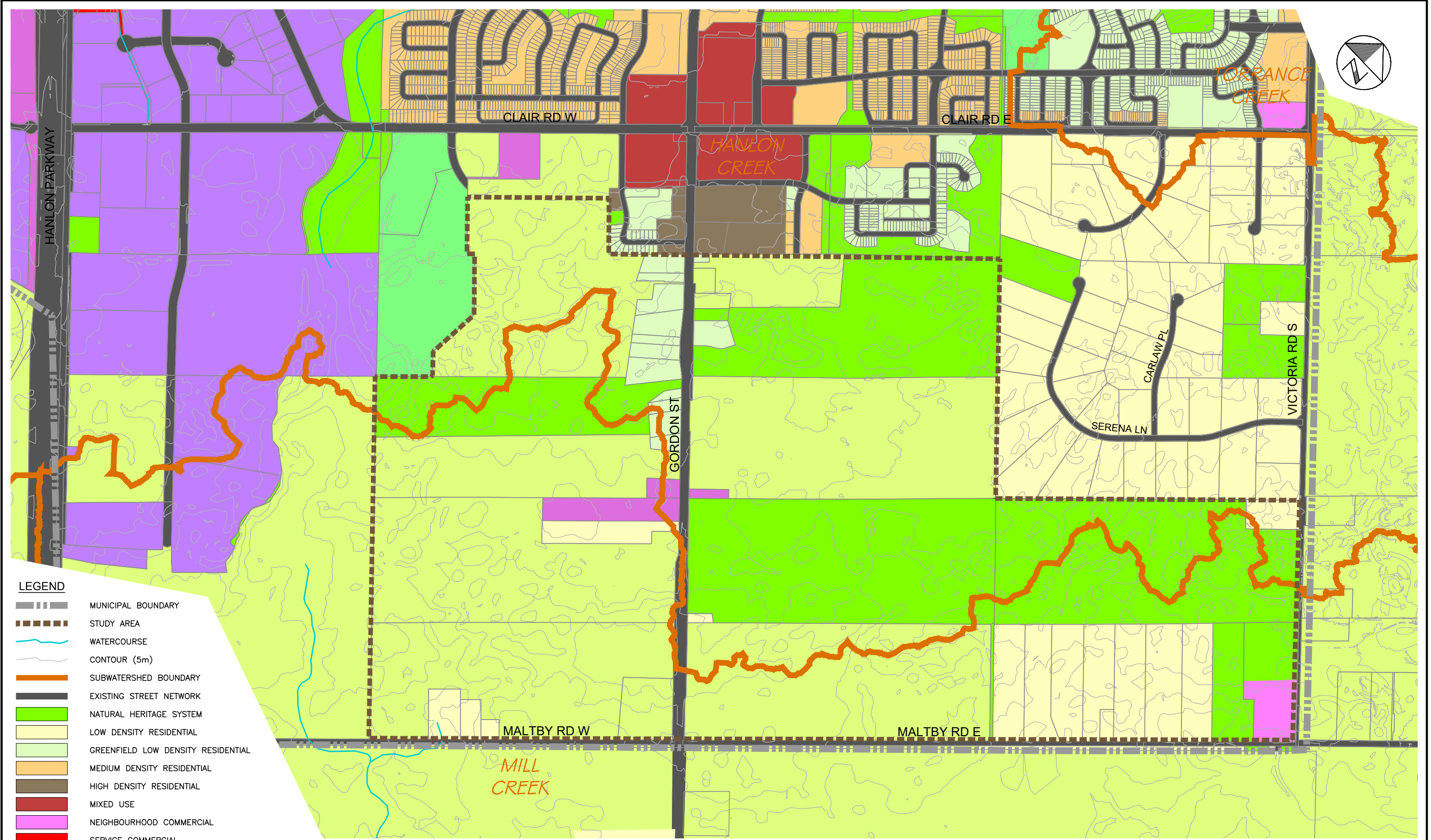
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Figure No.
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	CONTOUR (5m)
	SUBWATERSHED BOUNDARY
	EXISTING STREET NETWORK
	NATURAL HERITAGE SYSTEM
	LOW DENSITY RESIDENTIAL
	GREENFIELD LOW DENSITY RESIDENTIAL
	MEDIUM DENSITY RESIDENTIAL
	HIGH DENSITY RESIDENTIAL
	MIXED USE
	NEIGHBOURHOOD COMMERCIAL
	SERVICE COMMERCIAL
	CORPORATE BUSINESS PARK
	INDUSTRIAL
	OTHER LANDS
	OPEN SPACE AND PARK

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 CITY OF GUELPH

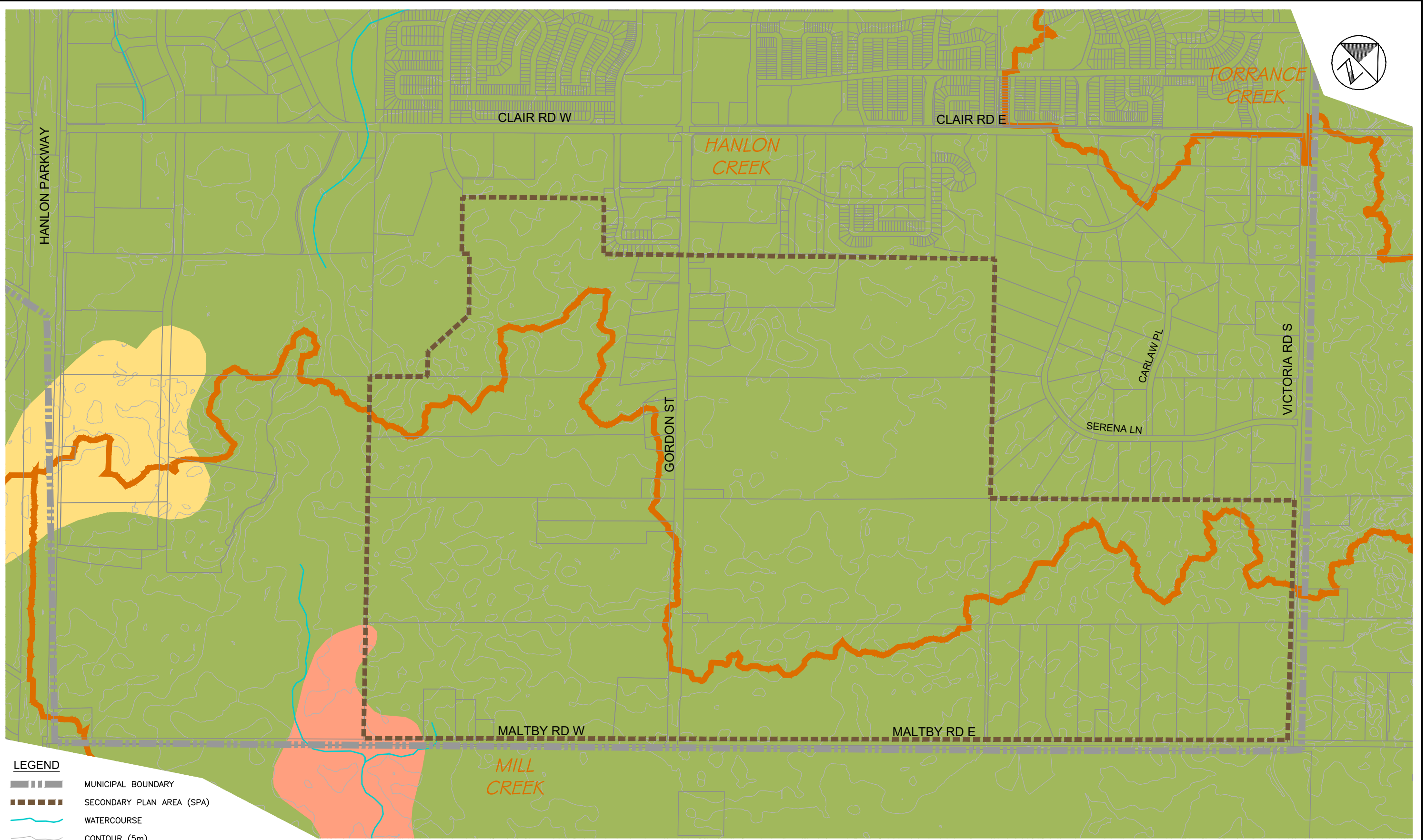
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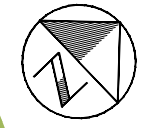
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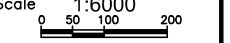
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-  SUBWATERSHED BOUNDARY
-  LOAM
-  SANDY LOAM
-  SILTY CLAY

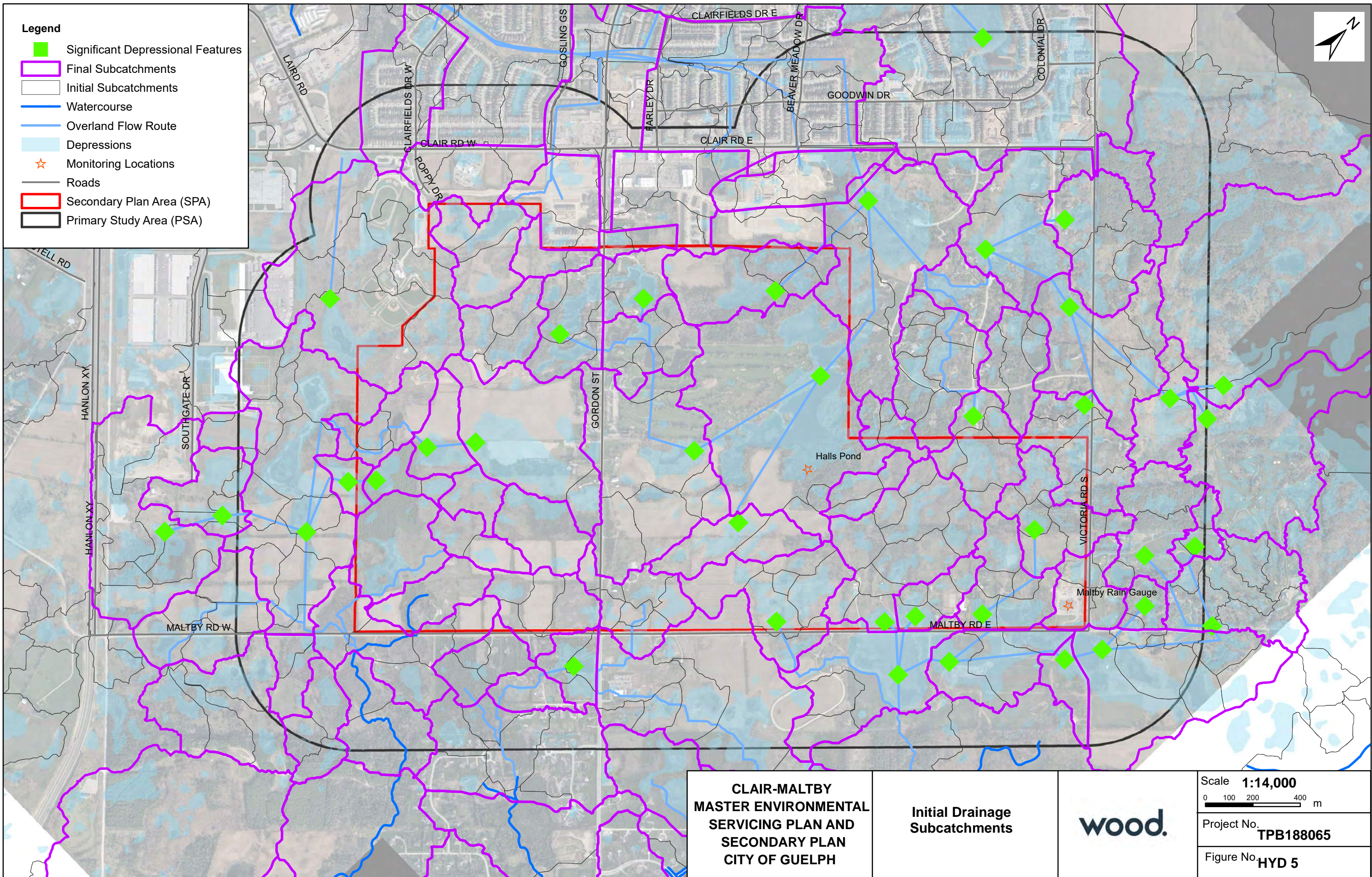


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 CITY OF GUELPH

EXISTING
SOILS CLASSIFICATION
PLAN



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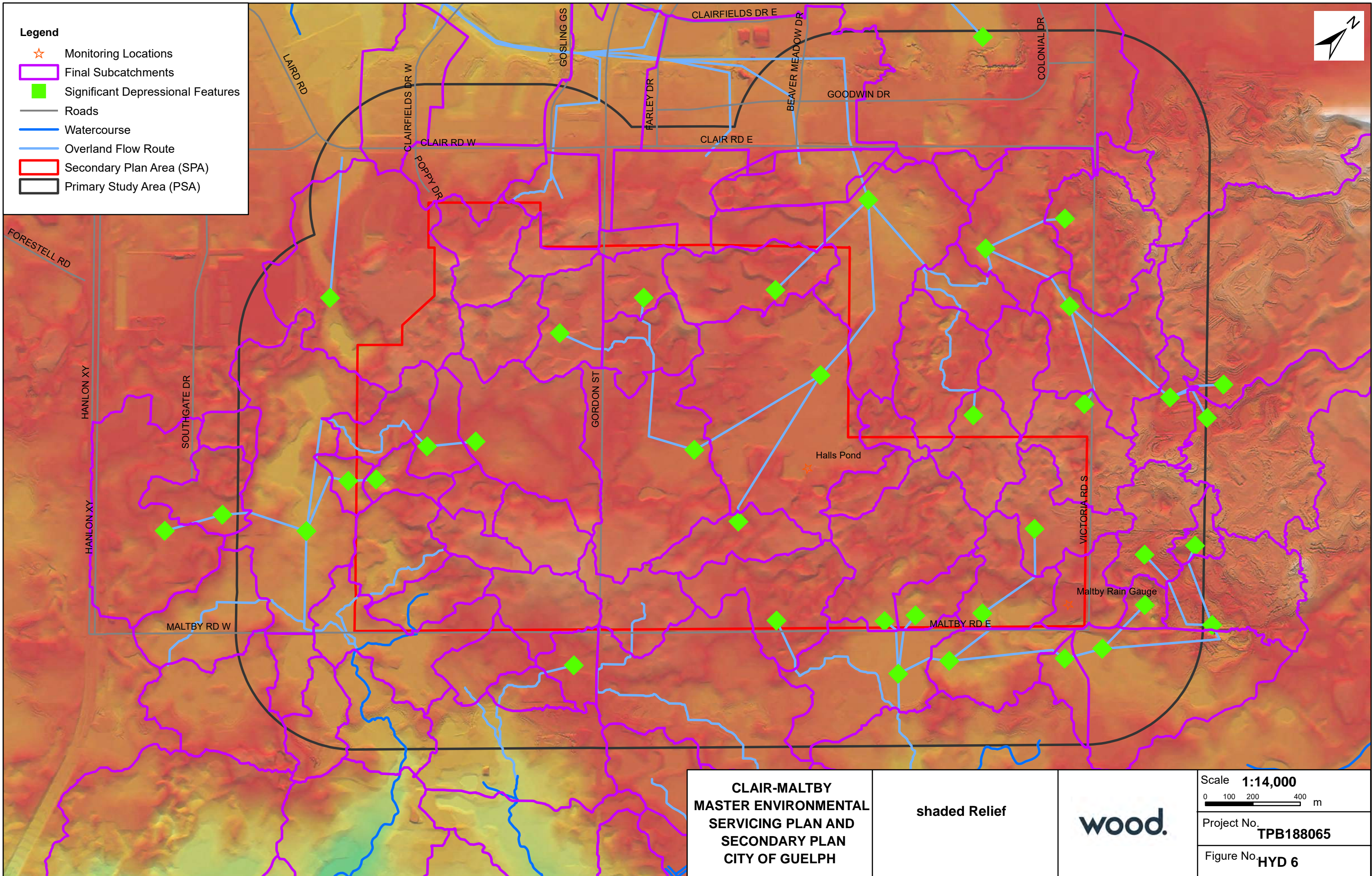


**CLAIR-MALTBY
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SECONDARY PLAN
CITY OF GUELPH**

**Initial Drainage
Subcatchments**



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 Project No. **TPB188065**
 Figure No. **HYD 5**



Legend

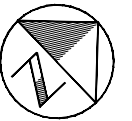
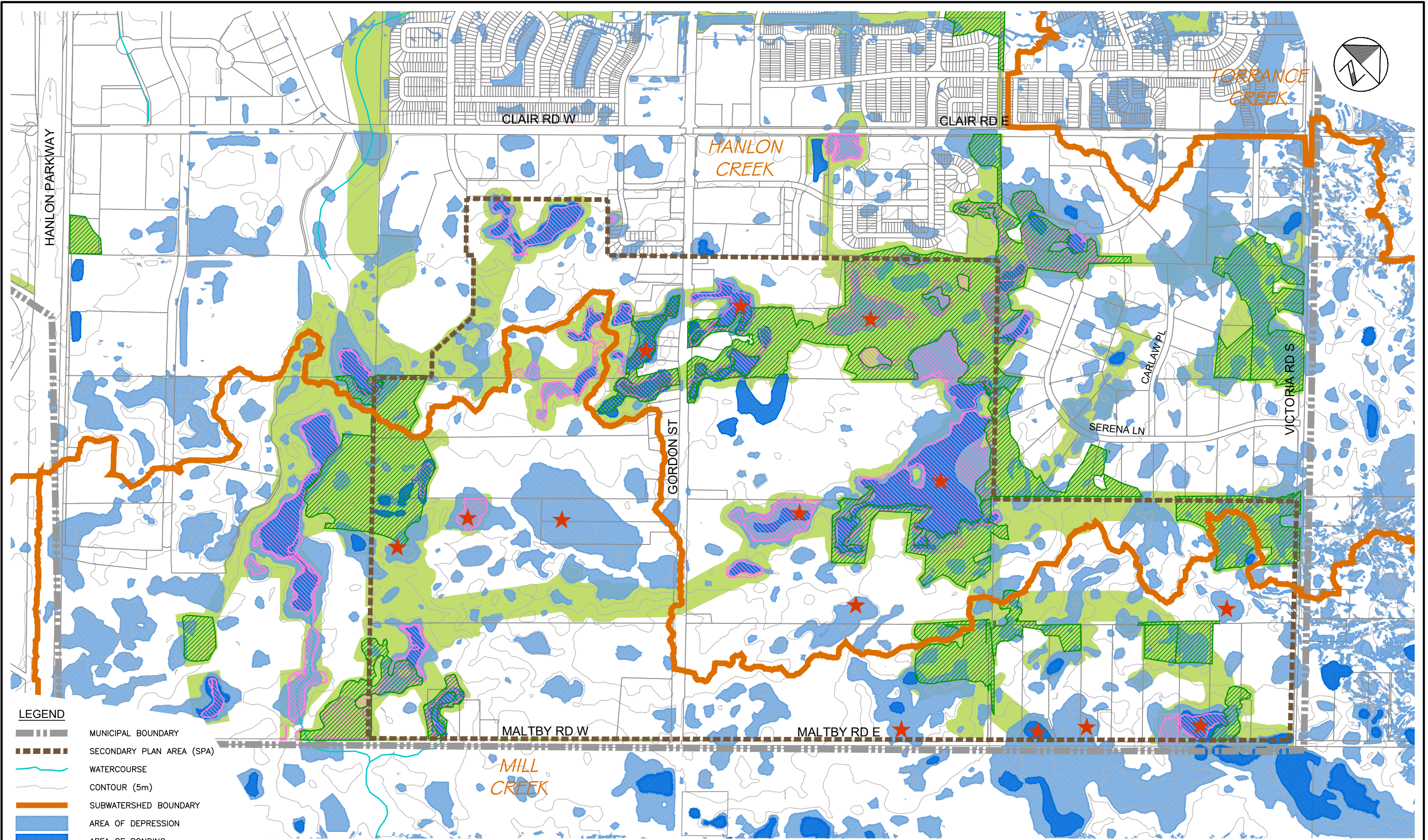
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- Final Subcatchments
- Significant Depressional Features
- Roads
- Watercourse
- Overland Flow Route
- Secondary Plan Area (SPA)
- Primary Study Area (PSA)



<p>CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH</p>	<p>shaded Relief</p>		<p>Scale 1:14,000</p> <p>0 100 200 400 m</p> <hr/> <p>Project No. TPB188065</p> <hr/> <p>Figure No. HYD 6</p>
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	WATERCOURSE
	CONTOUR (5m)
	SUBWATERSHED BOUNDARY
	AREA OF DEPRESSION
	AREA OF PONDING
	FEATURE DEPRESSION (>300mm STORAGE DEPTH)
	NATURAL HERITAGE SYSTEM
	SIGNIFICANT WOODLAND FEATURE
	SIGNIFICANT WETLAND FEATURE

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CITY OF GUELPH

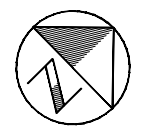
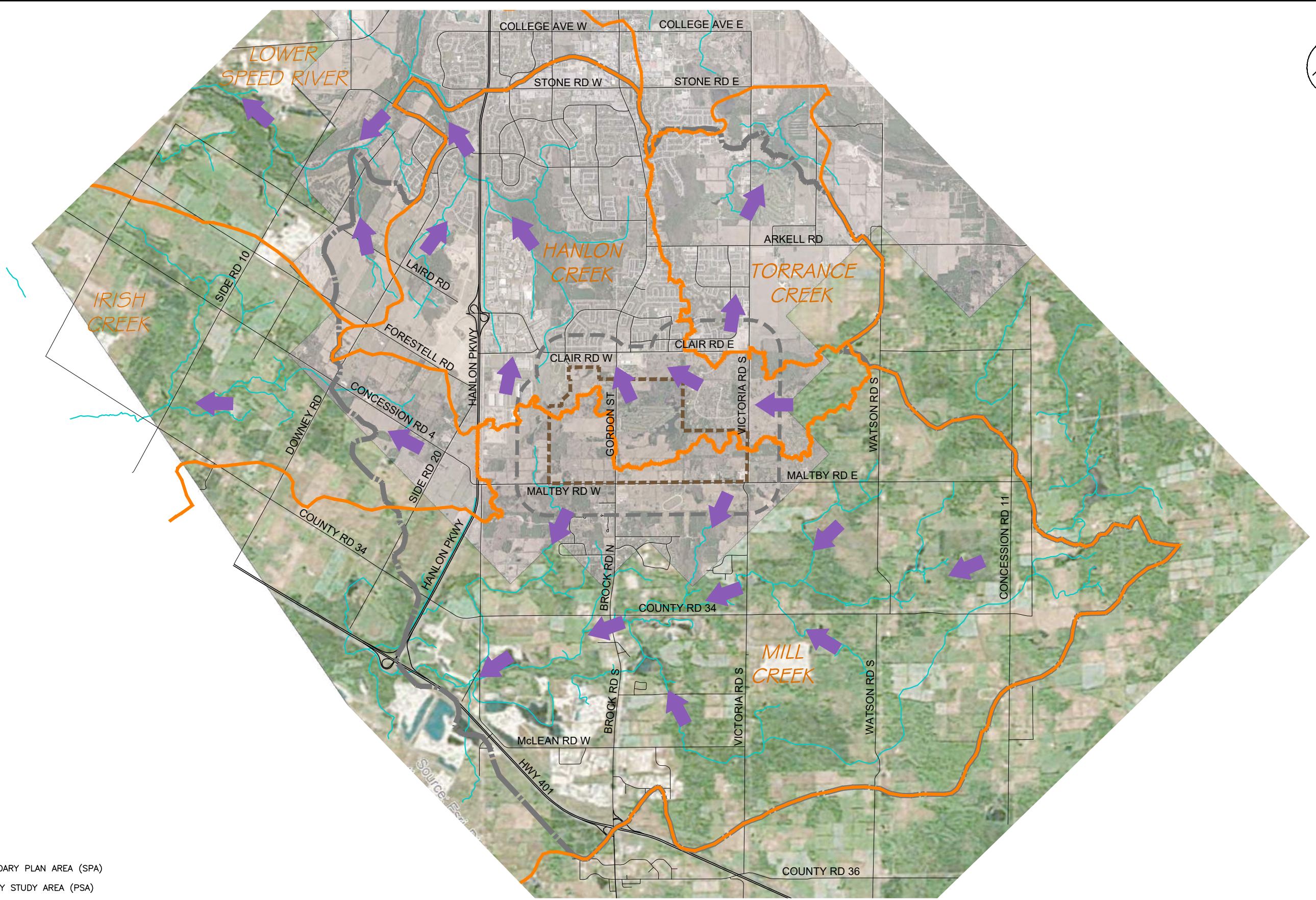
DEPRESSION AREAS WITH
NATURAL HERITAGE SYSTEM
(EXISTING CONDITION)



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- LEGEND**
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 - PRIMARY STUDY AREA (PSA)
 - SECONDARY STUDY AREA (SSA)
 - SUBWATERSHED BOUNDARY
 - WATERCOURSE
 - ROADWAY
 - MAJOR OVERLAND FLOW DIRECTION

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 SECONDARY PLAN
 CITY OF GUELPH

SUBWATERSHED
 DRAINAGE PATTERN
 PLAN



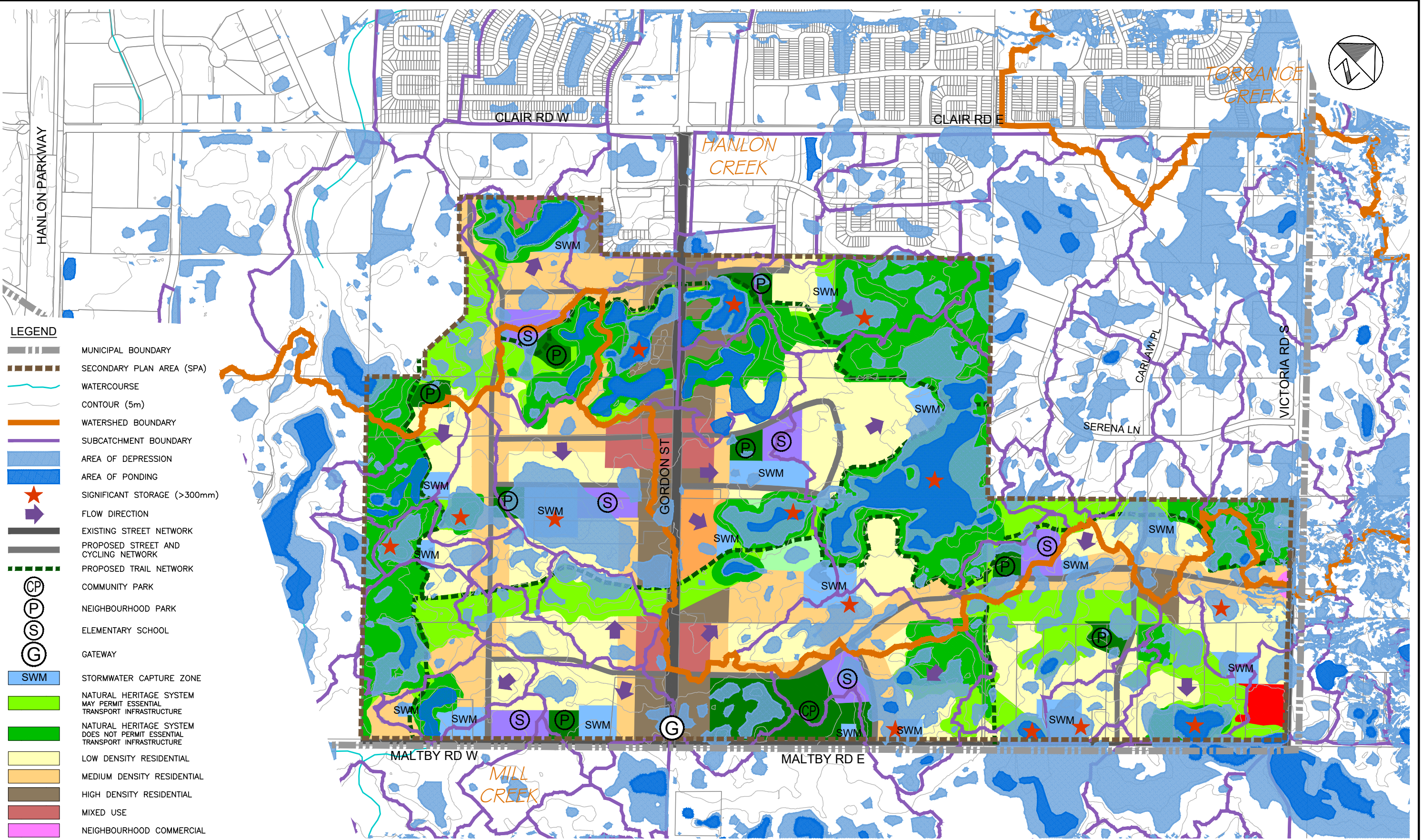
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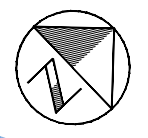
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Figure No.
 HYD8

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- LEGEND**
- MUNICIPAL BOUNDARY
 - SECONDARY PLAN AREA (SPA)
 - WATERCOURSE
 - CONTOUR (5m)
 - WATERSHED BOUNDARY
 - SUBCATCHMENT BOUNDARY
 - AREA OF DEPRESSION
 - AREA OF PONDING
 - SIGNIFICANT STORAGE (>300mm)
 - FLOW DIRECTION
 - EXISTING STREET NETWORK
 - PROPOSED STREET AND CYCLING NETWORK
 - PROPOSED TRAIL NETWORK
 - COMMUNITY PARK
 - NEIGHBOURHOOD PARK
 - ELEMENTARY SCHOOL
 - GATEWAY
 - STORMWATER CAPTURE ZONE
 - NATURAL HERITAGE SYSTEM MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - NATURAL HERITAGE SYSTEM DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - LOW DENSITY RESIDENTIAL
 - MEDIUM DENSITY RESIDENTIAL
 - HIGH DENSITY RESIDENTIAL
 - MIXED USE
 - NEIGHBOURHOOD COMMERCIAL
 - OFFICE COMMERCIAL
 - SERVICE COMMERCIAL
 - SCHOOL
 - PARK
 - OPEN SPACE



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 SECONDARY PLAN
 CITY OF GUELPH

EXISTING DRAINAGE
 FEATURES AND CONCEPTUAL
 LAND USE PLAN



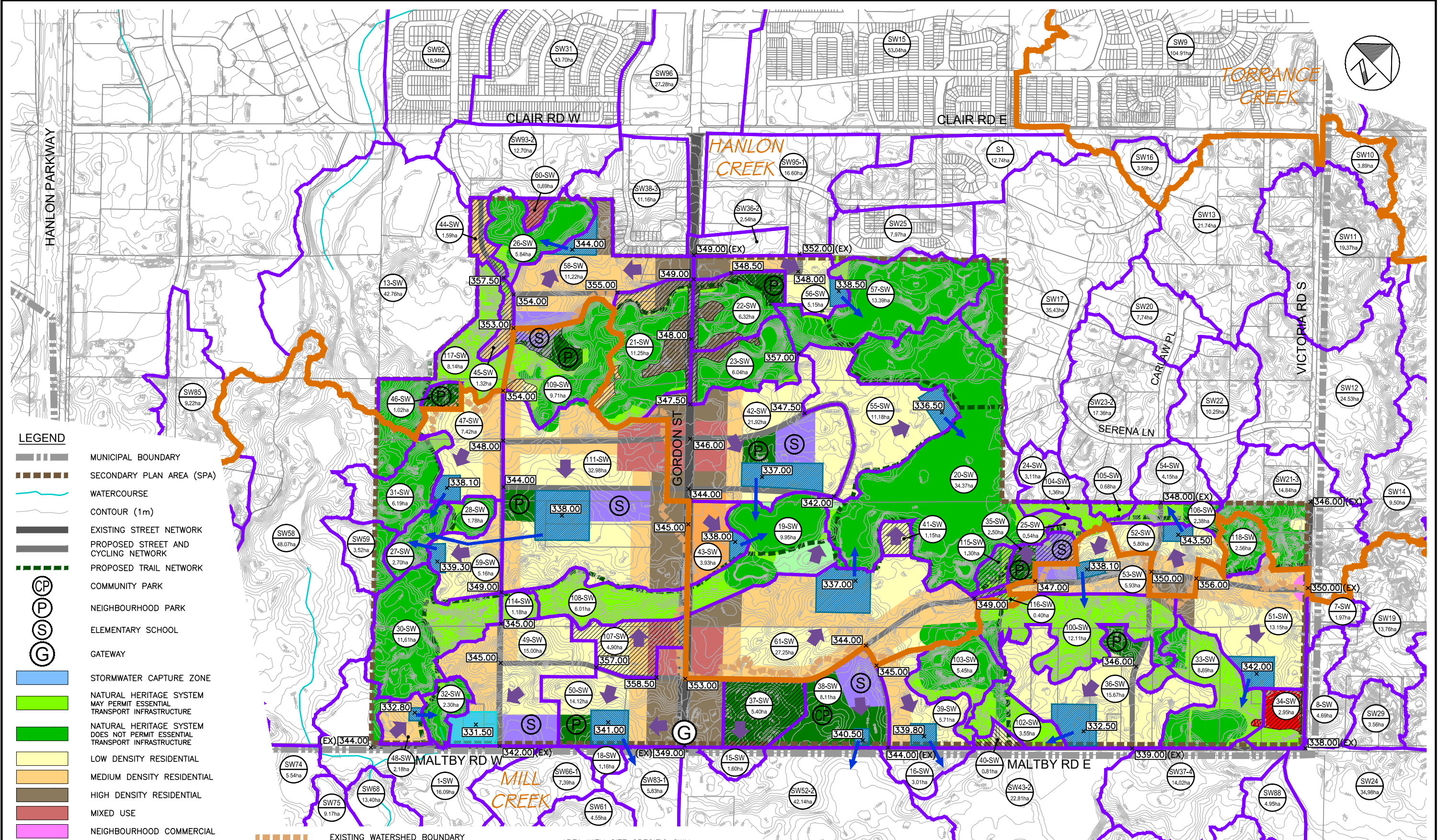
SCALE VALID ONLY FOR
 24"x36" VERSION

Scale 1:6000
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Consultant File No.
 TPB168050

Figure No.
 IA-HYD1

Plotted By: richard.bartolo
 Last Saved By: richard.bartolo
 2019-01-16
 2019-01-16
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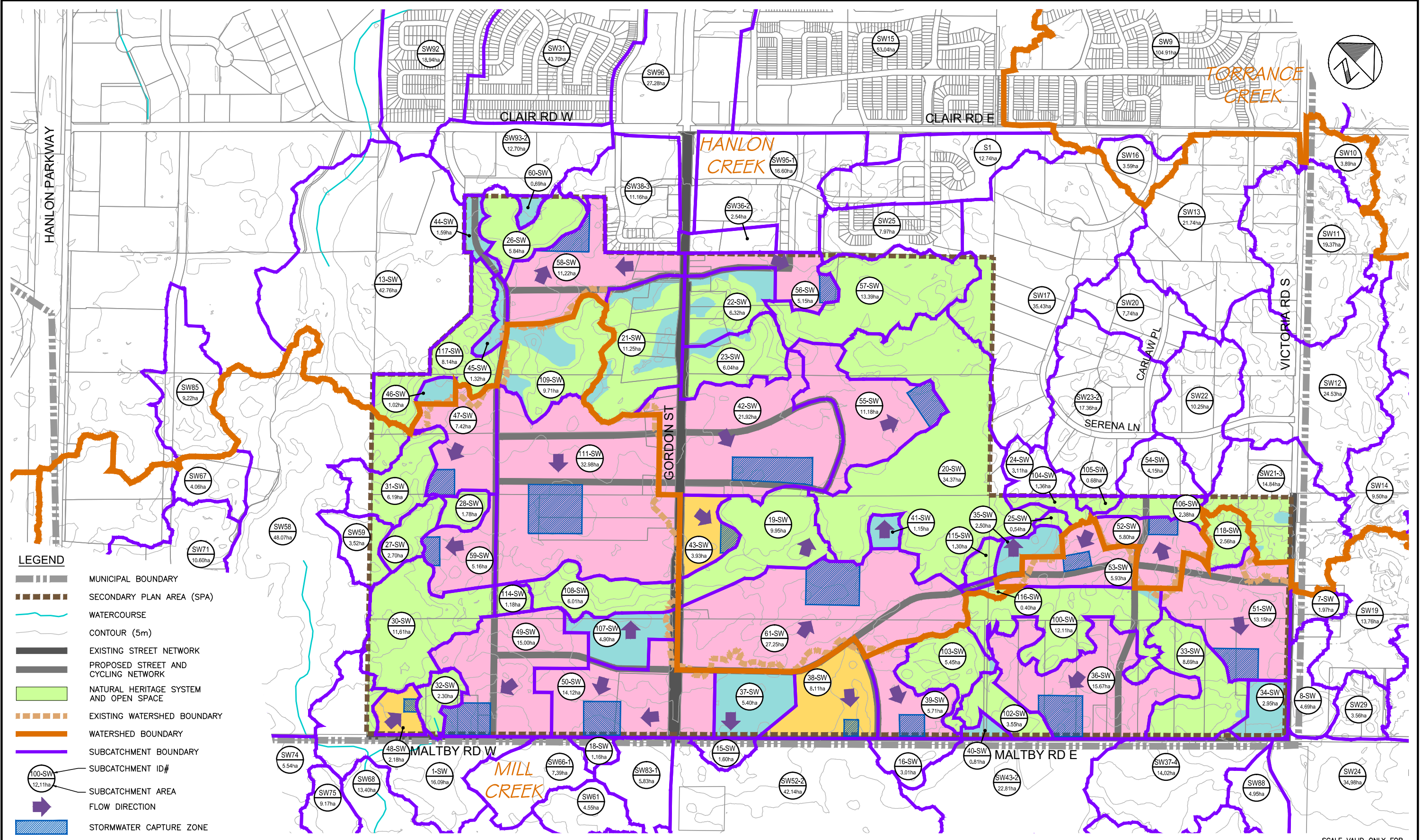
LEGEND

- MUNICIPAL BOUNDARY
- SECONDARY PLAN AREA (SPA)
- WATERCOURSE
- CONTOUR (1m)
- EXISTING STREET NETWORK
- PROPOSED STREET AND CYCLING NETWORK
- PROPOSED TRAIL NETWORK
- COMMUNITY PARK
- NEIGHBOURHOOD PARK
- ELEMENTARY SCHOOL
- GATEWAY
- STORMWATER CAPTURE ZONE
- NATURAL HERITAGE SYSTEM MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
- NATURAL HERITAGE SYSTEM DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MIXED USE
- NEIGHBOURHOOD COMMERCIAL
- OFFICE COMMERCIAL
- SERVICE COMMERCIAL
- SCHOOL
- PARK
- OPEN SPACE

- EXISTING WATERSHED BOUNDARY
- WATERSHED BOUNDARY
- SUBCATCHMENT BOUNDARY
- SUBCATCHMENT ID#
- SUBCATCHMENT AREA
- FLOW DIRECTION
- AREA WITH SITE SPECIFIC SWM (DRAINAGE AREA LESS THAN 5ha)
- CONCEPTUAL SWM FACILITY (CONVENTIONAL DESIGN)
- CONCEPTUAL SWM FACILITY (FULL CAPTURE)
- SWM FACILITY RELIEF OUTLET PROPOSED GRADE ELEVATION

<p>CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH</p>	<p>PRELIMINARY CONCEPTUAL STORMWATER MANAGEMENT AND GRADING PLAN</p>	<p>wood.</p>	<p>SCALE VALID ONLY FOR 24"x36" VERSION</p> <p>Scale 1:6000 0 50 100 200</p> <p>Consultant File No. TPB168050</p> <p>Figure No. IA-HYD2</p>
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Plotted: 2019-01-16
 Last Saved: 2019-01-16
 Plotted By: richard.bartolo
 Last Saved By: richard.bartolo
 Path: P:\2016\Projects\FBI68050 - Clair Maltby\06_DES-ENG\01_CAD\02_DWGS\05_WR\01_PROJECT\2019-01\FigA-HYD3_StrmWtrCapt.dwg

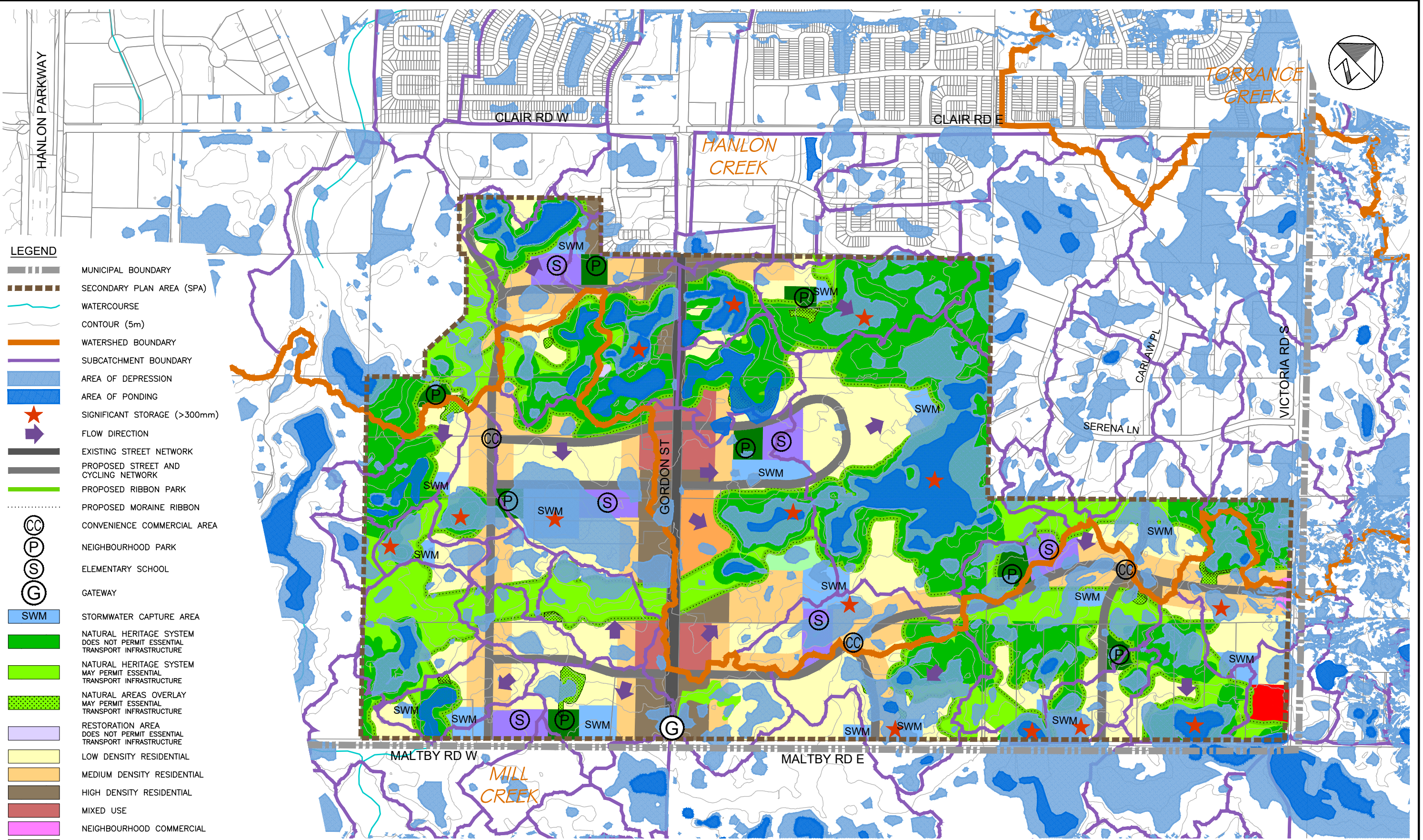


- LEGEND**
- MUNICIPAL BOUNDARY
 - SECONDARY PLAN AREA (SPA)
 - WATERCOURSE
 - CONTOUR (5m)
 - EXISTING STREET NETWORK
 - PROPOSED STREET AND CYCLING NETWORK
 - NATURAL HERITAGE SYSTEM AND OPEN SPACE
 - EXISTING WATERSHED BOUNDARY
 - WATERSHED BOUNDARY
 - SUBCATCHMENT BOUNDARY
 - 100-SW
12.11ha SUBCATCHMENT ID#
 - SUBCATCHMENT AREA
 - FLOW DIRECTION
 - STORMWATER CAPTURE ZONE
- SURFACE WATER CAPTURE**
- 27mm
 - 27mm + 88mm (100 YEAR)
 - 27mm + 285mm (REGIONAL)

SCALE VALID ONLY FOR 24"x36" VERSION

<p>CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH</p>	<p>SURFACE WATER CAPTURE</p>		<p>Scale 1:6000 0 50 100 200</p> <p>Consultant File No. TPB168050</p> <p>Figure No. IA-HYD3</p>
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Plotted By: richard.bartolo
 Last Saved By: richard.bartolo
 2020-03-16
 Last Saved: 2020-03-16
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- LEGEND**
- MUNICIPAL BOUNDARY
 - SECONDARY PLAN AREA (SPA)
 - WATERCOURSE
 - CONTOUR (5m)
 - WATERSHED BOUNDARY
 - SUBCATCHMENT BOUNDARY
 - AREA OF DEPRESSION
 - AREA OF PONDING
 - SIGNIFICANT STORAGE (>300mm)
 - FLOW DIRECTION
 - EXISTING STREET NETWORK
 - PROPOSED STREET AND CYCLING NETWORK
 - PROPOSED RIBBON PARK
 - PROPOSED MORaine RIBBON
 - CONVENIENCE COMMERCIAL AREA
 - NEIGHBOURHOOD PARK
 - ELEMENTARY SCHOOL
 - GATEWAY
 - STORMWATER CAPTURE AREA
 - NATURAL HERITAGE SYSTEM DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - NATURAL HERITAGE SYSTEM MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - NATURAL AREAS OVERLAY MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - RESTORATION AREA DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - LOW DENSITY RESIDENTIAL
 - MEDIUM DENSITY RESIDENTIAL
 - HIGH DENSITY RESIDENTIAL
 - MIXED USE
 - NEIGHBOURHOOD COMMERCIAL
 - OFFICE COMMERCIAL
 - SERVICE COMMERCIAL
 - SCHOOL
 - PARK
 - OPEN SPACE

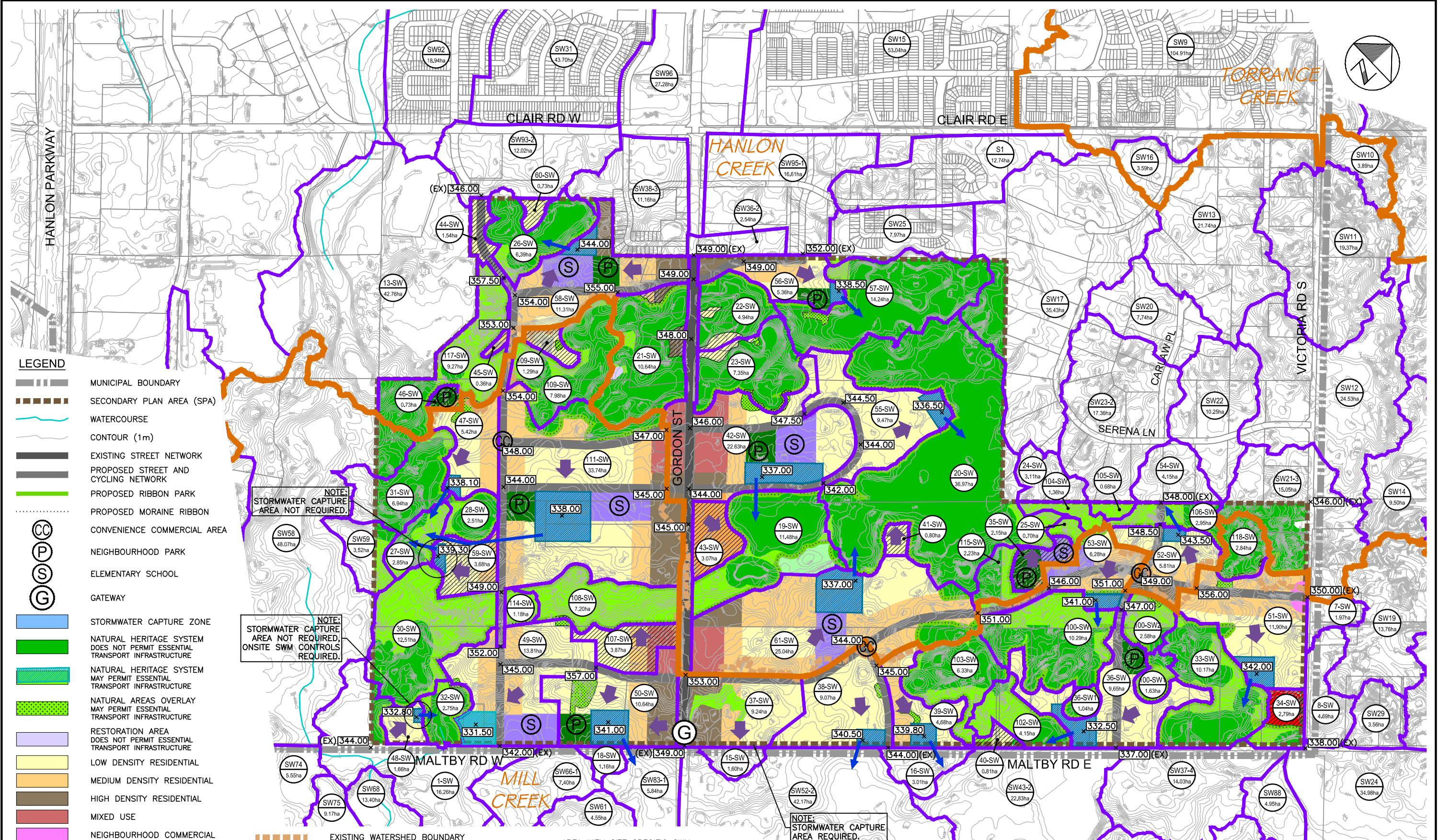
CLAIR-MALTBY
 MASTER ENVIRONMENTAL
 SERVICING PLAN AND
 SECONDARY PLAN
 CITY OF GUELPH

EXISTING DRAINAGE
 FEATURES AND CONCEPTUAL
 LAND USE PLAN



SCALE VALID ONLY FOR
 24"x36" VERSION
 Scale 1:6000
 0 50 100 200
 Consultant File No.
 TPB168050
 Figure No.
 IA2-HYD1

Plotted: 2021-03-01
Last Saved: 2021-03-01
richard.bartolo
Last Saved By: richard.bartolo
Path: I:\PB168050 - ClairMaltby\06_DES-ENG\01_CAD\02_DWGS\05_WR\01_PROJ\01_2021-03\Fig\02-HYD2_FutDmGrd.dwg



LEGEND

- MUNICIPAL BOUNDARY
- SECONDARY PLAN AREA (SPA)
- WATERCOURSE
- CONTOUR (1m)
- EXISTING STREET NETWORK
- PROPOSED STREET AND CYCLING NETWORK
- PROPOSED RIBBON PARK
- PROPOSED MORAIN RIBBON
- CONVENIENCE COMMERCIAL AREA
- NEIGHBOURHOOD PARK
- ELEMENTARY SCHOOL
- GATEWAY
- STORMWATER CAPTURE ZONE
- NATURAL HERITAGE SYSTEM DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
- NATURAL HERITAGE SYSTEM MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
- NATURAL AREAS OVERLAY MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
- RESTORATION AREA DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- MIXED USE
- NEIGHBOURHOOD COMMERCIAL
- OFFICE COMMERCIAL
- SERVICE COMMERCIAL
- SCHOOL
- PARK
- OPEN SPACE

NOTE: STORMWATER CAPTURE AREA NOT REQUIRED.

NOTE: STORMWATER CAPTURE AREA NOT REQUIRED, ONSITE SWM CONTROLS REQUIRED.

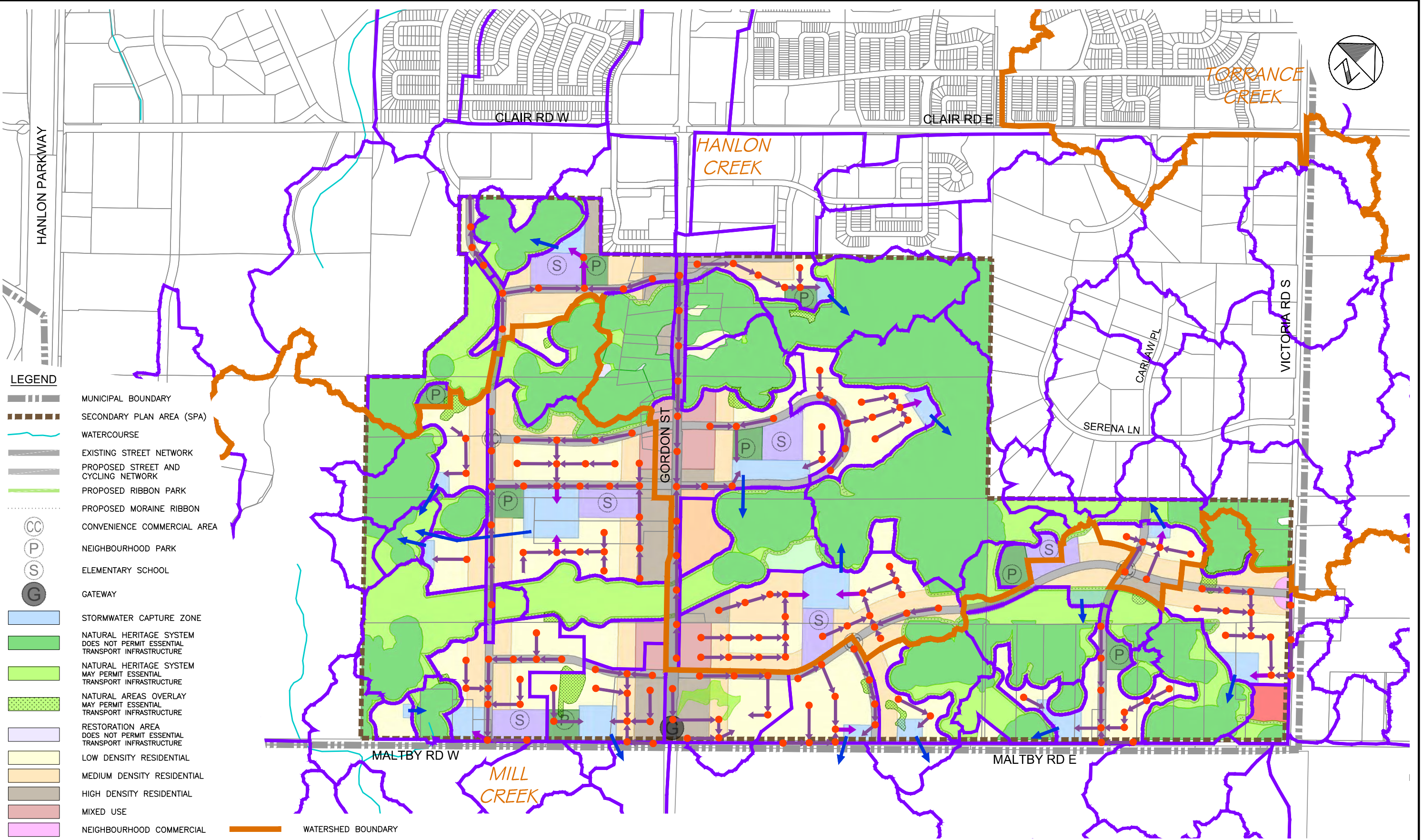
NOTE: STORMWATER CAPTURE AREA REQUIRED.

- EXISTING WATERSHED BOUNDARY
- WATERSHED BOUNDARY
- SUBCATCHMENT BOUNDARY
- SUBCATCHMENT ID #
- SUBCATCHMENT AREA
- FLOW DIRECTION
- AREA WITH SITE SPECIFIC SWM (DRAINAGE AREA LESS THAN 5ha)
- CONCEPTUAL SWM FACILITY (CONVENTIONAL DESIGN)
- CONCEPTUAL SWM FACILITY (FULL CAPTURE)
- SWM FACILITY RELIEF OUTLET
- PROPOSED GRADE ELEVATION

CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH	UPDATED PREFERRED COMMUNITY STRUCTURE STORMWATER MANAGEMENT AND GRADING PLAN	wood.	Scale 1:6000 0 50 100 200
			Consultant File No. TPB168050 Figure No. IA2-HYD2

SCALE VALID ONLY FOR 24"x36" VERSION

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 Last Saved: 2021-03-01
 Plotted By: richard.bartolo
 Last Saved By: richard.bartolo
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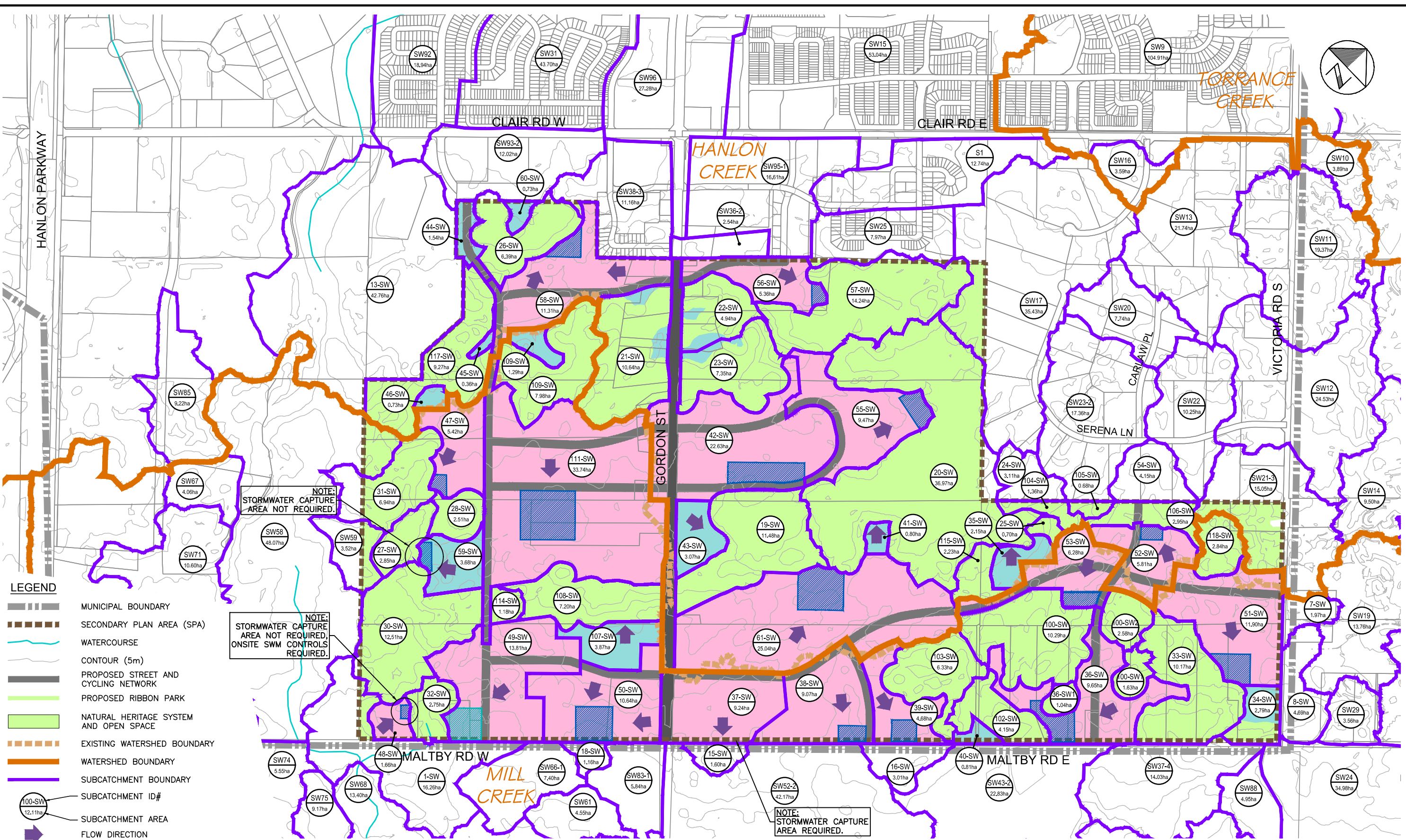
- LEGEND**
- MUNICIPAL BOUNDARY
 - SECONDARY PLAN AREA (SPA)
 - WATERCOURSE
 - EXISTING STREET NETWORK
 - PROPOSED STREET AND CYCLING NETWORK
 - PROPOSED RIBBON PARK
 - PROPOSED MORaine RIBBON
 - CONVENIENCE COMMERCIAL AREA
 - NEIGHBOURHOOD PARK
 - ELEMENTARY SCHOOL
 - GATEWAY
 - STORMWATER CAPTURE ZONE
 - NATURAL HERITAGE SYSTEM DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - NATURAL HERITAGE SYSTEM MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - NATURAL AREAS OVERLAY MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - RESTORATION AREA DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
 - LOW DENSITY RESIDENTIAL
 - MEDIUM DENSITY RESIDENTIAL
 - HIGH DENSITY RESIDENTIAL
 - MIXED USE
 - NEIGHBOURHOOD COMMERCIAL
 - OFFICE COMMERCIAL
 - SERVICE COMMERCIAL
 - SCHOOL
 - PARK
 - OPEN SPACE

- WATERSHED BOUNDARY
- SUBCATCHMENT BOUNDARY
- SWM FACILITY RELIEF OUTLET
- STORM SEWER (>900mm ϕ)
- STORM SEWER (<900mm ϕ)
- MAINTENANCE HOLE LOCATION



<p>CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH</p>	<p>UPDATED PREFERRED COMMUNITY STRUCTURE CONCEPTUAL STORM SEWER LAYOUT</p>	<p>wood.</p>	<p>SCALE VALID ONLY FOR 24"x36" VERSION</p> <p>Scale 1:6000 0 50 100 200</p> <p>Consultant File No. TPB168050</p> <p>Figure No. A2-HYD4</p>
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 Last Saved: 2021-03-01
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 Last Saved By: richard.bartolo
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- LEGEND**
- MUNICIPAL BOUNDARY
 - SECONDARY PLAN AREA (SPA)
 - WATERCOURSE
 - CONTOUR (5m)
 - PROPOSED STREET AND CYCLING NETWORK
 - PROPOSED RIBBON PARK
 - NATURAL HERITAGE SYSTEM AND OPEN SPACE
 - EXISTING WATERSHED BOUNDARY
 - WATERSHED BOUNDARY
 - SUBCATCHMENT BOUNDARY
 - SUBCATCHMENT ID#
 - SUBCATCHMENT AREA
 - FLOW DIRECTION
 - STORMWATER CAPTURE AREA
 - SURFACE WATER CAPTURE**
 - 20mm
 - 20mm + 285mm (REGIONAL)

NOTE:
STORMWATER CAPTURE
AREA NOT REQUIRED.

NOTE:
STORMWATER CAPTURE
AREA NOT REQUIRED,
ONSITE SWM
CONTROLS
REQUIRED.

NOTE:
STORMWATER CAPTURE
AREA REQUIRED.

CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN CITY OF GUELPH		UPDATED PREFERRED COMMUNITY STRUCTURE SURFACE WATER CAPTURE			SCALE VALID ONLY FOR 24"x36" VERSION
					Scale 1:6000
				Consultant File No. TPB168050	Figure No. IA2-HYD3

Mill Creek Monitoring Site Frequency Analysis

Year	Max Flow (m ³ /s)
1950	0.06008
1951	0.05490
1952	0.04537
1953	0.04277
1954	0.28147
1955	0.05323
1956	0.09178
1957	0.06633
1958	0.05228
1959	0.04100
1960	0.04513
1961	0.06354
1962	0.04256
1963	0.04158
1964	0.07204
1965	0.03595
1966	0.05635
1967	0.06064
1968	0.48457
1969	0.04942
1970	0.05240
1971	0.05786
1972	0.03552
1973	0.04440
1974	0.05768
1975	0.07809
1976	0.03562
1977	0.04394
1978	0.04484
1979	0.04952
1980	0.03480
1981	0.03501
1982	0.11608
1983	0.03405
1984	0.04321
1985	0.05449
1986	0.05800
1987	0.04559
1988	0.08438

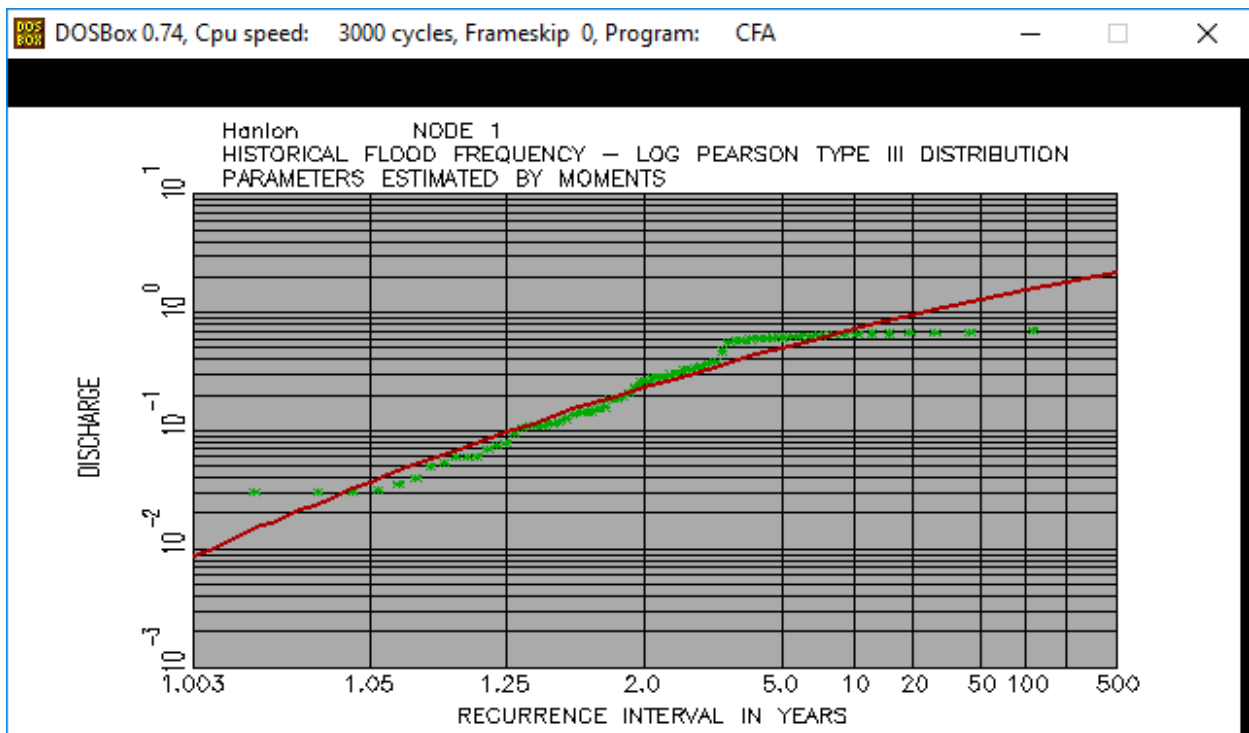
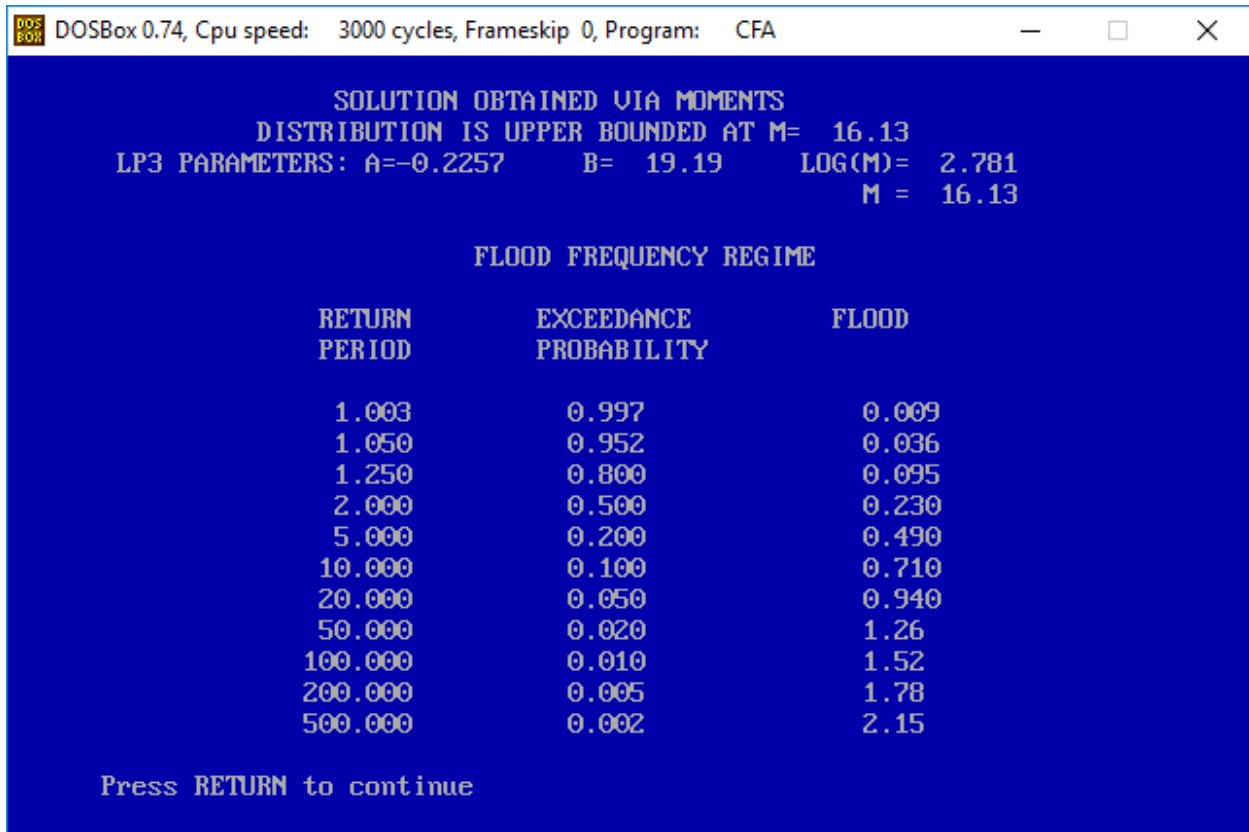
1989	0.03367
1990	0.05583
1991	0.05601
1992	0.04999
1993	0.04138
1994	0.03912
1995	0.05775
1996	0.03162
1997	0.03891
1998	0.04228
1999	0.05726
2000	0.04525
2001	0.05656
2002	0.04231
2003	0.03092
2004	0.03960
2005	0.71300
2006	0.07239
2007	0.03357
2008	0.06628
2009	0.07378
2010	0.05405
2011	0.03486
2012	0.05318
2013	0.06071
2014	0.06623
2015	0.04898
2016	0.07995
2017	0.03146

Hanlon Creek Monitoring Site Frequency Analysis

Year	Max Flow (m ³ /s)
1950	0.30880
1951	0.35954
1952	0.28508
1953	0.07880
1954	0.66395
1955	0.26176
1956	0.66996
1957	0.63376
1958	0.58056
1959	0.03000
1960	0.13584
1961	0.61061
1962	0.19401
1963	0.12565
1964	0.65846
1965	0.11393
1966	0.29947
1967	0.47191
1968	0.70607
1969	0.18552
1970	0.15778
1971	0.32171
1972	0.05959
1973	0.10688
1974	0.34056
1975	0.64533
1976	0.02999
1977	0.07467
1978	0.33147
1979	0.14364
1980	0.10834
1981	0.05322
1982	0.67437
1983	0.03138
1984	0.14545
1985	0.61988
1986	0.56686
1987	0.14245
1988	0.64103

1989	0.02999
1990	0.28338
1991	0.37399
1992	0.15241
1993	0.05950
1994	0.11887
1995	0.37938
1996	0.09420
1997	0.06026
1998	0.20639
1999	0.57473
2000	0.23711
2001	0.18584
2002	0.25667
2003	0.04987
2004	0.03982
2005	0.68234
2006	0.61254
2007	0.03543
2008	0.63278
2009	0.66241
2010	0.59457
2011	0.11139
2012	0.10872
2013	0.61320
2014	0.60294
2015	0.28419
2016	0.65530
2017	0.07005

Log Pearson Type III Distribution



Hanlon Subwatershed Annual Water Balance Under Future Land Use Conditions

Year	Precipitation (mm)	Baseflow (mm)	Starting Snow Depth (mm)	Infiltration (mm)	Evaporation (mm)	Ending Snow Depth (mm)	Outflow (mm)	Net (mm)	% Error
1950	1,001.10	115.20	0.00	894.10	31.84	85.80	115.21	-10.65	-1.06%
1951	962.01	115.21	85.80	937.76	38.46	79.20	115.18	-7.58	-0.79%
1952	739.31	115.53	79.29	813.45	31.76	0.00	115.49	-26.57	-3.59%
1953	857.80	115.21	0.00	824.96	38.32	0.00	114.90	-5.15	-0.60%
1954	1,032.11	115.21	0.00	1,004.02	37.19	11.77	117.92	-23.58	-2.28%
1955	812.01	115.21	11.77	764.71	30.99	36.50	115.04	-8.25	-1.02%
1956	977.02	115.53	36.60	979.65	45.02	9.78	117.13	-22.43	-2.30%
1957	897.11	115.21	10.21	904.18	33.83	0.00	116.01	-31.48	-3.51%
1958	728.02	115.21	0.00	647.69	29.12	67.42	115.42	-16.42	-2.26%
1959	845.30	115.21	67.62	860.53	36.64	25.50	114.87	-9.40	-1.11%
1960	760.49	115.53	25.50	767.37	27.40	2.09	115.34	-10.68	-1.40%
1961	770.10	115.21	2.09	746.85	28.80	10.52	115.28	-14.05	-1.82%
1962	685.39	115.21	10.60	681.52	26.98	0.00	114.99	-12.29	-1.79%
1963	564.79	115.21	0.00	549.52	22.59	0.00	114.91	-7.03	-1.24%
1964	825.89	115.53	0.61	839.06	25.19	0.00	115.93	-38.15	-4.62%
1965	925.29	115.21	0.32	900.85	30.01	0.00	114.92	-4.96	-0.54%
1966	760.60	115.21	0.00	699.61	29.54	38.18	115.09	-6.60	-0.87%
1967	880.40	115.21	38.18	891.52	30.92	18.05	115.27	-21.98	-2.50%
1968	1,022.39	115.53	18.12	1,059.92	28.25	34.06	120.49	-86.69	-8.48%
1969	781.09	115.21	34.40	759.22	24.32	36.55	114.99	-4.38	-0.56%
1970	846.09	115.21	36.66	805.71	27.58	63.57	115.13	-14.02	-1.66%
1971	774.99	115.21	63.58	806.33	29.86	23.89	115.33	-21.62	-2.79%
1972	930.59	115.53	23.91	876.50	29.69	51.78	115.25	-3.18	-0.34%
1973	846.59	115.21	52.08	841.00	28.17	40.20	114.91	-10.39	-1.23%
1974	779.31	115.21	40.28	791.22	29.90	12.33	115.17	-13.82	-1.77%
1975	895.31	115.21	12.51	855.22	26.48	33.67	116.20	-8.54	-0.95%
1976	889.40	115.53	33.67	876.18	33.14	22.15	115.26	-8.13	-0.91%
1977	1,091.59	115.21	22.34	1,009.17	29.00	72.30	114.94	3.73	0.34%
1978	790.00	115.21	72.66	848.19	29.89	4.22	115.14	-19.57	-2.48%
1979	953.00	115.21	4.19	930.72	30.28	6.79	114.94	-10.34	-1.09%
1980	866.10	115.53	6.79	824.68	28.22	28.60	115.27	-8.36	-0.97%
1981	876.50	115.21	28.85	859.36	34.09	15.67	114.90	-3.45	-0.39%
1982	1,094.30	115.21	16.27	1,104.86	34.46	0.00	117.43	-30.97	-2.83%
1983	943.00	115.21	0.00	802.68	30.90	103.60	114.86	6.16	0.65%
1984	895.79	115.53	103.72	975.97	36.23	1.56	115.29	-14.01	-1.56%
1985	1,137.70	115.21	1.56	1,080.03	35.01	51.89	115.46	-27.91	-2.45%
1986	1,118.39	115.21	51.89	1,132.83	36.83	48.02	117.02	-49.20	-4.40%
1987	790.30	115.21	48.23	819.50	32.14	3.93	114.96	-16.79	-2.12%
1988	843.11	115.53	3.95	827.88	32.14	7.08	115.86	-20.38	-2.42%
1989	740.01	115.21	7.08	708.27	36.05	0.00	114.87	3.11	0.42%
1990	1,055.60	115.21	0.00	1,034.66	39.53	2.76	115.34	-21.47	-2.03%
1991	924.50	115.21	2.76	881.48	36.23	17.17	115.12	-7.52	-0.81%
1992	1,126.49	115.53	17.17	1,107.87	43.40	0.00	115.33	-7.41	-0.66%
1993	834.10	115.21	0.00	797.06	39.12	0.00	114.89	-1.76	-0.21%
1994	763.20	115.21	0.00	721.91	36.25	4.19	114.92	1.15	0.15%
1995	868.19	115.21	4.69	846.83	28.70	35.07	115.67	-38.18	-4.40%
1996	1,021.60	115.53	35.09	1,011.00	41.54	12.16	115.23	-7.71	-0.75%
1997	849.60	115.21	12.31	814.91	32.09	19.01	114.91	-3.81	-0.45%
1998	668.30	115.21	19.02	665.55	25.42	6.56	115.06	-10.05	-1.50%
1999	862.69	115.21	6.61	868.05	30.15	0.00	115.44	-29.12	-3.38%
2000	883.30	115.53	0.00	795.57	35.61	62.74	115.52	-10.62	-1.20%
2001	770.80	115.21	62.74	814.02	29.25	0.00	115.60	-10.11	-1.31%
2002	763.40	115.21	0.00	750.66	31.24	2.10	115.20	-20.58	-2.70%
2003	773.19	115.21	2.20	751.97	26.55	0.00	114.89	-2.80	-0.36%
2004	779.01	115.53	0.00	733.62	36.02	6.53	115.21	3.16	0.41%
2005	797.00	115.21	6.47	760.54	33.56	35.70	118.62	-29.73	-3.73%
2006	931.60	115.21	35.79	950.70	33.81	2.25	115.33	-19.49	-2.09%
2007	543.18	115.21	6.03	528.72	23.60	2.49	114.82	-5.21	-0.96%
2008	991.09	115.53	3.54	984.82	33.50	2.00	116.12	-26.28	-2.65%
2009	792.89	115.21	2.00	794.58	29.14	8.72	115.57	-37.91	-4.78%
2010	761.79	115.21	8.72	765.63	28.12	0.00	115.37	-23.40	-3.07%
2011	900.60	115.21	0.00	866.99	28.16	9.20	114.92	-3.46	-0.38%
2012	638.40	115.53	9.19	616.24	23.24	14.63	115.20	-6.19	-0.97%
2013	945.70	115.21	14.63	920.16	29.26	34.04	115.46	-23.38	-2.47%
2014	696.00	115.21	34.05	717.54	26.78	0.00	115.52	-14.57	-2.09%
2015	787.70	115.21	0.00	799.56	24.28	9.16	115.45	-45.54	-5.78%
2016	769.40	115.53	9.16	769.84	34.44	8.02	115.99	-34.20	-4.45%
2017	809.50	115.21	8.02	788.60	33.08	6.30	114.87	-10.12	-1.25%

Hanlon Subwatershed Annual Water Balance Under Future Land Use Conditions Summary

	Precipitation (mm)	Baseflow (mm)	Starting Snow Depth (mm)	Infiltration (mm)	Evaporation (mm)	Ending Snow Depth (mm)	Outflow (mm)	Net (mm)	% Error
Mean	856.46	115.29	19.88	840.62	31.61	19.82	115.50	-15.92	-1.84%
Median	846.34	115.21	9.18	824.82	30.91	9.18	115.25	-10.67	-1.45%
Min	543.18	115.20	0.00	528.72	22.59	0.00	114.82	-86.69	-8.48%
Max	1137.70	115.53	103.72	1132.83	45.02	103.60	120.49	6.16	0.65%
Std Dev.	126.26	0.14	24.30	124.34	4.78	24.26	0.94	14.77	1.59%

Mill Creek Subwatershed Annual Water Balance Under Future Land Use Conditions

Year	Precipitation (mm)	Baseflow (mm)	Starting Snow Depth (mm)	Infiltration (mm)	Evaporation (mm)	Ending Snow Depth (mm)	Outflow (mm)	Net (mm)	% Error
1950	1,001.10	24.73	0.00	898.50	17.34	85.80	35.08	-10.89	-1.09%
1951	962.01	24.73	85.80	939.43	20.72	79.20	34.52	-1.32	-0.14%
1952	739.31	24.80	79.29	815.93	17.07	0.00	32.71	-22.32	-3.02%
1953	857.80	24.73	0.00	830.34	20.30	0.00	32.09	-0.19	-0.02%
1954	1,032.11	24.73	0.00	1,002.70	20.20	11.77	41.03	-18.87	-1.83%
1955	812.01	24.73	11.77	767.68	16.62	36.50	32.10	-4.40	-0.54%
1956	977.02	24.80	36.60	984.54	24.31	9.78	37.25	-17.46	-1.79%
1957	897.11	24.73	10.21	903.58	18.31	0.00	36.28	-26.12	-2.91%
1958	728.02	24.73	0.00	653.36	15.66	67.42	31.02	-14.71	-2.02%
1959	845.30	24.73	67.62	865.90	19.38	25.50	32.50	-5.63	-0.67%
1960	760.49	24.80	25.50	775.61	14.70	2.09	32.32	-13.92	-1.83%
1961	770.10	24.73	2.09	749.60	15.24	10.52	31.36	-9.80	-1.27%
1962	685.39	24.73	10.60	685.28	14.32	0.00	30.57	-9.44	-1.38%
1963	564.79	24.73	0.00	552.52	11.99	0.00	29.40	-4.40	-0.78%
1964	825.89	24.80	0.61	835.25	13.63	0.00	33.65	-31.23	-3.78%
1965	925.29	24.73	0.32	901.94	15.92	0.00	33.44	-0.96	-0.10%
1966	760.60	24.73	0.00	703.31	15.66	38.18	31.79	-3.61	-0.47%
1967	880.40	24.73	38.18	891.30	16.62	18.05	34.26	-16.91	-1.92%
1968	1,022.39	24.80	18.12	1,042.75	15.68	34.06	44.17	-71.36	-6.98%
1969	781.09	24.73	34.40	758.58	13.02	36.55	32.44	-0.38	-0.05%
1970	846.09	24.73	36.66	804.77	14.57	63.57	32.50	-7.92	-0.94%
1971	774.99	24.73	63.58	810.46	16.11	23.89	33.16	-20.31	-2.62%
1972	930.59	24.80	23.91	877.92	15.80	51.78	33.34	0.48	0.05%
1973	846.59	24.73	52.08	840.67	14.81	40.20	33.17	-5.44	-0.64%
1974	779.31	24.73	40.28	793.39	15.80	12.33	32.55	-9.75	-1.25%
1975	895.31	24.73	12.51	849.69	14.19	33.67	34.75	0.25	0.03%
1976	889.40	24.80	33.67	878.08	17.24	22.15	32.83	-2.43	-0.27%
1977	1,091.59	24.73	22.34	1,006.53	15.17	72.30	35.65	9.01	0.83%
1978	790.00	24.73	72.66	845.32	15.70	4.22	32.45	-10.30	-1.30%
1979	953.00	24.73	4.19	928.99	15.85	6.79	34.40	-4.11	-0.43%
1980	866.10	24.80	6.79	826.06	14.70	28.60	32.52	-4.20	-0.48%
1981	876.50	24.73	28.85	861.65	17.77	15.67	32.26	2.73	0.31%
1982	1,094.30	24.73	16.27	1,099.01	18.70	0.00	39.74	-22.15	-2.02%
1983	943.00	24.73	0.00	804.90	16.39	103.60	31.79	11.05	1.17%
1984	895.79	24.80	103.72	976.48	19.36	1.56	34.35	-7.44	-0.83%
1985	1,137.70	24.73	1.56	1,077.90	19.01	51.89	37.20	-22.01	-1.93%
1986	1,118.39	24.73	51.89	1,132.05	20.35	48.02	38.54	-43.94	-3.93%
1987	790.30	24.73	48.23	820.52	17.06	3.93	32.10	-10.35	-1.31%
1988	843.11	24.80	3.95	831.69	17.06	7.08	32.97	-16.94	-2.01%
1989	740.01	24.73	7.08	715.53	19.04	0.00	30.45	6.80	0.92%
1990	1,055.60	24.73	0.00	1,040.39	21.14	2.76	34.97	-18.93	-1.79%
1991	924.50	24.73	2.76	884.87	19.50	17.17	33.89	-3.43	-0.37%
1992	1,126.49	24.80	17.17	1,109.88	22.95	0.00	35.35	0.28	0.03%
1993	834.10	24.73	0.00	803.72	20.59	0.00	31.69	2.83	0.34%
1994	763.20	24.73	0.00	727.60	19.26	4.19	30.45	6.43	0.84%
1995	868.19	24.73	4.69	851.52	15.59	35.07	34.01	-38.56	-4.44%
1996	1,021.60	24.80	35.09	1,016.83	21.95	12.16	33.95	-3.40	-0.33%
1997	849.60	24.73	12.31	816.98	17.10	19.01	32.46	1.08	0.13%
1998	668.30	24.73	19.02	669.30	13.56	6.56	30.79	-8.15	-1.22%
1999	862.69	24.73	6.61	867.82	16.36	0.00	33.89	-24.04	-2.79%
2000	883.30	24.80	0.00	802.88	19.04	62.74	32.21	-8.78	-0.99%
2001	770.80	24.73	62.74	811.77	15.70	0.00	33.29	-2.48	-0.32%
2002	763.40	24.73	0.00	755.96	16.81	2.10	32.06	-18.80	-2.46%
2003	773.19	24.73	2.20	754.00	14.14	0.00	31.47	0.51	0.07%
2004	779.01	24.80	0.00	737.79	19.05	6.53	30.95	9.48	1.22%
2005	797.00	24.73	6.47	747.66	18.62	35.70	40.40	-14.17	-1.78%
2006	931.60	24.73	35.79	951.17	17.99	2.25	35.41	-14.70	-1.58%
2007	543.18	24.73	6.03	534.96	11.96	2.49	28.64	-4.10	-0.75%
2008	991.09	24.80	3.54	984.50	17.98	2.00	34.82	-19.86	-2.00%
2009	792.89	24.73	2.00	793.70	15.40	8.72	32.93	-31.13	-3.93%
2010	761.79	24.73	8.72	763.97	15.25	0.00	32.74	-16.72	-2.19%
2011	900.60	24.73	0.00	862.83	14.32	9.20	32.80	6.18	0.69%
2012	638.40	24.80	9.19	618.05	12.21	14.63	30.01	-2.50	-0.39%
2013	945.70	24.73	14.63	917.15	15.46	34.04	34.20	-15.79	-1.67%
2014	696.00	24.73	34.05	718.25	14.22	0.00	32.10	-9.79	-1.41%
2015	787.70	24.73	0.00	798.46	13.20	9.16	32.30	-40.69	-5.17%
2016	769.40	24.80	9.16	772.59	18.61	8.02	32.08	-27.93	-3.63%
2017	809.50	24.73	8.02	796.45	17.37	6.30	31.61	-9.49	-1.17%

Mill Creek Subwatershed Annual Water Balance Under Future Land Use Conditions Summary

	Precipitation (mm)	Baseflow (mm)	Starting Snow Depth (mm)	Infiltration (mm)	Evaporation (mm)	Ending Snow Depth (mm)	Outflow (mm)	Net (mm)	% Error
Mean	856.46	24.75	19.88	841.92	16.86	19.82	33.47	-10.99	-1.27%
Median	846.34	24.73	9.18	828.20	16.50	9.18	32.77	-9.11	-1.13%
Min	543.18	24.73	0.00	534.96	11.96	0.00	28.64	-71.36	-6.98%
Max	1137.70	24.80	103.72	1132.05	24.31	103.60	44.17	11.05	1.22%
Std Dev.	126.26	0.03	24.30	122.80	2.60	24.26	2.69	13.94	1.53%

Torrance Creek Subwatershed Annual Water Balance Under Future Land Use Conditions

Year	Precipitation (mm)	Baseflow (mm)	Starting Snow Depth (mm)	Infiltration (mm)	Evaporation (mm)	Ending Snow Depth (mm)	Outflow (mm)	Net (mm)	% Error
1950	1,001.10	0.00	0.00	855.66	41.75	85.80	34.18	-16.30	-1.63%
1951	962.01	0.00	85.80	896.87	50.01	79.20	31.65	-9.91	-1.03%
1952	739.31	0.00	79.29	777.79	41.15	0.00	27.51	-27.86	-3.77%
1953	857.80	0.00	0.00	795.25	50.52	0.00	23.43	-11.39	-1.33%
1954	1,032.11	0.00	0.00	929.39	48.18	11.77	52.93	-10.16	-0.98%
1955	812.01	0.00	11.77	729.09	39.84	36.50	24.40	-6.06	-0.75%
1956	977.02	0.00	36.60	920.04	58.40	9.78	42.34	-16.94	-1.73%
1957	897.11	0.00	10.21	853.30	44.31	0.00	38.44	-28.72	-3.20%
1958	728.02	0.00	0.00	620.69	37.82	67.42	20.98	-18.90	-2.60%
1959	845.30	0.00	67.62	827.24	47.70	25.50	24.57	-12.08	-1.43%
1960	760.49	0.00	25.50	748.27	36.41	2.09	25.18	-25.95	-3.41%
1961	770.10	0.00	2.09	714.62	38.21	10.52	22.98	-14.14	-1.84%
1962	685.39	0.00	10.60	655.30	35.41	0.00	20.04	-14.75	-2.15%
1963	564.79	0.00	0.00	533.64	30.07	0.00	16.04	-14.95	-2.65%
1964	825.89	0.00	0.61	791.01	33.19	0.00	32.21	-29.91	-3.62%
1965	925.29	0.00	0.32	871.68	39.14	0.00	27.17	-12.38	-1.34%
1966	760.60	0.00	0.00	665.82	38.59	38.18	23.78	-5.76	-0.76%
1967	880.40	0.00	38.18	850.67	40.98	18.05	33.45	-24.56	-2.79%
1968	1,022.39	0.00	18.12	958.84	37.07	34.06	59.22	-48.68	-4.76%
1969	781.09	0.00	34.40	723.85	31.85	36.55	24.68	-1.44	-0.18%
1970	846.09	0.00	36.66	779.85	37.06	63.57	24.84	-22.57	-2.67%
1971	774.99	0.00	63.58	777.40	39.26	23.89	28.94	-30.92	-3.99%
1972	930.59	0.00	23.91	843.05	39.21	51.78	27.64	-7.17	-0.77%
1973	846.59	0.00	52.08	817.08	37.51	40.20	26.17	-22.29	-2.63%
1974	779.31	0.00	40.28	758.36	39.94	12.33	27.97	-19.02	-2.44%
1975	895.31	0.00	12.51	812.53	35.54	33.67	36.88	-10.80	-1.21%
1976	889.40	0.00	33.67	853.20	44.26	22.15	24.15	-20.68	-2.33%
1977	1,091.59	0.00	22.34	981.43	39.61	72.30	31.62	-11.03	-1.01%
1978	790.00	0.00	72.66	812.33	39.81	4.22	26.95	-20.66	-2.62%
1979	953.00	0.00	4.19	897.71	40.87	6.79	30.20	-18.38	-1.93%
1980	866.10	0.00	6.79	809.95	38.22	28.60	23.80	-27.69	-3.20%
1981	876.50	0.00	28.85	833.32	45.80	15.67	23.39	-12.82	-1.46%
1982	1,094.30	0.00	16.27	1,051.46	46.09	0.00	49.99	-36.98	-3.38%
1983	943.00	0.00	0.00	773.57	40.41	103.60	21.95	3.46	0.37%
1984	895.79	0.00	103.72	949.47	47.69	1.56	30.63	-29.83	-3.33%
1985	1,137.70	0.00	1.56	1,028.69	46.30	51.89	40.93	-28.54	-2.51%
1986	1,118.39	0.00	51.89	1,057.66	48.58	48.02	49.91	-33.89	-3.03%
1987	790.30	0.00	48.23	787.01	42.88	3.93	24.50	-19.80	-2.50%
1988	843.11	0.00	3.95	793.88	43.22	7.08	27.66	-24.79	-2.94%
1989	740.01	0.00	7.08	685.18	47.52	0.00	18.38	-4.00	-0.54%
1990	1,055.60	0.00	0.00	986.21	51.70	2.76	33.46	-18.53	-1.75%
1991	924.50	0.00	2.76	847.34	48.05	17.17	30.46	-15.76	-1.70%
1992	1,126.49	0.00	17.17	1,069.55	57.39	0.00	34.75	-18.03	-1.60%
1993	834.10	0.00	0.00	769.29	51.65	0.00	21.12	-7.97	-0.96%
1994	763.20	0.00	0.00	698.49	47.35	4.19	18.93	-5.75	-0.75%
1995	868.19	0.00	4.69	798.34	38.17	35.07	34.41	-33.11	-3.81%
1996	1,021.60	0.00	35.09	979.24	54.22	12.16	28.76	-17.68	-1.73%
1997	849.60	0.00	12.31	791.22	41.82	19.01	23.42	-13.57	-1.60%
1998	668.30	0.00	19.02	643.07	33.33	6.56	21.13	-16.77	-2.51%
1999	862.69	0.00	6.61	821.24	39.79	0.00	33.86	-25.59	-2.97%
2000	883.30	0.00	0.00	770.54	47.28	62.74	26.48	-23.75	-2.69%
2001	770.80	0.00	62.74	776.37	37.98	0.00	29.91	-10.72	-1.39%
2002	763.40	0.00	0.00	722.57	40.47	2.10	23.06	-24.80	-3.25%
2003	773.19	0.00	2.20	727.54	34.57	0.00	21.69	-8.41	-1.09%
2004	779.01	0.00	0.00	710.07	47.10	6.53	20.01	-4.70	-0.60%
2005	797.00	0.00	6.47	687.43	43.49	35.70	49.23	-12.36	-1.55%
2006	931.60	0.00	35.79	905.76	44.70	2.25	32.58	-17.90	-1.92%
2007	543.18	0.00	6.03	507.78	32.67	2.49	13.18	-6.91	-1.27%
2008	991.09	0.00	3.54	944.10	44.38	2.00	33.65	-29.49	-2.98%
2009	792.89	0.00	2.00	748.96	39.15	8.72	29.25	-31.19	-3.93%
2010	761.79	0.00	8.72	722.53	37.20	0.00	28.32	-17.54	-2.30%
2011	900.60	0.00	0.00	851.56	38.94	9.20	24.65	-23.74	-2.64%
2012	638.40	0.00	9.19	600.82	31.10	14.63	16.18	-15.13	-2.37%
2013	945.70	0.00	14.63	885.30	39.48	34.04	30.44	-28.93	-3.06%
2014	696.00	0.00	34.05	683.90	35.61	0.00	24.76	-14.22	-2.04%
2015	787.70	0.00	0.00	756.89	32.16	9.16	27.63	-38.14	-4.84%
2016	769.40	0.00	9.16	725.04	44.63	8.02	28.18	-27.31	-3.55%
2017	809.50	0.00	8.02	761.98	43.84	6.30	21.79	-16.40	-2.03%

Torrance Creek Subwatershed Annual Water Balance Under Future Land Use Conditions Summary

	Precipitation (mm)	Baseflow (mm)	Starting Snow Depth (mm)	Infiltration (mm)	Evaporation (mm)	Ending Snow Depth (mm)	Outflow (mm)	Net (mm)	% Error
Mean	856.46	0.00	19.88	804.64	41.74	19.82	28.87	-18.73	-2.19%
Median	846.34	0.00	9.18	792.55	40.44	9.18	27.57	-17.79	-2.23%
Min	543.18	0.00	0.00	507.78	30.07	0.00	13.18	-48.68	-4.84%
Max	1137.70	0.00	103.72	1069.55	58.40	103.60	59.22	3.46	0.37%
Std Dev.	126.26	0.00	24.30	116.42	6.10	24.26	8.73	9.73	1.09%

Side slope for SWM 5:1 **SWCA Sizing**

WS Name	SWM Name	Imperviousness (%)	Routed through Pervious (%)	Total Drainage Area (ha)	SWM Area including 5m Roads (ha)	SWM Top Area(m2)	SWM Base Area(m2)	Sizing Storm	Total Volume of the SWM	Regional Storm		
										Maximum Storage Volume(m3)	Depth(m)	Wier Flow (cms)
38_SW	38STN	62.5	35.0	9.07	0.80	7118	3411	Regional	13160	11640	2.28	0
48_SW	48STN	65.0	45.1	1.66	Onsite Control	2200	447	Regional	3309	2962	2.34	0
36_SW	36STN	54.9	40.0	9.65	1.08	7900	4073	Regional	14966	11370	2.02	0
39_SW	39STN	60.2	42.1	4.68	0.51	4069	1492	Regional	6951	5754	2.19	0
42_SW	42STN	65.9	21.8	22.53	2.01	17973	10502	Regional	35593	30960	2.24	0
47_SW	47STN	63.3	40.2	5.42	0.58	4600	1751	Regional	7939	6889	2.27	0
49_SW	49STN	61.4	37.7	13.81	1.20	10720	6167	Regional	21108	17330	2.14	0
50_SW	50STN	58.8	31.0	10.64	1.05	8978	4858	Regional	17295	13290	2.03	0
51_SW	51STN	61.5	38.3	11.90	1.13	9187	5018	Regional	17757	14940	2.19	0
52_SW	52STN	64.3	29.6	5.81	0.60	5000	2030	Regional	8788	7705	2.28	0
53_SW	53STN	55.5	37.8	6.28	0.66	5123	1860	Regional	8729	7567	2.27	0
55_SW	55STN	60.2	39.9	9.47	1.01	7989	3928	Regional	14896	11680	2.08	0
56_SW	56STN	58.9	27.9	5.45	0.60	4500	1683	Regional	7729	6838	2.30	0
58_SW	58STN	61.8	25.5	11.31	1.14	9162	4858	Regional	17525	14800	2.19	0
59_SW	59STN	66.5	37.0	3.68	NO SWM							
61_SW	61STN	60.4	39.1	25.04	2.27	19717	13313	Regional	41287	30740	1.95	0
111_SW	111STN	57.1	36.6	33.74	3.02	25000	17706	Regional	53383	40710	1.98	0
37_SW	37STN	65.0	26.0	9.24	0.92	7785	3997	Regional	14728	12390	2.19	0
43_SW	43STN	85.0	0.0	3.07	NO SWM							

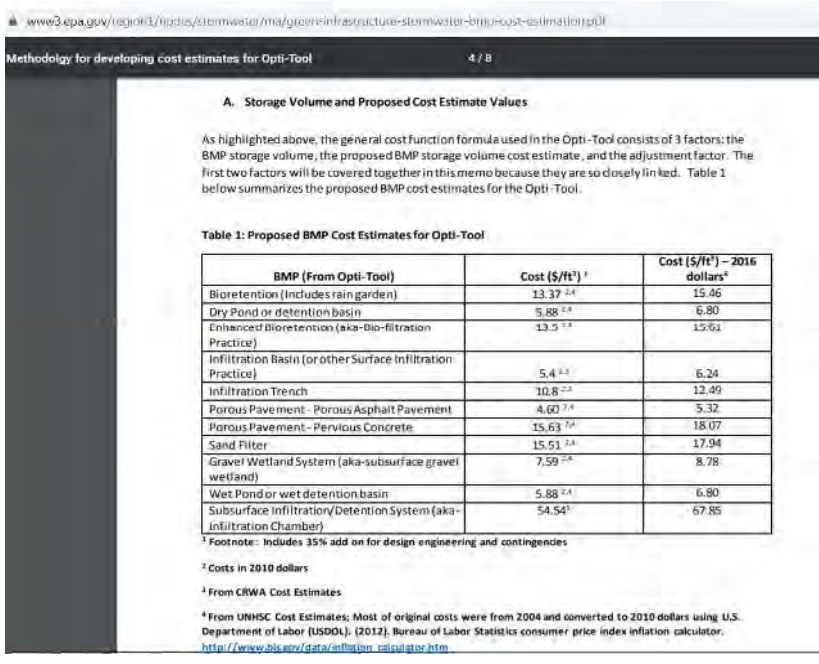
Subcatchment				LID Storages - 20mm	
Name	Outlet	Area (m2)	Imperv.(%)	Volume (m3)	coefficient (m2)
36_SW	36STN	96529	54.9	1059	3530.0
37_SW	37STN	92362	65.0	1201	4002.3
38_SW	38STN	90718	62.5	1134	3780.1
39_SW	39STN	46795	60.2	563	1877.3
42_SW	42STN	226284	65.9	2983	9943.1
47_SW	47STN	54179	63.3	686	2288.1
49_SW	49STN	138126	61.4	1696	5652.9
50_SW	50STN	106386	58.8	1250	4167.6
51_SW	51STN	119038	61.5	1464	4878.5
52_SW	52STN	58074	64.3	747	2489.4
53_SW	53STN	62811	55.5	698	2325.3
55_SW	55STN	94668	60.2	1140	3801.1
56_SW	56STN	53552	58.9	631	2103.4
58_SW	58STN	113058	61.8	1398	4660.6
61_SW	61STN	250425	60.4	3026	10088.1
111_SW	111STN	337437	57.1	3857	12855.9
21_SW	21STN	106392	30.1	94	314.5
22_SW	22STN	49369	33.1	123	410.9
23_SW	23STN	73537	23.1	107	355.3
34_SW	34STN	27929	55.7	311	1036.7
35_SW	35STN	21516	36.9	159	529.3
40_SW	40STN	8110	46.5	75	251.6
41_SW	41STN	8016	64.2	103	343.3
43_SW	43STN	30739	85.0	522	1741.3
44_SW	44STN	15438	64.4	199	663.3
46_SW	46STN	7258	19.8	29	96.0
59_SW	59STN	36790	66.5	489	1631.0
60_SW	60STN	7253	65.0	94	314.3
107_SW	107STN	38669	72.5	561	1869.4
45_SW	45STN	3569	65.8	47	156.5
109_SW1	109STN	12948	65.4	169	564.1
48_SW	48STN	16580	65.0	216	718.5

Stormwater Capture Area Costing

WS Name	Regional Storm Vol (m3) + 10%	Area Available for Ponding	Access Road Area	Overflow Length 1200 mm pipe assumed	Earth Removal Costs \$30	Inlet and Outlet \$50,000	Access Road \$150	Landscaping \$10	Overflow Costing \$3,300	Subtotal Cost	Contingency 10%	Design and Eng \$0.20	Total Cost \$0.15	Cost /m3
38_SW	12804	7117.52	920.67	100	\$384,120	\$50,000	\$138,101	\$71,175	\$355,000.00	\$998,396	\$199,679	\$149,759	\$1,347,835	\$105
48_SW	0	0.00	0.00	0	\$0	\$0	\$0	\$0	\$0.00	\$0	\$0	\$0	\$0	\$0
36_SW	12430	8552.32	2220.68	100	\$372,900	\$50,000	\$333,102	\$85,523	\$355,000.00	\$1,196,526	\$239,305	\$179,479	\$1,615,310	\$130
39_SW	4615	4068.51	1045.66	100	\$138,435	\$50,000	\$156,849	\$40,685	\$355,000.00	\$740,969	\$148,194	\$111,145	\$1,000,309	\$217
42_SW	34056	17973.00	2086.28	100	\$1,021,680	\$50,000	\$312,943	\$179,730	\$355,000.00	\$1,919,353	\$383,871	\$287,903	\$2,591,126	\$76
47_SW	7612	4253.70	1562.20	100	\$228,360	\$50,000	\$234,330	\$42,537	\$355,000.00	\$910,227	\$182,045	\$136,534	\$1,228,806	\$161
49_SW	19063	10719.89	1247.61	100	\$571,890	\$50,000	\$187,141	\$107,199	\$355,000.00	\$1,271,230	\$254,246	\$190,685	\$1,716,161	\$90
50_SW	14619	8977.55	1511.18	100	\$438,570	\$50,000	\$226,677	\$89,776	\$355,000.00	\$1,160,022	\$232,004	\$174,003	\$1,566,030	\$107
51_SW	16434	9187.44	2128.13	100	\$493,020	\$50,000	\$319,219	\$91,874	\$355,000.00	\$1,309,113	\$261,823	\$196,367	\$1,767,303	\$108
52_SW	8503	4759.86	1253.29	100	\$255,090	\$50,000	\$187,993	\$47,599	\$355,000.00	\$895,682	\$179,136	\$134,352	\$1,209,170	\$142
53_SW	8324	5123.32	1499.21	100	\$249,711	\$50,000	\$224,881	\$51,233	\$355,000.00	\$930,825	\$186,165	\$139,624	\$1,256,614	\$151
55_SW	0	0.00	0.00	0	\$0	\$50,000	\$0	\$0	\$0.00	\$50,000	\$0	\$7,500	\$57,500	\$0
56_SW	7537	4368.64	1583.64	100	\$226,116	\$50,000	\$237,545	\$43,686	\$355,000.00	\$912,348	\$182,470	\$136,852	\$1,231,670	\$163
58_SW	16280	9162.14	2195.09	100	\$488,400	\$50,000	\$329,264	\$91,621	\$355,000.00	\$1,314,285	\$262,857	\$197,143	\$1,774,285	\$109
59_SW	0	0.00	0.00	0	\$0	\$0	\$0	\$0	\$0.00	\$0	\$0	\$0	\$0	\$0
61_SW	33814	19716.52	3018.95	100	\$1,014,420	\$50,000	\$452,843	\$197,165	\$355,000.00	\$2,069,428	\$413,886	\$310,414	\$2,793,728	\$83
111_SW	44396	27620.80	2559.70	255	\$1,331,880	\$50,000	\$383,955	\$276,208	\$886,500.00	\$2,928,543	\$585,709	\$439,282	\$3,953,534	\$89
37_SW	13629	7784.92	1451.23	100.00	\$408,870	\$50,000	\$217,685	\$77,849	\$355,000.00	\$1,109,404	\$221,881	\$166,411	\$1,497,695	\$110
43_SW	0	0	0	0	\$0	\$0	\$0	\$0	\$0.00	\$0	\$0	\$0	\$0	\$0
254115					\$7,623,462	\$800,000	\$3,942,529	\$1,493,861	\$5,856,500	\$19,716,352	\$3,933,270	\$2,957,453	\$26,607,075	\$105

Table with columns: NAME, Watershed Type, Land Use, Imp. (%), PerRoute (%), Area, ha, IIMP (ha), IIMP (m^2), LID IIMP (m^2), Costs (\$), LID Costs (mm/Unit Cost (\$/m^2)), Land Use, Land Use Imp (%), Road Imp. (% of Land Use Imp (%)), Actual Road Imp (%). Rows include various catchments and their associated costs and land use metrics.

Costs based on EPA #s
\$307 /m3
\$16.06 /ft3



Memo

To: Arun Hindupur (Arun.Hindupur@guelph.ca)

From: Greg Junnor, A.Sc.T..

Date: March 13, 2020

File: TPB168050 Clair Maltby Cross-Section Study

cc: Stacey Laughlin, Mary Angelo, Jennifer Juste, Ron Scheckenberger (Wood), John McGill (Wood), Lachlan Fraser (Wood)

Re: **Comments Received and Actions on Evaluation Criteria for Selection of Preferred Cross-Section Designs**

Arun,

Please find below the following:

1. Summary of comments received on the preliminary evaluation criteria and indicators to be used for short-listing the long list (EXCEL) of alternative cross-sections as part of the Clair Maltby Area-Specific Cross-Section study
2. Our responses to those comments
3. Revised evaluation criteria based on comments and responses
4. Clarifications regarding weighting of criteria and scoring of sub-criteria
5. Summary of comments received on the long list of alternative cross-sections, the typical figures depicting them, and our responses to those comments
6. Completed scoring of all alternatives and identification of preferred alternative within each roadway classification (Attachment 1)

Background

The preliminary list of evaluation criteria was sent out by Wood to receive input and feedback. The list was split into 7 categories (Cost, Operations and Maintenance, Safety, Social Environment, Land Use Planning, Natural Environment, and Technical). Each category was further divided into criteria which had different indicators for effectiveness. Wood clarified that the indicators fall in line with typical class EA standards.

Comments were received from all participants.



Summary

Cost

Evaluation criteria capture the impacts of variances in cross-sectional design on the capital costs for linear transportation infrastructure and subsurface utilities (initial construction, rehabilitation, and reconstruction costs) over their intended lifecycle, along with operating and maintenance costs related to ensuring functionality, lifecycle preservation, fitness for use, and adequate safety.

Initial construction

Sub-criteria related to establishing the impacts of variances in cross-sectional design on the cost linear infrastructure and subsurface utilities in a green-field setting.

Operations

Sub-criteria related to the impacts of variances in cross-sectional design on the provision of year-round (patrolling, refuse collection, lighting energy and maintenance), summer (mowing, sweeping, catch basin cleaning, and preservation-management type activities such as crack-sealing) and winter (winter control of snow and ice through plowing, salting / sanding) activities specifically related to linear transportation infrastructure, that keep these facilities adequately safe and fit-to-purpose.

1. Comment: (Proposed edit to title) Annual or other time period Operations (including but not limited to mowing, pruning, and snow removal - (depends on the infrastructure). i.e. LID may not require annual maintenance but may require maintenance every 5 years.

Response: Agreed. Resolved via clarification. Sub-criteria are intended to capture all operational activities whether they occur frequently, infrequently or once within the lifecycle of the linear transportation infrastructure.

2. Comment: If new maintenance equipment is required, then those costs need to be captured somewhere.

Response: Agreed. Additions to the maintenance fleet and more operating staff may be required to address additional kilometres of roadway under City jurisdiction represented by the Clair Maltby Secondary Plan. However, for the purposes of this comparative analysis, unless variances in cross-section impact the number and type of units required and / or the number of additional staff needed to operate them, then the costs are the same for all alternatives and need not be evaluated. Impacts of variances in cross-section on fleet size,

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equipment requirements and operating staff are captured under Operations and Maintenance.

Utility rehabilitation

Sub-criteria related to the impacts of variances in cross-sectional design the difficulties associated with lifecycle replacement and / or upgrading of underground infrastructure, the potential for disruption of use of linear transportation infrastructure (i.e. closure of roads, lanes, cycle tracks, sidewalks or driveway accesses to allow for excavation); and restoration requirements (road, bikeway sidewalk reinstatement; impact on landscape elements such as street trees; or collateral impacts to other subsurface utilities where conflicts exist).

1. Comment: When going through the cost category at the October touch-point meeting, City of Guelph asked if the utility rehabilitation criteria considered a frequency of rehabilitation in the overall life cycle. The City clarified that rehabilitation generally occurs once every 10 years and that they can give Wood a more accurate number at a later point. The City also raised concerns over analyzing and capturing social costs that occur when rehabilitation occurs. As an example, the City defined capturing the social cost of rehabilitating utilities under a sidewalk which leaves the sidewalk inaccessible to all ages and abilities.

Response: Variance in ROW cross-section has no impact on the lifecycle of underground utilities. Some will need rehabilitation or expansion more of then that others in any case.

Cross-section, and the placement of underground utilities relative to surface elements of linear transportation infrastructure however, can have a major impact on the degree of difficulty associated with rehabilitation works, the amount of disruption experienced by road users, and the extent of restoration required once utilities are upgraded.

For example, placing utilities which will require more frequent rehabilitation than the roadway itself (e.g. telecommunications plant) under roadway elements (i.e. the travelled portion, cycle tracks or sidewalks) means that these facilities will be necessarily be damaged and users disrupted to accomplish the works, relative to what might occur were the utilities placed within the boulevard or to the outside of the sidewalk. Generally, costs associated with user disruption and restoration of surface elements, landscape, etc. will be significantly higher in more constrained cross-sections or in cases where utility placement remains ill-considered, relative to less constrained and / or well-considered cross-sections.

2. Comment: (Proposed edit to title) Utility rehabilitation (cost to access and reinstate and add additional/new utilities in the future).

Response: Agreed. Addressed via clarification

3. We need to somewhere and somehow capture the community cost of tree loss if a tree needs to be removed because it conflicts with a utility vs. no tree loss of the tree and utility are separated from each other. And we need to capture the cost of impact to the community when a sidewalk/MUP needs to be closed for a time period while the utility underneath the sidewalk/MUP is repaired vs. no impact to the community if the utility is not located underneath the sidewalk/MUP. And we need to capture the cost to the community when a sidewalk is repaired it becomes a trip hazard vs. no sidewalk cut then no trip hazard.

Response: Agreed. Addressed via clarification

Lifecycle renewal of linear transportation infrastructure

Sub-criteria related to the impacts of variances in cross-sectional design on capital cost of ownership: e.g. periodic resurfacing and eventual reconstruction of roads, curbs, boulevards, cycle tracks, sidewalks, and illumination.

1. Comment: Is a 25-year lifecycle for infrastructure renewal (reconstruction) reasonable (Jesse to confirm)

Response: A 25-year lifecycle is typically considered when addressing the major elements of linear transportation infrastructure. Granted, certain elements (e.g. bridges, culverts) may be designed to last much longer, and low-volume local roads may not age or deteriorate as quickly as heavily travelled arterial roads supporting transit and goods movement.

The key here is not so much to define an actual lifecycle but to assume a common lifecycle across all alternatives, and then to assess whether variances in cross-section have a material impact on the relative cost of renewal. For example, a roadway with a wider travelled portion will cost more to renew than one which is narrower curb-to-curb. Additional facilities such as sidewalks on both sides of the road, cycle tracks, multi-use paths, or specialized or aesthetic materials are likely to increase renewal costs relative to facilities where these elements are not included.

2. Just 25 years?

Response: See response above.

Operations and Maintenance

Evaluation criteria capture how well the cross-sectional design of the linear transportation infrastructure supports safe, efficient and cost-effective operations and maintenance activities.

Adequacy of boulevard space for snow storage

Sub-criteria related to the impacts of variances in cross-sectional design on the capacity of the boulevard (the area directly behind the curb face of the roadway) to store snow windrowed from the roadway, and shovelled from driveways by residents, without spillover (either back onto the roadway, or onto cycle tracks or pedestrian facilities to the outside of the boulevard).

1. Comment: At the October touch-point meeting, a question was raised by the City for the adequacy of boulevard space for snow storage criteria. They wanted to clarify that more than adequate space for snow storage does not necessarily meet the excellent indicator, as too much space can be a hinderance as well. The City also clarified that right-of-way (ROW) requirements for snow removal on cycle tracks and sidewalks should be ranked lower. They requested that the indicators should specify if equipment for snow removal of the specified ROW's exists, and not if the City already owns it.

Response: Agreed. "Sufficient" should be the highest-rated category. Implications for equipment, methods and operator requirements related to winter control are addressed in via the next sub-criteria.

2. 1.0 m is the minimum requirement; 1.5 m fully meets requirements.

Response: See response above.

3. Modify this – 'more than adequate space' would actually be 'poor' – the appropriate amount of space to adequately store snow would be 'excellent'

Response: See response above.

Impact on snow clearing operations on the roadway

Sub-criteria related to the impacts of variances in cross-sectional design on how well the design of the roadway supports safe, efficient and cost-effective winter control of the driving surface using commercially available equipment and one-pass methods. For example, if the design includes numerous horizontal traffic calming features (i.e. bump-outs), around which plows must navigate, or which require multiple passes to fully clear the roadway, then productivity in terms of kilometers cleared per hour per plow will be reduced, and winter control costs will be increased, relative to roadways which allow for uninterrupted operations.

1. Comment: Should be weighted less. Equipment might exist in 5 years when this is implemented; should reword to make sure design can be cleared using standardized equipment in one pass

Response: Agreed. Addressed via clarification. Weighting of all criteria and sub-criteria remains equal.

2. Modify – we will need new equipment to service this area (and existing equipment will likely be replaced before this area is developed) – so this should clearly refer to equipment that is available for purchase but not necessarily equipment that the City already owns

Response: See response above.

Impact on snow clearing operations for cycle tracks and sidewalks

Typically, smaller equipment is used separately to clear cycle-tracks and sidewalks. Sub-criteria relate to the impacts of variances in cross-sectional design on how well the design of the roadway facilitates the safe, efficient and cost-effective delivery of winter control measures on these facilities (i.e. lateral space, risk of damage to adjacent infrastructure elements or private property) using commercially available equipment and a one-pass operation.

1. Comment: Should be weighted less. Equipment might exist in 5 years when this is implemented; should reword to make sure design can be cleared using standardized equipment in one pass

Response: Agreed. Addressed via clarification. Weighting of all criteria and sub-criteria remains equal.

2. Comment: Modify – we will need new equipment to service this area (and existing equipment will likely be replaced before this area is developed) – so this should clearly refer to equipment that is available for purchase but not necessarily equipment that the City already owns

Response: See response above.

Impact on general maintenance (new sub-sets – year-round, summer, and winter activities)

Sub-criteria related to the impacts of variances in cross-sectional design on the provision of year-round (patrolling, sign replacement, refuse collection, lighting energy and maintenance), summer (mowing, sweeping, line-painting, catch basin cleaning, and preservation-management type activities such as crack-sealing) and winter (winter control of snow and ice through plowing, salting / sanding) activities specifically related to linear transportation infrastructure, that keep these facilities adequately safe and fit-to-purpose. Impacts in terms of equipment, methods and staffing are judged in terms of being more-costly, equally costly or less costly within each subset.

1. Comment: At the October touch-point meeting there was discussion about breaking up the “General maintenance” criteria into sub-sections for clarity. This could include Summer and Winter maintenance criteria. The City also wanted to include criteria for median maintenance depending on the selected short list cross sections.

Response: Agreed. Addressed via clarification, introduction of sub-sets and modification to range of indicators.

2. There’s a lot that could fit into this: pavement markings, sweeping, signage repair, mowing? Median.

Response: See response above.

Safety

Evaluation criteria capture the impacts of variances in cross-sectional design on how attribute of linear transportation infrastructure contributes to the safety of all road users by reducing exposure to hazards, the likelihood of harm and the consequences of collisions or other adverse occurrences (e.g. slips and falls, “dooring” of cyclists).

1. Comment: At the October touch-point meeting, in the safety category, the City pointed out that speed criteria were missing from the list. They requested that Wood include a criteria and way to capture the effect the cross sections have on speeding.

Response: New sub-criteria regarding speed management introduced. These sub-criteria specifically address how cross-sectional elements may impact the choice of speed by drivers midblock.

2. Can this include tighter turning radius, narrower travel lanes/perceived corridor width; impacts on speed.

Response: Sub-criteria specifically addresses midblock cross-sectional elements, and not intersections design (e.g. curb radii).

Speed management (new)

Sub-criteria related to the impacts of variances in cross-sectional design on the operating speed of vehicular traffic, and its corresponding effects on crash frequency and severity outcomes.

Emergency vehicle access

Sub-criteria related to the impacts of variances in cross-sectional design on how quickly emergency vehicles can navigate to incident scenes and perform necessary activities. Incident response times have a direct bearing on the chances of success in mitigating the severity outcomes of injuries.

1. Modify this – ‘more than adequate space’ would actually be ‘poor’ wide lanes and overbuilt roads can be a safety hazard and create more emergencies as they encourage drivers to speed – the appropriate amount of space to adequately accommodate emergency vehicle access would be ‘excellent’

Response: Agreed. Indicators modified to address insufficient, sufficient or excessive space, with sufficient receiving the highest score.

Adequacy of physical separation between vehicular traffic and vulnerable road users (new)

Sub-criteria related to the impacts of variances in cross-sectional design on whether vulnerable road users are separated from vehicular traffic, and if so, to what degree. Offset between facilities intended for motorized and non-motorized (walking, cycling) modes has a direct influence on the likelihood and severity outcomes of crashes involving roadway departures.

Note: Indicators modified to address insufficient, sufficient or excessive separation, with sufficient receiving the highest score.

Adequacy of physical separation between vehicular traffic and roadside hazards

Sub-criteria related to the impacts of variances in cross-sectional design on how fixed roadside hazards are placed relative to the travel lanes. Offset between the roadway and fixed object hazards has a direct influence on the likelihood and severity outcomes of crashes involving roadway departures.

Note: Indicators modified to address insufficient, sufficient or excessive separation, with sufficient receiving the highest score.

Addresses 'Vision Zero' objectives

The Vision Zero (VZ) concept is a multi-faceted strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all. Engineering of infrastructure, along with education, enforcement, emergency services and ergonomics (the understanding of human factors), are all key elements of this strategy.

Sub-criteria related to the impacts of variances in cross-sectional design on how the goal of eliminating fatalities and injuries to road users is furthered. Cross-sectional designs which control speed, provide separation between modes, eliminate roadside hazards, and incorporate positive guidance elements (those which respect the capabilities, limitations, expectations and information needs of road users) further VZ objectives.

1. Comment: Not sure if this captures "VZ" – what width implications does it have?

Response: Agreed. Addressed via clarification and modifications

2. Comment: Re-word this – the full intent of 'vision zero' isn't being captured through the indicators being included here

Response: See response above.

Impact on safety of right-of-way maintenance staff

Sub-criteria related to the impacts of variances in cross-sectional design on how right-of-way maintenance staff can establish work zones and manage traffic to improve their safety, and that of road users.

1. Comment: Should this be combined with category below?

Response: The activities involved in maintaining the ROW and those involved in maintaining sub-surface utilities have some commonalities. However, depending on the arrangement of surface and sub-surface elements, a greater proportion of utility maintenance may take place off the travelled way, and therefore away from the risks associated with motor vehicle traffic. For this reason, we see value in keeping the two separation as evaluation sub-criteria.

Impact on safety of utility personnel completing maintenance activities

Sub-criteria related to the impacts of variances in cross-sectional design on how right-of-way utility maintenance staff can establish work zones and manage traffic to improve their safety, and that of road users.

1. Should this be combined with category above? Safety of people working near the portion of the road used by cars is very important, however, including this in two categories feels like 'double-counting' the issue

Response: See response above.

Social Environment

Evaluation criteria related to the impacts of variances in cross-sectional design on the immediate physical and cultural setting in which people live or in which something happens or develops. It includes the society that the individual was educated or lives in, and the people and institutions with whom they interact. The social environment has direct impacts on the health of individuals and communities.

1. Comment: At the October touch-point meeting, for the Social Environment, the City requested that Wood use the terms "All Ages and Abilities" when discussing accessibility. The City also asked Wood about the locations of proposed bus shelters. Wood did not have a definitive answer at the time. The City suggested that they may be placed between trees in the landscape zone. The accessibility of the bus shelters should also be captured in the evaluation criteria.

Response: Bus shelter placement will vary along with variances in cross-section. Where the boulevard is sufficiently wide, bus shelters may be located there. Where sufficient space is available to the outside of the sidewalk (and further from the travelled portion of the

roadway), this location is preferred, as it places transit users further from traffic hazards and the splash zone.

2. Comment: Can we capture a way of inconveniencing the public when there are disruptions to using a section of infrastructure, e.g. a detour route is required?

Response: The degree of disruption associated with variances in cross-section and the corresponding placement of subsurface utilities may include impacts to pedestrians, cyclists and drivers. Where maintenance and / or rehabilitation activities must take place within the travelled portion, narrower cross-sections may preclude maintaining two-lane, two-way traffic and require either alternating right-of-way within a single lane or road closures and detours. Similarly, utilities under or close to cycle tracks and sidewalks may require their closure, and detours, to allow for the establishment of safe work zones.

We have included two new sub-criteria titled “maintenance of access” which provides a relative indication of how well or poorly a cross-section accommodates maintenance and / or rehabilitation activities while avoiding disruptions in service to a) drivers and b) pedestrians, cyclists and transit users.

Accessible to all ages and abilities

Sub-criteria related to the impacts of variances in cross-sectional design on accessibility within the ROW (e.g. getting into / out of vehicles; using mobility devices; walking, cycling, and waiting for / taking transit).

Cross-section elements flow naturally into surrounding land uses

Sub-criteria related to the impacts of variances in cross-sectional design on how well the cross-section of the roadway integrates with the built form outside of the ROW.

1. Comment: How is this being evaluated?

Response: These sub-criteria is somewhat subjective. However, the main indicator is how well the cross-section fits within the concept of complete streets, and a seamless and integrated harmony between ROW and adjacent land use.

Transit supportive

Sub-criteria related to the impacts of variances in cross-sectional design on the safe and efficient operation of transit vehicles (including specialized transit) and the accessibility of transit facilities and vehicles for people of all ages and abilities.

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1. Comment: Planning wants to know / understand where the bus shelters are going in the context of bump outs, other features?

Response: Refer to the response under the Social Environment heading above.

2. Comment: How are the bus shelters locations being determined without a plan view of the streets?

Response: See response above.

Aesthetics

Sub-criteria related to the impacts of variances in cross-sectional design on the aesthetics of the ROW.

1. Comment (relates to the indicators identified in the evaluation table): ? paving stones, different treatments unacceptable?

Response: The original indicator was: "Majority of ROW is hard-surfaced." This has been changed to "Majority of ROW is impermeable." This is not intended to preclude different treatments and textures, but to differentiate between cross-sections which are stark and utilitarian and those which incorporate natural elements and are thus more pleasing.

Land Use Planning

Evaluation criteria related to the impacts of variances in cross-sectional design on the degree to which the highest and best use of adjacent lands is supported.

1. Comment: At the October touch-point meeting, under the Land Use Planning category, the City also requested clarification of the "Compatibility with Guelph Transportation Master Plan" criteria. Wood clarified that they would discuss with the City to properly assess how the cross-sections correspond to the TMP core values.

Response: This section has been extensively reworked and expanded to address compatibility with the core values, vision and goals being incorporated into the TMP. See sub-criteria pertaining to the TMP below.

2. Comment: Stacey to provide input on what is considered “excellent” for each of the guiding principles.

Response: This will be discussed at the next workshop.

Impact on total developable land base within secondary plan area

Sub-criteria related to the impacts of variances in cross-sectional design on how much of the developable land base is consumed by ROW. In this instance, wider ROWs would score lower in this category, but higher in others related to ROW safety, functionality, and serviceability.

1. Comment: This should be tied into the actual number of roads anticipated within the SP area as the actual width may not have a statistically significant impact.

Response: Assuming the same length of arterial, collector and local roadways in all cases, it stands to reason that wider cross-sections will result in less developable land area. Notwithstanding the increased desirability of the remaining land area associated with wider cross-sections and their additional amenities, a calculation was made of the total land area consumed by each cross-section under each classification. The incremental consumption was then compared to the total developable area of the SP and expressed as a percentage.

The following Table quantifies the incremental amount of developable land consumed (as a percentage) under each scenario, when compared to existing standard cross-sections as a base case.

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Clair Maltby Secondary Plan Area Incremental Consumption of Developable Land through Changes in Roadway Cross-section						
Developable Area (Hectares)	491					
	Proposed Length (m)	Cross- sectional Width (m)	Developabl e Area Consumed (m ²)	Developable Area Consumed (Hectares)	Percentage of Developable Area Consumed	Incremental Percentage of Developable Area Consumed (Relative to Existing Standard)
Arterial Roadways	5,546					
<i>Existing Standard</i>		30.0	166,380	16.64	3.4%	
<i>Alternative 1 - Design Charet</i>		30.0	166,380	16.64	3.4%	
<i>Alternative 2 - Stakeholder Wish List</i>		38.2	211,857	21.19	4.3%	0.9%
<i>Alternative 3 - Design Hybrid</i>		33.8	187,455	18.75	3.8%	0.4%
Collector Roadways	9,378					
<i>Existing Standard</i>		26.0	243,828	24.38	5.0%	
<i>Alternative 1 - Design Charet</i>		26.0	243,828	24.38	5.0%	
<i>Alternative 2 - Stakeholder Wish List</i>		32.4	303,847	30.38	6.2%	1.2%
<i>Alternative 3 - Design Hybrid</i>		32.4	303,847	30.38	6.2%	1.2%
Local Roadways (Estimated as Three Times Collector Roadways Length)	12,134					
<i>Existing Standard</i>		18.0	218,412	21.84	4.4%	
<i>Alternative 1 - Design Charet</i>		18.0	218,412	21.84	4.4%	
<i>Alternative 2 - Stakeholder Wish List</i>		20.0	242,680	24.27	4.9%	0.5%
<i>Alternative 3 - Design Hybrid</i>		18.0	218,412	21.84	4.4%	

1 Hectare = 10,000 m²

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The Clair-Maltby Secondary Plan Area encompasses 491 hectares. 5,546 linear metres of Arterial Roadways and 9,378 linear metres of Collector Roadways are proposed. To estimate the likely linear metres of Local Roadways required to service the land area, the length of the Collector Roadways was multiplied by a factor of three (3), resulting in 28,134 linear metres of local roadways.

Total cross-section width was obtained for each scenario (Existing Standard, Alternative 1 - Design Charet, Alternative 2 - Stakeholder Wish List and Alternative 3 - Design Hybrid) under each roadway classification (Arterial, Collector and Local). Total developable area consumed was first expressed in metres squared, then converted to Hectares. This was compared to the total developable area and expressed as a percentage.

To examine the incremental increase in consumption of developable land, the existing standard for cross-sections under each roadway classification was taken as the base case. The consumption under alternative scenario was then compared to the base case and expressed as a percentage.

From the Table it can be seen that, worst case, the alternative cross-sections under the three roadway classifications (Arterial, Collector and Local) will consume an additional 0.9%, 1.2% and 0.5% of developable land, respectively.

Compatibility with Clair Maltby Secondary Plan Guiding Principal 1: Green and Resilient

Sub-criteria related to the impacts of variances in cross-sectional design on opportunities to protect, maintain, restore, and where possible, improve water resources and the Natural Heritage System, and support resiliency and environmental sustainability through measures such as energy efficiency, water conservation and green infrastructure.

Compatibility with Clair Maltby Secondary Plan Guiding Principal 2: Healthy and Sustainable

Sub-criteria related to the impacts of variances in cross-sectional design on opportunities to design the community for healthy, active living by providing a mix of land uses including a diversity of housing choices at appropriate densities with appropriate municipal services to ensure long-term sustainable development which is fiscally responsible.

Compatibility with Clair Maltby Secondary Plan Guiding Principal 3: Vibrant and Urban

Sub-criteria related to the impacts of variances in cross-sectional design on opportunities to create identifiable urban neighbourhoods that are pedestrian oriented and human-scaled, promoting forward-thinking and innovative design that integrates new development into the rolling topography, while conserving significant cultural heritage resources.

Compatibility with Clair Maltby Secondary Plan Guiding Principal 4: Interconnected and Interwoven

Sub-criteria related to the impacts of variances in cross-sectional design on opportunities to establish a multi-modal mobility network that provides choice and connects neighbourhoods to each other and the rest of the city, by creating a network of parks, open spaces and trails to provide opportunities for active and passive recreation, as well as active transportation choices.

Compatibility with Clair Maltby Secondary Plan Guiding Principal 5: Balanced and Liveable

Sub-criteria related to the impacts of variances in cross-sectional design on opportunities to create and sustain a valued and livable community which reflects the right balance between protecting the environment and fostering a healthy, equitable and complete community.

Compatibility with Guelph Transportation Master Plan (TMP)

Sub-criteria related to how variances in cross-sectional design align with TMP core values, vision and goals, as follows:

Six core values that will guide the work of the TMP update, which are:

- Safety for all road users
- Equitable access to jobs, services and housing, regardless of the chosen mode of transportation
- Multi-modal connectivity to ensure all areas of the city are connected by diverse forms of transportation
- Environmental sustainability to respect the natural environment and achieve a net-zero carbon future by 2050
- Tied to land use to put people and jobs where there are choices for transportation
- Financially sustainable to respect taxpayers and allocate resources responsibly

These core values and community engagement input now reflected in the draft vision and goals that have been framed for the TMP update. Goals are high-level aspirations that reflect the core values and vision of the TMP. These goals are also aligned to the City's Strategic Plan goals for Navigating Our Future. The draft goals include the following:

1. People of all ages and abilities will be able to travel safely using any transportation mode that they choose.
2. Guelph's transportation system will be easy-to-use, reliable and give people and businesses the options they want when they need them.
3. Transit service will provide travel times and traveler convenience at levels that are competitive with travel by car.
4. The carbon footprint from the transportation sector will aim for net zero by 2050.
5. Guelph's streets, trails, and rail networks will align with the City's land use objectives.

6. Investment decisions will be made considering the asset lifecycle costs.

1. Comment: Don't want to double count elements that are covered elsewhere...

Response: We do not believe this represents double counting, as it reflects the specific core values, vision and goals expressed under the development of the TMP.

Cross-Sections Incorporate Trees on both Sides of the Roadway.

Sub-criteria related to the impacts of variances in cross-sectional design on whether trees are incorporated into both sides of the roadway.

Note: The indicators have been revised to reflect a yes or no response, with scoring accordingly.

Natural Environment

Evaluation criteria related to the impacts of variances in cross-sectional design on living species, climate, weather, and natural resources such as air and water.

Impact of proposed cross-section on groundwater quantity

Sub-criteria related to the impacts of variances in cross-sectional design on groundwater recharge, primarily based upon how stormwater accumulation on hard surfaces is managed and the degree to which permeable surfaces and vegetation are employed.

Impact of proposed cross-section on water quality

Sub-criteria related to the impacts of variances in cross-sectional design on stormwater quality and the degree to which natural infiltration and reuse is employed as an alternative to piped solutions.

Impact of proposed cross-section on climate change

1. Comment: At the October touch-point meeting, for the Natural Environment category, the City commented on the "Impact of proposed cross-sections on climate change". They suggested that these criteria should be divided into smaller overall categories and that it should capture people's ability to move in carbon free modes. Wood commented that they will discuss with their Climate Change team to expand upon the climate change criteria.

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Response: Revised sub-criteria / clarification developed as follows:

Sub-criteria related to the impacts of variances in cross-sectional design contributes towards a net-zero carbon future. Considerations included: Ratio of permeable to impermeable surfaces; inclusion of street trees; degree of encouragement / facilities available to promote non-motorized travel (i.e. walking, cycling; and degree of speed management (lower speeds equate to relatively better fuel economy.

Technical

Evaluation criteria related to the impacts of variances in cross-sectional design on conformance to legislated requirements, beat-practice standards, applicable guidelines and provides flexibility to physically accommodate future innovations in transportation (e.g. electric vehicle charging, bike-sharing, autonomous and connected vehicles), along with innovations in utility services (e.g. 5G connectivity, greater electrical demand, two-way grid to accommodate localized power generation through rooftop solar).

1. Comment: At the October touch-point meeting, the City had one concern over the Technical category. For the vertical and horizontal clearance criteria, the City asked that the range of indicators be removed for these criteria and instead be replaced with either a pass or fail indicator which specifies that the utility clearance requirements are either met or not.

Response: Range of indicators for items with legislative or standards-based requirements revised to reflect either a compliant or a non-compliant response.

2. Comment: If these are requirements, then there shouldn't be option for "poor".

Response: See response above.

Provides flexibility in available space to incorporate innovative features in the future

Sub-criteria related to the impacts of variances in cross-sectional design on the accommodation of emerging transportation solutions such as bike-share facilities, transit as a service, and autonomous and connected vehicles, along with the anticipated evolution of connectivity solutions and smart electrical grids.

Surficial facility widths meet applicable design standards (AODA, TAC, MTO)

Sub-criteria related to the impacts of variances in cross-sectional design on compliance with current and anticipated, future legislated requirements, beat-practice standards and applicable guidelines pertaining to the design of linear transportation infrastructure.

1. If a legislated standard or requirement is not being met (and is clearly required by legislation) then that cross-section cannot be considered a viable option. This needs to be clarified.

Response: See response above.

2. Comment: Clarify what is being considered a 'standard'.

Response: A technical standard is an established norm or requirement. Providing relatively more leeway than a legislative requirement, a standard sets the benchmark against which a design or operational decision may be measured. While meeting or exceeding a standard does not guarantee optimum or even nominal outcomes and failing to meet a standard does not automatically render a design inadequate from an operational or safety perspective, non-compliance may be challenged. Failing to meet a standard must be justified as an outcome of the application of reasoned engineering judgement.

Lane widths support goods movement and transit

Sub-criteria related to the impacts of variances in cross-sectional design on lane widths, and by extension, the accommodation of transit vehicles and trucks in the essential movement of people and goods.

1. Comment: Please clarify why goods movement is being used as criteria for all streets? We don't want to encourage goods movement on all streets (i.e. local)

Response: References to lane width adequacy for goods movement and transit revised to be "where applicable". Lane widths of 3.3 m may not be the desirable minimum in all applications, such as on local roads without transit routes (served by specialized transit only), and goods movement is infrequent and for the purposes of local deliveries only.

2. If this is the width that accommodates transit/goods movement (and therefore I assume emergency vehicle access) why do we need to question the lane width? Wouldn't we just set it at 3.3m – or is there a significant benefit to having wider lanes? (Refers to explanation of "Poor" in table)

Response: See response above.

3. Modify this – 'exceed' would actually be 'poor' wide lanes and overbuilt roads can be a safety hazard and create more emergencies as they encourage drivers to speed – the appropriate amount of space to adequately accommodate design vehicles (transit and trucks) given the function of the road without encouraging speeding for all other vehicles would be 'excellent'. (Refers to explanation of "Excellent" in table)

Response: Agreed. Modified as suggested.

Vertical and horizontal clearance requirements for gas infrastructure met within ROW

Sub-criteria related to the impacts of variances in cross-sectional design on the ability to provide necessary separation between natural gas and other utilities as a matter of safety (when excavating) and ease of access with minimal disruption to traffic (including non-vehicular modes) or other services.

Vertical and horizontal clearance requirements for telecommunications and electrical infrastructure met within ROW

Sub-criteria related to the impacts of variances in cross-sectional design on the ability to provide necessary separation between telecommunications and electrical infrastructure and other utilities as a matter of safety (when excavating) and ease of access with minimal disruption to traffic (including non-vehicular modes) or other services.

1. Comment: Shouldn't this category and the one above be combined (utilities in ROW)? Not clear why they've been separated.

Response: Specific concerns were raised by stakeholders from the gas utility about the requirement to meet standards. This is not to suggest that meeting gas utility standards are any more or less important than those applicable to other utilities. It was broken out only to reflect the input received.

Weighting of Individual Evaluation Criteria

No differential weighting is applied to the evaluation criteria. All cross-sectional attributes are given equal weighting in the scoring matrix.

Scoring of Sub-criteria

By default, cross-sections are scored on sub-criteria based upon the following indicators:

- | | | |
|----------------|----------|---|
| • Poor | Score: 0 | Cross-section <u>does not</u> meet objectives |
| • Fair | Score: 2 | Cross-section <u>meets a minority</u> of objectives |
| • Satisfactory | Score: 5 | Cross-section <u>meets a majority</u> of objectives |
| • Good | Score: 7 | Cross-section <u>meets practically all</u> objectives |
| • Excellent | Score 10 | Cross-section <u>fully meets all</u> objectives |

Under certain sub-criteria, an abbreviated set of indicators may be used, as shown at the bottom of Attachment 1 at the back of this memo.

Comments Related to Cross-section Typical Drawings

1. Comment: At the October touch-point meeting, the City asked that 4m lane widths not be included in any of the cross-section.

Response: Applicable revisions were made to the cross-section typical drawings.

2. Comment: Cross section drawings don't match with the excel tables

Response: Applicable revisions were made to the tables and the cross-section typical drawings to ensure consistency.

3. Comment: 4.0 m outside lane is too wide and would not be entertained moving forward.

Response: Noted. Cross-section typical drawings will be revised accordingly.

4. Comment: Lane widths of 3.5 m still meets the requirements of bus and emergency vehicle operations as well as heavy trucks.

Response: Acknowledged. Lanes 3.5 m or wider do meet these requirements. However, lanes narrower than 3.5 m may be appropriate where speed management is desired, buses and goods movement are not considerations, and only emergency vehicles and specialized transit need be accommodated.

Long-list of Cross-section Alternatives (EXCEL)

At the October touch-point meeting, Wood introduced the long list of cross-section alternatives in an EXCEL format. This EXCEL sheet was broken up into 3 tabs, one for each of the roadway classifications (Arterial, Collector, Local). Each tab included various alternatives, showing the width of surface (cross-sectional) elements along with the proposed location of underground utilities.

Wood classified the alternatives under 4 main categories (Typical, Standard, Wish-list, Hybrid). The typical cross-sections were derived from the cross-section standards developed at the design charrette. The standard cross-sections use the existing City of Guelph standards as a base. The wish-list versions reflect the feedback received during Workshop #1. Finally, the hybrids combine elements from the wish-list and typical cross-sections.

Attachment 1 reformats this original presentation, updates the indicators, includes scoring for each, and presents our completed evaluation of each of the four cross-section alternatives under each of the three roadway classifications, and the identifies the preferred alternative for each.

Short-listing Results

Scoring for each roadway classification is presenting in the following three Tables.

Arterial			
Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid
237	273	266	280

Within the Arterial Roadway classification, Alternative 1, a product of the Design Charet, and Alternative 3, a Hybrid of Alternatives 1 and 2 scored the highest, and will be carried forward to the shortlist.

Collector			
Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid
215	272	275	275

Within the Collector Roadway classification, Alternative 2, a product of the Stakeholder Wish List, and Alternative 3, a Hybrid of Alternatives 1 and 2, scored equally high and will be carried forward to the shortlist.

Local			
Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid
215	240	232	225

Within the Local Roadway classification, Alternative 1, a product of the Design Charet and Alternative 2, a product of the Stakeholder Wish List scored the highest and will be carried forward to the shortlist.

Note that each of the shortlisted cross-sections may offer minor opportunities for fine-tuning in terms of the lateral placement of subsurface utilities relative to above ground elements to minimize disruption to road users and restoration costs when their expansion / rehabilitation becomes necessary.

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The full scoring matrix follows, as Attachment 1.

Regards,
Greg

Attachment 1 – Scoring and Ranking of Alternatives

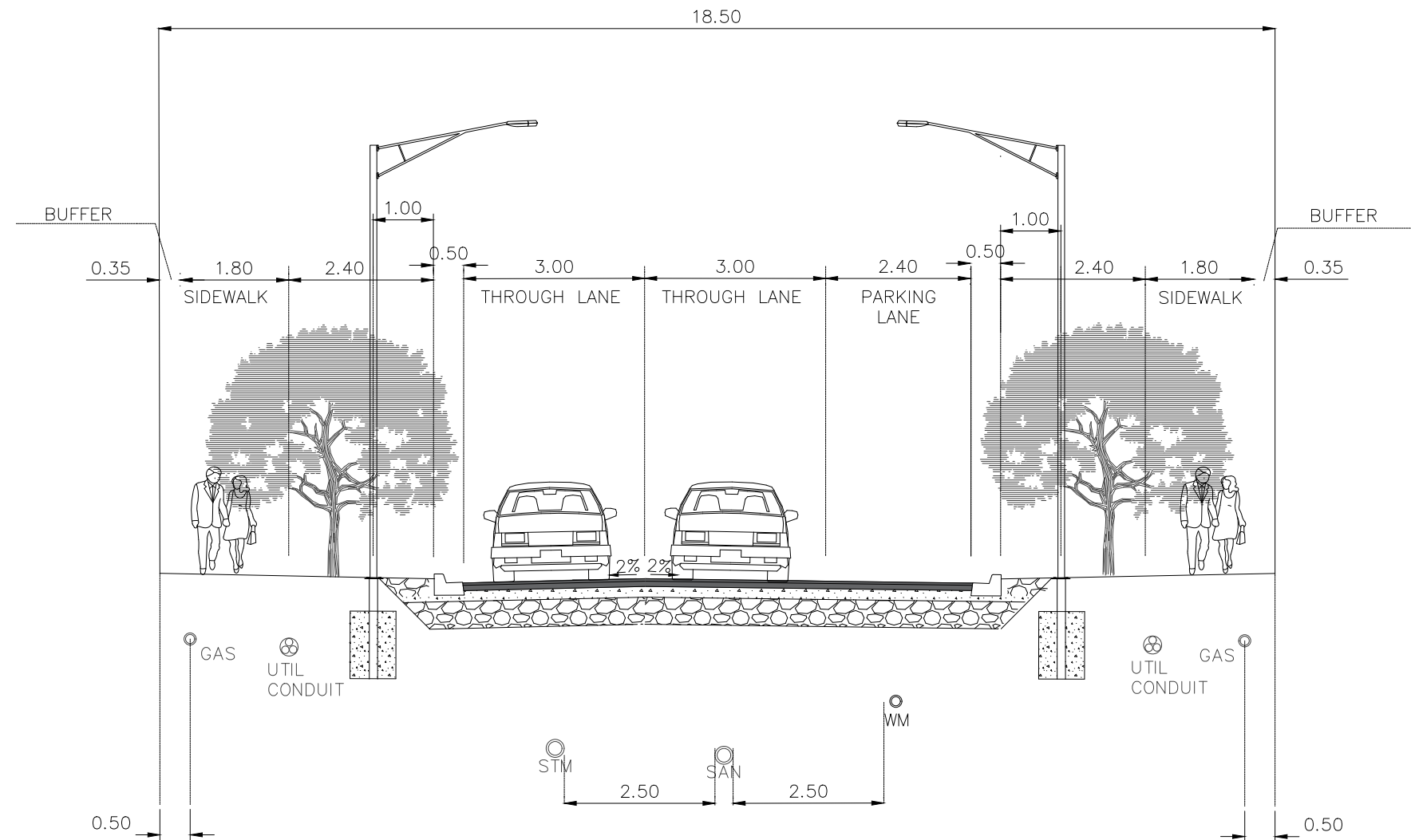
Category	Evaluation Criteria	Indicators		Score	Arterial				Collector				Local			
					Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid	Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid	Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid
Cost	Initial Construction	Poor	Most costly of the alternatives	0	10	7	0	5	10	5	0	0	10	5	5	5
		Fair		2												
		Satisfactory		5												
		Good		7												
		Excellent	Least costly of the alternatives	10												
	Operations	Poor	Most costly of the alternatives	0	10	5	5	5	10	5	2	2	10	5	5	5
		Fair		2												
		Satisfactory		5												
		Good		7												
		Excellent	Least costly of the alternatives	10												
	Utility rehabilitation	Poor	Most costly of the alternatives	0	5	2	10	7	7	10	2	2	10	5	5	5
		Fair		2												
		Satisfactory		5												
		Good		7												
		Excellent	Least costly of the alternatives	10												
	Lifecycle renewal	Poor	Most costly of the alternatives	0	10	5	2	2	10	2	0	0	10	5	5	5
Fair			2													
Satisfactory			5													
Good			7													
Excellent		Least costly of the alternatives	10													
Operations and Maintenance	Adequacy of boulevard space for snow storage	Absent	No space for snow storage.	0	5	2	10	2	10	2	2	2	10	10	5	10
		Inadequate	Not enough space for snow storage	2												
		Sufficient	Adequate space for snow storage	10												
		Excessive	More space for snow storage than is necessary	5												
	Impact on snow clearing operations for roadway.	Poor	Specialized equipment AND multiple passes required to meet winter control standards	0	10	10	10	10	10	5	5	5	10	5	5	5
		Fair	Specialized equipment OR multiple passes required to meet winter control standards	5												
		Satisfactory	Commercially available equipment and one-pass methods may be used to meet winter control standards	10												
	Impact on snow clearing operations for cycle track and sidewalk.	Poor	Specialized equipment AND multiple passes required to meet winter control standards	0	10	5	5	5	10	5	5	5	10	5	5	5
		Fair	Specialized equipment OR multiple passes required to meet winter control standards	5												
		Satisfactory	Commercially available equipment and one-pass methods may be used to meet winter control standards	10												
	Impact on general maintenance – year around	More costly	Specialized equipment, less-efficient methods to achieve same outcomes and / or more staff time to accomplish	0	10	5	5	5	10	0	0	0	10	5	5	5
		About the same cost	Equal requirements relative to other options	5												
		Less costly	Opportunities for cost-efficiencies relative to other options	10												
	Impact on general maintenance - summer	More costly	Specialized equipment, less-efficient methods to achieve same outcomes and / or more staff time to accomplish	0	5	5	5	5	10	5	5	5	5	5	5	5
		About the same cost	Equal requirements relative to other options	5												
		Less costly	Opportunities for cost-efficiencies relative to other options	10												

Social Environment	Cross-section elements flow naturally into surrounding land uses.	Poor	No continuity between road ROW and adjacent property (i.e. surfaces do not match or are not reflective of planned uses).	0	5	10	10	10	5	10	10	10	5	5	5	5	
		Fair		2													
		Satisfactory		5													
		Good		7													
	Transit supportive.	Poor		Lack of active transportation connectivity and space for bus shelters.	0	5	10	10	10	5	10	10	10	N/A	N/A	N/A	N/A
			Fair		2												
			Satisfactory		5												
		Good		7													
	Excellent	High quality active transportation connectivity and adequate space for bus shelters.	10														
	Aesthetics	Poor		Majority of ROW is impermeable.	0	5	7	7	7	7	10	10	10	5	7	7	7
			Fair		2												
			Satisfactory		5												
Good			7														
Excellent	Adequate space is provided for landscape elements and/or use of alternative, visually appealing materials.	10															
Land Planning	Impact on total developable land base within Secondary Plan Area	Poor	Widest right-of-way width.	0	7	7	0	5	7	7	0	0	7	7	0	7	
		Fair		2													
		Satisfactory		5													
		Good		7													
	Excellent	Minimum functional right-of-way width.	10														
	Compatibility with Clair Maltby Secondary Plan Guiding Principal 1: Green and Resilient	Poor	Incompatible		0	5	7	7	7	2	7	10	10	2	7	7	7
		Fair		2													
		Satisfactory		5													
		Good		7													
	Excellent	Entirely compatible	10														
	Compatibility with Clair Maltby Secondary Plan Guiding Principal 2: Healthy and Sustainable	Poor	Incompatible		0	5	7	10	10	2	7	10	10	2	7	7	7
		Fair		2													
		Satisfactory		5													
		Good		7													
	Excellent	Entirely compatible	10														
	Compatibility with Clair Maltby Secondary Plan Guiding Principal 3: Vibrant and Urban	Poor	Incompatible		0	2	7	7	7	2	7	10	10	2	7	7	7
		Fair		2													
		Satisfactory		5													
		Good		7													
	Excellent	Entirely compatible	10														
	Compatibility with Clair Maltby Secondary Plan Guiding Principal 4: Interconnected and Interwoven	Poor	Incompatible		0	2	7	7	7	2	7	10	10	2	7	7	7
		Fair		2													
		Satisfactory		5													
		Good		7													
Excellent	Entirely compatible	10															
Compatibility with Clair Maltby Secondary Plan Guiding Principal 5: Balanced and Liveable	Poor	Incompatible		0	5	7	7	7	2	7	10	10	2	7	7	7	
	Fair		2														
	Satisfactory		5														
	Good		7														
Excellent	Entirely compatible	10															
Compatibility with Guelph Transportation Master Plan	Poor	Incompatible		0	5	10	10	10	2	7	10	10	2	7	7	7	
	Fair		2														
	Satisfactory		5														
	Good		7														
Excellent	Entirely compatible	10															
Cross-Sections incorporate trees on both sides of the roadway.	No	Inadequate space for trees on either side of the roadway.	0	0	10	10	10	0	10	10	10	10	10	10	10	10	
	Excellent	Adequate space for trees is provided on both sides of the roadway.	10														
Impact of proposed cross-section on groundwater recharge (water balance)	Poor	Significant adverse impact	0	2	7	10	10	2	5	7	7	7	7	7	7	7	
	Fair		2														
	Satisfactory		5														
	Good		7														
Excellent	Significant positive impact	10															

Natural Environment	Impact of proposed cross-section on water quality	Poor	Significant adverse impact	0	5	7	7	7	5	10	10	10	5	7	7	7	
		Fair		2													
		Satisfactory		5													
		Good		7													
	Excellent	Significant positive impact	10														
	Impact of proposed cross-section on climate change	Poor	Significant adverse impact	0	2	7	7	7	2	7	5	5	2	5	7	7	5
		Fair		2													
		Satisfactory		5													
Good			7														
Excellent	Significant positive impact	10															
Technical	Provides flexibility in available space to incorporate innovative features in the future (i.e. bike share parking).	Poor	All available above and below grade space is utilized for essential infrastructure. Very limited flexibility.	0	2	10	10	10	2	7	7	7	5	5	7	5	
		Fair		2													
		Satisfactory		5													
		Good		7													
	Excellent	Adequate space exists in the proposed ROW to accommodate potential future needs. Space is flexible without being excessive.	10														
	Surficial facility widths meet applicable design standards (AODA, TAC, MTO)	Non-compliant	Legislative or standards-based requirements are not met	0	10	10	10	10	10	10	10	10	10	10	10	10	10
		Compliant	All legislative or standards-based requirements are met	10													
	Lane widths, where applicable, support goods movement and / or transit.	Non-compliant	Minimum lane widths for transit and / or goods movement not met	0	10	10	10	10	10	10	10	10	10	N/A	N/A	N/A	N/A
		Compliant	Minimum lane widths for transit and / or goods movement are met	10													
	Vertical and horizontal clearance requirements for gas infrastructure met within ROW.	Non-compliant	Insufficient cover and horizontal separation between the property line and adjacent utilities to meet CSA guidelines.	0	10	10	0	10	10	10	10	10	10	10	10	10	10
		Compliant	Vertical and horizontal clearances meet/exceed minimums and provide adequate buffers to perform maintenance activities without impacting other utilities.	10													
	Vertical and horizontal clearance requirements for telecommunications and electrical infrastructure met within ROW.	Non-compliant	Insufficient cover and horizontal separation to other utilities or transportation infrastructure.	0	10	10	0	10	10	10	10	10	10	0	0	0	0
Compliant		Vertical and horizontal clearances meet or exceed minimums and provide adequate space to allow for maintenance operations within impact to other facilities within the ROW.	10														

Key		
Indicator		Score
Poor	Cross-section <u>does not</u> meet objectives	Score: 0
Fair	Cross-section <u>meets</u> a <u>minority</u> of objectives	Score: 2
Satisfactory	Cross-section <u>meets</u> a <u>majority</u> of objectives	Score: 5
Good	Cross-section <u>meets</u> <u>practically</u> all objectives	Score: 7
Excellent	Cross-section <u>fully</u> <u>meets</u> all objectives	Score 10

Summary	Arterial				Collector				Local			
	Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid	Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid	Existing Standard	Alternative 1 - Design Charet	Alternative 2 - Stakeholder Wish List	Alternative 3 - Design Hybrid
	237	273	266	280	215	272	275	275	215	240	232	225



NOTES

Tree Species to be selected as per CoG Tree Technical Manual
Light standards may be dual-sided to aid with pedestrian visibility.
For vertical clearance of pipes and utilities, refer to CoG DEM section 5.0

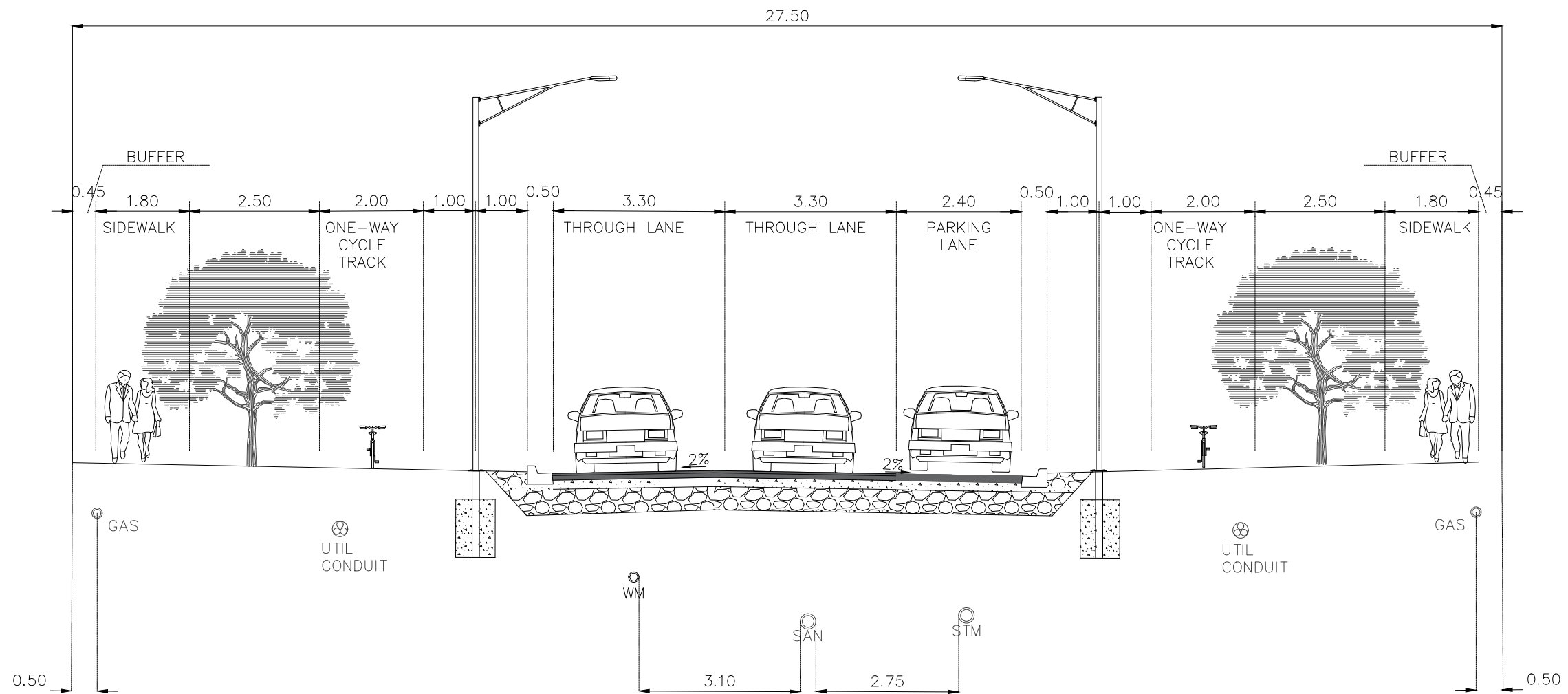
**CLAIR MALTBY
CROSS-SECTION STUDY
CITY OF GUELPH
SHORTLIST DESIGN
LOCAL ROADWAY**



Project No.	TPB168050
Date	JUNE. 2020
Scale	1:100
Drawing No.	3

Path: C:\Users\Mahsa.Mirhosseini\OneDrive - Wood PLC\Assignments\Lachlan\08-28-20
Revised Clair Maltby Cross Sections.dwg

Plotted By: mahsa.mirhosseini
Last Saved By: mahsa.mirhosseini
2021-04-26
Last Saved: 2020-08-31



NOTES

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Light standards may be dual-sided to aid with pedestrian visibility.
For vertical clearance of pipes and utilities, refer to CoG DEM section 5.0

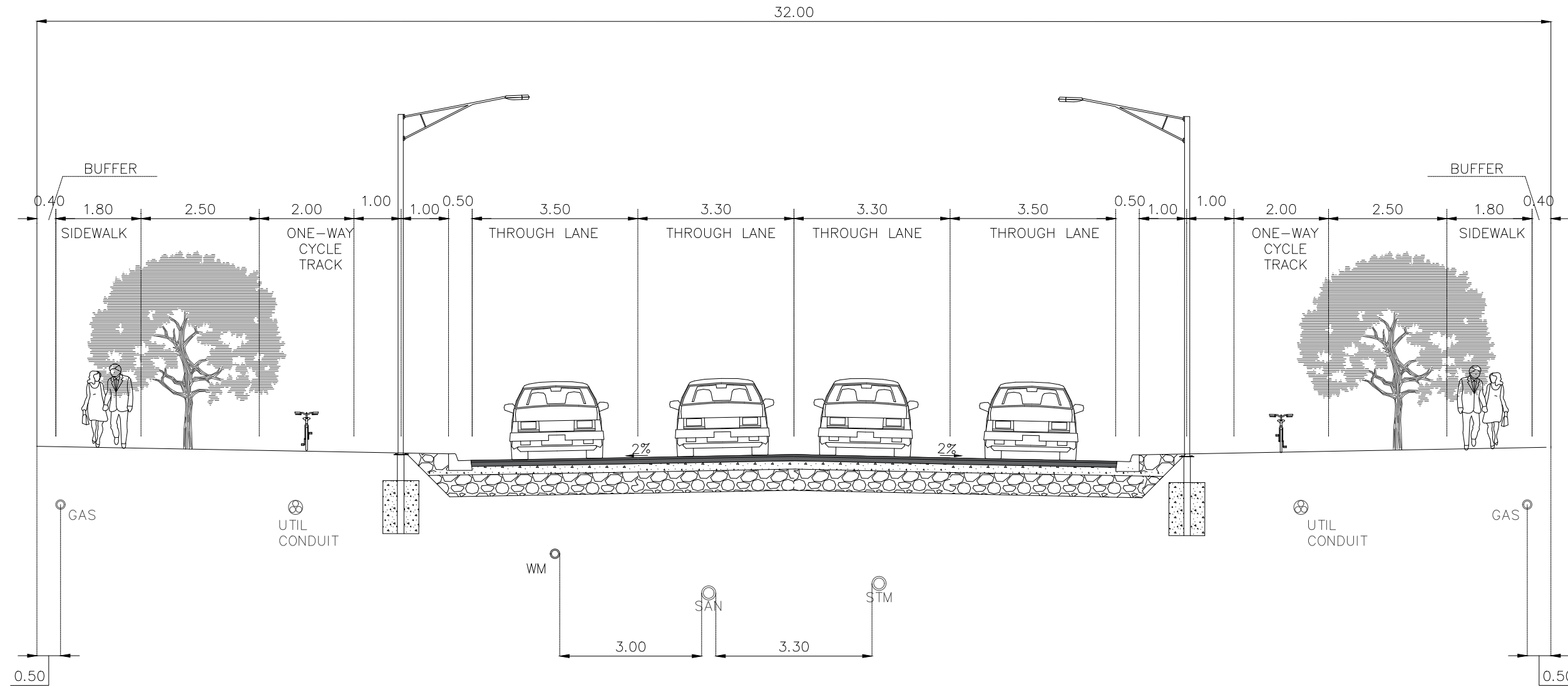
**CLAIR MALTBY
CROSS-SECTION STUDY
CITY OF GUELPH
SHORTLIST DESIGN
COLLECTOR ROADWAY**



Project No.	TPB168050
Date	JUNE. 2020
Scale	1:100
Drawing No.	2

Path: C:\Users\Mahsa.Mirhosseini\OneDrive - Wood PLC\Assignments\Lachlan\08-28-20 Revised Clair Maltby Cross Sections.dwg

Plotted By: mahsa.mirhosseini
 Last Saved By: mahsa.mirhosseini
 2021-04-26
 Last Saved: 2020-08-31



NOTES
 Tree Species to be selected as per CoG Tree Technical Manual.
 Light standards may be dual-sided to aid with pedestrian visibility.
 For vertical clearance of pipes and utilities, refer to CoG DEM section 5.0

**CLAIR MALTBY
 CROSS-SECTION STUDY
 CITY OF GUELPH
 SHORTLIST DESIGN
 ARTERIAL ROADWAY**

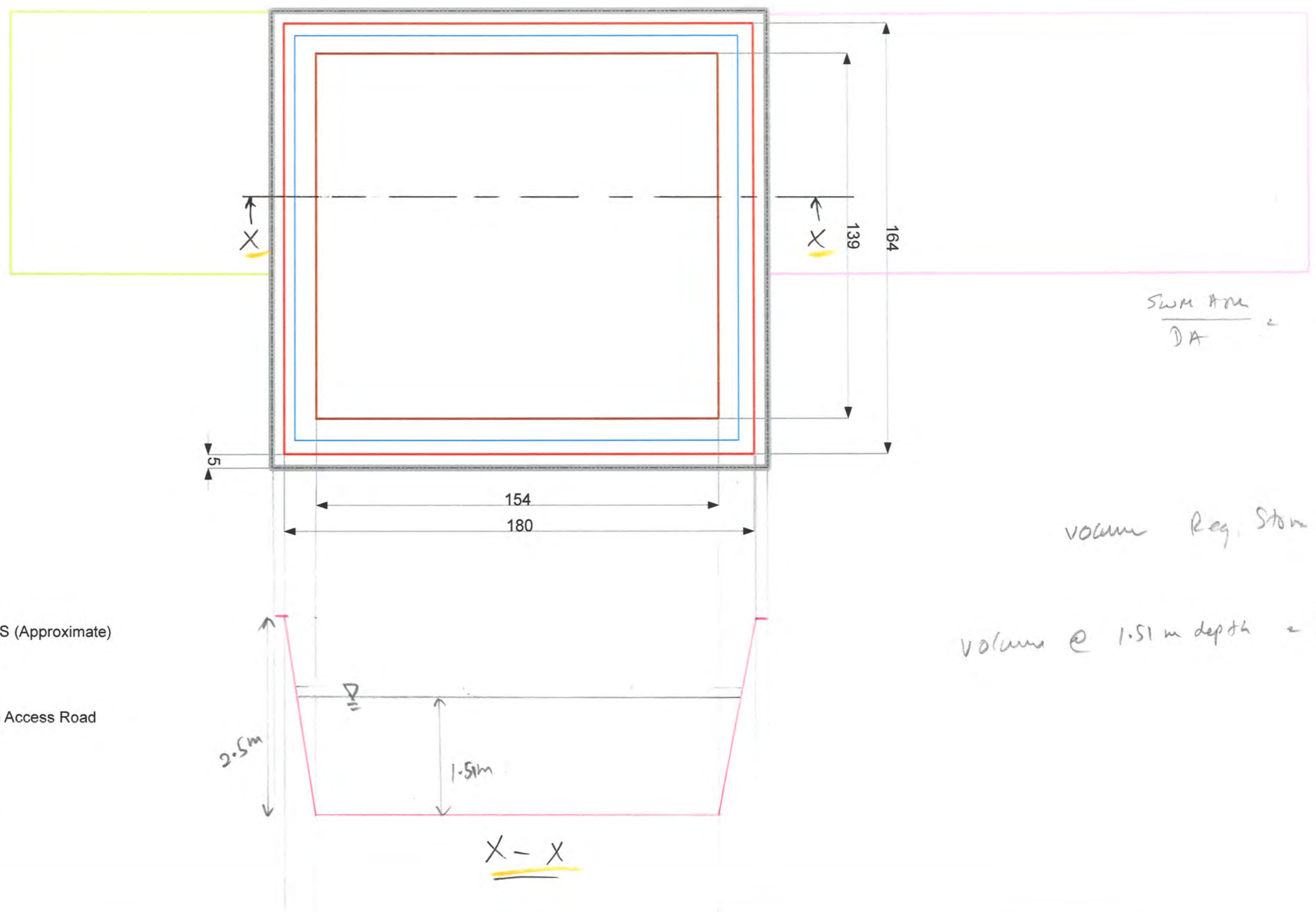


Project No.	TPB168050
Date	JUNE. 2020
Scale	1:100
Drawing No.	1

SWM #	111_SW						
Drainage Area Area (ha)	32.98						
Return Period	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	Regional Storm
Required Volume	0	2,112	4,662	7,889	10510	13,330	36,020

Case #	Depth (m)	Area(m2)		Volume (m3)	SWM Area (ha)	SWM area /DA	
		Top	Bottom				
Case 1 (Initial)	1.51	26334	21406	36044			> Regional Storm
	2.5	29520	21406	63658	2.95	9.0%	
Case 2	1.5	26349	21699	36036			> Regional Storm
	2.0	28000	21699	49699	2.80	8.5%	
Case 3	1.56	25438	20757	36032			> Regional Storm
	2.00	25438	20757	46551	2.89	8.8%	
Case 4	0.50	23109	21255	11091			> 50 Year Storm
	1.50	25694	21255	36283			> Regional Storm
	2.00	27339	21255	51257	3.20	9.7%	
Case 5	0.50	23431	20665	11024			> 50 Year Storm
	1.50	26184	20665	36208			> Regional Storm
	2.00	27689	20665	51017	3.23	9.8%	
Case 6	0.20	13049	13049	2610			> 5 Year Storm
	0.90	19549	17603	15613			> 50 Year Storm
	1.50	34532	31885	36610			> Regional Storm
	2.00	36282	34532	56456	4.09	12.4%	

CASE 1 (Initial)



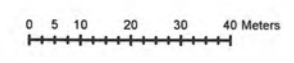
$$\frac{\text{SWM Area}}{\text{DA}} = 9\%$$

$$\text{Volume Req. Storm} = 36020 \text{ m}^3$$

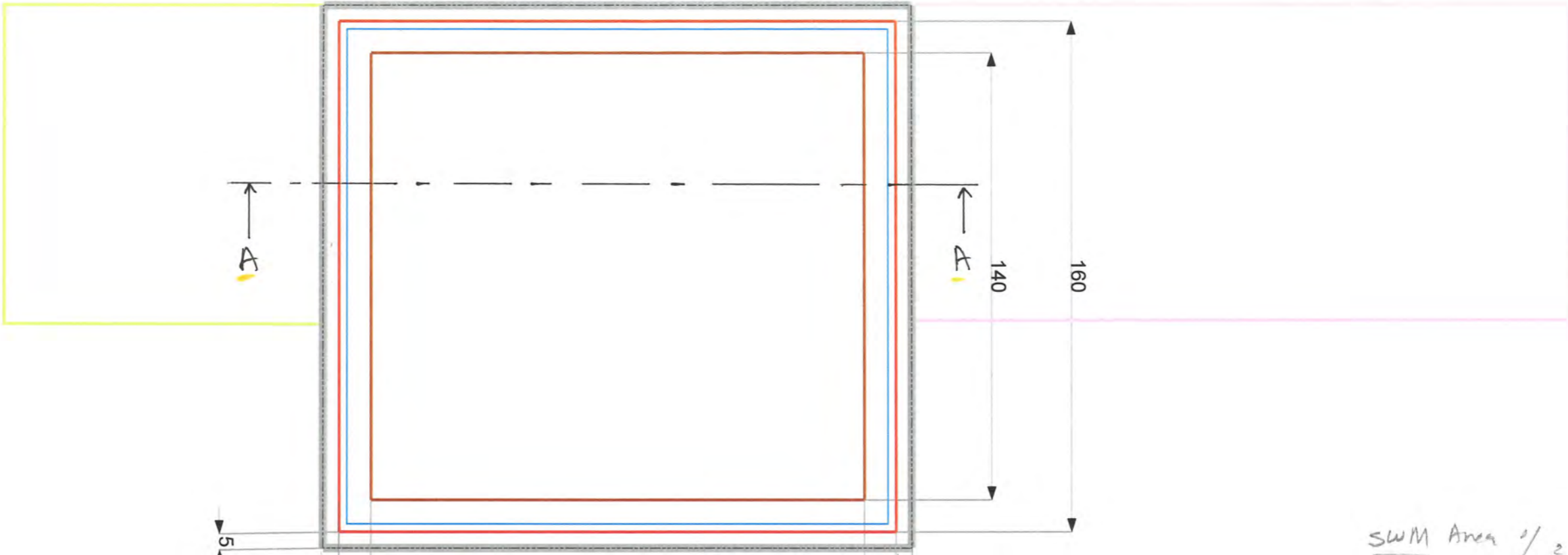
$$\text{Volume @ 1.51 m depth} = 36044 \text{ m}^3$$

Legend

- Description**
- Reg. Storm WS (Approximate)
 - SWM Bottom
 - SWM TOP
 - SWM With 5m Access Road
 - Park
 - School

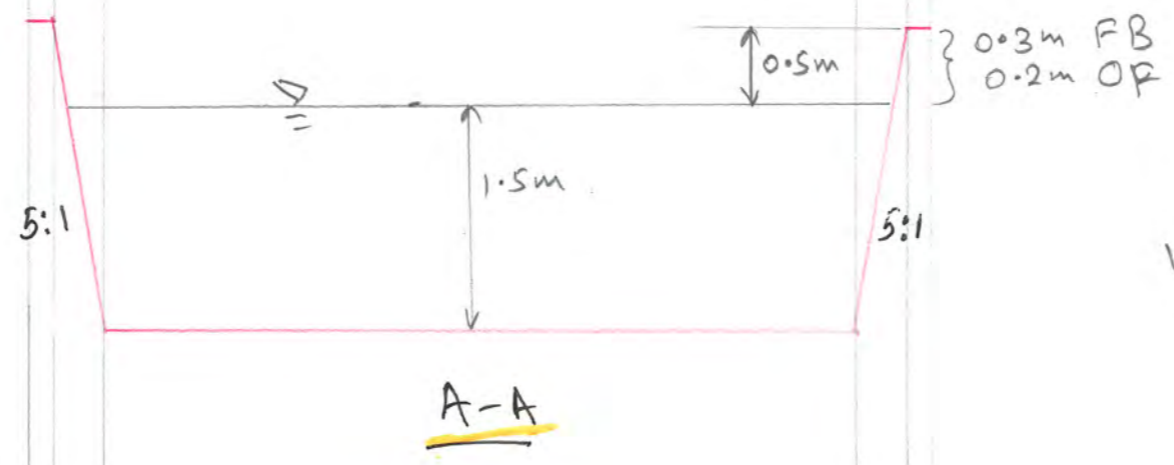


CASE 2



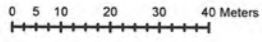
$$\frac{\text{SWM Area}}{\text{DA}} = 8.5\%$$

- Legend**
- Description**
- Reg. Storm WS (Approximate)
 - SWM Bottom
 - SWM TOP
 - SWM With 5m Access Road
 - Park
 - School

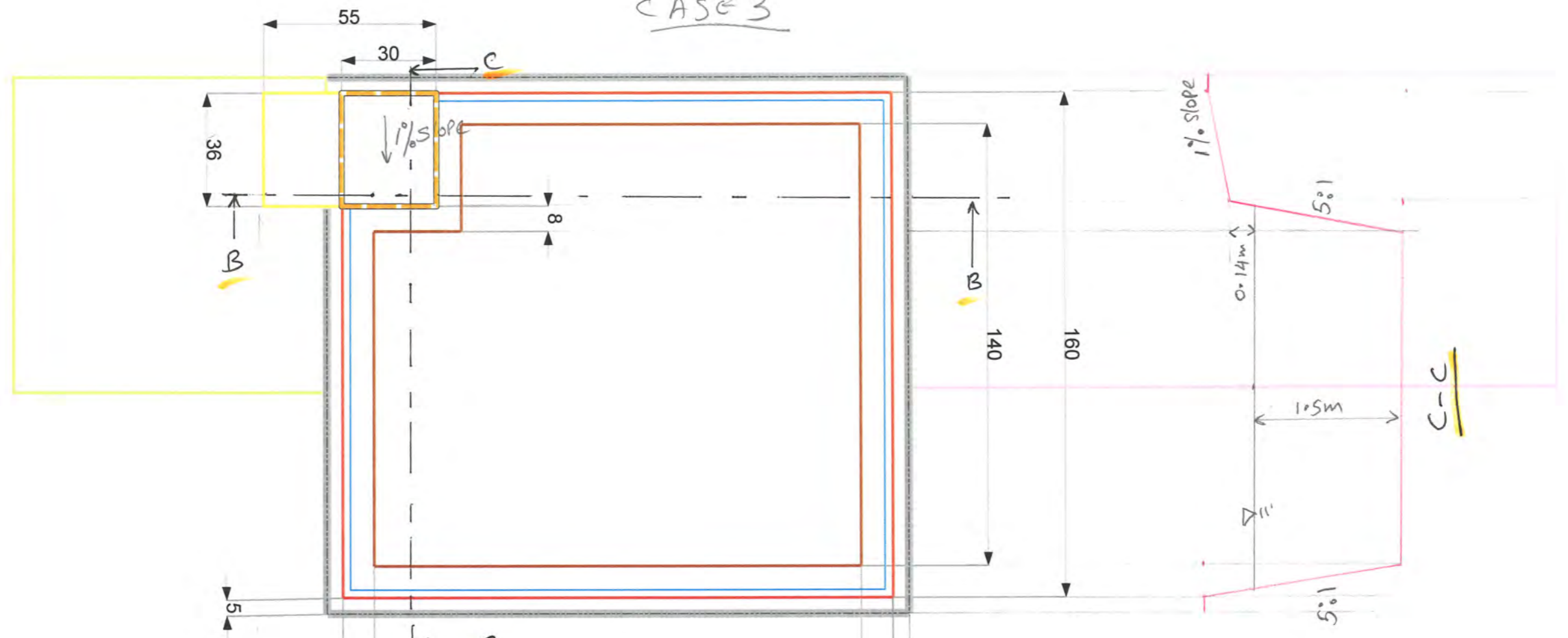


Volume Reg = 36020 m^3

Volume @ 1.5m depth = 36036 m^3



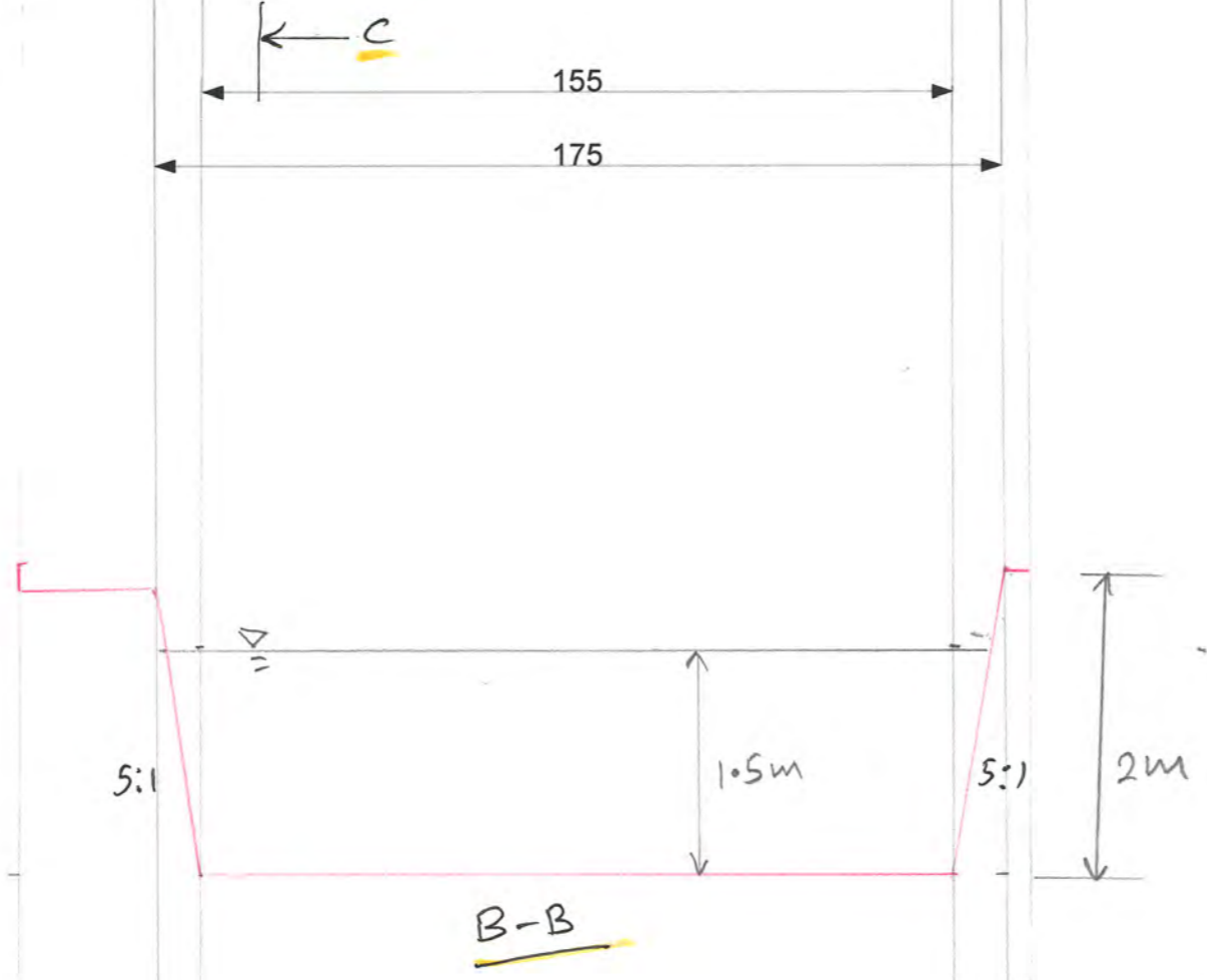
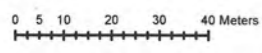
CASE 3



Legend

Description

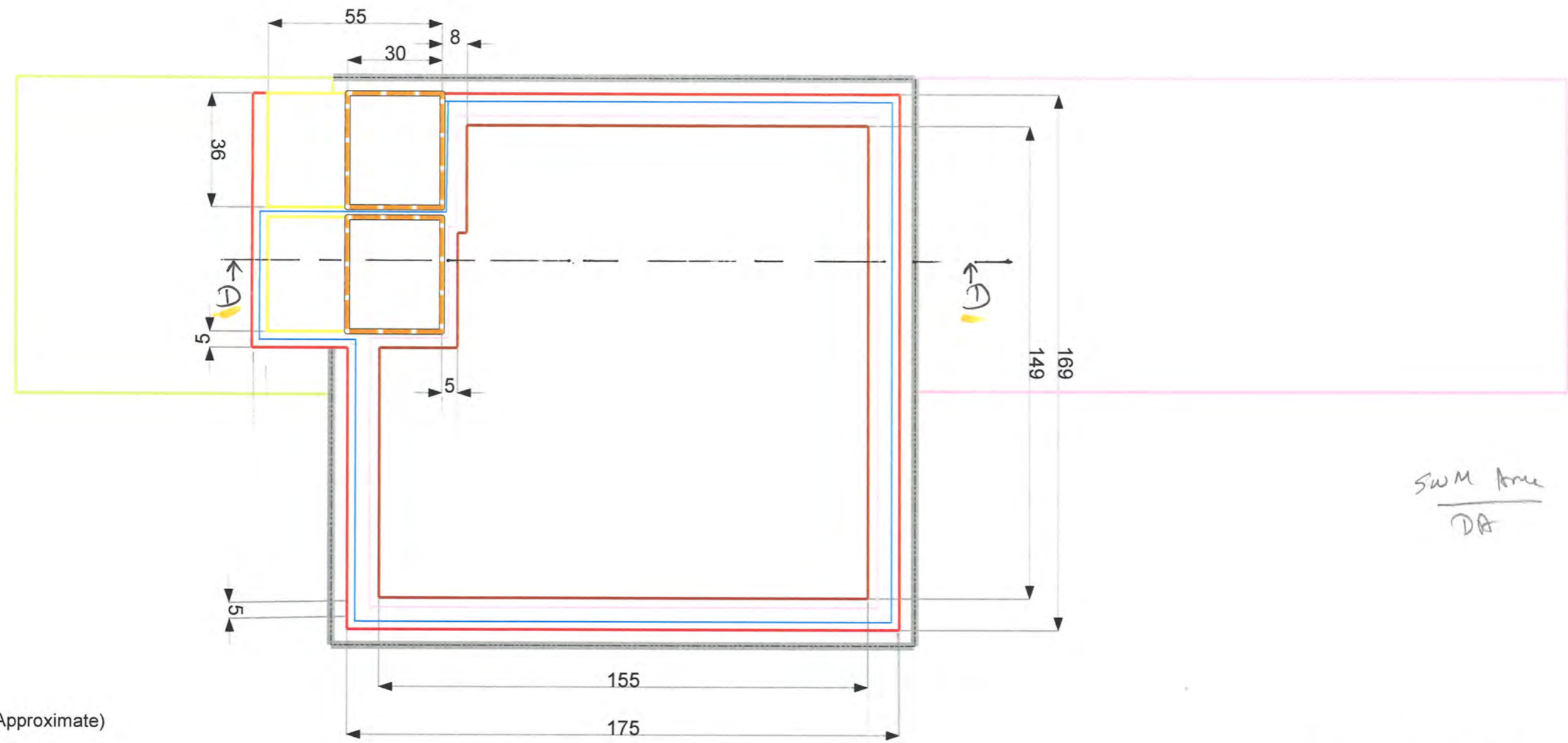
- 30 x 36 - Field U8
- 55 x 36 - Field U9 and U10
- Reg. Storm WS (Approximate)
- SWM Bottom
- SWM TOP
- SWM With 5m Access Road
- Park
- School



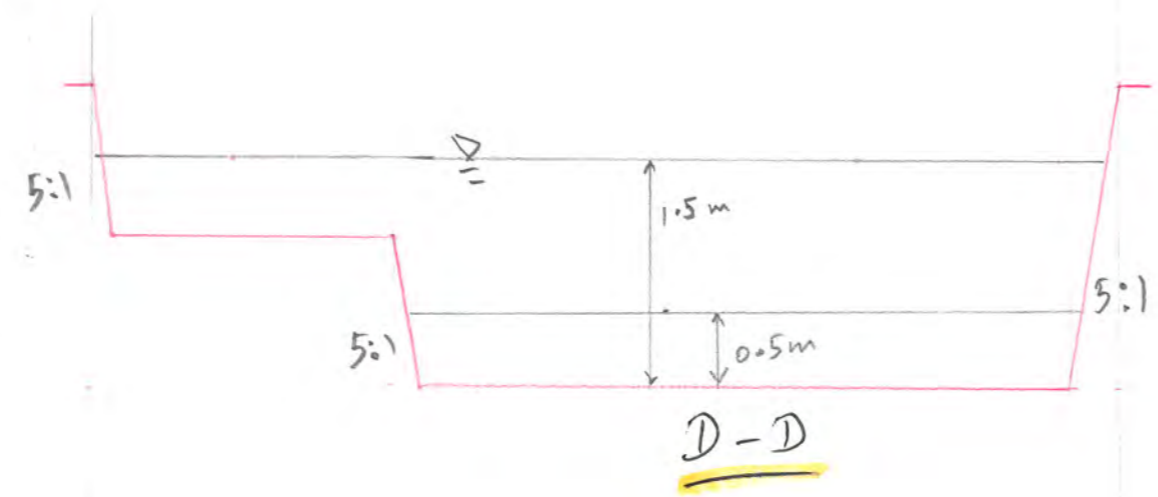
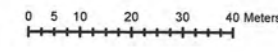
$$\frac{\text{SWM area}}{\text{DA}} = 8.8\%$$

Volume Reg. Storm = 36020 m³
 Volume @ 1.5m depth = 34646 m³
 @ 1.56m " = 36032 m³

Case 4



- Legend**
- Description**
- 50 Year WS (Approximate)
 - 30 x 36 - Field U8
 - 55 x 36 - Field U9 and U10
 - Reg. Storm WS (Approximate)
 - SWM Bottom
 - SWM TOP
 - SWM With 5m Access Road
 - Park
 - School

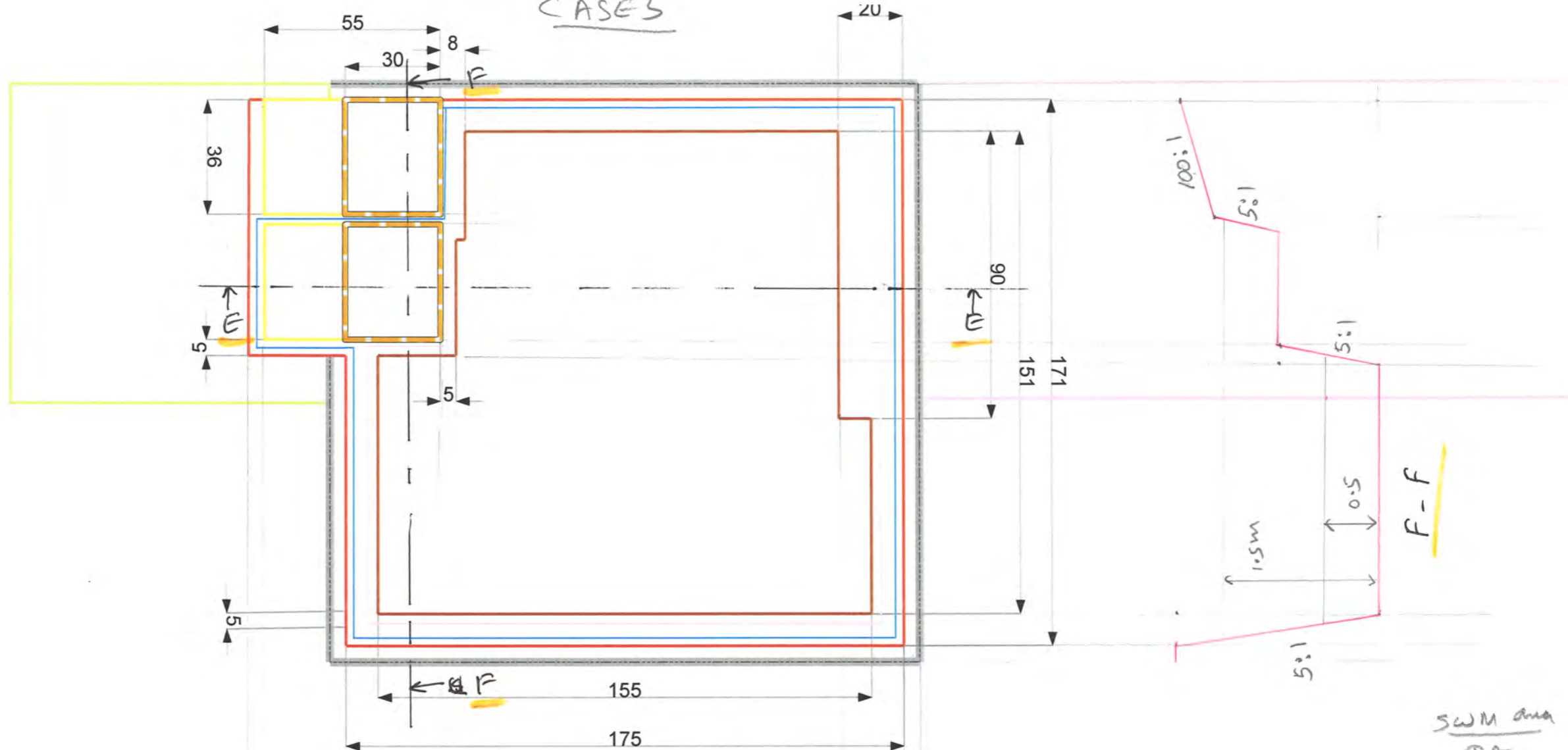


$$\frac{\text{SWM Area}}{\text{DA}} = 9.7\%$$

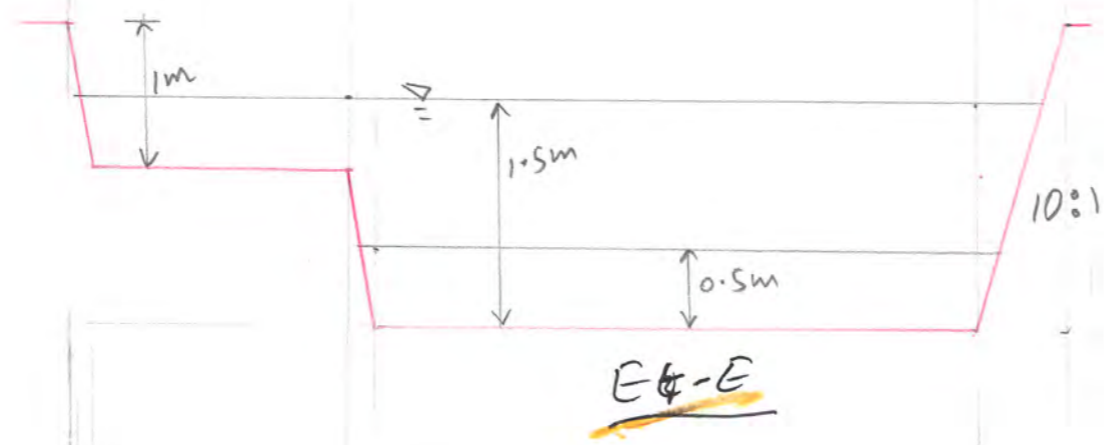
Volume Reg. storm = 36020m³
 Volume 50y storm = 10510m³

Volume @ 0.5m depth = 11091m³ ↑
 Volume @ 1.5m depth = 36283m³

CASES

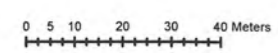


$$\frac{\text{SWM area}}{\text{DA}} = 9.8\%$$

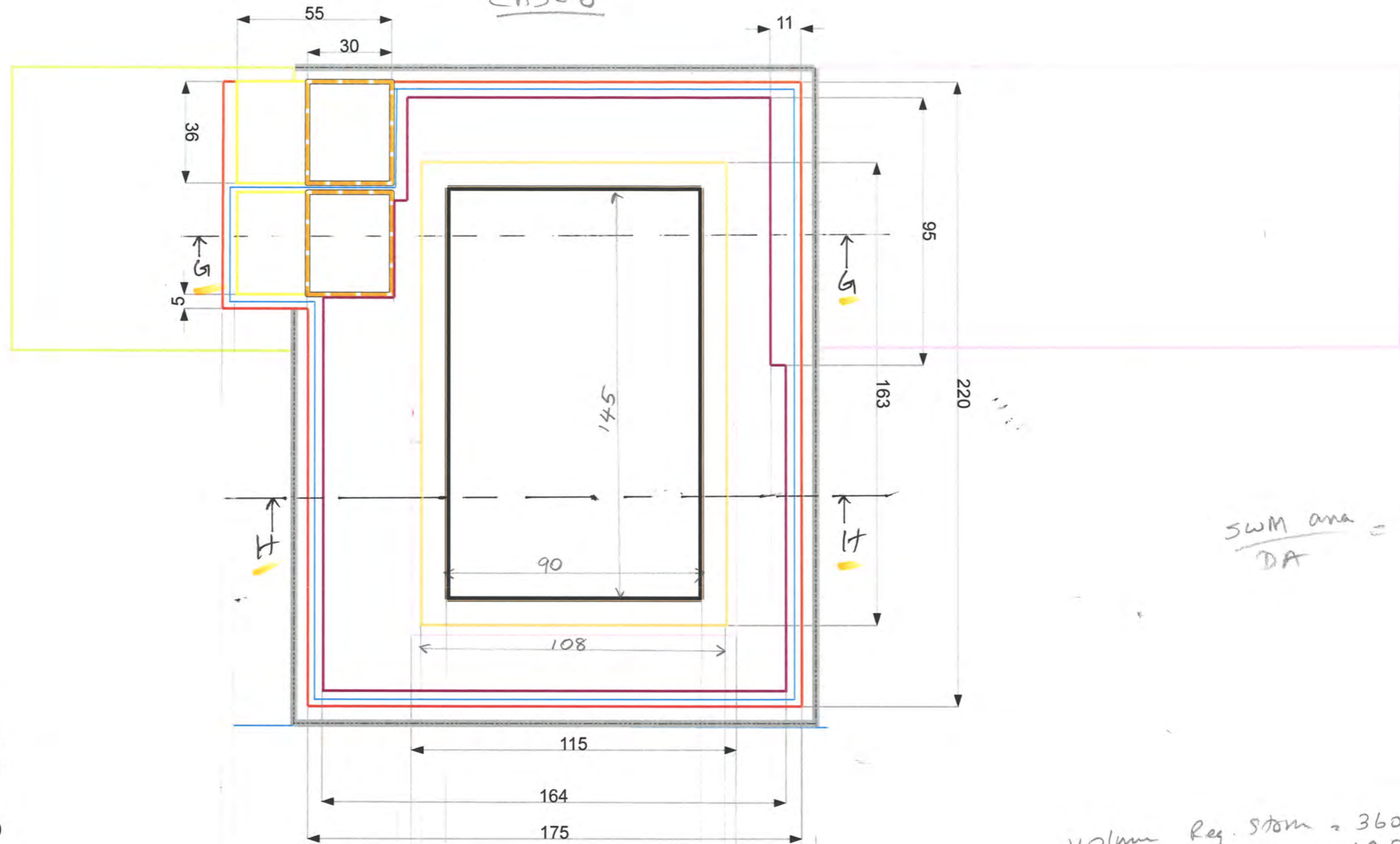


Volume Reg. storm = 36020 m³
 Volume 50y storm = 10510 m³
 Volume @ 0.5m depth = 11024 m³
 Volume @ 1.5m depth = 36208 m³

- Legend**
- Description**
- 50 Year WS (Approximate)
 - 30 x 36 - Field U8
 - 55 x 36 - Field U9 and U10
 - Reg. Storm WS (Approximate)
 - SWM Bottom
 - SWM TOP
 - SWM With 5m Access Road
 - Park
 - School



CASE 6

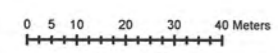
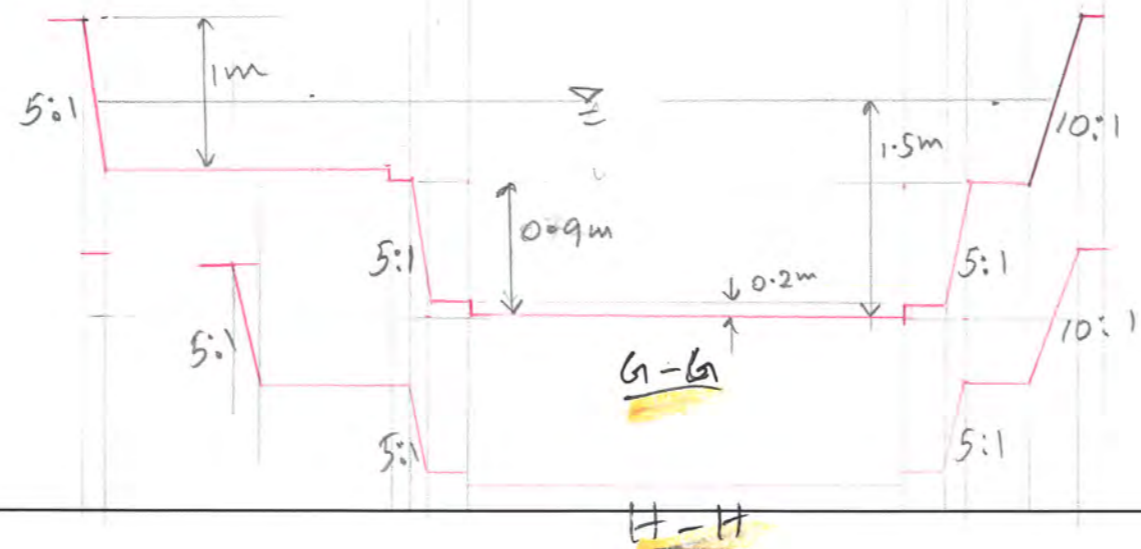


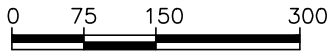
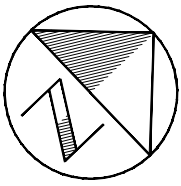
- Legend**
- Description**
- SWM Base3
 - SWM Base1
 - 5 Year WS (Approximate)
 - SWM Base2
 - ~~— 10 Year WS (Approximate)~~
 - 50 Year WS (Approximate)
 - 30 x 36 - Field U8
 - 55 x 36 - Field U9 and U10
 - Reg. Storm WS (Approximate)
 - ~~— SWM Bottom~~
 - SWM TOP
 - SWM With 5m Access Road
 - Park
 - School

$$\frac{\text{SWM area}}{\text{DA}} = 12.4\%$$





Volume Reg. Storm = 36020 m³
 Volume 50y Storm = 10510 m³
 Volume 5y Storm = 2112 m³

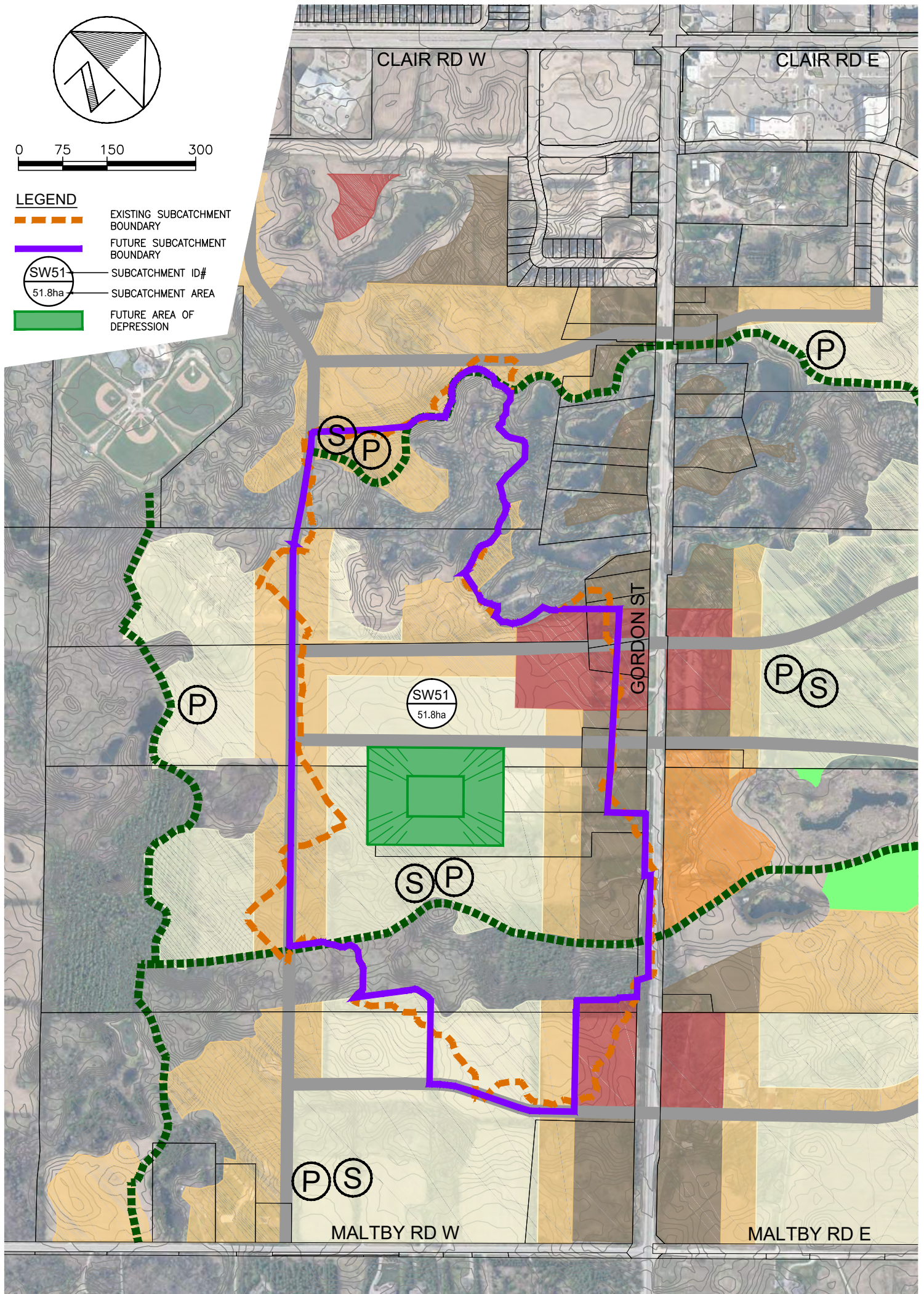
Volume @ 0.2m depth = 2610 m³
 Volume @ 0.9m depth = 15603 m³
 Volume @ 1.5m depth = 36610 m³



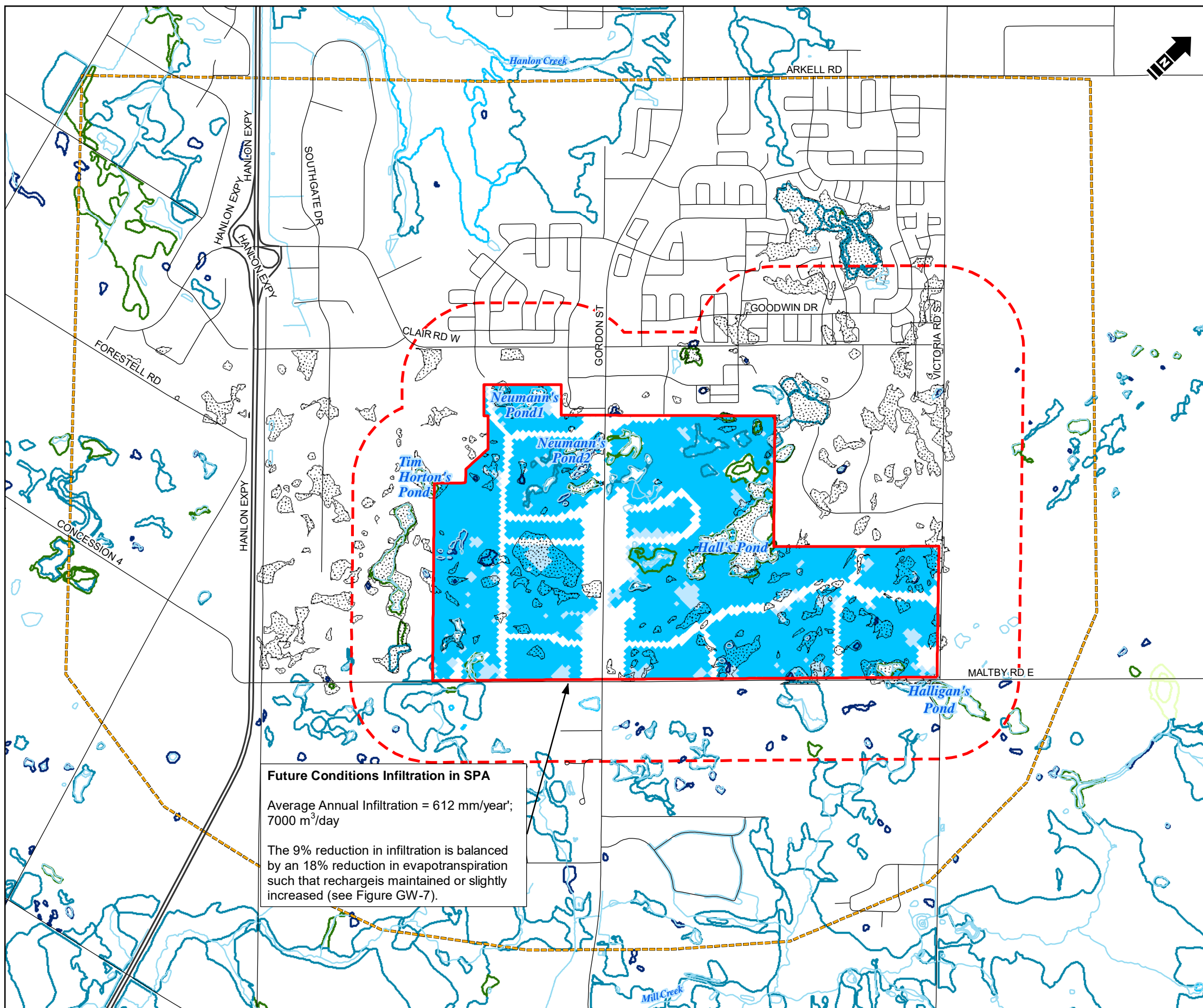


LEGEND

-  EXISTING SUBCATCHMENT BOUNDARY
-  FUTURE SUBCATCHMENT BOUNDARY
-  SUBCATCHMENT ID#
SUBCATCHMENT AREA
-  FUTURE AREA OF DEPRESSION



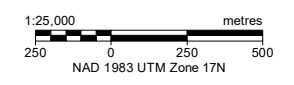
I:\CityOfGuelph\GIS\2017\FiguresandTables\GW9\Report\Phase3_Impact_Assessment\Figure-GW9-Simulated_Infiltration_Future_Conditions_2003_2017_Climate_Data.mxd - Tabloid_L - 02-Mar-20 11:21 AM - Inwright, TJD005



Future Conditions Infiltration in SPA
 Average Annual Infiltration = 612 mm/year';
 7000 m³/day
 The 9% reduction in infiltration is balanced
 by an 18% reduction in evapotranspiration
 such that recharges maintained or slightly
 increased (see Figure GW-7).

- Primary Study Area Boundary
 - Secondary Plan Area Boundary
 - MIKE SHE Model Domain
 - Closed Depression
 - Fen
 - Bog
 - Swamp
 - Marsh
 - Open Water
 - Unknown Wetland
 - Water Body
 - Watercourse
 - Highway
 - Road
- Average Annual Infiltration (mm/year)**
- 0 - 250
 - 250 - 800
 - > 800

Infiltration Definition:
 $INFIL = P - RO - E - \Delta S$
 Infiltration (INFIL) is the portion of
 Precipitation (P) that enters the subsurface
 after losses to Runoff (RO) at the ground
 surface. Net infiltration and Evaporation
 (E) from ground surface and change in
 surface water storage (ΔS).



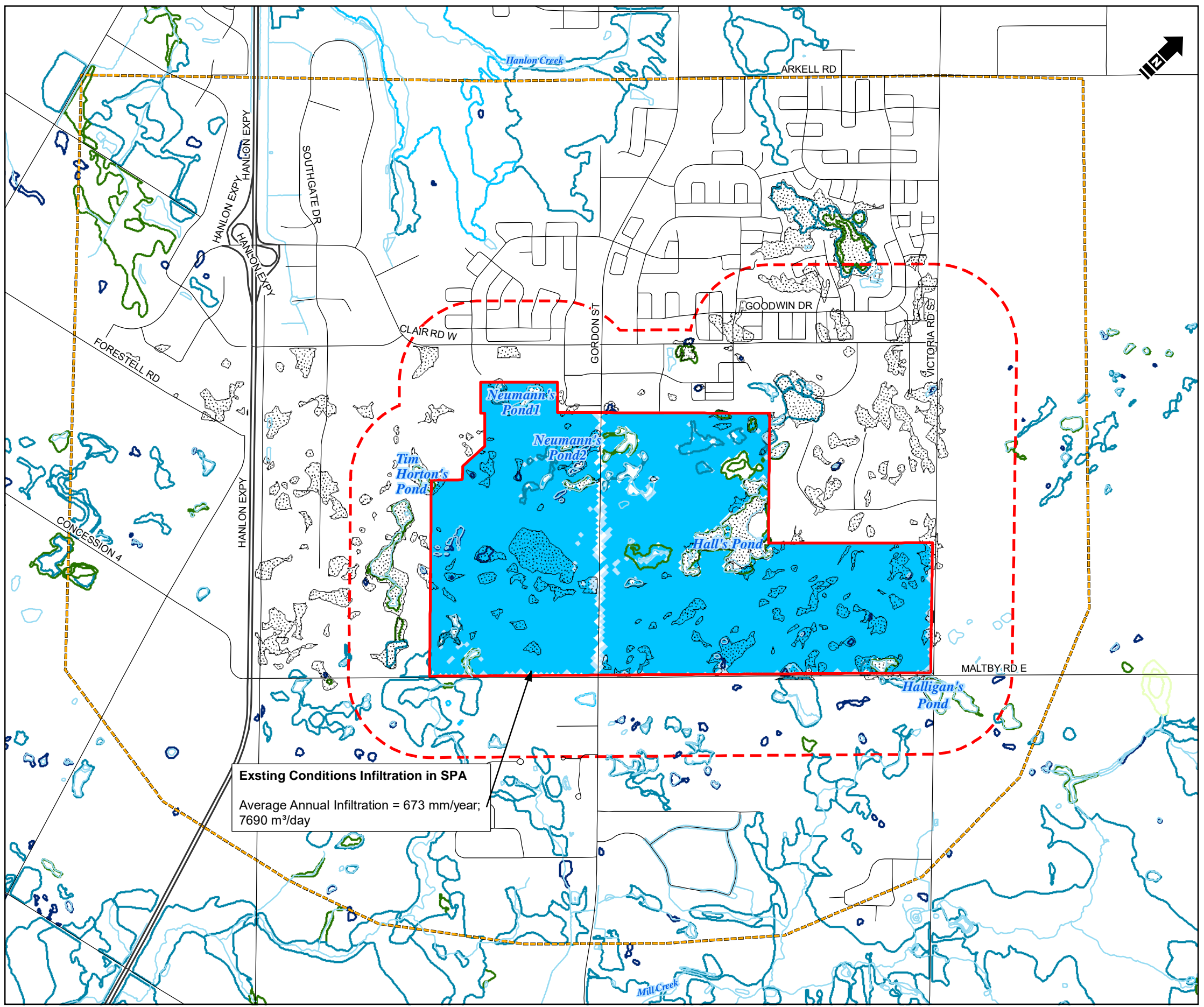
City of Guelph
 Clair- Maltby Comprehensive Environmental Impact Study
 Phase 3 Impact Assessment Report

**Simulated Infiltration Future Conditions
 (2003 to 2017 Existing Conditions)**

Date: March 2020 Project: 23089 Submitter: S. Murray Reviewer: D. Abbey

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

I:\CityOfGuelph\GIS\Projects\Phase3_Impact_Assessment\Figures\GW8_Simulated_Infiltration_Existing_Conditions_2003_2017_Climata_Data.mxd - Tabbed_L_02.March.2017.11:33 AM - Inveigh - TDD005

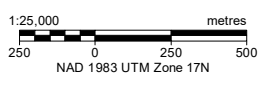


Existing Conditions Infiltration in SPA
 Average Annual Infiltration = 673 mm/year;
 7690 m³/day

- Primary Study Area Boundary
 - Secondary Plan Area Boundary
 - MIKE SHE Model Domain
 - Closed Depression
 - Fen
 - Bog
 - Swamp
 - Marsh
 - Open Water
 - Unknown Wetland
 - Water Body
 - Watercourse
 - Highway
 - Road
- Average Annual Infiltration (mm/year)**
- 0 - 250
 - 250 - 800
 - > 800

Infiltration Definition:
 $INFIL = P - RO - E - \Delta S$

Infiltration (INFIL) is the portion of Precipitation (P) that enters the subsurface after losses to Runoff (RO) at the ground surface. Net infiltration and Evaporation (E) from ground surface and change in surface water storage (ΔS).



Reference: Data provided by the City of Guelph, Geo Base® and Province of Ontario used under license.



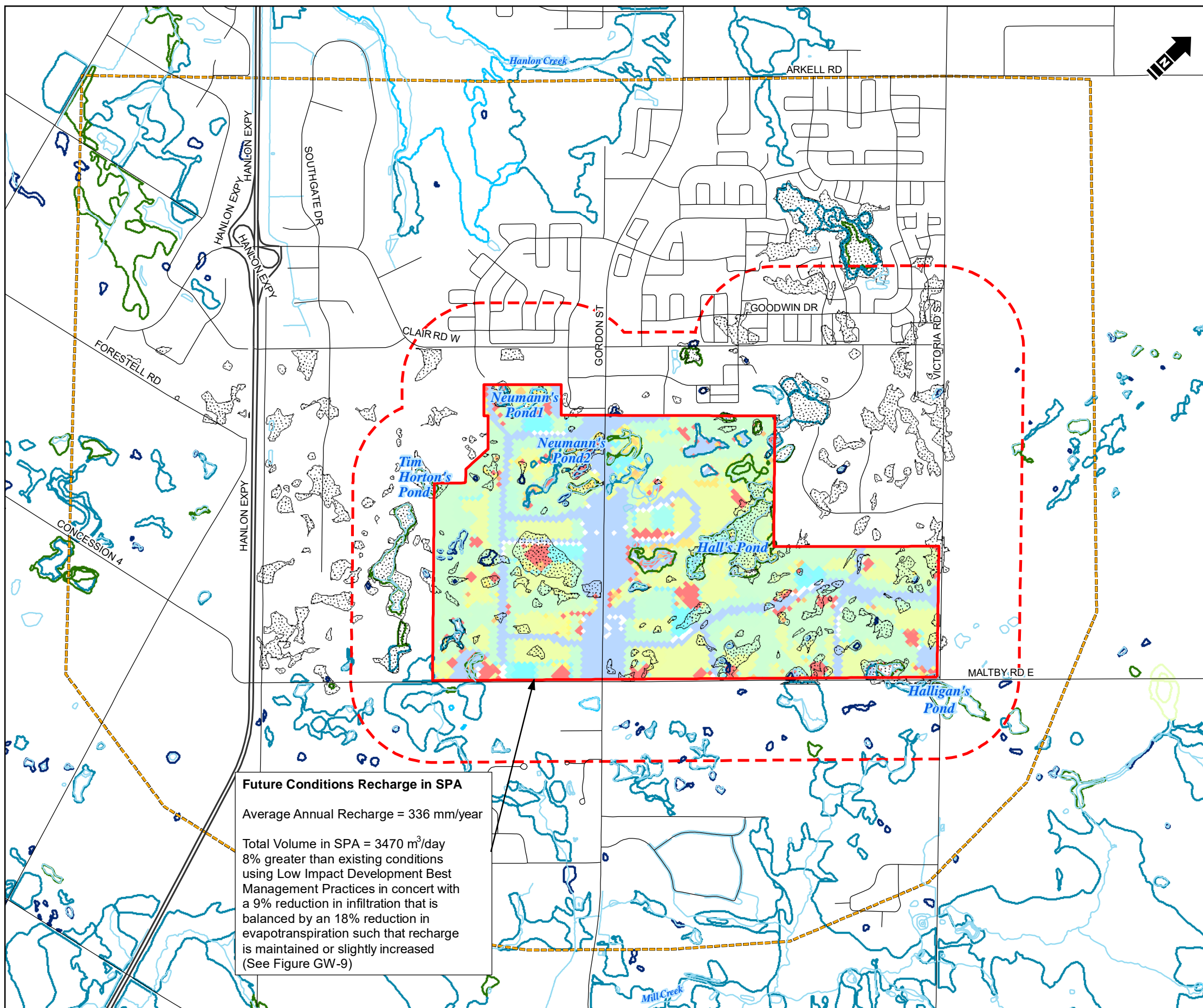
City of Guelph
 Clair- Maltby Comprehensive Environmental Impact Study
 Phase 3 Impact Assessment Report

**Simulated Infiltration Existing Conditions
 (2003 to 2017 Climate Data)**

Date: March 2020 Project: 23089 Submitter: S. Murray Reviewer: D. Abbey

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I:\CityOfGuelph\GIS\2017\Impact_Assessment\Figure-GW-7_Simulated_Groundwater_Recharge_Future_Conditions_2003_2017_Climate_Data.mxd - Tab04_L_03.Mar.20, 11:20 AM, Inwright, TD005



- Primary Study Area Boundary
 - Secondary Plan Area Boundary
 - MIKE SHE Model Domain
 - Closed Depression
 - Fen
 - Bog
 - Swamp
 - Marsh
 - Open Water
 - Unknown Wetland
 - Water Body
 - Watercourse
 - Highway
 - Road
- Average Annual Groundwater Recharge (mm/year)**
-
- > 500
< 100

Recharge Definition:

$R = P - RO - ET - \Delta S_s$

Recharge (R) is the portion of Precipitation (P) that infiltrates (INFIL) into the ground and reaches the water table; after losses to Runoff (RO) at the ground surface and Evapotranspiration (ET) from surfaces and the root zone and change in soil moisture storage (ΔS_s).

Future Conditions Recharge in SPA

Average Annual Recharge = 336 mm/year

Total Volume in SPA = 3470 m³/day
 8% greater than existing conditions using Low Impact Development Best Management Practices in concert with a 9% reduction in infiltration that is balanced by an 18% reduction in evapotranspiration such that recharge is maintained or slightly increased (See Figure GW-9)



Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

City of Guelph
Clair- Maltby Comprehensive Environmental Impact Study
Phase 3 Impact Assessment Report

Simulated Groundwater Recharge Future Conditions (2003 to 2017 Climate Data)

Date: March 2020	Project: 23089	Submitter: S. Murray	Reviewer: D. Abbey
------------------	----------------	----------------------	--------------------

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Figure GW-7

Appendix D
Mobility





BA Group

CLAIR - MALTBY SECONDARY PLAN

Transportation Master Plan Study
City of Guelph

Prepared For: City of Guelph

March 6, 2019; Revised February 2021



**MOVEMENT
IN URBAN
ENVIRONMENTS** BAGROUP.COM

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Toronto, ON M4V 1K9
www.bagroup.com

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1.0 TRANSPORTATION REPORT SUMMARY

This Transportation Master Plan Study is prepared in support of the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study being undertaken by the City of Guelph. This report firstly comprises Phase 1 Mobility Study documentation, including a review of existing transportation conditions and planning context for the Clair-Maltby study area. The remaining sections of this report review the Preferred Community Structure Plan, supportive transportation policies and objectives, and future conditions transportation analysis to inform potential transportation network improvements and high-level transportation infrastructure requirements and options.

The Mobility Study Transportation Report specifically includes:

1. an introduction and overview of the transportation study, including the objective of the Phase 1 study (June 2018), and subsequent transportation direction and analysis included herein;
2. an overview of the existing Secondary Plan area context and transportation elements;
3. a review of existing travel patterns, traffic operations, and collision history based on available data within the study area;
4. a review of relevant standards, active development applications, policies, and general planning framework based on available planning and transportation studies and reports;
5. a summary of key challenges and opportunities for the Secondary Plan, from a transportation perspective, which highlights key objectives sought through directive policies;
6. an overview of the planning processes and events undertaken over the course of the MESP study to review community structure options and achieve a Preferred Community Structure plan;
7. a review of the Clair-Maltby Secondary Plan Preferred Community Structure and associated transportation network elements and attributes;
8. an overview of general parking standards and best practice policies;
9. an overview of general transportation demand management (TDM) standards, policy objectives, and best practices;
10. a discussion of potential traffic calming measures most applicable to local streets planned as part of Secondary Plan development;
11. multi-modal travel demand forecasting for development associated with the Clair-Maltby Secondary Plan, based on the highest (most dense) land use budget developed in support of the MESP;
12. an assessment of forecast transit rider demands associated with development of the Secondary Plan; and
13. an assessment of forecast traffic resulting from development of the Secondary Plan, and summary of potential transportation improvements to accommodate anticipated traffic demands.

Background and Objectives

The Clair-Maltby Secondary Planning Area is located in the south end of the City of Guelph. It is bounded generally by Clair Road, Poppy Drive, development lands, and existing neighbourhoods to the north, Victoria Road (City Boundary) to the east, Maltby Road (City Boundary) to the south and the eastern limits of the Southgate Business Park to the west. It has an area of approximately 520 hectares which is currently comprised primarily of rural and agricultural land uses.

The study process for these lands in preparation of the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study, includes:

- Phase 1: includes the preparation of a background report outlining the results of the above-noted review of existing conditions, background documents, and opportunities/challenges for the study area. This background document also includes a technical work plan for the Phase 2 study.
- Phase 2: includes a Community Visioning Exercise, technical analysis work, design matters, and determining an appropriate street network.
- Phase 3: includes finalizing the Transportation Master Plan Study once a preferred Community Structure alternative is determined through the Design Charrette at the end of Phase 2. Additional refinement in support of Secondary Plan will also be dealt with in Phase 3, as required. The final study will meet the requirements of a Phase 1 and 2 Transportation Master Plan study under the Municipal Engineers Association Class EA process.

All material from the above-noted phases are comprehensively included herein as part of this final Transportation Master Plan Study.

Existing Transportation Facilities

The Clair-Maltby Secondary Plan area is served by a series of rural and urbanized roads. The area road system, under existing conditions is generally defined by three north-south routes: Gordon Street, Victoria Road, and Southgate Drive; and two east-west routes: Clair Road and Maltby Road. Additionally, Highway 6 (the Hanlon Parkway) operates in a north-south direction west of the secondary plan area.

Gordon Street is a major north-south corridor linking the City of Guelph with Highway 401 in the south, providing an important alternative (Highway 6 being the primary route) link for commuters connecting between Highway 401 and the City of Guelph.

Existing transit routes do not serve the Secondary Plan area except along a section of Clair Road west of Gordon Street. There are currently no transit services along Gordon Street (south of Clair Road), Victoria Road, Maltby Road, or Clair Road (east of Gordon Street). A number of transit routes located just north Clair Road provide connections to the University Centre hub, which is located approximately 5 kilometres north of the subject lands. One route connects directly to Guelph Central Station in the downtown. Frequency of buses along these routes varies from two to four vehicles per hour during peak morning activity.

The City of Guelph has actively pursued plans detailing future active transportation networks. A city-wide cycling network plan was established as part of the City's Transportation Master Plan.

Pedestrian sidewalks and bicycle lanes are currently provided along Clair Road and Gordon Street within the Secondary Plan area. Sidewalks are also provided along sections of new streets southeast of the Gordon Street / Clair Road intersection.

Existing Travel Patterns and Traffic Conditions

Weekday peak period trips to / from the South Guelph Area are predominately made by automobile (72% driver; 10% passenger), while small proportions are made by school bus, transit, or active means. The most common orientation for all trips to / from the South Guelph area are made within the City of Guelph (70% to 75%). Travel behaviour, by orientation, related to existing trips during the weekday peak hours in the South Guelph area is summarized in the following:

- 54% of trips are made within the local area - generally south of the Eramosa and Speed Rivers.
- Excluding of the aforementioned “local area”, another 20% of trips to / from the South Guelph Area are made within the City of Guelph – including 5% to / from the Downtown
- 10% of trips to / from the South Guelph Area are oriented / destined for Waterloo Region.
- 7% of trips to / from the South Guelph Area are oriented / destined for Halton / Peel Regions.
- 4% of trips to / from the South Guelph Area are oriented / destined for Wellington County.
- 1% of trips to / from the South Guelph Area are oriented / destined for the City of Toronto.

Existing trips to / from the South Guelph Area are made using the following modes of transportation during weekday peak travel periods:

- 21% of local trips within the local area are undertaken using transit and active transportation modes, most notably by transit (10%); 8% and 3% of trips are made by walking or cycling, respectively.
- For trips within Guelph, but outside the local area, approximately 94% of trips are made by car (81% driver; 13% vehicle passenger), and only 3% are made by transit.
- Trips made between the South Guelph Area and Halton, Peel and Waterloo Regions, are made by automobile to a greater extent than trips to other areas. Virtually all travel to / from Halton, Peel and Waterloo is undertaken within an automobile.
- The City of Toronto comprises a small proportion of overall travel (1%) to / from the South Guelph Area. These trips are predominately undertaken by car; however, transit mode share is greater for these trips than for trips between the South Guelph Area and other areas analyzed herein.

Existing traffic conditions were reviewed for the weekday afternoon peak hour. The signalized intersection traffic analysis indicates that all study area intersections perform acceptably, and without any traffic capacity constraints for any individual traffic movements. Overall signalized intersection traffic operations are good under existing conditions, and are generally reflective of new infrastructure (updated and widened roads) and limited area development.

A total of 134 collisions were reported at study area intersections within a 63 month period from 2012 to 2017. Of the total volume of collisions, 21 (16%) resulted in a non-fatal injury, while 42 collisions (31%) report property damage only (no injury). All other collisions were non-reported or “non-reportable”. No “fatal” collisions were reported. A total of 3 collisions involved vulnerable road users – in all instances, a cyclist.

Policy and Planning Framework and Active Applications

A number of policies and plans were reviewed to inform the existing transportation planning framework for the Clair-Maltby Secondary Plan area. These policies and plans establish direction for planning work to be undertaken in future phases, and provide a foundation for defining a Secondary Plan area transportation structure and multi-modal network. Specifically, the set of polices reviewed include:

- Provincial Policy Statement
- Places to Grow: Growth Plan for the Greater Golden Horseshoe
- City of Guelph Official Plan
- Official Plan Amendment 48
- City of Guelph Official Plan – Section 8: Transportation
- South Guelph Secondary Plan
- South Gordon Secondary Plan
- Guelph – Wellington Transportation Study (Transportation Master Plan)
- Gordon Street (Wellington Road 46) Class EA Environmental Study Report
- Clair Road Class EA Environmental Study Report
- Victoria Road (Clair Road to York Road) Class EA Study
- City of Guelph Transit Growth Strategy
- Moving Guelph Forward: Guelph Transit Growth Opportunities
- Guelph Trails Master Plan
- City of Guelph Cycling Master Plan
- City of Guelph Active Transportation Network Study
- Wellington County Active Transportation Plan

Summaries of planned road, transit, trail, cycling and pedestrian infrastructure, are detailed as part of this review. These plans provide an understanding of future infrastructure provisions for assessing future transportation impacts.

The overview of existing transportation plans, policies, and standards, as detailed in the documents noted above, provide a foundation on which to establish an area transportation plan, and to inform a future transportation structure and network for the study area lands.

Design Guidelines

City of Guelph Engineering and Capital Infrastructure Services prepared their Development Engineering Manual (DEM, Fall 2016) to guide engineering related aspects of development related work, including established Engineering Design Criteria and Standards intended to be used by developers, residents and the City to inform engineering design and related review and discussion. The DEM recognizes that the outlined standards may not be compatible to all scenarios, and engineering judgement should be used in such cases.

The DEM establishes geometric road standards, subdivision road standards, sight triangles, parking standards, and access design standards. It should be noted that road standards do not differentiate the use of pavement for passenger vehicles, transit, cyclists or otherwise and should be updated for the Clair-Maltby Secondary Plan area to include multi-modal uses where appropriate.

Review of Existing Transportation Network: Key Challenges and Opportunities

There are a series of challenges and opportunities for the Clair-Maltby Secondary Plan area. Challenges and opportunities are derived from the review of existing conditions, and informed by a review of various policies, standards, and plans.

Roadways

- The City of Guelph has a set of standard road cross-sections that guides design of the right-of-way, boulevard, and pavement width standards for municipal roadways. There is potential to update the road / design standards specifically for the Clair-Maltby Secondary Plan area to permit further programming within the pavement or boulevard spaces to include multi-modal uses where appropriate or to account for variations in natural landscape where a context sensitive standard may be most suitable.
- The Clair Maltby Secondary Plan area is challenged by natural heritage and land use constraints that are barriers to providing a 'grid like' network of local and collector roadways. The Secondary Plan develops a fine grained network within the geographical limits of the study to support suitable access, reasonable traffic capacity, and reasonably developable parcels to facilitate future development.
- Existing travel mode splits are heavily auto-oriented. Achieving a balance of successful development and adequate roadway capacity for this study area will require thoughtful integration of non-auto methods of travel – via infrastructure planning as well as programming and maintenance.

Cycling and Trails

- While achieving lower auto-mode shares will be a challenge, there is opportunity to provide strong connections within the Secondary Plan area through the provision of on and off-street bicycle facilities and trail system.
- Improving accessibility and connectivity within the study area and to / from major community nodes for non-auto modes of transportation (i.e. walking and cycling) will help to ensure mobility choice.
- Improving first and last mile active transportation connections to public transit will increase the ease of access and encourage multi-modal trips.

Transit

- Transit is limited under existing conditions within the study area. Providing frequent and efficient transit routing opportunities through the Secondary Plan area will provide mobility choice and could logically feed into the intensification corridor along Gordon Street and community node planned for the Gordon Street / Clair Road intersection.
- The Secondary Plan appropriately spaces collector streets so as to support the location of transit stops within a short distance of typical start / end of trip locations, and allows transit stops to be integrated with the trail network and / or sidewalk system to ensure pedestrian connectivity to transit facilities.
- There are opportunities to plan and accommodate “*first / last mile*” connections from future transit services. There is a substantial opportunity create links between multi-modal trip making, including the use of active transportation modes to connect transit service provisions to origins and destinations within the Secondary Plan area.

The Clair-Maltby Secondary Plan “Preferred Community Structure”

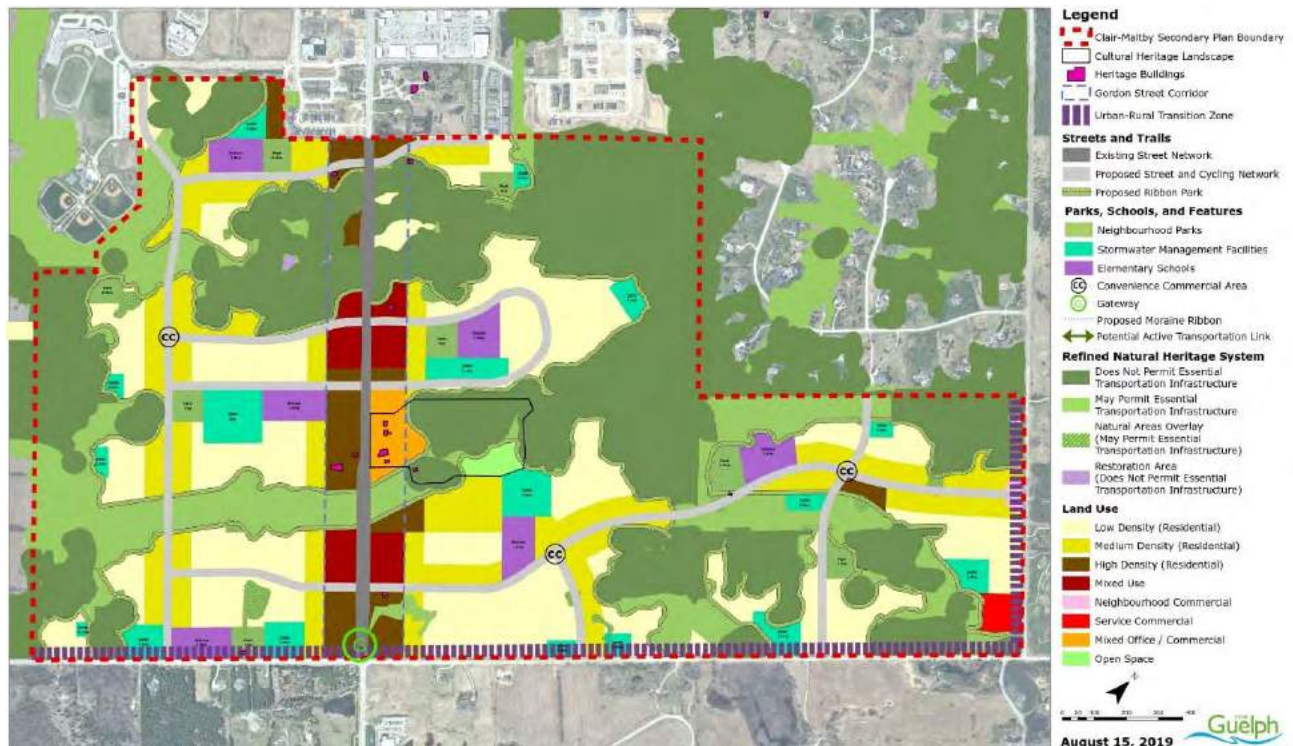
The Planning Process:

A Community Visioning Workshop was undertaken in September 2017 to assist in establishing a Conceptual Community Structure, which was carried-forward as part of meetings with a Community Working Group and Technical Advisory Group.

The Conceptual Community Structure was used in the development of three (3) Community Structure Alternatives, which formed the discussion of a 5-day planning and design charrette held in April 2018. The charrette was undertaken in order to develop a Preliminary Preferred Community Structure.

A “Preferred Community Structure” was developed as a planning objective for the future development of the Clair-Maltby Secondary Plan, and utilized as a basis for detailed technical analysis – including the transportation analysis prepared herein.

The Preferred Community Structure provides a general layout of land use, connective elements (arterial / collector streets and trails), community facilities, potential locations for storm water management facilities, existing cultural heritage recourses, and wetlands. The Preferred Community Structure is illustrated below.



Street Network:

A system of connected arterial and collector streets was advanced as part of the Preferred Community Structure, to support development of the Secondary Plan area, while respecting the Natural Heritage System and existing topography. The street network represents a modified grid system, which is intended to allow for frequent and robust routing for all street users, while respecting the important environmental features of the area.

A total of four (4) east-west oriented collector streets are proposed to cross Gordon Street between Gosling Gardens in the north and Maltby Road in the south. One (1) north-south oriented collector street is proposed to extend between Poppy Road in the north and Maltby Road in the south (west of Gordon Street). Two (2) additional north-south collector streets are illustrated in the south-eastern portions of the Secondary Plan area in order to establish a robust street-network grid in this location. The planned network of streets (and trails) are intended to achieve safe, convenient and comfortable travel and access for all street-users, with priority given to pedestrians, cyclists, and transit operations, to provide mobility choice and support city policy and modal-split objectives. Vehicular movement will be accommodated, but is not prioritized, and will be subject to levels-of-service which are more constrained than typical in new-build areas within the City.

The City of Guelph undertook a transportation modelling assessment of the anticipated future traffic conditions within the Secondary Plan area pending the introduction of a second north-south oriented collector street extending between Clair Road and Maltby Road (located east of Gordon Street). This assessment demonstrated that Gordon Street would be able to accommodate future traffic demands without a north-south collector street on the easterly side of Gordon Street. This modelling allowed a general understanding of the potential impacts that a collector street would have on the existing Natural Heritage System in two locations, as well as on an identified Cultural Heritage Landscape, and resulted in the removal of this collector road where it crosses these features, as part of the Secondary Plan.

The design of all collector streets and existing arterial streets is intended to allow for the operation of buses, to provide several opportunities and flexibility for transit vehicle routing throughout the Clair-Maltby Secondary Plan.

Gordon Street Main Street:

The Gordon Street corridor is a central element in the local transportation network, connects the area with the wider City and County, provides an opportunity for transit priority, and is envisioned as a main street / village core destination.

The Gordon Street right-of-way is intended to accommodate all street users through the delivery of multi-modal infrastructure. Its design will support the efficient and effective routing of transit services, the comfortable movement of cyclists and pedestrians, and accommodate for automobile travel.

A 4-lane Gordon Street cross-section is anticipated to appropriately accommodate traffic demands along the corridor given optimized signal timing and coordination, and the inclusion of ancillary turn lanes where necessary. Separate left-turn lanes should be provided at all junctions where left-turns are permitted, which may further support the introduction of a continuous left-turn / centre median lane along the extent of Gordon Street within the Secondary Plan area.

The Clair-Maltby Secondary Plan encourages dense, mixed-use development along the Gordon Street corridor to support the deployment of transit services. Transit priority measures can be potentially introduced along the Gordon Street corridor to increase the proportional uptake of transit use, and can include physical design elements to reduce transit vehicle delays and provide amenity and convenience to perspective riders, and policy measures to make transit more appealing, affordable and competitive with other travel modes.

Trail Network:

Trail locations are identified within the Master Environmental Service Plan for the Clair-Maltby Secondary Plan area, and are generally located along the edges of the Natural Heritage System. The function of the Trail Network is to provide additional pedestrian and cycling facilities throughout the Secondary Plan area in order to accommodate commuter and utilitarian pedestrian and cycling circulation and connectivity; provide recreational amenity and active transportation use; and augment the wider pedestrian and cycling networks in the southern parts of the City of Guelph.

Trail links are strategically located to compensate for limitations in the Secondary Plan street network (understanding the limitations of new road construction on the Natural Heritage System), and to provide the most direct and convenient pedestrian and cycling connections between residential areas and community facilities and commercial developments.

Opportunities for Transportation Demand Management

A Transportation Demand Management (TDM) framework will be pursued to establish a foundation for managing future travel demands upon development of the secondary plan area, to ensure that measures to promote transit and active transportation are implemented by way of the transportation amenities provided, as well as the built form of the community.

Upon review of existing policy statements in the Guelph Official Plan and the Guelph-Wellington Transportation Study relating to TDM, and a review of best practices in TDM policy in Ontario, it is recommended that the Clair-Maltby Secondary Plan incorporate a robust TDM framework requiring future development to pursue TDM measures.

Vehicle Parking Considerations

The Clair-Maltby Secondary Plan has the opportunity to develop vehicle parking standards that would provide parking supply to meet demands, where appropriate, and still encourage active transportation to support transit, the Gordon Street Main Street concept, and public realm.

There are a variety of factors influencing the development of parking requirements and standards, which are affected by population density, layout of the municipality, transit accessibility, location of the development and adjacent land uses.

Parking demands and supply can be managed through a combination of strategies implemented to guide overall development through the Clair-Maltby Secondary Plan area. The parking review and assessment provided herein includes a review of the in-force City of Guelph parking standards, a comparative review of other municipal parking standards, and various parking management strategies to affect supply and demand.

A number of policies can be implemented in support of reducing parking demands, and would provide a positive contribution towards the City's approach to parking management, including flexible area based parking standards, maximum and minimum parking standards, shared parking guidelines, parking reduction permissions, cash-in-lieu of parking policies, consolidated public parking strategies, on-street parking provisions, car-share parking provisions, TDM policies, public realm improvements, and unbundling of parking from the sale of residential units.

Traffic Calming Considerations

Particular attention may be directed to street segments in adjacency to schools or high-pedestrian areas, as well as other street segments where the propensity of vulnerable road users is more acute.

Community traffic calming strategies are primarily intended to address problems that include excessive speed, infiltration and congestion. A variety of measures are summarized herein, that are identified as Level I or Level II measures. Level I measures include minor changes to the roadway, that are generally lower cost and relatively straightforward, such as pavement markings, textures pavement/crossings and signage. Level II measures are generally more significant, more costly and require physical changes to the roadway.

Consultation with the various City stakeholders including Emergency Services, Guelph Transit, and Transportation Engineering is essential in reviewing and approving any mitigation solution. Community involvement is also a key part in determining the type of measures, if any, should be installed.

Multi-Modal Travel Demand Forecasting

Travel demand forecasts have been developed for residential and office land uses, understanding that new development is anticipated to be prominently residential, and that other retail and mixed-use development would result in relatively small travel demands, would often be internal to the Secondary Plan area, and could be considered ancillary to overall development travel demands.

Travel demand forecasts for development anticipated within the Clair-Maltby Secondary Plan have been developed for all travel modes based on existing area travel characteristics and those of proxy area developments, and to the extent that transit services and active transportation infrastructure is pursued as part of the Secondary Plan.

Travel demands for the Secondary Plan have been developed based on the most conservative (highest density) assumptions outlined in the "Land Development Budget" prepared by the project team. For the purposes of the analysis herein, a total of 10,125 residential units and 333 jobs were assessed.

The Clair-Maltby Secondary Plan would be anticipated to result in the order of 5,155 and 6,935 two-way trips during the weekday morning and weekday afternoon peak hours, respectively. Total trips include those trips that utilize "other" travel modes, including those using school buses, taxis, or ride-share services.

Approximately 3,770 and 5,785 two-way person trips are anticipated to be undertaken in a personal vehicle (as a driver or passenger), comprising approximately 73% to 83% of all trips during weekday morning and afternoon peak hours.

In the order of 455 and 555 two-way person trips are anticipated to be undertaken as a transit rider, comprising approximately 8% of all trips during weekday peak hours.

In the order of 615 and 345 two-way person trips are anticipated to be undertaken as a pedestrian or cyclists during the weekday morning and afternoon peak hours, respectively, comprising approximately 12% and 5% of all trips during the respective weekday peak hours.

Future Conditions Transit Assessment

A transit assessment was undertaken assuming improved transit provisions within the planning horizon (year 2031) of this study. It is anticipated that the local transit network will continue to evolve in sequence with development of the Secondary Plan area.

The Preferred Community Structure Plan has been advanced anticipating the introduction of frequent transit provisions on Gordon Street between Clair Road and Maltby Road, and the option for additional or expanded services routing along arterial and collector streets within the Secondary Plan area.

Person-based transit trips have been forecast and assigned to the area transit network in order to evaluate future transit demands.

A total of 455 and 555 new transit trips are forecast during the weekday morning and weekday afternoon peak hours, respectively. The majority of these transit trips are anticipated to route outbound during the weekday morning peak hour, and inbound during the weekday afternoon peak hour given the prevailing residential-related travel demands associated with the Secondary Plan.

It is expected that most transit trips to the Clair-Maltby Secondary Plan area will be captured by local transit services. Clair-Maltby Secondary Plan transit trips are predominantly anticipated to be oriented north of the Secondary Plan area, as transit riders tend to route to / from the downtown area, the University area, and central GO Transit Station. In the order of 370 and 450 two-way transit trips are anticipated to route to / from these areas during the weekday morning and weekday afternoon peak hours respectively.

Development contemplated as part of the Clair-Maltby Secondary Plan can be reasonably accommodated by transit services, given the introduction of new transit routes or the expansion of existing services operating within the Secondary Plan area, over the course of weekday peak hours.

Future Conditions Traffic Analysis

Future Background Traffic Scenario:

- Revisions to the local street network are planned within the 2031 planning year horizon, including planned improvements to Gordon Street and the extension of Southgate Drive to Maltby Road.
- Future background traffic operations analyses assess forecast future traffic demands resulting from general traffic growth and other site-specific background developments.

- Traffic patterns in the study area were reviewed over the past 10 years to provide an understanding of overall traffic growth trends on key street segments within the Secondary Plan area. Understanding the prevailing traffic growth trends associated with key arterial roads within the Secondary Plan area, traffic growth was applied to the 2031 planning horizon year.
- Area background developments provide an understanding of current changes within the vicinity of the Clair-Maltby Secondary Plan area. Traffic volumes associated with each of the identified background developments is assigned to the area road network.

Future Background Traffic Analysis:

- Overall signalized intersection traffic operations are generally acceptable under future background traffic conditions and are similar to those observed under existing traffic conditions, although longer delays and higher volume-to-capacity ratios are observed at the key Gordon Street / Clair Road and Victoria Road / Clair Road intersections relative to the existing conditions.
- The key Gordon Street / Clair Road intersection is anticipated to operate acceptably under future background traffic conditions, with an overall intersection v/c ratio 0.87 during the weekday afternoon peak hour. Relative to the existing condition, overall intersection v/c ratios increase by 32% during the weekday afternoon peak hour, which is generally the result of anticipated increases in through traffic volumes along Gordon Street and Clair Road, site-specific development traffic, and an increase in eastbound left-turn traffic volumes resulting from specific area developments.
- The future background traffic analysis indicates that the Victoria Road / Clair Road intersection generally operates acceptably, despite an increase in traffic delay and volume-to-capacity ratios. Relative to the existing condition, overall intersection v/c ratios increase by 25% during the weekday afternoon peak hour, which is generally the result of anticipated increases in southbound right-turn and eastbound left-turn traffic volumes resulting from area-specific background developments.
- Traffic operations at unsignalized intersections within the study area are anticipated to continue to operate similar to existing conditions.

Future Total Traffic Scenario:

- Revisions to the local street network are planned within the 2031 planning year horizon, as identified within the future background traffic scenario. Additionally, new streets contemplated as part of the Clair-Maltby Secondary Plan are included as part of the future total analysis scenario.
- Future Total traffic volumes are the sum of future background traffic volumes and traffic volumes resulting from development of the Clair-Maltby Secondary Plan area. Future Total traffic volumes have been forecast for existing study area intersections, as well as future collector road intersections as outlined within the Preferred Community Structure plan.
- Traffic forecast for Clair-Maltby Secondary Plan area development is based on the most conservative (highest density) Land Use Budget circulated for the purposes of this analysis.

Future Total Traffic Analysis:

- Future total traffic analysis is undertaken for a “base” scenario without improvements to existing intersections, and with a “recommended” scenario with suggested improvements to existing intersections.
- It is important to understand that the recommended intersection improvements are based on the modelling exercise undertaken herein, and that changes to the wider street network, improvements to regional corridors, and changes to travel behaviour and patterns can alter these recommendations.
- Traffic signal adjustments have been made as part of the analysis herein to accommodate for changes in traffic demands and patterns.

Traffic signal timing along the Gordon Street corridor has been set to 110 second cycle lengths during the weekday afternoon peak hour. Signal timing cycle lengths have been made consistent along the Gordon Street corridor to allow for optimization of traffic signal off-sets and permit signal timing synchronization in order to best limit traffic delays, reduce transit vehicle delays, and manage vehicle queuing.

- A total of eleven (11) new traffic signals are considered as part of the analysis herein, to accommodate future traffic demands and facilitate pedestrian movement across busy traffic corridors.

It is further recommended that two (2) existing STOP-controlled intersections be considered for signalization as development occurs within the Secondary Plan area.

- Recommended improvements are not intended to retain existing levels-of-service for motorists. However, improvements are intended to accommodate new traffic resulting from background traffic growth, current developments planned and under construction, and new traffic resulting from the development of the Clair-Maltby Secondary Plan.
- The improvements outlined in the following are in addition to signal timing adjustments. Improvements identified below relate to changes in the intersection lane configurations.

Gordon Street / Clair Road Intersection:

- Introduction of a northbound separate right-turn lane
- Introduction of a southbound separate right-turn lane
- Introduction of an eastbound separate right-turn lane

Clair Road / Clairfields Drive Intersection

- Introduction of a northbound separate left-turn lane
- Introduction of an eastbound separate right-turn lane
- Pavement restriping to accommodate a southbound separate left-turn lane

Gordon Street / Poppy Road Intersection

- Introduction of an eastbound separate left-turn lane
- Introduction of an westbound separate left-turn lane

Laird Road / Clair Road West Intersection

- Introduction of a northbound separate right-turn lane

Future Victoria Road / Street E Intersection

- Introduction of a southbound separate right-turn lane

- The signalized intersection traffic analysis indicates that most study area intersections perform acceptably during the prevailing weekday afternoon peak hour, and without any traffic capacity constraints for any individual traffic movements, except for certain movements at the key Gordon Street / Clair Road, Victoria Road / Clair Road, and Clairfields Drive / Clairfields Extension / Clair Road intersections. Assuming the introduction of the recommended intersection improvements, the following movements are anticipated to operate with longer delays and near theoretical capacity during the weekday afternoon peak hour.

Gordon Street / Clair Road

- | | |
|----------------------------------|------|
| • Eastbound left-turn | 0.95 |
| • Westbound left turn | 1.02 |
| • Westbound through / right-turn | 0.95 |
| • Northbound left-turn | 0.99 |
| • Southbound through | 0.94 |

Victoria Road / Clair Road

- | | |
|------------------------|------|
| • Eastbound left-turn | 0.96 |
| • Northbound left-turn | 0.92 |
| • Southbound through | 0.93 |

Clairfields Drive / Clair Road

- | | |
|------------------------|------|
| • Northbound left-turn | 0.93 |
|------------------------|------|

The above noted intersections are anticipated to operate with overall intersections v/c ratios of 0.92 to 1.01 during the weekday afternoon peak hour.

- Traffic operations at the Gordon Street / Clair Road intersection may be further mitigated through improvements to the Hanlon Parkway corridor, on-going improvements to the street network in the vicinity of the Gordon Street / Clair Road intersection, and the ability for motorists to respond to traffic delays at this intersection and utilize other streets in the local vicinity.
- Overall signalized intersection traffic operations within the Secondary Plan area are anticipated to be acceptable under future conditions, and are accommodated by the Preferred Community Structure street network plan.
- Traffic operations at the Gordon Street / Maltby Road and Clair Road West / Laird Road unsignalized intersections are anticipated to operate poorly under future total traffic conditions, and as such may warrant signalization.

- Five (5) new unsignalized intersections were reviewed within the future total traffic analysis scenario. These intersections are identified as new junctions within the Preferred Community Structure street network plan, and are recommended to operate under STOP-control.
- All other movements at unsignalized intersections within the study area are shown to operate at LOS C or better during the weekday afternoon peak hour, which is acceptable.
- A typical 4-lane street section is anticipated to sufficiently accommodate forecast traffic demands along the Gordon Street corridor, understanding the need for ancillary turn lanes – specifically separate left-turn lanes at all intersections where left-turns are permitted. Pending the frequency of separate left-turn lanes, a continuous left-turn / centre median lane along the extent, or portions of, Gordon Street within the Secondary Plan area may be warranted.

Gordon Street / Maltby Road Roundabout Analysis:

- The intersection of Gordon Street and Maltby Road is considered for the introduction of a roundabout. A roundabout, at this junction, may be appropriate considering:
 - its location as a gateway to / from the City of Guelph,
 - its boundary character between urban Guelph and rural Wellington County, and
 - the opportunity provided by a roundabout to accommodate transit vehicle loop functions as an alternative to an off-street turnaround facility or around-the-block routing.
- Understanding the opportunity for a roundabout at the junction of Gordon Street and Maltby Road, roundabout traffic analysis was completed under the future total traffic scenario, assuming typical roundabout geometry for a 2-lane traffic circle.
- Should a traffic roundabout be pursued for the junction of Gordon Street and Maltby Road, traffic operations are anticipated to be acceptable. Further consideration would be required as to its functional design and ability to appropriately accommodate pedestrian crossings and transit vehicle and articulated truck routing.

2.0 INTRODUCTION

2.1 CLAIR-MALTBY SECONDARY PLAN AND MESP STUDY

The City of Guelph is undertaking the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to comprehensively plan for the development of the area of Guelph located south of Clair Road and north of Maltby Road - the Clair-Maltby Secondary Planning Area. The lands are being considered for development to accommodate population and employment growth for the City in accordance with the requirements of Provincial policy, in particular Places to Grow: Growth Plan for the Greater Golden Horseshoe.

The MESP and Secondary Plan are being undertaken concurrently as part of the process approved by City Council which is designed to address the complexity of planning for development in the Clair-Maltby Secondary Planning Area. The MESP offers an integrated approach that coordinates the requirements of both the *Environmental Assessment Act* and the *Planning Act*.

2.1.1 Study Process

The Study Process will be undertaken in three phases:

- Phase 1 – Background;
- Phase 2 – Community Structure; and,
- Phase 3 – Secondary Plan and MESP.

2.2 PRIOR SUBMISSION: PHASE 1 MOBILITY STUDY BACKGROUND REPORT

A Mobility Study Background Report was prepared and submitted to the City of Guelph in June 2018. The background reporting and findings of that study are further incorporated into this current report to provide a comprehensive review of transportation considerations related to the Secondary Plan.

The purpose of the Phase 1 Mobility Study Background Report was to review available background information, as well as the details and conditions of supporting studies as part of the basis for the Secondary Plan. The Background Report was compiled to provide an overview of existing transportation conditions, plans, policies, and standards on which to establish an area transportation plan, and to inform a future transportation structure and network for the study area lands. Specifically this report considered the following.

Technical Overview of Phase 2 Analysis Work

A discussion of the final transportation study including community consultation and visioning exercises, detailed technical analysis, and considering multi-modal transportation networks for the secondary plan area. Phase 2 analysis work is included herein as part of this comprehensive Transportation Master Plan Study.

Review of Background Studies

A review of relevant existing background planning and transportation studies and reports, as well as any other documents determined to be relevant to informing the planning of development within the subject lands. For example, a review of existing City of Guelph road standards were included, with a view to identifying options for dealing with multi-modal transportation needs.

A review of background studies also provides a basis for documentation of the planned transportation network, and a summary of the transportation planning context and key policy objectives.

Review of Available Data

Available traffic data in the vicinity of the Clair-Maltby Secondary Plan area in the southern part of Guelph was obtained and reviewed. This data includes road network utilization counts (traffic counts), traffic accident data, and data from the most recent (2016) Transportation Tomorrow Survey (TTS). Existing travel data is summarized herein to document existing travel patterns and traffic operations, and to review collision frequency and trends.

A Summary of Challenges and Opportunities

A summary of area challenges and opportunities, from a transportation perspective, have been made available to provide direction on meeting performance measures – such as target travel mode splits, walkability, cycling connectivity and traffic operations.

2.3 PHASE 2 MOBILITY STUDY TRANSPORTATION REPORT

A work plan was established for Phase 2 of the Mobility Study, which included a community visioning exercise, technical analysis work, design matters, and determining an appropriate street network. Key components of Phase 2 of the Mobility Study are included herein and described briefly in the following.

Community Visioning Exercise

Information from the Phase 1 Background Report was provided to inform a community visioning exercise. Key inputs to this exercise were to include an overview of the existing and planned transportation network (including roads, transit, and active transportation infrastructure), the identification of existing transportation network constraints (related to natural features and/or capacity), and existing road standards that are available to address multi-modal mobility objectives. A Conceptual Community Structure was derived from the community visioning exercise to provide the basis for the development of three (3) community structure alternatives.

Close attention was paid to special designations and considerations derived from the community visioning exercise, including such concepts as a Main Street / Transit Spine designation for Gordon Street, street cross-sections supportive of multi-modal travel, traffic management and safety, and vehicle parking considerations.

Preferred Transportation Network

Using input from the CEIS and the parallel MESP studies, the constraints to developing an internal (collector) road network were identified and documented. Alternative conceptual transportation networks were prepared understanding the need to minimize impacts to the natural heritage system while providing an appropriate level of mobility for future residents, employees and visitors of the Secondary Plan area. A key priority of the preferred transportation network is to prioritize the needs of active transportation and transit users so as to create a transportation network that promotes these alternative modes.

Plans were developed to illustrate the alternative conceptual internal community road networks, and their connectivity with external transportation elements, adjacent neighborhoods and communities, and existing and proposed community services (such as recreational facilities and schools). All travel modes addressed in these plans, namely roadways, transit routing and nodes, cycling routes and trails, and pedestrian facilities.

The preferred transportation network formed the basis of transportation planning and analysis work undertaken herein.

Technical Analysis

On the basis of the preferred transportation network, and in consultation with City staff, a multi-modal Transportation Impact Study (TIS) was undertaken. This work was undertaken in conformity with the City of Guelph's "Traffic Impact Study Guidelines", and comprised a standard four-step analysis (trip generation, distribution, mode choice, and assignment). The scope and horizon years for this work was developed in coordination with City staff.

Upon establishing an analysis scope and planning horizon, analyses was conducted by BA Group with supporting data provided by the City to establish base future background travel demands on an existing and planned transportation network. A multi-modal travel demand forecasting exercise and subsequent distribution and assessment of various travel modes was undertaken. Directional distribution information was extracted from the Transportation Tomorrow Survey (2016 TTD Data Set).

The results of the technical analyses is used to compile a specific set of recommendations as they relate to the preferred transportation network, with respect to road widenings, intersection control (signalized or unsignalized), intersection turn lane configurations, and roundabout configurations (if appropriate).

A quantitative and qualitative assessment of the intersections within the scope of the Clair-Maltby Secondary Plan was undertaken with a view to ensuring that the following are provided for:

- adequate vehicular capacity,
- appropriate and safe active transportation features and facilities; and,
- transit priority where feasible.

This assessment included a review of the potential for the implementation of a roundabout located at junction of Gordon Street and Maltby Road. This pragmatic review accounts for the needs of all travel modes, particularly transit and emergency vehicles, cyclists, and pedestrians.

School Zones

Special consideration was given to traffic management elements and features in the vicinity of schools so as to ensure that the needs of pedestrians are prioritized. Traffic calming measures and processes are identified, and may be considered as part of future development of the lands and in consultation with stakeholders.

Vehicle and Bicycle Parking

A review of City of Guelph parking standards was undertaken, and a parking plan was developed for the community. This plan provides direction for addressing on street and off street parking provisions, and strategies to effectively reduce overall parking demands and efficiently accommodate resulting parking demands through consolidated and shared parking supplies.

Consideration is given to flexible design of parking facilities so that they can be adapted to other uses or combined with other uses if demand evolves over time.

Recreational Trails

The community transportation network concept includes a concept trail plan. This trail plan was developed in concert with the CEIS work so as to ensure that the trail system does not impinge on natural heritage features. The system is conceptually arranged with a view to connecting with, expanding and enhancing the active transportation elements in street rights-of-way. Off road trail standards are designated so as to meet appropriate standards (AODA and FADM), and are developed in conjunction with the parallel MESP studies so as to ensure that environmental and storm water considerations are dealt with.

Transportation Demand Management Framework

A Transportation Demand Management (TDM) framework is pursued to establish a foundation for managing future travel demands upon development of the Secondary Plan area, to ensure that measures to promote transit and active transportation are implemented by way of the transportation amenities provided, as well as the built form of the community. Target mode shares and viable options for achieving these targets are established for future development.

2.3.1 Report Format

The Transportation Master Plan Study is intended to address the requirements of the Secondary Plan process, appropriately suggest transportation policy directions for future development of Clair-Maltby Secondary Plan area, and advise on the technical specifications of planned development.

This report combines elements of the June 2018 Mobility Study with transportation analysis and discussion of various transportation design and policy considerations.

It should be noted that material from the June 2018 Mobility Study has been updated herein to account for changes in background documents and travel behaviour data where appropriate. Derived from the June 2018 Mobility Study, and included herein is:

- an overview of the existing transportation network;
- a review of existing travel behaviours and prevailing travel demands on the area transportation network;
- a summary of historical collision data;
- an overview of the area planning context from a transportation perspective; and
- a review and summary of relevant transportation policies, plans, and design guidelines.

This report builds upon the existing context description and relevant transportation data, policies, and guidelines outlined in the June 2018 Mobility Study to inform and guide the development of a preferred community structure plan for the Clair-Maltby Secondary Plan area and then test the plan through technical analysis. In addition to the elements listed above, this report:

- summarizes the planning process and community engagement undertaken in deriving a “Preferred Community Structure” plan for the subject lands;
- outlines the Preferred Community Structure mobility network, conceptual street plan and trail plan, and the role of Gordon Street within this network;
- provides an outline of Transportation Demand Management (TDM) measures and strategies that that can be pursued to support mobility choice for perspective residents, employees, and visitors of new development with the Clair-Maltby Secondary Plan area;
- a summary of vehicle parking requirements and parking management strategies that can be implemented to efficiently accommodate, and reduce to the extent practical, vehicle parking demands;
- a summary of traffic calming objectives and strategies to be implemented, if warranted, in appropriate locations of the Clair-Maltby Secondary Plan street network;
- forecasting of multi-modal travel demands resulting from conservative (most dense) land use budgets prepared to estimate development potential of Clair-Maltby Secondary Plan area;
- an assessment of resulting transit rider demands resulting from conservative (most dense) land use budgets prepared to estimate development potential of Clair-Maltby Secondary Plan area;
- an assessment of resulting traffic operations on the study area street network as a result of conservative (most dense) land use budgets prepared to estimate development potential of Clair-Maltby Secondary Plan area; and
- a summary of street network improvements recommended to accommodate potential traffic demands within a future total development scenario.

3.0 EXISTING TRANSPORTATION CONTEXT

3.1.1 The Clair-Maltby Secondary Plan Area

The Secondary Planning Area is located in the south end of the City of Guelph. It is bounded by Clair Road to the north, Victoria Road (City Boundary) to the east, Maltby Road (City Boundary) to the south and the eastern limits of the Southgate Business Park to the west. It has an area of more than 520 hectares which is currently primarily rural and agricultural in nature. The study area is illustrated in Figure 1.

3.1.2 Existing Transportation Elements

3.1.2.1 Existing Road Network

The secondary plan area is served by a series of rural and urbanized roads. Clair Road to the north of the study area, and Gordon Street north of Poppy Drive have been urbanized and widened to accommodate 2 to 4 travel lanes (plus auxiliary turn lanes), curbs and sidewalks. Other major roads in the area, including Gordon Street south of Poppy Drive have typical rural cross-sections and are have 2 travel lanes.

The area road system, under existing conditions is generally defined by three north-south routes: Gordon Street, Victoria Road, and Southgate Drive; and two east-west routes: Clair Road and Maltby Road. Additionally, Highway 6 (the Hanlon Parkway) operates in a north-south direction just west of the secondary plan area.

Gordon Street is a major north-south corridor that becomes Brock Road beyond the City boundary and I the City of Guelph with Highway 401 in the south, providing an important alternative (Highway 6 being the primary route) link for commuters connecting between Highway 401 and the City.

The existing local street network, including intersection lane configuration and traffic controls, is illustrated in Figure 21.

An overview of the surrounding municipal street network highways and key roadways is provided below.

Highway 6 (Hanlon Parkway) is a provincially-owned and maintained limited access highway (in the Guelph area) operating in a north-south direction west of the Secondary Plan area. Although the highway has limited access, and operates with a fully grade-separated interchange at Laird Road, it intersects with Maltby Road at an unsignalized intersection (east-west STOP-control). The highway operates with an 80 km/h. posted speed limit and two travel lanes in both the northbound and southbound directions. Northbound and southbound travel lanes are generally separated by a grassed median.

Highway 6 is a major traffic route linking the City of Guelph with the wider region and specifically with Highway 401 in the south. The highway begins at Highway 403 in the City of Hamilton (Dundurn) in the south and extends north through the City of Guelph to Tobermory at the northern end of the Bruce Peninsula.

Highway 6 includes a full interchange at its crossing with Laird Drive, which becomes Clair Road through the study area. The highway also intersects at an unsignalized intersection with Maltby Road, whereby eastbound / westbound traffic movements on Maltby Road operate under STOP-control.

Gordon Street is a two-way arterial road running north-south through the City of Guelph. Gordon Street becomes Brock Road south of the City Boundary at Maltby Road. The street extends south of Highway 401 as Highway 6, and north of Waterloo Avenue in Downtown Guelph as Norfolk Street, Woolwich Street, and then Highway 6 north of Woodlawn Road.

In the site vicinity, it has a 4-lane urban cross-section north of Poppy Drive and a 2-lane rural cross-section south of Poppy Drive. The roadway includes separate left-turn lanes at signalized intersections and bicycle lanes in both directions within the City limits. The street has an existing speed limit of 60 km/h. in its urban section, and a 70 km/h. speed limit in its rural section south of Poppy Drive.

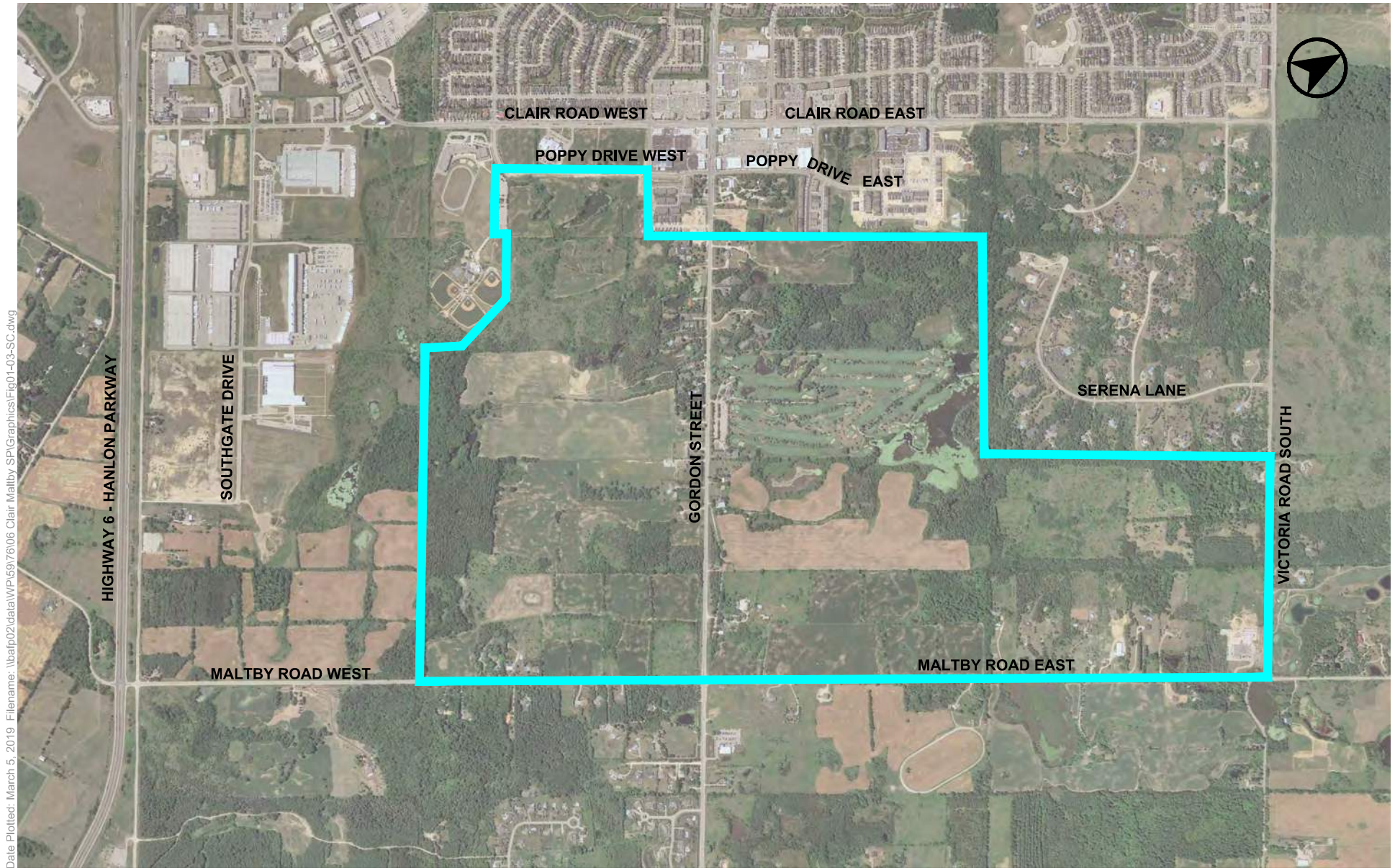
Victoria Road is a north-south direction roadway stretching through the City of Guelph from Wellington County Road 36 in the south (at Highway 401) to Highway 6 in the north. In the site vicinity, Victoria Road has a basic 2-lane rural cross section, with a separate north left-turn lane at Clair Road. Victoria Road intersects with Maltby Road in two separate T-intersections, with the section of Victoria Road north of Maltby Road extending from a point approximately 55 metres east of where the section of Victoria Road south of Maltby Road terminates.

Southgate Drive services industrial and employment areas in the southwest area of Guelph east of Highway 6 and north and south of Laird Road. Southgate Drive is a two-way roadway with a 50 km/h. speed limit and a basic 2-lane cross section and auxiliary left-turn lanes at its intersections with Laird Road and Clair Road. The street loops north of Laird Road, intersecting with Laird Road at two points, and extends south of Laird Road (at its western intersection) before terminating in a cul-de-sac approximately 1.4 kilometres south of Clair Road.

Clair Road is a two-way road running east-west between Hanlon Road / Crawley Road in the west (just east of Highway 6) and Victoria Road in the east. It generally operates with a 2-lane cross section except for the “urbanized” portion of the street which extends from 225 metres east of Laird Road to approximately 140 metres east of Beaver Meadow Drive – where the street generally has a 4-lane urban cross section. Within the street’s urban portion, auxiliary left-turn lanes are provided at all intersections, as well as bicycle lanes in both directions adjacent to the curb. Clair Road has a speed limit of 60 km/h.

Laird Road is a two-way road oriented generally in an east-west direction between Clair Road in the east and the street’s termination approximately 175 metres west of Quaterman Road. It generally operates with a 4-lane cross section west of the street’s signalized intersection with Southgate Drive, and a 2-lane cross section between this point and Clair Road in the east. West of the street’s signalized intersection with Southgate Drive to Cooper Drive, bicycle lanes are also provided in both directions adjacent to the curb. The street intersects with Highway 6 as a grade-separated interchange, providing a high-capacity traffic connection to Highway 6 in the Secondary Plan area. Laird Road has a speed limit of 50 km/h.

Maltby Road is a two-way rural road oriented generally in an east-west direction between Nassagaweya-Puslinch Townline in the east and Highway 6 in the west. West of Highway 6, Maltby Road continues as Concession Road 4 to Roszell Road near the Town of Hespeler. It operates with a 2-lane cross section and has a speed limit of 50 km/h.



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STUDY SCOPE LOCATION AND CONTEXT

3.1.2.2 Planned Road Network Improvements

A planned future public road network for the south Guelph area is discussed further in Section 4.3.2, while previously conducted environmental assessments for road widenings and improvements is detailed in Section 5.0 of this report.

3.1.3 Existing Transit Services

Guelph Transit is responsible for transit service in the vicinity of the Secondary Plan area, and provides services within the City of Guelph generally. Guelph Transit also connects the City of Guelph with major transit terminals in the Downtown area, including the University of Guelph and Guelph Central Station which provide connections to regional and inter-city transit services – including GO Transit, Greyhound and VIA Rail.

Transit routes do not currently service the Secondary Plan area except for a section of Clair Road west of Gordon Street, as the existing land uses are predominately rural and sections of Clair Road and Gordon Street were recently urbanized. There are currently no Guelph Transit services on Gordon Street, Victoria Road or Maltby Road. With build-out of the Secondary Plan area, it is anticipated that transit services will be introduced southwards within the City of Guelph.

A number of service transit bus routes currently operate north and west of the Secondary Plan area on Clair Road, Laird Road and Southgate Drive to service existing residential areas north of Clair Road and employment areas along Southgate Drive. These routes operate north of Clair Road serving Hanlon Industrial Park (Route 16), the University of Guelph (Routes 5 and 99), and the Guelph Central Station (Route 99) – which is located approximately 7.2 kilometres north of the subject lands. These routes are identified in Table 1, and may be revised to extend or reroute to the subject site area.

TABLE 1 EXISTING TRANSIT SERVICE FREQUENCY – MONDAY TO FRIDAY

Transit Route	Transit Type	Serviced Road	Morning Peak Hour	Afternoon Peak Hour
Route 5	Bus	Gordon St. / Farley Dr. / Goodwin Dr. / Victoria Rd.	20 min headway	2 to 3 buses in pk. hr. (variable headways)
Route 16	Bus	Gordon St. / Clairfields Dr. / Clair Rd. / Laird Rd. / Southgate Dr.	30 min headway	30 min headway
Route 99 (Mainline)	Bus	Gordon St. / Clair Rd. / Gosling Gdns. / Clairfields Dr.	10 min headway	10 min headway

Notes:
Bus route and schedule information effective January 7th, 2018.

Details related to future plans and transit-related policies, that will impact the future transit network in the Secondary Plan area, are summarized in Sections 4.6 and 7.0 of this report.

3.1.4 Pedestrians and Cyclists

Cycling and pedestrian facilities in the Secondary Plan area are limited under existing conditions, owing to the rural character of existing lands.

However, pedestrian sidewalks and bicycle lanes are currently provided along urbanized sections of Clair Road and Gordon Street within the Secondary Plan area. Bicycle lanes are provided on Gordon Street to the City limit, including within the rural section of the street south of Poppy Drive. Sidewalks are also provided along sections of new streets southeast of the Gordon Street / Clair Road intersection.

The City of Guelph has actively pursued plans detailing future active transportation networks. A city-wide cycling network plan was established as part of the City's Transportation Master Plan – detailed in Section 4.6, while additional trail and active transportation plans are summarized in Section 8 of this report.

3.2 EXISTING AREA TRAVEL CHARACTERISTICS

The Secondary Plan area is located in the south portion of the City of Guelph in a largely rural area with few existing transit and cycling / pedestrian facilities. These facilities will be pursued as part of the Clair-Maltby Secondary Plan, and would be anticipated to build on the sustainable transportation infrastructure and services made available to more established and recently developed areas in the south portion of the City.

A review of the travel characteristics information provided by the Transportation Tomorrow Survey (TTS) for trips made in the areas immediately north of the Secondary Plan area (herein referred to as the “South Guelph Area”) confirms, unsurprisingly given the site location, that a majority of trips are undertaken in a private automobile either as a driver or passenger. However, a proportion of travel is undertaken using non-auto means, specifically for peak direction travel during peak travel periods.

A review of the TTS travel characteristics of trips being made to / from the South Guelph Area during the weekday peak periods is provided in the following sections. The weekday peak travel periods analyzed include trips starting during the weekday morning peak period from 7:00 a.m. to 9:00 a.m. and during the weekday afternoon peak period from 4:00 p.m. to 6:00 p.m. The study area reviewed generally consists of the residential neighbourhoods east and west of Gordon Street between Kortright Road in the north and Clair Road in the south (2006 TTS Zones 8062, 8064, 8067-8076, 8078-8081). TTS data is reflective of the 2016 survey set, and has been updated relative to the June 2018 Mobility Study prepared as part of the Phase 1 work plan.

TTS data collection efforts have not, to date, surveyed travel patterns for weekend trips, limiting available data for the weekday periods.

3.2.1 Modal Share

Travel behaviour characteristics for trips to from the South Guelph Area during the weekday morning and afternoon peak periods are summarized in Table 2. Detailed TTS data calculations are included in **Appendix A**.

TABLE 2 MODAL SPLIT (TTS – 2016, SOUTH GUELPH AREA)

Mode	Morning Peak Period Inbound	Morning Peak Period Outbound	Afternoon Peak Period Inbound	Afternoon Peak Period Outbound	Total Peak Period Travel
Auto Driver ⁴	67%	67%	76%	76%	72%
Auto Passenger ⁵	7%	8%	9%	21%	10%
Transit	2%	8%	9%	2%	6%
Walk	17%	6%	1%	1%	5%
Cycle	3%	2%	2%	0%	2%
Other ⁶	4%	9%	3%	0%	5%
Total	100%	100%	100%	100%	100%

Notes:

1. Based on 2016 TTS results for morning (7:00 a.m. – 9:00 a.m.) and afternoon (4:00 p.m. – 6:00 p.m.) peak traffic periods.
2. Statistics specific to 2006 GTA Zones 8062, 8064, 8067-8076, and 8078-8081.
3. Trips represent an expanded value based on a sample of persons surveyed in the study area.
4. Auto driver trips (includes auto drivers and motorcycles).
5. Auto passenger trips (includes auto passenger trips only).
6. Other trips include school bus and taxi trips, consistent with The City's model document.

The proportion of people in the South Guelph Area who chose to drive a car during the morning and afternoon peak weekday periods is in the order of 70% to 75%. The balance of travel is undertaken, significantly, as a vehicle passenger (10%), while a small portion of travel is undertaken using transit or by walking / cycling (approximately 2% to 6%).

It should be noted that “other” trips during the weekday peak periods comprise of school bus trips – and that these represent approximately 4% to 9% of trips during the morning peak period. School bus trips comprise a smaller proportion of weekday afternoon peak period trips as they tend to occur before the afternoon peak travel period (before 4:00 p.m.).

The proportion of travel undertaken as a pedestrian, using a bicycle and by transit generally represents 7% of all trips, which is a small proportion of all trips and should be improved as part of new development planned within the Secondary Plan area.

It should be noted that the South Guelph Area (as reviewed in the above) comprises a low-density, suburban residential typology characterized by single detached dwelling units, considerable vehicle parking provisions and amenities, and a fragmented curvilinear street patterns. These features effectively discourage active transportation options, reduce transit efficiency and supportive densities, and prioritize automotive travel.

3.2.2 Trip Distribution Patterns

To understand the current travel distribution patterns of persons oriented to / from the South Guelph Area, TTS data was reviewed for weekday morning and afternoon peak period trips for all modes of travel. The study area reviewed consists of the South Guelph Area previously defined and illustrated in **Appendix A**.

The TTS data reveals that trips to / from the South Guelph Area during the weekday peak periods are predominately (74%) undertaken within the City of Guelph boundaries, and that many of these trips (54% of all trips) are “local” – south of the Eramosa and Speed Rivers. It is also important to note that a notable portion of trips are also oriented to / from Waterloo Region (10%), Halton and Peel Regions (7%), Wellington County (4%), and the City of Toronto (1%). Another 4% of trips were dispersed to other areas – notably the City of Hamilton and surrounding area.

A summary of existing resident travel characteristics including travel mode by certain areas of distribution is provided in Table 3. Detailed TTS data calculations are included in **Appendix A**.

TABLE 3 SOUTH GUELPH AREA: PEAK PERIOD TRIP DISTRIBUTION BY TRAVEL MODE

Destination Area	Proportion of All Trips	Mode Split	Legend
Local Area ¹	54%		<p><u>Travel Mode</u></p> <ul style="list-style-type: none"> Auto Driver Auto Passenger Transit Walk Cycle Other
Rest of Guelph	20% (5% Downtown)		
Waterloo Region	10%		
Halton / Peel Regions	7%		
Wellington County	4%		
City of Toronto	1%		

Note:

1. "Local area" consists of areas within the City of Guelph south of the Eramosa and Speed Rivers.
2. Another 4% of trips are oriented to "other" areas in the region.

A summary of weekday peak period (7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.) travel behaviour and distribution to / from the South Guelph Area is derived from Table 3, and is provided in the following.

- It is notable that approximately 54% of existing peak period trips to / from the South Guelph Area are made “locally”. The majority of these trips are undertaken in a private automobile as a driver (59%) or passenger (11%). Many of these trips are also undertaken on a school bus, which one can conclude are “school trips” (7%). Approximately 21% of trips to / from the South Guelph Area are undertaken by transit and active transportation modes, most notably as transit riders (10%) or pedestrians (8%).
- Most commonly, trips to / from the South Guelph Area are made from within the City of Guelph itself. Approximately 74% of trips to / from the South Guelph Area during the weekday peak periods are made within Guelph, including approximately 50% locally (noted above), approximately 5% to the Downtown, and 19% in the rest of Guelph (north of the Eramosa and Speed Rivers). For trips within Guelph, but outside the local area as defined above, approximately 94% of trips are made by car (81% driver; 13% vehicle passenger), and only 3% are made by transit.
- After the City of Guelph itself, Waterloo Region represents the second largest jurisdiction for trips to / from the South Guelph Area. Approximately 10% of trips to / from the South Guelph Area are to / from Waterloo Region. TTS data indicates that trips are made by automobile (94% driver; 5% passenger; 1% school bus or taxi / rideshare).
- Approximately 7% of trips to / from the South Guelph Area are to / from Halton / Peel Regions. Trips between the South Guelph Area and Halton and Peel Regions are made by automobile (89% driver; 10% passenger; 1% school bus or taxi / rideshare).
- Approximately 4% of trips to / from the South Guelph Area are to / from Wellington County. Trips between the South Guelph Area and Wellington County are made predominately by automobile (86% driver; 13% passenger; 1% school bus or taxi / rideshare).
- A small proportion - approximately 1% of trips to / from the South Guelph Area are made to / from the City of Toronto. Relative to trips to / from other areas, trips to / from Toronto are more likely to be made by transit. A greater proportion of all trips to / from Toronto are taken by transit (37%), but it is still predominantly car-based travel (63%).
- In summary, trips made “local” to the South Guelph Area are more likely to be undertaken by sustainable transportation means (transit, walking, cycling) relative to trips made within the City of Guelph generally, or to trips made between the South Guelph Area and neighbouring Waterloo, Halton, and Peel Regions. During weekday peak travel periods, approximately 11% of “local” trips are made by walking or cycling, while another 10% is made by transit.

During weekday peak travel periods, trips oriented within the City of Guelph (outside of the “local” area) and to neighbouring regions (Halton, Peel, Waterloo, Wellington County) are predominately and overwhelming undertaken in a private vehicle (see Table 3). During weekday peak travel periods, trips to / from the City of Toronto comprise a small proportion of overall travel (1%). Although trips to / from Toronto are still predominately undertaken by car, the transit mode share is greater than trips between the South Guelph Area and other areas analyzed herein.

3.3 COLLISION HISTORY

Collision data was made available for the 5-year time period from January 1st 2012 to March 31st, 2017, at a number of intersections within the study area, including:

- Clair Road at Gordon Street
- Clair Road West at Laird Road
- Clair Road West at Clairfields Drive West
- Clair Road East at Farley Drive
- Clair Road East at Beaver Meadow Drive
- Clair Road East at Victoria Road South
- Gordon Street at Maltby Road
- Gordon Street at Poppy Drive
- Victoria Road South at Maltby Road

Detailed collision reports are included in **Appendix B**.

A brief summary of collisions for the 2012 to 2017 (end March 2017) period, for each of the above-mentioned intersections, is provided in Table 4.

3.3.1 Collision Data Summary

A total of 134 collisions were reported at the above-mentioned intersections within the identified time frame (63 month period from 2012 to 2017). Of the total volume of collisions, 21 (16%) resulted in a non-fatal injury, while 42 collisions (31%) report property damage only (no injury). All other collisions were non-reported or “non-reportable”. No “fatal” collisions were reported.

Within the collision data scope, approximately 51% of the collisions recorded have occurred at the Gordon Street and Clair Road intersection. Most (greater than half) of these collisions were either “rear-end” collisions often resulting from following too closely or improper speed for road conditions, or “turning movement” collisions often resulting from left-turn traffic not yielding to on-coming traffic. Measures to reduce rear-end collisions include safety campaigns targeted at poor-weather vehicle operation, and greater enforcement. The introduction of protected left-turn phases at this intersection may have an impact on reducing turning movement collisions.

A total of 3 collisions involving vulnerable road users were recorded – in all instances involving cyclists. Two of these collisions occurred at the Gordon Street and Clair Road intersection, and one other at the Clair Road and Farley Drive intersection. Cycling facilities and pavement markings (including pedestrian crossings) should be highly visible and well-marked. Consideration may be made to reducing vehicle speeds and / or providing physical separation (bollards / buffers) between cycling facilities and vehicle travel lanes. It is noted that Gordon Street is planned to be upgraded to accommodate fully protected cycling infrastructure.

It should be noted that a total of 15 collisions were recorded at the Victoria Road South and Maltby Road intersection. This intersection is currently configured as two separate intersections (back to back T-intersections). This unusual configuration, which requires northbound / southbound traffic to conduct a right-turn then left-turn in short succession to continue in the same direction, may explain the rate of rear-end collisions at this intersection.

TABLE 4 COLLISION DATA SUMMARY

Intersection	Total Collisions (2012 to 2017) ¹	Average Collisions per Month	Impact Type	Classification	Collisions Involving Vulnerable Road Users
Clair Road / Gordon Street	69	1.1	<ul style="list-style-type: none"> • 31 rear-end • 12 turning movement • 8 angle • 10 single motor vehicle • 6 sideswipe • 1 approaching • 1 other 	<ul style="list-style-type: none"> • 12 non-fatal injury • 22 property damage only • 35 non-reportable 	<ul style="list-style-type: none"> • 2 involving cyclists
Clair Road West / Laird Road	4	0.1	<ul style="list-style-type: none"> • 2 rear-end • 1 single motor vehicle • 1 sideswipe 	<ul style="list-style-type: none"> • 2 property damage only • 2 non-reportable 	<ul style="list-style-type: none"> • 0 vulnerable road users
Clair Road West / Clairfields Drive West	13	0.2	<ul style="list-style-type: none"> • 7 rear-end • 1 turning movement • 2 angle • 3 sideswipe 	<ul style="list-style-type: none"> • 13 non-reportable 	<ul style="list-style-type: none"> • 0 vulnerable road users
Clair Road East / Farley Drive	13	0.2	<ul style="list-style-type: none"> • 1 rear-end • 7 turning movement (primarily east-west left turns) • 3 angle • 2 single motor vehicle 	<ul style="list-style-type: none"> • 3 non-fatal injury • 5 property damage only • 5 non-reportable 	<ul style="list-style-type: none"> • 1 involving cyclists
Clair Road East / Beaver Meadow Dr.	1	-	<ul style="list-style-type: none"> • 1 single motor vehicle 	<ul style="list-style-type: none"> • 1 non-fatal injury 	<ul style="list-style-type: none"> • 0 vulnerable road users
Clair Road East / Victoria Road South	12	0.2	<ul style="list-style-type: none"> • 3 rear-end • 5 angle • 3 single motor vehicle • 1 approaching 	<ul style="list-style-type: none"> • 1 non-fatal injury • 6 property damage only • 5 non-reportable 	<ul style="list-style-type: none"> • 0 vulnerable road users
Gordon Street / Maltby Road	5	0.1	<ul style="list-style-type: none"> • 2 angle • 3 single motor vehicle 	<ul style="list-style-type: none"> • 2 non-fatal injury • 2 property damage only • 1 non-reportable 	<ul style="list-style-type: none"> • 0 vulnerable road users
Gordon St. / Poppy Dr.	2	-	<ul style="list-style-type: none"> • 2 angle 	<ul style="list-style-type: none"> • 1 non-fatal injury • 1 non-reportable 	<ul style="list-style-type: none"> • 0 vulnerable road users
Victoria Road South / Maltby Road	15	0.2	<ul style="list-style-type: none"> • 7 rear-end • 2 turning movement • 6 single motor vehicle 	<ul style="list-style-type: none"> • 1 non-fatal injury • 5 property damage only • 9 non-reportable 	<ul style="list-style-type: none"> • 0 vulnerable road users
All Locations	134	2.1	<ul style="list-style-type: none"> • 51 rear-end • 22 turning movement • 22 angle • 26 single motor vehicle • 10 sideswipe • 2 approaching • 1 other 	<ul style="list-style-type: none"> • 21 non-fatal injury • 42 property damage • 71 non-reportable 	<ul style="list-style-type: none"> • 3 involving vulnerable road users

Notes:
1. Data collection to end of March 2017

4.0 POLICY AND REGULATORY PLANNING FRAMEWORK

The Clair-Maltby Secondary Plan transportation elements are guided by the policies and plans set out in the policies outlined below.

4.1 THE PROVINCIAL POLICY STATEMENT (PPS)

The **Provincial Policy Statement (PPS)** was enacted in 2005 and the most recent version came into effect on May 1, 2020. The PPS provides policy direction on land use planning, development and transportation matters. All planning decisions must be consistent with the PPS. The PPS is based on the principles of “maintaining strong communities, a clean and healthy environment and a strong economy” (Part IV Vision). The PPS supports:

- connectivity within and among multimodal transportation systems, including across jurisdictional boundaries;
- safe and efficient movement of people and goods, appropriately addressing projected needs;
- density and a mix of uses to support the planning and development of alternative transportation modes and limit the length and need of vehicle trips and support current and future use of transit and active transportation;
- public streets that meet the needs of pedestrians and facilitate active transportation and community connectivity;
- efficient use of existing and planned infrastructure, including through Transportation Demand Management (TDM) strategies, where feasible;
- protection of rights-of-way for infrastructure including transportation and transit to meet current and project needs; and,
- protecting for long term goods movement facilities and corridors.

In addition, the PPS promotes planning decisions including intensification, redevelopment, accounting for existing building stock, promoting various types of housings, making efficient use of existing infrastructure, etc.

4.2 PLACES TO GROW

“A Place to Grow” - the Growth Plan for the Greater Golden Horseshoe was initially prepared by the Provincial government in 2006 and should be read in conjunction with the PPS.

All decisions made by municipalities with respect to planning matters must conform to the Growth Plan. The Places to Grow Growth Plan has been recently updated. In May 2019, the Government of Ontario released A Place to Grow: Growth Plan for the Greater Golden Horseshoe (APTG), and Amendment 1 to APTG was approved with an effective date of August 28, 2020. APTG and Amendment 1 replace the Growth Plan for the Greater Golden Horseshoe, 2006 that initially took effect on June 16, 2006 and guides growth and development within the Greater Golden Horseshoe over the next 30 years.

The Growth Plan provides a vision and a framework for managing growth. It requires all municipalities to implement policies to achieve intensification and higher-densities to make efficient use of land and infrastructure and support transit viability, and directs growth to *urban growth centres* and *transit corridors* and

stations areas. The plan also calls for the consideration of climate change in planning for future growth that supports moving towards low-carbon communities and approaches to reduce greenhouse gas emissions. In these areas, the Growth Plan demands increased residential and employment densities to support existing and planned transit services, a mix of land uses, and designed access for various transportation modes to the transit facility including pedestrian and cycling infrastructure.

The Growth Plan requires land use planning to be coordinated with transportation planning and investment. The Plan states that transportation investments and the wider transportation system:

1. provide connectivity among transportation modes for moving people and for moving goods;
2. offer a balance of transportation choices that reduces reliance upon the automobile and promotes transit and *active transportation*;
3. be sustainable and reduce greenhouse gas emissions by encouraging the most financially and environmentally appropriate mode for trip-making and supporting the use of zero- and low-emission vehicles;
4. offer *multimodal* access to jobs, housing, schools, cultural and recreational opportunities, and goods and services;
5. accommodate agricultural vehicles and equipment, as appropriate; and
6. provide for the safety of system users.

The Growth Plan indicates that the design of new facilities and redesign of existing streets will adopt a complete-streets approach that will ensure the needs of all street users are accommodated; however, public transit will be the first priority for transportation infrastructure planning and major transportation investments. Supported by the implementation of complete street policies, municipalities will ensure that active transportation networks are comprehensive and integrated into transportation planning. The Growth Plan states that Municipalities will develop and implement transportation demand management policies in official plans or other planning documents or programs to:

1. reduce trip distance and time;
2. increase the modal share of alternatives to the automobile, which may include setting modal share targets;
3. prioritize active transportation, transit, and goods movement over single-occupant automobiles;
4. expand infrastructure to support active transportation; and
5. consider the needs of major trip generators.

The Growth Plan also speaks to accommodating goods movement, through linking international gateways and employment areas by appropriate transportation facilities / infrastructure, and that municipalities establish priority routes for goods movement.

4.3 CITY OF GUELPH OFFICIAL PLAN

The City of Guelph Official Plan is currently undergoing a statutory five year review. The Plan was established in 2001. The current Plan is a consolidation of the Official Plan policies in effect as of December 2014.

4.3.1 Official Plan Amendment 48

The City of Guelph Official Plan Amendment 48 was approved by City Council in June 2012, as the third and final phase in updating the City's Official Plan to ensure that its goals, objectives and policies conform and are consistent with provincial plans, policies and legislation.

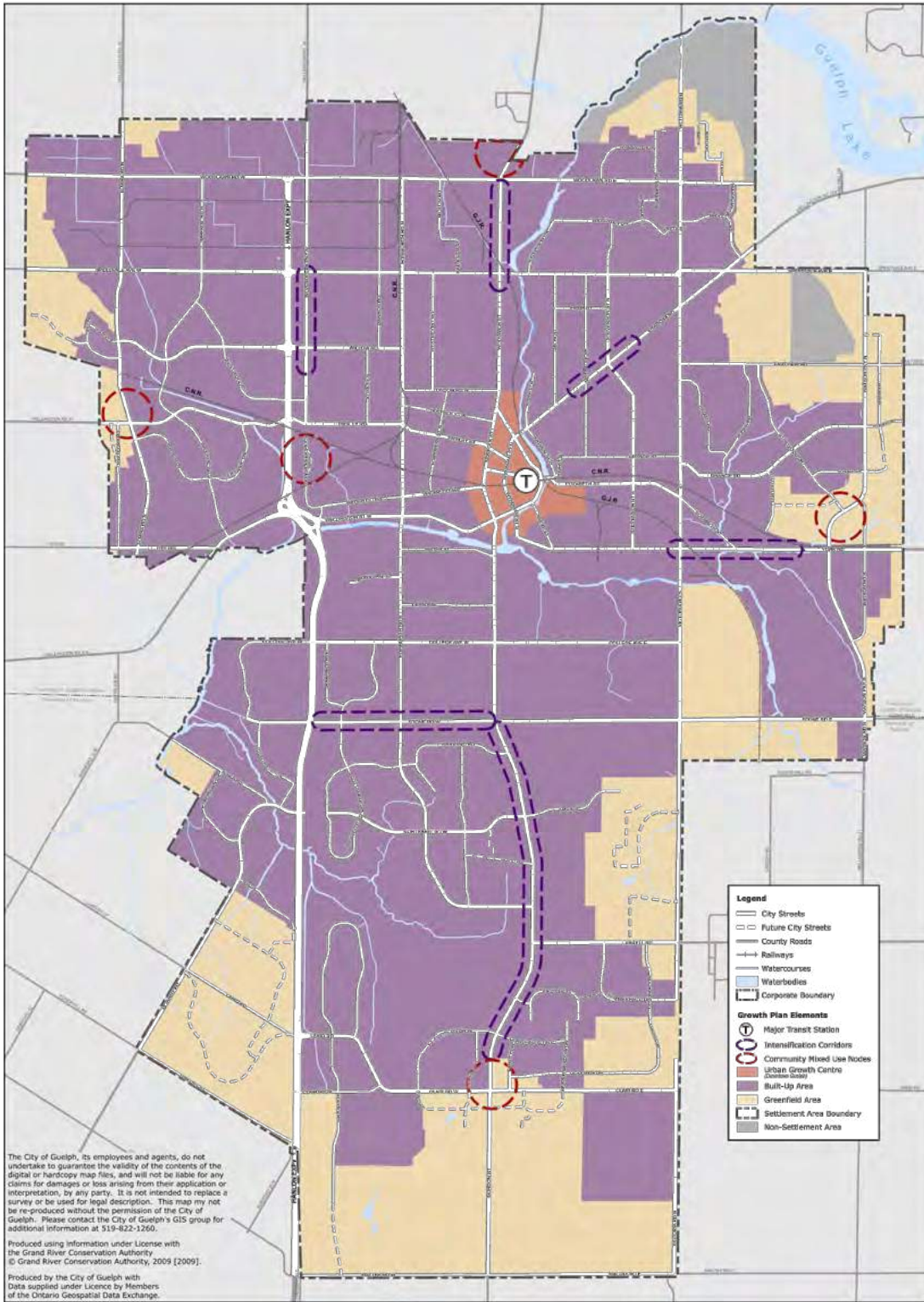
Transportation policies and objectives outlined in Amendment 48 are generally consistent with the initial Official Plan policies, and are described as part of the Current Official Plan in the following.

The City of Guelph Official Plan follows the policies laid out in the PPS and Growth Plan, and establishes a strategic vision, policies, actions and framework to support a healthy natural ecosystem, community services and facilities, education and employment opportunities, infrastructure that is supportive of alternative forms of transportation, community safety, and vibrant neighbourhoods and downtown.

Emphasis in the City of Guelph Official Plan is on maintaining quality of life, safety and stability of the community, and accommodating compact future development that avoids sprawl and is supported by existing infrastructure and services that can be supported by the efficient use of public expenditures. These objectives include developing a ***safe, efficient and convenient transportation system that provides for all modes of travel and supports the land use patterns of the City.***

The Official Plan identifies (in Figure 2) the Clair-Maltby Secondary Plan area as predominately a "greenfield area", while the Clair Road / Gordon Street junction is identified as a "community mixed-use node" (OP Schedule 1B). These areas are further noted as "reserve", "industrial" and "commercial" lands in OP Amendment 48 Schedule 2 (Figure 3).

In regards to development in new "greenfield" areas, the Official Plan directs new development to provide for a diverse mix of land uses at transit supportive densities (50 residents / jobs per hectare) that supports a multi-modal transportation network and efficient public transit that links to the City's Urban Growth Centre and surrounding communities. Transit, along with walking and cycling, are to be supported by new development for everyday travel. The identified community mixed-use node at Clair Road / Gordon Street, is an area identified for higher density and mixed-use development that serve the wider community. The node is intended to be well served by transit and facilitate pedestrian and cycling travel.



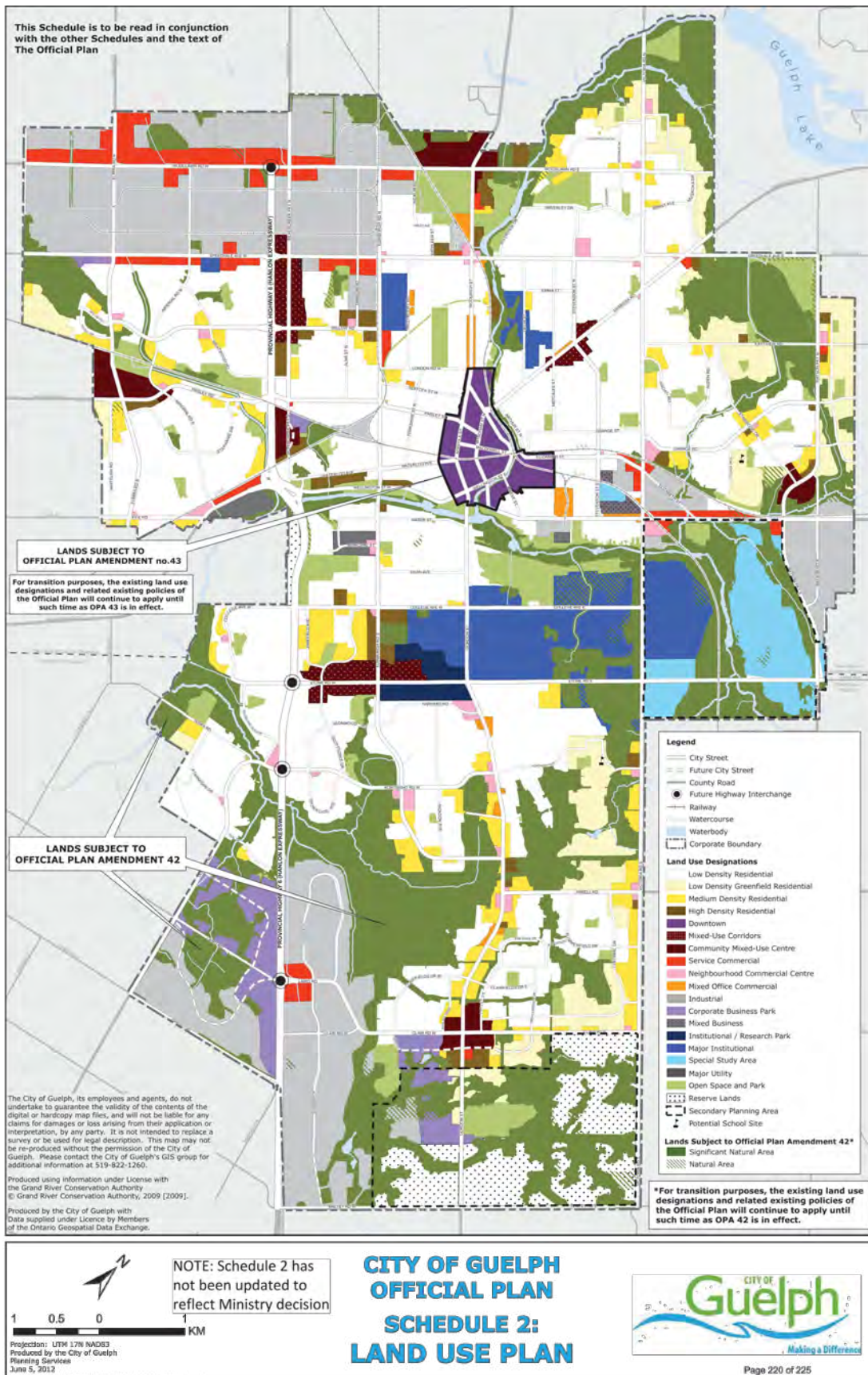
December 2012 Consolidation

**CITY OF GUELPH
OFFICIAL PLAN
SCHEDULE 1B:
GROWTH PLAN ELEMENTS**

1 0.5 0 1 KM

Produced by the City of Guelph
Community Design and Development Services, Planning Services
As Modified by the Ontario Municipal Board March 17, 2019

SCHEDULE 1B
CITY OF GUELPH OFFICIAL PLAN
- GROWTH PLAN ELEMENTS



SCHEDULE 2
CITY OF GUELPH OFFICIAL PLAN AMENDMENT 48
- LAND USE PLAN

Transportation policies are established within the Official Plan, which plans and manages the City's transportation system to accommodate the following:

- a) provide connectivity among transportation modes for moving people and goods;
- b) offer a balance of transportation choices that reduces reliance upon any single mode and promotes transit, cycling and walking;
- c) be sustainable, by encouraging the most financially and environmentally appropriate mode for trip-making;
- d) offer *multi-modal* access to jobs, housing, schools, cultural and recreational opportunities, and goods and services;
- e) provide for the safety of system users; and
- f) ensure coordination between transportation system planning, land use planning, and transportation investment.

In planning for new - or reconfiguring existing - transportation infrastructure, the Official Plan dictates that proponents consider separation of travel modes within transportation corridors, use transit infrastructure to shape growth, place priority on increasing the capacity of existing transit systems, expand transit services to areas that are planned to achieved transit supportive densities, facilitate improved linages to / from Downtown Guelph and other intensification areas, and increase mode share of transit. In all cases, and consistent with provincial directives, public transit will be the first priority for transportation infrastructure planning.

In addition to prioritizing transit, the City is directed to develop transportation demand management (TDM) policies, and pedestrian and cycling networks to be utilized by planned new development.

4.3.2 City of Guelph Official Plan: Transportation

This section of the Official Plan generally defines the transportation policy for the City. The planning and design of the City Transportation system should meet the following objectives:

- a) To derive a transportation system, involving all forms of transport modes, to move people and goods in an environmentally efficient and effective manner.
- b) To ensure that the transportation system is financially feasible and has received an acceptable level of public approval.
- c) To implement programs to facilitate and encourage greater and safer use of the bicycle as a mode of transport.
- d) To support measures to improve the pedestrian environment and system.
- e) To encourage the use and expansion of the public transit system to all parts of the City.

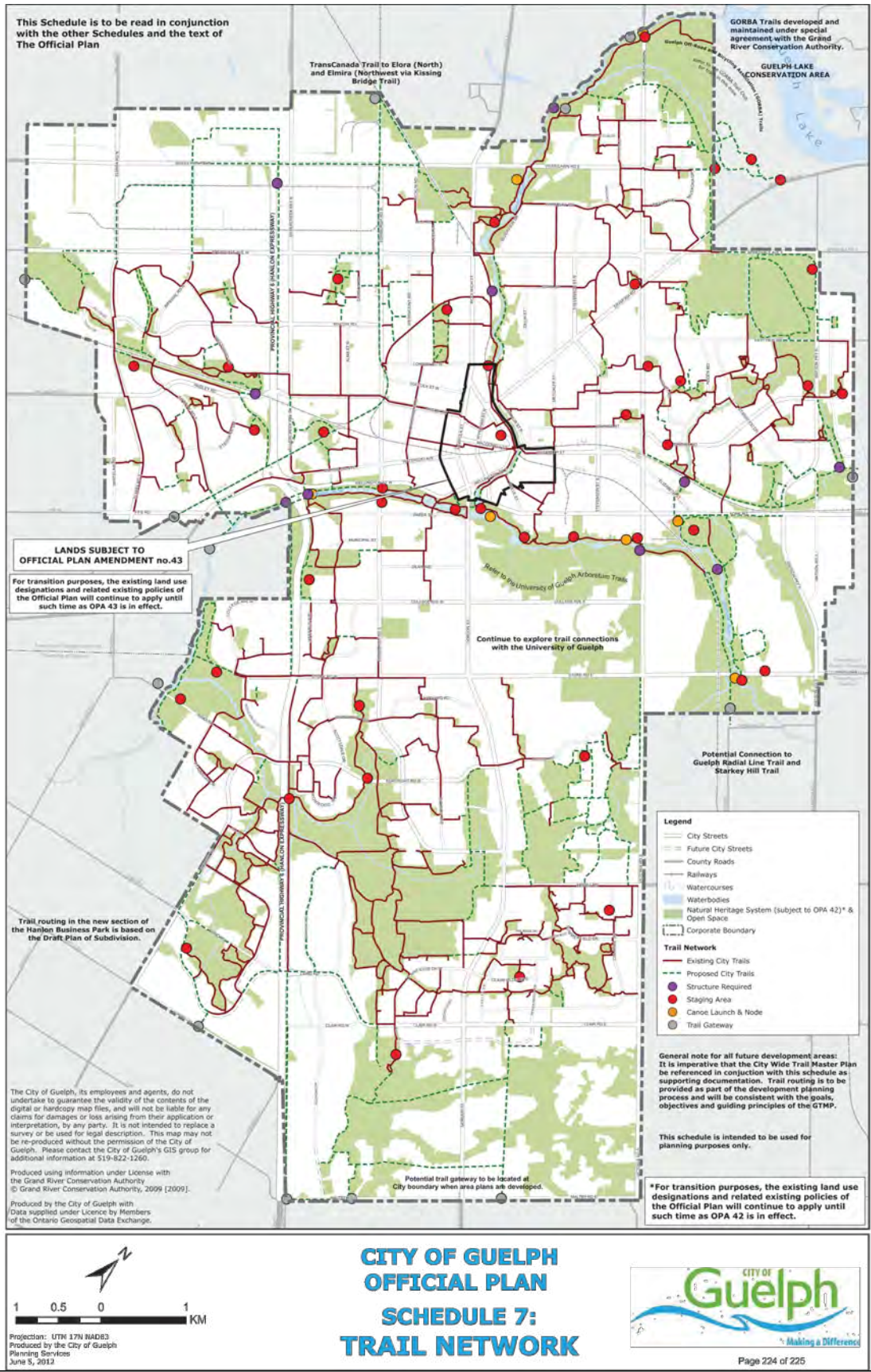
- f) To work towards achieving a transit "*modal split*" of at least 10 per cent of the average daily City trips which represents more than a doubling of the existing transit ridership in the community.
- g) To develop an appropriate hierarchy of roads to ensure the desired movement of residential, commercial, industrial and institutional traffic within and through the City.
- h) To outline a proposed road network that will be subject to environmental review processes, either through the City's *development* planning approval process and/or through the Environmental Assessment Act.
- i) To work in co-operation with the Provincial Ministry of Transportation and other local governments, to create a road network that can accommodate current and anticipated traffic movement volumes.
- j) To work towards minimizing road/rail conflicts by relocating minor or underutilized railway lines and removal of at-grade railroad crossings where feasible.
- k) To encourage the maintenance of adequate passenger and freight rail services.
- l) To ensure that adequate parking facilities are provided throughout the City.
- m) To develop a transportation system that minimizes impact on the environment and aesthetic character of the City.

Furthermore, the Official Plan establishes plans and objects related to pedestrian and bicycle movement (bicycle network plan – Schedule 9C), public transport, roads, new / reconfigured road design, transportation and related urban environment, railways, and parking.

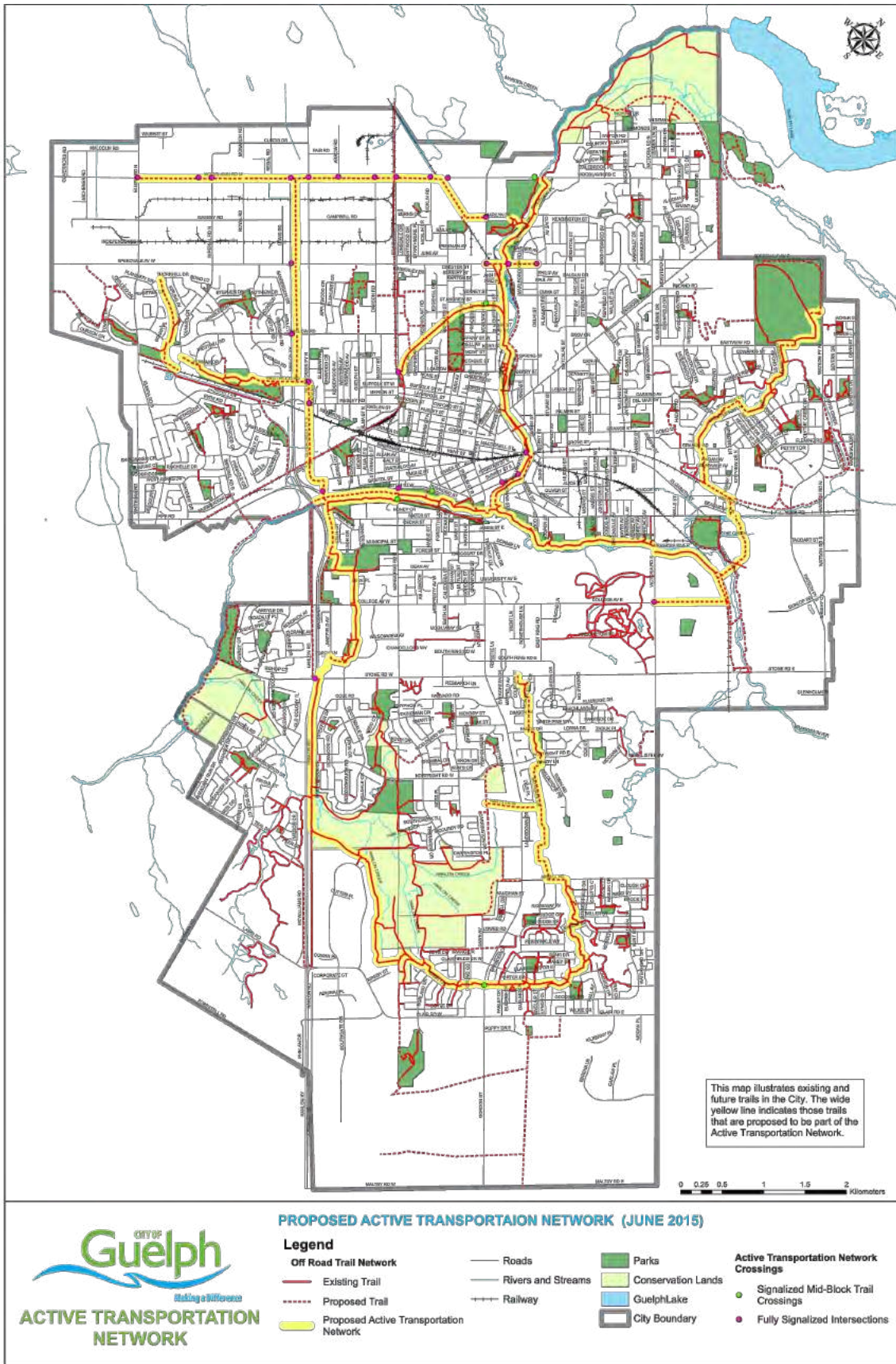
Key Pedestrian and Bicycle Policies

The City, through policies and standards, will support the creation of programs and facilities that will encourage walk and greater use of bicycles, through the integration of safe and convenient bike and pedestrian components into the design of new streets including shade trees, street furniture, lighting, street crossing and other traffic control. Additionally, all new development will provide for bicycle / pedestrian linkages and street sidewalks, and convenient and accessible bicycle parking facilities at major employment / shopping nodes and transportation terminals. New developments should provide conveniently located bicycle parking in close proximity to building entrances, and sheltered bicycle parking should be integrated into the built form.

The City, through policies established in the Official Plan, developed a Bicycle Network Plan that directs expansion of bicycle facilities in Guelph, including the Clair-Maltby Secondary Plan area. This network plan was updated as part of OPA 48 – Schedule 7 – and is complemented by the City Trail Network Plan, which is illustrated in Figure 4, and by the City of Guelph Active Transportation Network, 2017 (Figure 5).



**SCHEDULE 7
CITY OF GUELPH OFFICIAL PLAN AMENDMENT 48
- TRAIL NETWORK PLAN**



CITY OF GUELPH PROPOSED ACTIVE TRANSPORTATION NETWORK, JUNE 2015

Key Transit Policies

Important in maintaining and expanding transit services in the City of Guelph, the Official Plan cites developing a compact urban form with a mix of land uses, ensuring the creation of a street network that permits the location of transit stops within a reasonable walking distance of a significant majority of residents, jobs and other activities, and staging urban expansion to include the provision of transit service.

Within new development, transit facilities should be detailed in land use / development plans, and bus stops should be provided at regular intervals.

Roads and Road Design

The City of Guelph Official Plan recognizes that private automobiles will continue to represent the primary mode in meeting the travel need of residents and businesses in the City, and lays out a hierarchy of public street facilities and their intended purposes / permissions: expressways, arterials, collects and locals.

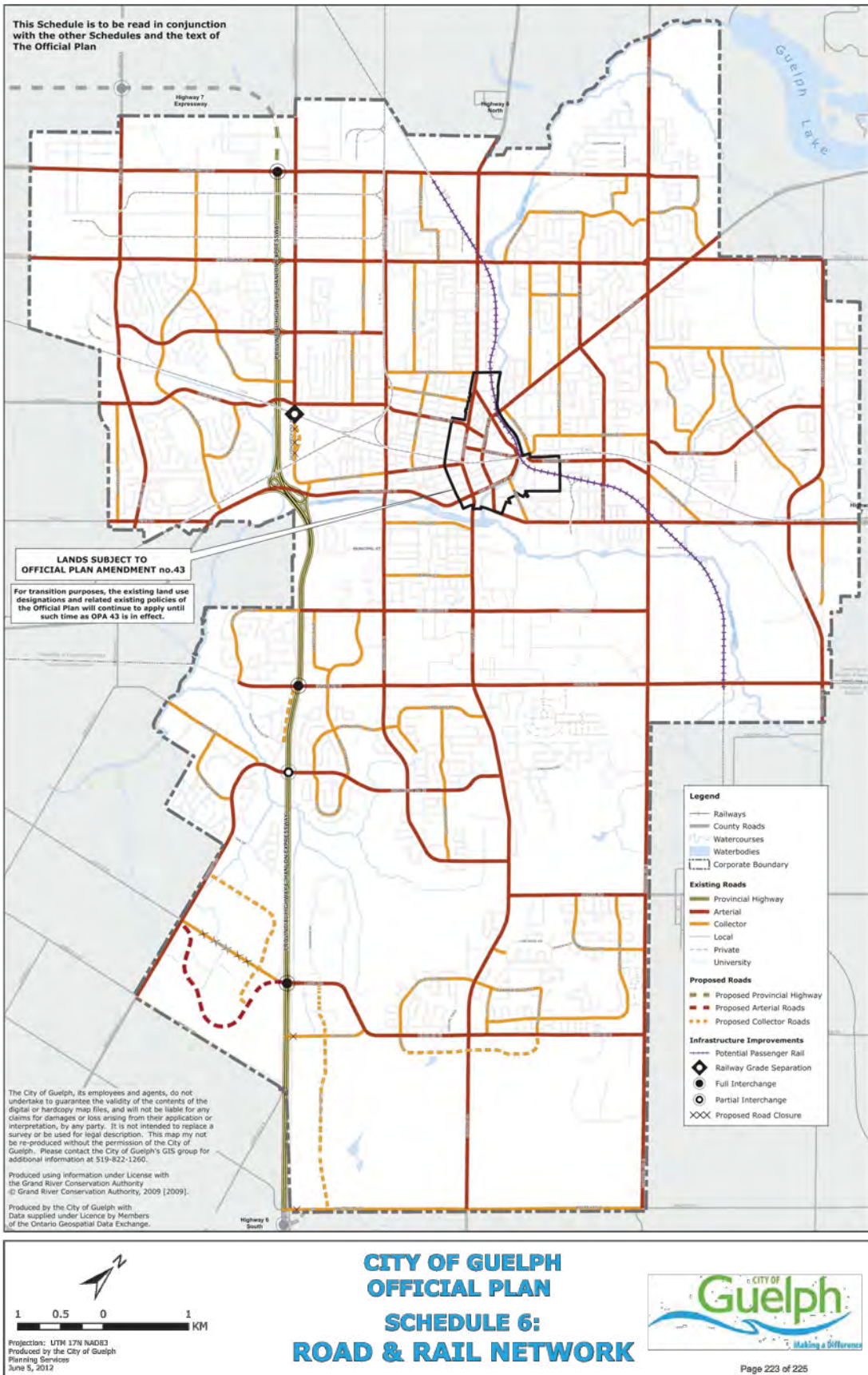
The main elements of the road network are identified in Schedule 7 of OP Amendment 48, which is included in Figure 6.

In regards to new public streets and street design, the Official Plan promotes the creation of an arterial – collector grid system in new development areas to assist in the dispersion of traffic and to provide a reasonable walking distance to transit services. A series of public street widenings and “Ultimate Widths” are also identified in the Official Plan (Tables 8.1 and 8.2).

Key street widenings as they related to the Clair-Maltby Secondary Plan area include:

- Clair Road – 30 metre “ultimate width” (5 metre widening on both sides)
- Gordon Street - 30 metre “ultimate width” between Clair Road and Maltby Road (5 metre widening on both sides)
- Maltby Road – 30 metre “ultimate width” (5 metre widening on both sides)
- Victoria Road - 36 metre “ultimate width” between Stone Road and South City Limit (8 metre widening on both sides)
- Clair Road and Laird Road (potential widening to accommodate intersections improvements)
- Clair Road and Crawley Road (potential widening to accommodate intersections improvements)
- Gordon Street and Maltby Road (potential widening to accommodate intersections improvements)
- Maltby Road and Crawley Road (potential widening to accommodate intersections improvements)
- Victoria Road and Clair Road (potential widening to accommodate intersections improvements)
- Victoria Road and Maltby Road (potential widening to accommodate intersections improvements)

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SCHEDULE 6
CITY OF GUELPH OFFICIAL PLAN AMENDMENT 48
- ROAD AND RAIL NETWORK

Urban Environment

The City of Guelph Official Plan establishes policies as they relate to the impact of transportation facilities on urban neighbourhoods and design. These policies include minimizing the impact of trucks upon residential areas, maintain and enhance the streetscape (tree planting), minimize land use conflicts between major transportation routes and residential areas, and noise and vibration mitigation.

Railways

The City recognizes the importance of rail facilities to support freight service and passenger rail service, and to minimize road / rail conflicts through a program of grade-separated under / over passes.

Parking

The City of Guelph Official Plan, through the application of the City Zoning By-law, can establish minimum and maximum vehicle parking requirements and permit shared parking, for all types of land uses to ensure parking demands are met. Off-site parking areas and facilities can be provided through zoning and the City of Guelph Official Plan, and can be acquired, developed and operated by the City.

Reduced parking requirements may be considered as part of a Parking Study, particularly within Downtown, Community Mixed-use Nodes and Intensification Corridors, or for affordable housing, or where high levels of transit exist or are planned. The City may encourage managing the supply of parking as a TDM measure.

Key Transportation Demand Management (TDM) Policies

The City has established, within the Official Plan, that transportation demand management (TDM) is an essential part of an integrated and sustainable transportation system. TDM policies will be developed and implemented to reduce trip distance and time, and to increase the modal share of alternatives to the automobile. Suggested TDM measures include the following:

- including provisions for active transportation in association with development and capital projects including secure bicycle storage facilities and pedestrian and cycling access to the road network;
- supporting transit through reduced parking standards for some land uses or locations, where appropriate, and making provisions for parking spaces for car share vehicles through the development approval process where appropriate; and
- encouraging carpooling programs, preferential parking for carpoolers, transit pass initiatives and flexible working hours.

In addition, a Transportation Demand Management Plan is listed among the type of transportation studies that the City may require as part of a development application.

4.4 SOUTH GUELPH SECONDARY PLAN

The purpose of the South Guelph Secondary Plan is to introduce new planning policies for southern areas that were annexed by the City of Guelph, to establish planning direction for the guidance of City Council and Staff, and to provide information for the public, landowners, development and other stakeholders.

The South Guelph plan was complete in 1998 and comprised a new section to the City of Guelph Official Plan that contains Secondary Plan policies that introduce goals, objectives and policies for lands in the South Guelph area including transportation policies. The South Guelph Secondary Plan comprises the areas generally south of Stone Road, north of Maltby Road, west of Victoria Road, and east of Downey Road / Forestell Road.

The plan identifies the “Gateway” character of the South Guelph area, and identifies Gordon Street and the Hanlon Expressway corridors as key locations to express this character. The plan specifies that development along the Gordon Street corridor should provide detailed planting and landscaping plans, and accommodate setbacks and built form such that new buildings are located behind the parkway belt of required landscaping and planting. Design controls on entrances off Gordon Street and on parking and loading within the Gordon Street corridor should be developed.

For the Clair-Maltby Secondary Plan area, the South Guelph plan specifies that a system of arterial and collector roads be planned to serve the study area. This road network is enhanced through the road widenings protected for under the City of Guelph OPA 48 document and previously described.

4.5 SOUTH GORDON SECONDARY PLAN

The South Gordon Secondary Plan does not include the lands defined within this study, but rather the lands immediately north of the Clair-Maltby Secondary Plan area (north of Clair Road). However, this 1999 document may provide some policy direction for the development of the subject lands.

Consistent with the South Guelph Secondary Plan, the South Gordon Secondary Plan identifies Gordon Street as a “Gateway” corridor into the City, and describes treating Gordon Street with appropriate landscaping,

From a transportation perspective the South Gordon Secondary Plan specifies that neighbourhoods should be connected to each other and to the rest of the city by roads, pedestrian paths, bicycle linkages, and transit routes to create a more accessible, convenient, safe and energy efficient environment. This objective includes measures to promote pedestrian safety and comfort (providing clearly defined public realm and reducing walking distances between origins and destinations) and the introduction of walking and bicycle paths that are visible, accessible, and aligned along routinely used public spaces. New trails are encouraged to be provided within trail corridors up to 15 metres in width. Bicycle lanes, routes and trails are intended to provide for utilitarian and recreational travel within the community and along the arterial road network.

The South Gordon Secondary Plan specifies that internal road networks should be designed to evenly distribute traffic throughout the neighbourhood along collector roads while discouraging through-traffic on local streets. Collector roads should also be designed to accommodate public transit bus routing – that would be routed to provide transit stops within 400 metres of 90% of residents. Roadways should also include special control measures to reduce vehicle speeds in appropriate locations, including locations that accommodate wildlife crossings.

Of note, the plan specifies that new development in the area provide for both on-street and off-street parking adjacent to parks with active recreational facilities, and to make use of shared parking arrangements between school sites and neighbouring parks.

4.6 GUELPH – WELLINGTON TRANSPORTATION STUDY (TRANSPORTATION MASTER PLAN)

The Guelph – Wellington Transportation Study was undertaken by a consortium of planning and engineering consultants on behalf of the City of Guelph and finalized in July 2005, in an effort to address long-term transportation needs and improvements in accordance with the Official Plan policies and City's Transportation Strategy and SmartGuelph Principles. The study has 5 main objectives:

1. Identify transportation needs and recommend practical improvements;
2. Recommend Transportation Demand Management (TDM) measures;
3. Identify improvements to City and County roadways;
4. Review Provincial highway initiatives affecting Guelph and Wellington County; and
5. Review inter-regional travel between Guelph, the Region of Waterloo, and the GTA and identify opportunities for transit initiatives to serve this need.

The Master Plan provides direction on the City's existing and planned cycling network, truck route network (Figure 7), and transit node and corridor framework which is intended to support transit routes and the potential removal of reduced / removed parking standards. These planned networks include components related to existing road facilities in the Clair-Maltby Secondary Plan area.

The Guelph – Wellington Transportation Study also reviews existing transportation behavior and forecasts future travel demands based on existing travel and demographic trends. The study concludes that travel demands are 2 to 3 times higher during weekday peak periods than typical weekday midday periods and that 83% of trips within the study area are undertaken in a private automobile, and since the mid-1990s - travel demands have generally increased and average persons per vehicle have reduced. It is also important to note that a significant and increase amount of work travel is occurring between the Waterloo Region and Guelph areas.

Given the aforementioned trends, there is anticipated to be considerable road network deficiencies and traffic congestion in the long term, assuming no new infrastructure improvements, particularly in the South Guelph area. To accommodate increased traffic demand in the South Guelph area, the study identifies a number of improvements, including:

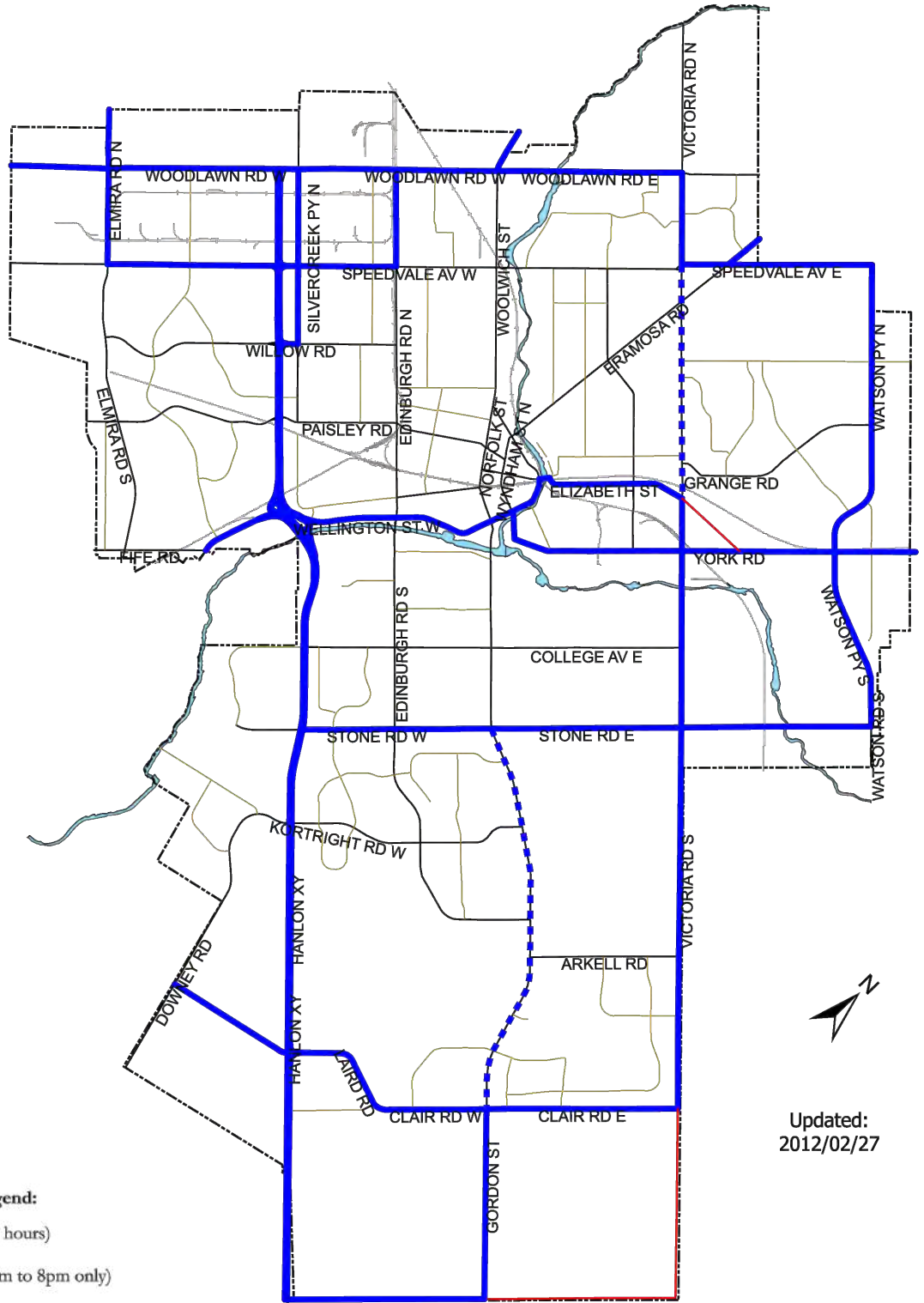
- Widening of Gordon Street from 2 to 4 lanes (approved 2001 EA) from Kortright Road to Wellington Road 34;
- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA) - COMPLETE
- Southerly extension of Southgate Drive to Maltby Road; and
- Development of an internal collector road system within the Clair-Maltby Secondary Plan area connecting to Gordon Street and Maltby Road.

Of note, the forecasting model does not indicate the need to widen Victoria Road south of Clair Road, or widen Maltby Road between Victoria Road and the Hanlon Express to be widened; however, both roads require upgrading.

The recommendation of TDM measures to reduce automobile use and increase use of alternative modes of transportation is identified as one of five primary study objectives in the Guelph-Wellington Transportation Study. The Study makes a connection between land use, urban form, density, neighbourhood design, and the transportation choices made by people making use of the network.

Ultimately, the document assesses an assortment of TDM measures and their practicality in Guelph; the following table (Table 4.1 in the Guelph-Wellington Transportation Study) is included identifying TDM measures that either encourage alternative transportation modes or discourage automobile use:

	Strategy	Practical	Limitations/Barriers
Encourage Walking, Cycling, Transit and Ridesharing	Urban Form	Yes	Long term effectiveness, market barriers
	Increased Density	Yes	Community acceptance, political commitment
	Mixed Uses	Yes	Development specialization, economics
	Neighbourhood Design	Yes	Some increase in private and public cost
	Car Pool/Van Pool Programs	Yes	Large employers, longer distance trips
	Guaranteed Ride Home	Yes	Part of a TDM program - not stand alone
	Parking Supply Management	Yes	Large employers and downtown
	HOV Lanes	No	Road right of way restrictions
	Cycling Routes and Facilities	Yes	Climate, fitness level, cost, trip length
	Pedestrian Trails and Walkways	Yes	Climate, fitness level, cost, trip length
	Increased Transit Service and Routes	Yes	Budget constraints, bus shelters, traffic congestion
	Transit Fare Strategies	Yes	Lack of tax incentives, cost
	Preferential Transit Facilities	Yes	Right of way constraints, traffic congestion
Improved Inter-City Transit	Yes	Inter-city licensing, reduced fare	
Programs to Discourage Auto Use	Telecommuting	Yes	Type of work, lack of supervision, security issues
	Alternative Work Schedules	Yes	Many in use - benefits may be minimal
	Vehicle Use Restrictions	No	Public acceptance and economic development issues
	Increasing Traffic Congestion	No	Emissions, emergency service, neighbourhood infiltration
	Congestion Pricing	No	Public acceptance and economic development issues
	Increase Driving Cost	No	Legislation changes, economic development issues
	Parking Pricing and Supply Management	Yes	Limited to downtown and University, economic development issues



GUELPH-WELLINGTON TRANSPORTATION STUDY TRUCK ROUTE NETWORK

4.7 ADDITIONAL GUELPH TRANSPORTATION DEMAND MANAGEMENT POLICY

Additional policy documents in the City of Guelph provide basis for the advancement of TDM.

The Downtown Guelph Secondary Plan includes TDM policy in support of the promotion of alternatives to automobile use. Policy tools that are mandated or suggested include working with transit providers, developers, and businesses to promote TDM, requiring large-scale developments to complete a TDM plan describing facilities and programs intended to reduce single occupancy vehicle trips, minimize parking and promote alternative travel modes, and finally, suggests the City may permit reduced parking supplies if a TDM plan proves that reduced parking is appropriate.

The Guelph Innovation District Secondary Plan promoted the implementation of TDM measures, through working with developers and businesses to reduce vehicular trips and to promote alternative travel modes.

The City of Guelph Community Energy Plan makes the connection between environmental and energy related goals and the need to reduce energy use and greenhouse gas emissions generated by transportation. A stated goal is to reduce transportation energy use by 25% (while accommodating Guelph's growing transport requirements) using sensitive urban design, effective alternative transport options (i.e. through TDM and a focused attention on competitive mass transit), and encouraging vehicle efficiencies.

5.0 AREA ROAD ENVIRONMENTAL ASSESSMENTS

5.1 GORDON STREET (WELLINGTON ROAD 46) CLASS EA ENVIRONMENTAL STUDY REPORT

The Gordon Street Class EA was undertaken by the City of Guelph and County of Wellington in December 2000 for the section of Gordon Street between Wellington Road 34 in the south and Lansdown Drive in the north.

The EA study utilizes three other previous transportation reports to judge the transportation impacts of new residential and commercial development along the Gordon Street corridor, and reconfirms the need for traffic capacity within this section of the street. In addition to traffic capacity and operation issues, the EA also identified other public concerns related to truck traffic volumes and roadway deficiencies, including a lack of sidewalks, bicycle lanes, and transit-related infrastructure.

At the time of the study, Gordon Street had a basic two-lane cross-section within the study area. The resulting EA concluded that Alternative 4 (basic improvements plus the widening of Gordon Street) was the preferred solution, and that widening of Gordon Street north of Clair Road would begin by 2002, while widening between Clair Road and Maltby Road would be dependent on the occurrence of development activity.

Upon the adoption of the Gordon Street EA, road widening has been undertaken from just south of Clair Road to Lansdown Drive. Gordon Street has not been widened from just south of Poppy Drive to Wellington Road 34 under existing conditions. This section is planned to be widened symmetrically from the road centreline except for a 500 metre section in the vicinity of the Mill Creek crossing where widening will occur on the west side only. The EA specified that rural drainage (ditches) be provided on both sides of the road, but did not specify sidewalk / bicycle lane provisions.

5.2 CLAIR ROAD CLASS EA ENVIRONMENTAL STUDY REPORT

The Clair Road Class EA was undertaken on behalf of the City of Guelph in September 2003 for the section of Clair Road and Laird Road between Southgate Drive in the west and Victoria Road in the east.

The EA concluded that Clair Road (at the time of study) will not provide the level of service necessary to avoid traffic congestion, frequent delays, and unsafe driving conditions, given the predicated traffic volumes, and that the road itself is in poor physical condition and lacks sidewalk and bicycle facilities to accommodate these travel modes. Given the prevailing conditions, the EA advanced four alternative planning solutions:

1. Do nothing.
2. Non-structural solutions (increase use of alternative modes; traffic diversion).
3. Construct a new road.
4. Improve the existing road.

In summary, from transportation, natural, social and physical environment perspective, the preferred alternative was the improvement of Clair Road from Victoria Road in the east to the Hanlon Business Park in the west. Improvements include the introduction of an “urban” cross-section with curbs and sidewalks, a landscaped median in the South Guelph District and adjacent to Bishop Macdonell High School and South End Community Park, provision of sidewalks on both sides of the street, and bicycle lanes within the road surface area.

The EA considered 2 and 4 traffic lane cross-sections, and determined that the western portion of the street (west of Beaver Meadow Drive) would include 4 travel lanes, while the eastern section (east of Beaver Meadow Drive) would include 2 travel lanes – one in either direction. This lane configuration has been implemented from Victoria Road in the east to approximately 200 metres west of Poppy Drive in the west. Bicycle lanes have also been introduced along this section of the street. Sidewalks are provided on both sides of the street west of Hawkins Drive, but are often interrupted (discontinuous) in sections east of this point.

5.3 VICTORIA ROAD (CLAIR ROAD TO YORK ROAD) CLASS EA STUDY

The Victoria Road Class EA was undertaken on behalf of the City of Guelph in December 2005 for the section of Victoria Road between York Road in the north and Clair Road in the south. The extent of the study area is generally north of Clair Road and does not include the section of Victoria Road adjacent to the Clair-Maltby Secondary Plan area (south of Clair Road).

The outcomes of the EA provided cross-section alignments of the street within the study area, including for Victoria Road immediately north of Clair Road. In this location, the EA identified a 3-lane cross-section with one travel lane in either direction and a continuous left-turn / median lane, bicycle lanes, and improvements at the Clair Road / Victoria Road intersection. These intersection improvements include installing traffic signal control and separate eastbound turn lanes and a northbound left-turn lane that have already been implemented.

6.0 ENGINEERING DESIGN CRITERIA AND STANDARDS

6.1 DEVELOPMENT ENGINEERING MANUAL, VERSION 1.0 (2016)

City of Guelph Engineering and Capital Infrastructure Services prepared their Development Engineering Manual (DEM, Fall 2016) to guide engineering related aspects of development related work, including established Engineering Design Criteria and Standards intended to be used by developers, residents and the City to inform engineering design and related review and discussion. The DEM recognizes that the outlined standards may not be compatible to all scenarios, and engineering judgement should be used in such cases.

The key objectives of the DEM are to:

- *Document existing process information related to the engineering submission of a development application;*
- *Outline requirements and standards for the engineering design of new developments within the City;*
- *Provide guidance and framework for applicants submitting engineering designs and reports in support of development applications;*
- *Provide guidance to City staff when reviewing and commenting on engineering aspects of a development application; and*
- *Identify the role and involvement of City departments and external agencies as part of the development engineering review and approval process.*

The DEM is complemented by Part B Specs (Linear Infrastructure Standards, 2017) that provides, in detail the City's standard specifications.

6.1.1 Road Standards

The DEM, outlines a range of pavement widths, typical AADT volumes, right-of-way widths, and maximum allowable grades for local and collector roadways. Subdivision Geometric Design Criteria for local and collector roadways are presented in Table 5 and Table 6..

TABLE 5 SUBDIVISION GEOMETRIC DESIGN CRITERIA, PART 1

Road Classification	A.A.D.T.	Pavement Width	Allowable Grade	Minimum Centerline Radius	Min SSSD	Minimum Tangent @ Intersection
Local	<1,000	8.4, 8.8, 10	0.5-8.0	18 (b)	65	10
Collector	<12,000	10	0.5-6.0	140	85	25

TABLE 6 SUBDIVISION GEOMETRIC DESIGN CRITERIA, PART 2

Road Classification	Minimum Tangent Between Curves	Property Line Radius @ Intersection	Right-of-Way Width (m)
Local	15	8	17, 18, 20
Collector	30	8	20

6.1.2 Sight Triangles

The use of Transportation Association of Canada (TAC) Stopping Sight Distance (3-second rule) for evaluation of sight triangles at intersections and access points for new developments is adopted by the City of Guelph. The DEM notes that reduction of a sight triangle may be considered for areas located in an “Urban Growth Centre” and the specific locations identified in the Clair Maltby study area below. Reductions to sight triangles still need to be reviewed by a professional engineer for the recommended design and should not create a condition prone to collisions. Adequate space should also continue to be provided for utility/traffic signal equipment and the final dimensions are also subject to minimum requirements set out in the City’s bylaw.

Intersections subject to further consideration for sight triangle in the Secondary Plan area include:

- Victoria Road and Clair Road
- Gordon Street and Clair Road
- Gordon and Poppy Drive

6.1.3 Parking

Off-street parking is outlined in the City’s comprehensive bylaw and repeated in the DEM for surface parking.

According to the DEM, on-street parallel parking should have a minimum of 15 m setback from the near side of an intersection, and a minimum of 9 m setback from the far side of the intersection (measured from the end of curb return), unless the minimum setback needs to be increased to address sight distance or operating speed.

6.1.4 Access Design

The DEM outlines design guidelines for throat width, lane width, radius, and spacing for access to/from residential/commercial/institutional areas and the public road network as summarized in Table 7 and Table 8.

TABLE 7 LAYOUT OF ACCESSES

Access Classification	Roadway Classification	Throat Width, W or Land Width, LW (m)	Radius, R (m)	Distance Between Accesses, S (m)
Multi-Residential	Local/Collector	6.0	6.0	7
	Arterial	7.5		25
Low Volume Commercial and Institutional	Local/Collector	7.5	9.0	23-30
	Arterial	8.0		60
High Volume Commercial and Institutional	Collector	8.0	12.0	60
	Collector (divided access)	3.0 m left 3.6 m through 3.6 m right 1.2 m island	12.0	60
	Arterial	9.0	12.0	100
	Arterial (divided access)	3.0 m left 3.6 m through 3.6 m right 1.2 m island	12.0	100
Industrial	Collector	9.0 (max 15.0)	12.0	40-60
	Arterial			

TABLE 8 NUMBER AND LOCATION OF ACCESSES

Access Classification	Roadway Classification	Distance from Non-Signalized Intersection (m)	Distance from Signalized Intersection (m)
Multi-Residential	Local / Collector	15	30 ¹
	Arterial	30	60 ²
Low Volume Commercial and Institutional (2-way access)	Local / Collector	30	30
	Arterial	60	60 ³
High Volume Commercial and Institutional	Collector / Arterial	60	60 ³
Industrial	Collector / Arterial	30	60 ³

Notes:

1. Multi-Residential of up to 30 units
2. Multi-Residential of over 30 units
3. Full movement accesses will not be allowed within 100 m of a signalized intersection on arterial roadways. Site specific turning movement restrictions will be determined by City staff upon application.
4. Should a site require a right in/out access, the layout shall be approved by traffic engineering staff and conform to the most current TAC specifications.

The City’s Access Details Figures from the DEM are attached in **Appendix C**.

7.0 EXISTING TRANSIT FRAMEWORK

7.1 TRANSIT GROWTH STRATEGY AND PLAN

The “Guelph Transit Growth Strategy and Plan and Mobility Service Review” was prepared in 2010, and was prepared to assess the transit market, estimate future travel demand (ridership forecasts), outline mobility service and higher-order transit opportunities, and detail associated capital and revenue implications associated with service recommendations. It should be noted that the plan is now seven years old and, at the time of the study, did not forecast any substantial development within the Clair-Maltby Secondary Plan area within the 2031 horizon year period.

Of the report’s key recommendations, that implicates development of the South Guelph area, include:

1. Establish the Gordon / Norfolk / Woolwich spine as a Bus Rapid Transit priority corridor, starting with the implementation of queue jump lanes, traffic signal priority, and express bus services, and additional infrastructure as demand increases (dedicated bus / HOV lanes). Specifically, the report recommends that as transit demand increases, a dedicated transit / HOV lane be provided in each direction of Gordon Street, firstly between Stone Road and Clair Road, and eventually on Gordon Street south of Clair Road. Transit service improvements along the Gordon Street corridor should include improved passenger amenities at transit stops.
2. Introduction of train service on the Guelph Junction Railway, including the introduction of up to 4 stations including a station servicing the Guelph Innovation District (northeast of the Clair-Maltby area) and the downtown.
3. Establish new inter-city / inter-regional bus and rail transit connections, most notably to Kitchener, Waterloo, Cambridge, and potentially, Georgetown, Brampton, Milton, Mississauga, and Hamilton.
4. Work with property owners to establish a 4 to 6 bay bus terminal within the South End Node (Gordon Street and Clair Road).

Recommendations 1 and 2 above establish a transit structure for the City by connecting key existing and emerging nodes via priority corridors.

7.2 MOVING GUELPH FORWARD: GUELPH TRANSIT GROWTH OPPORTUNITIES

This report identifies immediate and recommended route service changes while highlighting potential long-term areas of growth related to service enhancements and infrastructure. The report was released in 2016 and outlines existing trends and service standards, and potential opportunities to make transit more attractive and increase ridership.

The report includes a summary of rider survey data, which indicates among other items, that transit riders are evenly satisfied / dissatisfied with service frequency and on-time arrival, and generally dissatisfied with local service connections to GO (regional service) facilities.

Moving Guelph Forward also describes recommended service changes and future measures that are intended to increase ridership and achieve a 15% transit mode share – consistent with policy objectives of OPA 48 and the Guelph – Wellington Transportation Study. Recommended service changes, in the vicinity of the Clair-Maltby Secondary Plan area include minor alterations to the #5 Clair and #56 Victoria Express bus routes, which will potentially be altered again given the development of the Clair-Maltby precinct. Transit priority measures, to be potentially integrated within the Maltby Secondary Plan area to increase ridership, include:

- Queue jump lanes,
- Reversible lanes,
- Roundabouts,
- Transit signal priority, and
- Reserved bus lanes.

8.0 EXISTING CYCLING AND TRAILS FRAMEWORK

8.1 GUELPH TRAILS MASTER PLAN (2005)

The Guelph Trail Master Plan (GTMP, Fall 2005) was established to provide an overall vision to the developing trail system.

The Goal of the GTMP is to:

“develop a cohesive city wide trail system that will connect people and places through a network that is off-road wherever possible and supported by on-road links where necessary”

The GTMP outlines the following areas of recommendations:

- Establishing the Need for Trails;
- Understanding the Resources;
- Planning for Trails;
- Building Trails; and,
- Supporting Trails.

The GTMP outlines a hierarchy of trail types: Primary, Secondary, Tertiary, and Water Routes for canoeists and kayakers.

8.1.1 The GTMP Trail Network

The GTMP Trail Network, outlining the hierarchy of trail routes including desire lines for the Clair Maltby study area is presented in Figure 8.

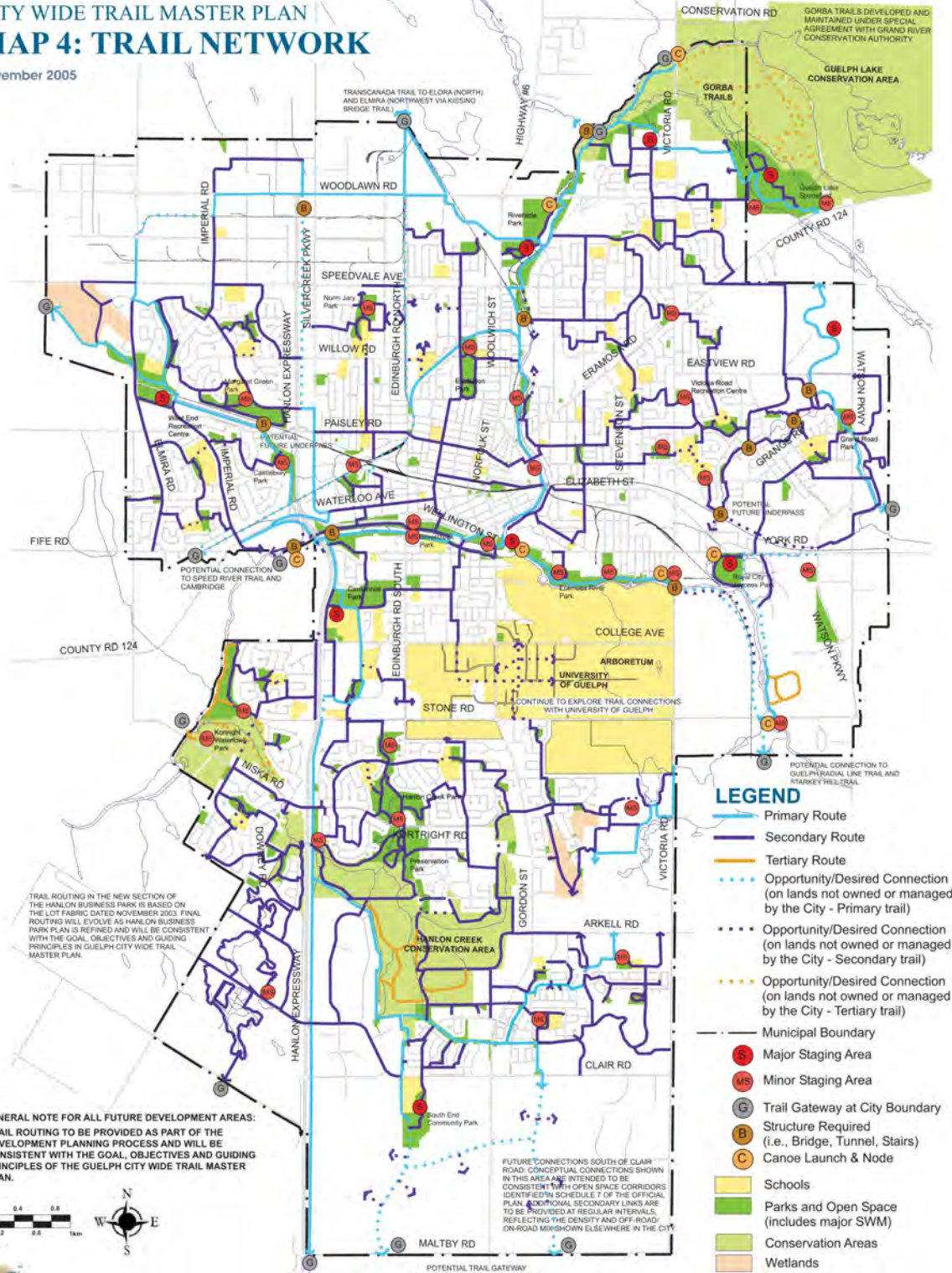
The GTMP Trail Network identifies conceptual connections through the Clair Maltby study area that are generally consistent with the Open Space Corridors outlined in the City's Official Plan. There are two north-south Primary conceptual connections through the Clair Maltby study area and one east-west Primary conceptual connection crossing Gordon Street midblock between Clair Road and Maltby Road. The north-south connections provide an opportunity to connect to the primary trail network north of Clair Road and also to connect with potential Trail Gateways at the Maltby Road City Boundary. Conceptual secondary connections are shown at regular intervals south of Clair Road.

8.1.2 The GTMP Trail Network – On and Off-Road

The GTMP Trail Network, outlining the On and Off-Road Breakdown of trails, is presented in Figure 9. The primary trails identified in the Clair Maltby study area are largely intended to be off-road routes, with some local connections secondary connections intended to be on and off-road and located at regular intervals.

CITY WIDE TRAIL MASTER PLAN
MAP 4: TRAIL NETWORK

November 2005



GENERAL NOTE FOR ALL FUTURE DEVELOPMENT AREAS. TRAIL ROUTING TO BE PROVIDED AS PART OF THE DEVELOPMENT PLANNING PROCESS AND WILL BE CONSISTENT WITH THE GOAL, OBJECTIVES AND GUIDING PRINCIPLES OF THE GUELPH CITY WIDE TRAIL MASTER PLAN.



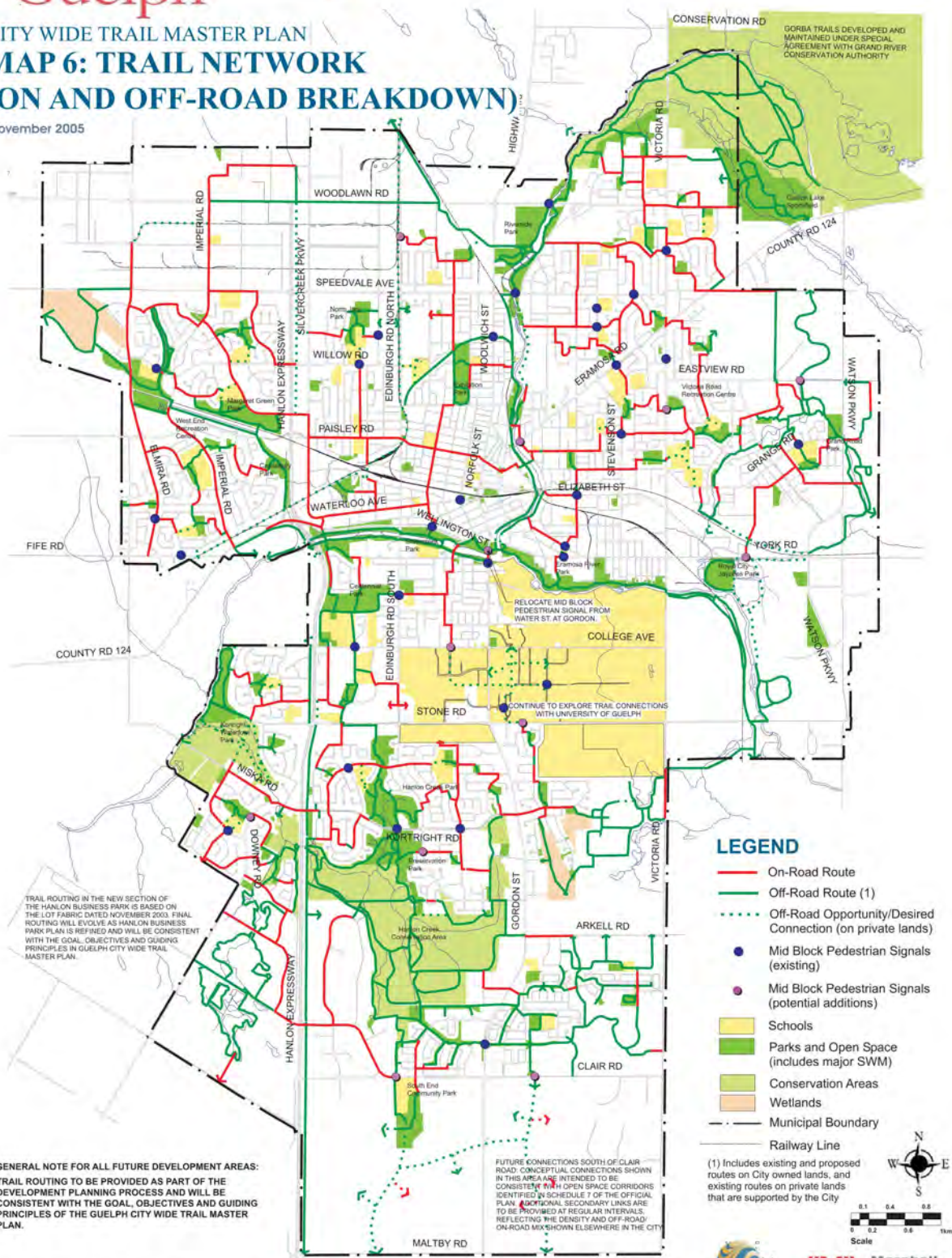
This map is to be used as a planning tool. Background information depicted (e.g. land use designations) is included for illustrative purposes only. Please consult the appropriate official documents for further details. The location and exact alignment of trail routes will evolve through more detailed technical studies and/or community consultation as required. At the same time, it is important to note that the extensive community consultation that established the direction for this plan must be respected, therefore changes to the routing will be evaluated in the context of the overall network.

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CITY WIDE TRAIL MASTER PLAN:
TRAIL NETWORK

CITY WIDE TRAIL MASTER PLAN MAP 6: TRAIL NETWORK (ON AND OFF-ROAD BREAKDOWN)

November 2005



TRAIL ROUTING IN THE NEW SECTION OF THE HANLON BUSINESS PARK IS BASED ON THE LOT FABRIC DATED NOVEMBER 2003. FINAL ROUTING WILL EVOLVE AS HANLON BUSINESS PARK PLAN IS REFINED AND WILL BE CONSISTENT WITH THE GOAL, OBJECTIVES AND GUIDING PRINCIPLES IN GUELPH CITY WIDE TRAIL MASTER PLAN.

GENERAL NOTE FOR ALL FUTURE DEVELOPMENT AREAS:
TRAIL ROUTING TO BE PROVIDED AS PART OF THE DEVELOPMENT PLANNING PROCESS AND WILL BE CONSISTENT WITH THE GOAL, OBJECTIVES AND GUIDING PRINCIPLES OF THE GUELPH CITY WIDE TRAIL MASTER PLAN.

FUTURE CONNECTIONS SOUTH OF CLAIR ROAD: CONCEPTUAL CONNECTIONS SHOWN IN THIS AREA ARE INTENDED TO BE CONSISTENT WITH OPEN SPACE CORRIDORS IDENTIFIED IN SCHEDULE 7 OF THE OFFICIAL PLAN. ADDITIONAL SECONDARY LINKS ARE TO BE PROVIDED AT REGULAR INTERVALS, REFLECTING THE DENSITY AND OFF-ROAD ON-ROAD MESH SHOWN ELSEWHERE IN THE CITY.

This map is to be used as a planning tool. Background information depicted (e.g. land use designations) is included for illustrative purposes only. Please consult the appropriate official documents for further details. The location and exact alignment of trail routes will evolve through more detailed technical studies and/or community consultation as required. At the same time, it is important to note that the extensive community consultation that established the direction for this plan must be respected, therefore changes to the routing will be evaluated in the context of the overall network.



CITY WIDE TRAIL MASTER PLAN: TRAIL NETWORK (ON AND OFF-ROAD BREAKDOWN)

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8.1.3 The GTMP Trail Network – On-Road Cycling Linkages

The GTMP Trail Network, outlining the potential On -Road Cycling Linkages, is presented in Figure 10. The arterial roadways in the Clair Maltby study area, including Clair Road, Maltby Road, Gordon Street, and Victoria Road are all identified as On-Road Bicycle Network linkages. A potential connection south of the City is also identified on this figure at Maltby Road / Victoria Road.

8.1.4 The GTMP Trail Network – Timing of Priorities

The GTMP Trail Network recommends three timeline phases:

- Short Term (0 to 5 years - 2005-2010)
- Medium Term (5 to 15 years – 2011 to 2021)
- Long Term (beyond year 15 – beyond 2021)

The trail network proposed for the Clair Maltby study area is identified as a “Medium Term” priority, as illustrated in Figure 11.

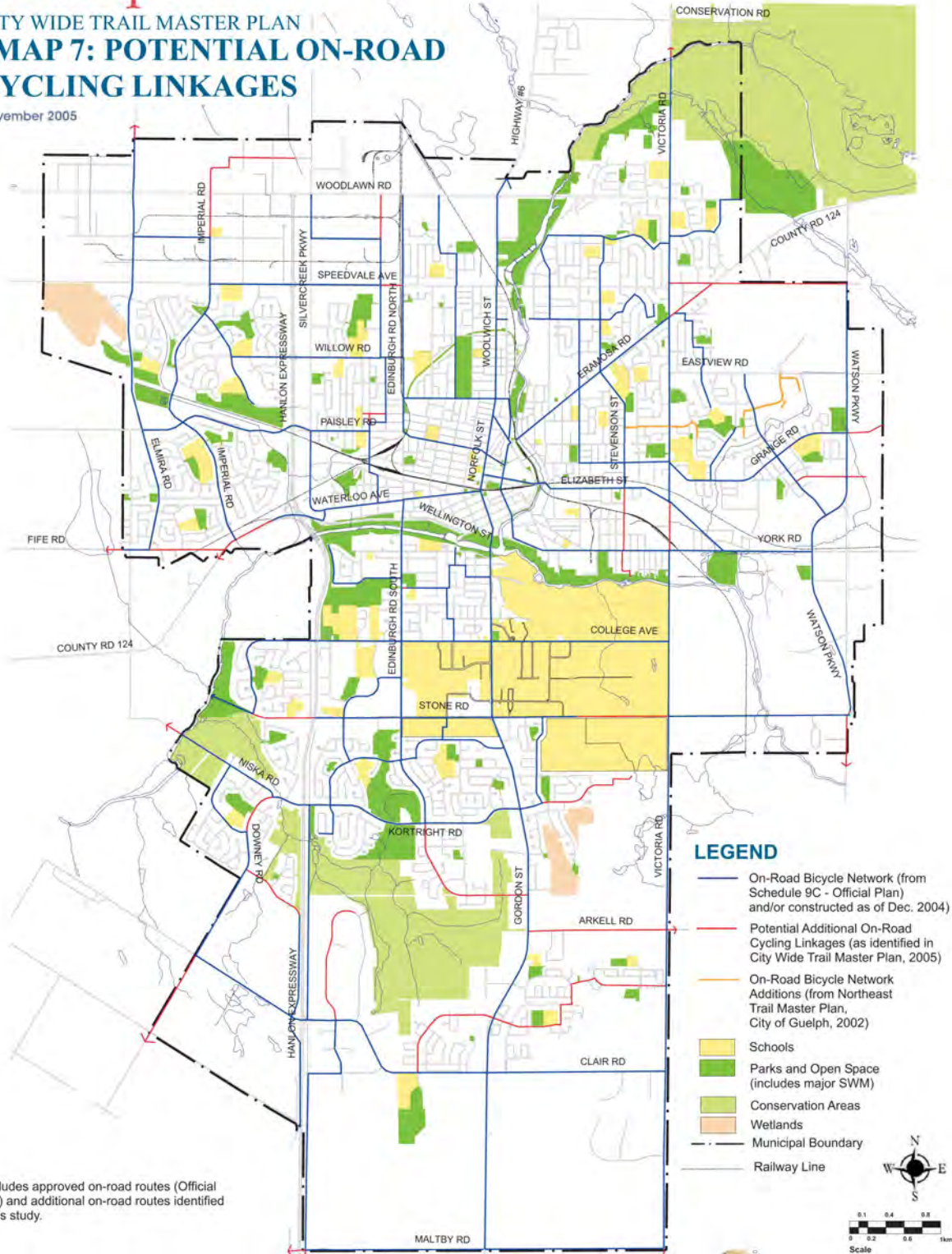
8.1.5 Building and Supporting Trails

The GTMP outlines available resources for design guidelines and construction details applicable to the trail network. Recommendations are also made for promoting, encouraging trail use, educating users, maintaining, managing, and monitoring trails.



CITY WIDE TRAIL MASTER PLAN
***MAP 7: POTENTIAL ON-ROAD CYCLING LINKAGES**

November 2005



* Includes approved on-road routes (Official Plan) and additional on-road routes identified in this study.

This map is to be used as a planning tool. Background information depicted (e.g. land use designations) is included for illustrative purposes only. Please consult the appropriate official documents for further details. The location and exact alignment of trail routes will evolve through more detailed technical studies and/or community consultation as required. At the same time, it is important to note that the extensive community consultation that established the direction for this plan must be respected, therefore changes to the routing will be evaluated in the context of the overall network.

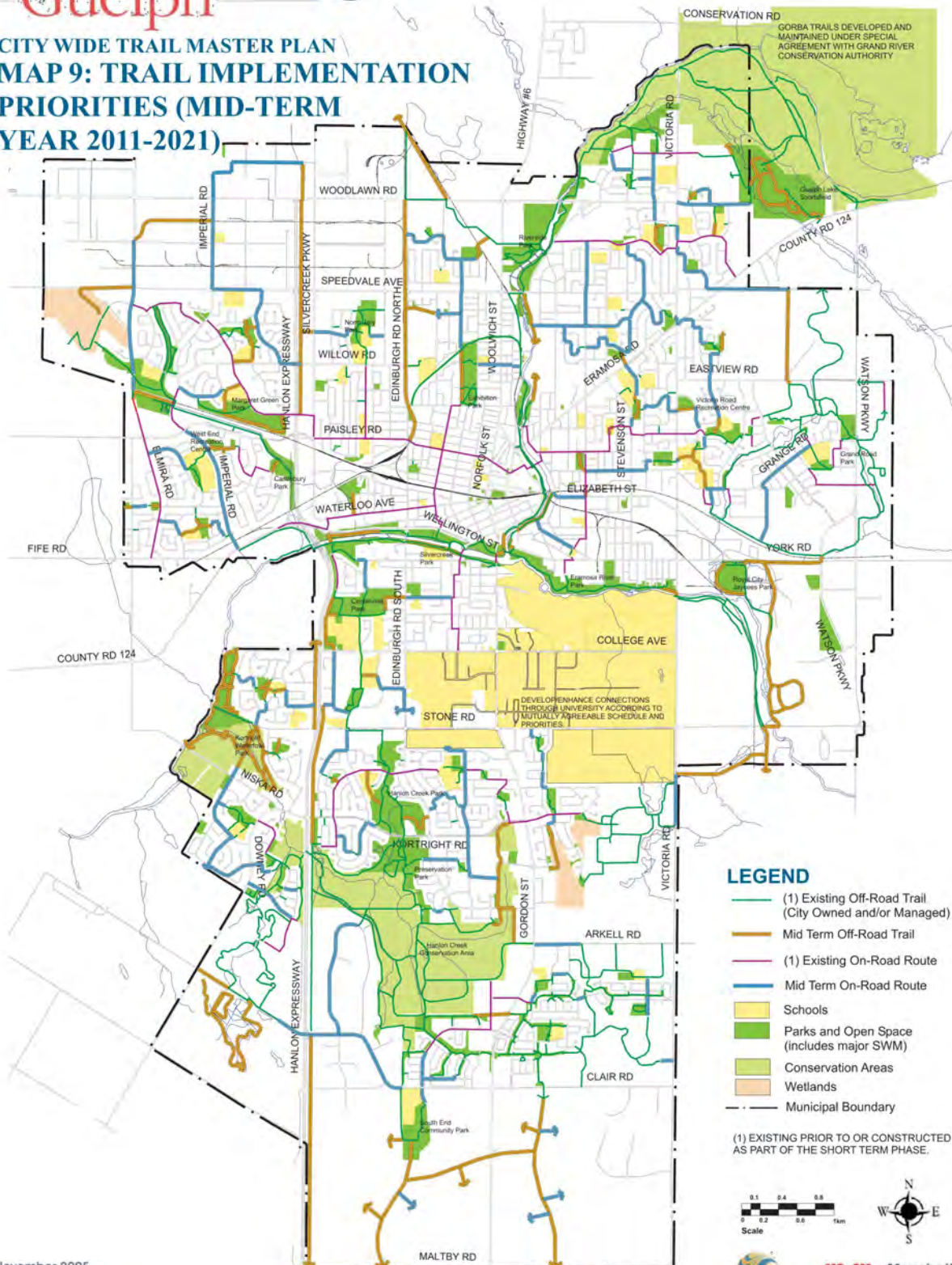


**CITY WIDE TRAIL MASTER PLAN:
 POTENTIAL ON-ROAD CYCLING LINKAGES**

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**CITY WIDE TRAIL MASTER PLAN
MAP 9: TRAIL IMPLEMENTATION
PRIORITIES (MID-TERM
YEAR 2011-2021)**



November 2005

This map is to be used as a planning tool. Background information depicted (e.g. land use designations) is included for illustrative purposes only. Please consult the appropriate official documents for further details. The location and exact alignment of trail routes will evolve through more detailed technical studies and/or community consultation as required. At the same time, it is important to note that the extensive community consultation that established the direction for this plan must be respected, therefore changes to the routing will be evaluated in the context of the overall network.



**CITY WIDE TRAIL MASTER PLAN:
TRAIL IMPLEMENTATIONS PRIORITIES
(MID-TERM YEAR 2011-2021)**

8.2 CYCLING MASTER PLAN – BICYCLE FRIENDLY GUELPH (2012)

The City's Cycling Master Plan (February 2012), is directed by the City's Office Plan, and provides recommendations and strategies that aim to operationalize the visions of the Bicycle-Friendly Guelph Initiative formed by the City.

The City's vision for becoming one of Canada's most bicycle-friendly communities includes 1) more people cycling, 2) a safer and more connected network, 3) strong culture of cycling, and 4) measured improvements.

The Cycling Master Plan developed the following seven principles:

1. Cycling and safety are not mutually exclusive.
2. Cycling is an essential transportation mode for Guelph.
3. Every street is a cycling street and bicycles are vehicles.
4. Bicycles are unlike other vehicles that share the road.
5. Cycling is for everyone to enjoy.
6. A successful cycling network is a product of a well-integrated transportation network.
7. Transportation choices create opportunities for everyone to get to their destination.

The Cycling Master Plan addresses both physical and social infrastructure needs within the context of the 5E's:

1. Engineering: Enhance the Bikeway Network
2. Education & 3. Encouragement: Promote a bicycle-friendly city
4. Enforcement: Protect a cycling-friendly environment
5. Evaluation: Monitor progress in achieving targets and goals; and

The Cycling Master Plan provides 22 actionable recommendations within the 5E's for City staff, stakeholders, and residents to achieve implementation of the City's visions.

8.2.1 Engineering Principles

The Cycling Master Plan's recommendations for Safe and Continuous Infrastructure (Engineering) outlines tools for selecting types of bikeways relative to vehicular volume, vehicular speed, and local context that influence cyclist safety and comfort levels relative to other on-street facilities and vehicles.

Bikeway Treatments

The Cycling Master Plan identifies several types of bikeway treatments for consideration by the City of Guelph:

- Signed Routes
- Bicycle Boulevards
- Shared-Use Lanes (Sharrows)
- Advisory or Suggested Lanes
- Bike Lanes and Paved Shoulders
- Multi-Use Boulevard Trails, and,
- Cycle Tracks / Physically-Separated Bike Lanes

Intersection Treatments

The plan also recommends that the design of intersections should also take into account the many possible movements of cyclists at intersections including:

- General intersection guidelines to address visibility where there is a higher presence of conflicts between cyclists, motorists, and pedestrians;
- Accommodating Left Turns at signalized and unsignalized intersections; and,
- Specific cases where two arterial roads intersect and all intersections with multi-use boulevard trails.

Cycling Network Plan

The recommended Cycling Network Plan from the Cycling Master Plan is provided in Figure 12.

This Cycling Network Plan identifies several existing and proposed surface treatments for the Clair Maltby study area. Existing and proposed cycling treatments within the study area include:

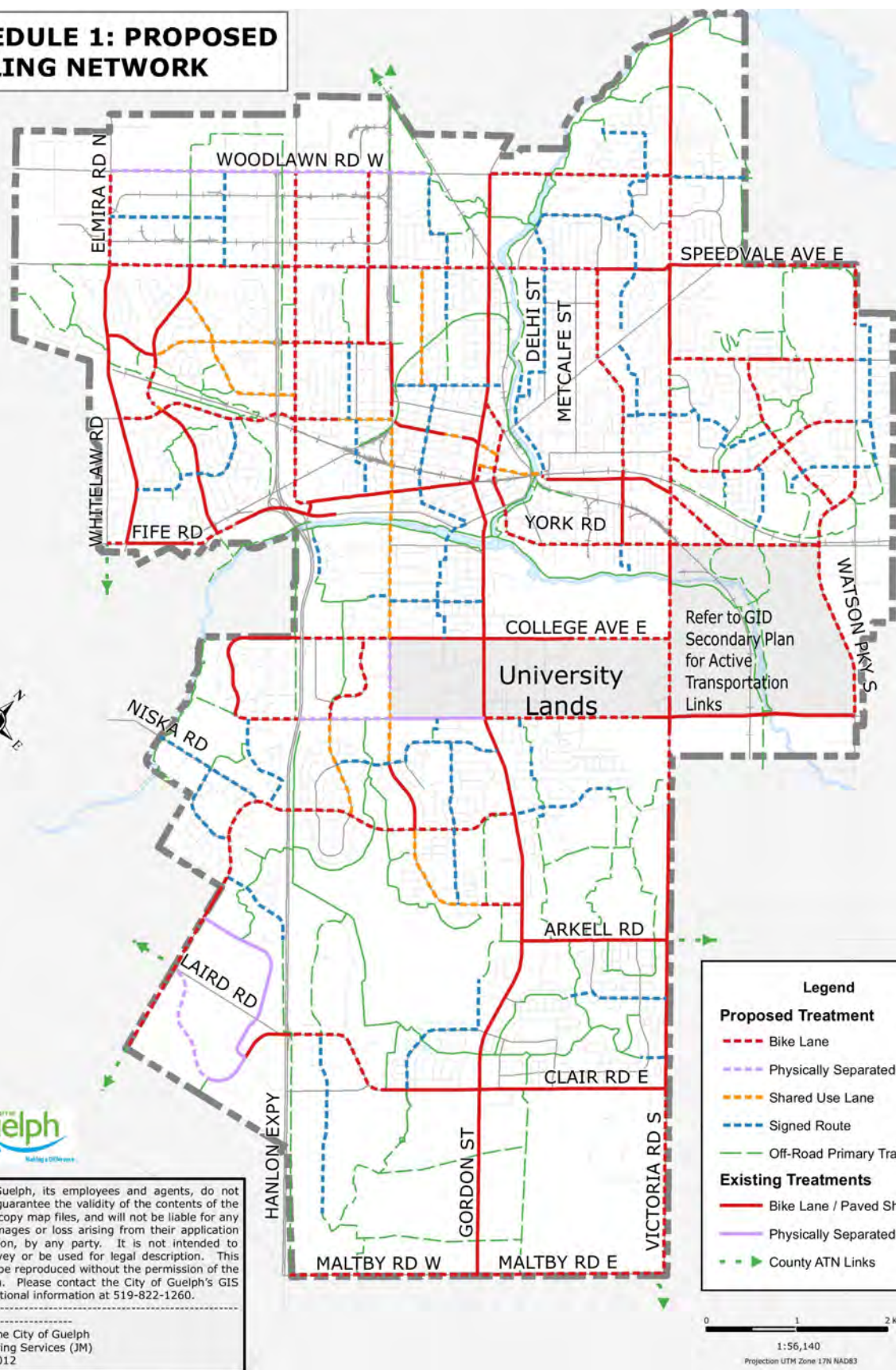
- **Existing Bike Lanes / Paved Shoulder** are identified along both Clair Road East and Gordon Street within the study area.
- **Proposed 1 metre Paved Shoulder** is proposed along east-west Maltby Road and along north-south Victoria Road South (between Clair Road and Maltby Road)
- **Off-Road Primary Trails** are proposed at two locations running east-west across Gordon Street that will make connections to the proposed north-south signed routes along Southgate Drive. North-south off-road trails are also proposed within the study area that will connect to proposed signed routes along Clairfields Drive West, existing trails north of Clair Road, as well as at two locations potentially crossing Maltby Road to the south.
- **County ATN Links** are proposed at the southeast corner of the study area at the intersection of Maltby Road East and Victoria Road South.

SCHEDULE 1: PROPOSED CYCLING NETWORK



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Produced by the City of Guelph
 PBEE Engineering Services (JM)
 January 15, 2012



Legend	
Proposed Treatment	
	Bike Lane
	Physically Separated Lane
	Shared Use Lane
	Signed Route
	Off-Road Primary Trail
Existing Treatments	
	Bike Lane / Paved Shoulder
	Physically Separated Lane
	County ATN Links

0 1 2 Kilometres
 1:56,140
 Projection UTM Zone 17N NAD83

PROPOSED CYCLING NETWORK - 2013 GUELPH CYCLING MASTER PLAN

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End-of-Trip Facilities Recommendations

The Cycling Master Plan outlines guidelines for providing end-of-trip facilities (bike parking facilities). They have identified two classes of bicycle parking as follows:

- Class One: Long-term bicycle parking
- Class Two: Short-term bicycle parking
- Additional Class: Artistic bicycle parking

The Cycling Master Plan outlines recommended Bicycles Parking Requirements for each Class of parking, by type of land use. Recommendations for General Rack Spacing and Rack Spacing within the Public Right-of-Way are also recommended as part of this section of the Cycling Master Plan.

8.2.2 Education and Encouragement

The Cycling Master Plan recommends complementing the guidelines for providing a safe cycling environment with complementary encouragement and education with a set of recommended objectives and actions.

8.2.3 Enforcement

The Cycling Master Plan recommends continued and improved actions to cycling enforcement as a means to reduce incidents and provide front-line education to both drivers and cyclists.

8.2.4 Evaluation

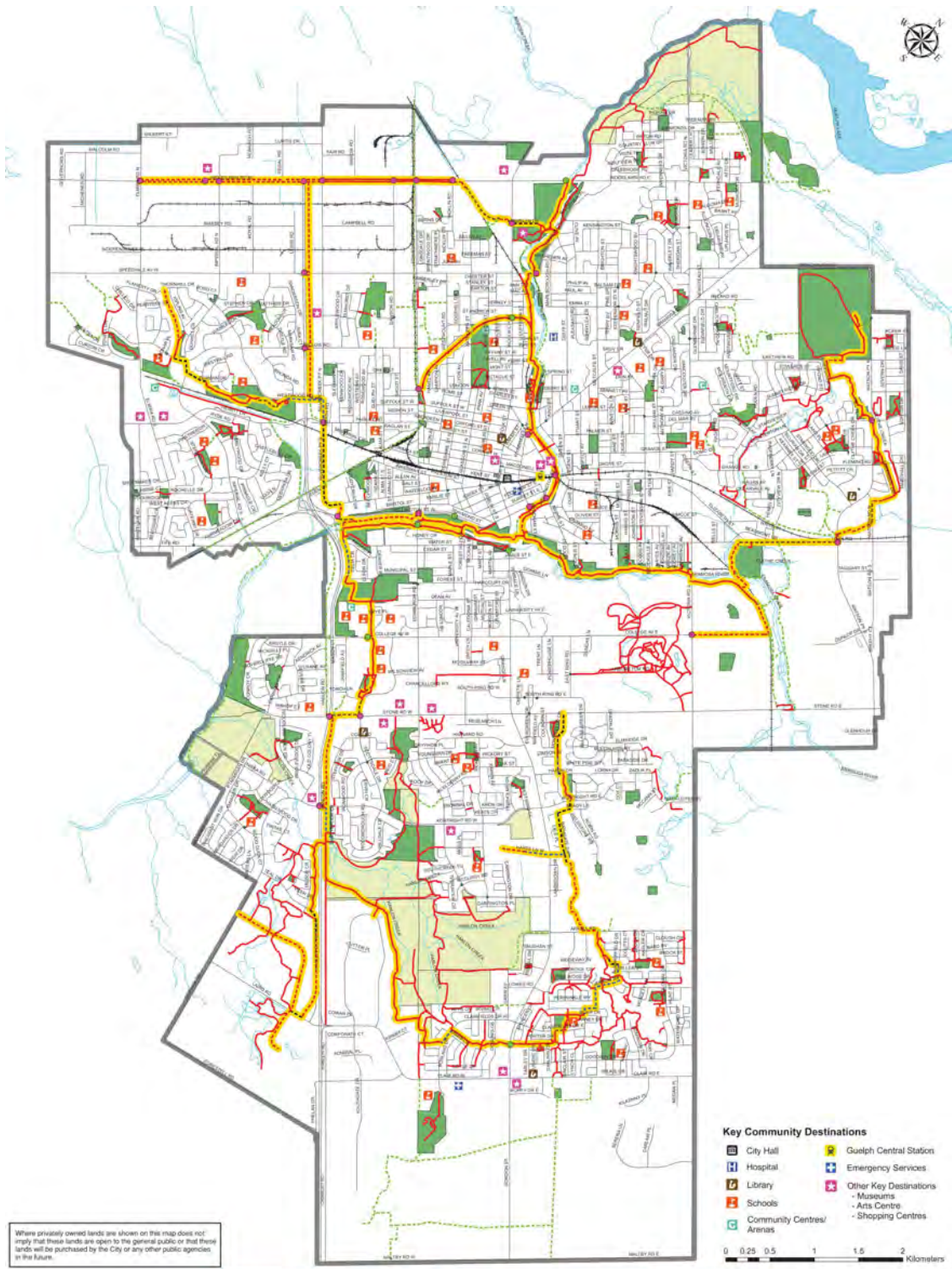
The Cycling Master Plan recommends actions to monitor and measure success in order to guide future planning and policy decisions.

8.3 ACTIVE TRANSPORTATION NETWORK STUDY (2017)

The Active Transportation Network Study (ATN Study, January 2017) builds on the Primary Trails system of the Guelph Trails Master Plan (2005) and the infrastructure (Engineering) objectives of the Cycling Master Plan (2012).

The ATN Study was prepared by MMM Group / Paradigm Transportation Solutions on behalf of the City of Guelph to assess the feasibility of upgrading and maintaining existing and proposed Primary Trails in Guelph – notably the trail network identified in the City’s Draft Proposed Active Transportation Network (ATN).

The ATN’s Recommended Active Transportation Network is presented in Figure 13. However, given that the ATN largely reviewed the primary trail system identified by the Trail Master Plan and Cycling Master Plan, the planned trails identified in the Clair Maltby study were outside of the scope of the ATN.



4.1 RECOMMENDED ACTIVE TRANSPORTATION NETWORK



Off-Road Trail Network

- Existing Trail
- Proposed Trail (from previously approved plans, alignment to be confirmed in the next Guelph Trail Master Plan Update)
- Proposed trail route identified during the ATN Study
- Recommended Active Transportation Network
- Proposed trail identified in the Guelph Trail Master Plan (2005) or other approved City plan / planning approval process. Shown for illustrative purposes only; not examined during the ATN Study

On-Road Links

- On-road link: critical to connectivity of the Active Transportation Network. Route also identified in the Guelph Cycling Master Plan (2013)
- On-road link: critical to connectivity of the Active Transportation Network. Route identified during the ATN Study

Existing Active Transportation Network Crossings

- Existing Mid-block Pedestrian Signal located on the ATN Study Route
- Existing Signalized Road Intersection located on the ATN Study Route

- Roads
- Rivers and Streams
- Railway
- City-owned Park or Open Space
- Conservation Authority Lands
- Guelph Lake
- City Boundary

RECOMMENDED ACTIVE TRANSPORTATION NETWORK

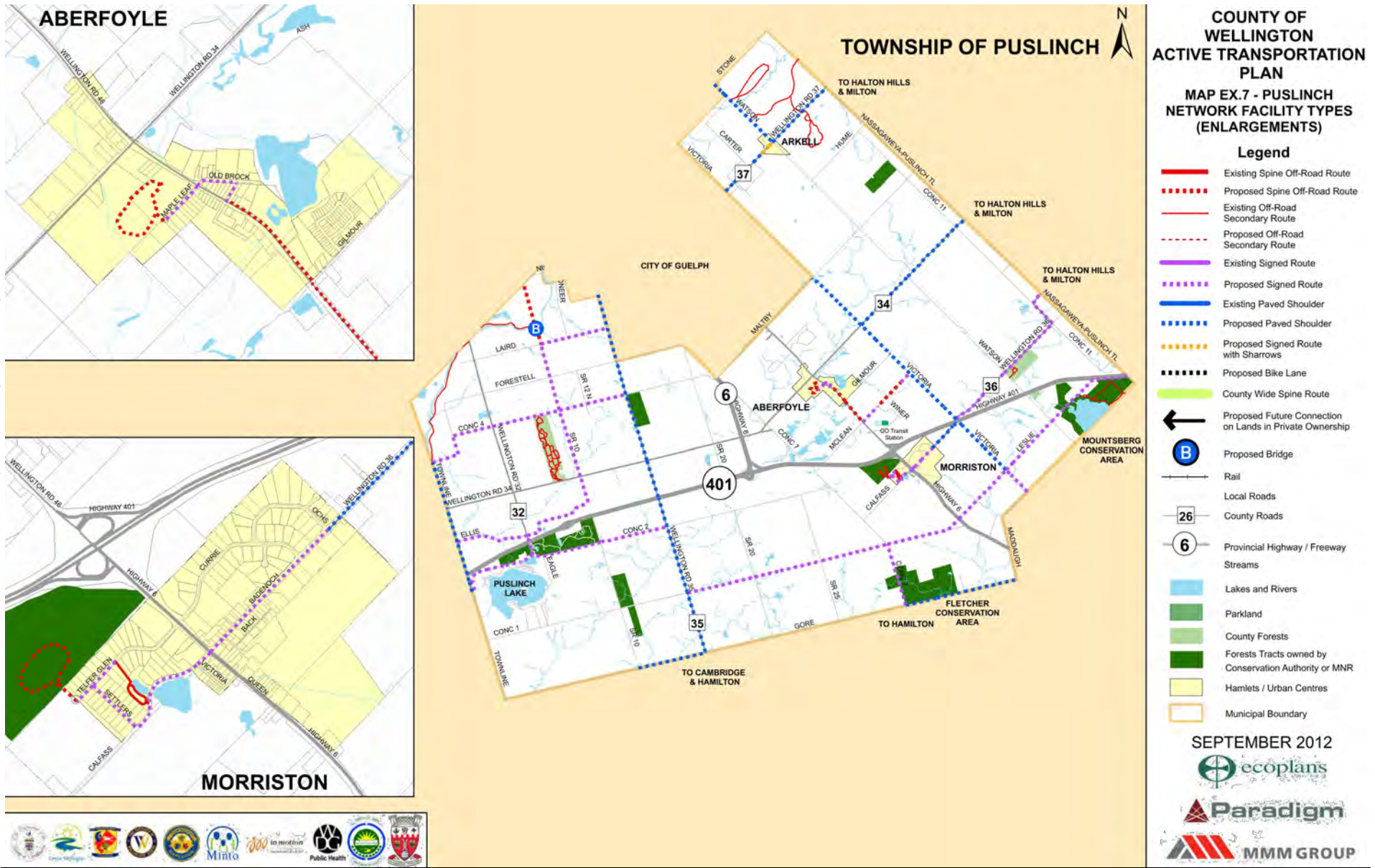
8.4 WELLINGTON COUNTY ACTIVE TRANSPORTATION PLAN

The Wellington County Active Transportation Plan (ATP, September 2012) provides guidelines and strategies that aim to meet the County's goals in fostering a healthy and more sustainably community, notably including an Active Transportation Network (ATN) that connects the County's communities.

The Township of Puslinch, within Wellington County, is directly adjacent to the Clair Maltby study area.

The County of Wellington Active Transportation Plan for Puslinch is illustrated in Figure 14. A proposed paved shoulder condition is recommended along Victoria Road, connecting with the southeast corner of the Clair Maltby study area.

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COUNTY OF WELLINGTON ACTIVE TRANSPORTATION PLAN:
 MAP EX. 7 PUSLINCH NETWORK FACILITY TYPES (ENLARGEMENTS)

9.0 CLAIR-MALTBY SECONDARY PLAN

9.1 COMMUNITY VISIONING EXERCISE AND CHARRETTE

A Community Visioning Workshop was undertaken in September 2017 to assist in establishing a Conceptual Community Structure, which was carried-forward as part of meetings with a Community Working Group and Technical Advisory Group.

The Conceptual Community Structure was used in the development of three (3) Community Structure Alternatives, which formed the discussion of a 5-day planning and design charrette held in April 2018. The charrette was a multi-disciplinary, intensive, and collaborative design and planning workshop, and was undertaken in order to develop a Preliminary Preferred Community Structure – which was presented for information purposes on April 9, 2018.

9.2 PREFERRED COMMUNITY STRUCTURE

A “Preferred Community Structure” has been pursued as a planning objective for the future development of the Clair-Maltby Secondary Plan, and utilized as a basis for detailed technical analysis – including the transportation analysis prepared herein. The Preferred Community Structure was advanced through modifications to the Preliminary Preferred Community Structure developed as part of the April 2018 design and planning workshop. These modifications to the community structure plan included adjustments to the Secondary Plan boundary, the removal of a conceptual north-south direction collector street aligned east of Gordon Street, changes to the location of high-density residential development, and the identification of cultural heritage resources and existing wetlands.

The Preferred Community Structure provides a general layout of land use, connective elements (arterial / collector streets and trails), community facilities, potential locations for storm water management facilities, existing cultural heritage resources, and wetlands.

The Clair-Maltby Secondary Plan Preferred Community Structure advances an urban village concept comprised of the Gordon Street Corridor, surrounding neighbourhoods and the Natural Heritage System. The Plan indicates that the area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents. The Natural Heritage System and the Paris Moraine, together with a system of parks and open spaces, provide a framework for the balanced development of interconnected and sustainable neighbourhoods. The Natural Heritage System further informs the opportunities for transportation infrastructure including a network of development-supportive collector streets.

9.3 MOBILITY NETWORK

A system of connected arterial and collector streets was advanced as part of the Preferred Community Structure to support development of the Secondary Plan area, while respecting the Natural Heritage System and existing topography. The street network represents a modified grid system, which is intended to allow for frequent and robust routing for all street users, while respecting the important environmental features of the area.

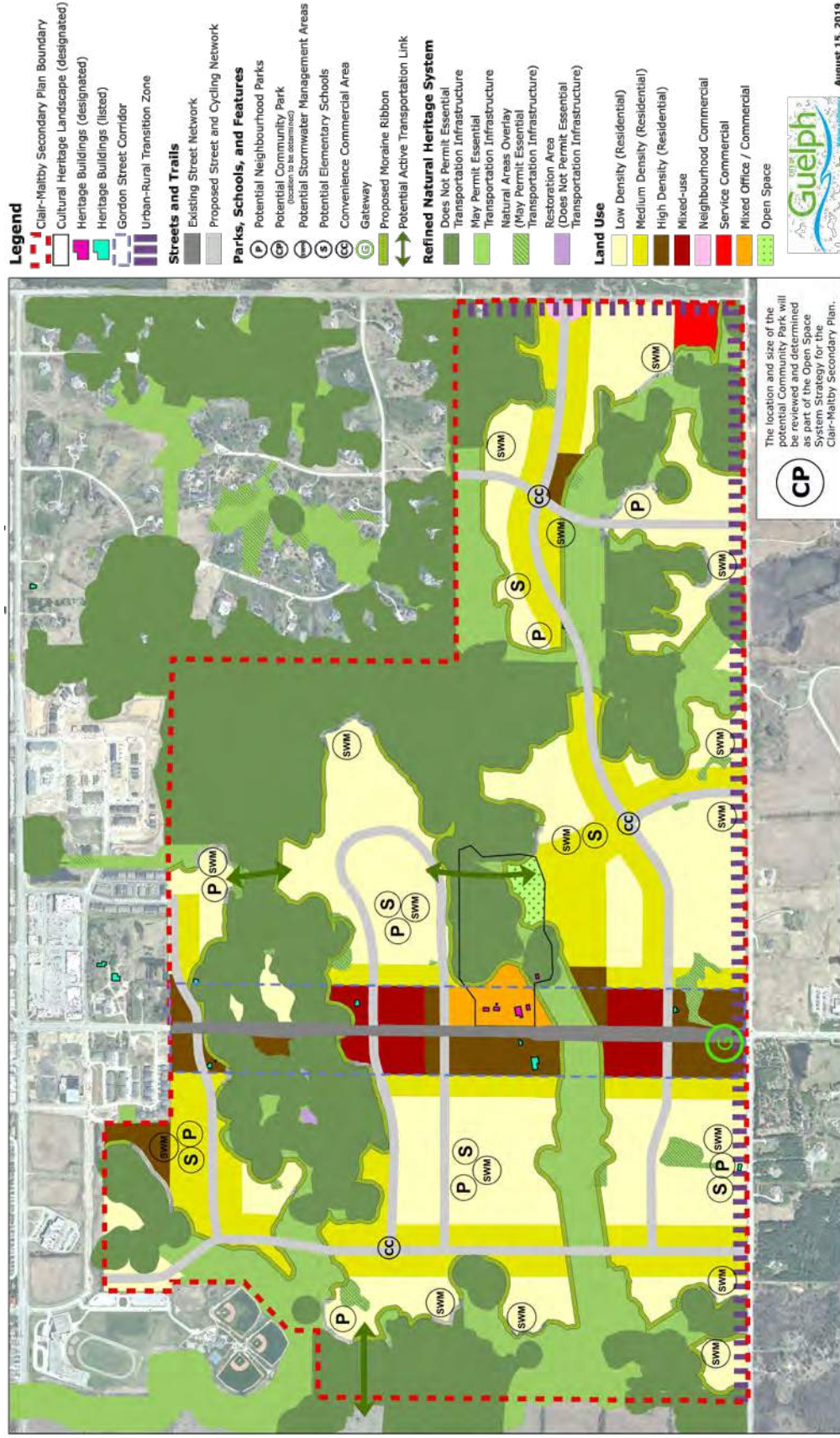
A total of four (4) east-west oriented collector streets are proposed to cross Gordon Street between Gosling Gardens in the north and Maltby Road in the south. One (1) north-south oriented collector street is proposed to extend between Poppy Road in the north and Maltby Road in the south, and will be located in the western portion of the Secondary Plan area (west of Gordon Street). Two (2) additional north-south collector streets are illustrated in the south-eastern portions of the Secondary Plan area in order to establish a robust street-network grid in this location. All collector streets, as well as existing arterial streets, are intended to appropriately integrate cycling and pedestrian facilities to ensure multi-modal mobility and accessibility.

The design of all collector streets and existing arterial streets is intended to allow for the operation of buses, to provide several opportunities and flexibility for transit vehicle routing throughout the Clair-Maltby Secondary Plan. Transit services are intended to route throughout the Secondary Plan area, allowing for bus stops to be provided at regular intervals within 400 metres of 90 percent of residents. Additional transit provisions may also be made along the Gordon Street corridor to allow for convenient service transfers, and infrastructure to support the efficient and reliable routing of transit vehicles (discussed further in Section 9.5).

The planned network of streets (and trails – as discussed in Section 9.4) are intended to achieve safe, convenient and comfortable travel and access for all street-users, with priority given to pedestrians, cyclists, and transit operations, to provide mobility choice and support city policy and modal-split objectives. Vehicular movement will be accommodated, but is not prioritized, and will be subject to levels-of-service which are more constrained than typical in new-build areas within the City.

Following the planning and design charrette, the City of Guelph undertook a transportation modelling assessment of the anticipated future traffic conditions within the Secondary Plan area pending the introduction of a second north-south oriented collector street extending between Clair Road and Maltby Road (located east of Gordon Street). This assessment demonstrated that Gordon Street would be able to accommodate future traffic demands without a north-south collector street on the easterly side of Gordon Street. This modelling allowed a general understanding of the potential impacts that a collector street would have on the existing Natural Heritage System in two locations, as well as on an identified Cultural Heritage Landscape, and resulted in the removal of this collector road where it crosses these features as part of the Secondary Plan. The analysis undertaken herein supports this conclusion, understanding certain traffic movements are anticipated to operate near theoretical capacity during weekday peak hours at the key Gordon Street / Clair Road intersection north of the Secondary Plan area.

The Preferred Community Structure, and associated Mobility Network, are illustrated in Figure 15.



PREFERRED COMMUNITY STRUCTURE PLAN

9.3.1 Concept Public Right-of-Way Cross Sections

Conceptual right-of-way cross-sections have been developed for collector streets contemplated as part off the Clair-Maltby Secondary Plan, as well as existing arterial streets and future local streets within the area.

A series of conceptual cross-sections are developed for different types of streets, which are appropriately designed to accommodate a diverse mix of users and respond to the urban design, land use, and public realm contexts. Cross-sections are intended to be understood in conjunction with City of Guelph construction standards and guidelines, and should be flexible enough to meet context specific limitations and servicing / utility requirements and will be designed in detailed plan and section view as part of future area development.

Cross sections prepared in support of the Clair-Maltby Secondary Plan intend the design and delivery of complete streets, which include pedestrian and cycling infrastructure, support transit service routing, street trees and landscaping, and utility / service delivery. Vehicle travel lanes are reduced to an appropriate level, to accommodate vehicle movement while not prioritizing vehicles over other street users.

In the design of public right-of-ways, the City will balance the provision of safe, functional and attractive pedestrian-oriented, cyclist friendly and transit-supportive environments while accommodating for an acceptably level of vehicular traffic and operation.

Different public right-of-way cross-sections have been developed for unique circumstances that accommodate for differences in adjacent land uses and the types of demands these uses can place on a typical street. For example, three-lane collector street cross-sections may be more appropriate for corridors with frequent transit service, larger (heavy) turning vehicles, intended to accommodate a greater number of “through” traffic, or frequent driveway connections. Wider pavement areas, or off-centre median lane designs, may also be pursued in instances where on-street parking will be accommodated. Similarly, wider right-of-ways may be pursued in instances where other infrastructure are required such as major trunk utilities, municipal service corridors, or overland flow routes.

The narrowest public right-of-ways are typically reserved for local streets intended to provide property access, accommodate local traffic and relatively low volumes of street users, and serve low and medium density development.

Cross sections will be advanced as part of detailed design of new streets within the Secondary Plan, and would reflect the policies and requirements of the City. Additional right-of-way space may be required for separate vehicle turn lanes (i.e. separate left-turn lanes along Gordon Street), transit-supportive infrastructure, higher-order off-street cycling infrastructure, landscape / public realm objectives, or other utility or service infrastructure.

Concept street cross-sections, developed as part of the Clair-Maltby Secondary Plan, are included in Exhibit 1.



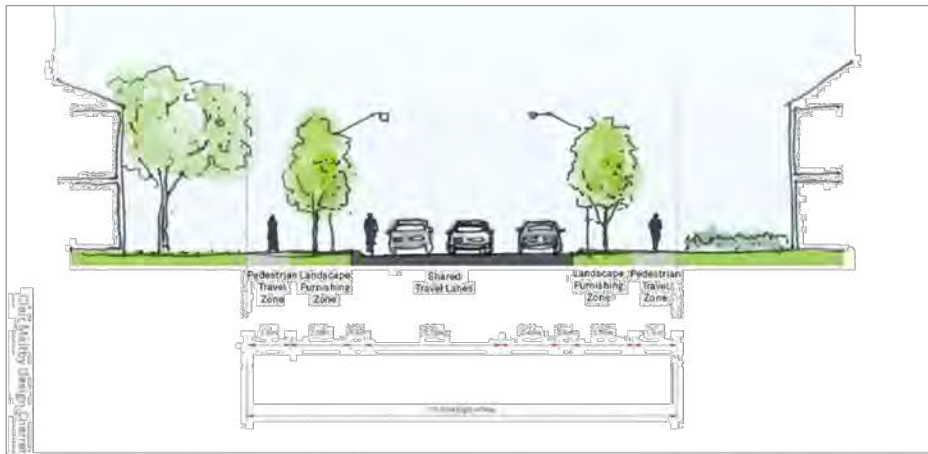
Gordon Street Arterial Road
30 m ROW - Raised Cycle Track

Clair-Maltby Secondary Plan
Scale 1:150
BrookMcIlroy



Collector Road
26 m ROW - Parking Lane and Raised Cycle Track

Clair-Maltby Secondary Plan
Scale 1:150
BrookMcIlroy



Local Road
18 m ROW - Shared Travel Lanes and On Street
Parking

Clair-Maltby Secondary Plan
Scale 1:150
BrookMcIlroy

Date Plotted: March 5, 2019 File name: \\bafp02\data\WP\59176106 Clair Maltby SPI\Graphics\Exhibit-1 Rev3.dwg

CLAIR-MALTBY SECONDARY PLAN CONCEPTUAL CROSS SECTIONS

9.4 CLAIR-MALTBY SECONDARY PLAN TRAIL NETWORK

Trail locations are identified within the Master Environmental Service Plan for the Clair-Maltby Secondary Plan area, and are generally located along the edges of the Natural Heritage System. The function of the Trail Network is to provide additional pedestrian and cycling facilities throughout the Secondary Plan area in order to:

- accommodate commuter and practical pedestrian and cycling circulation and connectivity;
- provide recreational amenity and active transportation use;
- augment the wider trail network in the southern parts of the City of Guelph; and
- augment the collector street network prepared as part of the Preferred Community Structure plan.

The Clair-Maltby Secondary Plan creates a linked trail system for both recreational and utilitarian users, and is intended to accommodate and prioritize active transportation travel modes. Trail links are strategically located to compensate for limitations in the Secondary Plan street network (understanding the limitations of new road construction on the Natural Heritage System), and to provide the most direct and convenient pedestrian and cycling connections between residential areas and community facilities and commercial developments.

East of Gordon Street, important elements of the Trail Network are proposed to cross the Natural Heritage System to continue to allow for pedestrian and cycling connectivity where typical street right-of-ways would otherwise not be permitted. Future studies will be required to demonstrate that active transportation links are compatible with natural and cultural heritage attributes in these areas.

Potential trail sections are also identified, which are intended to support utilitarian access to the trail system itself, and provide more direct linkages within the wider mobility network identified as part of the Preferred Community Structure plan. Potential linkages are also identified conceptually to extend beyond the Clair-Maltby Secondary Plan area and connect with the wider trail network and adjacent neighbourhoods.

The proposed trail network is illustrated on the Preferred Community Structure Plan and outlined in Figure 16. Detailed trail and path design guidelines are discussed in Section 8.0, herein, and detailed in the City of Guelph Active Transportation Network Study Plan (2017).

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CLAIR-MALTBY SECONDARY PLAN TRAIL NETWORK

9.5 GORDON STREET MAIN STREET CONCEPT

Gordon Street plays an important role in accommodating development within the Clair-Maltby Secondary Plan area. The Gordon Street corridor is a central element in the local transportation network, connects the area with the wider City and County, provides an opportunity for transit priority, and is envisioned as a main street / village core destination.

The Gordon Street corridor is intended to be designed to highlight and celebrate the public realm, cultural and natural heritage features, and otherwise be framed by a continuous urban built form with building facades fronting onto the street. Given the variety of land uses and cultural / public facilities anticipated along the Gordon Street corridor, the public right-of-way is required to accommodate all street users through the delivery of multi-modal infrastructure. Its design will support the efficient and effective routing of transit services, the comfortable movement of cyclists and pedestrians, and accommodate for automobile travel.

Vehicle parking is not intended to separate the Gordon Street right-of-way from private buildings. Vehicle parking should generally be located underground, in structures, or to the rear or sides of buildings, and designed in a manner such that it does not have a direct impact on the street.

9.5.1 Traffic Operations

Gordon Street is intended to be a multi-modal travel corridor, prioritizing transit, cycling and walking. However, the corridor is also anticipated to accommodate considerable traffic volumes given its role as a regional traffic corridor, its interchange with Highway 401 to the south, and the extent of north / south vehicular routes planned within the Secondary Plan area.

Understanding this, important improvements should be advanced to allow for additional traffic routing in the northbound and southbound directions, including planned improvements to Hanlon Parkway, the extension of Southgate Drive to Maltby Road, and new north-south oriented collector roads outlined in the Preferred Community Structure Plan.

To improve traffic flow along the corridor, Gordon Street itself can also be optimized through appropriate signal timing and coordination, and the inclusion of ancillary turn lanes when necessary. Separate left-turn lanes should be provided at all junctions where left-turns are permitted, which may further support the introduction of a continuous left-turn / centre median lane along the extent of Gordon Street within the Secondary Plan area. The location of ancillary turn lanes and traffic signal control for intersections along the Gordon Street corridor are further detailed in Section 15.5.

Traffic signal coordination can process estimated future traffic volumes through the corridor, limit traffic queue impacts and decrease associated traffic delays. It may also be appropriate that traffic signal timing prioritize traffic movement northbound and southbound along the Gordon Street corridor in lieu of eastbound and westbound movements across the corridor.

A 4-lane Gordon Street cross-section is anticipated to appropriately accommodate traffic demands along the corridor, but will also require the inclusion of ancillary turn lanes at signalized intersections. Separate left-turn lanes are appropriate at all signalized intersections along the corridor. Separate right-turn lanes may be

supported in certain instances when traffic demands warrant them or longer transit-stop dwell times are expected – specifically at the Gordon Street / Clair Road intersection.

9.5.2 Transit-Support Elements

The Clair-Maltby Secondary Plan encourages dense, mixed-use development along the Gordon Street corridor to support the deployment of transit services currently operating along Gordon Street and anticipated to be extended along the corridor through the Secondary Plan area. The provision of frequent transit service along the Gordon Street corridor also supports the urban development of the corridor, provides mobility choice for area residents, employees, and visitors, and establishes a multi-modal and public amenity framework for the corridor.

Transit priority measures, to be potentially integrated within the Maltby Secondary Plan area to increase transit mode split and the proportional uptake of transit use, can include physical design elements to reduce transit vehicle delays and provide amenity and convenience to perspective riders, and policy measures to make transit more appealing, affordable and competitive with other travel modes.

A variety of measures can be introduced within the Secondary Plan area to support Gordon Street as a *Transit Spine*, are summarized in Table 9 and segmented into three primary categories:

1. Transit vehicle priority,
2. Transit policy and operations, and
3. Transit amenity.

The measures outlined in Table 9 provide a high-level summary of potential infrastructure and policies to prioritize transit service delivery within the Clair-Maltby Secondary Plan area and specifically along the Gordon Street corridor. Other measures can be pursued for the area, or for the City overall, to better deliver transit. The detailed design and location of transit services, as well as operational provisions, are to be developed in consultation with Guelph Transit.

The ability for Gordon Street to respond to traffic demands, reduce traffic queue impacts, and minimize traffic delay will also have an impact on transit vehicles routing along the corridor. Where traffic delays persist, additional measures can be implemented to prioritize transit vehicle travel. These measures should be given greater consideration when planning for key transit terminals or transfer points, which typically are associated with higher transit vehicle volumes and tend to be located in more densely-populated locations. The addition of traffic signals to facilitate specific transit vehicle movements at the location of transit terminals should also be considered. Within the context of the Secondary Plan, it may be appropriate to locate a bus terminal near the intersections of Gordon Street / Street B or Gordon Street / Street C, to accommodate intra and inter-city transit services.

The location and design of transit stops will impact the attractiveness of transit in a variety of ways. Transit stops and stations should be designed to be universally accessible, safe and amenity-rich. Transit stops should be clear of clutter and obstructions, well-lit, have boarding / alighting areas, and appropriate shelter and convenience items (transit information, seating, etc.). The location of transit stops should reflect the local pedestrian and cycling networks, and further be supported by these networks. Transit stops must also be appropriately spaced to service new development while not incurring induced delay to transit vehicles and

their riders. The spacing of transit stops depends on the type of service provided, whereas local bus services would have higher stop frequencies than express bus or other higher-order transit services.

Potential Transit Terminal

Opportunity may exist to pursue the development of a transit terminal in the area of the Clair-Maltby Secondary Plan to achieve a number of objectives, including:

- 1) Support dense, mixed-use urban development;
- 2) Support and encourage Transit Oriented Development;
- 3) Support transit service operations;
- 4) Encourage transit use; and
- 5) Take advantage of the strategic urban boundary location of the Clair-Maltby Secondary Plan to support interaction and transfers between local and regional transit services.

The introduction of a transit (bus) terminal is also supported in the City's Transit Growth Strategy and Plan (2010) which specifies that the City work with property owners to establish a 4 to 6 bay bus terminal within the South End Node (Gordon Street and Clair Road intersection).

Transit terminals are supported by robust active transportation connections, an appropriate mix of commercial uses, and higher density residential and employment uses. Metrolinx highlights six important aspects of Transit Oriented Development, which support the creation of transit hubs and transit terminals:

- i) Multi-modal transportation allowing transportation choice;
- ii) Urban density and use intensity;
- iii) High levels of pedestrian priority, including spaces designed for pedestrian priority;
- iv) Embedded technology (i.e. access to real time transit information, internet, and seamless transfers between transportation modes);
- v) Economic vitality and competitiveness, consisting of significant development potential and strong economic anchors; and
- vi) A strong sense of place – a vibrant and vital place to support the transportation experience.

Within the context of the Clair-Maltby Secondary Plan, it may be appropriate to locate a bus terminal in a location that accommodates intra and inter-city transit services and associated transfer activity, in proximity to public amenity, and high density and mixed land uses.

Conceptually, a transit terminal may be located in vicinity of the Gordon Street / Clair Road intersection (as noted within the Transit Growth Strategy and Plan), or within higher-density mixed-use areas of the Secondary Plan (as preferred by Guelph Transit), such as in proximity to the intersections of Gordon Street / Street B or Gordon Street / Street C. A transit terminal near the south extent of the Clair-Maltby Secondary Plan area would support mixed-use and high-density residential development planned in this area, and allow for a logical southern terminus for local transit routes that could, potentially, connect with existing GO Transit bus routes routing along Gordon Street from Highway 401.

A transit terminal facility, should it be pursued, would be developed in consultation with Guelph Transit, Metrolinx, and other potential private and public transit service providers, in order to appropriately design and locate a desirable facility.

TABLE 9 POTENTIAL TRANSIT-SUPPORTIVE MEASURES

Transit-Supportive Policy	Potential Implementation Measure	Description	Examples
Transit Vehicle Priority	Transit Priority Signal (TPS)	Traffic signals can be calibrated with bus detection technology, extending traffic signal <i>green-time</i> for transit vehicles.	Saskatoon Transit 3 rd Avenue and Broadway Avenue BRT Transport for London Selective Vehicle Detection Technology
	Transit Queue Jump Lanes	Right-turn lanes paired with a transit stop can be extend beyond typical traffic queue lengths to accommodate transit vehicles.	City of Toronto Complete Streets Guidelines
	Transit Vehicle Priority Turning Lanes	Designated transit-only turning lanes to accommodate transit routes with turns or transit vehicles routing to key transit terminals / stations. These can effectively reduced transit delays associated with typical left-turn movements.	Millway Avenue at Vaughan Metropolitan Centre Station (Toronto Transit Commission) Albany Highway / Nicholson Road, Perth, Australia (Western Australia PTA)
	Designated Transit-Only Lanes	Designated transit-only travel lanes or transit lanes within a separated right-of-way. Transit lanes can be separated by traffic lanes by physical barriers or appropriate pavement markings.	Express Bus Lanes (XBL) Network in New York City Bus Rapid Transit Network, Bogota, Colombia
Transit Policy and Operations	Free-Transit Use	To encourage transit use, transit fares can be removed on days with higher pollution levels, adverse weather, or for certain / designated trips.	Free Fare for Clean Air Program, Prince George, B.C.
	Pre-paid boarding	Provide options / services for fare payment before boarding a vehicle to reduce transit vehicle dwell times at transit stops.	Transport For London Fare Policy
	All-door boarding / alighting	Allow transit vehicle boarding and alighting at all transit vehicle doors to reduce transit vehicle dwell times at transit stops.	Toronto Transit Commission Streetcar Boarding / Alighting
	Minimum Service Standards	Provide a minimum service frequency (15-minutes or less), all-day, along designed corridors.	Toronto Transit Commission (Ridership Growth Strategy; Express Bus Network)
	Express Service	Provide supplementary express transit service operating with fewer stops, in addition to local frequent stop service.	
Transit Amenity	Provision of Transit Stop Amenities	Inclusion of transit stop shelters, furniture, lighting, landscape, public art, "next-bus" real-time information, and boarding / alighting pads.	City of Toronto Complete Street Guidelines
	Accommodate Transfers	Reduce the space between bus route transfers, or consolidate transfers within designated stops / stations. It may be appropriate to locate a bus terminal near the intersection of Gordon Street / Street B to accommodate intra and inter-city transit services transfers. Prioritize pedestrian movement allowing for safe, convenient walking spaces between transit stops where transfers are anticipated.	
	Incorporate "last-mile" Facilities	Transit stops should be well connected to area pedestrian and cycling infrastructure, include bicycle parking, wayfinding, and fare payment options.	
	Universal Accessibility	Design transit stops / stations to accommodate for all ages and users.	

10.0 MOBILITY PLAN FRAMEWORK: TRANSPORTATION DEMAND MANAGEMENT (TDM)

10.1 SECONDARY PLAN APPROACH TO TRANSPORTATION PLANNING

A Transportation Demand Management (TDM) framework will be pursued to:

- establish a foundation for managing future travel demands with development of the Secondary Plan area, and
- ensure that measures to promote transit and active transportation are implemented by way of the transportation amenities provided, as well as the built form of the community.

It is recommended that policy statements pertaining to TDM be included within the Clair-Maltby Secondary Plan. Within this section, a best practice review of municipal policy documents in southwestern Ontario and the Greater Toronto & Hamilton Area is outlined. The purpose of the review is to identify policy themes that could be included within the Clair-Maltby Secondary Plan, building upon TDM-related policy statements currently included in the City of Guelph Official Plan and the Guelph-Wellington Transportation Study.

10.2 APPLICABLE TRANSPORTATION DEMAND MANAGEMENT POLICY

The City of Guelph Official Plan contains policy statements relating to TDM, referring to it as an essential part of the City's integrated sustainable transportation system. TDM measures are suggested to increase the modal share of automobile travel alternatives, including bicycle infrastructure, providing support for transit, allocating car-share parking spaces, and other initiatives, all of which are expected to be considered as part of future development applications.

The Guelph-Wellington Transportation Study identifies TDM strategies, which partly accommodates forecast future travel demands through reductions in vehicular travel demands. These TDM measures include:

- a supportive land use and urban design practices (as outlined in the Official Plan);
- ridesharing, cycling and walking;
- alternative measures for reducing auto use (parking pricing / supply management, telecommuting, alternative work schedules, congestion pricing); and
- TDM programs (alternative strategies, education, etc.).

More detail relating to TDM policy found within the City of Guelph Official Plan and the Guelph-Wellington Transportation Study is included in Section 4.3.2 and Section 4.6, respectively, and additional policy documents making reference to TDM policy goals, including the Downtown Guelph Secondary Plan, Guelph Innovation District Secondary Plan, and City of Guelph Community Energy Plan, are included in Section 4.7.

10.2.1 Comparative Review of Transportation Demand Management Policy

BA Group has conducted a review of TDM policies found within the Official Plans, Secondary Plans, and Transportation Master Plans of municipalities in the Greater Toronto & Hamilton Area and Southwestern Ontario. The purpose of the review is to identify best practices that can inform the development of TDM policy that can be included in the Clair-Maltby Secondary Plan.

A complete set of researched TDM policy can be read in **Appendix D**. Within this section, a thematic review of TDM policies is provided, identifying the general purpose of the examined policy, comparable examples, and a list of Official Plans and Secondary Plans where similar TDM policy is present.

Policy Theme #1: Require a Transportation Demand Management Plan as part of Development Applications.

Several policy documents either stated that a TDM Plan would be a requirement as part of development applications, or indicated that a TDM Plan may be required.

Rationale:

Ensure that development applications not only take into consideration the vehicular traffic that the future development will generate, but to develop a strategy for mitigating vehicular trip generation through infrastructure improvements, marketing efforts, and the development of partnerships, each of which promote alternatives to automobile travel among residents or tenants.

Examples:

Section 6.11 of the Cambridge West Lands Secondary Plan states the following:

The implementation of Transportation Demand Management measures shall be considered as part of every application for new development or redevelopment within the Secondary Plan area.

In some cases, the requirement for a TDM Plan is stipulated based upon the scale of the proposed development, as is the case with Section 7.7.2.3.(b) of the North Oakville East Secondary Plan:

The Town will encourage any development which contains more than 3,000 square metres of office use or 9,290 square metres of industrial use to establish with the Town a travel demand management plan and implementation strategy for the specific development.

The following policy documents include similar policy statements:

- Downtown Guelph Secondary Plan, City of Kitchener Official Plan, City of Mississauga Official Plan, Port Credit Local Area Plan (Mississauga), City of London Official Plan, City of Vaughan Official Plan, Town of Aurora Official Plan, Newmarket Urban Centres Secondary Plan, Town of Oakville Official Plan, North Oakville West Secondary Plan, Town of Milton Official Plan

Policy Theme #2: Indicate that vehicular parking standards may be reduced with the implementation of Transportation Demand Management Measures.

Several municipalities indicate that either a TDM plan or a commitment to the implementation of TDM measures will be considered as justification for a reduction to vehicular parking requirements.

Rationale:

Sensible vehicular parking management and the provision of an extensive suite of TDM measures are mutually supportive. If vehicular parking is oversupplied, future residents, tenants, or visitors to a development would have less incentive to utilize the alternative transportation options that are available to them. Likewise, a modest parking supply without appropriate TDM measures would negatively affect local traffic and place undue parking demand on the surrounding area. Therefore, it is sensible to permit reductions to vehicular parking requirements if appropriate TDM measures are proposed as part of a development application.

Examples:

Section 13.C.8.2 of the City of Kitchener Official Plan states the following:

The City may consider adjustments to parking requirements for properties within an area or areas, where the City is satisfied that adequate alternative parking facilities are available, where developments adopt transportation demand management (TDM) measures or where sufficient transit exists or is to be provided.

Similarly, Section 11.1.4.1.4 of the Downtown Guelph Secondary Plan states the following:

The City may permit reduced parking standards for developments which demonstrate through a TDM plan and implementation strategy that a reduction in parking standards is appropriate.

The following policy documents include similar policy statements:

- City of Cambridge Official Plan, City of Waterloo Official Plan, Region of Waterloo Official Plan, City of London Official Plan, Newmarket Urban Centres Secondary Plan, Town of Oakville Official Plan, North Oakville East Secondary Plan, North Oakville West Secondary Plan, Sheppard Lansing Secondary Plan (Toronto)

Policy Theme #3: Provide a list of recommended or suggested Transportation Demand Management Measures or Initiatives.

It is common practice to include a list of suggested TDM measures to be included as part of a TDM Plan within the examined policy documents.

Rationale:

Generally, providing a list of suggested TDM measures serves to help the community gain a better understanding of what TDM is; it is generally not a well understood concept outside of the development community. Further, naming specific TDM measures sets expectations as to the kind of infrastructure can be expected in the community (i.e. car-share vehicles or preferential carpool spaces). As it relates to development applications, providing a suggestive list provides guidance to the type of TDM measures the municipality will favour.

Examples:

Section 9.3.5(iv) of the Newmarket Urban Centres Secondary Plan states the following:

TDM strategies should be designed to decrease single occupancy vehicle use, reduce peak period demands, especially discretionary trips in the afternoon peak period, promote active transportation and transit use, and to increase vehicle occupancy during peak periods and should include, but not be limited to:

- a) provision for car share opportunities in major residential developments;*
- b) secure indoor bicycle parking and showers in conjunction with major office and commercial uses, institutional and civic uses;*
- c) preferential parking for carpool and electric vehicles in non-residential developments;*
- d) provision for bicycle parking in close proximity to building entrances and transit stations;*
- e) transit incentive programs, including subsidized transit fares; and*
- f) incorporating paid parking requirements with non-residential development.*

The following policy documents include similar policy statements:

- City of Cambridge Official Plan, City of Kitchener Official Plan, City of Mississauga Official Plan, City of Vaughan Official Plan, City of Markham Official Plan, Town of Oakville Official Plan, Downsview Area Secondary Plan (Toronto), North York Centre Secondary Plan (Toronto)

Policy Theme #4: Pledge to promote Transportation Demand Management initiatives through Transportation Management Associations and associated marketing efforts or through programming.

In municipalities with existing Transportation Management Associations (TMA), several policy documents indicate that the municipality will continue to work with the TMA to promote TDM initiatives. In other cases, the document pledges to promote TDM measures and implement monitoring programs to measure the success of TDM programming.

Rationale:

Generally, a TMA is a non-profit organization that provides transportation services within a geographically defined area. Normally, it is member-controlled and focussed upon employment areas; they are generally public-private partnerships. The presence of a TMA is a significant advantage to the promotion of TDM programs, measures, and initiatives, given that it is an organization that exists to serve that purpose. The inclusion of policy statements indicating support for TMA's further strengthens TDM efforts.

Examples:

Section 8.5.3 of the Mississauga Official Plan indicates broad support for TDM programming:

Mississauga will encourage employers to implement TDM programs.

Section 5.4.1 of the Kitchener Transportation Master Plan specifically indicates support for the local TMA:

Expand employer TDM programs in Kitchener through existing TDM tools and services. This can begin with the City's membership in the TravelWise TMA to adopt carpool ridematching, subsidized transit passes, guaranteed-ride home and outreach programs to encourage its staff to choose sustainable modes of travel to and from work. Given TravelWise is a well-established program in the Region, TDM efforts and outreach should be expanded beyond City staff and beyond the downtown area to encourage major employers throughout the City to adopt these services.

The following policy documents include similar policy statements:

- Region of Waterloo Official Plan, City of Vaughan Official Plan, City of Markham Official Plan, Newmarket Urban Centres Secondary Plan, Town of Oakville Official Plan, Sheppard Lansing Secondary Plan (Toronto), Downsview Area Secondary Plan (Toronto)

Policy Theme #5: Indicate that a Transportation Demand Checklist will be created (or exists) to assess development applications.

In **Appendix D**, a selection of existing TDM checklists is provided; the intent of the documents are to assess development applications. In some cases, the TDM checklist is notified as a policy implementation instrument in the examined policy.

Rationale:

The utilization of a TDM checklist by a municipality (potentially within a Secondary Plan area) provides a streamlined instrument to review development applications. Further, it indicates the expectations of the municipality in regards to TDM, showing what needs to be included in development proposals for them to be acceptable from a TDM perspective.

Examples:

Section 5.4.4 of the Kitchener Transportation Master Plan states the following:

The City should develop a TDM checklist to help review and evaluate development applications, City of Kitchener transportation-related projects and projects of the Region and Province. This checklist would assign points and provide a rating, similar to the Region of Waterloo's Travel Demand Management Implementation Checklist. Another example of a TDM checklist was developed in the study "TDM Supportive Guidelines for Development Approvals" prepared by the Association for Commuter Transportation in Canada.

Part of this TDM checklist can include a requirement to prepare TDM plans as part of transportation impact studies for new developments and major transportation projects.

Policy Theme #6: Enable the inclusion of a Transportation Demand Management Plan as part of the rationale for increases to land density.

Several policy documents enable TDM initiatives (or a plan) to be included as part of the rationale to increase density permissions.

Rationale:

A policy statement indicating added leniency to density permissions if a TDM Plan (or initiatives) is proposed greatly enhances the appeal of TDM to a development proponent, and is likely to improve the TDM measures proposed as part of a project. Further, the City of Guelph can pledge, within the policy statement, to work with development proponents to cater appropriate TDM measures to the development proposal, as part of this effort.

Examples:

Section 11.1.38(5), which is a specific area provision, of the City of Waterloo Official Plan states the following:

The determination of appropriate increases in density for areas designated high density, shall be considered based on the ability of the project to meet one or more of the following objectives and shall be specified on a site by site basis, in the implementing zoning:

(i) To encourage improvements suggested by a Transportation Demand Management Plan, where appropriate;

The following policy documents include similar policy statements:

- City of Kitchener Official Plan, Port Credit Local Area Plan (Mississauga)

Additional Policy Themes

In addition to the aforementioned policy themes that appear in many policy documents in the study area, there are policy statements that are unique. These policy themes generally involve connecting TDM to other policy areas, including the following:

- The City of Kitchener Official Plan (Section 6.C.1.2) indicates that a Health Impact Assessment may be required as part of development applications, and indicates that it may be evaluated based upon the proposals support for physical activity, which could be connected to reducing automobile dependency and TDM measures.
- The City of Kitchener Official Plan (Section 7.C.7) makes a direct connection between air quality and TDM, as a policy goal.
- Similarly, the City of Waterloo Official Plan (Section 8.5.3(1)) makes a direct connection between energy conservation and TDM.
- The Region of Waterloo Official Plan (Section 3.C.3) specifies that when a development applicant agrees to implement TDM measures, the Region may consider granting reductions to the level of road improvement that would otherwise be required, associated with the proposed development.
- The City of Vaughan Official Plan (Section 4.3.3.5) pledges to work with developers to provide new homebuyers with information on multi-modal transportation options.

10.2.2 Land Use Planning and Transportation Demand Management Integration

In addition to the aforementioned policy statements identified from outside of Guelph, the City should consider including a policy statement highlighting the importance of the relationship between land use planning and transportation demand management. Land use planning decisions should be evaluated on the basis of their ability to facilitate and encourage shorter trip distances between typical weekday needs, including access to commuter services, amenities, routine errands/purchases, and schools.

10.3 TRANSPORTATION DEMAND MANAGEMENT FRAMEWORK

Upon review of existing policy statements in the Guelph Official Plan and the Guelph-Wellington Transportation Study relating to TDM, and a review of best practices in TDM policy in southwestern Ontario and the Greater Toronto & Hamilton Area, it is recommended that the Clair-Maltby Secondary Plan provide a robust framework of requirements ensuring that the development being pursued in the area meets a strict TDM standard.

The following policy themes, outlined in Table 10, are recommended for inclusion in the Clair-Maltby Secondary Plan.

TABLE 10 CLAIR-MALTBY SECONDARY PLAN RECOMMENDED TDM FRAMEWORK

Policy Theme Recommended for Inclusion	Best Practice Examples	Additional Notes
Policy Theme #1: Require a TDM Plan with Development Applications.	Cambridge West Lands Secondary Plan, North Oakville East Secondary Plan	Already included in Guelph Official Plan.
Policy Theme #2: Encourage TDM provision to reduce vehicular parking standards.	City of Kitchener Official Plan, Downtown Guelph Secondary Plan	Currently suggested in Guelph Official Plan; can be made more specific in Clair-Maltby Secondary Plan.
Policy Theme #3: Provide suggested TDM Measures list.	Newmarket Urban Centres Secondary Plan	Already in Guelph Official Plan, list can be expanded in Clair-Maltby Secondary Plan.
Policy Theme #4: Work with TMA's to promote TDM initiatives and programming.	Mississauga Official Plan, Kitchener Transportation Master Plan	This would advocate the creation of a TMA in Guelph.
Policy Theme #5: Utilize TDM checklist to assess development applications.	Kitchener Transportation Master Plan	A selection of existing TDM Checklists in neighbouring municipalities is included in Appendix D .
Policy Theme #6: TDM Plan to rationalize increases to land density.	City of Waterloo Official Plan	Enable developers to propose a robust TDM Plan as a means of procuring additional density permissions.
Policy Theme #7: Support the integration of land use planning and transportation demand management decision making.	City of Mississauga Official Plan	Land use planning can be a TDM measure if it facilitates shorter trip distances.

11.0 VEHICLE PARKING CONSIDERATIONS

As the City of Guelph develops policies for the Clair-Maltby Secondary Plan and eventually, an area specific Zoning By-law, the challenge will be the development of standards that would provide parking supply to meet demands, where appropriate, while supporting sustainable transportation options and public realm objectives.

Parking within this section is reviewed from two (2) perspectives:

1. The first perspective is policy based and influences the overall required parking supply. Parking standards are set out within the applicable Zoning By-law, which outlines the ratios and provides regulations governing the number of spaces and the location of these spaces based upon land use, unit type, and floor area.
2. The second perspective influences the use of the parking infrastructure – parking demand. Parking demands are influenced by the type of unit, ownership, location, demographic of the area, surrounding land uses, transit accessibility and pedestrian environment.

Both of these perspectives are discussed within this chapter. It is important to note the difference between 1) parking supply, and 2) parking demand particularly as management strategies.

The parking review and assessment is organized into four (4) key topic areas – as outlined in the following.

1. Review of the in-force City of Guelph parking standards based on land use to understand the variables and measurements (i.e. type of unit, floor area) used to calculate parking requirements.
2. A comparative review of parking regulations within neighbouring and comparable municipalities across southern Ontario to establish the range of parking requirements based upon type of land use.
3. Identification and discussion of effective parking management strategies to influence supply and demand.
4. A discussion of the appropriate parking management techniques which could be implemented to influence parking behaviour within the new Clair-Maltby Secondary Plan area.

There are a variety of factors influencing the development of parking requirements and standards. These factors (i.e. vehicular use, trip generation and travel choices) are affected by population density, layout of the municipality, transit accessibility, location of the development and adjacent land uses.

The purpose of this comparative parking standards review is to provide an understanding of the existing parking standards with the City of Guelph, how they compare relative to other neighbouring and similar municipalities, and how they might apply to the Clair-Maltby Secondary Plan area.

11.1 COMPARATIVE REVIEW OF PARKING REQUIREMENTS

11.1.1 Methodology

BA Group has completed a high-level comparative review of general parking requirements, which include common types of residential and non-residential uses that would likely be developed within the Clair-Maltby Secondary Plan area.

The purpose of this review is to understand the variations in minimum parking requirements for common land uses and to provide the City of Guelph with a range of standards, which can be used generally, to understand the current parking standards as they compare to other similar municipalities. The intent of this section is provide a foundation to guide discussions related to parking requirements, the approval process, and strategies that may be implemented to guide development within the Secondary Plan area.

We note that this high-level review is not meant to provide a set of parking regulations to be implemented. It is important to understand that each municipality exhibits their own unique characteristics and has implemented parking standards based upon development and approval patterns, reflective of parking demands and trends that may be occurring.

The parking standards, based upon land use, that have been selected for comparative review include common types of uses for residential and non-residential uses, as noted below:

- **Residential Uses:**
Includes single family dwelling units, multiple dwelling units, visitors to apartment buildings, mixed-use buildings and live-work units
- **Non-Residential Uses:**
Includes retail uses, service uses, office uses (exclusive of medical office uses), community uses, hospitality uses and restaurant uses

11.1.2 Understanding the Current Parking Context

Proposed developments located within the City of Guelph are required to review parking standards outlined within the applicable Zoning By-law. These standards are used to calculate the minimum number of parking spaces required based upon land use and location. The two applicable Zoning By-laws for proposed developments are:

- Downtown Zoning By-law (2017)-20187
- City of Guelph Comprehensive Zoning By-law 1995-14864

We understand that the City of Guelph has recently initiated a review of the in-force Zoning By-law. It is our understanding that the Clair-Maltby Secondary Plan parking requirements will align with the overall vision that the City of Guelph has towards its growth and development.

BA Group has generally reviewed the applicable parking standards for residential and non-residential uses based upon the in-force Zoning By-laws. Parking requirements for residential and non-residential uses are further discussed and summarized in Section 11.1.3.

11.1.2.1 Parking Reduction Permissions

Parking reductions are typically permitted within the Zoning By-law, depending on a number of factors, not limited to land use compatibility (i.e. shared parking) or other development restrictive factors (i.e. heritage buildings).

The City of Guelph currently permits parking reductions for proposed development sites, notably for Designated Structures. In these applications, *a reduction of 20% of the required parking spaces are permitted, however, in no case shall the reduction be greater than 5 parking spaces.*

11.1.3 Parking Requirements Based Upon Land Use

11.1.3.1 Residential Uses

Residential land uses include a variety of dwelling unit types ranging from single family dwelling units (i.e. single-detached housing) to multiple dwelling units (i.e. apartment buildings or townhouses). We also note that the layout of multiple dwelling units can also result in varying standards depending upon the municipal interpretation and understanding of the urban form. To clarify, multiple dwelling units can refer to apartment buildings (i.e. units stacked on top of each other) or townhouses (i.e. units that are divided vertically and are side-by-side, sharing a common wall).

The layout of multiple dwelling units has resulted in varying standards within municipalities depending on the layout (i.e. units stacked on top of each other or units side by side). The City of Guelph has not differentiated between the two layouts. Multiple dwelling units have the same parking requirement whether they are stacked on top of each other or sharing a common wall horizontally. Parking requirements for this type of use are calculated based upon the number of dwelling units. A summary of the residential parking standards can be found in Table 11.

11.1.3.2 Non-Residential Uses

Non-residential land uses include retail, office, service, restaurant, and hospitality (i.e. hotel) land uses. These are the most common types of commercial units that are likely to be developed within the Clair-Maltby Secondary Plan area. Parking requirements for this type of unit are calculated based upon gross floor area (GFA). The City of Guelph has defined the GFA within the Zoning By-law as, *the total floor area of a building measured from the centre line of the partition walls and the exterior face of outside walls, but does not include any floor area of a basement, cellar, attic, garage, porch or any floor area used for parking or any floor area which does not have a clear floor to ceiling height of 2.15 metres.*

TABLE 11 GUELPH ZONING BY-LAW REVIEW– RESIDENTIAL USES

Municipality	Apartment Building / Multiple Dwelling Unit	Visitors to Apartment Buildings	Mixed-Use or Live-Work Unit
Guelph Downtown	1 per residential dwelling unit	See below for D1 and D2 zones	In addition to the non-residential parking requirement, 1 parking space per residential dwelling unit is required.
Guelph Special Downtown Zones (D1/D2)	1 per residential dwelling unit	0.05 spaces per dwelling units reserved for exclusive use of visitors, for 10+ dwelling units	Parking is required for residential uses only
Guelph General By-law Standard	For the first 20 units: 1.5 spaces per unit, and for each unit in excess of 20: 1.25 per unit	--	--
Burlington (Zoning By-law 2020)	1-Bed: 1.25 spaces per unit 2-bed: 1.50 spaces per unit 3+bed: 1.75 spaces per unit	0.35 spaces per unit	--
Burlington (Zoning By-law 2020) <i>(townhouse dwelling)</i>	2 occupant spaces per unit	0.50 spaces per unit	--
Cambridge (Zoning By-law 150-85) <i>(apartment house, maisonette, mixed terrace or cluster attached duplexes)</i>	1 space per dwelling unit;	plus 1 space for each 4 dwelling units for visitors only.	--
Cambridge (Zoning By-law 150-85) <i>(cluster row housing)</i>	1 space for the first 4 bedrooms per dwelling unit; plus 1 space for each additional 2 bedrooms	Plus 1 space for each 2 dwelling units for visitors only	--
Hamilton (Comprehensive Zoning By-law 05-200)	1 space per unit OR 0.3 spaces per unit ⁴	--	--
Kitchener (UGC Zones) (Final Draft Zoning By-law, April 2018)	0.8 spaces per dwelling unit	0 spaces per dwelling unit	--
Kitchener (MIX Zones) (Final Draft Zoning By-law, April 2018)	0.9 spaces per dwelling unit	0.1 spaces per dwelling unit only where 5 or more dwelling units are on a lot	--
Kitchener (All Other Zones) (Final Draft Zoning By-law, April 2018)	1 space per dwelling unit	0.1 spaces per dwelling unit only where 5 or more dwelling units are on a lot	--
London (Zoning By-law Z-1)	1.25 spaces per unit OR 1 space per unit OR Zero parking ¹	--	--

Municipality	Apartment Building / Multiple Dwelling Unit	Visitors to Apartment Buildings	Mixed-Use or Live-Work Unit
Mississauga (Zoning By-law 0225-2007): Downtown Apartment (within CC1 to CC4 zones)	1 space per unit	0.15 spaces per unit	1.25 spaces per unit (dwelling units located above a commercial development with a maximum height of 3 storeys)
Oshawa (Zoning By-law 60-94)	1.45 spaces per unit OR 1 space per unit OR 0.87 spaces per unit ²	0.3 spaces per unit OR 0.33 spaces per unit	--
Toronto (Zoning By-law 569-2013): Policy Area 3	Bachelor: 0.6 spaces per unit 1-Bed: 0.7 spaces per unit 2-Bed: 0.9 spaces per unit 3+ Bed: 1.5 spaces per unit	0.1 spaces per unit	Bachelor: 0.6 spaces per unit 1-Bed: 0.7 spaces per unit 2-Bed: 0.9 spaces per unit 3+ Bed: 1.5 spaces per unit
Toronto (Zoning By-law 569-2013): Policy Area 4 (Areas with Surface Transit)	Bachelor: 0.7 spaces per unit 1-Bed: 0.8 spaces per unit 2-Bed: 0.9 spaces per unit 3+Bed: 1.1 spaces per unit	0.15 spaces per unit	Bachelor: 0.7 spaces per unit 1-Bed: 0.8 spaces per unit 2-bed: 0.9 spaces per unit 3+bed: 1.1 spaces per unit
Toronto (Zoning By-law 569-2013): All Other Areas	Bachelor: 0.8 spaces per unit 1-Bed: 0.9 spaces per unit 2-bed: 1 space per unit 3+bed: 1.2 spaces per unit	0.2 spaces per unit	Bachelor: 0.8 spaces per unit 1-Bed: 0.9 spaces per unit 2-bed: 1 space per unit 3+bed: 1.2 spaces per unit
Waterloo (Zoning By-law 1108)	1.5 spaces per unit	--	1 space per dwelling unit
Waterloo (Zoning By-law 1418)	1.5 spaces per unit	--	1 space per dwelling unit

Notes:

- 1.25 spaces / unit is for Parking Areas 2 & 3 (PA2 & PA3); 1 space / unit is for Parking Area 1 (PA1); for all lands zoned "Downtown" in PA1, zero parking is required.
- 1.45 spaces / unit applies to condominium apartments; 1 space per unit applies to rental apartments; 0.87 spaces per unit for "Apartment Building – Rental for student accommodation only" in MU-B(1) zones (Mixed Use Zones)

TABLE 12 GUELPH ZONING BY-LAW REVIEW – COMMERCIAL USES

Municipality	Retail Uses	Service Uses	Office Uses	Restaurant Uses	Hotel Uses
Guelph Downtown	1 per 100 m ² of GFA	1 per 100 m ² of GFA	1 per 67 m ² of GFA	--	0.75 spaces per guest room + 1 parking space per 10 m ² of GFA open to the public, exclusive of corridors, lobbies or foyers
Guelph Special Downtown Zones (D1/D2)	No off-street parking is required	No off-street parking is required	No off-street parking is required	No off-street parking is required	No off-street parking is required
Guelph General By-law Standard	1 per 16.5 m ² of GFA	--	1 per 33 m ² of GFA	1 per 7.5 m ² of GFA (tavern) 1 per 9 m ² of GFA (take-out)	1 per guest room plus 1 per 10 m ² of GFA open to the public excluding corridors, lobbies or foyers
Burlington (Zoning By-law 2020)	4 spaces per 100 m ² of GFA	4 spaces per 100 m ² of GFA	3.5 spaces per 100 m ² of GFA	1 space per 4 persons capacity (standard restaurant) 1 space per 4 persons capacity or 25 spaces per 100 m ² of GFA, whichever is greater.	1 space per guest room or suite
Cambridge (Zoning By-law 150-85)	2.5 spaces per 100 m ² of GLCFA ¹	2.5 spaces per 100 m ² of GLCFA	2.5 spaces per 100 m ² of GLCFA	12 spaces per 100 m ² of GFA	1 space per guest room or suite; plus parking required for any other retail or other service commercial or commercial-recreational establishment provided in the hotel or motel
Hamilton (Comprehensive Zoning By-law 05-200)	1 space per 20 m ² of GFA	1 space per 16 m ² of GFA (personal services)	1 space per 50 m ² of GFA in excess of 450 m ² , which accommodates such use	1 space per 8.0 m ² of GFA	1 space per guest room
Kitchener (UGC Zones) (Final Draft Zoning By-law, April 2018)	1 per 95 m ² of GFA	1 per 95 m ² of GFA	1 per 50 m ² of GFA	1 per 19 m ² of GFA	0.7 spaces per guest room

Municipality	Retail Uses	Service Uses	Office Uses	Restaurant Uses	Hotel Uses
Kitchener (MIX Zones) (Final Draft Zoning By-law, April 2018)	1 per 40 m ² of GFA	1 per 40 m ² of GFA	1 per 33 m ² of GFA	1 per 7.5 m ² of GFA, or for a restaurant within a mixed use building, mixed use development, multi-unit building, or multi-unit development, a rate of 1 per 19 m ² GFA shall apply to the first 750 m ² of restaurant, and a rate of 1 per 7.5 m ² shall apply thereafter.	1 space per guest room
Kitchener (All Other Zones) (Final Draft Zoning By-law, April 2018)	1 space per 33 m ² of GFA	1 space per 33 m ² of GFA	1 space per 33 m ² of GFA	1 space per 7.5 m ² of GFA, or for a restaurant within a mixed use building, mixed use development, multi-unit building, or multi-unit development, a rate of 1 per 19 m ² GFA shall apply to the first 750 m ² of restaurant, and a rate of 1 per 7.5 m ² shall apply thereafter.	1 space per guest room
London (Zoning By-law Z-1)	1 space per 25 m ²	1 space per 15 m ² (personal services)	1 space per 40 m ²	1 space per 15 m ² (eat-in) 1 per 8 m ² (take-out)	1.25 spaces per unit
Mississauga (Zoning By-law 0225-2007): Downtown Apartment (within CC1 to CC4 zones)	5.4 spaces per 100 m ² of GFA 4.0 spaces per 100 m ² of GFA in a C4 zone 4.3 spaces per 100 m ² of GFA in a CC2 to CC4 zones	1 space per 100 m ² of GFA	3.2 spaces per 100 m ² of GFA	16.0 spaces per 100 m ² of GFA 6.0 spaces per 100 m ² of GFA (take-out) 9.0 spaces per 100 m ² of GFA (in a C4 zone)	0.8 spaces per guest room; plus 10.0 spaces per 100 m ² of GFA - non-residential used for public use areas including meeting rooms, conference rooms, recreational facilities, dining and lounge areas and other commercial facilities, but excluding bedrooms, kitchens, laundry rooms, washrooms, lobbies, hallways, elevators, stairways and recreational facilities directly related to the function of the overnight accommodation

Municipality	Retail Uses	Service Uses	Office Uses	Restaurant Uses	Hotel Uses
Oshawa (Zoning By-law 60-94)	1 space per 24 m ²	--	1 space per 28 m ²	1 space per 11 m ²	1 space per suite
Toronto (Zoning By-law 569-2013): Policy Area 3	1 space per 100 m ² of GFA	1 space per 100 m ² of GFA (personal services)	1 space per 100 m ² of GFA	0 spaces per unit (if GFA < 200 m ²)	0.2 spaces per 100 m ² of GFA
Toronto (Zoning By-law 569-2013): Policy Area 4 (Areas with Surface Transit)	1 space per 100 m ² of GFA	1 space per 100 m ² of GFA (personal services)	1 space per 100 m ² of GFA	0 spaces unit (if GFA < 200 m ²)	0.2 spaces per 100 m ² of GFA
Toronto (Zoning By-law 569-2013): All Other Areas	1.5 spaces per 100 m ² of GFA (if 10,000 m ² > GFA > 200 m ²) 3 spaces per 100 m ² of GFA (if 20,000 m ² > GFA > 10,000 m ²) 6 spaces per 100 m ² of GFA (if GFA > 20,000 m ²) 0 spaces if GFA < OR = 200 m ²)	1.5 spaces per 100 m ² of GFA (personal services)	1.5 spaces per 100 m ² of GFA	3 spaces per 100 m ² of GFA (if 500 m ² > GFA > 200 m ²) 5 spaces per 100 m ² of GFA (if GFA > 500 m ²)	1 space per guest room
Waterloo (Zoning By-law 1108 (within C4 and C5 zones)	5 spaces per 100 m ² of Gross Retail Commercial Space (in zone C5)	4.5 spaces per 100 m ² of building floor area (personal services in zone C4) 5 spaces per 100 m ² of building floor area (personal services in zone C5)	3 spaces per 100 m ² of building floor area where office space is on ground floor) 1 space per 100 m ² of building floor area where office space is greater than 10 % but less than 50% of the total Gross Leasable Retail Commercial Space 3 spaces per 100 m ² of building floor area which the Office space is 50% or greater of the Gross Leasable Retail Commercial Space (in zone C5)	1 space per 4 seats 15 spaces per 100 m ² of building floor area (take-out) (in zone C4 where the total building floor area is < 1000 m ²)	1 space per guest room plus 5 spaces per 100 m ² of all other building floor area (in zone C5)

Municipality	Retail Uses	Service Uses	Office Uses	Restaurant Uses	Hotel Uses
Waterloo (Zoning By-law 1418) (within C4 and C5 zones)	5 spaces per 100 m ² of Gross Retail Commercial Space (in zone C5)	5 spaces per 100 m ² of building floor area (personal services in zone C5)	3 spaces per 100 m ² of building floor area where office space is on ground floor) 1 space per 100 m ² of building floor area where office space is greater than 10 % but less than 50% of the total Gross Leasable Retail Commercial Space 3 spaces per 100 m ² of building floor area which the Office space is 50% or greater of the Gross Leasable Retail Commercial Space (in zone C5)	1 space per 4 seats 15 spaces per 100 m ² of building floor area (take- out) (in zone C4 where the total building floor area is < 1000 m ²)	1 space per guest room plus 5 spaces per 100 m ² of all other building floor area (in zone C5)

Notes:

1. GLCFA = gross leasable commercial floor area.
2. City of Waterloo, C4= Commercial Zone 4, C5= Commercial Zone 5

11.2 PARKING MANAGEMENT STRATEGIES

The Clair-Maltby Secondary Plan area is the City's last unplanned greenfield area, currently undergoing a comprehensive planning process to establish policies to guide development towards the realization of an urban village – a sustainable community which provides a full range and mix of residential housing, commercial and employment uses.

One of the key guiding principles established within the Clair-Maltby Secondary Plan, includes the careful consideration of connections to other areas of the City. The ability to integrate the Clair-Maltby Secondary Plan area into adjacent neighbourhoods is reliant upon a multi-modal mobility network which provides alternative transportation choices and connections to other neighbourhoods, the Downtown and surrounding employment areas.

Key to the realization of this vision is the appropriate consideration and management of vehicular parking. Parking supply and demand are two (2) facets which influence transportation choice in new and emerging neighbourhoods. Establishing the parking requirements and understanding parking demands will encourage active transportation and transit use in multi-modal supportive communities and discourage unnecessary auto use.

In order for parking management strategies to be successful in guiding development, they must be applied in conjunction with other strategies. The purpose of this section is to outline a variety of strategies and discuss methods for implementation to affect both parking supply and demand.

11.2.1 Parking Management Strategies to Affect Supply

Development within the City of Guelph is governed by the in-force Zoning By-law, which outlines where development can happen, the number of parking spaces associated with the land use and the location of these parking spaces relative to the primary pedestrian accesses. It is important to understand that while municipal policies govern parking space provisions, the use of parking spaces inform the user experience with a proposed development. Societal perceptions and user experience regarding these parking facilities directly affect transportation choices.

11.2.1.1 Flexible Area Based Parking Standards

Land use and transportation need to be well integrated to ensure the success of a development plan. One of the driving components behind a successful transportation plan is the development of an appropriate land use plan which recognizes mixed-uses and land use compatibility. Land use adjacencies influence the transportation choices that are made by users to the site. Generally speaking, parking requirements have typically been established recognizing variables which affect the supply and demand (i.e. location and access to transit services, density of use, mixed land uses, population ages and abilities, car-share provisions, cycling facilities and infrastructure, and walkability).

Municipalities have established parking requirements which vary based upon land use adjacencies and the vision of growth for the area. The City of Guelph already recognizes the difference between areas and incorporates these within their Zoning By-law. The Downtown parking requirements, for example, have lower minimum ratios per unit type to encourage growth, the use of public parking facilities and transit services which are typically more prevalent and frequent in urban cores. By comparison, the in-force Zoning By-law outlines a different requirement for other areas of the City, recognizing the auto-oriented nature of some areas.

The Clair-Maltby Community Structure includes three (3) neighbourhood “theme” areas which will independently define the mix of land uses and residential character to meet the needs of residents and will also direct growth in an organized manner to support the proposed transit and natural heritage system connections.

1. Gordon Street Corridor

The Gordon Street Corridor, running in a north-south direction, forms the transit “spine” for the Clair-Maltby area and includes a mix of land uses and residential developments that will be developed with transit-supportive densities. Within the Clair-Maltby Secondary Plan area, the highest density will occur along this spine.

2. Urban Village Core

The Urban Village Core is the central focus of the Clair-Maltby secondary plan and includes the intersection of the Gordon Street corridor and the Main Street which runs in an east-west direction. The Core is intended to be pedestrian oriented with mixed-use buildings, high quality signature and landmark buildings.

3. Residential Neighbourhoods

There are eight (8) residential neighbourhoods where low and medium density residential uses will be directed. These neighbourhoods will be walkable, with each one anchored by a focal point (i.e. neighbourhood-scale mixed use development, commercial development, park or other community facility).

Parking requirements within these areas should be established recognizing the unique characteristics of each area. These nuances can help create a neighbourhood where residents, patrons and visitors prefer to live, work and play in. Ultimately, variations within parking requirements will affect transit use and travel mode choices.

Areas that are intended for higher density developments (i.e. Gordon Street Corridor and Urban Village Core) should have parking standards that encourage transit use and discourage non-essential parking. Limiting parking supply and offering viable transportation alternatives at the site ensures that other parking management strategies (i.e. shared parking, cash-in-lieu of parking, and consolidated parking) will also be effective at managing and mitigating parking demands as they arise.

Areas which are intended to be pedestrian oriented can also include locational requirements, in addition to the parking standards. The specification of location for parking provisions (i.e. to the rear of building or underground) also reinforces urban design principles and guidelines in developing the pedestrian realm.

11.2.1.2 Minimum and Maximum Parking Requirements

Minimum and maximum parking requirements control the amount of parking provided on a development site, based upon the type of use, the floor area or unit, and the standard being applied. Minimum parking standards outline the lowest number of parking spaces that must be provided from a municipality's perspective. A maximum parking standard outlines the highest number of parking spaces that are allowed to be located on a development site.

There are a variety of approaches which various municipalities have applied, depending on the nuances and characteristics that are specific and unique to them. Most commonly, minimum parking standards have been outlined within Zoning By-laws with some Zoning By-laws including maximum parking standards. The application of these standards can also be location specific (i.e. minimum and maximum parking standards along transit corridors) to influence the type of development and to encourage the use of active transportation modes.

Parking minimums are typically established based upon an understanding of the number of parking spaces that are considered to be necessary to enable the success of a development. However, as parking demands and traffic patterns shift and change over time, these minimum standards can become antiquated. For example, as transit services improve and traffic congestion increases, travel behaviour and associated mode choice shifts to more active modes (i.e. walking and cycling).

Maximum parking requirements have also been outlined within Zoning By-law regulations to limit the oversupply of parking which can occasionally occur for a number of reasons, including developer perceptions of parking and to fulfill certain tenant requirements. Parking maximums are not considered to be difficult to include within Zoning By-laws; however, the implication and impact of parking maximums should be considered with the decision to include or exclude them.

Use of parking maximums within transit corridors or transit station areas encourages use of alternative modes of transportation and the development of a public realm where pedestrians are prioritized. However, implementation of parking maximums should be carefully considered to avoid being overly restrictive – this could result in a potential spillover of parking into neighbourhoods or adjacent areas if it results in an undersupply.

It is recommended that the application of parking minimums and maximums be implemented with other parking management strategies to control parking demands in areas to encourage transit use and active transportation, densification and design policies to improve the public realm.

11.2.1.3 Shared Parking (Temporal Characteristics)

Consideration of shared parking opportunities is common and becoming more prevalent through Zoning By-law reviews. The concept of shared parking reflects the variations in usage levels of different land uses by time of day and day of week. Shared parking principles recognize that not all land uses will be at their peak parking demand at the same time throughout the day. This allows for the derivation of efficiencies in the overall parking supply requirements through a permissive sharing of a common pool of parking to support a range of planned uses at different times. The efficiency also unlocks development potential across the site by limiting the parking infrastructure to be built. Space that would have otherwise been utilized for parking can be re-allocated for building or program purposes.

The focus of a shared parking strategy within mixed-use development or master planned communities is to reduce the overall amount of parking infrastructure to be provided, which would allow for a mixed-use, multi-faceted proposals, such as the Clair-Maltby Secondary Plan area, to avoid, to the extent practical, the permanent and unnecessary allocation of parking to specific uses and users.

When considering the allocation of parking to certain uses given specific needs, the exclusive use and allocation of parking for some uses is appropriate, for instance, parking for residential uses (i.e. residents), given the usage patterns of such spaces and that parking spaces are privately and individually owned or rented.

Shared parking calculations utilize a range of “occupancy rates” that reflect the typical variation in parking demand over the course of a weekday or weekend (by hour). The occupancy rate is expressed as a percentage of the peak demand generated by a particular land use on a typical weekday or weekend day. These occupancy rates are recommended based upon industry resources and similar municipal by-laws that permit shared parking.

11.2.1.4 Parking Reduction Permissions

Municipalities are recognizing the impact of parking and its effect on changing travel behaviours. Parking reductions within Zoning By-laws or through the development approval process (i.e. Development Application Checklists) have become more prevalent recently.

Permissions for parking reductions can be implemented through physical infrastructure provisions stated within the Zoning By-law (i.e. City of Toronto permits parking reductions for extra bicycle parking spaces on-site, located in a conspicuous area) or with input from the municipality through a development application checklist which permits parking reductions in exchange for a variety of design improvements (i.e. City of Kitchener’s Development Application Checklist).

The inclusion of parking reduction permissions should be considered as they provide additional flexibility for the municipality to vary parking requirements and can result in urban design or program elements which also shift travel behaviour from auto usage to alternative modes.

11.2.1.5 Cash-in-Lieu

Cash-in-Lieu of parking is also known as payment-in-lieu of parking. This parking management strategy allows developers to seek a parking reduction (approved by Committee of Adjustment and City Staff) in exchange for a cost that is paid to the municipality. Cash-in-lieu of parking applications are evaluated on a project-by-project basis. The cost that is paid is typically associated with the cost of a parking space. The municipality then uses these funds to plan, operate or maintain a public parking facility which is intended to accommodate parking demands in the area.

Cash-in-lieu of parking is typically calculated on a per space basis and can be applied to residential or commercial land uses. It is noted that the municipality can outline tiers or levels where different formulae are applied based on the location. For example, the City of Toronto has specified a per space rate for areas of low transit service compared to a formula which accounts for land value within areas of higher density and transit accessibility (i.e. Downtown).

11.2.1.6 Consolidated Public Parking Facilities

Consolidation of private or public parking facilities provides a common pool of parking within an urban area which can be used by the general public. Public facilities are typically operated by the municipal parking authority and support underlying urban design principles by minimizing impacts of smaller individual parking lots through the consolidation of parking infrastructure into one structure or facility. It also encourages pedestrian activity through the area as parking is no longer located at a “front door”.

Consolidated public parking facilities inherently adhere to shared parking principles, recognizing that adjacent land uses will peak at varying times. For example, a parking facility within the downtown can accommodate business employees and visitors during the day and recreational facility users in the evening when businesses are closed. The surrounding land uses and proximity to activity centres, nodes or hubs must be considered when determining the appropriate location for a consolidated facility. Additionally, the parking pricing model must be considered to encourage use of the facility.

The City of Guelph can also consider longer-term impacts to land acquisition for a consolidated parking facility. As the area is developed, land values are likely to increase. The City could consider divesting the property at a later time or continue to provide public parking, allowing development in the area to provide a reduced parking supply. This however, would require further in-depth study.

11.2.1.7 On-Street Parking Permissions

Curbside space is often overlooked relative to its ability to accommodate a range of activity that would otherwise need dedicated space within a development site. While curbside is a physical infrastructure provision, it is also important to recognize that it is also a programmable space, which can be managed by the City of Guelph.

The functions of curbside space can contribute to the overall design and operations in the area, provided that there is enough pavement width for vehicular through movements. These programs can range from temporary events (i.e. parking space to a parkette in the summer) to pilot projects (i.e. signage permitting taxi ranks) and physical infrastructure provisions (i.e. EV charging stations).

Similar to consolidated public parking facilities, these spaces can also be managed by the municipality through signage or permits (i.e. 1 hour free parking in main corridors during certain periods of time or paid overnight visitor parking permits). These spaces, in fact, provide additional flexibility to accommodate parking demands – signage and operations can be changed based upon use.

The allowance of on-street parking capitalizes on the infrastructure that is built as part of the neighbourhood. It also provides additional parking spaces for the general public, to be utilized when land uses are at their peak. It also encourages better urban design and supports the pedestrian realm by providing a buffer to pedestrians from traffic and slowing down traffic speeds by activating the travel lane next to traffic and providing drivers with a visual cue to slow down.

11.2.2 Parking Management Strategies to Affect Demand

Parking demand can be influenced through a number of ways to change behaviour and perspectives towards non-single occupancy vehicle use or alternative modes of transportation. These strategies rely upon the implementation of parking management strategies / infrastructure which affect the supply. Changing travel behaviours and mindsets without the limiting parking supply will be near impossible if an easier alternative is ever present.

A key component in affecting parking demand is the implementation of a Transportation Demand Management (TDM) plan. TDM, as generally described below, includes a range of options both physical and operational, to influence these demands. Inclusion of TDM policies to support parking management will contribute significantly to the achievement of mobility goals outlined in the Clair-Maltby Secondary Plan.

11.2.2.1 Transportation Demand Management Plans

As specified in the previous section, Transportation Demand Management (TDM) strategies seek to increase the efficiency of a transportation system by influencing travel behaviour. This goal can be achieved through development of physical infrastructure or implementation of programs/operational measures. Often, a TDM or Mobility Plan can be required by municipalities as part of the development application process. This plan should outline the measures or programs to be implemented with the goal of reducing single occupancy vehicle use or shift travel behaviours to reduce congestion (i.e. encourage transit use, encourage bicycle use, etc). Implementation of TDM and Parking Strategies are most successful when implemented in conjunction with the other. The provision of TDM strategies encourages a shift to other modes of transportation and parking strategies often consider limiting or constraining the supply so that discretionary drivers are more likely to utilize other options.

11.2.2.2 Transit Oriented Development

Transit oriented development is a term which identifies areas where transit infrastructure or investment is located. It endeavours to leverage the transit investment through careful consideration of specific parking requirements for areas easily accessible by the BRT. The Gordon Street Corridor within the Clair-Maltby Secondary Plan area, is one example.

To ensure that developments around transit station areas are successful, municipalities have typically established policy guidelines with the goal of mixing complementary land uses, recognizing that these land uses are complementary to each other and provide a level of convenience where day-to-day activities can be accomplished without a vehicle.

Another method to ensure that transit oriented developments are successful, is the limitation of parking within areas easily accessible by the BRT. When the ability to use a vehicle is limited, transit use becomes a more attractive and viable option. Often, these policy guidelines also focus on design and include housing typologies to support a transit friendly development. Vehicle sharing programs (i.e. car-share) are also introduced to reduce overall vehicle ownership.

11.2.2.3 Car-Share

Car-sharing programs have evolved into common practice. The low-commitment and growing fleet size has created an alternative mode for automobile ownership and, in urban areas, further reduced the appeal of automobile use and person vehicle ownership. Car-share programs are becoming an increasingly relevant factor in the determination of minimum required parking standards. Where the private automobile ownership model requires a space for each user expected to own a car in a residential development, the car-share ownership model would only require a space for the number of users expected to use a car at the same time. Since the period of use does not necessarily overlap between users, more users are able to leverage the same parking space.

Car-share systems operate on a self-serve platform, where members may rent a vehicle from any car-share lot across the company's service area. Time-based user rates apply and a subscription to the service is generally based on a fixed membership fee. Car-share programs have become prevalent by locating vehicles within private developments or within municipal lots. This logistical dexterity enables program expansion. As vehicles become further dispersed and used increasingly, so too does the convenience and reliability for its users.

Car-share programs have been studied to understand their impact on vehicle ownership and to establish a standard that could be applied to developments which allow car-share to be located on-site. Review of car-share program impacts could be considered as a strategy to provide parking reductions.

For example, the City of Toronto permits a reduction of up to 4 vehicular parking spaces (net 3 spaces) for the provision of a car-share vehicle. This is based upon a study commissioned by the City (*Parking Standards Review: Examination of Potential Options and Impacts of Car Share Programs on Parking Standards, IBI Group, March 2009*) and is predicated on survey results which indicated the likelihood of a car owner to rely on a fleet vehicle instead of a personal vehicle, if the option were available.

Other municipalities have also recognized the positive impacts of car-share and the associated potential reduction of vehicular ownership. As such, an increasing number of municipalities are adopting car-share policies to encourage use of other modes of transportation, as summarized below in Table 13.

TABLE 13 MUNICIPALITIES WITH CAR-SHARE POLICIES

Municipality	Approval Mechanism	Policy Statement / Vehicular Allowance
City of Toronto	City Staff review	<p>For any apartment or condominium development, the minimum parking requirement should be reduced by up to 4 parking spaces for each dedicated car-share stall. The limit on this parking reduction is calculated as the greater of:</p> <ul style="list-style-type: none"> • 4 * (Total number of units / 60), rounded down to the nearest whole number; or • 1 space
City of Kitchener	Part of TDM Checklist	Commercial Uses: Provide car-share spaces equivalent to 2% of building occupants
Town of Newmarket	Recommendation for Urban Centres Secondary Plan	<p>For any apartment (freehold or condominium) development, the minimum parking requirement should be reduced by up to 3 parking spaces for each dedicated car-share stall. The limit on this parking reduction is calculated as the greater of:</p> <ul style="list-style-type: none"> • 4 * (Total number of units / 60), rounded down to the nearest whole number; or • 1 space
City of Richmond	Zoning By-law	<p>The minimum on-site parking requirements may be reduced by up to a maximum of 10% where:</p> <p>a) The City implements transportation demand management measures, including the use of car cooperatives, transit passes, private shuttles, carpools, or enhanced end-of-trip cycling facilities; and</p> <p>b) The minimum on-site parking requirements are substantiated by a parking study that is prepared by a registered professional engineer and is subject to review and approval of the City.</p>
City of Kelowna	Draft Policy Recommendation	Amend the parking and loading section of the Zoning By-law to provide a reduction of five parking spaces for every classic car-share vehicle and parking space provided to a maximum 10% of the total number of required spaces provided.

11.2.2.4 Improved Public Realm

Parking demands can be reduced as the user experience through a street or corridor improves. The easier or more pleasant the trip, the more likely it is that a member of the public would choose to walk or cycle instead of drive. There are varying methods to improve the public realm with most of these strategies typically outlined within an “Urban Design Guideline”.

These include consideration of the location of parking (i.e. towards the rear of the building instead of abutting a sidewalk), encouragement of underground parking facilities, screening of loading spaces and the location of visible, bicycle racks to encourage cycling use.

Amenities can range in costs as well from those easy to implement (i.e. benches, street furniture) to those that are higher in cost (i.e. transit plaza).

Establishing urban design principles that developments are required to adhere to will influence the overall corridor and area as buildings are built over time. It will also provide guidance towards the overall character of the neighbourhood and ensure that the vision for the area is achieved.

11.2.2.5 Unbundled Parking

Unbundled parking refers to the separation of the cost of a parking space with the rental or purchase price of a unit. When costs are not separated, the use of a vehicle is encouraged since the perception is that the unit comes with the parking space. However, if the costs were to be separated, this would ensure that owners or tenants are aware of the cost of parking. The pricing then affects trip making decisions by influencing whether or not a vehicle is needed / warranted over time. It can also encourage the exploration of other alternative modes or the use of car-share for the occasional trip where a vehicle is necessary.

Unbundled parking is a policy that can be suggested and implemented within a Secondary Plan. The concept should be discussed by municipal staff and developers to ensure that it is understood and properly implemented.

11.3 REVIEW & MONITORING

As part of the development of the Clair-Maltby Secondary Plan area, any implementation of parking management strategies should include review and monitoring of these strategies to understand their impacts on parking demand and supply. It is likely that parking demands will fluctuate and vary year to year as new residents move in, businesses change and transit services evolve to meet demands.

It is recommended that a review and monitoring plan be established to help provide flexibility to the City of Guelph as the area changes and matures. These reviews can be completed on an annual basis or every other year, depending on the progress of development. This will ensure that the necessary parking demands can be accommodated and provide information to help shift travel behaviour changes.

Future-proofing parking facilities are an important consideration as well, as buildings become more dynamic and the transportation landscape changes based upon technological advancements (i.e. Autonomous Vehicles). A further in-depth study to understand and maximize a structure's full potential and capability for adaptive re-use is also recommended.

11.4 SUMMARY OF PARKING MANAGEMENT STRATEGIES

Parking demands and supply can be managed through a combination of strategies implemented to guide overall development through the Clair-Maltby Secondary Plan area. This urban village is envisioned to be a walkable, sustainable development supported by a transit "spine" along Gordon Road.

BA Group's parking review and assessment includes a review of the in-force City of Guelph parking standards, a comparative review of other municipal parking standards, and various parking management strategies to affect both supply and demand.

We understand that parking demands will fluctuate and vary over time, as the Clair-Maltby Secondary Plan area develops and matures. The opportunities discussed and summarized in Table 14, in our opinion, form the basis for applicable parking policies to be considered for inclusion within the Clair-Maltby Zoning By-law. These policies will likely have the most impact and would be a significant, positive contribution towards the City's approach to parking management.

TABLE 14 OPPORTUNITIES FOR PARKING MANAGEMENT STRATEGIES

Strategy	Potential Impact	Implementation Tool / Partner
Flexible Area Based Parking Standards	<ul style="list-style-type: none"> Accounts for variability in parking standards based upon land use, proximity to transit and overall character of the neighbourhood 	Zoning By-law
Minimum and Maximum Parking Standards	<ul style="list-style-type: none"> Controls parking supply Limits overbuilding of parking within transit oriented areas 	Zoning By-law
Shared Parking	<ul style="list-style-type: none"> Recognizes efficiencies that could be made between complementary land uses Acknowledges that parking demands will peak at varying times 	Zoning By-law
Parking Reduction Permissions	<ul style="list-style-type: none"> Provides flexibility to the municipality to reduce parking supply based upon the provision of TDM measures or other vehicle ownership reduction measures 	Zoning By-law
Cash-in-Lieu of Parking	<ul style="list-style-type: none"> Reduces parking requirements on a case-by-case basis Provides municipality with funds to operate, manage and maintain public parking infrastructure 	Municipal Operations / Cash-in-Lieu Parking Policy
Consolidated Public Parking	<ul style="list-style-type: none"> Location of a common pool / supply of parking limits the impact of small individual parking lots Allows for better urban design and encourages pedestrian activity 	Municipal Operations / Private Sector
On-Street Parking	<ul style="list-style-type: none"> Flexibly increases parking supply Allows the municipality to operate paid parking / parking permits Utilizes existing infrastructure to accommodate temporary and temporal needs 	Municipal Operations
TDM Plan Requirement as part of Development Application	<ul style="list-style-type: none"> Encourages developer to think about ways to reduce parking and single occupancy travel Physical infrastructure and program elements contribute to the shift in overall travel behaviour 	Zoning By-law / Special Municipal Policy
Car-Share Parking Reductions	<ul style="list-style-type: none"> Provides an alternative to vehicle ownership 	Zoning By-law / Special Municipal Policy
Public Realm Improvements	<ul style="list-style-type: none"> Encourages active transportation within core areas Reduces overall vehicle use 	Urban Design Guidelines
Unbundled Parking	<ul style="list-style-type: none"> Allows for the real cost of parking to be distributed to those who use the facilities Reduces parking requirements 	Private Sector / Developer

12.0 TRAFFIC CALMING CONSIDERATIONS

12.1 COMMUNITY ROAD SAFETY STRATEGY

The Community Road Safety Strategy (CRSS) is a high-level road safety plan for the City of Guelph. The CRSS provides a range of holistic road safety measures, such as education campaigns, enforcement strategies and infrastructure modifications for roads that meet the thresholds for road safety measures set out in the Traffic Calming policy. As part of this project, the City also plans to update the Traffic Calming policy to address road safety concerns across Guelph in a fair and consistent way.

12.2 TRAFFIC CALMING OBJECTIVES

Community traffic calming strategies are primarily intended to address problems that include excessive speed, infiltration and congestion. It involves a range of measures, devices and techniques that include:

- Engineering - traffic control, speed limits, signs and markings, physical changes to the road.
- Education - speed monitoring, public information, 'Road Watch' type programs
- Enforcement - speed enforcement, turn restrictions, community safety zones

The ultimate goal of traffic calming is to increase the safety and liveability of the community by reducing speeding and excessive traffic volumes, while accommodating local traffic, transit and emergency vehicles. This objective is in keeping with the City of Guelph's own "Neighbourhood Traffic Management Policy", intended to outline the procedures for initiating, reviewing and implementing neighbourhood traffic management plans to address traffic safety concerns related to speeding and high volumes.

Managing motorist speeds supports active travel modes, and helps to ensure a right to safe mobility for those who are unable to use a vehicle or choose not to. It also prioritizes place and the livability of residents who live along a street over motorists who are 'passing through'.

12.3 TRAFFIC CALMING OPPORTUNITIES

The Clair-Maltby Secondary Plan area includes provisions for local schools, recreation facilities, and mixed-use retail areas. Although certain traffic calming strategies may be applicable for all new street segments within the Secondary Plan area, particular attention may be directed to street segments in adjacency to the aforementioned land uses, as well as other street segments where the propensity of vulnerable road users is more acute.

With regards to potential community traffic calming measures that might be implemented along segments of new local streets and collector streets planned as part of the Clair-Maltby Secondary Plan, it is generally recommended that a pro-active approach be taken so as to implement traffic calming in sequence with new development. This strategy establishes a degree of expectation for motorists and other road users, and ascertains the priority of pedestrians and cyclists within the prevailing urban design context.

Traffic calming measures are identified as Level I or Level II measures. Level I measures include minor changes to the roadway, that are generally lower cost and relatively straightforward, such as pavement markings, textures pavement / crossings and signage. Level II measures are generally more significant, more costly and require physical changes to the roadway. Some Level II examples include raised crosswalks, curb extensions, roundabouts and road closures.

THE FOLLOWING TABLES AND FIGURES IDENTIFY AND DESCRIBE A VARIETY TRAFFIC CALMING MEASURES THAT MAY BE APPROPRIATE FOR CERTAIN LOCAL STREET AND / OR COLLECTOR STREET SEGMENTS WITHIN THE CLAIR-MALTBY SECONDARY PLAN AREA. THEY TAKE INTO CONSIDERATION FACTORS SUCH AS ROAD WIDTH, RIGHT-OF-WAY AVAILABILITY, PROXIMITY TO SCHOOLS, AND STREET PARKING PROVISIONS. POTENTIAL LEVEL I TRAFFIC CALMING MEASURES ARE IDENTIFIED IN

Table 15, while several Level II measures are identified in Table 16. Conceptual and basic curb extension and median design examples are also provided in Figure 17, and would need to be designed in detail to reflect intersection traffic control, pedestrian crossing facilities, accommodation of specific vehicles, and street context. In addition to the potential measures summarized below, the “Canadian Guide to Neighbourhood Traffic Calming” lists 25 traffic calming measures available for consideration

FIGURE 17 TYPICAL CURB EXTENSIONS AND CENTER MEDIAN

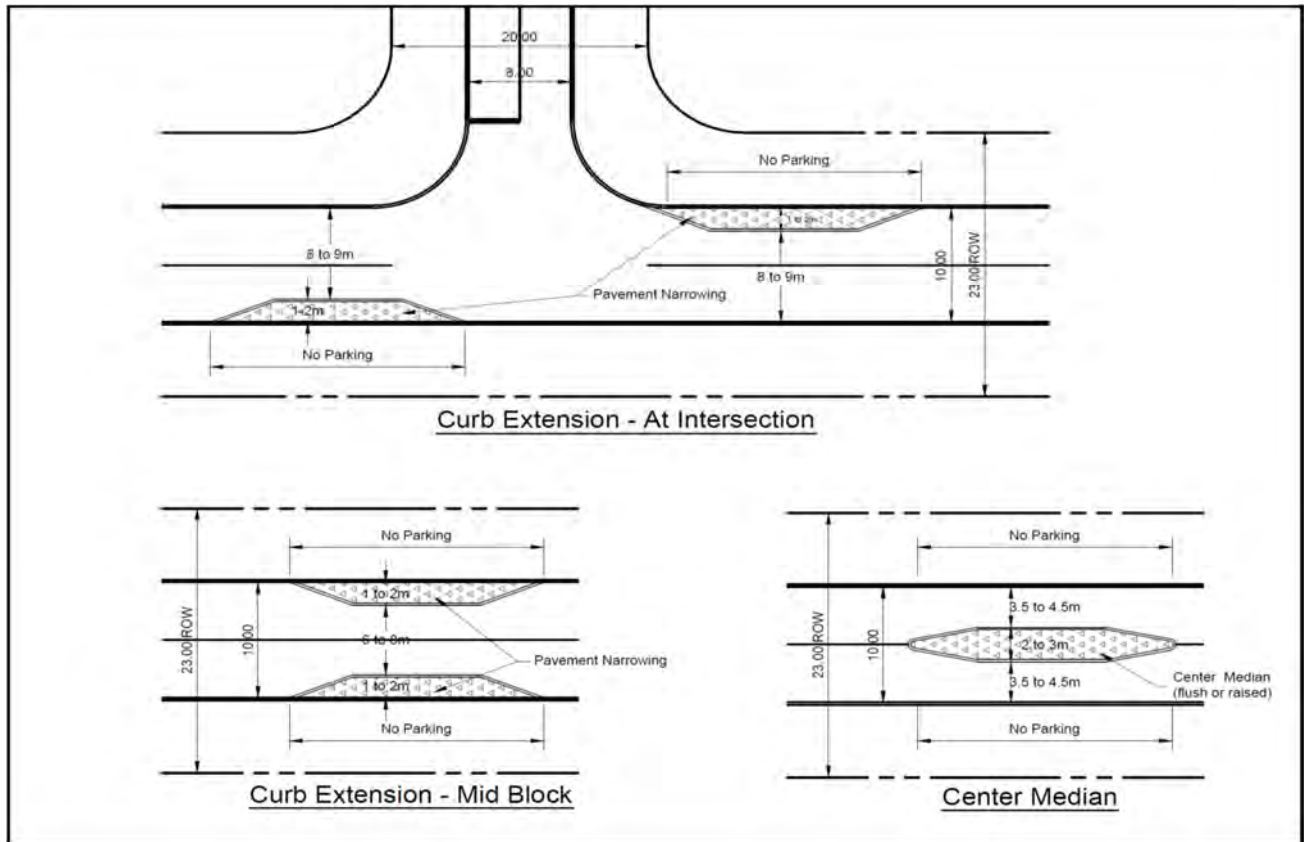


TABLE 15 LEVEL I TRAFFIC CALMING MEASURING

Mitigation Measure	Description	Implementation
Traffic Control Signage and Pavement Markings	Relatively inexpensive and easy to implement, but is not an enforcement tool in its own right.	
Through Traffic / Turn Traffic Restrictions	Regulatory control measure that restricts specific traffic movements at intersections.	<p>Certain movements could be restricted during peak travel periods.</p> <p>Good level of compliance even without direct enforcement.</p> <p>Disadvantage is that restrictions generally conflict with legitimate school or local-based trips into and out of specified areas.</p> <p>Implementation can be done at any time.</p>
Pavement Markings / Lane Narrowing	Pavement markings can be implemented that visually 'narrow' the traffic lane width in order to reduce speeds.	<p>Pavement widths could be painted to formally define parking lanes or traffic lanes.</p> <p>Implementation can be done at any time.</p>

TABLE 16 LEVEL II TRAFFIC CALMING MEASURING

Mitigation Measure	Description	Implementation
Physical Measures	Generally a more expensive option that entails engineering and reconfiguring the road to implement physical changes that lead to reduced speeds and traffic volumes.	
Median Islands (Flush or Raised)	<p>Medians can be implemented to narrow the width travel lanes with the goal to reduce speeds.</p> <p>Medians can also be implemented in conjunction with pedestrian crossing facilities to allow for reduced pedestrian crossing distances.</p>	<p>A 1.5m to 2.5m wide median can allow for 3.0m to 3.5m travel lanes on either side within a local street context.</p> <p>Disadvantage would be loss of on-street parking and possible restricted access to driveways.</p> <p>Raised medians may be too restrictive for emergency, transit, and / or maintenance vehicles.</p>
Curb Extensions	<p>A horizontal extrusion of the curb into the roadway with the effect of reducing the travel width and reduce speeds.</p> <p>Additional benefits of intersection curb extensions relates to reducing pedestrian crossing distances and increasing pedestrian visibility.</p>	<p>Minimum street width adjacent to an intersection (throat width) opening of 6.0m with a wider opening at intersections to accommodate turning vehicles.</p> <p>Disadvantage would be loss of on-street parking</p> <p>Curb extensions may be too restrictive for certain transit, and / or maintenance vehicles.</p>
Roundabout / Traffic Circle	<p>A road junction in which traffic streams circulate around a central island.</p> <p>Roundabouts are intended to reduce vehicle speeds and reduce vehicle conflicts by virtue of their design.</p>	<p>Provide for continuous, managed-speed vehicle flow, lower vehicle emissions, and do not require traffic signal infrastructure.</p> <p>Roundabouts require more land than a typical intersection, which makes it difficult to retrofit into an existing urban built form.</p> <p>Some jurisdictions have taken the position that roundabouts should not be placed in proximity to school sites due to concerns related to pedestrian crossing facilities.</p> <p>Certain transit authorities have commented that they generally do not support the inclusion of traffic circles or roundabouts on collector roads designated as transit routes for a number of operational and customer service reasons.</p>
Raised Intersection (with All-Way Stop Control)	A speed control device that consists of a raised section of roadway that cause drivers to slow down, prior to and as the cross over them.	<p>Appropriate use is at a limited number of key intersections in the vicinity of schools where there are a substantial number students crossing the road</p> <p>All-way Stop control is not a recommended method for speed control, and is not supported by the City's "Neighbourhood Traffic Management Policy"</p>
Speed Humps	A speed control device that consists of raised sections of roadway that cause drivers to slow down, prior to and as the cross over them.	<p>Effective tool to slow vehicle speeds.</p> <p>Disadvantages include delay to emergency services and transit, and general inconvenience for local road users.</p>

12.4 MONITORING AND CONSULTATION

Many communities manage a Neighbourhood Traffic Monitoring program that reviews and identifies municipal streets that may qualify for traffic calming and management measures. These programs specifically tend to monitor the level of traffic infiltration (i.e. through traffic not local to the area), overall traffic volumes, traffic speeds, and the volume of pedestrians and cyclists.

If there are any expressed concerns from the community as it relates to traffic during or after solutions are implemented, further mitigation measures are then typically pursued by the municipality through this type of program.

Consultation with the various City stakeholders including Emergency Services, Guelph Transit, and Transportation Engineering is essential in reviewing and approving any mitigation solution. Community involvement is also a key part in determining the type of measures, if any, that should be implemented. The public is to be advised and allowed to offer feedback, comments and participate in the process through public meetings or working groups.

The City of Guelph's "Neighbourhood Traffic Management Policy" further identifies monitoring principles that specify the undertaking of a follow-up review after implementation of any specific traffic management measures. A review includes a comparison of traffic volumes, speed data, collision data, and feedback from emergency services, residents and other stakeholders.

13.0 MULTI-MODAL TRAVEL FORECASTING

The Clair-Maltby Secondary Plan area is located at the southern extent of the City of Guelph within a greenfield development area. As part of this study BA Group has established travel demand forecasts for auto-based and non-auto-based trips for the Secondary Plan area, understanding the travel characteristics in the southern portions of the City of Guelph, and travel behaviour associated with other new development areas in the Greater Toronto and Hamilton area that exhibit contemporary planning methods. Further details are provided in the following sections.

13.1 APPROACH AND BASELINE PARAMETERS

Travel demand forecasts have been developed for residential and office land uses, understanding that new development is anticipated to be prominently residential, and that other retail and mixed-use development would result in relatively small travel demands, would often be internal to the Secondary Plan area, and could be considered ancillary to overall development travel demands.

Travel demand forecasts for residential and office land uses have been developed by applying traffic generation rates as derived from the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition*, and factoring prevailing non-automobile trips based on selected travel mode splits anticipated for residential and office development in the Secondary Plan area. Modal split information has been obtained from the Transportation Tomorrow Survey (TTS) while total traffic generation rates and direction of travel has been obtained from information provided in the ITE Trip Generation Manual (10th Edition).

Travel demand forecasts for the Clair-Maltby Secondary Plan area development have been developed to reflect pedestrian, cycling and transit usage that is reflective of the existing travel characteristics of the area, and to the extent that transit services and active transportation infrastructure is pursued as part of the Secondary Plan. The addition of mixed-use zones within the Clair-Maltby Secondary Plan area further supports sustainable and short trip making, particular during weekday peak travel periods, and is considered in travel demand forecasting in mixed-use development zones.

13.2 MODE SHARE ASSUMPTIONS

For the purpose of this analysis, travel demands to and from the Clair-Maltby Secondary Plan area have been developed for residential and office land uses by applying modal share information, which is based on a review of data retrieved from the 2016 Transportation Tomorrow Survey (TTS). A combination of study area travel information, and proxy development information was utilized in selecting an appropriate travel mode split for Secondary Plan residential development.

13.2.1 Resident-Based Trips – South Guelph

For the purposes of this analysis, future Clair-Maltby Secondary Plan resident-related trips are assumed, conservatively, to have mode shares similar to the existing condition. Existing resident-related mode share for weekday morning and weekday afternoon peak periods in the southern portions of the City of Guelph are summarized in Table 17.

TABLE 17 RESIDENT-RELATED TRIPS: TRAVEL MODE SPLITS

Travel Mode	Weekday Morning Peak Hour		Weekday Afternoon Peak Hour	
	<i>Inbound</i>	<i>Outbound</i>	<i>Inbound</i>	<i>Outbound</i>
Auto Driver ⁴	83%	65%	75%	64%
Auto Passenger ⁵	2%	8%	9%	32%
Transit	5%	9%	10%	4%
Walk	10%	5%	1%	0%
Cycle	0%	3%	2%	0%
Other ⁶	0%	10%	3%	0%

Notes:

Notes:

1. Based on 2016 TTS results for morning (7:00 a.m. – 9:00 a.m.) and afternoon (4:00 p.m. – 6:00 p.m.) peak traffic periods.
2. Statistics specific to 2006 GTA Zones 8062, 8064, 8067-8076, and 8078-8081. TTS data included in **Appendix E**. ¹ 2016 TTS data was used to determine existing mode split for home-based trips during the morning and afternoon peak hours in the vicinity of the Secondary Plan area. The selected study area (proxy zone) is bounded generally by Kortnight Road to the north, Clair Road to the south, Victoria Road to the east and Preservation Park to the west).
3. Trips represent an expanded value based on a sample of persons surveyed in the study area.
4. Auto driver trips (includes auto drivers and motorcycles).
5. Auto passenger trips (includes auto passenger trips only).
6. Other trips include school bus and taxi trips, consistent with The City's model document.

For key outbound trips during the weekday morning peak travel period and inbound trips during the weekday afternoon peak travel period, approximately 65% to 75% of resident-related trips are undertaken as an auto drivers, 8% to 9% are undertaken as an auto passenger, and 9% to 10% are undertaken by transit. The remaining proportion of priority outbound trips in the morning and inbound trips in the afternoon, are undertaken by walking, cycling and other modes (i.e. taxi and school bus).

For the purposes of this study, existing travel mode share in the southern portions of the City of Guelph (as summarized in Table 17) are compared with other proxy area developments that are summarized in the following.

13.2.2 Resident-Based Trips – Proxy Development Areas

A number of proxy development areas were reviewed using 2016 TTS data to understand general mode split for resident-related travel. A total of three (3) development areas were reviewed, all of which comprise relatively recent construction and best practices in planning, and include:

- (i) Cornell in Markham, Ontario;
- (ii) Oak Park (Uptown Core) in Oakville, Ontario; and
- (iii) Orchard Park in Burlington, Ontario.

The Clair-Maltby Secondary Plan is located within a similar suburban land use and transportation context as the proxy development areas chosen, and would be anticipated to exhibit similar transportation behaviour given the anticipated level of transit services provided within the secondary plan area, the land uses and residential density mixes proposed, and the greenfield development context. All proxy development areas generally adhere to contemporary planning design principles, and are relatively recent greenfield residential

developments, are provided basic transit service provisions, and are located near the edge of the built-up areas of municipalities in the Greater Toronto and Hamilton area.

TTS data was reviewed for the 2016 survey year, to understand resident-related travel mode split in the inbound and outbound directions during weekday peak travel periods. Data was also summarized based on the type of residential dwelling unit (house, townhouse, or apartment). Noted in the TTS survey data, amongst the proxy development areas reviewed, is that there is no sustained difference in travel mode split between low-density and medium to high-density residential development. Proxy development area travel mode split data is included in **Appendix F**.

An average mode split for inbound and outbound resident-related travel during weekday peak travel periods, amongst the proxy development areas reviewed, is summarized in Table 18.

TABLE 18 RESIDENT-RELATED TRIPS: PROXY DEVELOPMENT AREA AVERAGE MODE SPLITS

Travel Mode	Weekday Morning Peak Hour		Weekday Afternoon Peak Hour	
	<i>Inbound</i>	<i>Outbound</i>	<i>Inbound</i>	<i>Outbound</i>
Auto Driver ⁴	86%	60%	72%	65%
Auto Passenger ⁵	1%	15%	10%	26%
Transit	0%	10%	13%	5%
Walk	13%	9%	2%	3%
Cycle	0%	1%	1%	1%
Other ⁶	0%	6%	2%	0%

Notes:

1. Based on 2016 TTS results for morning (7:00 a.m. – 9:00 a.m.) and afternoon (4:00 p.m. – 6:00 p.m.) peak traffic periods.
2. Statistics specific to 2006 GTA Zones associated with the identified proxy development areas. TTS data included in **Appendix F**.
3. Trips represent an expanded value based on a sample of persons surveyed in the study area.
4. Auto driver trips (includes auto drivers and motorcycles).
5. Auto passenger trips (includes auto passenger trips only).
6. Other trips include school bus and taxi trips, consistent with The City’s model document.

Overall travel mode splits for the proxy development areas are generally shown to be similar to travel mode splits observed for the southern portions of the City of Guelph (as summarized in Table 17).

On average, for key outbound trips during the weekday morning peak travel period, approximately 60% resident-related trips are undertaken as an auto drivers, 15% are undertaken as an auto passenger, 10% are undertaken by transit, 9% are undertaken by walking and 1% are undertaken by cycling. The remaining proportion of priority outbound trips in the morning are undertaken by other modes (i.e. taxi and school bus). For key inbound trips during the weekday afternoon peak travel period, on average, approximately 72% of resident-related trips are undertaken as an auto drivers, 10% are undertaken as an auto passenger, 13% are undertaken by transit, 2% are undertaken by walking and 1% are undertaken by cycling. The remaining proportion of priority inbound trips in the afternoon are undertaken by other modes (i.e. taxi and school bus).

13.2.3 Employee (Office)-Based Trips – South Guelph

Clair-Maltby Secondary Plan area employee-related trips are assumed, conservatively, to have mode shares similar to the existing conditions in the southern portions of the City of Guelph. Existing employee-related mode share for weekday morning and weekday afternoon peak periods in the southern portions of the City of Guelph are summarized in Table 17.

TABLE 19 EMPLOYEE-RELATED TRIPS: TRAVEL MODE SPLITS

Travel Mode	Weekday Morning Peak Hour	Weekday Afternoon Peak Hour
	<i>Inbound</i>	<i>Outbound</i>
Auto Driver ⁴	93%	86%
Auto Passenger ⁵	0%	4%
Transit	3%	6%
Walk	2%	4%
Cycle	2%	0%

Notes:

1. Based on 2016 TTS results for morning (6:00 a.m. – 9:00 a.m.) and afternoon (3:00 p.m. – 6:00 p.m.) peak traffic periods.
2. Statistics specific to 2006 GTA Zones 8062, 8064, 8067-8076, and 8078-8081. TTS data included in **Appendix G**.
3. Trips represent an expanded value based on a sample of persons surveyed in the study area.
4. Auto driver trips (includes auto drivers and motorcycles).
5. Auto passenger trips (includes auto passenger trips only).-

For key inbound trips during the weekday morning peak travel period and outbound trips during the weekday afternoon peak travel period, approximately 90% to 93% of employee-related trips are undertaken as an auto driver or passenger, and 3% to 6% are undertaken by transit. The remaining proportion of priority inbound trips in the morning and outbound trips in the afternoon, are undertaken by walking and cycling (in the order of 4%).

13.3 SECONDARY PLAN MULTI-MODAL TRAVEL DEMAND FORECASTS

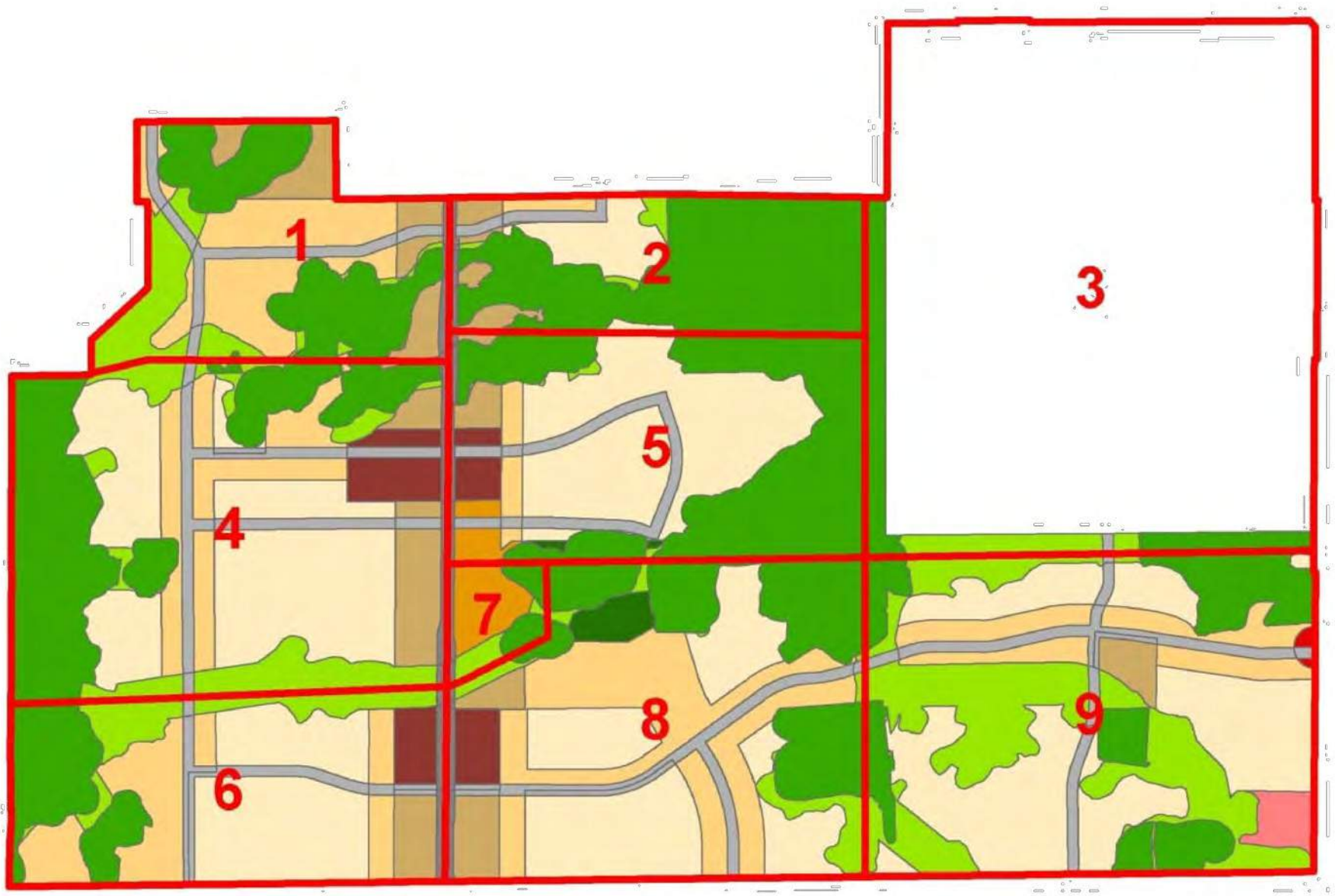
Travel demands for development anticipated within the Secondary Plan area are summarized in the following, and have been developed based on the most conservative (highest density) assumptions outlined in the “Land Development Budget” prepared by the project team – dated August 27, 2018. For the purposes of the analysis herein, a total of 10,125 residential units and 333 jobs were assessed.

Travel demands are developed for nine (9) individual “Traffic Zones” that comprise the Secondary Plan area, to provide appropriately-sized areas to assign travel demands on the area transportation network and assess the overall transportation impacts of Secondary Plan development.

Traffic zones were established based for segmented areas within the overall Preferred Community Structure Plan, and generally comprise zones east and west of Gordon Street. Travel demands for each zone are forecast and assigned individually on the area transportation network.

The nine identified Clair-Maltby Secondary Plan Traffic Zones are illustrated Figure 18.

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SECONDARY PLAN AREA TRAFFIC ZONES

13.3.1 Selected Mode Splits

As previously noted, Clair-Maltby Secondary Plan area travel demands have been developed for residential and office land uses by applying modal share information derived from the south Guelph area and the selected proxy development areas. A “selected” mode split was utilized for the purposes of forecasting Clair-Maltby Secondary Plan development traffic, and then forecasting multi-modal (non-traffic) trips.

The “selected” travel mode split is informed by the travel mode split characteristics summarized in Section 13.2, and would be considered achievable given reasonable expansion of transit services into the Clair-Maltby Secondary Plan area, the development of a comprehensive cycling network as identified in the Preferred Community Structure, and the extent of mixed-use land development contemplated. The selected travel mode splits generally reflect a higher degree of transit use and active transportation travel relative to what is currently observed in the south portions of the City of Guelph, and results in a lower degree of automobile use relative to other areas of the City.

The “selected” travel mode split for new development associated with the Clair-Maltby Secondary Plan, for resident-related and employee-related travel during weekday morning and afternoon peak hours, is summarized in Table 20

TABLE 20 SELECTED CLAIR-MALTBY SECONDARY PLAN TRAVEL MODE SPLITS

Travel Mode	Weekday Morning Peak Hour		Weekday Afternoon Peak Hour	
	<i>Inbound</i>	<i>Outbound</i>	<i>Inbound</i>	<i>Outbound</i>
<i>Resident Travel</i>				
Auto Driver ¹	85%	60%	72%	65%
Auto Passenger ²	2%	10%	10%	25%
Transit	5%	10%	10%	5%
Walk	8%	10%	3%	3%
Cycle	0%	3%	2%	2%
Other ³	0%	7%	3%	0%
<i>Employee Travel ⁴</i>				
Auto Driver ¹	90%		90%	
Auto Passenger ²	2%		2%	
Transit	4%		4%	
Walk	2%		2%	
Cycle	2%		2%	

Notes:

1. Auto driver trips (includes auto drivers and motorcycles).
2. Auto passenger trips (includes auto passenger trips only).
3. Other trips include school bus and taxi trips, consistent with The City’s model document.
4. Employee-based mode share is summarized for the key inbound movement during the weekday morning peak period, and the key outbound movement during the weekday afternoon peak hour.

13.3.2 Traffic Forecasts

Residential and office employee traffic forecasts for the Clair-Maltby Secondary Plan have been developed using Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition) traffic generation rates, combined with TTS data on residential and employee travel characteristics in the vicinity of the Secondary Plan area¹.

Residential Traffic Volumes

For residential related traffic volumes, ITE Trip Generation Manual traffic generation rates were derived for Single-Family Detached Housing (ITE Code 210) and applied to low-density housing; for Multi-Family Housing - Mid-Rise (ITE Code 221) and applied to medium density housing; and Multi-Family Housing – High-Rise (ITE Code 222) and applied to high-density housing. In all instances, traffic generation is based on:

- the proposed number of units for each housing type (trips / unit);
- reflects peak travel periods adjacent to the generator of traffic; and
- derived from ITE data reflecting general urban / suburban contexts.

A fitted-curve equation (rather than average) trip generation rate was utilized and applied to development contemplated for each individual traffic zone.

Office Traffic Volumes

For office related traffic volumes, ITE Trip Generation Manual traffic generation rates were derived for General Office (ITE Code 710) and applied to traffic zones with anticipated office-related employment. Office traffic generation is based on:

- the anticipated number of employees (trips / employee);
- reflects peak travel periods adjacent to the generator of traffic; and
- derived from ITE data reflecting general urban / suburban contexts.

A fitted-curve equation (rather than average) trip generation rate was utilized and applied to employment contemplated for each individual traffic zone.

Retail and Mixed-Use Traffic Volumes

Retail and mixed-use development is anticipated to result in relatively small amounts of “external” traffic, would often be internal to the Secondary Plan area, and could be considered ancillary to overall development travel demands. As such, traffic demands are not forecast for retail uses contemplated as part of mixed-use.

¹ 2016 TTS data was used to determine existing mode split for home-based trips during the morning and afternoon peak hours in the vicinity of the Secondary Plan area. The selected study area (proxy zone) is bounded generally by Kortnight Road to the north, Clair Road to the south, Victoria Road to the east and Preservation Park to the west).

Overall Traffic Volumes

ITE Trip Generation Manual traffic generation rates are factored for the selected travel mode splits, as summarized in Section 13.3.1. Traffic generation rates are factored from an assumed 95% auto mode share to a more appropriate level of automobile use for residential trips: 75% during the weekday morning peak hour, and 85% during the weekday afternoon peak hour. Given that employee-related trips currently are in the order of 90% to 95% undertaken by automobile, traffic generation rates are not factored for greater non-auto use for work-related trips.

Forecast residential and office traffic volumes for each traffic zone in the Clair-Maltby Secondary Plan area are summarized in Table 21.

Assuming the most conservative land use budget comprising 10,125 residential units and 333 employment positions, provided for the purposes of this analysis, the Clair-Maltby Secondary Plan would be anticipated to generate in the order of 3,350 and 4,700 two-way traffic trips during the weekday morning and weekday afternoon peak hours, respectively. The resulting vehicle trip rates are 0.33 trips per unit during the weekday morning peak hour, and 0.46 trips per unit in the weekday afternoon peak hour.

TABLE 21 CLAIR-MALTY TRAFFIC GENERATION SUMMARY

Land Use	Units / Employees	AM Peak Hour			PM Peak Hour		
		In	Out	2-Way	In	Out	2-Way
<i>Traffic Zone 1</i>							
Medium density residential	492 units	33	96	129	111	72	183
High density residential	804 units	45	143	188	154	98	252
Total (rounded to nearest 5):	80 units	80	240	315	265	170	435
<i>Traffic Zone 2</i>							
Low density residential	56 units	9	27	36	33	19	52
Medium density residential	44 units	3	9	12	11	7	18
High density residential	284 units	17	55	73	57	37	94
Total (rounded to nearest 5):	384 units	30	90	120	100	65	165
<i>Traffic Zone 3</i>							
n/a							
<i>Traffic Zone 4</i>							
Low density residential	584 units	83	248	331	311	183	495
Medium density residential	659 units	44	127	171	148	95	242
High density residential	1,113 units	62	195	257	211	135	346
Total (rounded to nearest 5):	2,356 units	190	570	760	670	415	1,085

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Traffic Zone 5							
Low density residential	441 units	63	188	251	238	140	378
Medium density residential	120 units	9	24	32	29	19	47
High density residential	373 units	22	70	92	73	47	121
Office	114 emp.	44	9	53	11	43	54
Total (rounded to nearest 5):	934 units; 114 emp.	140	290	430	350	250	600
Traffic Zone 6							
Low density residential	294 units	43	126	169	161	95	256
Medium density residential	743 units	50	143	193	166	106	272
High density residential	516 units	30	94	124	100	64	164
Total (rounded to nearest 5):	1,553 units	125	365	485	425	265	690
Traffic Zone 7							
Office	219 emp.	71	14	85	17	66	83
Traffic Zone 8							
Low density residential	114 units	17	51	68	64	38	103
Medium density residential	1,309 units	88	249	336	385	183	468
High density residential	719 units	40	129	167	138	89	226
Total (rounded to nearest 5):	2,142 units	145	430	570	585	310	795
Traffic Zone 9							
Low density residential	663 units	94	282	376	352	207	558
Medium density residential	558 units	38	108	146	126	81	207
High density residential	239 units	15	48	63	49	31	81
Total (rounded to nearest 5):	1,460 units	145	440	585	525	320	845
Clair-Maltby Secondary Plan Maximum Density Scenario							
Low density residential	2,152 units	310	920	1,230	1,160	680	1,840
Medium density residential	3,925 units	265	755	1,020	975	565	1,435
High density residential	4,048 units	230	735	965	780	500	1,285
Office	333 emp.	115	25	140	30	110	135
Total (rounded to nearest 5):	10,125 units; 333 emp	925	2,440	3,350	2,935	1,860	4,700

Notes:

1. Residential unit and employee positions derived from "Clair-Maltby Secondary Plan Study Area Population and Employment": August 27, 2018. For the purposes of the analysis herein, maximum density allocations are assumed.
2. Total trips rounded to nearest 5.

13.3.3 Multi-Modal Forecasts

A proportion of residential and office travel to / from the Secondary Plan area will be made by sustainable transportation modes – including transit, walking and cycling. The uptake of transit and active transportation modes for residents, employees and visitors of the Secondary Plan area is anticipated to reflect the existing transportation context and travel behaviour present in the southern portions of the City of Guelph and other similar proxy development areas (as summarized in Section 13.2.2).

Multi-modal travel forecasts are derived by factoring forecast traffic volumes for selected mode splits. Transit and active transportation trips are estimated for each established Traffic Zone, so as to appropriately assign trips on the local transportation network, and understand the extent of travel demands for specific sections of the Secondary Plan area.

Forecast multi-modal travel demand for residential and office trips to / from the Secondary Plan area during the weekday morning and weekday afternoon peak hours is summarized in Table 21. Auto driver, auto passenger, transit, and active transportation trips are summarized, while “other” trips (i.e. school bus and taxi) are not included in the following summary.

Detailed calculations for multi-modal travel demands, including associated person trip generation rates, are attached in **Appendix H**.

TABLE 22 CLAIR-MALTY MULTI-MODAL TRAVEL DEMAND SUMMARY

Travel Mode	Units / Employees	AM Peak Hour			PM Peak Hour		
		In	Out	2-Way	In	Out	2-Way
Traffic Zone 1							
Auto Driver Trips (Traffic)	1,296 units	80	240	315	265	170	435
Auto Passenger Trips		0	40	40	35	65	100
Transit Trips		5	40	45	35	15	50
Active Trips		10	50	60	20	15	35
Total Trips:		95	400	495	370	260	630
Traffic Zone 2							
Auto Driver Trips (Traffic)	384 units	30	90	120	100	65	165
Auto Passenger Trips		0	15	15	15	25	40
Transit Trips		0	15	15	15	5	20
Active Trips		5	20	25	5	5	100
Total Trips:		35	150	185	140	100	240
Traffic Zone 3							
n/a							
Traffic Zone 4							
Auto Driver Trips (Traffic)	2,356 units	190	570	760	670	415	1,085
Auto Passenger Trips		5	95	100	95	160	255
Transit Trips		10	95	105	95	30	125
Active Trips		20	125	145	45	30	75
Total Trips:		225	950	1,175	930	640	1,570
Traffic Zone 5							
Auto Driver Trips (Traffic)	934 units; 114 employees.	140	290	430	350	250	600
Auto Passenger Trips		0	45	45	45	80	125
Transit Trips		10	45	55	45	25	70
Active Trips		10	60	70	25	20	45
Total Trips:		165	480	645	485	385	870
Traffic Zone 6							
Auto Driver Trips (Traffic)	1,553 units	125	365	485	425	265	690
Auto Passenger Trips		5	60	65	60	105	165
Transit Trips		5	60	65	60	20	80
Active Trips		10	80	90	30	20	50
Total Trips:		145	610	755	590	410	1,000

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Traffic Zone 7							
Auto Driver Trips (Traffic)	219 employees	70	15	85	15	65	80
Auto Passenger Trips		0	0	0	0	0	0
Transit Trips		5	0	5	0	5	5
Active Trips		5	0	5	0	5	5
Total Trips:		80	15	95	15	75	90
Traffic Zone 8							
Auto Driver Trips (Traffic)	2,142 units	145	430	570	585	310	795
Auto Passenger Trips		5	70	75	80	120	200
Transit Trips		10	70	80	80	25	105
Active Trips		15	95	110	40	25	65
Total Trips:		170	715	885	815	475	1,290
Traffic Zone 9							
Auto Driver Trips (Traffic)	1,460 units	145	440	585	525	320	845
Auto Passenger Trips		5	75	80	75	125	200
Transit Trips		10	75	85	75	25	100
Active Trips		15	95	110	35	25	60
Total Trips:		170	735	905	730	490	1,220
Clair-Maltby Secondary Plan Maximum Density Scenario Travel Demands							
Auto Driver Trips (Traffic)	10,125 units; 333 employees	925	2,440	3,350	2,935	1,860	4,700
Auto Passenger Trips		20	400	420	405	680	1,085
Transit Trips		55	400	455	405	150	555
Active Trips		90	525	615	200	145	345
Total Trips:		1,090	4,065	5,155	4,075	2,860	6,935

Notes:

1. Residential unit and employee positions derived from "Clair-Maltby Secondary Plan Study Area Population and Employment": August 27, 2018. For the purposes of the analysis herein, maximum density allocations are assumed.
2. Trips rounded to nearest 5.

Assuming the most conservative land use budget comprising 10,125 residential units and 333 employee positions, provided for the purposes of this analysis, the Clair-Maltby Secondary Plan would be anticipated to result in the order of 5,155 and 6,935 two-way trips during the weekday morning and weekday afternoon peak hours, respectively. Total trips include those trips that utilize "other" travel modes, including those using school buses, taxis, or ride-share services, despite these travel modes not being explicitly identified in the above summary.

Overall, approximately 3,770 and 5,785 two-way person trips are anticipated to be undertaken in a personal vehicle (as a driver or passenger), comprising approximately 73% to 83% of all trips during weekday morning and afternoon peak hours. In the order of 455 and 555 two-way person trips are anticipated to be undertaken as a transit rider, comprising approximately 8% of all trips during weekday peak hours. Comparatively, in the order of 615 and 345 two-way person trips are anticipated to be undertaken as a pedestrian or cyclists during the weekday morning and afternoon peak hours, respectively, comprising approximately 12% and 5% of all trips during the respective weekday peak hours.

14.0 TRANSIT ASSESSMENT

14.1 AREA TRANSIT CONTEXT

14.1.1 Existing Context

The Secondary Plan area is not currently served by local or regional transit. Generally, the area transit network is limited to Guelph Transit local bus services operating along and north of Clair Road. GO Transit regional bus services route along Gordon Street within the Secondary Plan, but do not service the area.

14.1.2 Planned Transit Improvements

This transit assessment considers improved transit provisions within the planning horizon (year 2031) of this study, including potential new bus services routing along Secondary Plan arterial and collector streets.

The “Moving Guelph Forward” Transit Plan describes recommended service changes and future measures that are intended to increase ridership and achieve a 15% transit mode share – consistent with policy objectives of OPA 48 and the Guelph – Wellington Transportation Study. Implemented service improvements, in the vicinity of the Clair-Maltby Secondary Plan area include minor alterations to the #5 Clair and #56 Victoria Express bus routes, which will potentially be altered again given the development of the Clair-Maltby precinct.

It is anticipated that the local transit network will continue to evolve in sequence with development of the Secondary Plan area, and as part of on-going service reviews conducted by Guelph Transit. The Preferred Community Structure Plan has been advanced anticipating the introduction of frequent transit provisions on Gordon Street between Clair Road and Maltby Road, and the option for additional or expanded services routing along arterial and collector streets within the Secondary Plan area.

New transit services would be anticipated to offer more robust connections for future area transit riders and encourage greater transit use as a proportion of overall mode share in keeping with the policy objectives of the Moving Guelph Forward Transit Plan.

14.2 EVALUATION APPROACH

Person-based transit trips have been forecast and assigned to the area transit network in order to evaluate future transit demands.

Transit trips are derived from the analysis undertaken in Section 13.3, which then forms the basis for assigning transit rider trips by orientation. Assignment of transit trips is based on a review of origin and destination data collected as part of the 2016 Transportation Tomorrow Survey (TTS) for the southern parts of the City of Guelph.

Clair-Maltby Secondary Plan transit trips are assigned to general directions, and would be captured by local transit services. Additional opportunities to explore regional transit connectivity and demands are discussed in the later portions of this chapter.

14.3 TRANSIT RIDER DEMANDS

Transit trips resulting from development contemplated within the Clair-Maltby Secondary Plan area are forecast for planned residential and office land uses, based on the trip forecasting methods outlined in Section 13.3. Transit trip forecasts are based on the most conservative (highest density) “Land Use Budget” circulated in support of planning for Secondary Plan development. Forecast new transit trips to / from each Secondary Plan “Traffic Zone” during analyzed peak hours is summarized in Table 23.

TABLE 23 FORECAST SECONDARY PLAN TRANSIT TRIPS

Transit Trips	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
	Inbound	Outbound	2-Way	Inbound	Outbound	2-Way
Traffic Zone 1	5	40	45	35	15	50
Traffic Zone 2	0	15	15	15	5	20
Traffic Zone 3	n/a					
Traffic Zone 4	10	95	105	95	30	125
Traffic Zone 5	10	45	55	45	25	70
Traffic Zone 6	5	60	65	60	20	80
Traffic Zone 7	5	0	5	0	5	5
Traffic Zone 8	10	70	80	80	25	105
Traffic Zone 9	10	75	85	75	25	100
Total:	55	400	455	405	150	555

Notes

1. Trips Rounded to the nearest 5

The majority of transit trips are anticipated to route outbound during the weekday morning peak hour, and inbound during the weekday afternoon peak hour given the prevailing residential-related travel demands associated with the Secondary Plan.

A total of 455 and 555 new transit trips are forecast during the weekday morning and weekday afternoon peak hours, respectively.

14.4 TRANSIT DISTRIBUTION AND ASSIGNMENT

14.4.1 Distribution of Site Transit Trips

A review of TTS data was undertaken to understand the existing distribution and type of transit service utilized for resident-based trips to / from the southern parts of the City of Guelph (TTS Zones: 8062, 8064, 8067-8076, and 8078-8081). Work-related trips were not reviewed given the relative small number of forecast employee transit trips (in the order of 10 inbound trips during the weekday morning peak hour, and 10 outbound trips during the weekday afternoon peak hour).

The distribution of forecast transit trips generated by development within the Clair-Maltby Secondary Plan area is based upon existing transit distribution data made available in the TTS data set. A wider data area was established to accommodate a sizable base of data points, and reflect general transit distribution for resident based transit trips in the southern parts of the City of Guelph.

The review of resident-based area transit trips indicated that the majority of transit trips were undertaken exclusively by local transit services - in the order of 85% to 90%, while a smaller proportion of trips utilized regional GO Transit services to access other parts of the region. TTS transit distribution analysis data is included in **Appendix I**.

It is expected that most transit trips to the Clair-Maltby Secondary Plan area will be captured by local transit services, which is anticipated to continue to evolve in sequence with development of the Secondary Plan area, and as part of on-going service reviews conducted by Guelph Transit.

The anticipated distribution of transit trips and resulting number transit trips, based on the TTS transit distribution and forecast transit rider volumes, are summarized in Table 24. Forecast transit rider volumes are summarized based on the type of service riders would be anticipated to utilize (local or regional), and general directional orientation those riders would travel. Detailed transit rider assignment calculations for the Clair-Maltby Secondary Plan area, are included in **Appendix J**.

TABLE 24 RESULTING NEW TRANSIT TRIPS BY ORIENTATION AND SERVICE

Orientation	Orientation of Transit Trips	Two-way Transit Trips		
		Distribution	AM	PM
Regional Transit Services (GO Transit)				
East	Kitchener GO Line (Guelph Station); Aberfoyle GO Park and Ride Bus Stop	14%	65	75
Local Transit Services (Guelph Transit)				
North	Old Guelph (Downtown) Area	81%	370	450
	University of Guelph Area			
Northeast	Northeast areas of Guelph	2%	10	15
Northwest	Northwest and West areas of Guelph	3%	10	15

Notes:

1. Trips Rounded to the Nearest 5.

Clair-Maltby Secondary Plan area transit trips are predominantly anticipated to be oriented north of the Secondary Plan area, as transit riders tend to route to / from the downtown area, the University area, and central GO Transit Station. In the order of 370 and 450 two-way transit trips are anticipated to route to / from these areas during the weekday morning and weekday afternoon peak hours respectively.

In the order of 65 and 75 two-way transit trips are anticipated to route to / from GO Transit service stops during the weekday morning and weekday afternoon peak hours respectively, including the Guelph GO Station, as well as the existing GO Transit Bus Services routing through Aberfoyle GO Park and Ride.

A small number of transit trips are expected to route to other employment areas in the east and west portions of the City. However, as employment growth is anticipated in the Laird / Highway 6 area, opportunity to capture more trips via transit may exist given the proximity of this employment area to the Clair-Maltby Secondary Plan area, and relative direct options for transit routing.

Transit rider volumes related to development anticipated with the Clair-Maltby Secondary Plan are illustrated by general direction in Figure 19.

14.5 TRANSIT CAPACITY CONSIDERATIONS

Transit trips associated with development of the Clair-Maltby Secondary Plan area are analyzed for the prevailing directions in each of the key weekday morning and afternoon peak hours. Given that most new transit trips are resident-based, prevailing transit impacts are outbound during the weekday morning peak hour, and inbound during the weekday afternoon peak hour.

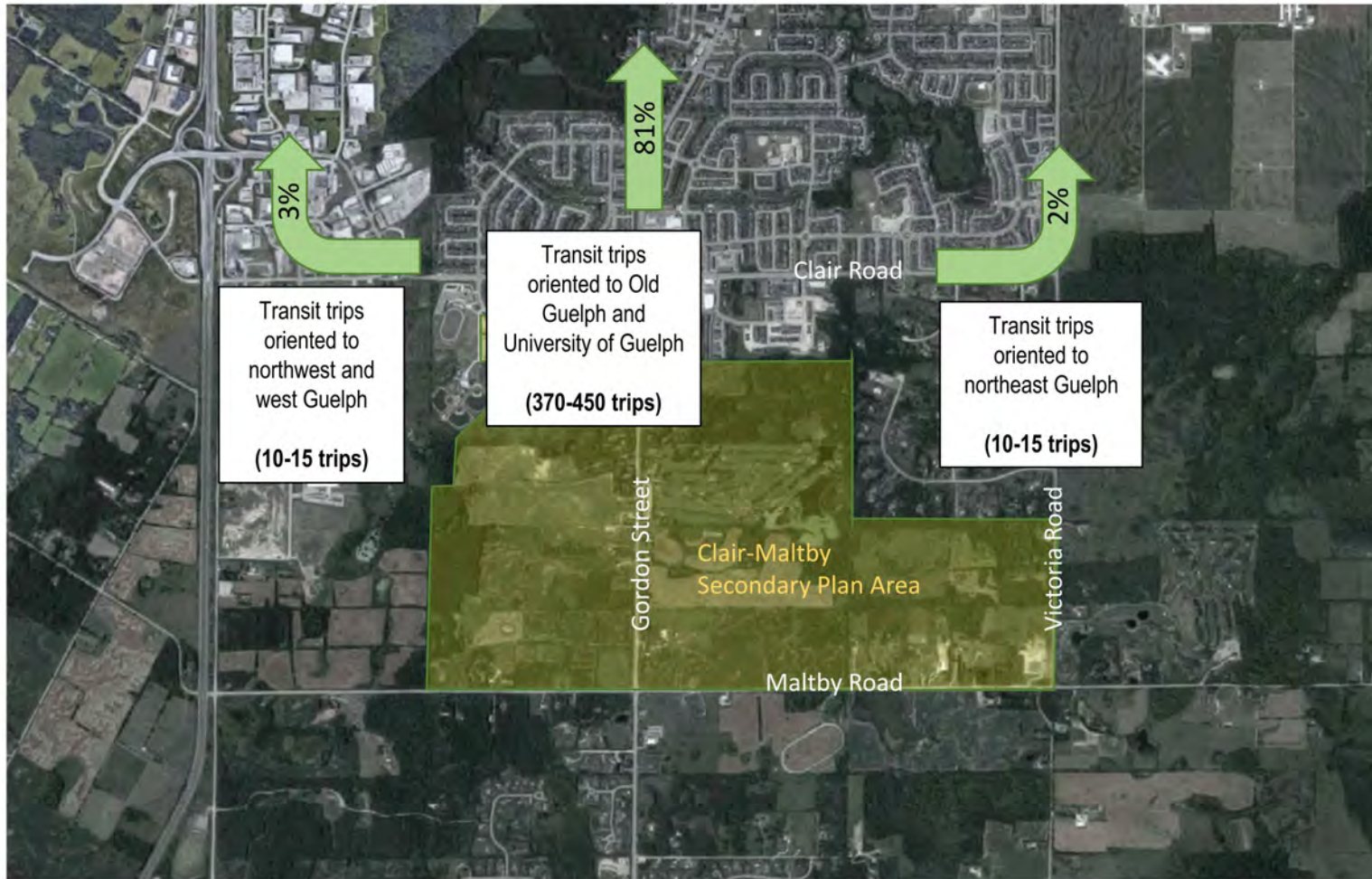
Understanding transit rider forecasts are based on the most conservative (highest density) “Land Use Budget” circulated in support of planning for Secondary Plan development, up to 400 outbound transit trips can be anticipated during the weekday morning peak hour, and 405 inbound trips can be anticipated during the weekday afternoon peak hour. In the order of 90% to 95% of these trips can be expected (conservatively) to be oriented north of the Secondary Plan area to / from the University and Downtown areas. Therefore, up to 385 peak direction transit trips can be expected between the Secondary Plan area and central areas of the City during weekday peak hours.

Guelph Transit currently utilizes Nova Bus LFS 40-foot buses, which have a total passenger capacity of 50 to 60 persons per vehicle.² As such, in the order of 7 buses would be required to accommodate peak direction, peak time transit ridership demands associated with travel between the Clair-Maltby Secondary Plan area and central Guelph areas. However, transit service provisions would also have to accommodate for existing (and future) down-stream transit rider demands associated with existing developed areas north of the Secondary Plan.

The requirement for a minimum of 5 new buses (per hour) in excess of existing services, operating between the Secondary Plan area and the central areas of the City to accommodate development associated with the Secondary Plan area, can be accommodated through the provision of various routes, express-only services, or frequent services routing along the Gordon Street spine and supporting collector roads.

Based on the foregoing, development contemplated as part of the Clair-Maltby Secondary Plan can be reasonably accommodated by local and regional transit services, given the introduction of new transit services or the expansion of existing services operating within the Secondary Plan area, over the course of the weekday morning and afternoon peak hours

² Bus capacity provided by Guelph Transit.



* Remaining percentage of transit rider trips (approx. 14%) are anticipated to utilize regional transit services (GO Transit) only via Guelph Station or Aberfoyle GO Park and Ride.

WEEKDAY PEAK HOUR FORECAST TRANSIT RIDER TRIPS

15.0 TRAFFIC OPERATIONS ANALYSIS

15.1 METHODOLOGY

15.1.1 Analysis Scope

Traffic operations analyses have been undertaken for a number of intersections within the Clair-Maltby Secondary Plan area in order to understand existing and future traffic conditions and demands. Traffic conditions have been reviewed at the following intersections under both existing and future traffic scenarios:

Signalized Intersections:

- Gordon Street and Clair Road;
- Gordon Street and Poppy Drive;
- Gordon Street and Gosling Gardens;
- Clair Road and Poppy Drive;
- Clair Road and Farley Drive;
- Clair Road and Beaver Meadow Drive;
- Clair Road and Victoria Road;
- Laird Road and Highway 6 northbound off-ramp; and
- Laird Road and Highway 6 southbound off-ramp.

Unsignalized Intersections:

- Laird Road and Clair Road West;
- Gordon Street and Maltby Road;
- Victoria Road and Maltby Road (east intersection); and
- Victoria Road and Maltby Road (west intersection).

The free traffic movements associated with the existing Highway 6 access ramps to / from Laird Road East are not analyzed as part of the traffic analysis herein.

Additional intersections are analyzed as part of the Future Total Traffic Operations Analysis, reflecting the introduction of new intersections associated with the build-out of the Preferred Community Structure plan.

New intersections include:

- Gordon Street and Collector Street B;
- Gordon Street and Collector Street C;
- Gordon Street and Collector Street D;
- Gordon Street and Collector Street E;
- Clairfields Extension (Street A) and Poppy Road;
- Clairfields Extension (Street A) and Collector Street B;
- Clairfields Extension (Street A) and Collector Street C;
- Clairfields Extension (Street A) and Collector Street D;
- Clairfields Extension (Street A) and Collector Street E;
- Clairfields Extension(Street A) and Maltby Road;
- Collector Street E and Collector Street F;
- Maltby Road and Collector Street F
- Maltby Road and Collector Street G; and
- Victoria Road and Collector Street E.

15.1.2 Analysis Scenarios

Traffic operations analyses have been undertaken during the prevailing weekday afternoon street peak hour under the following traffic conditions:

1. Existing traffic scenario: reflecting existing traffic volumes, lane configurations and traffic controls.
2. Future Background traffic scenario: reflecting traffic volumes projected to the year 2031 planning horizon that are not associated with the development of the Clair-Maltby Secondary Plan area, planned future lane configurations, planned future traffic controls, and planned new street elements (such as the southward extension of Southgate Drive to Maltby Road).
3. Future Total traffic scenario: reflecting traffic volumes projected to the year 2031 planning horizon including those associated with the development of the Clair-Maltby Secondary Plan area, planned future lane configurations, planned future traffic controls, and planned new street elements (such as new collector streets proposed as part of the Preferred Community Structure plan).

15.1.3 Analysis Assumptions

15.1.3.1 Intersection Capacity Analysis Methodology

Traffic operations analyses have been undertaken at study area intersections using standard capacity analysis procedures as follows.

The traffic operations analysis for signalized and unsignalized intersections was undertaken using *Synchro Version 10* software, adhering to the analysis methodology outlined in the *Highway Capacity Manual 2000*. Key performance indicators utilized for the signalized and unsignalized analyses are volume-to-capacity (v/c) ratios, delay times, and level-of-service (LOS).

Input parameters for the analyses are based on data acquired from traffic surveys. Peak hour factors and heavy traffic percentage parameters were calculated based on the traffic data acquired where appropriate. Bus blockages were estimated based on transit service frequency during prevailing traffic volume peak hours.

15.1.3.2 Calibration

Vehicle delay surveys were undertaken for the eastbound and westbound traffic movements at the Gordon Street and Maltby Road intersection so as to ensure that the traffic model appropriately reflects existing traffic delays for the eastbound and westbound movements. The existing traffic analysis herein is calibrated to reflect existing delay results observed during updated data collection and traffic delay surveys. Parameters calibrated under existing traffic conditions is carried forward as part of future analysis traffic scenarios.

Vehicle delay surveys are included in **Appendix K**.

15.2 EXISTING TRAFFIC OPERATIONS ANALYSIS

Existing traffic operations analysis contemplate existing traffic volumes and existing street network configurations and traffic control.

15.2.1.1 Traffic Volume Data

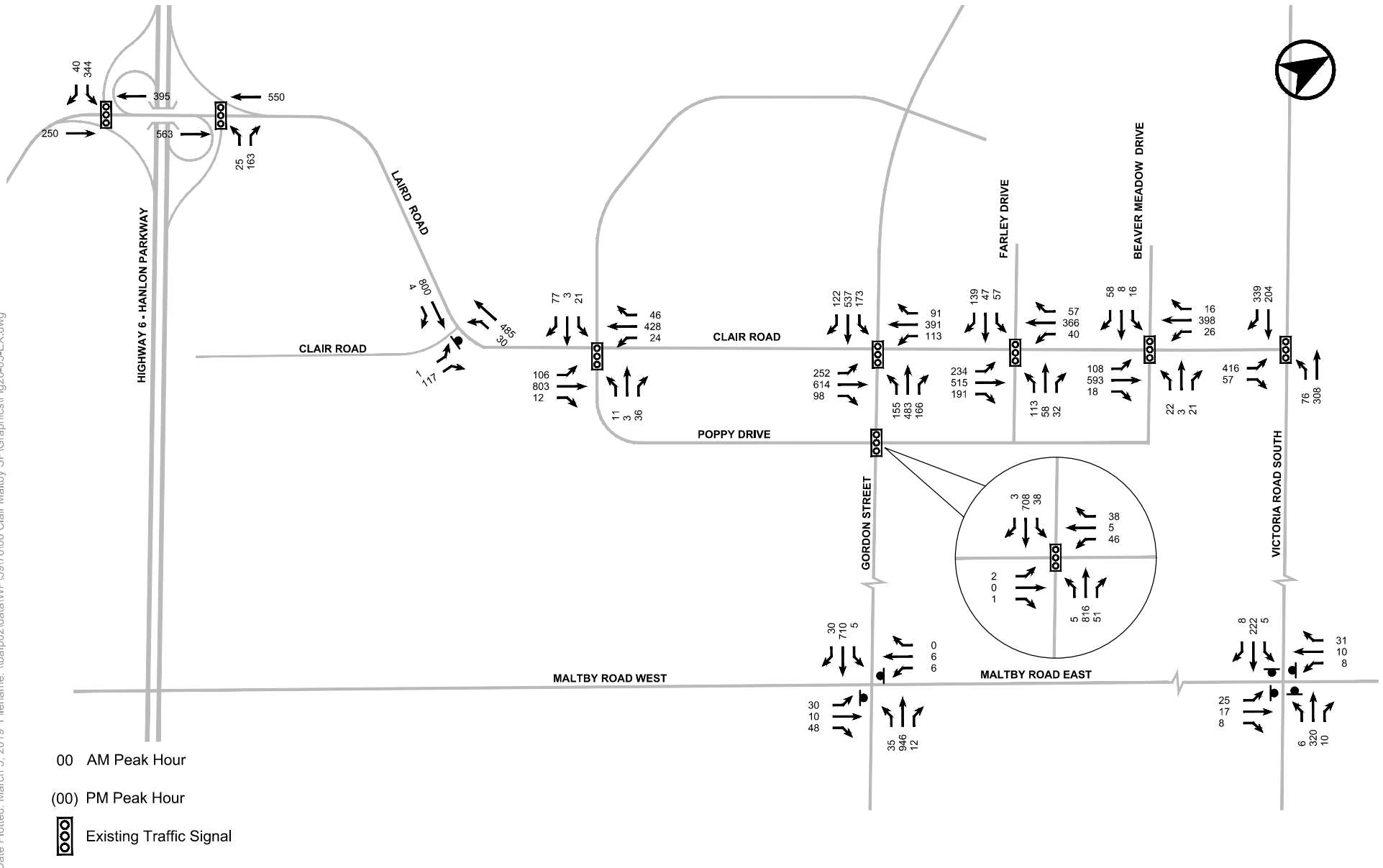
Existing traffic volume data were obtained for all study area intersections from the City of Guelph and / or traffic counts collected by Spectrum Traffic Data Inc. on behalf of BA Group.

Traffic volume data was collected for the period 2012 to 2017 for key intersections in the study area, as well as older traffic volume data for use as reference. Traffic volumes were reviewed against historical data (TMCs and ATRs) to verify general trends and understand potential inconsistencies. Generally, the most recent intersection counts (those from 2015 to 2017) were selected at key study area intersections, and utilized as the basis for analysis. Existing area traffic volumes utilized in assessing current traffic operations are illustrated in Figure 20. Traffic count data utilized in the traffic analysis prepared herein, are included in **Appendix L**.

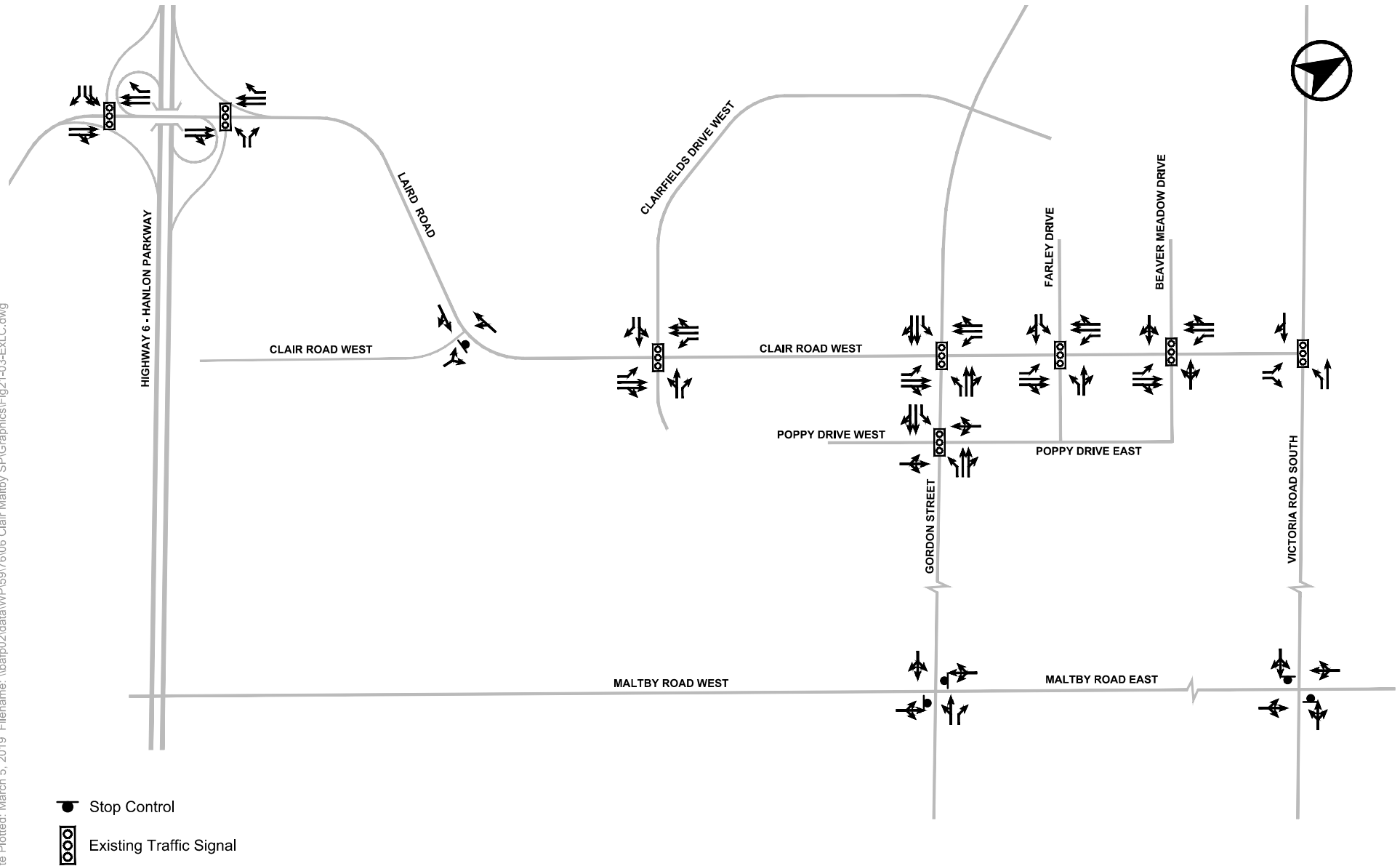
Traffic signal timing plans were provided by the Ministry of Transportation and the City of Guelph for signalized intersection included as part of the analysis.

15.2.1.2 Existing Transportation Network

Existing lane configurations on the public area road network reflect existing lane configurations and traffic controls. Existing traffic lane configurations and traffic controls are illustrated in Figure 21.



EXISTING WEEKDAY AFTERNOON PEAK HOUR TRAFFIC VOLUMES



EXISTING TRAFFIC LANE CONFIGURATIONS AND CONTROLS

15.2.2 Signalized Intersection Analysis Results

Detailed results of the Synchro analysis of signalized intersections within the study area under existing traffic conditions are included in **Appendix M**. A discussion of the traffic analysis findings follows.

A summary of existing signalized and unsignalized traffic operations at key existing study area intersections is provided in Figure 22.

15.2.2.1 General Findings

The traffic operations analyses outlined herein reflect traffic operations at the key intersections in the study area without explicitly considering the downstream congestion extending beyond study area intersections.

Individual movement and overall volume-to-capacity ratios for each of the signalized intersections within the study area are summarized in Table 25.

The signalized intersection traffic analysis indicates that all study area intersections perform acceptably, and without any traffic capacity constraints for any individual traffic movements. During the weekday afternoon peak hour, overall intersection v/c ratios are shown to be 0.70 or less, while individual traffic movements are shown to all operate with a v/c ratio of 0.73 or less.

Overall signalized intersection traffic operations are good under existing conditions, and are generally reflective of new infrastructure (updated and widened roads) and limited area development. Existing delay and capacity results are acceptable.

The key Gordon Street and Clair Road intersection operates acceptably under existing traffic conditions, with an overall intersection v/c ratio of 0.63 during the weekday afternoon peak hour. Traffic volumes and resulting traffic operations are reflective of the commercial land uses prevalent in each of the intersection's four quadrants.

The intersection of Clair Road East and Victoria Road was recently signalized. The signalized intersection analysis indicates that this intersection generally operates acceptably.

**TABLE 25 EXISTING CONDITIONS SIGNALIZED INTERSECTIONS ANALYSIS SUMMARY:
WEEKDAY AFTERNOON PEAK HOUR**

Intersection	Traffic Movement	Volume to Capacity (v/c) Ratio
Gordon Street and Clair Road	EB L	0.65
	EB TR	0.60
	WB L	0.47
	WB TR	0.42
	NB L	0.52
	NB TR	0.57
	SB L	0.56
	SB TR	0.59
	Overall	0.63
Gordon Street and Poppy Drive	EB LTR	0.00
	WB LTR	0.41
	NB L	0.01
	NB TR	0.37
	SB L	0.09
	SB TR	0.29
	Overall	0.36
Clair Road West and Poppy Drive West / Clairfields Drive	EB L	0.21
	EB TR	0.46
	WB L	0.08
	WB TR	0.29
	NB LT	0.03
	NB R	0.02
	SB LT	0.05
	SB R	0.05
	Overall	0.31
Clair Road East and Farley Drive	EB L	0.44
	EB TR	0.37
	WB L	0.13
	WB TR	0.28
	NB LT	0.32
	NB R	0.12
	SB LT	0.14
	SB R	0.17
	Overall	0.41

Clair Road East and Beaver Meadow Drive	EB L	0.20
	EB TR	0.35
	WB L	0.06
	WB TR	0.25
	NB LTR	0.07
	SB LT	0.04
	SB R	0.06
	Overall	0.25
Clair Road East and Victoria Road	EB L	0.68
	EB R	0.06
	NB L	0.38
	NB T	0.46
	SB T	0.73
	Overall	0.70
Laird Road and Highway 6 Northbound Off-Ramp	EB T	0.47
	WB T	0.46
	NB L	0.03
	NB R	0.15
	Overall	0.29
Laird Road and Highway 6 Southbound Off-Ramp	EB T	0.21
	WB T	0.32
	NB L	0.22
	NB R	0.03
	Overall	0.26

15.2.3 Unsignalized Intersection Analysis Results

The results of the capacity analysis performed for unsignalized intersections in the study area are summarized in Table 26.

Detailed Synchro analysis output sheets are included in **Appendix M**. A summary of existing signalized and unsignalized traffic operations at key existing study area intersections is provided in Figure 22.

**TABLE 26 EXISTING CONDITIONS UNSIGNALIZED INTERSECTIONS ANALYSIS SUMMARY:
WEEKDAY AFTERNOON PEAK HOUR**

Intersection	Movement of Interest	Existing Traffic Conditions	
		Delay (s)	LOS
Clair Road West and Laird Road	WB L	1.0	A
	NB (Clair Rd.) LR	18.6	C
Gordon Street and Maltby Road	EB LTR	19.6	C
	WB LTR	33.1	D
	NB LTR	1.2	A
	SB LTR	0.2	A
Victoria Road and Maltby Road (west intersection)	WB LT	7.1	A
	NB LR	10.3	B
Victoria Road and Maltby Road (east intersection)	EB LT	7.7	A
	SB LR	11.8	B

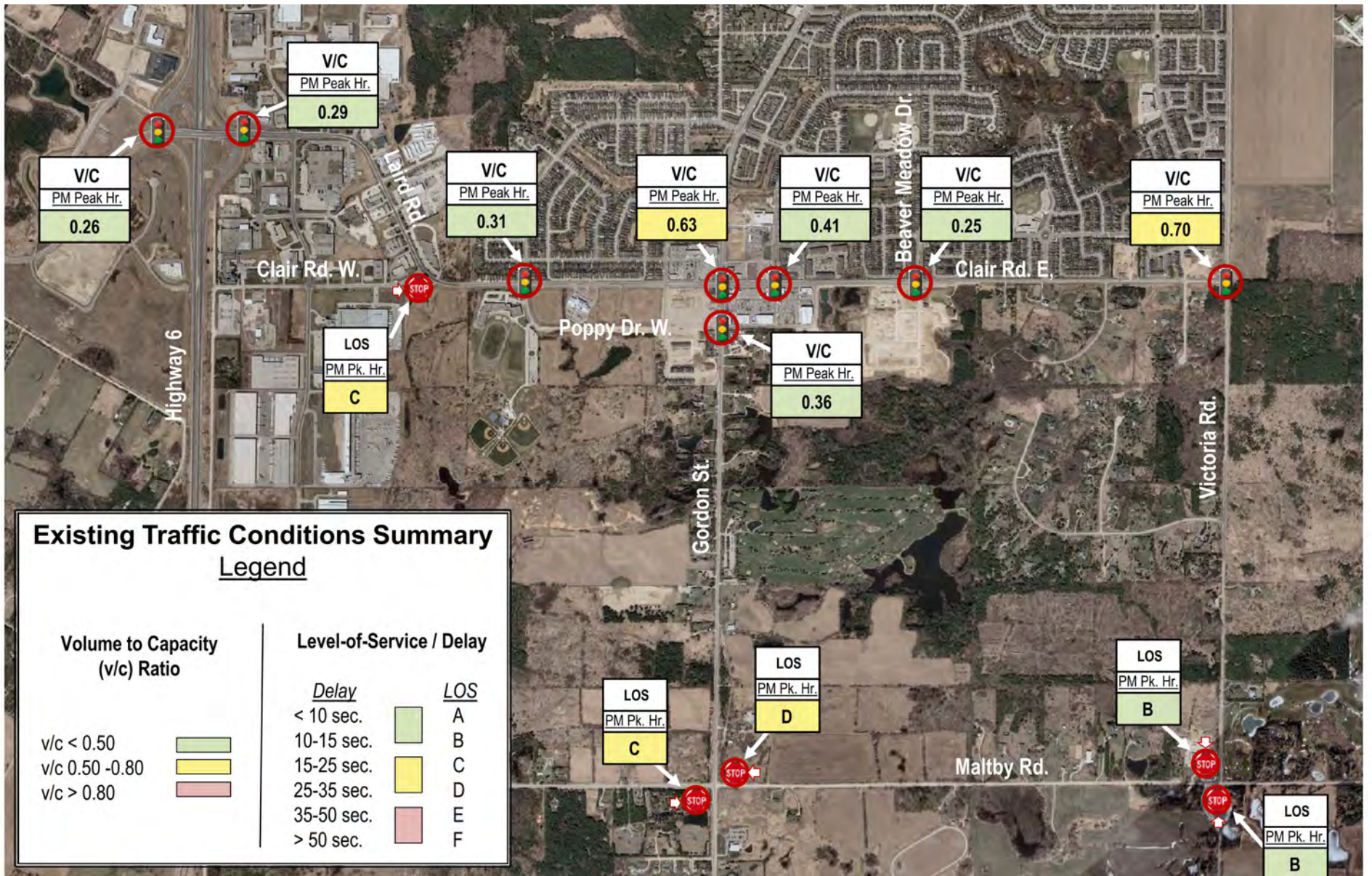
Existing Unsignalized Intersections

A total of four (4) unsignalized intersections were reviewed within the unsignalized intersection analysis. Traffic operations at unsignalized intersections within the study area operate acceptably, except for the following:

Gordon Street and Maltby Road:

The existing conditions traffic analysis indicates that eastbound and westbound STOP-control movements at the Gordon Street and Maltby Road intersection operate with longer delays and fewer gap opportunities. The unsignalized traffic analysis indicates that the eastbound movement operates with LOS C during the weekday afternoon peak hour, while the westbound movement operates with LOS D during the weekday afternoon peak hour. Signalization of this intersection may be considered in the longer-term given anticipated traffic growth along both streets. This intersection can be monitored, and will be considered more closely in the future traffic analysis to be completed as part of traffic analyses in forthcoming sections of this report.

All other movements at unsignalized intersections within the study area are shown to operate at LOS C or better during the weekday afternoon peak hour, which is acceptable.



SUMMARY OF EXISTING TRAFFIC OPERATIONS ANALYSIS

15.3 FUTURE BACKGROUND TRAFFIC CONSIDERATIONS

15.3.1 Future Background Scenario Road Network Assumptions

Future lane configurations on the area street network reflect the following planned improvements that are assumed as part of the future traffic analysis scenarios:

- Widening of Gordon Street from 2 to 4 lanes (approved 2001 EA) from Kortright Road to Wellington Road 34;
- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA) – COMPLETE; and
- Southerly extension of Southgate Drive to Maltby Road.

15.3.2 General Corridor Growth

BA Group has undertaken a review of traffic patterns in the study area over the past 10 years (2008 to 2018) to provide an understanding of overall traffic growth trends on key street segments within the Secondary Plan area.

Traffic volumes were reviewed for the following street segments to provide an indication of prevailing trends in vehicle activity along the arterial road corridors of Gordon Street, Clair Road, and Victoria Road within this period.

1. Gordon Street south of Clair Road,
2. Gordon Street north of Maltby Road,
3. Clair Road east of Gordon Street,
4. Clair Road west of Gordon Street, and
5. Victoria Road south of Clair Road.

It should be noted that traffic volumes were also reviewed for segments of Maltby Road east of Gordon Street; however, the infrequency of historical data and generally small traffic volumes could not produce a reflective traffic growth rate. Traffic volumes on Maltby Road were shown to be relatively small, and variable from count to count.

Traffic corridor review observations are outlined in the following and are summarized in **Appendix N**.

- In the **northbound and southbound directions on Gordon Street**. Traffic volumes on the street segment south of Clair Road and on the street segment north of Maltby Road illustrate consistent traffic patterns for the entire Gordon Street segment through the Secondary Plan area. Two-way traffic volumes are shown to have increased in the order of +0.4% to +0.7% during the weekday afternoon peak hour.

During the weekday afternoon peak hour, northbound traffic is shown to have increased by +0.5% to +0.6% per annum over the last 10-year period, while southbound traffic is shown to have increased between +0.3% to +0.8% per annum over the same period.

- In the **eastbound and westbound directions on Clair Road**. Over the previous 10-year period, two-way traffic volumes on Clair Road are shown to have increased in the order of +3% to +4% annually during the weekday afternoon peak hour west of Gordon Street, and in the order of +4% to +5% annually during the weekday afternoon peak hour east of Gordon Street.

- In the **northbound and southbound directions on Victoria Road**. It is important to note that the rate of traffic growth on Victoria Road (percentage change) is somewhat misleading for the following reasons:
 - Victoria Road traffic volumes are relatively low, and despite higher rates of vehicle growth, the absolute volume of new traffic is less than those observed on Clair Road.
 - Historical traffic volume data indicates that most of the increase in traffic volumes on Victoria Road occurred between 2013 and 2014, and that traffic volumes after 2014 are shown to be more consistent.

Understanding this, two-way traffic volumes on Victoria Road south of Clair Road are shown to have increased by +16% to +18% annually during the weekday afternoon peak hour.

The general weekday afternoon corridor growth rates observed as part of the corridor analysis review are summarized in Table 27.

TABLE 27 CORRIDOR TRAFFIC GROWTH SUMMARY

Street	Direction	Observed Annual Growth Rate
Gordon Street Two-way Traffic	Northbound / Southbound	+0.4% to +0.7%
Clair Road Two-way Traffic	Eastbound / Westbound	+3.7% to +4.7%
Victoria Street Two-way Traffic	Northbound / Southbound	+18%

Understanding the prevailing traffic growth trends associated with key arterial roads within the Secondary Plan area (Gordon Street, Victoria Road and Clair Road), traffic growth was assumed for these corridors. Corridor traffic growth was carried through the study area, and in the case of Clair Road, assigned to terminal ramps at the Highway 6 / Laird Road interchange based on existing turning movement proportions. Corridor growth rates were applied over a 14-year period to the 2031 planning horizon year, to account for the 2017 date of traffic data collection associated with this project.

Application of Background Corridor Growth Rates:

An average annual corridor growth rate of 0.5% was applied to Gordon Street during the weekday afternoon peak hour.

Higher traffic growth rates along Victoria Road and Clair Road are expected to result from recent development along these corridors; however, this growth would not be expected to be maintained over the long-term without the introduction of new site-specific developments (accounted for in the following section). As such, a corridor growth rate of 1.5% per annum was applied to these corridors, which is generally consistent with growth rates applied by the City in traffic planning modelling exercises.

Traffic volumes resulting from the application of corridor growth rates outlined herein, are summarized in **Appendix O**.

15.3.3 Site Specific Background Developments

Future background traffic operations will be forecast and assessed, understanding general traffic growth trends (corridor growth assessed in the foregoing), and other area site-specific background developments – which are summarized in Table 28.

Area background developments also provide an understanding of current changes within the vicinity of the Clair-Maltby Secondary Plan area, and the existing development context that will be considered as part of future planning for the subject lands.

Traffic volumes associated with each of the developments outlined in Table 28 is assigned to the area road network.

It should be noted that traffic related to the proposed development comprising the Dallan Residential Subdivision (161, 205, and 253 Clair Road East) would be somewhat captured as part of existing traffic volumes given the initial occupancy of this development. For the purposes of the traffic analysis herein, traffic volumes associated with this development are reduced by 25% to account for existing occupancy.

Traffic volumes related to the Dallan, Neumann and Bird Subdivisions were slightly adjusted as part of the analysis herein to account for the introduction of Poppy Road, which was not utilized in the assignment of site specific trips within Transportation Studies prepared for these developments.

Traffic volumes resulting from the introduction of the site-specific developments cited herein, are summarized in **Appendix O**.

TABLE 28 AREA DEVELOPMENT APPLICATIONS

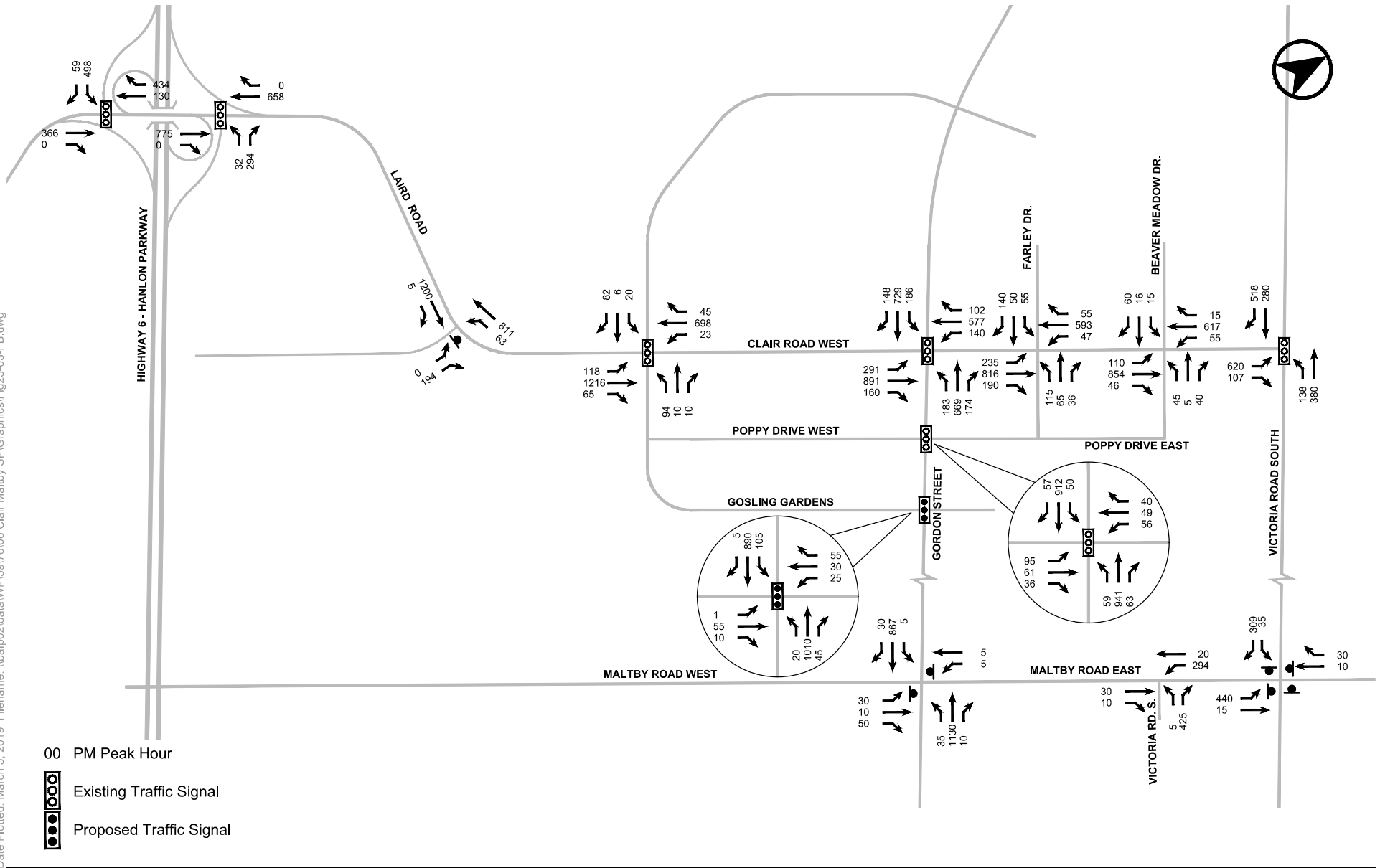
Development	Residential Units	Non-Residential GFA	Two-Way Site Traffic ¹ AM (PM)	Transportation Study / Analysis
1888 Gordon Street (Tricar Developments Inc.)	460 Apartment Units	6,350 sq. ft. non-residential GFA	297 (329)	<i>1888 Gordon Street Traffic Impact Study</i> , September 22, 2017, Stantec.
Neumann Subdivision (Coldwell Banker Neumann REB Ltd.)	Stacked townhouses and apartments (permitted use). Number of units unspecified.	3.22 ha Corporate Business Park <u>0.98 ha Commercial</u> 4.2 ha	205 (203)	<i>Neumann Subdivision Guelph, ON Transportation Impact Study</i> , October 2014, Paradigm Transportation Solutions Ltd.
Bird Subdivision (Thomasfield Homes Ltd.)	21 Single Family Units 36 Townhouse Units <u>249 Apartment Units</u> 306 Total Units	0.04 ha Future Development	107 (137)	<i>Bird Residential Subdivision Traffic Impact Study</i> , October 2010, Paradigm Transportation Solutions Ltd.
Southwest Corner of Gordon Street / Clair Road (Fieldgate)	-	7,408 sq. m. Retail	515 ²	<i>Gordon Street and Clair Road</i> October 2015, LEA Consulting Ltd.
Southgate Business Park (Industrial Equities)	-	27,870 sq. m. Manufacturing 122,632 sq. m. Warehouse	476 (450)	<i>Southgate Business Park Transportation Impact Study</i> June 2012, IBI Group
Hanlon Creek Business Park	--	--	--	--
Dallan Residential Subdivision 161, 205 & 253 Clair Road East	409 residential units (Mix of densities)	--	--	1888 Gordon TIS assumed 105 units. ±400 units were previously proposed. Unclear what's currently being built...
South End Centre	-	13,935 sq.m. (150,000 sq.ft.) Recreation Centre	308 (411)	No TIS. Traffic referenced from 1888 Gordon TIS.
Westminster Woods Victoria Road South & Clair Road East	101 residential apartment units	745 sq. m. Commercial	70 (149)	<i>Kingsbury C Westminster Woods Traffic Impact Study</i> , March 2015, Stantec.

Notes:

1. Two-Way Site Traffic based on individual TIS reports.
2. 515 total PM trips, 340 net new PM trip

15.3.4 Future Background Traffic Analysis Results

Future Background traffic volumes, which is the sum of existing traffic volumes, corridor growth traffic volumes, and site-specific background development traffic volumes, is illustrated in Figure 23.



FUTURE BACKGROUND TRAFFIC VOLUMES

15.3.5 Signalized Intersection Analysis Results

Detailed results of the Synchro analysis of signalized intersections within the study area under future background traffic conditions are included in **Appendix P**. A discussion of the traffic analysis findings follows.

A summary of future background signalized and unsignalized traffic operations at key existing study area intersections is provided in Figure 24.

15.3.5.1 General Findings

The traffic operations analyses outlined herein reflect traffic operations at the key intersections in the Secondary Plan analysis scope without explicitly considering the downstream congestion extending beyond study area intersections.

Individual movement and overall volume-to-capacity ratios for each of the signalized intersections within the study area are summarized in Table 29.

The signalized intersection traffic analysis indicates that all study area intersections are anticipated to perform acceptably under future background traffic conditions. During the weekday afternoon peak hour, overall intersection v/c ratios are shown to be 0.87 or less, while individual traffic movements are shown to all operate with a v/c ratio of 0.87 or less.

Overall signalized intersection traffic operations are generally good under future background traffic conditions and are similar to those observed under existing traffic conditions, although longer delays and higher volume-to-capacity ratios are observed at the key Gordon Street / Clair Road and Victoria Road / Clair Road intersections relative to the existing conditions.

The key Gordon Street / Clair Road intersection is anticipated to operate acceptably under future background traffic conditions, with an overall intersection v/c ratio of 0.87 during the weekday afternoon peak hour. Relative to the existing condition, overall intersection v/c ratios increase by 32% during the weekday afternoon peak hour, which is generally the result of anticipated increases in through traffic volumes along Gordon Street and Clair Road, site-specific development traffic, and an increase in eastbound left-turn traffic volumes resulting from specific area developments.

The future background traffic analysis indicates that the Victoria Road / Clair Road intersection generally operates acceptably, despite an increase in traffic delay and volume-to-capacity ratios. Relative to the existing condition, overall intersection v/c ratios increase by 25% during the weekday afternoon peak hour, which is generally the result of anticipated increases in southbound right-turn and eastbound left-turn traffic volumes resulting from area-specific background developments.

**TABLE 29 FUTURE BACKGROUND CONDITIONS SIGNALIZED INTERSECTIONS ANALYSIS
SUMMARY: WEEKDAY AFTERNOON PEAK HOUR**

Intersection	Traffic Movement	Volume to Capacity (v/c) Ratio
Gordon Street and Clair Road	EB L	0.87
	EB TR	0.84
	WB L	0.70
	WB TR	0.54
	NB L	0.86
	NB TR	0.87
	SB L	0.83
	SB TR	0.87
	Overall	0.87
Gordon Street and Poppy Drive	EB LTR	0.67
	WB LTR	0.47
	NB L	0.17
	NB TR	0.50
	SB L	0.15
	SB TR	0.48
	Overall	0.52
Gordon Street and Gosling Gardens	EB LTR	0.15
	WB LTR	0.21
	NB L	0.06
	NB TR	0.46
	SB L	0.37
	SB TR	0.39
	Overall	0.40
Clair Road West and Poppy Drive West / Clairfields Drive	EB L	0.31
	EB TR	0.72
	WB L	0.16
	WB TR	0.46
	NB LT	0.26
	NB R	0.01
	SB LT	0.06
	SB R	0.05
	Overall	0.54

Clair Road East and Farley Drive	EB L	0.56
	EB TR	0.53
	WB L	0.20
	WB TR	0.43
	NB L	0.31
	NB TR	0.14
	SB L	0.14
	SB TR	0.18
	Overall	0.48
Clair Road East and Beaver Meadow Drive	EB L	0.26
	EB TR	0.53
	WB L	0.18
	WB TR	0.37
	NB LTR	0.14
	SB L	0.04
	SB TR	0.07
	Overall	0.37
Clair Road East and Victoria Road	EB L	0.82
	EB R	0.11
	NB L	0.41
	NB T	0.67
	SB T	0.48
	SB R	0.34
	Overall	0.76
Laird Road and Highway 6 Northbound Off-Ramp	EB T	0.64
	WB T	0.55
	NB L	0.03
	NB R	0.40
	Overall	0.50
Laird Road and Highway 6 Southbound Off-Ramp	EB T	0.30
	WB T	0.35
	SB L	0.31
	SB R	0.04
	Overall	0.33

15.3.6 Unsignalized Intersection Analysis Results

The results of the capacity analysis performed for unsignalized intersections in the study area are summarized in Table 30.

Detailed Synchro analysis output sheets are included in **Appendix P**. A summary of existing signalized and unsignalized traffic operations at key existing study area intersections is provided in Figure 24.

TABLE 30 FUTURE BACKGROUND CONDITIONS UNSIGNALIZED INTERSECTION ANALYSIS SUMMARY: WEEKDAY AFTERNOON PEAK HOUR

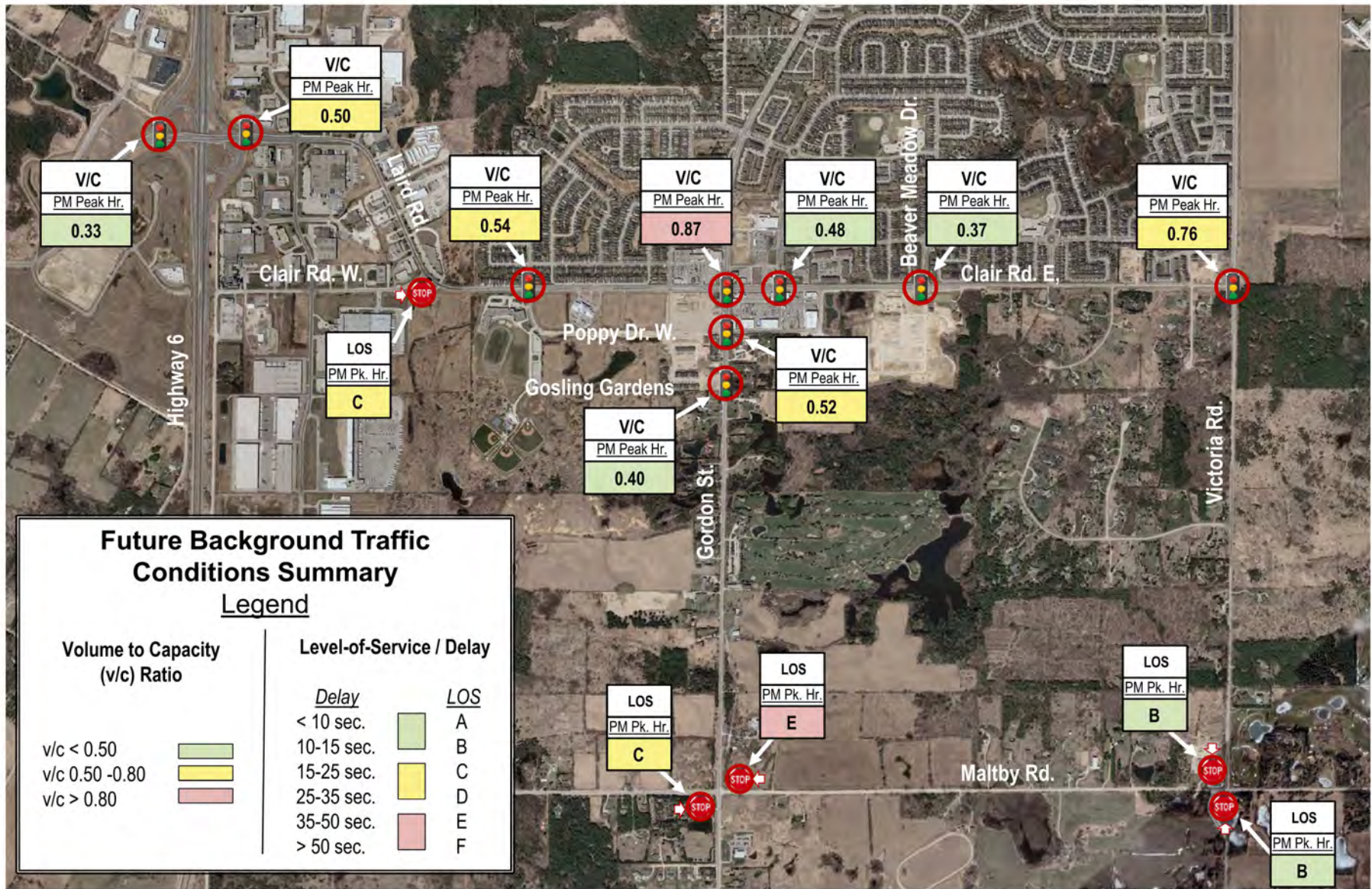
Intersection	Movement of Interest	Existing Traffic Conditions	
		Delay (s)	LOS
Clair Road West and Laird Road	WB L	12.1	C
	NB (Clair Rd.) LR	20.2	C
Gordon Street and Maltby Road	EB LTR	17.7	C
	WB LTR	36.3	E
	NB L	10.1	B
	SB L	12.1	B
Victoria Road and Maltby Road (west intersection)	WB LT	7.4	A
	NB LR	11.2	B
Victoria Road and Maltby Road (east intersection)	EB LT	8.0	A
	SB LR	13.8	B

Future Background Unsignalized Intersections

A total of four (4) unsignalized intersections were reviewed within the future background traffic conditions unsignalized intersection analysis. Traffic operations at unsignalized intersections within the study area are anticipated to continue to operate similar to existing conditions, and overall acceptably except for the Gordon Street / Maltby Road intersection.

The widening of Gordon Street at its intersection with Maltby Road is anticipated to somewhat off-set the delay implications of additional northbound / southbound traffic for eastbound and westbound STOP-controlled traffic. The future background conditions traffic analysis indicates that eastbound and westbound STOP-control movements at the Gordon Street and Maltby Road intersection will continue operate with longer delays and fewer gap opportunities, similar to conditions summarized as part of the existing traffic analysis. Signalization of this intersection may be considered in the longer-term given anticipated traffic growth along both streets.

All other movements at unsignalized intersections within the study area are shown to operate at LOS C or better during the weekday afternoon peak hour, which is acceptable.



SUMMARY OF FUTURE BACKGROUND WEEKDAY AFTERNOON TRAFFIC OPERATIONS

15.4 FORECAST CLAIR-MALTBY SECONDARY PLAN TRAFFIC

15.4.1 Existing Secondary Plan Traffic

Traffic volumes generated by the existing buildings within the Secondary Plan area are expected to be small, and generally represent individual households, small businesses, an existing golf course, and general rural activities.

A marginal volume of traffic results from existing operations and activities within the Secondary Plan area relative to the planned redevelopment of these lands. For the purposes of the traffic analysis conducted herein, existing Secondary Plan area traffic was conservatively retained on the area street network.

Reductions to future forecast Clair-Maltby Secondary Plan traffic were not made to account for existing traffic resulting from current development within the subject lands.

15.4.2 Future Site Traffic Generation

Peak hour traffic volume forecasts for the Clair-Maltby Secondary Plan area are based upon the trip forecasting strategies outlined in Section 13, and have been developed based on the most conservative (highest density) assumptions outlined in the “Land Development Budget” prepared by the project team – dated August 27, 2018. For the purposes of the analysis herein, a total of 10,125 residential units and 333 jobs have been assessed to understand the traffic impacts on the area street network.

A summary of forecast traffic volumes, resulting from development of the Clair-Maltby Secondary Plan area, by land use and traffic zone, are summarized in Table 31.

TABLE 31 FORECAST CLAIR-MALTBY SECONDARY PLAN TRAFFIC GENERATION

Vehicle Trips	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
	Inbound	Outbound	2-Way	Inbound	Outbound	2-Way
Traffic Zone 1	80	240	315	265	170	435
Traffic Zone 2	30	90	120	100	65	165
Traffic Zone 3	n/a					
Traffic Zone 4	190	570	760	670	415	1,085
Traffic Zone 5 (Residential)	95	280	375	340	205	545
Traffic Zone 5 (Employment)	45	10	55	10	45	55
Traffic Zone 6	125	365	485	425	265	690
Traffic Zone 7 (Employment)	70	15	85	15	65	80
Traffic Zone 8	145	430	570	585	310	795
Traffic Zone 9	145	440	585	525	320	845
Total:	925	2,440	3,350	2,935	1,860	4,700

Notes:

1. All trips rounded to the nearest 5.

The most dense land use scenario, as identified in the Clair-Maltby Secondary Plan Land Use Budget, would be anticipated to generate in the order of 3,350 and 4,700 two-way vehicle trips during the weekday morning and afternoon peak hours, respectively.

15.4.3 Clair-Maltby Secondary Plan Traffic Distribution and Assignment

The directional distribution of vehicle trips made to and from the Clair-Maltby Secondary Plan area has been based upon a review of information obtained from the 2016 Transportation Tomorrow Survey (TTS).

Residential and employment-related traffic distribution patterns have been developed based upon a review of 2016 TTS survey data for the 2006 TTS traffic zones 8062, 8064, 8067-8076, and 8078-8081, which generally comprises the area north of the Secondary Plan and would be identified as the southern portions of the City of Guelph. This local proxy area was chosen because it is anticipated that traffic resulting from the development of the Secondary Plan area would exhibit similar auto travel characteristics to existing residential and employment buildings in the identified area.

Travel patterns for traffic generated by the residential and employments uses planned within the Secondary Plan area are based upon a review of the following:

- Travel destination information provided in the 2016 Transportation Tomorrow Survey (TTS). A comprehensive series of surveys were conducted in the development of the TTS database that describes, among other information, the travel behaviour of motorists of a specific area during the street peak periods;
- Capacity constraints on turning movements at area intersections that would, because of the extent of the delays that may be experienced, influence motorists to choose alternate routes while travelling to and from the proposed building; and
- The introduction of planned new roads and road improvements within the vicinity of the Secondary Plan, advanced through City and County transportation planning and / or site-specific development.

For destinations within the City of Guelph, forecast site traffic is routed along both local (collector) and regional transportation corridors depending on their distance to / from the Secondary Plan area. At the regional level, a greater reliance on regional corridors such as Highway 6 - the Hanlon Parkway and Gordon Street is expected as many drivers would take advantage of highway and higher-order roads to travel greater distances across the region and connect with Highway 401 to the south.

Overall traffic distribution assumptions are applied to individual Traffic Zones, identified within the Secondary Plan area, to appropriately assign traffic volumes related to specific development areas within the overall Plan. As such, deviation from the general distribution of traffic can be anticipated given the variability in routing options for motorists from different traffic zones within the Secondary Plan area. For example, motorist in Traffic Zones 6 or 8 may utilize Gordon Street to travel north into the central portions of the City of Guelph given that these areas are bounded by Gordon Street, more so than motorists resulting from Traffic Zone 9 development which is located adjacent to Victoria Road – a viable north-south direction arterial to Gordon Street.

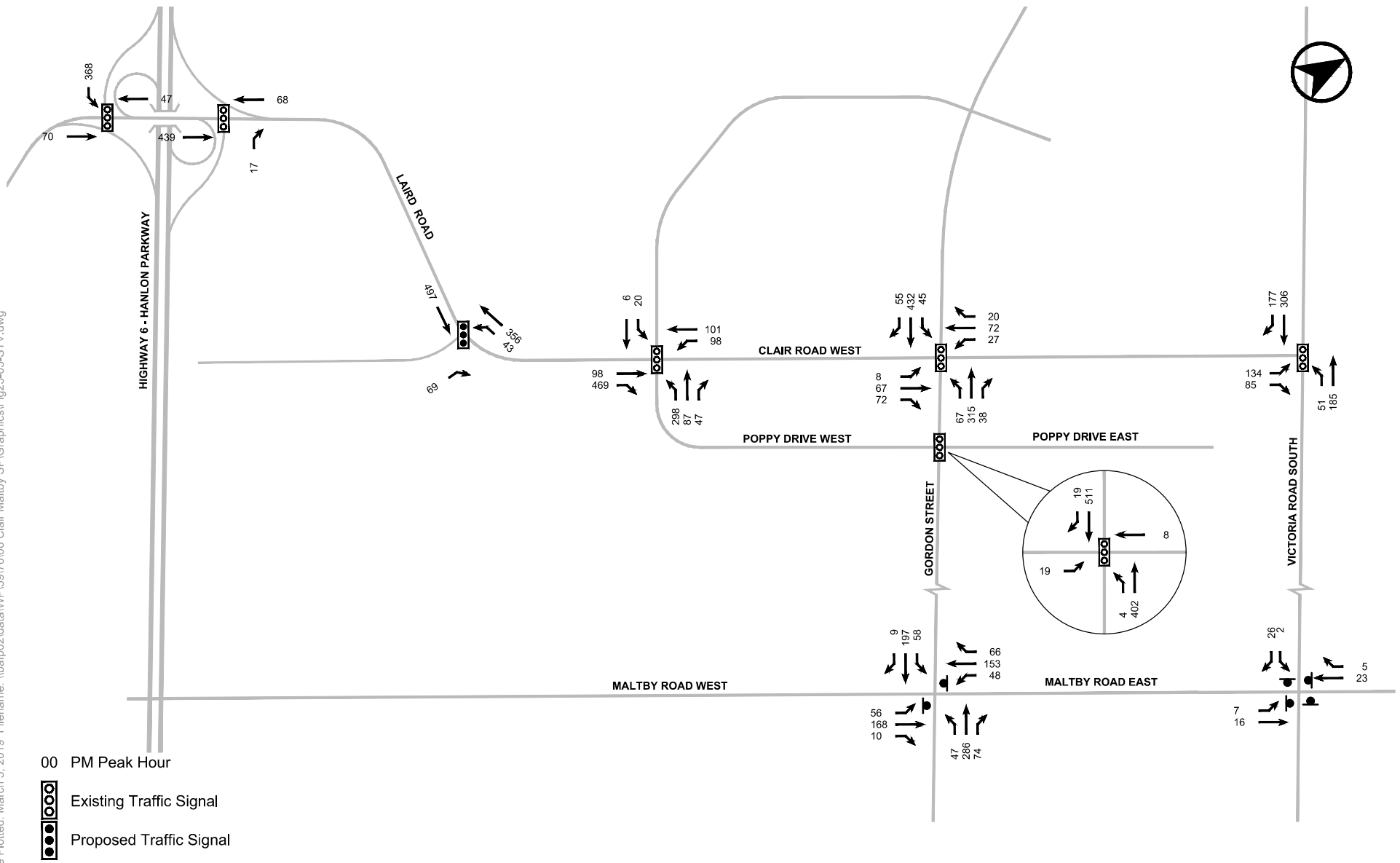
Table 32 summarizes the general directional distribution for traffic routing to / from the Clair-Maltby Secondary Plan area. Residential and employment-related Secondary Plan traffic volumes assignment calculations are summarized in **Appendix Q**. Forecast new Secondary Plan traffic volumes on the area street network are illustrated in Figure 25.

TABLE 32 CLAIR-MALTBY SECONDARY PLAN TRAFFIC ASSIGNMENT

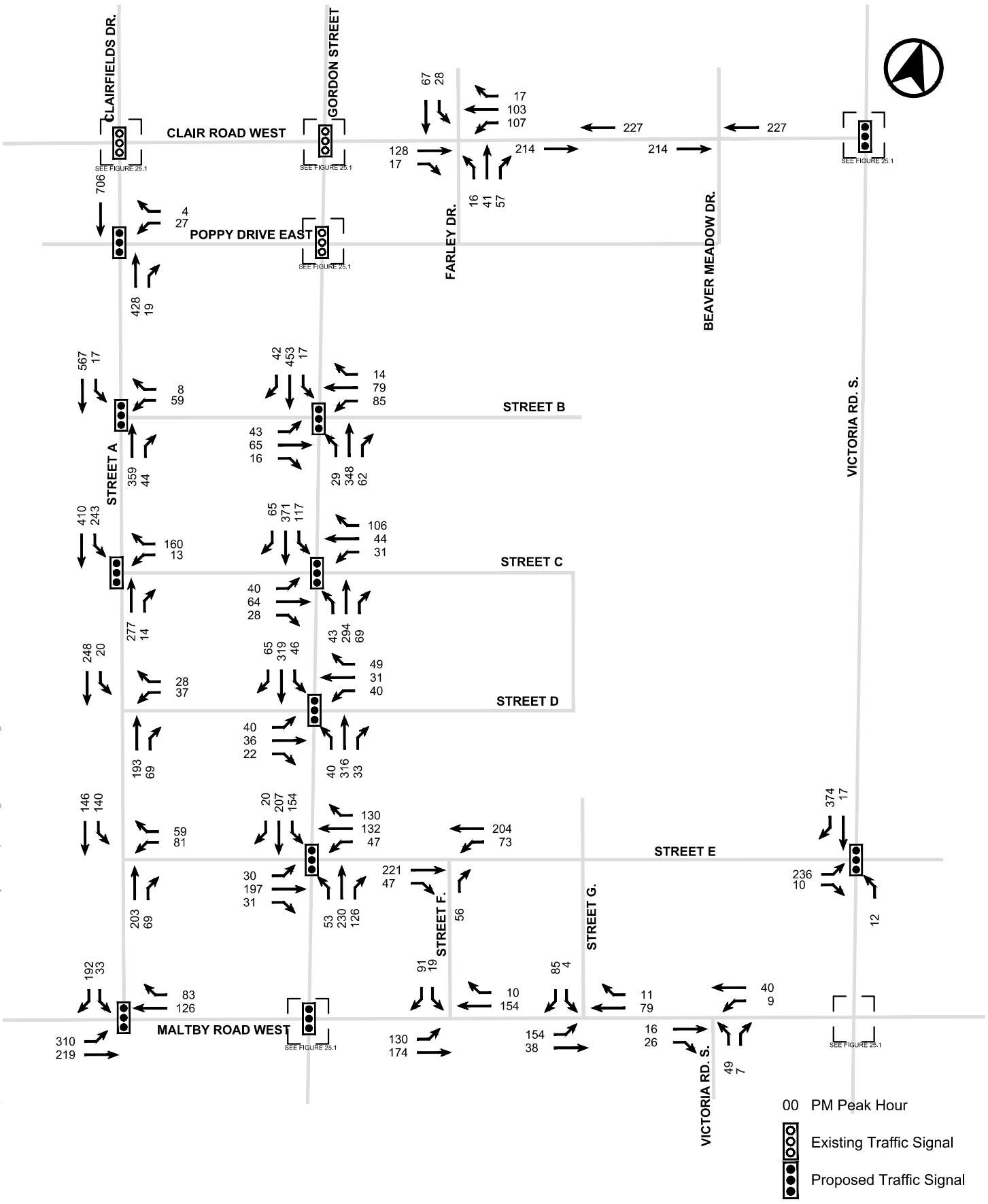
Direction (Route)	Orientation to / from Clair-Maltby Secondary Plan Area	General Distribution Proportion
Residential Trips		
Highway 401 (via Gordon St. or Hanlon Pkwy.)	East	11%
Highway 401 (via Gordon St. or Hanlon Pkwy.)	West	10%
Hanlon Parkway	North	17%
Gordon Street	North	26%
Gordon Street (south of Hwy. 401)	South	2%
Victoria Road	North	14%
Victoria Road	South	2%
Clair Road / Laird Road	West	9%
Maltby Road	East	1%
Maltby Road	West	2%
Southgate Drive (business area)	West	2%
Farley Drive / Beaver Meadow Drive	North	3%
Clairfields Drive	North	1%
Total		100%
Employment Trips		
Highway 401 (via Gordon St. or Hanlon Pkwy.)	East	3%
Highway 401 (via Gordon St. or Hanlon Pkwy.)	West	12%
Hanlon Parkway	North	34%
Gordon Street	North	5%
Gordon Street (south of Hwy. 401)	South	18%
Victoria Road	North	17%
Clair Road / Laird Road	West	4%
Farley Drive / Beaver Meadow Drive	North	3%
Clairfields Drive	North	4%
Total		100%

Notes:

1. Residential unit and employee positions derived from "Clair-Maltby Secondary Plan Study Area Population and Employment": August 27, 2018. For the purposes of the analysis herein, maximum density allocations are assumed.
2. Residential and employee trip distribution based on 2016 TTS data for home-based and work-based vehicle trips to and from 2006 TTS zones 8062, 8064, 8067-8076, and 8078-8081 during the morning and afternoon peak hours



CLAIR-MALTBY SECONDARY PLAN TRAFFIC VOLUMES



CLAIR-MALTBY SECONDARY PLAN TRAFFIC VOLUMES

15.5 FUTURE TOTAL TRAFFIC ANALYSIS

15.5.1 Future Total Scenario Road Network Assumptions

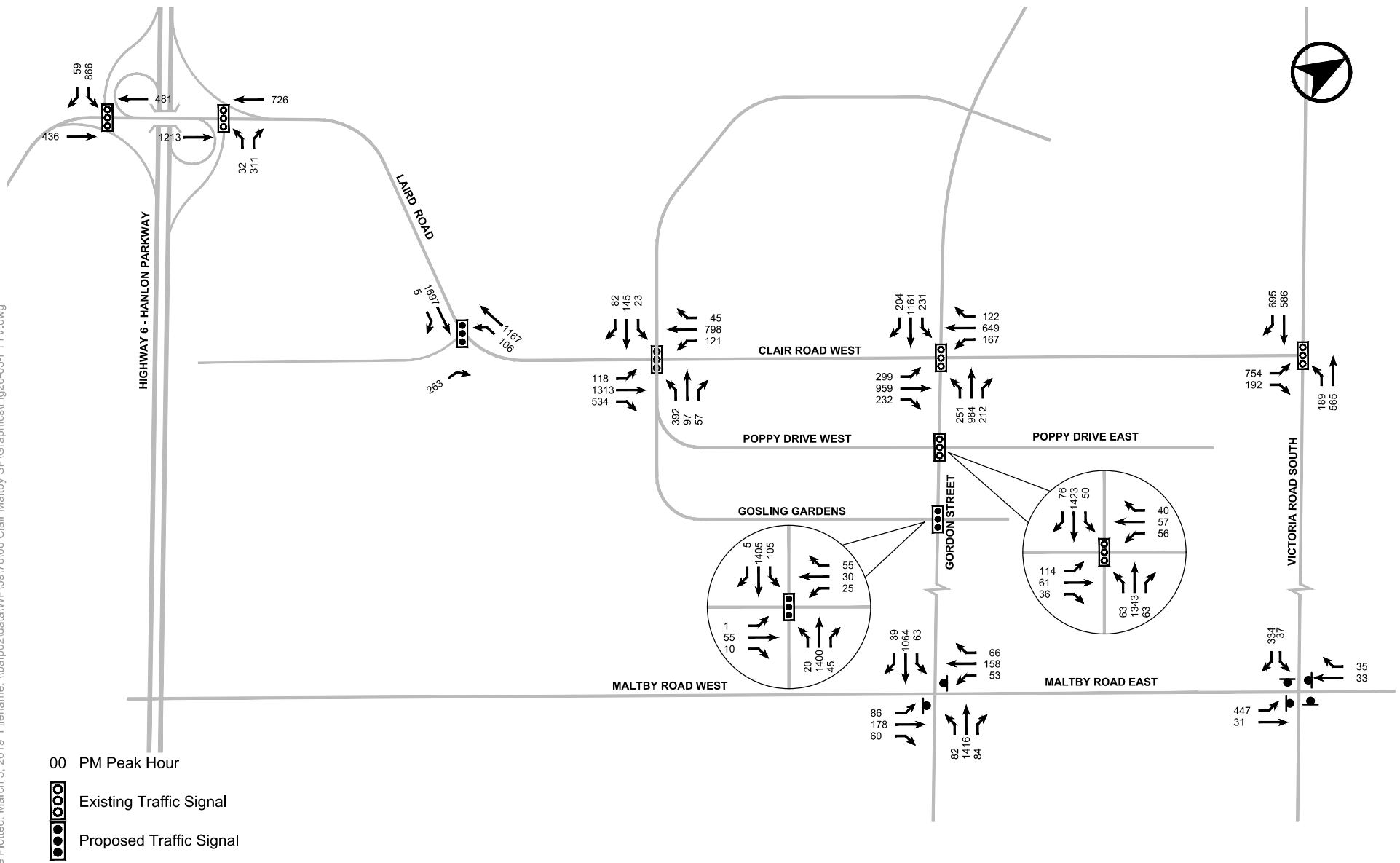
Future total traffic scenario lane configurations on the area street network reflect the following planned improvements that are assumed as part of the future traffic analysis scenarios:

- Widening of Gordon Street from 2 to 4 lanes (approved 2001 EA) from Kortright Road to Wellington Road 34;
- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA) – COMPLETE;
- Southerly extension of Southgate Drive to Maltby Road; and
- Clair-Maltby Secondary Plan collector road network as outlined in the preferred “Community Structure”.

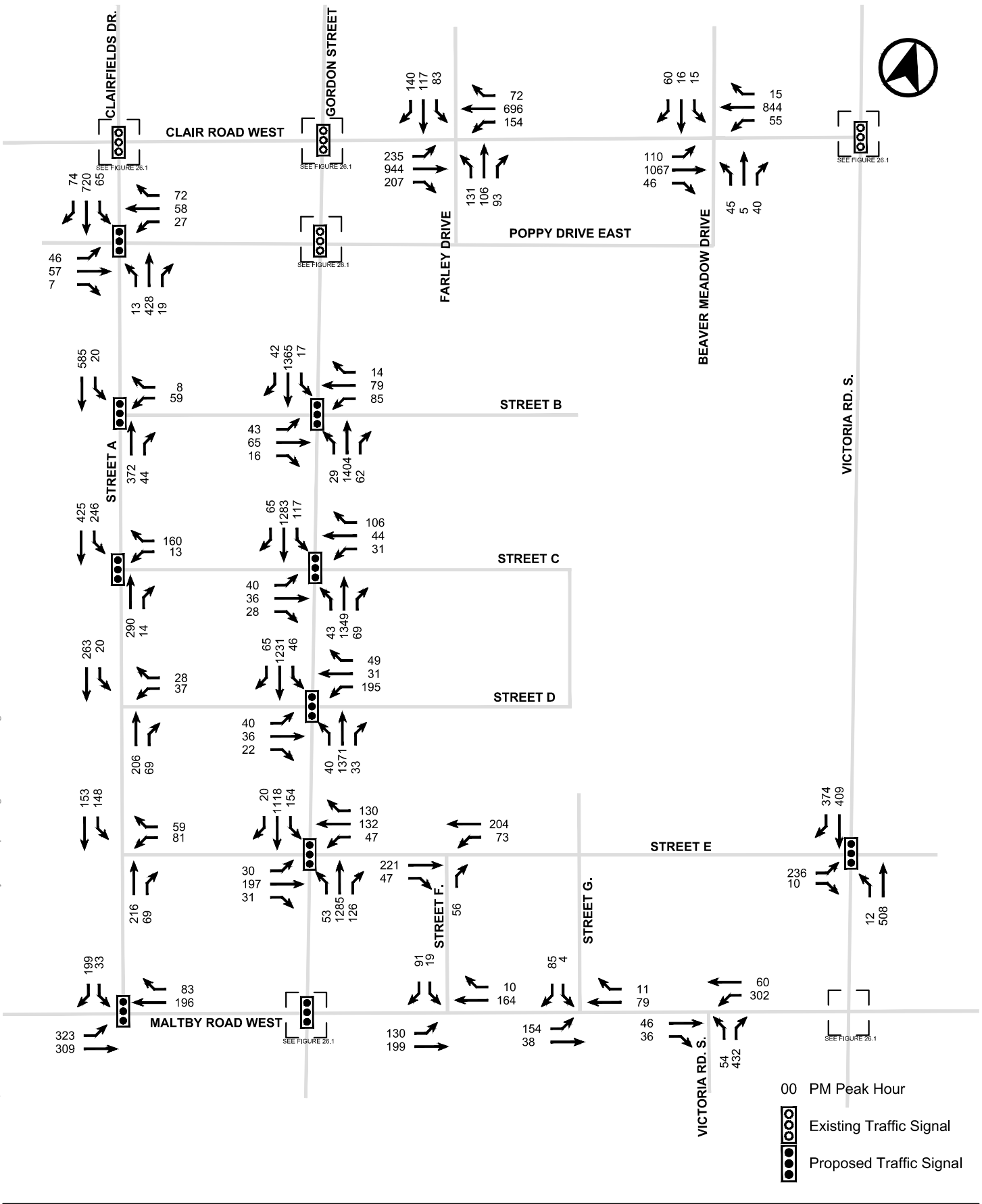
Future Total traffic volumes, which is the sum of future background traffic volumes and traffic volumes resulting from development of the Clair-Maltby Secondary Plan area, are illustrated in Figure 26. Future total traffic volumes also include minor adjustments to existing traffic volumes associated with Bishop Macdonell Catholic Secondary School and South End Community Park, which would be anticipated to utilize Poppy Drive upon completion of this street between Gordon Street and Clair Road West rather than being required to route through the Poppy Drive West / Clair Road West intersection.

Future Total traffic volumes have been forecast for existing study area intersections, as well as future collector road intersections as outlined within the Preferred Community Structure plan. The base future traffic lane configurations and traffic controls are illustrated in Figure 27, as are general street names for reference purposes.

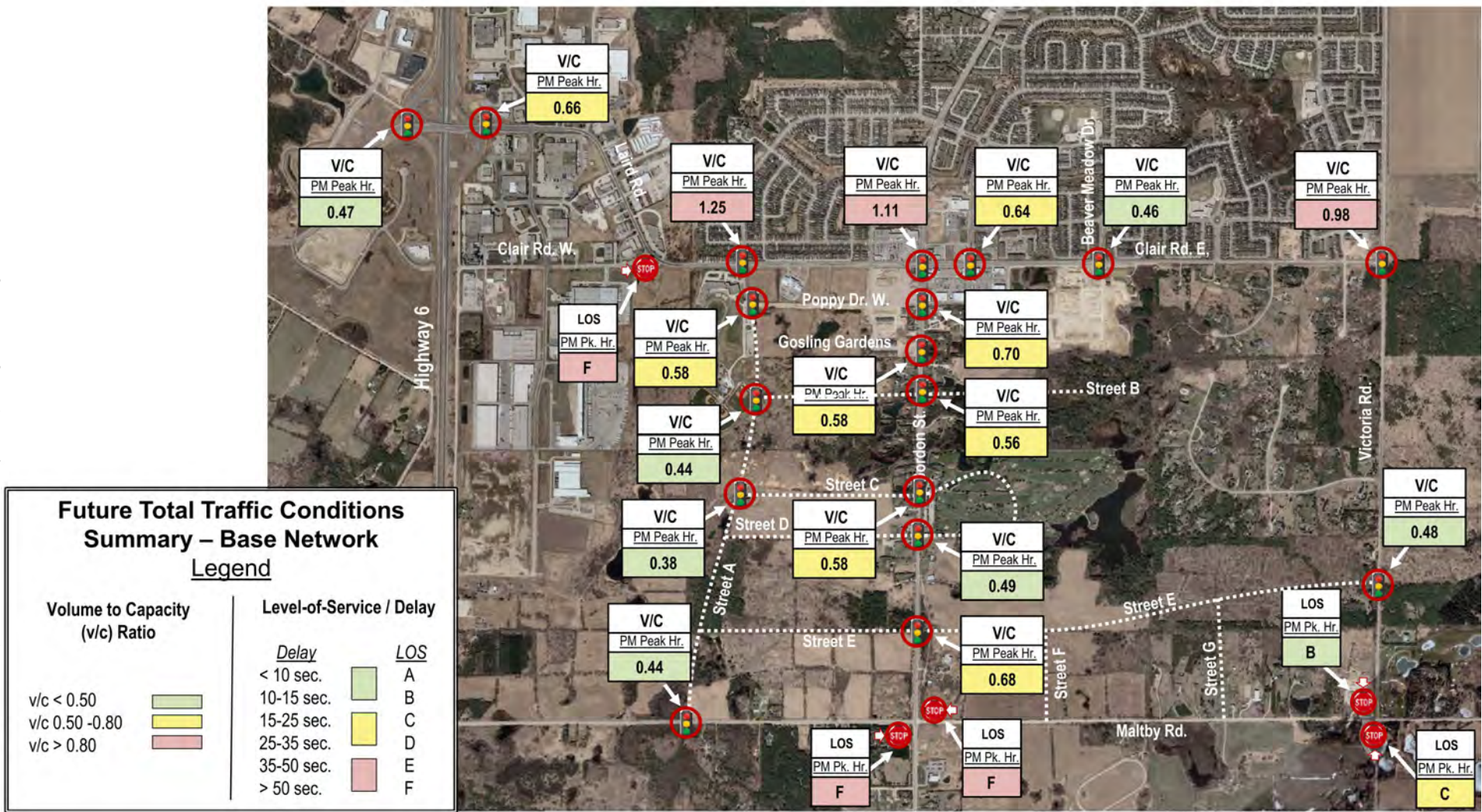
Clair-Maltby Secondary Plan forecast traffic volumes are assigned based on the Traffic Zones identified in Figure 18. Understanding that local streets have not been identified within the Preferred Community Structure, forecast traffic volumes have been assigned generally to collector roads. As such, collector road traffic volumes will not balance along collector street corridors.



FUTURE TOTAL TRAFFIC VOLUMES



FUTURE TOTAL TRAFFIC VOLUMES



SUMMARY OF FUTURE TOTAL WEEKDAY AFTERNOON TRAFFIC OPERATIONS - BASE FUTURE TRAFFIC NETWORK

15.5.2 Signalized Intersection Analysis Results

Detailed results of the Synchro analysis of signalized intersections within the study area under future total traffic conditions are included in **Appendix R**. A discussion of the traffic analysis findings follows.

15.5.2.1 General Findings

The traffic operations analyses outlined herein reflect traffic operations at the key intersections in the Secondary Plan area without explicitly considering the downstream congestion extending beyond study area intersections.

Base Future Total Street Network

Individual movement and overall volume-to-capacity ratios for each of the signalized intersections within the study area, under the future total traffic scenario, are summarized in Table 33.

Base future street network assumptions are analyzed for all signalized intersections.

A summary of future total signalized and unsignalized traffic operations at key study area intersections under base future total street network conditions is provided in Figure 28.

Recommended Future Total Street Network

Additional analysis is undertaken with recommended intersection improvements (as summarized in Section 15.5.4), at certain signalized intersections within the study area. Recommended improvements specifically imply physical improvements to existing intersection configurations (additional traffic lanes), or traffic control (signalization). Traffic analysis results with recommended improvements are also summarized in Table 33.

Assuming the introduction of the recommended intersection improvements (as outlined in Section 15.5.4), traffic operations at signalized and unsignalized intersections are anticipate to be acceptable, except for certain capacity constraints expected for specific traffic movements at key study area intersections.

A summary of future total signalized and unsignalized traffic operations at key study area intersections under recommended future total street network conditions is provided in Figure 30.

**TABLE 33 STUDY AREA SIGNALIZED INTERSECTIONS OVERALL V/C RATIOS:
WEEKDAY AFTERNOON PEAK HOUR**

Intersection	Traffic Movement	Volume to Capacity (v/c) Ratio	
		Base Future Street Network	Base Future Street Network with Recommended Improvements
Gordon Street and Clair Road	EB L	0.97	0.97
	EB T(R)	1.01	0.88
	EB R	--	0.30
	WB L	1.06	1.02
	WB TR	0.84	0.95
	NB L	1.05	0.99
	NB T(R)	1.03	0.78
	NB R	--	0.22
	SB L	0.95	0.85
	SB T(R)	1.19	0.94
	SB R	--	0.24
	Overall	1.11	1.01
Gordon Street and Poppy Drive	EB L	--	0.41
	EB (L)TR	0.72	0.20
	WB L	--	0.20
	WB (L)TR	0.45	0.19
	NB L	0.31	0.29
	NB TR	0.70	0.70
	SB L	0.22	0.22
	SB T(R)	0.74	0.74
	Overall	0.70	0.63
Gordon Street and Gosling Gardens	EB LTR	0.17	--
	WB LTR	0.24	--
	NB L	0.11	--
	NB TR	0.69	--
	SB L	0.45	--
	SB TR	0.58	--
	Overall	0.58	--

Gordon Street and Maltby Road	EB L	Unsignalized	0.45
	EB TR		0.52
	WB L		0.29
	WB TR		0.49
	NB L		0.32
	NB TR		0.66
	SB L		0.53
	SB TR		0.49
	Overall		0.62
Clair Road West and Clairfields Drive / Clairfields Extension	EB L	0.40	0.43
	EB T(R)	1.21	0.88
	EB R	--	0.40
	WB L	0.92	0.74
	WB TR	0.60	0.57
	NB L	--	0.93
	NB (L)TR	1.32	0.20
	SB L	--	0.09
	SB (L)T(R)	0.38	0.54
	Overall	1.25	0.92
Clair Road East and Farley Drive	EB L	0.56	--
	EB TR	0.69	--
	WB L	0.56	--
	WB TR	0.46	--
	NB L	0.56	--
	NB TR	0.36	--
	SB L	0.31	--
	SB TR	0.46	--
	Overall	0.64	--
Clair Road East and Beaver Meadow Drive	EB L	0.31	--
	EB TR	0.63	--
	WB L	0.21	--
	WB TR	0.49	--
	NB LTR	0.16	--
	SB L	0.04	--
	SB TR	0.07	--
	Overall	0.46	--

Clair Road East and Victoria Road	EB L	0.96	--
	EB R	0.14	--
	NB L	0.92	--
	NB T	0.70	--
	SB T	0.93	--
	SB R	0.53	--
	Overall	0.97	--
Laird Road and Highway 6 Northbound Off-Ramp	EB T	0.73	--
	WB T	0.44	--
	NB L	0.05	--
	NB R	0.58	--
	Overall	0.66	--
Laird Road and Highway 6 Southbound Off-Ramp	EB T	0.42	--
	WB T	0.45	--
	NB L	0.48	--
	NB R	0.04	--
	Overall	0.47	--
Clair Road West and Laird Road	EB TR	Unsignalized	0.82
	WB L		0.38
	WB T		0.45
	NB L		0.01
	NB R		0.86
	Overall		0.83
New Intersections Resulting from the Development of the Secondary Plan (Preferred Community Structure)			
Gordon Street and Street B	EB L	0.18	--
	EB TR	0.19	--
	WB L	0.33	--
	WB TR	0.23	--
	NB L	0.17	--
	NB TR	0.63	--
	SB L	0.09	--
	SB TR	0.60	--
	Overall	0.56	--

Gordon Street and Street C	EB L	0.16	--
	EB TR	0.21	--
	WB L	0.11	--
	WB TR	0.20	--
	NB L	0.24	--
	NB TR	0.72	--
	SB L	0.46	--
	SB TR	0.58	--
	Overall	0.58	--
Gordon Street and Street D	EB L	0.14	--
	EB TR	0.10	--
	WB L	0.14	--
	WB TR	0.11	--
	NB L	0.19	--
	NB TR	0.60	--
	SB L	0.26	--
	SB TR	0.55	--
	Overall	0.49	--
Gordon Street and Street E	EB L	0.19	--
	EB TR	0.56	--
	WB L	0.25	--
	WB TR	0.61	--
	NB L	0.21	--
	NB TR	0.72	--
	SB L	0.62	--
	SB TR	0.49	--
	Overall	0.68	--
Clairfields Extension (Street A) and Poppy Drive West	EB LTR	0.31	--
	WB L	0.10	--
	WB TR	0.25	--
	NB L	0.05	--
	NB TR	0.37	--
	SB L	0.01	--
	SB TR	0.65	--
	Overall	0.58	--

Clairfields Extension (Street A) and Street B	WB LR	0.12	--
	NB TR	0.46	--
	SB L	0.05	--
	SB T	0.64	--
	Overall	0.44	--
Clairfields Extension (Street A) and Street C	WB LR	0.14	--
	NB TR	0.50	--
	SB L	0.48	--
	SB T	0.46	--
	Overall	0.38	--
Maltby Road and Clairfields Extension (Street A)	EB L	0.56	--
	EB T	0.30	--
	WB TR	0.37	--
	SB L	0.07	--
	SB R	0.14	--
	Overall	0.44	--
Victoria Road and Street E	EB L	0.41	--
	EB R	0.01	--
	NB L	0.02	--
	NB T	0.53	--
	SB T	0.42	--
	SB R	0.24	--
	Overall	0.48	--

Notes:

1. Reference Figure 27 for new collector street names.

The signalized intersection traffic analysis indicates that most study area intersections perform acceptably, and without any traffic capacity constraints for any individual traffic movements, except for certain movements at the key Gordon Street / Clair Road; Victoria Road / Clair Road; and Clairfields Drive / Clairfields Extension / Clair Road intersections. The following movements are anticipated to operate with longer delays and / or near theoretical capacity during weekday peak hours.

Gordon Street / Clair Road

- Eastbound left-turn 0.95
- Westbound left turn 1.02
- Westbound through / right-turn 0.95
- Northbound left-turn 0.99
- Southbound through 0.94

Victoria Road / Clair Road

- Eastbound left-turn 0.96
- Northbound left-turn 0.92
- Southbound through 0.93

Clairfields Drive / Clair Road

- Northbound left-turn 0.93

The above noted intersections are anticipated to operate with overall intersections v/c ratios of 0.92 to 1.01 during the prevailing weekday afternoon peak hour, assuming the introduction of street network improvements outlined in Section 15.5.5.

During the weekday afternoon peak hour, all other signalized intersections within the study area are anticipated to operate with overall intersection v/c ratios of 0.83 or less, while individual traffic movements are shown to all operate with a v/c ratio of 0.86 or less (i.e. intersection of Laird Road / Clair Road).

Overall signalized intersection traffic operations within the Secondary Plan area are anticipated to be acceptable under future total conditions, and are accommodated by the Preferred Community Structure street network plan understanding that specific traffic movements are anticipated to operate at or near capacity during the prevailing weekday afternoon peak hour.

15.5.2.2 Gordon Street and Clair Road

The key Gordon Street and Clair Road intersection is anticipated to operate at theoretical capacity during the weekday afternoon peak hour under future total traffic conditions – even when accounting for the recommended intersection improvements at this location. This intersection, given its location within the wider street network and surrounding retail development pattern, would be anticipated to operate under busy conditions during weekday peak hours.

Specifically, during the weekday afternoon peak hour, left-turn movements, the westbound through / right-turn movement, and the southbound through movement are anticipated to operate with v/c ratios of 0.90 or greater, resulting in longer traffic queues and delay relative to the existing conditions.

Recommended improvements are not intended to retain existing levels-of-service for motorists. However, improvements (as recommended in Section 15.5.5) are intended to accommodate new traffic resulting from background traffic growth, current developments planned and under construction, and new traffic resulting from the development of the Clair-Maltby Secondary Plan area.

As noted previously, traffic forecast for Secondary Plan area development is based on the most conservative (highest density) Land Use Budget circulated for the purposes of this analysis. As such, the identified improvements outlined in Section 15.5.5 may not be warranted should a less-dense development programme be realized.

Traffic operations at the Gordon Street / Clair Road intersection may be further mitigated through improvements to the Hanlon Parkway corridor which may redirect some existing Gordon Street traffic volumes to this corridor. Other, on-going improvements to the street network in the vicinity of the Gordon Street / Clair

Road intersection will also further improve conditions at this intersection and provide viable routing alternative for motorists. The ability for motorists to respond to traffic delays at this intersection, and utilize other streets in the local vicinity also provides an imperative to monitor traffic operations at this intersection over the long-term to assess changes in the local and regional road network.

15.5.3 Unsignalized Intersection Analysis Results

The results of the future total traffic conditions capacity analysis performed for unsignalized intersections in the study area are summarized in Table 34.

Detailed Synchro analysis output sheets are included in **Appendix R**. A summary of future total traffic conditions signalized and unsignalized traffic operations at key study area intersections is provided in Figure 28 (base future condition) and Figure 29 (with recommended improvements).

Future Total Unsignalized Intersections

A total of four (4) existing unsignalized intersections were reviewed within the unsignalized intersection analysis, of which two (2) are recommended to be signalized in the future. Traffic operations at the Gordon Street / Maltby Road and Clair Road West / Laird Road intersections is anticipated to operate poorly under future total traffic conditions, and as such may warrant signalization.

Five (5) new unsignalized intersections were reviewed within the future total traffic analysis scenario. These intersections are identified as new junctions within the Preferred Community Structure street network plan, and are recommended to operate under STOP-control.

The new intersections of Clairfields Drive extension (Street A) / Street D; Clairfields Drive extension (Street A) / Street E; and Street E / Street F are proposed to operate with all-way STOP-control. The intersections of Maltby Road / Street F and Maltby Road / Street G are proposed to operate with one-way STOP-control in the southbound direction.

All other movements at unsignalized intersections within the study area are shown to operate at LOS C or better during weekday peak hours, which is acceptable.

Victoria Road / Maltby Road Intersections

The intersections of Victoria Road and Maltby Road are anticipated to continue to operate acceptably under future total traffic conditions. From a traffic capacity perspective, this intersection is not anticipated to warrant improvements.

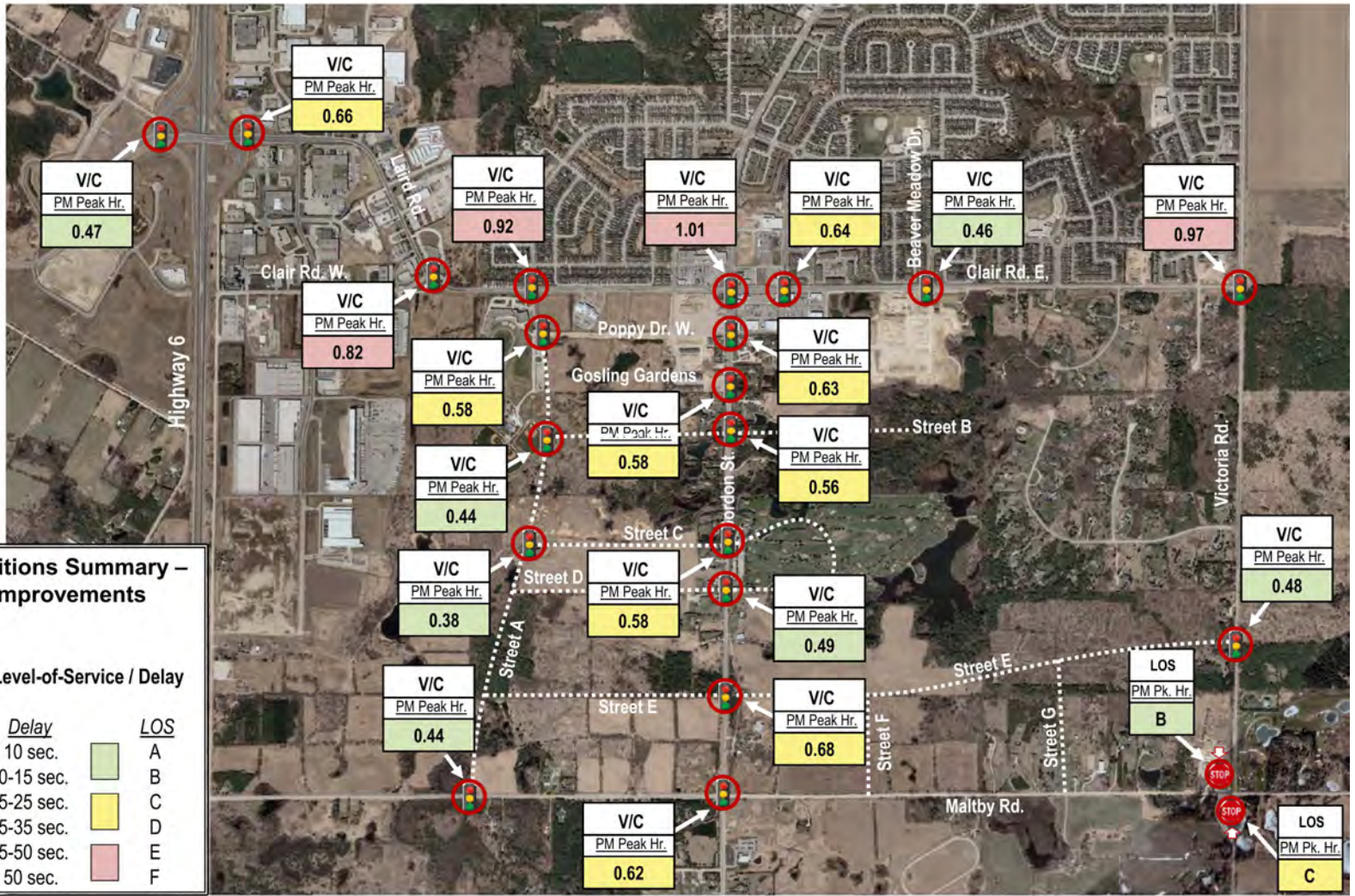
Further consideration may be given to this intersection to accommodate for traffic control or alignment alterations to improve safety or mitigate traffic speeds.

TABLE 34 UNSIGNALIZED INTERSECTION ANALYSIS RESULTS SUMMARY

Intersection	Movement of Interest	Future Total Traffic Conditions	
		Delay (s)	LOS
Clair Road West and Laird Road ¹	WB L	18.5	C
	NB (Clair Rd.) LR	76.1	F
Gordon Street and Maltby Road ¹	EB LTR	>120	F
	WB LTR	>120	F
	NB L	11.4	B
	SB L	18.4	C
Victoria Road and Maltby Road (west intersection)	WB LT	6.9	A
	NB LR	17.1	C
Victoria Road and Maltby Road (east intersection)	EB LT	7.9	A
	SB LR	14.7	B
New Intersections Resulting from the Development of the Secondary Plan (Preferred Community Structure)			
Clairfields Extension (Street A) and Street D	WB LR	8.5	A
	NB TR	9.3	A
	SB LT	9.7	A
Clairfields Extension (Street A) and Street E	WB LR	9.4	A
	NB TR	10.1	B
	SB LT	10.9	B
Maltby Road and Street F	EB L	7.8	A
	SB LR	10.9	B
Maltby Road and Street G	EB L	7.7	A
	SB LR	9.3	A
Street E and Street F	EB TR	9.2	A
	WB LT	9.7	A
	NB LR	8.0	A

Notes:

1. Recommended to be signalized under future total traffic conditions.



SUMMARY OF FUTURE TOTAL WEEKDAY AFTERNOON TRAFFIC OPERATIONS - WITH RECOMMENDED TRAFFIC NETWORK IMPROVEMENTS



15.5.4 Traffic Signal Timing Considerations

Traffic Signal Optimization

Traffic signal adjustments have been made as part of the analysis herein to accommodate for changes in traffic demands and patterns.

To accommodate an increase in traffic demands in the northbound and southbound directions along Gordon Street, and eastbound and westbound along Clair Road west of Gordon Street, traffic signal cycle lengths have been increased during the weekday afternoon peak hour.

Traffic signal timing along the Gordon Street corridor has been set to 110 second cycle lengths during the weekday afternoon peak hour. Signal timing cycle lengths have been made consistent along the Gordon Street corridor to allow for optimization of traffic signal off-sets and permit signal timing synchronization in order to best limit traffic delays, reduce transit vehicle delays, and manage vehicle queuing.

New Traffic Signal Controls

A total of eleven (11) new traffic signals are considered as part of the analysis herein, to accommodate future traffic demands and facilitate pedestrian movement across busy traffic corridors.

It is recommended that two (2) existing STOP-controlled intersections be considered for signalization as development occurs within the Secondary Plan area. The following existing unsignalized intersections are expected to warrant the introduction of traffic signals:

- Gordon Street / Maltby Road
- Clair Road West / Laird Road

A number of new arterial / collector street junctures are anticipated with the application of the Preferred Community Structure street network plan, including a total of four (4) new collector street intersections with Gordon Street between Gosling Gardens and Maltby Road.

It is recommended that all new east-west oriented collector streets include traffic signal control at their juncture with Gordon Street, to allow for acceptable levels-of-service for minor street traffic approaches, and accommodate pedestrian movement across Gordon Street.

In addition traffic signals recommended for new collector street intersections with Gordon Street, additional traffic signals may be warranted for intersections along the Clairfields Drive extension (Street A) and Victoria Road.

In addition to the two existing intersections noted above, the following new intersections are anticipated to warrant traffic signal control, or should be signalized to strategically allow for controlled pedestrian crossing. The expectation for these intersections to operate under traffic signal control has been informed by the analysis herein, and have subsequently been analyzed assuming traffic signal control under future total traffic conditions.

- Gordon Street / Street B
- Gordon Street / Street C
- Gordon Street / Street D
- Gordon Street / Street E
- Maltby Road West / Clarifields Drive extension (Street A)
- Victoria Road / Street E
- Clarifields Drive extension (Street A) and Poppy Road West
- Clarifields Drive extension (Street A) / Street B
- Clarifields Drive extension (Street A) / Street C

15.5.5 Recommended Intersection Traffic Capacity Improvements

It is important to understand that the recommended intersection improvements are based on the modelling exercise undertaken herein, and that changes to the wider street network, improvements to regional corridors, and changes in travel behaviour and patterns can alter these recommendations. Therefore, updated traffic analysis will be required in sequence with development in the Clair-Maltby Secondary Plan area to justify the recommended improvements, and / or indicate further or alternative improvements.

The improvements outlined in the following are in addition to signal timing adjustments identified in Section 15.5.4. Improvements identified below relate to changes in the intersection lane configurations, intersection approach configuration, or traffic control.

Gordon Street / Clair Road Intersection

The intersection of Gordon Street / Clair Road is most impacted by forecast future traffic volume demands, and is anticipated to require changes to accommodate these future demands. Right-turn lanes are recommended for most intersection approaches to accommodate for increased through traffic demands, turning traffic demands (specifically for the eastbound approach leg), and transit vehicle layby. The following improvements are recommended based on the analysis herein:

- Introduction of a northbound separate right-turn lane
- Introduction of a southbound separate right-turn lane
- Introduction of an eastbound separate right-turn lane

Clair Road / Clairfields Drive Intersection

The intersection of Clair Road / Clairfields Drive is anticipated to be impacted by forecast Clair-Maltby Secondary Plan development-related traffic volumes as motorists route to / from the Hanlon Parkway via Clair Road and Laird Road. Changes to the eastbound, northbound and southbound approach legs of the intersection are recommended to accommodate these future demands. Separate left-turn lanes are recommended for the northbound and southbound approaches, and a separate right-turn lane is recommended in the eastbound direction. These improvements are suggested to accommodate the key northbound to westbound and eastbound to southbound traffic demands resulting from development of the Clair-Maltby Secondary Plan. Considerations should also be given to the length of the northbound separate left-turn lane, understanding relatively high number of traffic volumes anticipated for this movement.

The following improvements for this intersection are recommended based on the analysis herein:

- Introduction of a northbound separate left-turn lane
- Introduction of an eastbound separate right-turn lane
- Pavement restriping to accommodate a southbound separate left-turn lane

Gordon Street / Poppy Road Intersection

The intersection of Gordon Street / Poppy Road is anticipated to be impacted by forecast future traffic volumes – specifically as they relate to background site-specific developments. Changes to the eastbound and westbound approach legs of the intersection are recommended to better accommodate turning movement demands. Separate left-turn lanes are recommended for the eastbound and westbound approaches. These improvements are suggested to accommodate a good level-of-service for traffic anticipated to route along Poppy Road.

The following improvements for this intersection are recommended based on the analysis herein:

- Introduction of an eastbound separate left-turn lane
- Introduction of an westbound separate left-turn lane

Laird Road / Clair Road West Intersection

The intersection of Laird Road / Clair Road West is anticipated to warrant the introduction of traffic signal control under future total traffic conditions. In addition to this improvement, the introduction of a northbound right-turn lane (Clair Road approach) is recommended to accommodate northbound right-turn movements that may otherwise be blocked by the occasional motorists making a northbound left-turn.

The following improvements for this intersection are recommended based on the analysis herein:

- Introduction of a northbound separate right-turn lane

Future Victoria Road / Street E Intersection

The intersection of Victoria Road / Street E is anticipated to operate acceptably under future total traffic conditions. However, unlike other new collector street intersections as outlined in the Preferred Community Structure street network plan, this intersection is anticipated to accommodate a notable volume of southbound right-turn traffic – specifically during the weekday afternoon peak hour. As such, a separate southbound right-turn lane is advised in this location.

The following improvements for this intersection are recommended based on the analysis herein:

- Introduction of a southbound separate right-turn lane

Summary of Recommended Improvements

The improvements outlined above are summarized in Figure 29.

A summary of future total traffic conditions at signalized and unsignalized traffic operations at key study area intersections assuming the introduction of the recommended improvements is provided in Figure 30.

As previously noted, this traffic analysis reflects the highest density land use scenario advanced for the purposes of the Clair-Maltby Secondary Planning study and should, in itself, illustrate the conservative nature of the analysis herein. Furthermore, various changes in the transportation network, the introduction and advancement of TDM and Transit-Oriented Development (TOD), can collectively work to potentially change travel behaviour and improve traffic capacity concerns as they are identified herein.

Therefore, updated traffic analysis will be required in sequence with development in the Clair-Maltby Secondary Plan area to justify the recommended improvements, and / or indicate further or alternative improvements.

15.5.6 North-South Collector Road West of Gordon Street

The transportation modelling undertaken herein indicates that a second north-south oriented street is required to connect to Clair Road to accommodate the land budget considered as part of the planning process (approx. 10,125 units). In absence of a second street connection between the Secondary Plan area and Clair Road, considerable improvements are required to the Gordon Street / Clair Road and Victoria Road / Clair Road intersections, beyond those already recommended herein.

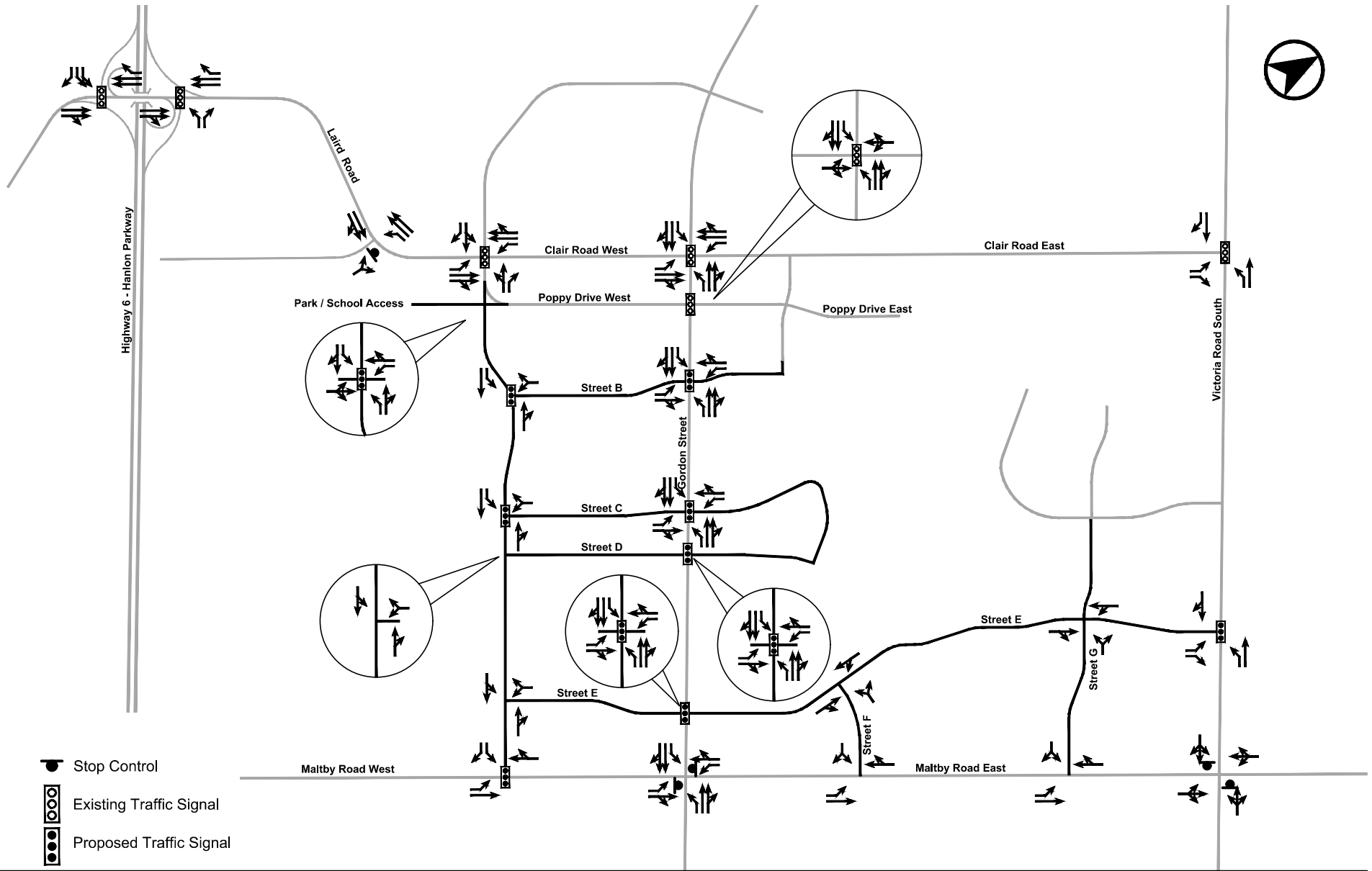
This collector street (west of Gordon Street) also provides important connectivity between Secondary Plan development and recreational and institutional uses in the area of Clair Road / Poppy Drive West. A more robust, resilient street network is also provided that can better distribute traffic, accommodate transit vehicle routing, and provide more direct access to Secondary Plan area development (including for emergency vehicles).

15.5.7 Additional North-South Collector Road East of Gordon Street

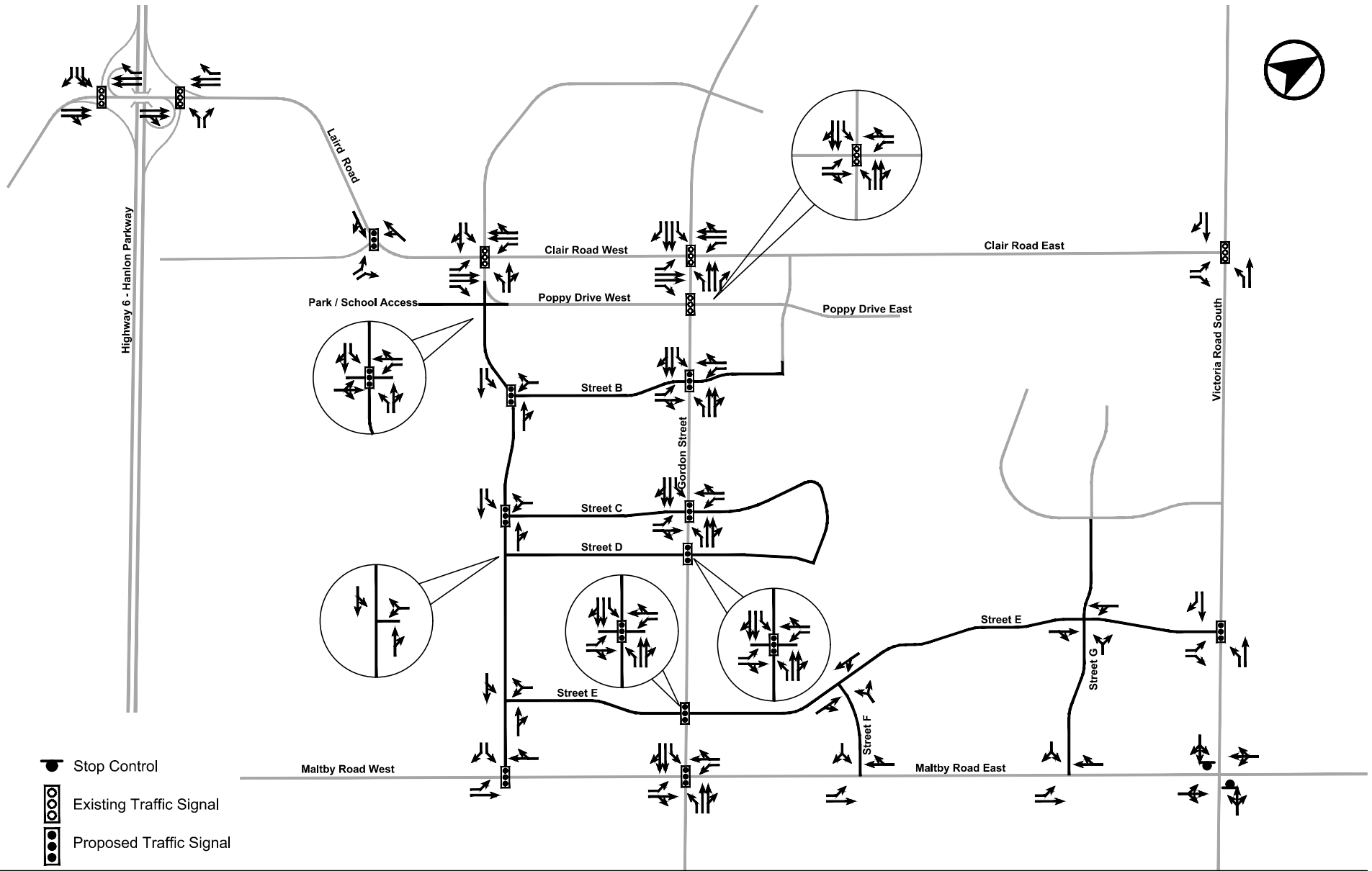
The transportation modelling undertaken herein demonstrates that traffic volumes resulting from background traffic and traffic related to the development of the Clair-Maltby Secondary Plan area, can be accommodated by Gordon Street as planned (i.e. with four through-traffic lanes), understanding that certain traffic movements at the Gordon Street / Clair Road intersection will operate under busy conditions during the prevailing weekday afternoon peak hour. Specifically, southbound through movements and left-turn movements in the weekday afternoon peak hour are anticipated to operate near theoretical capacity, with v/c ratios between 0.90 and 1.00, assuming the highest density Land Budget development scenario tested herein.

The macro-model analysis undertaken by the City of Guelph, and supported through the traffic analysis and forecasts undertaken herein, support the implementation of 4 through-traffic lanes along Gordon Street within the Clair-Maltby Secondary Plan area. Traffic capacity constraints, should they develop during prevailing weekday peak travel periods, may be anticipated at the key Gordon Street / Clair Road intersection, but are otherwise not anticipated for link segments of Gordon Street. Improvements, by way of ancillary turn lanes, are recommended herein to mitigate traffic capacity constraints at the Gordon Street / Clair Road intersection.

A typical 4-lane street section is anticipated to sufficiently accommodate forecast traffic demands along the Gordon Street corridor, understanding the need for ancillary turn lanes – specifically separate left-turn lanes at all intersections where left-turns are permitted. Pending the frequency of separate left-turn lanes, a continuous left-turn / centre median lane along the extent, or portions of, Gordon Street within the Secondary Plan area may be warranted.



FUTURE BASE TRAFFIC LANE CONFIGURATIONS AND CONTROLS



RECOMMENDED FUTURE TRAFFIC LANE CONFIGURATIONS AND CONTROLS

15.5.8 Gordon / Maltby Roundabout

The intersection of Gordon Street and Maltby Road is considered for the introduction of a roundabout, as an alternative to recommended signalization. A roundabout, at this junction, may be appropriate considering:

- its location as a gateway to / from the City of Guelph,
- its boundary character between urban Guelph and rural Wellington County, and
- the opportunity provided by a roundabout to accommodate transit vehicle loop functions as an alternative to an off-street transit terminal facility.

With regards to the first two points noted above, a roundabout may be appropriate as an option to reduce vehicle speeds on approach to the City of Guelph in transition from rural highway to urban arterial.

Understanding the opportunity for a roundabout at the junction of Gordon Street and Maltby Road, roundabout traffic analysis was completed for the future total traffic scenario.

15.5.8.1 Analysis Methodology

Future total traffic volumes were developed herein, and utilized in conducting the future total roundabout analysis. Traffic analysis was conducted for the weekday afternoon peak hour, consistent with the methodology pursued herein.

Roundabouts were analyzed using ARCADY 9 with no capacity adjustment and without y-intercept adjustments to account for downstream traffic platoons.

Key performance indicators cited in the roundabout analysis, and summarized for each approach leg, are volume-to-capacity (v/c) ratios, average delay, and level-of-service (LOS).

Roundabout geometries, for purposes of this roundabout analysis, are based generally on the functional design of planned 2-lane roundabouts in the City of Waterloo set within an approximate 60 metre diameter. The proposed roundabout design assumes a two-lane roundabout. The northbound and southbound approaches (Gordon Street) assumes two traffic lanes in either direction, and two roundabout entry lanes in either direction. The eastbound and westbound approaches (Maltby Road) assumes one traffic lane in either direction, which widen on approach to the roundabout to accommodate two roundabout entry lanes.

15.5.8.2 Analysis Results

ARCADY 9 traffic analysis results for the analyzed roundabout under future traffic conditions are summarized in Table 35. Detailed results analysis outputs are included in **Appendix S**.

TABLE 35 ROUNDABOUT ANALYSIS SUMMARY

Intersection	Approach Leg	Future Total Traffic Conditions		
		V/C Ratio	Average Delay (sec)	LOS
Gordon Street and Maltby Road	WB	0.56	17.12	C
	SB	0.60	4.13	A
	EB	0.39	6.53	A
	NB	0.81	9.01	A
	Overall	--	7.74	A

Notes:

1. Overall intersection capacity indicated as “residual” capacity.

Overall roundabout delay for the Gordon Street / Maltby Road junction is anticipated to be 7.74 seconds, reflecting an overall level-of-service ‘A’. Generally, eastbound and westbound traffic approaches are anticipated to operate with a level-of-service of ‘A’ to ‘C’ during the weekday afternoon peak hour, while northbound and southbound traffic movements are anticipated to operate with a level-of-service of ‘A’. Generally, short average delays are anticipated for northbound, southbound and eastbound motorists (less than 10 seconds). Generally acceptable average delays are anticipated for westbound motorists (approximately 17 seconds).

Should a traffic roundabout be pursued for the junction of Gordon Street and Maltby Road, traffic operations are anticipated to be acceptable. Further consideration would be required as to its functional design and ability to appropriately accommodate pedestrian crossings, cyclists, transit vehicles and articulated trucks.

Appendix A – Transportation Tomorrow Survey (TTS) Details: Local Travel Behaviour

TWO-WAY PEAK PERIOD TRIP DISTRIBUTION

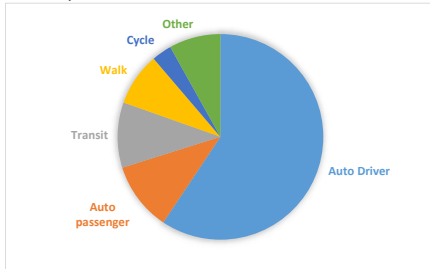
Orientation to / from South Guelph	Transit excluding GO rail	Cycle	Auto driver	GO rail only	Joint GO rail and local transit	Auto passenger	School bus & Taxi	Walk	Total Trips from TTS Zone
Local Area	1304	401	7536	0	0	1367	1027	1057	12692
	10%	3%	59%	0%	0%	11%	8%	8%	
Old City (Downtown)	61	0	905	0	0	275	43	0	1284
	5%	0%	70%	0%	0%	21%	3%	0%	
Rest of Guelph	77	27	2873	0	0	329	84	0	3390
	2%	1%	85%	0%	0%	10%	2%	0%	
Waterloo Region	0	0	2225	0	0	112	22	0	2359
	0%	0%	94%	0%	0%	5%	1%	0%	
Peel / Halton Regions	0	0	1512	0	0	161	19	0	1692
	0%	0%	89%	0%	0%	10%	1%	0%	
City of Toronto	52	0	170	53	0	9	0	0	284
	18%	0%	60%	19%	0%	3%	0%	0%	
Wellington County	0	0	901	0	0	134	8	0	1043
	0%	0%	86%	0%	0%	13%	1%	0%	
Other	0	0	736	0	0	84	0	0	820
	0%	0%	90%	0%	0%	10%	0%	0%	

	Auto Driver	Auto passenger	Transit	Walk	Cycle	Other
53.9%	59%	11%	10%	8%	3%	8%
5.4%	70%	21%	5%	0%	0%	3%
14.4%	85%	10%	2%	0%	1%	2%
10.0%	94%	5%	0%	0%	0%	1%
7.2%	89%	10%	0%	0%	0%	1%
1.2%	60%	3%	37%	0%	0%	0%
4.4%	86%	13%	0%	0%	0%	1%
3.5%	90%	10%	0%	0%	0%	0%

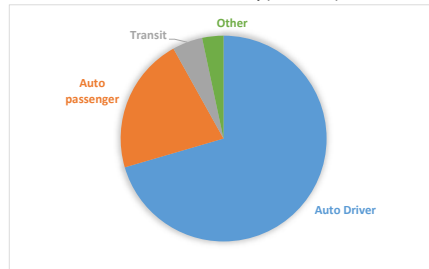
check: 14815 14815

	1494	428	16858	53	0	2471	1203	1057	23564	20%
Total Check:	1494	428	16858	53	0	2471	1203	1057	23564	
	6%	2%	72%	0%	0%	10%	5%	4%		81% 13% 3% 0% 1% 3%
	138	27	3778	0	0	604	127	0	4674	
	3%	1%	81%	0%	0%	13%	3%	0%		

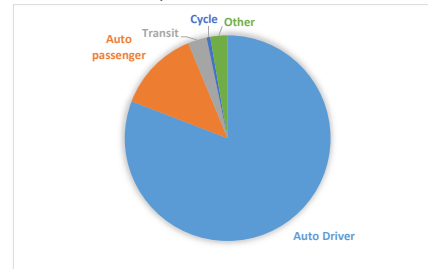
South Guelph



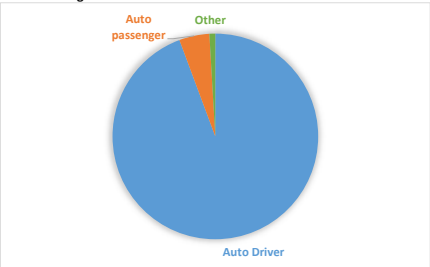
Old City (Downtown)



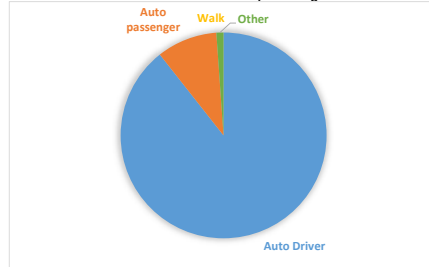
Rest of Guelph



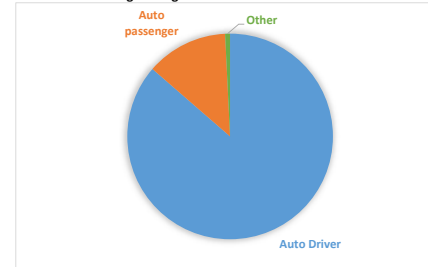
Waterloo Region



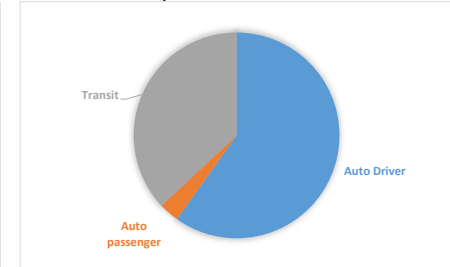
Halton / Peel Regions



Wellington Region



City of Toronto



Thu Dec 27 2018 18:20:11 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 700-900

and

2006 GTA z 8078-8081 8062 8064 8068 8067

Table: Trip 2016

Row:	Count:	Expanded:
Transit exc	2	45
Cycle	3	69
Auto driver	81	1712
Auto passe	9	186
School bus	4	96
Walk	23	440
Total:	122	2549

Thu Dec 27 2018 18:19:52 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 700-900

and

2006 GTA z 8078-8081 8062 8064 8068 8067

Table: Trip 2016

Row:	Count:	Expanded:
Transit exc	27	699
Cycle	8	215
Auto driver	277	5948
Auto passe	30	670
School bus	31	848
Walk	26	518
Total:	399	8897

Thu Dec 27 2018 18:20:33 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 1600-1800

and

2006 GTA z 8078-8081 8062 8064 8068 8067

Table: Trip 2016

Row:	Count:	Expanded:
Transit exc	26	669
Cycle	6	142
Auto driver	307	6200
GO rail only	3	53
Auto passe	37	751
School bus	9	211
Taxi passer	1	43
Walk	5	86
Total:	394	8157

Thu Dec 27 2018 18:18:57 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 1600-1800

and

2006 GTA z 8078-8081 8062 8064 8068 8067

Table: Trip 2016

Row:	Count:	Expanded:
Transit exc	2	82
Auto driver	145	2990
Auto passe	38	846
School bus	1	4
Walk	2	30
Total:	188	3951

Travel Mode	All Trips Travel Mode Split									
	Weekday AM Inbound		Weekday AM Outbound		Weekday PM Inbound		Weekday PM Outbound		Overall	
	Count	Proportion	Count	Proportion	Count	Proportion	Count	Proportion	Count	Proportion
Transit excluding GO rail	45	2%	699	8%	669	8%	82	2%	1495	6%
Cycle	69	3%	215	2%	142	2%		0%	426	2%
Auto driver	1712	67%	5948	67%	6200	76%	2990	76%	16850	72%
GO rail only		0%		0%	53	1%		0%	53	0%
Auto passenger	186	7%	670	8%	751	9%	846	21%	2453	10%
School bus	96	4%	848	10%	211	3%	4	0%	1159	5%
Taxi passenger		0%		0%	43	1%		0%	43	0%
Walk	440	17%	518	6%	86	1%	30	1%	1074	5%
Total:	2548	1	8898	1	8155	1	3952	1	23553	1

Appendix B – Detailed Collision Data



Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location CLAIR RD W @ GORDON ST

Municipality..... GUELPH

Traffic Control.... Traffic signal

Total Collisions.... 69

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
12-03079	2012-Jan-18, Wed,09:00	Clear	Rear end	Non-fatal injury	North	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					North		Stopped	Passenger van	Other motor vehicle	Driving properly	Daylight
12-12101	2012-Mar-04, Sun,23:35	Clear	Angle	P.D. only	South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Other	
Comments:					East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Other	Dark, artificial
12-501569641S	2012-Mar-09, Fri,08:25	Snow	Rear end		South	Loose snow	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					South	Loose snow	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
12-501587590S	2012-May-17, Thu,14:30	Clear	Rear end		South	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:					South	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Following too close	Daylight
12-501595303S	2012-Jun-12, Tue,17:15	Clear	SMV other		South	Dry	Stopped	Automobile, station wagon	Cyclist	Driving properly	
Comments:											Daylight
12-501605073S	2012-Jul-13, Fri,12:15	Clear	Rear end		East	Dry	Turning right	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					East	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
12-47925	2012-Sep-09, Sun,11:09	Clear	Angle	Non-fatal injury	West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:					North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	Daylight
12-501620497S	2012-Sep-09, Sun,14:00	Clear	Turning movement		South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:					North	Dry	Turning left	Pick-up truck	Other motor vehicle	Failed to yield right-of-way	Daylight
12-54333	2012-Oct-12, Fri,05:19	Clear	Turning movement	P.D. only	West	Dry	Going ahead	Pick-up truck	Other motor vehicle	Driving properly	
Comments:					East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	Dark

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12-64639	2012-Dec-11, Tue,09:35	Snow	Angle	P.D. only	North	Wet	Going ahead	Truck - closed	Other motor vehicle	Disobeyed traffic control	
Comments:					West	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
1313233	2013-Mar-22, Fri,18:52	Clear	Rear end	P.D. only	North	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:	Road #1: GORDON ST	Road #2: CLAIR RD E			North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Speed too fast for condition	Dusk
13-501691571s	2013-Apr-19, Fri,17:00	Clear	Rear end		South	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Other	
Comments:					South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
13-501708279s	2013-Jun-10, Mon,00:00	Clear	Rear end		West	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:					West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	Daylight
501708279	2013-Jun-10, Mon,16:00	Clear	Rear end	Non-reportable	West	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:	Road #1: CLAIR ROAD E	Road #2: CLAIR ROAD E			West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
13-13233 **	2013-Jun-22, Sat,18:52	Clear	Rear end	P.D. only	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Speed too fast for condition	
Comments:	CHARGED: D1 HTA 130 POT #1197527B				North	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Dusk
501713459	2013-Jun-25, Tue,06:45	Clear	Rear end	Non-reportable	South	Wet	Stopped	Passenger van	Other motor vehicle	Driving properly	
Comments:	Road #1: GORDON ST	Road #2: GORDON ST			South	Wet	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
1336985	2013-Aug-07, Wed,19:15	Clear	Sideswipe	P.D. only	North	Dry	Turning right	Automobile, station wagon	Cyclist	Driving properly	
Comments:	Road #1: GORDON ST	Road #2: CLAIR ROAD E			North	Dry	Going ahead	Bicycle	Other motor vehicle	Failed to yield right-of-way	Daylight
13-36985	2013-Aug-07, Wed,19:15	Clear	SMV other	Non-fatal injury	North	Dry	Going ahead	Bicycle		Failed to yield right-of-way	
Comments:	LINE 31 - V1 HAD NO REAR BRAKE (CABLE UNHOOKED) CHARGED: D1 PON #2775027B SEC. 139 (1) HTA				North	Dry	Going ahead	Automobile, station wagon	Cyclist	Driving properly	Daylight
13-501728773s	2013-Aug-08, Thu,17:30	Clear	Rear end		North	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Other	
Comments:					North	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
501731387	2013-Aug-15, Thu,02:00	Clear	Rear end	Non-reportable	North	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:	Road #1: GORDON ST	Road #2: GORDON ST			North	Dry	Slowing or stopping	Passenger van	Other motor vehicle	Driving properly	Dark, artificial

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13-42655**	2013-Sep-09, Mon,05:38	Clear	SMV other	P.D. only	South	Dry		Pulling onto shoulder or toward curb	Automobile, station wagon	Ran off road	Lost control	
Comments: CHARGED: D1 32(1) HTA, 2(1)(A) C.A.I.A TELEPHONE POLE, GUIDE WIRE RIPPED OFF												
1344314	2013-Sep-16, Mon,20:30	Clear	SMV unattendedNon-reportable West vehicle		West	Dry		Stopped	Automobile, station wagon	Other motor vehicle		Dark, artificial
Comments: Road #1: CLAIR RD E Road #2: CLAIR RD E												
13-501742645s	2013-Sep-16, Mon,20:30	Clear	Rear end		West	Dry		Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:												
					West			Going ahead	Unknown		Following too close	Dark
1349516	2013-Oct-13, Sun,05:03	Rain	SMV unattendedP.D. only vehicle		North	Wet		Turning right	Automobile, station wagon	Skidding/sliding	Improper turn	
Comments: Road #1: GORDON ST Road #2: CLAIR RD E												
13-49516	2013-Oct-13, Sun,05:03	Rain	SMV other	P.D. only	North	Wet		Turning right	Automobile, station wagon	Skidding/sliding	Improper turn	Dark
Comments: CHARGED: D1 SEC 130 HTA PON#2775625B												
1356784	2013-Nov-24, Sun,10:30	Snow	Rear end	Non-reportable	North	Ice		Stopped	Automobile, station wagon	Other motor vehicle		
Comments: Road #1: GORDON ST Road #2: GORDON ST												
					North	Ice		Slowing or stopping	Automobile, station wagon	Skidding/sliding		Daylight
14254	2014-Jan-02, Thu,18:21	Clear	Turning movement	P.D. only	South	Wet		Turning left	Pick-up truck	Other motor vehicle	Failed to yield right-of-way	
Comments: Road #1: GORDON ST Road #2: CLAIR RD W												
					North	Wet		Going ahead	Pick-up truck	Other motor vehicle	Driving properly	Dark, artificial
142012	2014-Jan-13, Mon,07:57	Clear	Turning movement	Non-reportable	West	Wet		Going ahead	Automobile, station wagon	Other motor vehicle		
Comments: Road #1: CLAIR RD W Road #2: CLAIR RD W												
					West	Wet		Turning right	Automobile, station wagon	Other motor vehicle		Daylight
14004254	2014-Jan-26, Sun,09:57	Clear	Approaching	P.D. only	North	Slush		Going ahead	Automobile, station wagon	Pole (utility, power)	Driving properly	
Comments: Road #1: GORDON ST Road #2: CLAIR RD E												
					South	Slush		Turning left	Automobile, station wagon	Other	Improper turn	Daylight
14004386	2014-Jan-27, Mon,10:00	Clear	Angle	P.D. only	South	Loose snow		Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	
Comments: Road #1: GORDON ST Road #2: CLAIR RD E												
					West	Loose snow		Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
501801711	2014-Feb-01, Sat,12:40	Snow	Rear end	Non-reportable	North	Wet		Stopped	Passenger van	Other motor vehicle		
Comments: Road #1: GORDON ST Road #2: GORDON ST												
					North	Wet						Daylight
14005368	2014-Feb-01, Sat,13:00	Snow	SMV other	P.D. only	North	Loose snow		Slowing or stopping	Automobile, station wagon	Pole (sign, parking meter)	Speed too fast for condition	
Comments: Road #1: GORDON ST Road #2: CLAIR RD W												
						Loose snow						Daylight

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14010272	2014-Mar-03, Mon,14:00	Clear	Angle	Non-reportable	North	Dry		Turning left	Ambulance	Other motor vehicle		
Comments: Road #1: CLAIR RD E Road #2: CLAIR RD E												
					West	Dry		Going ahead	Automobile, station wagon	Other motor vehicle		Daylight
501820599	2014-Mar-10, Mon,15:00	Clear	Rear end	Non-reportable	North	Dry		Stopped	Automobile, station wagon	Other motor vehicle		
Comments: Road #1: GORDON ST Road #2: GORDON ST												
					North	Dry		Slowing or stopping	Automobile, station wagon	Other motor vehicle		Daylight
14011646	2014-Mar-12, Wed,09:59	Snow	SMV other	P.D. only	North	Loose snow		Turning right	Passenger van	Other	Speed too fast for condition	
Comments: Road #1: CLAIR RD E Road #2: GORDON ST												
						Loose snow						Daylight
14015614	2014-Apr-03, Thu,15:18	Clear	Turning movement	Non-fatal injury	North	Dry		Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments: Road #1: GORDON ST Road #2: CLAIR RD W												
					South	Dry		Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
501837595	2014-Apr-17, Thu,17:30	Clear	Sideswipe	Non-reportable	North	Dry		Going ahead	Automobile, station wagon	Other motor vehicle		
Comments: Road #1: GORDON ST Road #2: GORDON ST												
					North	Dry		Changing lanes	Automobile, station wagon	Other motor vehicle		Daylight
14030787	2014-Jun-23, Mon,18:18	Rain	Turning movement	P.D. only	East	Wet		Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments: Road #1: CLAIR RD E Road #2: GORDON ST												
					West	Wet		Turning left	Automobile, station wagon	Other motor vehicle	Improper turn	Daylight
14030806	2014-Jun-23, Mon,20:12	Rain	SMV other	P.D. only	West	Wet		Turning right	Truck - tractor	Pole (sign, parking meter)	Improper turn	
Comments: Road #1: CLAIR RD E Road #2: GORDON ST												
						Wet						Daylight
14044011	2014-Sep-04, Thu,17:45	Clear	Rear end	Non-reportable	South	Dry		Stopped	Automobile, station wagon	Other motor vehicle		
Comments: Road #1: GORDON ST Road #2: GORDON ST												
					South	Dry		Going ahead	Automobile, station wagon	Other motor vehicle		Daylight
14045068	2014-Sep-09, Tue,17:17	Clear	Sideswipe	P.D. only	East	Dry		Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments: Road #1: CLAIR RD W Road #2: GORDON ST												
					East	Dry		Changing lanes	Truck - tractor	Other motor vehicle	Improper lane change	Daylight
501906850	2014-Oct-22, Wed,17:00	Clear	Rear end	Non-reportable	North	Dry		Stopped	Passenger van	Other motor vehicle		
Comments: Road #1: GORDON ST Road #2: GORDON ST												
					North	Dry						Daylight
501923890	2014-Nov-27, Thu,20:00	Snow	Rear end	Non-reportable	West	Ice		Stopped	Automobile, station wagon	Other motor vehicle		
Comments: Road #1: CLAIR RD W Road #2: CLAIR RD W												
					West	Ice						Dark, artificial
14063021	2014-Dec-24, Wed,05:26	Rain	Angle	Non-fatal injury	West	Wet		Going ahead	Pick-up truck	Other motor vehicle	Driving properly	
Comments: Road #1: GORDON ST Road #2: CLAIR RD E												
					South	Wet		Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Dark, artificial

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501958335	2015-Feb-12, Thu,15:45	Clear	Sideswipe	Non-reportable	North	Dry	Slowing or stopping	Passenger van	Other motor vehicle		
Comments:	Road #1: GORDON ST	Road #2: GORDON ST			North	Dry					Daylight
501959344	2015-Feb-14, Sat,13:00	Clear	Sideswipe	Non-reportable	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		
Comments:	Road #1: GORDON ST	Road #2: GORDON ST			North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		Daylight
15008007	2015-Feb-20, Fri,18:10	Clear	Turning movement	Non-fatal injury	East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Other	
Comments:	d1 charged				West	Dry	Going ahead	Passenger van	Other motor vehicle	Driving properly	Dusk
15016262	2015-Apr-13, Mon,18:00	Rain	Sideswipe	Non-reportable	East	Wet	Going ahead	Pick-up truck	Other motor vehicle		
Comments:	Road #1: CLAIR RD E	Road #2: CLAIR RD E			East	Wet	Changing lanes	Automobile, station wagon	Other motor vehicle		Daylight
15021903A	2015-May-15, Fri,19:31	Clear	Turning movement	Non-fatal injury	North	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments:	d1 charged				South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
15021903	2015-May-15, Fri,19:31	Clear	Turning movement	Non-fatal injury	North	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments:	d1 charged				South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
502002088A	2015-May-25, Mon,12:15	Clear	Rear end	Non-reportable	East	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:					East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		Daylight
502002088	2015-May-25, Mon,12:15	Clear	Rear end	Non-reportable	East	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:					East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		Daylight
502006645	2015-Jun-04, Thu,06:00	Clear	Rear end	Non-reportable	East	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:					East	Dry					Daylight
15043305	2015-Sep-14, Mon,08:58	Clear	Rear end	P.D. only	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:	d1 charged				North	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
15044486	2015-Sep-19, Sat,15:10	Clear	Rear end	P.D. only	West	Wet	Going ahead	Automobile, station wagon	Other motor vehicle		
Comments:					West	Wet	Going ahead	Automobile, station wagon	Other motor vehicle		Daylight

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502064738	2015-Oct-30, Fri,17:00	Clear	Rear end	Non-reportable	North	Dry	Stopped	Pick-up truck	Other motor vehicle		
Comments:					North	Dry	Stopped	Automobile, station wagon	Other motor vehicle		Daylight
15051958	2015-Nov-01, Sun,15:31	Clear	Angle	Non-fatal injury	South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	
Comments:	d1 charged				West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
15053891	2015-Nov-13, Fri,18:45	Rain	Turning movement	P.D. only	West	Wet	Turning left	Passenger van	Other motor vehicle	Driving properly	
Comments:	d1 charged				West	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Dark, artificial
15056451	2015-Nov-29, Sun,01:25	Clear	SMV other	P.D. only	West	Dry	Going ahead	Automobile, station wagon	Pole (utility, power)	Other	
Comments:	d1 charged					Dry					Dark
15057350	2015-Dec-04, Fri,16:39	Clear	Angle	Non-fatal injury	West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	
Comments:	d1 charged			d2 charged	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Dusk
15057465	2015-Dec-05, Sat,08:45	Fog, mist, smoke, dust	Rear end	Non-fatal injury	North	Wet	Changing lanes	Automobile, station wagon	Other motor vehicle	Improper lane change	
Comments:					North	Wet	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Other	Daylight
502093430	2016-Jan-10, Sun,18:30	Snow	Rear end	Non-reportable	East	Ice	Slowing or stopping	Automobile, station wagon	Other motor vehicle		
Comments:					East	Ice	Going ahead	Automobile, station wagon	Other motor vehicle		Dark, artificial
16003885	2016-Jan-25, Mon,13:35	Clear	Rear end	Non-fatal injury	South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:	d1-charged				South	Wet	Stopped	Passenger van	Other motor vehicle	Driving properly	Daylight
16013848	2016-Mar-23, Wed,21:08	Clear	Turning movement	P.D. only	East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments:					West	Dry	Going ahead	Passenger van	Other motor vehicle	Driving properly	Dark, artificial
502129547	2016-Apr-10, Sun,20:00	Freezing Rain	Rear end		North	Ice	Slowing or stopping	Automobile, station wagon	Other motor vehicle		
Comments:					North	Ice	Stopped	Automobile, station wagon	Other motor vehicle		Dark, artificial
502204755	2016-Oct-14, Fri,17:30	Clear	Rear end	Non-reportable	South	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:					South	Dry					Daylight

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502209067	2016-Oct-22, Sat,20:00	Clear	Rear end	Non-reportable West	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
Comments:				West	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Dark, artificial
502219191	2016-Nov-16, Wed,12:30	Clear	Other	Non-reportable West	Dry	Reversing	Automobile, station wagon	Other motor vehicle	
Comments:				East	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Daylight
16061845	2016-Dec-12, Mon,19:00	Clear	Turning movement	Non-reportable South	Wet	Turning left	Automobile, station wagon	Other motor vehicle	
Comments:	d1 charged			North	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Dark, artificial



Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location CLAIR RD W @ LAIRD RD

Municipality..... GUELPH

Traffic Control.... Stop sign

Total Collisions.... 4

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
12-501609147S	2012-Jul-30, Mon,12:32	Clear	Rear end		East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					East	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
13-12702	2013-Mar-19, Tue,10:06	Snow	SMV other	P.D. only	East	Loose snow	Slowing or stopping	Automobile, station wagon	Pole (utility, power)	Speed too fast for condition	
Comments:						Loose snow					Daylight
13-18565	2013-Apr-23, Tue,20:28	Clear	Sideswipe	P.D. only	North	Dry	Turning right	Tow truck	Other motor vehicle	Improper lane change	
Comments:	CHARGED: JOHN HALL - START FROM STOPPED POSITION NOT IN SAFETY, 142(2) HTA				North	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly	Dusk
13-501713749s	2013-Jun-25, Tue,19:30	Rain	Rear end		East	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					East	Wet	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight



Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location CLAIR RD E @ FARLEY DR

Municipality..... GUELPH

Traffic Control.... Traffic signal

Total Collisions.... 13

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuvre	Vehicle type	First Event	Driver Action	No. Ped
12-42187	2012-Aug-11, Sat,15:30	Rain	Angle	Non-fatal injury	East	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	
Comments:					North	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
1356588	2013-Nov-23, Sat,09:45	Snow	SMV other	Non-reportable	West	Slush	Going ahead	Passenger van	Skidding/sliding	Speed too fast for condition	
Comments:	Road #1: CLAIR RD E	Road #2: FARLEY DR				Slush					Daylight
1357139	2013-Nov-23, Sat,09:50	Snow	SMV unattended vehicle	Non-reportable	North	Ice	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:	Road #1: CLAIR RD E	Road #2: CLAIR RD E				Ice					Daylight
501836603	2014-Apr-16, Wed,09:00	Clear	Rear end	Non-reportable	South	Dry	Turning right	Automobile, station wagon	Other motor vehicle		
Comments:	Road #1: FARLEY DR	Road #2: FARLEY DR			South	Dry	Stopped	Automobile, station wagon	Other motor vehicle		Daylight
14048226	2014-Sep-25, Thu,06:39	Clear	Angle	P.D. only	East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	
Comments:	Road #1: CLAIR RD E	Road #2: FARLEY DR			South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Dawn
15041370	2015-Sep-04, Fri,16:50	Clear	Turning movement	P.D. only	East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments:					West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
16009138	2016-Feb-20, Sat,13:00	Clear	Turning movement	P.D. only	West	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:	d2-charged				East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	Daylight
16012219	2016-Mar-15, Tue,13:22	Clear	Turning movement	P.D. only	East	Dry	Turning left	Pick-up truck	Other motor vehicle	Failed to yield right-of-way	
Comments:	d1-charged				West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
16040747	2016-Aug-24, Wed,08:30	Clear	Angle	Non-fatal injury	South	Dry	Going ahead	Bicycle	Other motor vehicle	Disobeyed traffic control	
Comments:					East	Dry	Going ahead	Automobile, station wagon	Cyclist	Driving properly	Daylight

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502190116	2016-Sep-10, Sat,13:27	Clear	Turning movement	Non-reportable	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		
Comments:					West	Dry	Turning left	Automobile, station wagon	Other motor vehicle		Daylight
16053945	2016-Nov-02, Wed,21:55	Clear	Turning movement	Non-fatal injury	East	Wet	Turning left	Automobile, station wagon	Other motor vehicle	Other	
Comments:	d1 charged				West	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Dark, artificial
16055850	2016-Nov-14, Mon,15:28	Clear	Turning movement	P.D. only	East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments:	d1 charged				West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
17001674	2016-Dec-19, Mon,14:30	Clear	Turning movement	Non-reportable	West	Dry	Going ahead	Passenger van	Other motor vehicle		
Comments:	d2 charged				West	Dry	Changing lanes	Automobile, station wagon	Other motor vehicle		Daylight

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Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location CLAIR RD E @ VICTORIA RD S

Municipality..... GUELPH

Traffic Control.... Stop sign

Total Collisions.... 12

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuvre	Vehicle type	First Event	Driver Action	No. Ped
12-501575422S	2012-Apr-01, Sun,10:20	Clear	Angle		South	Wet	Turning right	Automobile, station wagon	Other motor vehicle	Speed too fast for condition	
Comments:					East	Wet	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
13-07923	2013-Feb-16, Sat,15:45	Clear	Angle	P.D. only	South	Wet	Turning right	Automobile, station wagon	Other motor vehicle	Speed too fast for condition	
Comments:					East	Wet	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
13-501690910s	2013-Apr-17, Wed,08:30	Clear	Rear end		South	Dry	Going ahead	Unknown		Driving properly	
Comments:					South	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Following too close	Daylight
13-41575	2013-Jul-04, Thu,15:15	Clear	Angle	P.D. only	South	Dry	Turning right	Automobile, station wagon	Other motor vehicle	Improper turn	
Comments:	CHARGED: D1 S.141 (2) HTA PON# 1195626B				East	Dry	Slowing or stopping	Pick-up truck	Other motor vehicle	Driving properly	Daylight
1354335	2013-Nov-10, Sun,03:40	Rain	SMV other	P.D. only	East	Wet	Slowing or stopping	Automobile, station wagon	Steel guide rail	Speed too fast for condition	
Comments:	Road #1: CLAIR RD E, GUELP		Road #2: VICTORIA RD S			Wet					Dark, artificial
13-54335	2013-Nov-10, Sun,03:40	Rain	SMV other	Non-fatal injury	East	Wet	Slowing or stopping	Automobile, station wagon	Curb	Speed too fast for condition	
Comments:											Dark, artificial
141081	2014-Jan-07, Tue,14:10	Clear	Rear end	Non-reportable	South	Ice	Slowing or stopping	Automobile, station wagon	Other motor vehicle		
Comments:	Road #1: VICTORIA RD S & CLAIR RD E GUELPH				Road #2: South	Ice	Stopped	Automobile, station wagon	Other motor vehicle		Daylight
50185889	2014-Jun-15, Sun,16:50	Clear	Angle	Non-reportable	South	Dry	Going ahead	Motorcycle	Other motor vehicle		
Comments:	Road #1: VICTORIA RD S		Road #2: VICTORIA RD S		East	Dry	Turning left	Automobile, station wagon	Other motor vehicle		Daylight
14030788	2014-Jun-23, Mon,16:19	Rain	Approaching	P.D. only	East	Wet	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:	Road #1: CLAIR RD E		Road #2: VICTORIA RD S		West	Wet	Turning right	Automobile, station wagon	Other motor vehicle	Speed too fast for condition	Daylight

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14054348	2014-Oct-31, Fri,14:45	Rain	Angle	P.D. only	East	Wet	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments:	Road #1: CLAIR RD E		Road #2: VICTORIA RD S		South	Wet	Going ahead	Pick-up truck	Other motor vehicle	Driving properly	Daylight
15039629	2015-Aug-25, Tue,23:20	Clear	SMV other	P.D. only	East	Dry	Going ahead	Automobile, station wagon	Steel guide rail	Other	
Comments:	d1 charged					Dry					Dark
502055091	2015-Oct-06, Tue,17:00	Clear	Rear end	Non-reportable	East	Dry	Stopped	Passenger van	Other motor vehicle		
Comments:					East	Dry	Going ahead	Truck - closed	Other motor vehicle		Daylight

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Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location CLAIR RD W @ CLAIRFIELDS DR W

Municipality..... GUELPH

Traffic Control.... Traffic signal

Total Collisions.... 13

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
12-501561016S	2012-Feb-08, Wed,08:15	Clear	Rear end		West	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					West	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
13-501696443s	2013-May-06, Mon,07:40	Clear	Rear end		South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					South	Dry	Stopped	Unknown	Other motor vehicle	Driving properly	Daylight
501696443	2013-May-06, Mon,07:40	Clear	Rear end	Non-reportable	South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Other motor vehicle	Daylight
Comments:	Road #1: CLAIRFIELDS DR	Road #2: CLAIRFIELDS DR			South	Dry	Stopped				Daylight
1359695	2013-Dec-11, Wed,12:00	Snow	Angle	Non-reportable	East	Loose snow	Slowing or stopping	Passenger van	Skidding/sliding		
Comments:	Road #1: CLAIR RD W	Road #2: CLAIR RD W			North	Slush	Stopped	School bus	Other motor vehicle		Daylight
501970219	2015-Mar-05, Thu,15:25	Clear	Sideswipe	Non-reportable	West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		
Comments:	Road #1: CLAIR RD W	Road #2: CLAIR RD W			West	Dry	Changing lanes	Automobile, station wagon	Other motor vehicle		Daylight
501996511	2015-May-13, Wed,15:05	Clear	Sideswipe	Non-reportable	West	Dry	Stopped	Pick-up truck	Other motor vehicle		
Comments:					West	Dry	Turning left	School bus	Other motor vehicle		Daylight
502039616	2015-Aug-27, Thu,16:35	Clear	Rear end	Non-reportable	West	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:					West	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle		Daylight
502070671	2015-Nov-13, Fri,17:35	Clear	Angle	Non-reportable	West	Dry	Going ahead	Automobile, station wagon	Skidding/sliding		
Comments:					South	Dry	Stopped	Automobile, station wagon	Other motor vehicle		Dark, artificial
502072008	2015-Nov-17, Tue,05:45	Clear	Rear end	Non-reportable	West	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:					West	Dry					Dark, artificial

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502093617	2016-Jan-10, Sun,17:45	Strong wind	Rear end	Non-reportable	East	Ice	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:					East	Ice					Dark
502094098	2016-Jan-12, Tue,12:40	Snow	Rear end	Non-reportable	East	Ice	Slowing or stopping	Automobile, station wagon	Other motor vehicle		
Comments:					East	Packed snow	Stopped	Automobile, station wagon	Other motor vehicle		Daylight
502101937	2016-Jan-29, Fri,11:00	Clear	Turning movement	Non-reportable	North	Dry	Turning right	Automobile, station wagon	Other motor vehicle		
Comments:					East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		Daylight
16062009	2016-Dec-12, Mon,08:15	Clear	Sideswipe	Non-reportable	West	Loose snow	Going ahead	Truck - closed	Other motor vehicle		
Comments:	d2 charged				West	Wet	Going ahead	Automobile, station wagon	Other motor vehicle		Daylight

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Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location BEAVER MEADOW DR @ CLAIR RD E

Municipality..... GUELPH

Traffic Control....

Total Collisions.... 1

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
12-21783	2012-Apr-23, Mon,11:22	Clear	SMV other	Non-fatal injury	East	Dry	Going ahead	Automobile, station wagon	Pole (utility, power)	Failed to yield right-of-way	
Comments:						Dry					Daylight



Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location GORDON ST @ MALTBY RD E

Municipality..... GUELPH

Traffic Control....

Total Collisions.... 5

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped	
1356949	2013-Nov-23, Sat,12:00	Snow	SMV other	Non-reportable	East	Ice	Going ahead	Automobile, station wagon	Skidding/sliding			
Comments: Road #1: MALTBY RD E Road #2: MALTBY RD E						Ice					Daylight	
14007199	2014-Feb-12, Wed,17:00	Clear	SMV other	P.D. only	West	Packed snow	Slowing or stopping	Passenger van	Pole (sign, parking meter)	Lost control		
Comments: Road #1: MALTBY RD E Road #2: GORDON ST						Dry					Daylight	
14051130	2014-Oct-11, Sat,17:55	Clear	Angle	Non-fatal injury	South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly		
Comments: Road #1: GORDON ST Road #2: MALTBY RD E						East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	Daylight
15059744	2015-Dec-19, Sat,08:04	Clear	Angle	Non-fatal injury	East	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control		
Comments: d1-charged						North	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	Daylight
16001977	2016-Jan-14, Thu,01:30	Snow	SMV other	P.D. only	East	Loose snow	Slowing or stopping	Pick-up truck	Ran off road	Speed too fast for condition		
Comments:						Ice					Dark	



Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location GORDON ST @ POPPY DR

Municipality..... GUELPH

Traffic Control.... Traffic signal

Total Collisions.... 2

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped	
12-20170	2012-Apr-15, Sun,11:27	Rain	Angle	Non-fatal injury	North	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control		
Comments: D1 CHARGED: SECTION 144(18) HTA PON# 8242161A							West	Wet	Turning left	Other motor vehicle	Driving properly	Daylight
12-501647502s	2012-Dec-01, Sat,09:00	Clear	Angle		West	Packed snow	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly		
Comments:							North	Packed snow	Going ahead		Daylight	



Collision Details Report

From: January 1, 2012 To: March 31, 2017

Location VICTORIA RD S @ MALTBY RD E

Municipality..... GUELPH

Traffic Control.... Stop sign

Total Collisions.... 15

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped	
12-501578669S	2012-Apr-14, Sat,09:30	Clear	Rear end		South	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close		
Comments:							South	Dry	Stopped	Other motor vehicle	Driving properly	Daylight
1352809	2013-Nov-01, Fri,09:00	Clear	Rear end	Non-reportable	South	Dry	Stopped	Automobile, station wagon	Other motor vehicle			
Comments: Road #1: VICTORIA RD S Road #2: VICTORIA RD S					South						Daylight	
15005190	2015-Feb-04, Wed,22:33	Snow	SMV other	P.D. only	South	Loose snow	Going ahead	Automobile, station wagon	Steel guide rail	Speed too fast for condition		
Comments: Road #1: VICTORIA RD S Road #2: MALTBY RD E						Loose snow					Dark	
502043335	2015-Sep-08, Tue,08:15	Rain	SMV other	Non-reportable	South	Wet	Slowing or stopping	Automobile, station wagon				
Comments:							Wet				Daylight	
15047987	2015-Oct-08, Thu,16:30	Clear	Turning movement	Non-fatal injury	South	Dry	Turning right	Automobile, station wagon	Other motor vehicle	Other		
Comments: d1 charged							South	Dry	Slowing or stopping	Other motor vehicle	Driving properly	Daylight
15049840	2015-Oct-20, Tue,11:18	Clear	Turning movement	P.D. only	West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly		
Comments: d2 charged					South	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Improper turn	Daylight	
502082229	2015-Dec-11, Fri,10:00	Clear	Rear end	Non-reportable	South	Dry	Stopped	Automobile, station wagon	Other motor vehicle			
Comments:							South	Dry	Going ahead	Pick-up truck	Other motor vehicle	Daylight
502098039	2016-Jan-14, Thu,16:30	Clear	Rear end	Non-reportable	South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle			
Comments:							South	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Daylight
16008748	2016-Feb-24, Wed,09:45	Snow	SMV other	P.D. only	South	Packed snow	Slowing or stopping	Automobile, station wagon	Steel guide rail	Speed too fast for condition		
Comments:							Packed snow				Daylight	

502136435	2016-Apr-29, Fri,09:00	Clear	Rear end		North	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:											
					North	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle		Daylight
502155172	2016-Jun-15, Wed,07:15	Clear	Rear end	Non-reportable	East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle		
Comments:											
					East	Dry					Daylight
502159487	2016-Jun-25, Sat,09:00	Clear	Rear end	Non-reportable	South	Dry	Stopped	Automobile, station wagon	Other motor vehicle		
Comments:											
					South	Dry					Daylight
16057677	2016-Nov-23, Wed,19:45	Snow	SMV other	Non-reportable	South	Loose snow	Slowing or stopping	Automobile, station wagon	Skidding/sliding		
Comments: metal guide rail											
						Loose snow					Dark
16057381	2016-Nov-23, Wed,21:45	Freezing Rain	SMV other	P.D. only	South	Ice	Slowing or stopping	Automobile, station wagon	Skidding/sliding	Speed too fast for condition	
Comments:											
						Ice					Dark, artificial
16057382	2016-Nov-23, Wed,23:55	Freezing Rain	SMV other	P.D. only	South	Ice	Going ahead	Automobile, station wagon	Skidding/sliding	Speed too fast for condition	
Comments:											
						Ice					Dark, artificial

Appendix C – City of Guelph Access Design Guidelines

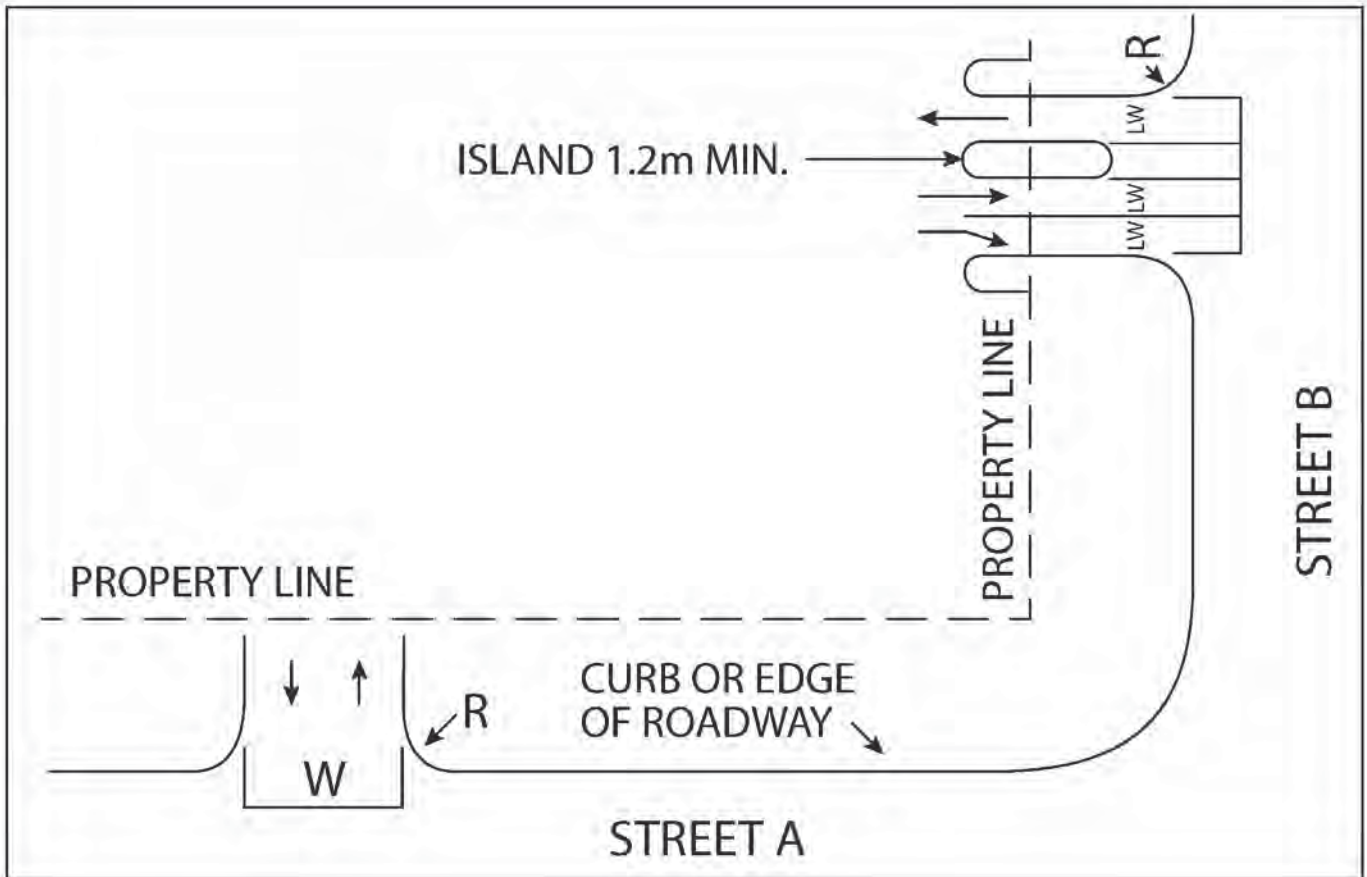


Figure 8
Access Details 1

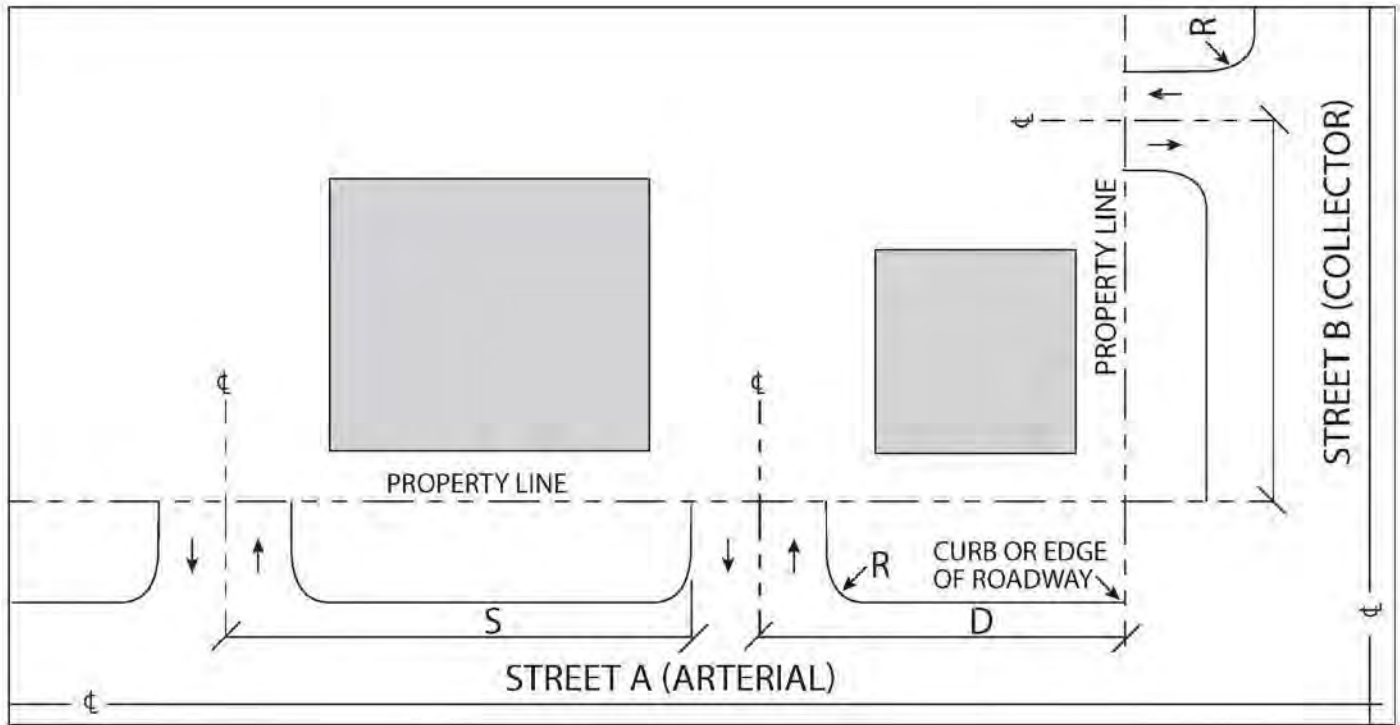


Figure 9
Access Details 2

Appendix D – TDM Policy Examples / Best Practices

Municipality	Province	Type of Plan/Policy	Year	Under Appeal?	Section	Text	Link
Guelph	Ontario	Downtown Guelph Secondary Plan	2012 (2016 Consolidation)	No	11.1.4.1.4	Transportation demand management (TDM) will be critical to achieving a transportation system Downtown that provides and promotes attractive alternatives to the automobile. The City shall work with transit providers, developers and businesses Downtown to develop and implement TDM measures that promote the use of transit, walking, cycling and carpooling. The City may require large-scale development or businesses to complete a TDM plan. TDM plans will describe facilities and programs intended to discourage single occupancy vehicle trips, minimize parking and promote transit use, cycling, car sharing and/or carpooling. The City may permit reduced parking standards for developments which demonstrate through a TDM plan and implementation strategy that a reduction in parking standards is appropriate.	https://guelph.ca/wp-content/uploads/Official-Plan-Consolidation-March-2018.pdf
Guelph	Ontario	Guelph Innovation District Secondary Plan	2014 (2017 Office Consolidation)	No	11.2.4.2.2	The City shall work with transit providers, developers and businesses within the University-Downtown-GID trinity area to develop and implement TDM measures that aim to reduce motorized vehicular trips and promote the use of active transportation modes, public transit, car-sharing and/or carpooling.	
Cambridge	Ontario	Official Plan	2012 (2018 Consolidation)	Yes, but only five sections, none of which are related to TDM	5.11.3	Shared parking arrangements between adjacent uses and reduced parking requirements may be considered through the development review process including transportation demand management measures as described in Section 6.15.	https://www.cambridge.ca/en/learn-about/resources/Official-Plan/Cambridge-2018-Official-Plan-Consolidation-AODA-2018-09-25.pdf
					6.10.4	Measures to encourage and/or support transit oriented development, existing and planned high frequency transit services, such as reductions in the amount of required parking, limiting the amount of surplus parking and considering transportation demand management programs as a community benefit under Section 10.16 of this Plan, may also be used	
					6.15.1	In order to maximize the efficiency of the transportation system through transportation demand management, the City will encourage the private and public sectors to implement measures, such as walking, cycling transit, car pooling, car sharing and flexible working hours, where feasible. Transportation demand management measures will be considered in evaluating development proposals	
					6.15.2	A comprehensive transportation demand management plan, including implementation measures, may be considered a component in justifying a reduction in the required amount of parking for a development or redevelopment, based on Section 10.11 of this Plan.	
					6.15.3	The City may prepare a city wide transportation demand management plan, which could be part of a future Master Transportation Plan.	
					10.11.2(f)	A reduction or exemption in required parking facilities may be considered where, in the opinion of the City, any of the following circumstances prevail f) the development is part of a comprehensive transportation demand management plan in accordance with the provisions of Section 6.15	
					10.16.1(xviii)	Development standards may be incorporated into a Zoning By-law to permit bonusing through an increase in height and/or density of development where such increase provides public benefits, and the increase: xviii) parking demand reduction measures as part of an approved transportation demand management plan, such as measures to increase access to public transit and/or participation in a formal car share program.	
Cambridge	Ontario	Secondary Plan: Cambridge West Lands	2016	No	6.11	The implementation of Transportation Demand Management measures shall be considered as part of every application for new development or redevelopment within the Secondary Plan area.	https://www.cambridge.ca/en/learn-about/resources/Cambridge-West-Draft-Plans/0800A_Cambridge-West-Secondary-Plan_June-2016---Copy.pdf
Cambridge	Ontario	Secondary Plan: Main Street and Dundas Street Area	2016	No	4.4.1.15	The implementing Zoning By-law may require the provision of secure bicycle parking facilities in a conspicuous location, long-term bike parking areas within buildings and on-site shower facilities and lockers for employees who bike to work. The City may allow for the reduction in the number of required parking spaces where bicycle parking facilities are provided	https://www.cambridge.ca/en/learn-about/resources/Main-and-Dundas-Draft-Secondary-Plan.pdf
					4.4.1.16	Council may require that development applications include a Transportation Demand Management (TDM) Plan, prepared to the satisfaction of the City of Cambridge. The intent of the TDM Plan shall be to implement and promote measures to reduce the use of low-occupancy automobiles for trips and to increase transit use, cycling and walking.	
Kitchener	Ontario	Official Plan	2014 (2018 Consolidation)	Yes	3.C.2.19 c)	c) a parking management and transportation demand management strategy for land uses within the station area to maximize intensification opportunities, minimize surface parking areas, to encourage large mixed use development and discourage auto-oriented land uses. Such strategies may include reduced parking requirements, shared parking, development of structured or underground parking facilities, parking pricing and other appropriate strategies;	https://www.kitchener.ca/en/resourcesGeneral/Documents/DSD_PLAN_New-Official-Plan--CONSOLIDATED-Version-Modifications-Deferrals--Appeals.pdf
					6.C.1.2(b)(iv)	The City may require a Health Impact Assessment in support of a development application or as part of an Environmental Assessment to ensure the proposal supports a complete and healthy community. The contents of a Health Impact Assessment will be outlined in a Terms of Reference. In general, the contents of a Health Impact Assessment may include, but not be limited to addressing the following: b) whether and how the proposal supports physical activity having regard for: iv) reducing the dependency on the automobile and encouraging active transportation and transportation demand management measures.	
					7.C.7(Preamble)	Clean air is essential for healthy, strong, liveable communities. Many day-to-day activities such as driving, home heating and industrial activities diminish air quality by producing a variety of harmful emissions and are a major source of pollution. One of the most effective strategies to ensure air quality is to encourage and achieve a complete and healthy community with a compact urban form and promote active modes of transportation such as walking, cycling and public transit and Transportation Demand Management (TDM) measures. The policies of this Plan seek to improve air quality in the city.	
					7.C.7.7	Transportation Demand Management (TDM) measures will be used in accordance with the policies in Section 13.C.7 to reduce the use of single occupancy vehicles and encourage increased transit ridership, walking and cycling	
					13.C.1	The City will implement the recommendations of Regional and/or City Transportation Master Plans, Transportation Demand Management Plans, Cycling Master Plans, Multi-Use Pathways and Trails Master Plans and Pedestrian Charters through the development review process, infrastructure projects and public realm improvements.	
					13.C.7 (entire section)	Objectives 13.7.1. To support and enhance sustainable transportation choices and discourage single occupant vehicle trips. 13.7.2. To reduce traffic congestion, parking supply needs, and demand for parking spaces by encouraging various modes of travel. Policies 13.C.7.1. The City will support the Region's Transportation Demand Management Policies and initiatives to reduce automobile dependency, make alternative travel modes more attractive, and influence people to adopt sustainable trip behaviours and practices. 13.C.7.2. The City will implement a comprehensive Transportation Demand Management program as recommended in the City of Kitchener Transportation Demand Management Plan which may include, but not limited to: a) community-wide, area-specific or site-specific practices or initiatives; b) employer programs that support and enhance sustainable transportation choices; and, c) requirements for features such as: car sharing, bike sharing facilities, van and carpool spaces, electric vehicle charging stations, shared parking, bicycle parking, transit waiting areas, and pedestrian facilities. 13.C.7.3. The City may require the incorporation of Transportation Demand Management measures. 13.C.7.4. The City will consider reduced parking requirements for development and/or redevelopment in accordance with Policy 13.C.8.2 where a comprehensive Transportation Demand Management Report is submitted to the satisfaction of the City.	
					13.C.8.2	The City may consider adjustments to parking requirements for properties within an area or areas, where the City is satisfied that adequate alternative parking facilities are available, where developments adopt transportation demand management (TDM) measures or where sufficient transit exists or is to be provided	
					15.D.2.22(b) (Urban Growth Centre - Downtown)	Where new parking spaces are proposed to be developed in combination with all new development or redevelopment, the City will: b) encourage owners/applicants to utilize Transportation Demand Management (TDM) measures	
					17.E.17.2(b) (Bonusing)	Community benefits may include: b) incorporation of Transportation Demand Management (TDM) strategies	
					5.4.1	Expand employer TDM programs in Kitchener through existing TDM tools and services. This can begin with the City's membership in the TravelWise TMA to adopt carpool ride-matching, subsidized transit passes, guaranteed-ride home and outreach programs to encourage its staff to choose sustainable modes of travel to and from work. Given TravelWise is a well-established program in the Region, TDM efforts and outreach should be expanded beyond City staff and beyond the downtown area to encourage major employers throughout the City to adopt these services	
					5.4.2	Have the city's TDM coordinator work closely with the Region and employers, especially in downtown Kitchener, to adopt TravelWise programs, help implement other TDM strategies such as telework and carbor tracking, and provide guidance on TDM-friendly site design of developments.	
					5.4.3	Support carsharing in the City through outreach and promotional events to increase awareness, and provisions for preferred parking for carsharing vehicles to promote these services, facilitate their growth and aid their long-term viability in the City and the Region.	https://www.kitchener.ca/en/resourcesGeneral

Kitchener	Ontario	Transportation Master Plan	2013	No	5.4.4	Integrate TDM strategies into site planning and development approval processes to provide for TDM-supportive measures in developments and encourage sustainable transportation choices. The City should develop a TDM checklist to help review and evaluate development applications, City of Kitchener transportation-related projects and projects of the Region and Province. This checklist would assign points and provide a rating similar to the Region of Waterloo's Travel Demand Management Implementation Checklist. Another example of a TDM checklist was developed in the study "TDM Supportive Guidelines for Development Approvals" prepared by the Association for Commuter Transportation in Canada. Part of this TDM checklist can include a requirement to prepare TDM plans as part of transportation impact studies for new developments and major transportation projects.	al/Documents/DSD_TRANSPORT_Transportation Master Plan 2013.pdf
					5.4.5	Work with Region and local partners to engage residents through individualized marketing to promote and encourage sustainable modes of transportation for all types of trips. As highlighted in the 2010 TDM plan, individualized marketing is aimed at targeted populations or groups and tailors the TDM strategies and programs based on the needs, opportunities and willingness to use other modes of travel.	
Waterloo (City)	Ontario	Official Plan	2012 (2018 Consolidation)	Yes	6.1.5(4)	To support transit and measures relating to transportation demand management through restrictions on parking supply, where appropriate.	
					6.4(1)	A Transportation Impact Study to assess the transportation demands, impacts and opportunities of a proposed development may form part of a development application. Applications for site plan approval may require a Transportation Impact Study if requested by the Ministry of Transportation. While the scope of the Transportation Impact Study will vary depending on the nature of the development application, the purpose of the Study will generally be to introduce appropriate transportation demand management measures and identify and implement mitigation measures or transportation improvements to accommodate travel generated by the development.	
					6.6.1(4)	The City will plan for the development of public and/or private parking facilities to meet parking needs while promoting the more efficient use of parking resources. In addition to establishing parking requirements through the Zoning By-Law, the City may use a range of mechanisms to require or facilitate the provision of such parking, including: (e) Pricing parking to cover some or all facility costs and to help fund Transportation Demand Management strategies	
					7.7.1(2)(g)	Post-secondary educational institutions are encouraged to create campus master plans in consultation with the City, surrounding neighbourhoods, and other stakeholders, provided further that campus master plans should: (g) Promote transportation demand management strategies for staff, faculty, and students	
					8.5.3(1)	The City will encourage energy conservation in the community by (c) promoting increased reliance on public transit and pedestrian and bicycle travel and a reduced reliance on motor vehicles through measures such as enhanced physical infrastructure for transit, pedestrians and cyclists and supporting transportation demand management initiatives	https://www.waterloo.ca/en/government/resources/Documents/Cityadministration/Official-plan/Official-Plan-Consolidated-August-2018.pdf
					10.1.1(12)	Development applications proposing to redesignate lands to the MixedUse Medium Density Residential designation, Mixed-Use Medium High Density Residential designation, or Mixed-Use High Density Residential designation may be contemplated based on the following: (h) The proposal identifies and implements any required transportation improvements, with a particular focus on transportation demand management measures	
					11.1.34(3) (Specific Provision Area 34 - University Expansion Area)	It shall be a policy of Council that creative parking strategies shall be encouraged, including: (b) Permitting reduced parking standards, subject to a Zoning By-Law Amendment. The review of such amendments will consider issues such as: (iv) Whether transportation demand management techniques are incorporated into the development.	
					11.1.38(5) (Specific Provision Area 38 - 247 and 253 King Street North)	The determination of appropriate increases in density for areas designated high density, shall be considered based on the ability of the project to meet one or more of the following objectives and shall be specified on a site by site basis, in the implementing zoning: (i) To encourage improvements suggested by a Transportation Demand Management Plan, where appropriate;	
Waterloo (City)	Ontario	Transportation Master Plan	2011	No	16.1.1 (Short Term Planning Horizon - 0-5 Years)	Land Use and Transportation Integration 1. Create a standardized list of TDM initiatives, based on real world experience, to enable developers to reduce auto trip numbers and parking spaces; 2. Establish maximum parking requirements for residential, commercial, industrial and institutional sites; 3. Require road networks to be transit friendly (i.e. grid structure); 4. Review development staging in new communities to ensure high density is contained in initial phasing; 5. Use trees and other green infrastructure to provide shelter, aesthetic value, shade and separation from motorized traffic; and 6. Pursue changes to Leadership in Energy and Environmental Design (LEED) rating systems transportation and parking credits (see more below in Section 16.1). Transportation Supply 7. Develop an incident detection and management system (IMS) for motorized vehicles that informs drivers of traffic congestion and alternative routes; 8. Expansion of a privately operated shared vehicle program (i.e. Grand River Car Share); and 9. Implement a bicycle sharing program (such as that being promoted at the University of Waterloo). Education Promotion and Outreach 10. Develop separate web based trip planners for cycling and walking, and provide on-route signage and maps	https://www.waterloo.ca/en/government/resources/Documents/Cityadministration/TransportationMasterPlan/Transportation-Master-Plan--PDF-Version.pdf
					16.1.2 (Long Term Planning Horizon - Recommended for Further Study)	Travel Incentives and Disincentives 11. Study the use of Transportation Pricing: - Road tolls, Congestion pricing, Area specific tolls, Distance-based auto insurance, High Occupancy Toll (HOT) Lanes, Vehicle user fees, Road space rationing, Emission fees, Fuel tax increases, Parking Program, Distance based fees	
Waterloo (Region)	Ontario	Official Plan	2009 (2015 Consolidation)	No, but there are deferrals	3.C.1	The Region, in collaboration with Area Municipalities, will implement a comprehensive Transportation Demand Management program as part of its efforts to reduce automobile dependency. This program will involve independent action as well as partnerships with the private sector, other levels of government and non-governmental organizations including educational institutions and community groups. It will also seek to make alternatives to driving more attractive, build a positive public attitude toward them, and provide information and incentives that encourage individuals to reduce automobile use. The Transportation Demand Management program will include, but not limited to: (a) community-wide and area-specific Transportation Demand Management programs; (b) employer Transportation Demand Management programs that support and enhance sustainable transportation choices to public and private sector employees and major institutions for such actions as walking, cycling, transit, carpooling, car sharing, teleworking, shuttle buses and ride-sharing programs, bicycle storage facilities and showers; and (c) increasing transportation system efficiency by encouraging van and carpooling, preferential parking for car and van pools, shared parking, bicycle parking facilities, indoor bus waiting areas, queue-jumping lanes for transit buses, smart cards and high-occupancy vehicle lanes.	https://www.regionofwaterloo.ca/en/resources/Regional-Official-Plan/Chapter_3_consolidated_rop_2015-access.pdf
					3.C.2	The Region will operate a commuter options program for Regional employees that supports and enhances sustainable transportation options for such actions as walking, cycling, transit, carpooling, car sharing, shuttle buses and ride-sharing programs, bicycle storage facilities and showers. Sustainable transportation options will also be supported and enhanced for commuter and business travel	
					3.C.3	Where an owner/applicant agrees to implement, and can appropriately secure, the transportation demand management strategies recommended in a Transportation Impact Study prepared in accordance with Policy 5.A.25, the Region may consider granting reductions in the level of road improvement that would otherwise be required to support the development.	
					3.C.4	Area Municipalities are encouraged to provide reduced parking standards for development applications where the owner/applicant agrees to incorporate transportation demand management strategies as part of the proposed development.	
					8.1.8	To better utilize existing infrastructure, Mississauga will encourage the application of transportation demand management (TDM) techniques, such as car-pooling, alternative work arrangements and shared parking.	
					8.4.1	Off-street parking facilities for vehicles and other modes of travel, such as bicycles, will be provided in conjunction with new development and will c. support transportation demand management (TDM) initiatives.	
					8.4.7	Within Intensification Areas, Mississauga will give consideration to: f. coordinating parking initiatives with transportation demand management (TDM) programs in order to effectively link transit planning, parking and other related issues in a comprehensive manner	
					8.5.1	Mississauga will encourage TDM strategies that promote transit use and active transportation, and reduce vehicle dependency, single occupant vehicle travel, trip distance and time and peak period congestion.	
					8.5.2	Mississauga will work with other levels of government, agencies and the private sector to encourage TDM measures.	
					8.5.3	Mississauga will encourage employers to implement TDM programs.	
					8.5.4	Mississauga will manage parking in Intensification Areas to encourage the use of alternative modes of transportation and the reduction of vehicular congestion.	
					8.5.5	Mississauga will encourage land uses permitted by this Plan that make efficient use of the transportation system and parking facilities during offpeak hours.	
					8.5.6	In appropriate areas, Mississauga will encourage a fee for parking and the separation of parking costs from other costs, such as transit fares, building occupancy and residential unit prices.	https://www2.mississauga.ca/online-services/transportation

Mississauga	Ontario	Official Plan	2010 (2018 Office Consolidation)	Yes	8.5.7	Prior to approval of development applications, particularly those that will generate significant employment opportunities, a TDM plan may be required that demonstrates, among other things, the following: a. building orientation that supports transit service; b. minimize distance between main building entrances and transit stations/stops; c. development that is integrated into the surrounding pedestrian and cycling network; d. parking facilities designed to provide safe and efficient access for pedestrians and cyclists emanating from the surrounding transit and active transportation network; e. secure, conveniently located, weather protected, on-site bicycle storage facilities, and associated amenities such as showers, change rooms and clothing lockers; f. reserved, priority car-pool parking spaces and, where applicable, car-share spaces and taxi stands; g. parking spaces for scooters, motorcycles and other similar motorized vehicles; h. techniques to manage the supply of on-site parking; and i. measures that: • increase the proportion of employee trips made by transit, walking and cycling; • increase the average car occupancy rate; • reduce the demand for vehicular travel; and • shift travel times from peak to off-peak periods.	http://www.mississauga.ca/onlinemaps/plan/bldg/MOP/Chapter8-Create_a_Multi-Modal_City.pdf
					8.5.8	Car-pooling will be encouraged through the provision of High Occupancy Vehicle Lanes, priority parking, and other measures as appropriate.	
					8.5.9	Further TDM policies may be identified through a Transportation Master Plan.	
Mississauga	Ontario	Port Credit Local Area Plan	2016	unknown	9.1.14	Development applications will be accompanied by transportation and traffic studies. Studies will address, among other things, strategies for limiting impacts on the transportation network, where appropriate, including measures such as: - transportation demand management	http://www6.mississauga.ca/onlinemaps/plan/bldg/MOP/PortCredit_LAP.pdf
					9.1.15	Due to capacity constraints on the Port Credit transportation network, development applications requesting increases in density and height, over and above what is currently permitted in the Port Credit Local Area Plan will be discouraged unless it can be demonstrated, to the City's satisfaction, that the proposed development has included measures to limit the amount of additional vehicular demand	
					9.2.1	Reduced parking requirements and maximum parking standards may be considered within a. the Community Node, particularly in proximity to the GO Station and future LRT stops; and b. the Mainstreet Neighbourhood Precinct.	
					9.2.3	The City will encourage Transportation Demand Management measures, where appropriate, within the Community Node and as part of any significant redevelopment projects outside of the node.	
London	Ontario	Official Plan	2016 (2018 Consolidation)	Yes, but sections copied here not under appeal	362_	Municipal commuter parking facilities will be established at strategic locations, to connect with other mobility choices and service surrounding communities.	http://www.london.ca/business/Planning-Development/Official-Plan/Documents/2018-London-Plan/The-London-Plan-Policies-In-Effect-August-2018-reduced.pdf
					363_	Commuter parking facilities integrated with transit will be directed to Transit Villages and transit station areas. These facilities will be designed to fit within the context of the surrounding area and should, where possible, be incorporated with other structures/buildings in the area	
					364_	Improvements to the mobility network will be planned with an emphasis on active mobility, improved transit services, and Transportation Demand Management (TDM) targets.	
					365_	A Transportation Demand Management Program may be provided as part of a complete planning and development application in support of lowered parking requirements or a Bonus Zone. The Transportation Demand Management Program may: 1. Be integrated with required transportation impact assessments submitted to support the proposed development. 2. Identify design and/or programmatic means to reduce single occupancy vehicle uses. 3. Identify the roles and responsibilities of the property owner with respect to each recommended program and its implementation. 4. Identify the operational and financial roles and responsibilities of the property owner including, but not limited to, program development, implementation and ongoing management and operations of the transportation demand management plan and/or program.	
					368_	Parking requirements may be reduced for developments that provide associated carshare and bikeshare services.	
Vaughan	Ontario	Official Plan	2010 (2017 Office Consolidation)	Yes, but sections copied here not under appeal	4.3.3	As Vaughan's population and travel needs grow, travel demand management will be increasingly necessary to promote efficient movement. A variety of travel demand management strategies at a number of scales ranging from building-specific efforts to regional initiatives such as the existing Smart Commute program and Metrolinx's proposed Mobility Hubs, will assist in reducing single-occupant vehicle travel and reducing congestion as a whole. It is the policy of Council:	https://www.vaughan.ca/projects/policy_planning_projects/General%20Documents/Official%20Plan%20Vol%201/VOP%202010%20Volume%201%202017%20Office%20Consolidation/VOP%202010_Volume%201%20Policies%20January%202017%20Consolidation(OPA%2013%20add%20Rev%20Oct%2012%202017im%20PDF).pdf
					4.3.3.1	To encourage and support City-wide and local travel demand management programs that reduce single-occupant vehicle travel.	
					4.3.3.2	To initiate a travel demand management program for City of Vaughan employees.	
					4.3.3.3	To work with York Region, Metrolinx and other stakeholders to support Smart Commute and other travel demand management organizations.	
					4.3.3.4	To work with school boards, the police department and residents to implement a Safe Routes to School program in all elementary schools to encourage children to walk to school, rather than relying upon auto transportation.	
					4.3.3.5	To work with developers to provide all new homebuyers with information on available pedestrian, cycling and transit facilities and carpooling options within the community, including local transit routes and schedules.	
					4.3.3.6	To facilitate choice and flexibility in mobility options by: a. encouraging, through the implementation of this Plan, the viability of pedestrian, bicycle and transit infrastructure and services as alternatives to driving; b. encouraging alternatives to peak period commuting, including telecommuting, hotelling work environments, zoning permissions for live-work units where appropriate, variable work start times and other means; c. supporting carpooling and ridesharing programs; and, d. adopting a recognition and/or awards program to highlight successful travel demand management initiatives and best practices in Vaughan.	
					4.3.3.7	To facilitate seamless connections between different modes of travel, where appropriate. The City will support a. park-and-ride lots and passenger pick-up and drop-off facilities at existing and future rapid transit and GO stations; b. working with the Region and the private sector to pursue shared use opportunities for park-and-ride facilities related to the Spadina subway. c. convenient bicycle and pedestrian access to transit stations and stops and appropriate bicycle parking facilities; d. carpool parking and coordination areas; and e. well-designed and convenient transfer stations and areas for transit users. To require the preparation and implementation of a travel demand management program for all site plan approval applications for office uses greater than 2,000 square metres or residential apartment or mixed use buildings with greater than 50 residential units. The travel demand management program shall: a. be integrated with required transportation impact assessments submitted to support the proposed development; b. identify design and/or programmatic means to reduce single occupancy vehicle use; c. identify the roles and responsibilities of the landowner with respect to each recommended program and its implementation; and d. identify the operational and financial roles and responsibilities of the landowner including, but not limited to, program development, implementation and ongoing management and operations of the travel demand management plan and/or program.	
					4.3.3.8	To require the preparation and implementation of a travel demand management program for all site plan approval applications for office uses greater than 2,000 square metres or residential apartment or mixed use buildings with greater than 50 residential units. The travel demand management program shall: a. be integrated with required transportation impact assessments submitted to support the proposed development; b. identify design and/or programmatic means to reduce single occupancy vehicle use; c. identify the roles and responsibilities of the landowner with respect to each recommended program and its implementation; and d. identify the operational and financial roles and responsibilities of the landowner including, but not limited to, program development, implementation and ongoing management and operations of the travel demand management plan and/or program.	
					4.3.3.9	To support the development of car-sharing and bike-sharing programs in Vaughan and to recognize car-sharing as an effective means for reducing parking demand.	

Markham	Ontario	Official Plan	2014 (2018 Consolidation)	Yes, TDM section specifically appealed	7.1.4.1	To provide leadership in the development, implementation and promotion of transportation demand management policies, programs and measures as an effective means of slowing the rate of growth in vehicle trips and managing peak-period congestion in the pursuit of a more environmentally sustainable future by: a) requiring that new significant development applications include a transportation demand management strategy; b) encouraging the inclusion of "travel plans" in the required transportation demand management strategies for non-residential development applications referred to in Section 7.1.4.1 a), in accordance with the Markham Transportation Strategic Plan; c) placing priority on the needs of pedestrians, cyclists and transit riders through the preparation of "mobility plans" in the 'Future Urban Area', as required by the Regional Official Plan; d) continuing to support and work with "Smart Commute Markham – Richmond Hill Transportation Management Association" to expand and strengthen the range of services offered to local workplaces; e) committing to support the continued provision of transportation demand management services and programs for Markham employees; f) supporting transportation demand management pilot projects as a strategic means to gain experience, develop best practices, build partnerships and demonstrate successful sustainable transportation initiatives; and g) continuing to work with the School Boards and the educational sector, and York Region to develop travel plans and to provide alternatives to car travel by developing safer and more attractive conditions for students to come to school by bicycle or on foot.	https://www.markham.ca/wps/wcm/connect/markham/d260f4ec-7547-4031-9b8e-53de79faa225/Official-Plan-Chapter-7-20180409.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE_Z18_2QD4H901OGV160QC8BLCR/1001-d260f4ec-7547-4031-9b8e-53de79faa225-msi7Z4m
					7.1.4.2	To support walking and cycling throughout Markham as competitive mobility choices for everyday activities such as work, school, shopping, business and leisure by: a) creating a more pedestrian-friendly environment that is interconnected by a network of safe, direct, comfortable and convenient pedestrian routes that are suitable for year-round walking; b) designing, constructing and integrating new streets and retrofitting existing streets, where appropriate, to focus on the needs of pedestrians, cyclists and persons with disabilities and ensuring safety, accessibility, convenience, and comfort of all street users are considered; c) to work with York Region to ensure that sidewalks and street lighting are provided on all streets served by transit; d) supporting the provision of accessible, grade-separated crossings, where feasible and environmentally acceptable, at barrier points where major roads, highways, rail lines, and natural features such as ravines and waterways present a significant disruption to the movement of pedestrians and cyclists; e) promoting a safe and comprehensive network of signed bike routes, bike lanes, cycling trails and multi-use paths for cyclists of all ages and abilities generally as identified in Appendix D – Cycling Facilities based on the Markham and York Region Cycling Master Plans; f) implementing segregated bicycle lanes and/or off-road bicycle paths along arterial roads and major and minor collector roads where cycling safety is a foremost concern; g) enhancing and integrating convenient and secure public bicycle parking within: i. inter-modal locations such as rail stations and transit stops; ii. major trip attractors such as sports venues, entertainment centres, shopping complexes and community service centres; and iii. the right-of-ways of streets in new mixed-use neighbourhoods and intensification areas; h) updating the zoning by-law to include bicycle parking standards and requirements for shower and change facilities in major non-residential developments; i) supporting the implementation of Markham's Pathways and Trails Master Plan to create a connected network of off-road trails through natural areas and hydro corridors for use by pedestrians and cyclists; j) considering the introduction of a bike-share program for residents and visitors to Markham; and k) partnering with the Region and organizations in the local cycling community to support on-going promotional, safety and educational programs for pedestrians and cyclists.	
					7.1.5.3	To support the inclusion of preferential parking measures for carpool vehicles, car-share vehicles and low-emission vehicles as part of transportation demand management strategies and to secure such arrangements through an appropriate agreement.	
Aurora	Ontario	Official Plan	2010	No	14.2.1(f)	Travel Demand Management (TDM) measures shall be identified and developed as part of any major development or redevelopment in order to reduce the single-occupant vehicle usage and to promote other modes of transportation such as walking, cycling, and public transit.	https://www.aurora.ca/TownHall/Documents/Planning%20Services/REVISED%202015%20Official%20Plan_Full%20Document.pdf
Newmarket	Ontario	Newmarket Urban Centres Secondary Plan	2014 (2016 Office Consolidation)	Yes	9.2	Transportation and mobility in the Urban Centres will be planned to f) include an active transportation network that connects the Urban Centres internally and that links the Urban Centres to the surrounding community	https://www.newmarket.ca/LivingHere/Documents/Planning%20Department/Secondary%20Plan/Urban%20Centres%20Secondary%20Plan%20-%20October%202016%20Consolidation.pdf
					9.3.4(iii)	Developments will be required to facilitate and promote connectivity to the Town-wide Active Transportation Network identified on Schedule D of the Official Plan through urban design and Transportation Demand Measures.	
					9.3.5(iii)	In addition to all studies that may be required in accordance with Newmarket Official Plan, all non-residential development in the Urban Centres and all residential development in the Urban Centres proposing 10 or more residential units shall be required to prepare a Transportation Demand Management Strategy as part of its Traffic Impact Report. The TDM strategy will describe actions intended to discourage single-occupancy vehicle trips, alternative parking standards, minimize parking, and promote transit use, cycling, car and bike sharing, carpooling, and other measures	
					9.3.5(iv)	TDM strategies should be designed to decrease single occupancy vehicle use, reduce peak period demands, especially discretionary trips in the afternoon peak period, promote active transportation and transit use and to increase vehicle occupancy during peak periods and should include, but not be limited to: a) provision for car share opportunities in major residential developments; b) secure indoor bicycle parking and showers in conjunction with major office and commercial uses, institutional and civic uses; c) preferential parking for carpool and electric vehicles in non-residential developments; d) provision for bicycle parking in close proximity to building entrances and transit stations; e) transit incentive programs, including subsidized transit fares; and f) incorporating paid parking requirements with non-residential development	
					9.3.6(i)	The Town will establish appropriate parking standards for the Urban Centres in the Zoning By-law. Parking requirements will seek to reduce the parking standards in order to encourage a shift toward non-auto modes of transportation and reflect the walking distance to transit and complementary uses	
					9.3.6(ii)	Parking facilities shall be designed to accommodate bicycle parking as well as reserved spaces for drivers of car-share or car pool vehicles and electric cars.	
					9.3.6(vi)	All commercial, office, institutional, mixed use and multi-unit residential buildings, excluding townhouses and stacked townhouses, shall include secure bicycle parking and storage facilities, preferably indoors.	
					9.3.6(vii)	The implementing by-law shall establish minimum requirements for bicycle parking. Major office developments and major institutional employers shall be encouraged to include change rooms, showers and lockers for bicycle commuters.	
Oakville	Ontario	Official Plan	2009 (2017 Office Consolidation)	No	8.14.1	Through the development process, the Town will encourage opportunities for developing transportation demand management (TDM) measures to reduce single occupancy motor vehicle use, especially during peak travel periods. TDM measures include, but are not limited to, carpooling programs, preferential parking for carpool members, transit pass incentives, cycling initiatives, telecommuting, flex hours, provision of private shuttles, and walking programs.	https://www.oakville.ca/assets/2011%20plan/2017-04-04%20Livable%20Oakville%20-%20Office%20Consolidation.pdf
					8.14.2	TDM will be used to reduce the use of single occupancy vehicles and encourage increased transit ridership, walking and cycling.	
					8.14.3	As an incentive to encourage TDM, the Town may permit reduced parking standards for developments which demonstrate, through a TDM plan and implementation strategy, that a reduction in parking standards is appropriate.	
					8.15.3	Reduced surface parking may be considered as part of a TDM plan.	
Oakville	Ontario	North Oakville East Secondary Plan	2008	No	7.7.2.3(a)	The Town recognizes the role of Travel Demand Management in promoting more efficient use of transportation infrastructure, making the use of private vehicles more sustainable and encouraging increased transit use. The Town shall encourage businesses and/or organizations to prepare and administer special transportation demand management strategies which promote more efficient use of existing road facilities including staggered work hours, car pooling and High Occupancy Vehicle (HOV) lanes and other similar approaches.	https://www.oakville.ca/assets/2011%20plan/nco-EastPlan.pdf
					7.7.2.3(b)	The Town will encourage any development which contains more than 3,000 square metres of office use or 9,290 square metres of industrial use to establish with the Town a travel demand management plan and implementation strategy for the specific development. Priority shall be given to measures which are not capital intensive (e.g. flexible working hours, priority parking for car pool vehicles) and which are feasible given the scale, ultimate occupant/user and location of the development.	
					7.7.2.3(c)	As an incentive to encourage travel demand management as set out in Subsection a) and b), the Town will permit reduced parking standards for developments which demonstrate through a travel demand management plan and implementation strategy that a reduction in parking standards is appropriate. A reduction in parking standards will also be considered where mixed use development is permitted, where there is significant density of development and good accessibility to transit, such as in the Urban Core Area designation.	
					6.4.1	Reduction of vehicle parking will be considered on the basis of the mix of uses, contributions to the installation and implementation of travel demand measures and other sustainable mobility options and facilities or services.	

Toronto	Ontario	Sheppard Lansing Secondary Plan	2017	Yes, completely	6.5.1	A Transportation Demand Management Program will be required for all applications to amend the zoning by-law and will: a. Be integrated with required transportation impact assessments submitted to support the proposed development; b. Identify design and/or programmatic means to reduce single occupancy vehicle use and encourage transit use, cycling and walking; c. Identify the roles and responsibilities of the property owner with respect to each recommended program and its implementation; and d. Identify the operational and financial roles and responsibilities of the property owner including, but not limited to, program development, implementation and ongoing management and operations of the <u>transportation demand management plan and/or program.</u>	https://www.toronto.ca/legdocs/bylaws/2017/aw0123.pdf
					6.5.2	Developments will provide transit supportive infrastructure, such as pavement markings at key stops, seating, street furniture and security features, to improve transit users' experience as part of the travel demand management strategies.	
Toronto	Ontario	Downsview Area Secondary Plan	1999 (updated in 2011)	No	2.3.20	Office and other employment development proponents will be encouraged to develop and implement appropriate travel demand management strategies to reduce peak period automobile trips, and facilitate non-automobile modes of travel such as transit, walking and cycling. In addition, measures to support transit use such as maximum parking standards, shared parking arrangements, public parking structures and payment-in-lieu of parking may be considered on sites within walking distances of rapid transit stations	https://www.toronto.ca/wp-content/uploads/2017/11/902d-cp-official-plan-SP-7-Downsview.pdf
					7.2.1	A transportation monitoring program will be developed with stakeholders to monitor the development levels and trends and associated travel characteristics. The monitoring program will address g) the results of Transportation Demand Management measures and the extent to which the objectives of the Downsview Area Secondary Plan Transportation Master Plan are being achieved	
Toronto	Ontario	North York Centre Secondary Plan	N/A	No	4.7(a)	It is a basic objective of this Secondary Plan to encourage the use of public transit and establish a high transit modal split in the North York Centre. This is desirable to make the best use of the available capacity of the existing and planned transportation network, and to minimize the environmental effects from automobile traffic. The City will actively work with developers, owners and tenants in the North York Centre to develop, implement, facilitate and promote measures to increase the use of transit, cycling and walking, and reduce the use of low-occupancy automobiles for trips, particularly work trips, to and from the North York Centre." These measures include: i. promoting the use of public transit by employees; ii. promoting the use of bicycles by employees, residents and visitors for business and recreational trips; iii. promoting measures to foster higher vehicle occupancy; iv. assisting in organizing and promoting car pooling; v. giving priority parking space assignments and/or reduced rates for car pools; vi. varying hours of work to reduce peak hour loads; vii. participating in a Transportation Management Association; viii. giving priority parking space assignments or reduced rates for non-polluting motor vehicles, such as electric cars, as they become available to the general market; and ix. other measures that may be identified	https://www.toronto.ca/wp-content/uploads/2017/11/8fe9-cp-official-plan-SP-8-North-York-Centre.pdf

Appendix E – Transportation Tomorrow Survey (TTS) Details: Residential Travel Mode Split (South Guelph)

Thu Dec 27 2018 18:16:16 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 700-900

and

2006 GTA zone of destination - gt 8078-8081 8062 8064 8068 8067

and

Trip purpose of destination - purp

Table: Trip 2016

Row:	Count:	Expanded:
Transit excluding GO rail	1	19
Auto driver	16	332
Auto passenger	1	8
Walk	2	42
Total:	20	401

Thu Dec 27 2018 18:15:33 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 700-900

and

2006 GTA zone of origin 8078-8081 8062 8064 8068 8067

and

Trip purpose of origin -

Table: Trip 2016

Row:	Count:	Expanded:
Transit excluding GO ra	27	699
Cycle	8	215
Auto driver	250	5310
Auto passenger	29	657
School bus	31	848
Walk	22	449
Total:	367	8177

Thu Dec 27 2018 18:17:00 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 1600-1800

and

2006 GTA z 8078-8081 8062 8064 8068 8067

and

Trip purpose

Table: Trip 2016

Row:	Count:	Expanded:
Transit exc	24	581
Cycle	6	142
Auto driver	243	4994
GO rail only	3	53
Auto passe	28	539
School bus	9	211
Taxi passer	1	43
Walk	5	86
Total:	319	6649

Thu Dec 27 2018 18:17:27 GMT-0500 (Eastern Standard Time)

Frequency Distribution Query Form - Trip - 2016 v1.1

Field: Primary travel mode of trip - mode_prime

Filters:

Start time of trip - start_time In 1600-1800

and

2006 GTA z 8078-8081 8062 8064 8068 8067

and

Trip purpos:

Table: Trip 2016

Row:	Count:	Expanded:
Transit exc	2	82
Auto driver	59	1249
Auto passe	28	627
Total:	89	1958

Travel Mode	Resident Travel Mode Split									
	Weekday AM Inbound		Weekday AM Outbound		Weekday PM Inbound		Weekday PM Outbound		Overall	
	Count	Proportion	Count	Proportion	Count	Proportion	Count	Proportion	Count	Proportion
Transit excluding GO rail	19	5%	699	9%	581	9%	82	4%	1381	8%
Cycle		0%	215	3%	142	2%		0%	357	2%
Auto driver	332	83%	5310	65%	4994	75%	1249	64%	11885	69%
GO rail only		0%		0%	53	1%		0%	53	0%
Auto passenger	8	2%	657	8%	539	8%	627	32%	1831	11%
School bus		0%	848	10%	211	3%		0%	1059	6%
Taxi passenger		0%		0%	43	1%		0%	43	0%
Walk	42	10%	449	5%	86	1%		0%	577	3%
Total:	401	1	8178	1	6649	1	1958	1	17186	1

Travel Mode	Resident Travel Mode Split			
	Weekday AM Total		Weekday PM Total	
	Count	Proportion	Count	Proportion
Transit excluding GO rail	718	8%	663	8%
Cycle	215	3%	142	2%
Auto driver	5642	66%	6243	73%
GO rail only	0	0%	53	1%
Auto passenger	665	8%	1166	14%
School bus	848	10%	211	2%
Taxi passenger	0	0%	43	0%
Walk	491	6%	86	1%
Total:	8579	1	8607	1

Auto	74%	86%
Transit	8%	8%
Walk	6%	1%
Cycle	3%	2%
Other	10%	3%

Appendix F – Transportation Tomorrow Survey (TTS) Details: Residential Travel Mode Split (Proxy Area Data)

Cornell, Markham

Mon Jan 07 2019 11:18:59 GMT-0500 (Eastern Standard Time) - Run Time: 1648ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 2457

and

Start time of trip - start_time In 700-900

and

Trip purpose of origin - purpose In 1

and

Type of dwelling unit - dwell_type In 1

Trip 2016

Table:

	2453	2454	2455	2457 Total	
Transit excluding GO rail	22	410	73	128	633
Cycle	0	19	0	9	28
Auto driver	177	1545	1029	517	3268
GO rail only	19	55	18	0	92
Joint GO rail and local transit	0	28	27	5	60
Auto passenger	32	587	102	313	1034
School bus	147	52	46	10	255
Walk	0	175	60	62	297
					5667

Travel Mode	Trips	Proportion
Auto Driver	3268	58%
Auto Passenger	1034	18%
Transit	785	14%
Walk	297	5%
Cycle	28	0%
Other	255	4%
	5667	

Mon Jan 07 2019 14:11:58 GMT-0500 (Eastern Standard Time) - Run Time: 1985ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime
Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination = 2457
and
Start time of trip - start_time In 700-900
and
Trip purpose of destination -
and
Type of dwelling unit - dwell

Trip 2016

Table:

	2454	2455	2457	Total
Auto driver	193	103	58	354
Auto passenger	0	26	0	26
Walk	0	42	16	58
				0
				0
				0
				0
				0
				438

Travel Mode	Trips	Proportion
Auto Driver	354	81%
Auto Passenger	26	6%
Transit	0	0%
Walk	58	13%
Cycle	0	0%
Other	0	0%
	438	

Mon Jan 07 2019 11:21:18 GMT-0500 (Eastern Standard Time) - Run Time: 1678ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 2457

and

Start time of trip - start_time In 700-900

and

Trip purpose of origin - purp_orig In 1-3

and

Type of dwelling unit - dwell_type In 2-3

Trip 2016

Table:

	2453	2454	2455	2457 Total	
Transit excluding GO rail	0	282	36	7	325
Auto driver	20	911	271	179	1381
GO rail only	0	66	15	0	81
Joint GO rail and local transit	0	9	0	0	9
Auto passenger	0	230	208	5	443
School bus	0	0	0	12	12
Walk	0	92	16	0	108
					0
					2359

Travel Mode	Trips	Proportion
Auto Driver	1381	59%
Auto Passenger	443	19%
Transit	415	18%
Walk	108	5%
Cycle		0%
Other	12	1%
	2359	

Mon Jan 07 2019 14:12:59 GMT-0500 (Eastern Standard Time) - Run Time: 2328ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - 2457

and

Start time of trip - start_time In 700-900

and

Trip purpose of destination - pu

and

Type of dwelling unit - dwell_ty 3

Trip 2016

Table:

	2454	2455	Total
Auto driver	159	75	234
Walk	18	0	18
			0
			0
			0
			0
			0
			0
			252

Travel Mode	Trips	Proportion
Auto Driver	234	93%
Auto Passenger	0	0%
Transit	0	0%
Walk	18	7%
Cycle	0	0%
Other	0	0%
	252	

Mon Jan 07 2019 11:13:23 GMT-0500 (Eastern Standard Time) - Run Time: 2404ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of dest 2457

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of destination

and

Type of dwelling unit - dwell_type In 1

Trip 2016

Table:

	2453	2454	2455	2457 Total	
Transit excluding GO r	22	271	198	121	612
Cycle	0	39	0	0	39
Auto driver	278	1287	979	582	3126
GO rail only	9	90	42	49	190
Joint GO rail and local	0	43	35	8	86
Auto passenger	32	232	114	40	418
School bus	58	0	23	0	81
Walk	0	14	18	0	32
					4584

Travel Mode	Trips	Proportion
Auto Driver	3126	68%
Auto Passenger	418	9%
Transit	888	19%
Walk	32	1%
Cycle	39	1%
Other	81	2%
	4584	

Mon Jan 07 2019 14:21:32 GMT-0500 (Eastern Standard Time) - Run Time: 1965ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of orig 2457

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of origin

and

Type of dwelling unit -

Trip 2016

Table:

	2453	2454	2455	2457 Total	
Transit excluding GO r	0	0	28	0	28
Cycle	0	38	0	0	38
Auto driver	53	307	277	91	728
Auto passenger	32	128	85	16	261
					0
					0
					0
					0
					1055

Travel Mode	Trips	Proportion
Auto Driver	728	69%
Auto Passenger	261	25%
Transit	28	3%
Walk	0	0%
Cycle	38	4%
Other	0	0%
	1055	

Mon Jan 07 2019 11:12:53 GMT-0500 (Eastern Standard Time) - Run Time: 2227ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime
Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destina 2457
and
Start time of trip - start_time In 1600-1800
and
Trip purpose of destinatic
and
Type of dwelling unit - dwell_type In 2-3

Trip 2016

Table:

	2454	2455	2457	Total
Transit excluding GO rail	134	45	0	179
Auto driver	937	305	140	1382
GO rail only	59	22	12	93
Joint GO rail and local tra	25	6	7	38
Auto passenger	168	161	0	329
Taxi passenger	0	16	0	16
Walk	0	21	0	21
				0
				2058

Travel Mode	Trips	Proportion
Auto Driver	1382	67%
Auto Passenger	345	17%
Transit	310	15%
Walk	21	1%
Cycle		0%
Other	0	0%
	2058	

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - 2457

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of origin - pu

and

Type of dwelling unit - dw 3

Trip 2016

Table:

	2453	2454	2455	2457 Total	
Transit excluding GO rail	0	0	64	0	64
Auto driver	20	166	90	43	319
Auto passenger	0	39	0	0	39
Walk	0	47	0	0	47
					0
					0
					0
					0
					469

Travel Mode	Trips	Proportion
Auto Driver	319	68%
Auto Passenger	39	8%
Transit	64	14%
Walk	47	10%
Cycle	0	0%
Other	0	0%
	469	

Oak Park, Oakville

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 4034-4036

and

Start time of trip - start_time In 700-900

and

Trip purpose of origin

and

Type of dwelling unit - dwell_type In 1

Trip 2016

Table:

	4034	4035	4036	Total
Transit excluding GO	0	9	35	44
Cycle	28	0	0	28
Auto driver	502	356	630	1488
GO rail only	39	10	17	66
Joint GO rail and local	0	0	19	19
Auto passenger	234	103	246	583
School bus	162	40	0	202
Walk	0	20	176	196
				2626

Travel Mode	Trips	Proportion
Auto Driver	1488	57%
Auto Passenger	583	22%
Transit	129	5%
Walk	196	7%
Cycle	28	1%
Other	202	8%
	2626	

Mon Jan 07 2019 14:32:49 GMT-0500 (Eastern Standard Time) - Run Time: 1855ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 4034-4036

and

Start time of trip - start_time In 700-900

and

Trip purpose of destir

and

Type of dwelling unit

Trip 2016

Table:

	4034	4035	4036	Total
Auto driver	108	72	90	270
Walk	0	0	44	44
				0
				0
				0
				0
				0
				0
				314

Travel Mode	Trips	Proportion
Auto Driver	270	86%
Auto Passenger	0	0%
Transit	0	0%
Walk	44	14%
Cycle	0	0%
Other	0	0%
	314	

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 4034-4036

and

Start time of trip - start_time In 700-900

and

Trip purpose of origin -

and

Type of dwelling unit - 3

Trip 2016

Table:

	4034	4035	4036 Total	
Transit excluding GO rail	0	28	49	77
Auto driver	306	483	388	1177
GO rail only	10	38	36	84
Joint GO rail and local transit	0	15	23	38
Auto passenger	69	54	43	166
School bus	71	0	0	71
Walk	0	32	68	100
				0
				1713

Travel Mode	Trips	Proportion
Auto Driver	1177	69%
Auto Passenger	166	10%
Transit	199	12%
Walk	100	6%
Cycle	0	0%
Other	71	4%
	1713	

Mon Jan 07 2019 14:32:27 GMT-0500 (Eastern Standard Time) - Run Time: 2302ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 4034-4036

and

Start time of trip - start_time In 700-900

and

Trip purpose of destination

and

Type of dwelling unit - 3

Trip 2016

Table:

	4034	4035	4036	Total
Auto driver	86	26	32	144
Walk	0	0	22	22
				0
				0
				0
				0
				0
				0
				166

Travel Mode	Trips	Proportion
Auto Driver	144	87%
Auto Passenger	0	0%
Transit	0	0%
Walk	22	13%
Cycle	0	0%
Other	0	0%
	166	

Mon Jan 07 2019 11:29:46 GMT-0500 (Eastern Standard Time) - Run Time: 2094ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime
Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 4034-4036
and
Start time of trip - start_time In 1600-1800
and
Trip purpose of destir
and
Type of dwelling unit - dwell_type In 1

Trip 2016

Table:

	4034	4035	4036	Total
Transit excluding GO	0	0	37	37
Cycle	28	0	23	51
Auto driver	420	369	506	1295
GO rail only	39	23	48	110
Joint GO rail and local	0	0	19	19
Auto passenger	13	14	105	132
Paid rideshare	23	0	0	23
Walk	0	0	23	23
				1690

Travel Mode	Trips	Proportion
Auto Driver	1295	77%
Auto Passenger	132	8%
Transit	166	10%
Walk	23	1%
Cycle	51	3%
Other	23	1%
	1690	

Mon Jan 07 2019 14:31:10 GMT-0500 (Eastern Standard Time) - Run Time: 1961ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 4034-4036

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of origin

and

Type of dwelling unit

Trip 2016

Table:

	4034	4035	4036	Total
Auto driver	33	52	169	254
GO rail only	0	0	35	35
Auto passenger	47	0	29	76
				0
				0
				0
				0
				0
				365

Travel Mode	Trips	Proportion
Auto Driver	254	70%
Auto Passenger	76	21%
Transit	35	10%
Walk	0	0%
Cycle	0	0%
Other	0	0%
	365	

Mon Jan 07 2019 11:29:27 GMT-0500 (Eastern Standard Time) - Run Time: 1996ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 4034-4036

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of destination

and

Type of dwelling unit - 3

Trip 2016

Table:

	4034	4035	4036	Total
Transit excluding GO rail	0	10	14	24
Cycle	0	17	0	17
Auto driver	199	356	274	829
GO rail only	10	18	14	42
Joint GO rail and local transit	0	25	0	25
Auto passenger	58	36	43	137
Walk	0	0	23	23
				0
				1097

Travel Mode	Trips	Proportion
Auto Driver	829	76%
Auto Passenger	137	12%
Transit	91	8%
Walk	23	2%
Cycle	17	2%
Other	0	0%
	1097	

Mon Jan 07 2019 14:31:41 GMT-0500 (Eastern Standard Time) - Run Time: 1969ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 4034-4036

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of origin -

and

Type of dwelling unit - 3

Trip 2016

Table:

	4034	4035	4036	Total
Auto driver	0	28	31	59
Auto passenger	0	10	49	59
Taxi passenger	14	0	0	14
Walk	0	10	0	10
				0
				0
				0
				0
				142

Travel Mode	Trips	Proportion
Auto Driver	59	42%
Auto Passenger	73	51%
Transit	0	0%
Walk	10	7%
Cycle	0	0%
Other	0	0%
	142	

Orchard, Burlington

Mon Jan 07 2019 11:46:00 GMT-0500 (Eastern Standard Time) - Run Time: 2228ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin = 4189

and

Start time of trip - start_time In 700-900

and

Trip purpose of origin

and

Type of dwelling unit

Trip 2016

Table:

	4079	4189	Total
Transit excluding GO rail	130	223	353
Cycle	19	50	69
Auto driver	2947	2675	5622
GO rail only	125	22	147
Joint GO rail and local	104	70	174
Auto passenger	559	373	932
School bus	360	502	862
Walk	783	785	1568
			9727

Travel Mode	Trips	Proportion
Auto Driver	5622	58%
Auto Passenger	932	10%
Transit	674	7%
Walk	1568	16%
Cycle	69	1%
Other	862	9%
	9727	

Mon Jan 07 2019 15:32:35 GMT-0500 (Eastern Standard Time) - Run Time: 2400ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime
Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of des 4189
and
Start time of trip - start_time In 700-900
and
Trip purpose of destir
and
Type of dwelling unit

Trip 2016

Table:

	4079	4189	Total
Auto driver	400	132	532
Walk	28	76	104
			0
			0
			0
			0
			0
			0
			636

Travel Mode	Trips	Proportion
Auto Driver	532	84%
Auto Passenger	0	0%
Transit	0	0%
Walk	104	16%
Cycle	0	0%
Other	0	0%
	636	

Mon Jan 07 2019 11:45:39 GMT-0500 (Eastern Standard Time) - Run Time: 2071ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin = 4189

and

Start time of trip - start_time In 700-900

and

Trip purpose of origin

and

Type of dwelling unit = 3

Trip 2016

Table:

	4079	4189	Total
Transit excluding GO rail	53	0	53
Auto driver	784	313	1097
GO rail only	0	16	16
Joint GO rail and local	22	0	22
Auto passenger	89	47	136
School bus	25	0	25
Walk	60	0	60
			0
			1409

Travel Mode	Trips	Proportion
Auto Driver	1097	78%
Auto Passenger	136	10%
Transit	91	6%
Walk	60	4%
Cycle	0	0%
Other	25	2%
	1409	

Mon Jan 07 2019 15:33:00 GMT-0500 (Eastern Standard Time) - Run Time: 2528ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime
Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of des 4189

and

Start time of trip - start_time In 700-900

and

Trip purpose of destir

and

Type of dwelling unit 3

Trip 2016

Table:

	4079	4189	Total
Auto driver	80	16	96
Auto driver			0
GO rail only			0
Joint GO rail and local transit			0
Auto passenger			0
School bus			0
Walk			0
			0
			96

Travel Mode	Trips	Proportion
Auto Driver	96	100%
Auto Passenger	0	0%
Transit	0	0%
Walk	0	0%
Cycle	0	0%
Other	0	0%
	96	

Mon Jan 07 2019 11:43:49 GMT-0500 (Eastern Standard Time) - Run Time: 2464ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of des 4189

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of destir

and

Type of dwelling unit - dwell_type In 1

Trip 2016

Table:

	4079	4189	Total
Transit excluding GO	55	170	225
Auto driver	2584	2321	4905
GO rail only	247	20	267
Joint GO rail and local	104	142	246
Auto passenger	201	390	591
School bus	51	213	264
Taxi passenger	0	17	17
Walk	23	220	243
			6758

Travel Mode	Trips	Proportion
Auto Driver	4905	73%
Auto Passenger	608	9%
Transit	738	11%
Walk	243	4%
Cycle	0	0%
Other	264	4%
	6758	

Mon Jan 07 2019 15:34:01 GMT-0500 (Eastern Standard Time) - Run Time: 2187ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin = 4189

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of origin

and

Type of dwelling unit

Trip 2016

Table:

	4079	4189	Total
Auto driver	732	514	1246
Auto passenger	329	272	601
Walk	0	28	28
			0
			0
			0
			0
			0
			1875

Travel Mode	Trips	Proportion
Auto Driver	1246	66%
Auto Passenger	601	32%
Transit	0	0%
Walk	28	1%
Cycle	0	0%
Other	0	0%
	1875	

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime
 Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of des 4189

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of destir

and

Type of dwelling unit 3

Trip 2016

Table:

	4079	4189	Total
Transit excluding GO	53	0	53
Auto driver	698	394	1092
GO rail only	61	0	61
Joint GO rail and local	22	18	40
Auto passenger	128	40	168
Walk	44	0	44
			0
			0
			1458

Travel Mode	Trips	Proportion
Auto Driver	1092	75%
Auto Passenger	168	12%
Transit	154	11%
Walk	44	3%
Cycle	0	0%
Other	0	0%
	1458	

Mon Jan 07 2019 15:33:43 GMT-0500 (Eastern Standard Time) - Run Time: 1937ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin = 4189

and

Start time of trip - start_time In 1600-1800

and

Trip purpose of origin

and

Type of dwelling unit = 3

Trip 2016

Table:

	4079	4189	Total
Auto driver	134	31	165
GO rail only	21	0	21
Auto passenger	35	0	35
Walk	44	0	44
			0
			0
			0
			0
			265

Travel Mode	Trips	Proportion
Auto Driver	165	62%
Auto Passenger	35	13%
Transit	21	8%
Walk	44	17%
Cycle	0	0%
Other	0	0%
	265	

Summary

Appendix G – Transportation Tomorrow Survey (TTS) Details: Employee (Office) Travel Mode Split

Mon Jan 14 2019 15:47:19 GMT-0500 (Eastern Standard Time) - Run Time: 2210ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of 8064 8067-8076 8078-8081

and

Trip purpose of d

and

Start time of trip - start_time In 600-900

Trip 2016

Table:

	8062	8064	8069	8070	8071	8072	8073	8074	8075	8079	
Transit excluding	0	0	0	0	26	0	0	0	0	0	26
Cycle	0	0	0	0	0	0	0	0	0	19	19
Auto driver	57	27	104	112	29	43	144	16	62	205	799
Walk	0	0	15	0	0	0	0	0	0	0	15
											859

Travel Mode	Trips	Propotion
Auto Driver	799	93%
Auto Pass	0	0%
Transit	26	3%
Walk	15	2%
Cycle	19	2%

859

Mon Jan 14 2019 15:45:57 GMT-0500 (Eastern Standard Time) - Run Time: 1854ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Primary travel mode of trip - mode_prime

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone c 8064 8067-8076 8078-8081

and

Trip purpose of c

and

Start time of trip - start_time In 1500-1600

Trip 2016

Table:

	8069	8070	8071	8072	8073	8075	8079	8080	
Transit excluding	0	0	26	0	0	0	0	0	26
Auto driver	51	23	0	11	110	88	54	18	355
Auto passenger	0	0	0	0	0	16	0	0	16
Walk	0	0	15	0	0	0	0	0	15
									0
									412

Travel Mode	Trips	Propotion
Auto Driver	355	86%
Auto Pass	16	4%
Transit	26	6%
Walk	15	4%
Cycle	0	0%

412

Appendix H – Multi-Modal Trip Forecast Calculations

Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units	1296	384	0	2356	934	1553	0	2142	1460	10125
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Forecast Development Traffic - Zone 1

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	Single-Family Detached Housing	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $T = 0.71(X) + 4.80$	1	4	5	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) + 0.20$	#NUM!	#NUM!	Equation: $T = 0.84(X) + 17$	10	8	18	
ITE Code:	Z10		Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!
Peak Hour:	Adjacent Street (Sat. Generator)		Auto Mode Split:	1	3	4	Auto Mode Split:	#NUM!	#NUM!	#NUM!	Auto Mode Split:	8	6	14
Notes:	General Urban / Suburban		Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
Sq. ft. GFA	Units		Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!

Land Use	Multi-Family Housing (MID-RISE)	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $\text{Ln}(T) = 0.98 \text{Ln}(X) - 0.98$	42	121	163	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) - 0.63$	124	80	284	Equation: $T = 0.42(X) + 6$	104	109	213
ITE Code:	Z21		Rate: Trips / Dwelling Unit	0.09	0.25	0.33	Rate: Trips / Dwelling Unit	0.25	0.16	0.41	Rate: Trips / Dwelling Unit	0.21	0.22	0.43
Peak Hour:	Adjacent Street (Sat. Generator)		Auto Mode Split:	33	96	129	Auto Mode Split:	111	72	183	Auto Mode Split:	104	109	213
Notes:	General Urban / Suburban		Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
Sq. ft. GFA	492 Units		Rate: Trips / Dwelling Unit	0.07	0.19	0.26	Rate: Trips / Dwelling Unit	0.23	0.15	0.37	Rate: Trips / Dwelling Unit	0.21	0.22	0.43

Land Use	Multi-Family Housing (HIGH-RISE)	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $T = 0.28(X) + 12.86$	57	181	238	Equation: $T = 0.34(X) + 8.56$	172	110	282	Equation: $T = 0.31(X) + 24$	150	123	273
ITE Code:	Z22		Rate: Trips / Dwelling Unit	0.07	0.23	0.30	Rate: Trips / Dwelling Unit	0.21	0.14	0.35	Rate: Trips / Dwelling Unit	0.19	0.15	0.34
Peak Hour:	Adjacent Street (Sat. Generator)		Auto Mode Split:	45	143	188	Auto Mode Split:	154	98	252	Auto Mode Split:	134	110	244
Notes:	General Urban / Suburban		Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
Sq. ft. GFA	804 Units		Rate: Trips / Dwelling Unit	0.06	0.18	0.23	Rate: Trips / Dwelling Unit	0.19	0.12	0.31	Rate: Trips / Dwelling Unit	0.17	0.14	0.30

Forecast Total Residential Trips	79	242	321	#NUM!	#NUM!	#NUM!	246	225	471
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Land Use	Office	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $\text{Ln}(T) = 0.72 \text{Ln}(X) + 0.56$	#NUM!	#NUM!	#NUM!	Equation: $T = 0.27(X) + 23.67$	5	19	24	Fixed Data (Average Rd)	0	0	0
ITE Code:	Z10		Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	0.53
Peak Hour:	Adjacent Street		Auto Mode Split:	#NUM!	#NUM!	#NUM!	Auto Mode Split:	5	19	24	Auto Mode Split:	0	0	0
Notes:	General Urban / Suburban		Transit Factor:	95%			Transit Factor:	95%			Transit Factor:	95%		
Employees	em.		Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Office Trips	#NUM!	#NUM!	#NUM!	5	19	24	0	0	0
-----------------------------	-------	-------	-------	---	----	----	---	---	---



Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units 1296 384 0 2356 934 1553 0 2142 1460 10125

Forecast Development Traffic - Zone 2

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor			
Single-Family Detached Housing	210	Adjacent Street (Sat. Generator)	General Urban / Suburban	46		Equation: $T = 0.71(X) + 4.80$	9	28	37	Equation: $\ln(T) = 0.96 \ln(X) + 0.20$	30	18	48	Equation: $T = 0.84(X) + 17$	31	26	57
						Rate: Trips / Dwelling Unit	0.20	0.61	0.80	Rate: Trips / Dwelling Unit	0.65	0.39	1.04	Rate: Trips / Dwelling Unit	0.67	0.57	1.24
						Auto Mode Split	7	22	29	Auto Mode Split	27	16	43	Auto Mode Split	24	21	45
						Transit Factor	75%			Transit Factor	85%			Transit Factor	95%		
						Rate: Trips / Dwelling Unit	0.15	0.48	0.64	Rate: Trips / Dwelling Unit	0.58	0.35	0.93	Rate: Trips / Dwelling Unit	0.53	0.45	0.98

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor			
Multi-Family Housing (MID-RISE)	221	Adjacent Street (Sat. Generator)	General Urban / Suburban	44		Equation: $\ln(T) = 0.98 \ln(X) - 0.98$	4	11	15	Equation: $\ln(T) = 0.96 \ln(X) - 0.63$	12	8	20	Equation: $T = 0.42(X) + 6$	12	13	25
						Rate: Trips / Dwelling Unit	0.09	0.25	0.34	Rate: Trips / Dwelling Unit	0.27	0.18	0.45	Rate: Trips / Dwelling Unit	0.27	0.30	0.57
						Auto Mode Split	3	9	12	Auto Mode Split	11	7	18	Auto Mode Split	12	13	25
						Transit Factor	75%			Transit Factor	85%			Transit Factor	95%		
						Rate: Trips / Dwelling Unit	0.07	0.20	0.27	Rate: Trips / Dwelling Unit	0.24	0.16	0.41	Rate: Trips / Dwelling Unit	0.27	0.30	0.57

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor			
Multi-Family Housing (HIGH-RISE)	222	Adjacent Street (Sat. Generator)	General Urban / Suburban	284		Equation: $T = 0.28(X) + 12.86$	22	70	92	Equation: $T = 0.34(X) + 8.56$	64	41	105	Equation: $T = 0.31(X) + 24$	62	50	112
						Rate: Trips / Dwelling Unit	0.08	0.25	0.32	Rate: Trips / Dwelling Unit	0.23	0.14	0.37	Rate: Trips / Dwelling Unit	0.22	0.18	0.39
						Auto Mode Split	17	55	73	Auto Mode Split	57	37	94	Auto Mode Split	55	45	100
						Transit Factor	75%			Transit Factor	85%			Transit Factor	95%		
						Rate: Trips / Dwelling Unit	0.06	0.19	0.26	Rate: Trips / Dwelling Unit	0.20	0.13	0.33	Rate: Trips / Dwelling Unit	0.20	0.16	0.35

Forecast Total Residential Trips 28 86 114 95 60 155 92 78 170

Land Use	ITE Code	Peak Hour	Notes	Employees	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
					Rate: Trips / Employee	Auto Mode Split	Transit Factor	Rate: Trips / 1,000 sq. ft.	Auto Mode Split	Transit Factor	Rate: Trips / 1,000 sq. ft.	Auto Mode Split	Transit Factor			
Office	710	Adjacent Street	General Urban / Suburban	em.	Equation: $\ln(T) = 0.72 \ln(X) + 0.56$	#NUM!	#NUM!	#NUM!	Equation: $T = 0.27(X) + 23.67$	5	19	24	Fixed Data (Average Rate)	0	0	0
					Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	0.53
					Auto Mode Split	#NUM!	#NUM!	#NUM!	Auto Mode Split	5	19	24	Auto Mode Split	0	0	0
					Transit Factor	95%			Transit Factor	95%			Transit Factor	95%		
					Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Office Trips #NUM! #NUM! #NUM! 5 19 24 0 0 0



Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units 1296 384 0 2356 934 1553 0 2142 1460 10125

Forecast Development Traffic - Zone 4

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	Single-Family Detached Housing	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $T = 0.71(X) + 4.80$	105	314	419	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) + 0.20$	348	205	553	Equation: $T = 0.84(X) + 17$	275	234	509
ITE Code:	Z10		Rate: Trips / Dwelling Unit	0.18	0.54	0.72	Rate: Trips / Dwelling Unit	0.60	0.35	0.95	Rate: Trips / Dwelling Unit	0.47	0.40	0.87
Peak Hour:	Adjacent Street (Sat. Generator)		Auto Mode Split:	83	248	331	Auto Mode Split:	311	183	495	Auto Mode Split:	217	185	402
Notes:	General Urban / Suburban		Transit Factor:	75%			85%			95%				
Sq. ft. GFA	584	Units	Rate: Trips / Dwelling Unit	0.14	0.42	0.57	Rate: Trips / Dwelling Unit	0.53	0.31	0.85	Rate: Trips / Dwelling Unit	0.37	0.32	0.69

Land Use	Multi-Family Housing (MID-RISE)	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $\text{Ln}(T) = 0.98 \text{Ln}(X) - 0.98$	54	161	217	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) - 0.63$	165	106	271	Equation: $T = 0.42(X) + 6$	139	145	284
ITE Code:	Z21		Rate: Trips / Dwelling Unit	0.08	0.24	0.33	Rate: Trips / Dwelling Unit	0.25	0.16	0.41	Rate: Trips / Dwelling Unit	0.21	0.22	0.43
Peak Hour:	Adjacent Street (Sat. Generator)		Auto Mode Split:	44	127	171	Auto Mode Split:	148	95	242	Auto Mode Split:	139	145	284
Notes:	General Urban / Suburban		Transit Factor:	75%			85%			95%				
Sq. ft. GFA	659	Units	Rate: Trips / Dwelling Unit	0.07	0.19	0.26	Rate: Trips / Dwelling Unit	0.22	0.14	0.37	Rate: Trips / Dwelling Unit	0.21	0.22	0.43

Land Use	Multi-Family Housing (HIGH-RISE)	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $T = 0.28(X) + 12.86$	78	247	325	Equation: $T = 0.34(X) + 8.56$	236	151	387	Equation: $T = 0.31(X) + 24$	203	166	369
ITE Code:	Z22		Rate: Trips / Dwelling Unit	0.07	0.22	0.29	Rate: Trips / Dwelling Unit	0.21	0.14	0.35	Rate: Trips / Dwelling Unit	0.18	0.15	0.33
Peak Hour:	Adjacent Street (Sat. Generator)		Auto Mode Split:	62	195	257	Auto Mode Split:	211	135	346	Auto Mode Split:	182	149	330
Notes:	General Urban / Suburban		Transit Factor:	75%			85%			95%				
Sq. ft. GFA	1113	Units	Rate: Trips / Dwelling Unit	0.06	0.18	0.23	Rate: Trips / Dwelling Unit	0.19	0.12	0.31	Rate: Trips / Dwelling Unit	0.16	0.13	0.30

Forecast Total Residential Trips 189 570 759 670 413 1084 538 478 1016

Land Use	Office	Fitted Curve Calc.:	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
			Equation: $\text{Ln}(T) = 0.72 \text{Ln}(X) + 0.56$	#NUM!	#NUM!	#NUM!	Equation: $T = 0.27(X) + 23.67$	5	19	24	United Data (Average Rate)	0	0	0
ITE Code:	Z10		Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	0.53
Peak Hour:	Adjacent Street		Auto Mode Split:	#NUM!	#NUM!	#NUM!	Auto Mode Split:	5	19	24	Auto Mode Split:	0	0	0
Notes:	General Urban / Suburban		Transit Factor:	95%			95%			95%				
Employees	em.		Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Office Trips #NUM! #NUM! #NUM! 5 19 24 0 0 0



Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units 1296 384 0 2356 934 1553 0 2142 1460 10125

Forecast Development Traffic - Zone 5

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $T = 0.71(X) + 4.80$	80	238	318	Equation: $\ln(T) = 0.96 \ln(X) + 0.20$	266	156	422	Equation: $T = 0.84(X) + 17$	210	178	388
Single-Family Detached Housing	210	Adjacent Street (Sat. Generator)	General Urban / Suburban	441		Rate: Trips / Dwelling Unit	0.18	0.54	0.72	Rate: Trips / Dwelling Unit	0.60	0.35	0.96	Rate: Trips / Dwelling Unit	0.48	0.40	0.88
		Auto Mode Split:				Auto Mode Split:	63	188	251	Auto Mode Split:	238	140	378	Auto Mode Split:	166	141	306
		Transit Factor:				Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
		Rate: Trips / Dwelling Unit				Rate: Trips / Dwelling Unit	0.14	0.43	0.57	Rate: Trips / Dwelling Unit	0.54	0.32	0.86	Rate: Trips / Dwelling Unit	0.38	0.32	0.69

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $\ln(T) = 0.98 \ln(X) - 0.98$	11	30	41	Equation: $\ln(T) = 0.96 \ln(X) - 0.63$	32	21	53	Equation: $T = 0.42(X) + 6$	28	29	57
Multi-Family Housing (MID-RISE)	221	Adjacent Street (Sat. Generator)	General Urban / Suburban	120		Rate: Trips / Dwelling Unit	0.09	0.25	0.34	Rate: Trips / Dwelling Unit	0.27	0.18	0.44	Rate: Trips / Dwelling Unit	0.23	0.24	0.48
		Auto Mode Split:				Auto Mode Split:	9	24	32	Auto Mode Split:	29	19	47	Auto Mode Split:	28	29	57
		Transit Factor:				Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
		Rate: Trips / Dwelling Unit				Rate: Trips / Dwelling Unit	0.07	0.20	0.27	Rate: Trips / Dwelling Unit	0.24	0.16	0.40	Rate: Trips / Dwelling Unit	0.23	0.24	0.48

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $T = 0.28(X) + 12.86$	28	89	117	Equation: $T = 0.34(X) + 8.56$	82	53	135	Equation: $T = 0.31(X) + 24$	77	63	140
Multi-Family Housing (HIGH-RISE)	222	Adjacent Street (Sat. Generator)	General Urban / Suburban	373		Rate: Trips / Dwelling Unit	0.08	0.24	0.31	Rate: Trips / Dwelling Unit	0.22	0.14	0.36	Rate: Trips / Dwelling Unit	0.21	0.17	0.38
		Auto Mode Split:				Auto Mode Split:	22	70	92	Auto Mode Split:	73	47	121	Auto Mode Split:	69	56	125
		Transit Factor:				Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
		Rate: Trips / Dwelling Unit				Rate: Trips / Dwelling Unit	0.06	0.19	0.25	Rate: Trips / Dwelling Unit	0.20	0.13	0.32	Rate: Trips / Dwelling Unit	0.18	0.15	0.34

Forecast Total Residential Trips 94 282 376 340 206 546 263 226 489

Land Use	ITE Code	Peak Hour	Notes	Employees	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $\ln(T) = 0.72 \ln(X) + 0.56$	44	9	53	Equation: $T = 0.27(X) + 23.67$	11	43	54	Input Data (Average Rate)	0	0	0
Office	710	Adjacent Street	General Urban / Suburban	114		Rate: Trips / Employee	0.39	0.08	0.46	Rate: Trips / 1,000 sq. ft.	0.10	0.38	0.47	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	0.53
		Auto Mode Split:				Auto Mode Split:	44	9	53	Auto Mode Split:	11	43	54	Auto Mode Split:	0	0	0
		Transit Factor:				Transit Factor:	95%			Transit Factor:	95%			Transit Factor:	95%		
		Rate: Trips / Employee				Rate: Trips / Employee	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Office Trips 44 9 53 11 43 54 0 0 0



Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units 1296 384 0 2356 934 1553 0 2142 1460 10125

Forecast Development Traffic - Zone 6

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour				Weekday PM Peak Hour				Saturday Peak Hour																							
						Equation: T = 0.71(X) + 4.80	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Equation: Ln(T) = 0.96 Ln(X) + 0.20	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Equation: T = 0.84(X) + 17	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor																				
Single-Family Detached Housing	210	Adjacent Street (Sat. Generator)	General Urban / Suburban	294		54	0.18	43	75%	160	0.54	126	85%	214	0.73	169	95%	180	0.61	161	95%	286	0.97	256	0.87	143	0.49	113	0.38	122	0.41	96	0.33	265	0.90	209	0.71

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour				Weekday PM Peak Hour				Saturday Peak Hour																					
						Equation: Ln(T) = 0.98 Ln(X) - 0.98	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Equation: Ln(T) = 0.96 Ln(X) - 0.63	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Equation: T = 0.42(X) + 6	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor																		
Multi-Family Housing (MID-RISE)	221	Adjacent Street (Sat. Generator)	General Urban / Suburban	743		63	0.08	50	75%	181	0.24	143	85%	244	0.33	193	95%	185	0.25	166	95%	304	0.41	272	0.37	156	0.21	156	0.21	163	0.22	319	0.43	319	0.43

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour				Weekday PM Peak Hour				Saturday Peak Hour																			
						Equation: T = 0.28(X) + 12.86	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Equation: T = 0.34(X) + 8.56	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Equation: T = 0.31(X) + 24	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor																
Multi-Family Housing (HIGH-RISE)	222	Adjacent Street (Sat. Generator)	General Urban / Suburban	516		38	0.07	30	75%	119	0.23	94	85%	157	0.30	124	95%	112	0.22	100	95%	184	0.36	165	0.32	101	0.20	90	0.18	83	0.16	184	0.36

Forecast Total Residential Trips 122 363 486 427 266 693 359 334 693

Land Use	ITE Code	Peak Hour	Notes	Employees	Weekday AM Peak Hour				Weekday PM Peak Hour				Saturday Peak Hour																					
					Equation: Ln(T) = 0.72 Ln(X) + 0.56	Rate: Trips / Employee	Auto Mode Split	Transit Factor	Equation: T = 0.27 (X) + 23.67	Rate: Trips / 1,000 sq. ft.	Auto Mode Split	Transit Factor	Equation: T = 0.27 (X) + 23.67	Rate: Trips / 1,000 sq. ft.	Auto Mode Split	Transit Factor																		
Office	710	Adjacent Street	General Urban / Suburban	em.	#NUM!	#NUM!	#NUM!	95%	#NUM!	#NUM!	#NUM!	95%	5	#DIV/0!	19	#DIV/0!	24	#DIV/0!	5	#DIV/0!	19	#DIV/0!	24	#DIV/0!	24	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!

Forecast Total Office Trips #NUM! #NUM! #NUM! 5 19 24 0 0 0



Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units 1296 384 0 2356 934 1553 0 2142 1460 10125

Forecast Development Traffic - Zone 7

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split			
Single-Family Detached Housing	210	Adjacent Street (Sat. Generator)	General Urban / Suburban	Units	Equation: $T = 0.71(X) + 4.80$	1	4	5	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) + 0.20$	#NUM!	#NUM!	#NUM!	Equation: $T = 0.84(X) + 12$	10	8	18	
						Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!
						Auto Mode Split:	1	3	4	Auto Mode Split:	#NUM!	#NUM!	#NUM!	Auto Mode Split:	8	6	14
						Transit Factor:	75%			85%				95%			
						Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split			
Multi-Family Housing (MID-RISE)	221	Adjacent Street (Sat. Generator)	General Urban / Suburban	Units	Equation: $\text{Ln}(T) = 0.98 \text{Ln}(X) - 0.98$	#NUM!	#NUM!	#NUM!	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) - 0.63$	#NUM!	#NUM!	#NUM!	Equation: $T = 0.42(X) + 6$	3	4	7	
						Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!
						Auto Mode Split:	#NUM!	#NUM!	#NUM!	Auto Mode Split:	#NUM!	#NUM!	#NUM!	Auto Mode Split:	3	4	7
						Transit Factor:	75%			85%				95%			
						Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#NUM!	#NUM!	#NUM!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split			
Multi-Family Housing (HIGH-RISE)	222	Adjacent Street (Sat. Generator)	General Urban / Suburban	Units	Equation: $T = 0.28(X) + 12.86$	3	10	13	Equation: $T = 0.34(X) + 8.56$	5	4	9	Equation: $T = 0.31(X) + 24$	13	11	24	
						Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!
						Auto Mode Split:	2	8	10	Auto Mode Split:	4	4	8	Auto Mode Split:	12	10	21
						Transit Factor:	75%			85%				95%			
						Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / Dwelling Unit	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Residential Trips #NUM! #NUM! #NUM! #NUM! #NUM! #NUM! #NUM! 23 20 43

Land Use	ITE Code	Peak Hour	Notes	Employees	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split	Equation	Rate	Auto Mode Split			
Office	710	Adjacent Street	General Urban / Suburban	219 em.	Equation: $\text{Ln}(T) = 0.72 \text{Ln}(X) + 0.56$	71	14	85	Equation: $T = 0.27(X) + 23.67$	17	66	83	Fixed Data (Average Rate)	0	0	0	
						Rate: Trips / Employee	0.32	0.06	0.39	Rate: Trips / 1,000 sq. ft.	0.08	0.30	0.38	Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	0.53
						Auto Mode Split:	71	14	85	Auto Mode Split:	17	66	83	Auto Mode Split:	0	0	0
						Transit Factor:	95%			95%				95%			
						Rate: Trips / Employee	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Office Trips 71 14 85 17 66 83 0 0 0



Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units 1296 384 0 2356 934 1553 0 2142 1460 10125

Forecast Development Traffic - Zone 8

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $T = 0.71(X) + 4.80$	22	64	86	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) + 0.20$	72	43	115	Equation: $T = 0.84(X) + 17$	62	52	114
Single-Family Detached Housing	210	Adjacent Street (Sat. Generator)	General Urban / Suburban	114		Rate: Trips / Dwelling Unit	0.19	0.56	0.75	Rate: Trips / Dwelling Unit	0.63	0.38	1.01	Rate: Trips / Dwelling Unit	0.54	0.46	1.00
		Auto Mode Split:				Auto Mode Split:	17	51	68	Auto Mode Split:	64	38	103	Auto Mode Split:	49	41	90
		Transit Factor:				Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
		Rate: Trips / Dwelling Unit				Rate: Trips / Dwelling Unit	0.15	0.44	0.60	Rate: Trips / Dwelling Unit	0.57	0.34	0.90	Rate: Trips / Dwelling Unit	0.43	0.36	0.79

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $\text{Ln}(T) = 0.98 \text{Ln}(X) - 0.98$	111	315	426	Equation: $\text{Ln}(T) = 0.96 \text{Ln}(X) - 0.63$	319	204	523	Equation: $T = 0.42(X) + 6$	273	284	557
Multi-Family Housing (MID-RISE)	221	Adjacent Street (Sat. Generator)	General Urban / Suburban	1309		Rate: Trips / Dwelling Unit	0.08	0.24	0.33	Rate: Trips / Dwelling Unit	0.24	0.16	0.40	Rate: Trips / Dwelling Unit	0.21	0.22	0.43
		Auto Mode Split:				Auto Mode Split:	88	249	336	Auto Mode Split:	285	183	468	Auto Mode Split:	273	284	557
		Transit Factor:				Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
		Rate: Trips / Dwelling Unit				Rate: Trips / Dwelling Unit	0.07	0.19	0.26	Rate: Trips / Dwelling Unit	0.22	0.14	0.36	Rate: Trips / Dwelling Unit	0.21	0.22	0.43

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $T = 0.28(X) + 12.86$	51	163	214	Equation: $T = 0.34(X) + 8.56$	154	99	253	Equation: $T = 0.31(X) + 24$	136	111	247
Multi-Family Housing (HIGH-RISE)	222	Adjacent Street (Sat. Generator)	General Urban / Suburban	719		Rate: Trips / Dwelling Unit	0.07	0.23	0.30	Rate: Trips / Dwelling Unit	0.21	0.14	0.35	Rate: Trips / Dwelling Unit	0.19	0.15	0.34
		Auto Mode Split:				Auto Mode Split:	40	129	169	Auto Mode Split:	138	89	226	Auto Mode Split:	122	99	221
		Transit Factor:				Transit Factor:	75%			Transit Factor:	85%			Transit Factor:	95%		
		Rate: Trips / Dwelling Unit				Rate: Trips / Dwelling Unit	0.06	0.18	0.23	Rate: Trips / Dwelling Unit	0.19	0.12	0.31	Rate: Trips / Dwelling Unit	0.17	0.14	0.31

Forecast Total Residential Trips 145 428 573 488 310 797 444 424 868

Land Use	ITE Code	Peak Hour	Notes	Employees	Fitted Curve Calc.	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Equation: $\text{Ln}(T) = 0.72 \text{Ln}(X) + 0.56$	#NUM!	#NUM!	#NUM!	Equation: $T = 0.27(X) + 23.67$	5	19	24	Fixed Data (Average Rate)	0	0	0
Office	710	Adjacent Street	General Urban / Suburban	em.		Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	0.53
		Auto Mode Split:				Auto Mode Split:	#NUM!	#NUM!	#NUM!	Auto Mode Split:	5	19	24	Auto Mode Split:	0	0	0
		Transit Factor:				Transit Factor:	95%			Transit Factor:	95%			Transit Factor:	95%		
		Rate: Trips / Employee				Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Office Trips #NUM! #NUM! #NUM! 5 19 24 0 0 0



Proposed Development Statistics

Land Use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Low Density Res.	0	56	--	584	441	294	--	114	663
Med. Density Res.	492	44	--	659	120	743	--	1309	558
High Density Res.	804	284	--	764	196	312	--	503	239
Mixed-Use Res.	0	0	--	349	177	204	--	216	0
Office Jobs	--	--	--	--	114	--	219	--	--
Employees									

2152
3925
3102
946
333

1298

Residential Units 1296 384 0 2356 934 1553 0 2142 1460 10125

Forecast Development Traffic - Zone 9

Land Use: Residential
ITE Trip Gen. Manual Volume 10

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor			
Single-Family Detached Housing	210	Adjacent Street (Sat. Generator)	General Urban / Suburban	663		Equation: $T = 0.71(X) + 4.80$	119	357	476	Equation: $\ln(T) = 0.96 \ln(X) + 0.20$	393	231	624	Equation: $T = 0.84(X) + 17$	311	264	575
						Rate: Trips / Dwelling Unit	0.18	0.54	0.72	Rate: Trips / Dwelling Unit	0.59	0.35	0.94	Rate: Trips / Dwelling Unit	0.47	0.40	0.87
						Auto Mode Split	94	282	376	Auto Mode Split	352	207	558	Auto Mode Split	246	208	454
						Transit Factor	75%			85%			95%				
						Rate: Trips / Dwelling Unit	0.14	0.43	0.57	Rate: Trips / Dwelling Unit	0.53	0.31	0.84	Rate: Trips / Dwelling Unit	0.37	0.31	0.68

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor			
Multi-Family Housing (MID-RISE)	221	Adjacent Street (Sat. Generator)	General Urban / Suburban	558		Equation: $\ln(T) = 0.98 \ln(X) - 0.98$	48	137	185	Equation: $\ln(T) = 0.96 \ln(X) - 0.63$	141	90	231	Equation: $T = 0.42(X) + 6$	118	123	241
						Rate: Trips / Dwelling Unit	0.09	0.25	0.33	Rate: Trips / Dwelling Unit	0.25	0.16	0.41	Rate: Trips / Dwelling Unit	0.21	0.22	0.43
						Auto Mode Split	38	108	146	Auto Mode Split	126	81	207	Auto Mode Split	118	123	241
						Transit Factor	75%			85%			95%				
						Rate: Trips / Dwelling Unit	0.07	0.19	0.26	Rate: Trips / Dwelling Unit	0.23	0.14	0.37	Rate: Trips / Dwelling Unit	0.21	0.22	0.43

Land Use	ITE Code	Peak Hour	Notes	Sq. ft. GFA	Units	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour					
						Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor	Rate: Trips / Dwelling Unit	Auto Mode Split	Transit Factor			
Multi-Family Housing (HIGH-RISE)	222	Adjacent Street (Sat. Generator)	General Urban / Suburban	239		Equation: $T = 0.28(X) + 12.86$	19	61	80	Equation: $T = 0.34(X) + 8.56$	55	35	90	Equation: $T = 0.31(X) + 24$	54	44	98
						Rate: Trips / Dwelling Unit	0.08	0.26	0.33	Rate: Trips / Dwelling Unit	0.23	0.15	0.38	Rate: Trips / Dwelling Unit	0.23	0.18	0.41
						Auto Mode Split	15	48	63	Auto Mode Split	49	31	81	Auto Mode Split	48	39	88
						Transit Factor	75%			85%			95%				
						Rate: Trips / Dwelling Unit	0.06	0.20	0.26	Rate: Trips / Dwelling Unit	0.21	0.13	0.34	Rate: Trips / Dwelling Unit	0.20	0.16	0.37

Forecast Total Residential Trips 147 438 585 527 319 846 412 371 783

Land Use	ITE Code	Peak Hour	Notes	Employees	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour						
					Rate: Trips / Employee	Auto Mode Split	Transit Factor	Rate: Trips / 1,000 sq. ft.	Auto Mode Split	Transit Factor	Rate: Trips / 1,000 sq. ft.	Auto Mode Split	Transit Factor				
Office	710	Adjacent Street	General Urban / Suburban	em.	Equation: $\ln(T) = 0.72 \ln(X) + 0.56$	#NUM!	#NUM!	#NUM!	Equation: $T = 0.27 (X) + 23.67$	5	19	24	Fixed Data (Average Rate)	0	0	0	
						Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	0.53
						Auto Mode Split	#NUM!	#NUM!	#NUM!	Auto Mode Split	5	19	24	Auto Mode Split	0	0	0
						Transit Factor	95%			95%			95%				
						Rate: Trips / Employee	#NUM!	#NUM!	#NUM!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!	Rate: Trips / 1,000 sq. ft.	#DIV/0!	#DIV/0!	#DIV/0!

Forecast Total Office Trips #NUM! #NUM! #NUM! 5 19 24 0 0 0



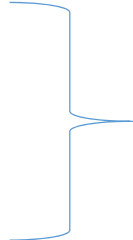
TRAVEL DEMANDS

MODE SPLITS used in Calculation

Travel Mode	Units / Employees	AM Peak Hour			PM Peak Hour		
		In	Out	2-Way	In	Out	2-Way
Traffic Zone 1							
Auto Driver Trips (Traffic)	1,296 units	80	240	315	265	170	435
Auto Passenger Trips		0	40	40	35	65	100
Transit Trips		5	40	45	35	15	50
Active Trips		10	50	60	20	15	35
Total Trips:		95	400	495	370	260	630
Traffic Zone 2							
Auto Driver Trips (Traffic)	384 units	30	90	120	100	65	165
Auto Passenger Trips		0	15	15	15	25	40
Transit Trips		0	15	15	15	5	20
Active Trips		5	20	25	5	5	10
Total Trips:		35	150	185	140	100	240
Traffic Zone 3							
n/a							
Traffic Zone 4							
Auto Driver Trips (Traffic)	2,356 units	190	570	760	670	415	1,085
Auto Passenger Trips		5	95	100	95	160	255
Transit Trips		10	95	105	95	30	125
Active Trips		20	125	145	45	30	75
Total Trips:		225	950	1175	930	640	1570
Traffic Zone 5							
Auto Driver Trips (Traffic)	934 units;	95	280	375	340	205	545
Auto Passenger Trips		0	45	45	45	80	125
Transit Trips		5	45	50	45	15	60
Active Trips		10	60	70	25	15	40
Total Trips:		110	465	575	470	315	785
Traffic Zone 5							
Auto Driver Trips (Traffic)	114 employees.	45	10	55	10	45	55
Auto Passenger Trips		0	0	0	0	0	0
Transit Trips		5	0	5	0	10	10
Active Trips		0	0	0	0	5	5
Total Trips:		55	15	70	15	70	85
Traffic Zone 6							
Auto Driver Trips (Traffic)	1,553 units	125	365	485	425	265	690
Auto Passenger Trips		5	60	65	60	105	165
Transit Trips		5	60	65	60	20	80
Active Trips		10	80	90	30	20	50
Total Trips:		145	610	755	590	410	1000
Traffic Zone 7							
Auto Driver Trips (Traffic)	219 employees	70	15	85	15	65	80
Auto Passenger Trips		0	0	0	0	0	0
Transit Trips		5	0	5	0	5	5
Active Trips		5	0	5	0	5	5
Total Trips:		80	15	95	15	70	85
Traffic Zone 8							
Auto Driver Trips (Traffic)	2,142 units	145	430	570	585	310	795
Auto Passenger Trips		5	70	75	80	120	200
Transit Trips		10	70	80	80	25	105
Active Trips		15	95	110	40	25	65
Total Trips:		170	715	885	815	475	1290
Traffic Zone 9							
Auto Driver Trips (Traffic)	1,460 units	145	440	585	525	320	845
Auto Passenger Trips		5	75	80	75	125	200
Transit Trips		10	75	85	75	25	100
Active Trips		15	95	110	35	25	60
Total Trips:		170	735	905	730	490	1220
Clair-Maltby Secondary Plan Maximum Density Scenario Travel Demands							
Auto Driver Trips (Traffic)	10,125 units;	925	2,440	3,350	2,935	1,860	4,700
Auto Passenger Trips	333 employees	20	400	420	405	680	1085
Transit Trips		55	400	455	405	150	555
Active Trips		90	525	615	200	145	345
Total Trips (less "other" trips):		1090	4065	5155	4075	2860	6935

	AM Peak Hour			PM Peak Hour		
	In	Out	2-Way	In	Out	2-Way
Residential						
Auto Driver	85%	60%		72%	65%	
Auto Pass	2%	10%		10%	25%	
Transit	5%	10%		10%	5%	
Active	8%	13%		5%	5%	
Total						
Other	0%	7%		3%	0%	
Office						
Auto Driver	90%	90%		90%	90%	
Auto Pass	2%	2%		2%	2%	
Transit	4%	4%		4%	4%	
Active	4%	4%		4%	4%	
Total						
Other						

Traffic Zone 5 Total							
Travel Mode	AM Peak Hour			PM Peak Hour			
	In	Out	2-Way	In	Out	2-Way	
Auto Driver Trips	140	290	430	350	250	600	
Auto Passenger Trips	0	45	45	45	80	125	
Transit Trips	10	45	55	45	25	70	
Active Trips	10	60	70	25	20	45	
Total Trips:	165	480	645	485	385	870	



Appendix I – Transportation Tomorrow Survey (TTS): Transit Trip Distribution Data

Fri Jan 18 2019 18:03:05 GMT-0500 (Eastern Standard Time) - Run Time: 3092ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of 8064 8067-81 8078-8081
and

Trip purpose - trip_purp In 1-3

and

Start time of trip - start_time In 600-900

and

Primary travel mo J G

and

2006 GTA zone of destination - gta06_dest In 1-9999

Trip 2016

Table:

Destination Zone	Origin Zone												Total	Destination Area	Orientation / Assignment of Transit Trip			
	8062	8069	8071	8072	8073	8074	8076	8078	8079	8080	8081	GO to Toronto			North to University and Downtown	NE via Victoria	NW via other	
51	0	0	0	0	0	0	0	26	0	0	0	26	Toronto	26				
55	0	0	0	0	0	0	0	10	0	0	0	10	Toronto	10				
63	0	0	0	0	0	0	0	0	0	0	0	18	18	Toronto	18			
65	0	0	0	0	0	0	27	0	0	0	0	27	27	Toronto	27			
66	0	0	0	0	0	0	0	0	0	0	26	26	26	Toronto	26			
67	17	0	0	0	0	0	0	0	0	0	0	17	17	Toronto	17			
8008	0	0	0	0	0	0	16	0	0	0	0	16	16	East Guelph			16	
8056	0	0	25	0	0	0	0	0	0	0	0	25	25	University		25		
8057	0	53	0	39	139	83	0	13	133	51	141	652	652	University		652		
8123	0	0	0	26	0	0	0	0	0	0	0	26	26	Old Guelph		26		
8129	0	0	0	0	0	0	0	0	0	16	0	16	16	Old Guelph		16		
8175	0	0	0	0	0	0	25	0	0	0	0	25	25	Northwest Guelph			25	
													884					
														124	719	16	25	
														14%	81%	2%	3%	

Appendix J – CMSP Future Development Transit Trip Assignment Calculations

Distribution of Clair-Maltby Secondary Plan Area

Forecast Transit Riders

Weekday Morning Peak Hour		Weekday Afternoon Peak Hour	
<i>Inbound</i>	<i>Outbound</i>	<i>Inbound</i>	<i>Outbound</i>
55	400	405	150

Distribution		Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
		<i>Inbound</i>	<i>Outbound</i>	<i>2-way</i>	<i>Inbound</i>	<i>Outbound</i>	<i>2-way</i>
Regional GO	14%	10	55	65	55	20	75
Local North	81%	45	325	370	330	120	450
Local Northwest	3%	0	10	10	10	5	15
Local Northeast	2%	0	10	10	10	5	15
Total		55	400	455	405	150	555

Appendix K – Vehicle Delay Survey Data

Project No: 5976-06
Project: Clair Maltby Secondary Plan
Study Location: Maltby Rd EB to Gordon St
Municipality: City of Guelph
Study Date: Wednesday November 22, 2017
Study Time: 7:00-9:00 & 16:00-18:00

Delay Study

	Overall Delay (sec)	Left Turn Delay (sec)	Through Delay (sec)	Right Turn Delay (sec)	Courtesy Gap (sec)			2-Stage Gap (sec)		
					Left Turn	Through	Right Turn	Left Turn	Through	Right Turn
2-HR Period 07:00-00:30										
Minimum Delay	0	0	0	0	0	0	0	0	0	0
Average Delay	21	27	30	8	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	46	54	79	15	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	78	74	105	23	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	122	122	111	44	0	0	0	0	0	0
Total Vehicles Measured	105	45	23	37	0	0	0	0	0	0
Total from Traffic Count	105	46	23	36	n/a	n/a	n/a	n/a	n/a	n/a
Sample	100%	98%	100%	103%	n/a	n/a	n/a	n/a	n/a	n/a
AM Peak Hour 7:45 - 8:45										
Minimum Delay	0	0	4	0	0	0	0	0	0	0
Average Delay	29	35	47	10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	62	62	100	19	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	101	79	108	35	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	122	122	111	44	0	0	0	0	0	0
Total Vehicles Measured	55	22	13	20	0	0	0	0	0	0
Total from Traffic Count	55	23	13	19	n/a	n/a	n/a	n/a	n/a	n/a
Sample	100%	96%	100%	105%	n/a	n/a	n/a	n/a	n/a	n/a
2-HR Period 16:00-18:00										
Minimum Delay	0	0	0	0	0	0	0	0	0	0
Average Delay	27	39	34	16	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	53	74	62	33	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	81	89	87	48	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	164	164	162	125	0	0	0	0	0	0
Total Vehicles Measured	164	62	18	84	0	0	0	0	0	0
Total from Traffic Count	162	61	18	83	n/a	n/a	n/a	n/a	n/a	n/a
Sample	101%	102%	100%	101%	n/a	n/a	n/a	n/a	n/a	n/a
PM Peak Hour 16:30 - 17:30										
Minimum Delay	0	3	6	0	0	0	0	0	0	0
Average Delay	24	32	39	16	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	43	59	57	27	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	64	77	118	41	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	164	164	162	106	0	0	0	0	0	0
Total Vehicles Measured	89	31	10	48	0	0	0	0	0	0
Total from Traffic Count	89	31	10	48	n/a	n/a	n/a	n/a	n/a	n/a
Sample	100%	100%	100%	100%	n/a	n/a	n/a	n/a	n/a	n/a

Project No: 5976-06
Project: Clair Maltby Secondary Plan
Study Location: Maltby Rd WB to Gordon St
Municipality: City of Guelph
Study Date: Wednesday November 22, 2017
Study Time: 7:00-9:00 & 16:00-18:00

Delay Study

	Overall Delay (sec)	Left Turn Delay (sec)	Through Delay (sec)	Right Turn Delay (sec)	Courtesy Gap (sec)			2-Stage Gap (sec)		
					Left Turn	Through	Right Turn	Left Turn	Through	Right Turn
2-HR Period 07:30-09:30										
Minimum Delay	0	6	0	0	0	0	0	0	0	0
Average Delay	17	29	15	10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	30	46	26	21	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	43	47	30	25	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	47	47	30	27	0	0	0	0	0	0
Total Vehicles Measured	24	6	11	7	0	0	0	0	0	0
Total from Traffic Count	24	6	11	7	n/a	n/a	n/a	n/a	n/a	n/a
Sample	100%	100%	100%	100%	n/a	n/a	n/a	n/a	n/a	n/a
AM Peak Hour 7:45 - 8:45										
Minimum Delay	0	6	7	0	0	0	0	0	0	0
Average Delay	20	29	19	10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	34	46	26	20	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	46	47	28	25	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	47	47	29	27	0	0	0	0	0	0
Total Vehicles Measured	15	6	4	5	0	0	0	0	0	0
Total from Traffic Count	15	6	4	5	n/a	n/a	n/a	n/a	n/a	n/a
Sample	100%	100%	100%	100%	n/a	n/a	n/a	n/a	n/a	n/a
2-HR Period 16:00-18:00										
Minimum Delay	0	0	2	0	0	0	0	0	0	0
Average Delay	37	32	46	4	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	70	58	92	8	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	108	68	121	11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	150	74	150	12	0	0	0	0	0	0
Total Vehicles Measured	30	10	17	3	0	0	0	0	0	0
Total from Traffic Count	27	10	14	3	n/a	n/a	n/a	n/a	n/a	n/a
Sample	111%	100%	121%	100%	n/a	n/a	n/a	n/a	n/a	n/a
PM Peak Hour 16:30 - 17:30										
Minimum Delay	0	0	5	-	0	0	0	0	0	0
Average Delay	41	27	51	-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85th Percentile	73	41	93	-	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
95th Percentile	116	63	130	-	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Maximum Delay	150	74	150	-	0	0	0	0	0	0
Total Vehicles Measured	15	6	9	0	0	0	0	0	0	0
Total from Traffic Count	12	6	6	0	n/a	n/a	n/a	n/a	n/a	n/a
Sample	125%	100%	150%	#DIV/0!	n/a	n/a	n/a	n/a	n/a	n/a

Appendix L – Existing Traffic Count Data

Turning Movement Count (3 - CLAIR RD & GORDON ST)

Start Time	E Approach CLAIR RD						S Approach GORDON ST						W Approach CLAIR RD						N Approach GORDON ST						Int. Total (15 min)	Int. Total (1 hr)
	Right E:N	Thru E:W	Left E:S	U-Turn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	U-Turn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	U-Turn W:W	Peds W:	Approach Total	Right N:W	Thru N:S	Left N:E	U-Turn N:N	Peds N:	Approach Total		
07:00:00	3	76	48	0	2	127	9	47	15	0	1	71	26	38	21	0	0	85	39	111	4	0	2	154	437	
07:15:00	4	108	56	0	2	168	13	63	28	0	0	104	30	37	23	0	0	90	53	93	11	0	3	157	519	
07:30:00	7	126	65	0	0	198	15	67	28	0	0	110	24	41	26	0	1	91	52	102	5	0	1	159	558	
07:45:00	14	161	58	0	0	233	25	76	24	0	0	125	30	58	21	0	0	109	53	112	11	0	3	176	643	
08:00:00	15	128	46	0	2	189	13	112	30	0	2	155	15	63	34	0	1	112	45	84	12	0	3	141	597	
08:15:00	7	134	41	0	0	182	25	128	18	0	0	171	23	66	23	0	0	112	51	82	15	0	5	148	613	
08:30:00	22	185	49	0	1	256	15	103	40	0	1	158	32	83	34	0	1	149	65	101	13	0	1	179	742	
08:45:00	10	133	42	0	0	185	16	135	21	0	2	172	19	81	54	0	1	154	65	94	33	0	1	192	703	
BREAK																										
16:00:00	18	86	24	0	0	128	35	128	30	0	3	193	28	147	60	0	2	235	22	119	42	0	1	183	739	
16:15:00	26	106	34	0	2	166	31	132	25	1	0	189	23	163	43	0	0	229	29	122	40	0	4	191	775	
16:30:00	20	80	26	0	6	126	45	132	36	0	1	213	23	168	60	0	0	251	37	135	46	0	6	218	808	
16:45:00	27	97	30	0	1	154	37	167	54	0	0	258	21	134	60	0	0	215	24	139	29	1	2	193	820	
17:00:00	19	115	26	0	2	160	42	149	35	0	5	226	27	174	74	0	2	275	31	129	46	0	3	206	867	
17:15:00	25	99	31	0	2	155	42	135	30	0	1	207	27	138	58	0	0	223	30	134	52	1	6	217	802	
17:30:00	15	116	26	0	3	157	44	135	30	0	3	209	20	156	63	0	4	239	21	124	38	0	7	183	788	
17:45:00	19	82	28	0	3	129	38	131	34	0	7	203	10	115	47	0	5	172	27	129	42	0	2	198	702	
Grand Total	251	1832	630	0	26	2713	445	1840	478	1	26	2764	378	1662	701	0	17	2741	644	1810	439	2	50	2895	11113	
Approach %	9.3%	67.5%	23.2%	0%	-	16.1%	66.6%	17.3%	0%	-	13.8%	60.6%	25.6%	0%	-	22.2%	62.5%	15.2%	0.1%	-	-	-	-	-	-	
Totals %	2.3%	16.5%	5.7%	0%	24.4%	4%	16.6%	4.3%	0%	24.9%	3.4%	15%	6.3%	0%	24.7%	5.8%	16.3%	4%	0%	26.1%	-	-	-	-	-	
Heavy	6	45	66	0	-	66	49	25	0	-	32	59	21	0	-	43	35	5	0	-	-	-	-	-	-	
Heavy %	2.4%	2.5%	10.5%	0%	-	14.8%	2.7%	5.2%	0%	-	8.5%	3.5%	3%	0%	-	6.7%	1.9%	1.1%	0%	-	-	-	-	-	-	
Bicycles	0	1	0	0	-	0	3	0	0	-	0	0	0	0	-	0	0	0	0	-	-	-	-	-	-	
Bicycle %	0%	0.1%	0%	0%	-	0%	0.2%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-	-	-	-	

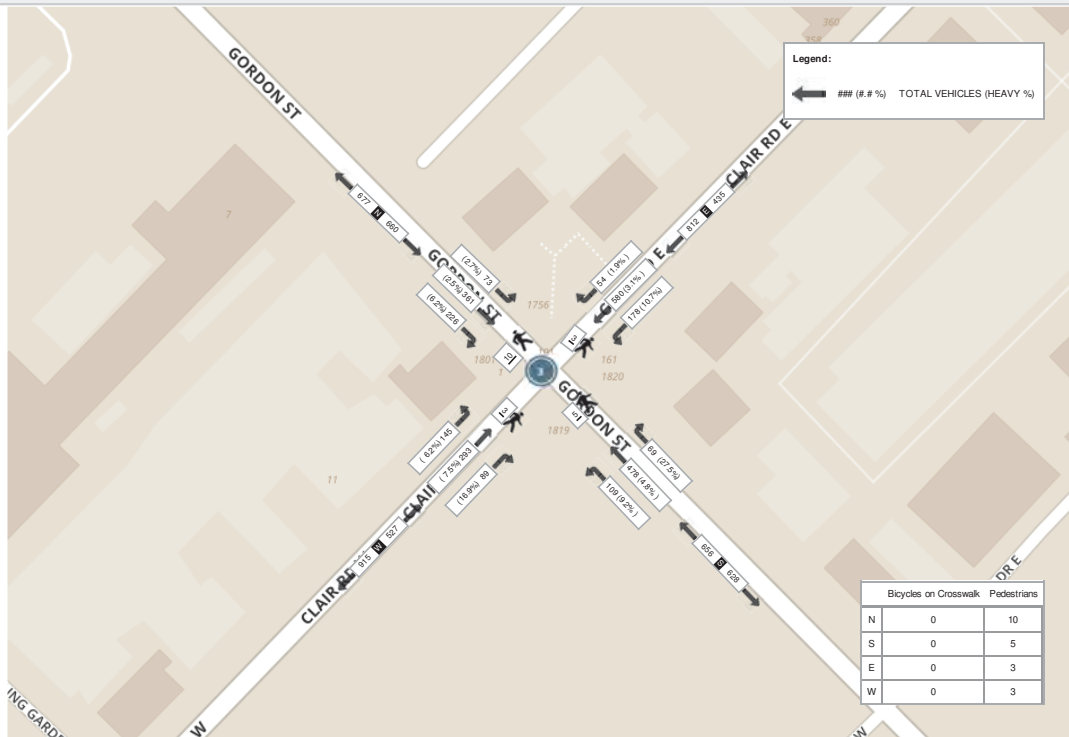
Peak Hour: 08:00 AM - 09:00 AM Weather: Mostly Cloudy (-1.9 °C)

Start Time	E Approach CLAIR RD						S Approach GORDON ST						W Approach CLAIR RD						N Approach GORDON ST						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
08:00:00	15	128	46	0	2	189	13	112	30	0	2	155	15	63	34	0	1	112	45	84	12	0	3	141	597
08:15:00	7	134	41	0	0	182	25	128	18	0	0	171	23	66	23	0	0	112	51	82	15	0	5	148	613
08:30:00	22	185	49	0	1	256	15	103	40	0	1	158	32	83	34	0	1	149	65	101	13	0	1	179	742
08:45:00	10	133	42	0	0	185	16	135	21	0	2	172	19	81	54	0	1	154	65	94	33	0	1	192	703
Grand Total	54	580	178	0	3	812	69	478	109	0	5	656	89	293	145	0	3	527	226	361	73	0	10	660	2655
Approach %	6.7%	71.4%	21.9%	0%	-	10.5%	72.9%	16.6%	0%	-	16.9%	55.6%	27.5%	0%	-	34.2%	54.7%	11.1%	0%	-	-	-	-	-	-
Totals %	2%	21.8%	6.7%	0%	30.6%	2.6%	18%	4.1%	0%	24.7%	3.4%	11%	5.5%	0%	19.8%	8.5%	13.6%	2.7%	0%	24.9%	-	-	-	-	-
PHF	0.61	0.78	0.91	0	0.79	0.69	0.89	0.68	0	0.95	0.7	0.88	0.67	0	0.86	0.87	0.89	0.55	0	0.86	-	-	-	-	-
Heavy	1	18	19	0	38	19	23	10	0	52	15	22	9	0	46	14	9	2	0	25	-	-	-	-	-
Heavy %	1.9%	3.1%	10.7%	0%	4.7%	27.5%	4.8%	9.2%	0%	7.9%	16.9%	7.5%	6.2%	0%	8.7%	6.2%	2.5%	2.7%	0%	3.8%	-	-	-	-	-
Lights	53	562	159	0	774	50	455	99	0	604	74	271	136	0	481	212	352	71	0	635	-	-	-	-	-
Lights %	98.1%	96.9%	89.3%	0%	95.3%	72.5%	95.2%	90.8%	0%	92.1%	83.1%	92.5%	93.8%	0%	91.3%	93.8%	97.5%	97.3%	0%	96.2%	-	-	-	-	-
Single-Unit Trucks	0	0	14	0	14	10	10	0	0	20	9	10	0	0	19	0	0	2	0	2	-	-	-	-	-
Single-Unit Trucks %	0%	0%	7.9%	0%	1.7%	14.5%	2.1%	0%	0%	3%	10.1%	3.4%	0%	0%	3.6%	0%	0%	2.7%	0%	0.3%	-	-	-	-	-
Buses	1	17	1	0	19	2	11	6	0	19	0	7	6	0	13	11	9	0	0	20	-	-	-	-	-
Buses %	1.9%	2.9%	0.6%	0%	2.3%	2.9%	2.3%	5.5%	0%	2.9%	0%	2.4%	4.1%	0%	2.9%	4.9%	2.5%	0%	0%	3%	-	-	-	-	-
Articulated Trucks	0	1	4	0	5	7	2	4	0	13	6	5	3	0	14	3	0	0	0	3	-	-	-	-	-
Articulated Trucks %	0%	0.2%	2.2%	0%	0.6%	10.1%	0.4%	3.7%	0%	2%	6.7%	1.7%	2.1%	0%	2.7%	1.3%	0%	0%	0%	0.5%	-	-	-	-	-
Pedestrians	-	-	-	-	3	-	-	-	-	5	-	-	-	-	3	-	-	-	-	10	-	-	-	-	-
Pedestrians %	-	-	-	-	14.3%	-	-	-	-	23.8%	-	-	-	-	14.3%	-	-	-	-	47.6%	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-
Bicycles on Crosswalk %	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	-
Bicycles on Road	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
Bicycles on Road %	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	-

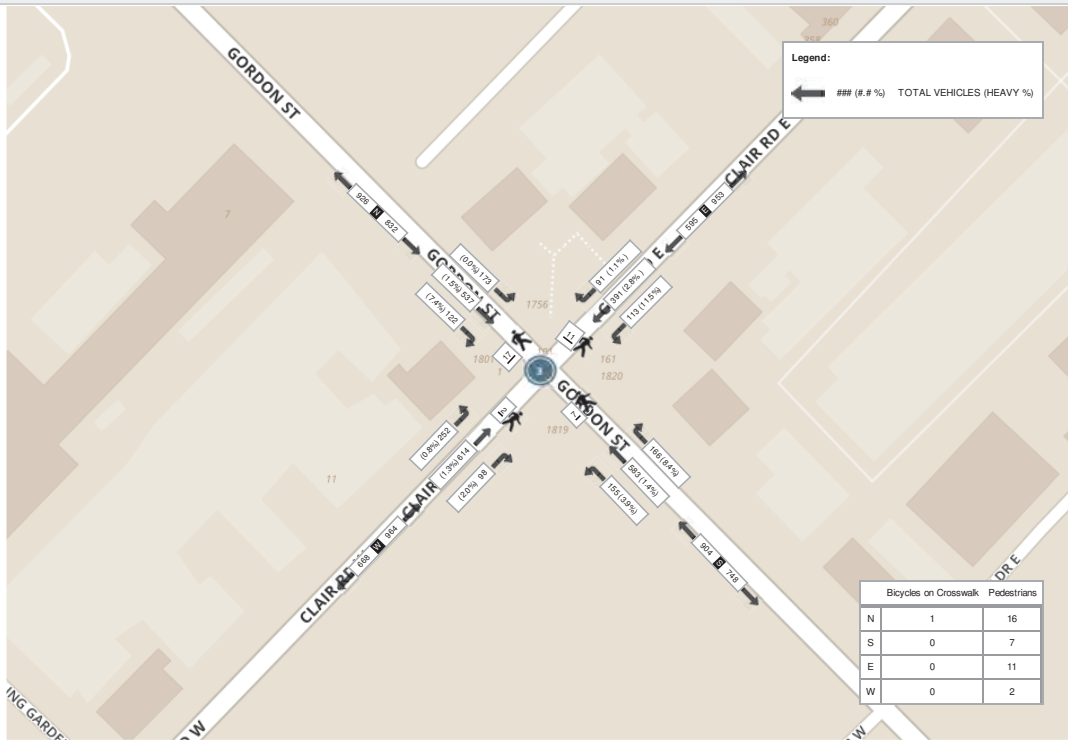
Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)

Start Time	E Approach CLAIR RD						S Approach GORDON ST						W Approach CLAIR RD						N Approach GORDON ST						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
16:30:00	20	80	26	0	6	126	45	132	36	0	1	213	23	168	60	0	0	251	37	135	46	0	6	218	808
16:45:00	27	97	30	0	1	154	37	167	54	0	0	258	21	134	60	0	0	215	24	139	29	1	2	193	820
17:00:00	19	115	26	0	2	160	42	149	35	0	5	226	27	174	74	0	2	275	31	129	46	0	3	206	867
17:15:00	25	99	31	0	2	155	42	135	30	0	1	207	27	138	58	0	0	223	30	134	52	1	6	217	802
Grand Total	91	391	113	0	11	595	166	583	155	0	7	904	98	614	252	0	2	964	122	537	173	2	17	834	3297
Approach%	15.3%	65.7%	19%	0%	-	-	18.4%	64.5%	17.1%	0%	-	-	10.2%	63.7%	26.1%	0%	-	-	14.6%	64.4%	20.7%	0.2%	-	-	-
Totals	2.8%	11.9%	3.4%	0%	18%	5%	17.7%	4.7%	0%	27.4%	3%	18.6%	7.6%	0%	29.2%	3.7%	16.3%	5.2%	0.1%	25.3%	-	-	-		
PHF	0.84	0.85	0.91	0	0.93	0.92	0.87	0.72	0	0.88	0.91	0.88	0.85	0	0.88	0.82	0.97	0.83	0.5	0.96	-	-	-		
Heavy	1	11	13	0	25	14	8	6	0	28	2	8	2	0	12	9	8	0	0	17	-	-	-		
Heavy %	1.1%	2.8%	11.5%	0%	4.2%	8.4%	1.4%	3.9%	0%	3.1%	2%	1.3%	0.8%	0%	1.2%	7.4%	1.5%	0%	0%	2%	-	-	-		
Lights	90	380	100	0	570	152	575	149	0	876	96	606	250	0	952	113	529	173	2	817	-	-	-		
Lights %	98.9%	97.2%	88.5%	0%	95.8%	91.6%	98.6%	96.1%	0%	96.9%	98%	98.7%	99.2%	0%	98.8%	92.6%	98.5%	100%	100%	98%	-	-	-		
Single-Unit Trucks	1	9	8	0	18	5	3	3	0	11	2	7	1	0	10	1	4	0	0	5	-	-	-		
Single-Unit Trucks %	1.1%	2.3%	7.1%	0%	3%	3%	0.5%	1.9%	0%	1.2%	2%	1.1%	0.4%	0%	1%	0.8%	0.7%	0%	0%	0.6%	-	-	-		
Buses	0	0	1	0	1	1	4	1	0	6	0	1	0	0	1	8	4	0	0	12	-	-	-		
Buses %	0%	0%	0.9%	0%	0.2%	0.6%	0.7%	0.6%	0%	0.7%	0%	0.2%	0%	0%	0.1%	6.6%	0.7%	0%	0%	1.4%	-	-	-		
Articulated Trucks	0	2	4	0	6	8	1	2	0	11	0	0	1	0	1	0	0	0	0	0	-	-	-		
Articulated Trucks %	0%	0.5%	3.5%	0%	1%	4.8%	0.2%	1.3%	0%	1.2%	0%	0%	0.4%	0%	0.1%	0%	0%	0%	0%	0%	-	-	-		
Pedestrians	-	-	-	-	11	-	-	-	-	7	-	-	-	2	-	-	-	-	16	-	-	-	-	-	
Pedestrians %	-	-	-	-	29.7%	-	-	-	-	18.9%	-	-	-	5.4%	-	-	-	-	43.2%	-	-	-	-	-	
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	0	-	-	-	0	-	-	-	-	1	-	-	-	-	-	
Bicycles on Crosswalk %	-	-	-	-	0%	-	-	-	-	0%	-	-	-	0%	-	-	-	-	2.7%	-	-	-	-	-	
Bicycles on Road	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	
Bicycles on Road %	-	-	-	-	0%	-	-	-	-	0%	-	-	-	0%	-	-	-	-	0%	-	-	-	-	-	

Peak Hour: 08:00 AM - 09:00 AM Weather: Mostly Cloudy (-1.9 °C)



Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)



Turning Movement Count (2. LAIRD RD & HANLON PKWY NB OFF RAMP)

Start Time	W Approach			SW Approach			S Approach			N Approach			E Approach			SE Approach			S Approach			SW Approach			W Approach			No. Observed (15 min)	No. Observed (1 hr)
	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left					
070000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127	306
071500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	124	304
073000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	153	447
074500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	472
080000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	378
081500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	180	402
083000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144	416
084500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	173	422
090000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	402
091500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	142	363
093000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	159	507
094500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148	448
170000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141	367
171500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	421
173000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166	426
174500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121	335
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2321	6867
Approach%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	33.7%	-
Heavy%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4	98
Heavy%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5.7%	4.4%
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycle %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

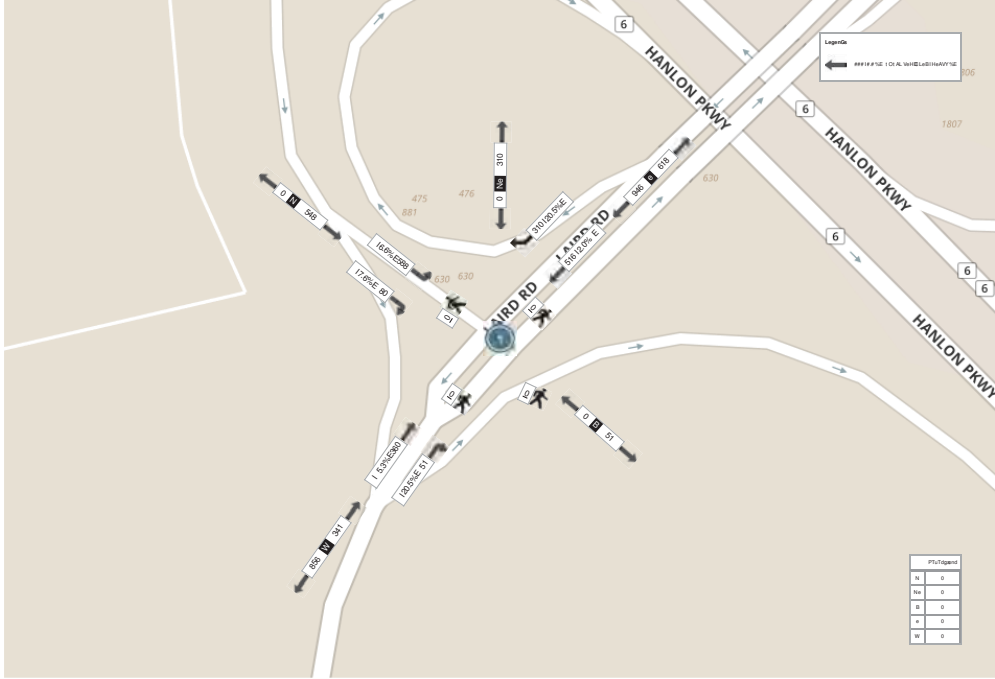
Peak Hour: 07:30 AM - 08:30 AM Weather: Mostly Cloudy (-1.9 °C)



Peak Hour: 04:15 PM - 05:15 PM Weather: Partly Cloudy (-3 °C)



Pea- Hours yd21 PM 8y121 PM Weathers Part%Cloud: 8 9CS



1.Sinar F pvTmTrgCp9g

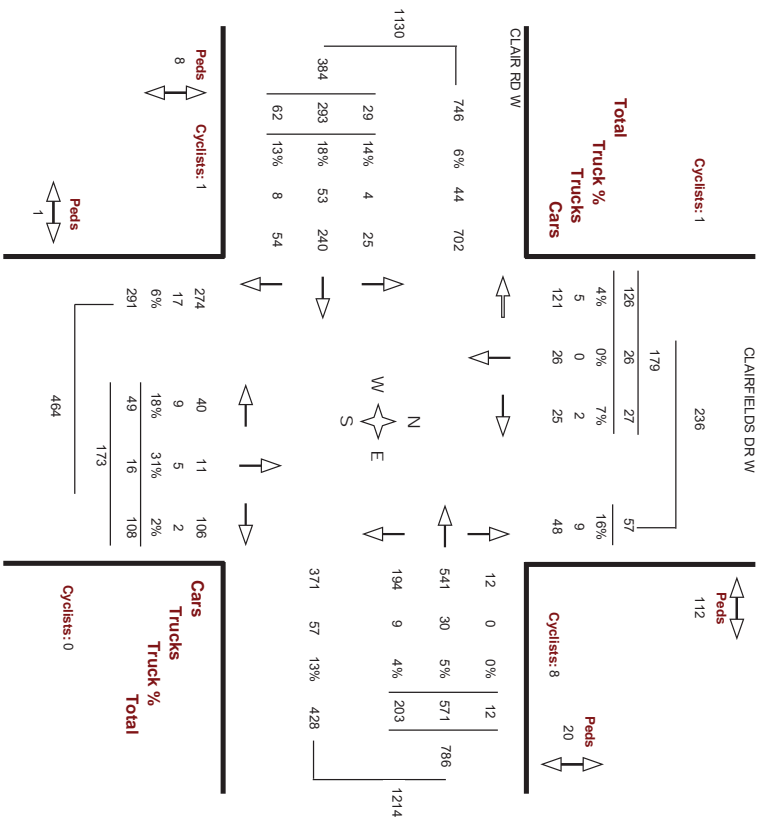
Por T6 pf 6

RAG279P



Turning Movements Report - AM Period

Location:..... CLAIR RD W @ CLAIRFIELDS DR W
 Municipality: GUELPH
 Traffic Cont.
 Major Dir..... None
 GeoID:..... 1730
 Count Date: Thursday, 17 September 2015
 Count Time: 07:00 AM — 09:00 AM
 Peak Hour: 08:00 AM — 09:00 AM



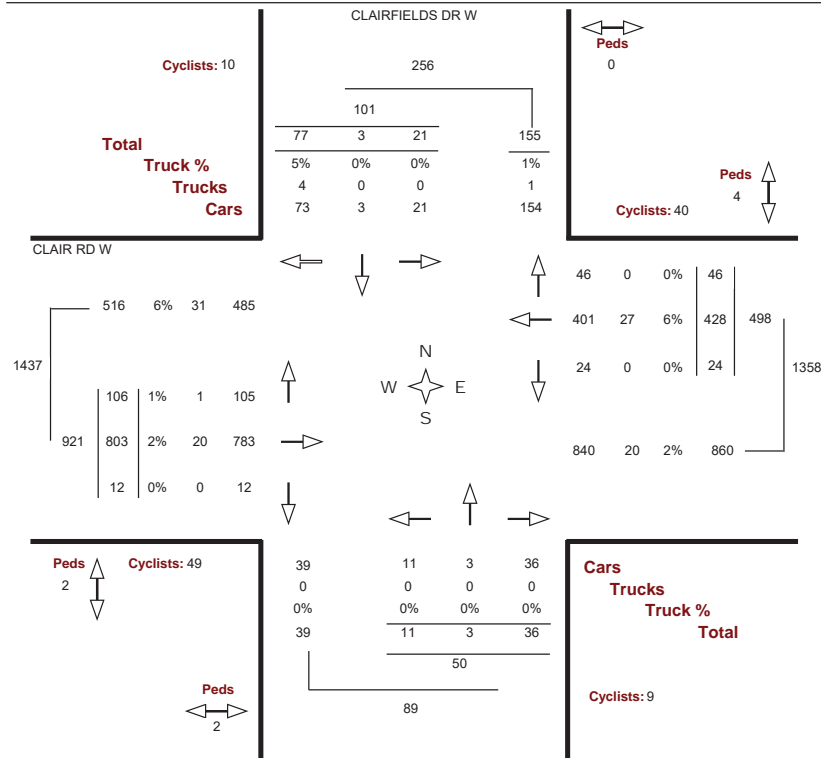
November 5, 2015

Page 1 of 4



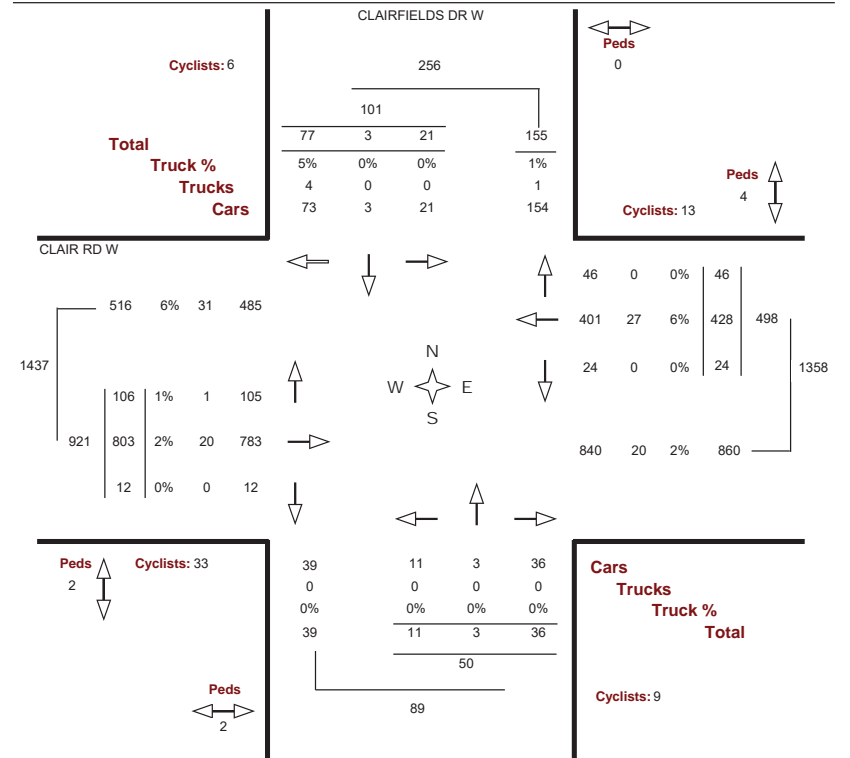
Turning Movements Report - Full Study

Location..... CLAIR RD W @ CLAIRFIELDS DR W **GeoID.....** I730
Municipality. GUELPH **Count Date.** Thursday, 17 September, 2015
Traffic Cont. **Count Time.** 07:00 AM — 06:00 PM
Major Dir..... None **Peak Hour..** 04:30 PM — 05:30 PM



Turning Movements Report - PM Period

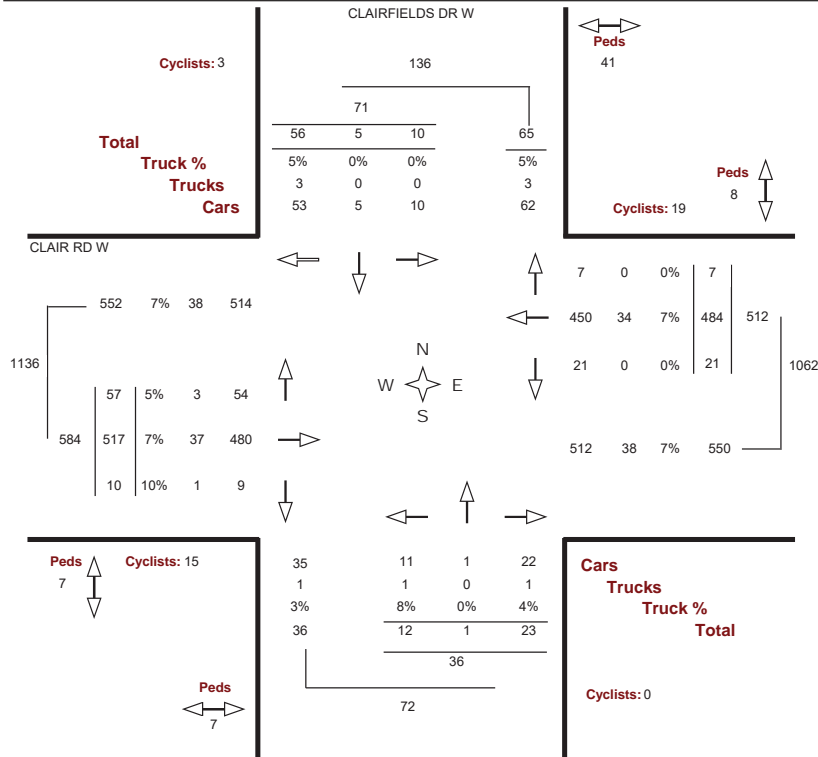
Location..... CLAIR RD W @ CLAIRFIELDS DR W **GeoID.....** I730
Municipality. GUELPH **Count Date.** Thursday, 17 September, 2015
Traffic Cont. **Count Time.** 03:00 PM — 06:00 PM
Major Dir..... None **Peak Hour..** 04:30 PM — 05:30 PM





Turning Movements Report - MD Period

Location..... CLAIR RD W @ CLAIRFIELDS DR W **GeoID.....** I730
Municipality. GUELPH **Count Date.** Thursday, 17 September, 2015
Traffic Cont. **Count Time.** 11:00 AM — 02:00 PM
Major Dir..... None **Peak Hour..** 12:00 PM — 01:00 PM



Poppy Dr & Gordon St

Morning Peak Diagram	Specified Period From: 6:30:00 To: 9:30:00	One Hour Peak From: 7:45:00 To: 8:45:00																												
Municipality: Guelph Site #: 0000006804 Intersection: Gordon St & Poppy Dr TFR File #: 1 Count date: 13-Sep-2016	Weather conditions: Clear Person(s) who counted: Lena																													
** Non-Signalized Intersection **		Major Road: Gordon St runs N/S																												
North Leg Total: 1300 North Entering: 636 North Peds: 2 Peds Cross: ⇄	<table border="1"> <tr><td>Cyclists</td><td>0</td><td>17</td><td>0</td><td>17</td></tr> <tr><td>Trucks</td><td>0</td><td>18</td><td>1</td><td>19</td></tr> <tr><td>Cars</td><td>0</td><td>592</td><td>8</td><td>600</td></tr> <tr><td>Totals</td><td>0</td><td>627</td><td>9</td><td></td></tr> </table>	Cyclists	0	17	0	17	Trucks	0	18	1	19	Cars	0	592	8	600	Totals	0	627	9		<table border="1"> <tr><td>Cyclists</td><td>25</td></tr> <tr><td>Trucks</td><td>22</td></tr> <tr><td>Cars</td><td>617</td></tr> <tr><td>Totals</td><td>664</td></tr> </table>	Cyclists	25	Trucks	22	Cars	617	Totals	664
Cyclists	0	17	0	17																										
Trucks	0	18	1	19																										
Cars	0	592	8	600																										
Totals	0	627	9																											
Cyclists	25																													
Trucks	22																													
Cars	617																													
Totals	664																													
East Leg Total: 68 East Entering: 33 East Peds: 3 Peds Cross: X	<table border="1"> <tr><td>Cars</td><td>Trucks</td><td>Cyclists</td><td>Totals</td></tr> <tr><td>21</td><td>0</td><td>0</td><td>21</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>11</td><td>0</td><td>0</td><td>11</td></tr> <tr><td>33</td><td>0</td><td>0</td><td></td></tr> </table>		Cars	Trucks	Cyclists	Totals	21	0	0	21	1	0	0	1	11	0	0	11	33	0	0									
Cars	Trucks	Cyclists	Totals																											
21	0	0	21																											
1	0	0	1																											
11	0	0	11																											
33	0	0																												
West Leg Total: 13 West Peds: 5 West Entering: 7 West Leg Total: 13	<table border="1"> <tr><td>Cars</td><td>605</td></tr> <tr><td>Trucks</td><td>18</td></tr> <tr><td>Cyclists</td><td>17</td></tr> <tr><td>Totals</td><td>640</td></tr> </table>	Cars	605	Trucks	18	Cyclists	17	Totals	640	<table border="1"> <tr><td>Cars</td><td>5</td><td>593</td><td>20</td><td>618</td></tr> <tr><td>Trucks</td><td>0</td><td>22</td><td>2</td><td>24</td></tr> <tr><td>Cyclists</td><td>0</td><td>24</td><td>3</td><td>27</td></tr> <tr><td>Totals</td><td>5</td><td>639</td><td>25</td><td></td></tr> </table>	Cars	5	593	20	618	Trucks	0	22	2	24	Cyclists	0	24	3	27	Totals	5	639	25	
Cars	605																													
Trucks	18																													
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Totals	640																													
Cars	5	593	20	618																										
Trucks	0	22	2	24																										
Cyclists	0	24	3	27																										
Totals	5	639	25																											
Peds Cross: X	<table border="1"> <tr><td>Cars</td><td>Trucks</td><td>Cyclists</td><td>Totals</td></tr> <tr><td>28</td><td>3</td><td>4</td><td>35</td></tr> </table>		Cars	Trucks	Cyclists	Totals	28	3	4	35																				
Cars	Trucks	Cyclists	Totals																											
28	3	4	35																											
	<table border="1"> <tr><td>Peds Cross:</td><td>⇄</td></tr> <tr><td>South Peds:</td><td>1</td></tr> <tr><td>South Entering:</td><td>669</td></tr> <tr><td>South Leg Total:</td><td>1309</td></tr> </table>		Peds Cross:	⇄	South Peds:	1	South Entering:	669	South Leg Total:	1309																				
Peds Cross:	⇄																													
South Peds:	1																													
South Entering:	669																													
South Leg Total:	1309																													
Comments																														

Poppy Dr & Gordon St

Mid-day Peak Diagram	Specified Period From: 11:30:00 To: 13:30:00	One Hour Peak From: 12:15:00 To: 13:15:00																																																																							
Municipality: Guelph Site #: 0000006804 Intersection: Gordon St & Poppy Dr TFR File #: 1 Count date: 13-Sep-2016	Weather conditions: Clear Person(s) who counted: Lena																																																																								
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Poppy Dr & Gordon St

Afternoon Peak Diagram	Specified Period From: 15:00:00 To: 18:00:00	One Hour Peak From: 16:30:00 To: 17:30:00																																																																							
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Poppy Dr & Gordon St

Total Count Diagram

Municipality: Guelph		Weather conditions: Clear	
Site #: 0000006804		Person(s) who counted: Lena	
Intersection: Gordon St & Poppy Dr			
TFR File #: 1			
Count date: 13-Sep-2016			
** Non-Signalized Intersection **		Major Road: Gordon St runs N/S	
North Leg Total: 9726	Cyclists 1 133 0 134	Cyclists 146	East Leg Total: 1025
North Entering: 4917	Trucks 1 110 5 116	Trucks 118	East Entering: 534
North Peds: 15	Cars 19 4445 203 4667	Cars 4545	East Peds: 12
Peds Cross: 1	Totals 21 4688 208	Totals 4809	Peds Cross: 1

Cyclists Trucks Cars Totals	←	↓	↑	→	Cars Trucks Cyclists Totals
2 1 54 57					269 15 2 286
	←			→	17 0 0 17
					222 4 5 231
					508 19 7
Cyclists Trucks Cars Totals	↑	↓	←	→	Cars Trucks Cyclists Totals
2 2 10 14					473 10 8 491
2 0 12 14					
1 1 17 19					
5 3 39					

Peds Cross: 1	Cars 4684	Cars 18 4266 258 4542	Peds Cross: 1
West Peds: 23	Trucks 115	Trucks 0 101 5 106	South Peds: 3
West Entering: 47	Cyclists 139	Cyclists 1 142 6 149	South Entering: 4797
West Leg Total: 104	Totals 4938	Totals 19 4509 269	South Leg Total: 9735

Comments

Poppy Dr & Gordon St Traffic Count Summary

Intersection: Gordon St & Poppy Dr						Count Date: 13-Sep-2016		Municipality: Guelph					
North Approach Totals						North/South Total Approaches	South Approach Totals						
Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds		Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds	
	Left	Thru	Right	Grand Total			Left	Thru	Right	Grand Total			
7:00:00	6	276	0	282	1	433	7:00:00	1	137	13	151	1	
8:00:00	5	671	4	680	0	1127	8:00:00	6	430	11	447	0	
9:00:00	12	607	1	620	3	1259	9:00:00	3	610	26	639	1	
12:00:00	20	487	3	510	1	981	12:00:00	2	444	25	471	0	
13:00:00	42	460	6	508	7	1022	13:00:00	0	472	42	514	0	
15:00:00	14	237	1	252	0	521	15:00:00	1	248	20	269	0	
16:00:00	35	573	2	610	1	1292	16:00:00	1	640	41	682	0	
17:00:00	30	675	3	708	0	1505	17:00:00	2	760	35	797	1	
18:00:00	44	702	1	747	2	1574	18:00:00	3	768	56	827	0	
Totals:	208	4688	21	4917	15	9714		19	4509	269	4797	3	
East Approach Totals						East/West Total Approaches	West Approach Totals						
Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds		Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds	
	Left	Thru	Right	Grand Total			Left	Thru	Right	Grand Total			
7:00:00	7	0	6	13	0	14	7:00:00	0	0	1	1	1	
8:00:00	10	0	17	27	2	33	8:00:00	3	0	3	6	6	
9:00:00	15	1	24	40	4	44	9:00:00	2	1	1	4	2	
12:00:00	26	2	26	54	1	59	12:00:00	1	2	2	5	2	
13:00:00	34	4	61	99	1	109	13:00:00	0	3	7	10	0	
15:00:00	22	1	29	52	0	52	15:00:00	0	0	0	0	0	
16:00:00	31	3	33	67	1	73	16:00:00	1	4	1	6	4	
17:00:00	51	3	41	95	3	105	17:00:00	5	2	3	10	2	
18:00:00	35	3	49	87	0	92	18:00:00	2	2	1	5	6	
Totals:	231	17	286	534	12	581		14	14	19	47	23	
Calculated Values for Traffic Crossing Major Street													
Hours Ending:	8:00	9:00	12:00	13:00		15:00	16:00	17:00	18:00				
Crossing Values:	13	22	30	45		23	37	60	42				

Turning Movement Count (1 - CLAIR RD & FARLEY DR)

Start Time	N Approach FARLEY DR						E Approach CLAIR RD						S Approach FARLEY DR						W Approach CLAIR RD						Int. Total (15 min)	Int. Total (1 hr)	
	Right N-W	Thru N-S	Left N-E	U-Turn N-N	Peds N:	Approach Total	Right E-N	Thru E-W	Left E-S	U-Turn E-E	Peds E:	Approach Total	Right S-E	Thru S-N	Left S-W	U-Turn S-S	Peds S:	Approach Total	Right W-S	Thru W-E	Left W-N	U-Turn W-W	Peds W:	Approach Total			
07:00:00	29	0	5	0	0	34	7	86	1	0	0	94	0	4	2	0	0	6	5	32	6	0	0	43	177		
07:15:00	38	3	6	0	0	47	5	103	2	0	0	110	2	2	4	0	0	8	10	35	6	0	0	51	216		
07:30:00	44	2	9	0	0	55	27	126	0	0	0	153	3	2	5	0	1	10	1	46	13	0	2	60	278		
07:45:00	47	1	7	0	1	55	22	153	4	0	0	179	2	2	4	0	0	8	9	37	22	0	0	68	310	981	
08:00:00	27	1	9	0	0	37	10	127	3	0	0	140	0	3	6	0	1	9	8	72	16	0	0	96	282	1086	
08:15:00	30	5	6	0	1	41	14	131	6	0	0	151	1	3	5	0	1	9	9	69	24	0	1	102	303	1173	
08:30:00	43	3	3	0	1	49	20	195	9	0	0	224	3	3	7	0	0	13	9	75	25	0	0	109	395	1290	
08:45:00	45	11	7	0	1	63	17	140	9	0	1	166	2	4	12	0	0	18	20	75	36	0	1	131	378	1358	
BREAK																											
16:00:00	40	12	10	0	1	62	11	54	7	0	1	72	9	14	28	0	0	51	40	144	52	0	1	236	421		
16:15:00	32	17	10	0	1	59	17	79	4	0	0	100	14	18	28	0	1	60	43	110	55	0	1	208	427		
16:30:00	27	20	16	0	2	63	12	74	6	0	5	92	7	15	25	0	2	47	63	136	54	0	6	253	455		
16:45:00	38	21	5	0	1	64	14	85	15	0	3	114	12	27	23	0	3	62	58	119	50	0	4	227	467	1770	
17:00:00	42	20	18	0	1	80	27	78	10	0	2	115	7	28	22	0	0	57	44	129	51	0	5	224	476	1825	
17:15:00	27	20	13	0	0	60	12	71	12	0	4	95	8	27	35	0	1	70	57	148	57	0	2	262	487	1885	
17:30:00	44	12	20	0	4	76	22	71	11	0	6	104	10	24	31	0	4	65	61	131	74	0	5	266	511	1941	
17:45:00	27	18	13	0	3	58	10	65	11	0	7	86	10	22	29	0	3	61	67	107	51	0	1	225	430	1904	
Grand Total	580	166	157	0	17	903	247	1638	110	0	29	1995	90	198	266	0	17	554	504	1465	592	0	29	2561	6013	-	
Approach%	64.2%	18.4%	17.4%	0%	-	-	12.4%	82.1%	5.5%	0%	-	-	16.2%	35.7%	48%	0%	-	-	19.7%	57.2%	23.1%	0%	-	-	-	-	-
Totals%	9.6%	2.8%	2.6%	0%	-	15%	4.1%	27.2%	1.8%	0%	-	33.2%	1.5%	3.3%	4.4%	0%	-	9.2%	8.4%	24.4%	9.8%	0%	-	42.6%	-	-	
Heavy	3	0	2	0	-	-	2	93	0	0	-	-	2	2	5	0	-	-	8	87	11	0	-	-	-	-	-
Heavy %	0.5%	0%	1.3%	0%	-	-	0.8%	5.7%	0%	0%	-	-	2.2%	1%	1.9%	0%	-	-	1.6%	5.9%	1.9%	0%	-	-	-	-	-
Bicycles	0	0	0	0	-	-	0	0	0	0	-	-	0	1	0	0	-	-	0	1	0	0	-	-	-	-	-
Bicycle %	0%	0%	0%	0%	-	-	0%	0%	0%	0%	-	-	0%	0.5%	0%	0%	-	-	0%	0.1%	0%	0%	-	-	-	-	-

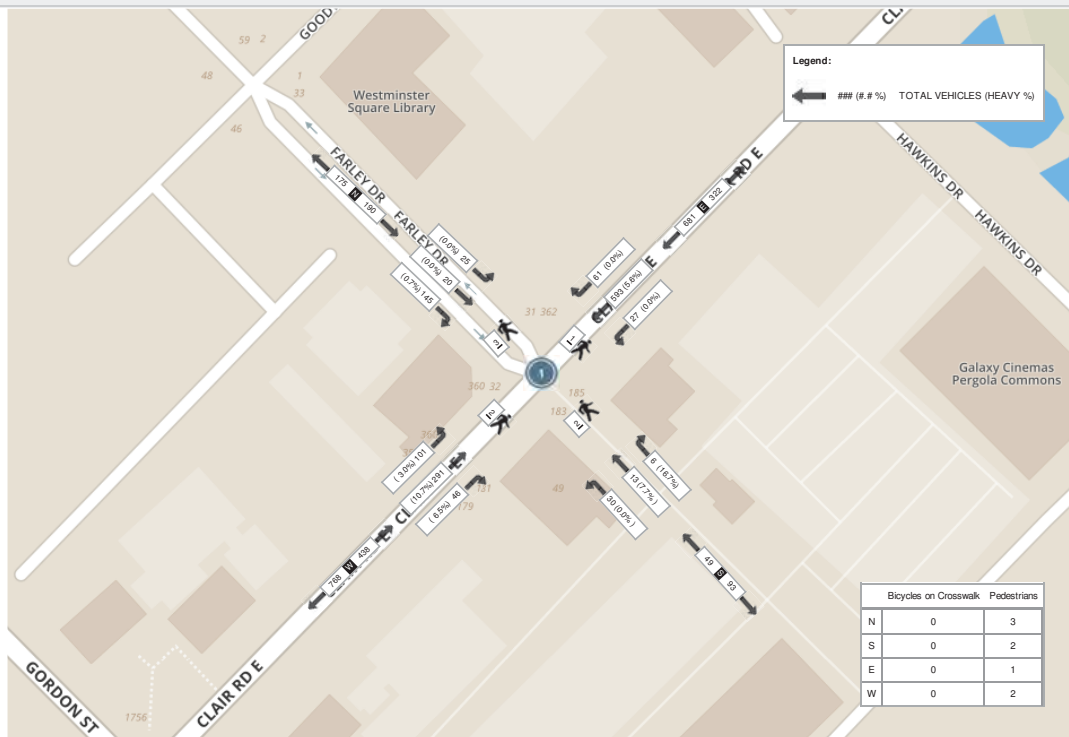
Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast (2.1 °C)

Start Time	N Approach FARLEY DR						E Approach CLAIR RD						S Approach FARLEY DR						W Approach CLAIR RD						Int. Total (15 min)		
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total			
08:00:00	27	1	9	0	0	37	10	127	3	0	0	140	0	3	6	0	1	9	8	72	16	0	0	96	282		
08:15:00	30	5	6	0	1	41	14	131	6	0	0	151	1	3	5	0	1	9	9	69	24	0	1	102	303		
08:30:00	43	3	3	0	1	49	20	195	9	0	0	224	3	3	7	0	0	13	9	75	25	0	0	109	395		
08:45:00	45	11	7	0	1	63	17	140	9	0	1	166	2	4	12	0	0	18	20	75	36	0	1	131	378		
Grand Total	145	20	25	0	3	190	61	593	27	0	1	681	6	13	30	0	2	49	46	291	101	0	2	438	1358		
Approach%	76.3%	10.5%	13.2%	0%	-	-	9%	87.1%	4%	0%	-	-	12.2%	26.5%	61.2%	0%	-	-	10.5%	66.4%	23.1%	0%	-	-	-	-	
Totals%	10.7%	1.5%	1.8%	0%	-	14%	4.5%	43.7%	2%	0%	-	50.1%	0.4%	1%	2.2%	0%	-	3.6%	3.4%	21.4%	7.4%	0%	-	32.3%	-	-	
PHF	0.81	0.45	0.69	0	-	0.75	0.76	0.76	0.75	0	-	0.76	0.5	0.81	0.63	0	-	0.68	0.58	0.97	0.7	0	-	0.84	-	-	
Heavy	1	0	0	0	-	1	0	33	0	0	-	33	1	1	0	0	-	2	3	31	3	0	-	37	-	-	
Heavy %	0.7%	0%	0%	0%	-	0.5%	0%	5.6%	0%	0%	-	4.8%	16.7%	7.7%	0%	0%	-	4.1%	6.5%	10.7%	3%	0%	-	8.4%	-	-	
Lights	144	20	25	0	-	189	61	560	27	0	-	648	5	12	30	0	-	47	43	260	98	0	-	401	-	-	
Lights %	99.3%	100%	100%	0%	-	99.5%	100%	94.4%	100%	0%	-	95.2%	83.3%	92.3%	100%	0%	-	95.9%	93.5%	89.3%	97%	0%	-	91.6%	-	-	
Single-Unit Trucks	1	0	0	0	-	1	0	8	0	0	-	8	1	1	0	0	-	2	3	14	1	0	-	18	-	-	
Single-Unit Trucks %	0.7%	0%	0%	0%	-	0.5%	0%	1.3%	0%	0%	-	1.2%	16.7%	7.7%	0%	0%	-	4.1%	6.5%	4.8%	1%	0%	-	4.1%	-	-	
Buses	0	0	0	0	-	0	0	7	0	0	-	7	0	0	0	0	-	0	0	8	2	0	-	10	-	-	
Buses %	0%	0%	0%	0%	-	0%	0%	1.2%	0%	0%	-	1%	0%	0%	0%	0%	-	0%	0%	2.7%	2%	0%	-	2.3%	-	-	
Articulated Trucks	0	0	0	0	-	0	0	18	0	0	-	18	0	0	0	0	-	0	0	9	0	0	-	9	-	-	
Articulated Trucks %	0%	0%	0%	0%	-	0%	0%	3%	0%	0%	-	2.6%	0%	0%	0%	0%	-	0%	0%	3.1%	0%	0%	-	2.1%	-	-	
Pedestrians	-	-	-	-	3	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-
Pedestrians%	-	-	-	-	37.5%	-	-	-	-	-	12.5%	-	-	-	-	-	25%	-	-	-	-	-	25%	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-
Bicycles on Crosswalk%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	-	-	-
Bicycles on Road%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-

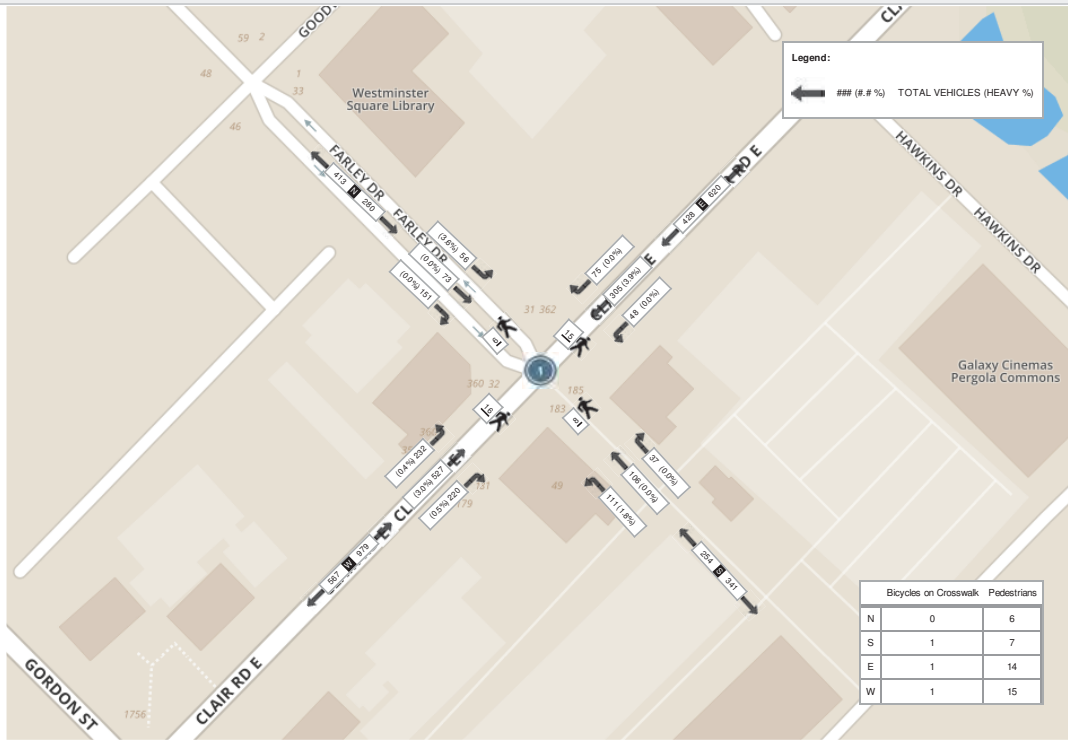
Peak Hour: 04:45 PM - 05:45 PM Weather: Mostly Cloudy (2.8 °C)

Start Time	N Approach FARLEY DR						E Approach CLAIR RD						S Approach FARLEY DR						W Approach CLAIR RD						Int. Total (15 min)	
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total		
16:45:00	38	21	5	0	1	64	14	85	15	0	3	114	12	27	23	0	3	62	58	119	50	0	4	227	467	
17:00:00	42	20	18	0	1	80	27	78	10	0	2	115	7	28	22	0	0	57	44	129	51	0	5	224	476	
17:15:00	27	20	13	0	0	60	12	71	12	0	4	95	8	27	35	0	1	70	57	148	57	0	2	262	487	
17:30:00	44	12	20	0	4	76	22	71	11	0	6	104	10	24	31	0	4	65	61	131	74	0	5	266	511	
Grand Total	151	73	56	0	6	280	75	305	48	0	15	428	37	106	111	0	8	254	220	527	232	0	16	979	1941	
Approach%	53.9%	26.1%	20%	0%	-	-	17.5%	71.3%	11.2%	0%	-	-	14.6%	41.7%	43.7%	0%	-	-	22.5%	53.8%	23.7%	0%	-	-	-	-
Totals	7.8%	3.8%	2.9%	0%	14.4%	3.9%	15.7%	2.5%	0%	22.1%	1.9%	5.5%	5.7%	0%	13.1%	11.3%	27.2%	12%	0%	50.4%	-	-	-	-		
PHF	0.86	0.87	0.7	0	0.88	0.69	0.9	0.8	0	0.93	0.77	0.95	0.79	0	0.91	0.9	0.89	0.78	0	0.92	-	-	-	-		
Heavy	0	0	2	0	2	0	12	0	0	12	0	0	2	0	2	1	16	1	0	18	-	-	-	-		
Heavy %	0%	0%	3.6%	0%	0.7%	0%	3.9%	0%	0%	2.8%	0%	0%	1.8%	0%	0.8%	0.5%	3%	0.4%	0%	1.8%	-	-	-	-		
Lights	151	73	54	0	278	75	293	48	0	416	37	106	109	0	252	219	511	231	0	961	-	-	-	-		
Lights %	100%	100%	96.4%	0%	99.3%	100%	96.1%	100%	0%	97.2%	100%	98.2%	0%	99.2%	99.5%	97%	99.6%	0%	98.2%	-	-	-	-	-		
Single-Unit Trucks	0	0	2	0	2	0	6	0	0	6	0	0	2	0	2	1	2	1	0	4	-	-	-	-		
Single-Unit Trucks %	0%	0%	3.6%	0%	0.7%	0%	2%	0%	0%	1.4%	0%	1.8%	0%	0.8%	0.5%	0.4%	0.4%	0%	0.4%	-	-	-	-	-		
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Buses %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Articulated Trucks %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Pedestrians	-	-	-	-	6	-	-	-	-	14	-	-	-	-	7	-	-	-	-	15	-	-	-	-		
Pedestrians %	-	-	-	-	13.3%	-	-	-	-	31.1%	-	-	-	-	15.6%	-	-	-	-	33.3%	-	-	-	-		
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-		
Bicycles on Crosswalk %	-	-	-	-	0%	-	-	-	-	2.2%	-	-	-	-	2.2%	-	-	-	-	2.2%	-	-	-	-		
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0		
Bicycles on Road %	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-		

Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast (2.1 °C)



Peak Hour: 04:45 PM - 05:45 PM Weather: Mostly Cloudy (2.8 °C)



Turning Movement Count (2 . CLAIR RD & BEAVER MEADOW DR)

Start Time	N Approach BEAVER MEADOW DR						E Approach CLAIR RD						S Approach BEAVER MEADOW DR						W Approach CLAIR RD						Int. Total (15 min)	Int. Total (1 hr)
	Right N/W	Thru N/S	Left N/E	U-Turn N/N	Peds N:	Approach Total	Right E/N	Thru E/W	Left E/S	U-Turn E/E	Peds E:	Approach Total	Right S/E	Thru S/N	Left S/W	U-Turn S/S	Peds S:	Approach Total	Right W/S	Thru W/E	Left W/N	U-Turn W/W	Peds W:	Approach Total		
07:00:00	24	0	2	0	0	26	1	69	3	0	1	73	2	1	1	0	0	4	2	30	5	0	0	37	140	
07:15:00	18	0	4	0	0	22	0	94	5	0	0	99	4	1	6	0	0	11	0	38	4	0	0	42	174	
07:30:00	20	2	0	0	0	22	4	137	4	0	0	145	4	2	3	0	0	9	4	51	12	0	0	67	243	
07:45:00	25	0	6	0	0	31	2	148	3	1	0	154	5	1	4	0	0	10	2	41	4	0	0	47	242	799
08:00:00	17	1	9	0	0	27	1	120	3	0	0	124	6	3	5	0	0	14	5	63	10	0	0	78	243	902
08:15:00	27	1	11	0	0	39	6	124	3	0	2	133	8	6	12	0	1	26	6	63	17	0	0	86	284	1012
08:30:00	35	2	2	0	0	39	8	197	7	0	0	212	7	1	3	0	0	11	4	61	20	0	0	85	347	1116
08:45:00	17	2	5	0	2	24	9	137	2	0	0	148	6	1	4	0	0	11	5	66	15	0	0	86	269	1143
BREAK																										
16:00:00	10	1	5	0	0	16	3	70	3	0	1	76	5	2	2	0	0	9	6	141	20	1	0	168	269	
16:15:00	10	0	2	0	0	12	3	92	6	0	1	101	9	1	5	0	0	15	5	141	18	0	0	164	292	
16:30:00	13	2	5	0	1	20	8	87	5	0	0	100	6	1	6	0	0	13	5	161	21	0	0	187	320	
16:45:00	12	4	5	0	1	21	5	106	4	0	0	115	2	0	6	0	0	8	6	131	29	0	0	166	310	1191
17:00:00	24	1	3	0	0	28	8	105	2	0	3	115	6	2	4	0	0	12	5	145	28	0	0	178	333	1255
17:15:00	9	1	3	0	0	13	5	100	5	0	0	110	7	0	6	0	1	13	2	156	30	1	3	189	325	1288
17:30:00	13	2	5	0	0	20	4	97	6	0	0	107	3	1	4	0	0	8	3	158	22	1	0	184	319	1287
17:45:00	4	1	2	0	0	7	3	95	3	0	0	101	2	1	2	0	0	5	8	118	23	1	0	150	263	1240
Grand Total	278	20	69	0	4	367	70	1778	64	1	8	1913	82	24	73	0	2	179	68	1564	278	4	3	1914	4373	-
Approach%	75.7%	5.4%	18.8%	0%	-	3.7%	92.9%	3.3%	0.1%	-	45.8%	13.4%	40.8%	0%	-	3.6%	81.7%	14.5%	0.2%	-	-	-	-	-	-	
Totals %	6.4%	0.5%	1.6%	0%	8.4%	1.6%	40.7%	1.5%	0%	43.7%	1.9%	0.5%	1.7%	0%	4.1%	1.6%	35.8%	6.4%	0.1%	43.8%	-	-	-	-	-	-
Heavy	4	0	4	0	-	2	97	5	0	-	5	1	1	0	-	2	92	4	0	-	-	-	-	-	-	-
Heavy %	1.4%	0%	5.8%	0%	-	2.9%	5.5%	7.8%	0%	-	6.1%	4.2%	1.4%	0%	-	2.9%	5.9%	1.4%	0%	-	-	-	-	-	-	-
Bicycles	0	0	0	0	-	0	2	0	0	-	0	0	0	0	-	1	1	0	0	-	-	-	-	-	-	-
Bicycle %	0%	0%	0%	0%	-	0%	0.1%	0%	0%	-	0%	0%	0%	0%	-	1.5%	0.1%	0%	0%	-	-	-	-	-	-	-

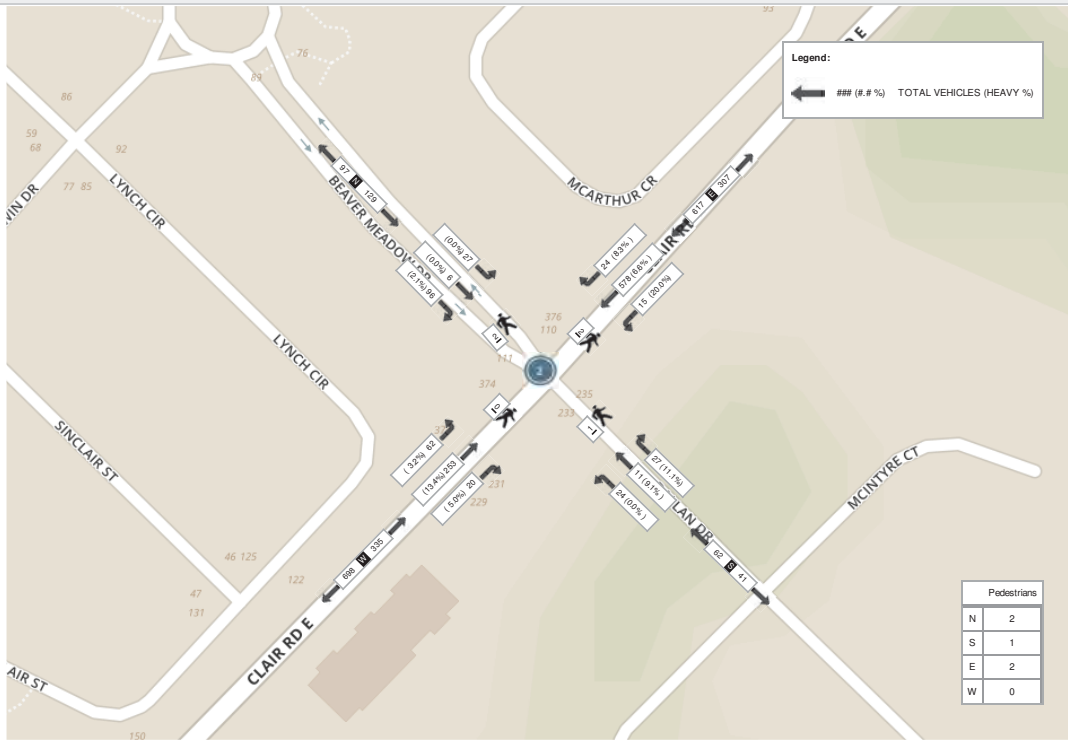
Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast (2.1 °C)

Start Time	N Approach BEAVER MEADOW DR						E Approach CLAIR RD						S Approach BEAVER MEADOW DR						W Approach CLAIR RD						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
08:00:00	17	1	9	0	0	27	1	120	3	0	0	124	6	3	5	0	0	14	5	63	10	0	0	78	243
08:15:00	27	1	11	0	0	39	6	124	3	0	2	133	8	6	12	0	1	26	6	63	17	0	0	86	284
08:30:00	35	2	2	0	0	39	8	197	7	0	0	212	7	1	3	0	0	11	4	61	20	0	0	85	347
08:45:00	17	2	5	0	2	24	9	137	2	0	0	148	6	1	4	0	0	11	5	66	15	0	0	86	269
Grand Total	96	6	27	0	2	129	24	578	15	0	2	617	27	11	24	0	1	62	20	253	62	0	0	335	1143
Approach%	74.4%	4.7%	20.9%	0%	-	-	3.9%	93.7%	2.4%	0%	-	43.5%	17.7%	38.7%	0%	-	6%	75.5%	18.5%	0%	-	-	-	-	-
Totals %	8.4%	0.5%	2.4%	0%	-	11.3%	2.1%	50.6%	1.3%	0%	-	54%	2.4%	1%	2.1%	0%	-	5.4%	1.7%	22.1%	5.4%	0%	-	29.3%	-
PHF	0.69	0.75	0.61	0	-	0.83	0.67	0.73	0.54	0	-	0.73	0.84	0.46	0.5	0	-	0.6	0.83	0.96	0.78	0	-	0.97	-
Heavy	2	0	0	0	-	2	2	38	3	0	-	43	3	1	0	0	-	4	1	34	2	0	-	37	-
Heavy %	2.1%	0%	0%	0%	-	1.6%	8.3%	6.6%	20%	0%	-	7%	11.1%	9.1%	0%	0%	-	6.5%	5%	13.4%	3.2%	0%	-	11%	-
Lights	94	6	27	0	-	127	22	540	12	0	-	574	24	10	24	0	-	58	19	219	60	0	-	298	-
Lights %	97.9%	100%	100%	0%	-	98.4%	91.7%	93.4%	80%	0%	-	93%	88.9%	90.9%	100%	0%	-	93.5%	95%	86.6%	96.8%	0%	-	89%	-
Single-Unit Trucks	0	0	0	0	-	0	0	8	2	0	-	10	1	0	0	0	-	1	0	16	0	0	-	16	-
Single-Unit Trucks %	0%	0%	0%	0%	-	0%	0%	1.4%	13.3%	0%	-	1.6%	3.7%	0%	0%	0%	-	1.6%	0%	6.3%	0%	0%	-	4.8%	-
Buses	2	0	0	0	-	2	2	9	1	0	-	12	1	1	0	0	-	2	0	9	2	0	-	11	-
Buses %	2.1%	0%	0%	0%	-	1.6%	8.3%	1.6%	6.7%	0%	-	1.9%	3.7%	9.1%	0%	0%	-	3.2%	0%	3.6%	3.2%	0%	-	3.3%	-
Articulated Trucks	0	0	0	0	-	0	0	21	0	0	-	21	1	0	0	0	-	1	1	9	0	0	-	10	-
Articulated Trucks %	0%	0%	0%	0%	-	0%	0%	3.6%	0%	0%	-	3.4%	3.7%	0%	0%	0%	-	1.6%	5%	3.6%	0%	0%	-	3%	-
Pedestrians	-	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	1	-	-	-	-	-	0	-	-
Pedestrians %	-	-	-	-	40%	-	-	-	-	40%	-	-	-	-	-	-	20%	-	-	-	-	-	0%	-	-
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	-
Bicycles on Road %	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	-	0%	-	-

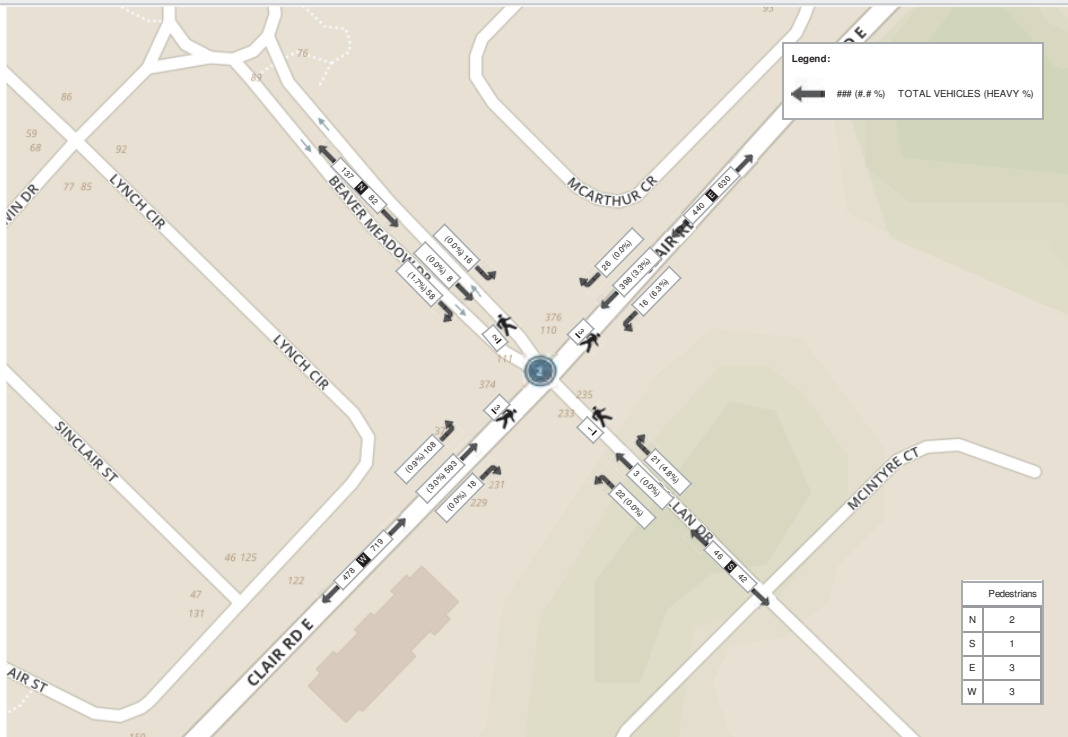
Peak Hour: 04:30 PM - 05:30 PM Weather: Mostly Cloudy (2.8 °C)

Start Time	N Approach BEAVER MEADOW DR						E Approach CLAIR RD						S Approach BEAVER MEADOW DR						W Approach CLAIR RD						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
16:30:00	13	2	5	0	1	20	8	87	5	0	0	100	6	1	6	0	0	13	5	161	21	0	0	187	320
16:45:00	12	4	5	0	1	21	5	106	4	0	0	115	2	0	6	0	0	8	6	131	29	0	0	166	310
17:00:00	24	1	3	0	0	28	8	105	2	0	3	115	6	2	4	0	0	12	5	145	28	0	0	178	333
17:15:00	9	1	3	0	0	13	5	100	5	0	0	110	7	0	6	0	1	13	2	156	30	1	3	189	325
Grand Total	58	8	16	0	2	82	26	398	16	0	3	440	21	3	22	0	1	46	18	553	108	1	3	720	1288
Approach%	70.7%	9.8%	19.5%	0%	-	-	5.9%	90.5%	3.6%	0%	-	45.7%	6.5%	47.8%	0%	-	2.5%	82.4%	15%	0.1%	-	-	-	-	
Totals %	4.5%	0.6%	1.2%	0%	-	6.4%	2%	30.9%	1.2%	0%	-	34.2%	1.6%	0.2%	1.7%	0%	-	3.6%	1.4%	46%	8.4%	0.1%	-	55.9%	-
PHF	0.6	0.5	0.8	0	-	0.73	0.81	0.94	0.8	0	-	0.96	0.75	0.38	0.92	0	-	0.88	0.75	0.92	0.9	0.25	-	0.95	-
Heavy	1	0	0	0	-	1	0	13	1	0	-	14	1	0	0	0	-	1	0	18	1	0	-	19	-
Heavy %	1.7%	0%	0%	0%	-	1.2%	0%	3.3%	6.3%	0%	-	3.2%	4.8%	0%	0%	0%	-	2.2%	0%	3%	0.9%	0%	-	2.6%	-
Lights	57	8	16	0	-	81	26	385	15	0	-	426	20	3	22	0	-	45	18	575	107	1	-	701	-
Lights %	98.3%	100%	100%	0%	-	98.8%	100%	96.7%	93.8%	0%	-	96.8%	95.2%	100%	100%	0%	-	97.8%	100%	97%	99.1%	100%	-	97.4%	-
Single-Unit Trucks	1	0	0	0	-	1	0	7	1	0	-	8	0	0	0	0	-	0	0	5	1	0	-	6	-
Single-Unit Trucks %	1.7%	0%	0%	0%	-	1.2%	0%	1.8%	6.3%	0%	-	1.8%	0%	0%	0%	0%	-	0%	0%	0.8%	0.9%	0%	-	0.8%	-
Buses	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	1	0	3	0	0	-	3	-
Buses %	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	4.8%	0%	0%	0%	-	2.2%	0%	0.5%	0%	0%	-	0.4%	-
Articulated Trucks	0	0	0	0	-	0	0	6	0	0	-	6	0	0	0	0	-	0	0	10	0	0	-	10	-
Articulated Trucks %	0%	0%	0%	0%	-	0%	0%	1.5%	0%	0%	-	1.4%	0%	0%	0%	0%	-	0%	0%	1.7%	0%	0%	-	1.4%	-
Pedestrians	-	-	-	-	2	-	-	-	-	3	-	-	-	-	-	-	1	-	-	-	-	-	3	-	-
Pedestrians %	-	-	-	-	22.2%	-	-	-	-	33.3%	-	-	-	-	-	-	11.1%	-	-	-	-	-	33.3%	-	-
Bicycles on Road	0	0	0	0	0	-	0	2	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	-
Bicycles on Road %	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-

Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast (2.1 °C)



Peak Hour: 04:30 PM - 05:30 PM Weather: Mostly Cloudy (2.8 °C)



Turning Movement Count (6 . CLAIR ROAD E & VICTORIA RD S)

Start Time	S Approach VICTORIA RD S					W Approach CLAIR ROAD E					N Approach VICTORIA RD S					Int. Total (15 min)	Int. Total (1 hr)
	Thru S:N	Left S:W	U-Turn S:S	Peds S:	Approach Total	Right W:S	Left W:N	U-Turn W:W	Peds W:	Approach Total	Right N:W	Thru N:S	U-Turn N:N	Peds N:	Approach Total		
07:00:00	16	4	0	0	20	12	33	0	0	45	47	59	0	0	106	171	
07:15:00	23	8	0	0	31	19	33	0	0	52	86	63	0	0	149	232	
07:30:00	41	15	0	0	56	13	34	0	0	47	93	73	0	0	166	269	
07:45:00	50	10	0	0	60	15	61	0	0	76	135	75	0	0	210	346	1018
08:00:00	52	10	0	0	62	9	59	0	0	68	84	56	0	0	140	270	1117
08:15:00	67	11	0	0	78	8	57	0	0	65	107	51	0	0	158	301	1186
08:30:00	57	8	0	0	65	8	51	0	0	59	107	48	0	0	155	279	1196
08:45:00	48	19	0	0	67	11	50	0	0	61	91	60	0	0	151	279	1129
BREAK																	
16:00:00	62	10	0	0	72	14	86	0	0	100	68	38	0	0	106	278	
16:15:00	66	12	0	0	78	13	109	0	0	122	81	56	0	0	137	337	
16:30:00	77	15	0	0	92	18	105	0	0	123	66	61	0	0	127	342	
16:45:00	78	18	0	0	96	11	103	0	0	114	76	47	0	0	123	333	1290
17:00:00	79	21	0	0	100	13	99	0	0	112	96	50	0	0	146	358	1370
17:15:00	74	22	0	0	96	15	109	0	0	124	101	46	0	0	147	367	1400
17:30:00	58	12	0	0	70	15	91	0	0	106	81	43	0	0	124	300	1358
17:45:00	70	16	0	0	86	11	70	0	0	81	64	28	0	0	92	259	1284
Grand Total	918	211	0	0	1129	205	1150	0	0	1355	1383	854	0	0	2237	4721	-
Approach%	81.3%	18.7%	0%	-	-	15.1%	84.9%	0%	-	-	61.8%	38.2%	0%	-	-	-	-
Totals %	19.4%	4.5%	0%	-	23.9%	4.3%	24.4%	0%	-	28.7%	29.3%	18.1%	0%	-	47.4%	-	-
Heavy	39	7	0	-	-	5	104	0	-	-	87	27	0	-	-	-	-
Heavy %	4.2%	3.3%	0%	-	-	2.4%	9%	0%	-	-	6.3%	3.2%	0%	-	-	-	-
Bicycles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycle %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

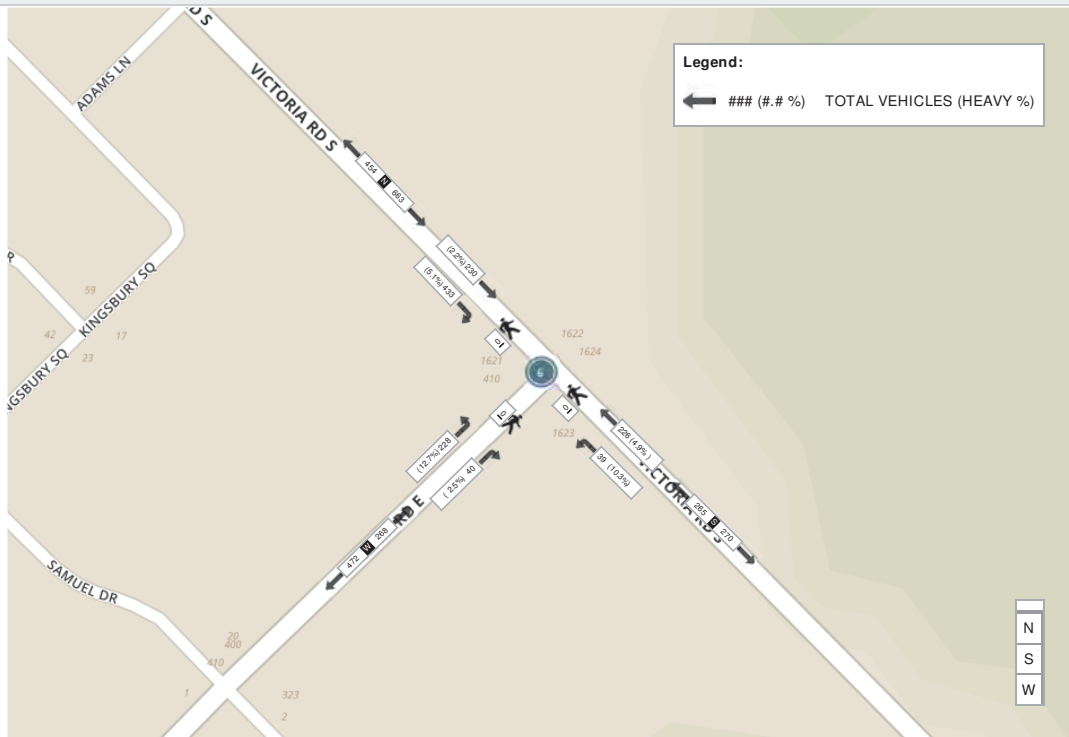
Peak Hour: 07:45 AM - 08:45 AM Weather: Mostly Cloudy (-1.9 °C)

Start Time	S Approach VICTORIA RD S					W Approach CLAIR ROAD E					N Approach VICTORIA RD S					Int. Total (15 min)	
	Thru	Left	U-Turn	Peds	Approach Total	Right	Left	U-Turn	Peds	Approach Total	Right	Thru	U-Turn	Peds	Approach Total		
07:45:00	50	10	0	0	60	15	61	0	0	76	135	75	0	0	210	346	
08:00:00	52	10	0	0	62	9	59	0	0	68	84	56	0	0	140	270	
08:15:00	67	11	0	0	78	8	57	0	0	65	107	51	0	0	158	301	
08:30:00	57	8	0	0	65	8	51	0	0	59	107	48	0	0	155	279	
Grand Total	226	39	0	0	265	40	228	0	0	268	433	230	0	0	663	1196	
Approach%	85.3%	14.7%	0%	-	-	14.9%	85.1%	0%	-	-	65.3%	34.7%	0%	-	-	-	-
Totals %	18.9%	3.3%	0%	-	22.2%	3.3%	19.1%	0%	-	22.4%	36.2%	19.2%	0%	-	55.4%	-	-
PHF	0.84	0.89	0	-	0.85	0.67	0.93	0	-	0.88	0.8	0.77	0	-	0.79	-	-
Heavy	11	4	0	-	15	1	29	0	-	30	22	5	0	-	27	-	-
Heavy %	4.9%	10.3%	0%	-	5.7%	2.5%	12.7%	0%	-	11.2%	5.1%	2.2%	0%	-	4.1%	-	-
Lights	215	35	0	-	250	39	199	0	-	238	411	225	0	-	636	-	-
Lights %	95.1%	89.7%	0%	-	94.3%	97.5%	87.3%	0%	-	88.8%	94.9%	97.8%	0%	-	95.9%	-	-
Single-Unit Trucks	5	0	0	-	5	0	14	0	-	14	15	2	0	-	17	-	-
Single-Unit Trucks %	2.2%	0%	0%	-	1.9%	0%	6.1%	0%	-	5.2%	3.5%	0.9%	0%	-	2.6%	-	-
Buses	6	4	0	-	10	1	2	0	-	3	5	2	0	-	7	-	-
Buses %	2.7%	10.3%	0%	-	3.8%	2.5%	0.9%	0%	-	1.1%	1.2%	0.9%	0%	-	1.1%	-	-
Articulated Trucks	0	0	0	-	0	0	13	0	-	13	2	1	0	-	3	-	-
Articulated Trucks %	0%	0%	0%	-	0%	0%	5.7%	0%	-	4.9%	0.5%	0.4%	0%	-	0.5%	-	-

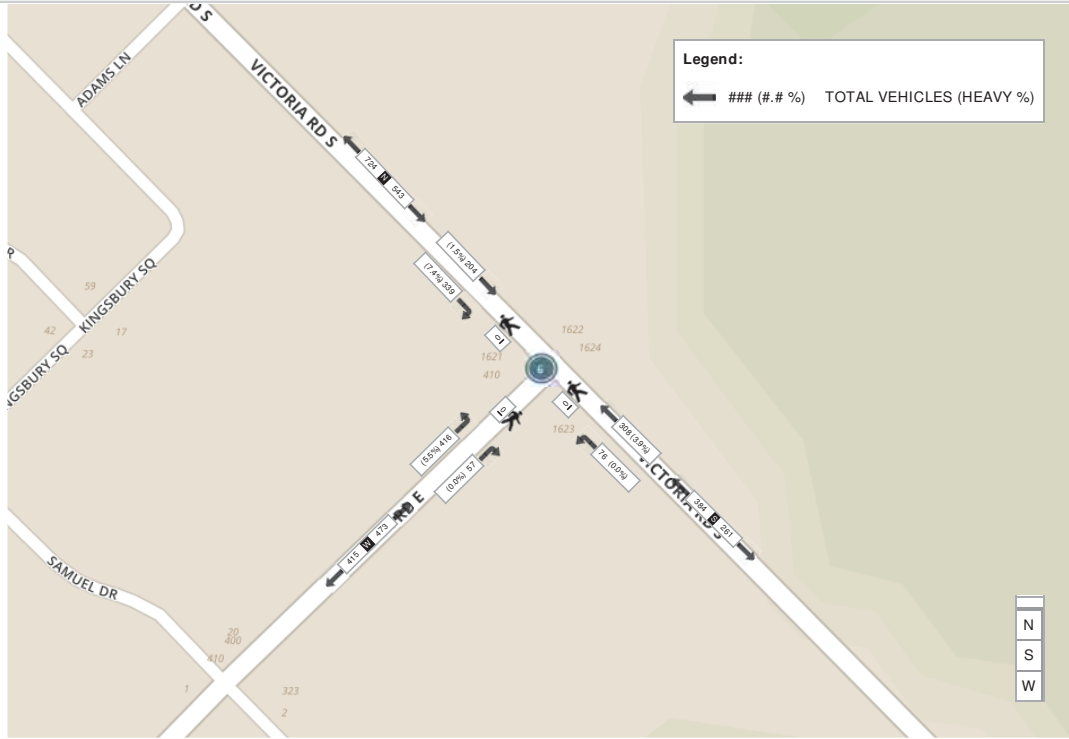
Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)

Start Time	S Approach VICTORIA RD S					W Approach CLAIR ROAD E					N Approach VICTORIA RD S					Int. Total (15 min)
	Thru	Left	U-Turn	Peds	Approach Total	Right	Left	U-Turn	Peds	Approach Total	Right	Thru	U-Turn	Peds	Approach Total	
16:30:00	77	15	0	0	92	18	105	0	0	123	66	61	0	0	127	342
16:45:00	78	18	0	0	96	11	103	0	0	114	76	47	0	0	123	333
17:00:00	79	21	0	0	100	13	99	0	0	112	96	50	0	0	146	358
17:15:00	74	22	0	0	96	15	109	0	0	124	101	46	0	0	147	367
Grand Total	308	76	0	0	384	57	416	0	0	473	339	204	0	0	543	1400
Approach%	80.2%	19.8%	0%	-	-	12.1%	87.9%	0%	-	-	62.4%	37.6%	0%	-	-	-
Totals %	22%	5.4%	0%	-	27.4%	4.1%	29.7%	0%	-	33.8%	24.2%	14.6%	0%	-	38.8%	-
PHF	0.97	0.86	0	-	0.96	0.79	0.95	0	-	0.95	0.84	0.84	0	-	0.92	-
Heavy	12	0	0	-	12	0	23	0	-	23	25	3	0	-	28	-
Heavy %	3.9%	0%	0%	-	3.1%	0%	5.5%	0%	-	4.9%	7.4%	1.5%	0%	-	5.2%	-
Lights	296	76	0	-	372	57	393	0	-	450	314	201	0	-	515	-
Lights %	96.1%	100%	0%	-	96.9%	100%	94.5%	0%	-	95.1%	92.6%	98.5%	0%	-	94.8%	-
Single-Unit Trucks	5	0	0	-	5	0	14	0	-	14	17	2	0	-	19	-
Single-Unit Trucks %	1.6%	0%	0%	-	1.3%	0%	3.4%	0%	-	3%	5%	1%	0%	-	3.5%	-
Buses	6	0	0	-	6	0	2	0	-	2	0	1	0	-	1	-
Buses %	1.9%	0%	0%	-	1.6%	0%	0.5%	0%	-	0.4%	0%	0.5%	0%	-	0.2%	-
Articulated Trucks	1	0	0	-	1	0	7	0	-	7	8	0	0	-	8	-
Articulated Trucks %	0.3%	0%	0%	-	0.3%	0%	1.7%	0%	-	1.5%	2.4%	0%	0%	-	1.5%	-

Peak Hour: 07:45 AM - 08:45 AM Weather: Mostly Cloudy (-1.9 °C)



Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)



Turning Movement Count

Page 5 of 6

BAC17Y6P

Turning Movement Count (7 . MALTBY RD & GORDON ST)

Start Time	E Approach BEAVR NBO					S Approach WCDOCLMV					W Approach BEAVR NBO					N Approach WCDOCLMV					Int. Total (15 min)	Int. Total (1 hr)				
	Dight NL	VhT Nu	ASt NL	f UvT N:N	nSPd N:	Ess t'pashW/ptoc	Dight L:N	VhT L:L	ASt L:u	f UvT L:L	nSPd L:	Ess t'pashW/ptoc	Dight u:l	VhT u:N	ASt u:L	f UvT u:u	nSPd u:	Ess t'pashW/ptoc	Dight L:u	VhT L:L			ASt L:N	f UvT L:L	nSPd L:	Ess t'pashW/ptoc
1:01:31	1	1	1	1	1	1	7	02	0	1	1	46	1	7	7	1	1	2	4	101	1	1	1	109	734	
1:02:11	1	7	1	1	1	7	1	92	11	1	1	112	5	5	5	1	1	9	71	130	1	1	1	140	515	
1:03:31	7	7	1	1	1	6	7	95	2	1	1	111	4	7	4	1	1	14	75	131	1	1	1	146	513	
1:04:21	1	5	1	1	1	6	5	170	6	1	1	156	4	1	2	1	1	16	10	149	7	1	1	171	531	1750
1:41:11	7	1	1	1	1	6	2	135	15	1	1	141	3	6	3	1	1	10	4	165	1	1	1	121	525	1577
1:42:11	1	1	5	1	1	5	1	126	9	1	1	136	6	6	2	1	1	15	4	152	1	1	1	166	576	1565
1:43:31	7	1	7	1	1	6	1	101	11	1	1	147	1	6	0	7	1	16	12	136	1	1	1	109	509	1613
1:44:21	1	5	1	1	1	5	1	154	7	1	1	161	2	5	11	1	1	14	11	150	1	1	1	169	511	1533
1:45:21	1	1	1	1	1	1	1	154	7	1	1	161	2	5	11	1	1	14	11	150	1	1	1	169	511	1533
13:11:31	1	1	1	1	1	7	5	710	0	1	1	710	11	7	6	1	1	13	11	160	5	1	1	137	590	
13:12:11	1	7	1	1	1	5	7	143	9	1	1	190	11	5	9	1	1	77	6	103	7	1	1	147	616	
13:13:31	1	1	7	1	1	5	5	773	11	1	1	761	11	1	4	1	1	71	2	141	1	1	1	143	669	
13:14:21	1	1	7	1	1	7	2	706	11	1	1	749	9	5	2	1	1	10	6	149	1	1	1	196	217	1027
10:11:31	1	5	1	1	1	5	1	774	17	1	1	761	16	5	2	1	1	77	11	101	7	1	1	145	664	1415
10:12:11	1	7	7	1	1	6	6	714	7	1	1	776	16	5	15	1	1	51	11	101	1	1	1	147	661	1459
10:13:31	7	1	1	1	1	6	1	753	11	1	1	760	9	1	0	1	1	10	9	123	1	1	1	132	655	1475
10:14:21	1	2	1	1	1	3	1	192	5	1	1	194	3	7	11	1	1	14	5	129	5	1	1	132	540	1014
Grand Total	11	72	13	1	1	21	57	7043	176	1	1	7967	119	61	110	5	1	701	130	7316	14	1	1	741	6063	U
Approach%	19%	69%	51%	1%		U	1%	99%	6%	1%	U	66%	12%	59%	1%		U	3%	99%	1%	1%		U	-	U	
Totals%	1%	1%	1%	1%		1%	1%	1%	6%	1%	64%	7%	1%	1%	1%		6%	7%	65%	1%	1%		63%	-	U	
Heavy	7	1	1	1		U	2	156	7	1	U	6	3	3	1		U	5	17	2	1		U	-	U	
Heavy %	71%	6%	3%	1%		U	12%	6%	1%	1%	U	5%	1%	2%	1%		U	1%	6%	70%	1%		U	-	U	
Bicycles	1	1	1	1		U	1	1	1	1	U	1	1	1	1		U	1	1	1	1		U	-	U	
Bicycle %	1%	1%	1%	1%		U	1%	1%	1%	1%	U	1%	7%	1%	1%		U	1%	1%	1%	1%		U	-	U	

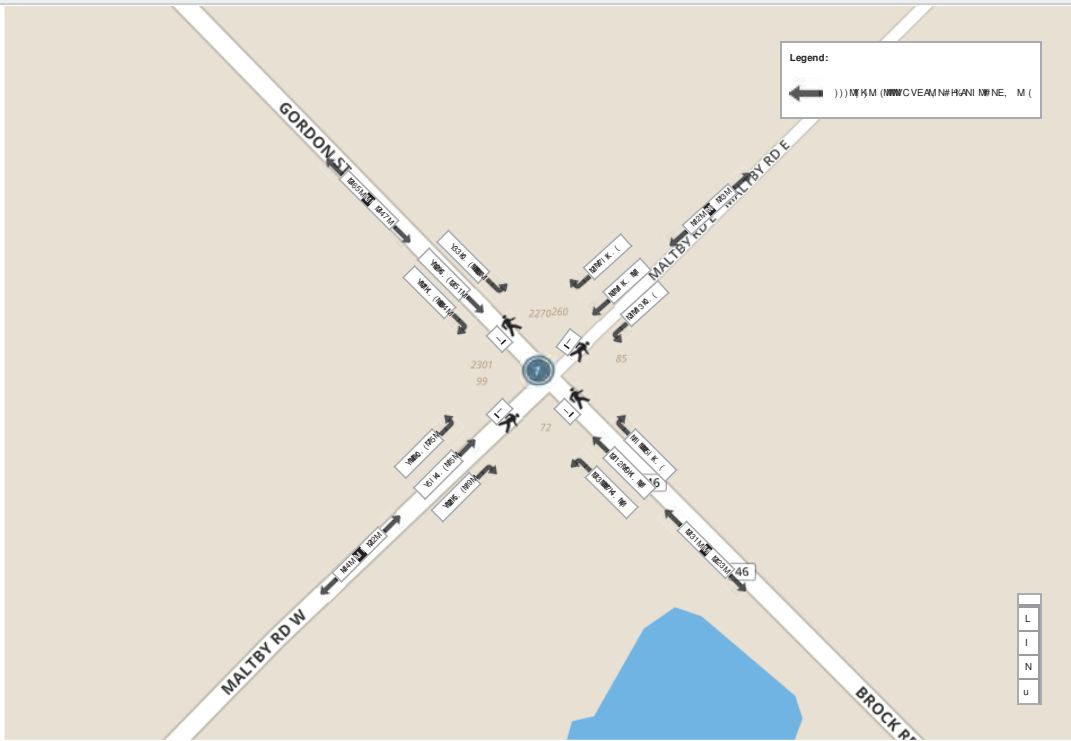
Peak Hour: 07:45 AM - 08:45 AM Weather: Mostly Cloudy (-1.9 °C)

Start Time	E Approach BEAVR NBO					S Approach WCDOCLMV					W Approach BEAVR NBO					N Approach WCDOCLMV					Int. Total (15 min)				
	Dght	VhT	ASat	f UvT	nSPi	Ess'p'oahW'p'toc	Dght	VhT	ASat	f UvT	nSPi	Ess'p'oahW'p'toc	Dght	VhT	ASat	f UvT	nSPi	Ess'p'oahW'p'toc	Dght	VhT		ASat	f UvT	nSPi	Ess'p'oahW'p'toc
10:02:11	1	5	1	1	1	6	5	170	6	1	1	156	4	1	2	1	1	16	10	149	7	1	1	714	531
14:11:31	7	1	1	1	1	6	2	135	15	1	1	141	3	6	3	1	1	10	4	165	1	1	1	121	525
14:12:11	1	1	5	1	1	5	1	128	9	1	1	136	6	6	2	1	1	15	4	152	1	1	1	166	576
14:5:31	7	1	7	1	1	6	1	101	11	1	1	147	1	6	0	7	1	16	12	136	1	1	1	109	509
Grand Total	2	6	3	1	1	12	11	312	53	1	1	331	19	15	75	5	1	24	64	351	5	1	1	347	1416
Approach%	596	730	61	1	1	U	112	95	216	1	1	U	574	776	590	217	1	U	0	972	116	1	1	U	-
Totals %	116	116	116	1	1	116	110	696	712	1	1	630	116	116	116	117	1	61	516	696	117	1	1	647	-
PHF	1105	1105	112	1	1	1106	112	110	1109	1	1	1101	1129	1181	1187	1164	1	1182	1101	1185	1164	1	1	1187	-
Heavy	1	1	1	1	1	7	5	23	1	1	3	1	6	7	1	1	1	0	1	56	7	1	1	50	-
Heavy %	71	1	130	1	1	156	51	94	74	1	1	94	216	518	40	1	1	174	74	216	330	1	1	216	-
Lights	6	6	2	1	1	15	0	229	52	1	1	31	14	9	71	5	1	21	60	290	1	1	1	362	-
Lights %	41	111	4516	1	1	430	01	910	907	1	1	910	990	397	9116	111	1	406	906	968	5516	1	1	968	-
Single-Unit Trucks	1	1	1	1	1	1	5	71	1	1	76	1	5	7	1	1	1	2	1	10	1	1	1	14	-
Single-Unit Trucks %	1	1	130	1	1	30	51	516	1	1	516	1	794	40	1	1	1	416	74	70	1	1	1	76	-
Buses	1	1	1	1	1	1	1	71	1	1	71	1	1	1	1	1	1	7	1	3	7	1	1	4	-
Buses %	71	1	1	1	1	30	1	516	1	1	5	216	00	1	1	1	1	516	1	1	330	1	1	117	-
Articulated Trucks	1	1	1	1	1	1	1	12	1	1	13	1	1	1	1	1	1	1	1	11	1	1	1	11	-
Articulated Trucks %	1	1	1	1	1	1	1	76	74	1	1	76	1	1	1	1	1	1	1	110	1	1	1	110	-
Bicycles on Road	1	1	1	1	1	U	1	1	1	1	U	1	1	1	1	1	1	U	1	1	1	1	1	U	-
Bicycles on Road %	U	U	U	U	U	M	U	U	U	U	M	U	U	U	U	U	U	M	U	U	U	U	U	M	-

Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)

Start Time	E Approach BEAVR NBO					S Approach WCDOCLMV					W Approach BEAVR NBO					N Approach WCDOCLMV					Int. Total (15 min)				
	Dght	VhT	ASat	f UvT	nSPi	Ess'p'oahW'p'toc	Dght	VhT	ASat	f UvT	nSPi	Ess'p'oahW'p'toc	Dght	VhT	ASat	f UvT	nSPi	Ess'p'oahW'p'toc	Dght	VhT		ASat	f UvT	nSPi	Ess'p'oahW'p'toc
13:5:11	1	1	7	1	1	5	5	773	11	1	1	781	11	1	4	1	1	71	2	141	1	1	1	143	669
13:62:11	1	1	7	1	1	7	2	706	11	1	1	749	9	5	2	1	1	10	6	149	1	1	1	196	217
10:11:11	1	5	1	1	1	5	1	774	17	1	1	781	16	5	2	1	1	77	11	101	7	1	1	145	664
10:12:11	1	7	7	1	1	6	6	714	7	1	1	776	16	5	15	1	1	51	11	101	1	1	1	147	661
Grand Total	1	3	3	1	1	17	17	963	52	1	1	995	64	11	51	1	1	49	51	011	2	1	1	062	1839
Approach%	1	21	21	1	1	U	117	9216	512	1	1	U	2510	1117	564	1	1	U	6	9216	110	1	1	U	-
Totals %	1	116	116	1	1	110	110	2116	116	1	1	26	716	112	110	1	1	61	116	546	116	1	1	612	-
PHF	1	112	1102	1	1	1102	110	1183	1105	1	1	1183	1183	1185	118	1	1	1106	1104	1106	1105	1	1	1183	-
Heavy	1	1	1	1	1	1	1	70	1	1	79	7	1	5	1	1	1	2	1	73	1	1	1	74	-
Heavy %	1	1	1	1	1	1	416	716	716	1	1	716	617	1	910	1	1	216	516	510	71	1	1	516	-
Lights	1	3	3	1	1	17	11	919	56	1	1	936	63	11	74	1	1	46	79	346	6	1	1	010	-
Lights %	1	111	111	1	1	111	9110	904	904	1	1	904	924	111	9116	1	1	916	930	9316	41	1	1	937	-
Single-Unit Trucks	1	1	1	1	1	1	1	9	1	1	11	7	1	1	1	1	1	7	1	13	1	1	1	14	-
Single-Unit Trucks %	1	1	1	1	1	1	1	716	1	1	1	617	1	1	1	1	1	717	516	716	71	1	1	716	-
Buses	1	1	1	1	1	1	1	3	1	1	3	1	1	5	1	1	1	5	1	2	1	1	1	2	-
Buses %	1	1	1	1	1	1	1	116	1	1	116	1	1	910	1	1	1	516	1	110	1	1	1	110	-
Articulated Trucks	1	1	1	1	1	1	1	17	1	1	15	1	1	1	1	1	1	1	1	2	1	1	1	2	-
Articulated Trucks %	1	1	1	1	1	1	416	116	1	1	116	1	1	1	1	1	1	1	1	110	1	1	1	110	-
Bicycles on Road	1	1	1	1	1	U	1	1	1	1	U	1	1	1	1	1	1	U	1	1	1	1	1	U	-
Bicycles on Road %	U	U	U	U	U	M	U	U	U	U	M	U	U	U	U	U	U	M	U	U	U	U	U	M	-

Peak Hour: 07:45 AM - 08:45 AM Weather: Mostly Cloudy (-1.9 °C)



Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)



Turning Movement Count (8 - MALTBY RD & VICTORIA RD S (NORTH LEG))

Start Time	N Approach VICTORIA RD S LEORTh ru: N					E Approach e ArTf t RD					W Approach e ArTf t RD					Int. Total (15 min)	Int. Total (1 hr)
	RW-n ERl	r spn ERl	o aTcli EIE	gs07 EP	A111642- T6n43	RW-n uFE	T-lc uRl	o aTcli uRl	gs07 uP	A111642- T6n43	T-lc d Rl	r spn d IE	o aTcli d Rl	gs07 d P	A111642- T6n43		
59P5P55	89	9	5	5	9*	B	K	5	5	.	B	B9	5	5	BK	%B	
59P. P55	9%	%B	5	5	GK	.	K	5	5	G	%	B9	5	5	BG	%v	
59R5P55	G6	.	5	5	G	8	.	5	5	%8	K	*K	5	5	*8	%B	
59P. P55	95	v	5	5	9v	.	B	5	5	9	B	.	5	5	.8	%B	.5.
5G55P55	8.	K	5	5	8G	*	8	5	5	%6	*	8v	5	5	9K	%%	..*
5CP. P55	8%	%	5	5	8B	9	%	5	5	G	B	.v	5	5	8%	%K%	.88
5GR5P55	*8	%	5	5	*9	*	%	5	5	.	B	.8	5	5	.G	%6	.K*
5CP. P55	85	%B	5	5	98	v	K	5	5	%B	K	*v	5	5	.B	%5	.KB

...f RuAM..

%B5P55	*%	G	5	5	*v	%6	B	5	5	%B	*	9G	5	5	G6	%K	
%P. P55	.K	9	5	5	85	.	K	5	5	G	B	.G	5	5	85	%BG	
%R5P55	8v	%6	5	5	9v	%8	5	5	5	%8	*	G6	5	5	G	%9.	
%P. P55	..	v	5	%	8*	B	.	5	5	9	.	v%	5	5	v8	%B9	8%K
%R5P55	.B	%6	5	5	8B	v	%	5	5	%6	*	v%	5	5	v.	%B9	8K9
%P. P55	.*	8	5	5	85	v	*	5	5	%K	*	G6	5	5	G6	%v	88G
%R5P55	*v	*	5	5	.K	.	K	5	5	G	*	8K	5	5	89	%BG	8B%
%P. P55	K%	.	5	5	K9	9	*	5	5	%8	B	9.	5	5	99	%B*	.9G
Grand Total	vB*	%K	5	%	%K9	%5	*8	5	5	%8	*G	vv9	5	5	%6*	2228	a
Approach%	Qrnl&	%m&	5&	a	8Qm&	K9m&	5&	a	*r8&	v.rn&	5&	a	-	a	-	a	-
Totals %	*%n&	.rn&	5&	*8m&	*m&	B7n&	5&	8rn&	B7n&	**r8&	5&	*8rn&	-	a	-	a	-
Heavy	B.	%6	5	a	.	8	5	a	K	*B	5	a	-	a	-	a	-
Heavy %	B7n&	G7n&	5&	a	.&	%K&	5&	a	8rn&	*rn&	5&	a	-	a	-	a	-
Bicycles	5	5	5	a	5	5	5	a	%	5	5	a	-	a	-	a	-
Bicycle %	5&	5&	5&	a	5&	5&	5&	a	B7n&	5&	5&	a	-	a	-	a	-

Peak Hour: 07:30 AM - 08:30 AM Weather: Mostly Cloudy (-1.9 °C)

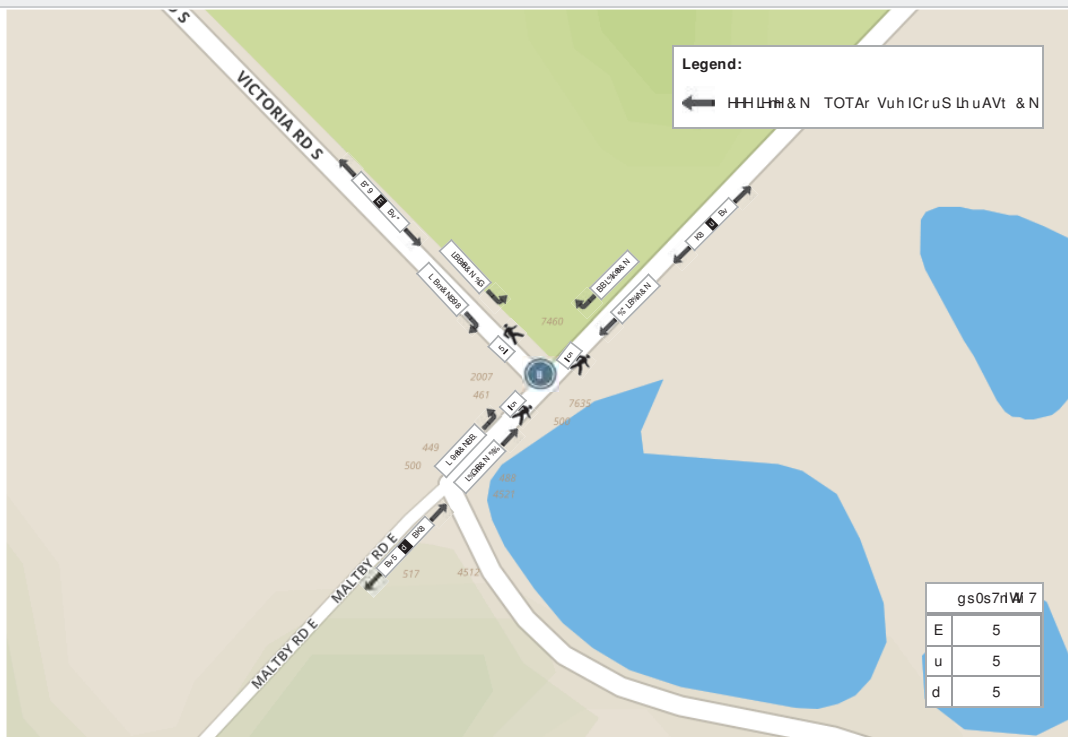
Start Time	N Approach VICTORIA RD S LEORTh ru: N					E Approach e ArTf t RD					W Approach e ArTf t RD					Int. Total (15 min)
	RW-n	r spn	o aTcli	gs07	A111642- T6n43	RW-n	T-lc	o aTcli	gs07	A111642- T6n43	T-lc	r spn	o aTcli	gs07	A111642- T6n43	
59R5P55	G6	.	5	5	G	8	.	5	5	%8	K	*K	5	5	*8	%B
59P. P55	95	v	5	5	9v	.	B	5	5	9	B	.	5	5	.8	%B
5G55P55	8.	K	5	5	8G	*	8	5	5	%6	*	8v	5	5	9K	%%
5CP. P55	8%	%	5	5	8B	9	%	5	5	G	B	.v	5	5	8%	%K%
Grand Total	B98	%G	5	5	Bv*	BB	%	5	5	K8	%%	B6	5	5	BK8	566

Approach%	vKn&	8rn&	5&	a	8%rn&	KQrn&	5&	a	*r8&	v.rn&	5&	a	-	a	-	a	-
Totals %	*G7n&	K7n&	5&	.%n&	Krn&	B7n&	5&	8rn&	%n&	Kvrn&	5&	*%8&	-	a	-	a	-
PHF	5rn&	5m	5	5rn&	5rnv	5mG	5	5rn&	5rnv	5rn&	5	5rn&	-	a	-	a	-
Heavy	9	*	5	%8	K	K	5	8	B	%8	5	%v	-	a	-	a	-
Heavy %	Bm&	BB7n&	5&	K7n&	%K7n&	B7n&	5&	%B7n&	%G7n&	9rn&	5&	G7n&	-	a	-	a	-
Lights	B8v	%	5	BCK	%v	%8	5	K5	v	B5G	5	B7n&	-	a	-	a	-
Lights %	v9m&	99rn&	5&	v8rn&	G7n&	9G7n&	5&	G7n&	G7n&	vB7n&	5&	v%n&	-	a	-	a	-
Single-Unit Trucks	*	5	5	*	5	%	5	%	%	v	5	%6	-	a	-	a	-
Single-Unit Trucks %	%n&	5&	5&	%n&	5&	9rn&	5&	B7n&	v7n&	*&	5&	*rn&	-	a	-	a	-
Buses	B	*	5	8	K	B	5	.	%	G	5	v	-	a	-	a	-
Buses %	5rn&	BB7n&	5&	B&	%K7n&	%rn&	5&	%Kn&	v7n&	K7n&	5&	K7n&	-	a	-	a	-
Articulated Trucks	%	5	5	%	5	5	5	5	5	5	5	5	-	a	-	a	-
Articulated Trucks %	5rn&	5&	5&	5rn&	5&	5&	5&	5&	5&	5&	5&	5&	-	a	-	a	-
Pedestrians	a	a	5	a	a	a	5	a	a	a	5	a	-	a	-	a	-
Pedestrians%	a	a	5&	a	a	a	5&	a	a	a	5&	a	-	a	-	a	-
Bicycles on Road	5	5	5	a	5	5	5	a	5	5	5	5	-	a	-	a	-
Bicycles on Road%	a	a	5&	a	a	a	5&	a	a	a	5&	a	-	a	-	a	-

Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)

Start Time	N Approach VICTORIA RD S IEORTh ru: N					E Approach e ArTf t RD					W Approach e ArTf t RD					Int. Total (15 min)
	RW-n	r spn	oa fcli	gs07	A111642- T6m43	RW-n	T- lc	oa fcli	gs07	A111642- T6m43	T- lc	r spn	oa fcli	gs07	A111642- T6m43	
%8R5F55	8v	%5	5	5	9v	%%	5	5	5	%%	*	G%	5	5	G	%0.
%8P . F55	..	v	5	%	8*	B	.	5	5	9	.	v%	5	5	v8	%89
%9F55F55	.B	%5	5	5	8B	v	%	5	5	%5	*	v%	5	5	v.	%89
%9P% F55	.*	8	5	5	85	v	*	5	5	%K	*	G%	5	5	G%	%v
Grand Total	8K5	K	5	%	88.	K%	%5	5	5	*%	%0	K.	5	5	K8B	668
Approach%	G8r6%	%KrB%	5&		a	9.r6%	B' r6%	5&		a	*r6%	v.r6%	5&		a	-
Totals %	K' r6%	. r6%	5&		Kv r6%	* r6%	%6&	5&		8r6%	Bm&	. %6&	5&		* r6%	-
PHF	5r6K	5r6G	5		5r6T	5r6	5m	5		5r6v	5r6	5m.	5		5m*	-
Heavy	.	%	5		8	%	5	5		%	5	%	5		%	-
Heavy %	B r6%	B r6%	5&		B r6%	K r6%	5&	5&		B r6%	5&	K r6%	5&		K&	-
Lights	BB.	K'	5		B.v	K5	%5	5		*5	%9	K'	5		K %	-
Lights %	v9r6%	v9r6%	5&		v9r6%	v8r6%	%5&	5&		v9r6%	%5&	v8r6%	5&		v9&	-
Single-Unit Trucks	*	5	5		*	5	5	5		5	5	.	5		.	-
Single-Unit Trucks %	%6&	5&	5&		%6&	5&	5&	5&		5&	5&	%6&	5&		%6&	-
Buses	5	%	5		%	%	5	5		%	5	.	5		.	-
Buses %	5&	B r6%	5&		5r6%	K r6%	5&	5&		B r6%	5&	%6&	5&		%6&	-
Articulated Trucks	%	5	5		%	5	5	5		5	5	%	5		%	-
Articulated Trucks %	5r6%	5&	5&		5r6%	5&	5&	5&		5&	5&	5r6%	5&		5r6%	-
Pedestrians	a	a	a	%	a	a	a	5		a	a	a	a	5	a	-
Pedestrians%	a	a	a	%5&	a	a	a	5&		a	a	a	a	5&	a	-
Bicycles on Road	5	5	5	5	a	5	5	5	5	a	%	5	5	5	a	-
Bicycles on Road%	a	a	a	5&	a	a	a	5&		a	a	a	5&		5&	-

Peak Hour: 07:30 AM - 08:30 AM Weather: Mostly Cloudy (-1.9 °C)



Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)



Tcll WJJe 6ys(si nC6ci n

g4Ls . 6p8

f AC%9t 8g

Turning Movement Count (9 . MALTBY RD & VICTORIA RD S (SOUTH LEG))

Start Time	W Approach				S Approach				E Approach				Int. Total (15 min)	Int. Total (1 hr)
	VICTO RA	DTS. R.Æ	hru: RA	NeeSt t WUDf 0-	nr RD /R	VICTO /Æ	hru: A	NeeSt t WUDf 0-	DTS. E/R	nr RD EA	hru: EA	NeeSt t WUDf 0-		
dsAIdAId	p	o	d	a	p	cl	d	pc	o	ai	d	al	la	
dsAci AId	d	i	d	i	d	po	d	po	i	ag	d	s0	cdp	
dsA0dAId	c	l	d	cd	c	0g	d	0l	o	ss	d	gc	c0d	
dsA0i AId	p	s	d	l	c	i0	d	i0	s	a0	d	sd	c00	oac
dgAIdAId	i	s	d	cp	p	aa	d	ag	s	il	d	aa	coa	icc
dgAci AId	d	s	d	s	d	io	d	io	i	is	d	ap	cp0	i0p
dgA0dAId	0	g	d	cc	p	id	d	ip	p	os	d	ol	ccp	ico
dgA0i AId	0	o	d	s	c	ip	d	i0	i	ia	d	ac	cpc	idp
7771 VEN677														
caAIdAId	d	g	d	g	d	si	d	si	o	0s	d	oc	cpo	
caAci AId	0	i	d	g	d	io	d	io	o	ip	d	ia	ccg	
caA0dAId	p	l	d	cc	c	ss	d	sg	i	ao	d	al	cig	
caA0i AId	p	cd	d	cp	o	gs	d	lc	i	i0	d	ig	cac	iac
csAIdAId	c	g	d	l	c	gi	c	ga	o	os	d	ic	coa	ig0
csAci AId	0	i	d	g	d	gc	d	gc	o	ip	d	ia	coi	acd
csA0dAId	d	a	d	a	d	ap	d	ap	a	oa	d	ip	cpd	isp
csA0i AId	0	0	d	a	0	so	d	ss	o	0c	d	0l	ccg	ipl
Grand Total	0d	cdi	d	c0i	cg	lic	c	lal	si	gso	d	lol	2053	4
Approach%	pp3	ss3		4	c23	lg23		4	s23	lp23		4	-	4
Totals %	c23	i23		a23	d23	oa23		os23	023	op23		oa23	-	4
Heavy	0	i		4	p	pp		4	o	pd		4	-	4
Heavy %	cd3	o23		4	cc23	p23		4	i23	p23		4	-	4
Bicycles	d	c		4	d	d		4	d	d		4	-	4
Bicycle %	d3	c3		4	d3	d3		4	d3	d3		4	-	4

DLS1'06f8r, r*0fl'0

ht 0 l0WU

1N9 csMh

Peak Hour: 07:30 AM - 08:30 AM Weather: Mostly Cloudy (-1.9 °C)

Start Time	W Approach				S Approach				E Approach				Int. Total (15 min)
	VICTO	DTSL	hr u:	NeeSt WUDf 0-	nr FD	VICTO	hr u:	NeeSt WUDf 0-	DTSL	nr FD	hr u:	NeeSt WUDf 0-	
dsAd/Atid	c	l	d	cd	c	0g	d	0l	o	ss	d	gc	c0d
dsAi /Atid	p	s	d	l	c	i 0	d	i o	s	a0	d	sd	c00
dgAd/Atid	i	s	d	cp	p	aa	d	ag	s	i l	d	aa	coa
dgAi /Atid	d	s	d	s	d	i o	d	i o	i	i s	d	ap	cp0
Grand Total	g	0d	d	0g	o	pcc	d	pci	p0	pi a	d	psl	532
Approach%	pc23	sg23		4	c23	lg23		4	g23	lc23		4	-
Totals %	c23	i2a3		s23	d23	0l2a3		od23	o23	og23		i p23	-
PHF	d2b	d2g0		d2l	d2	d2g		d2l	d2p	d2g0		d2ga	-
Heavy	p	c		0	d	a		a	d	p		p	-
Heavy %	pi 3	023		s23	d3	p23		p23	d3	d23		d23	-
Lights	a	pl		0i	o	pdi		pdl	p0	pi o		pss	-
Lights %	si 3	la23		lp23	cdd3	ls23		ls23	cdd3	ll23		ll23	-
Single-Unit Trucks	d	d		d	d	d		d	d	d		d	-
Single-Unit Trucks %	d3	d3		d3	d3	d3		d3	d3	d3		d3	-
Buses	p	c		0	d	a		a	d	p		p	-
Buses %	pi 3	023		s23	d3	p23		p23	d3	d23		d23	-
Articulated Trucks	d	d		d	d	d		d	d	d		d	-
Articulated Trucks %	d3	d3		d3	d3	d3		d3	d3	d3		d3	-
Pedestrians	4	4	d	4	4	4	d	4	4	4	d	4	-
Pedestrians%	4	4	d3	U	4	4	d3	U	4	4	d3	U	-
Bicycles on Road	d	d	d	4	d	d	d	4	d	d	d	4	-
Bicycles on Road%	4	4	d3	U	4	4	d3	U	4	4	d3	U	-

Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)

Start Time	W Approach				S Approach				E Approach				Int. Total (15 min)
	VICTO	DTSL	hr u:	NeeSt WUDf 0-	nr FD	VICTO	hr u:	NeeSt WUDf 0-	DTSL	nr FD	hr u:	NeeSt WUDf 0-	
caAd/Atid	p	l	d	cc	c	ss	d	sg	i	ao	d	al	ci g
caAi /Atid	p	cd	d	cp	o	gs	d	lc	i	i 0	d	ig	cac
csAd/Atid	c	g	d	l	c	gi	c	ga	o	os	d	ic	coa
csAi /Atid	0	i	d	g	d	gc	d	gc	o	ip	d	ia	coi
Grand Total	g	0p	d	od	a	00d	c	00a	cg	pca	d	p0o	610
Approach%	pd3	gd3		4	c23	lg23		4	s23	lp23		4	-
Totals %	c23	i23		a23	c3	io23		ii23	03	oi23		og23	-
PHF	d2as	d2g		d2g0	d2g	d2i		d2p	d2	d2g0		d2ji	-
Heavy	c	c		p	p	cc		c0	p	0		i	-
Heavy %	cp23	023		i3	0023	023		023	cc23	c23		p23	-
Lights	s	0c		0g	o	0cl		0p0	ca	pc0		ppl	-
Lights %	gs23	la23		li3	aa23	la23		la23	gg23	lg23		ls23	-
Single-Unit Trucks	d	d		d	p	a		g	p	0		i	-
Single-Unit Trucks %	d3	d3		d3	0023	c23		p23	cc23	c23		p23	-
Buses	c	d		c	d	i		i	d	d		d	-
Buses %	cp23	d3		p23	d3	c23		c23	d3	d3		d3	-
Articulated Trucks	d	c		c	d	d		d	d	d		d	-
Articulated Trucks %	d3	023		p23	d3	d3		d3	d3	d3		d3	-
Pedestrians	4	4	d	4	4	4	c	4	4	4	d	4	-
Pedestrians%	4	4	d3	U	4	4	cdd3	U	4	4	d3	U	-
Bicycles on Road	d	c	d	4	d	d	d	4	d	d	d	4	-
Bicycles on Road%	4	4	d3	U	4	4	d3	U	4	4	d3	U	-

Peak Hour: 07:30 AM - 08:30 AM Weather: Mostly Cloudy (-1.9 °C)



Peak Hour: 04:30 PM - 05:30 PM Weather: Partly Cloudy (-3 °C)

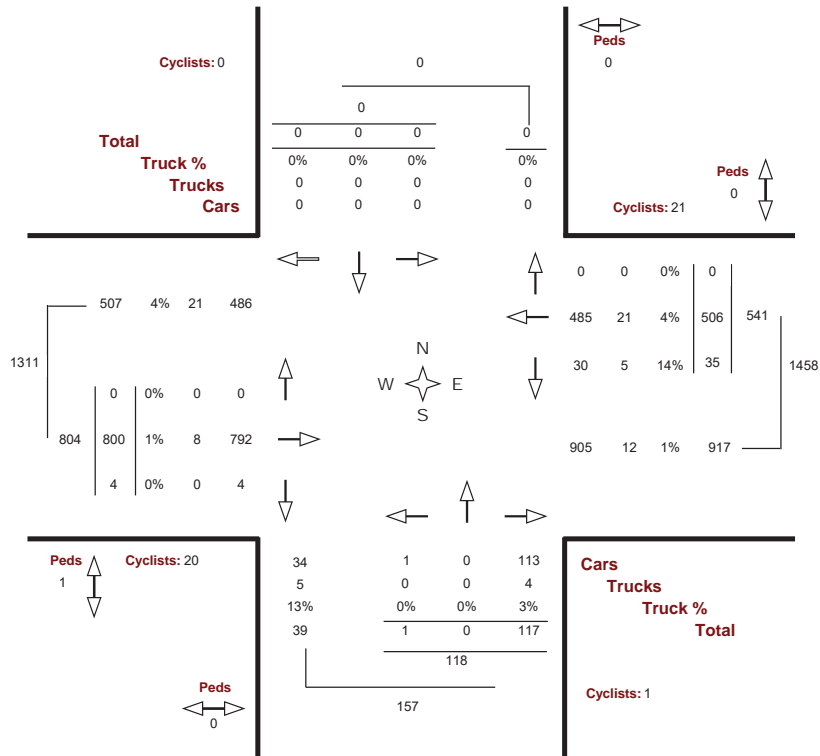




Turning Movements Report - Full Study

Location..... CLAIR RD W @ LAIRD RD
Municipality. GUELPH
Traffic Cont.
Major Dir..... None

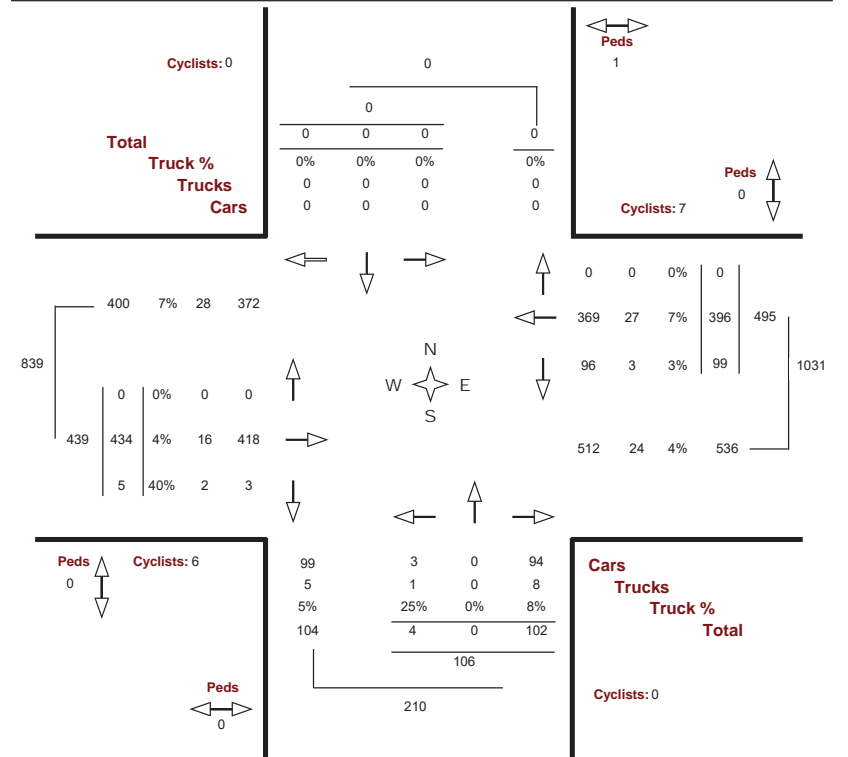
GeoID..... 1725
Count Date. Thursday, 08 October, 2015
Count Time. 07:00 AM — 06:00 PM
Peak Hour.. 04:30 PM — 05:30 PM



Turning Movements Report - MD Period

Location..... CLAIR RD W @ LAIRD RD
Municipality. GUELPH
Traffic Cont.
Major Dir..... None

GeoID..... 1725
Count Date. Thursday, 08 October, 2015
Count Time. 11:00 AM — 02:00 PM
Peak Hour.. 12:00 PM — 01:00 PM

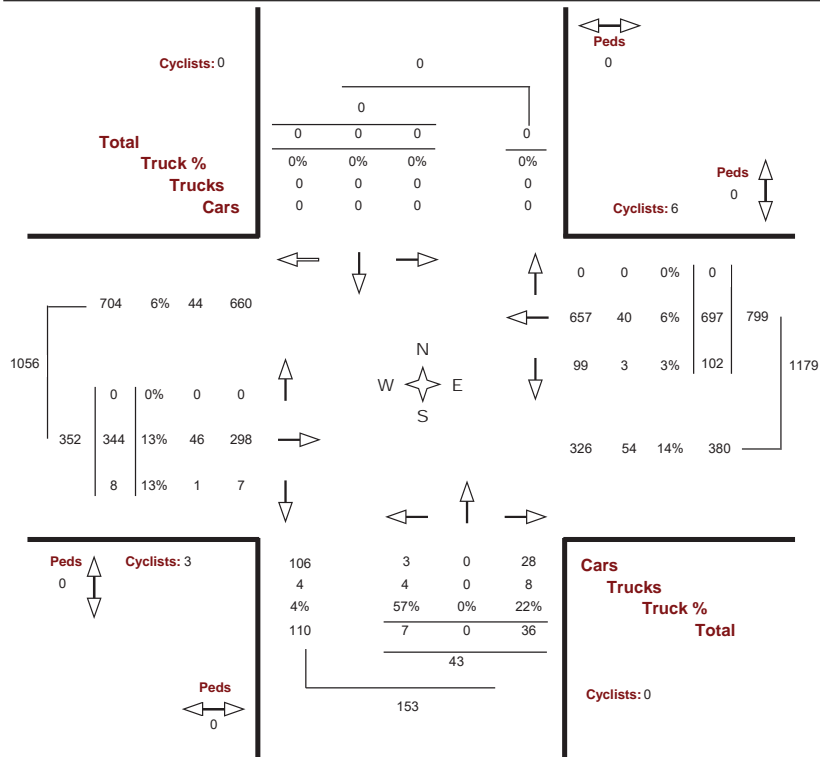




Turning Movements Report - AM Period

Location..... CLAIR RD W @ LAIRD RD
Municipality. GUELPH
Traffic Cont.
Major Dir..... None

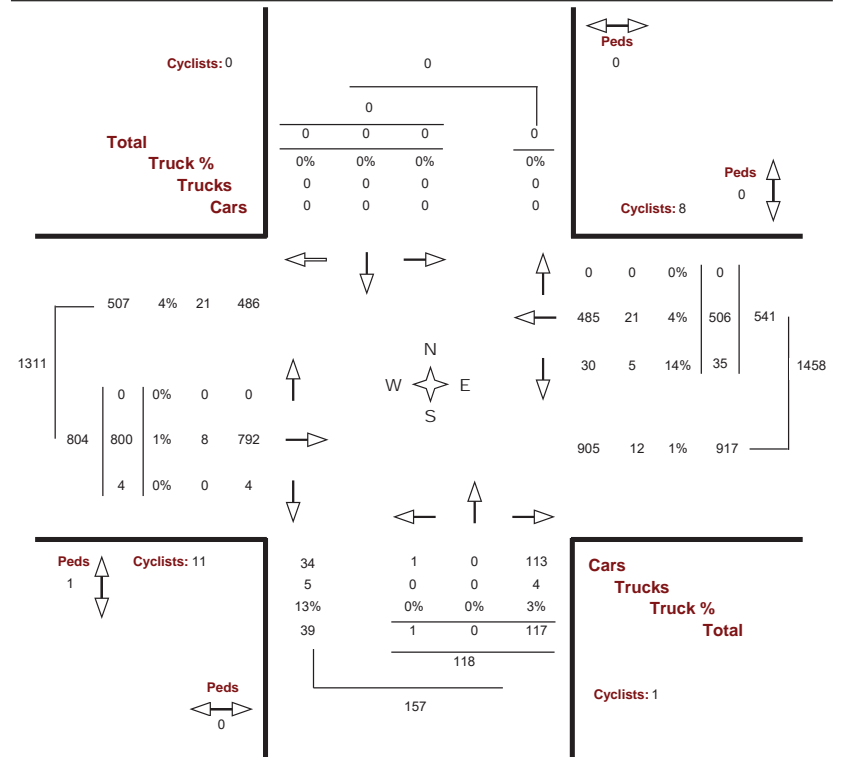
GeoID..... I725
Count Date. Thursday, 08 October, 2015
Count Time. 07:00 AM — 09:00 AM
Peak Hour.. 08:00 AM — 09:00 AM



Turning Movements Report - PM Period

Location..... CLAIR RD W @ LAIRD RD
Municipality. GUELPH
Traffic Cont.
Major Dir..... None

GeoID..... I725
Count Date. Thursday, 08 October, 2015
Count Time. 03:00 PM — 06:00 PM
Peak Hour.. 04:30 PM — 05:30 PM



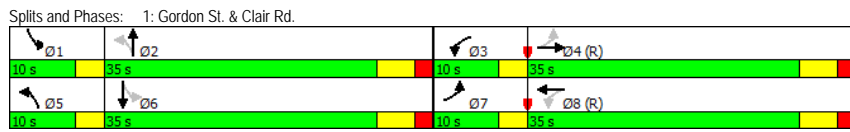
Appendix M – Synchro Analysis Results: Existing Traffic Conditions

Queues
1: Gordon St. & Clair Rd.

Existing Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖↗	↙	↙↘	↖	↖↗	↙	↙↘
Traffic Volume (vph)	250	615	115	390	155	485	175	535
Future Volume (vph)	250	615	115	390	155	485	175	535
Lane Group Flow (vph)	250	715	115	480	155	650	175	655
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	9.5	24.0	9.5	24.0
Total Split (s)	10.0	35.0	10.0	35.0	10.0	35.0	10.0	35.0
Total Split (%)	11.1%	38.9%	11.1%	38.9%	11.1%	38.9%	11.1%	38.9%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0	3.0	6.0	3.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	Max	None	Max
v/c Ratio	0.63	0.60	0.41	0.43	0.49	0.59	0.53	0.59
Control Delay	39.6	41.4	15.4	20.8	20.1	25.8	21.0	26.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.6	41.4	15.4	20.8	20.1	25.8	21.0	26.9
Queue Length 50th (m)	46.0	71.4	14.4	34.5	15.9	47.2	18.2	49.6
Queue Length 95th (m)	69.9	90.4	24.7	47.7	28.3	65.3	31.3	67.8
Internal Link Dist (m)		775.0		194.1		153.6		314.0
Turn Bay Length (m)	75.0		25.0		50.0		140.0	
Base Capacity (vph)	399	1200	284	1104	316	1106	330	1105
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.60	0.40	0.43	0.49	0.59	0.53	0.59

Intersection Summary
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green, Master Intersection
 Natural Cycle: 70
 Control Type: Actuated-Coordinated



HCM Signalized Intersection Capacity Analysis
1: Gordon St. & Clair Rd.

Existing Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓	↖	↙	↘	↗	↓
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↖	↖↗		↙	↙↘		↖	↖↗		↙	↙↘		
Traffic Volume (vph)	250	615	100	115	390	90	155	485	165	175	535	120	
Future Volume (vph)	250	615	100	115	390	90	155	485	165	175	535	120	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0		
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95		
Frbp, 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		1.00	1.00		1.00	1.00		
Frt	1.00	0.98		1.00	0.97		1.00	0.96		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)	1760	3445		1593	3357		1716	3317		1783	3364		
Flt Permitted	0.39	1.00		0.27	1.00		0.29	1.00		0.29	1.00		
Satd. Flow (perm)	729	3445		453	3357		516	3317		542	3364		
Peak-hour factor, PHF	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Adj. Flow (vph)	250	615	100	115	390	90	155	485	165	175	535	120	
RTOR Reduction (vph)	0	14	0	0	22	0	0	37	0	0	21	0	
Lane Group Flow (vph)	250	701	0	115	458	0	155	613	0	175	634	0	
Conf. Peds. (#/hr)	17		7	7		17	2		11	11		2	
Conf. Bikes (#/hr)									1				
Heavy Vehicles (%)	1%	1%	2%	12%	3%	1%	4%	1%	8%	0%	2%	7%	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA		
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)	37.4	30.4		34.6	29.0		36.0	29.0		36.0	29.0		
Effective Green, g (s)	37.4	30.4		34.6	29.0		36.0	29.0		36.0	29.0		
Actuated g/C Ratio	0.42	0.34		0.38	0.32		0.40	0.32		0.40	0.32		
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	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)	383	1163		245	1081		299	1068		313	1083		
v/s Ratio Prot	c0.05	0.20		0.03	0.14		0.04	0.18		c0.04	c0.19		
v/s Ratio Perm	c0.22			0.15			0.17			0.18			
v/c Ratio	0.65	0.60		0.47	0.42		0.52	0.57		0.56	0.59		
Uniform Delay, d1	19.1	24.8		18.9	23.9		18.3	25.4		18.5	25.5		
Progression Factor	1.94	1.60		0.79	0.87		1.00	1.00		1.00	1.00		
Incremental Delay, d2	3.7	2.2		1.4	1.2		1.5	2.2		2.2	2.3		
Delay (s)	40.8	41.8		16.3	22.0		19.8	27.6		20.6	27.8		
Level of Service	D	D		B	C		B	C		C	C		
Approach Delay (s)		41.6			20.9			26.1			26.3		
Approach LOS		D			C			C			C		

Intersection Summary
 HCM 2000 Control Delay 29.8 HCM 2000 Level of Service C
 HCM 2000 Volume to Capacity ratio 0.63
 Actuated Cycle Length (s) 90.0 Sum of lost time (s) 18.0
 Intersection Capacity Utilization 74.2% ICU Level of Service D
 Analysis Period (min) 15
 c Critical Lane Group

Queues
2: Gordon St. & Poppy Dr.

Existing Traffic Conditions
Weekday Afternoon Peak Hour

Lane Group	WBL	WBT	NBL	NBT	SBL	SBT	Ø4
Lane Configurations		↔	↔	↕	↕	↕	
Traffic Volume (vph)	45	5	5	815	40	710	
Future Volume (vph)	45	5	5	815	40	710	
Lane Group Flow (vph)	0	90	5	865	40	715	
Turn Type	Perm	NA	pm+pt	NA	pm+pt	NA	
Protected Phases		8	5	2	1	6	4
Permitted Phases		8				6	
Detector Phase		8	8	5	2	1	6
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	9.5	24.0	9.5	24.0	24.0
Total Split (s)	30.0	30.0	10.0	50.0	10.0	50.0	30.0
Total Split (%)	33.3%	33.3%	11.1%	55.6%	11.1%	55.6%	33%
Yellow Time (s)	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	0.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	3.0	6.0	3.0	6.0	6.0	
Lead/Lag			Lead	Lag	Lead	Lag	
Lead-Lag Optimize?			Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	Max	None	Max	None
v/c Ratio		0.45	0.01	0.35	0.08	0.27	
Control Delay		26.9	2.8	7.1	2.8	4.8	
Queue Delay		0.0	0.0	0.0	0.0	0.0	
Total Delay		26.9	2.8	7.1	2.8	4.8	
Queue Length 50th (m)		6.8	0.2	30.1	1.0	14.6	
Queue Length 95th (m)		19.9	0.9	49.8	3.6	38.6	
Internal Link Dist (m)		256.4		1837.2		153.6	
Turn Bay Length (m)			65.0		27.0		
Base Capacity (vph)		505	648	2447	549	2642	
Starvation Cap Reductn		0	0	0	0	0	
Spillback Cap Reductn		0	0	0	0	0	
Storage Cap Reductn		0	0	0	0	0	
Reduced v/c Ratio		0.18	0.01	0.35	0.07	0.27	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 73.5
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Gordon St. & Poppy Dr.



HCM Signalized Intersection Capacity Analysis
2: Gordon St. & Poppy Dr.

Existing Traffic Conditions
Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↕		↕	↕		↕	↕	
Traffic Volume (vph)	0	0	0	45	5	40	5	815	50	40	710	5
Future Volume (vph)	0	0	0	45	5	40	5	815	50	40	710	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.0		3.0	6.0		3.0	6.0	
Lane Util. Factor					1.00		1.00	0.95		1.00	0.95	
Frt					0.94		1.00	0.99		1.00	1.00	
Flt Protected					0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)					1689		1750	3470		1750	3496	
Flt Permitted					0.84		0.38	1.00		0.30	1.00	
Satd. Flow (perm)					1457		700	3470		546	3496	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	45	5	40	5	815	50	40	710	5
RTOR Reduction (vph)	0	0	0	0	36	0	0	3	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	54	0	5	862	0	40	715	0
Turn Type				Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases					8		5	2		1	6	
Permitted Phases		4			8		2			6		
Actuated Green, G (s)					7.0		52.8	51.7		57.8	54.2	
Effective Green, g (s)					7.0		52.8	51.7		57.8	54.2	
Actuated g/C Ratio					0.09		0.68	0.67		0.75	0.70	
Clearance Time (s)					6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)					3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)					131		493	2320		464	2451	
v/s Ratio Prot					0.00		0.00	c0.25		c0.00	0.20	
v/s Ratio Perm					c0.04		0.01			0.06		
v/c Ratio					0.41		0.01	0.37		0.09	0.29	
Uniform Delay, d1					33.2		3.9	5.6		2.7	4.3	
Progression Factor					1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2					2.1		0.0	0.5		0.1	0.3	
Delay (s)					35.3		3.9	6.1		2.8	4.6	
Level of Service					D		A	A		A	A	
Approach Delay (s)		0.0			35.3		6.1			4.5		
Approach LOS		A			D		A			A		

Intersection Summary

HCM 2000 Control Delay: 6.9, HCM 2000 Level of Service: A
 HCM 2000 Volume to Capacity ratio: 0.36
 Actuated Cycle Length (s): 77.3, Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 46.8%, ICU Level of Service: A
 Analysis Period (min): 15

c Critical Lane Group

Queues

3: Poppy Dr./Clairfields Dr. & Clair Rd.

Existing Traffic Conditions

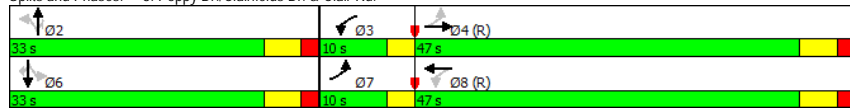
Weekday Afternoon Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations											
Traffic Volume (vph)	105	805	25	430	10	5	35	20	5	75	
Future Volume (vph)	105	805	25	430	10	5	35	20	5	75	
Lane Group Flow (vph)	105	815	25	475	0	15	35	0	25	75	
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	Perm	NA	Perm	
Protected Phases	7	4	3	8		2			6		
Permitted Phases	4		8		2		2	6		6	
Detector Phase	7	4	3	8	2	2	2	6	6	6	
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	9.5	24.0	9.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	10.0	47.0	10.0	47.0	33.0	33.0	33.0	33.0	33.0	33.0	
Total Split (%)	11.1%	52.2%	11.1%	52.2%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	3.0	6.0	3.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max	
v/c Ratio	0.19	0.45	0.06	0.29		0.03	0.07		0.05	0.14	
Control Delay	8.6	15.1	11.7	19.4		22.6	1.4		23.0	6.6	
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	8.6	15.1	11.7	19.4		22.6	1.4		23.0	6.6	
Queue Length 50th (m)	7.4	40.9	2.6	34.8		1.9	0.0		3.2	0.0	
Queue Length 95th (m)	14.3	70.3	m5.6	45.7		6.5	1.8		9.1	9.9	
Internal Link Dist (m)		186.5		775.0		114.2			150.9		
Turn Bay Length (m)	55.0		45.0			20.0			20.0		
Base Capacity (vph)	541	1831	413	1656		490	520		465	522	
Starvation Cap Reductn	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.19	0.45	0.06	0.29		0.03	0.07		0.05	0.14	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 86.4 (96%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Poppy Dr./Clairfields Dr. & Clair Rd.



HCM Signalized Intersection Capacity Analysis

3: Poppy Dr./Clairfields Dr. & Clair Rd.

Existing Traffic Conditions

Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	805	10	25	430	45	10	5	35	20	5	75
Future Volume (vph)	105	805	10	25	430	45	10	5	35	20	5	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0			6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.96	1.00
Satd. Flow (prot)	1750	3493		1750	3450			1783	1566		1771	1566
Flt Permitted	0.43	1.00		0.30	1.00			0.89	1.00		0.84	1.00
Satd. Flow (perm)	793	3493		560	3450			1634	1566		1554	1566
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	105	805	10	25	430	45	10	5	35	20	5	75
RTOR Reduction (vph)	0	1	0	0	8	0	0	0	25	0	0	53
Lane Group Flow (vph)	105	814	0	25	467	0	0	15	11	0	25	25
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	51.0	45.4		45.0	42.4			27.0	27.0		27.0	27.0
Effective Green, g (s)	51.0	45.4		45.0	42.4			27.0	27.0		27.0	27.0
Actuated g/C Ratio	0.57	0.50		0.50	0.47			0.30	0.30		0.30	0.30
Clearance Time (s)	3.0	6.0		3.0	6.0			6.0	6.0		6.0	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)	508	1762		314	1625			490	469		466	469
v/s Ratio Prot	c0.01	c0.23		0.00	0.14						c0.02	0.01
v/s Ratio Perm	0.10			0.04				0.01	0.01			
v/c Ratio	0.21	0.46		0.08	0.29			0.03	0.02		0.05	0.05
Uniform Delay, d1	9.1	14.4		11.6	14.6			22.3	22.2		22.4	22.4
Progression Factor	1.00	1.00		1.53	1.32			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.9		0.1	0.4			0.1	0.1		0.2	0.2
Delay (s)	9.3	15.3		17.7	19.6			22.4	22.3		22.6	22.6
Level of Service	A	B		B	B			C	C		C	C
Approach Delay (s)		14.6			19.5			22.3			22.6	
Approach LOS		B			B			C			C	

Intersection Summary

HCM 2000 Control Delay: 16.9, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.31
 Actuated Cycle Length (s): 90.0, Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 48.1%, ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

Queues
4: Hwy. 6 Northbound Off-Ramp & Laird Rd.

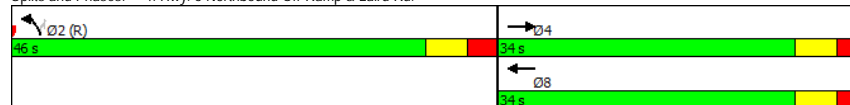
Existing Traffic Conditions
Weekday Afternoon Peak Hour

	→	←	↶	↷
Lane Group	EBT	WBT	NBL	NBR
Lane Configurations	↑↑	↑↑	↶	↷
Traffic Volume (vph)	565	550	25	165
Future Volume (vph)	565	550	25	165
Lane Group Flow (vph)	565	550	25	165
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	2	
Permitted Phases				2
Minimum Split (s)	24.0	24.0	25.0	25.0
Total Split (s)	34.0	34.0	46.0	46.0
Total Split (%)	42.5%	42.5%	57.5%	57.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	7.0	7.0
Lead/Lag				
Lead-Lag Optimize?				
v/c Ratio	0.47	0.46	0.03	0.23
Control Delay	17.6	21.7	10.9	4.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	17.6	21.7	10.9	4.4
Queue Length 50th (m)	31.8	35.3	2.0	2.8
Queue Length 95th (m)	45.0	49.8	5.9	12.7
Internal Link Dist (m)	282.0	205.6	157.0	
Turn Bay Length (m)				100.0
Base Capacity (vph)	1190	1190	870	726
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.47	0.46	0.03	0.23

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green
 Natural Cycle: 50
 Control Type: Pretimed

Splits and Phases: 4: Hwy. 6 Northbound Off-Ramp & Laird Rd.



HCM Signalized Intersection Capacity Analysis
4: Hwy. 6 Northbound Off-Ramp & Laird Rd.

Existing Traffic Conditions
Weekday Afternoon Peak Hour

	→	↶	↷	←	↶	↷
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↶	↷
Traffic Volume (vph)	565	0	0	550	25	165
Future Volume (vph)	565	0	0	550	25	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	7.0	7.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3400			3400	1785	1353
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	3400			3400	1785	1353
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	565	0	0	550	25	165
RTOR Reduction (vph)	0	0	0	0	0	67
Lane Group Flow (vph)	565	0	0	550	25	98
Heavy Vehicles (%)	5%	2%	2%	5%	0%	18%
Turn Type	NA			NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases						2
Actuated Green, G (s)	28.0			28.0	39.0	39.0
Effective Green, g (s)	28.0			28.0	39.0	39.0
Actuated g/C Ratio	0.35			0.35	0.49	0.49
Clearance Time (s)	6.0			6.0	7.0	7.0
Lane Grp Cap (vph)	1190			1190	870	659
v/s Ratio Prot	c0.17			0.16	0.01	
v/s Ratio Perm						c0.07
v/c Ratio	0.47			0.46	0.03	0.15
Uniform Delay, d1	20.3			20.2	10.7	11.3
Progression Factor	0.79			1.00	1.00	1.00
Incremental Delay, d2	1.3			1.3	0.1	0.5
Delay (s)	17.4			21.5	10.7	11.8
Level of Service	B			C	B	B
Approach Delay (s)	17.4			21.5	11.7	
Approach LOS	B			C	B	

Intersection Summary

HCM 2000 Control Delay: 18.3, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.29
 Actuated Cycle Length (s): 80.0, Sum of lost time (s): 13.0
 Intersection Capacity Utilization: 36.7%, ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

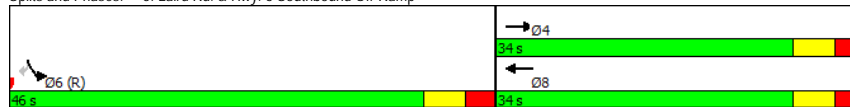
Queues
5: Laird Rd. & Hwy. 6 Southbound Off-Ramp

Existing Traffic Conditions
Weekday Afternoon Peak Hour

	→	←	↘	↙
Lane Group	EBT	WBT	SBL	SBR
Lane Configurations	↑↑	↑↑	↑↓	↑
Traffic Volume (vph)	250	395	345	40
Future Volume (vph)	250	395	345	40
Lane Group Flow (vph)	250	395	345	40
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	6	
Permitted Phases				6
Minimum Split (s)	24.0	24.0	25.0	25.0
Total Split (s)	34.0	34.0	46.0	46.0
Total Split (%)	42.5%	42.5%	57.5%	57.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	7.0	7.0
Lead/Lag				
Lead-Lag Optimize?				
v/c Ratio	0.21	0.32	0.22	0.05
Control Delay	18.8	26.3	12.2	4.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	18.8	26.3	12.2	4.0
Queue Length 50th (m)	14.4	20.2	15.4	0.0
Queue Length 95th (m)	23.1	34.5	23.4	4.8
Internal Link Dist (m)	199.6	282.0	265.0	
Turn Bay Length (m)				40.0
Base Capacity (vph)	1213	1237	1592	741
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.32	0.22	0.05

Intersection Summary
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 50
 Control Type: Pretimed

Splits and Phases: 5: Laird Rd. & Hwy. 6 Southbound Off-Ramp



HCM Signalized Intersection Capacity Analysis
5: Laird Rd. & Hwy. 6 Southbound Off-Ramp

Existing Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	←	↗	↘	
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↓	↑
Traffic Volume (vph)	0	250	395	0	345	40
Future Volume (vph)	0	250	395	0	345	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		7.0	7.0
Lane Util. Factor		0.95	0.95		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3466	3535		3267	1479
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		3466	3535		3267	1479
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	250	395	0	345	40
RTOR Reduction (vph)	0	0	0	0	0	21
Lane Group Flow (vph)	0	250	395	0	345	20
Heavy Vehicles (%)	2%	3%	1%	2%	6%	8%
Turn Type	NA	NA		Prot	Perm	
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		28.0	28.0		39.0	39.0
Effective Green, g (s)		28.0	28.0		39.0	39.0
Actuated g/C Ratio		0.35	0.35		0.49	0.49
Clearance Time (s)		6.0	6.0		7.0	7.0
Lane Grp Cap (vph)		1213	1237		1592	721
v/s Ratio Prot		0.07	c0.11		c0.11	
v/s Ratio Perm						0.01
v/c Ratio		0.21	0.32		0.22	0.03
Uniform Delay, d1		18.2	19.0		11.7	10.6
Progression Factor		1.00	1.33		1.00	1.00
Incremental Delay, d2		0.4	0.6		0.3	0.1
Delay (s)		18.6	26.0		12.1	10.7
Level of Service		B	C		B	B
Approach Delay (s)		18.6	26.0		11.9	
Approach LOS		B	C		B	

Intersection Summary
 HCM 2000 Control Delay: 18.9, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.26
 Actuated Cycle Length (s): 80.0, Sum of lost time (s): 13.0
 Intersection Capacity Utilization: 36.7%, ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

Queues

6: Farley Dr. & Clair Rd.

Existing Traffic Conditions

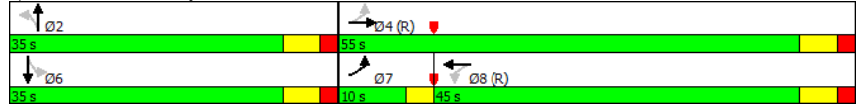
Weekday Afternoon Peak Hour

	↖	→	↘	←	↙	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖↗	↖	↖↗	↖	↖↗	↖	↖↗
Traffic Volume (vph)	235	515	40	365	115	60	55	45
Future Volume (vph)	235	515	40	365	115	60	55	45
Lane Group Flow (vph)	235	705	40	420	115	90	55	185
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4	8	8	2	2	6	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	10.0	55.0	45.0	45.0	35.0	35.0	35.0	35.0
Total Split (%)	11.1%	61.1%	50.0%	50.0%	38.9%	38.9%	38.9%	38.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	Max	Max	Max	Max
v/c Ratio	0.42	0.38	0.13	0.29	0.32	0.15	0.14	0.30
Control Delay	16.9	15.8	13.3	13.7	26.1	16.0	22.9	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.9	15.8	13.3	13.7	26.1	16.0	22.9	8.3
Queue Length 50th (m)	30.0	44.7	5.3	30.3	15.7	7.6	7.0	5.7
Queue Length 95th (m)	45.6	58.2	13.3	41.8	30.5	18.6	16.1	20.8
Internal Link Dist (m)		194.1		563.0		111.7		152.1
Turn Bay Length (m)	125.0		50.0		45.0		20.0	
Base Capacity (vph)	564	1843	310	1471	360	588	398	616
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.38	0.13	0.29	0.32	0.15	0.14	0.30

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 50.4 (56%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated

Splits and Phases: 6: Farley Dr. & Clair Rd.



HCM Signalized Intersection Capacity Analysis

6: Farley Dr. & Clair Rd.

Existing Traffic Conditions

Weekday Afternoon Peak Hour

	↖	→	↘	←	↙	↑	↘	↓	↙	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗		↖	↖↗		↖	↖↗		↖	↖↗	
Traffic Volume (vph)	235	515	190	40	365	55	115	60	30	55	45	140
Future Volume (vph)	235	515	190	40	365	55	115	60	30	55	45	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.99		1.00	1.00		1.00	0.99		1.00	0.97	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.98	1.00		0.98	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.95		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1779	3308		1772	3367		1718	1764		1682	1621	
Flt Permitted	0.46	1.00		0.38	1.00		0.62	1.00		0.70	1.00	
Satd. Flow (perm)	855	3308		715	3367		1120	1764		1237	1621	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	235	515	190	40	365	55	115	60	30	55	45	140
RTOR Reduction (vph)	0	42	0	0	13	0	0	20	0	0	95	0
Lane Group Flow (vph)	235	663	0	40	407	0	115	70	0	55	90	0
Confl. Peds. (#/hr)	6		8	8		6	16		15	15		16
Confl. Bikes (#/hr)							1					
Heavy Vehicles (%)	0%	3%	1%	0%	4%	0%	2%	0%	0%	4%	0%	0%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		8	8		2	2		6	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	49.0	49.0		39.0	39.0		29.0	29.0		29.0	29.0	
Effective Green, g (s)	49.0	49.0		39.0	39.0		29.0	29.0		29.0	29.0	
Actuated g/C Ratio	0.54	0.54		0.43	0.43		0.32	0.32		0.32	0.32	
Clearance Time (s)	3.0	6.0		6.0	6.0		6.0	6.0		6.0	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)	537	1801		309	1459		360	568		398	522	
v/s Ratio Prot	c0.03	0.20			0.12			0.04			0.06	
v/s Ratio Perm	c0.20			0.06			c0.10			0.04		
v/c Ratio	0.44	0.37		0.13	0.28		0.32	0.12		0.14	0.17	
Uniform Delay, d1	10.9	11.7		15.3	16.4		23.0	21.5		21.6	21.9	
Progression Factor	1.58	1.50		0.78	0.84		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.5		0.9	0.5		2.3	0.4		0.7	0.7	
Delay (s)	17.6	18.0		12.8	14.3		25.4	22.0		22.4	22.6	
Level of Service	B	B		B	B		C	C		C	C	
Approach Delay (s)	17.9			14.2			23.9			22.6		
Approach LOS	B			B			C			C		

Intersection Summary

HCM 2000 Control Delay: 18.2, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.41
 Actuated Cycle Length (s): 90.0, Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 67.7%, ICU Level of Service: C
 Analysis Period (min): 15
 c Critical Lane Group

Queues

7: Beaver Meadow Dr. & Clair Rd.

Existing Traffic Conditions

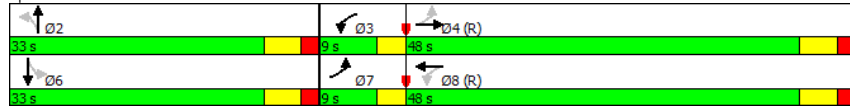
Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖↗	↙	↙↘		↖↗	↙	↙↘
Traffic Volume (vph)	110	595	25	400	20	5	15	10
Future Volume (vph)	110	595	25	400	20	5	15	10
Lane Group Flow (vph)	110	615	25	415	0	45	15	70
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	24.0	24.0	24.0	24.0
Total Split (s)	9.0	48.0	9.0	48.0	33.0	33.0	33.0	33.0
Total Split (%)	10.0%	53.3%	10.0%	53.3%	36.7%	36.7%	36.7%	36.7%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0		6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max
v/c Ratio	0.19	0.34	0.05	0.24	0.10	0.04	0.14	
Control Delay	5.6	10.7	7.6	14.3	15.5	22.8	8.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	5.6	10.7	7.6	14.3	15.5	22.8	8.8	
Queue Length 50th (m)	3.8	13.3	1.7	22.7	3.2	1.9	1.3	
Queue Length 95th (m)	7.2	63.5	4.8	32.6	11.3	6.6	10.8	
Internal Link Dist (m)		563.0		1233.2		183.8	182.6	
Turn Bay Length (m)	55.0		30.0					
Base Capacity (vph)	571	1835	495	1696		467	399	516
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.34	0.05	0.24	0.10	0.04	0.14	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 86.4 (96%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated

Splits and Phases: 7: Beaver Meadow Dr. & Clair Rd.



HCM Signalized Intersection Capacity Analysis

7: Beaver Meadow Dr. & Clair Rd.

Existing Traffic Conditions

Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓	↖	↗	↓	↙	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↖	↖↗		↙	↙↘			↖↗	↙↘	↙	↙↘		
Traffic Volume (vph)	110	595	20	25	400	15	20	5	20	15	10	60	
Future Volume (vph)	110	595	20	25	400	15	20	5	20	15	10	60	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0			6.0		6.0	6.0		
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00		
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.99		
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		0.99	1.00		
Frt	1.00	1.00		1.00	0.99			0.94		1.00	0.87		
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	1.00		
Satd. Flow (prot)	1748	3480		1749	3478			1670		1738	1583		
Flt Permitted	0.48	1.00		0.41	1.00			0.89		0.73	1.00		
Satd. Flow (perm)	878	3480		748	3478			1512		1331	1583		
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	595	20	25	400	15	20	5	20	15	10	60	
RTOR Reduction (vph)	0	2	0	0	3	0	0	14	0	0	42	0	
Lane Group Flow (vph)	110	613	0	25	412	0	0	31	0	15	28	0	
Confl. Peds. (#/hr)	2		1	1		2	3		3	3		3	
Confl. Bikes (#/hr)			1	1		2							
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA		
Protected Phases	7	4		3	8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)	50.4	45.6		45.6	43.2			27.0		27.0	27.0		
Effective Green, g (s)	50.4	45.6		45.6	43.2			27.0		27.0	27.0		
Actuated g/C Ratio	0.56	0.51		0.51	0.48			0.30		0.30	0.30		
Clearance Time (s)	3.0	6.0		3.0	6.0			6.0		6.0	6.0		
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0		
Lane Grp Cap (vph)	538	1763		405	1669			453		399	474		
v/s Ratio Prot	c0.01	c0.18		0.00	0.12						0.02		
v/s Ratio Perm	0.10			0.03				c0.02		0.01			
v/c Ratio	0.20	0.35		0.06	0.25			0.07		0.04	0.06		
Uniform Delay, d1	9.3	13.3		11.1	13.8			22.5		22.3	22.4		
Progression Factor	0.62	0.78		1.00	1.00			1.00		1.00	1.00		
Incremental Delay, d2	0.2	0.5		0.1	0.4			0.3		0.2	0.2		
Delay (s)	6.0	11.0		11.2	14.2			22.8		22.5	22.7		
Level of Service	A	B		B	B			C		C	C		
Approach Delay (s)		10.2			14.0			22.8			22.6		
Approach LOS		B			B			C			C		

Intersection Summary

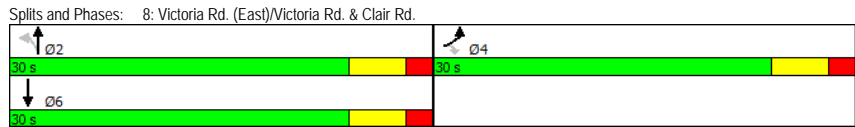
HCM 2000 Control Delay: 12.7
 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.25
 Actuated Cycle Length (s): 90.0
 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 49.6%
 ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

Queues
8: Victoria Rd. (East)/Victoria Rd. & Clair Rd.

Existing Traffic Conditions
 Weekday Afternoon Peak Hour

	←	↖	↗	↑	↓
Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations	↖	↗	↖	↗	↖
Traffic Volume (vph)	415	55	75	310	205
Future Volume (vph)	415	55	75	310	205
Lane Group Flow (vph)	415	55	75	310	545
Turn Type	Prot	Perm	Perm	NA	NA
Protected Phases	4			2	6
Permitted Phases		4	2		
Detector Phase	4	4	2	2	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Min	Min	Min
v/c Ratio	0.69	0.09	0.38	0.47	0.78
Control Delay	20.2	7.3	18.6	14.5	18.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	20.2	7.3	18.6	14.5	18.4
Queue Length 50th (m)	28.2	1.3	4.3	18.6	25.0
Queue Length 95th (m)	63.4	7.4	16.2	43.7	#70.5
Internal Link Dist (m)	1233.2		2005.5	465.2	
Turn Bay Length (m)		10.0	65.0		
Base Capacity (vph)	939	904	299	1008	986
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.44	0.06	0.25	0.31	0.55

Intersection Summary
 Cycle Length: 60
 Actuated Cycle Length: 45.9
 Natural Cycle: 50
 Control Type: Actuated-Uncoordinated
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis
8: Victoria Rd. (East)/Victoria Rd. & Clair Rd.

Existing Traffic Conditions
 Weekday Afternoon Peak Hour

	←	↖	↗	↑	↓	↘
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	415	55	75	310	205	340
Future Volume (vph)	415	55	75	310	205	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.92	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1684	1597	1785	1807	1637	
Flt Permitted	0.95	1.00	0.29	1.00	1.00	
Satd. Flow (perm)	1684	1597	537	1807	1637	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	415	55	75	310	205	340
RTOR Reduction (vph)	0	19	0	0	105	0
Lane Group Flow (vph)	415	36	75	310	440	0
Heavy Vehicles (%)	6%	0%	0%	4%	2%	7%
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	16.4	16.4	16.7	16.7	16.7	
Effective Green, g (s)	16.4	16.4	16.7	16.7	16.7	
Actuated g/C Ratio	0.36	0.36	0.37	0.37	0.37	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	612	580	198	669	606	
v/s Ratio Prot	c0.25			0.17	c0.27	
v/s Ratio Perm		0.02	0.14			
v/c Ratio	0.68	0.06	0.38	0.46	0.73	
Uniform Delay, d1	12.1	9.3	10.4	10.8	12.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.0	0.0	1.2	0.5	4.3	
Delay (s)	15.1	9.4	11.6	11.3	16.6	
Level of Service	B	A	B	B	B	
Approach Delay (s)	14.4			11.4	16.6	
Approach LOS	B			B	B	

Intersection Summary
 HCM 2000 Control Delay: 14.4, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.70
 Actuated Cycle Length (s): 45.1, Sum of lost time (s): 12.0
 Intersection Capacity Utilization: 73.8%, ICU Level of Service: D
 Analysis Period (min): 15
 c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
9: Clair Rd. & Laird Rd.

Existing Traffic Conditions
Weekday Afternoon Peak Hour

	→	↘	↙	←	↗	↖
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↖			↗	↖	↗
Traffic Volume (veh/h)	800	5	30	485	1	115
Future Volume (Veh/h)	800	5	30	485	1	115
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	800	5	30	485	1	115
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			805		1348	802
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			805		1348	802
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		99	70
cM capacity (veh/h)			819		160	384
Direction, Lane #	EB 1	WB 1	NE 1			
Volume Total	805	515	116			
Volume Left	0	30	1			
Volume Right	5	0	115			
cSH	1700	819	379			
Volume to Capacity	0.47	0.04	0.31			
Queue Length 95th (m)	0.0	0.9	10.2			
Control Delay (s)	0.0	1.0	18.6			
Lane LOS		A	C			
Approach Delay (s)	0.0	1.0	18.6			
Approach LOS			C			
Intersection Summary						
Average Delay		1.9				
Intersection Capacity Utilization		63.9%		ICU Level of Service	B	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
10: Gordon St. & Maltby Rd.

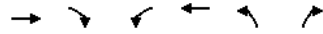
Existing Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	↘	↙	←	↗	↖	↗	↖	↗	↖	↗
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖			↗			↖	↗		↖	↗
Traffic Volume (veh/h)	30	10	50	5	5	0	35	945	10	5	710	30
Future Volume (Veh/h)	30	10	50	5	5	0	35	945	10	5	710	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	30	10	50	5	5	0	35	945	10	5	710	30
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	1752	1760	725	1805	1765	945	740			955		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1752	1760	725	1805	1765	945	740			955		
tC, single (s)	*4.8	*4.6	*4.4	*5.6	*5.0	6.2	4.1			4.3		
tC, 2 stage (s)												
tF (s)	*3.2	*3.0	*3.0	3.5	*3.5	3.3	2.2			2.4		
p0 queue free %	85	96	92	96	97	100	96			99		
cM capacity (veh/h)	202	230	659	113	177	320	862			652		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total	90	10	980	10	745							
Volume Left	30	5	35	0	5							
Volume Right	50	0	0	10	30							
cSH	336	138	862	1700	652							
Volume to Capacity	0.27	0.07	0.04	0.01	0.01							
Queue Length 95th (m)	8.5	1.8	1.0	0.0	0.2							
Control Delay (s)	19.6	33.1	1.2	0.0	0.2							
Lane LOS	C	D	A		A							
Approach Delay (s)	19.6	33.1	1.1		0.2							
Approach LOS	C	D										
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			86.0%		ICU Level of Service	E						
Analysis Period (min)			15									

* User Entered Value

HCM Unsignalized Intersection Capacity Analysis
11: Victoria Rd. (West) & Maltby Rd.

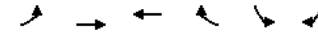
Existing Traffic Conditions
Weekday Afternoon Peak Hour



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	30	10	215	20	5	330
Future Volume (Veh/h)	30	10	215	20	5	330
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	30	10	215	20	5	330
Pedestrians					1	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.2	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			41		486	36
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			41		486	36
tC, single (s)			4.1		6.7	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.8	3.3
p0 queue free %			86		99	68
cM capacity (veh/h)			1574		421	1033
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	40	235	335			
Volume Left	0	215	5			
Volume Right	10	0	330			
cSH	1700	1574	1011			
Volume to Capacity	0.02	0.14	0.33			
Queue Length 95th (m)	0.0	3.8	11.7			
Control Delay (s)	0.0	7.1	10.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	7.1	10.3			
Approach LOS			B			
Intersection Summary						
Average Delay		8.4				
Intersection Capacity Utilization		47.0%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
12: Maltby Rd. & Victoria Rd. (East)

Existing Traffic Conditions
Weekday Afternoon Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Traffic Volume (veh/h)	345	15	10	30	35	230
Future Volume (Veh/h)	345	15	10	30	35	230
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	345	15	10	30	35	230
Pedestrians					1	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.2	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	41				731	26
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	41				731	26
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				88	78
cM capacity (veh/h)	1561				301	1049
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	360	40	265			
Volume Left	345	0	35			
Volume Right	0	30	230			
cSH	1561	1700	790			
Volume to Capacity	0.22	0.02	0.34			
Queue Length 95th (m)	6.8	0.0	11.8			
Control Delay (s)	7.7	0.0	11.8			
Lane LOS	A		B			
Approach Delay (s)	7.7	0.0	11.8			
Approach LOS			B			
Intersection Summary						
Average Delay		8.9				
Intersection Capacity Utilization		49.4%	ICU Level of Service	A		
Analysis Period (min)		15				

Appendix N – Corridor Growth Traffic Analysis Calculations

Background Traffic Growth/Decline Summary

Location: **Gordon Street Background Growth, South of Clair Road**
Time Period: **2008** to **2017**
Analyst: **IFC**

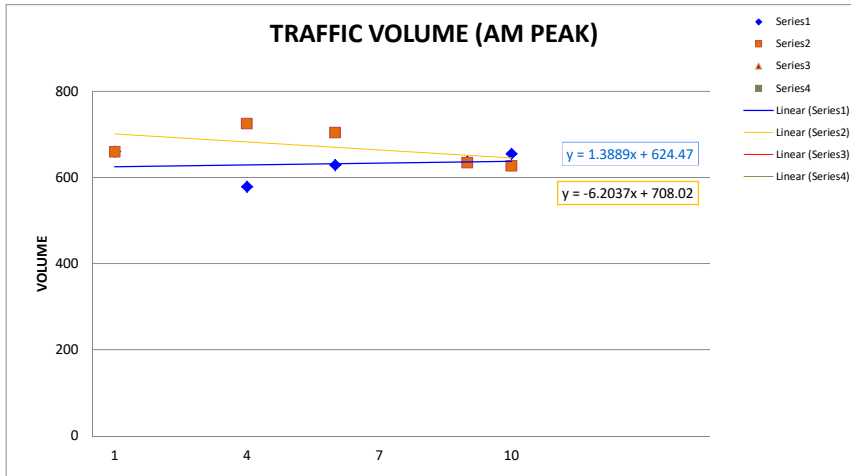
Weekday AM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	0.20%
Southbound	-0.80%
Eastbound	0.00%
Westbound	0.00%

Weekday PM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	0.62%
Southbound	0.80%
Eastbound	0.00%
Westbound	0.00%

Gordon Street Background Growth, South of Clair Road

Gordon Street Background Growth, South of Clair Road

Movement	1 2008		4 2011		6 2013		9 2016		10 2017	
	am	pm	am	pm	am	pm	am	pm	am	pm
NBT	661	832	579	813	630	1111	638	831	656	904
SBT	660	702	726	697	705	1005	635	757	628	748



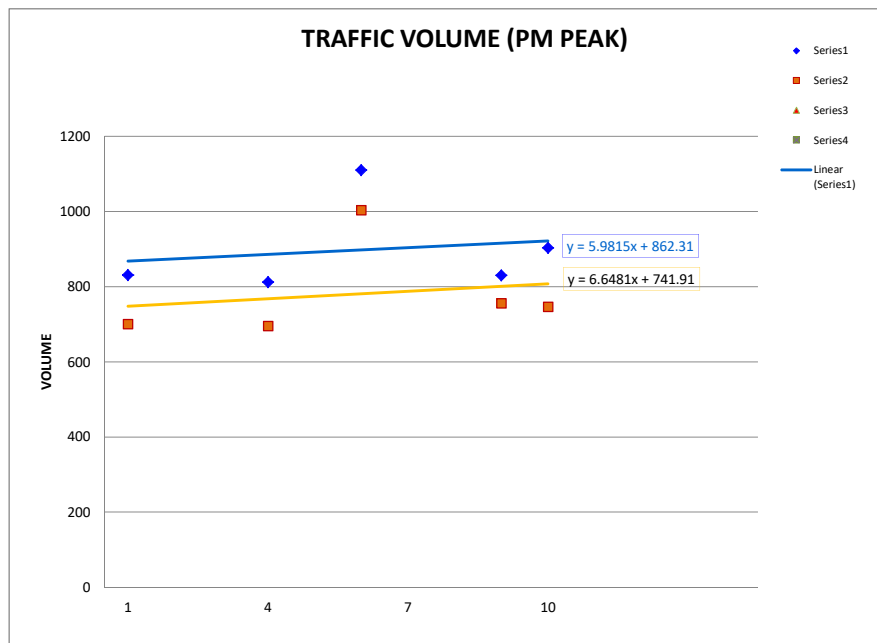
Year	X	Y
2008	1	626
2017	10	638

Year	X	Y
2008	1	702
2017	10	646

Growth/year NB	
1	0.20%

N-S Average	-0.3%
-------------	-------

Growth/year SB	
-6	-0.80%



Year	X	Y
2008	1	868
2017	10	922

Year	X	Y
2008	1	749
2017	10	808

Growth/year NB	
5	0.62%

N-S Average	0.7%
E-W Average	0.0%
Total Average	0.4%

Growth/year SB	
6	0.80%

Background Traffic Growth/Decline Summary

Location: **Gordon Street Background Growth, North of Maltby Road**
Time Period: **2008** to **2017**
Analyst: **IFC**

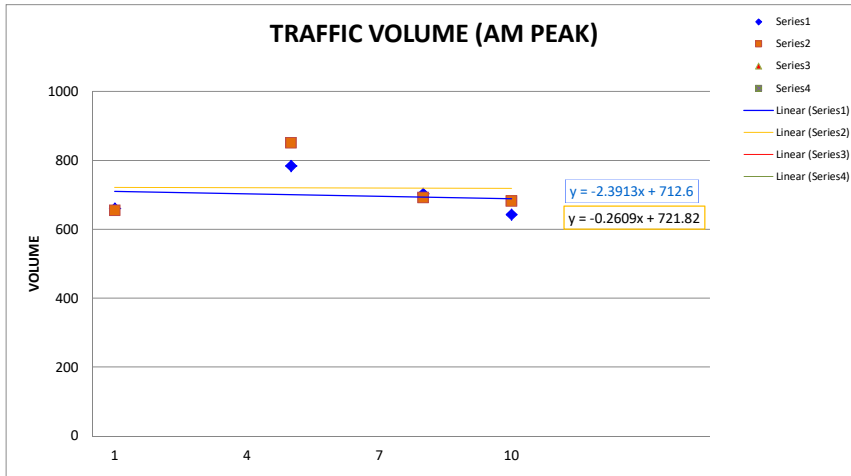
Weekday AM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	-0.30%
Southbound	-0.03%
Eastbound	0.00%
Westbound	0.00%

Weekday PM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	0.47%
Southbound	0.27%
Eastbound	0.00%
Westbound	0.00%

Gordon Street Background Growth, North of Maltby Road

Gordon Street Background Growth, North of Maltby Road

Movement	1		5		8		10		10	
	2008		2012		2015		2017			
	am	pm	am	pm	am	pm	am	pm	am	pm
NBT	661	1074	785	1019	704	1371	643	977		
SBT	655	845	851	852	693	1109	682	745		

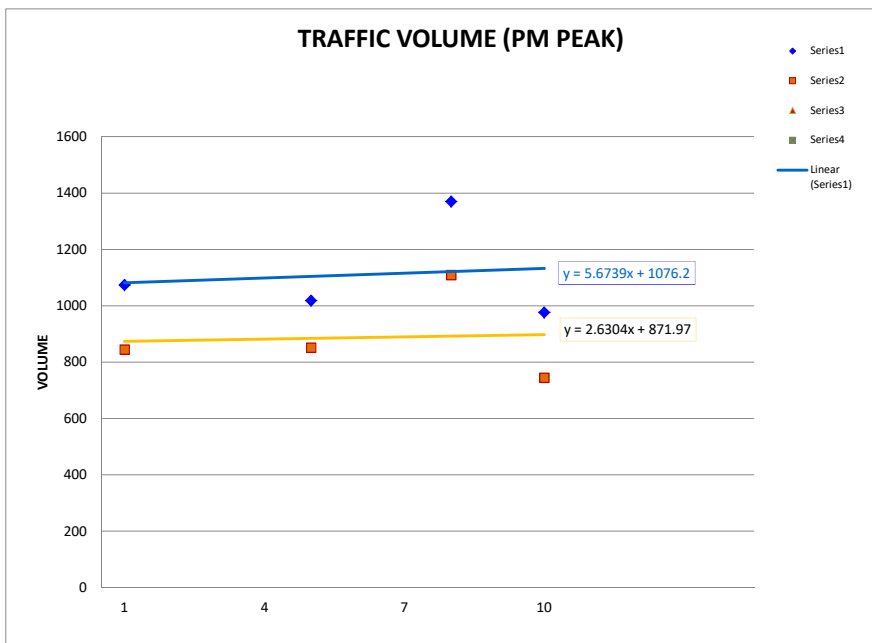


Year	X	Y
2008	1	710
2017	10	689
Year	X	Y
2008	1	722
2017	10	719

Growth/year NB	
-2	-0.30%

N-S Average	0%
-------------	----

Growth/year SB	
0	-0.03%



Year	X	Y
2008	1	1082
2017	10	1133
Year	X	Y
2008	1	875
2017	10	898

Growth/year NB	
5	0.47%

N-S Average	0%
E-W Average	0%
Total Average	0%

Growth/year SB	
2	0.27%

Background Traffic Growth/Decline Summary

Location: **Clair Road Background Growth, East of Gordon Street**
Time Period: **2008** to **2017**
Analyst: **IFC**

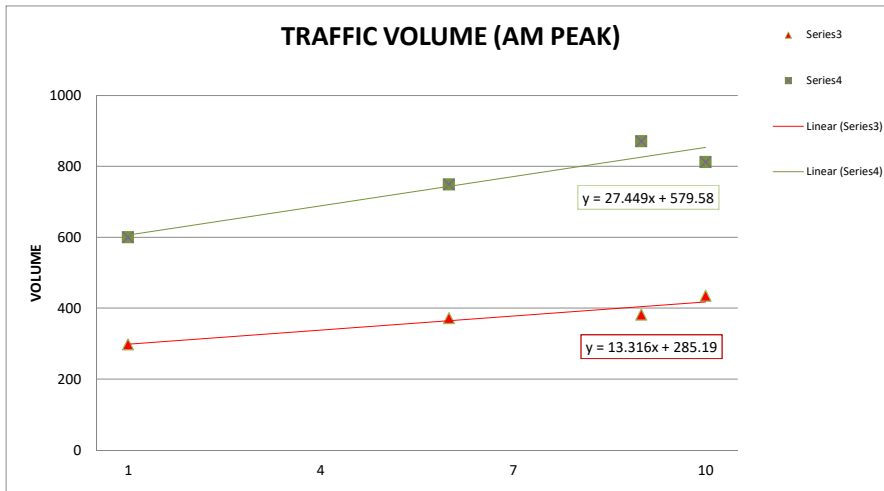
Weekday AM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	0.00%
Southbound	0.00%
Eastbound	4.01%
Westbound	4.07%

Weekday PM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	0.00%
Southbound	0.00%
Eastbound	4.07%
Westbound	5.37%

Clair Road Background Growth, East of Gordon Street

Clair Road Background Growth, East of Gordon Street

Movement	1		6		9		10		10	
	2008		2013		2016		2017			
	am	pm	am	pm	am	pm	am	pm	am	pm
EBT	298	662	372	1049	382	978	435	953		
WBT	600	370	749	639	871	592	812	595		



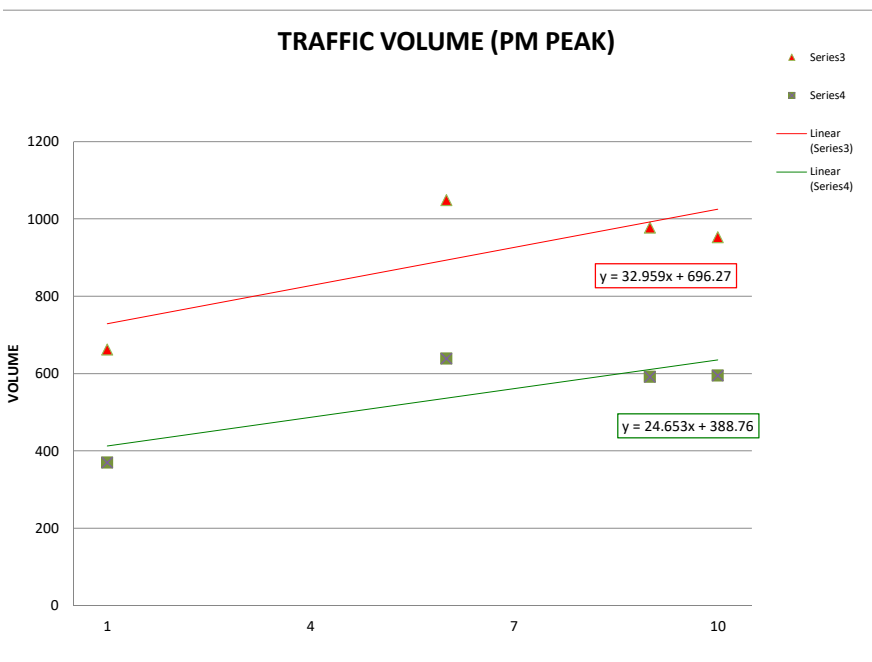
Year	X	Y
2008	1	299
2017	10	418

Year	X	Y
2008	1	607
2017	10	854

Growth/year EB	
12	4.01%

E-W Average	4.0%
-------------	------

Growth/year WB	
25	4.07%



Year	X	Y
2008	1	729
2017	10	1026

Year	X	Y
2008	1	413
2017	10	635

Growth/year EB	
30	4.07%

E-W Average	4.7%
-------------	------

Growth/year WB	
22	5.37%

Background Traffic Growth/Decline Summary

Location: **Clair Road Background Growth, West of Gordon Street**

Time Period: **2008** to **2017**

Analyst: **IFC**

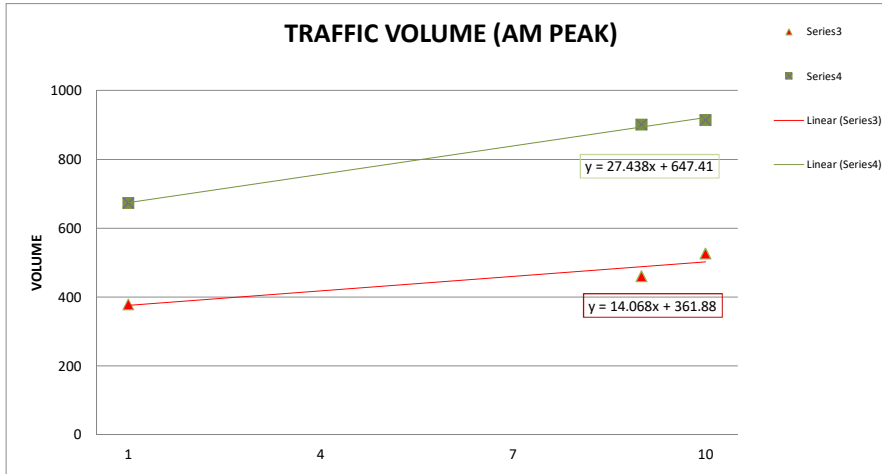
Weekday AM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	0.00%
Southbound	0.00%
Eastbound	3.51%
Westbound	3.66%

Weekday PM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	0.00%
Southbound	0.00%
Eastbound	3.39%
Westbound	3.97%

Clair Road Background Growth, West of Gordon Street

Clair Road Background Growth, West of Gordon Street

Movement	1		6		9		10		10	
	2008		2013		2016		2017			
	am	pm	am	pm	am	pm	am	pm	am	pm
EBT	379	726			461	957	527	964		
WBT	674	465			902	600	915	668		

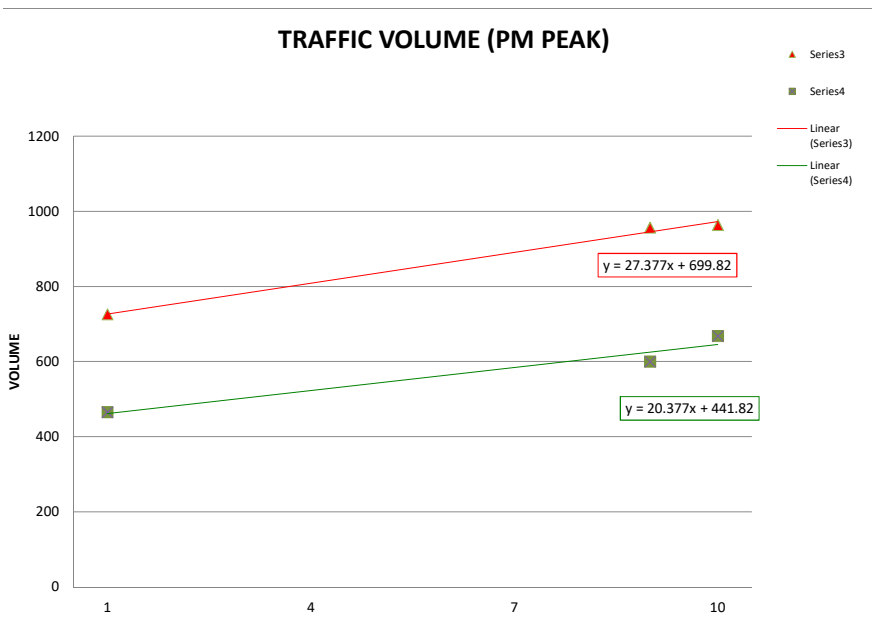


Year	X	Y
2008	1	377
2017	10	509
Year	X	Y
2008	1	675
2017	10	922

Growth/year EB	
13	3.51%

E-W Average	3.6%
-------------	------

Growth/year WB	
25	3.66%



Year	X	Y
2008	1	727
2017	10	974
Year	X	Y
2008	1	462
2017	10	646

Growth/year EB	
25	3.39%

E-W Average	3.7%
-------------	------

Growth/year WB	
18	3.97%

Background Traffic Growth/Decline Summary

Location: **Victoria Road Background Growth, South of Clair Road**
Time Period: **2008** to **2017**
Analyst: **IFC**

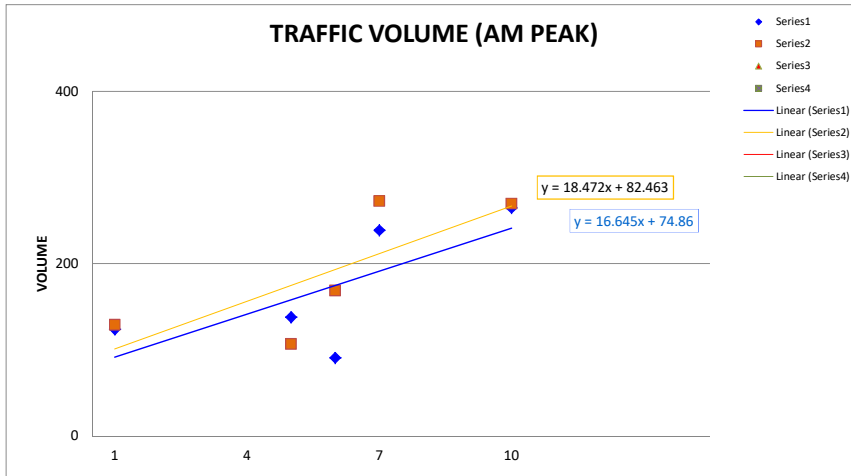
Weekday AM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	16.37%
Southbound	16.47%
Eastbound	0.00%
Westbound	0.00%

Weekday PM Peak Hour	
<i>Direction</i>	<i>Percent Change</i>
Northbound	25.48%
Southbound	11.40%
Eastbound	0.00%
Westbound	0.00%

Victoria Road Background Growth, South of Clair Road

Victoria Road Background Growth, South of Clair Road

Movement	1 2008		5 2012		6 2013		7 2014		10 2017	
	am	pm	am	pm	am	pm	am	pm	am	pm
NBT	124	171	138	89	91	142	239	338	265	384
SBT	129	128	107	191	169	178	273	279	270	261



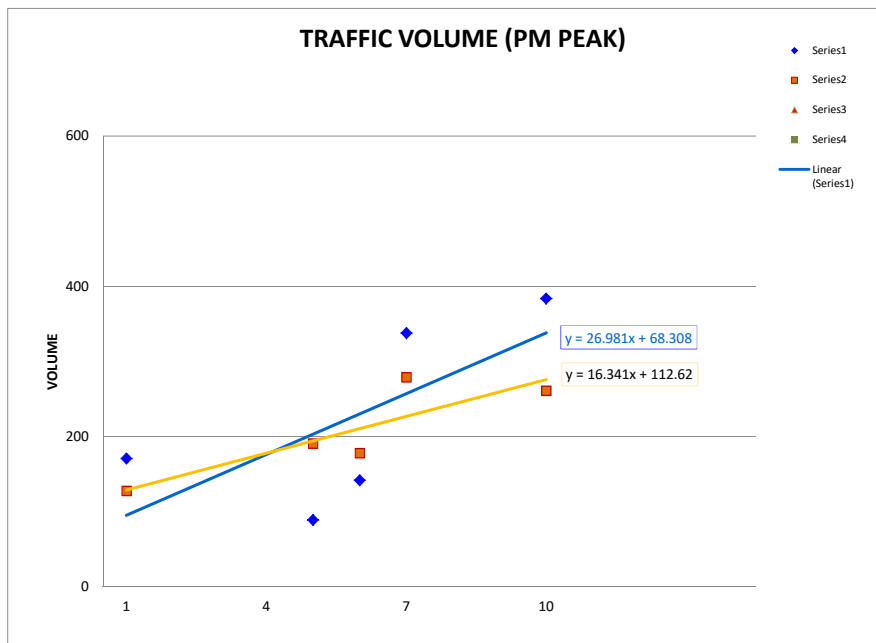
Year	X	Y
2008	1	92
2017	10	241

Year	X	Y
2008	1	101
2017	10	267

Growth/year NB	
15	16.37%

N-S Average	
	16%

Growth/year SB	
17	16.47%



Year	X	Y
2008	1	95
2017	10	338

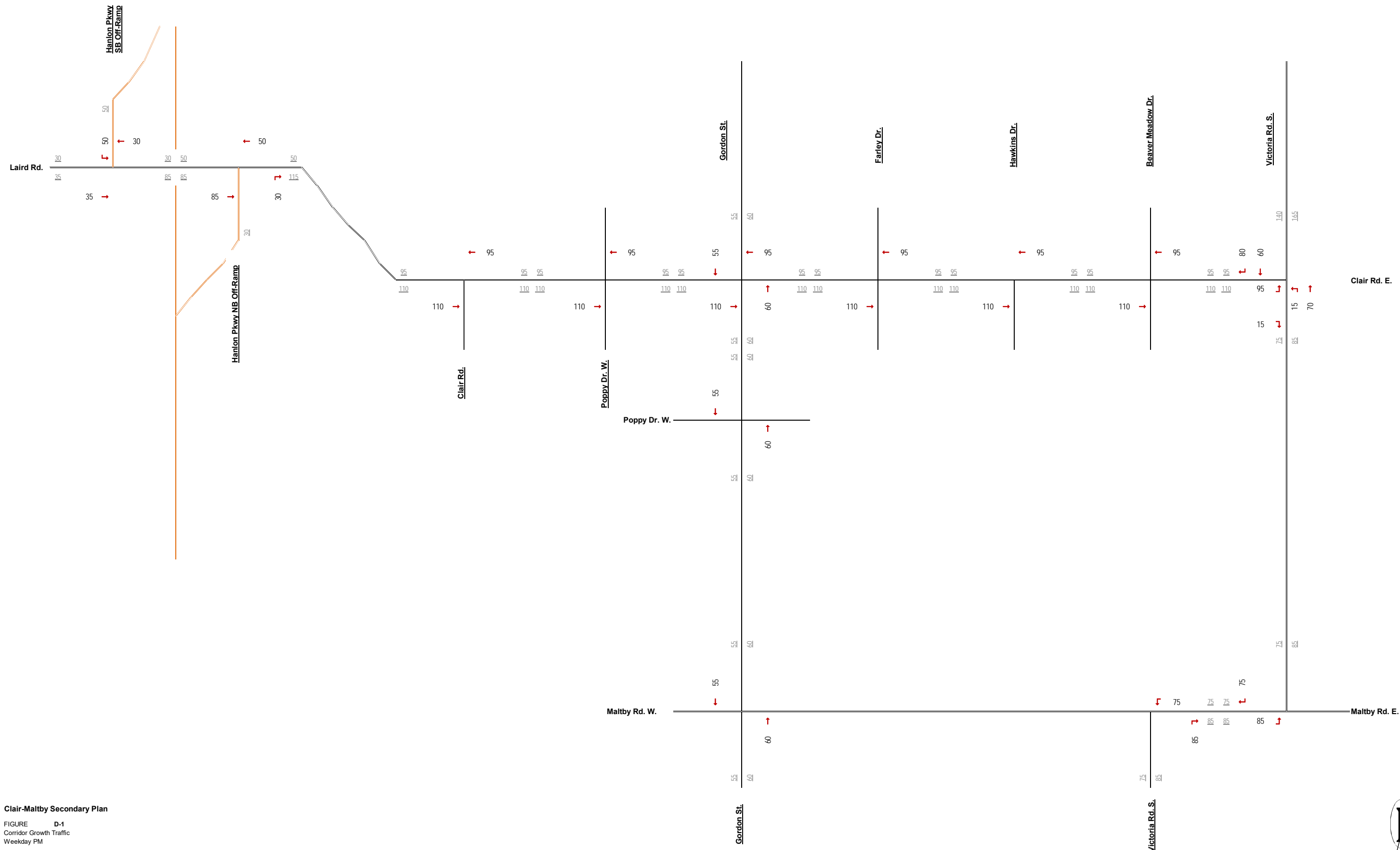
Year	X	Y
2008	1	129
2017	10	276

Growth/year NB	
24	25.48%

N-S Average	
	18%
E-W Average	
	0%
Total Average	
	9%

Growth/year SB	
15	11.40%

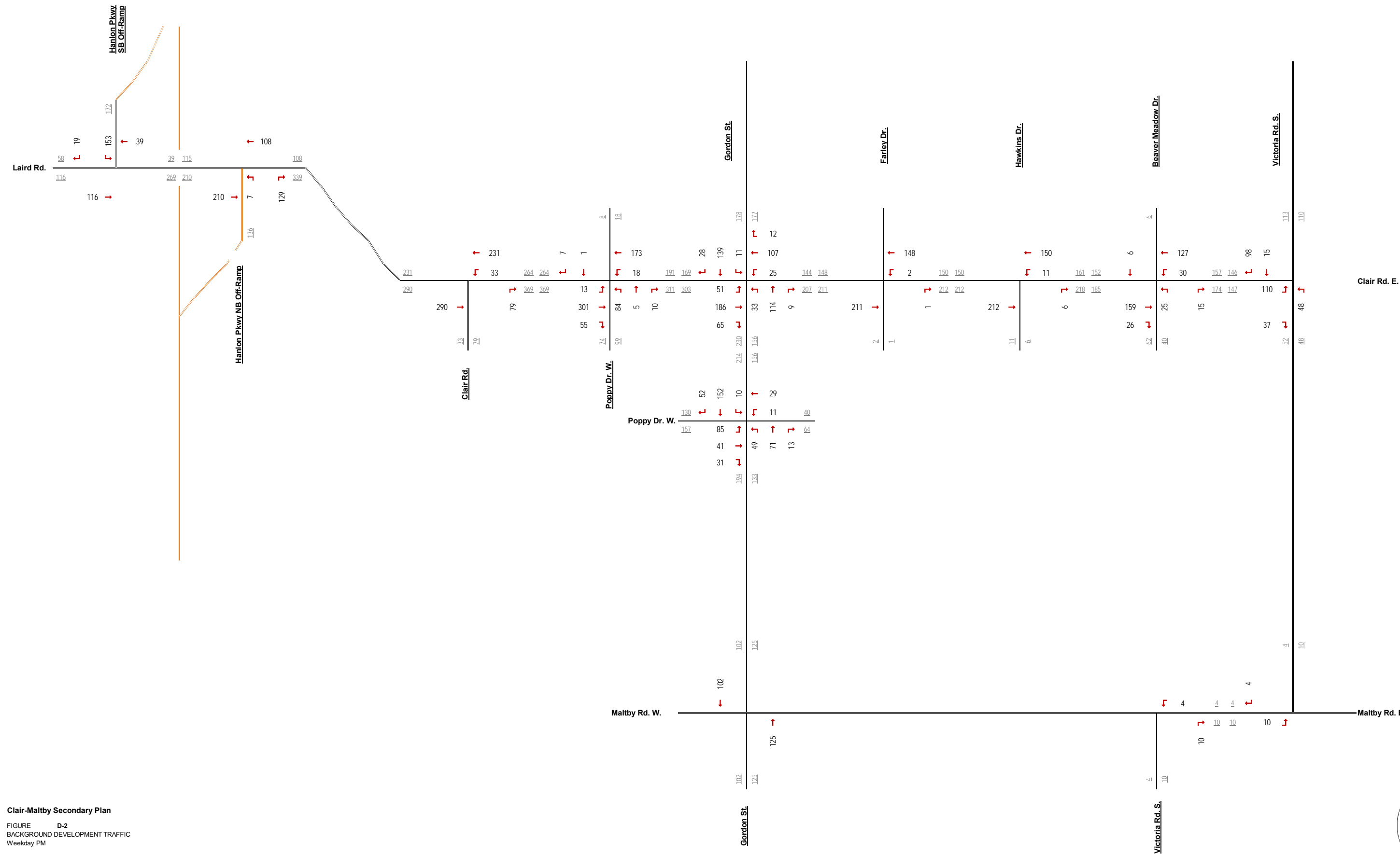
Appendix O – Background Traffic Volumes (Corridor Growth and Site-Specific Background Developments)



Clair-Maltby Secondary Plan

FIGURE D-1
Corridor Growth Traffic
Weekday PM





Clair-Maltby Secondary Plan
 FIGURE D-2
 BACKGROUND DEVELOPMENT TRAFFIC
 Weekday PM

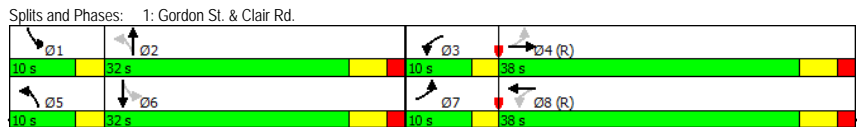


Appendix P – Synchro Analysis Results: Future Background Traffic Conditions

Queues
1: Gordon St. & Clair Rd. Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	↘	←	↙	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖↗	↖	↖↗	↖	↖↗	↖	↖↗
Traffic Volume (vph)	290	890	140	575	185	700	185	730
Future Volume (vph)	290	890	140	575	185	700	185	730
Lane Group Flow (vph)	290	1050	140	675	185	875	185	880
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	9.5	24.0	9.5	24.0
Total Split (s)	10.0	38.0	10.0	38.0	10.0	32.0	10.0	32.0
Total Split (%)	11.1%	42.2%	11.1%	42.2%	11.1%	35.6%	11.1%	35.6%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0	3.0	6.0	3.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	Max	None	Max
v/c Ratio	0.83	0.84	0.68	0.55	0.82	0.87	0.79	0.88
Control Delay	50.2	48.8	28.4	22.2	48.0	40.1	43.0	41.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.2	48.8	28.4	22.2	48.0	40.1	43.0	41.0
Queue Length 50th (m)	54.3	107.5	19.2	56.1	20.7	76.5	20.6	77.7
Queue Length 95th (m)	m#94.7	129.0	#35.4	69.5	#51.8	#110.8	#49.3	#112.5
Internal Link Dist (m)		775.0		194.1		153.6		314.0
Turn Bay Length (m)	75.0		25.0		50.0		140.0	
Base Capacity (vph)	351	1251	207	1231	225	1006	234	1004
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.84	0.68	0.55	0.82	0.87	0.79	0.88

Intersection Summary
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green, Master Intersection
 Natural Cycle: 80
 Control Type: Actuated-Coordinated
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis
1: Gordon St. & Clair Rd. Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	↘	←	↙	↑	↘	↓	↙	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗		↖	↖↗		↖	↖↗		↖	↖↗	
Traffic Volume (vph)	290	890	160	140	575	100	185	700	175	185	730	150
Future Volume (vph)	290	890	160	140	575	100	185	700	175	185	730	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.97		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)	1784	3475		1612	3418		1735	3400		1804	3411	
Flt Permitted	0.29	1.00		0.12	1.00		0.15	1.00		0.15	1.00	
Satd. Flow (perm)	550	3475		212	3418		281	3400		292	3411	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	290	890	160	140	575	100	185	700	175	185	730	150
RTOR Reduction (vph)	0	16	0	0	15	0	0	24	0	0	19	0
Lane Group Flow (vph)	290	1034	0	140	660	0	185	851	0	185	861	0
Confl. Peds. (#/hr)	17		7	7		17	2		11	11		2
Confl. Bikes (#/hr)							1					
Heavy Vehicles (%)	1%	1%	2%	12%	3%	1%	4%	1%	8%	0%	2%	7%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	39.0	32.0		39.0	32.0		33.0	26.0		33.0	26.0	
Effective Green, g (s)	39.0	32.0		39.0	32.0		33.0	26.0		33.0	26.0	
Actuated g/C Ratio	0.43	0.36		0.43	0.36		0.37	0.29		0.37	0.29	
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	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)	334	1235		200	1215		216	982		224	985	
v/s Ratio Prot	c0.07	0.30		0.05	0.19		c0.07	0.25		0.06	c0.25	
v/s Ratio Perm	c0.31			0.25			0.25			0.24		
v/c Ratio	0.87	0.84		0.70	0.54		0.86	0.87		0.83	0.87	
Uniform Delay, d1	20.7	26.6		18.7	23.2		22.1	30.4		22.0	30.4	
Progression Factor	2.10	1.65		0.83	0.91		1.00	1.00		1.00	1.00	
Incremental Delay, d2	16.7	5.4		9.6	1.6		26.7	10.2		21.3	10.7	
Delay (s)	60.2	49.2		25.0	22.7		48.9	40.5		43.3	41.1	
Level of Service	E	D		C	C		D	D		D	D	
Approach Delay (s)		51.6			23.1			42.0			41.5	
Approach LOS		D			C			D			D	

Intersection Summary
 HCM 2000 Control Delay 41.3 HCM 2000 Level of Service D
 HCM 2000 Volume to Capacity ratio 0.87
 Actuated Cycle Length (s) 90.0 Sum of lost time (s) 18.0
 Intersection Capacity Utilization 89.6% ICU Level of Service E
 Analysis Period (min) 15
 c Critical Lane Group

Queues
2: Gordon St. & Poppy Dr.

Future Background Traffic Conditions
Weekday Afternoon Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔	↔	↔	↔	↔
Traffic Volume (vph)	95	60	55	50	60	940	50	910
Future Volume (vph)	95	60	55	50	60	940	50	910
Lane Group Flow (vph)	0	190	0	145	60	1005	50	965
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	pm+pt	NA
Protected Phases		4		8		5		2
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	9.5	24.0	9.5	24.0
Total Split (s)	30.0	30.0	30.0	30.0	10.0	50.0	10.0	50.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	11.1%	55.6%	11.1%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0		3.0		6.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
v/c Ratio		0.67		0.49	0.14	0.49	0.13	0.47
Control Delay		39.5		30.0	5.8	12.3	5.8	12.2
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		39.5		30.0	5.8	12.3	5.8	12.2
Queue Length 50th (m)		27.0		17.9	2.6	49.7	2.1	47.2
Queue Length 95th (m)		48.8		35.6	8.1	83.6	7.0	79.3
Internal Link Dist (m)		247.7		256.4		171.0		153.6
Turn Bay Length (m)					65.0		27.0	
Base Capacity (vph)		440		450	428	2045	411	2043
Starvation Cap Reductn		0		0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0
Reduced v/c Ratio		0.43		0.32	0.14	0.49	0.12	0.47

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 78.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Gordon St. & Poppy Dr.



HCM Signalized Intersection Capacity Analysis
2: Gordon St. & Poppy Dr.

Future Background Traffic Conditions
Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↔	↔		↔	↔	
Traffic Volume (vph)	95	60	35	55	50	40	60	940	65	50	910	55
Future Volume (vph)	95	60	35	55	50	40	60	940	65	50	910	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		3.0	6.0		3.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt		0.98			0.96		1.00	0.99		1.00	0.99	
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1772			1760		1770	3505		1770	3509	
Flt Permitted		0.77			0.79		0.25	1.00		0.23	1.00	
Satd. Flow (perm)		1406			1417		464	3505		436	3509	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	95	60	35	55	50	40	60	940	65	50	910	55
RTOR Reduction (vph)	0	10	0	0	17	0	0	5	0	0	4	0
Lane Group Flow (vph)	0	180	0	0	128	0	60	1000	0	50	961	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		15.4			15.4		49.6	45.9		49.6	45.9	
Effective Green, g (s)		15.4			15.4		49.6	45.9		49.6	45.9	
Actuated g/C Ratio		0.19			0.19		0.62	0.57		0.62	0.57	
Clearance Time (s)		6.0			6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		270			272		348	2010		332	2013	
v/s Ratio Prot							c0.01	c0.29		0.01	0.27	
v/s Ratio Perm		c0.13			0.09		0.10			0.09		
v/c Ratio		0.67			0.47		0.17	0.50		0.15	0.48	
Uniform Delay, d1		29.9			28.7		6.4	10.2		6.4	10.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		6.1			1.3		0.2	0.9		0.2	0.8	
Delay (s)		36.1			30.0		6.6	11.1		6.6	10.8	
Level of Service		D			C		A	B		A	B	
Approach Delay (s)		36.1			30.0			10.8			10.6	
Approach LOS		D			C			B			B	

Intersection Summary

HCM 2000 Control Delay: 13.9, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.52
 Actuated Cycle Length (s): 80.0, Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 61.0%, ICU Level of Service: B
 Analysis Period (min): 15

c Critical Lane Group

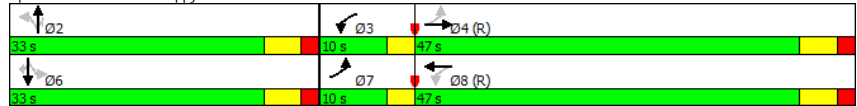
Queues
3: Poppy Dr./Clairfields Dr. & Clair Rd. Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	↖		→		↗		←		↙	
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖	↖	↖		↖	↖	↖	↖	↖
Traffic Volume (vph)	120	1215	25	700	95	10	10	20	5	80
Future Volume (vph)	120	1215	25	700	95	10	10	20	5	80
Lane Group Flow (vph)	120	1280	25	745	0	105	10	0	25	80
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	3	8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	10.0	47.0	10.0	47.0	33.0	33.0	33.0	33.0	33.0	33.0
Total Split (%)	11.1%	52.2%	11.1%	52.2%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0		6.0	6.0		6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes						
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max
v/c Ratio	0.30	0.69	0.11	0.46	0.26	0.02		0.06	0.15	
Control Delay	9.8	19.4	12.1	23.6	26.0	0.1		23.0	6.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	9.8	19.4	12.1	23.6	26.0	0.1		23.0	6.5	
Queue Length 50th (m)	8.6	77.2	2.9	58.8	14.4	0.0		3.2	0.0	
Queue Length 95th (m)	16.0	128.5	m4.5	m73.5	28.1	0.0		9.2	10.1	
Internal Link Dist (m)		186.5		775.0		114.2			150.9	
Turn Bay Length (m)	55.0		45.0			20.0			20.0	
Base Capacity (vph)	404	1844	256	1610		408	526		450	530
Starvation Cap Reductn	0	0	0	0		0	0		0	0
Spillback Cap Reductn	0	0	0	0		0	0		0	0
Storage Cap Reductn	0	0	0	0		0	0		0	0
Reduced v/c Ratio	0.30	0.69	0.10	0.46		0.26	0.02		0.06	0.15

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 86.4 (96%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Poppy Dr./Clairfields Dr. & Clair Rd.



HCM Signalized Intersection Capacity Analysis
3: Poppy Dr./Clairfields Dr. & Clair Rd. Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	↖		→		↗		←		↙			
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖		↖	↖			↖	↖	↖	↖	↖
Traffic Volume (vph)	120	1215	65	25	700	45	95	10	10	20	5	80
Future Volume (vph)	120	1215	65	25	700	45	95	10	10	20	5	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0			6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	1.00
Flt	1.00	0.99		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1770	3512		1770	3507			1782	1583		1791	1583
Flt Permitted	0.28	1.00		0.13	1.00			0.73	1.00		0.80	1.00
Satd. Flow (perm)	522	3512		242	3507			1359	1583		1499	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	120	1215	65	25	700	45	95	10	10	20	5	80
RTOR Reduction (vph)	0	4	0	0	5	0	0	0	7	0	0	56
Lane Group Flow (vph)	120	1276	0	25	740	0	105	3	0	25	24	24
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	51.0	45.4		43.8	41.2			27.0	27.0		27.0	27.0
Effective Green, g (s)	51.0	45.4		43.8	41.2			27.0	27.0		27.0	27.0
Actuated g/C Ratio	0.57	0.50		0.49	0.46			0.30	0.30		0.30	0.30
Clearance Time (s)	3.0	6.0		3.0	6.0			6.0	6.0		6.0	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)	390	1771		161	1605			407	474		449	474
v/s Ratio Prot	c0.02	c0.36		0.00	0.21						0.02	0.02
v/s Ratio Perm	0.15			0.07				c0.08	0.00		0.02	0.02
v/c Ratio	0.31	0.72		0.16	0.46			0.26	0.01		0.06	0.05
Uniform Delay, d1	9.8	17.4		13.6	16.8			23.9	22.1		22.4	22.4
Progression Factor	1.00	1.00		1.53	1.36			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	2.6		0.3	0.7			1.5	0.0		0.2	0.2
Delay (s)	10.3	19.9		21.2	23.5			25.4	22.1		22.7	22.6
Level of Service	B	B		C	C			C	C		C	C
Approach Delay (s)		19.1			23.5			25.1			22.6	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay: 20.9, HCM 2000 Level of Service: C
 HCM 2000 Volume to Capacity ratio: 0.54
 Actuated Cycle Length (s): 90.0, Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 65.6%, ICU Level of Service: C
 Analysis Period (min): 15
 c Critical Lane Group

Queues
4: Hwy. 6 Northbound Off-Ramp & Laird Rd.

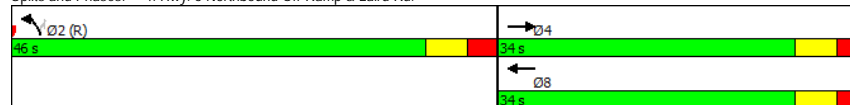
Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	→	←	↶	↷
Lane Group	EBT	WBT	NBL	NBR
Lane Configurations	↑↑	↑↑	↶	↷
Traffic Volume (vph)	775	660	30	295
Future Volume (vph)	775	660	30	295
Lane Group Flow (vph)	775	660	30	295
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	2	
Permitted Phases				2
Minimum Split (s)	24.0	24.0	25.0	25.0
Total Split (s)	34.0	34.0	46.0	46.0
Total Split (%)	42.5%	42.5%	57.5%	57.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	7.0	7.0
Lead/Lag				
Lead-Lag Optimize?				
v/c Ratio	0.64	0.55	0.03	0.42
Control Delay	21.6	23.0	10.9	12.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	21.6	23.0	10.9	12.8
Queue Length 50th (m)	45.3	43.9	2.4	22.8
Queue Length 95th (m)	69.6	60.7	6.6	42.4
Internal Link Dist (m)	282.0	205.6	157.0	
Turn Bay Length (m)				100.0
Base Capacity (vph)	1203	1203	879	696
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.64	0.55	0.03	0.42

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green
 Natural Cycle: 50
 Control Type: Pretimed

Splits and Phases: 4: Hwy. 6 Northbound Off-Ramp & Laird Rd.



HCM Signalized Intersection Capacity Analysis
4: Hwy. 6 Northbound Off-Ramp & Laird Rd.

Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	→	↶	↷	←	↶	↷
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↶	↷
Traffic Volume (vph)	775	0	0	660	30	295
Future Volume (vph)	775	0	0	660	30	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	7.0	7.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Flt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3438			3438	1805	1369
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	3438			3438	1805	1369
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	775	0	0	660	30	295
RTOR Reduction (vph)	0	0	0	0	0	29
Lane Group Flow (vph)	775	0	0	660	30	266
Heavy Vehicles (%)	5%	2%	2%	5%	0%	18%
Turn Type	NA			NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases						2
Actuated Green, G (s)	28.0			28.0	39.0	39.0
Effective Green, g (s)	28.0			28.0	39.0	39.0
Actuated g/C Ratio	0.35			0.35	0.49	0.49
Clearance Time (s)	6.0			6.0	7.0	7.0
Lane Grp Cap (vph)	1203			1203	879	667
v/s Ratio Prot	c0.23			0.19	0.02	
v/s Ratio Perm						c0.19
v/c Ratio	0.64			0.55	0.03	0.40
Uniform Delay, d1	21.8			20.9	10.7	13.0
Progression Factor	0.86			1.00	1.00	1.00
Incremental Delay, d2	2.6			1.8	0.1	1.8
Delay (s)	21.3			22.7	10.8	14.8
Level of Service	C			C	B	B
Approach Delay (s)	21.3			22.7	14.5	
Approach LOS	C			C	B	

Intersection Summary

HCM 2000 Control Delay: 20.6, HCM 2000 Level of Service: C
 HCM 2000 Volume to Capacity ratio: 0.50
 Actuated Cycle Length (s): 80.0, Sum of lost time (s): 13.0
 Intersection Capacity Utilization: 50.5%, ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

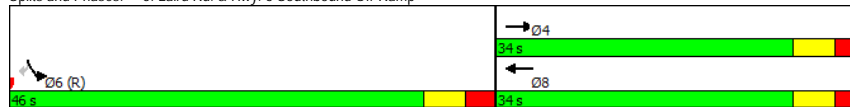
Queues
5: Laird Rd. & Hwy. 6 Southbound Off-Ramp

Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	→	←	↘	↙
Lane Group	EBT	WBT	SBL	SBR
Lane Configurations	↑↑	↑↑	↑↓	↑
Traffic Volume (vph)	365	435	500	60
Future Volume (vph)	365	435	500	60
Lane Group Flow (vph)	365	435	500	60
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	6	
Permitted Phases				6
Minimum Split (s)	24.0	24.0	25.0	25.0
Total Split (s)	34.0	34.0	46.0	46.0
Total Split (%)	42.5%	42.5%	57.5%	57.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	7.0	7.0
Lead/Lag				
Lead-Lag Optimize?				
v/c Ratio	0.30	0.35	0.31	0.08
Control Delay	19.7	29.8	13.1	3.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	19.7	29.8	13.1	3.5
Queue Length 50th (m)	21.9	25.1	23.6	0.0
Queue Length 95th (m)	32.7	40.0	33.8	5.8
Internal Link Dist (m)	199.6	282.0	265.0	
Turn Bay Length (m)				40.0
Base Capacity (vph)	1226	1250	1610	759
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.30	0.35	0.31	0.08

Intersection Summary
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 50
 Control Type: Pretimed

Splits and Phases: 5: Laird Rd. & Hwy. 6 Southbound Off-Ramp



HCM Signalized Intersection Capacity Analysis
5: Laird Rd. & Hwy. 6 Southbound Off-Ramp

Future Background Traffic Conditions
Weekday Afternoon Peak Hour

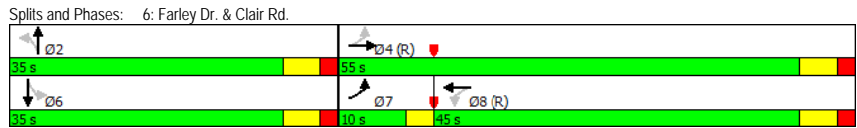
	↖	→	←	↗	↘	
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↓	↑
Traffic Volume (vph)	0	365	435	0	500	60
Future Volume (vph)	0	365	435	0	500	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		7.0	7.0
Lane Util. Factor		0.95	0.95		0.97	1.00
Flt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3505	3574		3303	1495
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		3505	3574		3303	1495
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	365	435	0	500	60
RTOR Reduction (vph)	0	0	0	0	0	31
Lane Group Flow (vph)	0	365	435	0	500	29
Heavy Vehicles (%)	2%	3%	1%	2%	6%	8%
Turn Type	NA	NA		Prot	Perm	
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		28.0	28.0		39.0	39.0
Effective Green, g (s)		28.0	28.0		39.0	39.0
Actuated g/C Ratio		0.35	0.35		0.49	0.49
Clearance Time (s)		6.0	6.0		7.0	7.0
Lane Grp Cap (vph)		1226	1250		1610	728
v/s Ratio Prot		0.10	c0.12		c0.15	
v/s Ratio Perm						0.02
v/c Ratio		0.30	0.35		0.31	0.04
Uniform Delay, d1		18.9	19.2		12.4	10.7
Progression Factor		1.00	1.50		1.00	1.00
Incremental Delay, d2		0.6	0.7		0.5	0.1
Delay (s)		19.5	29.5		12.9	10.8
Level of Service		B	C		B	B
Approach Delay (s)		19.5	29.5		12.7	
Approach LOS		B	C		B	

Intersection Summary
 HCM 2000 Control Delay: 19.9, HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.33
 Actuated Cycle Length (s): 80.0, Sum of lost time (s): 13.0
 Intersection Capacity Utilization: 50.5%, ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

Queues
6: Farley Dr. & Clair Rd. Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	↘	←	↙	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖↗	↖	↖↗	↖	↖↗	↖	↖↗
Traffic Volume (vph)	235	815	45	595	115	65	55	50
Future Volume (vph)	235	815	45	595	115	65	55	50
Lane Group Flow (vph)	235	1005	45	650	115	100	55	190
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4	8	8	2	2	6	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	10.0	55.0	45.0	45.0	35.0	35.0	35.0	35.0
Total Split (%)	11.1%	61.1%	50.0%	50.0%	38.9%	38.9%	38.9%	38.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	Max	Max	Max	Max
v/c Ratio	0.53	0.54	0.20	0.44	0.32	0.17	0.14	0.30
Control Delay	16.5	17.2	14.3	15.8	26.1	16.2	22.9	8.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	17.2	14.3	15.8	26.1	16.2	22.9	8.6
Queue Length 50th (m)	33.1	78.1	6.2	51.8	15.7	8.6	7.0	6.3
Queue Length 95th (m)	m38.7	m98.5	16.0	67.7	30.5	20.3	16.1	21.7
Internal Link Dist (m)		194.1		563.0		111.7		152.1
Turn Bay Length (m)	125.0		50.0		45.0		20.0	
Base Capacity (vph)	440	1870	227	1492	360	594	399	624
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.54	0.20	0.44	0.32	0.17	0.14	0.30

Intersection Summary
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 50.4 (56%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis
6: Farley Dr. & Clair Rd. Future Background Traffic Conditions
Weekday Afternoon Peak Hour

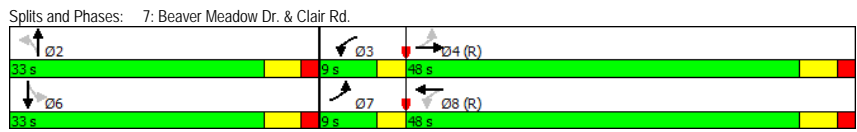
	↖	→	↘	←	↙	↑	↘	↓	↙	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗		↖	↖↗		↖	↖↗		↖	↖↗	↖
Traffic Volume (vph)	235	815	190	45	595	55	115	65	35	55	50	140
Future Volume (vph)	235	815	190	45	595	55	115	65	35	55	50	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.99		1.00	1.00		1.00	0.99		1.00	0.97	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.98	1.00		0.98	1.00	
Frt	1.00	0.97		1.00	0.99		1.00	0.95		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1803	3392		1796	3428		1738	1778		1702	1646	
Flt Permitted	0.32	1.00		0.28	1.00		0.61	1.00		0.69	1.00	
Satd. Flow (perm)	604	3392		525	3428		1119	1778		1240	1646	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	235	815	190	45	595	55	115	65	35	55	50	140
RTOR Reduction (vph)	0	22	0	0	8	0	0	22	0	0	95	0
Lane Group Flow (vph)	235	983	0	45	642	0	115	78	0	55	95	0
Confl. Peds. (#/hr)	6		8	8		6	16		15	15		16
Confl. Bikes (#/hr)							1					
Heavy Vehicles (%)	0%	3%	1%	0%	4%	0%	2%	0%	0%	4%	0%	0%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8		2	2		6	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	49.0	49.0		39.0	39.0		29.0	29.0		29.0	29.0	
Effective Green, g (s)	49.0	49.0		39.0	39.0		29.0	29.0		29.0	29.0	
Actuated g/C Ratio	0.54	0.54		0.43	0.43		0.32	0.32		0.32	0.32	
Clearance Time (s)	3.0	6.0		6.0	6.0		6.0	6.0		6.0	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)	422	1846		227	1485		360	572		399	530	
v/s Ratio Prot	0.04	0.29			0.19		0.04			0.06		
v/s Ratio Perm	c0.26			0.09			c0.10			0.04		
v/c Ratio	0.56	0.53		0.20	0.43		0.32	0.14		0.14	0.18	
Uniform Delay, d1	11.4	13.2		15.8	17.8		23.0	21.6		21.6	21.9	
Progression Factor	1.46	1.31		0.74	0.85		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	0.6		1.9	0.9		2.3	0.5		0.7	0.7	
Delay (s)	17.5	17.8		13.6	15.9		25.4	22.1		22.4	22.7	
Level of Service	B	B		B	B		C	C		C	C	
Approach Delay (s)		17.8			15.8			23.9			22.6	
Approach LOS		B			B			C			C	

Intersection Summary
 HCM 2000 Control Delay 18.2 HCM 2000 Level of Service B
 HCM 2000 Volume to Capacity ratio 0.48
 Actuated Cycle Length (s) 90.0 Sum of lost time (s) 15.0
 Intersection Capacity Utilization 74.3% ICU Level of Service D
 Analysis Period (min) 15
 c Critical Lane Group

Queues
7: Beaver Meadow Dr. & Clair Rd. Future Background Traffic Conditions
Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖↗	↙	↙↘		↕	↖	↖↗
Traffic Volume (vph)	110	855	55	615	45	5	15	15
Future Volume (vph)	110	855	55	615	45	5	15	15
Lane Group Flow (vph)	110	901	55	630	0	90	15	75
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	24.0	24.0	24.0	24.0
Total Split (s)	9.0	48.0	9.0	48.0	33.0	33.0	33.0	33.0
Total Split (%)	10.0%	53.3%	10.0%	53.3%	36.7%	36.7%	36.7%	36.7%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0		6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max
v/c Ratio	0.24	0.53	0.16	0.37		0.20	0.04	0.14
Control Delay	4.5	12.5	8.6	15.6		15.5	22.7	9.4
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	4.5	12.5	8.6	15.6		15.5	22.7	9.4
Queue Length 50th (m)	2.5	78.1	3.8	37.4		6.6	1.9	1.9
Queue Length 95th (m)	4.9	98.0	8.5	50.6		18.1	6.6	11.9
Internal Link Dist (m)		563.0		1233.2		183.8		182.6
Turn Bay Length (m)	55.0		30.0					
Base Capacity (vph)	465	1710	342	1716		461	414	527
Starvation Cap Reductn	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.24	0.53	0.16	0.37		0.20	0.04	0.14

Intersection Summary
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 86.4 (96%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated



HCM Signalized Intersection Capacity Analysis Future Background Traffic Conditions
7: Beaver Meadow Dr. & Clair Rd. Weekday Afternoon Peak Hour

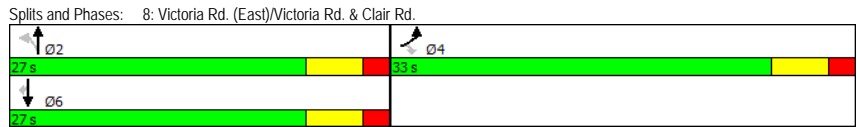
	↖	→	↙	←	↘	↑	↗	↓	↖	↖↗	↙	←	↘	↓	↖	↖↗
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR				
Lane Configurations	↖	↖↗		↙	↙↘			↕	↖↗	↙	↙↘					
Traffic Volume (vph)	110	855	46	55	615	15	45	5	40	15	15	60				
Future Volume (vph)	110	855	46	55	615	15	45	5	40	15	15	60				
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Total Lost time (s)	3.0	6.0		3.0	6.0			6.0		6.0	6.0					
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00					
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.99					
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		0.99	1.00					
Frt	1.00	0.99		1.00	1.00			0.94		1.00	0.88					
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	1.00					
Satd. Flow (prot)	1769	3508		1769	3524			1684		1758	1618					
Flt Permitted	0.37	1.00		0.24	1.00			0.84		0.75	1.00					
Satd. Flow (perm)	687	3508		443	3524			1446		1383	1618					
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	855	46	55	615	15	45	5	40	15	15	60				
RTOR Reduction (vph)	0	4	0	0	2	0	0	28	0	0	42	0				
Lane Group Flow (vph)	110	897	0	55	628	0	0	62	0	15	33	0				
Confl. Peds. (#/hr)	2		1	1		2	3		3	3		3				
Confl. Bikes (#/hr)			1	1		2										
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA					
Protected Phases	7	4		3	8			2			6					
Permitted Phases	4			8			2			6						
Actuated Green, G (s)	48.0	43.2		48.0	43.2			27.0		27.0	27.0					
Effective Green, g (s)	48.0	43.2		48.0	43.2			27.0		27.0	27.0					
Actuated g/C Ratio	0.53	0.48		0.53	0.48			0.30		0.30	0.30					
Clearance Time (s)	3.0	6.0		3.0	6.0			6.0		6.0	6.0					
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0					
Lane Grp Cap (vph)	424	1683		306	1691			433		414	485					
v/s Ratio Prot	c0.01	c0.26		0.01	0.18						0.02					
v/s Ratio Perm	0.12			0.09				c0.04		0.01						
v/c Ratio	0.26	0.53		0.18	0.37			0.14		0.04	0.07					
Uniform Delay, d1	10.6	16.4		10.8	14.8			23.0		22.3	22.5					
Progression Factor	0.43	0.69		1.00	1.00			1.00		1.00	1.00					
Incremental Delay, d2	0.3	1.1		0.3	0.6			0.7		0.2	0.3					
Delay (s)	4.9	12.4		11.1	15.4			23.7		22.5	22.8					
Level of Service	A	B		B	B			C		C	C					
Approach Delay (s)		11.6			15.1			23.7			22.7					
Approach LOS		B			B			C			C					

Intersection Summary
 HCM 2000 Control Delay: 14.0 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.37
 Actuated Cycle Length (s): 90.0 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 57.6% ICU Level of Service: B
 Analysis Period (min): 15
 c Critical Lane Group

Queues **Future Background Traffic Conditions**
8: Victoria Rd. (East)/Victoria Rd. & Clair Rd. Weekday Afternoon Peak Hour

	↖	↗	↙	↘	↑	↓
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↙	↘	↑	↓
Traffic Volume (vph)	620	105	140	380	280	520
Future Volume (vph)	620	105	140	380	280	520
Lane Group Flow (vph)	620	105	140	380	280	520
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	33.0	33.0	27.0	27.0	27.0	27.0
Total Split (%)	55.0%	55.0%	45.0%	45.0%	45.0%	45.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Min	Min	Min	Min
v/c Ratio	0.83	0.14	0.41	0.67	0.49	0.63
Control Delay	24.7	6.6	19.0	22.5	18.0	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	6.6	19.0	22.5	18.0	5.6
Queue Length 50th (m)	48.4	3.3	10.9	32.6	22.4	0.0
Queue Length 95th (m)	#114.6	11.4	25.3	60.1	42.8	17.9
Internal Link Dist (m)	1233.2			2005.5	465.2	
Turn Bay Length (m)		10.0	65.0			20.0
Base Capacity (vph)	961	930	482	802	818	954
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.11	0.29	0.47	0.34	0.55

Intersection Summary
 Cycle Length: 60
 Actuated Cycle Length: 49.9
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis **Future Background Traffic Conditions**
8: Victoria Rd. (East)/Victoria Rd. & Clair Rd. Weekday Afternoon Peak Hour

	↖	↗	↙	↘	↑	↓
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↙	↘	↑	↓
Traffic Volume (vph)	620	105	140	380	280	520
Future Volume (vph)	620	105	140	380	280	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1703	1615	1805	1827	1863	1509
Flt Permitted	0.95	1.00	0.58	1.00	1.00	1.00
Satd. Flow (perm)	1703	1615	1098	1827	1863	1509
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	620	105	140	380	280	520
RTOR Reduction (vph)	0	23	0	0	0	358
Lane Group Flow (vph)	620	82	140	380	280	162
Heavy Vehicles (%)	6%	0%	0%	4%	2%	7%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	22.0	22.0	15.4	15.4	15.4	15.4
Effective Green, g (s)	22.0	22.0	15.4	15.4	15.4	15.4
Actuated g/C Ratio	0.45	0.45	0.31	0.31	0.31	0.31
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	758	719	342	569	580	470
v/s Ratio Prot	c0.36			c0.21	0.15	
v/s Ratio Perm		0.05	0.13			0.11
v/c Ratio	0.82	0.11	0.41	0.67	0.48	0.34
Uniform Delay, d1	12.0	8.0	13.4	14.8	13.8	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.9	0.1	0.8	3.0	0.6	0.4
Delay (s)	18.8	8.1	14.2	17.7	14.4	13.6
Level of Service	B	A	B	B	B	B
Approach Delay (s)	17.3			16.8	13.9	
Approach LOS	B			B	B	

Intersection Summary
 HCM 2000 Control Delay: 15.8 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.76
 Actuated Cycle Length (s): 49.4 Sum of lost time (s): 12.0
 Intersection Capacity Utilization: 71.8% ICU Level of Service: C
 Analysis Period (min): 15
 c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
9: Clair Rd. & Laird Rd.

Future Background Traffic Conditions
Weekday Afternoon Peak Hour

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↕↕		↕	↕↕	↕	↕
Traffic Volume (veh/h)	1200	5	65	810	1	195
Future Volume (Veh/h)	1200	5	65	810	1	195
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1200	5	65	810	1	195
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			1205		1738	602
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1205		1738	602
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		99	56
cM capacity (veh/h)			575		69	442
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NE 1
Volume Total	800	405	65	405	405	196
Volume Left	0	0	65	0	0	1
Volume Right	0	5	0	0	0	195
cSH	1700	1700	575	1700	1700	431
Volume to Capacity	0.47	0.24	0.11	0.24	0.24	0.46
Queue Length 95th (m)	0.0	0.0	3.0	0.0	0.0	18.6
Control Delay (s)	0.0	0.0	12.1	0.0	0.0	20.2
Lane LOS			B			C
Approach Delay (s)	0.0		0.9			20.2
Approach LOS						C
Intersection Summary						
Average Delay			2.1			
Intersection Capacity Utilization			59.1%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
10: Gordon St. & Maltby Rd.

Future Background Traffic Conditions
Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	30	10	50	5	5	0	35	1130	10	5	865	30
Future Volume (Veh/h)	30	10	50	5	5	0	35	1130	10	5	865	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	30	10	50	5	5	0	35	1130	10	5	865	30
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	1528	2100	448	1702	2110	570	895			1140		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1528	2100	448	1702	2110	570	895			1140		
tC, single (s)	*4.8	*4.6	*4.4	*5.6	*5.0	6.9	4.2			4.5		
tC, 2 stage (s)												
tF (s)	*3.2	*3.0	*3.0	3.5	*3.5	3.3	2.2			2.4		
p0 queue free %	88	94	94	96	96	100	95			99		
cM capacity (veh/h)	249	164	832	128	122	470	748			515		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	90	10	35	753	387	5	577	318				
Volume Left	30	5	35	0	0	5	0	0				
Volume Right	50	0	0	0	10	0	0	30				
cSH	372	125	748	1700	1700	515	1700	1700				
Volume to Capacity	0.24	0.08	0.05	0.44	0.23	0.01	0.34	0.19				
Queue Length 95th (m)	7.5	2.1	1.2	0.0	0.0	0.2	0.0	0.0				
Control Delay (s)	17.7	36.3	10.1	0.0	0.0	12.1	0.0	0.0				
Lane LOS	C	E	B				B					
Approach Delay (s)	17.7	36.3	0.3				0.1					
Approach LOS	C	E										
Intersection Summary												
Average Delay					1.1							
Intersection Capacity Utilization					44.1%		ICU Level of Service	A				
Analysis Period (min)					15							

* User Entered Value

HCM Unsignalized Intersection Capacity Analysis
11: Victoria Rd. (West) & Maltby Rd.

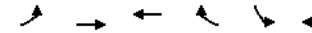
Future Background Traffic Conditions
Weekday Afternoon Peak Hour



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔		↔	
Traffic Volume (veh/h)	30	10	295	20	5	425
Future Volume (Veh/h)	30	10	295	20	5	425
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	30	10	295	20	5	425
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			41	646	36	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			41	646	36	
tC, single (s)			4.1	6.7	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.8	3.3	
p0 queue free %			81	98	59	
cM capacity (veh/h)			1574	317	1033	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	40	315	430			
Volume Left	0	295	5			
Volume Right	10	0	425			
cSH	1700	1574	1006			
Volume to Capacity	0.02	0.19	0.43			
Queue Length 95th (m)	0.0	5.5	17.4			
Control Delay (s)	0.0	7.4	11.2			
Lane LOS	A		B			
Approach Delay (s)	0.0	7.4	11.2			
Approach LOS			B			
Intersection Summary						
Average Delay			9.1			
Intersection Capacity Utilization			57.3%		ICU Level of Service B	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
12: Maltby Rd. & Victoria Rd. (East)

Future Background Traffic Conditions
Weekday Afternoon Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔		↔		↔	
Traffic Volume (veh/h)	440	15	10	30	35	310
Future Volume (Veh/h)	440	15	10	30	35	310
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	440	15	10	30	35	310
Pedestrians	1					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	41			921	26	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	41			921	26	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	72			84	70	
cM capacity (veh/h)	1561			215	1049	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	455	40	345			
Volume Left	440	0	35			
Volume Right	0	30	310			
cSH	1561	1700	752			
Volume to Capacity	0.28	0.02	0.46			
Queue Length 95th (m)	9.3	0.0	19.4			
Control Delay (s)	8.0	0.0	13.8			
Lane LOS	A		B			
Approach Delay (s)	8.0	0.0	13.8			
Approach LOS			B			
Intersection Summary						
Average Delay			10.0			
Intersection Capacity Utilization			59.6%		ICU Level of Service B	
Analysis Period (min)	15					

Queues Future Background Traffic Conditions
 13: Gordon St. & Gosling Gardens Weekday Afternoon Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Traffic Volume (vph)	1	55	25	30	20	1010	105	890
Future Volume (vph)	1	55	25	30	20	1010	105	890
Lane Group Flow (vph)	0	66	0	110	20	1055	105	895
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases		4		8		2		6
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	25.0	25.0	25.0	25.0	65.0	65.0	65.0	65.0
Total Split (%)	27.8%	27.8%	27.8%	27.8%	72.2%	72.2%	72.2%	72.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0
Total Lost Time (s)		6.0		6.0		6.0		6.0
Lead/Lag								
Lead-Lag Optimize?								
v/c Ratio		0.17		0.29	0.06	0.46	0.37	0.39
Control Delay		27.2		19.5	6.1	8.3	11.5	7.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		27.2		19.5	6.1	8.3	11.5	7.7
Queue Length 50th (m)		8.5		8.9	1.2	43.5	7.7	35.0
Queue Length 95th (m)		19.7		23.3	3.8	56.4	18.8	45.8
Internal Link Dist (m)		183.5		226.8		1642.2		171.0
Turn Bay Length (m)					50.0		50.0	
Base Capacity (vph)		391		378	355	2309	287	2318
Starvation Cap Reductn		0		0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0
Reduced v/c Ratio		0.17		0.29	0.06	0.46	0.37	0.39

Intersection Summary
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed

Splits and Phases: 13: Gordon St. & Gosling Gardens



HCM Signalized Intersection Capacity Analysis Future Background Traffic Conditions
 13: Gordon St. & Gosling Gardens Weekday Afternoon Peak Hour

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↖	↗		↖	↗	
Traffic Volume (vph)	1	55	10	25	30	55	20	1010	45	105	890	5
Future Volume (vph)	1	55	10	25	30	55	20	1010	45	105	890	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.98			0.93		1.00	0.99		1.00	1.00	
Flt Protected		1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1823			1717		1770	3517		1770	3536	
Flt Permitted		1.00			0.92		0.29	1.00		0.24	1.00	
Satd. Flow (perm)		1819			1603		542	3517		438	3536	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	55	10	25	30	55	20	1010	45	105	890	5
RTOR Reduction (vph)	0	7	0	0	40	0	0	3	0	0	0	0
Lane Group Flow (vph)	0	59	0	0	70	0	20	1052	0	105	895	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases		4			8			2			6	
Actuated Green, G (s)		19.0			19.0		59.0	59.0		59.0	59.0	
Effective Green, g (s)		19.0			19.0		59.0	59.0		59.0	59.0	
Actuated g/C Ratio		0.21			0.21		0.66	0.66		0.66	0.66	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lane Grp Cap (vph)		384			338		355	2305		287	2318	
v/s Ratio Prot							c0.30				0.25	
v/s Ratio Perm		0.03			c0.04		0.04			0.24		
v/c Ratio		0.15			0.21		0.06	0.46		0.37	0.39	
Uniform Delay, d1		28.9			29.3		5.5	7.6		7.0	7.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.8			1.4		0.3	0.7		3.6	0.5	
Delay (s)		29.8			30.7		5.8	8.3		10.6	7.6	
Level of Service		C			C		A	A		B	A	
Approach Delay (s)		29.8			30.7			8.2			7.9	
Approach LOS		C			C			A			A	

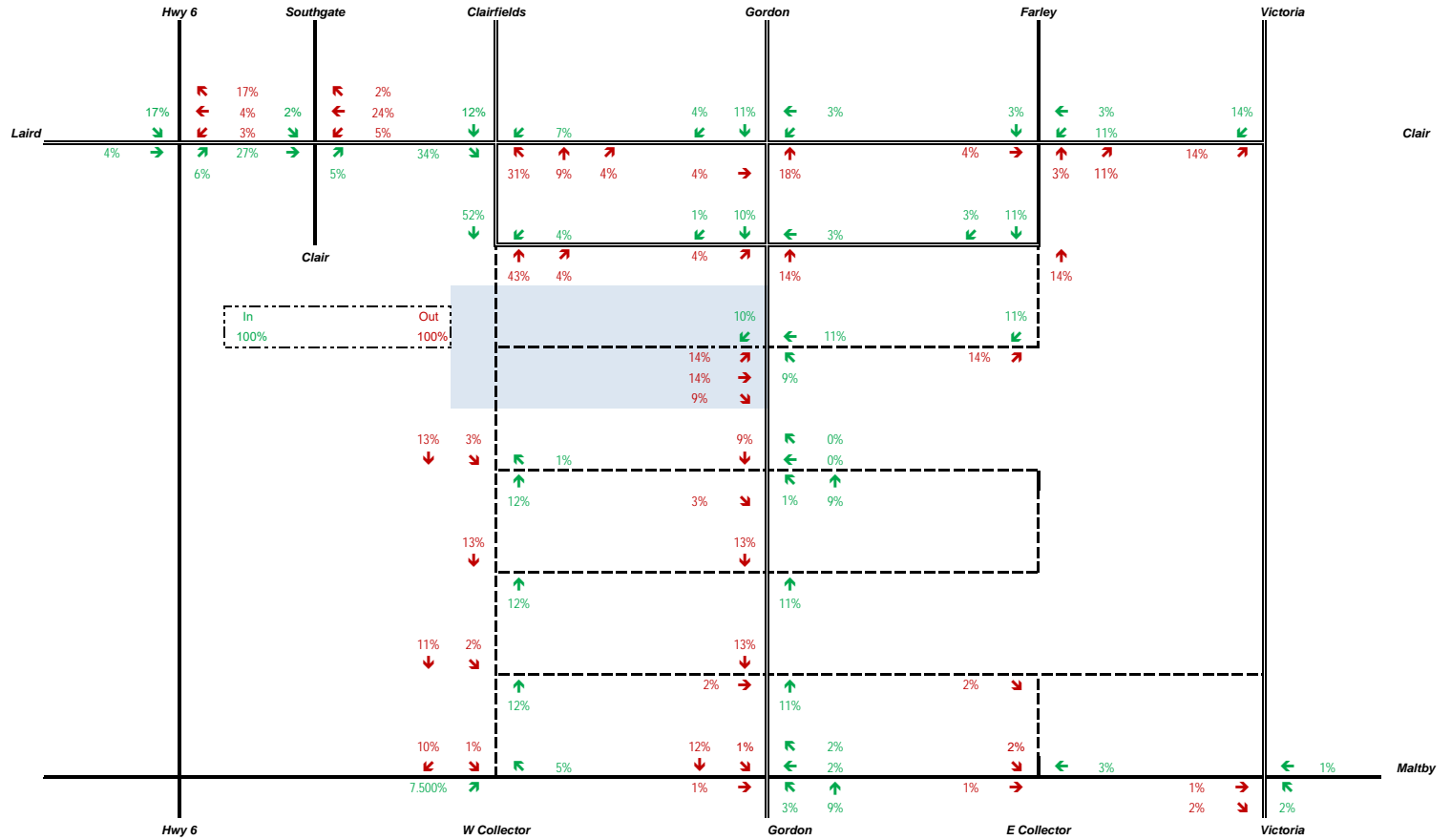
Intersection Summary
 HCM 2000 Control Delay: 9.8
 HCM 2000 Volume to Capacity ratio: 0.40
 Actuated Cycle Length (s): 90.0
 Intersection Capacity Utilization: 63.2%
 Analysis Period (min): 15
 c Critical Lane Group

Appendix Q – CMSP Future Development Traffic Trip Assignment Calculations

General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	17%	17%
	Clairfields	12%	9%
	Gordon	15%	18%
	Hawkins	3%	3%
	Victoria	14%	14%
	Southgate	2%	2%
	Total	63%	63%
S	Hwy.6	11%	11%
	Gordon	12%	12%
	Victoria	2%	2%
	Total	25%	25%
E			
	Maltby	1%	1%
	Total	1%	1%
W	Laird	4%	4%
	Maltby	2%	2%
	Clair	5%	5%
	Total	11%	11%

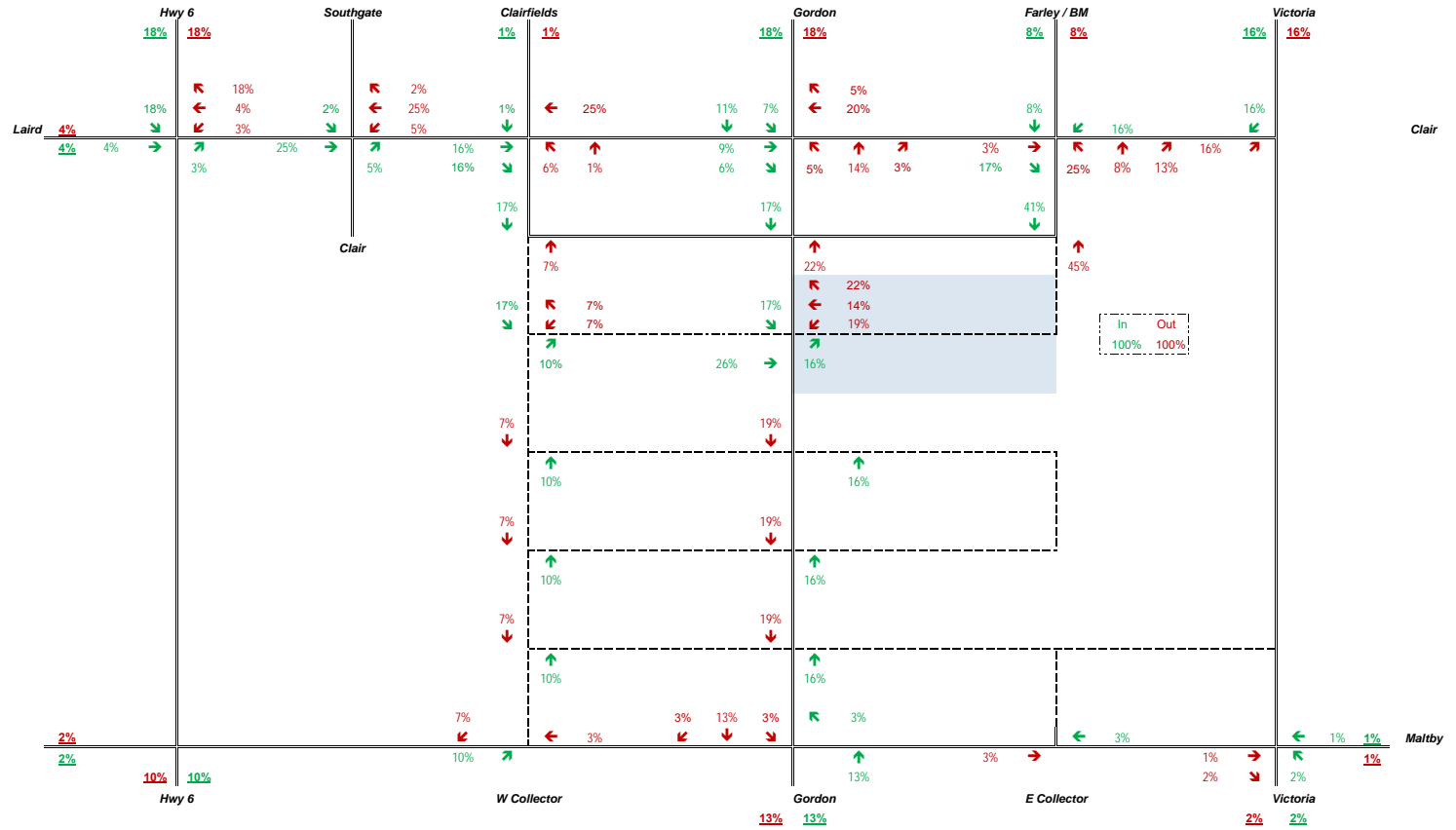
100% 100%

Zone 1 Distribution Map



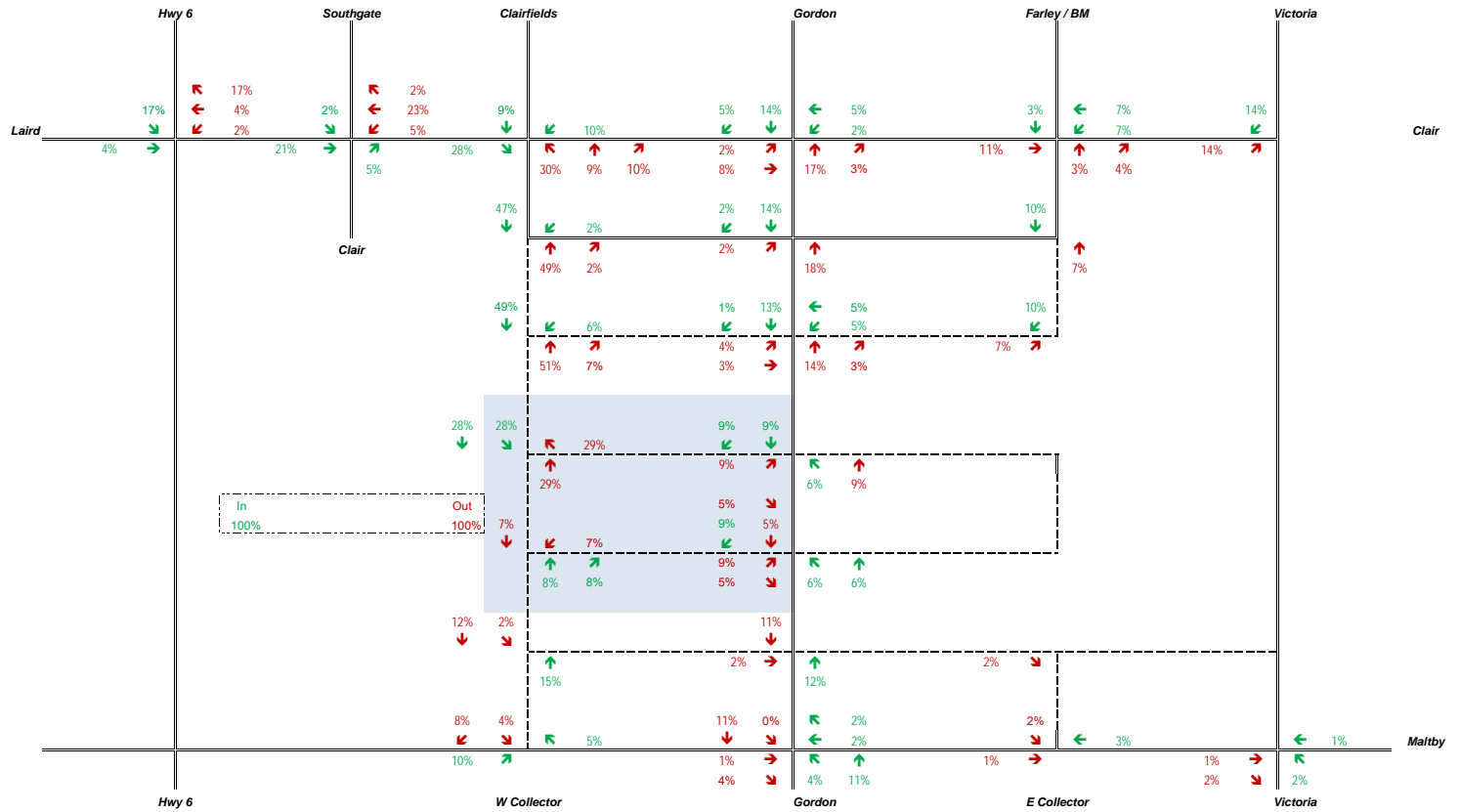
General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	18%	18%
	Clairfields	1%	1%
	Gordon	18%	18%
	Hawkins	8%	8%
	Victoria	16%	16%
	Southgate	2%	2%
	Total	63%	63%
S	Hwy.6	10%	10%
	Gordon	13%	13%
	Victoria	2%	2%
	Total	25%	25%
E	Maltby	1%	1%
	Total	1%	1%
W	Laird	4%	4%
	Maltby	2%	2%
	Clair	5%	5%
	Total	11%	11%
		100%	100%

Zone 2 Distribution Map



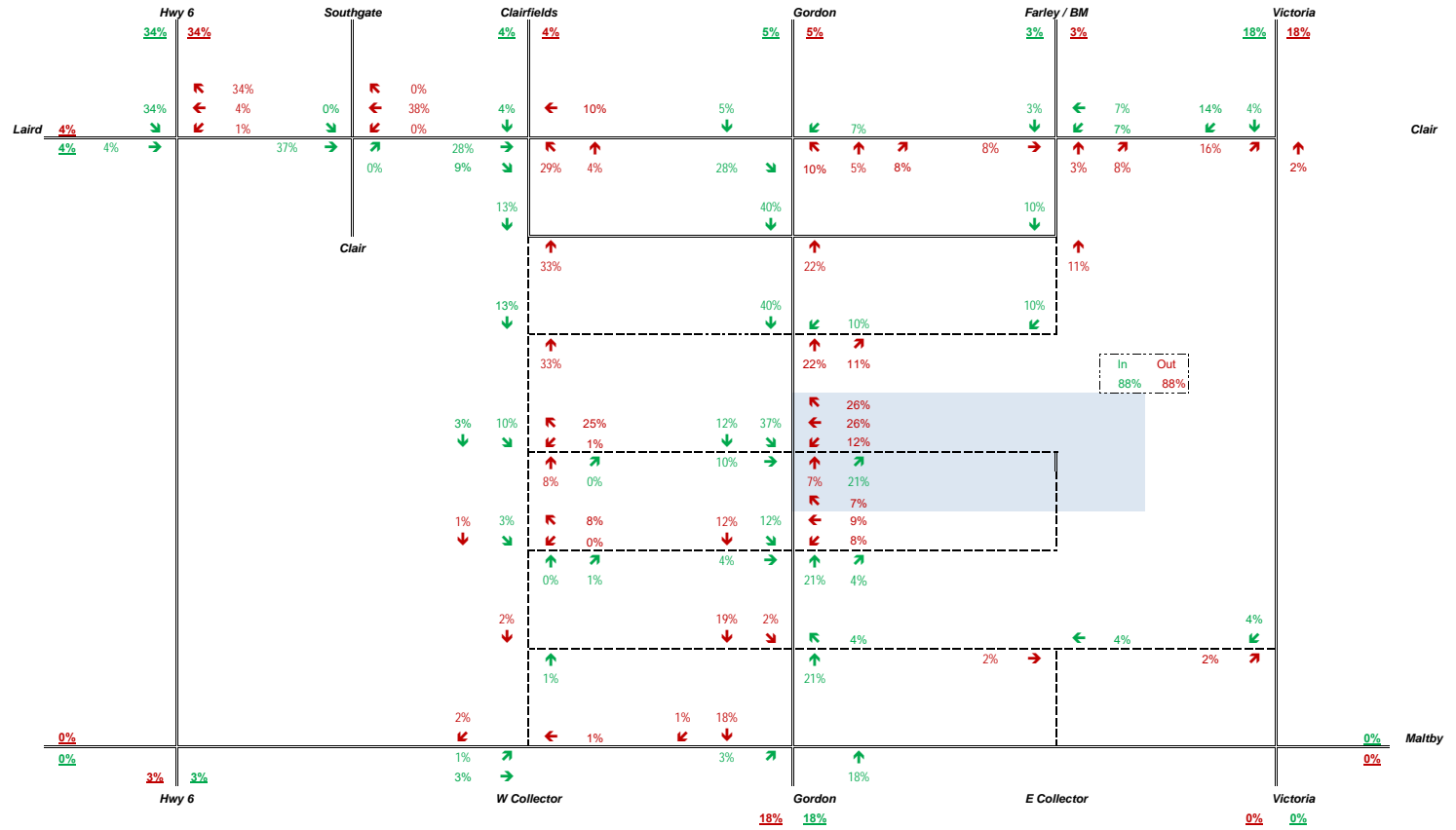
General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	17%	17%
	Clairfields	9%	9%
	Gordon	19%	19%
	Hawkins	3%	3%
	Victoria	14%	14%
	Southgate	2%	2%
	Total	64%	64%
S	Hwy.6	10%	10%
	Gordon	14%	14%
	Victoria	2%	2%
	Total	26%	26%
E	Maltby	1%	1%
	Total	1%	1%
W	Laird	4%	4%
	Maltby	2%	2%
	Clair	5%	5%
	Total	11%	11%
		102%	102%

Zone 4 Distribution Map



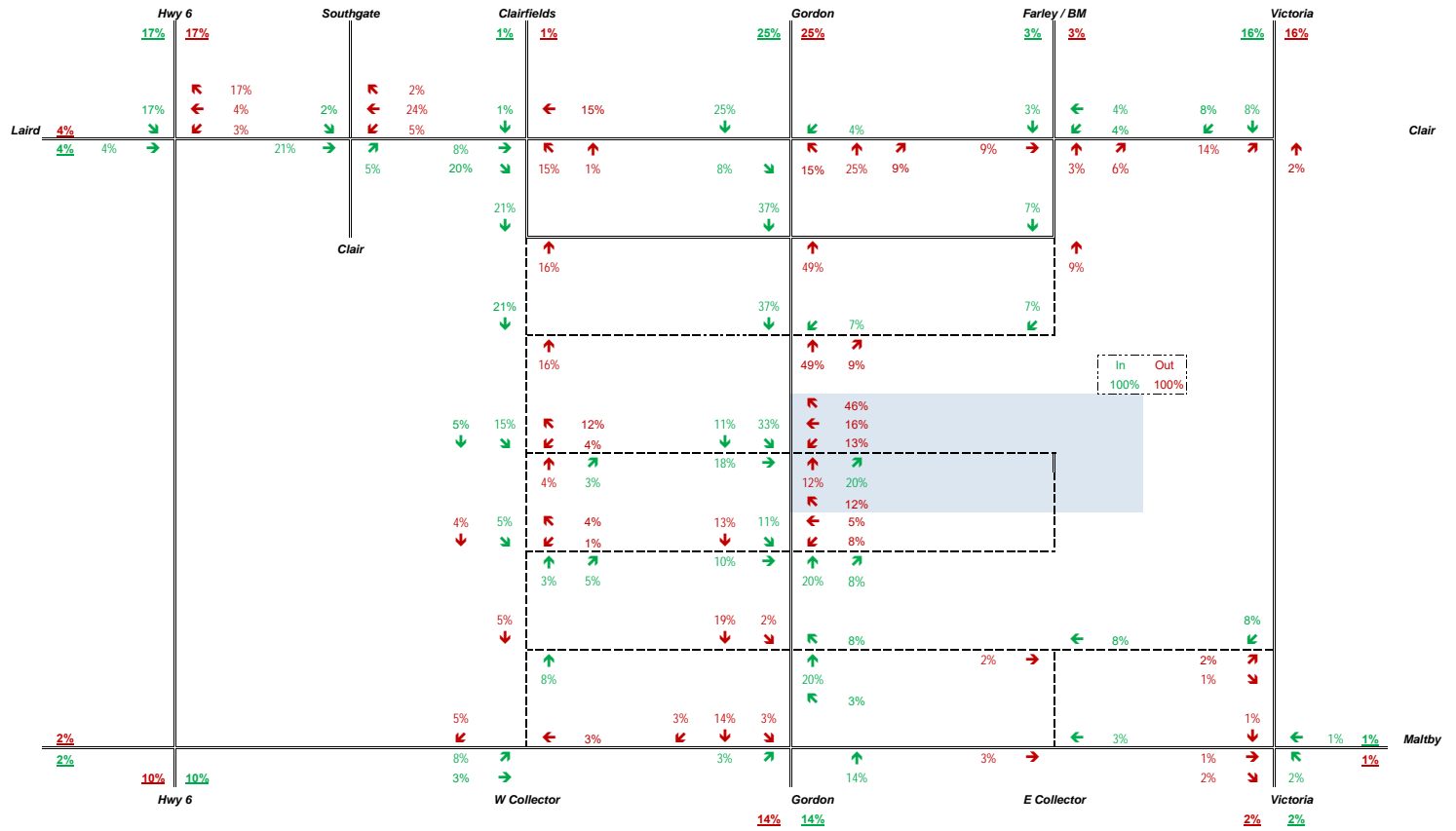
Zone 5 (EMPLOYMENT) Distribution Map

General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	34%	34%
	Clairfields	4%	4%
	Gordon	5%	5%
	Hawkins	3%	3%
	Victoria	18%	18%
	Southgate	0%	0%
	Total	63%	63%
S	Hwy.6	3%	3%
	Gordon	18%	18%
	Victoria	0%	0%
	Total	21%	21%
E	Maltby	0%	0%
	Total	0%	0%
W	Laird	4%	4%
	Maltby	0%	0%
	Clair	0%	0%
	Total	4%	4%
		88%	88%



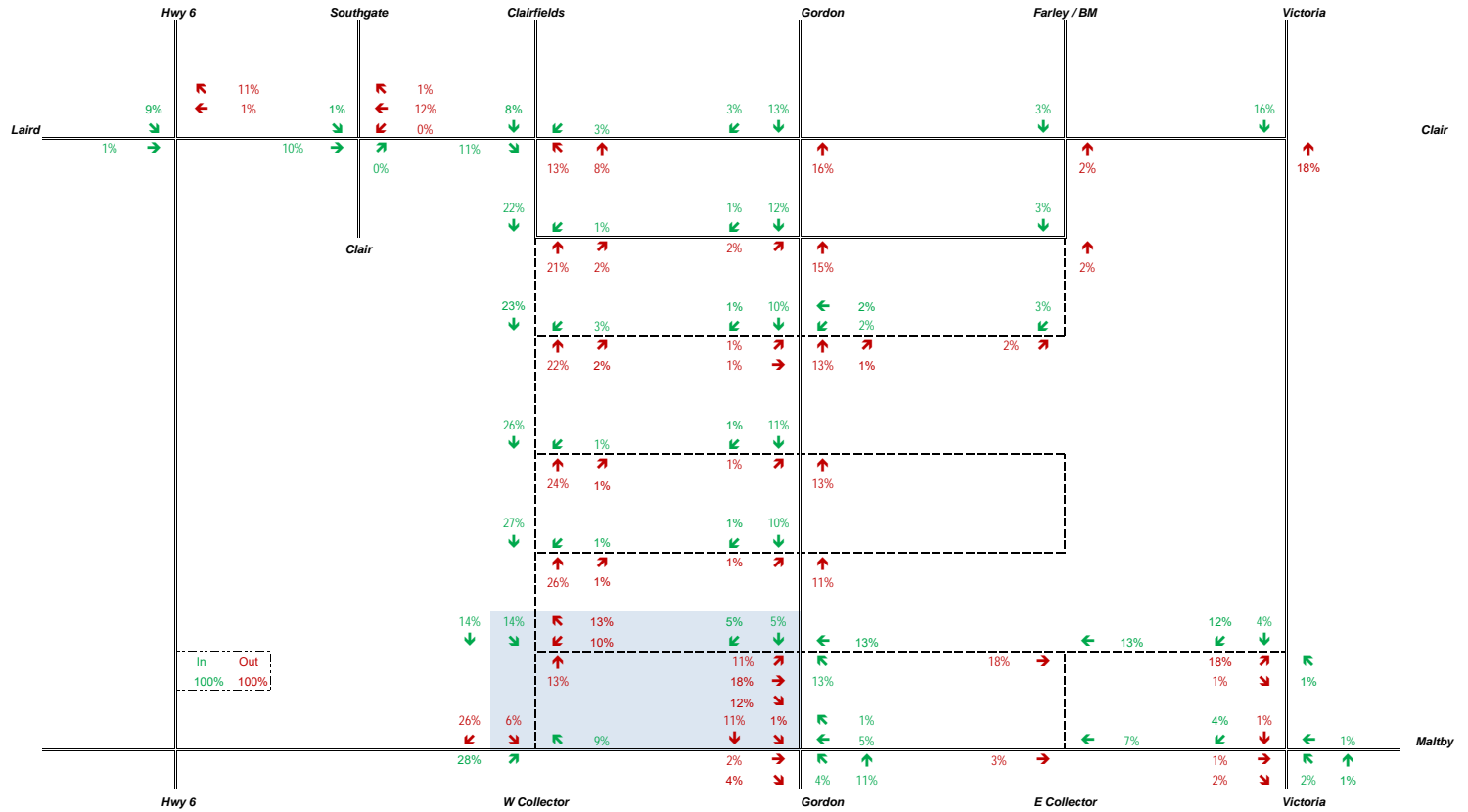
General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	17%	17%
	Clairfields	1%	1%
	Gordon	25%	25%
	Hawkins	3%	3%
	Victoria	16%	16%
	Southgate	2%	2%
	Total	64%	64%
S	Hwy.6	10%	10%
	Gordon	14%	14%
	Victoria	2%	2%
	Total	26%	26%
E	Maltby	1%	1%
	Total	1%	1%
W	Laird	4%	4%
	Maltby	2%	2%
	Clair	5%	5%
	Total	11%	11%
		102%	102%

Zone 5 Distribution Map



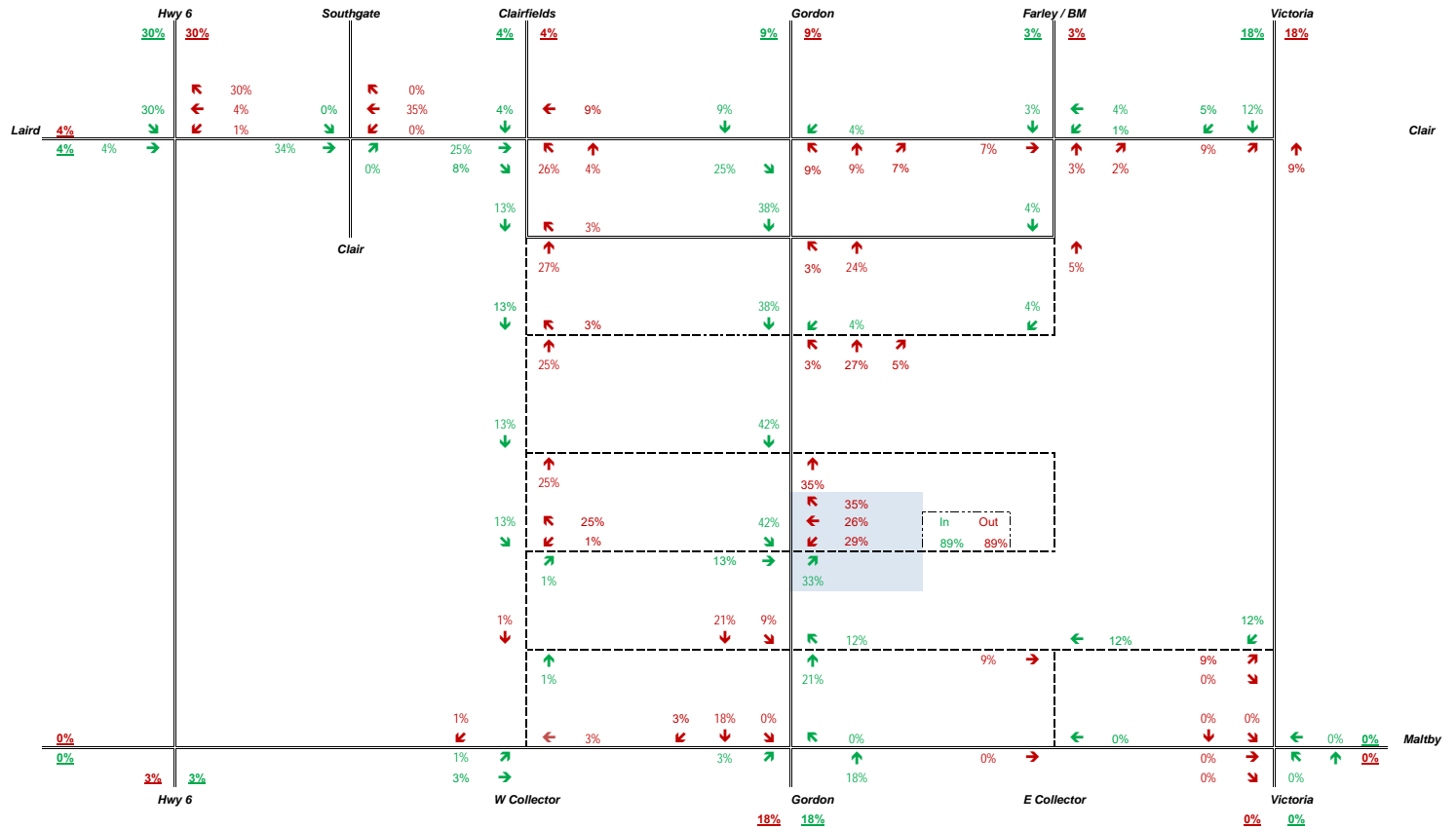
Zone 6 Distribution Map

General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	18%	18%
	Clairfields	8%	6%
	Gordon	16%	18%
	Hawkins	3%	3%
	Victoria	16%	16%
	Southgate	2%	2%
	Total	63%	63%
S	Hwy.6	8%	8%
	Gordon	15%	15%
	Victoria	2%	2%
	Total	25%	25%
E	Maltby	1%	1%
	Total	1%	1%
W	Laird	4%	4%
	Maltby	2%	2%
	Clair	5%	5%
	Total	11%	11%
		100%	100%



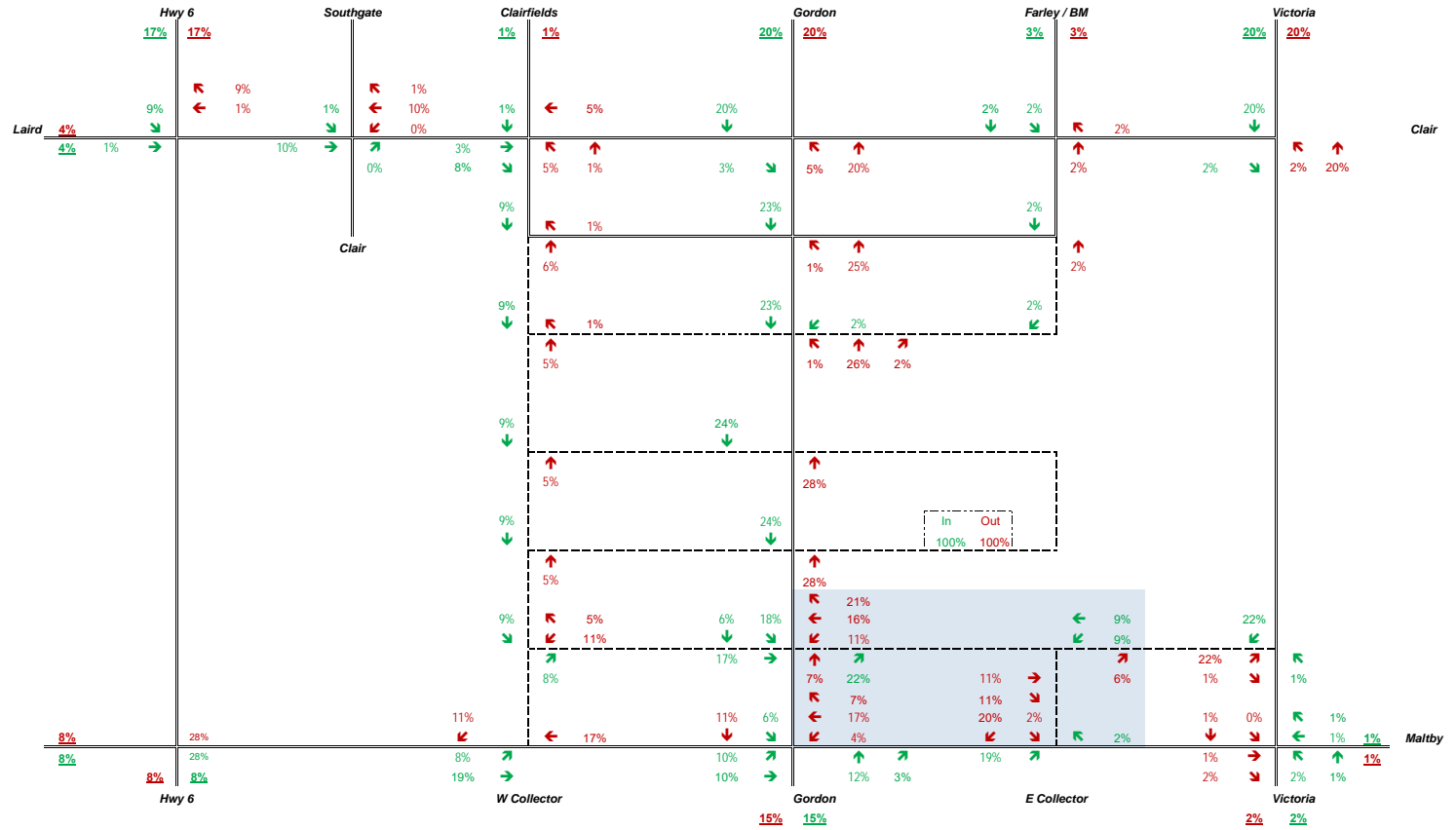
General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	30%	30%
	Clairfields	4%	4%
	Gordon	9%	9%
	Hawkins	3%	3%
	Victoria	18%	18%
	Southgate		
	Total	64%	64%
S	Hwy.6	3%	3%
	Gordon	18%	18%
	Victoria		
	Total	21%	21%
E	Maltby		
	Total	0%	0%
W	Laird	4%	4%
	Maltby		
	Clair		
	Total	4%	4%
		89%	89%

Zone 7 Distribution Map



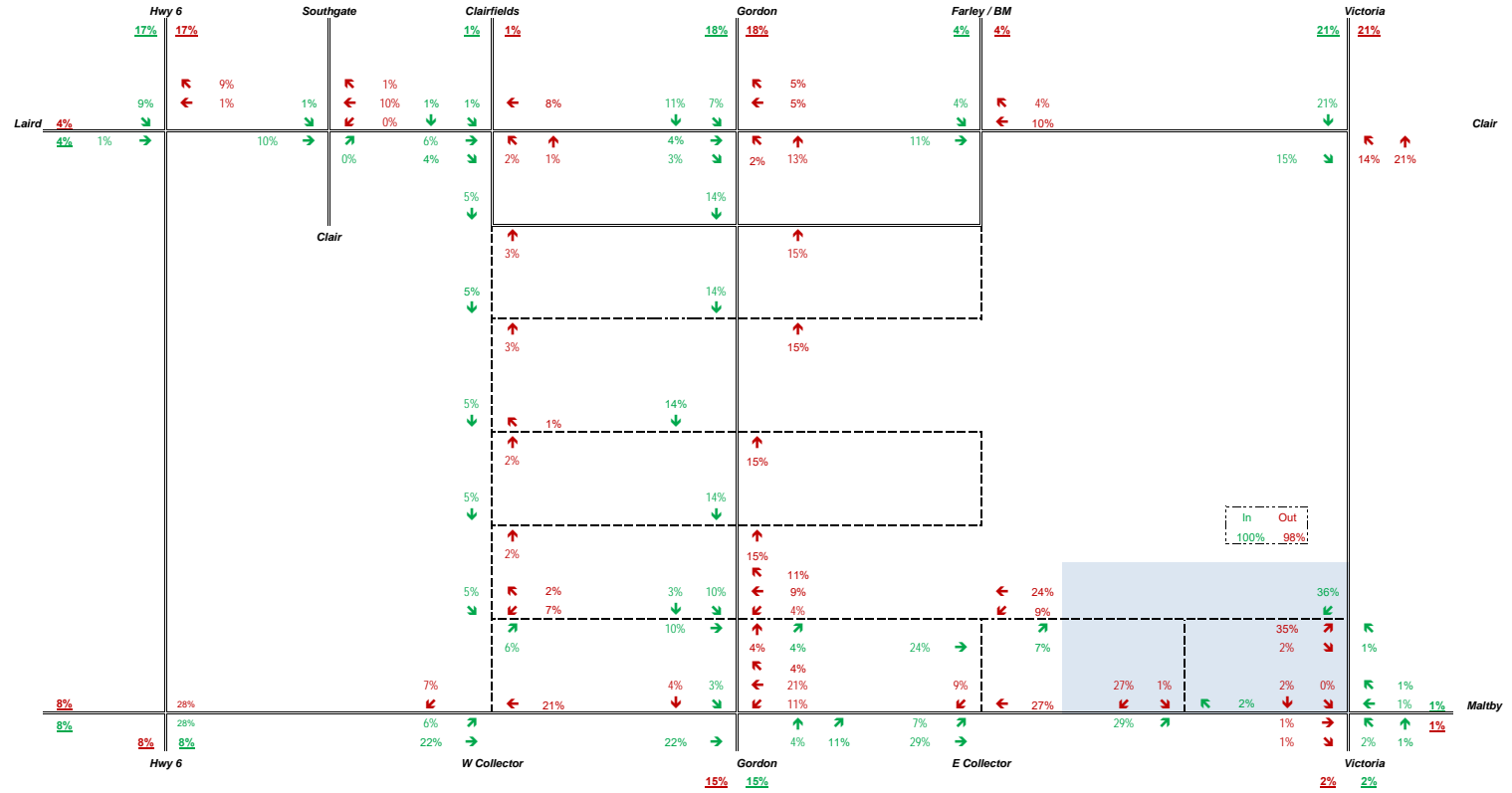
Zone 8 Distribution Map

General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	17%	17%
	Clairfields	1%	1%
	Gordon	20%	20%
	Hawkins	3%	3%
	Victoria	20%	20%
	Southgate	2%	2%
	Total	63%	63%
S	Hwy.6	8%	8%
	Gordon	15%	15%
	Victoria	2%	2%
	Total	25%	25%
E			
	Maltby	1%	1%
	Total	1%	1%
W	Laird	4%	4%
	Maltby	2%	2%
	Clair	5%	5%
	Total	11%	11%
		100%	100%



Zone 9 Distribution Map

General Res. Distribution			
Orientation	Route	Peak Hr.	
		In	Out
N	Hwy.6	17%	17%
	Clairfields	1%	1%
	Gordon	18%	18%
	Hawkins	4%	4%
	Victoria	21%	21%
	Southgate	2%	2%
	Total	63%	63%
S	Hwy.6	8%	8%
	Gordon	15%	15%
	Victoria	2%	2%
	Total	25%	25%
E	Maltby	1%	1%
	Total	1%	1%
W	Laird	4%	4%
	Maltby	2%	2%
	Clair	5%	5%
	Total	11%	11%
		100%	100%

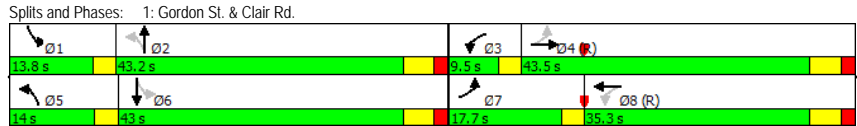


Appendix R – Synchro Analysis Results: Future Total Traffic Conditions

Queues Future Traffic Conditions - Base Future Street Network
1: Gordon St. & Clair Rd. Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖↗	↙	↙↘	↖	↖↗	↙	↙↘
Traffic Volume (vph)	300	960	165	650	250	985	230	1160
Future Volume (vph)	300	960	165	650	250	985	230	1160
Lane Group Flow (vph)	300	1190	165	770	250	1195	230	1365
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	9.5	24.0	9.5	24.0
Total Split (s)	17.7	43.5	9.5	35.3	14.0	43.2	13.8	43.0
Total Split (%)	16.1%	39.5%	8.6%	32.1%	12.7%	39.3%	12.5%	39.1%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0	3.0	6.0	3.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	Max	None	Max
v/c Ratio	0.95	1.01	1.02	0.84	1.03	1.03	0.92	1.18
Control Delay	43.3	58.5	104.2	47.1	100.1	73.1	66.3	125.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Total Delay	43.3	58.5	104.2	47.1	100.1	73.1	66.3	126.3
Queue Length 50th (m)	69.0	-151.0	-22.4	84.8	-53.7	-110.3	34.0	-195.0
Queue Length 95th (m)	m61.2	m127.7	#67.4	#112.1	m#97.0	#158.2	#82.4	#239.6
Internal Link Dist (m)		775.0		194.1		153.6		314.0
Turn Bay Length (m)	75.0		25.0		50.0		140.0	
Base Capacity (vph)	315	1181	161	912	242	1160	249	1152
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	144
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.95	1.01	1.02	0.84	1.03	1.03	0.92	1.35

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green, Master Intersection
 Natural Cycle: 110
 Control Type: Actuated-Coordinated
 - Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
1: Gordon St. & Clair Rd. Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓	↖	↗	↙	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗		↙	↙↘		↖	↖↗	↙↘	↙	↙↘	
Traffic Volume (vph)	300	960	230	165	650	120	250	985	210	230	1160	205
Future Volume (vph)	300	960	230	165	650	120	250	985	210	230	1160	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.97		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1767	3409		1594	3373		1716	3381		1785	3388	
Flt Permitted	0.13	1.00		0.14	1.00		0.11	1.00		0.11	1.00	
Satd. Flow (perm)	246	3409		229	3373		194	3381		203	3388	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	300	960	230	165	650	120	250	985	210	230	1160	205
RTOR Reduction (vph)	0	19	0	0	14	0	0	17	0	0	13	0
Lane Group Flow (vph)	300	1171	0	165	756	0	250	1178	0	230	1352	0
Confl. Peds. (#/hr)	17		7	7		17	2		11	11		2
Confl. Bikes (#/hr)							1					
Heavy Vehicles (%)	1%	1%	2%	12%	3%	1%	4%	1%	8%	0%	2%	7%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	47.0	37.5		35.8	29.3		48.2	37.2		47.8	37.0	
Effective Green, g (s)	47.0	37.5		35.8	29.3		48.2	37.2		47.8	37.0	
Actuated g/C Ratio	0.43	0.34		0.33	0.27		0.44	0.34		0.43	0.34	
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	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)	308	1162		155	898		237	1143		243	1139	
v/s Ratio Prot	c0.13	c0.34		c0.06	0.22		c0.11	0.35		0.09	c0.40	
v/s Ratio Perm	0.29			0.28			0.36			0.32		
v/c Ratio	0.97	1.01		1.06	0.84		1.05	1.03		0.95	1.19	
Uniform Delay, d1	29.1	36.2		34.3	38.2		30.3	36.4		28.6	36.5	
Progression Factor	1.39	1.40		1.00	1.00		1.78	1.22		1.00	1.00	
Incremental Delay, d2	10.1	9.9		90.5	9.4		64.4	30.8		42.7	93.1	
Delay (s)	50.7	60.8		124.8	47.6		118.2	75.4		71.3	129.6	
Level of Service	D	E		F	D		F	E		E	F	
Approach Delay (s)	58.7				61.2		82.8			121.2		
Approach LOS	E				E		F			F		

Intersection Summary
 HCM 2000 Control Delay 83.7 HCM 2000 Level of Service F
 HCM 2000 Volume to Capacity ratio 1.11
 Actuated Cycle Length (s) 110.0 Sum of lost time (s) 18.0
 Intersection Capacity Utilization 112.3% ICU Level of Service H
 Analysis Period (min) 15
 c Critical Lane Group

Queues Future Traffic Conditions - Base Future Street Network
2: Gordon St. & Poppy Dr. Weekday Afternoon Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔	↔	↔	↔	↔
Traffic Volume (vph)	115	60	55	55	65	1345	50	1425
Future Volume (vph)	115	60	55	55	65	1345	50	1425
Lane Group Flow (vph)	0	210	0	150	65	1410	50	1500
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	pm+pt	NA
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Minimum Split (s)	24.0	24.0	24.0	24.0	9.5	24.0	9.5	24.0
Total Split (s)	30.0	30.0	30.0	30.0	10.0	70.0	10.0	70.0
Total Split (%)	27.3%	27.3%	27.3%	27.3%	9.1%	63.6%	9.1%	63.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0		6.0	3.0	6.0	3.0	6.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
v/c Ratio		0.73		0.47	0.30	0.70	0.21	0.74
Control Delay		54.5		39.1	15.7	41.7	3.7	10.5
Queue Delay		0.2		0.0	0.0	4.9	0.0	31.9
Total Delay		54.7		39.1	15.7	46.7	3.7	42.4
Queue Length 50th (m)		42.7		26.6	9.9	167.1	1.5	154.4
Queue Length 95th (m)		#77.3		47.6	m12.8	191.1	m1.3	m41.7
Internal Link Dist (m)		727.4		256.4		172.0		153.6
Turn Bay Length (m)					65.0		27.0	
Base Capacity (vph)		288		321	214	2025	236	2023
Starvation Cap Reductn		0		0	0	541	0	608
Spillback Cap Reductn		2		2	0	0	0	159
Storage Cap Reductn		0		0	0	0	0	0
Reduced v/c Ratio		0.73		0.47	0.30	0.95	0.21	1.06

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 61 (55%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Pretimed
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
2: Gordon St. & Poppy Dr. Weekday Afternoon Peak Hour

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	115	60	35	55	55	40	65	1345	65	50	1425	75
Future Volume (vph)	115	60	35	55	55	40	65	1345	65	50	1425	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		3.0	6.0		3.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.98			0.96		1.00	0.99		1.00	0.99	
Flt Protected		0.97			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1753			1744		1750	3476		1750	3474	
Flt Permitted		0.72			0.80		0.09	1.00		0.11	1.00	
Satd. Flow (perm)		1295			1420		170	3476		206	3474	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	115	60	35	55	55	40	65	1345	65	50	1425	75
RTOR Reduction (vph)	0	6	0	0	12	0	0	3	0	0	3	0
Lane Group Flow (vph)	0	204	0	0	138	0	65	1407	0	50	1497	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		24.0			24.0		71.0	64.0		71.0	64.0	
Effective Green, g (s)		24.0			24.0		71.0	64.0		71.0	64.0	
Actuated g/C Ratio		0.22			0.22		0.65	0.58		0.65	0.58	
Clearance Time (s)		6.0			6.0		3.0	6.0		3.0	6.0	
Lane Grp Cap (vph)		282			309		210	2022		231	2021	
v/s Ratio Prot							c0.02	0.40		0.01	c0.43	
v/s Ratio Perm		c0.16			0.10		0.18			0.13		
v/c Ratio		0.72			0.45		0.31	0.70		0.22	0.74	
Uniform Delay, d1		39.9			37.3		12.3	16.2		10.8	16.9	
Progression Factor		1.00			1.00		2.45	2.46		0.67	0.60	
Incremental Delay, d2		14.9			4.6		2.8	1.5		0.2	0.2	
Delay (s)		54.8			41.9		32.9	41.2		7.4	10.3	
Level of Service		D			D		C	D		A	B	
Approach Delay (s)		54.8			41.9			40.8			10.2	
Approach LOS		D			D			D			B	

Intersection Summary
 HCM 2000 Control Delay 27.7 HCM 2000 Level of Service C
 HCM 2000 Volume to Capacity ratio 0.70
 Actuated Cycle Length (s) 110.0 Sum of lost time (s) 15.0
 Intersection Capacity Utilization 77.5% ICU Level of Service D
 Analysis Period (min) 15
 c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 3: Gordon St. & Maltby Rd. Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	↔
Traffic Volume (veh/h)	85	180	60	55	160	65	80	1415	85	65	1065	40
Future Volume (Veh/h)	85	180	60	55	160	65	80	1415	85	65	1065	40
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	85	180	60	55	160	65	80	1415	85	65	1065	40
Pedestrians	50			50			50			50		
Lane Width (m)	3.5			3.5			3.5			3.5		
Walking Speed (m/s)	1.2			1.2			1.2			1.2		
Percent Blockage	4			4			4			4		
Right turn flare (veh)												
Median type	None						None					
Median storage (veh)							211					
Upstream signal (m)	211											
pX, platoon unblocked	0.85	0.85	0.85	0.85	0.85		0.85					
vC, conflicting volume	2328	2975	652	2530	2952	850	1155			1550		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2208	2971	234	2446	2944	850	826			1550		
tC, single (s)	*4.8	*4.6	*4.4	*5.6	*5.0	6.9	4.2			4.5		
tC, 2 stage (s)												
tF (s)	*3.2	*3.0	*3.0	3.5	*3.5	3.3	2.2			2.4		
p0 queue free %	0	0	92	0	0	77	88			80		
cM capacity (veh/h)	0	40	775	0	29	284	647			333		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3		
Volume Total	85	240	55	225	80	943	557	65	710	395		
Volume Left	85	0	55	0	80	0	0	65	0	0		
Volume Right	0	60	0	65	0	0	85	0	0	40		
cSH	0	53	0	39	647	1700	1700	333	1700	1700		
Volume to Capacity	Err	4.56	Err	5.78	0.12	0.55	0.33	0.20	0.42	0.23		
Queue Length 95th (m)	Err	Err	Err	Err	3.4	0.0	0.0	5.7	0.0	0.0		
Control Delay (s)	Err	Err	Err	Err	11.4	0.0	0.0	18.4	0.0	0.0		
Lane LOS	F	F	F	F	B			C				
Approach Delay (s)	Err		Err		0.6			1.0				
Approach LOS	F		F									
Intersection Summary												
Average Delay	Err		Err									
Intersection Capacity Utilization	77.2%		ICU Level of Service D									
Analysis Period (min)	15											
* User Entered Value												

Queues Future Traffic Conditions - Base Future Street Network
 4: Laird Rd. & Hwy. 6 Southbound Off-Ramp Weekday Afternoon Peak Hour

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations	↔	↔	↔	↔
Traffic Volume (vph)	435	480	865	60
Future Volume (vph)	435	480	865	60
Lane Group Flow (vph)	435	480	865	60
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	6	
Permitted Phases				6
Minimum Split (s)	24.0	24.0	25.0	25.0
Total Split (s)	33.0	33.0	57.0	57.0
Total Split (%)	36.7%	36.7%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	7.0	7.0
Lead/Lag				
Lead-Lag Optimize?				
v/c Ratio	0.42	0.45	0.48	0.07
Control Delay	26.7	15.1	13.2	2.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	26.7	15.1	13.2	2.9
Queue Length 50th (m)	33.2	13.8	45.9	0.0
Queue Length 95th (m)	47.1	18.4	60.6	5.3
Internal Link Dist (m)	199.6	282.0	265.0	
Turn Bay Length (m)				40.0
Base Capacity (vph)	1039	1060	1815	848
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.42	0.45	0.48	0.07
Intersection Summary				
Cycle Length: 90				
Actuated Cycle Length: 90				
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green				
Natural Cycle: 50				
Control Type: Pretimed				
Splits and Phases: 4: Laird Rd. & Hwy. 6 Southbound Off-Ramp				

HCM Signalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 4: Laird Rd. & Hwy. 6 Southbound Off-Ramp Weekday Afternoon Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	↑
Traffic Volume (vph)	0	435	480	0	865	60
Future Volume (vph)	0	435	480	0	865	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		7.0	7.0
Lane Util. Factor		0.95	0.95		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3466	3535		3267	1479
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		3466	3535		3267	1479
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	435	480	0	865	60
RTOR Reduction (vph)	0	0	0	0	0	27
Lane Group Flow (vph)	0	435	480	0	865	33
Heavy Vehicles (%)	2%	3%	1%	2%	6%	8%
Turn Type		NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		27.0	27.0		50.0	50.0
Effective Green, g (s)		27.0	27.0		50.0	50.0
Actuated g/C Ratio		0.30	0.30		0.56	0.56
Clearance Time (s)		6.0	6.0		7.0	7.0
Lane Grp Cap (vph)		1039	1060		1815	821
v/s Ratio Prot		0.13	c0.14		c0.26	
v/s Ratio Perm						0.02
v/c Ratio		0.42	0.45		0.48	0.04
Uniform Delay, d1		25.2	25.5		12.1	9.1
Progression Factor		1.00	0.54		1.00	1.00
Incremental Delay, d2		1.2	1.3		0.9	0.1
Delay (s)		26.5	15.0		13.0	9.2
Level of Service		C	B		B	A
Approach Delay (s)		26.5	15.0		12.7	
Approach LOS		C	B		B	

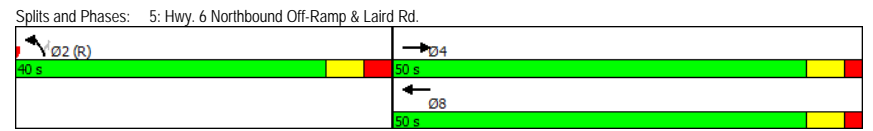
Intersection Summary			
HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues Future Traffic Conditions - Base Future Street Network
 5: Hwy. 6 Northbound Off-Ramp & Laird Rd. Weekday Afternoon Peak Hour

Lane Group	EBT	WBT	NBL	NBR
Lane Configurations	↑↑	↑↑	↑	↑
Traffic Volume (vph)	1215	725	30	310
Future Volume (vph)	1215	725	30	310
Lane Group Flow (vph)	1215	725	30	310
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	2	
Permitted Phases				2
Minimum Split (s)	24.0	24.0	25.0	25.0
Total Split (s)	50.0	50.0	40.0	40.0
Total Split (%)	55.6%	55.6%	44.4%	44.4%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	7.0	7.0
Lead/Lag				
Lead-Lag Optimize?				
v/c Ratio	0.73	0.44	0.05	0.60
Control Delay	22.9	16.0	18.7	25.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	22.9	16.0	18.7	25.8
Queue Length 50th (m)	95.8	43.1	3.5	39.3
Queue Length 95th (m)	126.7	57.7	9.3	67.8
Internal Link Dist (m)	282.0	205.6	157.0	
Turn Bay Length (m)				100.0
Base Capacity (vph)	1662	1662	654	520
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.73	0.44	0.05	0.60

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 60	
Control Type: Pretimed	



HCM Signalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
5: Hwy. 6 Northbound Off-Ramp & Laird Rd. Weekday Afternoon Peak Hour

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↖	↗
Traffic Volume (vph)	1215	0	0	725	30	310
Future Volume (vph)	1215	0	0	725	30	310
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	7.0	7.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3400			3400	1785	1353
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	3400			3400	1785	1353
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1215	0	0	725	30	310
RTOR Reduction (vph)	0	0	0	0	0	24
Lane Group Flow (vph)	1215	0	0	725	30	286
Heavy Vehicles (%)	5%	2%	2%	5%	0%	18%
Turn Type	NA			NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases						2
Actuated Green, G (s)	44.0			44.0	33.0	33.0
Effective Green, g (s)	44.0			44.0	33.0	33.0
Actuated g/C Ratio	0.49			0.49	0.37	0.37
Clearance Time (s)	6.0			6.0	7.0	7.0
Lane Grp Cap (vph)	1662			1662	654	496
v/s Ratio Prot	c0.36			0.21	0.02	
v/s Ratio Perm						c0.21
v/c Ratio	0.73			0.44	0.05	0.58
Uniform Delay, d1	18.3			14.9	18.4	22.9
Progression Factor	1.09			1.00	1.00	1.00
Incremental Delay, d2	2.6			0.8	0.1	4.8
Delay (s)	22.5			15.8	18.5	27.7
Level of Service	C			B	B	C
Approach Delay (s)	22.5			15.8	26.9	
Approach LOS	C			B	C	
Intersection Summary						
HCM 2000 Control Delay		21.0			HCM 2000 Level of Service C	
HCM 2000 Volume to Capacity ratio		0.66				
Actuated Cycle Length (s)		90.0			Sum of lost time (s)	13.0
Intersection Capacity Utilization		63.6%			ICU Level of Service	B
Analysis Period (min)		15				
c Critical Lane Group						

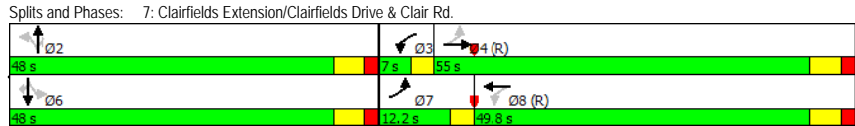
HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
6: Clair Rd. & Laird Rd. Weekday Afternoon Peak Hour

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↑↑		↖	↑↑	↖	↗
Traffic Volume (veh/h)	1695	5	105	1165	1	265
Future Volume (Veh/h)	1695	5	105	1165	1	265
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1695	5	105	1165	1	265
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			1700		2490	850
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1700		2490	850
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			72		94	13
cM capacity (veh/h)			371		17	304
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NE 1
Volume Total	1130	570	105	582	582	266
Volume Left	0	0	105	0	0	1
Volume Right	0	5	0	0	0	265
cSH	1700	1700	371	1700	1700	286
Volume to Capacity	0.66	0.34	0.28	0.34	0.34	0.93
Queue Length 95th (m)	0.0	0.0	9.2	0.0	0.0	70.5
Control Delay (s)	0.0	0.0	18.5	0.0	0.0	76.1
Lane LOS			C			F
Approach Delay (s)	0.0		1.5			76.1
Approach LOS						F
Intersection Summary						
Average Delay			6.9			
Intersection Capacity Utilization			79.3%		ICU Level of Service	D
Analysis Period (min)			15			

Queues Future Traffic Conditions - Base Future Street Network
 7: Clairfields Extension/Clairfields Drive & Clair Rd. Weekday Afternoon Peak Hour

	←		→		↖		↗		↑		↓	
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations	↖	↖	↖	↖		↖	↖	↖	↖	↖		↖
Traffic Volume (vph)	120	1315	120	800	390	95	55	25	145	80		
Future Volume (vph)	120	1315	120	800	390	95	55	25	145	80		
Lane Group Flow (vph)	120	1850	120	845	0	485	55	0	170	80		
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	Perm	NA	Perm		
Protected Phases	7	4	3	8		2			6			
Permitted Phases	4		8		2		2	6		6		
Detector Phase	7	4	3	8	2	2	2	6	6	6		
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		
Minimum Split (s)	9.5	24.0	9.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0		
Total Split (s)	12.2	55.0	7.0	49.8	48.0	48.0	48.0	48.0	48.0	48.0		
Total Split (%)	11.1%	50.0%	6.4%	45.3%	43.6%	43.6%	43.6%	43.6%	43.6%	43.6%		
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0		
Total Lost Time (s)	3.0	6.0	3.0	6.0		6.0	6.0		6.0	6.0		
Lead/Lag	Lead	Lag	Lead	Lag								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max		
v/c Ratio	0.39	1.21	0.89	0.60		1.08	0.08		0.30	0.12		
Control Delay	16.6	128.6	61.2	44.3		98.9	1.8		25.6	4.5		
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0		
Total Delay	16.6	128.6	61.2	44.3		98.9	1.8		25.6	4.5		
Queue Length 50th (m)	12.9	-265.2	21.8	104.1		-122.3	0.0		26.5	0.0		
Queue Length 95th (m)	22.7	#310.7	m23.6	m113.6		#187.4	3.4		44.3	8.5		
Internal Link Dist (m)		186.5		775.0		156.4			150.9			
Turn Bay Length (m)	55.0		45.0			20.0			20.0			
Base Capacity (vph)	316	1531	135	1409		450	652		563	652		
Starvation Cap Reductn	0	0	0	0		0	0		0	0		
Spillback Cap Reductn	0	0	0	0		0	0		0	0		
Storage Cap Reductn	0	0	0	0		0	0		0	0		
Reduced v/c Ratio	0.38	1.21	0.89	0.60		1.08	0.08		0.30	0.12		

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 150
 Control Type: Actuated-Coordinated
 - Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
 7: Clairfields Extension/Clairfields Drive & Clair Rd. Weekday Afternoon Peak Hour

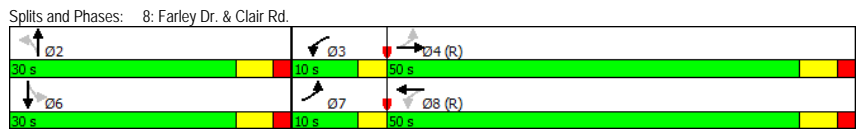
	←		→		↖		↗		↑		↓	
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖		↖	↖			↖	↖	↖	↖	↖
Traffic Volume (vph)	120	1315	535	120	800	45	390	95	55	25	145	80
Future Volume (vph)	120	1315	535	120	800	45	390	95	55	25	145	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0			6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	1.00
Flt	1.00	0.96		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.99	1.00
Satd. Flow (prot)	1750	3348		1750	3472			1771	1566		1829	1566
Flt Permitted	0.20	1.00		0.09	1.00			0.64	1.00		0.80	1.00
Satd. Flow (perm)	376	3348		166	3472			1181	1566		1476	1566
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	120	1315	535	120	800	45	390	95	55	25	145	80
RTOR Reduction (vph)	0	40	0	0	4	0	0	0	34	0	0	49
Lane Group Flow (vph)	120	1810	0	120	841	0	0	485	21	0	170	31
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	56.0	49.0		48.5	44.5			42.0	42.0		42.0	42.0
Effective Green, g (s)	56.0	49.0		48.5	44.5			42.0	42.0		42.0	42.0
Actuated g/C Ratio	0.51	0.45		0.44	0.40			0.38	0.38		0.38	0.38
Clearance Time (s)	3.0	6.0		3.0	6.0			6.0	6.0		6.0	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)	297	1491		130	1404			450	597		563	597
v/s Ratio Prot	0.03	c0.54		c0.03	0.24							
v/s Ratio Perm	0.17			0.37				c0.41	0.01		0.12	0.02
v/c Ratio	0.40	1.21		0.92	0.60			1.08	0.04		0.30	0.05
Uniform Delay, d1	16.2	30.5		29.3	25.7			34.0	21.3		23.8	21.4
Progression Factor	1.00	1.00		2.35	1.68			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	102.7		26.7	0.6			64.9	0.1		1.4	0.2
Delay (s)	17.1	133.2		95.5	43.8			98.9	21.4		25.1	21.6
Level of Service	B	F		F	D			F	C		C	C
Approach Delay (s)		126.1			50.3			91.0			24.0	
Approach LOS		F			D			F			C	

Intersection Summary
 HCM 2000 Control Delay: 94.5
 HCM 2000 Level of Service: F
 HCM 2000 Volume to Capacity ratio: 1.14
 Actuated Cycle Length (s): 110.0
 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 114.0%
 ICU Level of Service: H
 Analysis Period (min): 15
 c Critical Lane Group

Queues
8: Farley Dr. & Clair Rd. Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↖	↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	235	945	155	695	130	105	85	115
Future Volume (vph)	235	945	155	695	130	105	85	115
Lane Group Flow (vph)	235	1150	155	765	130	200	85	255
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	24.0	24.0	24.0	24.0
Total Split (s)	10.0	50.0	10.0	50.0	30.0	30.0	30.0	30.0
Total Split (%)	11.1%	55.6%	11.1%	55.6%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max
v/c Ratio	0.54	0.69	0.55	0.46	0.56	0.41	0.31	0.51
Control Delay	12.3	19.7	28.4	17.7	39.3	23.1	30.3	24.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.3	19.7	28.4	17.7	39.3	23.1	30.3	24.7
Queue Length 50th (m)	16.3	78.6	19.0	36.5	20.4	22.1	12.4	28.7
Queue Length 95th (m)	26.6	102.3	38.5	57.9	40.2	42.1	25.9	52.7
Internal Link Dist (m)		194.1		563.0		111.7		152.1
Turn Bay Length (m)	125.0		50.0		45.0		20.0	
Base Capacity (vph)	433	1667	286	1663	232	493	271	499
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.69	0.54	0.46	0.56	0.41	0.31	0.51

Intersection Summary
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
 8: Farley Dr. & Clair Rd. Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓	↖	↗	↓	↖
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖		↖	↖		↖	↖		↖	↖	↖
Traffic Volume (vph)	235	945	205	155	695	70	130	105	95	85	115	140
Future Volume (vph)	235	945	205	155	695	70	130	105	95	85	115	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.99		1.00	1.00		1.00	0.98		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		0.98	1.00	
Frt	1.00	0.97		1.00	0.99		1.00	0.93		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1783	3361		1785	3387		1724	1716		1689	1691	
Flt Permitted	0.30	1.00		0.15	1.00		0.48	1.00		0.57	1.00	
Satd. Flow (perm)	566	3361		283	3387		869	1716		1019	1691	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	235	945	205	155	695	70	130	105	95	85	115	140
RTOR Reduction (vph)	0	20	0	0	8	0	0	36	0	0	48	0
Lane Group Flow (vph)	235	1130	0	155	757	0	130	164	0	85	207	0
Confl. Peds. (#/hr)	6		8	8		6	16		15	15		16
Confl. Bikes (#/hr)							1					
Heavy Vehicles (%)	0%	3%	1%	0%	4%	0%	2%	0%	0%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	51.1	44.1		50.9	44.0		24.0	24.0		24.0	24.0	
Effective Green, g (s)	51.1	44.1		50.9	44.0		24.0	24.0		24.0	24.0	
Actuated g/C Ratio	0.57	0.49		0.57	0.49		0.27	0.27		0.27	0.27	
Clearance Time (s)	3.0	6.0		3.0	6.0		6.0	6.0		6.0	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)	416	1646		275	1655		231	457		271	450	
v/s Ratio Prot	c0.04	c0.34		0.04	0.22		0.10			0.12		
v/s Ratio Perm	0.28			0.28			c0.15			0.08		
v/c Ratio	0.56	0.69		0.56	0.46		0.56	0.36		0.31	0.46	
Uniform Delay, d1	10.1	17.6		11.8	15.1		28.5	26.8		26.4	27.6	
Progression Factor	1.00	1.00		3.10	1.12		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.8	2.4		2.4	0.8		9.6	2.2		3.0	3.3	
Delay (s)	11.9	20.0		38.8	17.8		38.0	29.0		29.4	30.9	
Level of Service	B	B		D	B		D	C		C	C	
Approach Delay (s)	18.6			21.4			32.5			30.5		
Approach LOS	B			C			C			C		

Intersection Summary
 HCM 2000 Control Delay: 22.4 HCM 2000 Level of Service: C
 HCM 2000 Volume to Capacity ratio: 0.64
 Actuated Cycle Length (s): 90.0 Sum of lost time (s): 15.0
 Intersection Capacity Utilization: 82.4% ICU Level of Service: E
 Analysis Period (min): 15
 c Critical Lane Group

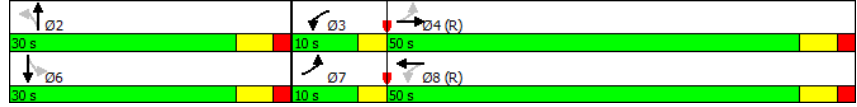
Queues Future Traffic Conditions - Base Future Street Network
 9: Beaver Meadow Dr. & Clair Rd. Weekday Afternoon Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Traffic Volume (vph)	110	1065	55	845	45	5	15	15
Future Volume (vph)	110	1065	55	845	45	5	15	15
Lane Group Flow (vph)	110	1110	55	860	0	90	15	75
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	24.0	24.0	24.0	24.0	24.0
Total Split (s)	10.0	50.0	10.0	50.0	30.0	30.0	30.0	30.0
Total Split (%)	11.1%	55.6%	11.1%	55.6%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	6.0		6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max
v/c Ratio	0.28	0.62	0.19	0.48		0.22	0.04	0.16
Control Delay	14.2	30.0	7.8	15.9		17.2	25.0	10.4
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	14.2	30.0	7.8	15.9		17.2	25.0	10.4
Queue Length 50th (m)	11.9	96.2	3.4	53.3		6.9	2.0	2.0
Queue Length 95th (m)	m20.0	119.7	7.7	70.1		19.1	6.9	12.6
Internal Link Dist (m)		563.0		1233.2		183.8		182.6
Turn Bay Length (m)	55.0		30.0					
Base Capacity (vph)	392	1791	303	1784		409	365	470
Starvation Cap Reductn	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0		0	0	0
Reduced v/c Ratio	0.28	0.62	0.18	0.48		0.22	0.04	0.16

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 86.4 (96%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Beaver Meadow Dr. & Clair Rd.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
 9: Beaver Meadow Dr. & Clair Rd. Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖ ↗	↖ ↗		↖ ↗	↖ ↗		↖ ↗	↖ ↗		↖ ↗	↖ ↗	
Traffic Volume (vph)	110	1065	45	55	845	15	45	5	40	15	15	60
Future Volume (vph)	110	1065	45	55	845	15	45	5	40	15	15	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		3.0	6.0			6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00	
Frbp, ped/bikes	1.00	1.00		1.00	1.00			0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00			0.94		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	1.00	
Satd. Flow (prot)	1750	3475		1750	3489			1674		1743	1600	
Flt Permitted	0.26	1.00		0.17	1.00			0.83		0.75	1.00	
Satd. Flow (perm)	483	3475		317	3489			1427		1372	1600	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	1065	45	55	845	15	45	5	40	15	15	60
RTOR Reduction (vph)	0	3	0	0	1	0	0	29	0	0	44	0
Lane Group Flow (vph)	110	1107	0	55	859	0	0	61	0	15	31	0
Confl. Peds. (#/hr)	2		1	1		2	3		3	3		3
Confl. Bikes (#/hr)			1	1		2						
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	51.3	45.7		50.7	45.4			24.0		24.0	24.0	
Effective Green, g (s)	51.3	45.7		50.7	45.4			24.0		24.0	24.0	
Actuated g/C Ratio	0.57	0.51		0.56	0.50			0.27		0.27	0.27	
Clearance Time (s)	3.0	6.0		3.0	6.0			6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	354	1764		262	1760			380		365	426	
v/s Ratio Prot	c0.02	c0.32		0.01	0.25						0.02	
v/s Ratio Perm	0.16			0.11				c0.04		0.01		
v/c Ratio	0.31	0.63		0.21	0.49			0.16		0.04	0.07	
Uniform Delay, d1	9.5	16.0		10.3	14.7			25.3		24.5	24.7	
Progression Factor	1.92	1.76		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	0.4	1.4		0.4	1.0			0.9		0.2	0.3	
Delay (s)	18.5	29.5		10.7	15.6			26.2		24.7	25.0	
Level of Service	B	C		B	B			C		C	C	
Approach Delay (s)		28.5			15.3			26.2			25.0	
Approach LOS		C			B			C			C	

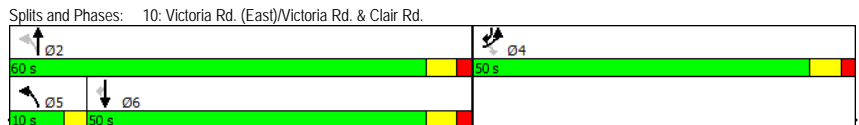
Intersection Summary

HCM 2000 Control Delay 23.1 HCM 2000 Level of Service C
 HCM 2000 Volume to Capacity ratio 0.46
 Actuated Cycle Length (s) 90.0 Sum of lost time (s) 15.0
 Intersection Capacity Utilization 63.4% ICU Level of Service B
 Analysis Period (min) 15
 c Critical Lane Group

Queues Future Traffic Conditions - Base Future Street Network
10: Victoria Rd. (East)/Victoria Rd. & Clair Rd. Weekday Afternoon Peak Hour

	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	755	190	190	565	585	695
Future Volume (vph)	755	190	190	565	585	695
Lane Group Flow (vph)	755	190	190	565	585	695
Turn Type	Prot	Perm	pm+pt	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4	2			6
Detector Phase	4	4	5	2	6	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	9.5	24.0	24.0	24.0
Total Split (s)	50.0	50.0	10.0	60.0	50.0	50.0
Total Split (%)	45.5%	45.5%	9.1%	54.5%	45.5%	45.5%
Yellow Time (s)	4.0	4.0	3.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	0.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	3.0	6.0	6.0	6.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None	Min	Min	None
v/c Ratio	0.99	0.25	0.89	0.69	0.90	0.54
Control Delay	61.6	6.6	57.4	27.2	49.0	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.6	6.6	57.4	27.2	49.0	3.4
Queue Length 50th (m)	-159.2	4.8	22.2	91.4	114.4	20.0
Queue Length 95th (m)	#263.2	20.0	#54.7	130.1	162.1	32.8
Internal Link Dist (m)	1233.2		1674.8	465.2		
Turn Bay Length (m)			75.0		75.0	
Base Capacity (vph)	763	773	214	954	792	1280
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.99	0.25	0.89	0.59	0.74	0.54

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 102.7
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated
 - Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
10: Victoria Rd. (East)/Victoria Rd. & Clair Rd. Weekday Afternoon Peak Hour

	EBL	EBR	NBL	NBT	SBT	SBR
Movement	↖	↗	↖	↗	↖	↗
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	755	190	190	565	585	695
Future Volume (vph)	755	190	190	565	585	695
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	3.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1773	1597	1785	1807	1842	1493
Flt Permitted	1.00	1.00	0.12	1.00	1.00	1.00
Satd. Flow (perm)	1773	1597	224	1807	1842	1493
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	755	190	190	565	585	695
RTOR Reduction (vph)	0	86	0	0	0	29
Lane Group Flow (vph)	755	104	190	565	585	666
Heavy Vehicles (%)	6%	0%	0%	4%	2%	7%
Turn Type	Prot	Perm	pm+pt	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4	2			6
Actuated Green, G (s)	44.2	44.2	46.5	46.5	36.5	80.7
Effective Green, g (s)	44.2	44.2	46.5	46.5	36.5	80.7
Actuated g/C Ratio	0.43	0.43	0.45	0.45	0.36	0.79
Clearance Time (s)	6.0	6.0	3.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	763	687	207	818	654	1260
v/s Ratio Prot	c0.43		c0.06	0.31	0.32	0.23
v/s Ratio Perm		0.07	c0.35			0.22
v/c Ratio	0.99	0.15	0.92	0.69	0.89	0.53
Uniform Delay, d1	29.0	17.8	22.5	22.4	31.3	4.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	29.6	0.1	40.0	2.5	14.7	0.4
Delay (s)	58.6	17.9	62.4	24.9	46.0	4.4
Level of Service	E	B	E	C	D	A
Approach Delay (s)	50.5			34.3	23.4	
Approach LOS	D			C	C	

Intersection Summary
 HCM 2000 Control Delay 34.8 HCM 2000 Level of Service C
 HCM 2000 Volume to Capacity ratio 0.98
 Actuated Cycle Length (s) 102.7 Sum of lost time (s) 15.0
 Intersection Capacity Utilization 96.5% ICU Level of Service F
 Analysis Period (min) 15
 c Critical Lane Group

Queues Future Traffic Conditions - Base Future Street Network
11: Gordon St. & Gosling Gardens Weekday Afternoon Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↔	↕	↕	↕
Traffic Volume (vph)	1	55	25	30	20	1400	105	1405
Future Volume (vph)	1	55	25	30	20	1400	105	1405
Lane Group Flow (vph)	0	66	0	110	20	1445	105	1410
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases		4		8		2	1	6
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	9.5	24.0
Total Split (s)	28.0	28.0	28.0	28.0	72.0	72.0	10.0	82.0
Total Split (%)	25.5%	25.5%	25.5%	25.5%	65.5%	65.5%	9.1%	74.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0
Total Lost Time (s)		6.0		6.0		6.0		6.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
v/c Ratio		0.18		0.32	0.11	0.69	0.44	0.58
Control Delay		34.3		26.6	18.0	35.1	13.2	22.8
Queue Delay		0.0		1.0	0.0	48.7	0.0	4.3
Total Delay		34.3		27.7	18.0	83.7	13.2	27.0
Queue Length 50th (m)		11.1		13.2	3.6	178.0	12.4	169.5
Queue Length 95th (m)		23.6		29.8	m5.4	200.1	m14.5	192.3
Internal Link Dist (m)		118.2		132.0		118.1		172.0
Turn Bay Length (m)					30.0		30.0	
Base Capacity (vph)		365		349	184	2091	239	2415
Starvation Cap Reductn		0		0	0	820	0	910
Spillback Cap Reductn		0		102	0	173	0	0
Storage Cap Reductn		0		0	0	0	0	0
Reduced v/c Ratio		0.18		0.45	0.11	1.14	0.44	0.94

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 70
 Control Type: Pretimed
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
11: Gordon St. & Gosling Gardens Weekday Afternoon Peak Hour

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↔	↕	↕	↕	↕	
Traffic Volume (vph)	1	55	10	25	30	55	20	1400	45	105	1405	5
Future Volume (vph)	1	55	10	25	30	55	20	1400	45	105	1405	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0		3.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.98			0.93		1.00	1.00		1.00	1.00	
Flt Protected		1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1803			1698		1750	3484		1750	3498	
Flt Permitted		1.00			0.92		0.17	1.00		0.11	1.00	
Satd. Flow (perm)		1799			1585		308	3484		195	3498	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	55	10	25	30	55	20	1400	45	105	1405	5
RTOR Reduction (vph)	0	6	0	0	33	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	60	0	0	77	0	20	1443	0	105	1410	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases		4			8			2		1	6	
Actuated Green, G (s)		22.0			22.0		66.0	66.0		76.0	76.0	
Effective Green, g (s)		22.0			22.0		66.0	66.0		76.0	76.0	
Actuated g/C Ratio		0.20			0.20		0.60	0.60		0.69	0.69	
Clearance Time (s)		6.0			6.0		6.0	6.0		3.0	6.0	
Lane Grp Cap (vph)		359			317		184	2090		233	2416	
v/s Ratio Prot							c0.41			0.03	c0.40	
v/s Ratio Perm		0.03			c0.05		0.06			0.28		
v/c Ratio		0.17			0.24		0.11	0.69		0.45	0.58	
Uniform Delay, d1		36.4			37.0		9.4	15.0		11.2	8.8	
Progression Factor		1.00			1.00		1.69	2.19		1.99	2.46	
Incremental Delay, d2		1.0			1.8		0.9	1.5		4.1	0.7	
Delay (s)		37.4			38.8		16.9	34.5		26.4	22.4	
Level of Service		D			D		B	C		C	C	
Approach Delay (s)		37.4			38.8		34.2			22.6		
Approach LOS		D			D		C			C		

Intersection Summary
 HCM 2000 Control Delay 28.9 HCM 2000 Level of Service C
 HCM 2000 Volume to Capacity ratio 0.58
 Actuated Cycle Length (s) 110.0 Sum of lost time (s) 15.0
 Intersection Capacity Utilization 72.3% ICU Level of Service C
 Analysis Period (min) 15
 c Critical Lane Group

Queues
12: Gordon St. & Street B
Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	45	65	85	80	30	1405	15	1365
Future Volume (vph)	45	65	85	80	30	1405	15	1365
Lane Group Flow (vph)	45	80	85	95	30	1465	15	1405
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	30.0	30.0	30.0	30.0	80.0	80.0	80.0	80.0
Total Split (%)	27.3%	27.3%	27.3%	27.3%	72.7%	72.7%	72.7%	72.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
v/c Ratio	0.18	0.21	0.33	0.24	0.17	0.63	0.09	0.60
Control Delay	37.2	32.4	40.4	34.4	15.8	25.2	12.1	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	49.0	0.0	0.5
Total Delay	37.2	32.4	40.4	34.4	15.8	74.2	12.1	12.1
Queue Length 50th (m)	8.3	13.0	16.3	16.3	4.6	183.3	1.1	55.5
Queue Length 95th (m)	18.8	26.7	31.7	31.3	m7.0	207.3	m2.6	85.1
Internal Link Dist (m)		725.3		381.8		529.0		118.1
Turn Bay Length (m)	30.0		30.0		50.0		50.0	
Base Capacity (vph)	256	390	260	392	176	2326	160	2335
Starvation Cap Reductn	0	0	0	0	0	0	0	451
Spillback Cap Reductn	0	0	0	2	0	1086	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.21	0.33	0.24	0.17	1.18	0.09	0.75

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 65 (59%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis
12: Gordon St. & Street B
Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	45	65	15	85	80	15	30	1405	60	15	1365	40
Future Volume (vph)	45	65	15	85	80	15	30	1405	60	15	1365	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	0.98		1.00	0.98		1.00	0.99		1.00	1.00	
Flpb, ped/bikes	0.92	1.00		0.92	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1609	1756		1606	1770		1750	3454		1750	3468	
Flt Permitted	0.70	1.00		0.70	1.00		0.14	1.00		0.13	1.00	
Satd. Flow (perm)	1178	1756		1192	1770		261	3454		237	3468	
Peak-hour factor, PHF	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Adj. Flow (vph)	45	65	15	85	80	15	30	1405	60	15	1365	40
RTOR Reduction (vph)	0	8	0	0	6	0	3	0	0	2	0	0
Lane Group Flow (vph)	45	72	0	85	89	0	30	1462	0	15	1403	0
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	24.0	24.0		24.0	24.0		74.0	74.0		74.0	74.0	
Effective Green, g (s)	24.0	24.0		24.0	24.0		74.0	74.0		74.0	74.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.67	0.67		0.67	0.67	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Grp Cap (vph)	257	383		260	386		175	2323		159	2333	
v/s Ratio Prot		0.04			0.05			c0.42			0.40	
v/s Ratio Perm	0.04			c0.07			0.11			0.06		
v/c Ratio	0.18	0.19		0.33	0.23		0.17	0.63		0.09	0.60	
Uniform Delay, d1	35.0	35.1		36.2	35.4		6.7	10.2		6.3	9.9	
Progression Factor	1.00	1.00		1.00	1.00		1.94	2.34		1.63	1.06	
Incremental Delay, d2	1.5	1.1		3.3	1.4		1.5	0.9		1.0	1.0	
Delay (s)	36.4	36.1		39.5	36.8		14.5	24.9		11.2	11.4	
Level of Service	D	D		D	D		B	C		B	B	
Approach Delay (s)		36.3			38.1			24.7			11.4	
Approach LOS		D			D			C			B	

Intersection Summary
 HCM 2000 Control Delay: 20.0, HCM 2000 Level of Service: C
 HCM 2000 Volume to Capacity ratio: 0.56
 Actuated Cycle Length (s): 110.0, Sum of lost time (s): 12.0
 Intersection Capacity Utilization: 65.9%, ICU Level of Service: C
 Analysis Period (min): 15
 c Critical Lane Group

Queues
13: Gordon St. & Street C
Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗	↙	↘	↖	↗	↙	↘
Traffic Volume (vph)	40	65	30	45	45	1350	115	1285
Future Volume (vph)	40	65	30	45	45	1350	115	1285
Lane Group Flow (vph)	40	95	30	150	45	1420	115	1350
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	9.5	24.0
Total Split (s)	30.0	30.0	30.0	30.0	68.0	68.0	12.0	80.0
Total Split (%)	27.3%	27.3%	27.3%	27.3%	61.8%	61.8%	10.9%	72.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
v/c Ratio	0.16	0.24	0.11	0.34	0.24	0.72	0.45	0.58
Control Delay	37.0	30.1	35.8	16.5	20.8	22.7	16.8	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	37.0	30.1	35.8	16.5	20.8	22.8	16.8	3.4
Queue Length 50th (m)	7.4	14.1	5.5	9.5	5.0	83.3	6.2	12.0
Queue Length 95th (m)	17.4	29.0	14.0	27.8	m9.4	150.9	m14.5	13.5
Internal Link Dist (m)		719.7		611.7		130.0		529.0
Turn Bay Length (m)	30.0		30.0		50.0		50.0	
Base Capacity (vph)	245	397	279	436	191	1962	255	2341
Starvation Cap Reductn	0	0	0	0	0	43	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.24	0.11	0.34	0.24	0.74	0.45	0.58

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 70
 Control Type: Pretimed
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis
13: Gordon St. & Street C
Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	↖	→	↙	←	↘	↑	↗	↓	↙	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↙	↘		↖	↗		↙	↘	↙
Traffic Volume (vph)	40	65	30	30	45	105	45	1350	70	115	1285	65
Future Volume (vph)	40	65	30	30	45	105	45	1350	70	115	1285	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		3.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	0.90		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	1755		1750	1649		1750	3474		1750	3475	
Flt Permitted	0.61	1.00		0.70	1.00		0.18	1.00		0.10	1.00	
Satd. Flow (perm)	1126	1755		1281	1649		339	3474		181	3475	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	65	30	30	45	105	45	1350	70	115	1285	65
RTOR Reduction (vph)	0	15	0	0	77	0	0	3	0	0	3	0
Lane Group Flow (vph)	40	80	0	30	73	0	45	1417	0	115	1347	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	24.0	24.0		24.0	24.0		62.0	62.0		74.0	74.0	
Effective Green, g (s)	24.0	24.0		24.0	24.0		62.0	62.0		74.0	74.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.56	0.56		0.67	0.67	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		3.0	6.0	
Lane Grp Cap (vph)	245	382		279	359		191	1958		250	2337	
v/s Ratio Prot		c0.05			0.04			c0.41		0.04	c0.39	
v/s Ratio Perm	0.04			0.02			0.13			0.27		
v/c Ratio	0.16	0.21		0.11	0.20		0.24	0.72		0.46	0.58	
Uniform Delay, d1	34.9	35.2		34.4	35.2		12.1	17.7		12.9	9.6	
Progression Factor	1.00	1.00		1.00	1.00		1.39	1.16		1.90	0.26	
Incremental Delay, d2	1.4	1.2		0.8	1.3		2.4	2.0		4.9	0.9	
Delay (s)	36.3	36.5		35.2	36.5		19.2	22.4		29.4	3.3	
Level of Service	D	D		D	D		B	C		C	A	
Approach Delay (s)		36.4			36.3			22.3			5.4	
Approach LOS		D			D			C			A	

Intersection Summary
 HCM 2000 Control Delay: 16.0
 HCM 2000 Volume to Capacity ratio: 0.58
 Actuated Cycle Length (s): 110.0
 Intersection Capacity Utilization: 77.2%
 Analysis Period (min): 15
 c Critical Lane Group

Queues
14: Gordon St. & Street D
Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	40	35	40	30	40	1370	45	1230
Future Volume (vph)	40	35	40	30	40	1370	45	1230
Lane Group Flow (vph)	40	55	40	80	40	1405	45	1295
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	30.0	30.0	30.0	30.0	80.0	80.0	80.0	80.0
Total Split (%)	27.3%	27.3%	27.3%	27.3%	72.7%	72.7%	72.7%	72.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
v/c Ratio	0.14	0.14	0.14	0.20	0.19	0.60	0.26	0.55
Control Delay	36.4	25.4	36.3	17.5	6.5	6.4	6.2	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3
Total Delay	36.4	25.4	36.3	17.5	6.5	6.4	6.2	5.0
Queue Length 50th (m)	7.4	6.4	7.3	5.4	2.1	41.4	2.2	59.6
Queue Length 95th (m)	17.2	17.5	17.2	18.5	m2.8	45.7	m5.3	87.9
Internal Link Dist (m)		715.4		532.4		581.1		130.0
Turn Bay Length (m)	30.0		30.0		50.0		50.0	
Base Capacity (vph)	283	395	289	403	207	2346	176	2339
Starvation Cap Reductn	0	0	0	0	0	0	0	397
Spillback Cap Reductn	0	0	0	1	0	104	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.14	0.14	0.20	0.19	0.63	0.26	0.67

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 8 (7%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis
14: Gordon St. & Street D
Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	40	35	20	40	30	50	40	1370	35	45	1230	65
Future Volume (vph)	40	35	20	40	30	50	40	1370	35	45	1230	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	0.91		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	1742		1750	1669		1750	3487		1750	3474	
Flt Permitted	0.70	1.00		0.72	1.00		0.17	1.00		0.14	1.00	
Satd. Flow (perm)	1299	1742		1328	1669		308	3487		261	3474	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	35	20	40	30	50	40	1370	35	45	1230	65
RTOR Reduction (vph)	0	16	0	0	39	0	0	2	0	0	4	0
Lane Group Flow (vph)	40	39	0	40	41	0	40	1403	0	45	1291	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	24.0	24.0		24.0	24.0		74.0	74.0		74.0	74.0	
Effective Green, g (s)	24.0	24.0		24.0	24.0		74.0	74.0		74.0	74.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.67	0.67		0.67	0.67	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Grp Cap (vph)	283	380		289	364		207	2345		175	2337	
v/s Ratio Prot		0.02			0.02			c0.40			0.37	
v/s Ratio Perm	c0.03			0.03			0.13			0.17		
v/c Ratio	0.14	0.10		0.14	0.11		0.19	0.60		0.26	0.55	
Uniform Delay, d1	34.7	34.4		34.7	34.5		6.8	9.9		7.1	9.4	
Progression Factor	1.00	1.00		1.00	1.00		0.67	0.56		0.41	0.42	
Incremental Delay, d2	1.0	0.5		1.0	0.6		1.4	0.8		3.0	0.8	
Delay (s)	35.7	34.9		35.7	35.1		6.0	6.3		5.9	4.7	
Level of Service	D	C		D	D		A	A		A	A	
Approach Delay (s)		35.3			35.3			6.3			4.8	
Approach LOS		D			D			A			A	

Intersection Summary
 HCM 2000 Control Delay: 7.7
 HCM 2000 Volume to Capacity ratio: 0.49
 Actuated Cycle Length (s): 110.0
 Intersection Capacity Utilization: 57.9%
 Analysis Period (min): 15
 c Critical Lane Group

Queues
15: Gordon St. & Street E

Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	30	195	45	130	55	1285	155	1120
Future Volume (vph)	30	195	45	130	55	1285	155	1120
Lane Group Flow (vph)	30	225	45	260	55	1410	155	1140
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases		4		8		2	1	6
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	9.5	24.0
Total Split (s)	30.0	30.0	30.0	30.0	68.0	68.0	12.0	80.0
Total Split (%)	27.3%	27.3%	27.3%	27.3%	61.8%	61.8%	10.9%	72.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
v/c Ratio	0.19	0.57	0.25	0.64	0.21	0.72	0.61	0.49
Control Delay	39.0	43.6	39.8	40.9	14.6	20.1	26.4	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.0	43.6	39.8	40.9	14.6	20.1	26.4	11.1
Queue Length 50th (m)	5.6	44.4	8.5	45.0	5.8	115.6	22.7	74.5
Queue Length 95th (m)	14.7	70.2	19.5	74.1	14.0	142.9	42.9	101.5
Internal Link Dist (m)		709.2		605.3		187.1		581.1
Turn Bay Length (m)	30.0		30.0		50.0		50.0	
Base Capacity (vph)	155	398	183	404	258	1953	256	2348
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.57	0.25	0.64	0.21	0.72	0.61	0.49

Intersection Summary

Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 70
 Control Type: Pretimed

Splits and Phases: 15: Gordon St. & Street E



HCM Signalized Intersection Capacity Analysis
15: Gordon St. & Street E

Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	30	195	30	45	130	130	55	1285	125	155	1120	20
Future Volume (vph)	30	195	30	45	130	130	55	1285	125	155	1120	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		3.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.93		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	1805		1750	1704		1750	3453		1750	3491	
Flt Permitted	0.39	1.00		0.46	1.00		0.25	1.00		0.10	1.00	
Satd. Flow (perm)	711	1805		840	1704		459	3453		185	3491	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	30	195	30	45	130	130	55	1285	125	155	1120	20
RTOR Reduction (vph)	0	5	0	0	33	0	0	7	0	0	1	0
Lane Group Flow (vph)	30	220	0	45	227	0	55	1403	0	155	1139	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases		4			8			2		1	6	
Actuated Green, G (s)	24.0	24.0		24.0	24.0		62.0	62.0		74.0	74.0	
Effective Green, g (s)	24.0	24.0		24.0	24.0		62.0	62.0		74.0	74.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.56	0.56		0.67	0.67	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		3.0	6.0	
Lane Grp Cap (vph)	155	393		183	371		258	1946		252	2348	
v/s Ratio Prot		0.12			c0.13			c0.41		c0.05	0.33	
v/s Ratio Perm	0.04			0.05			0.12			0.36		
v/c Ratio	0.19	0.56		0.25	0.61		0.21	0.72		0.62	0.49	
Uniform Delay, d1	35.1	38.3		35.5	38.8		11.9	17.6		14.1	8.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.83	1.18	
Incremental Delay, d2	2.8	5.7		3.2	7.4		1.9	2.3		9.3	0.6	
Delay (s)	37.9	44.0		38.7	46.2		13.8	20.0		35.2	10.9	
Level of Service	D	D		D	D		B	B		D	B	
Approach Delay (s)		43.3			45.1			19.8			13.8	
Approach LOS		D			D			B			B	

Intersection Summary

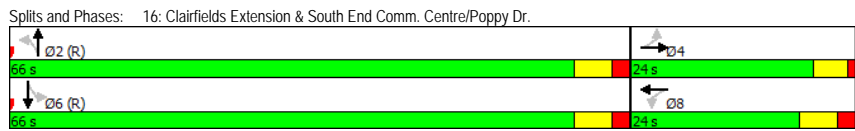
HCM 2000 Control Delay: 21.6
 HCM 2000 Volume to Capacity ratio: 0.68
 Actuated Cycle Length (s): 110.0
 Intersection Capacity Utilization: 85.4%
 Analysis Period (min): 15
 c Critical Lane Group

HCM 2000 Level of Service: C
 Sum of lost time (s): 15.0
 ICU Level of Service: E

Queues Future Traffic Conditions - Base Future Street Network
 16: Clairfields Extension & South End Comm. Centre/Poppy Dr. Weekday Afternoon Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	45	55	25	60	15	430	5	720
Future Volume (vph)	45	55	25	60	15	430	5	720
Lane Group Flow (vph)	0	105	25	130	15	450	5	795
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Minimum Split (s)	22.5	22.5	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	66.0	66.0	66.0	66.0
Total Split (%)	26.7%	26.7%	26.7%	26.7%	73.3%	73.3%	73.3%	73.3%
Yellow Time (s)	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		4.5	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
v/c Ratio	0.32	0.10	0.34	0.05	0.37	0.01	0.65	
Control Delay	31.9	30.7	20.5	5.7	7.6	5.2	12.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	1.5	
Total Delay	31.9	30.7	20.5	5.7	7.6	5.2	13.4	
Queue Length 50th (m)	15.7	3.7	11.1	0.8	31.4	0.3	74.2	
Queue Length 95th (m)	30.8	10.7	27.2	3.0	47.6	1.4	111.8	
Internal Link Dist (m)	84.0		727.4		311.0		156.4	
Turn Bay Length (m)			30.0		30.0		30.0	
Base Capacity (vph)	333	254	385	315	1221	576	1214	
Starvation Cap Reductn	0	0	0	0	0	0	234	
Spillback Cap Reductn	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.32	0.10	0.34	0.05	0.37	0.01	0.81	

Intersection Summary
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
 16: Clairfields Extension & South End Comm. Centre/Poppy Dr. Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (vph)	45	55	5	25	60	70	15	430	20	5	720	75
Future Volume (vph)	45	55	5	25	60	70	15	430	20	5	720	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.99		1.00	0.92		1.00	0.99		1.00	0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1792		1750	1693		1750	1830		1750	1816	
Flt Permitted		0.83		0.69	1.00		0.26	1.00		0.47	1.00	
Satd. Flow (perm)		1527		1270	1693		474	1830		864	1816	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	45	55	5	25	60	70	15	430	20	5	720	75
RTOR Reduction (vph)	0	2	0	0	46	0	0	2	0	0	4	0
Lane Group Flow (vph)	0	103	0	25	84	0	15	448	0	5	791	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.5		18.0	18.0		60.0	60.0		60.0	60.0	
Effective Green, g (s)		19.5		18.0	18.0		60.0	60.0		60.0	60.0	
Actuated g/C Ratio		0.22		0.20	0.20		0.67	0.67		0.67	0.67	
Clearance Time (s)		4.5		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Grp Cap (vph)		330		254	338		316	1220		576	1210	
v/s Ratio Prot				0.05			0.24				c0.44	
v/s Ratio Perm		c0.07		0.02			0.03			0.01		
v/c Ratio		0.31		0.10	0.25		0.05	0.37		0.01	0.65	
Uniform Delay, d1		29.6		29.4	30.3		5.2	6.6		5.0	8.9	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.4		0.8	1.7		0.3	0.9		0.0	2.8	
Delay (s)		32.1		30.2	32.0		5.4	7.5		5.1	11.6	
Level of Service		C		C	C		A	A		A	B	
Approach Delay (s)		32.1			31.7			7.4			11.6	
Approach LOS		C			C			A			B	

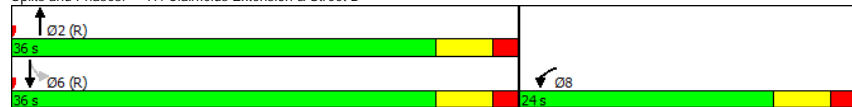
Intersection Summary
 HCM 2000 Control Delay 13.8 HCM 2000 Level of Service B
 HCM 2000 Volume to Capacity ratio 0.58
 Actuated Cycle Length (s) 90.0 Sum of lost time (s) 12.0
 Intersection Capacity Utilization 69.3% ICU Level of Service C
 Analysis Period (min) 15
 c Critical Lane Group

Queues Future Traffic Conditions - Base Future Street Network
 17: Clairfields Extension & Street B Weekday Afternoon Peak Hour

Lane Group	WBL	NBT	SBL	SBT
Lane Configurations	↖ ↗	↑	↖ ↗	↖ ↗
Traffic Volume (vph)	60	375	20	585
Future Volume (vph)	60	375	20	585
Lane Group Flow (vph)	70	420	18	587
Turn Type	Prot	NA	Perm	NA
Protected Phases	8	2		6
Permitted Phases			6	
Minimum Split (s)	24.0	24.0	24.0	24.0
Total Split (s)	24.0	36.0	36.0	36.0
Total Split (%)	40.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
v/c Ratio	0.13	0.46	0.04	0.67
Control Delay	14.5	10.6	8.2	16.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	14.5	10.6	8.2	16.1
Queue Length 50th (m)	5.0	42.3	1.0	49.6
Queue Length 95th (m)	13.0	62.1	4.0	84.0
Internal Link Dist (m)	725.3	531.6		311.0
Turn Bay Length (m)	50.0		50.0	
Base Capacity (vph)	526	915	405	874
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.13	0.46	0.04	0.67

Intersection Summary	
Cycle Length:	60
Actuated Cycle Length:	60
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	55
Control Type:	Pretimed

Splits and Phases: 17: Clairfields Extension & Street B



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Base Future Street Network
 17: Clairfields Extension & Street B Weekday Afternoon Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖ ↗		↑		↖ ↗	↖ ↗
Traffic Volume (vph)	60	10	375	45	20	585
Future Volume (vph)	60	10	375	45	20	585
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0	6.0
Lane Util. Factor	1.00		1.00		0.95	0.95
Frt	0.98		0.99		1.00	1.00
Flt Protected	0.96		1.00		0.95	1.00
Satd. Flow (prot)	1732		1815		1662	1750
Flt Permitted	0.96		1.00		0.46	1.00
Satd. Flow (perm)	1732		1815		810	1748
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	10	375	45	20	585
RTOR Reduction (vph)	7	0	7	0	0	0
Lane Group Flow (vph)	63	0	413	0	18	587
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	18.0		30.0		30.0	30.0
Effective Green, g (s)	18.0		30.0		30.0	30.0
Actuated g/C Ratio	0.30		0.50		0.50	0.50
Clearance Time (s)	6.0		6.0		6.0	6.0
Lane Grp Cap (vph)	519		907		405	874
v/s Ratio Prot	c0.04		0.23			
v/s Ratio Perm					0.02	c0.34
v/c Ratio	0.12		0.46		0.04	0.67
Uniform Delay, d1	15.3		9.7		7.7	11.3
Progression Factor	1.00		0.93		1.00	1.00
Incremental Delay, d2	0.5		1.5		0.2	4.1
Delay (s)	15.7		10.5		7.9	15.4
Level of Service	B		B		A	B
Approach Delay (s)	15.7		10.5			15.2
Approach LOS	B		B			B

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Queues
18: Clairfields Extension & Street C

Future Traffic Conditions - Base Future Street Network
Weekday Afternoon Peak Hour

Lane Group	WBL	NBT	SBL	SBT
Lane Configurations	↖ ↗	↑	↖ ↗	↑
Traffic Volume (vph)	15	290	245	425
Future Volume (vph)	15	290	245	425
Lane Group Flow (vph)	175	305	245	425
Turn Type	Prot	NA	pm+pt	NA
Protected Phases	8	2	1	6
Permitted Phases			6	
Minimum Split (s)	24.0	24.0	9.5	24.0
Total Split (s)	24.0	26.0	10.0	36.0
Total Split (%)	40.0%	43.3%	16.7%	60.0%
Yellow Time (s)	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	3.0	6.0
Lead/Lag		Lag	Lead	
Lead-Lag Optimize?		Yes	Yes	
v/c Ratio	0.32	0.50	0.45	0.46
Control Delay	5.8	19.2	4.1	3.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	5.8	19.2	4.1	3.4
Queue Length 50th (m)	1.2	27.2	3.1	5.6
Queue Length 95th (m)	13.4	48.0	m4.9	8.5
Internal Link Dist (m)	719.7	130.0		531.6
Turn Bay Length (m)	30.0		30.0	
Base Capacity (vph)	549	610	543	921
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.32	0.50	0.45	0.46

Intersection Summary	
Cycle Length:	60
Actuated Cycle Length:	60
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	60
Control Type:	Pretimed
m	Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
18: Clairfields Extension & Street C
Weekday Afternoon Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖ ↗		↑		↖ ↗	↑
Traffic Volume (vph)	15	160	290	15	245	425
Future Volume (vph)	15	160	290	15	245	425
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		3.0	6.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frbp, ped/bikes	0.91		0.99		1.00	1.00
Flpb, ped/bikes	1.00		1.00		0.98	1.00
Frt	0.88		0.99		1.00	1.00
Flt Protected	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1458		1821		1716	1842
Flt Permitted	1.00		1.00		0.45	1.00
Satd. Flow (perm)	1458		1821		805	1842
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	160	290	15	245	425
RTOR Reduction (vph)	112	0	3	0	0	0
Lane Group Flow (vph)	63	0	302	0	245	425
Confl. Peds. (#/hr)	50	50		50	50	
Turn Type	Prot		NA		pm+pt	NA
Protected Phases	8		2		1	6
Permitted Phases					6	
Actuated Green, G (s)	18.0		20.0		30.0	30.0
Effective Green, g (s)	18.0		20.0		30.0	30.0
Actuated g/C Ratio	0.30		0.33		0.50	0.50
Clearance Time (s)	6.0		6.0		3.0	6.0
Lane Grp Cap (vph)	437		607		508	921
v/s Ratio Prot	c0.04		0.17		c0.06	0.23
v/s Ratio Perm					c0.18	
v/c Ratio	0.14		0.50		0.48	0.46
Uniform Delay, d1	15.4		16.0		9.0	9.7
Progression Factor	1.00		1.00		0.26	0.20
Incremental Delay, d2	0.7		2.9		2.6	1.3
Delay (s)	16.1		18.9		5.0	3.3
Level of Service	B		B		A	A
Approach Delay (s)	16.1		18.9			3.9
Approach LOS	B		B			A

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 19: Clairfields Extension & Street E Weekday Afternoon Peak Hour

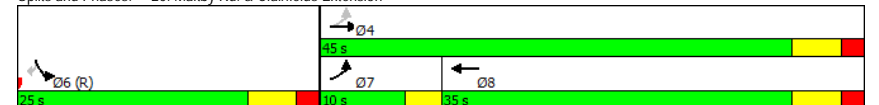
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↑		↑		↑	
Sign Control	Stop		Stop		Stop	
Traffic Volume (vph)	80	60	215	70	150	155
Future Volume (vph)	80	60	215	70	150	155
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	80	60	215	70	150	155
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total (vph)	140	285	305			
Volume Left (vph)	80	0	150			
Volume Right (vph)	60	70	0			
Hadj (s)	-0.11	-0.11	0.13			
Departure Headway (s)	5.2	4.5	4.7			
Degree Utilization, x	0.20	0.36	0.40			
Capacity (veh/h)	632	763	729			
Control Delay (s)	9.4	10.1	10.9			
Approach Delay (s)	9.4	10.1	10.9			
Approach LOS	A	B	B			
Intersection Summary						
Delay			10.3			
Level of Service			B			
Intersection Capacity Utilization			55.7%	ICU Level of Service	B	
Analysis Period (min)			15			

Queues Future Traffic Conditions - Base Future Street Network
 20: Maltby Rd. & Clairfields Extension Weekday Afternoon Peak Hour

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations	↑		↑		↑
Traffic Volume (vph)	325	310	195	35	200
Future Volume (vph)	325	310	195	35	200
Lane Group Flow (vph)	325	310	280	35	200
Turn Type	pm+pt	NA	NA	Prot	Perm
Protected Phases	7	4	8	6	
Permitted Phases	4		6		
Minimum Split (s)	9.5	24.0	24.0	24.0	24.0
Total Split (s)	10.0	45.0	35.0	25.0	25.0
Total Split (%)	14.3%	64.3%	50.0%	35.7%	35.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
v/c Ratio	0.53	0.30	0.38	0.07	0.38
Control Delay	10.6	9.3	14.1	19.6	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.6	9.3	14.1	19.6	5.9
Queue Length 50th (m)	19.5	20.7	22.0	3.6	0.0
Queue Length 95th (m)	32.8	34.6	40.0	10.1	14.3
Internal Link Dist (m)	695.6		711.4	191.8	
Turn Bay Length (m)	50.0			50.0	
Base Capacity (vph)	612	1026	728	475	521
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.53	0.30	0.38	0.07	0.38

Intersection Summary						
Cycle Length: 70						
Actuated Cycle Length: 70						
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green						
Natural Cycle: 60						
Control Type: Pretimed						

Splits and Phases: 20: Maltby Rd. & Clairfields Extension



HCM Signalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 20: Maltby Rd. & Clairfields Extension Weekday Afternoon Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔		↔	↔
Traffic Volume (vph)	325	310	195	85	35	200
Future Volume (vph)	325	310	195	85	35	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frb, ped/bikes	1.00	1.00	0.97		1.00	0.88
Flpb, ped/bikes	0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1702	1842	1705		1750	1385
Flt Permitted	0.50	1.00	1.00		0.95	1.00
Satd. Flow (perm)	903	1842	1705		1750	1385
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	325	310	195	85	35	200
RTOR Reduction (vph)	0	0	22	0	0	146
Lane Group Flow (vph)	325	310	258	0	35	54
Confl. Peds. (#/hr)	50			50	50	50
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)	39.0	39.0	29.0		19.0	19.0
Effective Green, g (s)	39.0	39.0	29.0		19.0	19.0
Actuated g/C Ratio	0.56	0.56	0.41		0.27	0.27
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Lane Grp Cap (vph)	583	1026	706		475	375
v/s Ratio Prot	c0.06	0.17	0.15		0.02	
v/s Ratio Perm	c0.25					c0.04
v/c Ratio	0.56	0.30	0.37		0.07	0.14
Uniform Delay, d1	8.8	8.3	14.1		19.0	19.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.8	0.8	1.5		0.3	0.8
Delay (s)	12.6	9.0	15.6		19.3	20.1
Level of Service	B	A	B		B	C
Approach Delay (s)		10.9	15.6		20.0	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

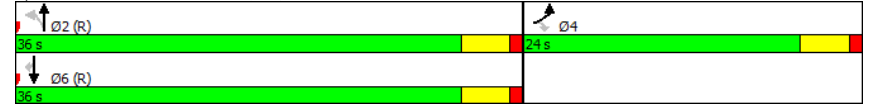
c Critical Lane Group

Queues Future Traffic Conditions - Base Future Street Network
 21: Victoria Rd. (East) & Street E Weekday Afternoon Peak Hour

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	235	10	10	510	410	375
Future Volume (vph)	235	10	10	510	410	375
Lane Group Flow (vph)	235	10	10	510	410	375
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
v/c Ratio	0.41	0.02	0.02	0.53	0.42	0.38
Control Delay	18.5	8.3	7.1	11.9	10.4	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.5	8.3	7.1	11.9	10.4	2.2
Queue Length 50th (m)	20.8	0.0	0.5	35.3	26.4	0.0
Queue Length 95th (m)	38.1	2.7	2.4	59.0	44.7	10.5
Internal Link Dist (m)	617.1			306.7	1674.8	
Turn Bay Length (m)	50.0		50.0			50.0
Base Capacity (vph)	568	515	442	967	967	1000
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.02	0.02	0.53	0.42	0.38

Intersection Summary
 Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 45
 Control Type: Pretimed

Splits and Phases: 21: Victoria Rd. (East) & Street E



HCM Signalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
21: Victoria Rd. (East) & Street E Weekday Afternoon Peak Hour

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔	↔	↔	↑	↑	↔
Traffic Volume (vph)	235	10	10	510	410	375
Future Volume (vph)	235	10	10	510	410	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1750	1566	1750	1842	1842	1566
Flt Permitted	0.95	1.00	0.46	1.00	1.00	1.00
Satd. Flow (perm)	1750	1566	842	1842	1842	1566
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	235	10	10	510	410	375
RTOR Reduction (vph)	0	7	0	0	0	178
Lane Group Flow (vph)	235	3	10	510	410	197
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	19.5	19.5	31.5	31.5	31.5	31.5
Effective Green, g (s)	19.5	19.5	31.5	31.5	31.5	31.5
Actuated g/C Ratio	0.32	0.32	0.52	0.52	0.52	0.52
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	568	508	442	967	967	822
v/s Ratio Prot	c0.13			c0.28	0.22	
v/s Ratio Perm		0.00	0.01			0.13
v/c Ratio	0.41	0.01	0.02	0.53	0.42	0.24
Uniform Delay, d1	15.8	13.7	6.9	9.4	8.7	7.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	0.0	0.1	2.1	1.4	0.7
Delay (s)	18.0	13.7	6.9	11.4	10.1	8.4
Level of Service	B	B	A	B	B	A
Approach Delay (s)	17.8			11.3	9.3	
Approach LOS	B			B	A	
Intersection Summary						
HCM 2000 Control Delay			11.3	HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio			0.48			
Actuated Cycle Length (s)			60.0	Sum of lost time (s)		9.0
Intersection Capacity Utilization			47.4%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
22: Maltby Rd. & Victoria Rd. (East) Weekday Afternoon Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	435	30	35	35	35	335
Future Volume (Veh/h)	435	30	35	35	35	335
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	435	30	35	35	35	335
Pedestrians					1	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.2	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	71				954	54
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	71				954	54
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	71				83	67
cM capacity (veh/h)	1522				204	1013
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	465	70	370			
Volume Left	435	0	35			
Volume Right	0	35	335			
cSH	1522	1700	737			
Volume to Capacity	0.29	0.04	0.50			
Queue Length 95th (m)	9.5	0.0	22.8			
Control Delay (s)	7.9	0.0	14.7			
Lane LOS	A		B			
Approach Delay (s)	7.9	0.0	14.7			
Approach LOS			B			
Intersection Summary						
Average Delay			10.1			
Intersection Capacity Utilization			61.6%	ICU Level of Service		B
Analysis Period (min)			15			

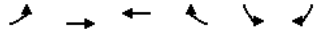
HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 23: Victoria Rd. (West) & Maltby Rd. Weekday Afternoon Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔		↔	
Traffic Volume (veh/h)	45	35	300	60	55	430
Future Volume (Veh/h)	45	35	300	60	55	430
Sign Control	Free		Free		Stop	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	45	35	300	60	55	430
Pedestrians	1					
Lane Width (m)	3.5					
Walking Speed (m/s)	1.2					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			81		724	64
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			81		724	64
tC, single (s)			4.1		6.7	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.8	3.3
p0 queue free %			80		80	57
cM capacity (veh/h)			1522		281	997
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	80	360	485			
Volume Left	0	300	55			
Volume Right	35	0	430			
cSH	1700	1522	774			
Volume to Capacity	0.05	0.20	0.63			
Queue Length 95th (m)	0.0	5.9	35.9			
Control Delay (s)	0.0	6.9	17.1			
Lane LOS	A		C			
Approach Delay (s)	0.0	6.9	17.1			
Approach LOS	C		C			
Intersection Summary						
Average Delay			11.7			
Intersection Capacity Utilization			62.7%		ICU Level of Service B	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 24: Clairfields Extension & Street D Weekday Afternoon Peak Hour

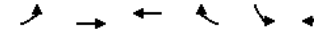
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	
Sign Control	Stop		Stop		Stop	
Traffic Volume (vph)	35	30	205	70	20	265
Future Volume (vph)	35	30	205	70	20	265
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	35	30	205	70	20	265
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total (vph)	65	275	285			
Volume Left (vph)	35	0	20			
Volume Right (vph)	30	70	0			
Hadj (s)	-0.14	-0.12	0.05			
Departure Headway (s)	5.0	4.3	4.4			
Degree Utilization, x	0.09	0.33	0.35			
Capacity (veh/h)	649	823	793			
Control Delay (s)	8.5	9.3	9.7			
Approach Delay (s)	8.5	9.3	9.7			
Approach LOS	A	A	A			
Intersection Summary						
Delay			9.4			
Level of Service	A					
Intersection Capacity Utilization			40.9%		ICU Level of Service A	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 25: Maltby Rd. & Traffic Zone 8 North-South Collector Weekday Afternoon Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↑	↔		↔	
Traffic Volume (veh/h)	130	200	165	10	20	90
Future Volume (Veh/h)	130	200	165	10	20	90
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	130	200	165	10	20	90
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	175			630	170	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	175			630	170	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	91			95	90	
cM capacity (veh/h)	1401			404	874	
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	130	200	175	110		
Volume Left	130	0	0	20		
Volume Right	0	0	10	90		
cSH	1401	1700	1700	721		
Volume to Capacity	0.09	0.12	0.10	0.15		
Queue Length 95th (m)	2.4	0.0	0.0	4.3		
Control Delay (s)	7.8	0.0	0.0	10.9		
Lane LOS	A			B		
Approach Delay (s)	3.1		0.0	10.9		
Approach LOS				B		
Intersection Summary						
Average Delay			3.6			
Intersection Capacity Utilization			33.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 26: Maltby Rd. & Traffic Zone 9 North-South Collector Weekday Afternoon Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↑	↔		↔	
Traffic Volume (veh/h)	155	40	80	10	5	85
Future Volume (Veh/h)	155	40	80	10	5	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	155	40	80	10	5	85
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	90			435	85	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	90			435	85	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	90			99	91	
cM capacity (veh/h)	1505			519	974	
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	155	40	90	90		
Volume Left	155	0	0	5		
Volume Right	0	0	10	85		
cSH	1505	1700	1700	929		
Volume to Capacity	0.10	0.02	0.05	0.10		
Queue Length 95th (m)	2.7	0.0	0.0	2.6		
Control Delay (s)	7.7	0.0	0.0	9.3		
Lane LOS	A			A		
Approach Delay (s)	6.1		0.0	9.3		
Approach LOS				A		
Intersection Summary						
Average Delay			5.4			
Intersection Capacity Utilization			27.5%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis Traffic Conditions - Base Future Street Network
 27: Traffic Zone 8 North-South Collector & Street E Weekday Afternoon Peak Hour

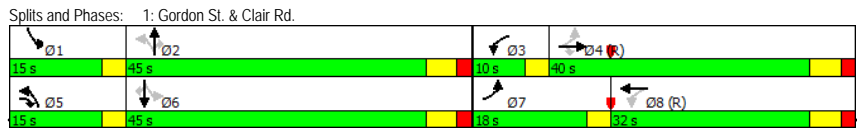


Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	220	45	75	205	5	55
Future Volume (vph)	220	45	75	205	5	55
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	220	45	75	205	5	55
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total (vph)	265	280	60			
Volume Left (vph)	0	75	5			
Volume Right (vph)	45	0	55			
Hadj (s)	-0.07	0.09	-0.50			
Departure Headway (s)	4.3	4.4	4.6			
Degree Utilization, x	0.31	0.34	0.08			
Capacity (veh/h)	823	793	703			
Control Delay (s)	9.2	9.7	8.0			
Approach Delay (s)	9.2	9.7	8.0			
Approach LOS	A	A	A			
Intersection Summary						
Delay			9.3			
Level of Service			A			
Intersection Capacity Utilization			42.9%	ICU Level of Service	A	
Analysis Period (min)			15			

Queues Future Traffic Conditions - Recommended Improvements
1: Gordon St. & Clair Rd. Weekday Afternoon Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	300	960	230	165	650	250	985	210	230	1160	205
Future Volume (vph)	300	960	230	165	650	250	985	210	230	1160	205
Lane Group Flow (vph)	300	960	230	165	770	250	985	210	230	1160	205
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	5	3	8	5	2		1	6	
Permitted Phases	4		4	8		2		2	6		6
Detector Phase	7	4	5	3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	9.5	24.0	9.5	24.0	24.0	9.5	24.0	24.0
Total Split (s)	18.0	40.0	15.0	10.0	32.0	15.0	45.0	45.0	15.0	45.0	45.0
Total Split (%)	16.4%	36.4%	13.6%	9.1%	29.1%	13.6%	40.9%	40.9%	13.6%	40.9%	40.9%
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	0.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	None	Max	Max	None	Max	Max
v/c Ratio	0.95	0.88	0.32	0.98	0.95	0.97	0.78	0.35	0.82	0.94	0.34
Control Delay	62.7	52.0	33.3	91.1	62.4	83.8	45.1	20.3	44.8	49.0	12.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0
Total Delay	62.7	52.0	33.3	91.1	62.4	83.8	45.2	20.3	44.8	58.8	12.3
Queue Length 50th (m)	69.1	122.2	45.7	23.3	88.7	52.8	90.0	19.0	28.7	131.9	12.6
Queue Length 95th (m)	m#90.0	m#141.0	m55.0	#63.8	#128.3	#94.5	112.5	m32.7	#69.9	#176.7	31.3
Internal Link Dist (m)		775.0			194.1		153.6			314.0	
Turn Bay Length (m)	75.0		50.0	25.0		50.0		50.0	140.0		50.0
Base Capacity (vph)	315	1092	717	169	811	258	1263	607	284	1240	600
Starvation Cap Reductn	0	0	0	0	0	0	3	0	0	0	0
Spillback Cap Reductn	0	0	2	0	0	0	0	0	0	83	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.95	0.88	0.32	0.98	0.95	0.97	0.78	0.35	0.81	1.00	0.34

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green, Master Intersection
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Recommended Improvements
1: Gordon St. & Clair Rd. Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	300	960	230	165	650	120	250	985	210	230	1160	205
Future Volume (vph)	300	960	230	165	650	120	250	985	210	230	1160	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frbp, ped/bikes	1.00	1.00	0.98	1.00	0.99		1.00	1.00	0.97	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1767	3535	1537	1593	3373		1716	3535	1431	1785	3500	1469
Flt Permitted	0.14	1.00	1.00	0.15	1.00		0.10	1.00	1.00	0.12	1.00	1.00
Satd. Flow (perm)	257	3535	1537	258	3373		184	3535	1431	234	3500	1469
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	300	960	230	165	650	120	250	985	210	230	1160	205
RTOR Reduction (vph)	0	0	35	0	14	0	0	0	96	0	0	79
Lane Group Flow (vph)	300	960	195	165	756	0	250	985	114	230	1160	126
Conf. Peds. (#/hr)	17		7	7		17	2		11	11		2
Conf. Bikes (#/hr)									1			
Heavy Vehicles (%)	1%	1%	2%	12%	3%	1%	4%	1%	8%	0%	2%	7%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	44.0	34.0	46.0	33.0	26.0		51.3	39.3	39.3	50.7	39.0	39.0
Effective Green, g (s)	44.0	34.0	46.0	33.0	26.0		51.3	39.3	39.3	50.7	39.0	39.0
Actuated g/C Ratio	0.40	0.31	0.42	0.30	0.24		0.40	0.36	0.36	0.46	0.35	0.35
Clearance Time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	308	1092	642	162	797		252	1262	511	272	1240	520
v/s Ratio Prot	c0.13	0.27	0.03	0.06	0.22		c0.11	0.28		0.09	0.33	
v/s Ratio Perm	c0.26		0.09	0.24			c0.35		0.08	0.30		0.09
v/c Ratio	0.97	0.88	0.30	1.02	0.95		0.99	0.78	0.22	0.85	0.94	0.24
Uniform Delay, d1	29.9	36.1	21.3	34.6	41.3		30.8	31.5	24.7	22.3	34.3	25.1
Progression Factor	1.26	1.26	2.47	1.00	1.00		1.66	1.30	2.26	1.00	1.00	1.00
Incremental Delay, d2	32.6	6.4	0.2	75.7	21.6		46.5	3.6	0.8	20.8	14.2	1.1
Delay (s)	70.2	51.7	52.9	110.2	63.0		97.7	44.5	56.5	43.0	48.4	26.2
Level of Service	E	D	D	F	E		F	D	E	D	D	C
Approach Delay (s)		55.6			71.3			55.5			44.8	
Approach LOS		E			E			E			D	

Intersection Summary
 HCM 2000 Control Delay: 55.1 HCM 2000 Level of Service: E
 HCM 2000 Volume to Capacity ratio: 1.01
 Actuated Cycle Length (s): 110.0 Sum of lost time (s): 18.0
 Intersection Capacity Utilization: 101.3% ICU Level of Service: G
 Analysis Period (min): 15
 c Critical Lane Group

Queues Future Traffic Conditions - Recommended Improvements
2: Gordon St. & Poppy Dr. Weekday Afternoon Peak Hour

	←		→		↖		↗	
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	115	60	55	55	65	1345	50	1425
Future Volume (vph)	115	60	55	55	65	1345	50	1425
Lane Group Flow (vph)	115	95	55	95	65	1410	50	1500
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	pm+pt	NA
Protected Phases	4		8		5		2	
Permitted Phases	4		8		2		6	
Minimum Split (s)	24.0	24.0	24.0	24.0	9.5	24.0	9.5	24.0
Total Split (s)	30.0	30.0	30.0	30.0	10.0	70.0	10.0	70.0
Total Split (%)	27.3%	27.3%	27.3%	27.3%	9.1%	63.6%	9.1%	63.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	3.0	6.0	3.0	6.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
v/c Ratio	0.41	0.24	0.20	0.24	0.30	0.70	0.21	0.74
Control Delay	42.2	28.2	37.4	26.3	15.8	41.8	3.8	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	4.7	0.0	22.8
Total Delay	42.2	28.2	37.4	26.3	15.8	46.5	3.8	31.6
Queue Length 50th (m)	22.5	13.2	10.2	12.0	9.9	167.0	0.4	10.0
Queue Length 95th (m)	40.6	28.0	22.0	26.8	m13.2	191.0	m1.1	m176.1
Internal Link Dist (m)		727.4		256.4		172.0		153.6
Turn Bay Length (m)	30.0		30.0		65.0		27.0	
Base Capacity (vph)	279	398	279	400	214	2025	236	2023
Starvation Cap Reductn	0	0	0	0	0	537	0	575
Spillback Cap Reductn	0	3	1	0	0	0	0	159
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.24	0.20	0.24	0.30	0.95	0.21	1.04

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 61 (55%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Pretimed
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Recommended Improvements
2: Gordon St. & Poppy Dr. Weekday Afternoon Peak Hour

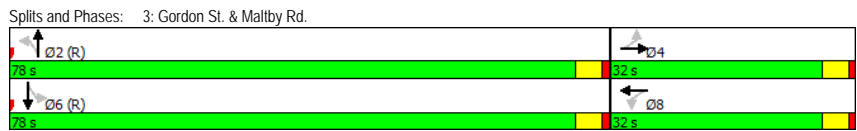
	←		→		↖		↗					
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Traffic Volume (vph)	115	60	35	55	55	40	65	1345	65	50	1425	75
Future Volume (vph)	115	60	35	55	55	40	65	1345	65	50	1425	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.94		1.00	0.94		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	1740		1750	1726		1750	3476		1750	3474	
Flt Permitted	0.70	1.00		0.70	1.00		0.09	1.00		0.11	1.00	
Satd. Flow (perm)	1281	1740		1281	1726		170	3476		206	3474	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	115	60	35	55	55	40	65	1345	65	50	1425	75
RTOR Reduction (vph)	0	19	0	0	23	0	0	3	0	0	3	0
Lane Group Flow (vph)	115	76	0	55	72	0	65	1407	0	50	1497	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	4			8			5			2		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	24.0	24.0		24.0	24.0		71.0	64.0		71.0	64.0	
Effective Green, g (s)	24.0	24.0		24.0	24.0		71.0	64.0		71.0	64.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.65	0.58		0.65	0.58	
Clearance Time (s)	6.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Lane Grp Cap (vph)	279	379		279	376		210	2022		231	2021	
v/s Ratio Prot		0.04			0.04		c0.02	0.40		0.01	c0.43	
v/s Ratio Perm	c0.09			0.04			0.18			0.13		
v/c Ratio	0.41	0.20		0.20	0.19		0.31	0.70		0.22	0.74	
Uniform Delay, d1	36.9	35.2		35.1	35.1		12.3	16.2		10.8	16.9	
Progression Factor	1.00	1.00		1.00	1.00		2.45	2.46		0.54	0.44	
Incremental Delay, d2	4.4	1.2		1.6	1.1		2.9	1.5		1.1	1.3	
Delay (s)	41.4	36.4		36.7	36.2		33.0	41.2		6.9	8.7	
Level of Service	D	D		D	D		C	D		A	A	
Approach Delay (s)	39.1			36.4			40.9			8.6		
Approach LOS	D			D			D			A		

Intersection Summary
 HCM 2000 Control Delay 25.8 HCM 2000 Level of Service C
 HCM 2000 Volume to Capacity ratio 0.63
 Actuated Cycle Length (s) 110.0 Sum of lost time (s) 15.0
 Intersection Capacity Utilization 72.3% ICU Level of Service C
 Analysis Period (min) 15
 c Critical Lane Group

Queues Future Traffic Conditions - Recommended Improvements
3: Gordon St. & Maltby Rd. Weekday Afternoon Peak Hour

	←		→		↖		↗	
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	85	180	55	160	80	1415	65	1065
Future Volume (vph)	85	180	55	160	80	1415	65	1065
Lane Group Flow (vph)	85	240	55	225	80	1500	65	1105
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4		8		2		6	
Permitted Phases	4		8		2		6	
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	32.0	32.0	32.0	32.0	78.0	78.0	78.0	78.0
Total Split (%)	29.1%	29.1%	29.1%	29.1%	70.9%	70.9%	70.9%	70.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag								
Lead-Lag Optimize?								
v/c Ratio	0.46	0.54	0.29	0.50	0.32	0.66	0.53	0.49
Control Delay	44.8	38.6	38.4	36.9	11.8	12.5	26.7	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.8	38.6	38.4	36.9	11.8	12.5	26.7	6.0
Queue Length 50th (m)	16.4	44.2	10.1	40.1	6.9	95.2	2.5	21.7
Queue Length 95th (m)	33.4	70.2	22.6	64.9	16.4	117.5	m#30.0	22.6
Internal Link Dist (m)	711.4		659.2		165.0		187.1	
Turn Bay Length (m)	50.0		50.0		50.0		50.0	
Base Capacity (vph)	183	447	190	449	253	2270	122	2271
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.54	0.29	0.50	0.32	0.66	0.53	0.49

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 107 (97%), Referenced to phase 2:NBL and 6:SBTL, Start of Green
 Natural Cycle: 65
 Control Type: Pretimed
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Recommended Improvements
3: Gordon St. & Maltby Rd. Weekday Afternoon Peak Hour

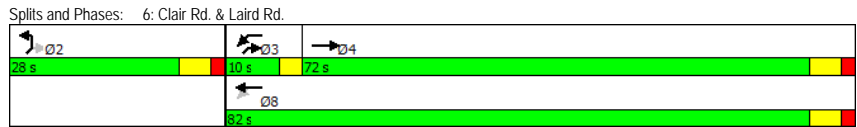
	←		→		↖		↗					
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	85	180	60	55	160	65	80	1415	85	65	1065	40
Future Volume (vph)	85	180	60	55	160	65	80	1415	85	65	1065	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	0.97		1.00	0.97		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.95	1.00		0.95	1.00		0.98	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.96		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1536	1745		1694	1745		1696	3394		1487	3394	
Flt Permitted	0.45	1.00		0.43	1.00		0.21	1.00		0.12	1.00	
Satd. Flow (perm)	734	1745		763	1745		380	3394		183	3394	
Peak-hour factor, PHF	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Adj. Flow (vph)	85	180		60	55		80	1415		85	1065	
RTOR Reduction (vph)	0	11		0	14		0	4		0	2	
Lane Group Flow (vph)	85	229		55	212		80	1496		65	1103	
Confl. Peds. (#/hr)	50			50			50			50		
Heavy Vehicles (%)	10%	0%		4%	0%		0%	3%		3%	8%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	27.5	27.5		27.5	27.5		73.5	73.5		73.5	73.5	
Effective Green, g (s)	27.5	27.5		27.5	27.5		73.5	73.5		73.5	73.5	
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.67	0.67		0.67	0.67	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	183	436		190	436		253	2267		122	2267	
v/s Ratio Prot	c0.13			0.12			c0.44			0.32		
v/s Ratio Perm	0.12			0.07			0.21			0.36		
v/c Ratio	0.46	0.52		0.29	0.49		0.32	0.66		0.53	0.49	
Uniform Delay, d1	35.0	35.6		33.4	35.2		7.7	10.8		9.4	9.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.94	0.58	
Incremental Delay, d2	8.2	4.5		3.8	3.8		3.3	1.5		14.1	0.7	
Delay (s)	43.3	40.1		37.2	39.0		10.9	12.4		22.9	5.9	
Level of Service	D	D		D	D		B	B		C	A	
Approach Delay (s)	40.9			38.7			12.3			6.9		
Approach LOS	D			D			B			A		

Intersection Summary
 HCM 2000 Control Delay: 15.4 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.62
 Actuated Cycle Length (s): 110.0 Sum of lost time (s): 9.0
 Intersection Capacity Utilization: 80.9% ICU Level of Service: D
 Analysis Period (min): 15
 c Critical Lane Group

Queues Future Traffic Conditions - Recommended Improvements
6: Clair Rd. & Laird Rd. Weekday Afternoon Peak Hour

	→	↖	←	↗	↘
Lane Group	EBT	WBL	WBT	NEL	NER
Lane Configurations	↑↑	↖	↑↑	↖	↖
Traffic Volume (vph)	1695	105	1165	1	265
Future Volume (vph)	1695	105	1165	1	265
Lane Group Flow (vph)	1700	105	1165	1	265
Turn Type	NA	pm+pt	NA	Prot	pm+ov
Protected Phases	4	3	8	2	3
Permitted Phases		8			2
Detector Phase	4	3	8	2	3
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	9.5	24.0	24.0	9.5
Total Split (s)	72.0	10.0	82.0	28.0	10.0
Total Split (%)	65.5%	9.1%	74.5%	25.5%	9.1%
Yellow Time (s)	4.0	3.0	4.0	4.0	3.0
All-Red Time (s)	2.0	0.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	3.0	6.0	6.0	3.0
Lead/Lag	Lag	Lead		Lead	
Lead-Lag Optimize?	Yes	Yes		Yes	
Recall Mode	None	None	None	Min	None
v/c Ratio	0.82	0.37	0.45	0.01	0.60
Control Delay	14.6	6.6	4.0	34.0	28.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.6	6.6	4.0	34.0	28.7
Queue Length 50th (m)	83.2	2.1	23.5	0.1	27.2
Queue Length 95th (m)	110.6	7.9	31.7	1.8	#70.4
Internal Link Dist (m)	795.3		198.1	144.4	
Turn Bay Length (m)		50.0		50.0	
Base Capacity (vph)	3276	299	3441	579	456
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.52	0.35	0.34	0.00	0.58

Intersection Summary
 Cycle Length: 110
 Actuated Cycle Length: 67.8
 Natural Cycle: 80
 Control Type: Actuated-Uncoordinated
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Recommended Improvements
6: Clair Rd. & Laird Rd. Weekday Afternoon Peak Hour

	→	↖	←	↗	↘	
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↑↑		↖	↑↑	↖	↖
Traffic Volume (vph)	1695	5	105	1165	1	265
Future Volume (vph)	1695	5	105	1165	1	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	3.0	6.0	6.0	3.0	
Lane Util. Factor	0.95	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	1.00	0.85	
Flt Protected	1.00	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	3498		1750	3500	1750	1566
Flt Permitted	1.00	0.09	1.00	0.95	1.00	
Satd. Flow (perm)	3498		171	3500	1750	1566
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1695	5	105	1165	1	265
RTOR Reduction (vph)	0	0	0	0	0	20
Lane Group Flow (vph)	1700	0	105	1165	1	245
Turn Type	NA	pm+pt	NA	Prot	pm+ov	
Protected Phases	4	3	8	2	3	
Permitted Phases		8			2	
Actuated Green, G (s)	40.2		49.8	49.8	5.7	12.3
Effective Green, g (s)	40.2		49.8	49.8	5.7	12.3
Actuated g/C Ratio	0.60		0.74	0.74	0.08	0.18
Clearance Time (s)	6.0		3.0	6.0	6.0	3.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2083		280	2582	147	285
v/s Ratio Prot	c0.49		0.04	0.33	0.00	c0.08
v/s Ratio Perm			0.24			0.07
v/c Ratio	0.82		0.38	0.45	0.01	0.86
Uniform Delay, d1	10.7		8.3	3.5	28.3	26.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.6		0.8	0.1	0.0	22.4
Delay (s)	13.3		9.2	3.6	28.3	49.1
Level of Service	B		A	A	C	D
Approach Delay (s)	13.3		4.1	49.1		
Approach LOS	B		A	D		

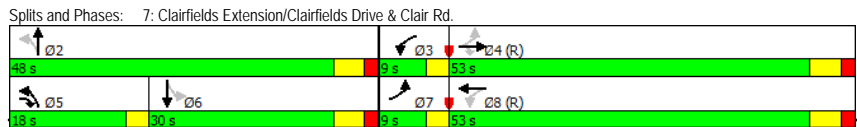
Intersection Summary
 HCM 2000 Control Delay 12.6 HCM 2000 Level of Service B
 HCM 2000 Volume to Capacity ratio 0.83
 Actuated Cycle Length (s) 67.5 Sum of lost time (s) 15.0
 Intersection Capacity Utilization 71.8% ICU Level of Service C
 Analysis Period (min) 15
 c Critical Lane Group

Queues Future Traffic Conditions - Recommended Improvements
 7: Clairfields Extension/Clairfields Drive & Clair Rd. Weekday Afternoon Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔↔	↔	↔	↔↔	↔	↔	↔	↔
Traffic Volume (vph)	120	1315	535	120	800	390	95	25	145
Future Volume (vph)	120	1315	535	120	800	390	95	25	145
Lane Group Flow (vph)	120	1315	535	120	845	390	150	25	225
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	7	4	5	3	8	5	2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	7	4	5	3	8	5	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.0	9.5	9.5	24.0	9.5	24.0	24.0	24.0
Total Split (s)	9.0	53.0	18.0	9.0	53.0	18.0	48.0	30.0	30.0
Total Split (%)	8.2%	48.2%	16.4%	8.2%	48.2%	16.4%	43.6%	27.3%	27.3%
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	3.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	0.0	2.0	0.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead		Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	None	Max	Max	Max
v/c Ratio	0.42	0.88	0.48	0.72	0.57	0.88	0.22	0.09	0.57
Control Delay	17.4	37.2	3.9	48.2	48.6	49.3	19.0	35.6	40.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.4	37.2	3.9	48.2	48.6	49.3	19.0	35.6	40.6
Queue Length 50th (m)	12.9	140.5	10.6	24.7	103.6	65.8	17.6	4.5	40.9
Queue Length 95th (m)	22.7	173.1	27.8	m28.1	m113.0	#120.5	32.8	12.2	66.6
Internal Link Dist (m)		186.5			775.0		156.4		150.9
Turn Bay Length (m)	55.0		200.0	45.0		100.0		50.0	
Base Capacity (vph)	288	1495	1125	166	1486	442	683	265	398
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.88	0.48	0.72	0.57	0.88	0.22	0.09	0.57

Intersection Summary

Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Recommended Improvements
 7: Clairfields Extension/Clairfields Drive & Clair Rd. Weekday Afternoon Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔↔	↔	↔	↔↔		↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	120	1315	535	120	800	45	390	95	55	25	145	80
Future Volume (vph)	120	1315	535	120	800	45	390	95	55	25	145	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.94		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	3500	1566	1750	3472		1750	1741		1750	1744	
Flt Permitted	0.23	1.00	1.00	0.09	1.00		0.41	1.00		0.66	1.00	
Satd. Flow (perm)	423	3500	1566	157	3472		747	1741		1219	1744	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	120	1315	535	120	800	45	390	95	55	25	145	80
RTOR Reduction (vph)	0	0	180	0	3	0	19	0	0	18	0	0
Lane Group Flow (vph)	120	1315	355	120	842	0	390	131	0	25	207	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA		Perm	NA	
Protected Phases	7	4	5	3	8		5	2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	53.0	47.0	62.0	53.0	47.0		42.0	42.0		24.0	24.0	
Effective Green, g (s)	53.0	47.0	62.0	53.0	47.0		42.0	42.0		24.0	24.0	
Actuated g/C Ratio	0.48	0.43	0.56	0.48	0.43		0.38	0.38		0.22	0.22	
Clearance Time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	276	1495	882	162	1483		421	664		265	380	
v/s Ratio Prot	0.02	c0.38	0.05	c0.04	0.24		c0.13	0.08			0.12	
v/s Ratio Perm	0.19		0.17	0.32			c0.23			0.02		
v/c Ratio	0.43	0.88	0.40	0.74	0.57		0.93	0.20		0.09	0.54	
Uniform Delay, d1	17.1	28.9	13.5	22.4	23.8		29.9	22.7		34.3	38.2	
Progression Factor	1.00	1.00	1.00	2.27	2.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	7.7	0.3	9.0	0.8		26.2	0.7		0.7	5.5	
Delay (s)	18.2	36.6	13.8	59.7	48.4		56.1	23.4		35.0	43.7	
Level of Service	B	D	B	E	D		E	C		D	D	
Approach Delay (s)		29.3			49.8		47.0			42.8		
Approach LOS		C			D		D			D		

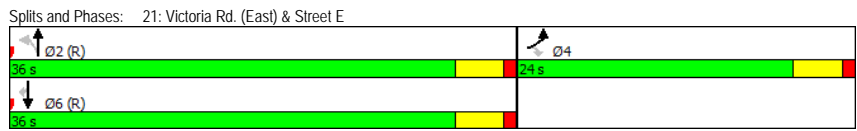
Intersection Summary

HCM 2000 Control Delay: 38.1 HCM 2000 Level of Service: D
 HCM 2000 Volume to Capacity ratio: 0.92
 Actuated Cycle Length (s): 110.0 Sum of lost time (s): 18.0
 Intersection Capacity Utilization: 93.8% ICU Level of Service: F
 Analysis Period (min): 15
 c Critical Lane Group

Queues Future Traffic Conditions - Recommended Improvements
 21: Victoria Rd. (East) & Street E Weekday Afternoon Peak Hour

	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	235	10	10	510	410	375
Future Volume (vph)	235	10	10	510	410	375
Lane Group Flow (vph)	235	10	10	510	410	375
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	24.0	24.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
v/c Ratio	0.41	0.02	0.02	0.53	0.42	0.38
Control Delay	18.5	8.3	7.1	11.9	10.4	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.5	8.3	7.1	11.9	10.4	2.2
Queue Length 50th (m)	20.8	0.0	0.5	35.3	26.4	0.0
Queue Length 95th (m)	38.1	2.7	2.4	59.0	44.7	10.5
Internal Link Dist (m)	617.1			306.7	1674.8	
Turn Bay Length (m)	50.0		50.0			50.0
Base Capacity (vph)	568	515	442	967	967	1000
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.02	0.02	0.53	0.42	0.38

Intersection Summary
 Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
 Natural Cycle: 45
 Control Type: Pretimed



HCM Signalized Intersection Capacity Analysis Future Traffic Conditions - Recommended Improvements
 21: Victoria Rd. (East) & Street E Weekday Afternoon Peak Hour

	EBL	EBR	NBL	NBT	SBT	SBR
Movement	↖	↗	↖	↖	↖	↖
Lane Configurations	↖	↗	↖	↖	↖	↖
Traffic Volume (vph)	235	10	10	510	410	375
Future Volume (vph)	235	10	10	510	410	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1750	1566	1750	1842	1842	1566
Flt Permitted	0.95	1.00	0.46	1.00	1.00	1.00
Satd. Flow (perm)	1750	1566	842	1842	1842	1566
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	235	10	10	510	410	375
RTOR Reduction (vph)	0	7	0	0	0	178
Lane Group Flow (vph)	235	3	10	510	410	197
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	19.5	19.5	31.5	31.5	31.5	31.5
Effective Green, g (s)	19.5	19.5	31.5	31.5	31.5	31.5
Actuated g/C Ratio	0.32	0.32	0.52	0.52	0.52	0.52
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	568	508	442	967	967	822
v/s Ratio Prot	c0.13			c0.28	0.22	
v/s Ratio Perm		0.00	0.01			0.13
v/c Ratio	0.41	0.01	0.02	0.53	0.42	0.24
Uniform Delay, d1	15.8	13.7	6.9	9.4	8.7	7.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	0.0	0.1	2.1	1.4	0.7
Delay (s)	18.0	13.7	6.9	11.4	10.1	8.4
Level of Service	B	B	A	B	B	A
Approach Delay (s)	17.8			11.3	9.3	
Approach LOS	B			B	A	

Intersection Summary
 HCM 2000 Control Delay: 11.3 HCM 2000 Level of Service: B
 HCM 2000 Volume to Capacity ratio: 0.48
 Actuated Cycle Length (s): 60.0 Sum of lost time (s): 9.0
 Intersection Capacity Utilization: 47.4% ICU Level of Service: A
 Analysis Period (min): 15
 c Critical Lane Group

Appendix S – Roundabout Analysis Results

<h1>Junctions 9</h1>
<h2>ARCADY 9 - Roundabout Module</h2>
Version: 9.0.1.4646 [] © Copyright TRL Limited, 2019
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Filename: Gordon and Maltby - FT_PM.j9

Path: P:\59\76\06 Clair Maltby SP\Traffic Analysis\Phase 2\5. Roundabout Analysis

Report generation date: 2019-02-13 3:12:23 PM

«Gordon Street / Maltby Road - Future Total Traffic, Weekday Afternoon Peak Hour

- »Intersection Network
- »Legs
- »Traffic Demand
- »Origin-Destination Data
- »Vehicle Mix
- »Results

Summary of intersection performance

	Weekday Afternoon Peak Hour						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
Gordon Street / Maltby Road - Future Total Traffic							
1 - Maltby Road East (East Leg)	1.4	6.9	17.12	0.59	C	7.74	A
2 - Gordon Street (North Leg)	1.5	2.0	4.13	0.60	A		
3 - Maltby Road East (West Leg)	0.6	3.0	6.53	0.39	A		
4 - Gordon Street (South Leg)	4.3	16.9	9.01	0.81	A		

There are warnings associated with this model run - see the 'Data Errors and Warnings' tables.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

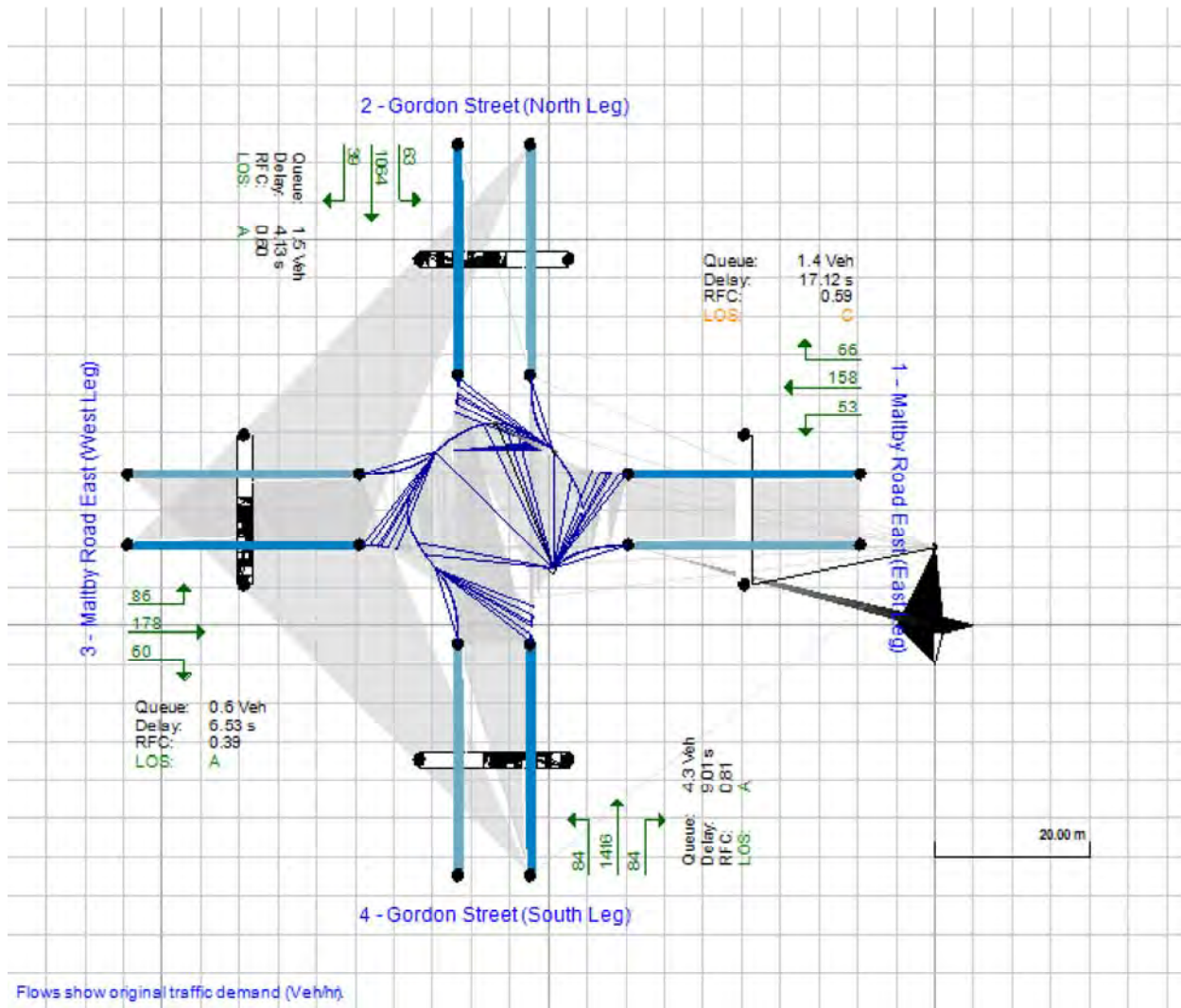
File summary

File Description

Title	Future Total Traffic Conditions
Location	Erb St. W. / Ira Needles Blvd.
Site number	1
Date	2017-04-26
Version	
Status	Weekday Afternoon Peak Hour
Identifier	
Client	
Jobnumber	
Analyst	BACTOR\ifc
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin



Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	V/C Ratio Threshold	Average Delay threshold (s)	Queue threshold (PCE)
✓		0.85	36.00	20.00

Analysis Set Details

ID	Name	Network flow scaling factor (%)
A2	Gordon Street / Maltby Road	100.000

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	Future Total Traffic	Weekday Afternoon Peak Hour	ONE HOUR	15:45	17:15	15

Gordon Street / Maltby Road - Future Total Traffic, Weekday Afternoon Peak Hour

Data Errors and Warnings

Severity	Area	Item	Description
Last Run	Last Run	1 - Maltby Road East (East Leg) - Capacity	Pedestrian Crossing causes blocking on previous leg due to traffic queuing to leave the intersection in 6 timesegment(s).
Last Run	Last Run	3 - Maltby Road East (West Leg) - Capacity	Pedestrian Crossing causes blocking on previous leg due to traffic queuing to leave the intersection in 6 timesegment(s).
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection Type	Intersection Delay (s)	Intersection LOS
2	Gordon Street / Maltby Road	Standard Roundabout	7.74	A

Intersection Network Options

Driving side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Name	Description
1	Maltby Road East (East Leg)	
2	Gordon Street (North Leg)	
3	Maltby Road East (West Leg)	
4	Gordon Street (South Leg)	

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1 - Maltby Road East (East Leg)	3.70	8.00	25.0	50.0	60.0	20.0	
2 - Gordon Street (North Leg)	7.00	8.00	15.0	60.0	60.0	30.0	
3 - Maltby Road East (West Leg)	3.70	8.00	25.0	50.0	60.0	20.0	
4 - Gordon Street (South Leg)	7.00	8.00	15.0	60.0	60.0	30.0	

Unsignalled Pedestrian Crossing Crossings

Leg	Space between crossing and intersection entry (Unsignalled Pedestrian Crossing) (PCE)	Vehicles queueing on exit (Unsignalled Pedestrian Crossing) (PCE)	Central Refuge	Crossing data type	Crossing length (entry side) (m)	Crossing time (entry side) (s)	Crossing length (exit side) (m)	Crossing time (exit side) (s)
1 - Maltby Road East (East Leg)	2.00	2.00	✓	Distance	3.70	2.64	3.70	2.64
2 - Gordon Street (North Leg)	2.00	2.00	✓	Distance	7.00	5.00	7.00	5.00
3 - Maltby Road East (West Leg)	2.00	2.00	✓	Distance	3.70	2.64	3.70	2.64
4 - Gordon Street (South Leg)	2.00	2.00	✓	Distance	7.00	5.00	7.00	5.00

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Final slope	Final intercept (PCE/hr)
1 - Maltby Road East (East Leg)	0.641	2087

2 - Gordon Street (North Leg)	0.695	2448
3 - Maltby Road East (West Leg)	0.641	2087
4 - Gordon Street (South Leg)	0.695	2448

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Vehicle mix source	PCE Factor for a Truck (PCE)
Truck Percentages	2.00

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1 - Maltby Road East (East Leg)		✓	277	100.000
2 - Gordon Street (North Leg)		✓	1166	100.000
3 - Maltby Road East (West Leg)		✓	324	100.000
4 - Gordon Street (South Leg)		✓	1584	100.000

Demand overview (Pedestrians)

Leg	Average pedestrian flow (Ped/hr)
1 - Maltby Road East (East Leg)	15.00
2 - Gordon Street (North Leg)	100.00
3 - Maltby Road East (West Leg)	15.00
4 - Gordon Street (South Leg)	15.00

Origin-Destination Data

Demand (Veh/hr)

		To			
		1 - Maltby Road East (East Leg)	2 - Gordon Street (North Leg)	3 - Maltby Road East (West Leg)	4 - Gordon Street (South Leg)
From	1 - Maltby Road East (East Leg)	0	66	158	53
	2 - Gordon Street (North Leg)	63	0	39	1064
	3 - Maltby Road East (West Leg)	178	86	0	60
	4 - Gordon Street (South Leg)	84	1416	84	0

Vehicle Mix

Truck Percentages

		To			
		1 - Maltby Road East (East Leg)	2 - Gordon Street (North Leg)	3 - Maltby Road East (West Leg)	4 - Gordon Street (South Leg)
From	1 - Maltby Road East (East Leg)	2	2	2	2
	2 - Gordon Street (North Leg)	2	2	2	2
	3 - Maltby Road East (West Leg)	2	2	2	2
	4 - Gordon Street (South Leg)	2	2	2	2

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS
1 - Maltby Road East (East Leg)	0.59	17.12	1.4	6.9	C
2 - Gordon Street (North Leg)	0.60	4.13	1.5	2.0	A
3 - Maltby Road East (West Leg)	0.39	6.53	0.6	3.0	A
4 - Gordon Street (South Leg)	0.81	9.01	4.3	16.9	A

Main Results for each time segment

15:45 - 16:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	End queue (Veh)	Delay (s)	LOS
1 - Maltby Road East (East Leg)	209	1189	11.29	968	0.215	207	0.3	4.727	A
2 - Gordon Street (North Leg)	878	221	75.29	2239	0.392	875	0.6	2.636	A
3 - Maltby Road East (West Leg)	244	886	11.29	1260	0.194	243	0.2	3.535	A
4 - Gordon Street (South Leg)	1193	245	11.29	2227	0.535	1188	1.1	3.449	A

16:00 - 16:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	End queue (Veh)	Delay (s)	LOS
1 - Maltby Road East (East Leg)	249	1423	13.48	767	0.325	248	0.5	6.914	A
2 - Gordon Street (North Leg)	1048	264	89.90	2204	0.476	1047	0.9	3.108	A
3 - Maltby Road East (West Leg)	291	1060	13.48	1108	0.263	291	0.4	4.402	A
4 - Gordon Street (South Leg)	1424	294	13.48	2192	0.650	1421	1.8	4.655	A

16:15 - 16:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	End queue (Veh)	Delay (s)	LOS
1 - Maltby Road East (East Leg)	305	1737	16.52	521	0.586	301	1.4	16.173	C
2 - Gordon Street (North Leg)	1284	322	110.10	2157	0.595	1282	1.5	4.103	A
3 - Maltby Road East (West Leg)	357	1296	16.52	910	0.392	356	0.6	6.476	A
4 - Gordon Street (South Leg)	1744	359	16.52	2143	0.814	1735	4.2	8.631	A

16:30 - 16:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	End queue (Veh)	Delay (s)	LOS
1 - Maltby Road East (East Leg)	305	1746	16.52	515	0.593	305	1.4	17.120	C
2 - Gordon Street (North Leg)	1284	325	110.10	2155	0.596	1284	1.5	4.132	A
3 - Maltby Road East (West Leg)	357	1299	16.52	908	0.393	357	0.6	6.528	A
4 - Gordon Street (South Leg)	1744	360	16.52	2142	0.814	1744	4.3	9.012	A

16:45 - 17:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	End queue (Veh)	Delay (s)	LOS
1 - Maltby Road East (East Leg)	249	1435	13.48	758	0.329	253	0.5	7.179	A
2 - Gordon Street (North Leg)	1048	269	89.90	2201	0.476	1050	0.9	3.132	A
3 - Maltby Road East (West Leg)	291	1064	13.48	1105	0.264	292	0.4	4.436	A
4 - Gordon Street (South Leg)	1424	295	13.48	2191	0.650	1434	1.9	4.814	A

17:00 - 17:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	End queue (Veh)	Delay (s)	LOS
1 - Maltby Road East (East Leg)	209	1197	11.29	962	0.217	209	0.3	4.792	A
2 - Gordon Street (North Leg)	878	223	75.29	2238	0.392	879	0.6	2.651	A
3 - Maltby Road East (West Leg)	244	890	11.29	1257	0.194	244	0.2	3.559	A
4 - Gordon Street (South Leg)	1193	247	11.29	2226	0.536	1195	1.2	3.501	A

Queue Variation Results for each time segment

15:45 - 16:00

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
1 - Maltby Road East (East Leg)	0.27	0.00	0.00	0.27	0.27			N/A	N/A
2 - Gordon Street (North Leg)	0.64	0.55	1.00	1.40	1.45			N/A	N/A
3 - Maltby Road East (West Leg)	0.24	0.00	0.00	0.24	0.24			N/A	N/A

4 - Gordon Street (South Leg)	1.14	0.55	1.00	1.40	1.45			N/A	N/A
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16:00 - 16:15

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
1 - Maltby Road East (East Leg)	0.48	0.04	0.41	1.25	1.37			N/A	N/A
2 - Gordon Street (North Leg)	0.90	0.06	0.76	1.63	2.03			N/A	N/A
3 - Maltby Road East (West Leg)	0.35	0.00	0.00	0.35	0.35			N/A	N/A
4 - Gordon Street (South Leg)	1.83	0.04	0.43	4.91	8.42			N/A	N/A

16:15 - 16:30

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
1 - Maltby Road East (East Leg)	1.36	0.03	0.27	1.36	2.87			N/A	N/A
2 - Gordon Street (North Leg)	1.45	0.03	0.26	1.45	1.45			N/A	N/A
3 - Maltby Road East (West Leg)	0.64	0.03	0.25	0.64	0.64			N/A	N/A
4 - Gordon Street (South Leg)	4.16	0.03	0.30	4.16	16.95			N/A	N/A

16:30 - 16:45

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
1 - Maltby Road East (East Leg)	1.41	0.03	0.30	1.90	6.87			N/A	N/A
2 - Gordon Street (North Leg)	1.46	0.03	0.26	1.46	1.46			N/A	N/A
3 - Maltby Road East (West Leg)	0.64	0.03	0.30	1.04	3.04			N/A	N/A
4 - Gordon Street (South Leg)	4.27	0.03	0.27	4.27	5.55			N/A	N/A

16:45 - 17:00

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
1 - Maltby Road East (East Leg)	0.50	0.04	0.43	1.27	1.39			N/A	N/A
2 - Gordon Street (North Leg)	0.91	0.51	0.99	1.42	1.48			N/A	N/A
3 - Maltby Road East (West Leg)	0.36	0.00	0.00	0.36	0.36			N/A	N/A
4 - Gordon Street (South Leg)	1.88	0.06	0.86	4.72	6.98			N/A	N/A

17:00 - 17:15

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
1 - Maltby Road East (East Leg)	0.28	0.03	0.30	0.87	1.20			N/A	N/A
2 - Gordon Street (North Leg)	0.65	0.08	0.78	1.36	1.43			N/A	N/A
3 - Maltby Road East (West Leg)	0.24	0.00	0.00	0.24	0.24			N/A	N/A
4 - Gordon Street (South Leg)	1.16	0.04	0.38	2.94	5.22			N/A	N/A



Appendix E
Public Consultation



Clair-Maltby Secondary Plan

Master Environmental Servicing
Plan and Community Plan

guelph.ca/clair-maltby





Project Progress

August 11, 2015 – Open House

September 17, 2015 – Focus Group

October 23, 2015 – Draft TOR released

December 2015 – Council Approval of TOR

January-March 2016 – Retained Consultant Team



Study Structure



Task A – CEIS

Task B – Water/Wastewater

Task C – Stormwater Management

Task D – Mobility Study

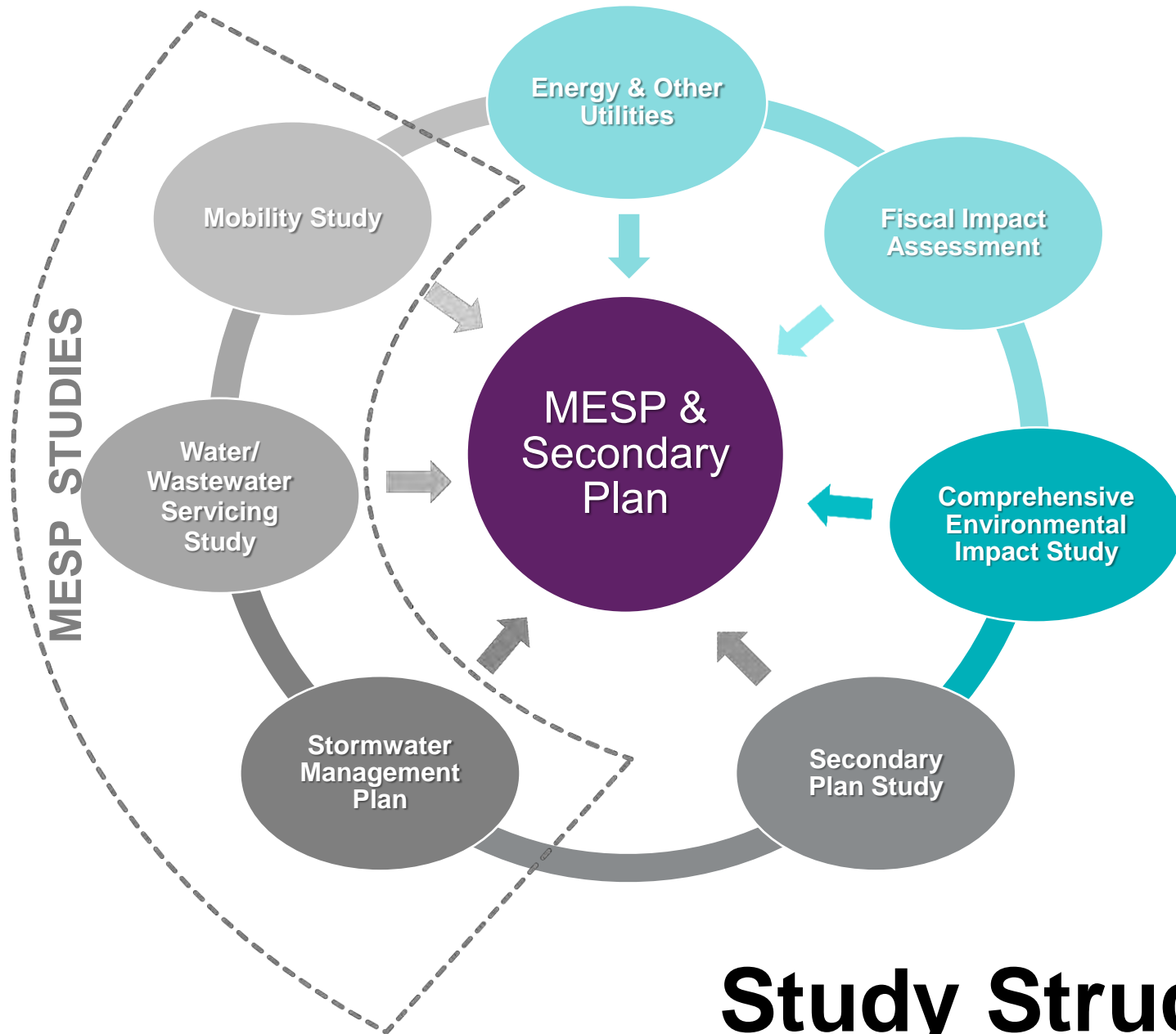
Task E – Energy & Other Utilities

Task F – Secondary Plan

Task G – Fiscal Impact Assessment

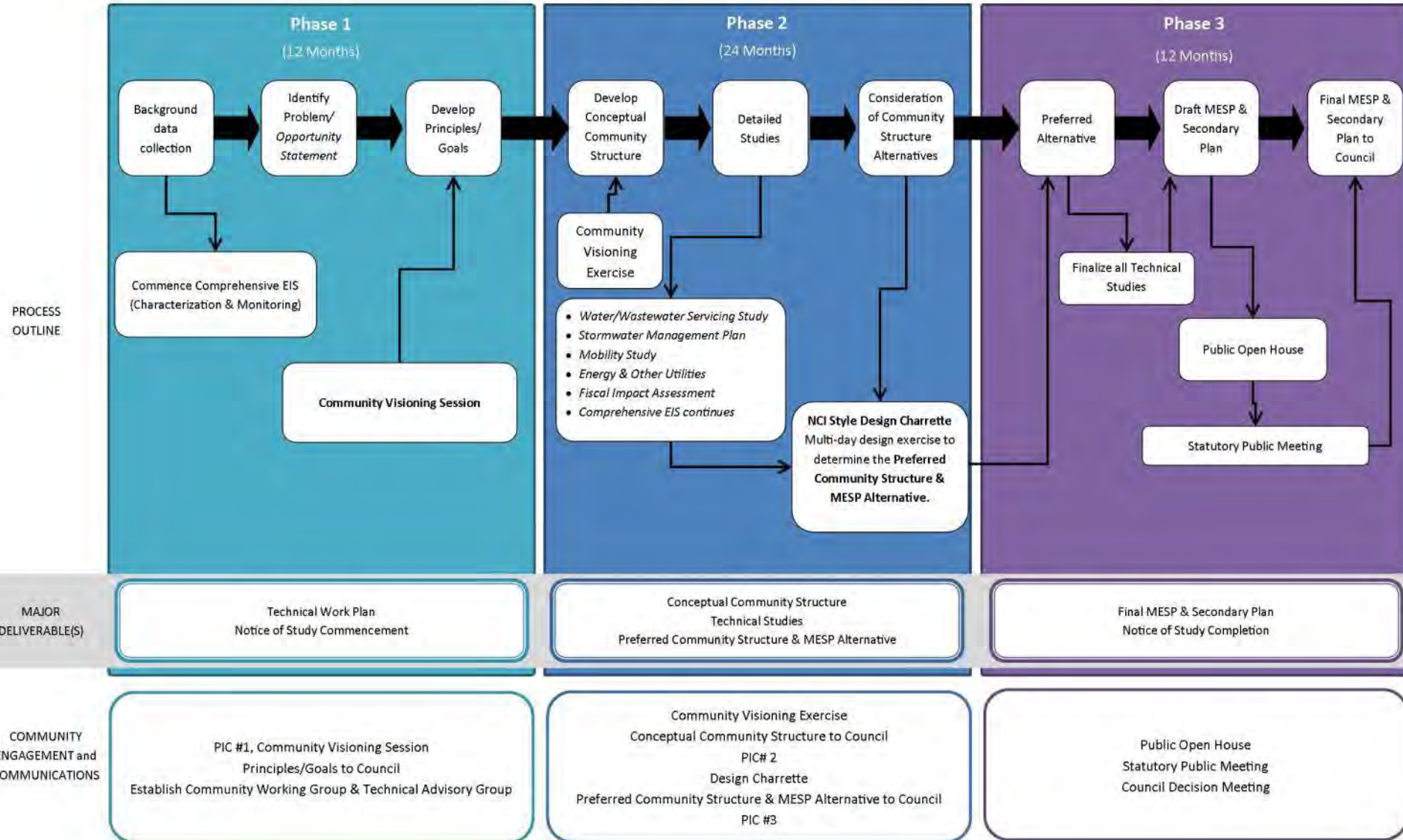
Task H – Community Engagement & Communications





Study Structure

Clair-Maltby Secondary Plan - Process Outline



Clair-Maltby Secondary Plan

Consulting Team

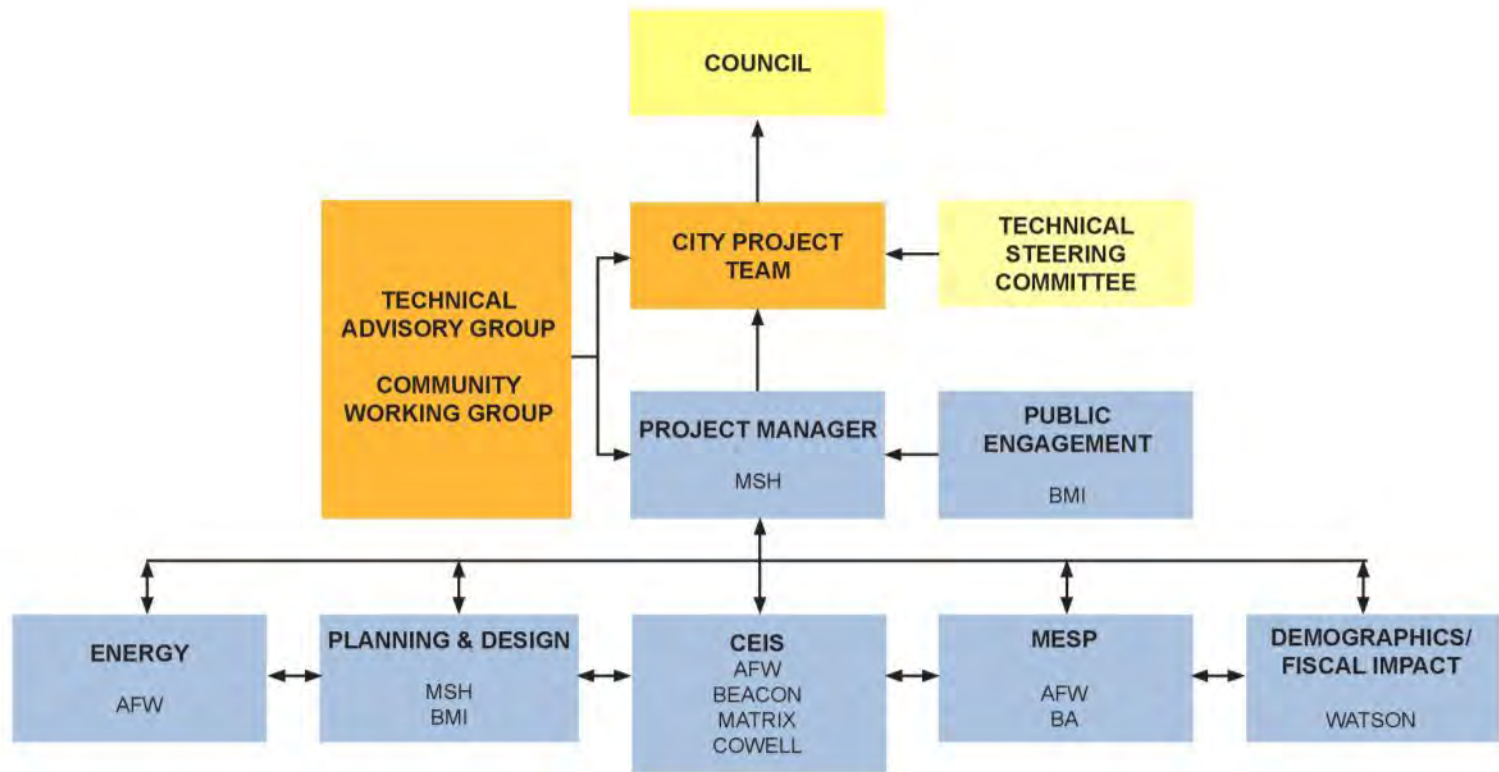
- Macaulay Shiomi Howson Ltd. (MSH) - *Project Management / Planning/Sustainable Development/Facilitation*
- Brook McIlroy Inc. - *Community Outreach / Urban Design*
- Amec Foster Wheeler (AFW) - *Water / Wastewater / Stormwater Management / Energy*
- Beacon Environmental Ltd. – *Natural Heritage*
- Daryl Cowell - *Landform*
- Matrix Solutions Inc. – *Hydrogeology*
- BA Group – *Mobility/Parking*
- Watson & Associates - *Fiscal Impact/Land Economics*
- ASI - *Archaeology, Cultural Heritage & Aboriginal Engagement*



Clair-Maltby Secondary Plan

Study Reporting Structure

CITY OF GUELPH
CLAIR-MALTBY SECONDARY PLAN
CONSULTANT TEAM ORGANIZATION





Clair-Maltby Secondary Plan

Comprehensive Environmental Impact Study (CEIS)

What is the study about?

- examination and verification of environmental features and functions
- assessment of the role of water in the study area to support natural systems (groundwater/surface water)
- constraints and opportunities definition
- assessment of impacts associated with possible land use changes
- establishment of integrated management strategies



Clair-Maltby Secondary Plan

Comprehensive Environmental Impact Study (CEIS)

How will this study be conducted?

- review of background information
- multi-year monitoring and field studies
- modelling of surface and groundwater
- agency and stakeholder consultation
- reporting



Clair-Maltby Secondary Plan

Comprehensive Environmental Impact Study (CEIS)

Field Monitoring

- Surface Water
- Groundwater
- Ecological



Clair-Maltby Secondary Plan

Field Monitoring

Surface Water (2016, 2017, 2018)

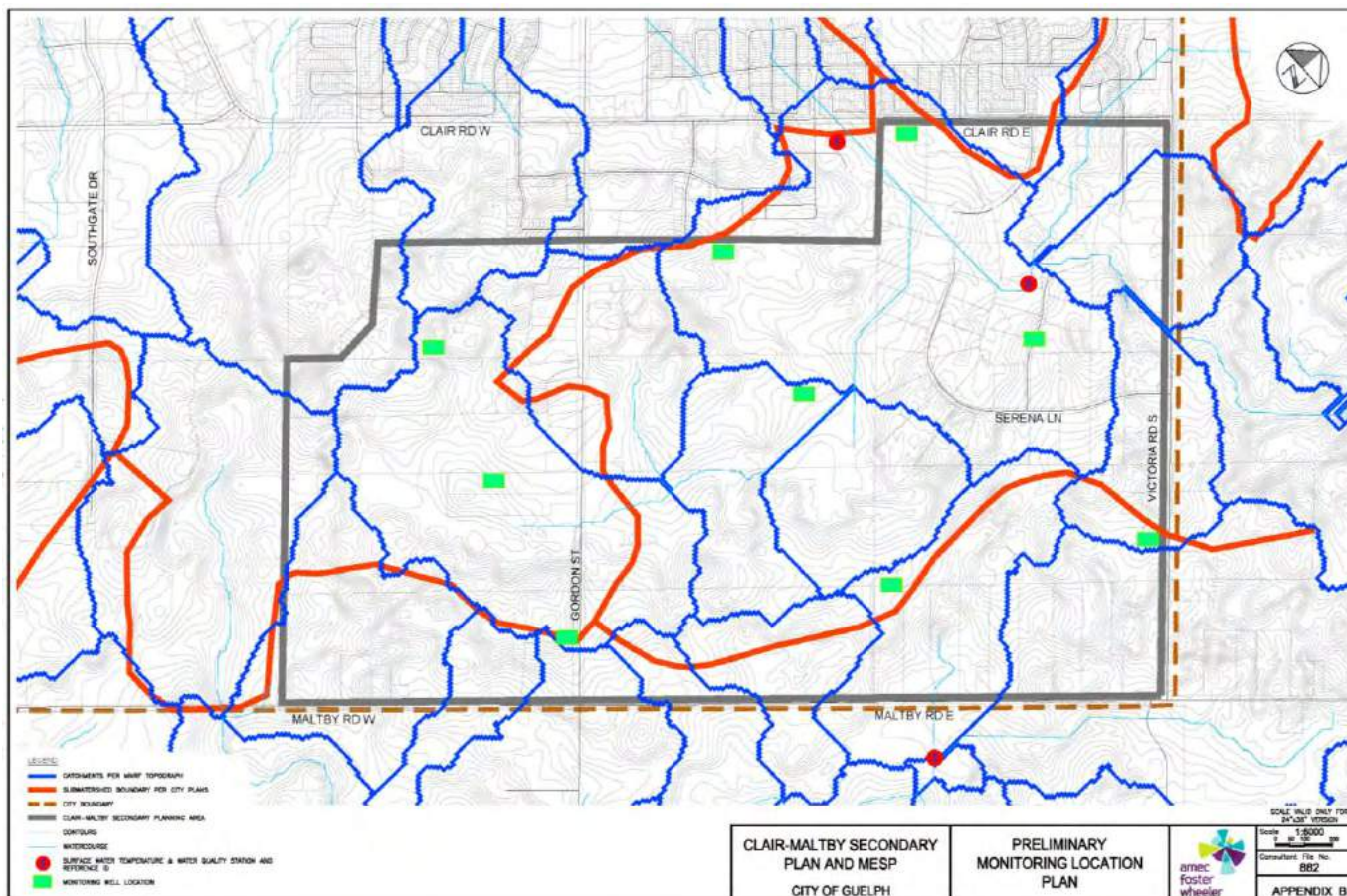
- Rainfall
- Water Levels
- Water Quality
- Temperature
- Velocity metering



Clair-Maltby Secondary Plan

Field Monitoring

Surface Water





Clair-Maltby Secondary Plan

Field Monitoring

Groundwater (2016, 2017, 2018)

- 18 monitoring wells at 9 locations across 3 transects
 - Dataloggers at 9 locations, monthly manual water level measurements
 - Water quality sampling twice / year for 3 years
 - Hydraulic testing of each well
- Ideally drill wells in 2016

Guelph permeameter testing across primary study area (3 days)



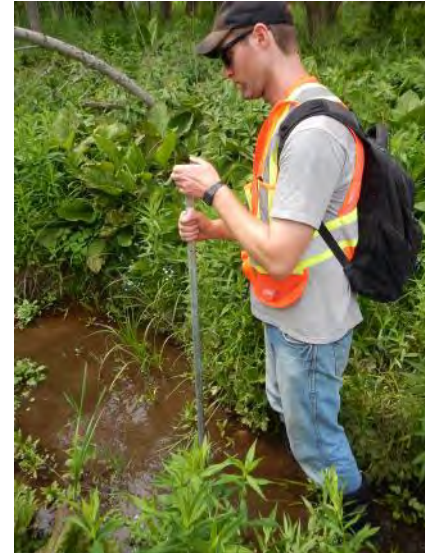


Clair-Maltby Secondary Plan

Field Monitoring

Groundwater (2016, 2017, 2018)

- Drive point piezometer nests at 20 locations around wetlands in primary study area and along tributaries outside of primary study area
 - Monthly water level measurements





Clair-Maltby Secondary Plan

Field Monitoring

Groundwater (2016, 2017, 2018)

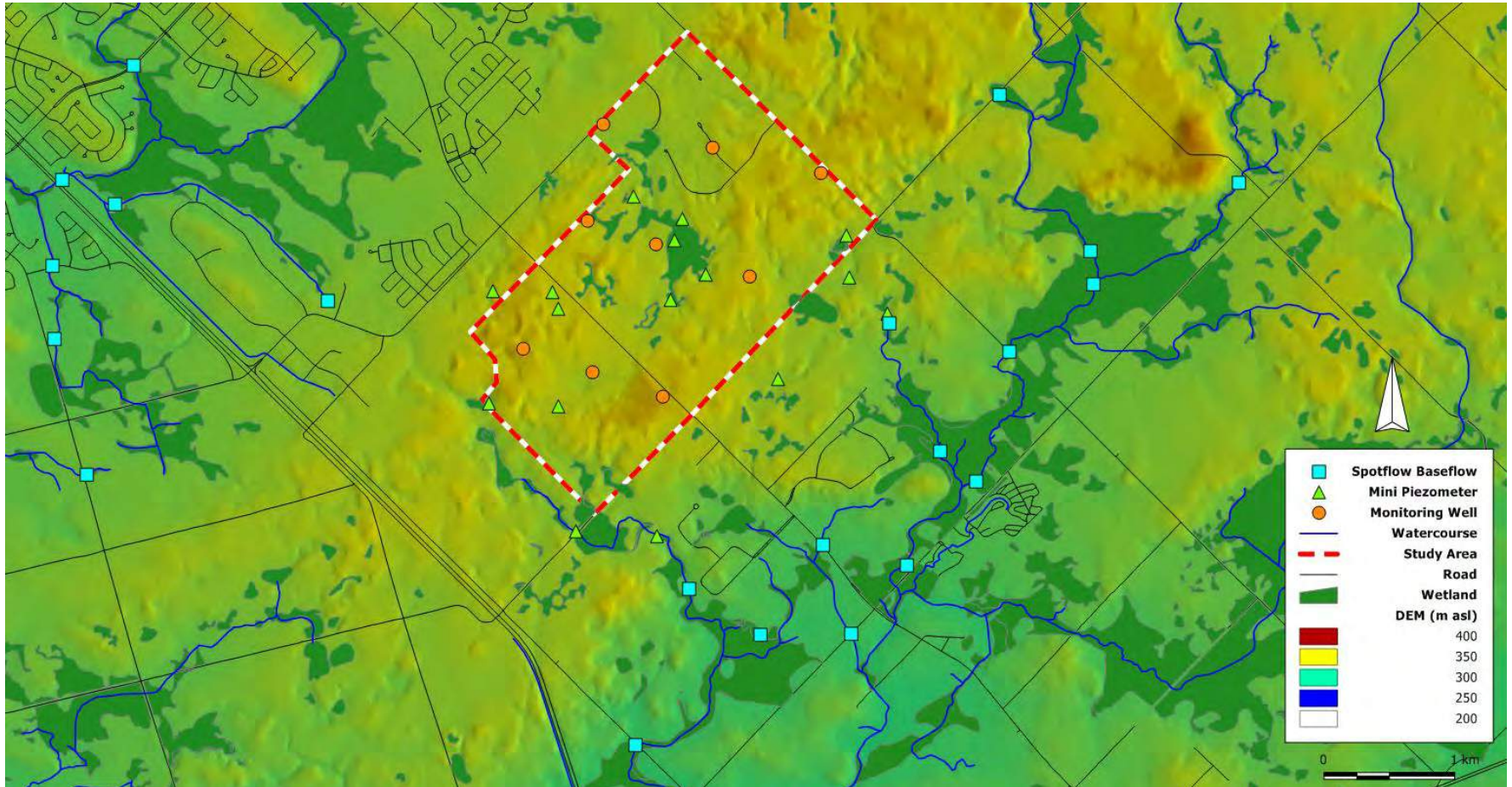
- Spotflow / baseflow measurements at 25 locations outside primary study area (Mill Creek, Hanlon Creek, Torrance Creek)
 - 3x / year for 3 years





Clair-Maltby Secondary Plan

Field Monitoring - Groundwater





Clair-Maltby Secondary Plan

Field Monitoring

Ecology: General Approach

Build on work done to date and focus on functions best addressed at a landscape / Secondary Plan scale

- | | |
|---------------|---|
| 2016 | pull together base of existing information |
| 2016 | start wetland water level and quality monitoring |
| 2017 | bulk of field work (surveys for wildlife, plants) |
| 2017 and 2018 | wetland monitoring and wildlife movement |
| 2018 | wetland water level and quality monitoring |
| 2018 | targeted follow-up surveys TBD |

Clair-Maltby Secondary Plan

Field Monitoring

Ecology: Preliminary Work Plan within the Primary Study Area

Plan to undertake surveys in representative locations across the primary study area

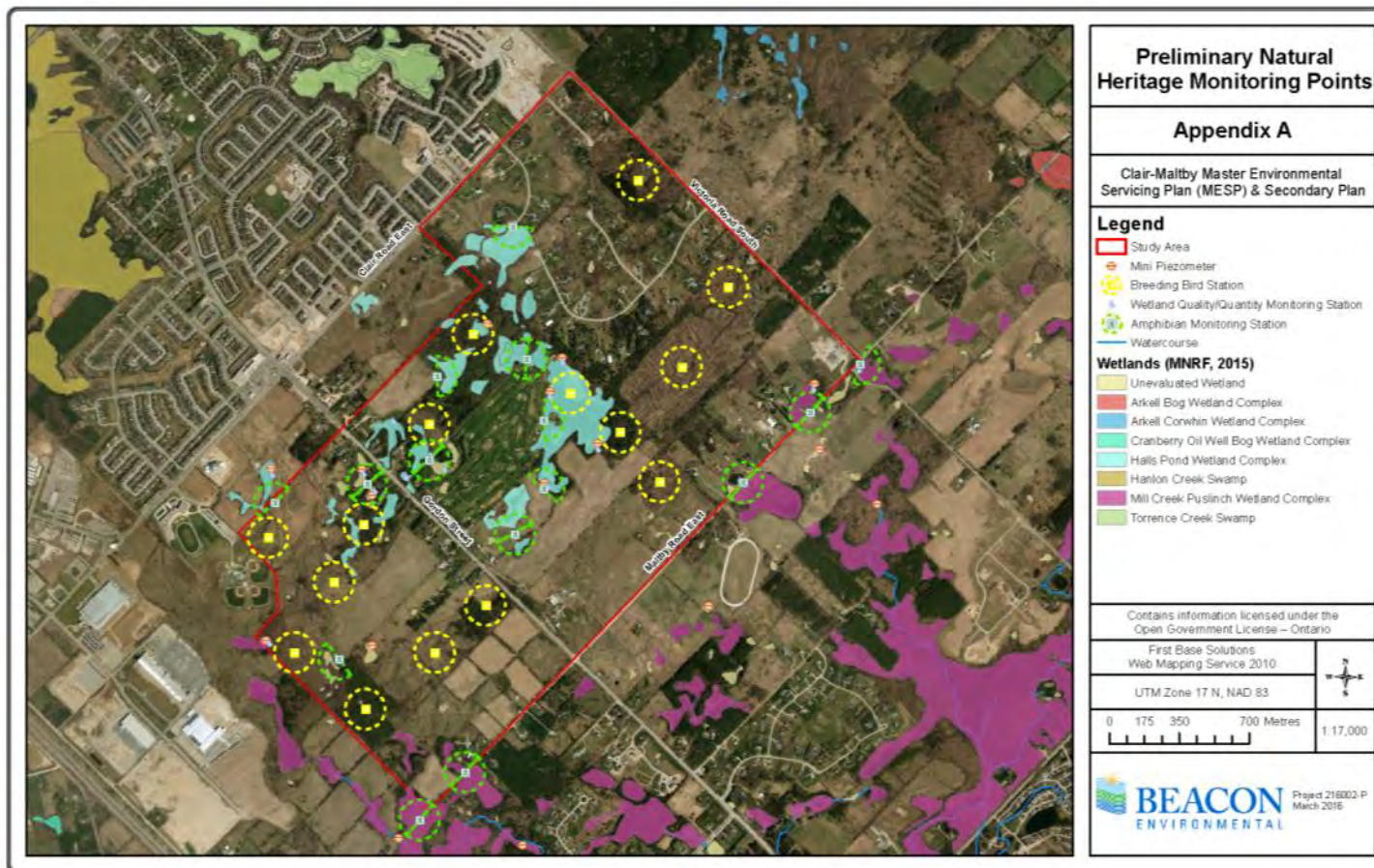
- Vegetation community classification / verification – up to 10 days
- Breeding amphibian surveys (frogs/roads) - about 20 stations
- Amphibian movement surveys (frogs/salamanders) – 3 or 4 locations
- Turtle surveys (basking) – about 5 locations
- Deer movement surveys – transects in selected areas (in winter)
- Bird surveys – about 15 stations



Clair-Maltby Secondary Plan

Field Monitoring

Ecology





Questions?

Property Access Surface Water Gauges



Visual flow monitoring and surface water level gauges installed by hand; no drilling required

Property Access Mini-piezometers



Installed by hand; no drilling required

Property Access Groundwater Wells



Drilling is required

Property Access Amphibian Surveys



In person visits three times between
late March and late June in the evenings

Property Access Bird Surveys



In person visits two to three times between mid-May and early July early in the morning

Property Access Plant & Vegetation Community Surveys



In person visits two or three times between mid-May and late September during the day



1 WELCOME

Thank you for attending, and welcome to the Public Information Centre and Visioning Workshop for the Clair-Maltby Secondary Plan.

Your feedback is important to us, and will help inform the development of the vision and guiding principles for the secondary plan study.

Agenda

- | | |
|-------------------------------------|----------------|
| 1 Sign in and Display Boards | 6:30 - 7:00 pm |
| 2 Presentation | 7:00 - 7:30pm |
| 3 Workshop | 7:30 - 8:30 pm |

Three rounds: Guiding Principles - choose up to 3 topics

1. Sustainability & Servicing
2. Mobility
3. Natural Heritage Network and Parks System
4. Land Use, Urban Design, and Cultural Heritage

Final round: Vision

- | | |
|-----------------------------------|----------------|
| 4 Report Back & Next Steps | 8:30 - 9:00 pm |
|-----------------------------------|----------------|

Contact Us

Stacey Laughlin, MCIP, RPP

Senior Policy Planner

Planning, Urban Design and Building Services

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Arun Hindupur, M.Sc., P.Eng.

Infrastructure Planning Engineer

Engineering and Capital Infrastructure Services

arun.hindupur@guelph.ca

2 THE STUDY

Study Purpose

The City of Guelph is undertaking the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study. Clair-Maltby is the last unplanned greenfield area within the city. This Study will establish a plan for future development in the area.

The Clair-Maltby Secondary Plan and the Master Environmental Servicing Plan (MESP) are being developed simultaneously to provide an integrated planning approach within the Study Area. Comments from our community engagement sessions will be analysed alongside land use, environment, mobility and servicing studies for a comprehensive review of the Clair-Maltby Secondary Plan Area and its needs.

Your input today will provide critical guidance for the conceptual community structure, which will be developed during the next phase of this study.

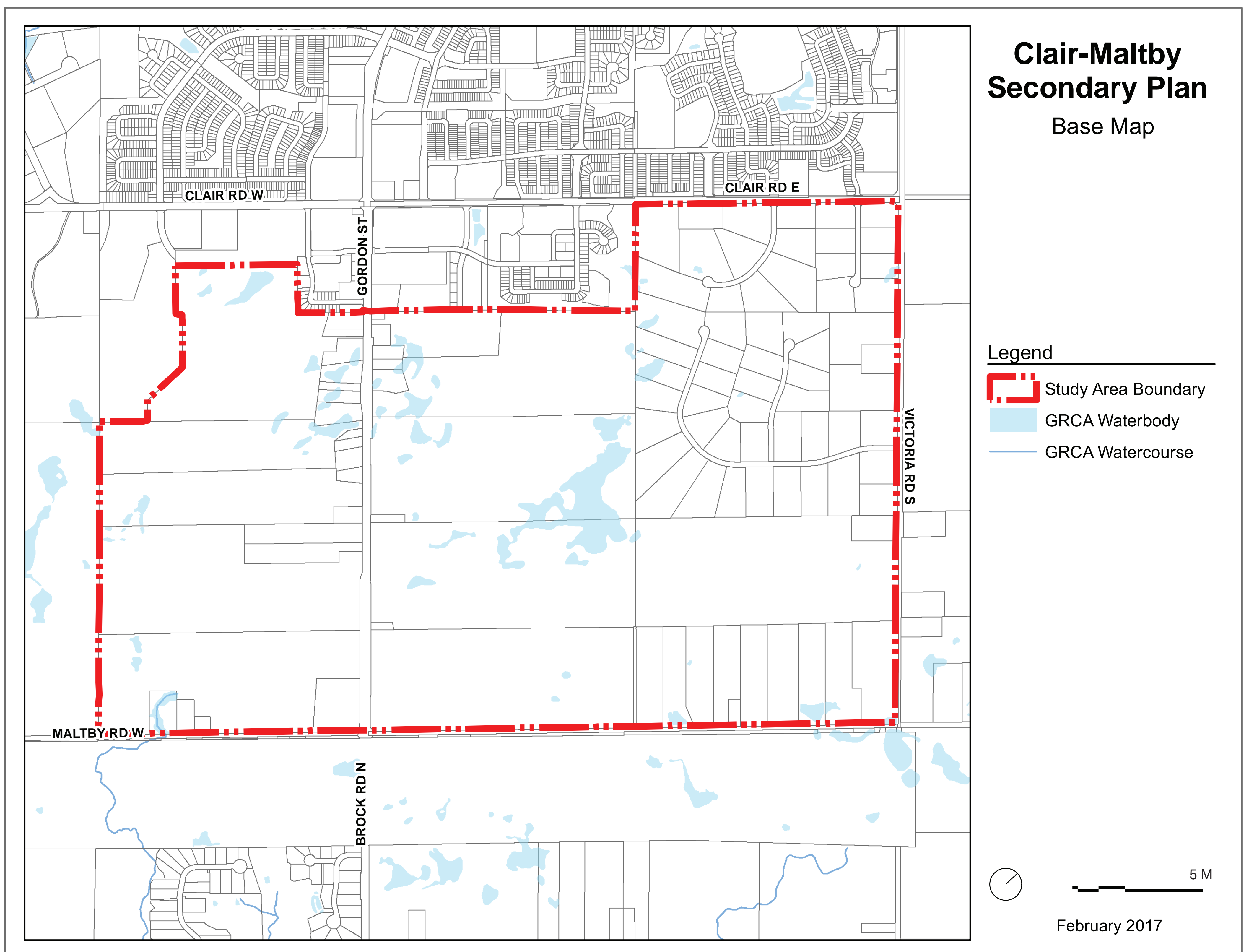
Study Schedule



3 SECONDARY PLAN AREA

Physical Context

The Secondary Planning Area is located in the south end of the City of Guelph. It is bounded by Clair Road to the north, Victoria Road (City Boundary) to the east, Maltby Road (City Boundary) to the south and the eastern limits of the Southgate Business Park to the west. It has an area of more than 520 hectares which is currently primarily rural and agricultural in nature.



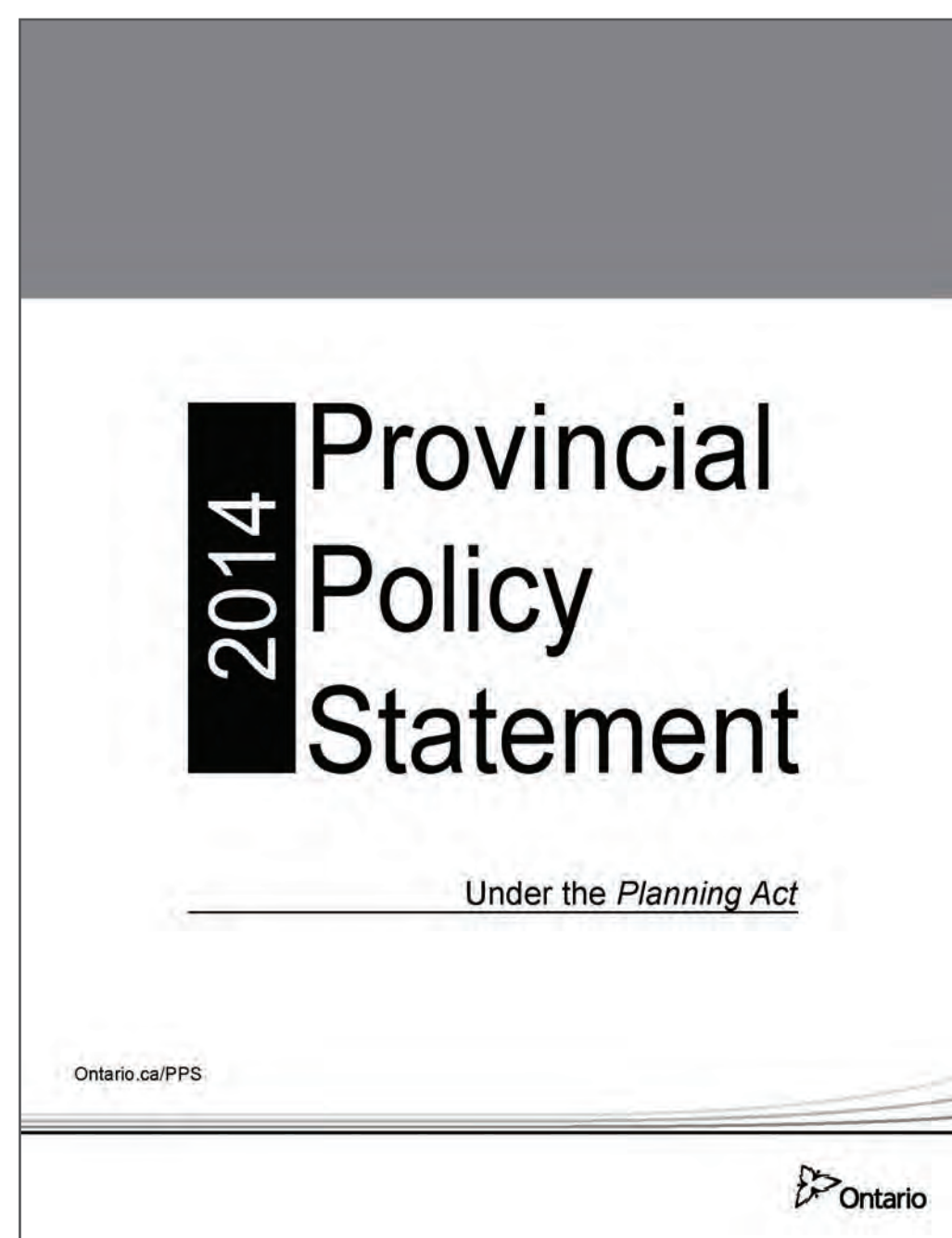
4 GUIDING DOCUMENTS

Provincial and Municipal legislation contain policy that will influence the direction for the Secondary Plan Area. These include the:

Provincial Policy Statement (PPS)

Relevant themes include:

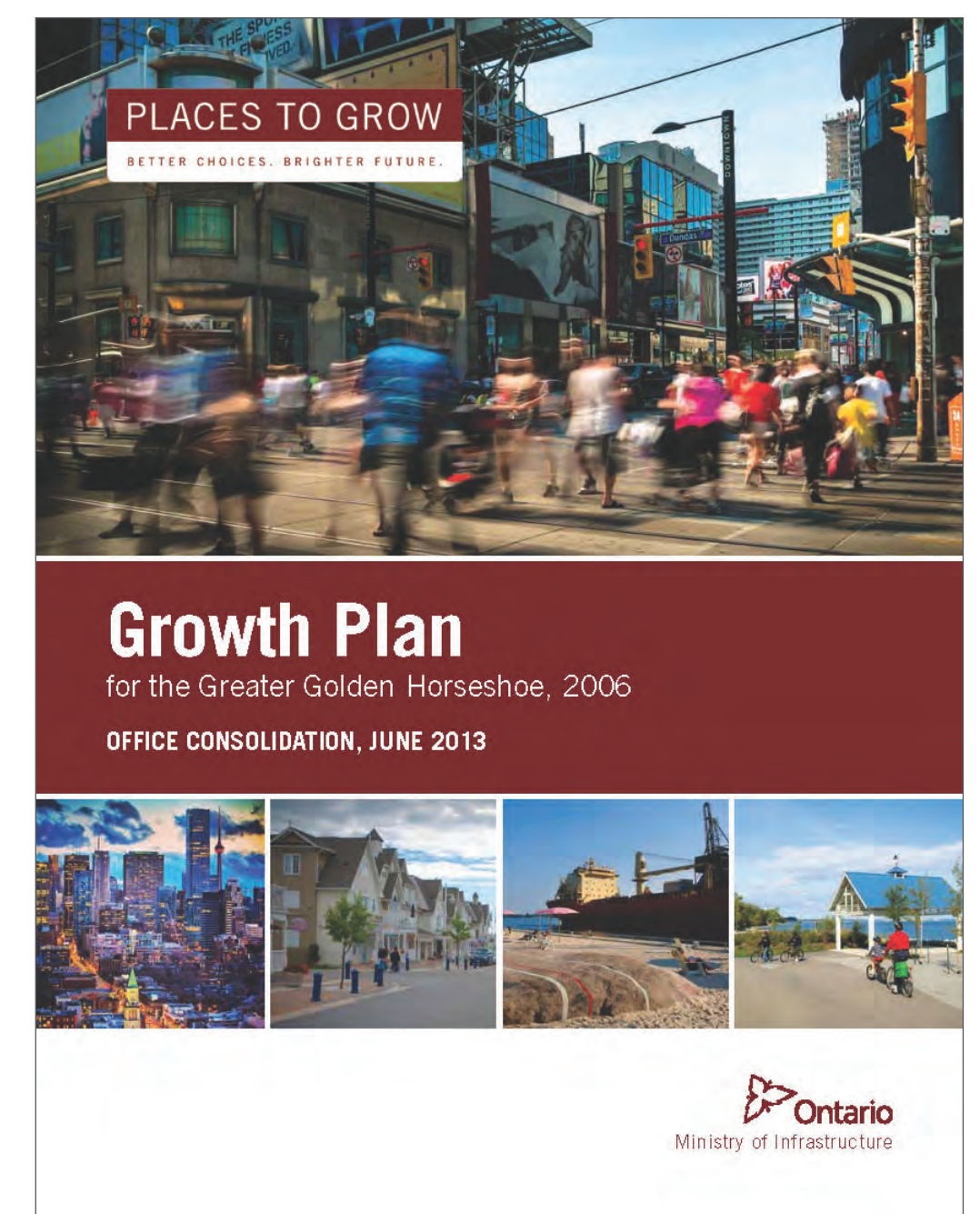
- Creating strong, livable and healthy communities;
- Protecting the environment, public health and safety; and
- Facilitating economic growth.



Places to Grow: Growth Plan for the Greater Golden Horseshoe

Relevant themes include:

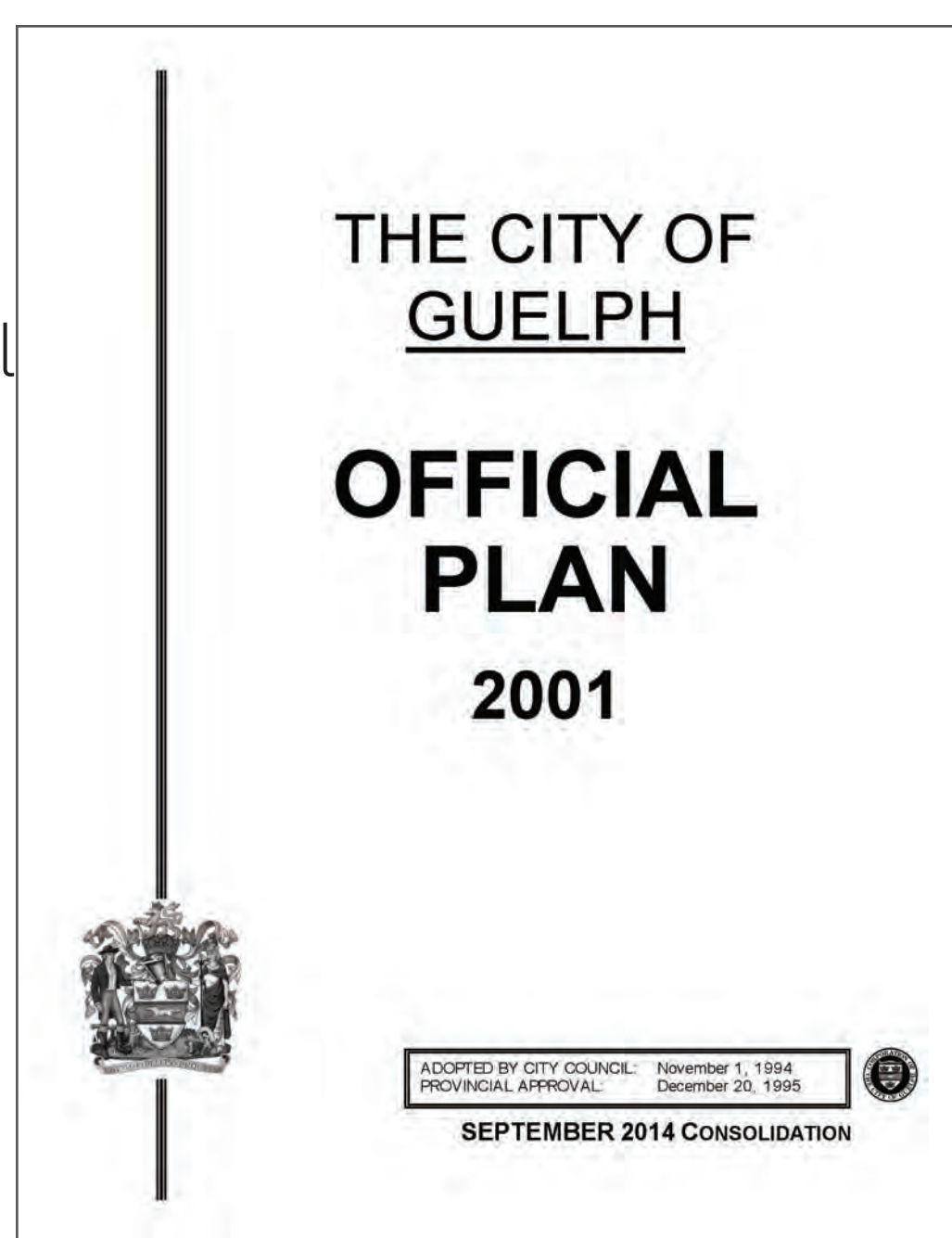
- Growth management directions;
- Greenfield residential targets; and
- People/jobs density targets.



City of Guelph Official Plan

Relevant themes include:

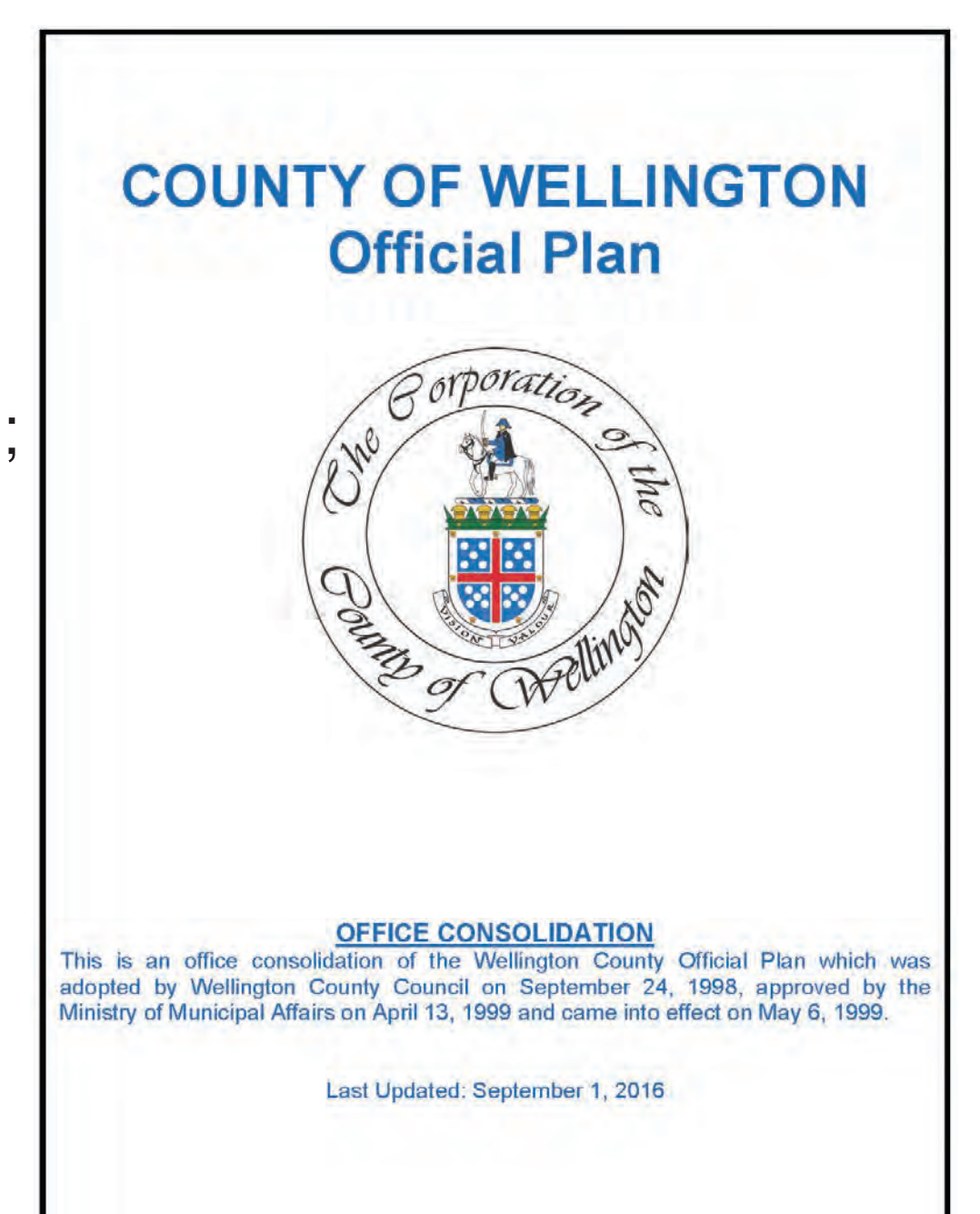
- Complete communities;
- Protection of the Natural Heritage Network;
- Multimodal transportation system;
- Environmental and built form sustainability;
- Varied and affordable housing types; and
- Conservation of built and cultural heritage and archaeological resources.



Wellington County Official Plan (relevant to adjacent lands)

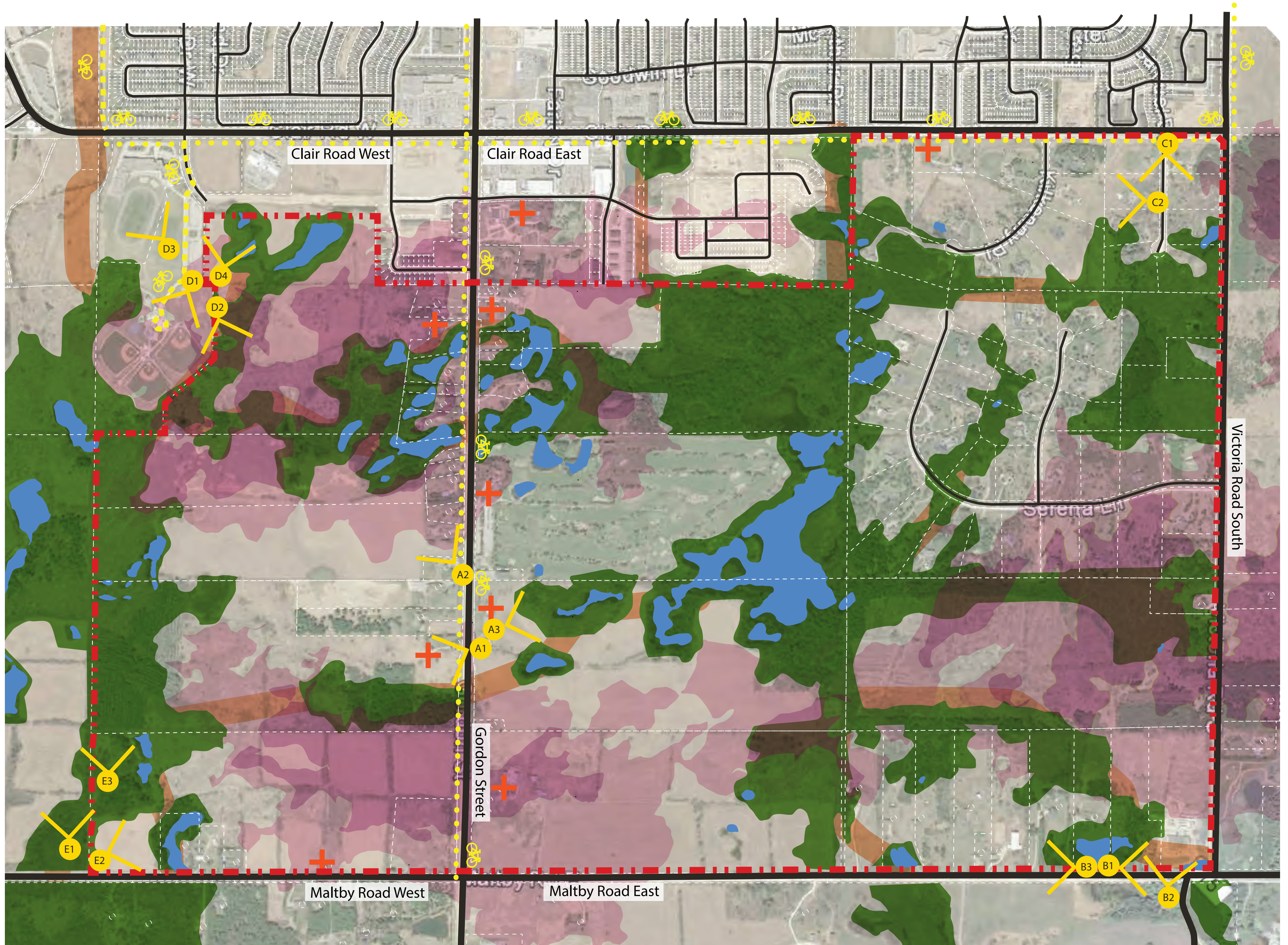
Relevant themes include:

- Land use designations and policies;
- Gordon Street Extension; and
- Significant Drinking Water Threat policies.



5 EXISTING CONDITIONS

Existing Conditions Map



- | | | | | |
|---------------------------|--------------------------|--------------------------------------|------------------------------|-------------|
| Natural Heritage System | Built Heritage Resources | Existing Roads | Bike Lane | Drone Views |
| Significant Natural Areas | | Higher Elevation Areas | Bike Lane or Paved Shoulders | |
| Ecological Linkages | | Clair Maltby Secondary Plan Boundary | Off Road Bike Route | |
| Water Bodies | | | | |

What are your top priorities for development in the Secondary Plan Area?

6 EXISTING CONDITIONS

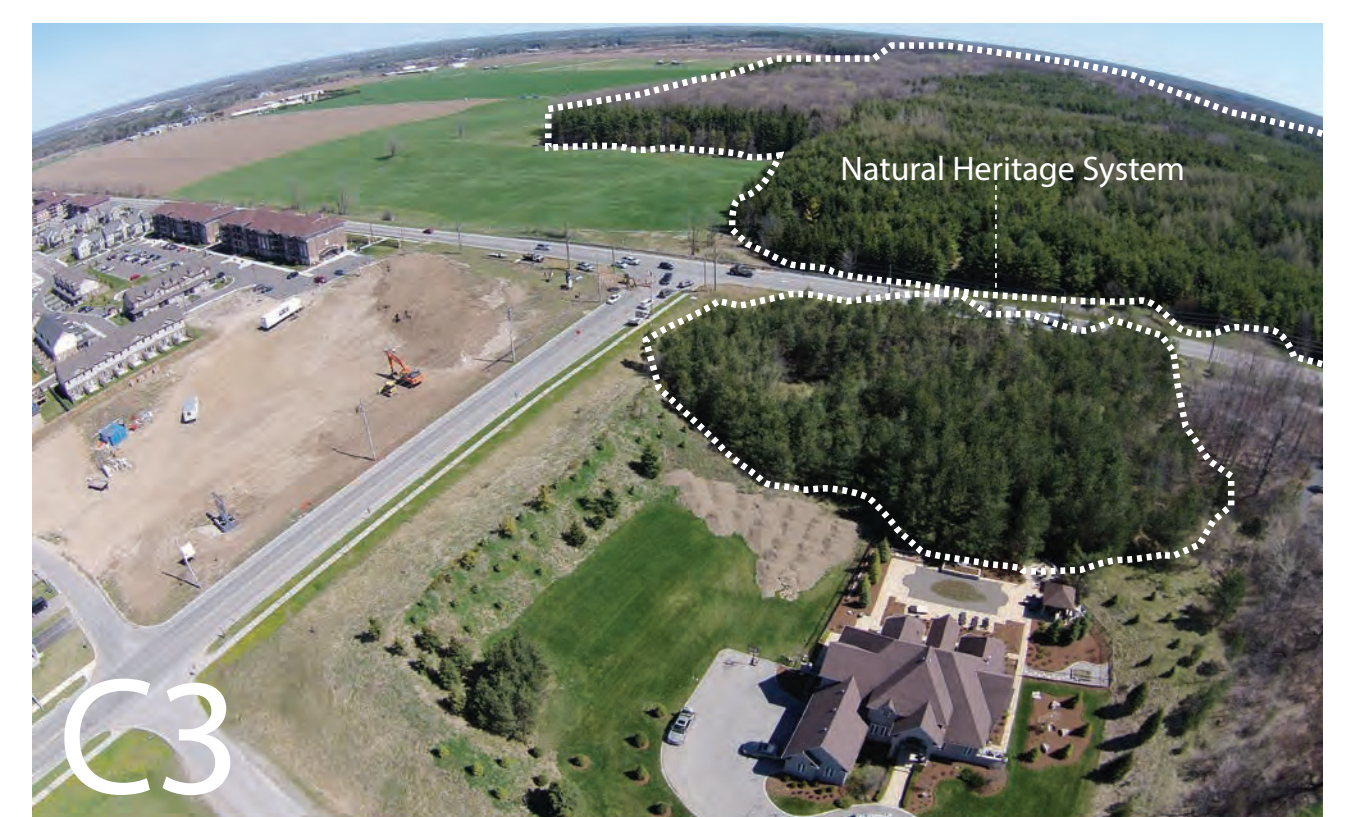
Central Views



South East Views



North East Views



North West Views



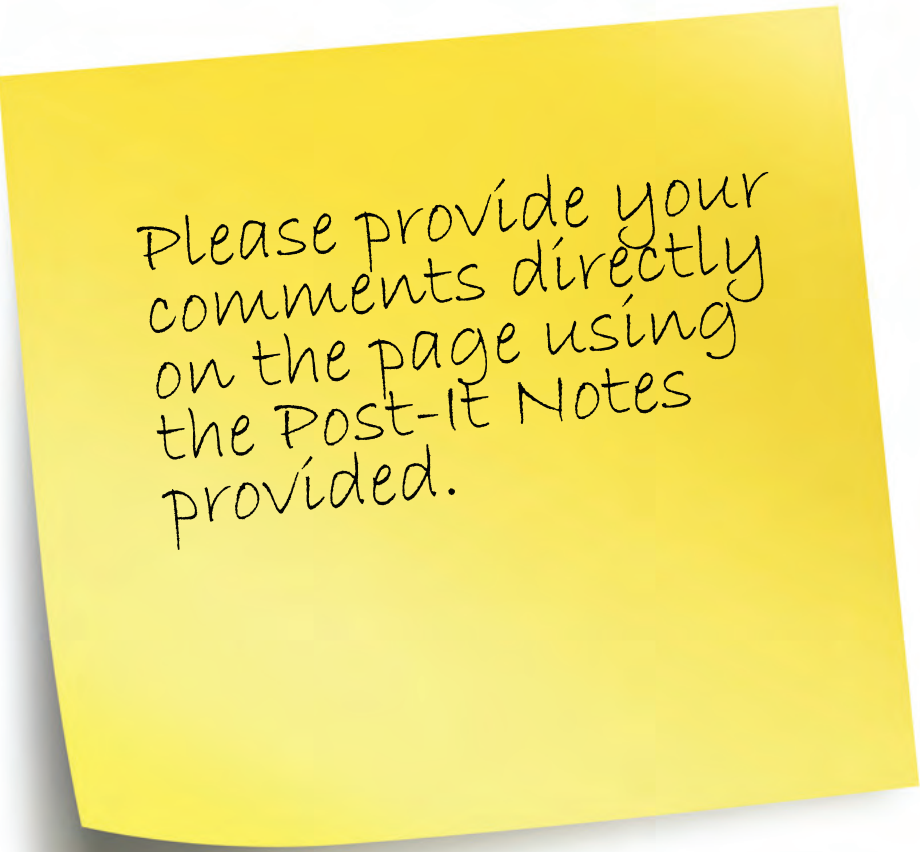
South West Views



7 COMMENTS AND NEXT STEPS

Please provide any additional comments about your vision for the Clair-Maltby area in the space below, using the post-it notes and pencils which have been provided.

Transform. Connect. Community. When fully developed, the Clair-Maltby area will be known for...



Please provide your comments directly on the page using the Post-It Notes provided.

NEXT STEPS

Vision / Principles to Council for endorsement - July 2017

Visioning Exercise: Conceptual Community Structure - September 2017 (tentative)

Conceptual Community Structure to Council for endorsement - Q4 2017 (tentative)

Design Charrette: Preferred Community Structure Alternative - March 2018 (tentative)

Conceptual Community Structure to Council for endorsement - Q2 2018 (tentative)

April 6, 2017

Clair-Maltby Secondary Plan and Master Environmental Servicing Plan

Notice of Study Commencement, Public Information Centre No. 1 and Visioning Workshop

Join us for a Public Information Centre (PIC) and Visioning Workshop
about the Clair-Maltby Secondary Plan

**Thursday, April 27, 2017
6:30-9 p.m.**

Bishop Macdonell Catholic High School, Gymnasium
200 Clair Road West, Guelph

Visioning Workshop

The visioning workshop will help to establish a vision, goals and guiding principles for the study. These will inform future decisions regarding the secondary plan.

- | | |
|----------------|--|
| 6:30-7 p.m. | Sign-in and display board viewing |
| 7-7:30 p.m. | Presentation |
| 7:30-8:30 p.m. | Workshop exercise <ul style="list-style-type: none">• Individual top priorities• Group visioning• Group guiding principles• Group precedent ranking |
| 8:30-9:00 p.m. | Report back and next steps |

How to Participate

Drop-in anytime from 6:30-9 p.m. to review project information, meet the project team, ask questions or provide comments.

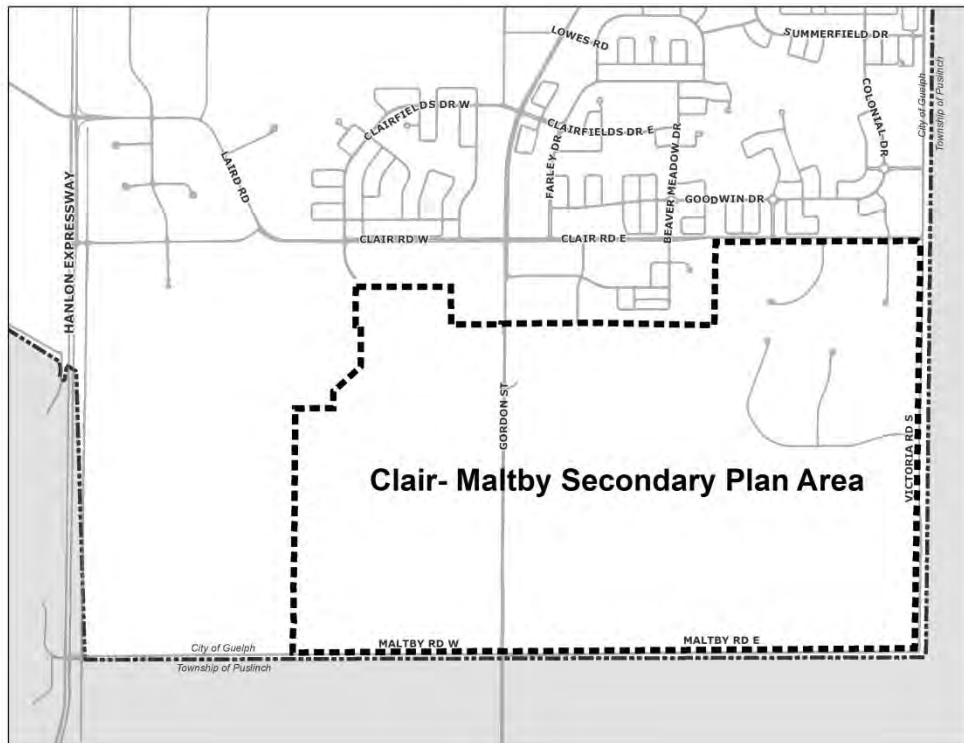
To participate in the workshop exercise, registration by **Tuesday, April 25** is suggested. You can register at guelph.ca/clair-maltby. If you require assistance with registration please call Planning Services at 519-837-5615 extension 2459.

Unable to attend?

Email your comments to clair-maltby@guelph.ca

The Project

The City of Guelph has initiated the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to plan the last unplanned greenfield area of the City. The study area is approximately 520 hectares and is generally located between Clair Road and Maltby Road in the southeast corner of Guelph.



Through the secondary plan, a vision for a complete and healthy community will be created including:

- an integrated mix of land uses (residential, employment and commercial);
- appropriate building heights, densities and built form to contribute to a vibrant community of neighbourhoods;
- the preservation of environmental features and functions;
- parks and open space;
- an integrated transportation network to promote transit, walking and cycling; and
- servicing and infrastructure (e.g. watermains, sanitary sewers, stormwater management).

The Process

The MESP will be carried out in accordance with the Master Plan (Approach #1) requirements of the Municipal Engineers Association Class Environmental Assessment (EA) process (Section A.2.7 of the Class EA document- October 2000, as amended in 2007 and 2011) which is an approved process under the Ontario Environmental Assessment Act.

This process will include Phases 1 and 2 of the Class EA process to identify a series of related projects/studies necessary to support urban development of this area. In addition this study will be integrated with the Planning Act as outlined in Section A.2.9 of the Municipal Class EA process.

The MESP will provide direction on municipal water/wastewater servicing, stormwater management and mobility.

For more information

guelph.ca/clair-maltby

Please contact one of our project team members if you have questions, comments, would like to be added to the project mailing list, or if you require this document to be provided in an alternative format as per the *Accessibility for Ontarians with Disabilities Act (2005)*.

Stacey Laughlin, MCIP, RPP

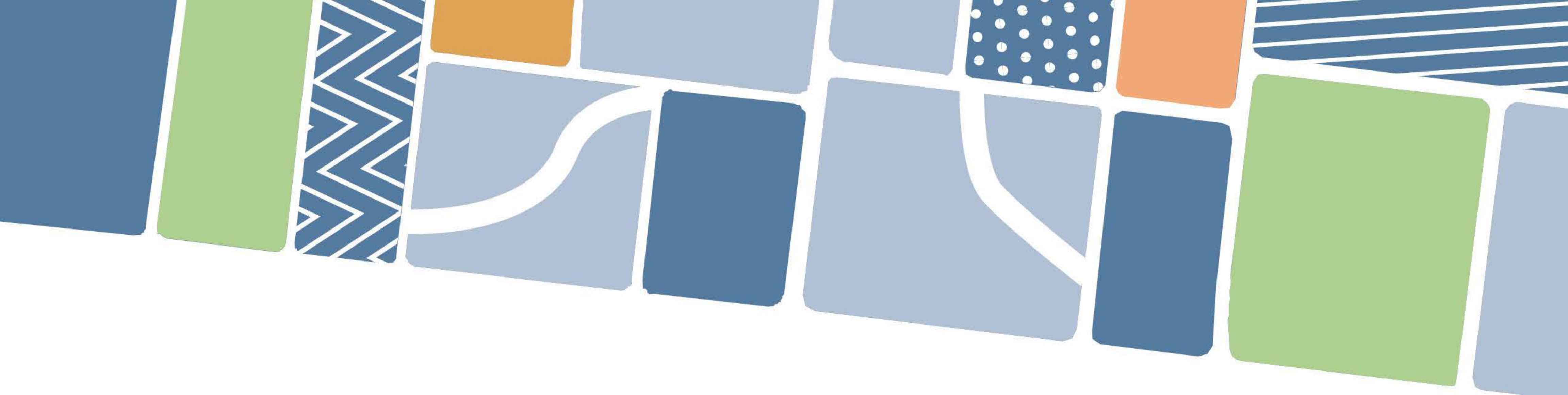
Senior Policy Planner
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stacey.laughlin@guelph.ca

Arun Hindupur, M.Sc., P.Eng.

Infrastructure Planning Engineer
Engineering and Capital Infrastructure Services
519-822-1260 x2282
arun.hindupur@guelph.ca

Information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act*. With the exception of personal information, all comments will become part of the public record.

(This notice first issued April 6, 2017)



CLAIR-MALTBY

MASTER ENVIRONMENTAL SERVICING PLAN (MESP)

&

COMPREHENSIVE ENVIRONMENTAL IMPACT STUDY (CEIS)

1 PROBLEM/OPPORTUNITY STATEMENT

Problem

- The City of Guelph is undertaking the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to comprehensively plan the last unplanned greenfield area within the city. The current study area does not have full municipal services to support future development.

Opportunity

- The Clair-Maltby Secondary Plan and the Master Environmental Servicing Plan (MESP) are being developed concurrently to provide an integrated planning approach to establish a plan for future urban development and full municipal services within this area.

2 GOVERNING PROVINCIAL LEGISLATION

Municipal Class Environmental Assessment Process (October 2000), as amended in 2007 & 2011)

- The Municipal Class Environmental Assessment (Class EA) process categorizes proposed municipal projects according to their anticipated environmental impact, and calls for increasingly stringent review requirements as the magnitude of the anticipated environmental impact increases.
- The Class EA defines a Master Plan as:
“A Long Range Plan, integrating infrastructure requirements for present and future land use with environmental planning principles. The Plan examines the whole infrastructure system in order to outline a framework for planning subsequent projects and/or developments (Class EA, October 2000, as amended in 2007 & 2011)”.

Planning Act

- The Planning Act sets out the ground rules for land use planning in Ontario and describes how land uses may be controlled, and who may control them.

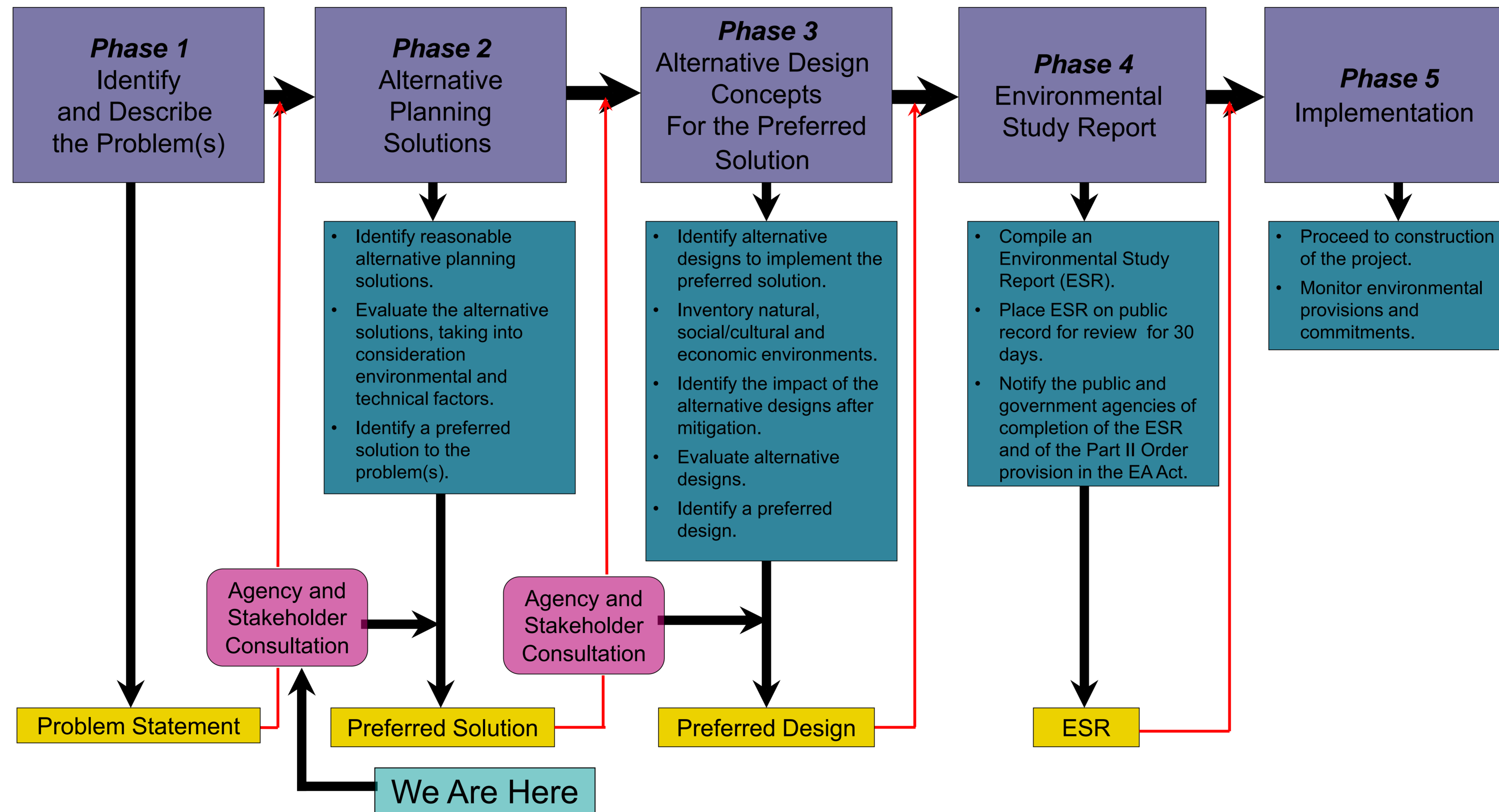
Provincial Policy Statement

- The Provincial Policy Statement contains clear, overall policy directions on matters of provincial interest related to land use planning and development.
- It promotes a policy-led planning system that recognizes there are complex inter-relationships among and between environmental, economic and social factors in land use planning.

The Master Environmental Servicing Plan (MESP) being prepared for the Clair-Maltby Community constitutes a municipal services plan (stormwater, wastewater, water and transportation) along with environmental management to support future urbanization.

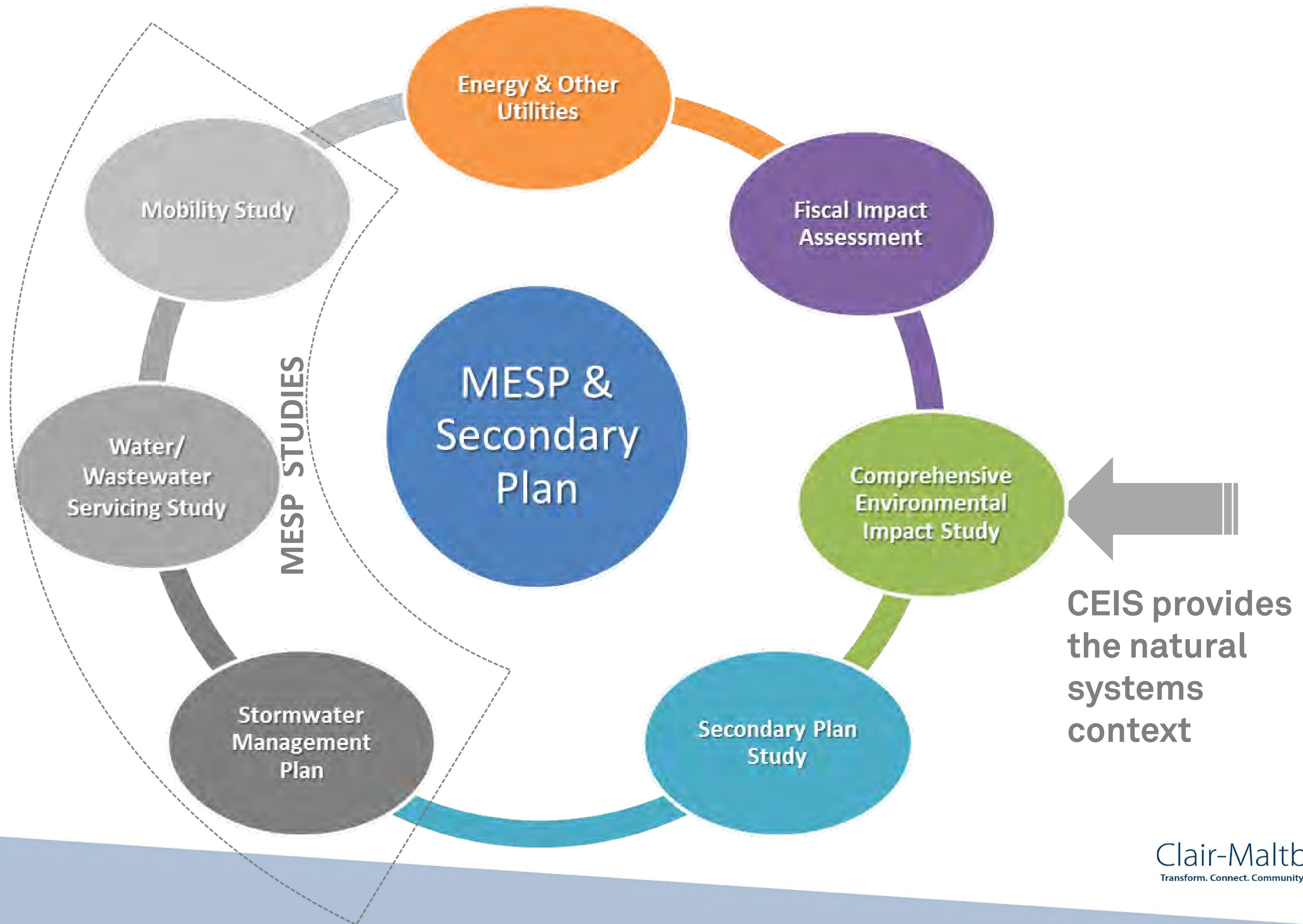
3

MUNICIPAL CLASS EA PROCESS



4

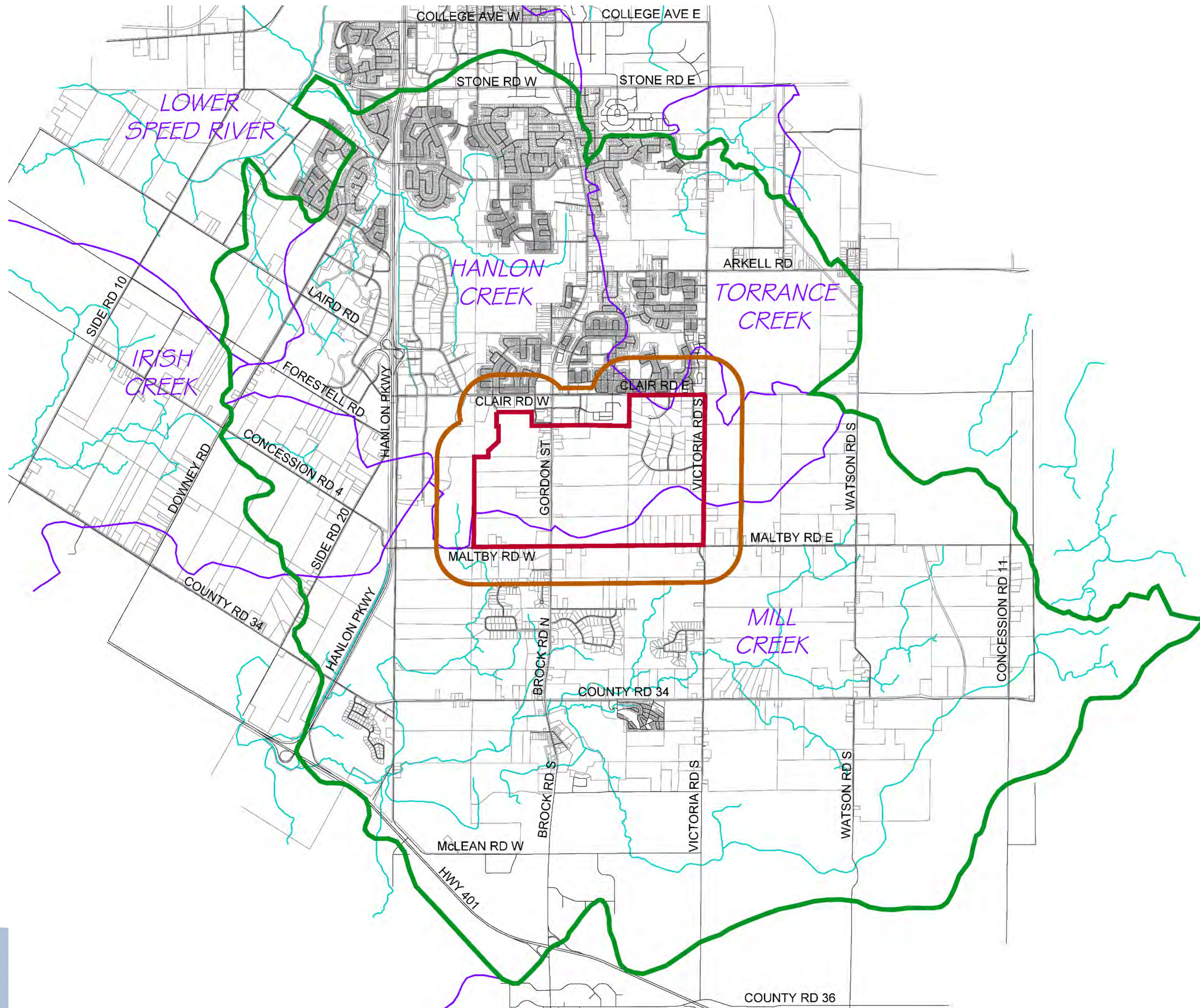
CLAIR-MALTBY SECONDARY PLAN PROCESS DIAGRAM



5 PURPOSE OF COMPREHENSIVE ENVIRONMENTAL IMPACT STUDY (CEIS)

- Technical basis for informing:
 - Potential land uses
 - Servicing and mobility infrastructure
 - Community Structure options
 - Preferred Community Structure Alternative
- Technical basis for Management Plan(s)
- Technical basis for Implementation and Monitoring Plan(s)
- Policies specific to the Secondary Plan Area

STUDY AREAS



Secondary Plan Area (SPA)

Primary Study Area (PSA)

Secondary Study Area (SSA)

7 COMPREHENSIVE ENVIRONMENTAL IMPACT STUDY (CEIS)

Key CEIS Tasks

- Verification / refinement / assessment of environmental features and functions
- Assessment of the role of water in the study areas to support natural systems (groundwater/surface water)
- Constraints and opportunities definition
- Assessment of impacts associated with different community structure options
- Establishment of integrated management strategies

Approach

- Review of background information
- Multi-year monitoring and field studies
- Modelling of surface and groundwater
- Refinement of Natural Heritage System
- Agency and stakeholder consultation

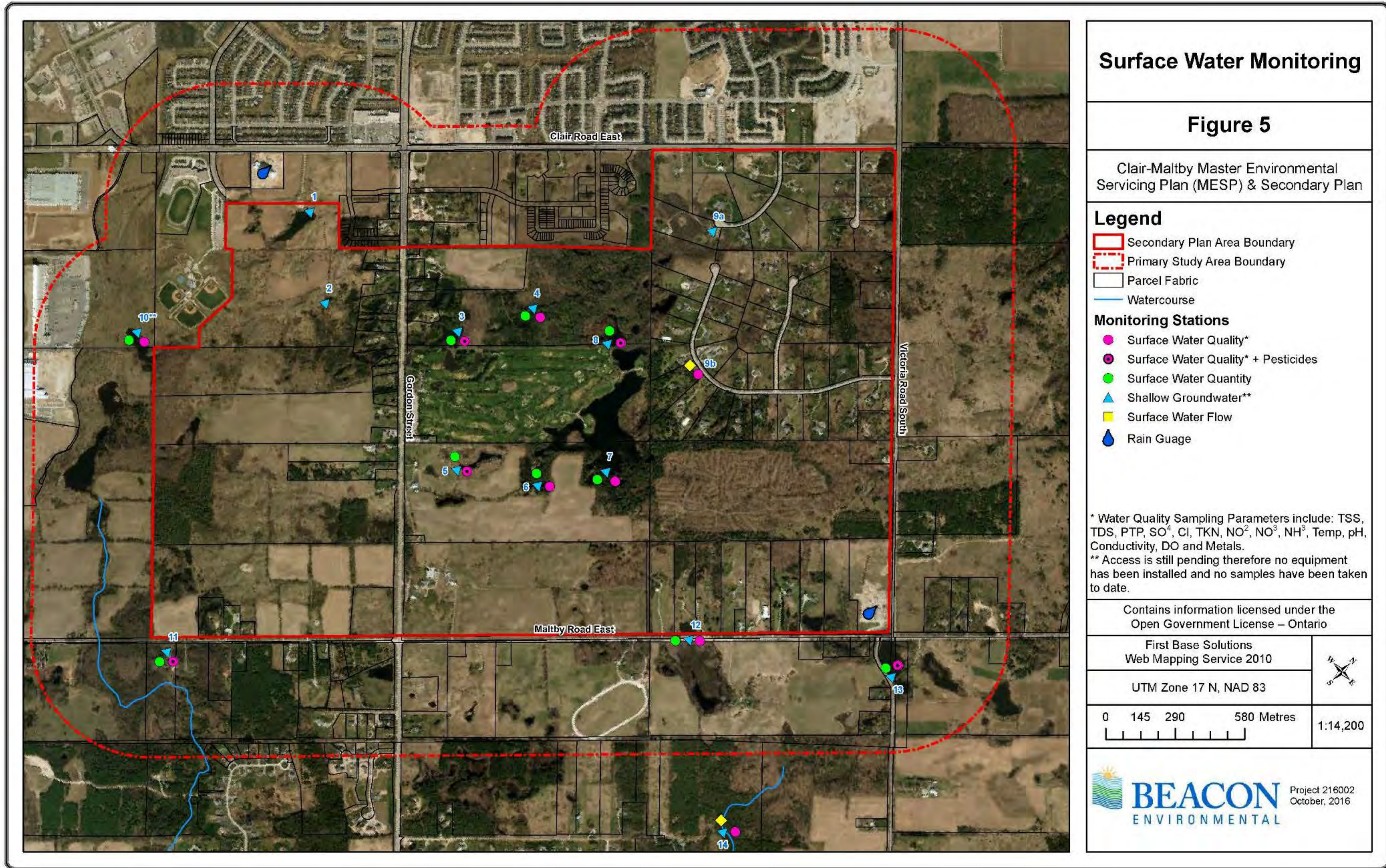
8 SURFACE WATER



Objective / Purpose

- Need to define runoff characteristics (peak and volume) in the study area
 - Headwaters of Mill, Hanlon and Torrance Creeks
- Assist in the definition of the role of water in supporting natural systems functionality
- Fundamental component of Stormwater Management Plan development

9 SURFACE WATER MONITORING



Surface Water Monitoring

Figure 5

Clair-Maltby Master Environmental Servicing Plan (MESP) & Secondary Plan

Legend

- Secondary Plan Area Boundary
- Primary Study Area Boundary
- Parcel Fabric
- Watercourse

Monitoring Stations

- Surface Water Quality*
- Surface Water Quality* + Pesticides
- Surface Water Quantity
- ▲ Shallow Groundwater**
- ◆ Surface Water Flow
- 💧 Rain Guage

* Water Quality Sampling Parameters include: TSS, TDS, PTP, SO⁴, Cl, TKN, NO², NO³, NH³, Temp, pH, Conductivity, DO and Metals.
 ** Access is still pending therefore no equipment has been installed and no samples have been taken to date.

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First Base Solutions Web Mapping Service 2010	
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0 145 290 580 Metres	1:14,200

BEACON ENVIRONMENTAL Project 216002
October, 2016

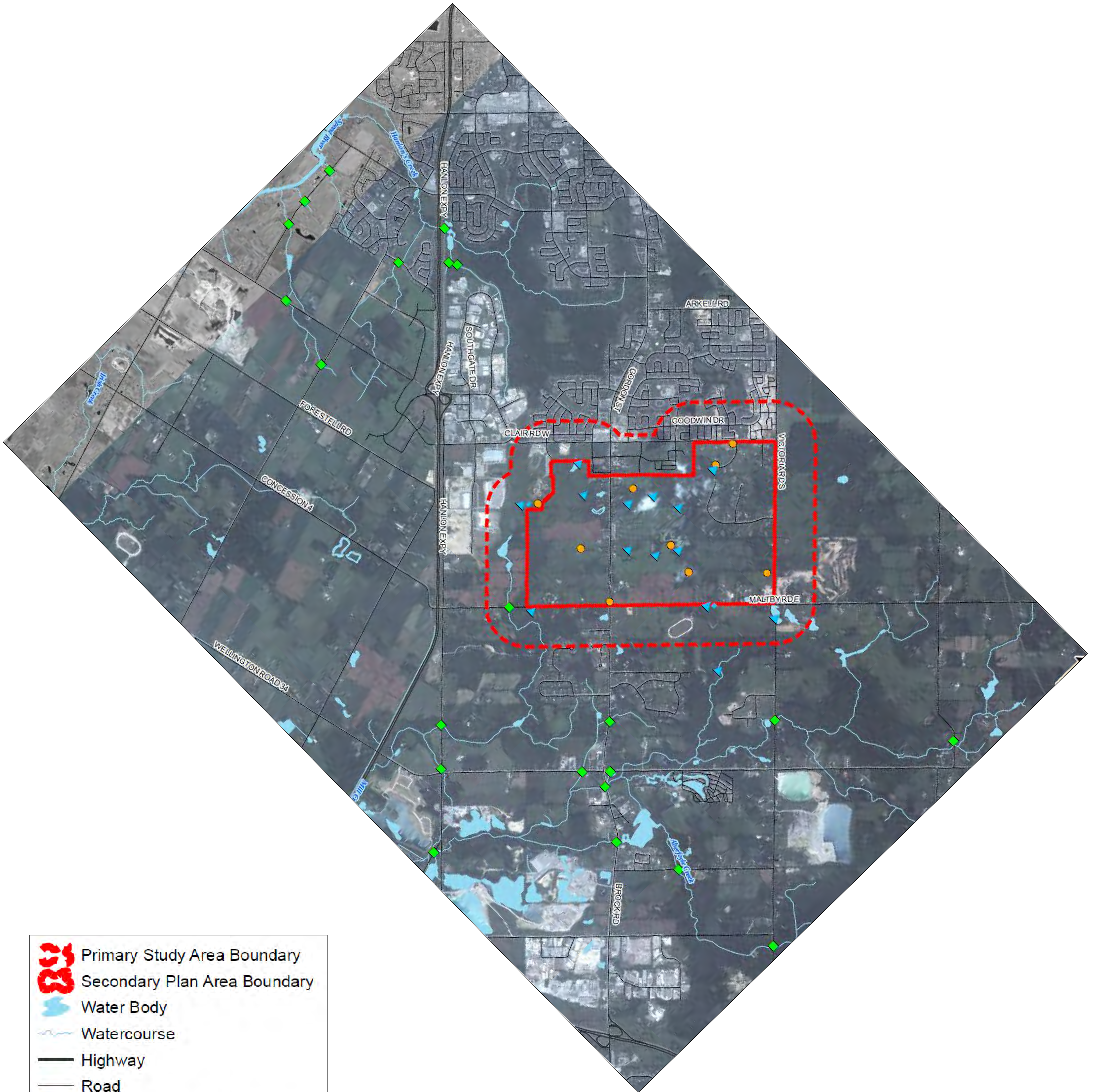
10 GROUNDWATER











Objective / Purpose

- Hydrogeological characterization to establish baseline conditions within the SPA and PSA
- Field program will contribute to water balance, help identify constraints and opportunities, and establish ongoing monitoring locations
- Integrated modelling will quantify components of the existing and future conditions water budgets, assess impacts to surface and groundwater, and assess alternative management options

11

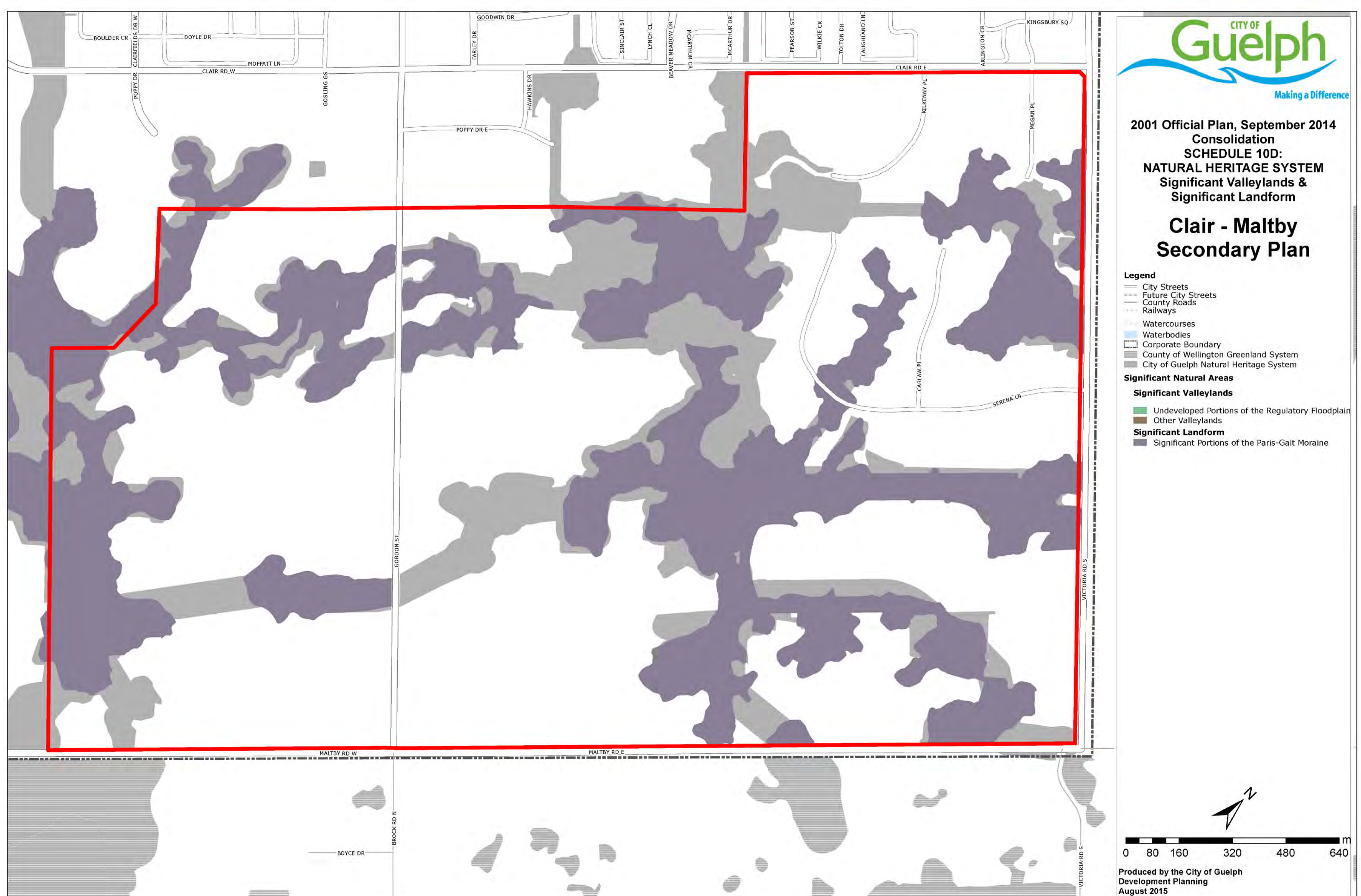
GROUNDWATER MONITORING



-  Primary Study Area Boundary
-  Secondary Plan Area Boundary
-  Water Body
-  Watercourse
-  Highway
-  Road
-  Mini Piezometer Installed
-  Mini Piezometer Proposed
-  Spotflow Station
-  Monitoring Well Nest

12 SIGNIFICANT LANDFORM

- Secondary Plan Area falls within Paris Moraine
- MNRF has identified a portion of this landform in an Earth Science ANSI just east of the Secondary Plan Area
- Significant Landform already defined and identified as part of the City's NHS
- CEIS work to focus on approaches for integration of this landform into the Secondary Plan through design and policy

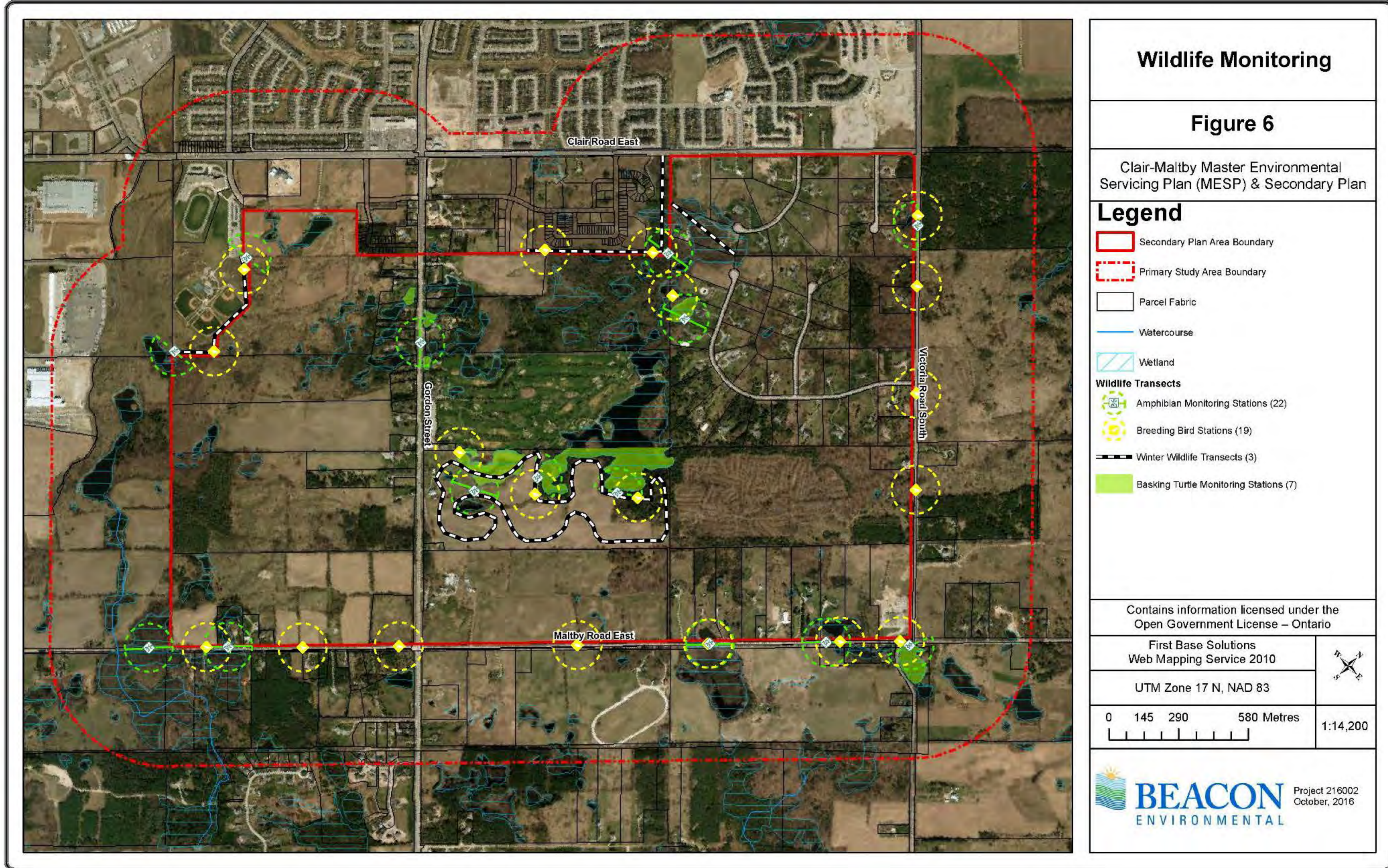


13 NATURAL SYSTEMS

Objective / Purpose

- Confirm and refine the Natural Heritage System (NHS)
- Update wetland mapping in consultation with GRCA and MNRF
- Develop a better understanding of how surface and groundwater support Natural Heritage System functions

WILDLIFE MONITORING



15 STORMWATER MANAGEMENT PLAN

- Fundamental component of the MESP studies
- Inherently linked to the CEIS:
 - Surface water modelling / monitoring
 - Ground water modelling / monitoring
- Hydrologic Model (PCSWMM) and Hydraulic Model (HEC-RAS) will be used to set targets and criteria for stormwater management (flooding and erosion) including water balance from the Groundwater Model (MIKE-SHE)

16 STORMWATER MANAGEMENT PLAN

- Three (3) Community Structure Alternatives will be analysed to determine impacts
 - Quantity (flooding and erosion)
 - Quality
 - Water Budget
- Assessment of Preferred Stormwater Management System
 - Traditional (end-of-pipe)
 - Innovative (LID BMPs)
 - Climate Change Influences
- Functional Planning of Stormwater Management System
 - Functional grading
 - Outlets
 - Major / Minor flow paths
 - Stormwater management practices

17 WATER INFRASTRUCTURE

Water Supply

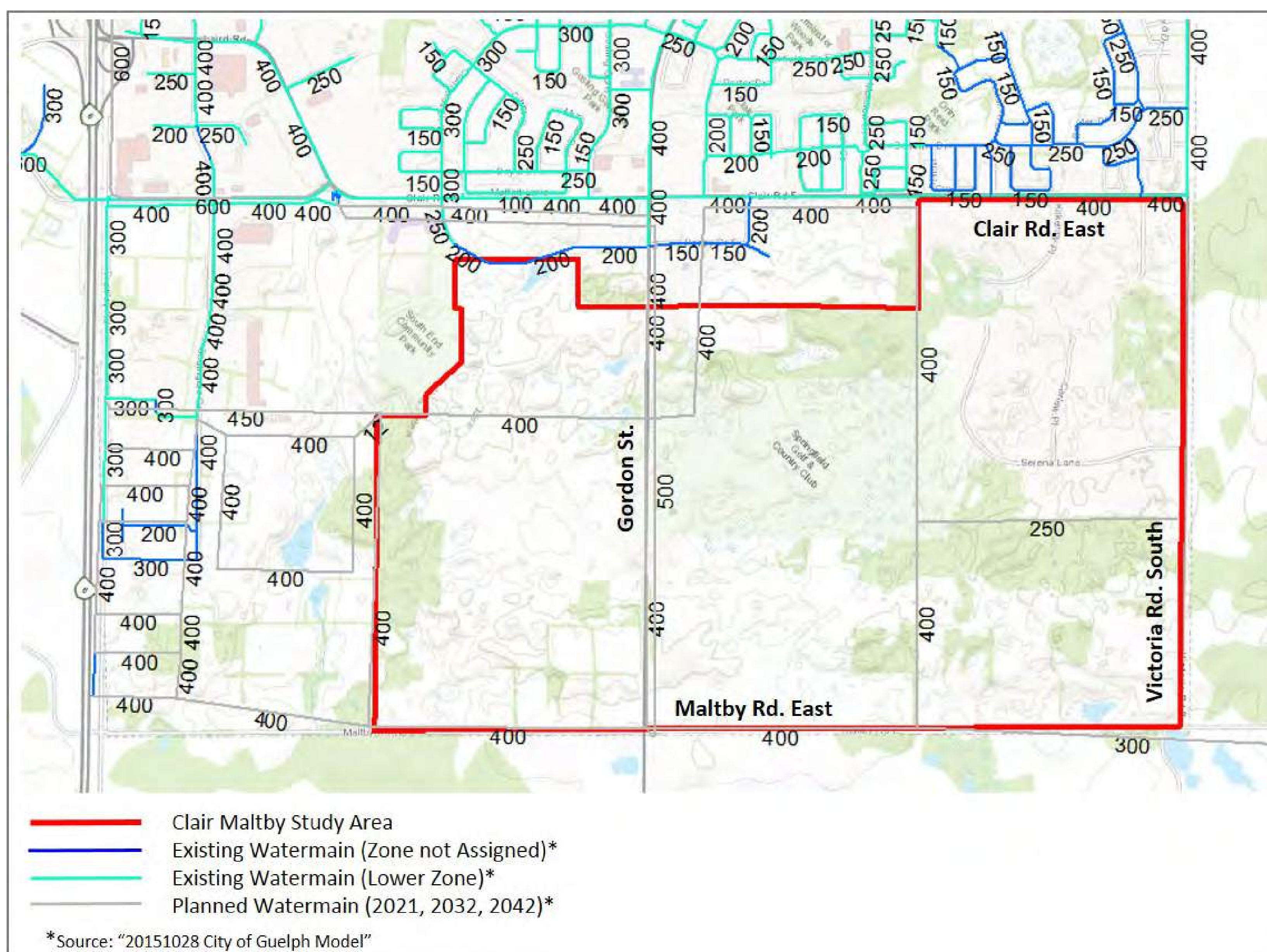
Guelph has completed a Water Supply Master Plan to address the needs related to future growth to the year 2038. Water supply alternatives to accommodate future growth within the City will primarily be achieved through the following measures:

- Conservation & Demand Management
- Groundwater: Existing Municipal Off-line Wells
- Groundwater: Municipal Test Wells
- Groundwater: New Well inside City

Water Distribution

There is currently no water distribution network in the Clair-Maltby Secondary Plan Area. These lands will be serviced via a recently established pressure zone called Zone 3.

Zone 3 is now functional since the commissioning of the Clair Road Booster Pumping Station (BPS). Additional components such as a storage facility (i.e. elevated tank or underground reservoir) and watermains will be required as the Clair-Maltby lands develop to complete the water distribution network for these lands.

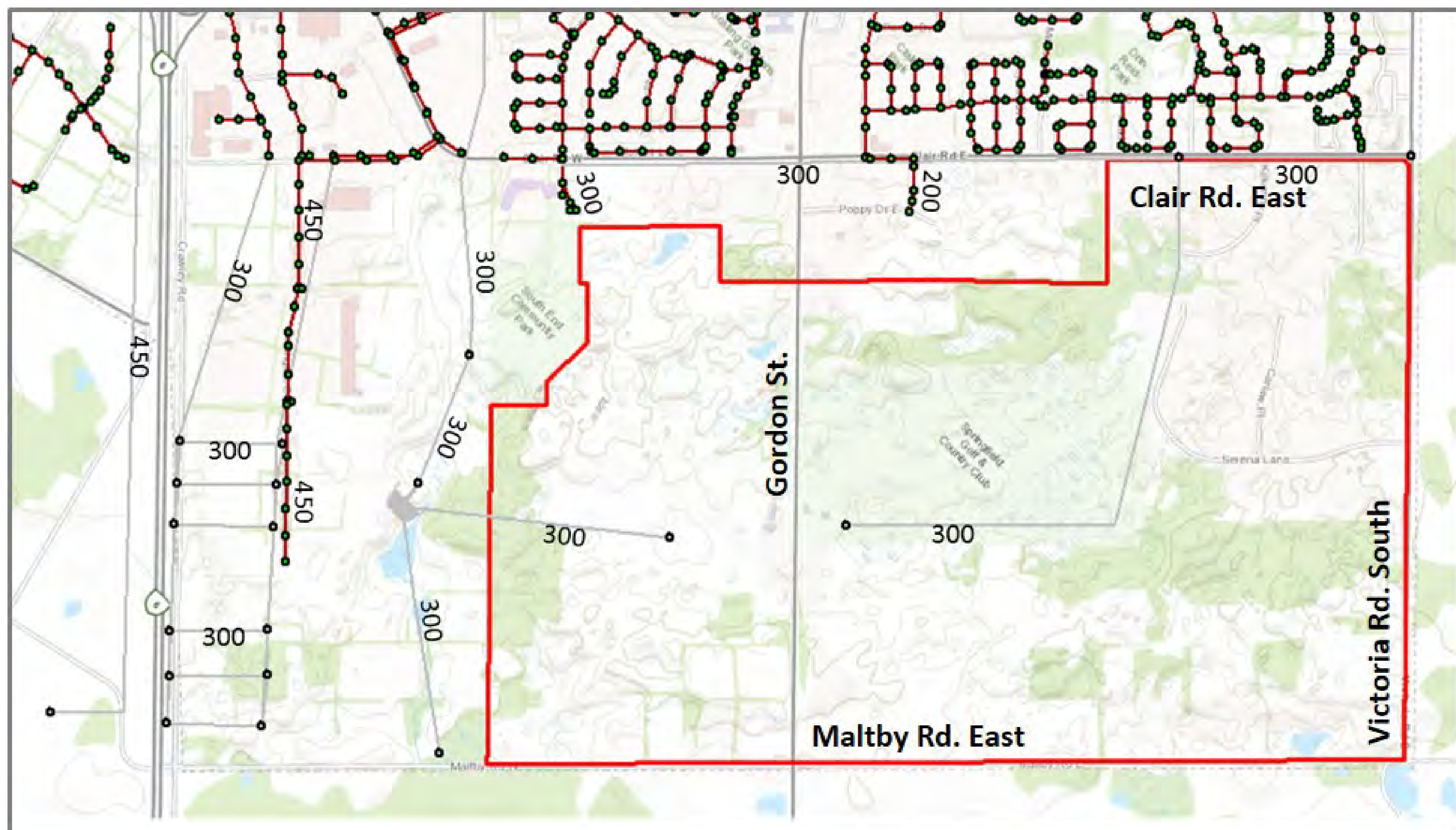


18

WASTEWATER INFRASTRUCTURE

The Clair-Maltby Lands will be serviced by a trunk sewer system that is directed to the Guelph Wastewater Treatment Plant (WWTP). The lands are high such that gravity service to the WWTP is likely feasible through the existing trunk system north of Clair Road.

A review of the capacity of the trunk system to the WWTP is required to verify the available conveyance capacity.



- Clair Maltby Study Area
- Existing Wastewater*
- Planned Wastewater (2019, 2031..)*

*Source: "2013-11-21-Guelph_Sanitary Model-60298422"

Purpose

Identify a transportation network and design standards to ensure that the network meets the needs of all modes of transportation including walking, cycling, transit and vehicular traffic

Context

The Official Plan provides direction for the establishment of an integrated transportation system that:

- Places priority on walking, biking and transit
- Connects to the existing road system and provides linkages between existing and future developments
- Creates a modified grid system

Opportunities and Constraints

- Existing development pattern and limited opportunities for connections due to the extensive Natural Heritage System (NHS) and topography will make it challenging to fully achieve the City's objectives
- All opportunities to promote connectivity will be carefully assessed to ensure the community is connected, easy to navigate and facilitates walking, biking and transit



Clair-Maltby Public Information Centre & Visioning Session

April 27, 2017

Purpose

- Project overview
- Public and stakeholder input into vision and guiding principles

Presentation Outline

- Introductions
- Background/Study Context
- Next Steps
- Visioning Approach

Background/Context

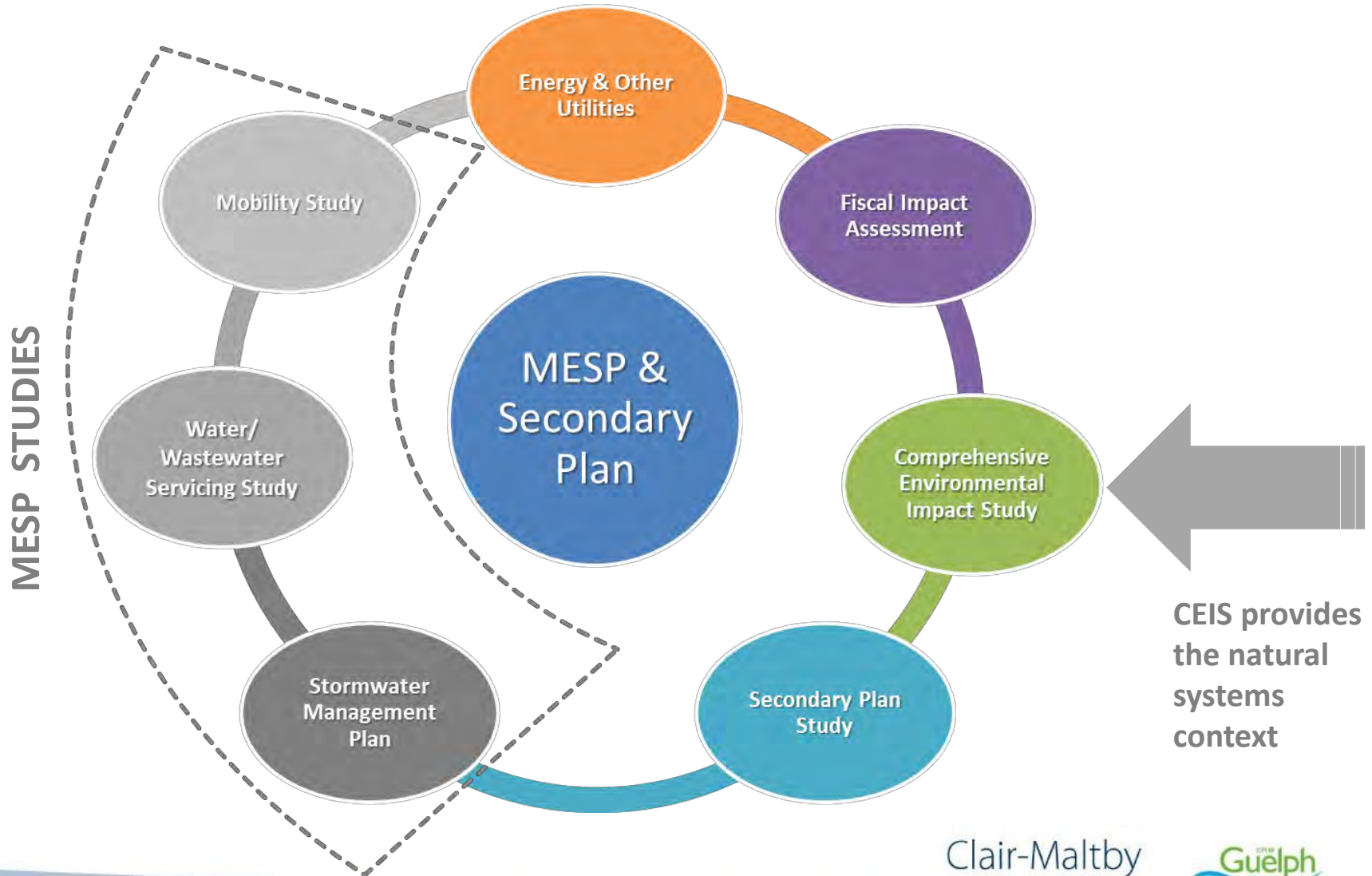
Background

- The Clair-Maltby Secondary Plan (CMSP) and Master Environmental Servicing Plan (MESP) process provides an integrated approach to advance the development of the CMSP Area.
- The approach integrates land use, environment, transportation and servicing studies/plans to guide the Secondary Plan.

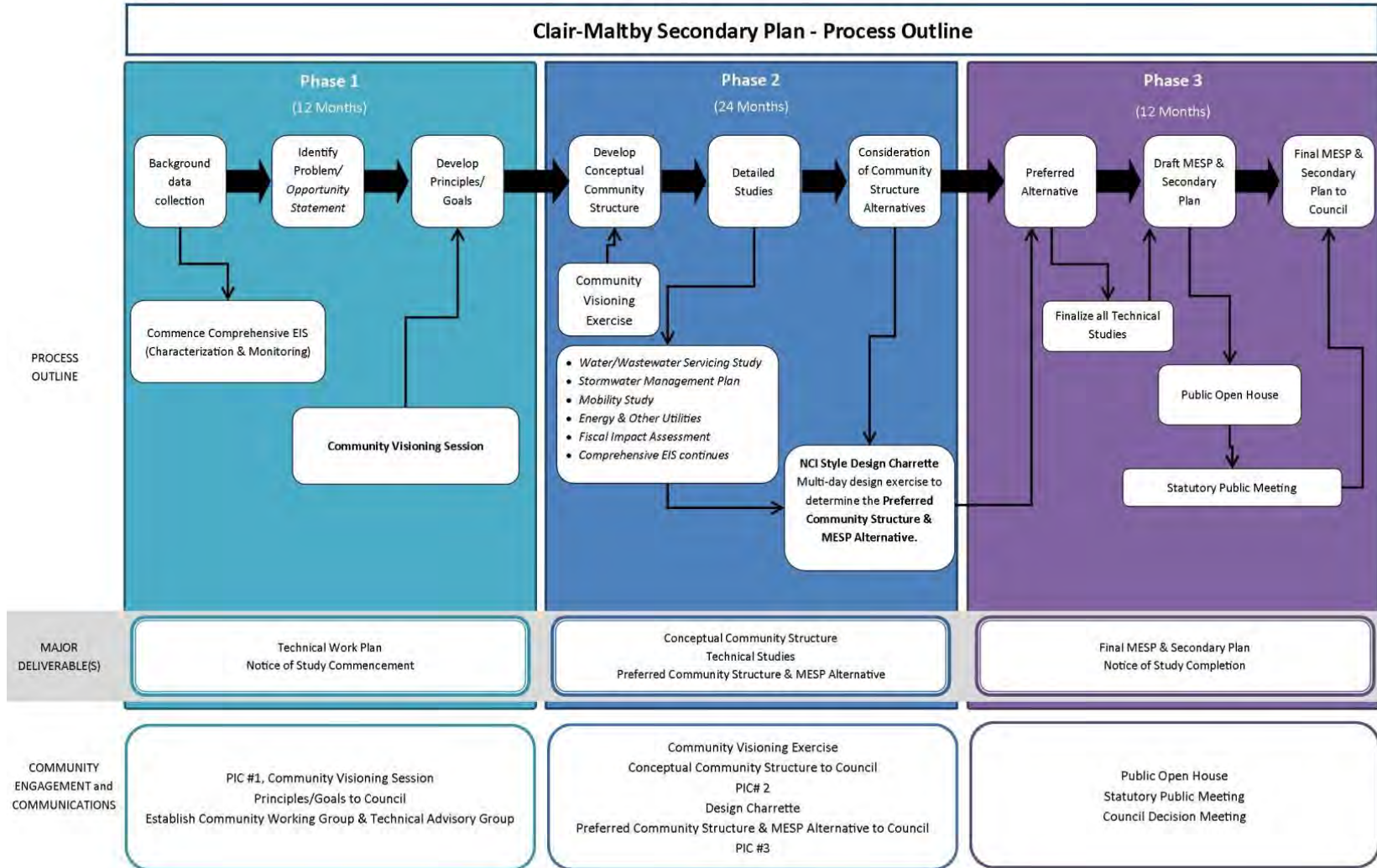
Study Area



Study Components



Overview of Study Process



Technical Study Work Plan Context

- Preliminary Work Plans were submitted as part of the proposal for mobility, servicing, stormwater management, energy and Comprehensive Environmental Impact Study (CEIS).
- The Consultant Team is updating and refining the Work Plans based on:
 - Review of background information;
 - Field reconnaissance;
 - Consultation with stakeholders.

Purpose of Comprehensive Environmental Impact Study (CEIS)

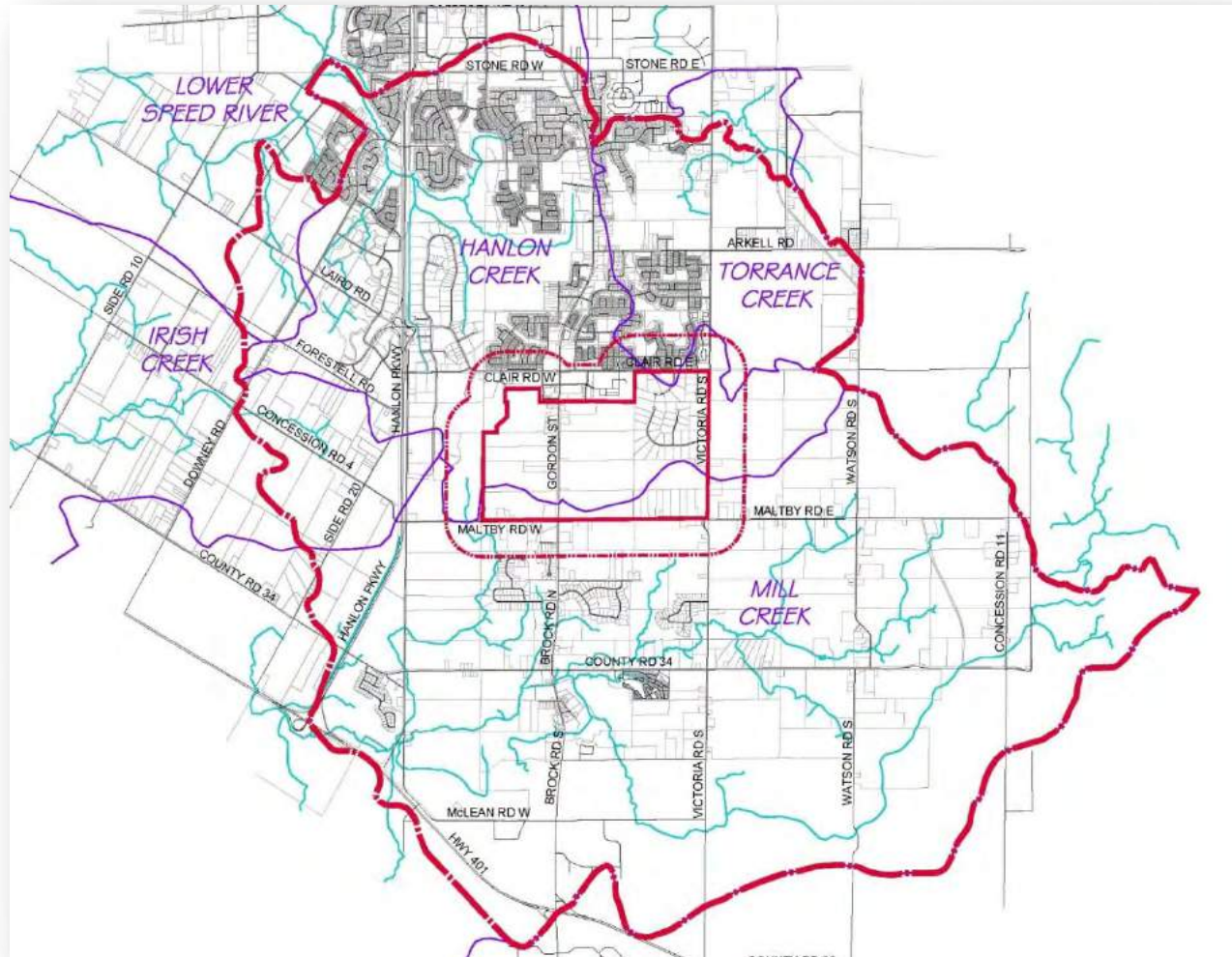
- Technical basis for informing:
 - Servicing and transportation, including trails;
 - Conceptual Community Structure Options; and,
 - Preferred Community Structure Alternative.
- Relates to
 - Surface water (Hydrology/Hydraulics);
 - Groundwater (Hydrogeology);
 - Landform (Geology); and,
 - Natural Heritage (Terrestrial/Aquatic).

CEIS Study Areas

Secondary
Plan Area
(SPA)

Primary
Study Area
(PSA)

Secondary
Study Area
(SSA)



Status/Process Update

- Water Monitoring (Groundwater and Surface Water) associated with CEIS currently underway – 3 years required (2016, 2017, 2018);
- Winter wildlife surveys have been carried out;
- Joint RSAC/EAC meeting (November 16, 2016) to discuss work plan for CEIS;
- MNRF/GRCA meeting (January 11, 2017) to discuss work plan for CEIS;
- Technical Advisory Group established and first meeting held on February 7, 2017 to discuss CEIS technical work plan – other disciplines being discussed throughout the project; and,
- CEIS Work Plan to be finalized based on all comments received (April 2017).

Secondary Plan Status

Preliminary background analysis of existing conditions will be complete by end of April 2017 including:

- Planning Policy Framework;
- Cultural Heritage Resources;
- Archaeological Resources;
- Energy and Utilities;
- Mobility;
- Stormwater Management;
- Water and Wastewater Servicing; and,
- Demographic and Economic Trends.

Secondary Plan: Policy Framework

Provincial Policy Statement (PPS) and Growth Plan provide direction on the creation of efficient land use and development patterns with the intent of:

- Creating strong, livable and healthy communities;
- Protecting the environment and public health and safety; and,
- Facilitating economic growth.

The Growth Plan provides specific direction related to growth management (e.g. greenfield residential/jobs target).

Secondary Plan: Policy Framework

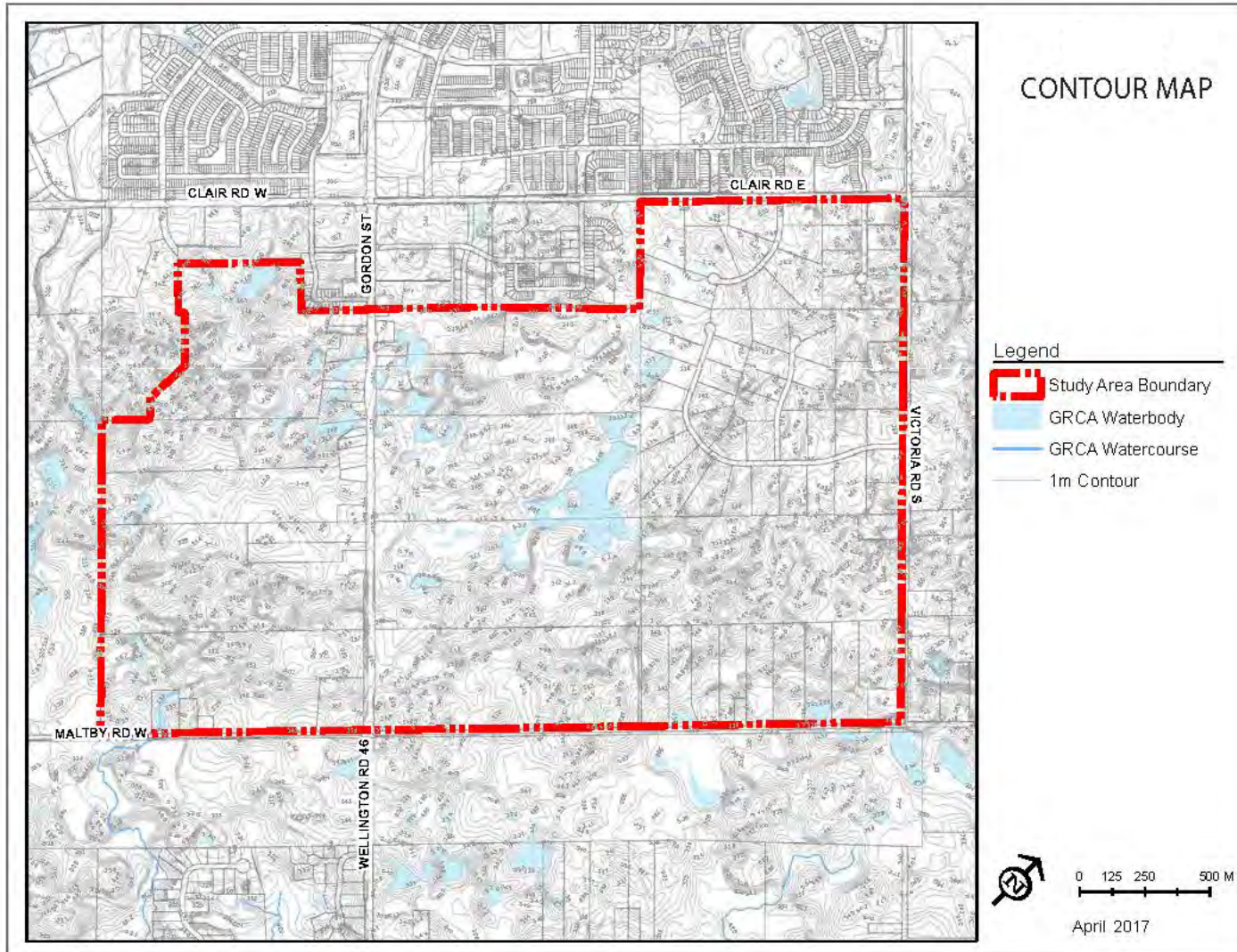
The City's Official Plan builds on Provincial policy. Key themes include:

- Complete communities;
- Natural Heritage System;
- Transportation including transit, cycling and walking;
- Climate change;
- Phasing of development and services;
- Urban design;
- Range of housing types and densities;
- Cultural heritage resources; and,
- Sustainable neighbourhoods.

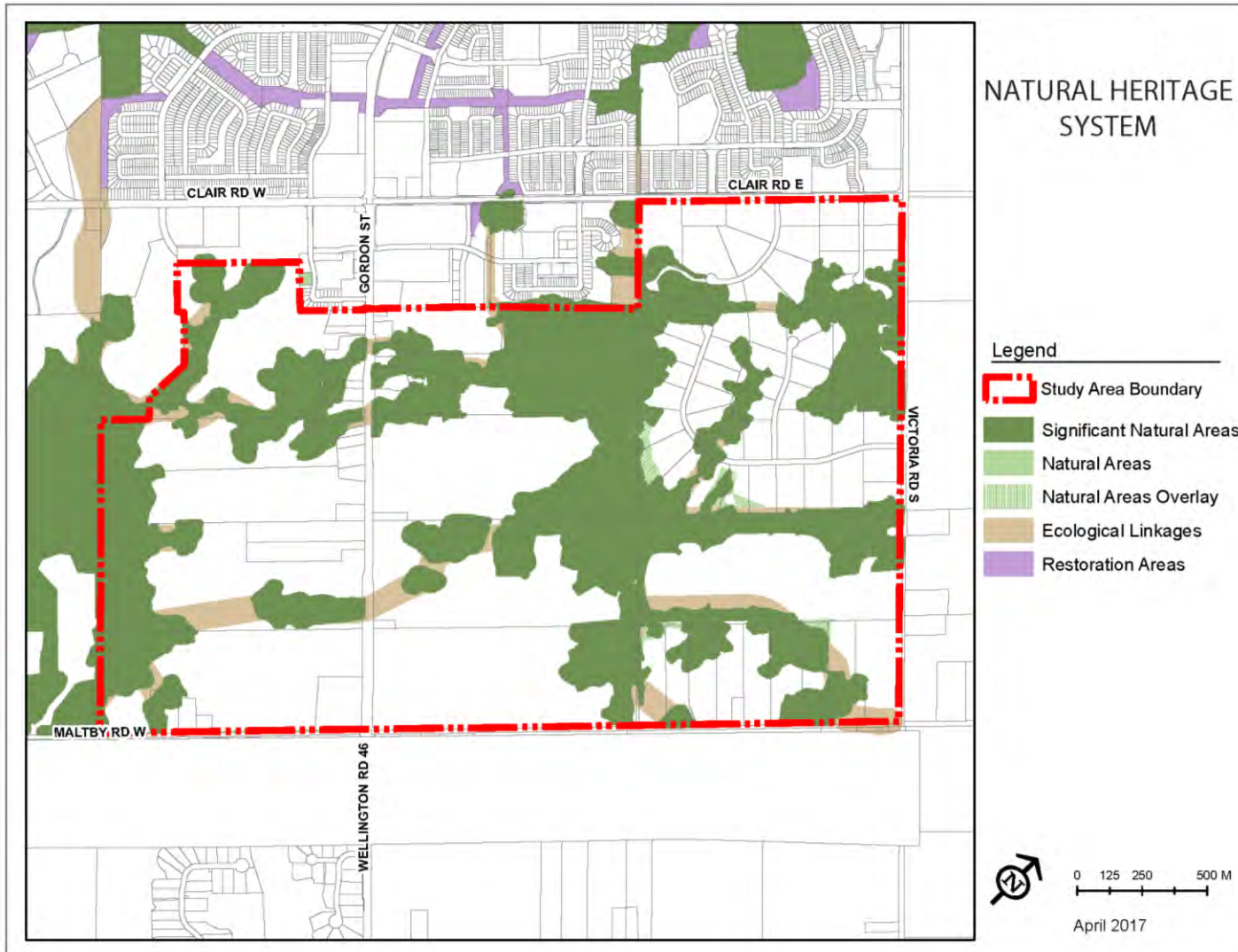
Secondary Plan: Current Influences

- Hummocky topography and drainage issues;
- Balancing the protection of the natural heritage system with accommodating urban development;
- Existing land uses;
- Cultural heritage resources;
- Potential for presence of archaeological resources;
- Challenges related to the achievement of a connected transportation system which supports all transportation modes; and,
- Need to extend services into the area.

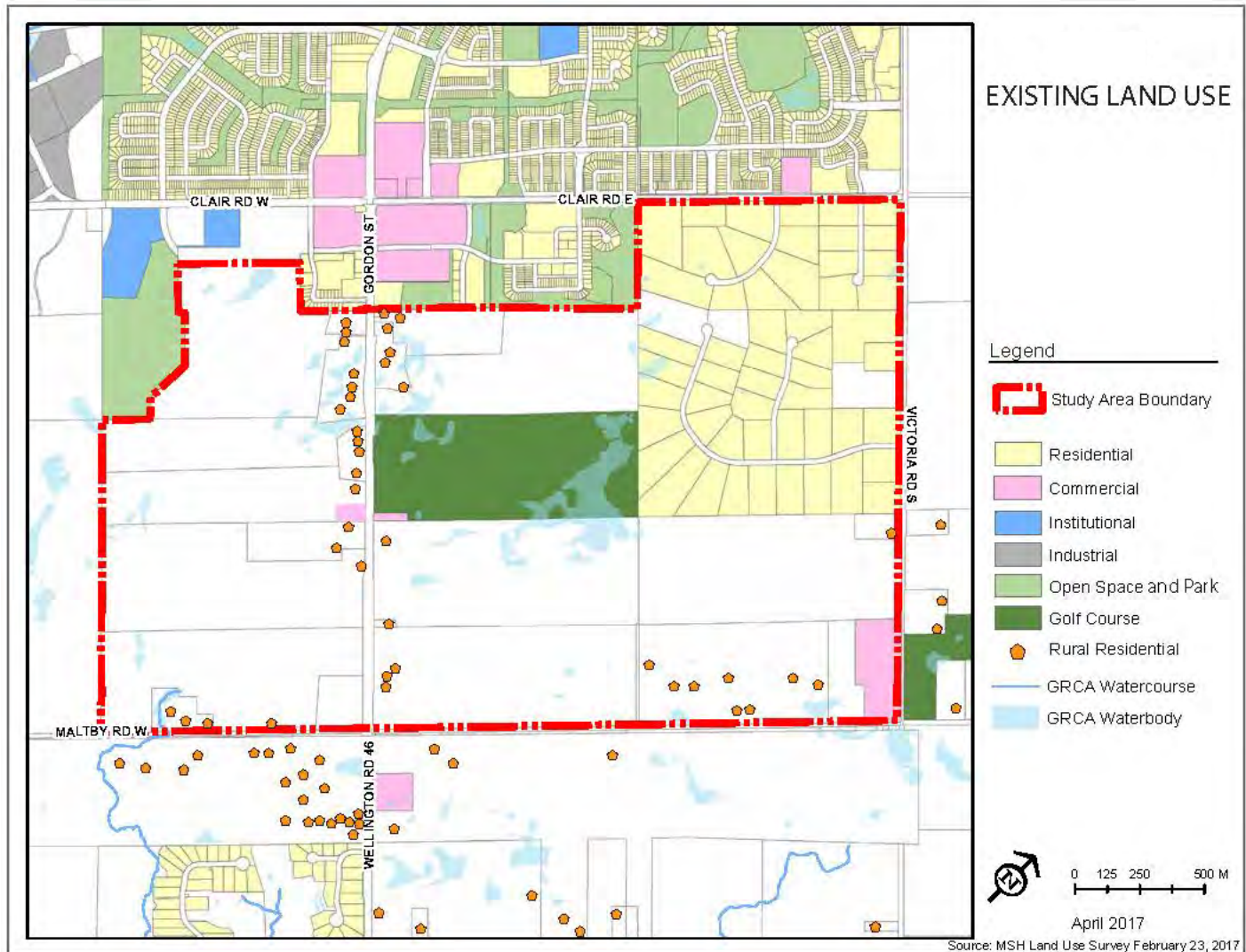
Secondary Plan: Current Influences



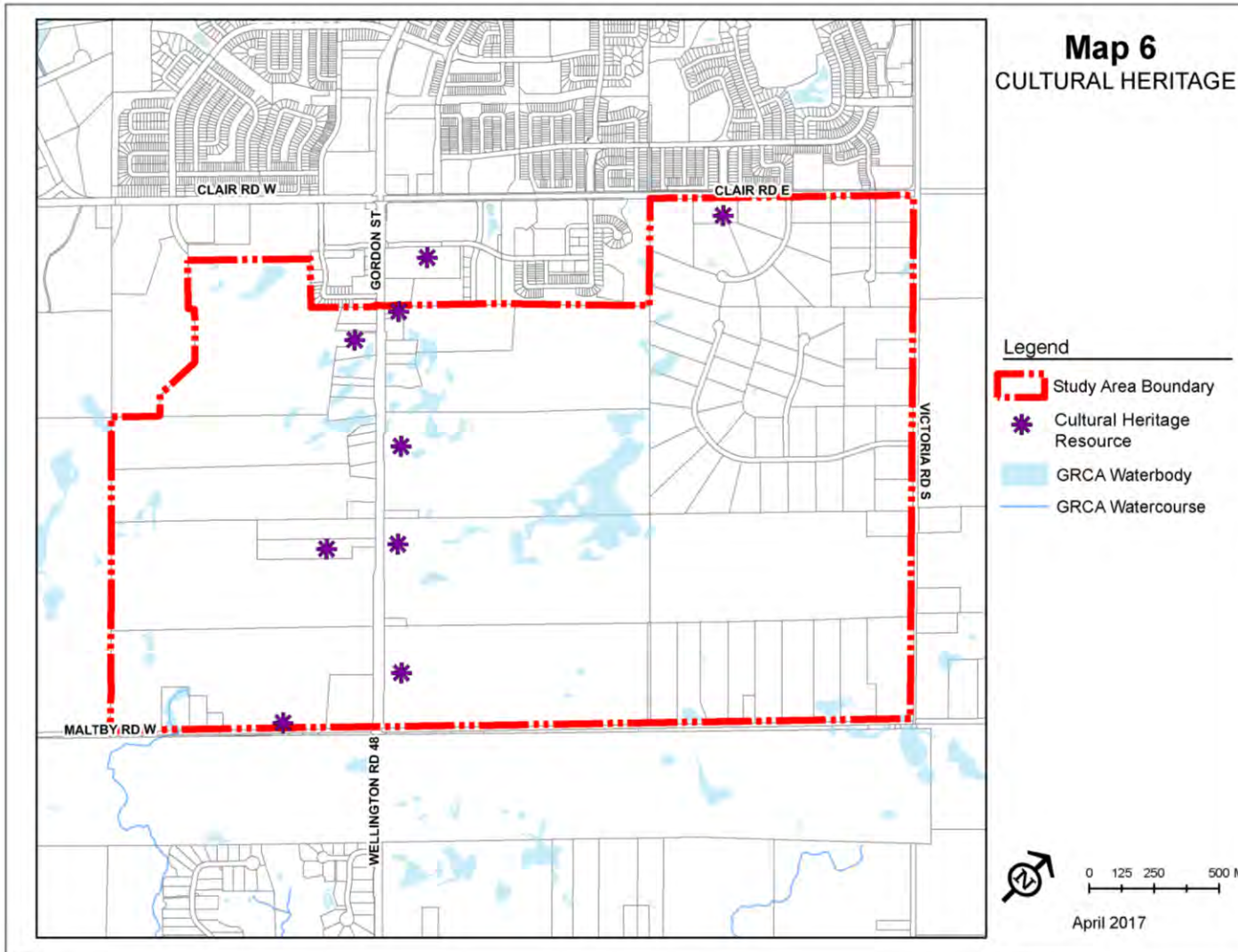
Secondary Plan: Current Influences



Secondary Plan: Current Influences



Secondary Plan: Current Influences



Secondary Plan: Other Considerations

Planning will take into account:

- Vision and Guiding Principles;
- Demographic, land use and employment trends;
- Conclusions of the various supporting studies including the CEIS as well as the other technical studies and the fiscal impact assessment; and,
- Urban design considerations.

Next Steps & Anticipated Timing

March/April 2017	Develop and finalize all technical work plans
April 27, 2017	Visioning Workshop/PIC #1 to develop draft vision and guiding principles for the Study
July 2017	Vision/principles to Council for endorsement
<u>Tentative Timing</u>	
September 2017	Visioning Exercise to develop Conceptual Community Structure
Q4 2017	Conceptual Community Structure to Council for endorsement
March 2018	Design Charrette to determine the Preferred Community Structure Alternative
Q2 2018	Preferred Community Structure Alternative to Council for endorsement

Visioning Approach

Guiding Principles - Examples

Guelph Innovation District Secondary Plan 'Principles'

1. Protect what is Valuable
2. Create Sustainable and Energy Efficient Infrastructure
3. Establish a Multi-modal Pedestrian-focused Mobility System
4. Create an Attractive and Memorable Place
5. Promote a Diversity of Land Uses and Densities
6. Grow Innovative Employment Opportunities

Downtown Secondary Plan 'Principles'

1. Celebrate What We've Got
2. Set the Scene for Living Well Downtown
3. A Creative Place for Business
4. We Come Together Here
5. Reconnect with the River
6. Make it Easy to Move Around
7. Embody Guelph's Green Ambitions
8. Build Beautifully

Vision

Example Vision

Downtown Secondary Plan

Downtown Guelph: a distinct and vital urban centre nestled against the Speed River, comprised of beautiful buildings and public spaces, and surrounded by leafy neighbourhoods, where people live, work, shop, dine, play and celebrate.

Vision

Example Vision

A Vision for Guelph's Innovation District

The Guelph Innovation District (GID) is a compact, mixed use community that straddles the Eramosa River in the City's east end. The GID will serve predominately as the home of innovative, sustainable employment uses with an adjacent urban village connecting residential and compatible employment uses. The urban village is meant to be an identifiable, pedestrian oriented space, with street-related built form that supports a mix of medium and high density commercial, residential and employment uses. Important land use connections are also envisioned between the GID, as an innovation centre, the University of Guelph, as a knowledge-based research centre and the Downtown, as the City's civic hub and cultural centre, supporting the emergence of a University-Downtown-GID trinity of innovation spaces.

The GID is at once highly energetic and intimately familiar, because it showcases an entirely new approach to planning, designing, and developing urban places, and at the same time, reflects Guelph's history and celebrates the rich heritage resources of the district, including the stunning river valley, dramatic topography and views, and historic Reformatory Complex.

The GID is attractive, pedestrian-focused and human-scaled. It provides a mix of land uses at transit-supportive densities, offers meaningful places to live, work, shop, play and learn, and supports a wide range of employment and residential land uses. It protects valuable natural and cultural heritage resources while fully integrating them with the new community, features sustainable buildings and infrastructure, and works towards carbon neutrality. It makes needed connections between all modes of transportation, but in a manner that prioritizes pedestrians, cyclists and transit users over drivers, and stitches the GID into the overall fabric of the City. It is exciting and new and feels like it has been part of the City for a long time.

Transform. Connect. Community.

**When fully developed the
Clair-Maltby area
will be known for...**

Vision and Guiding Principles

- 4 Rounds of Conversation – 15 minutes each
- First 3 rounds – Guiding Principles, there are four topics, you can choose up to 3 different ones.
 - Last round – Vision, you will remain at the third station to have a conversation about the potential Vision for the Clair-Maltby area

Guiding Principles Topics

- Sustainability & Servicing
- Mobility
- Natural Heritage Network and Parks System
- Land Use, Urban Design and Cultural Heritage
- Vision Workbooks

Café Etiquette

- Write down your ideas
- Focus on what matters
- Listen to understand
- Contribute your thinking
- Speak your mind & heart
- Link & connect ideas
- Listen for insights & ask deeper questions
- It's OK to change tables

World Café Agenda

1. Guiding Principles Round 1 (15 min)
2. Guiding Principles Round 2 (15 min)
3. Guiding Principles Round 3 (15 min – including prioritization of the ideas)
4. Visioning Round (15 min)
5. Report Back (15 min)

Thank You



WELCOME

Thank you for attending tonight's Public Workshop.

Your feedback is important to us and will help in evaluating the Community Structure Alternatives.

- | | |
|---|----------------|
| 1 View Display Boards | 6:00 - 7:00 pm |
| 2 Presentation | 7:00 - 7:30pm |
| 3 Workshop - Evaluation of Alternatives | 7:30 - 8:30 pm |
| 4 Report Back & Next Steps | 8:30 - 9:00 pm |

Contact Us

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Planning, Urban Design and Building Services
stacey.laughlin@guelph.ca

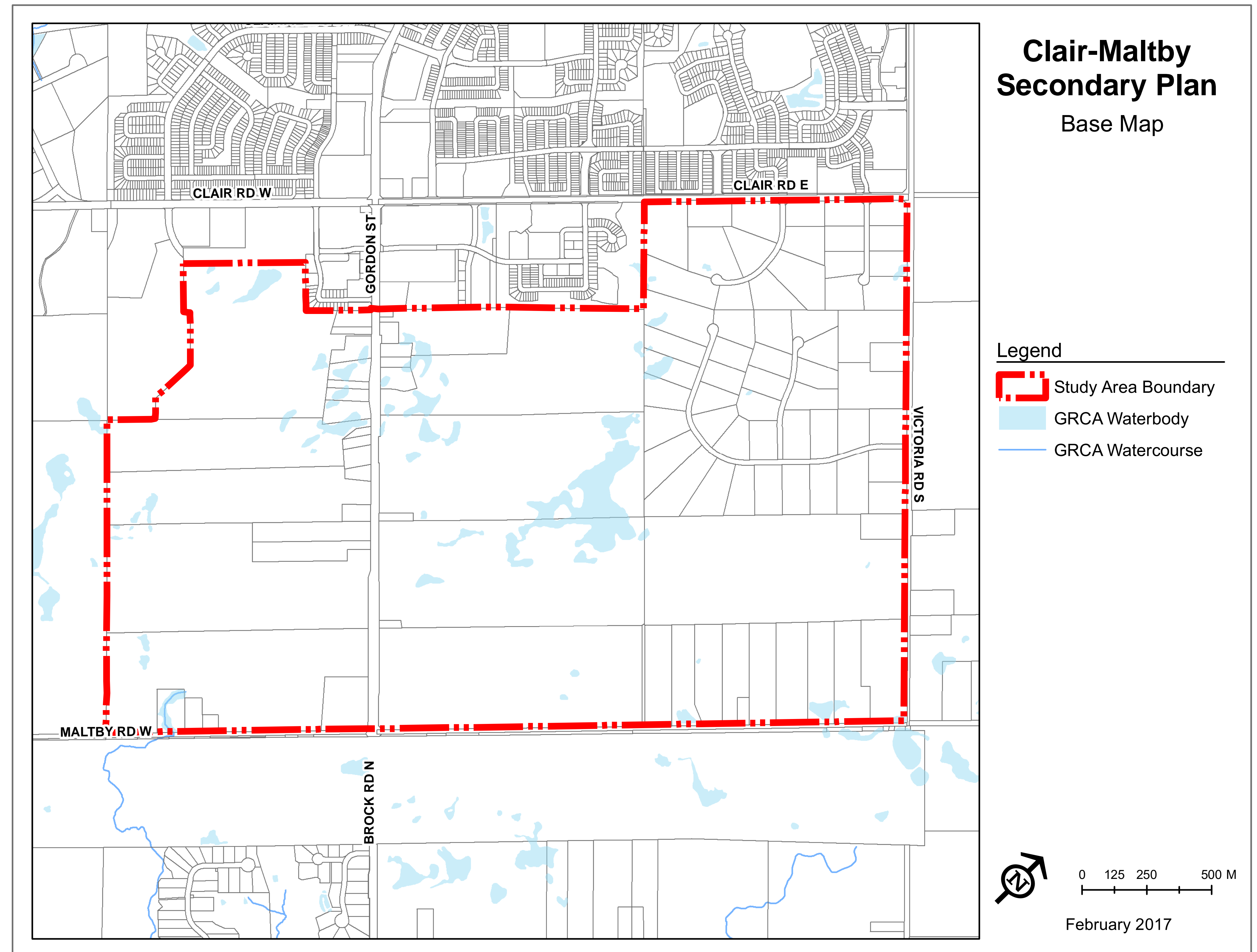
Arun Hindupur, M.Sc., P.Eng.
Supervisor, Infrastructure Engineering
Engineering and Capital Infrastructure Services
arun.hindupur@guelph.ca

THE SECONDARY PLAN

The Clair-Maltby Secondary Plan (CMSP) and Master Environmental Servicing Plan (MESP) process provides an integrated approach to advance the development of the CMSP Area.

The approach integrates land use, environment, transportation and servicing studies/plans to guide the Secondary Plan.

The Secondary Plan Area is bounded by Clair Road, Victoria Road South, Maltby Road, and Poppy Drive.



STUDY PURPOSE AND SCHEDULE

Clair-Maltby is the last unplanned greenfield area within the city. The City of Guelph is undertaking the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to establish a plan for future development in the area.

The Clair-Maltby Secondary Plan and the MESP are being developed simultaneously to provide an integrated planning approach within the Study Area. Comments from our community engagement sessions will be analyzed alongside land use, environment, mobility and servicing studies for a comprehensive review of the Clair-Maltby Secondary Plan Area and its needs.

Your input will provide critical guidance for the preferred community structure, which will be developed through the design charrette.



THE CHARENTE

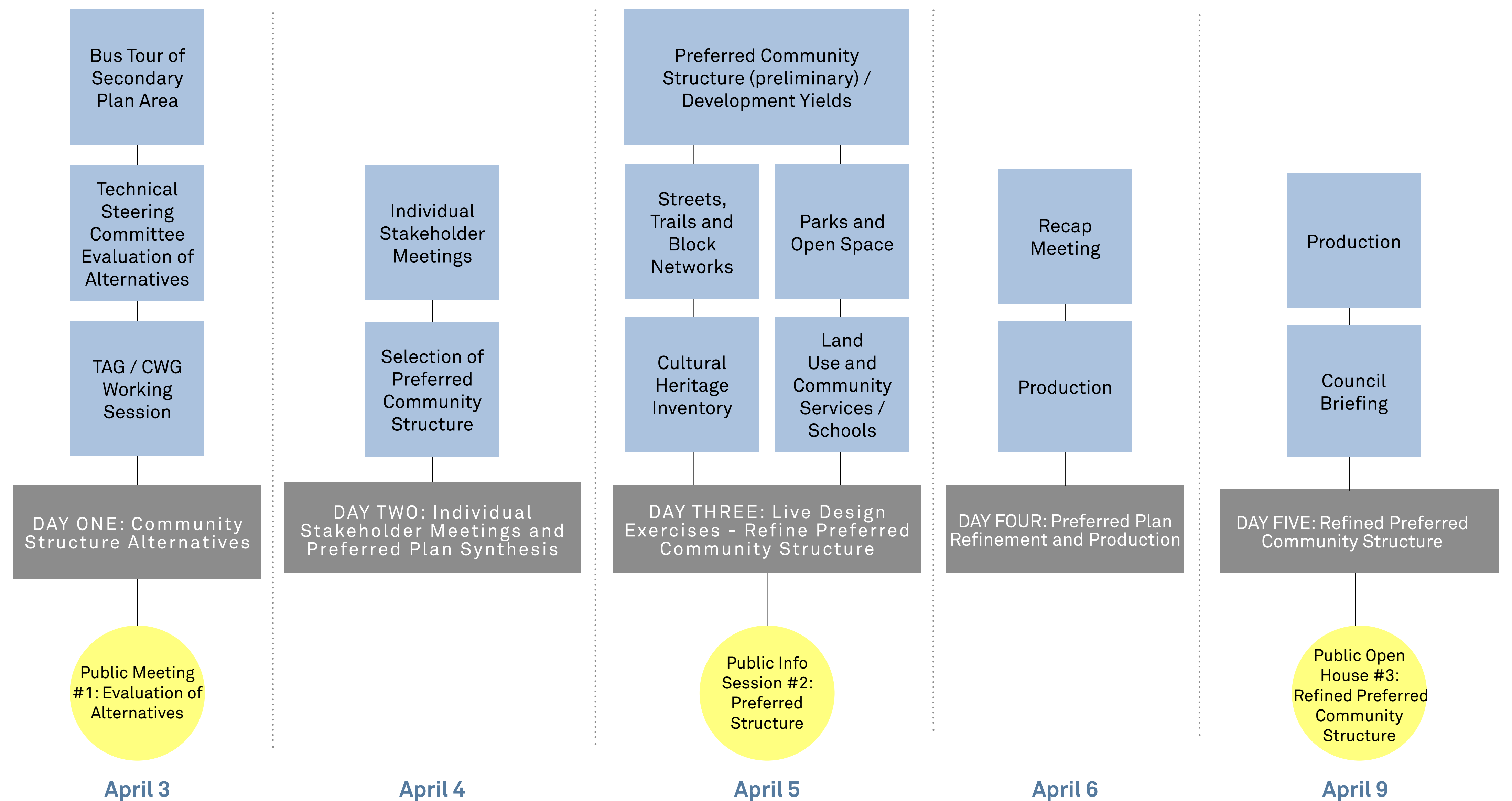
A charrette is an intensive, multi-disciplinary workshop with the aim of developing a design or vision for a project or planning activity. Charrettes are often conducted to design such things as parks and buildings, or to plan communities or transportation systems.

The purpose of the charrette is to create an implementable Preferred Community Structure for the Secondary Plan Area that reflects good planning and the input from the community and stakeholders.

As part of the charrette process potential versions of all elements required for the Preferred Community Structure including environment, mobility, urban design and servicing will be considered.

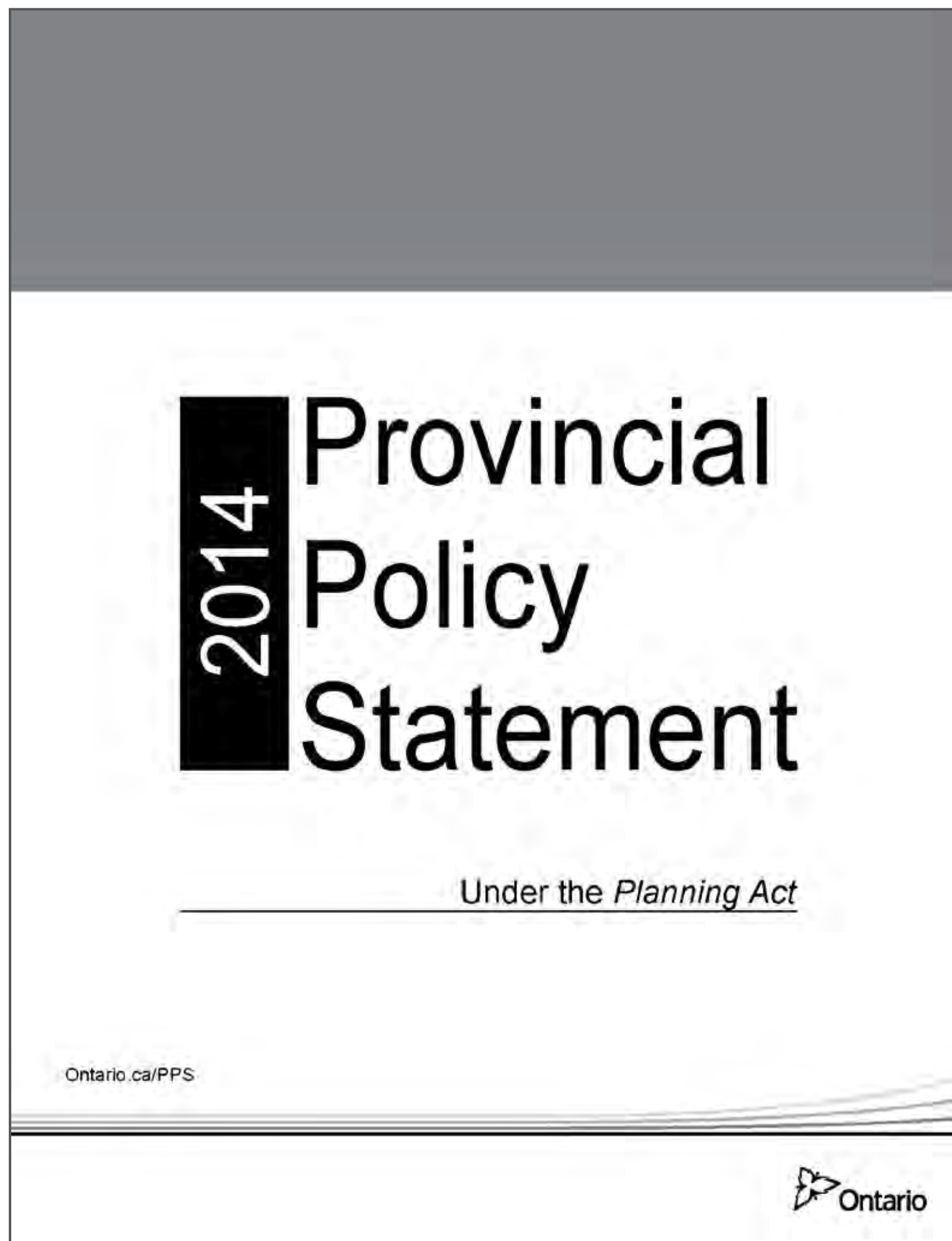
The charrette will be a collaborative 5-day exercise focused on creating an implementable solution.

DESIGN CHARRETTE OVERVIEW



GUIDING DOCUMENTS

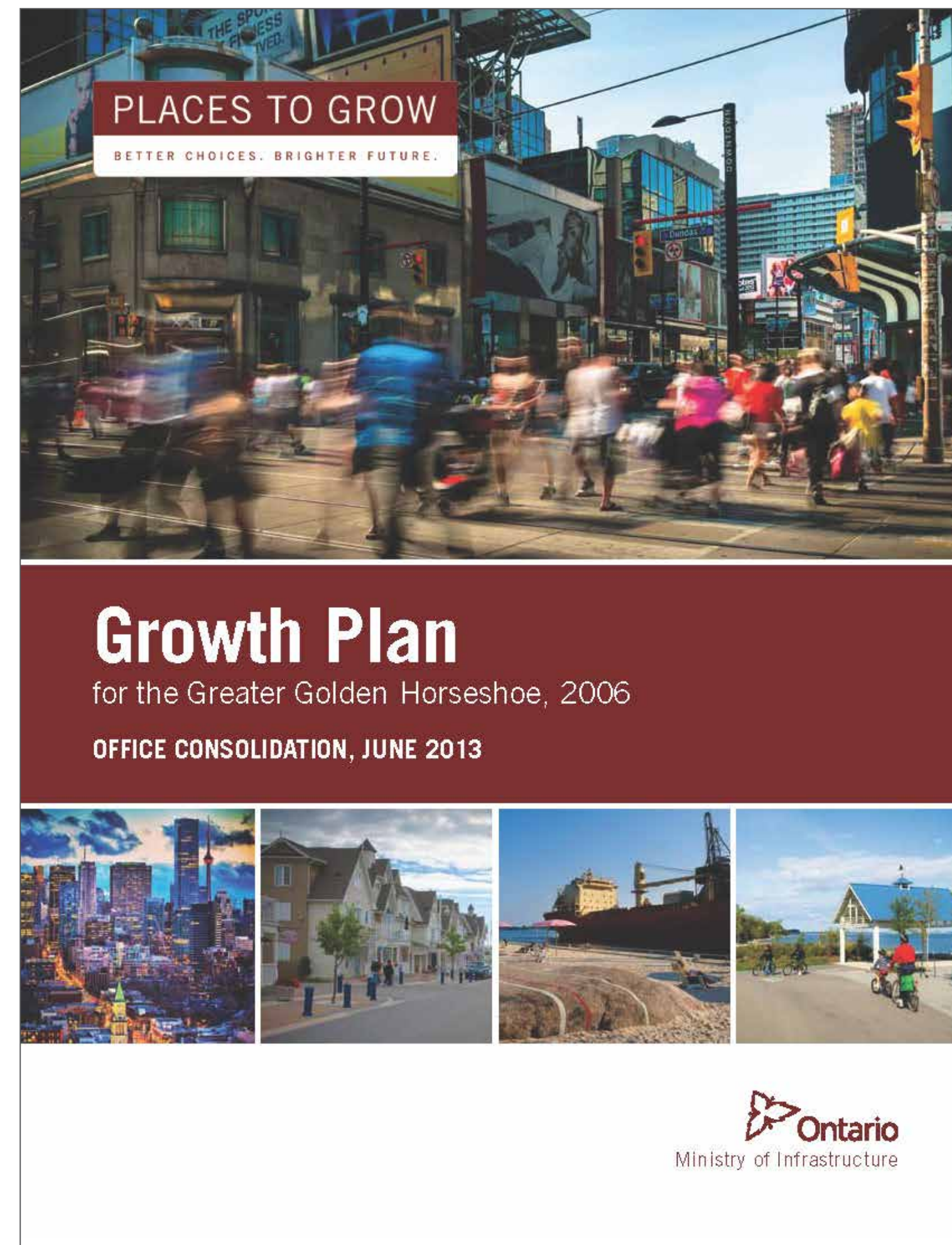
Provincial Policy Statement (PPS)



Relevant themes include:

- Creating strong, livable and healthy communities;
- Protecting the environment, public health and safety; and
- Facilitating economic growth.

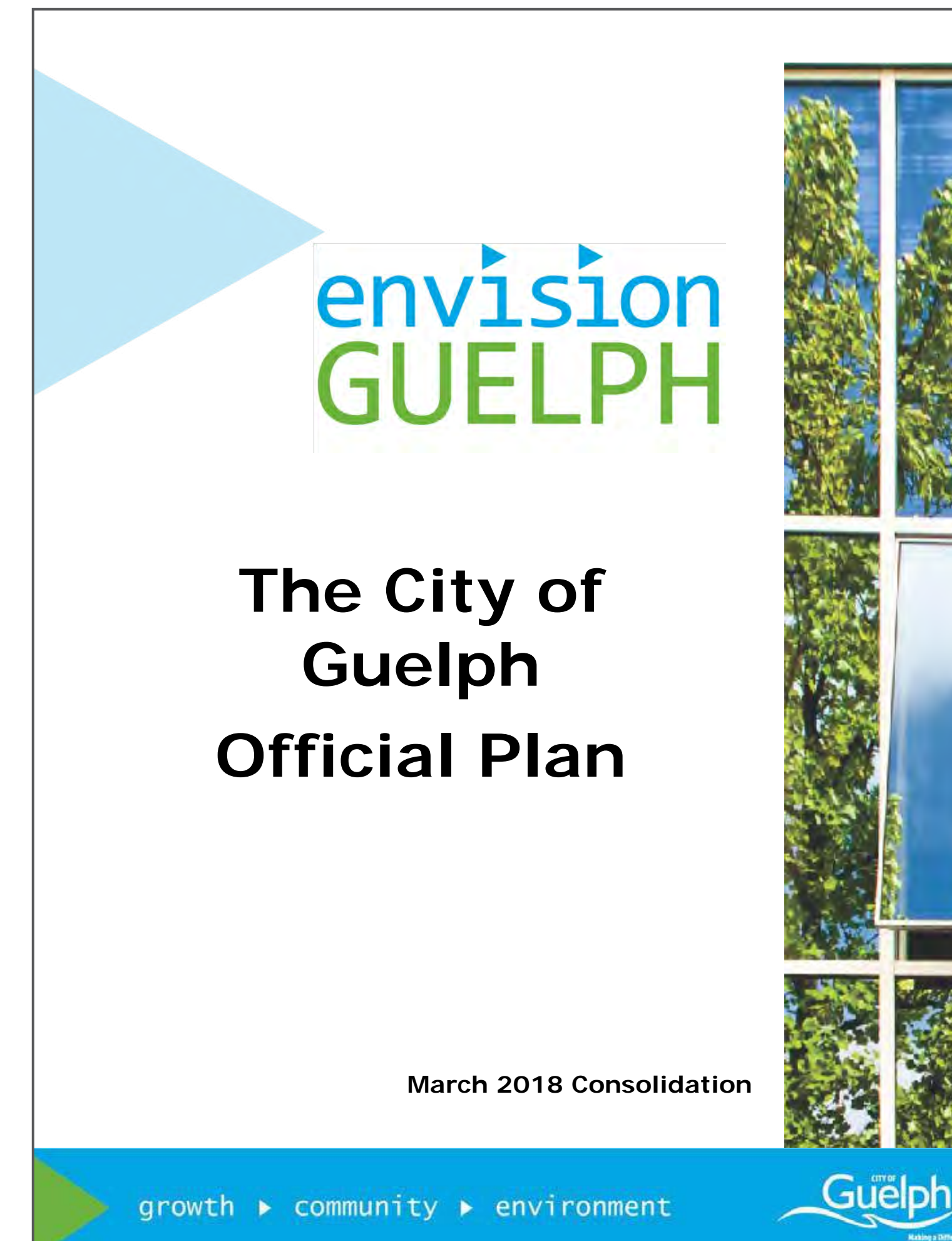
Places to Grow: Growth Plan for the Greater Golden Horseshoe



Relevant themes include:

- Growth management directions;
- Greenfield residential targets; and
- People/jobs density targets.

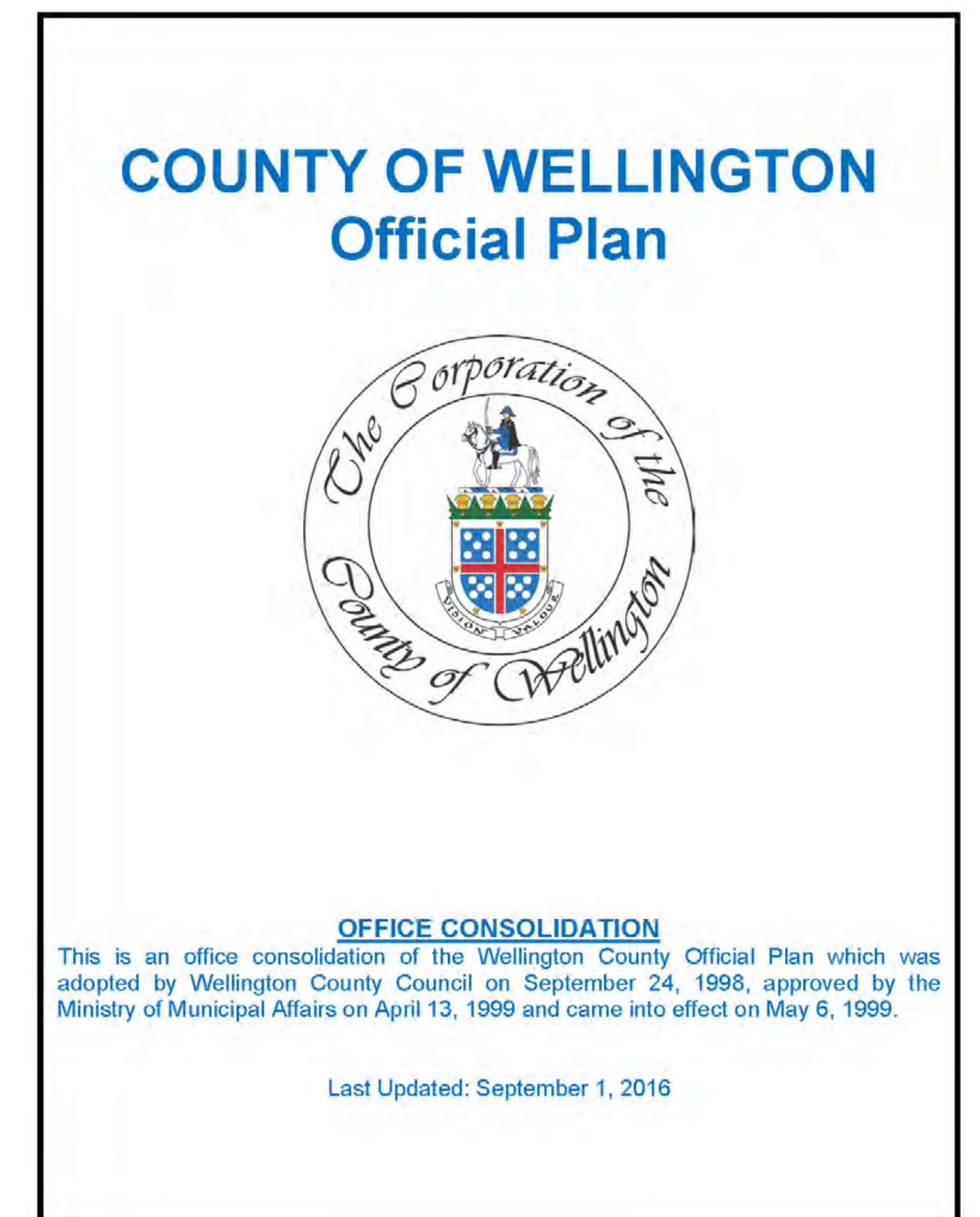
City of Guelph Official Plan



Relevant themes include:

- Complete communities;
- Protection of the Natural Heritage System;
- Multimodal transportation system;
- Environmental and built form sustainability;
- Varied and affordable housing types; and
- Conservation of built and cultural heritage and archaeological resources.

Wellington County Official Plan (relevant to adjacent lands)

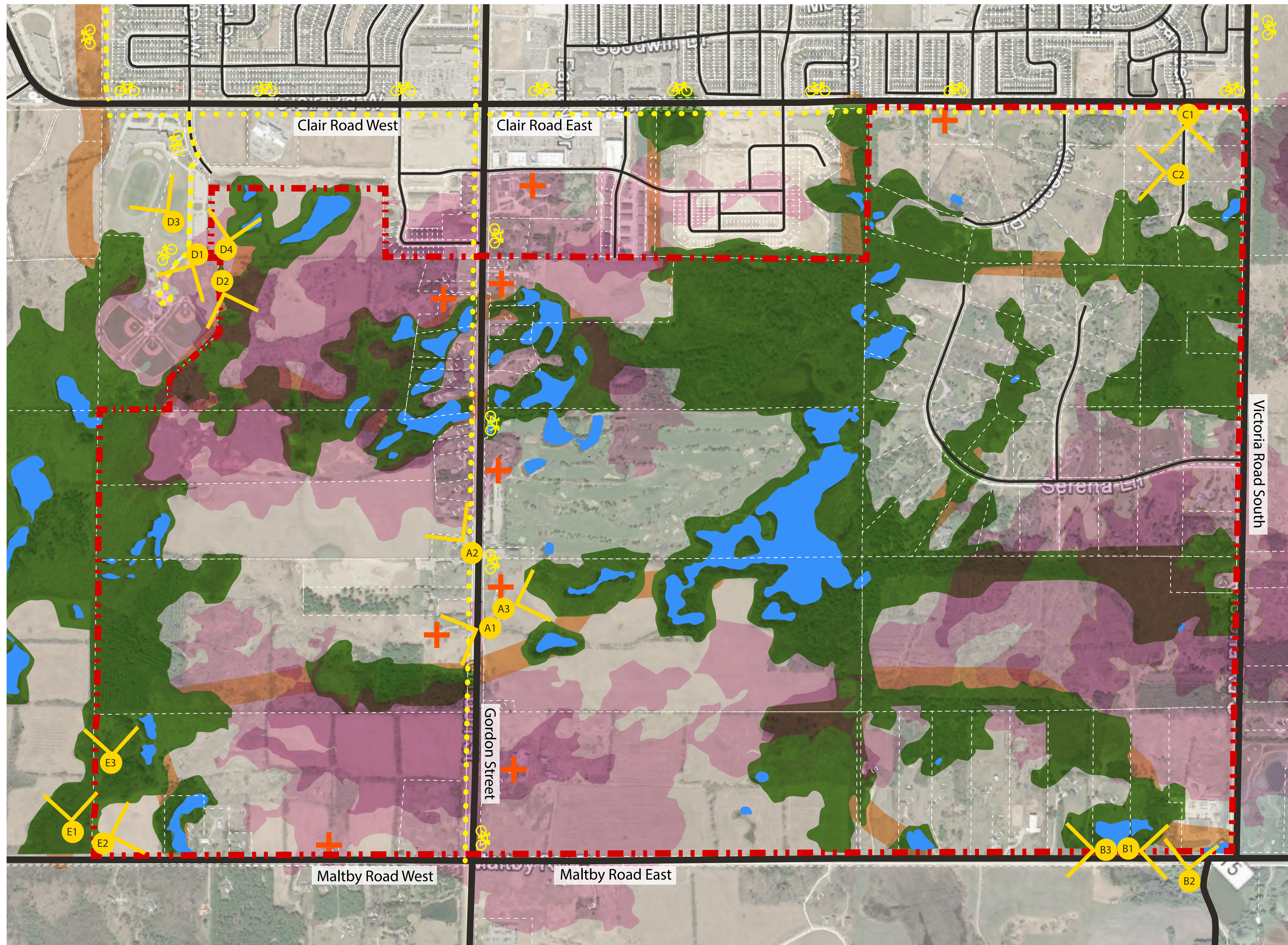


Relevant themes include:

- Land use designations and policies;
- Gordon Street Extension; and
- Significant Drinking Water Threat policies.

EXISTING CONDITIONS

Existing Conditions Map



Central Views



South East Views



North East Views



North West Views



South West Views



Legend

- Existing Roads
- Paris Moraine
- Clair Maltby Secondary Plan Boundary
- Natural Heritage System
- Significant Natural Areas and Natural Areas
- Ecological Linkages
- Water Bodies
- Bike Lanes
- Bike Lane or Paved Shoulders
- Off Road Bike Route
- ✚ Built Heritage Resources
- 📷 Drone Views

VISION AND GUIDING PRINCIPLES

Vision:

Clair-Maltby will be a vibrant, urban community that is integrated with Guelph's southern neighbourhoods, as well as having strong connections to Downtown, employment areas and the rest of the City.

The Natural Heritage System and the Paris Moraine provide the framework for the balanced development of interconnected and sustainable neighbourhoods.

This area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents.

A system of parks, open spaces and trails will be interwoven throughout to provide opportunities for active and passive recreation.

Guiding Principles:



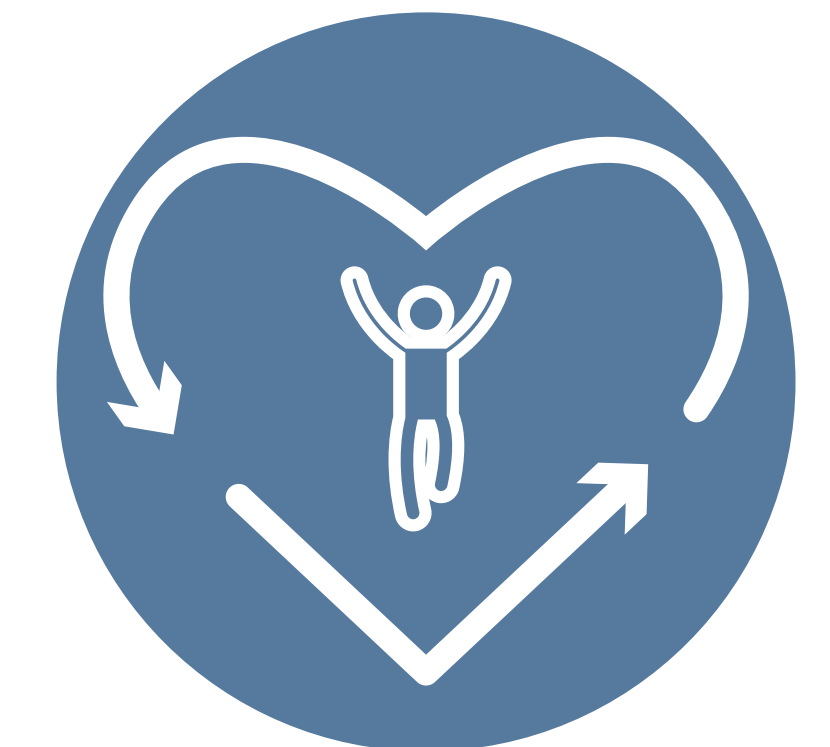
Vibrant and Urban

Create identifiable urban neighbourhoods that are pedestrian oriented and human-scaled.
Promote forward-thinking and innovative design that integrates new development into the rolling topography, while conserving significant cultural heritage resources.



Green and Resilient

Protect, maintain, restore, and where possible, improve water resources and the Natural Heritage System.
Support resiliency and environmental sustainability through measures such as energy efficiency, water conservation and green infrastructure.



Healthy and Sustainable

Design the community for healthy, active living.
Provide a mix of land uses including a diversity of housing choices at appropriate densities with appropriate municipal services to ensure long-term sustainable development which is fiscally responsible.



Interconnected and Interwoven

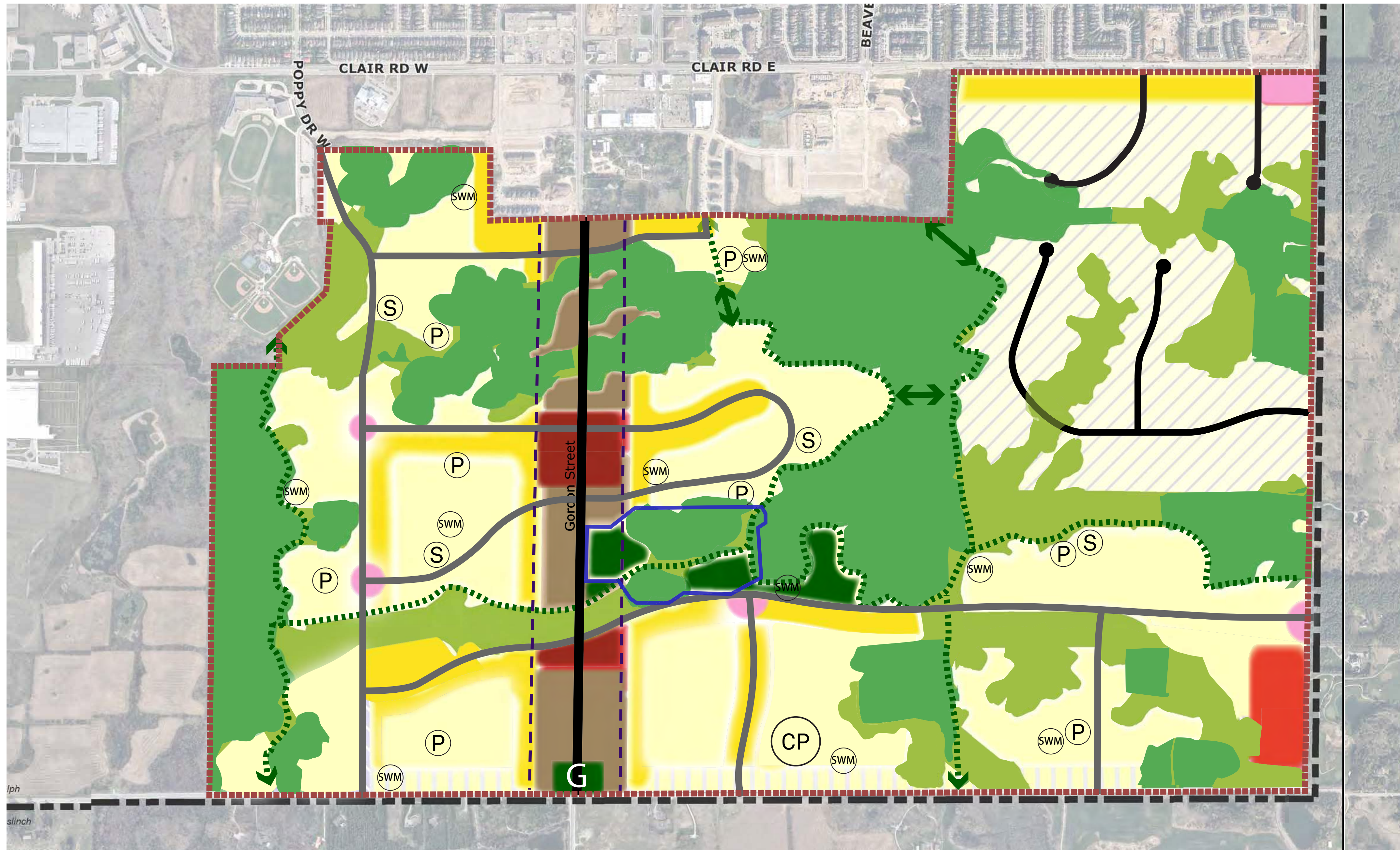
Establish a multi-modal mobility network that provides choice and connects neighbourhoods to each other and the rest of the City.
Create a network of parks, open spaces and trails to provide opportunities for active and passive recreation, as well as active transportation choices.



Balanced and Liveable

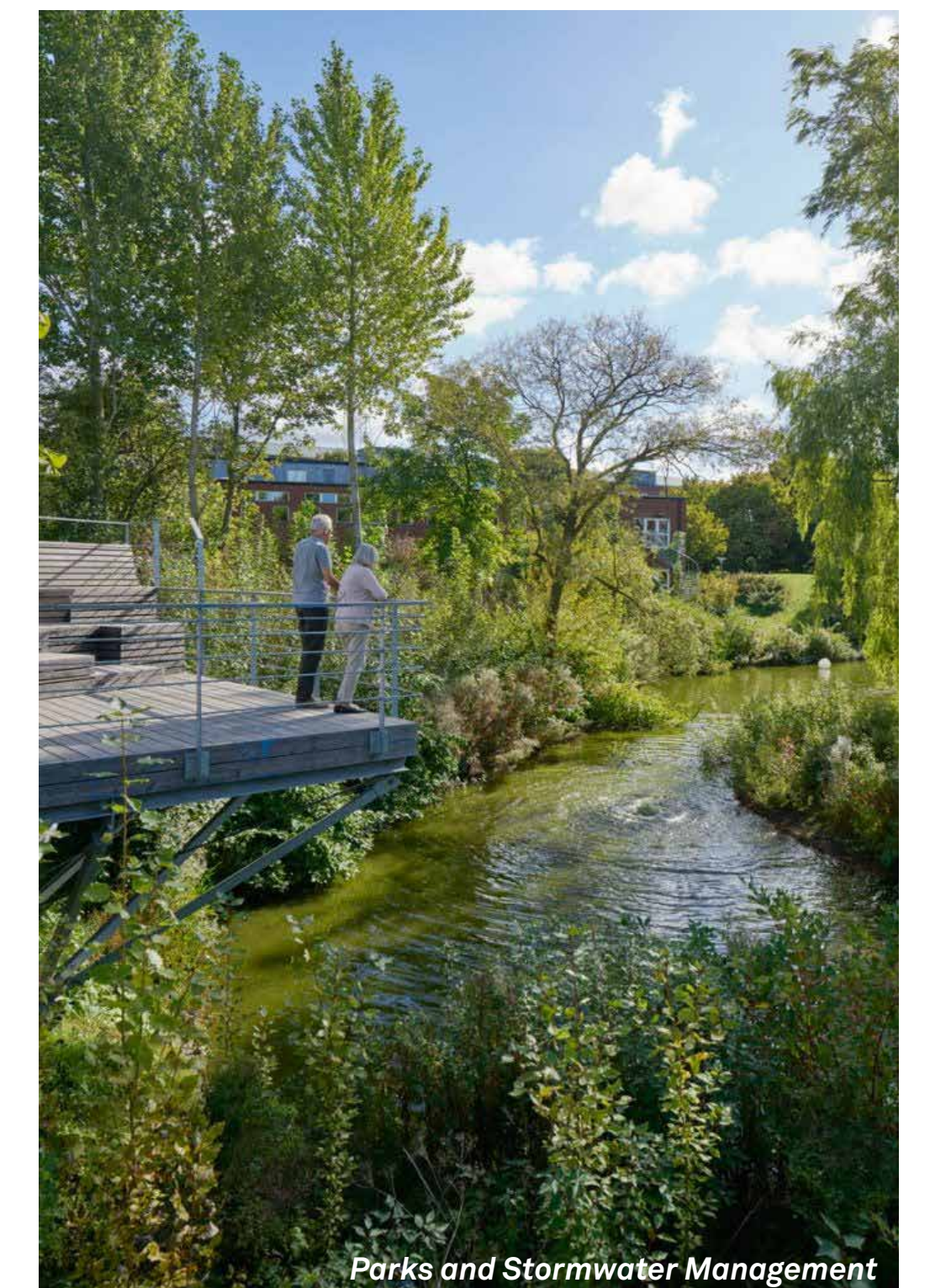
A valued and livable community which reflects the right balance between protecting the environment and fostering a healthy, equitable and complete community.

ALTERNATIVE 1: FEATURING THE GREEN

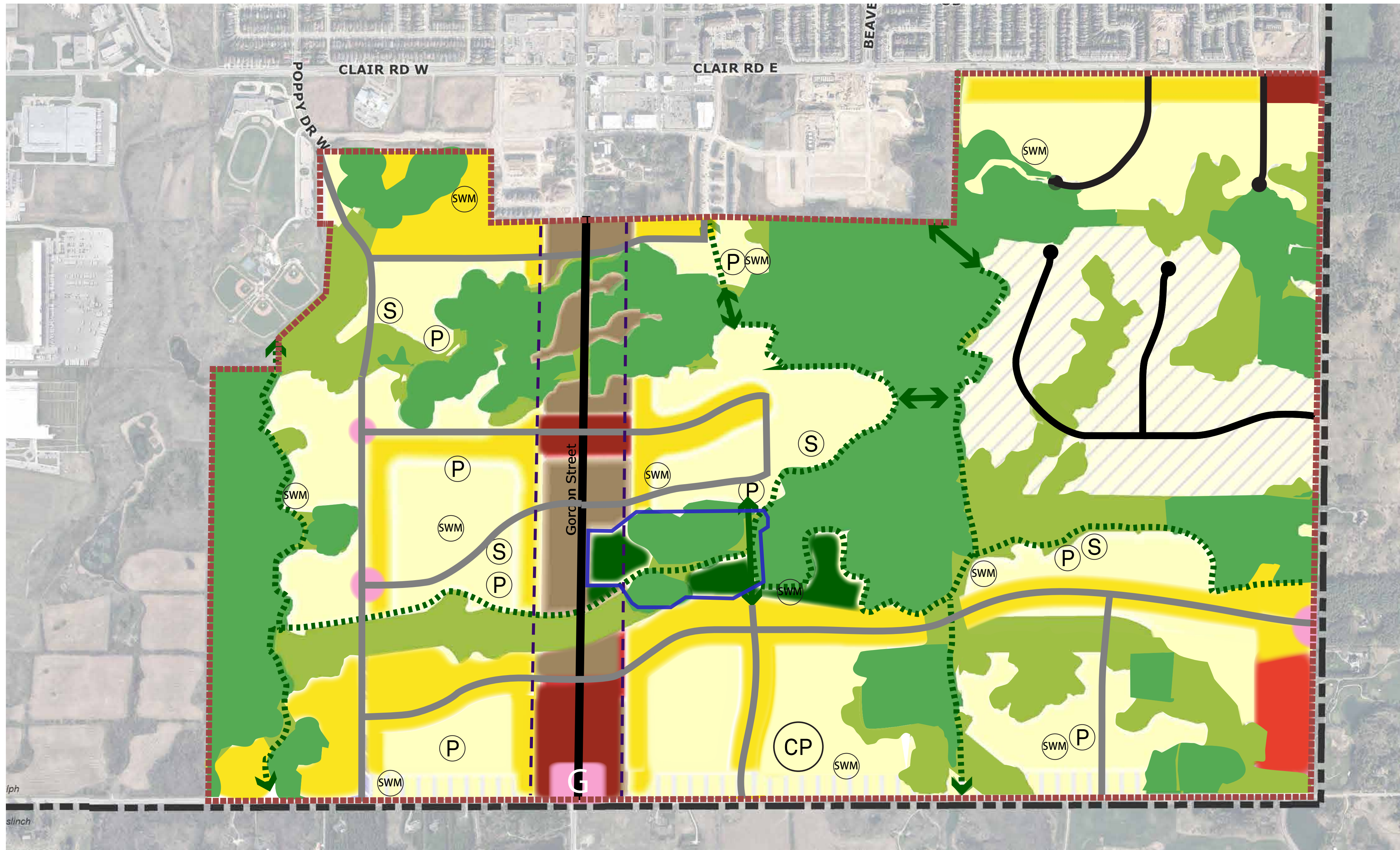


LEGEND

- | | | | | |
|---|--|--|---|--|
| <ul style="list-style-type: none"> --- Clair-Maltby Secondary Plan Boundary --- Cultural Heritage Landscape --- Urban-Rural Transition Zone --- Gordon St. Corridor | <ul style="list-style-type: none"> — Existing Street Network — Proposed Street and Cycling Network --- Proposed Trail Network ↔ Potential Active Transportation Link | <ul style="list-style-type: none"> (P) Neighbourhood Park (CP) Community Park (S) Elementary School (SWM) Stormwater Management (G) Gateway | <p>Natural Heritage System:</p> <ul style="list-style-type: none"> ■ May Permit Essential Transportation Infrastructure ■ Does Not Permit Transportation Infrastructure | <p>Land Use:</p> <ul style="list-style-type: none"> ■ Low Density (Residential) ■ Medium Density (Residential) ■ High Density (Residential) ■ Mixed Use ■ Neighbourhood Commercial ■ Service Commercial ■ Rolling Hills Residential ■ Open Space |
|---|--|--|---|--|



ALTERNATIVE 2: FOCUS ON COMMUNITY SERVICES

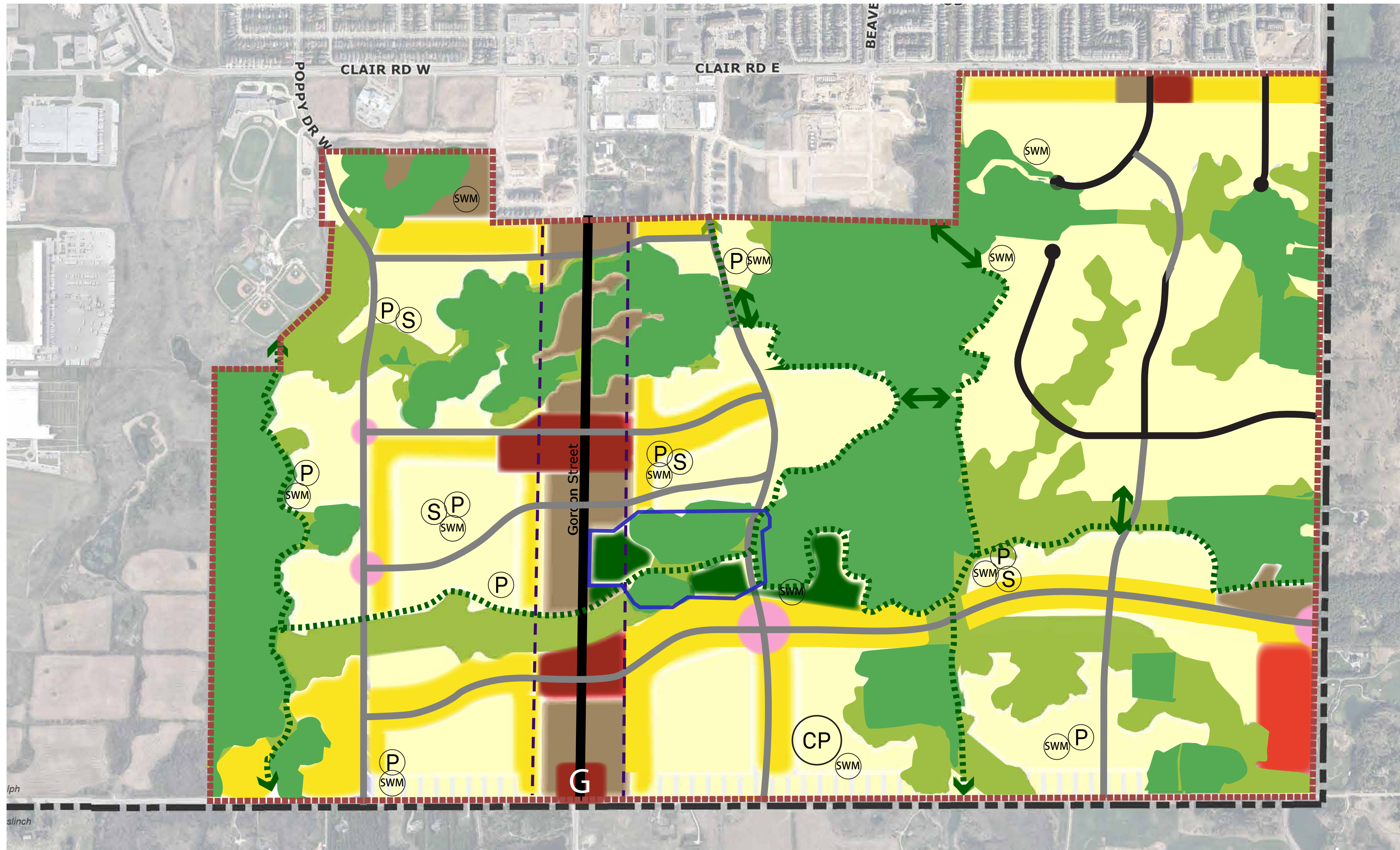


LEGEND

<ul style="list-style-type: none"> ▬▬▬ Clair-Maltby Secondary Plan Boundary ▬ Cultural Heritage Landscape ▭ Urban-Rural Transition Zone ▬ Gordon St. Corridor 	<ul style="list-style-type: none"> ▬ Existing Street Network ▬ Proposed Street and Cycling Network ▬ Proposed Trail Network ↔ Potential Active Transportation Link 	<ul style="list-style-type: none"> (P) Neighbourhood Park (CP) Community Park (S) Elementary School (SWM) Stormwater Management (G) Gateway 	<p>Natural Heritage System:</p> <ul style="list-style-type: none"> ▭ May Permit Essential Transportation Infrastructure ▭ Does Not Permit Transportation Infrastructure 	<p>Land Use:</p> <ul style="list-style-type: none"> ▭ Low Density (Residential) ▭ Medium Density (Residential) ▭ High Density (Residential) ▭ Mixed Use ▭ Neighbourhood Commercial ▭ Service Commercial ▭ Rolling Hills Residential ▭ Open Space
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ALTERNATIVE 3: URBAN AND CONNECTED



LEGEND

<ul style="list-style-type: none"> ▬ Existing Street Network ▬ Proposed Street and Cycling Network ▬ Cultural Heritage Landscape ▬ Urban-Rural Transition Zone ▬ Gordon St. Corridor 	<ul style="list-style-type: none"> (P) Neighbourhood Park (CP) Community Park (S) Elementary School (SWM) Stormwater Management (G) Gateway 	<p>Natural Heritage System:</p> <ul style="list-style-type: none"> ▬ May Permit Essential Transportation Infrastructure ▬ Does Not Permit Transportation Infrastructure 	<p>Land Use:</p> <ul style="list-style-type: none"> ▬ Low Density (Residential) ▬ Medium Density (Residential) ▬ High Density (Residential) ▬ Mixed Use ▬ Neighbourhood Commercial ▬ Service Commercial ▬ Rolling Hills Residential ▬ Open Space
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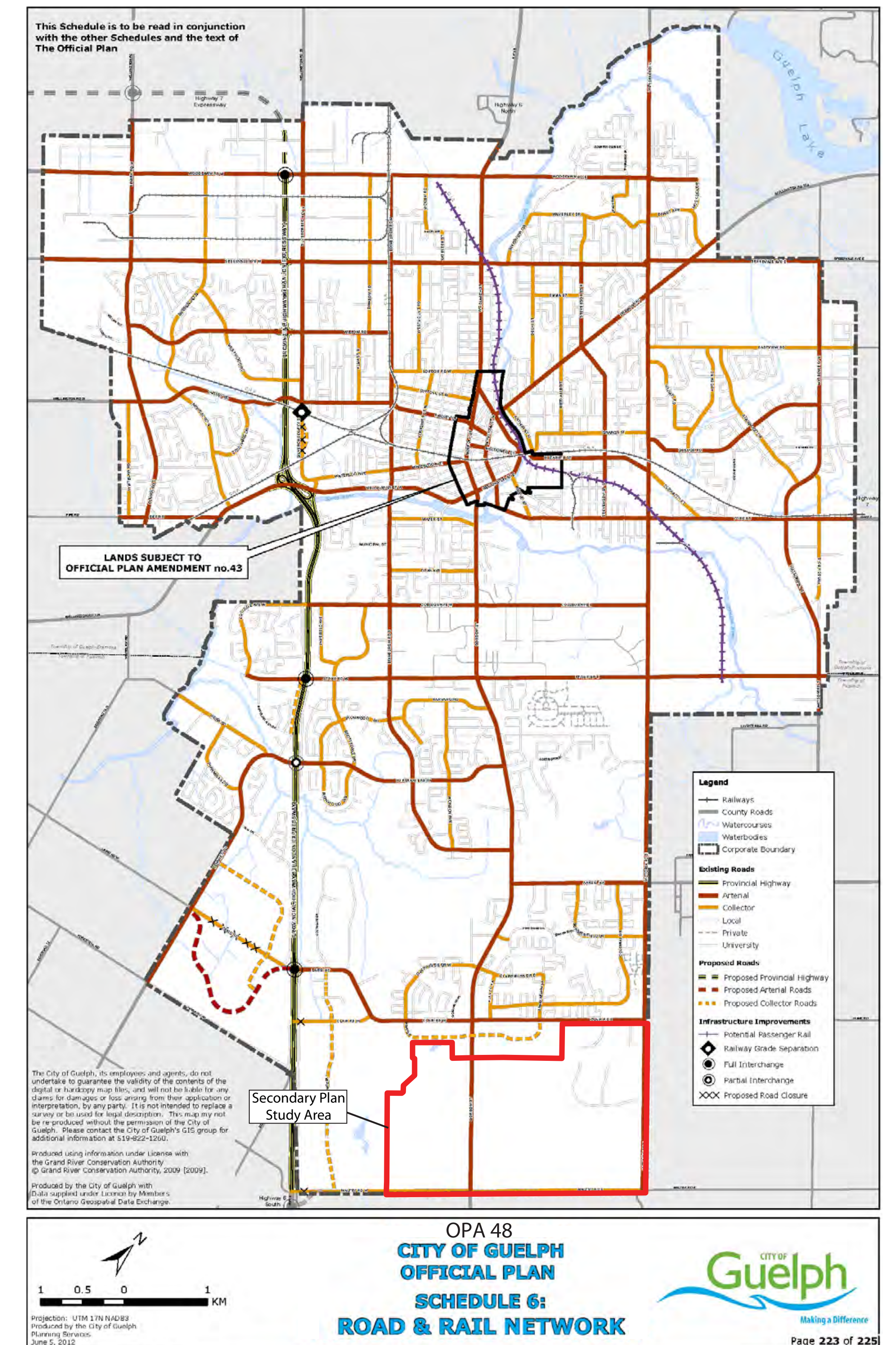
GUELPH WELLINGTON TRANSPORTATION STUDY

Key Improvements in Secondary Plan Area:

- Widening of Gordon Street from 2 to 4 lanes (approved 2001 EA) from Kortright Road to Wellington Road 34;
- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA) - COMPLETE
- Southerly extension of Southgate Drive to Maltby Road; and
- Development of an internal collector road system within the Clair-Maltby Secondary Plan area connecting to Gordon Street and Maltby Road

Other Key Studies Informing the Transportation Network:

- Guelph Active Transportation Network Study
- Bicycle Friendly Guelph: Cycling Master Plan
- Guelph Transit, Transit Growth Strategy and Plan
- Guelph Trails Master Plan
- Wellington County Active Transportation Plan
- Various Environmental Assessments (i.e. Gordon Street, Victoria Road)



TRANSPORTATION NETWORK CONSIDERATIONS

Existing Travel Behaviour

TABLE 3 SOUTH GUELPH AREA:
PEAK PERIOD TRIP DISTRIBUTION BY TRAVEL MODE

Destination Area	Proportion of All Trips	Mode Split	Legend
Local Area ¹	50%		Travel Mode Auto Driver Auto Passenger Transit Walk Cycle Other
Rest of Guelph (7% Downtown)	26%		
Halton / Peel Regions	7%		
Waterloo Region	7%		
City of Toronto	3%		

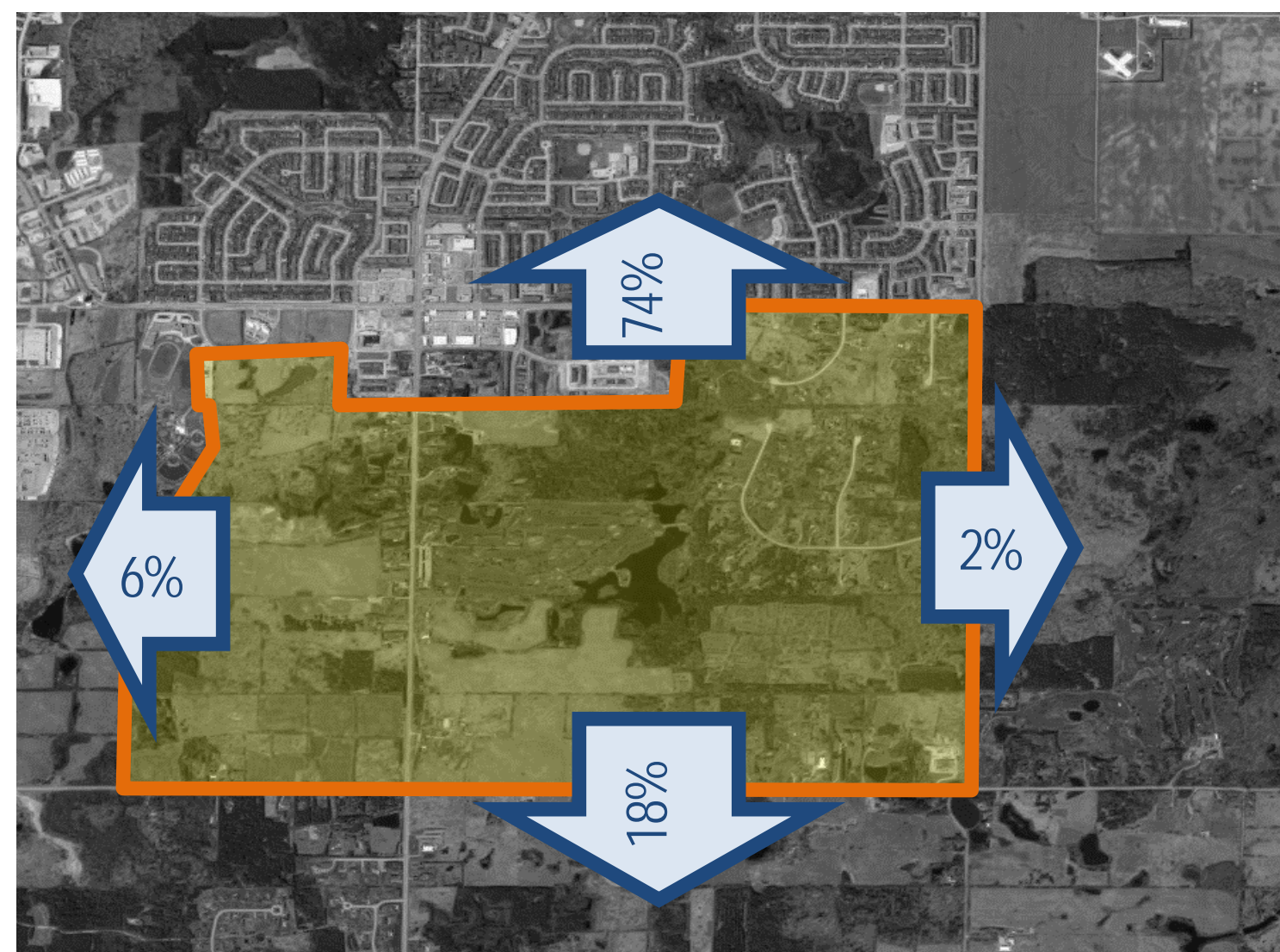
Note:
1. "Local area" consists of areas within the City of Guelph south of the Eramosa River.
2. Another 7% of trips are oriented to "other" areas in the region, including Wellington County, City of Hamilton, etc.

Travel Orientation and Primary Travel Mode

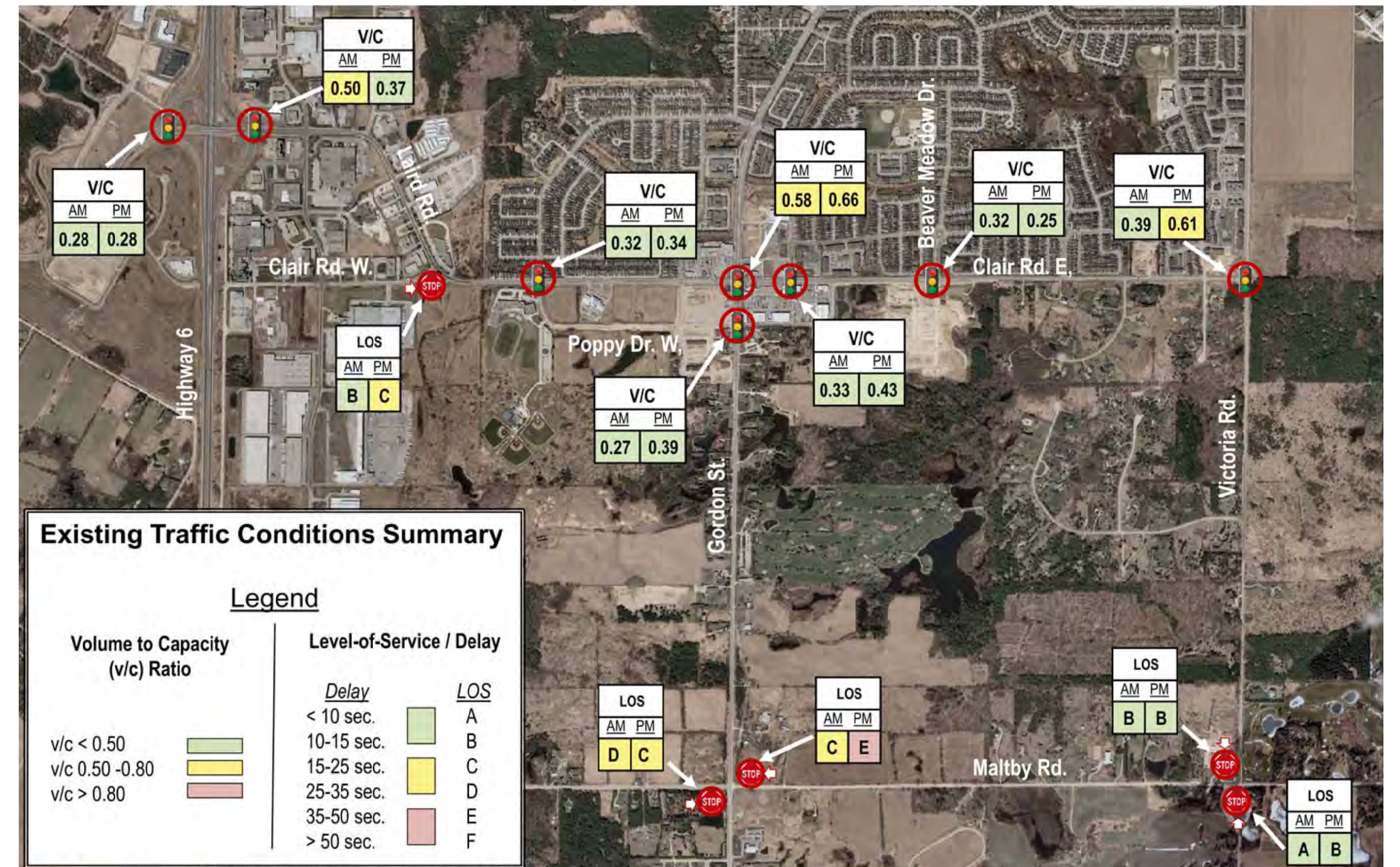
- Approx. 75% of trips stay within the City of Guelph.
- Most trips are undertaken in a private vehicle (86% of trips in Guelph; 88% overall).

General Traffic Distribution

- Approx. 75% of local area traffic volumes are anticipated to be oriented north of the study area.



Existing Traffic Conditions



Existing Weekday Peak Hour Area Traffic Operations

- Acceptable traffic operations at area signalized intersections under existing conditions.
- Gordon Street / Clair Road intersection can be busy during peak travel periods under existing conditions.
- Eastbound and westbound movements at Gordon Street / Maltby Road can experience longer delays.
- Other unsignalized intersections operate acceptably under existing conditions.

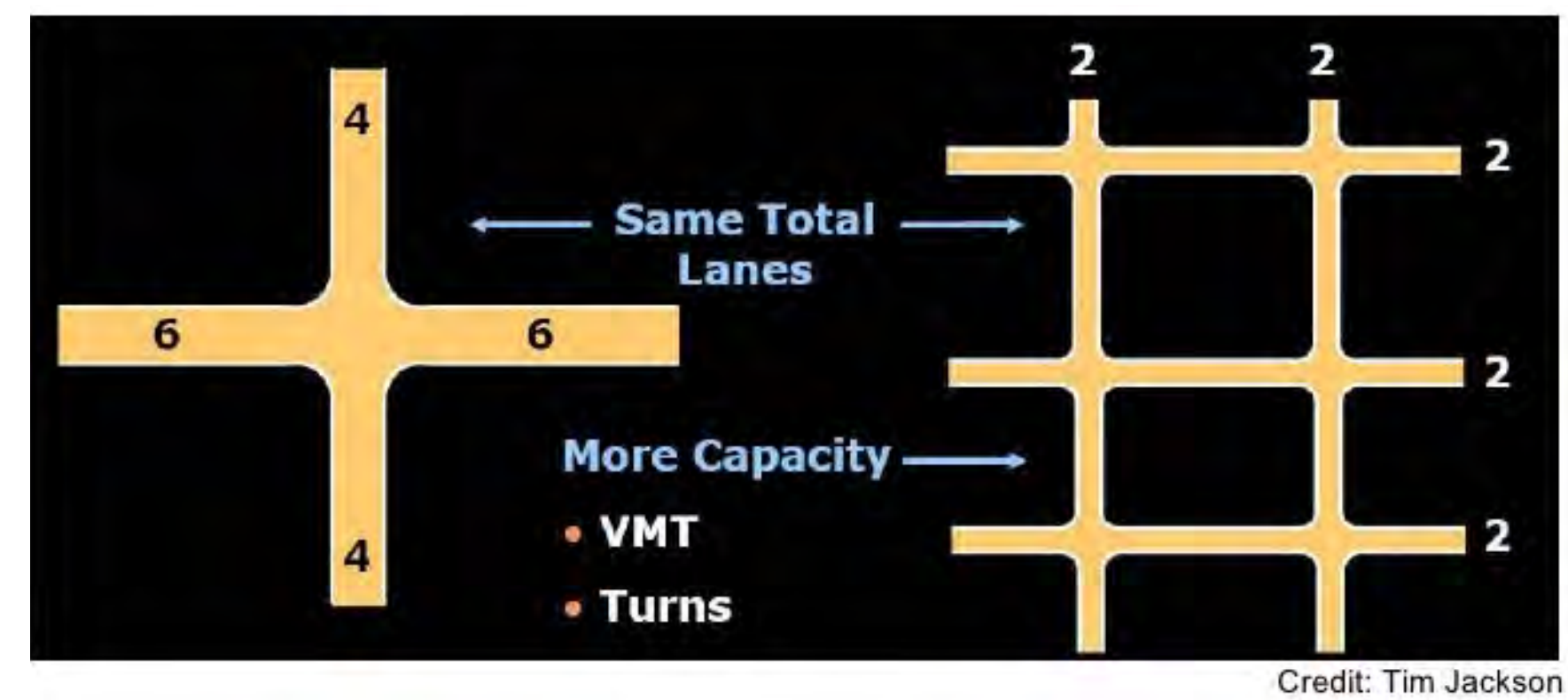
TRANSPORTATION NETWORK CONSIDERATIONS

Principles of Transportation Network:

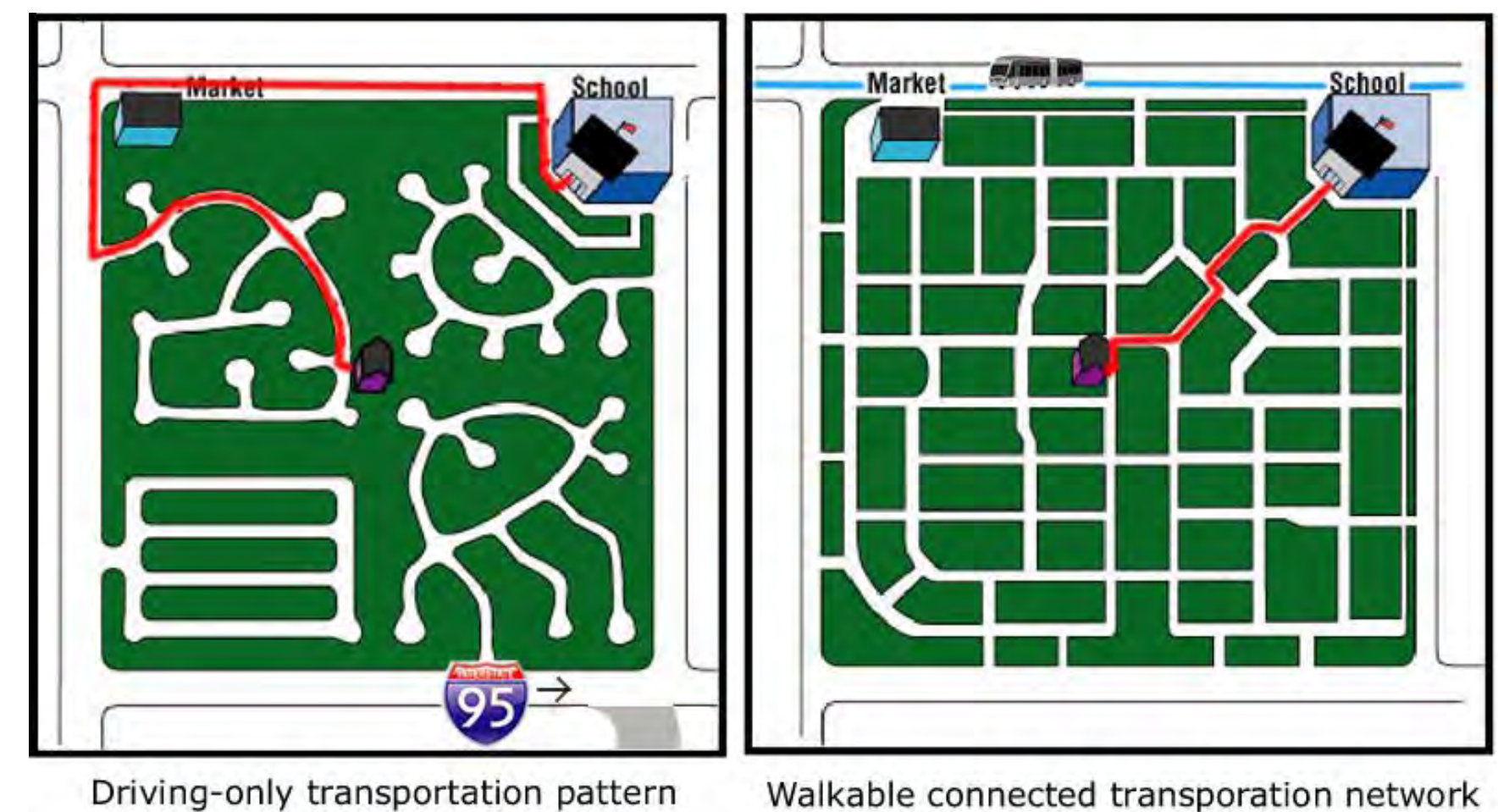
1. Provide flexibility, redundancy, and continuity;
2. Support transit service operations;
3. Support multi-modal transportation;
4. Enhance connectivity for all travel modes;
5. Provide robust and frequent connectivity internal to the neighbourhood, and to adjacent neighbourhoods; and
6. Respect natural heritage features.

Some Benefits of a Well-Planned Street Network:

1. Street capacity



2. Walkability

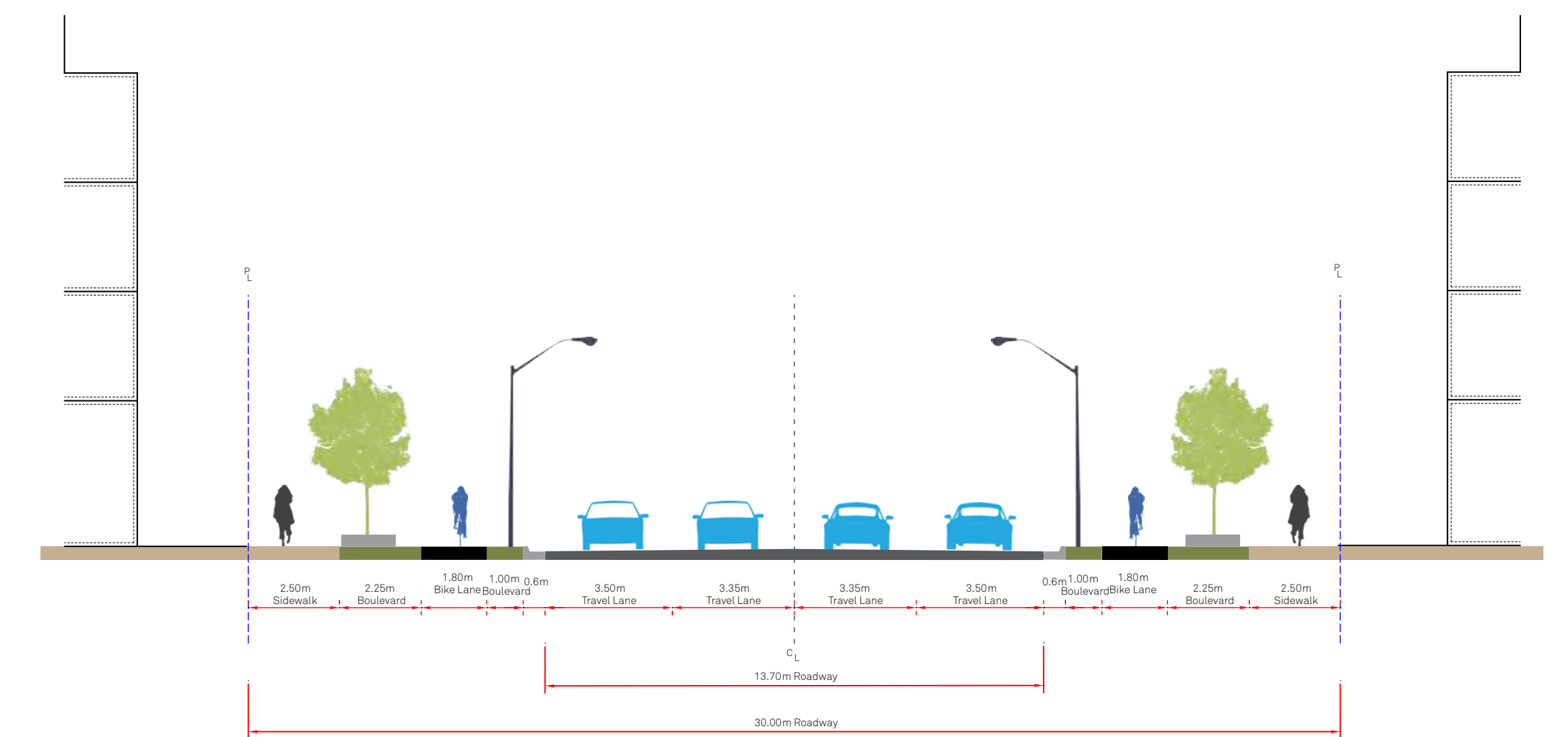


3. Safety

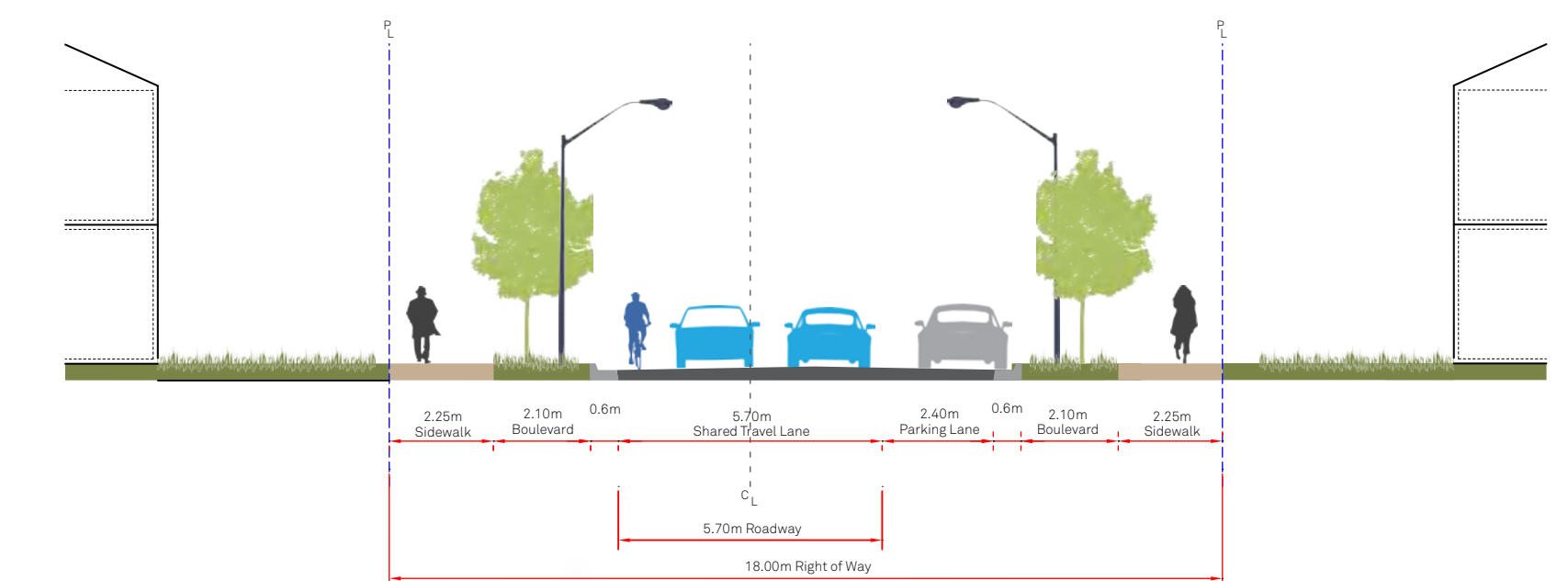
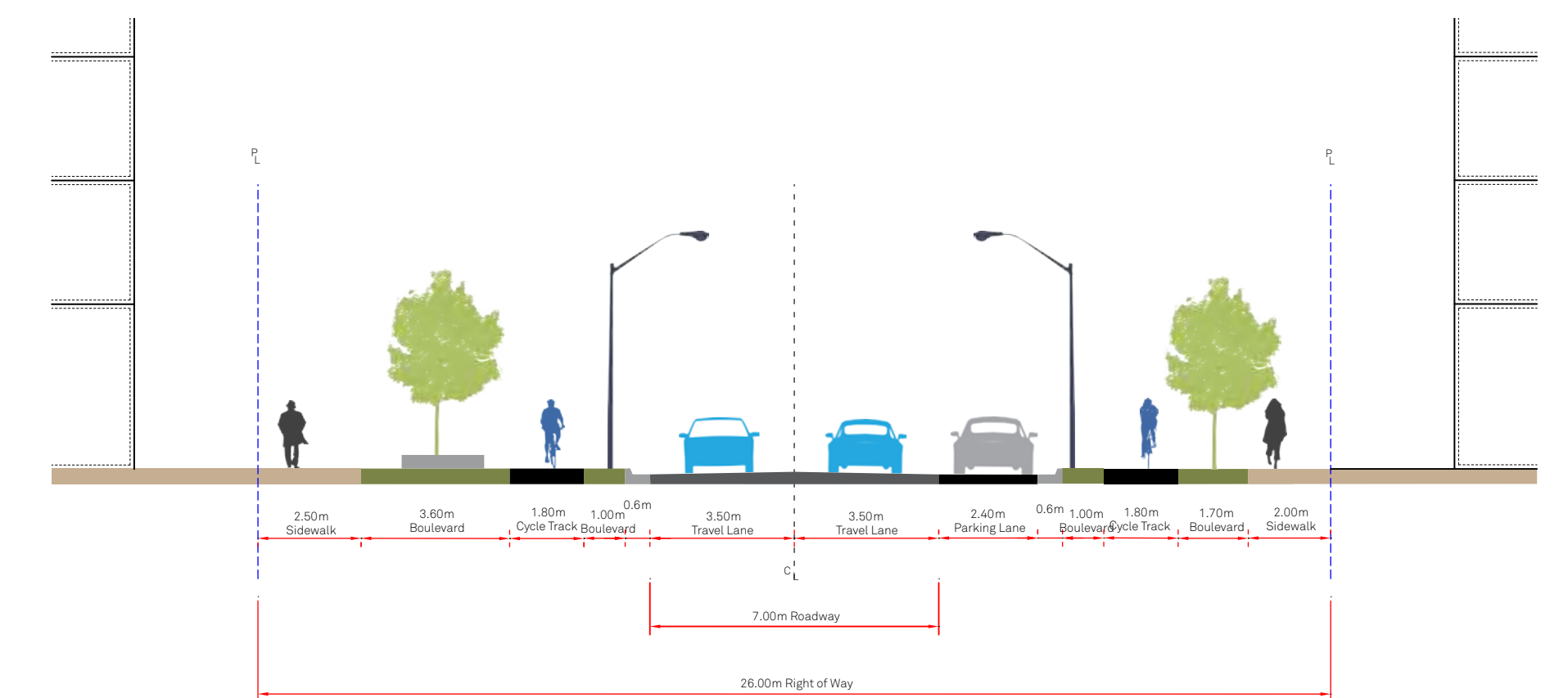
- Accommodate all street users
- Reduce street crossing distances
- Reduce vehicle speeds

Examples of New Potential Street Cross Sections

1. Arterial Street



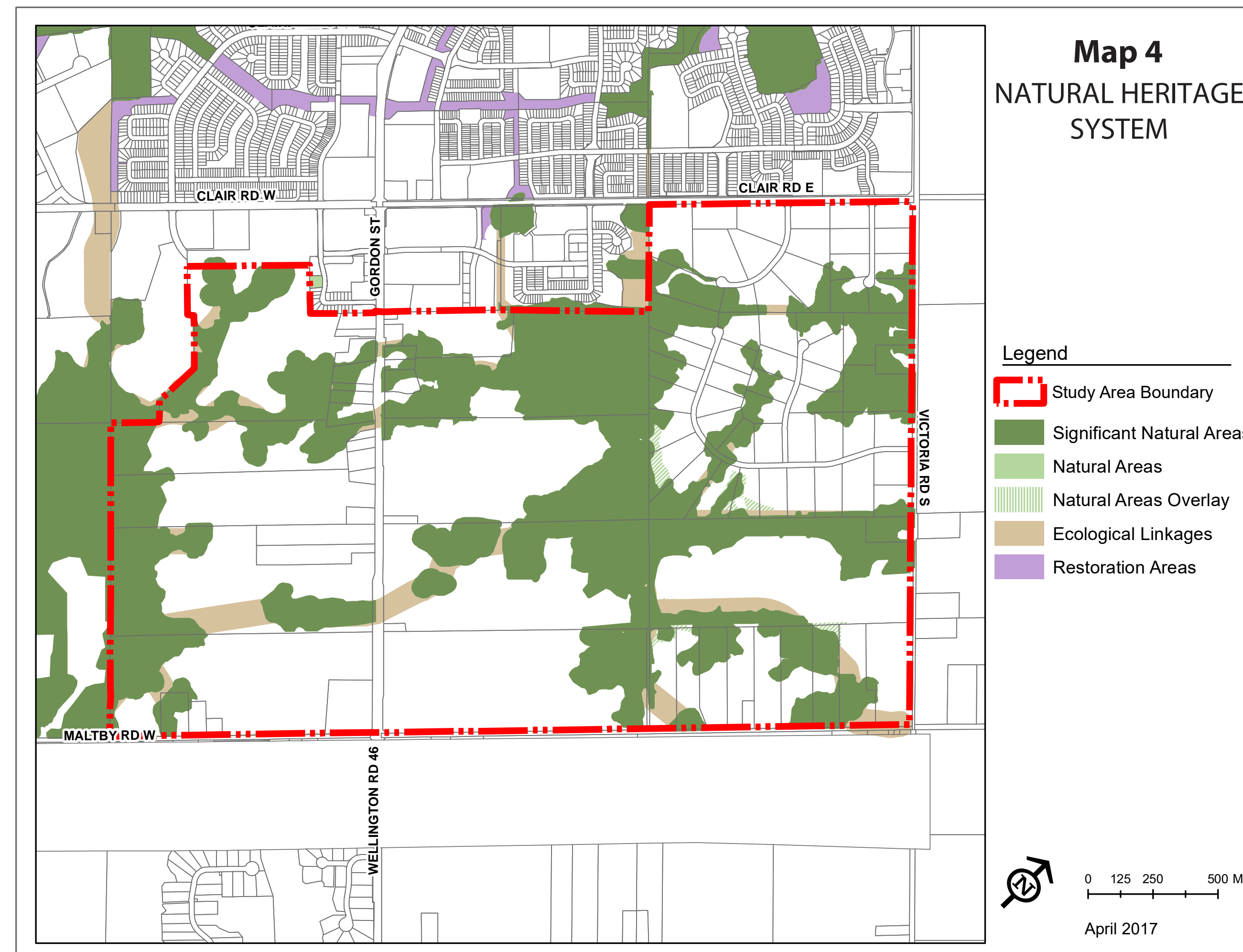
2. Collector Street



NATURAL HERITAGE SYSTEM

A Natural Heritage System (NHS) already exists for the Secondary Plan Area. This NHS is mapped and described in the City's current Official Plan. It is based on the technical work and consultations undertaken as part of the City's Natural Heritage Strategy (2004 – 2009). This NHS was approved by Council (Official Plan Amendment 42) in 2010, and was refined and finalized by the Ontario Municipal Board's approval of the City's Official Plan Amendment 42 in 2014. This is the NHS shown in the various maps presented as part of this charrette.

The purpose of the natural heritage work undertaken through the Clair-Maltby Secondary Plan process has been to verify and update the NHS, as needed, based on relevant changes to existing conditions and application of current legislation, policies and guidelines. A work plan for these updates was developed in consultation with the City and key stakeholders.



467 species of plants can be found in the Clair-Maltby Secondary Plan Area



7 species of frog and 1 species of toad can be found in the Clair-Maltby Secondary Plan Area



112 species of birds can be found in the Clair-Maltby Secondary Plan Area

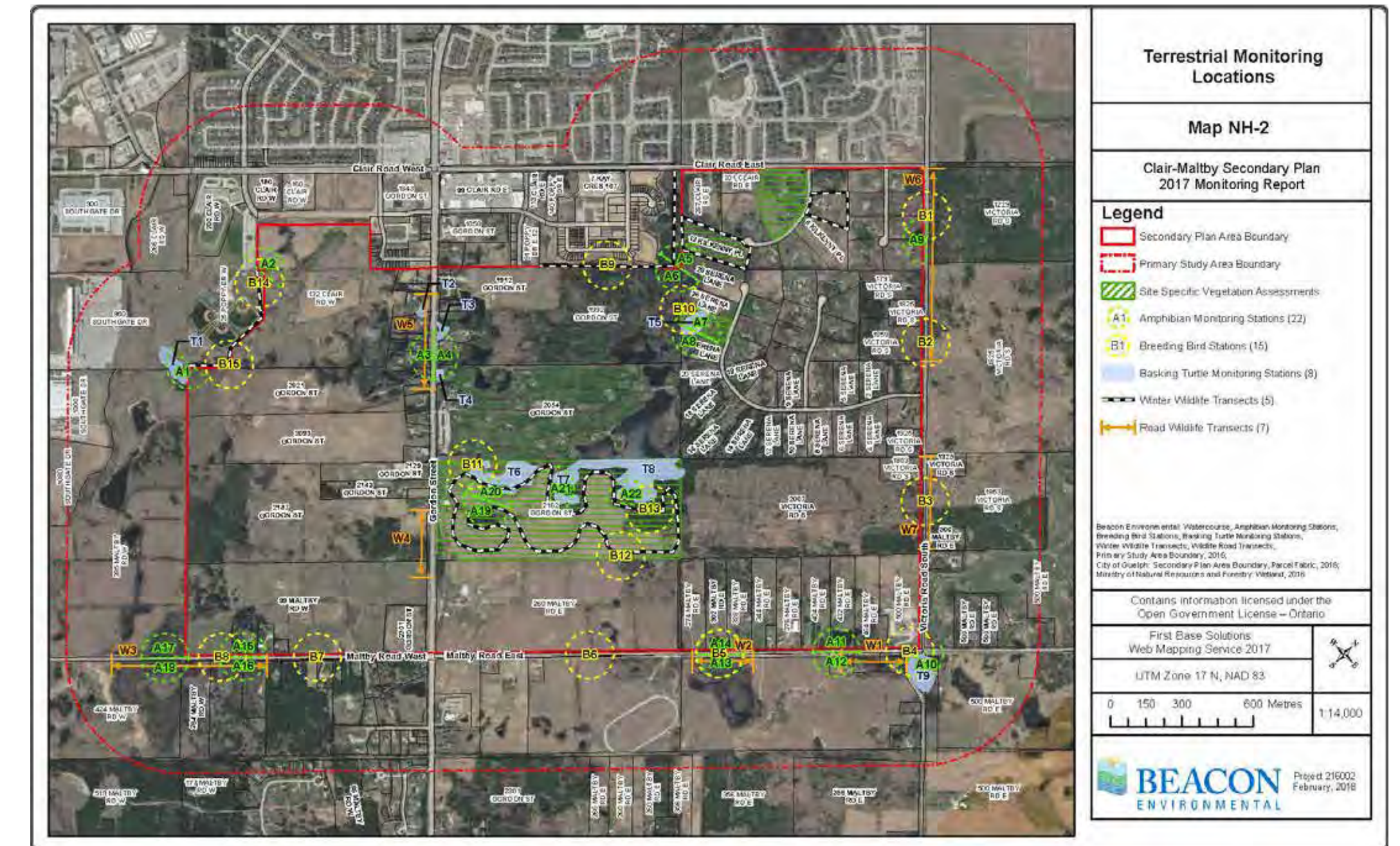
NATURAL HERITAGE SYSTEM

Natural heritage field studies undertaken as part of the Clair-Maltby Secondary Plan process over 2016 and 2017 have included:

- Preliminary screening for headwater drainage features;
- Assessment of the water levels and quality of selected wetlands;
- Air photo interpretation to verify and update vegetation community mapping supplemented with scoped vegetation assessments and botanical surveys;
- Amphibian and reptile surveys, including movement surveys over roads;
- Breeding bird and winter wildlife surveys (including for deer and raptors); and
- Incidental observations of seeps, springs and other wildlife.

Field studies have been limited to properties where access was provided, public lands and road rights-of-way. Surface water sampling stations were coordinated with shallow groundwater sampling stations to gain a better understanding of how the different wetlands function. Field work has been supplemented by a review of all available background studies and data in the study area from the last decade or so.

Over 2018, refinements and updates to the NHS will be confirmed based on the technical work undertaken. These updates will be reviewed with the City and key stakeholders including: local agencies and advisory committees, as well as the landowners and advisory groups established for this project. Updates to the NHS will be integrated into the various models and planning studies to inform the different technical components (e.g., transportation, servicing, storm water management) and the Secondary Plan itself, including the related policies.



Wetland Monitoring Station 8 at various points from April-November 2017

PROBLEM AND OPPORTUNITY STATEMENT

Problem

The City of Guelph is undertaking the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to comprehensively plan the last unplanned greenfield area within the city. The current study area does not have full municipal services to support future development.

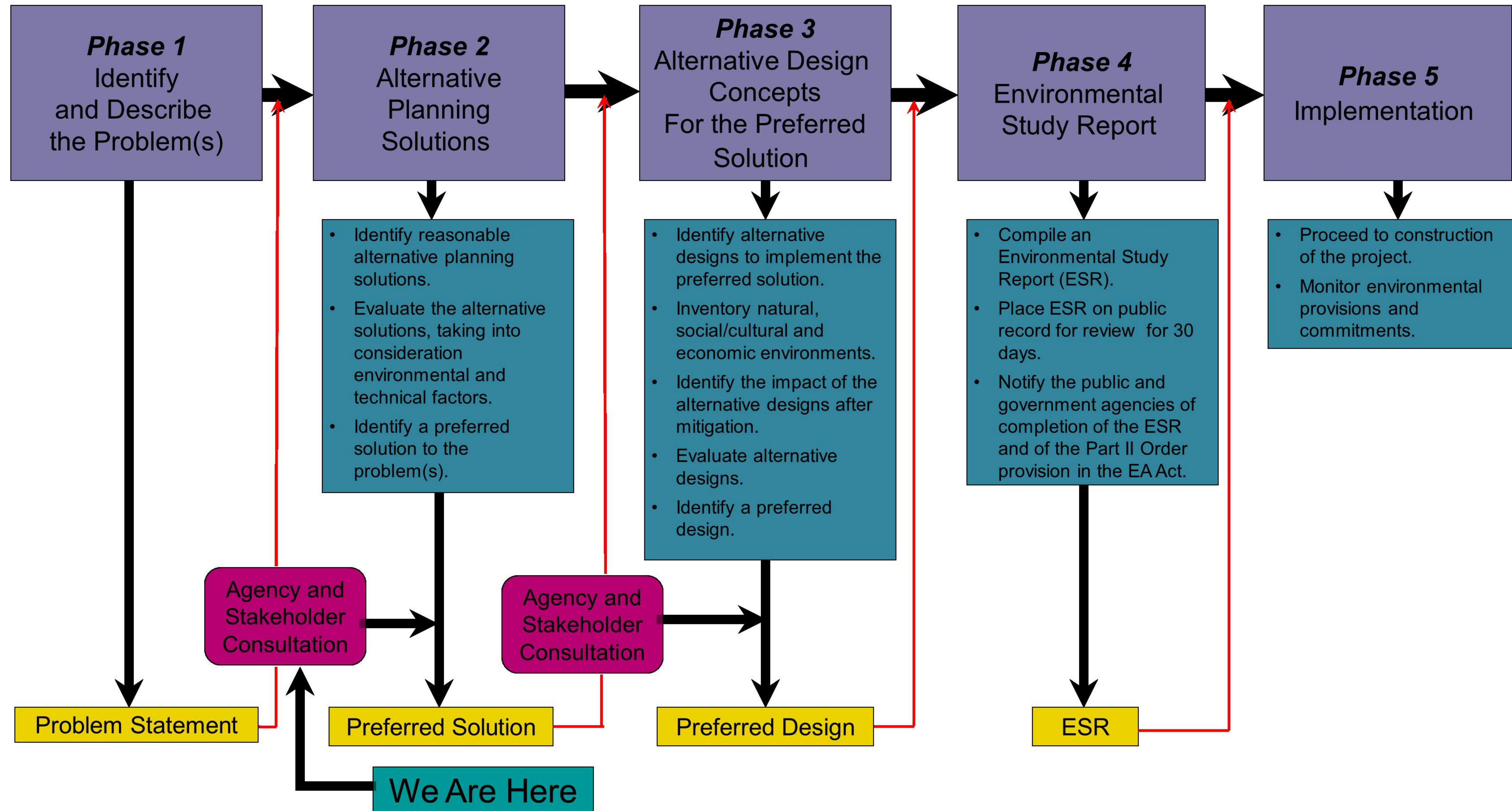
Opportunity

The Clair-Maltby Secondary Plan and the Master Environmental Servicing Plan (MESP) are being developed concurrently to provide an integrated planning approach to establish a plan for future urban development and full municipal services within this area.

Newly urbanizing lands require municipal services in the form of roads, water, wastewater and stormwater infrastructure, in order to meet municipal and provincial requirements. The process involving the conversion of undeveloped land to a fully serviced, urbanized form is governed through an integrated approach addressing the needs of the Planning Act and the Environmental Assessment Act, including the Municipal Engineers Association Class Environmental Assessment Process for public infrastructure planning and design.



MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT



The MESP for Clair-Maltby is intended to fulfill Phases 1 and 2

STORMWATER MANAGEMENT PLANNING

Background

Urbanizing existing natural and rural lands has the potential to alter surface runoff and groundwater functions, possibly negatively affecting the area's wetlands, drainage features and associated wildlife and fish. Stormwater Management techniques can both pro-actively and reactively manage and mitigate the impacts of urbanization to address regulatory and functional objectives.

Objectives

Stormwater Management is intended to address the following objectives:

- i. Control drainage (quantity and quality) and associated risks
- ii. Manage impacts to drainage features and related habitat (Clair-Maltby open water drainage features are limited due to the hummocky terrain)
- iii. Maintain/improve water quality in accordance with Provincial requirements
- iv. Work towards water balance preserving surface water infiltration and groundwater quantity and quality



STORMWATER MANAGEMENT ALTERNATIVES

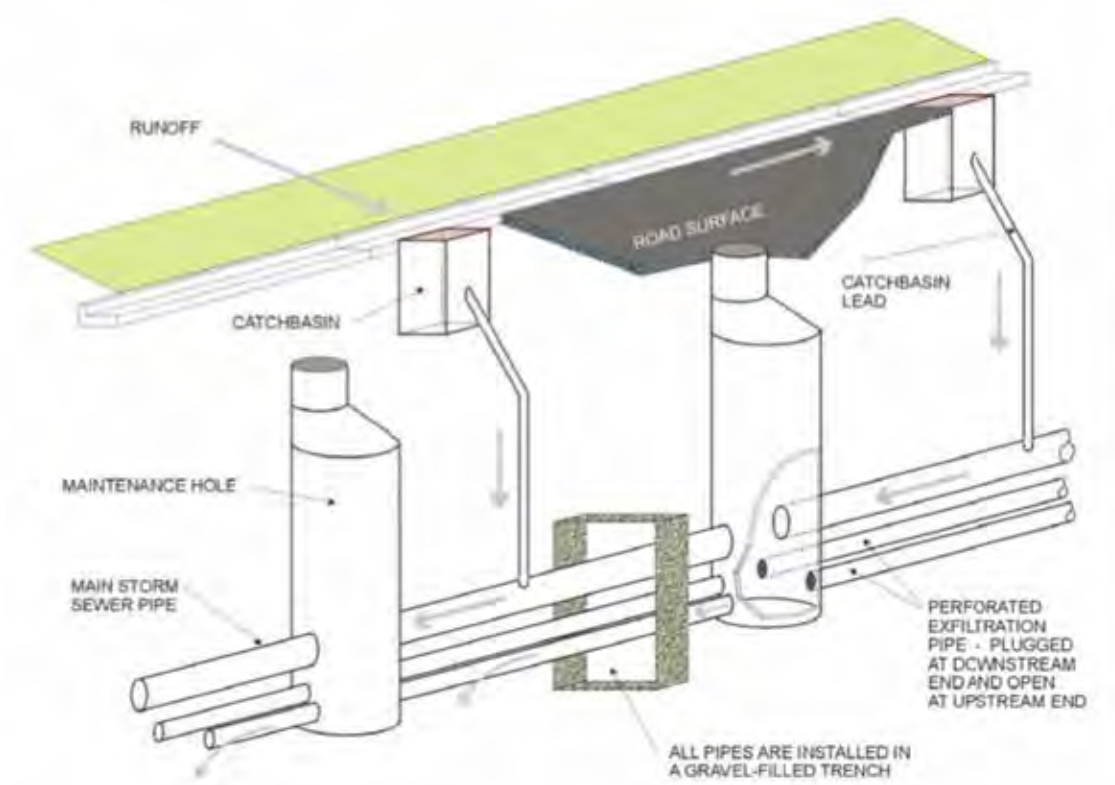
There are a number of Stormwater Management techniques available to address the objectives which fall into various categories as follows:



- Dry ponds
- Wet ponds
- Wetlands
- Hybrids
- Greenways
- Infiltration Systems
- Oil and grit separators

- Perforated pipes
- Swales
- Enhanced swales

- Bioretention (rain gardens)
- Soak away Pits
- Permeable pavements
- Rain water harvesting
- Rain gardens
- Biofilters



The Do Nothing alternative is required to be considered in the Municipal Class Environmental Assessment process. It would however not address the stormwater management objectives for the future development area.

PRELIMINARY STORMWATER MANAGEMENT FACILITY CONSIDERATIONS

- **Location** – preliminary locations established based on existing topography and drainage routes, and functional connections to features
- **Size** – to be determined to meet stormwater management objectives
- **Geometry** – there are options (rectangular, greenway, circular etc.) – which will have to consider compatibility with the planning for adjacent land uses
- **Form** – functional considerations (i.e. dry or wet) as well as opportunities to make some spaces multi-functional – particularly where parks, schools and natural areas are adjacent to stormwater management facilities
- **Other complementary considerations:**
 - Extent and size of Low Impact Development Best Management Practices – this may affect community design and street widths
 - Stormwater Management Facility's Overflows – most of the area has inwardly draining systems which will need to have relief overflows
 - Drainage system layout (sewer and overland) – will be influenced by future land use and road patterns
 - Enhanced water quality protection need to include pre-treatment of runoff before being infiltrated, source water protection considerations and salt management imperative

WATER AND WASTEWATER SERVICING

Background

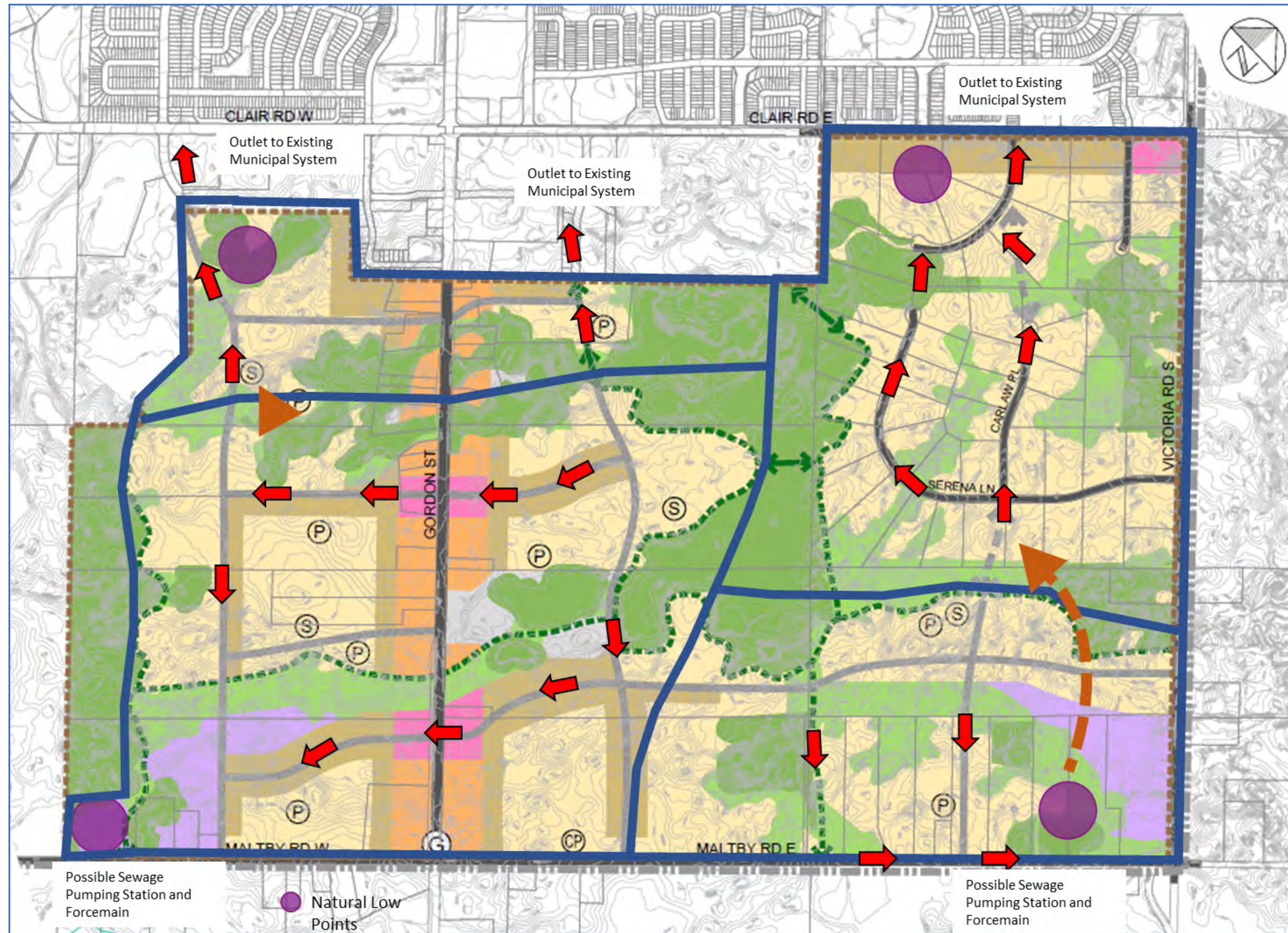
The Clair Maltby Lands Water and Wastewater Servicing will be integrated with the City of Guelph's existing water distribution and wastewater collection systems. As all of the roads in the development will have commercial or residential users, each building will be provided with a water service connection and a sanitary service connection. Site topography is a key consideration governing the integration of the water and wastewater services within the existing City of Guelph System.

Objectives

1. The Clair Maltby Lands will be serviced in accordance with the City of Guelph's Master Planned Infrastructure
2. The City's water distribution network will be expanded with a 300 mm water main on every new road in a fully looped configuration (i.e. with no dead end watermains).
3. The City's wastewater collection system will be expanded such that there is a gravity sewer on every road that collects the wastewater and conveys it to the Guelph wastewater treatment plant.



WASTEWATER COLLECTION



The City's wastewater collection system is accessible in three sub-trunk sewer systems to the North.

The undulating topography of the Clair Maltby lands, presents a challenge in regards to gravity servicing.

Most of the Clair Malby lands naturally drains to low points in the South East and in the South West. It is not possible for all of the proposed lands to be connected to the Guelph system without pumping stations.

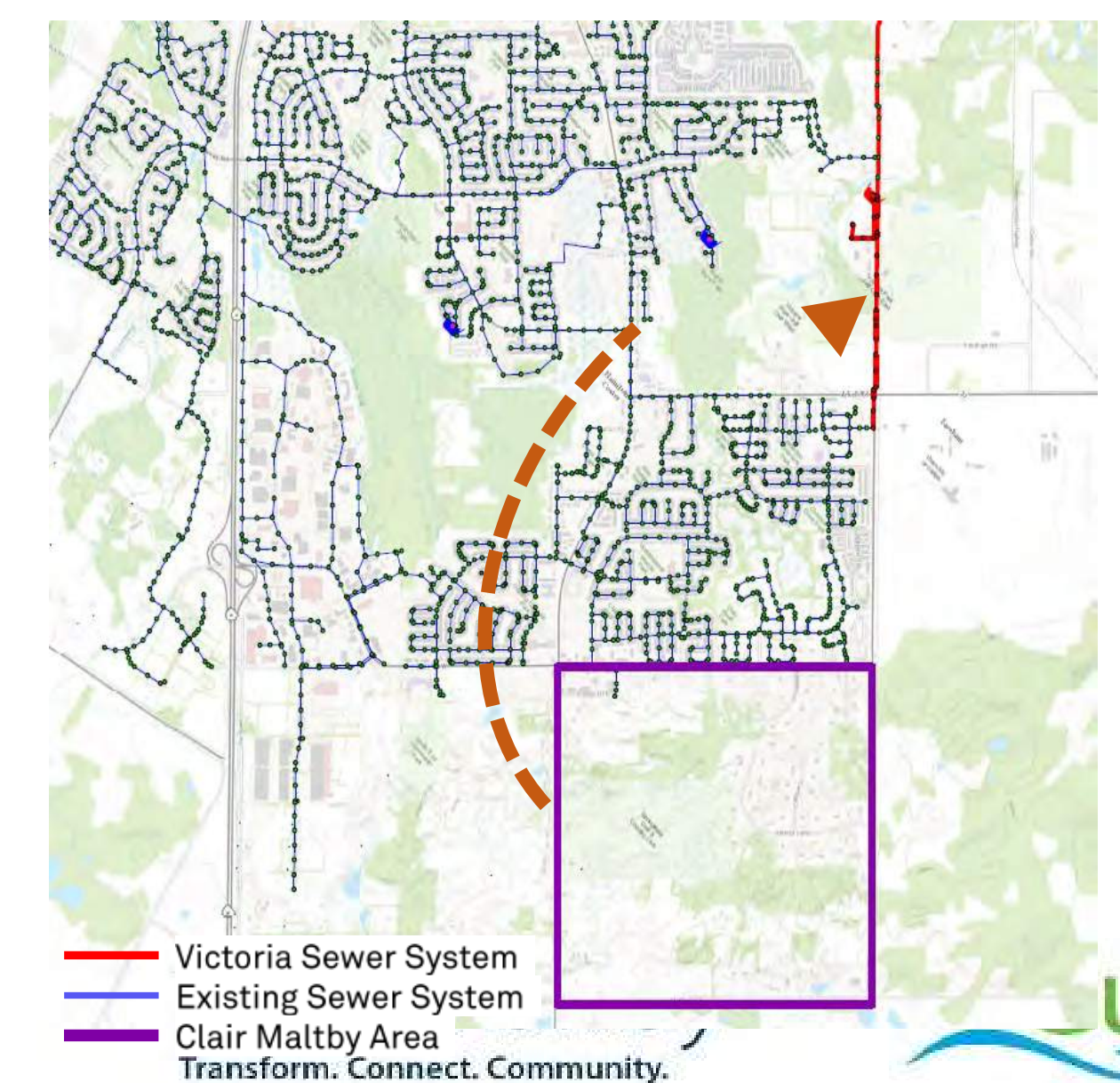
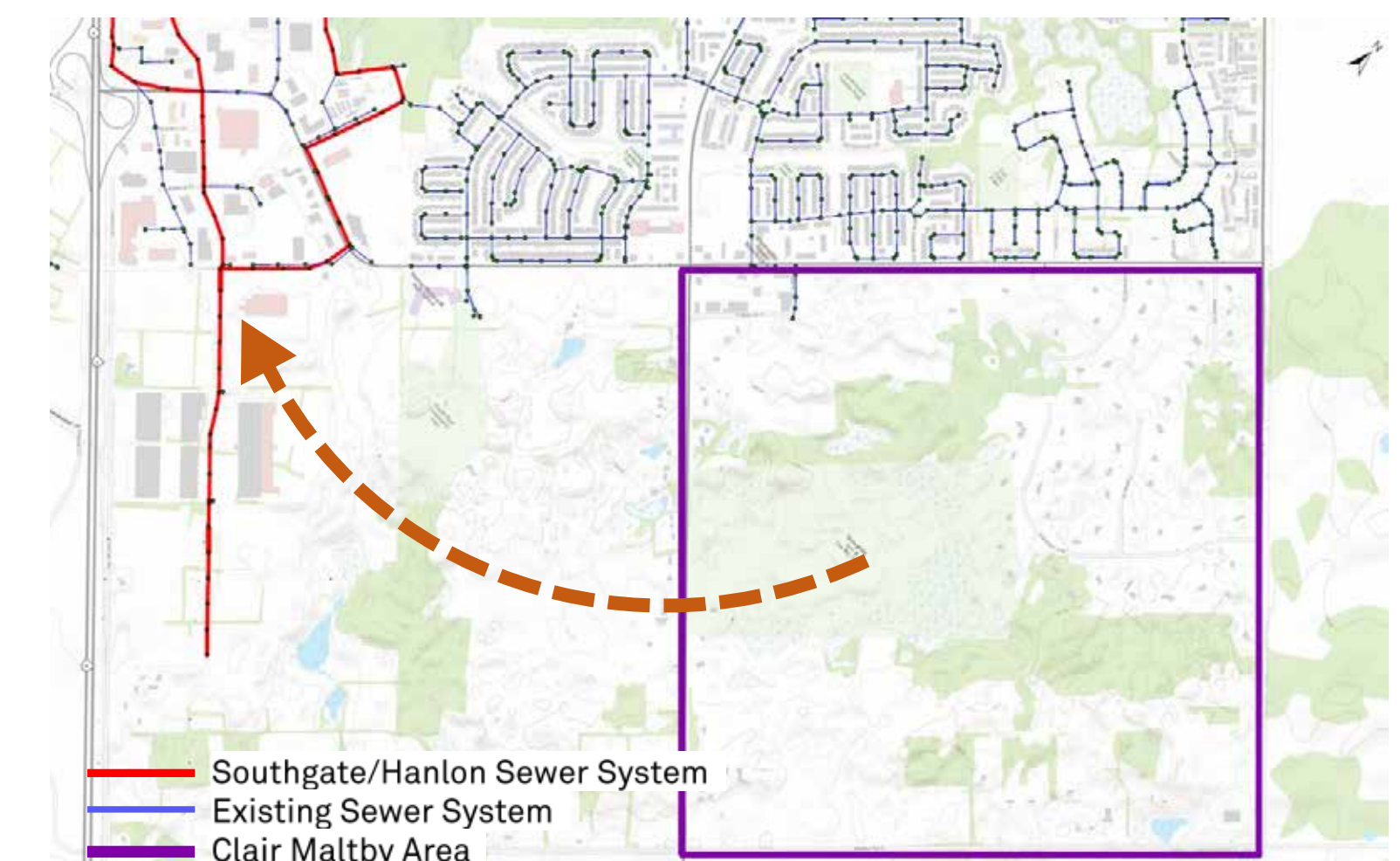
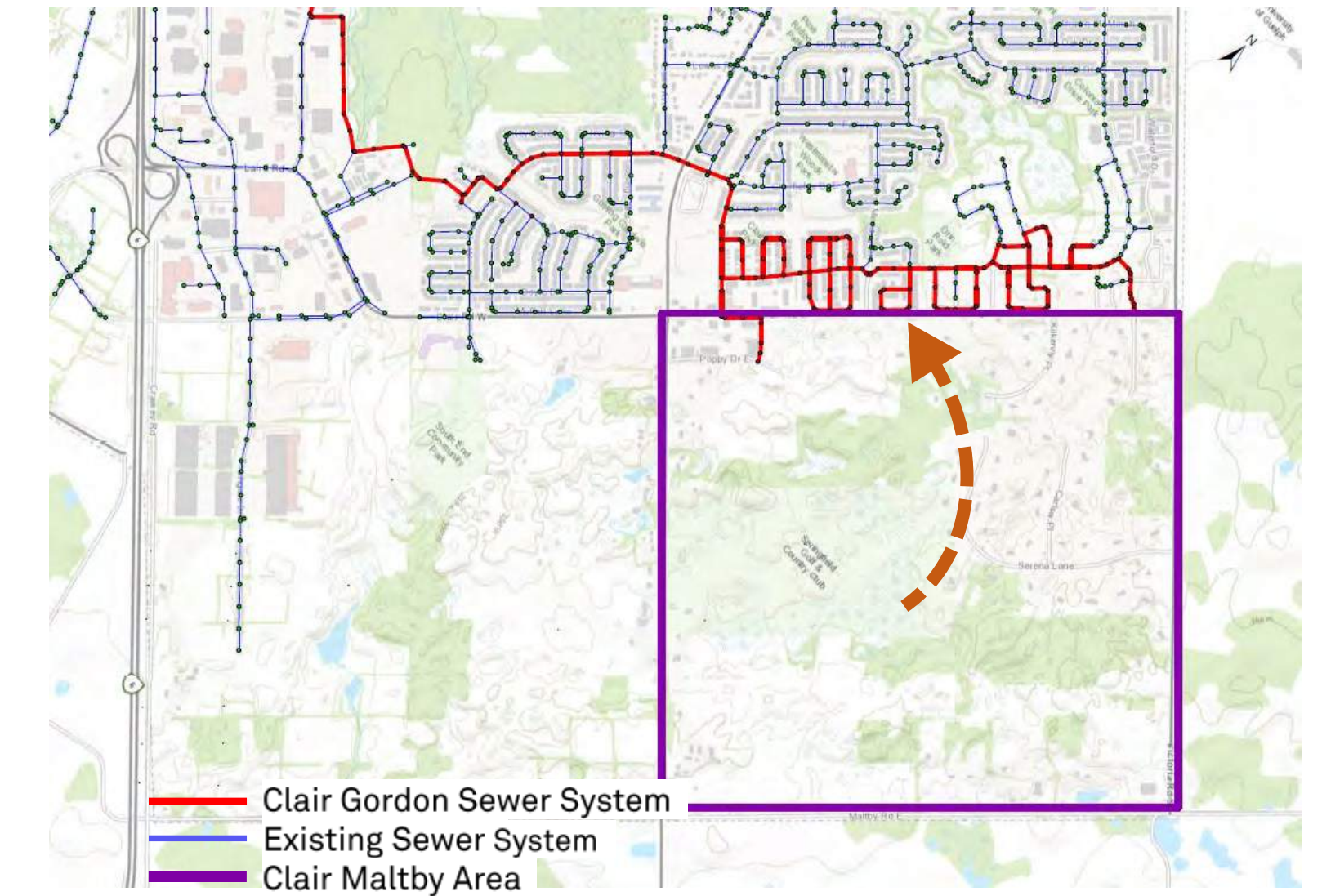
WASTEWATER CONVEYANCE ALTERNATIVES

Alternative Approaches

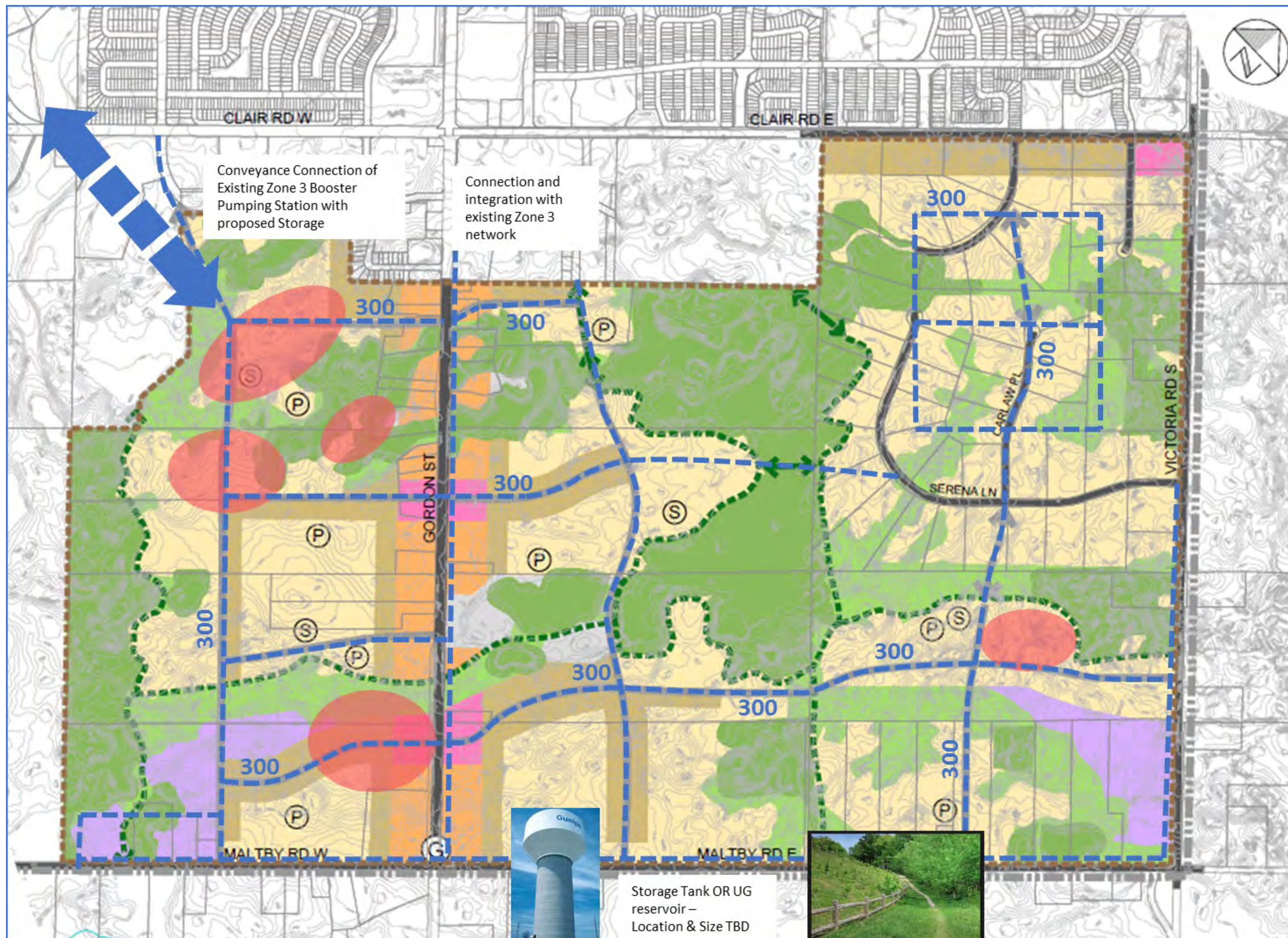
- 1. Do Nothing** *A moratorium on new wastewater collection infrastructure*
- 2. Limit Growth** *Growth is limited to reduce demand and costs of operating and maintaining wastewater infrastructure*
- 3. New Infrastructure – Gravity collection system** – *Areas serviced by gravity only – limited by topography*
- 4. New Infrastructure – Pump Station(s) and forcemain(s)** – *Pumping Stations and forcemains to lift wastewater from areas that are too low to drain by gravity*
- 5. New Infrastructure – Gravity collection system, pump station(s), forcemain(s)**

Alternative System Configurations

- 1. Clair Gordon Trunk System**
 - a. use existing sewers no upgrades
 - b. use existing sewer routes with capacity upgrades
- 2. Southgate / Hanlon Trunk System**
 - a. use existing sewers no upgrades
 - b. use existing sewer routes with capacity upgrades
- 3. Victoria Trunk System**
 - a. use existing sewers no upgrades
 - b. use existing sewer routes with capacity upgrades



WATER DISTRIBUTION



Water distribution is organized in pressure zones that are suitable for lands within a given geodetic elevation range.

The Clair Maltby Lands are higher in elevation than much of the rest of the City. The City's water distribution system is currently being expanded in the South Side of Guelph through a new pressure zone (Zone 3) that will operate at levels that are suitable for the Clair Maltby Lands.

Zone 3 is now live with pumping into the zone, however as demand increases in its service area, it will require storage to meet mandated operating requirements.

The high points within the Clair Maltby Lands are suitable locations for the implementation of elevated storage for the new pressure zone.

WATER DISTRIBUTION ALTERNATIVES

Alternative Approaches

- 1. Do Nothing** *A moratorium on new wastewater collection infrastructure*
- 2. Limit Growth** *Growth is limited to reduce demand and costs of operating and maintaining water infrastructure*
- 3. Service through Development of Zone 3 – New Storage & Transmission System expansion as per Current City – Wide Master Planning Context**

Alternative System Configurations

1. New Storage & Transmission

a. Underground storage – in combination with pumps



b. Elevated Tank Storage – Floating



COMMENTS AND NEXT STEPS

Please provide any additional comments about your vision for the Clair-Maltby area in the space below, using the post-it notes and pencils which have been provided.



Please provide your comments directly on the page using the Post-It Notes provided.

Next Steps:

Charrette Public Meeting 2 - April 5

An overview of the Preferred Community Structure and an opportunity to further refine the vision for Clair-Maltby

Charrette Public Meeting 3 - April 9

A presentation of the final Preferred Community Structure and more detailed information regarding built form, streets, blocks, and the open space system.

Following the charrette, the Preferred Community Structure will go to City Council for approval in June 2018.



WELCOME

Thank you for attending tonight's Public Workshop.

Your feedback is important to us and will help in evaluating the Community Structure Alternatives.

- | | | |
|---|---------------------------------------|----------------|
| 1 | View Display Boards | 6:00 - 7:00 pm |
| 2 | Presentation | 7:00 - 7:30pm |
| 3 | Workshop - Evaluation of Alternatives | 7:30 - 8:30 pm |
| 4 | Report Back & Next Steps | 8:30 - 9:00 pm |

Contact Us

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Senior Policy Planner
Planning, Urban Design and Building Services
stacey.laughlin@guelph.ca

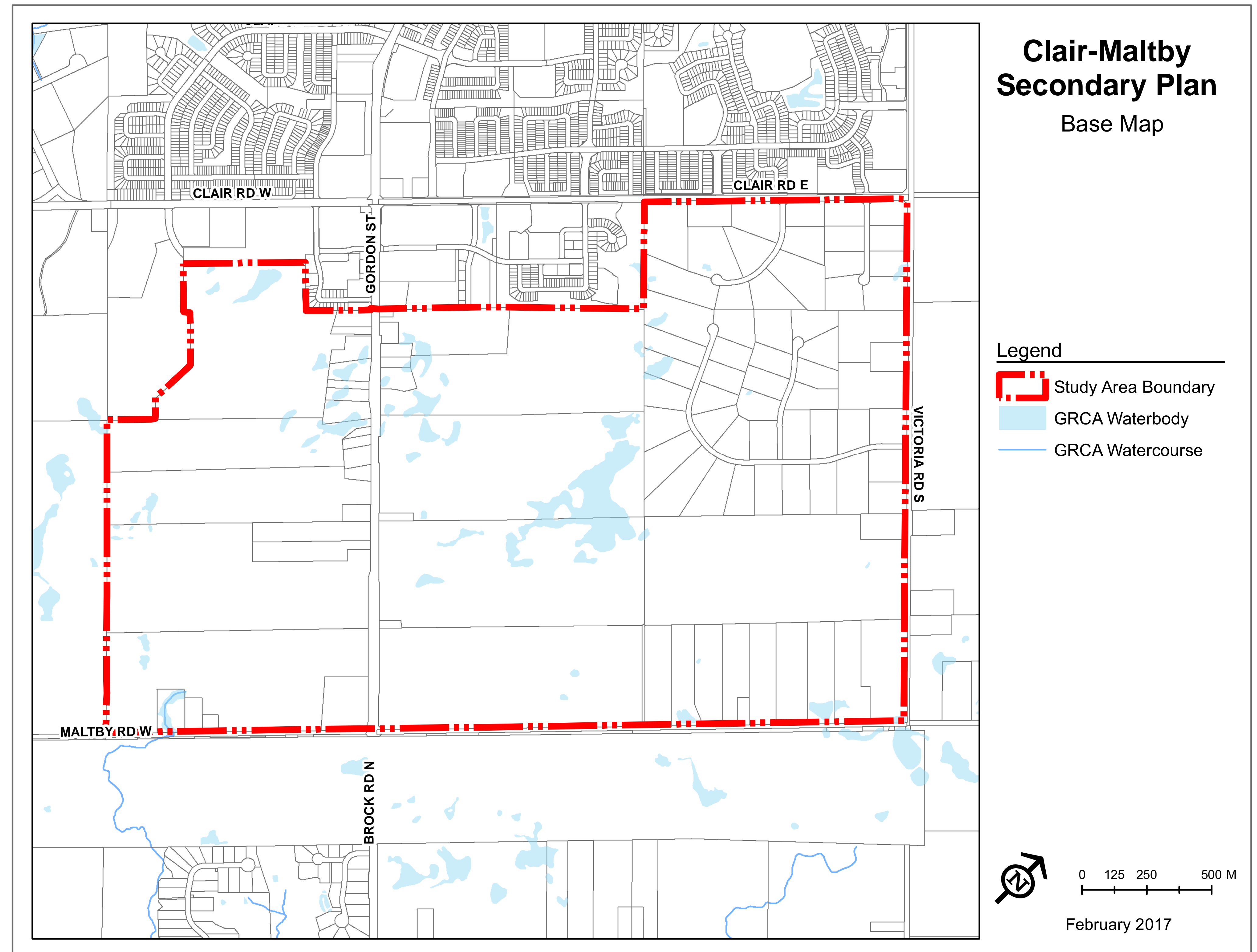
Arun Hindupur, M.Sc., P.Eng.
Supervisor, Infrastructure Engineering
Engineering and Capital Infrastructure Services
arun.hindupur@guelph.ca

THE SECONDARY PLAN

The Clair-Maltby Secondary Plan (CMSP) and Master Environmental Servicing Plan (MESP) process provides an integrated approach to advance the development of the CMSP Area.

The approach integrates land use, environment, transportation and servicing studies/plans to guide the Secondary Plan.

The Secondary Plan Area is bounded by Clair Road, Victoria Road South, Maltby Road, and Poppy Drive.



STUDY PURPOSE AND SCHEDULE

Clair-Maltby is the last unplanned greenfield area within the city. The City of Guelph is undertaking the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to establish a plan for future development in the area.

The Clair-Maltby Secondary Plan and the MESP are being developed simultaneously to provide an integrated planning approach within the Study Area. Comments from our community engagement sessions will be analyzed alongside land use, environment, mobility and servicing studies for a comprehensive review of the Clair-Maltby Secondary Plan Area and its needs.

Your input will provide critical guidance for the preferred community structure, which will be developed through the design charrette.



THE CHARENTE

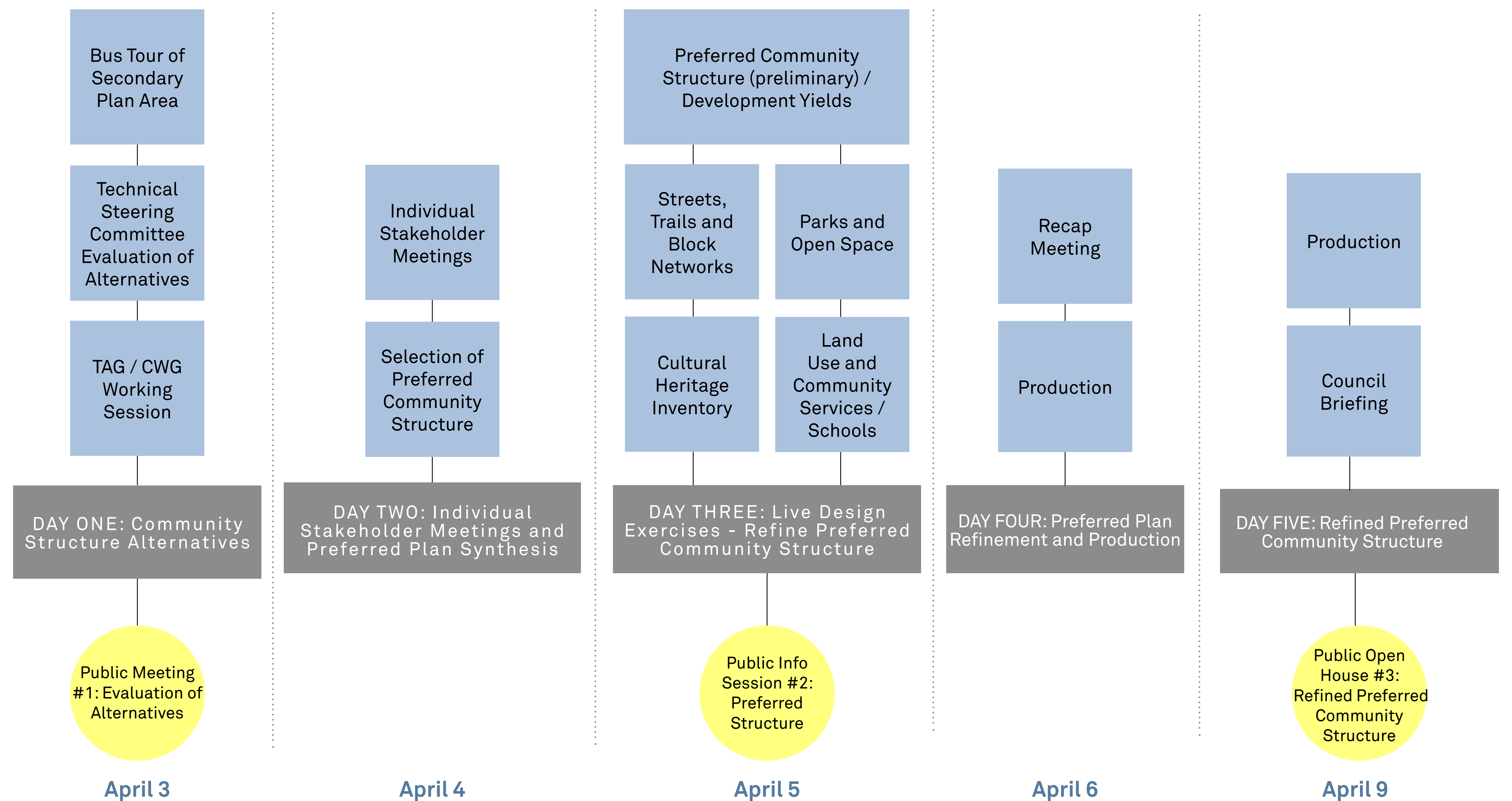
A charrette is an intensive, multi-disciplinary workshop with the aim of developing a design or vision for a project or planning activity. Charrettes are often conducted to design such things as parks and buildings, or to plan communities or transportation systems.

The purpose of the charrette is to create an implementable Preferred Community Structure for the Secondary Plan Area that reflects good planning and the input from the community and stakeholders.

As part of the charrette process potential versions of all elements required for the Preferred Community Structure including environment, mobility, urban design and servicing will be considered.

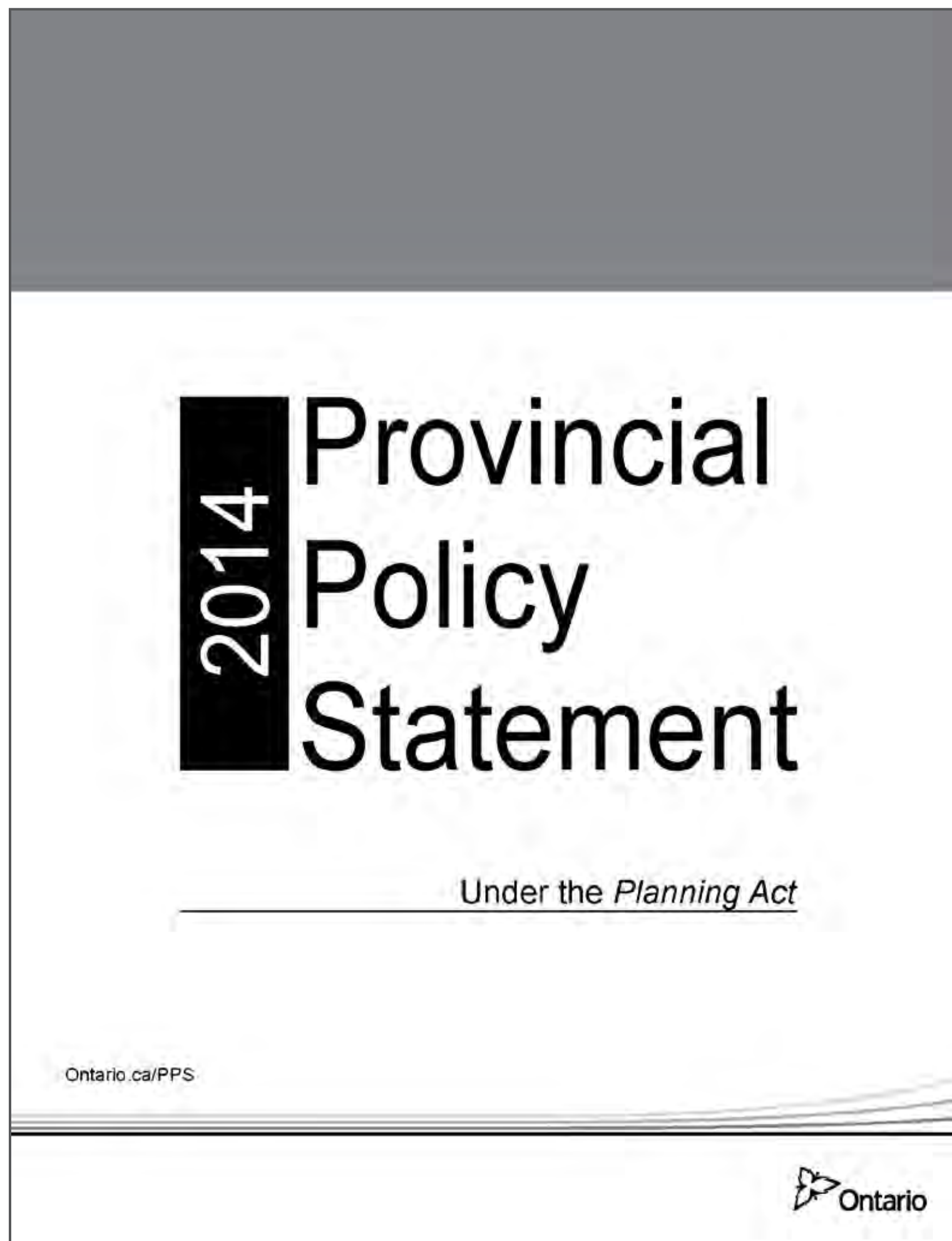
The charrette will be a collaborative 5-day exercise focused on creating an implementable solution.

DESIGN CHARRETTE OVERVIEW



GUIDING DOCUMENTS

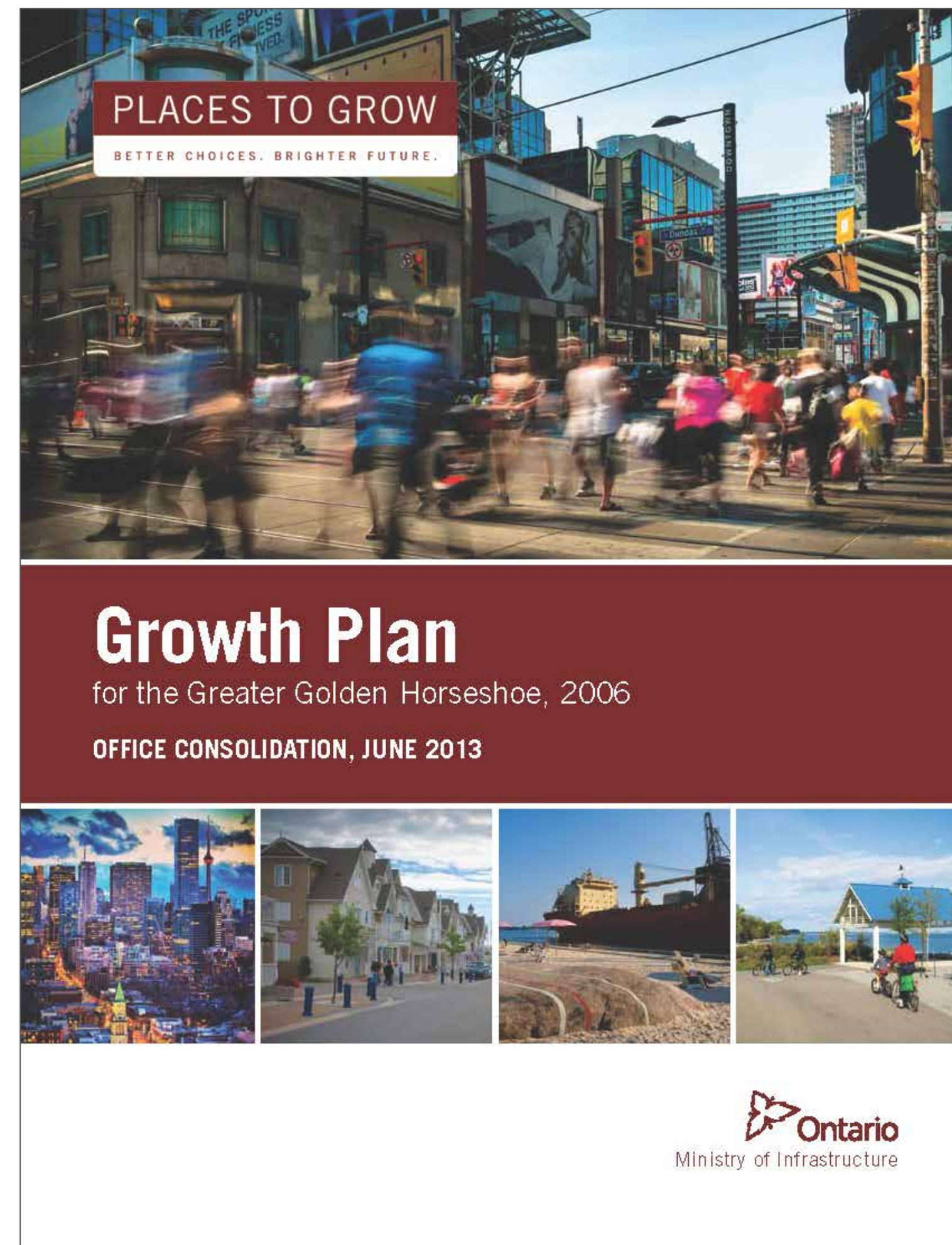
Provincial Policy Statement (PPS)



Relevant themes include:

- Creating strong, livable and healthy communities;
- Protecting the environment, public health and safety; and
- Facilitating economic growth.

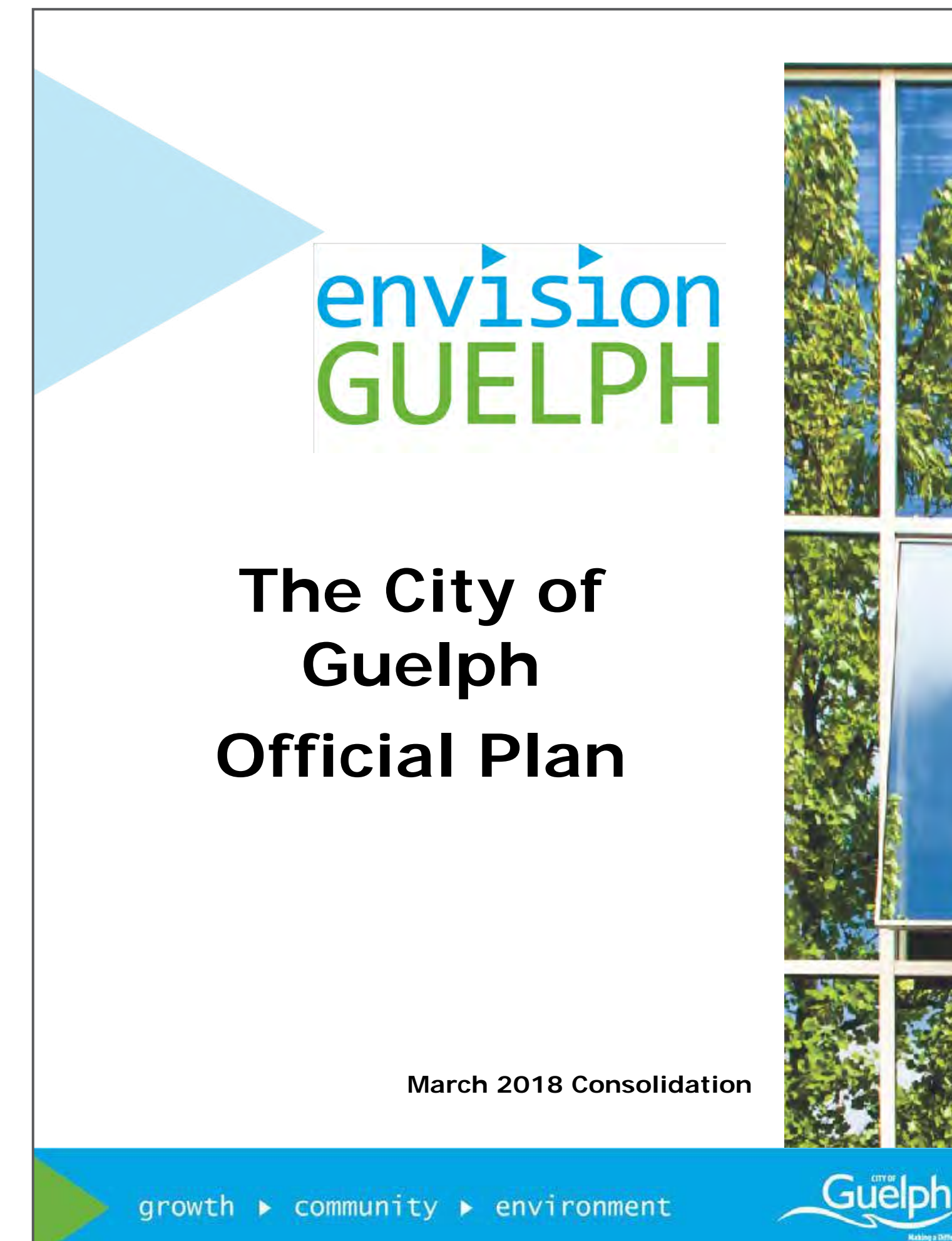
Places to Grow: Growth Plan for the Greater Golden Horseshoe



Relevant themes include:

- Growth management directions;
- Greenfield residential targets; and
- People/jobs density targets.

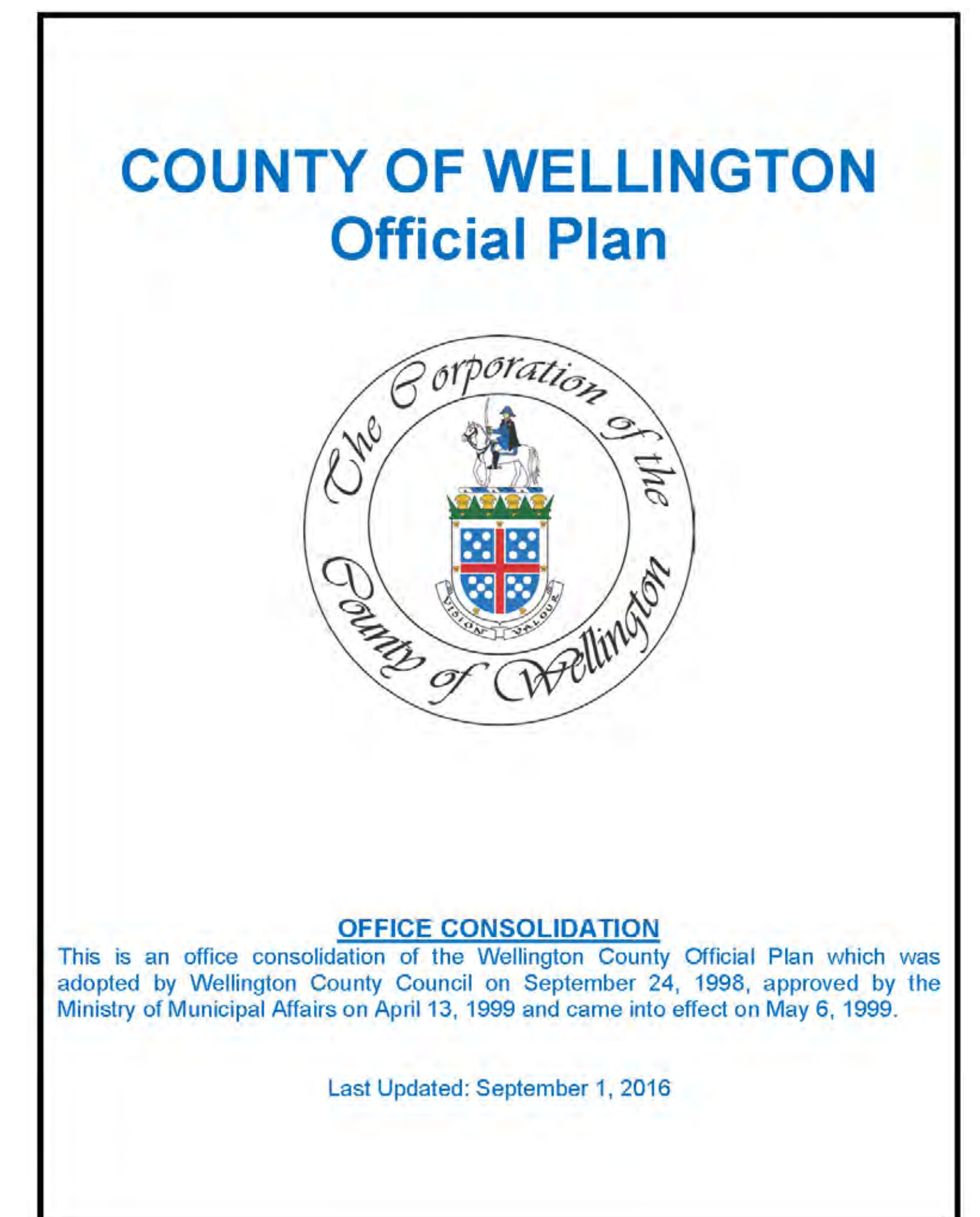
City of Guelph Official Plan



Relevant themes include:

- Complete communities;
- Protection of the Natural Heritage System;
- Multimodal transportation system;
- Environmental and built form sustainability;
- Varied and affordable housing types; and
- Conservation of built and cultural heritage and archaeological resources.

Wellington County Official Plan (relevant to adjacent lands)

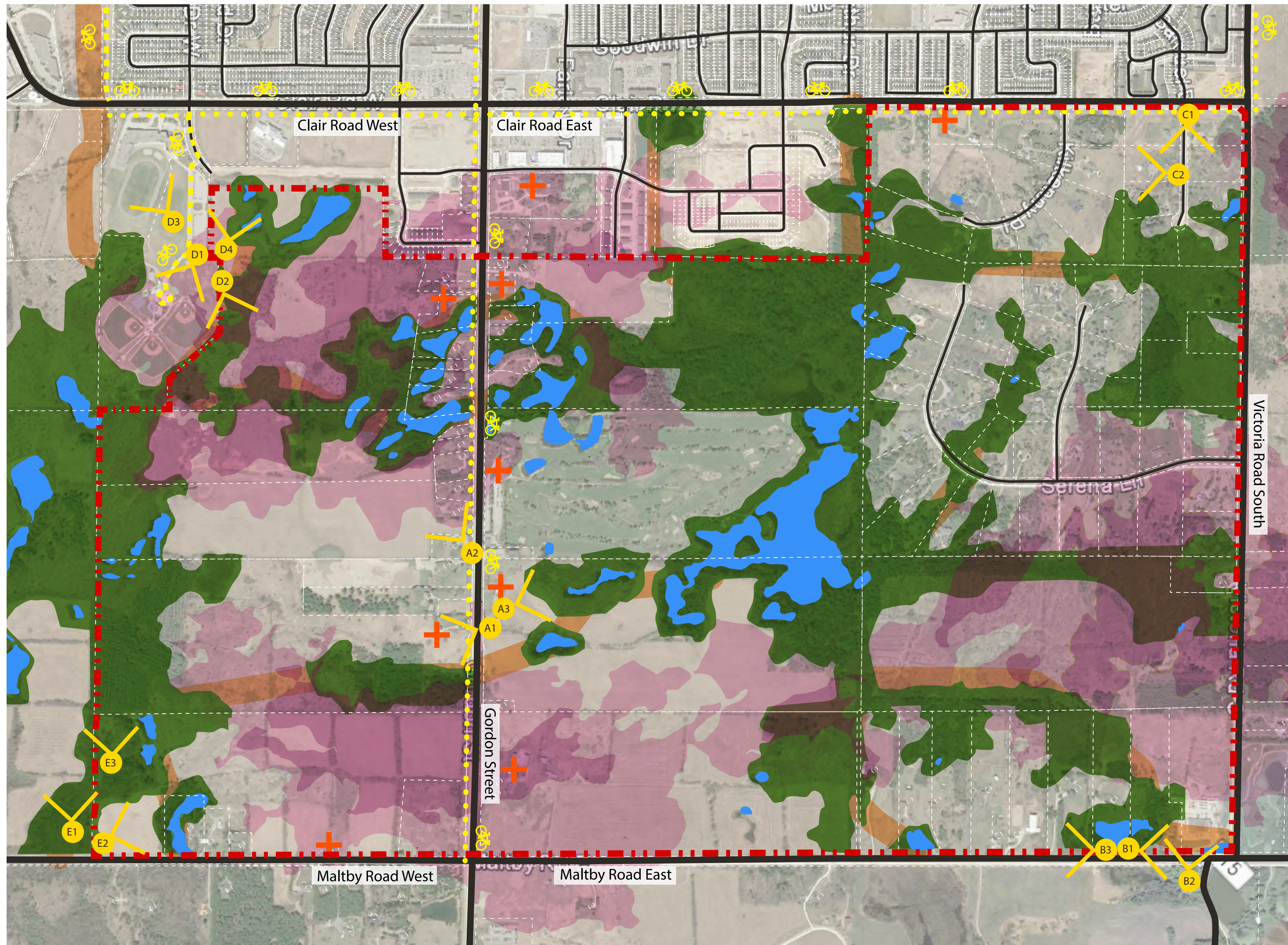


Relevant themes include:

- Land use designations and policies;
- Gordon Street Extension; and
- Significant Drinking Water Threat policies.

EXISTING CONDITIONS

Existing Conditions Map



Central Views



South East Views



North East Views



North West Views



South West Views



Legend

- Existing Roads
- Paris Moraine
- Clair Maltby Secondary Plan Boundary
- Natural Heritage System
 - Significant Natural Areas and Natural Areas
 - Ecological Linkages
 - Water Bodies
- Bike Lanes
 - Bike Lane or Paved Shoulders
 - Off Road Bike Route
- ✚ Built Heritage Resources
- ✚ Drone Views

VISION AND GUIDING PRINCIPLES

Vision:

Clair-Maltby will be a vibrant, urban community that is integrated with Guelph's southern neighbourhoods, as well as having strong connections to Downtown, employment areas and the rest of the City.

The Natural Heritage System and the Paris Moraine provide the framework for the balanced development of interconnected and sustainable neighbourhoods.

This area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents.

A system of parks, open spaces and trails will be interwoven throughout to provide opportunities for active and passive recreation.

Guiding Principles:



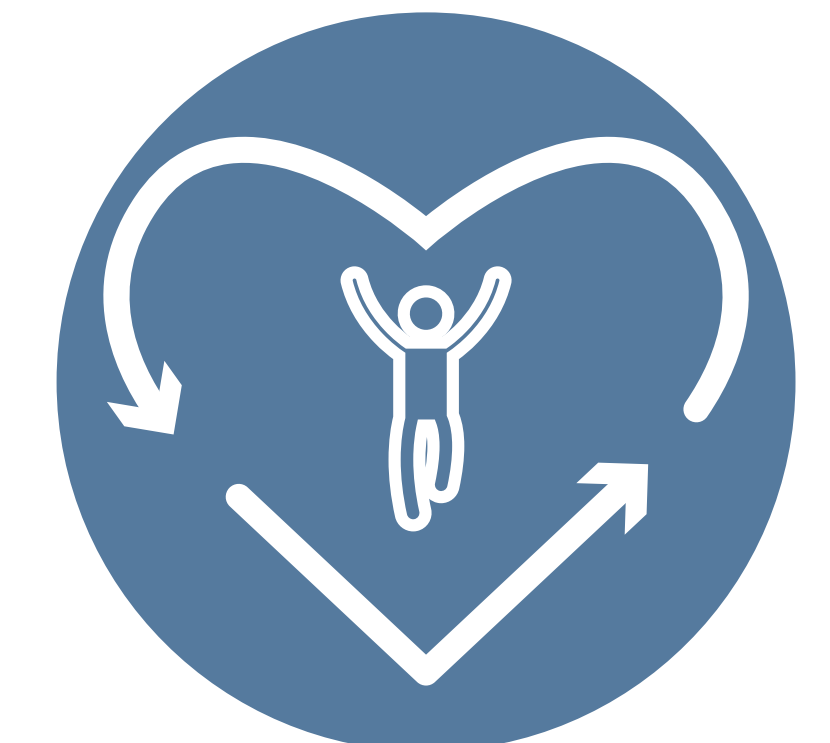
Vibrant and Urban

Create identifiable urban neighbourhoods that are pedestrian oriented and human-scaled.
Promote forward-thinking and innovative design that integrates new development into the rolling topography, while conserving significant cultural heritage resources.



Green and Resilient

Protect, maintain, restore, and where possible, improve water resources and the Natural Heritage System.
Support resiliency and environmental sustainability through measures such as energy efficiency, water conservation and green infrastructure.



Healthy and Sustainable

Design the community for healthy, active living.
Provide a mix of land uses including a diversity of housing choices at appropriate densities with appropriate municipal services to ensure long-term sustainable development which is fiscally responsible.



Interconnected and Interwoven

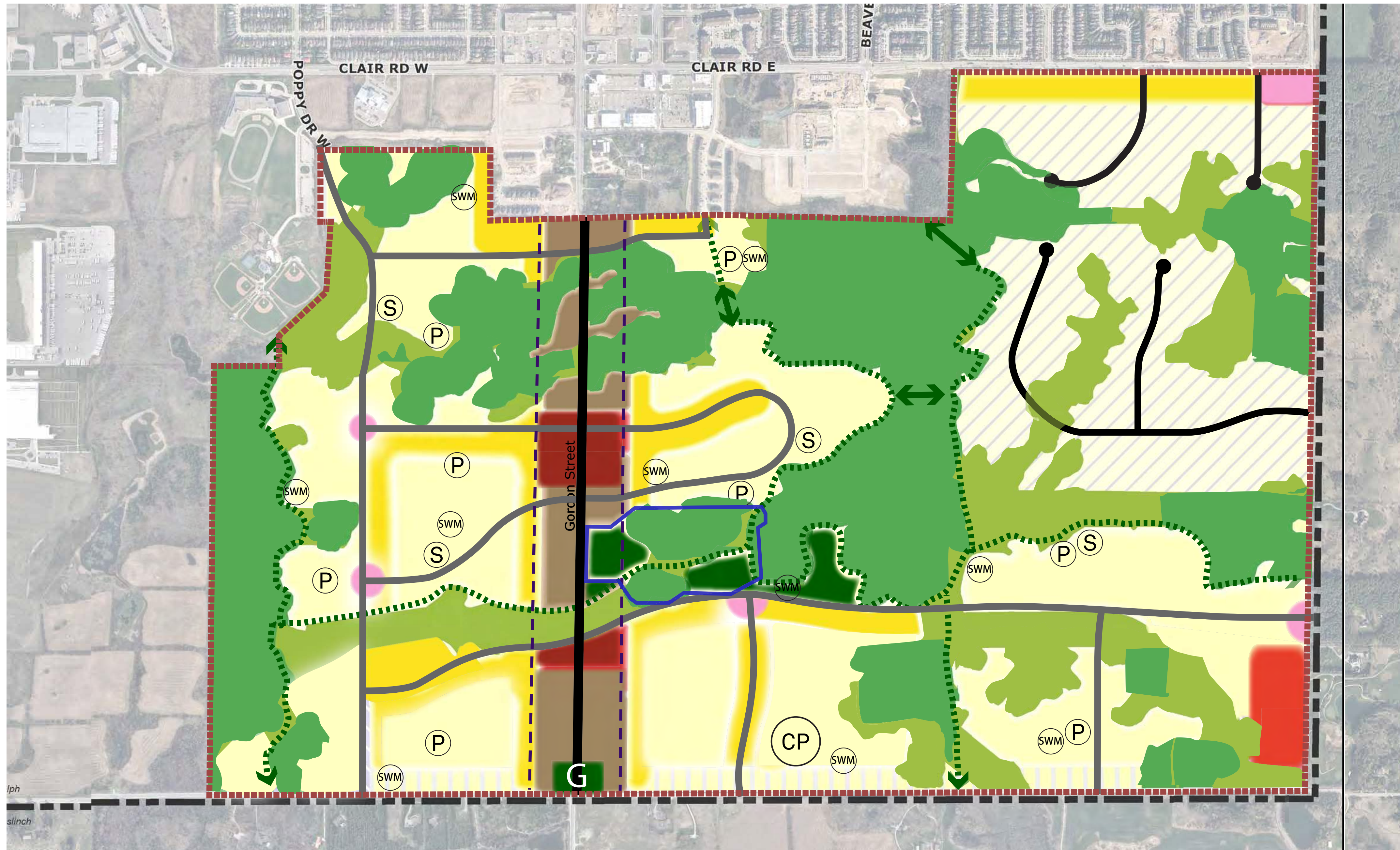
Establish a multi-modal mobility network that provides choice and connects neighbourhoods to each other and the rest of the City.
Create a network of parks, open spaces and trails to provide opportunities for active and passive recreation, as well as active transportation choices.



Balanced and Liveable

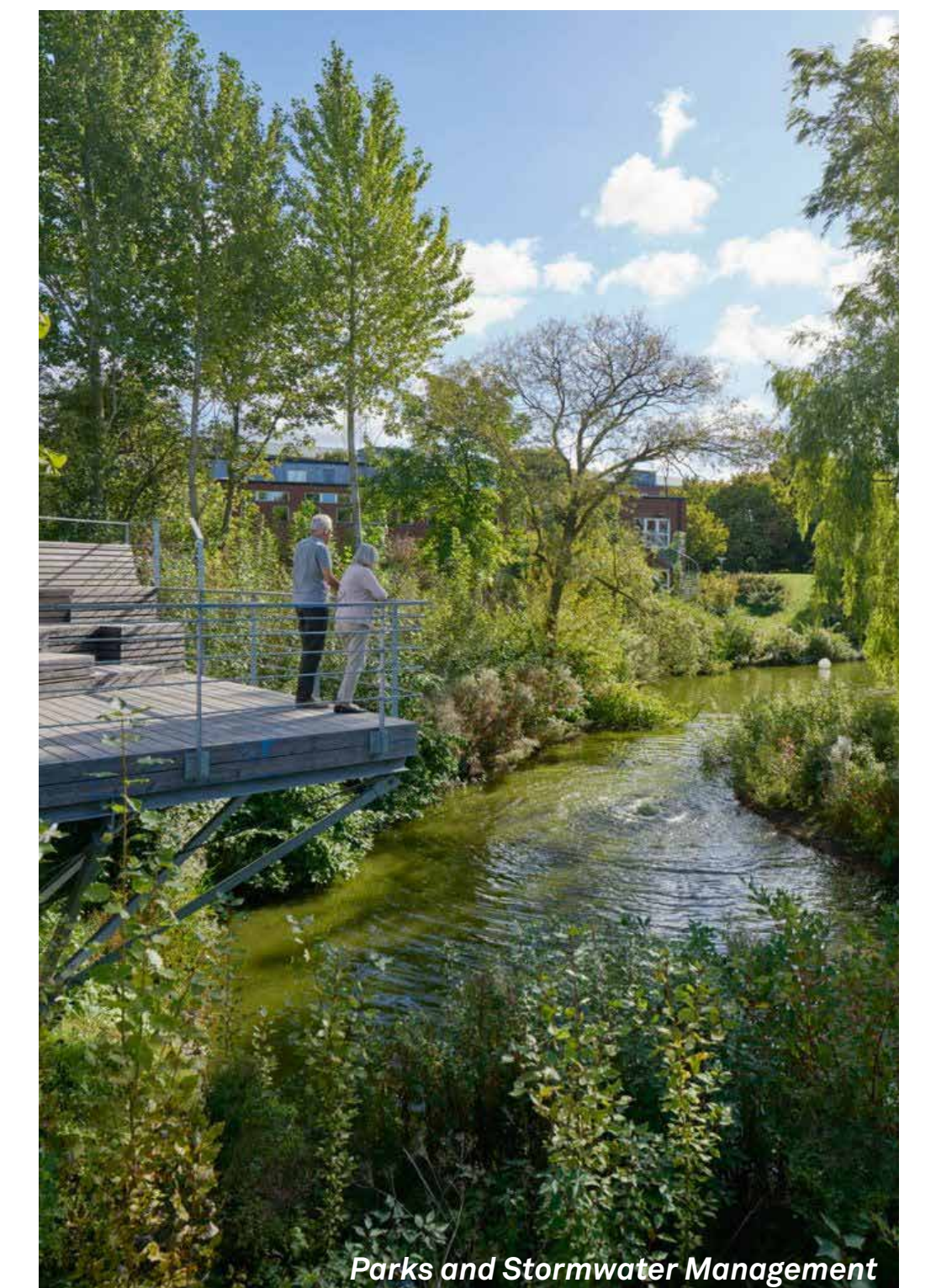
A valued and livable community which reflects the right balance between protecting the environment and fostering a healthy, equitable and complete community.

ALTERNATIVE 1: FEATURING THE GREEN

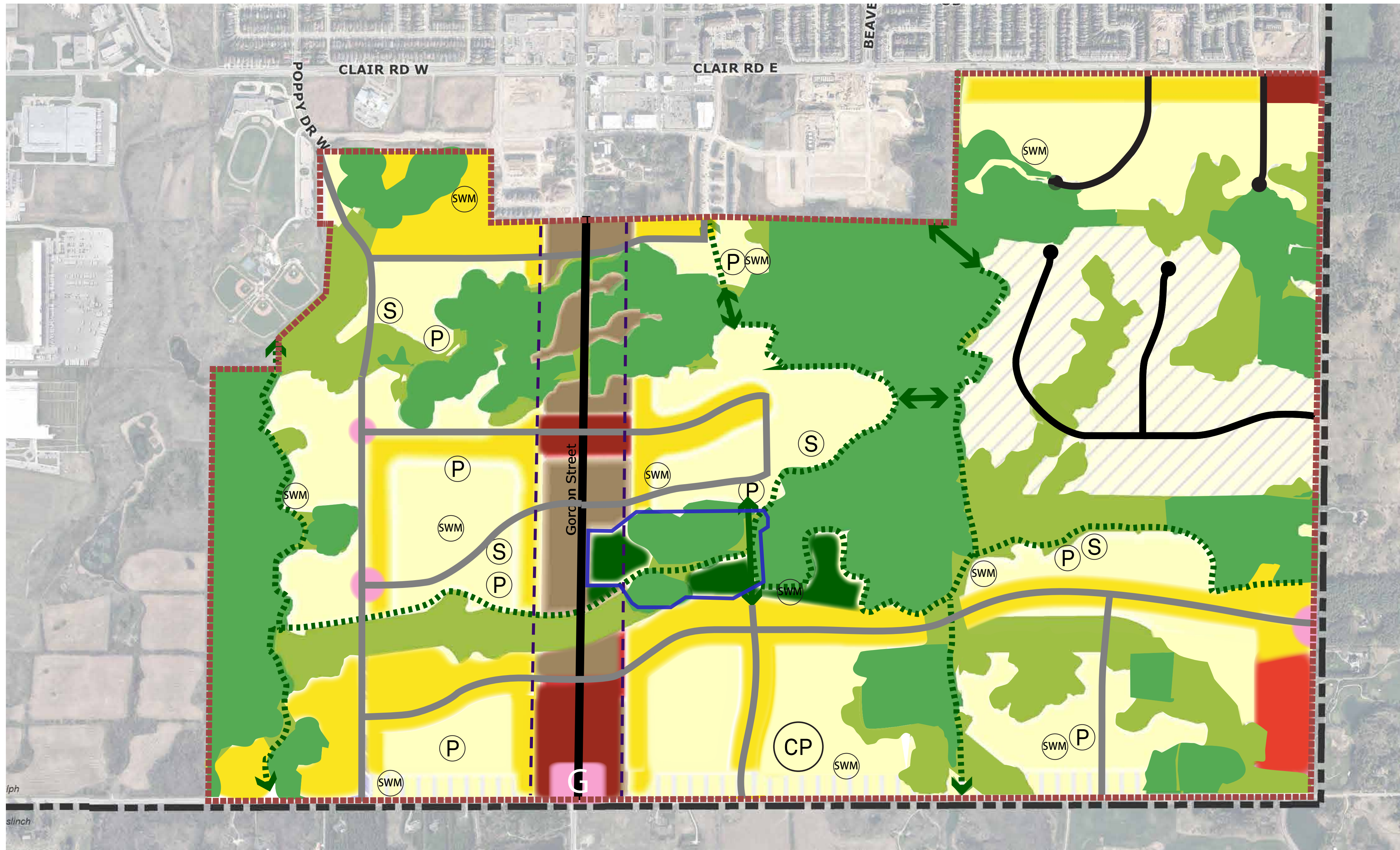


LEGEND

Clair-Maltby Secondary Plan Boundary	Existing Street Network	Neighbourhood Park	Natural Heritage System:	Low Density (Residential)	Neighbourhood Commercial
Cultural Heritage Landscape	Proposed Street and Cycling Network	Community Park	May Permit Essential Transportation Infrastructure	Medium Density (Residential)	Service Commercial
Urban-Rural Transition Zone	Proposed Trail Network	Elementary School	Does Not Permit Transportation Infrastructure	High Density (Residential)	Rolling Hills Residential
Gordon St. Corridor	Potential Active Transportation Link	Stormwater Management	Gateway	Mixed Use	Open Space



ALTERNATIVE 2: FOCUS ON COMMUNITY SERVICES

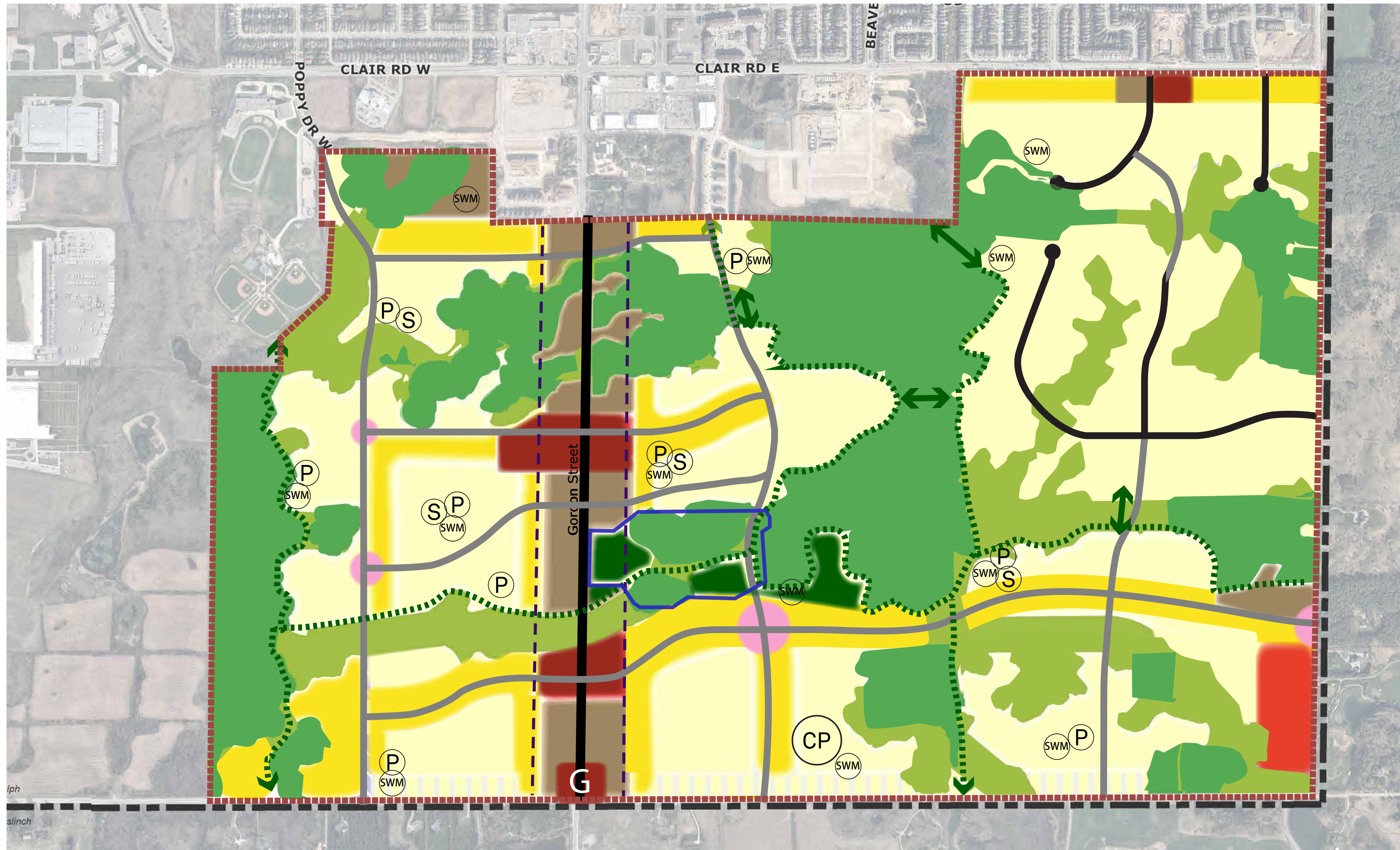


LEGEND

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ALTERNATIVE 3: URBAN AND CONNECTED



LEGEND

- ▬▬▬ Clair-Maltby Secondary Plan Boundary
- ▬ Cultural Heritage Landscape
- ▬ Urban-Rural Transition Zone
- ▬ Gordon St. Corridor

- ▬ Existing Street Network
- ▬ Proposed Street and Cycling Network
- ▬ Proposed Trail Network
- ↔ Potential Active Transportation Link

- (P) Neighbourhood Park
- (CP) Community Park
- (S) Elementary School
- (SWM) Stormwater Management
- (G) Gateway

- Natural Heritage System:
- ▬ May Permit Essential Transportation Infrastructure
 - ▬ Does Not Permit Transportation Infrastructure

- Land Use:
- ▬ Low Density (Residential)
 - ▬ Medium Density (Residential)
 - ▬ High Density (Residential)
 - ▬ Mixed Use

- ▬ Neighbourhood Commercial
- ▬ Service Commercial
- ▬ Rolling Hills Residential
- ▬ Open Space



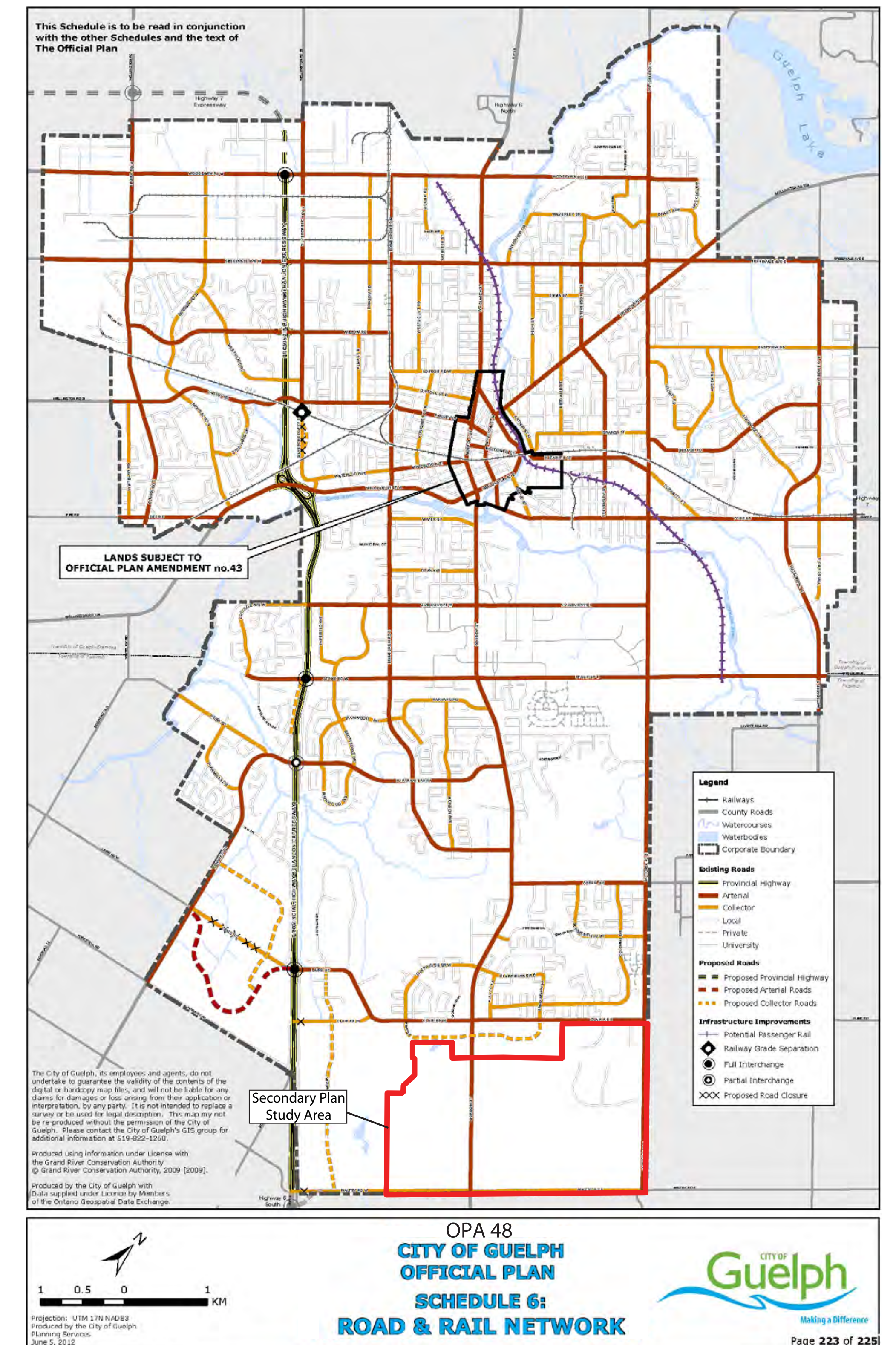
GUELPH WELLINGTON TRANSPORTATION STUDY

Key Improvements in Secondary Plan Area:

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- Widening of Clair Road from 2 to 4 lanes (approved 2003 EA) - COMPLETE
- Southerly extension of Southgate Drive to Maltby Road; and
- Development of an internal collector road system within the Clair-Maltby Secondary Plan area connecting to Gordon Street and Maltby Road

Other Key Studies Informing the Transportation Network:

- Guelph Active Transportation Network Study
- Bicycle Friendly Guelph: Cycling Master Plan
- Guelph Transit, Transit Growth Strategy and Plan
- Guelph Trails Master Plan
- Wellington County Active Transportation Plan
- Various Environmental Assessments (i.e. Gordon Street, Victoria Road)



TRANSPORTATION NETWORK CONSIDERATIONS

Existing Travel Behaviour

TABLE 3 SOUTH GUELPH AREA:
PEAK PERIOD TRIP DISTRIBUTION BY TRAVEL MODE

Destination Area	Proportion of All Trips	Mode Split	Legend
Local Area ¹	50%		Travel Mode
Rest of Guelph (7% Downtown)	26%		
Halton / Peel Regions	7%		
Waterloo Region	7%		
City of Toronto	3%		

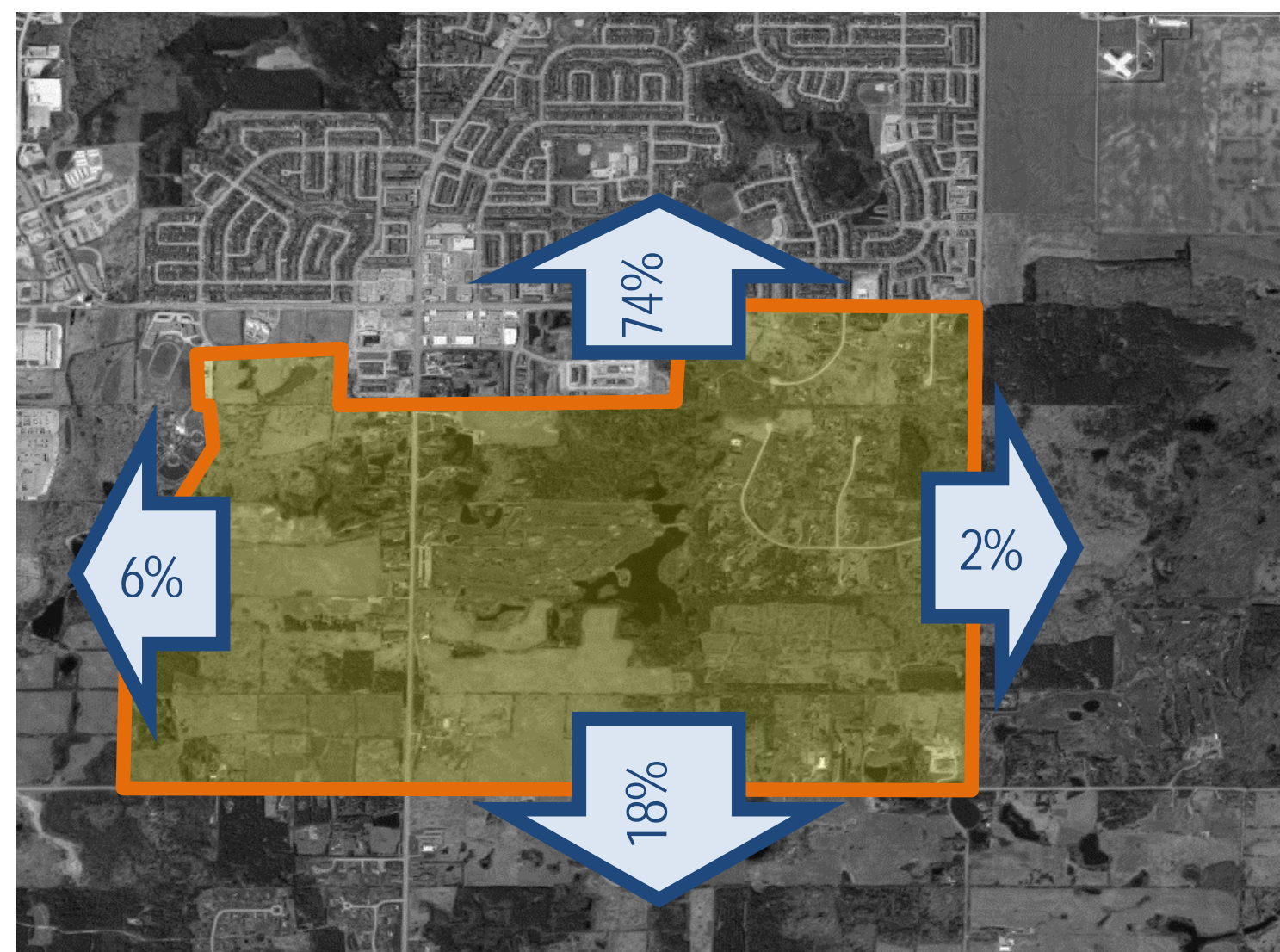
Note:
1. "Local area" consists of areas within the City of Guelph south of the Eramosa River.
2. Another 7% of trips are oriented to "other" areas in the region, including Wellington County, City of Hamilton, etc.

Travel Orientation and Primary Travel Mode

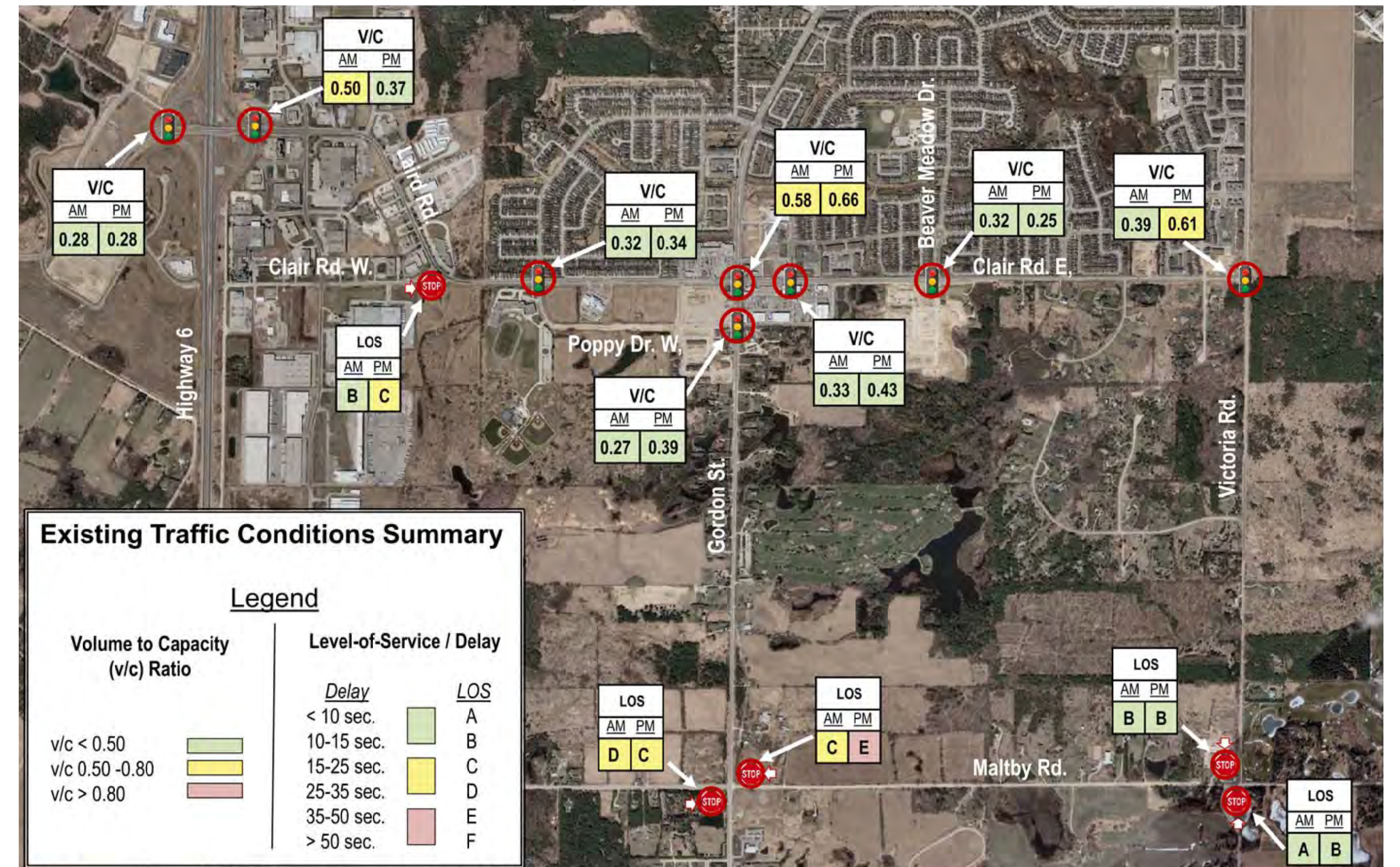
- Approx. 75% of trips stay within the City of Guelph.
- Most trips are undertaken in a private vehicle (86% of trips in Guelph; 88% overall).

General Traffic Distribution

- Approx. 75% of local area traffic volumes are anticipated to be oriented north of the study area.



Existing Traffic Conditions



Existing Weekday Peak Hour Area Traffic Operations

- Acceptable traffic operations at area signalized intersections under existing conditions.
- Gordon Street / Clair Road intersection can be busy during peak travel periods under existing conditions.
- Eastbound and westbound movements at Gordon Street / Maltby Road can experience longer delays.
- Other unsignalized intersections operate acceptably under existing conditions.

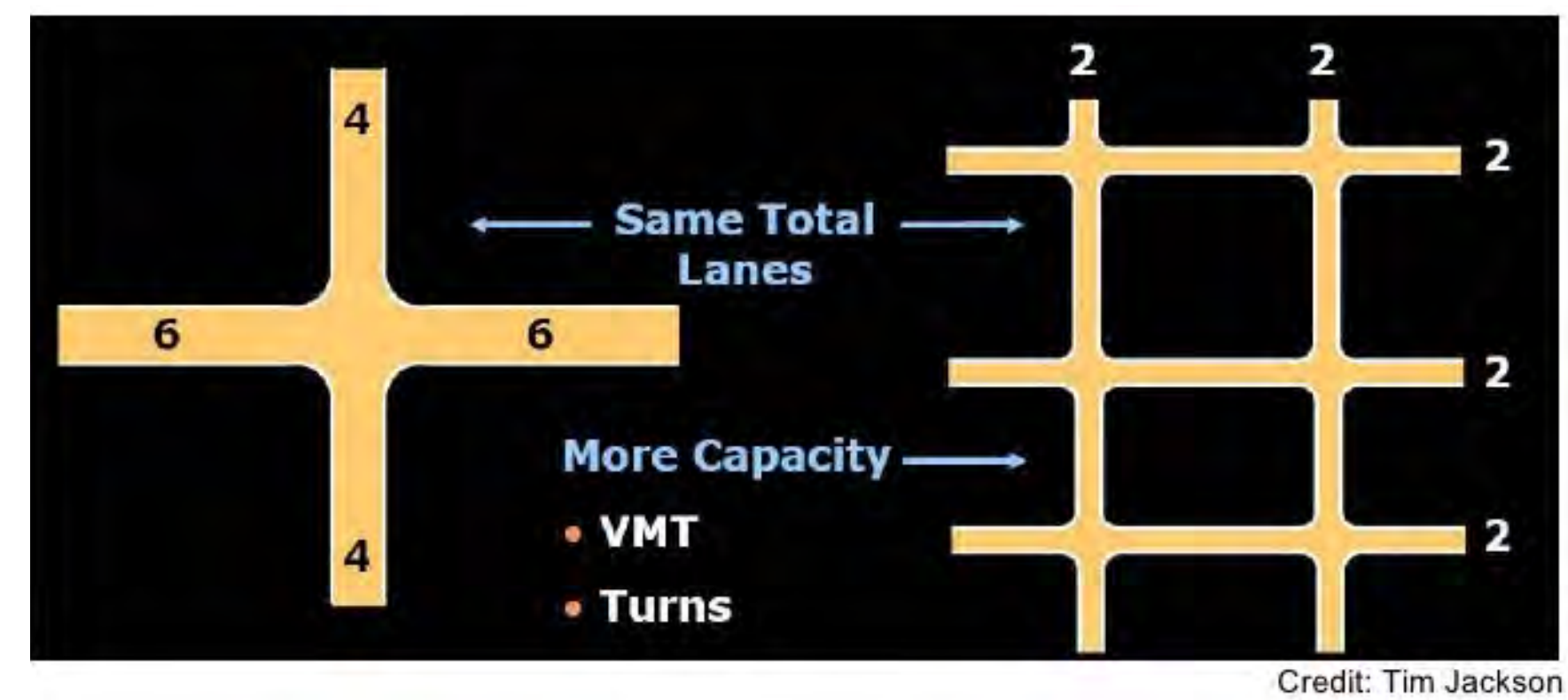
TRANSPORTATION NETWORK CONSIDERATIONS

Principles of Transportation Network:

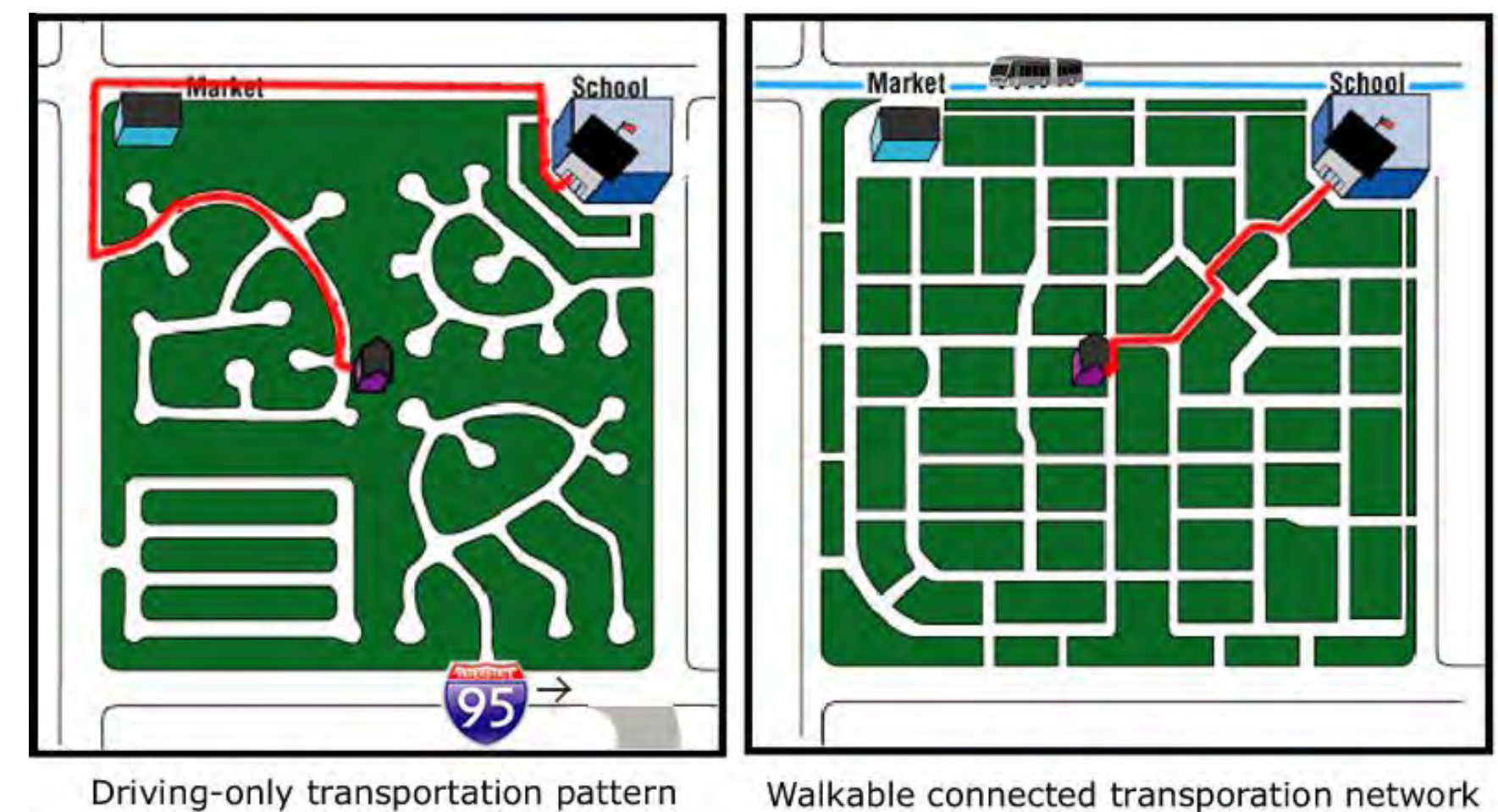
1. Provide flexibility, redundancy, and continuity;
2. Support transit service operations;
3. Support multi-modal transportation;
4. Enhance connectivity for all travel modes;
5. Provide robust and frequent connectivity internal to the neighbourhood, and to adjacent neighbourhoods; and
6. Respect natural heritage features.

Some Benefits of a Well-Planned Street Network:

1. Street capacity



2. Walkability

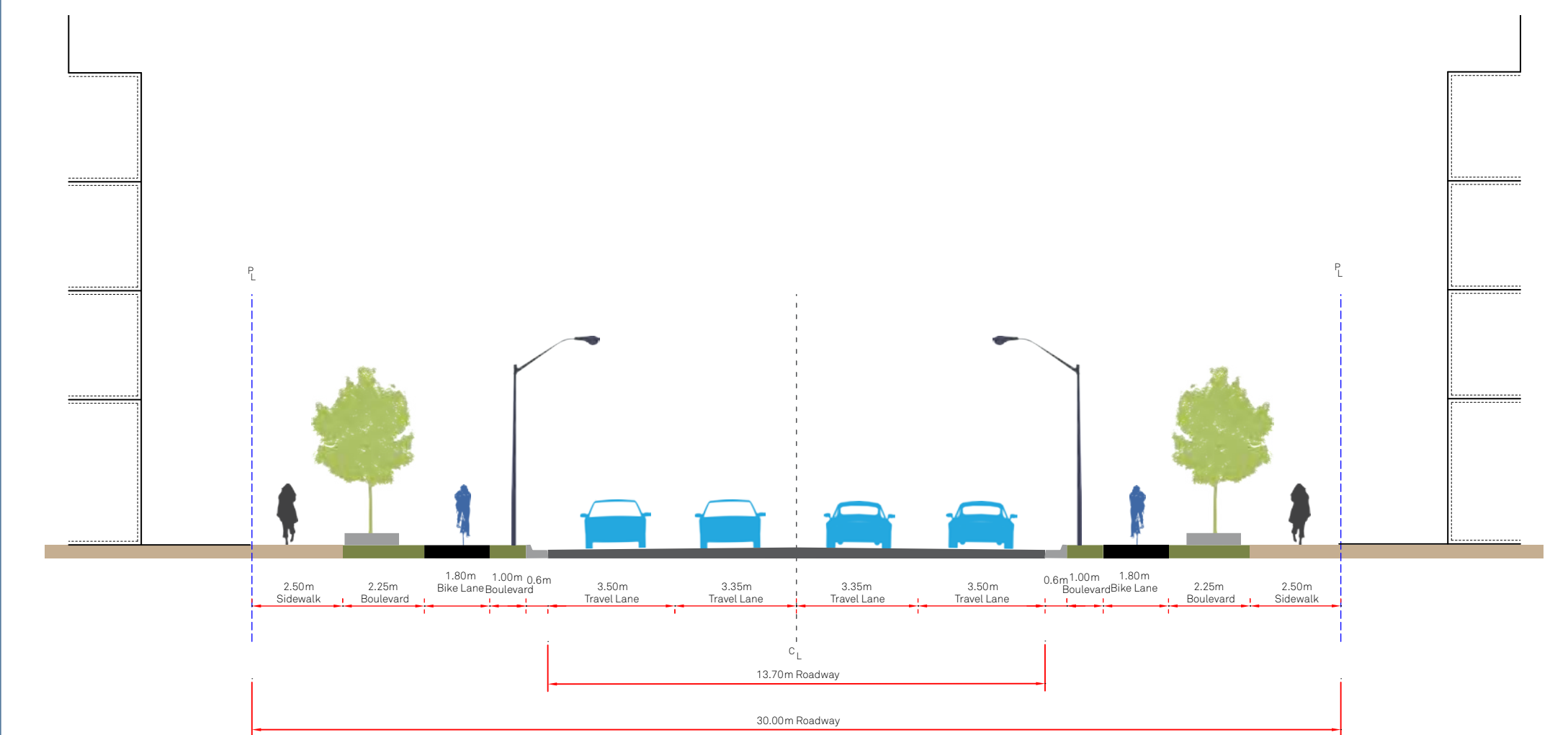


3. Safety

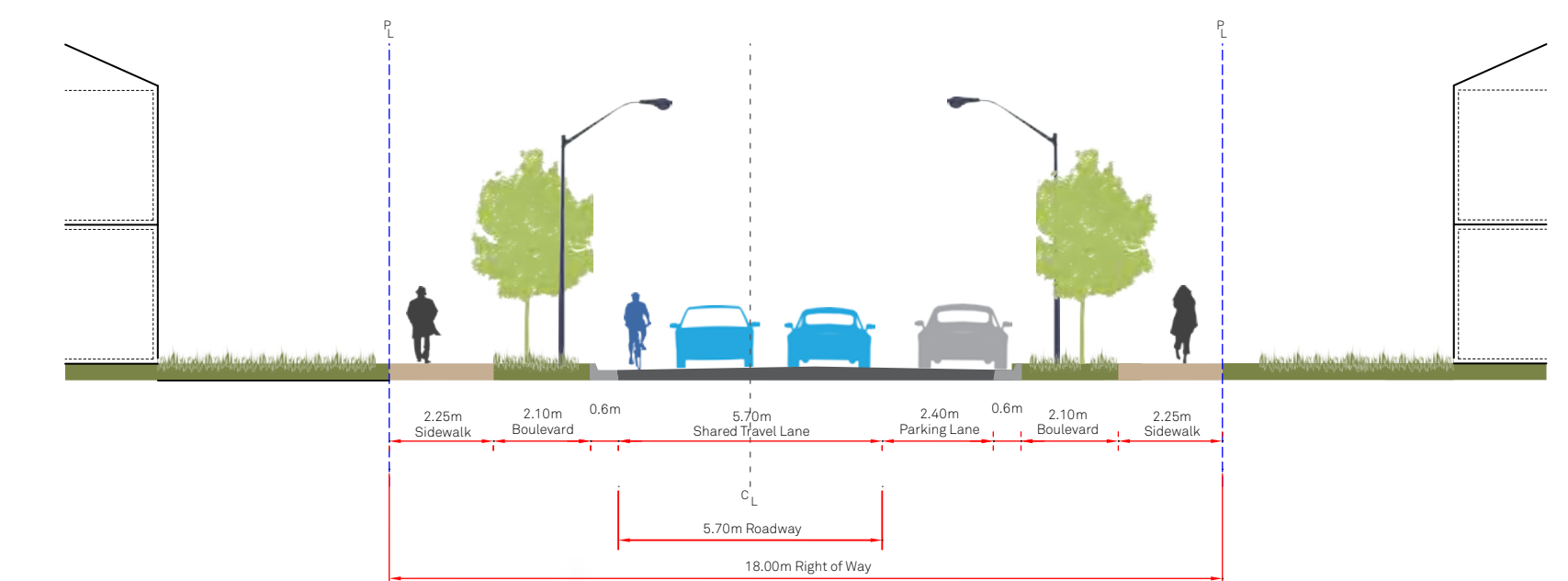
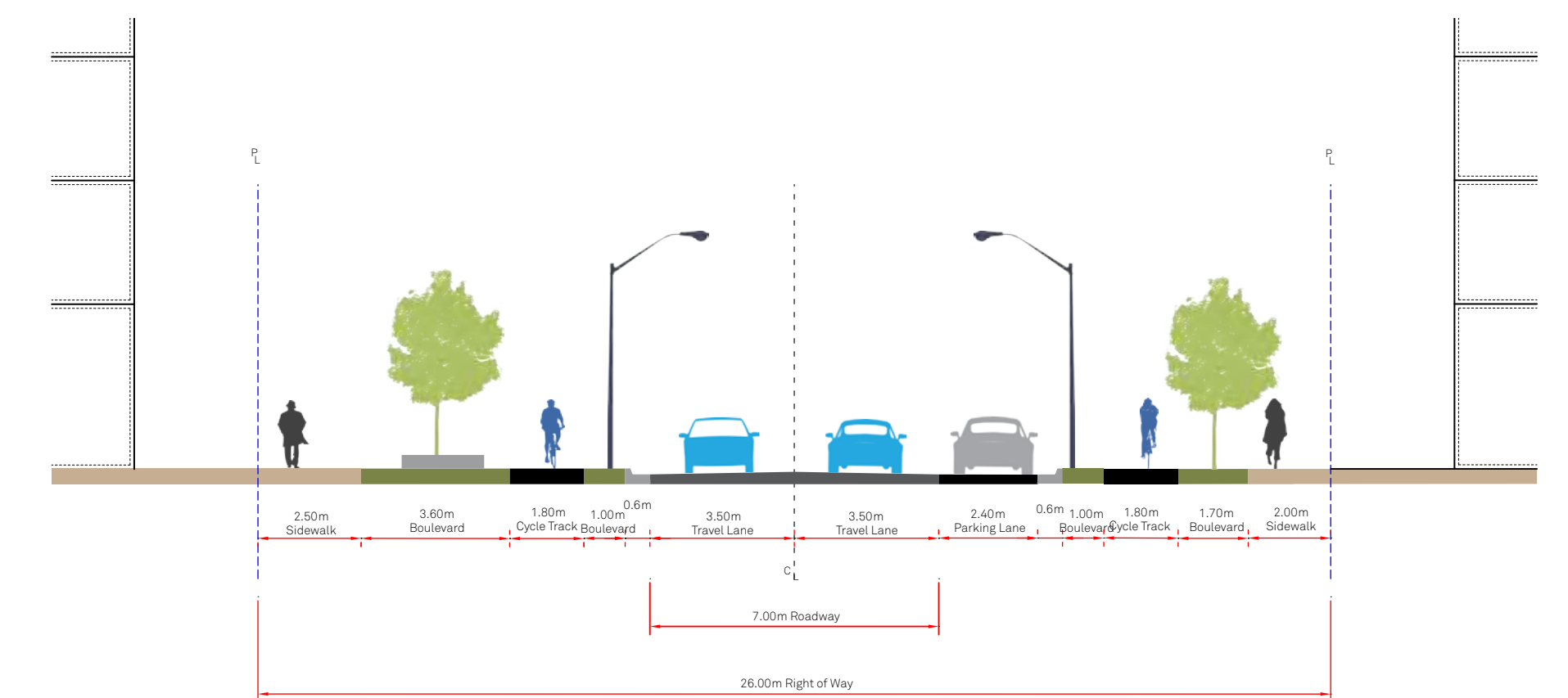
- Accommodate all street users
- Reduce street crossing distances
- Reduce vehicle speeds

Examples of New Potential Street Cross Sections

1. Arterial Street



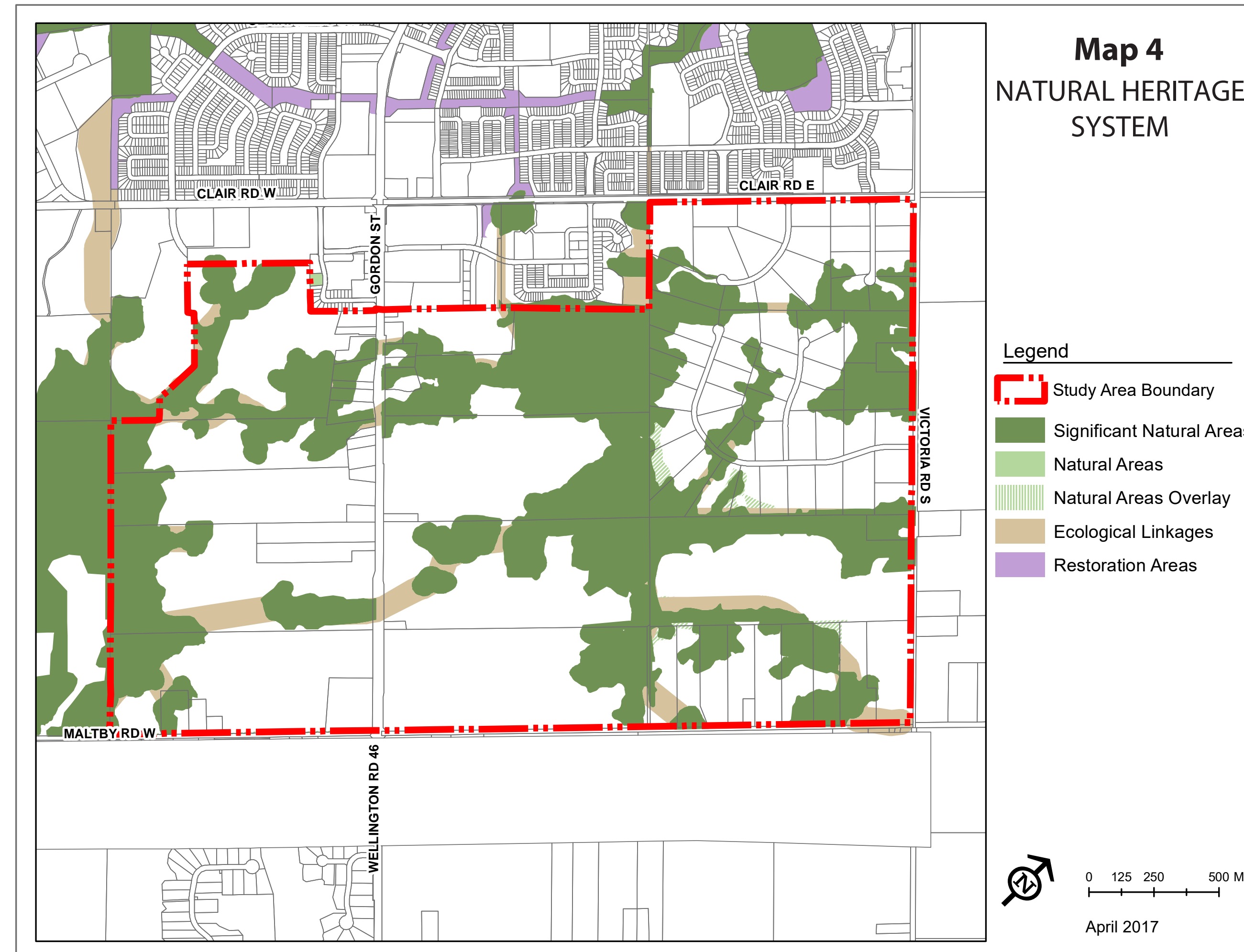
2. Collector Street



NATURAL HERITAGE SYSTEM

A Natural Heritage System (NHS) already exists for the Secondary Plan Area. This NHS is mapped and described in the City's current Official Plan. It is based on the technical work and consultations undertaken as part of the City's Natural Heritage Strategy (2004 – 2009). This NHS was approved by Council (Official Plan Amendment 42) in 2010, and was refined and finalized by the Ontario Municipal Board's approval of the City's Official Plan Amendment 42 in 2014. This is the NHS shown in the various maps presented as part of this charrette.

The purpose of the natural heritage work undertaken through the Clair-Maltby Secondary Plan process has been to verify and update the NHS, as needed, based on relevant changes to existing conditions and application of current legislation, policies and guidelines. A work plan for these updates was developed in consultation with the City and key stakeholders.



467 species of plants can be found in the Clair-Maltby Secondary Plan Area



112 species of birds can be found in the Clair-Maltby Secondary Plan Area



7 species of frog and 1 species of toad can be found in the Clair-Maltby Secondary Plan Area

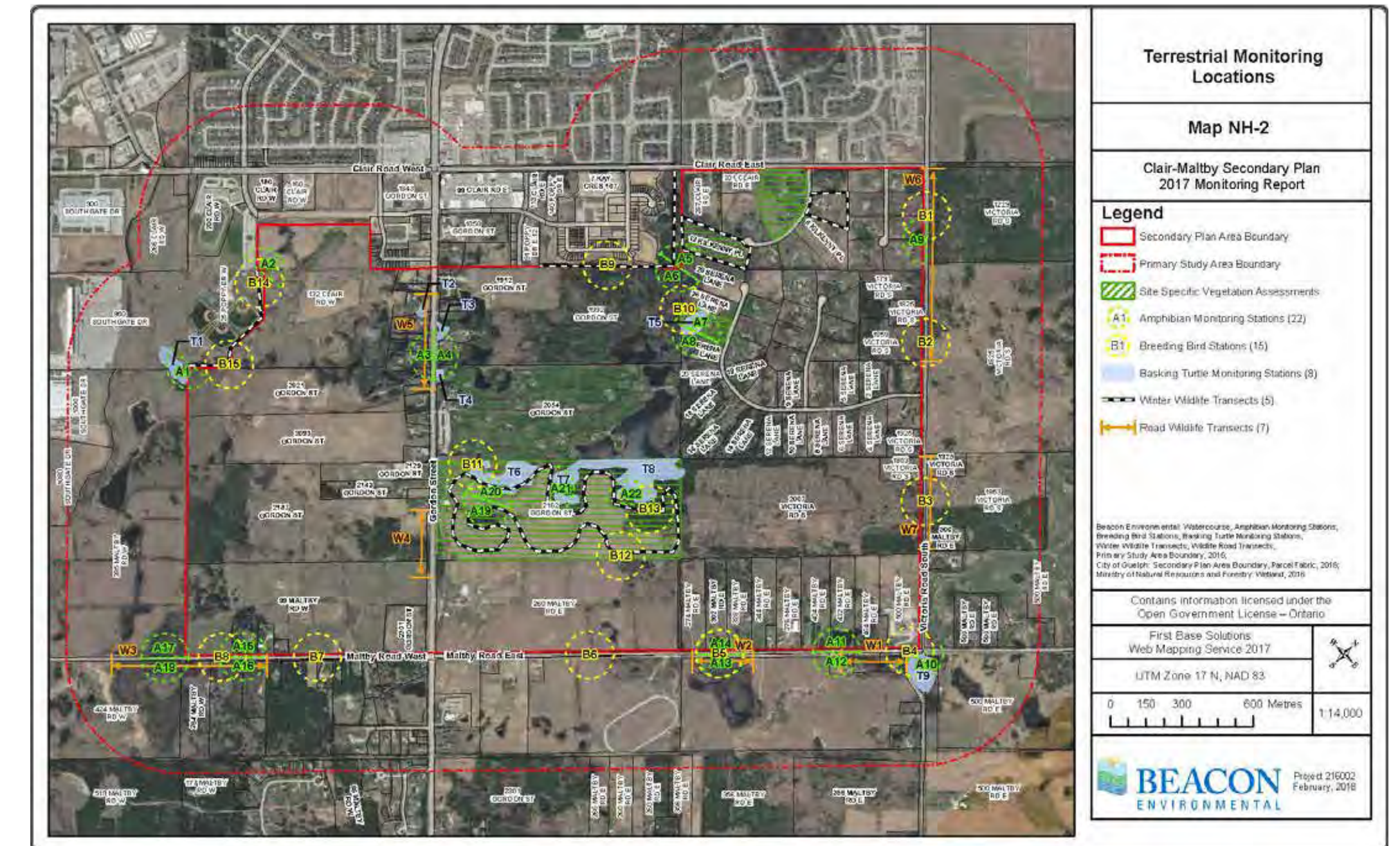
NATURAL HERITAGE SYSTEM

Natural heritage field studies undertaken as part of the Clair-Maltby Secondary Plan process over 2016 and 2017 have included:

- Preliminary screening for headwater drainage features;
- Assessment of the water levels and quality of selected wetlands;
- Air photo interpretation to verify and update vegetation community mapping supplemented with scoped vegetation assessments and botanical surveys;
- Amphibian and reptile surveys, including movement surveys over roads;
- Breeding bird and winter wildlife surveys (including for deer and raptors); and
- Incidental observations of seeps, springs and other wildlife.

Field studies have been limited to properties where access was provided, public lands and road rights-of-way. Surface water sampling stations were coordinated with shallow groundwater sampling stations to gain a better understanding of how the different wetlands function. Field work has been supplemented by a review of all available background studies and data in the study area from the last decade or so.

Over 2018, refinements and updates to the NHS will be confirmed based on the technical work undertaken. These updates will be reviewed with the City and key stakeholders including: local agencies and advisory committees, as well as the landowners and advisory groups established for this project. Updates to the NHS will be integrated into the various models and planning studies to inform the different technical components (e.g., transportation, servicing, storm water management) and the Secondary Plan itself, including the related policies.



Wetland Monitoring Station 8 at various points from April-November 2017

PROBLEM AND OPPORTUNITY STATEMENT

Problem

The City of Guelph is undertaking the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to comprehensively plan the last unplanned greenfield area within the city. The current study area does not have full municipal services to support future development.

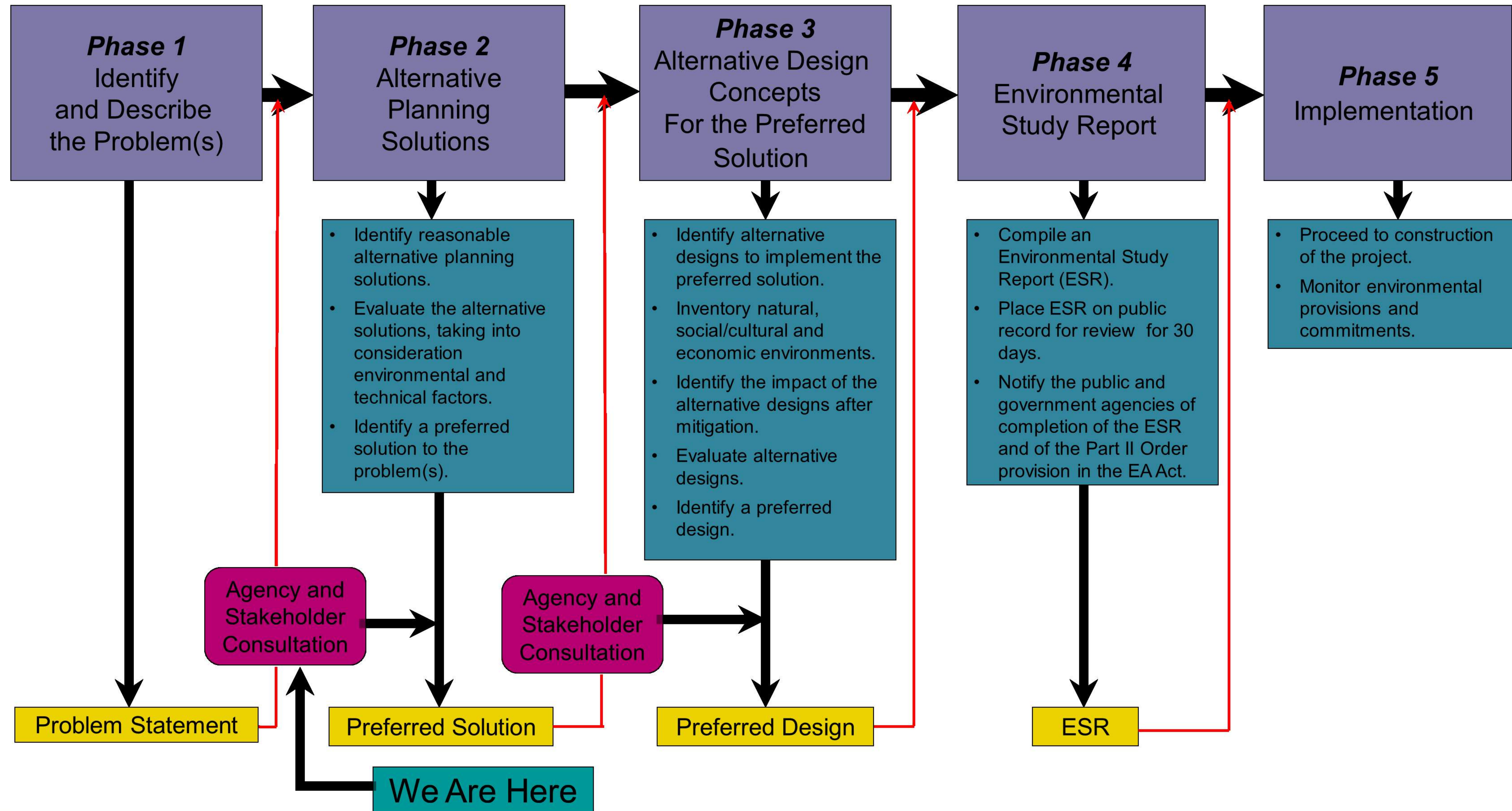
Opportunity

The Clair-Maltby Secondary Plan and the Master Environmental Servicing Plan (MESP) are being developed concurrently to provide an integrated planning approach to establish a plan for future urban development and full municipal services within this area.

Newly urbanizing lands require municipal services in the form of roads, water, wastewater and stormwater infrastructure, in order to meet municipal and provincial requirements. The process involving the conversion of undeveloped land to a fully serviced, urbanized form is governed through an integrated approach addressing the needs of the Planning Act and the Environmental Assessment Act, including the Municipal Engineers Association Class Environmental Assessment Process for public infrastructure planning and design.



MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT



The MESP for Clair-Maltby is intended to fulfill Phases 1 and 2

STORMWATER MANAGEMENT PLANNING

Background

Urbanizing existing natural and rural lands has the potential to alter surface runoff and groundwater functions, possibly negatively affecting the area's wetlands, drainage features and associated wildlife and fish. Stormwater Management techniques can both pro-actively and reactively manage and mitigate the impacts of urbanization to address regulatory and functional objectives.

Objectives

Stormwater Management is intended to address the following objectives:

- i. Control drainage (quantity and quality) and associated risks
- ii. Manage impacts to drainage features and related habitat (Clair-Maltby open water drainage features are limited due to the hummocky terrain)
- iii. Maintain/improve water quality in accordance with Provincial requirements
- iv. Work towards water balance preserving surface water infiltration and groundwater quantity and quality



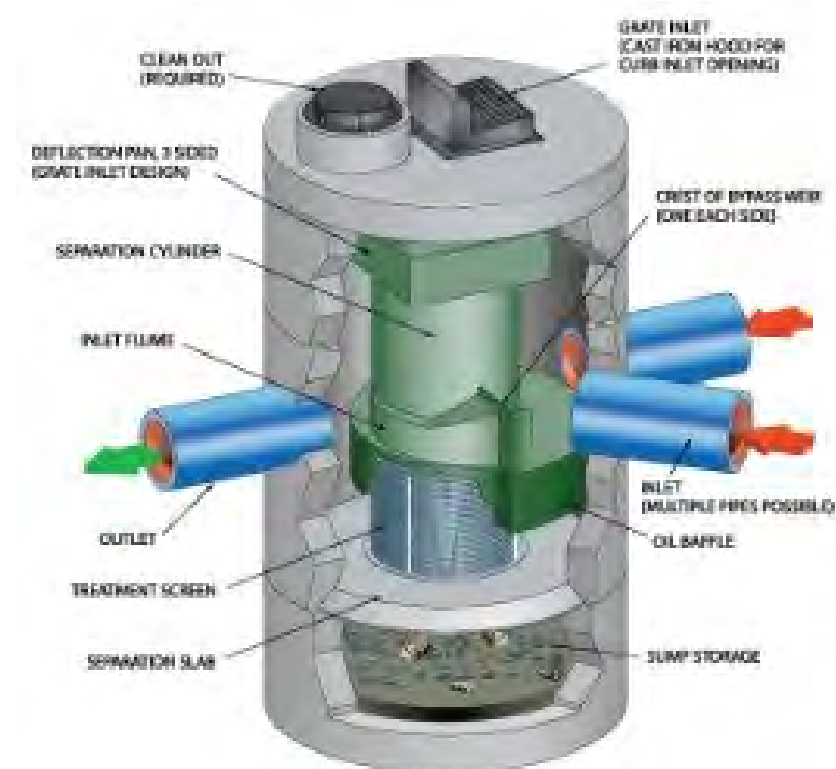
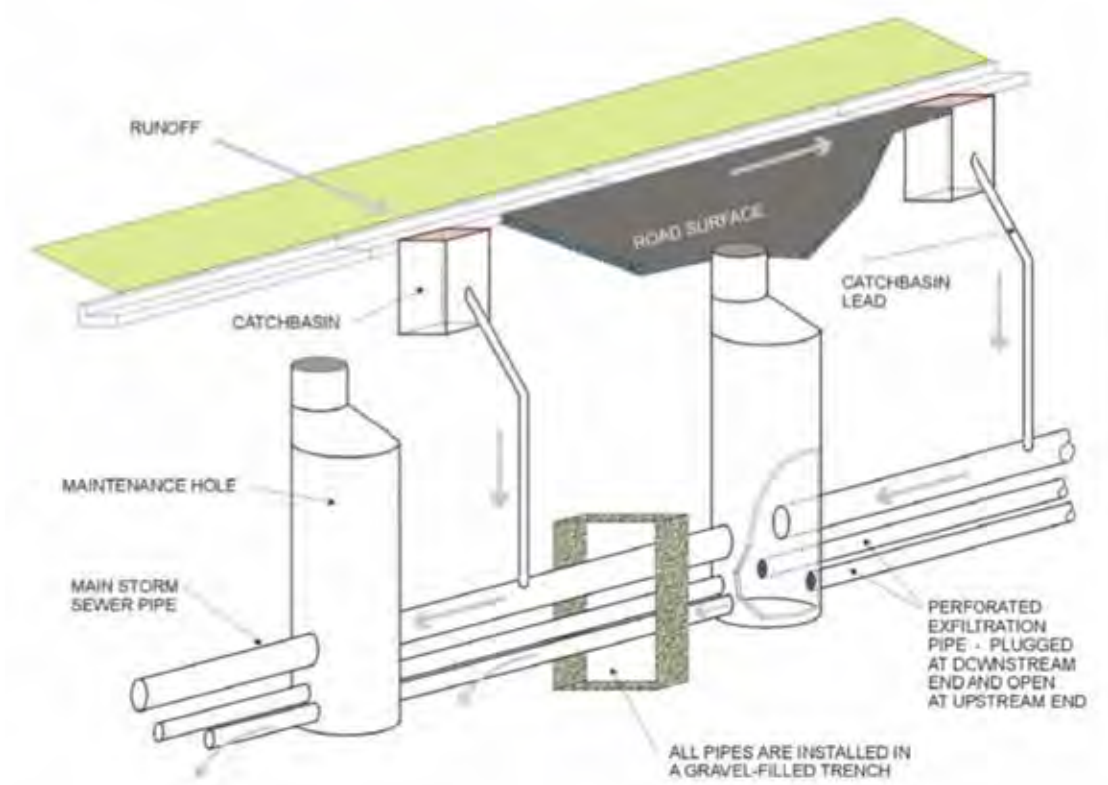
STORMWATER MANAGEMENT ALTERNATIVES

There are a number of Stormwater Management techniques available to address the objectives which fall into various categories as follows:

- Dry ponds
- Wet ponds
- Wetlands
- Hybrids
- Greenways
- Infiltration Systems
- Oil and grit separators

- Perforated pipes
- Swales
- Enhanced swales

- Bioretention (rain gardens)
- Soak away Pits
- Permeable pavements
- Rain water harvesting
- Rain gardens
- Biofilters



The Do Nothing alternative is required to be considered in the Municipal Class Environmental Assessment process. It would however not address the stormwater management objectives for the future development area.

PRELIMINARY STORMWATER MANAGEMENT FACILITY CONSIDERATIONS

- **Location** – preliminary locations established based on existing topography and drainage routes, and functional connections to features
- **Size** – to be determined to meet stormwater management objectives
- **Geometry** – there are options (rectangular, greenway, circular etc.) – which will have to consider compatibility with the planning for adjacent land uses
- **Form** – functional considerations (i.e. dry or wet) as well as opportunities to make some spaces multi-functional – particularly where parks, schools and natural areas are adjacent to stormwater management facilities
- **Other complementary considerations:**
 - Extent and size of Low Impact Development Best Management Practices – this may affect community design and street widths
 - Stormwater Management Facility's Overflows – most of the area has inwardly draining systems which will need to have relief overflows
 - Drainage system layout (sewer and overland) – will be influenced by future land use and road patterns
 - Enhanced water quality protection need to include pre-treatment of runoff before being infiltrated, source water protection considerations and salt management imperative

WATER AND WASTEWATER SERVICING

Background

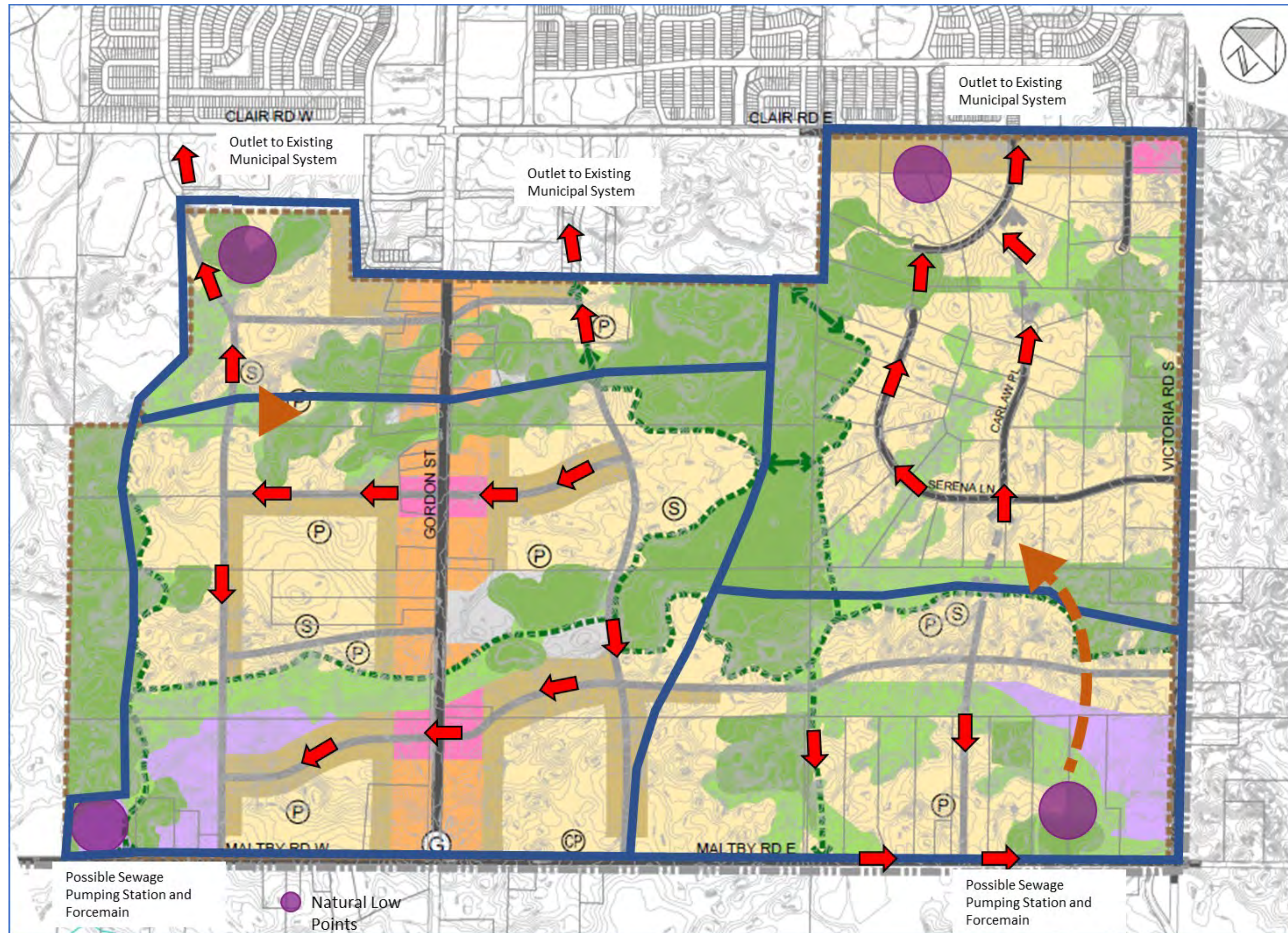
The Clair Maltby Lands Water and Wastewater Servicing will be integrated with the City of Guelph's existing water distribution and wastewater collection systems. As all of the roads in the development will have commercial or residential users, each building will be provided with a water service connection and a sanitary service connection. Site topography is a key consideration governing the integration of the water and wastewater services within the existing City of Guelph System.

Objectives

1. The Clair Maltby Lands will be serviced in accordance with the City of Guelph's Master Planned Infrastructure
2. The City's water distribution network will be expanded with a 300 mm water main on every new road in a fully looped configuration (i.e. with no dead end watermains).
3. The City's wastewater collection system will be expanded such that there is a gravity sewer on every road that collects the wastewater and conveys it to the Guelph wastewater treatment plant.



WASTEWATER COLLECTION



The City's wastewater collection system is accessible in three sub-trunk sewer systems to the North.

The undulating topography of the Clair Maltby lands, presents a challenge in regards to gravity servicing.

Most of the Clair Malby lands naturally drains to low points in the South East and in the South West. It is not possible for all of the proposed lands to be connected to the Guelph system without pumping stations.

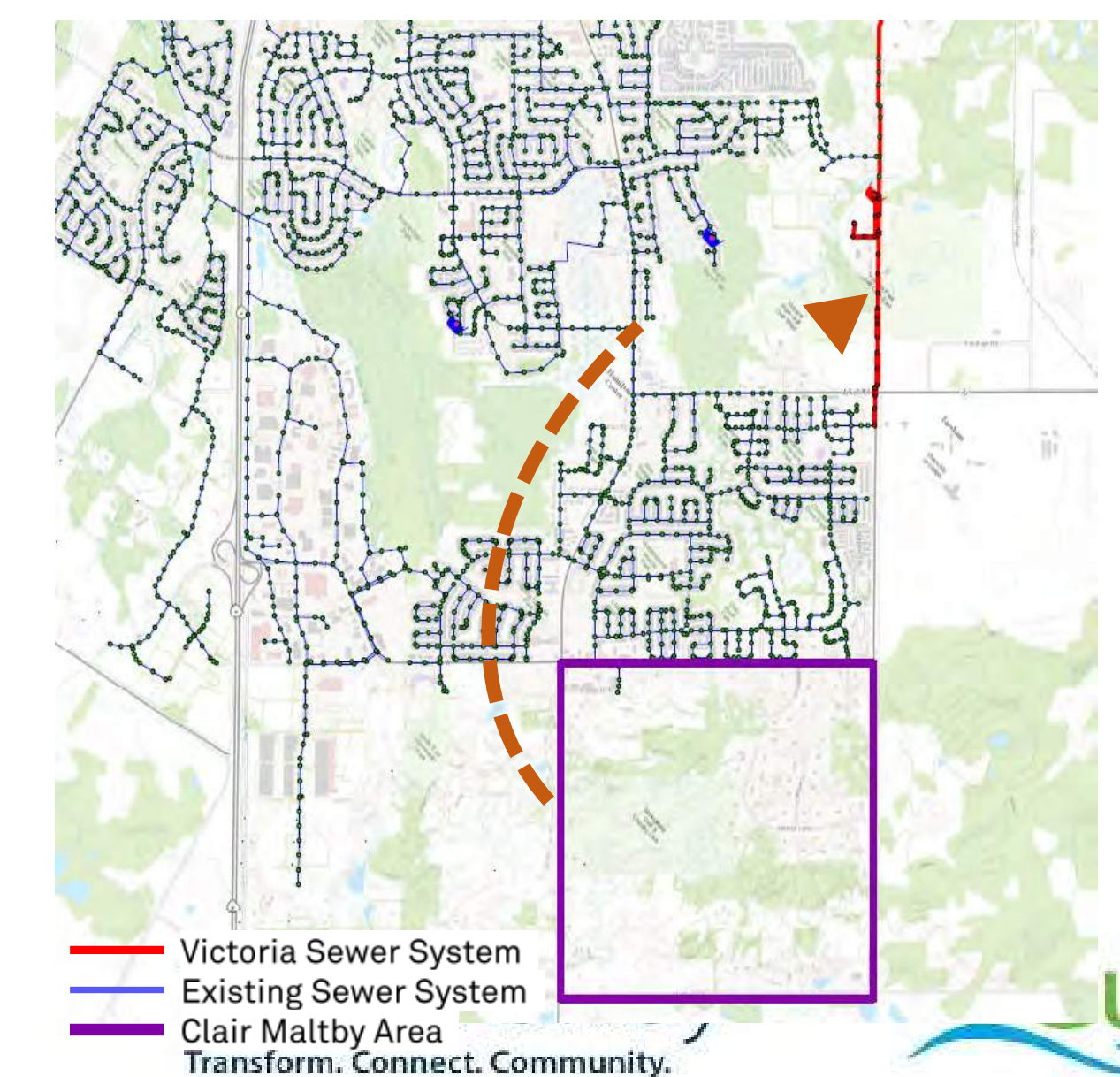
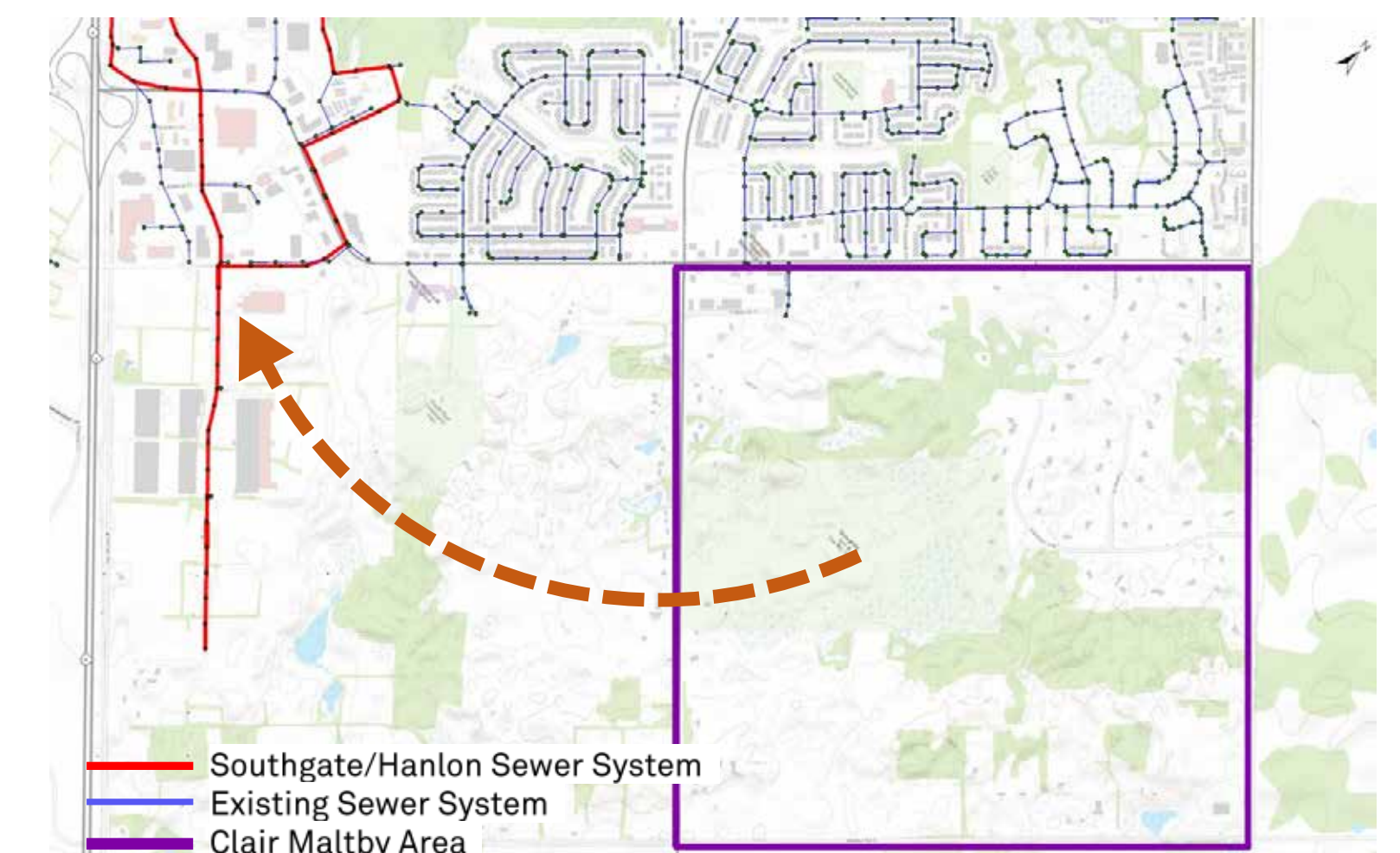
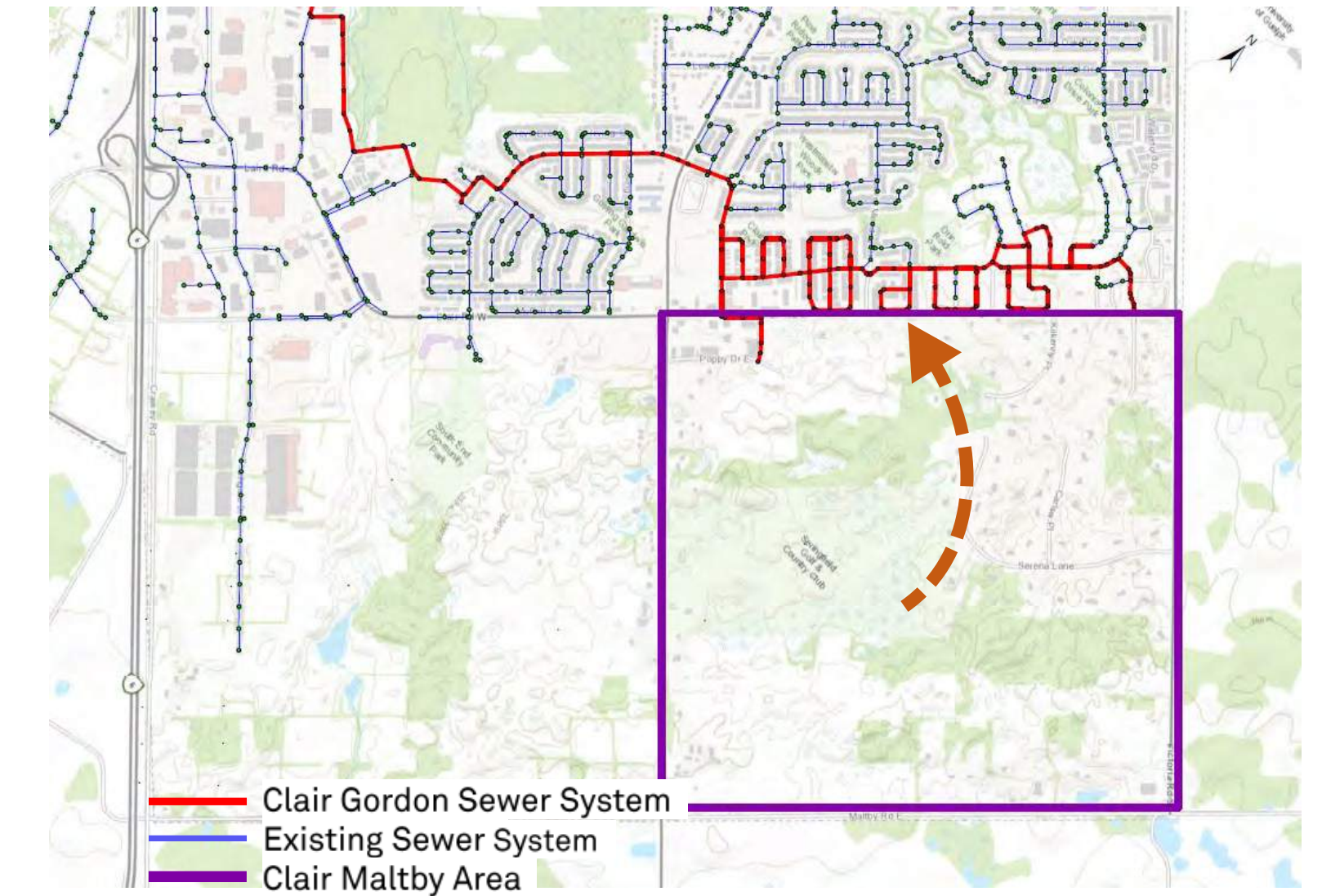
WASTEWATER CONVEYANCE ALTERNATIVES

Alternative Approaches

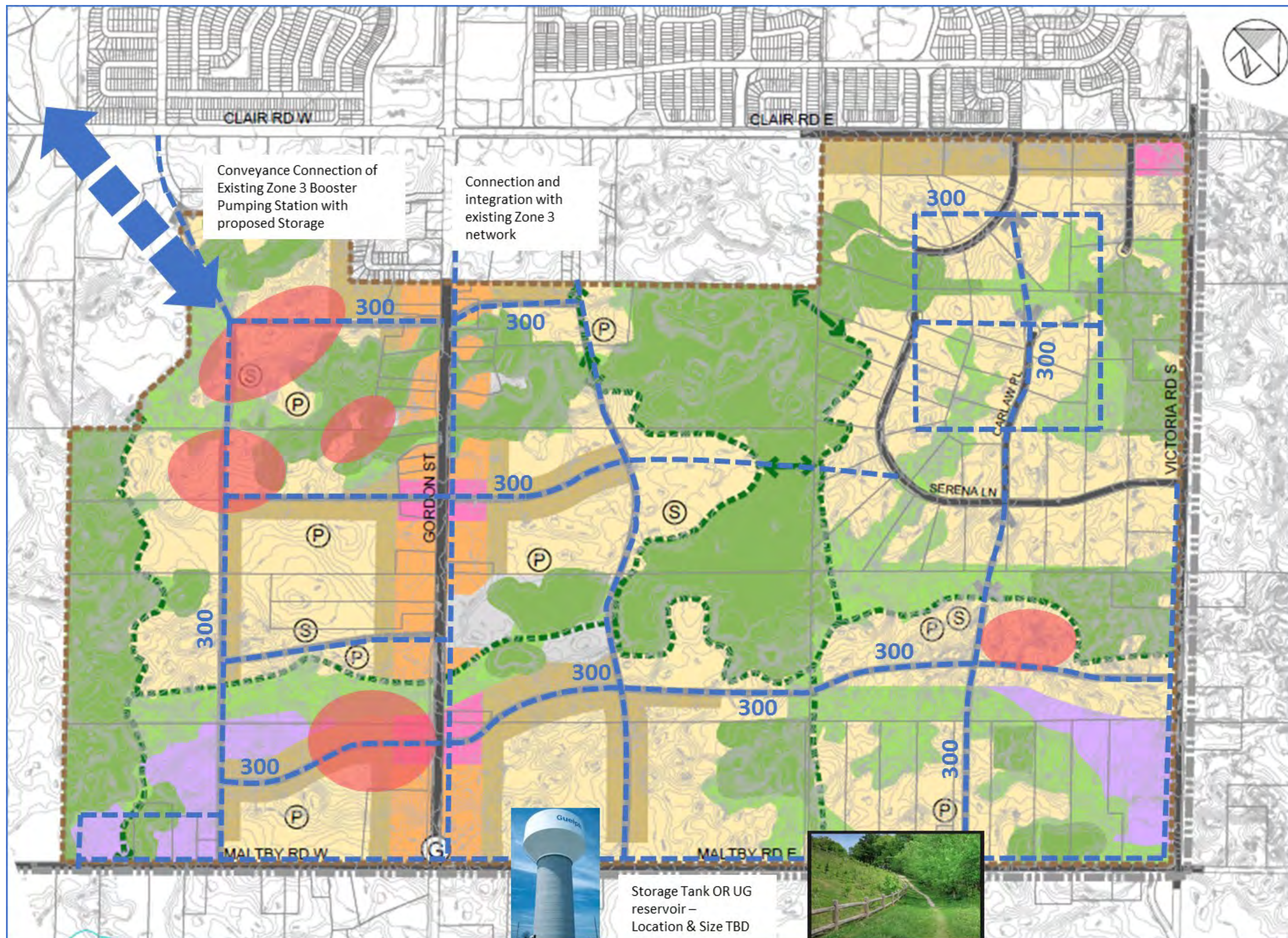
- 1. Do Nothing** *A moratorium on new wastewater collection infrastructure*
- 2. Limit Growth** *Growth is limited to reduce demand and costs of operating and maintaining wastewater infrastructure*
- 3. New Infrastructure – Gravity collection system** – *Areas serviced by gravity only – limited by topography*
- 4. New Infrastructure – Pump Station(s) and forcemain(s)** – *Pumping Stations and forcemains to lift wastewater from areas that are too low to drain by gravity*
- 5. New Infrastructure – Gravity collection system, pump station(s), forcemain(s)**

Alternative System Configurations

- 1. Clair Gordon Trunk System**
 - a. use existing sewers no upgrades
 - b. use existing sewer routes with capacity upgrades
- 2. Southgate / Hanlon Trunk System**
 - a. use existing sewers no upgrades
 - b. use existing sewer routes with capacity upgrades
- 3. Victoria Trunk System**
 - a. use existing sewers no upgrades
 - b. use existing sewer routes with capacity upgrades



WATER DISTRIBUTION



Water distribution is organized in pressure zones that are suitable for lands within a given geodetic elevation range.

The Clair Maltby Lands are higher in elevation than much of the rest of the City. The City's water distribution system is currently being expanded in the South Side of Guelph through a new pressure zone (Zone 3) that will operate at levels that are suitable for the Clair Maltby Lands.

Zone 3 is now live with pumping into the zone, however as demand increases in its service area, it will require storage to meet mandated operating requirements.

The high points within the Clair Maltby Lands are suitable locations for the implementation of elevated storage for the new pressure zone.

WATER DISTRIBUTION ALTERNATIVES

Alternative Approaches

- 1. Do Nothing** *A moratorium on new wastewater collection infrastructure*
- 2. Limit Growth** *Growth is limited to reduce demand and costs of operating and maintaining water infrastructure*
- 3. Service through Development of Zone 3 – New Storage & Transmission System expansion as per Current City – Wide Master Planning Context**

Alternative System Configurations

1. New Storage & Transmission

a. Underground storage – in combination with pumps



b. Elevated Tank Storage – Floating



COMMENTS AND NEXT STEPS

Please provide any additional comments about your vision for the Clair-Maltby area in the space below, using the post-it notes and pencils which have been provided.



Please provide your comments directly on the page using the Post-It Notes provided.

Next Steps:

Charrette Public Meeting 2 - April 5

An overview of the Preferred Community Structure and an opportunity to further refine the vision for Clair-Maltby

Charrette Public Meeting 3 - April 9

A presentation of the final Preferred Community Structure and more detailed information regarding built form, streets, blocks, and the open space system.

Following the charrette, the Preferred Community Structure will go to City Council for approval in June 2018.



Clair-Maltby Secondary Plan

Transform. Connect. Community.

Public Meeting
April 3, 2018

Clair-Maltby

Transform. Connect. Community.

Public Meeting
April 3, 2018



Agenda

1. Presentation 7:00 – 7:30 PM
 - What is a Charrette
 - Structuring Elements and Vision and Guiding Principles
 - Community Structure Alternatives
 - Green Infrastructure and Building Typologies
 - Workshop Introduction
2. Workshop – Evaluation of Alternatives 7:30 – 8:45 PM
3. Report Back and Next Steps 8:45 – 9:00 PM

The Secondary Plan Process



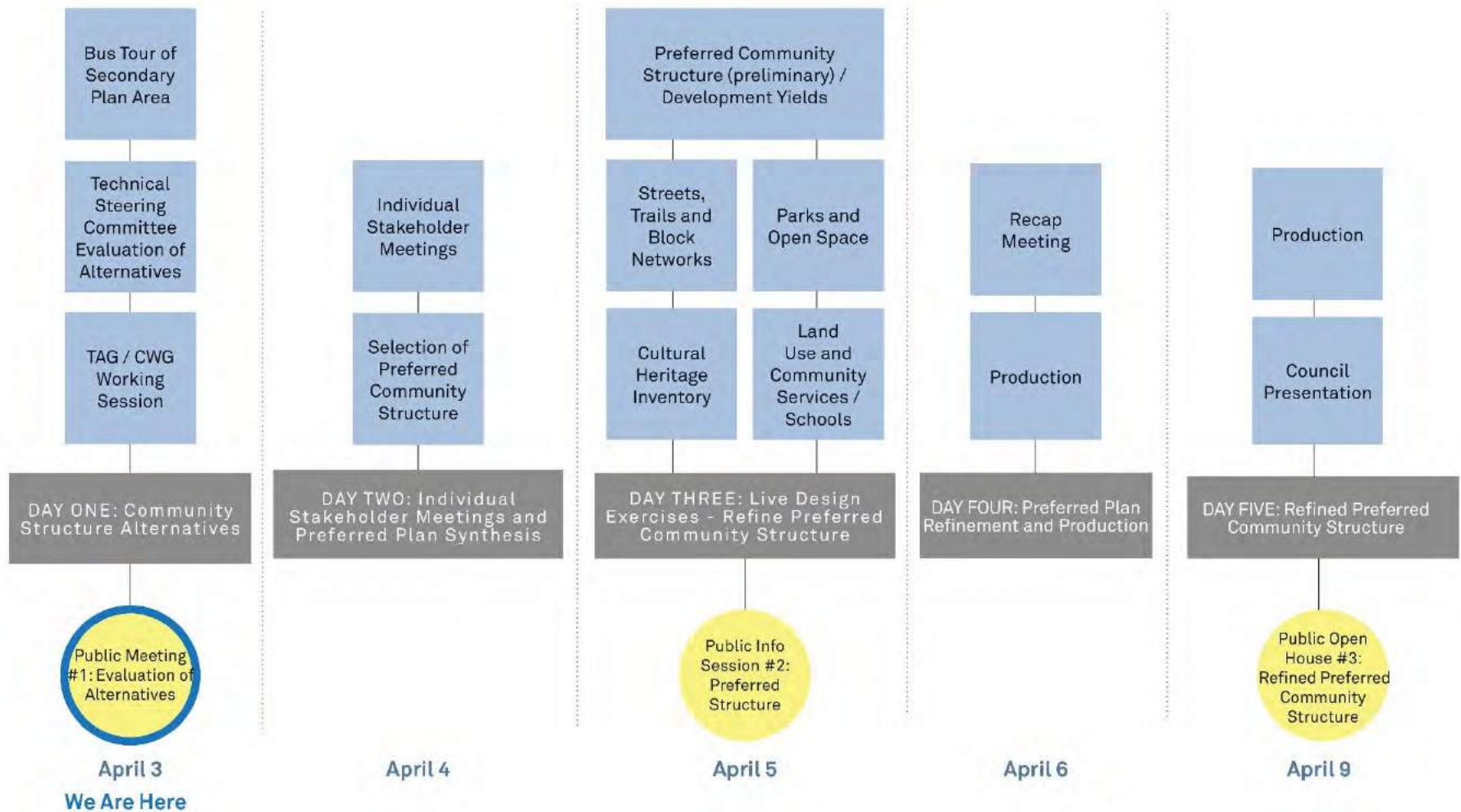
What is a Charrette?

A multi-disciplinary, intensive and collaborative design and planning workshop inclusive of all affected stakeholders with the aim of developing a design or vision for a project or planning activity.



Literally, charrette is from the French term for “cart” or “chariot.”

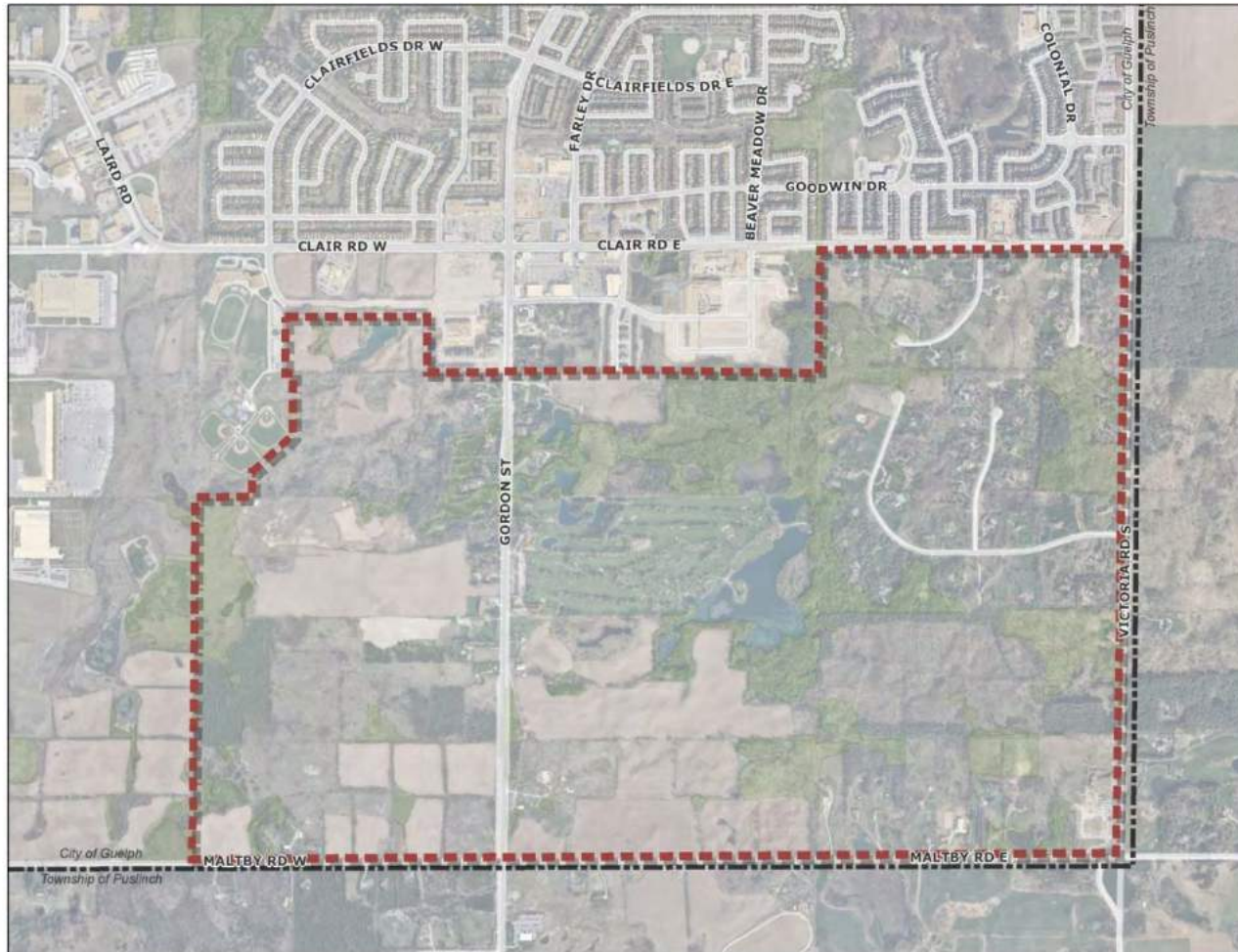
Design Charrette Overview



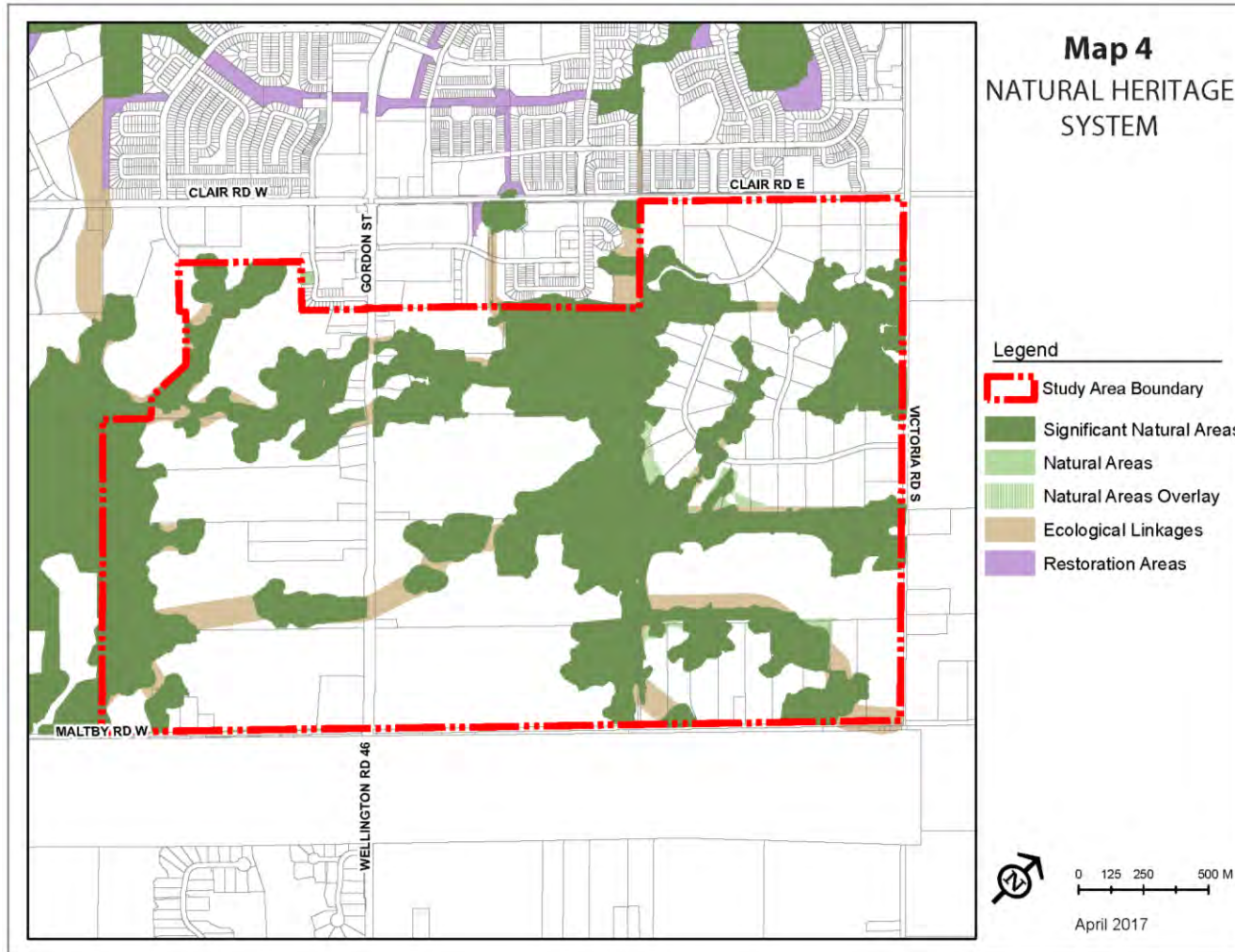
Structuring Elements



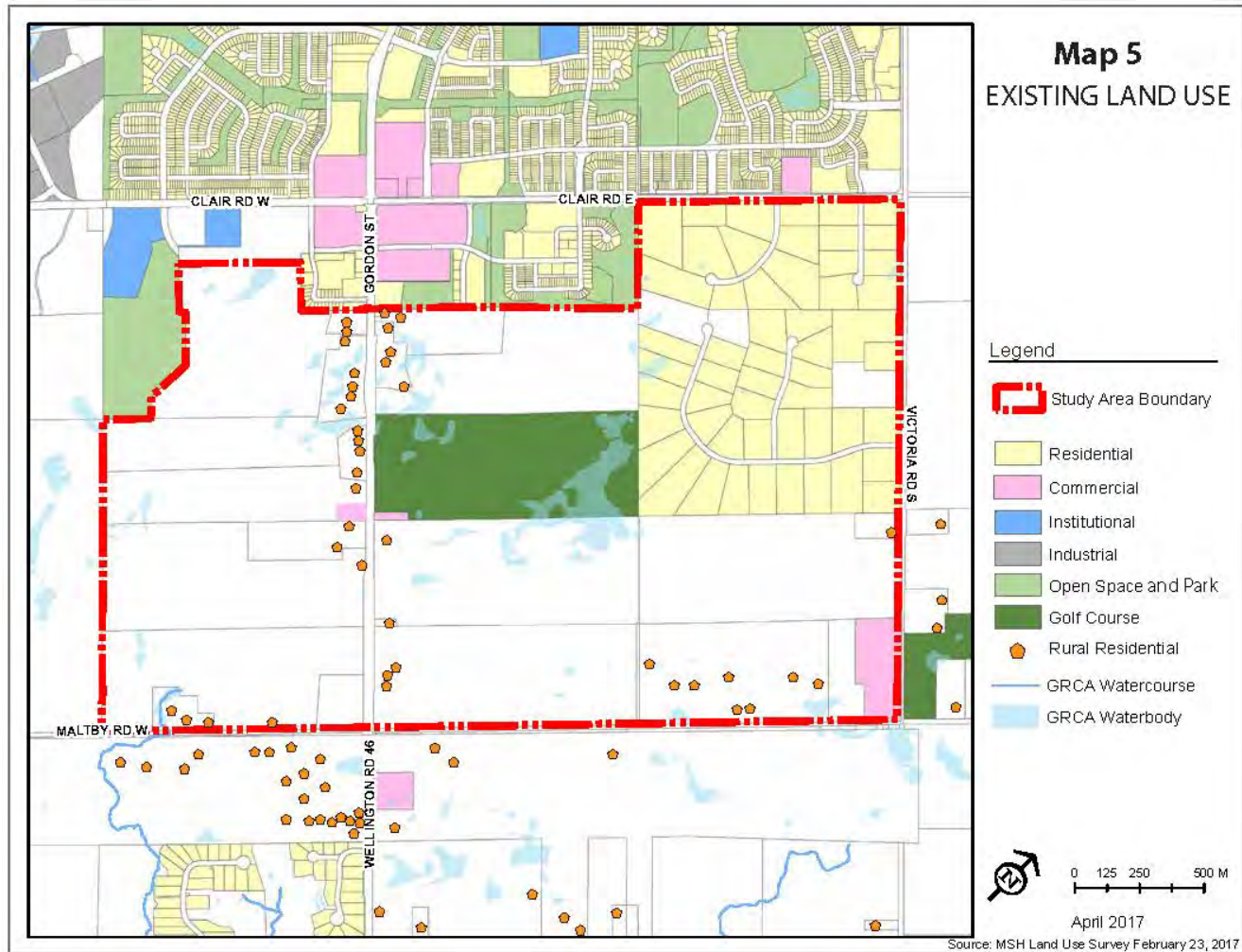
Study Area



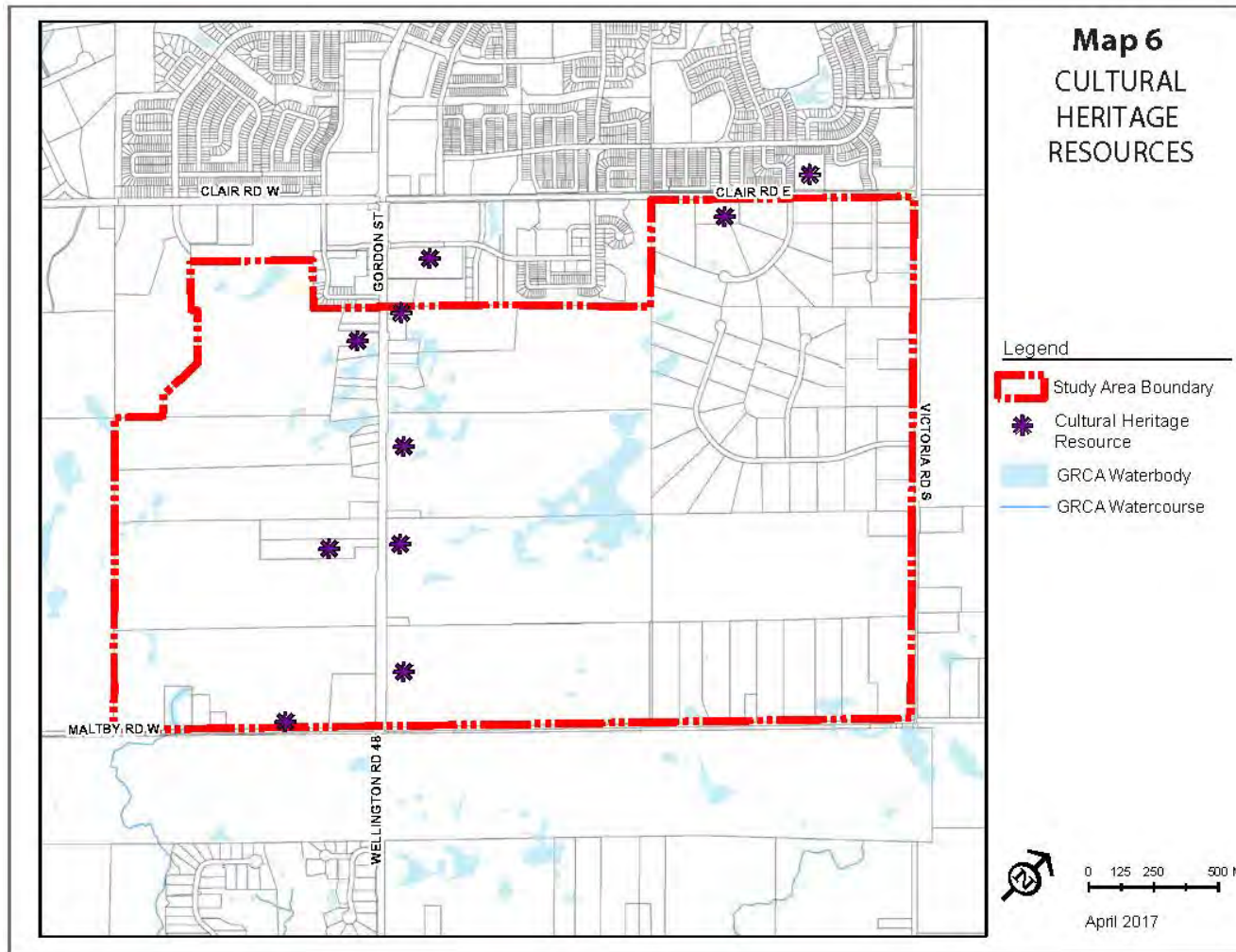
Natural Features



Existing Land Use



Cultural Heritage Resources



Vision

Clair Maltby will be a vibrant, urban community that is integrated with Guelph's southern neighbourhoods, as well as having strong connections to Downtown, employment areas and the rest of the City.

The Natural Heritage System and the Paris Moraine provided the framework for the balanced development of interconnected and sustainable neighbourhoods.

The area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents.

A system of parks, open spaces and trails will be interwoven throughout to provide opportunities for active and passive recreation.



Guiding Principles



Vibrant and Urban



Green and Resilient



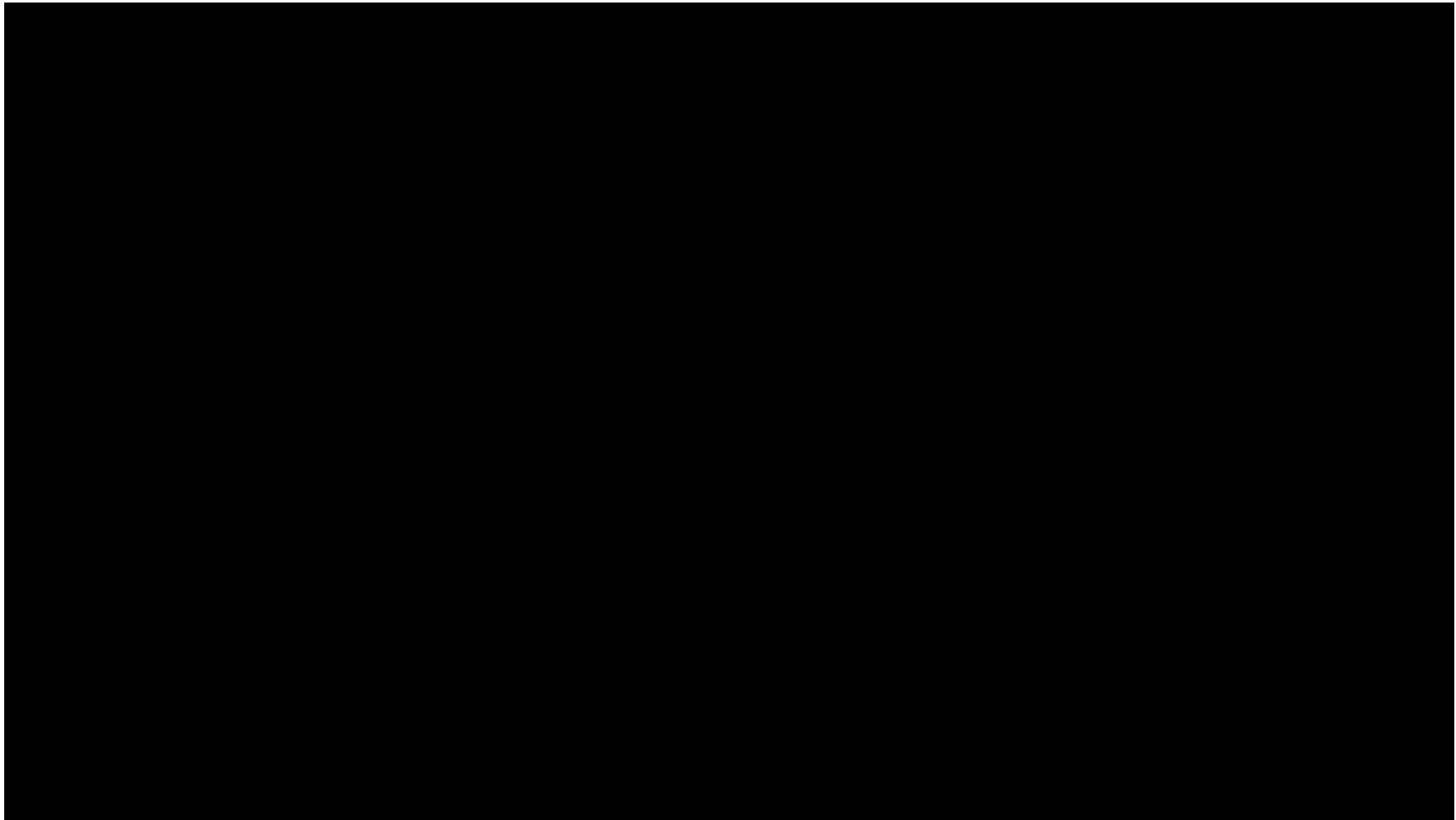
Healthy and Sustainable



Interconnected and Interwoven

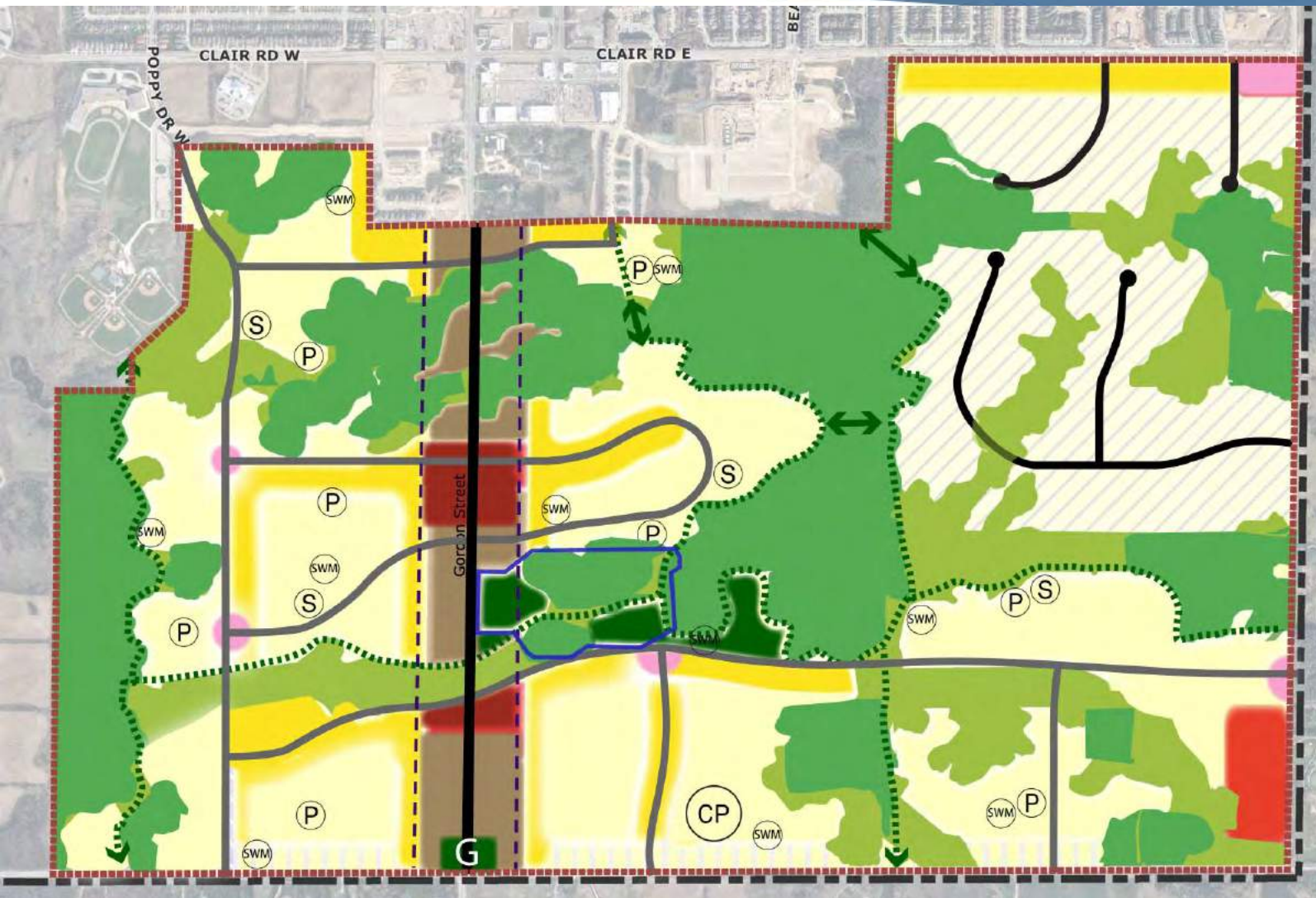


Balanced and Liveable



Community Structure Alternatives





Legend

- Clair-Maltby Secondary Plan Boundary
- Cultural Heritage Landscape
- Urban-Rural Transition Zone
- Gordon St. Corridor
- Existing Street Network
- Proposed Street and Cycling Network
- Potential Street Connection
- Proposed Trail Network
- Potential Active Transportation Link
- Neighbourhood Park
- Community Park
- Elementary School
- Stormwater Management
- Gateway

Natural Heritage System

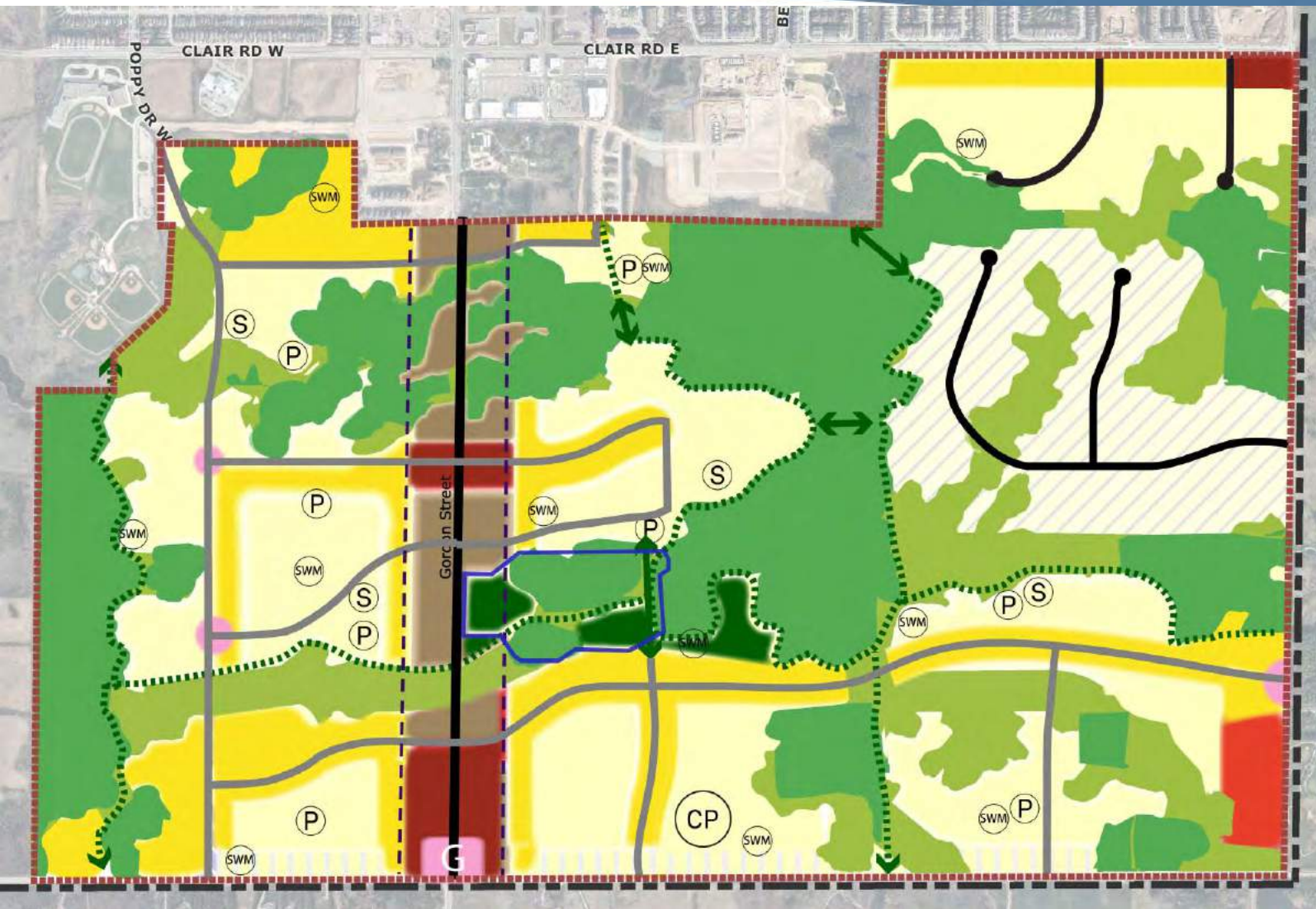
- May Permit Essential Transportation Infrastructure
- Does Not Permit Transportation Infrastructure

Land Use

- Low Density (Residential)
- Medium Density (Residential)
- High Density (Residential)
- Mixed Use
- Neighbourhood Commercial
- Service Commercial
- Rolling Hills Residential
- Open Space

N

Alternative 1: Featuring the Green



Legend

Clair-Maltby Secondary Plan Boundary

- Cultural Heritage Landscape
- Urban-Rural Transition Zone
- Gordon St. Corridor
- Existing Street Network
- Proposed Street and Cycling Network
- Potential Street Connection
- Proposed Trail Network
- ↔ Potential Active Transportation Link
- P Neighbourhood Park
- CP Community Park
- S Elementary School
- SWM Stormwater Management
- G Gateway

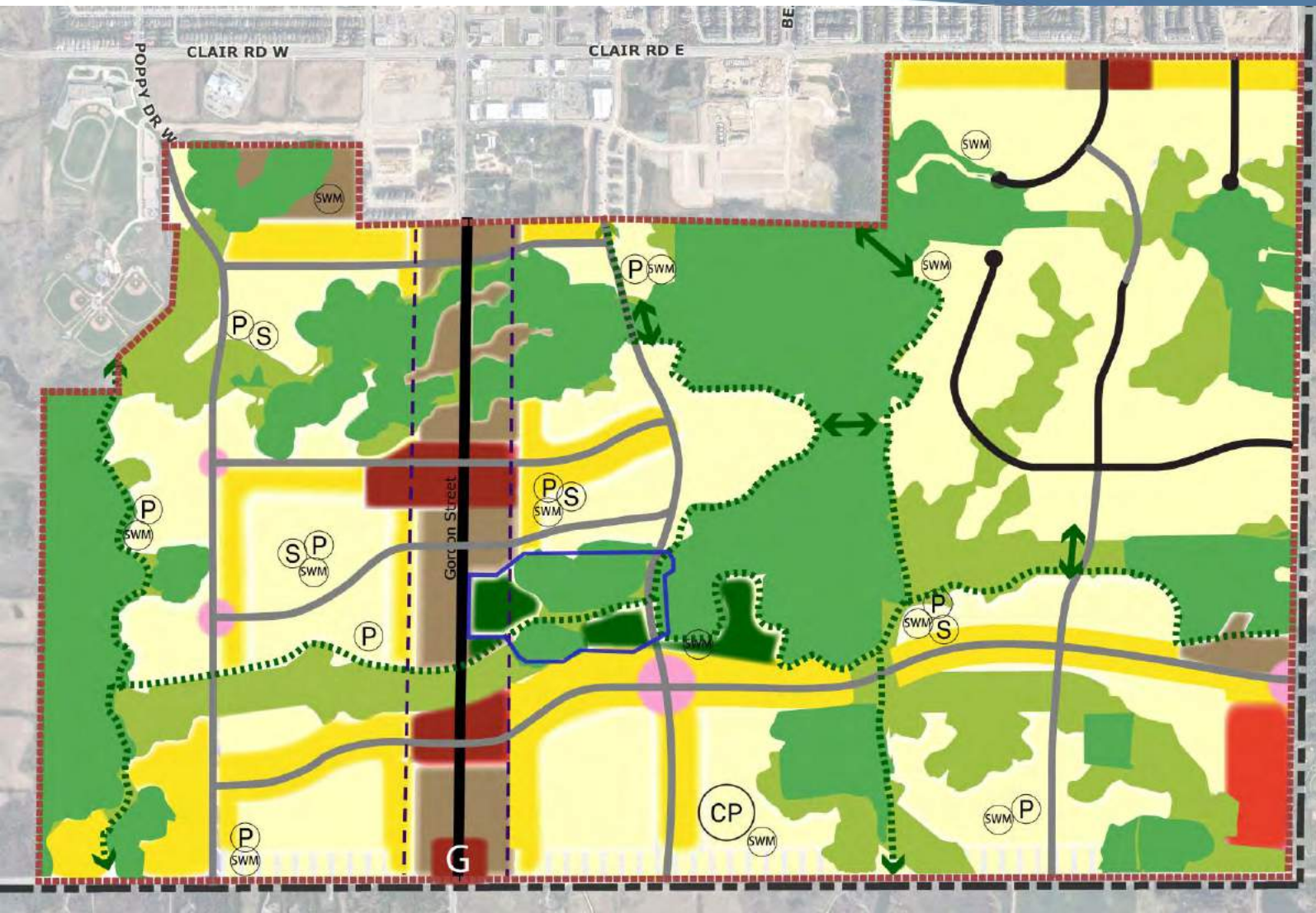
Natural Heritage System

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- Open Space

Alternative 2: Focus on Community and Services



Legend

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- Community Park
- Elementary School
- Stormwater Management
- Gateway

Natural Heritage System

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- Does Not Permit Transportation Infrastructure

Land Use

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- Mixed Use
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- Service Commercial
- Rolling Hills Residential
- Open Space

Alternative 3: Connected and Urban

Land Use Typologies

Low Density Residential



Medium Density Residential



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High Density Residential



Mixed Use



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Neighbourhood Commercial



Natural Heritage System



Community Parks



Neighbourhood Parks



Stormwater Management



Gateways



Streets and Blocks



Cycling Trails and Multi-Use Paths



Workshop Exercise (Evaluating the Alternatives)

At your tables:

- Exercise #1 – 15 min: Vibrant and Urban
 - Land uses are...
- Exercise #2 – 15 min: Green and Resilient / Healthy and Sustainable
 - Parks and open spaces are...
- Exercise #3 – 15 min: Interconnected and Interwoven
 - The street network connects...
- Exercise #4 – 15 min: Balanced and Liveable
 - Provides appropriate...

Thank You

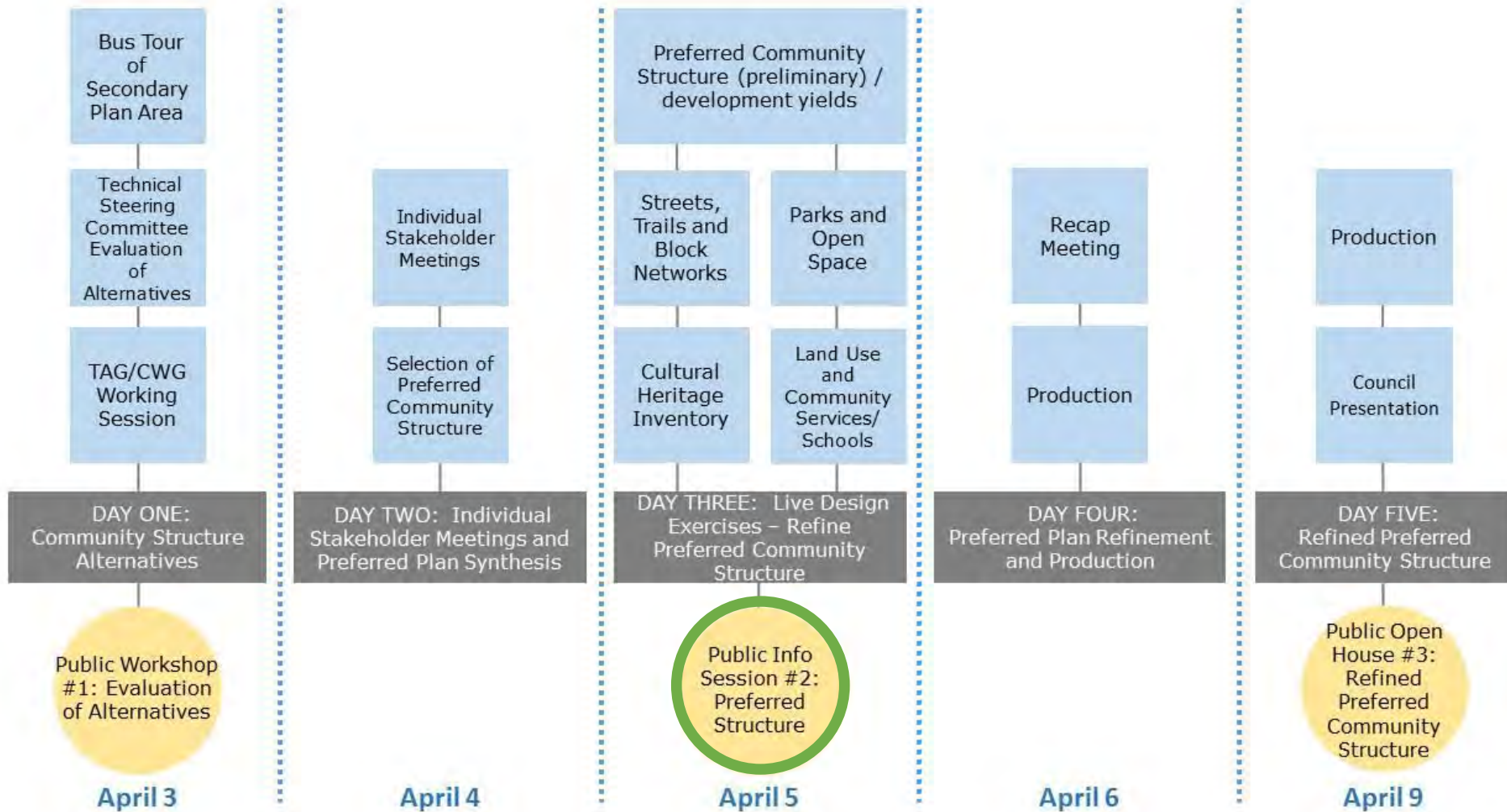


Clair-Maltby Secondary Plan

Transform. Connect. Community.

Public Meeting
April 5, 2018

Design Charrette Overview



The Secondary Plan Process



Vision

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The Natural Heritage System and the Paris Moraine provided the framework for the balanced development of interconnected and sustainable neighbourhoods.

The area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents.

A system of parks, open spaces and trails will be interwoven throughout to provide opportunities for active and passive recreation.

Guiding Principles



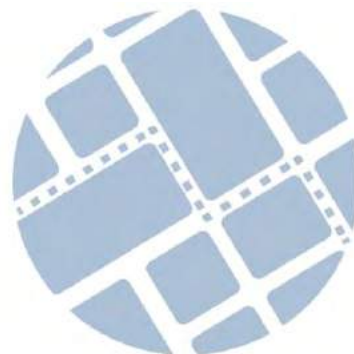
Vibrant and Urban



Green and Resilient



Healthy and Sustainable



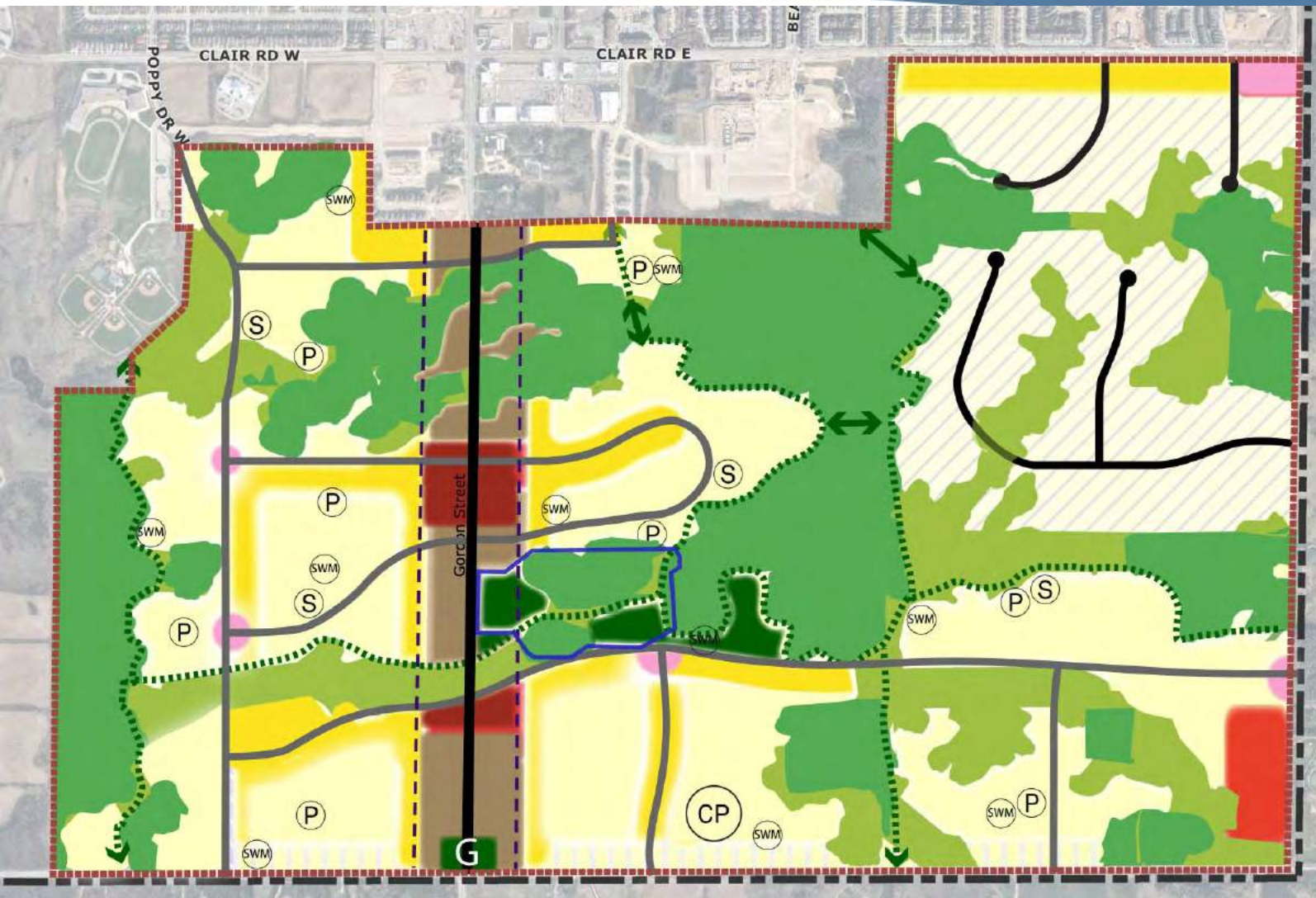
Interconnected and Interwoven



Balanced and Liveable

Community Structure Alternatives





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- Potential Active Transportation Link
- Neighbourhood Park (P)
- Community Park (CP)
- Elementary School (S)
- Stormwater Management (SWM)
- Gateway (G)

Natural Heritage System

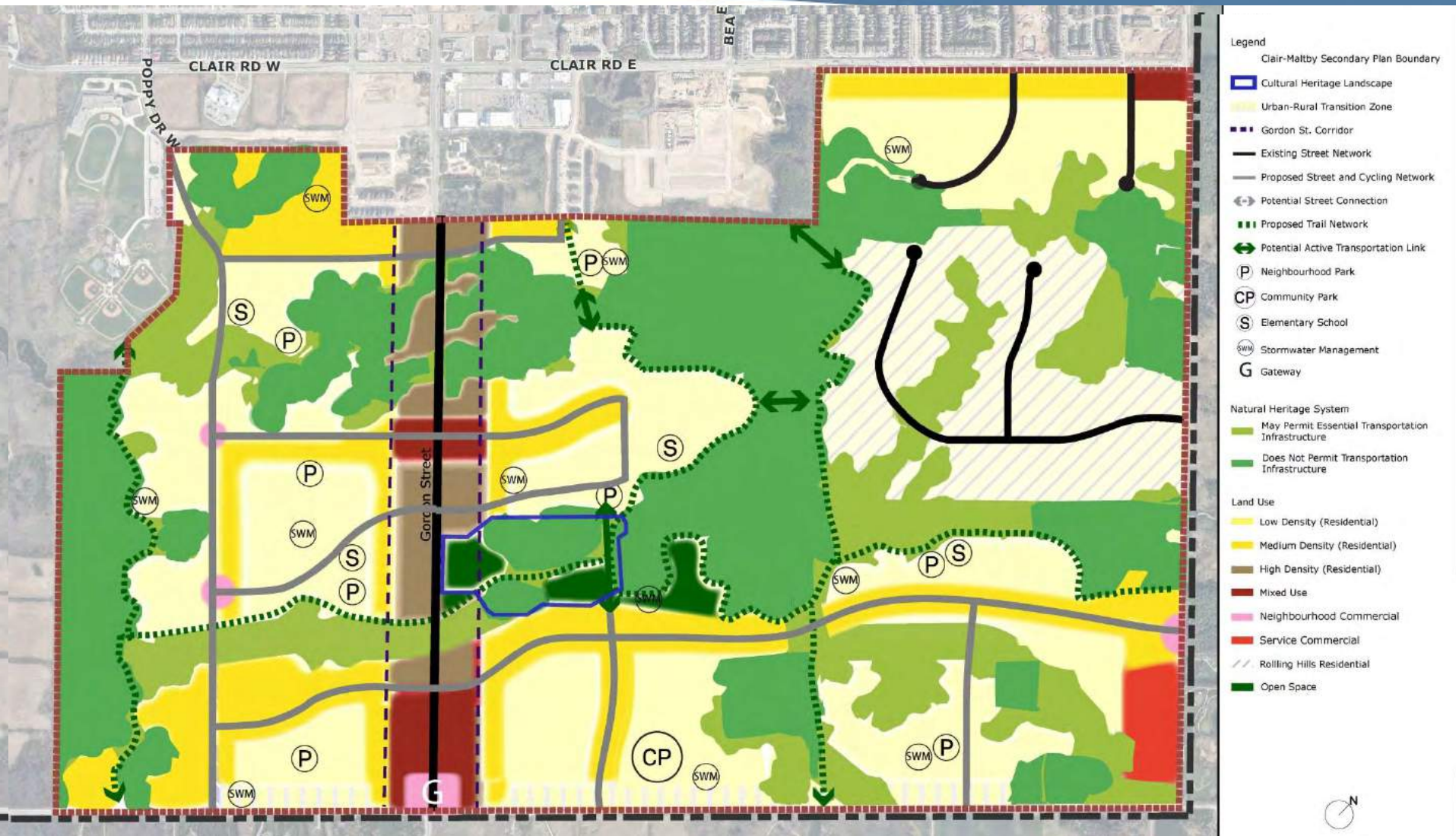
- May Permit Essential Transportation Infrastructure
- Does Not Permit Transportation Infrastructure

Land Use

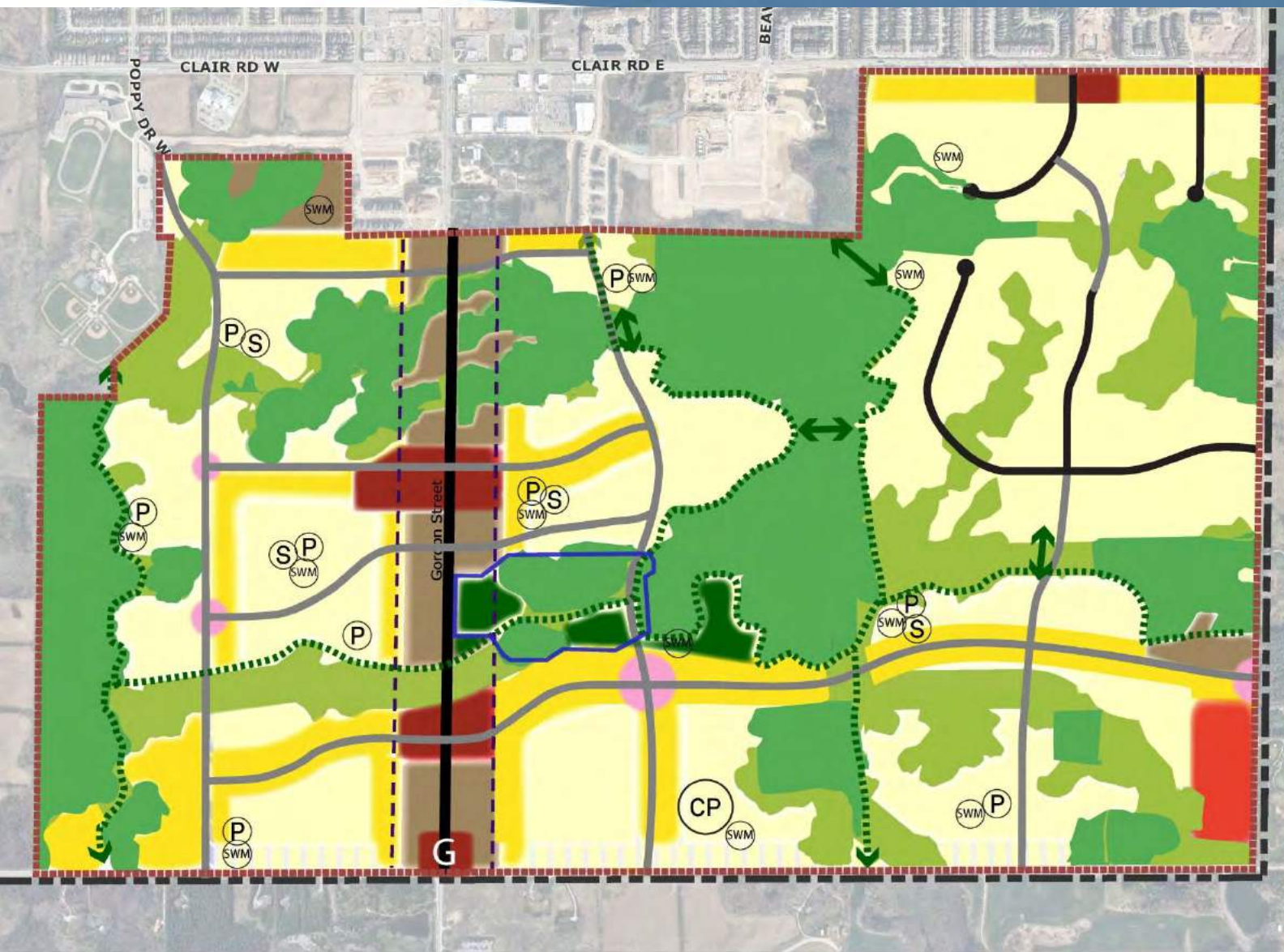
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- Service Commercial
- Rolling Hills Residential
- Open Space

N

Alternative 1: Featuring the Green



Alternative 2: Focus on Community and Services



- Legend**
- Clair-Maltby Secondary Plan Boundary
 - Cultural Heritage Landscape
 - Urban-Rural Transition Zone
 - Gordon St. Corridor
 - Existing Street Network
 - Proposed Street and Cycling Network
 - Potential Street: Connection
 - Proposed Trail Network
 - Potential Active Transportation Link
 - Neighbourhood Park
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- Natural Heritage System**
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- Land Use**
- Low Density (Residential)
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Alternative 3: Connected and Urban

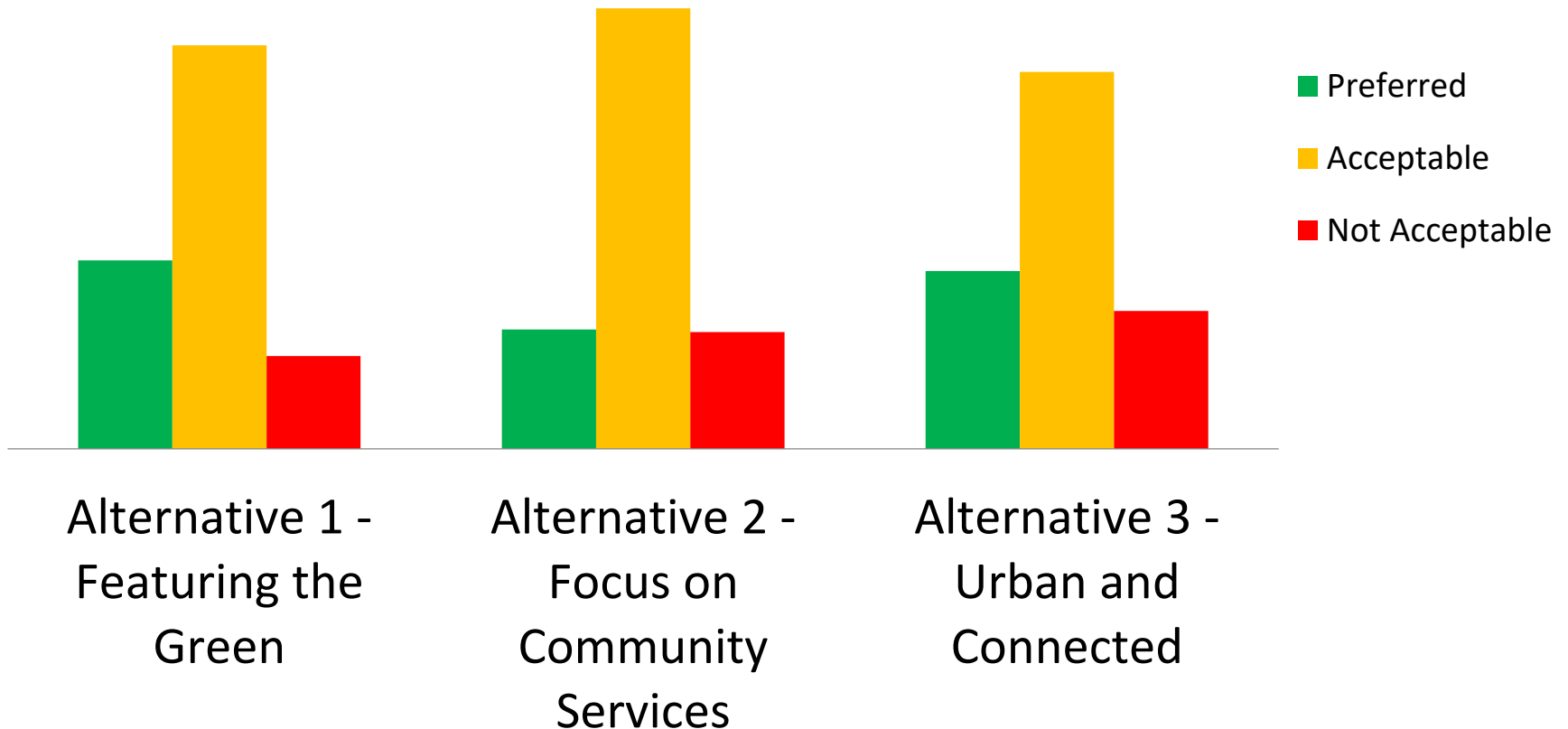
Clair-Maltby
Transform. Connect. Community.



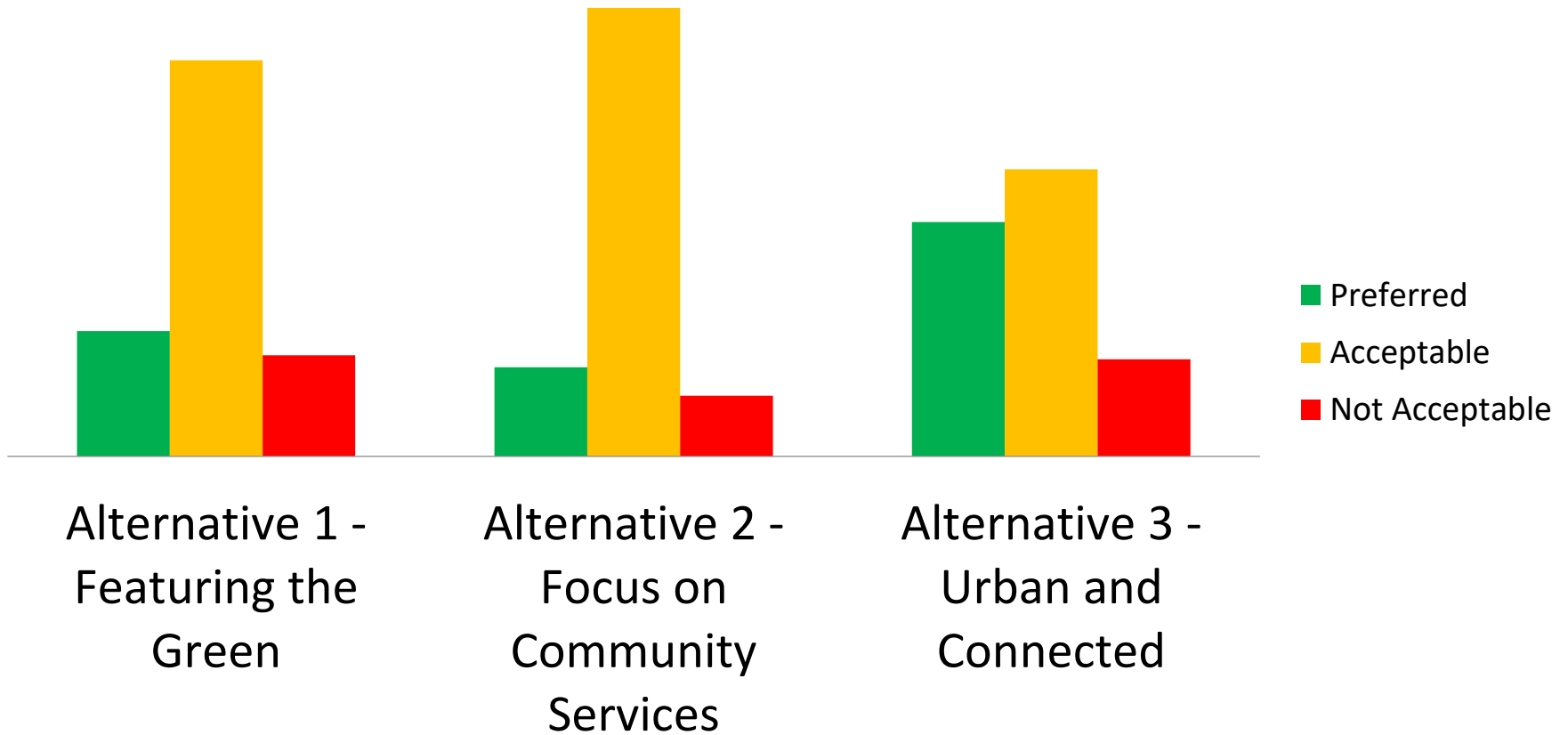
What We Heard



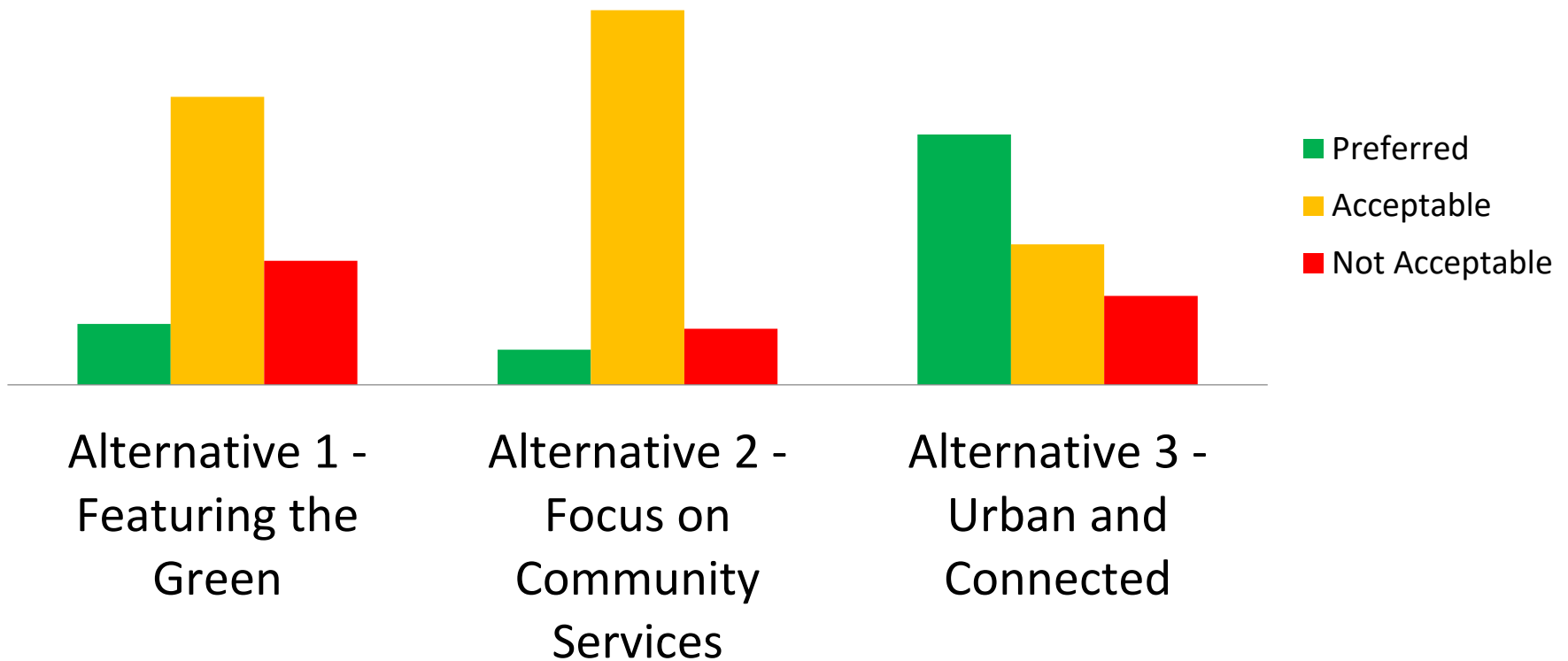
Vibrant and Urban



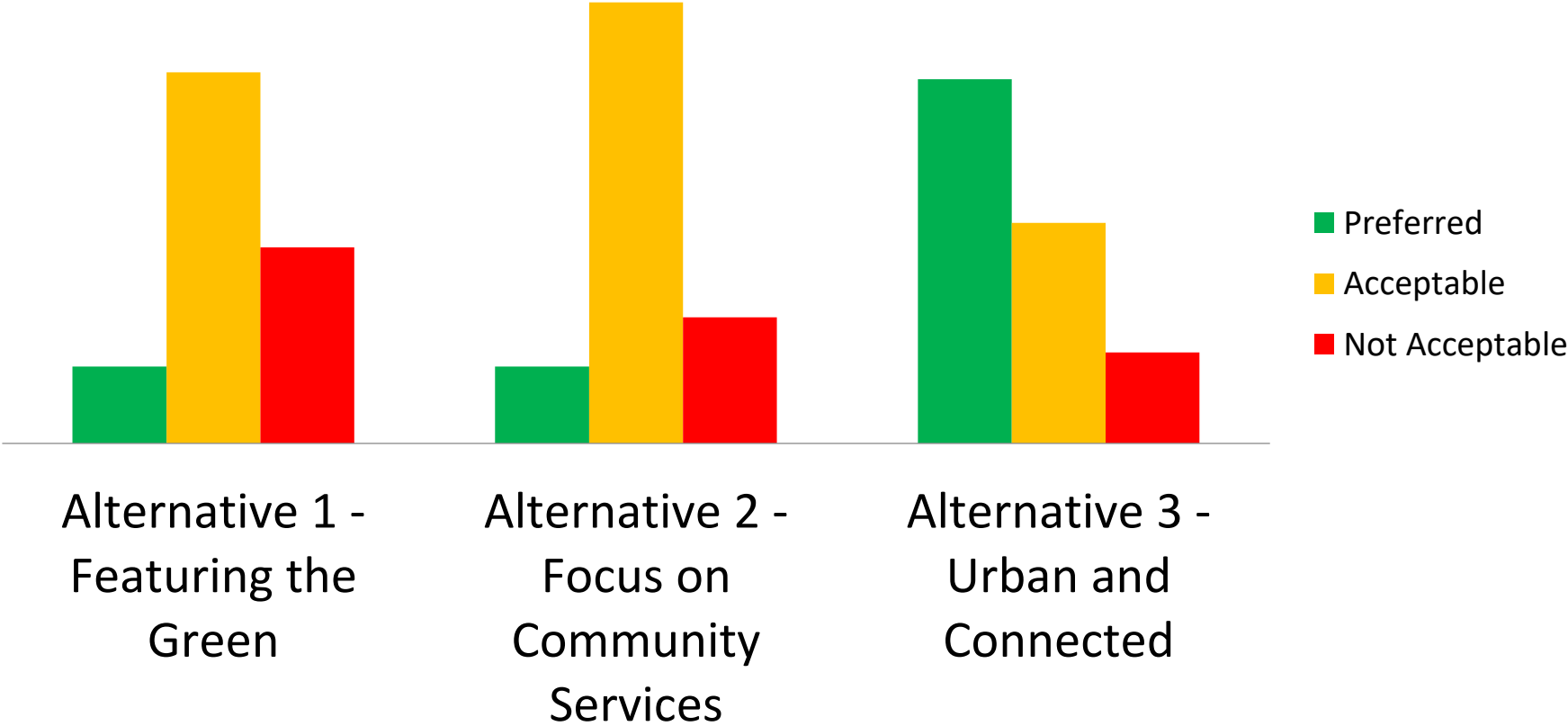
Green and Resilient



Interconnected and Interwoven



Balanced and Liveable



What we heard

- Road locations and alignments
 - Grid network
 - Natural Heritage System crossings
 - Concerns related to single loaded roads
- Additional trails, including to employment lands
- Road through Cultural Heritage Landscape and Natural Heritage System

What we heard

- Location and number of mixed-use and neighbourhood commercial
- Location of community park
- General support for collocating dry stormwater management, parks and schools
- Rural-urban transition, especially along Victoria Road
- Importance of Natural Heritage System including landform
- General support for green gateway
- Integrate safe options active transportation

What we heard

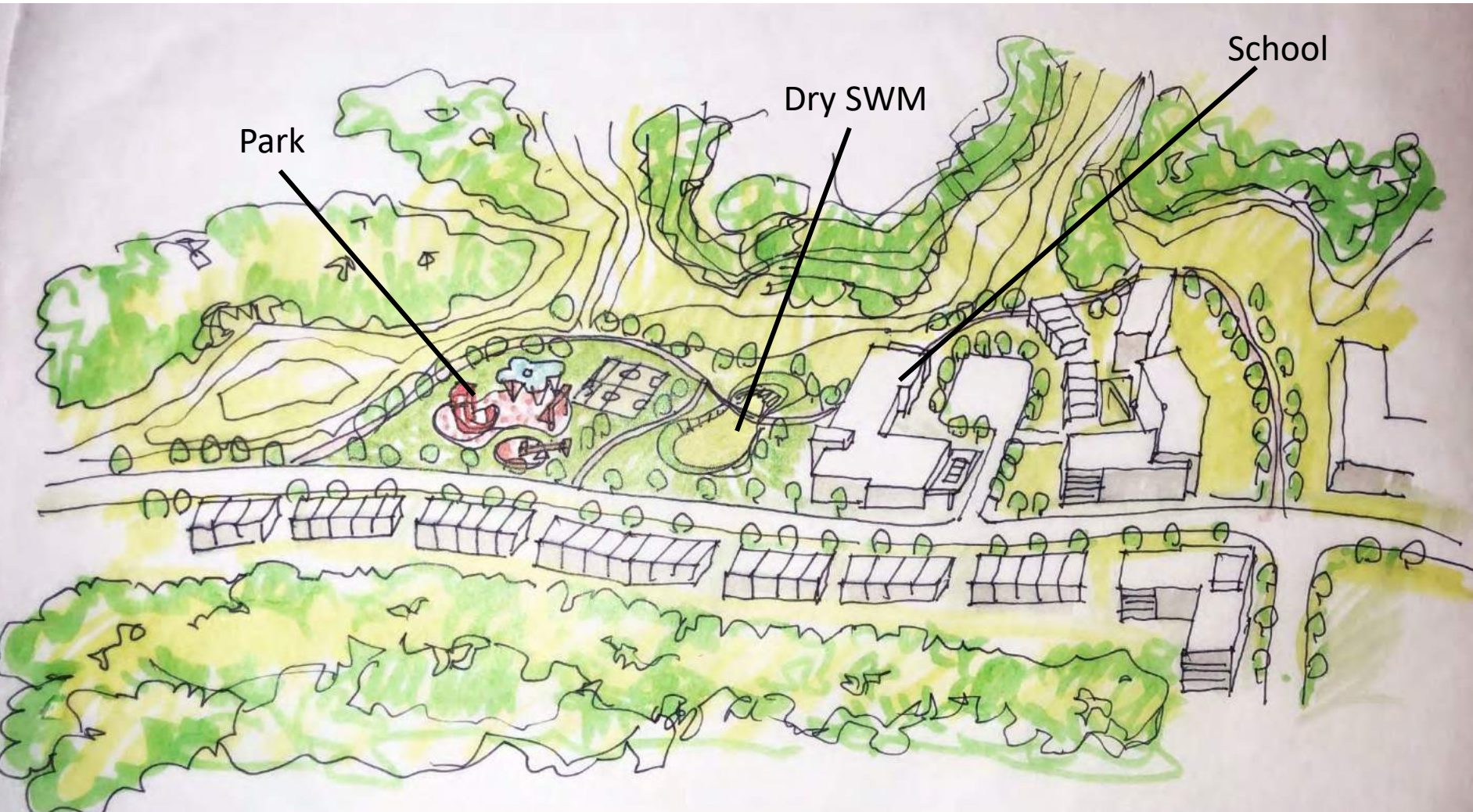
- Rolling Hills
 - Concern about showing any redevelopment
 - Support for some development along Clair Road
 - If developed there are no schools and parks shown. Should more density be added along roads?
 - Concern about economic impacts

Preliminary Preferred Concept

Key Area Demonstration sketches



Key Area Demonstration sketches



Next Steps

Galleria & Room 112 – ask questions, provide your written comments or mark-up a copy of the preferred concept plan

April 9, 2018

- Open House 4:30-6:30
- Council Presentation 6:30
- deadline to register as a delegation is Friday at 10am

June 2018 – Preferred Concept to Council for consideration

July 2018 – Q1/Q2 2019 – Phase 3 of the project

Thank You

Land Use Typologies

Low Density Residential



Medium Density Residential



Clair-Maltby
Transform. Connect. Community.



High Density Residential



Mixed Use



Neighbourhood Commercial



Natural Heritage System



Community Parks



Neighbourhood Parks



Stormwater Management



Gateways



Streets and Blocks



Cycling Trails and Multi-Use Paths



Structuring Elements





Clair-Maltby Secondary Plan

Transform. Connect. Community.

Council Meeting
April 9, 2018

The Secondary Plan Process



CMSP & MESP Project

Community Engagement Opportunities

2015	June – Project Kick-off Report to Council August – TOR Open House September – TOR Focus Group Session October – consultation on draft TOR
2016	May – Property Owners Meeting
2017	February/March – Establishment of the Community Working Group April – Visioning Workshop July – COW/Council approval of vision and guiding principles September – Visioning Workshop December – COW/Council approval of Conceptual Community Structure
2018	March – EAC/RSAC, Council Workshop April – Planning and Design Charrette

City of Guelph Retweeted
Stacey Laughlin @staceylaughlin · Apr 4
 Days 1 & 2 of the Clair-Maltby Charrette are complete! Great input, discussion and ideas are being shared. Check out this video which explains the vision for the #clairmaltby area!
 Planning #Guelph's newest community: Clair Maltby youtu.be/zAyljeAm5c via @YouTube

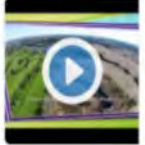


City of Guelph @cityofguelph · Apr 4
 Thank you to everyone who came to yesterday's #clairmaltby workshop! More chances to get involved on April 5 and again on the 9th. Learn more at ow.ly/L9xS30jgpn

Dominique O'Rourke @DORourke
 Standing room only for @cityofguelph consultation for Clair-Maltby development. Important conversations about environment, development, wellbeing and more. That's democracy.



City of Guelph @cityofguelph · Mar 28
 Imagine the possibilities for the Clair-Maltby community! Help the City design homes, parks, trails and more in Guelph's south end community. Workshops April 3-9 ow.ly/yhaA30j9TBo



Help us plan Guelph's next community: Clair-Maltby
 April 6 to 9, the City is hosting several opportunities for you to help plan a new community in Guelph's south end (between Clair Road and Maltby Road) learn...
[youtube.com](https://www.youtube.com)

Now available
 All funding provided by the Government of Ontario. Client applications will be reviewed by the local planning department in mid-March. After successful applications are received, the City will be in a position to begin the design process.
Session 1
 Tuesday, September 19
 6:00 p.m. - 8:00 p.m.
 City Hall, 1 Guelph Street, Guelph
Session 2
 Monday, September 25
 6:00 p.m. - 8:00 p.m.
 City Hall, 1 Guelph Street, Guelph
For more information
 Alex Goss, Manager of Community Development
 519-822-1260 or alex.goss@cityofguelph.ca

ROAD CLOSURE
Safe Semester
September 8
Weekend road closure
 On Kellogg and Isabella
 - All parking lot openings
 - All streets closed to traffic
 - All streets closed to one-way traffic
 - All streets closed to two-way traffic
 - All streets closed to one-way traffic
 - All streets closed to two-way traffic
 - All streets closed to one-way traffic
 - All streets closed to two-way traffic



City of Guelph Retweeted
Scott Stewart @S_Stewart · Apr 3
 Bus tour of Clair-Maltby with lots of interesting and informative stops. Led by our terrific co-chairs Arun and Stacey. Great to see our Councillors participating alongside staff. #gettinginformed #planningourfuture now see you at the charrette tonight Guelph. @cityofguelph



Clair-Maltby

Transform. Connect. Community.

Help us plan

the Clair-Maltby community through a planning and design charrette and public information sessions

April 3-6 and 9
 City Hall, 1 Guelph Street, Guelph

Specific times and meeting details available at guelph.ca/clair-maltby

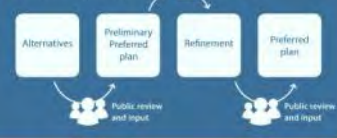
Clair-Maltby will be a vibrant, urban community in south Guelph—a community that will connect to Guelph's existing southern neighbourhoods and the rest of the City.



We need your help to get it there.

What is a charrette?

A key step for a meeting or a series of meetings, where we all work together to map solutions, in this case developing a preliminary plan for the Clair-Maltby community.



Get involved. Learn more. guelph.ca/clair-maltby

For more information
 Stacey Laughlin, SAC, SAC Senior Policy Planner
 Planning Urban Design and Building Services
 519-822-1260 x3127

Clair-Maltby

Transform. Connect. Community.



Help us plan Guelph's newest community

Clair-Maltby design charrette and open house

Save the dates

April 3-6 and 9

Design charrette with public input and public information sessions

Times and locations will be confirmed in March.

City Council will participate in a workshop on March 21. The public can observe this session and then provide input at the charrette.

Join us and help design a feasible plan that will lead to a vibrant, urban community in south Guelph—a community that will connect to Guelph's existing southern neighbourhoods and the rest of the City.

Help us transform, connect and plan for development of the Clair-Maltby community.

Clair-Maltby

Transform. Connect. Community.

guelph.ca/clair-maltby



CITY NEWS

Secondary Plan Community Working Group
 The purpose of this group is to provide advice to the community regarding the Clair-Maltby Secondary Plan. The group will meet on a regular basis to discuss the plan and provide input to the City.

How to apply
 Applications for the Clair-Maltby Secondary Plan Community Working Group will be accepted on a rolling basis. For more information, visit guelph.ca/clair-maltby.

Member selection
 The City Council will select the Clair-Maltby Secondary Plan Community Working Group members on Wednesday, February 22 at the meeting at City Hall.

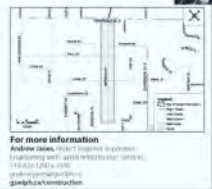
For more information
 Planning Urban Design and Building Services
 519-822-1260 or alex.goss@cityofguelph.ca

Metcave Street construction

Speedvale Avenue East to Terry Boulevard
 The City is hosting an open house to present the Clair-Maltby Secondary Plan to the community. The open house will be held on Wednesday, February 22 at the meeting at City Hall.

Wednesday, February 22
 Day in hours: 6-8pm
 Location: City Hall
 400 Guelph Street, Guelph

Why come to the open house?
 The City is presenting the Clair-Maltby Secondary Plan to the community. The open house will be held on Wednesday, February 22 at the meeting at City Hall. The public can observe this session and then provide input at the charrette.



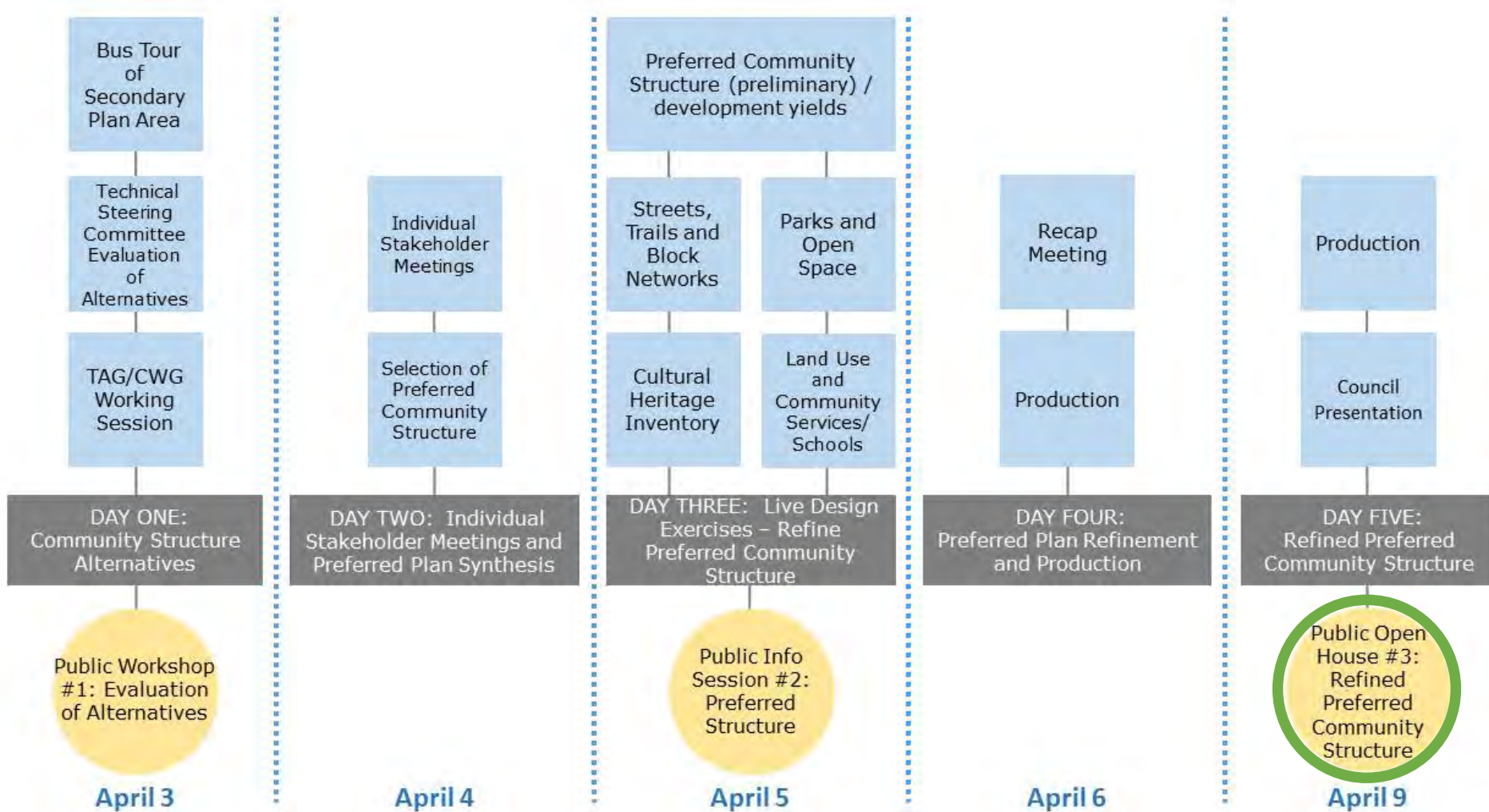
For more information
 Alex Goss, Manager of Community Development
 519-822-1260 or alex.goss@cityofguelph.ca

Follow us on twitter @cityofguelph

Alternate formats are available upon request in accordance with the Accessibility for Ontarians with Disabilities Act: 519-822-1260 or TTY 519-826-9771

519-826-9771

Design Charrette Overview



Charrette Day 1



Charrette Days 2&3



Vision

Clair-Maltby will be a vibrant, urban community that is integrated with Guelph's southern neighbourhoods, as well as having strong connections to Downtown, employment areas and the rest of the City.

The Natural Heritage System and the Paris Moraine provided the framework for the balanced development of interconnected and sustainable neighbourhoods.

The area will be primarily residential in character with a full range and mix of housing types and a variety of other uses that meet the needs of all residents.

A system of parks, open spaces and trails will be interwoven throughout to provide opportunities for active and passive recreation.

Guiding Principles



Vibrant and Urban



Green and Resilient



Healthy and Sustainable



Interconnected and Interwoven

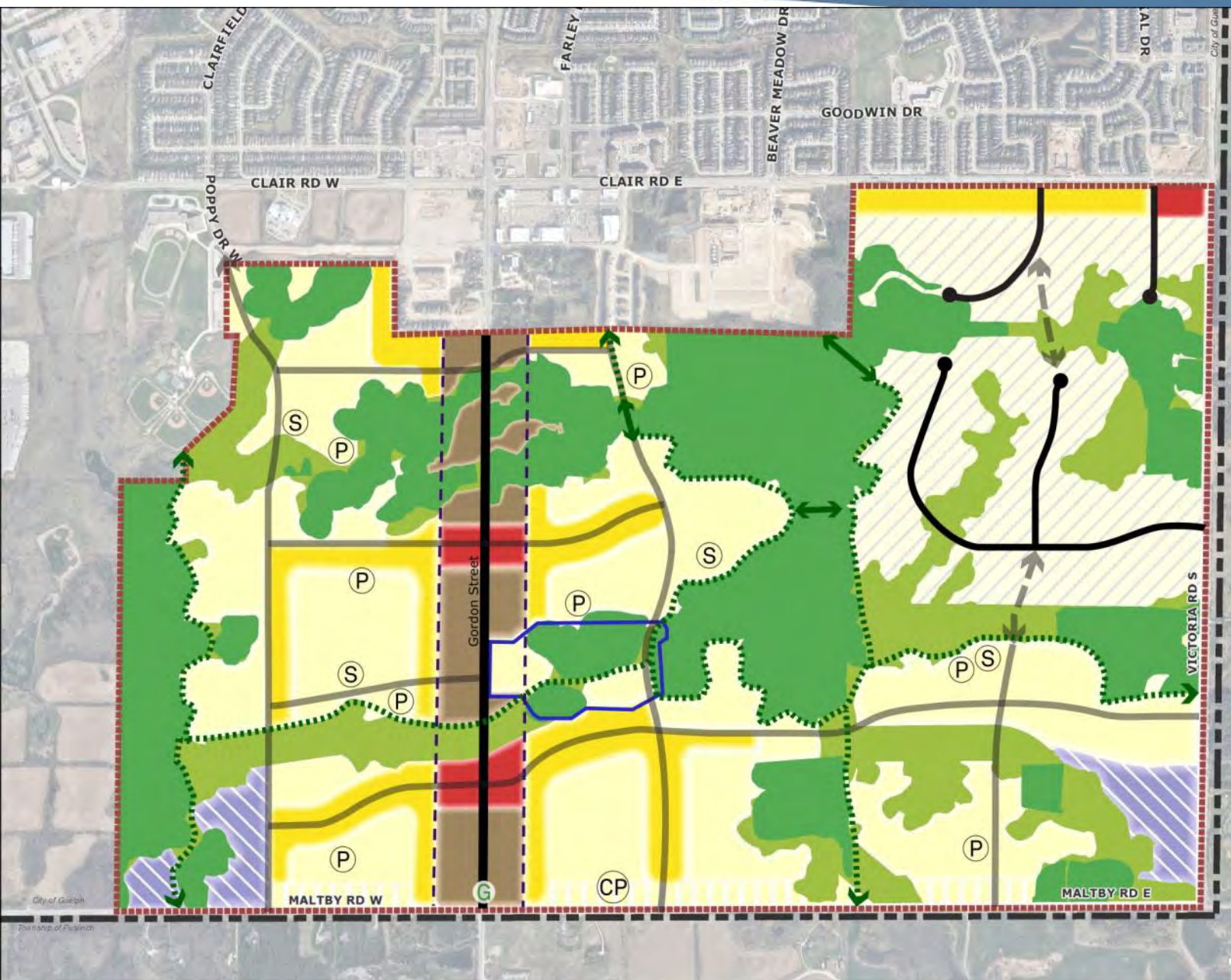


Balanced and Liveable

Conceptual Community Structure

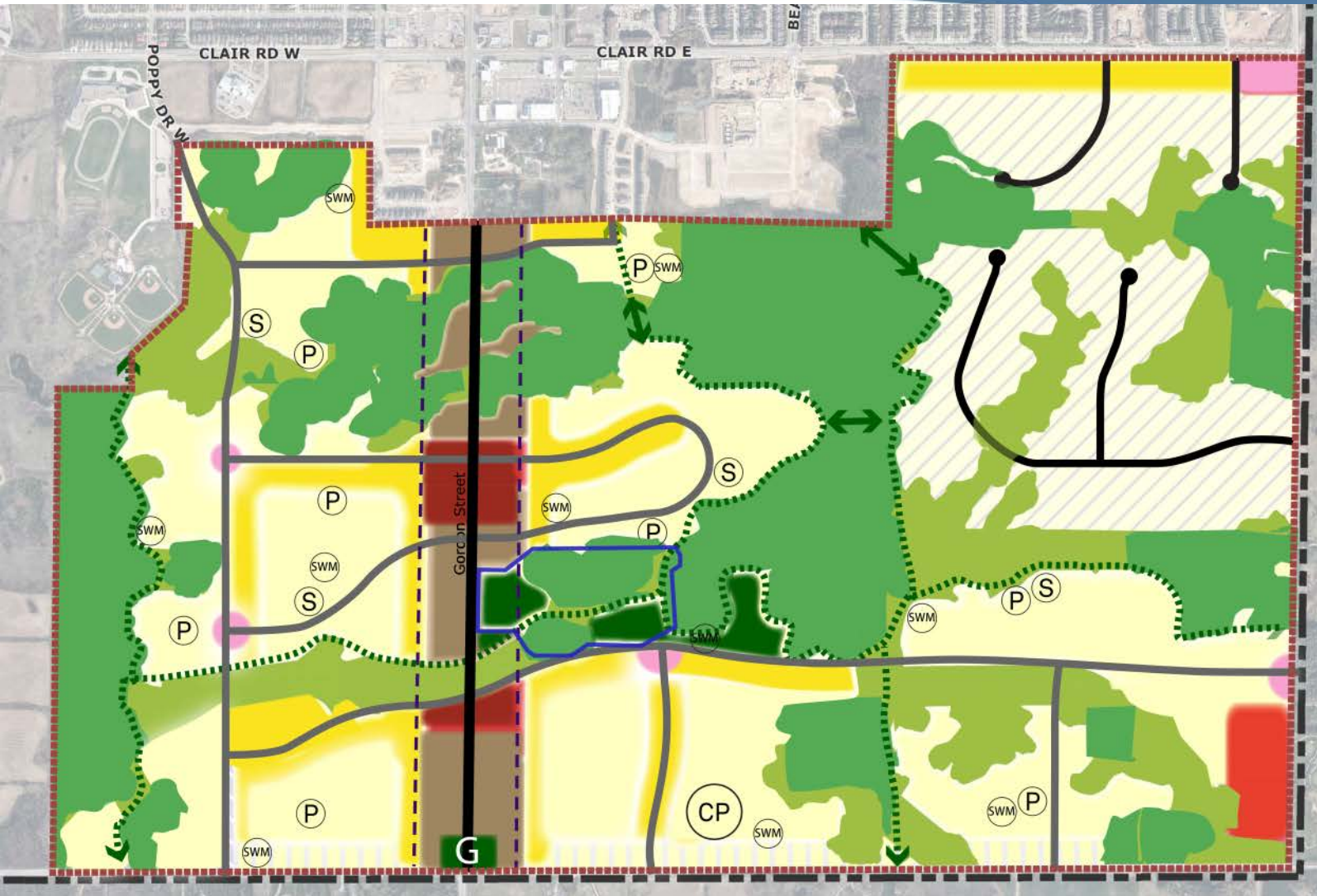
Clair-Maltby Conceptual Community Structure

- Legend**
- Clair-Maltby Secondary Plan Boundary
 - Cultural Heritage Landscape
 - Urban-Rural Transition Zone
 - Gordon St. Corridor
 - Existing Street Network
 - Proposed Street and Cycling Network
 - Potential Street Connection
 - Proposed Trail Network
 - Potential Active Transportation Link
 - Neighbourhood Park
 - Community Park
 - Elementary School
 - Gateway
- Natural Heritage System**
- May Permit Essential Transportation Infrastructure
 - Does Not Permit Transportation Infrastructure
- Land Use**
- Low Density (Residential)
 - Medium Density (Residential)
 - High Density (Residential)
 - Mixed Use
 - Employment
 - Rolling Hills Residential



City of Guelph
Township of Pasquid

Community Structure Alternatives



Legend

- Clair-Maltby Secondary Plan Boundary
- Cultural Heritage Landscape
- Urban-Rural Transition Zone
- Gordon St. Corridor
- Existing Street Network
- Proposed Street and Cycling Network
- Potential Street and Cycling Connection
- Potential Trail Network
- Potential Active Transportation Link
- Neighbourhood Park (P)
- Community Park (CP)
- Elementary School (S)
- Stormwater Management (SWM)
- Gateway (G)

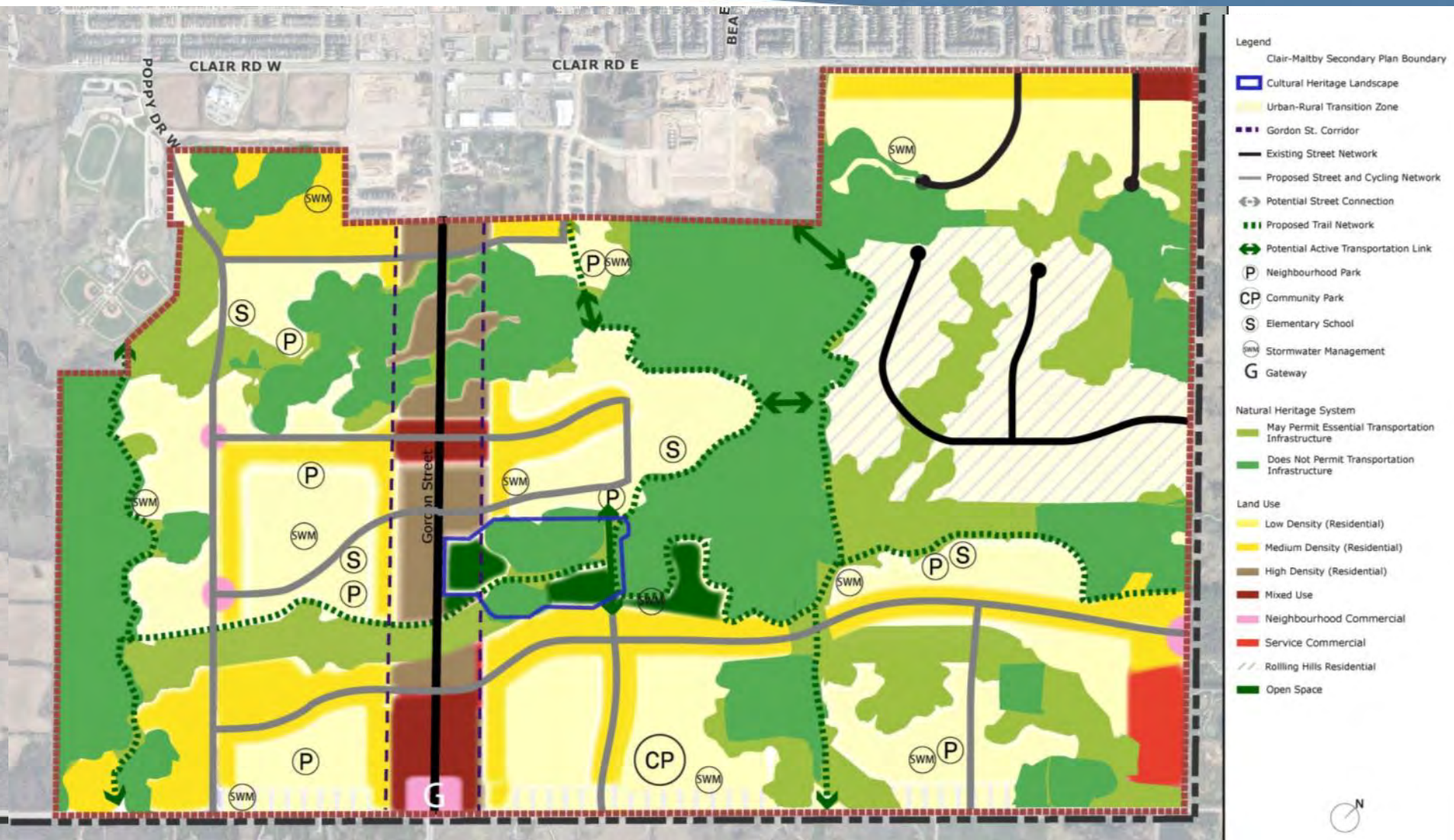
Natural Heritage System

- May Permit Essential Transportation Infrastructure
- Does Not Permit Transportation Infrastructure

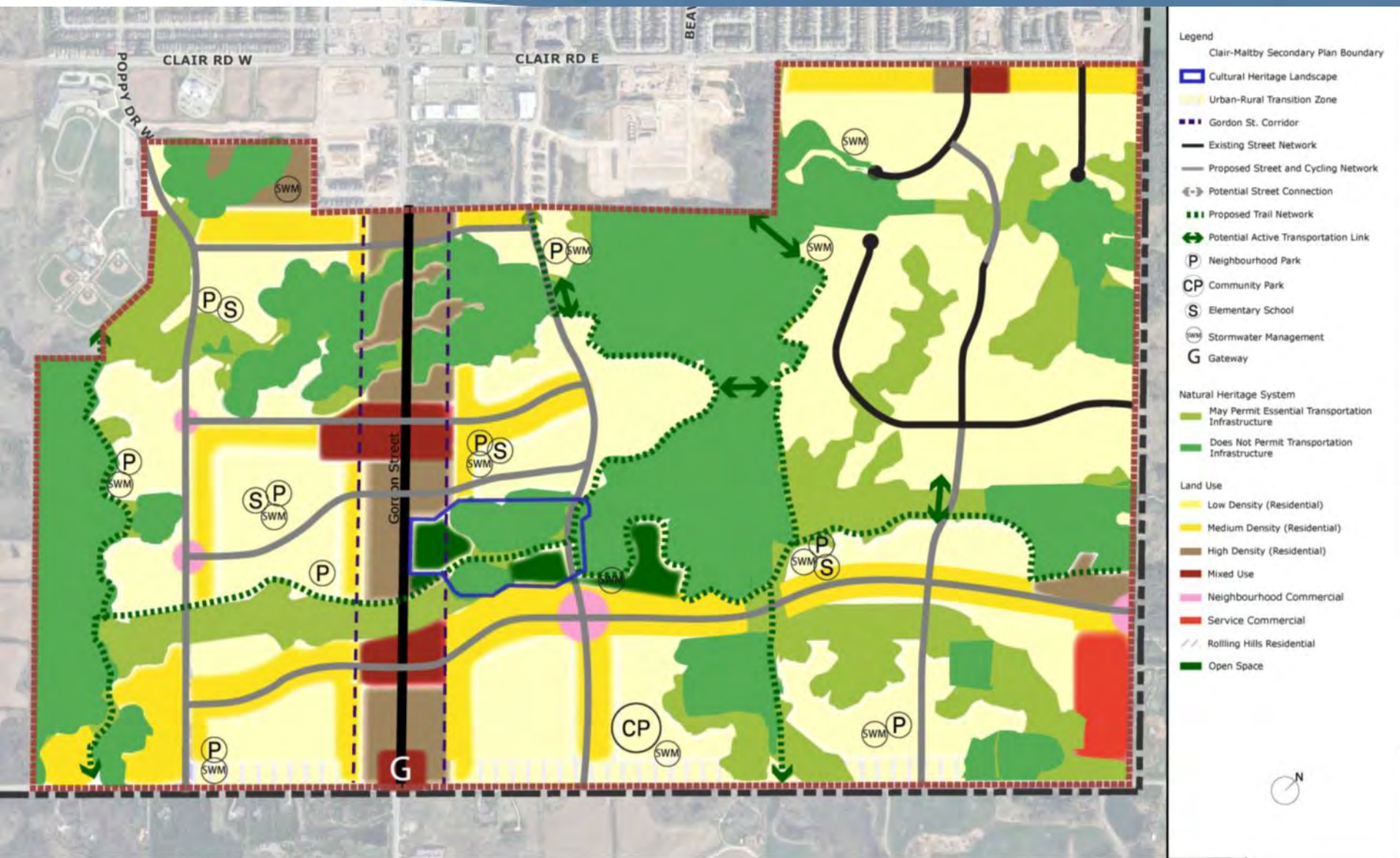
Land Use

- Low Density (Residential)
- Medium Density (Residential)
- High Density (Residential)
- Mixed Use
- Neighbourhood Commercial
- Service Commercial
- Rolling Hills Residential
- Open Space

Alternative 1: Featuring the Green



Alternative 2: Focus on Community and Services

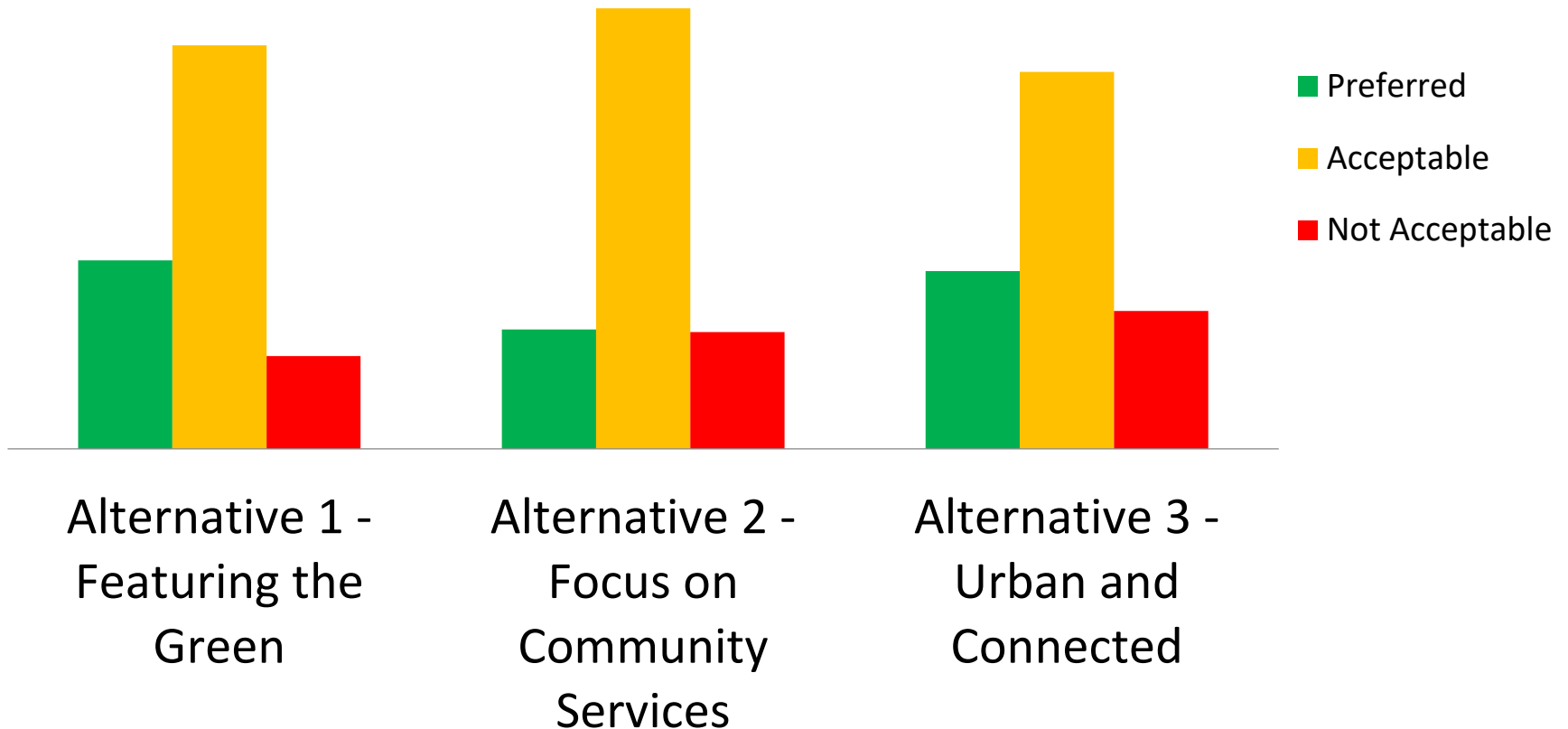


Alternative 3: Connected and Urban

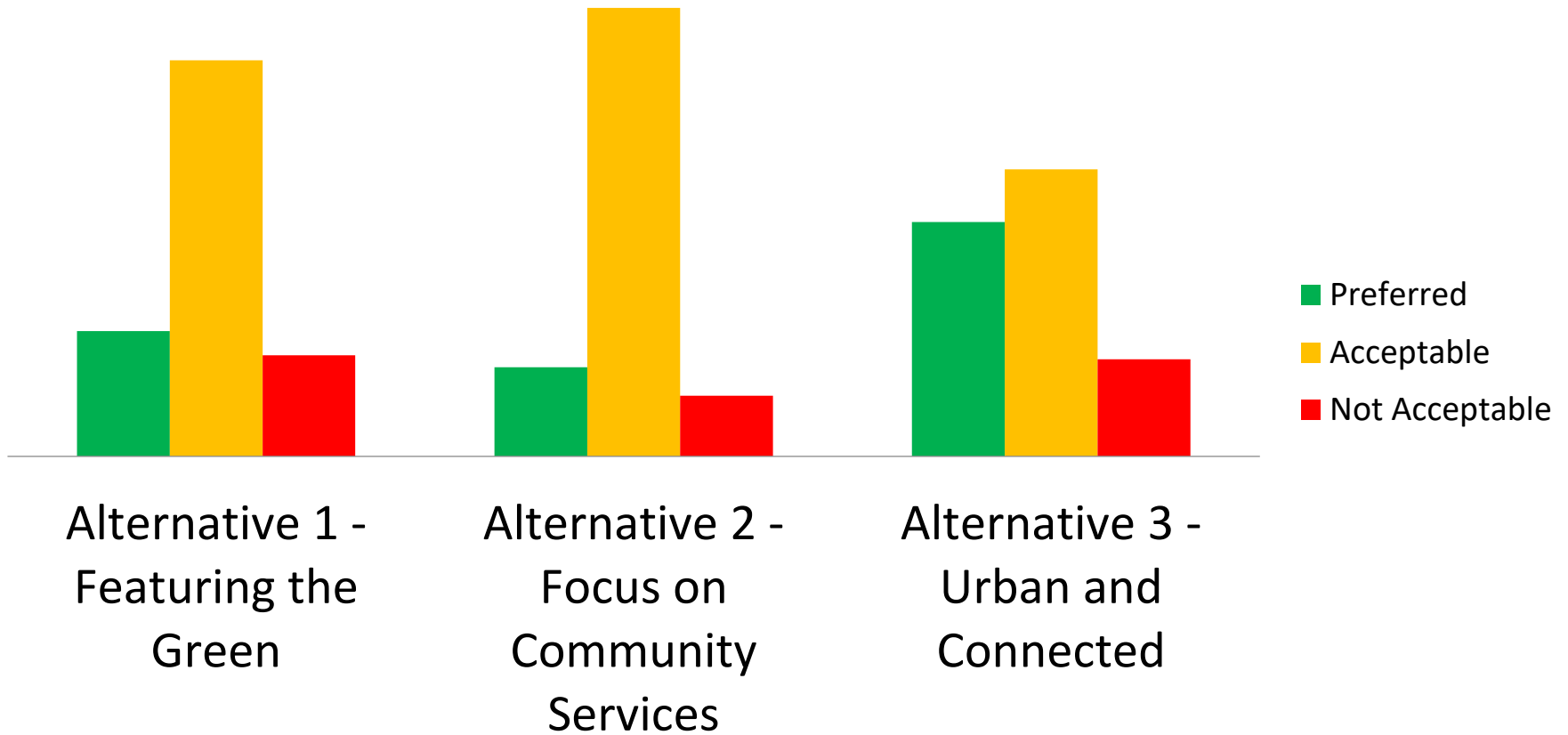
What We Heard



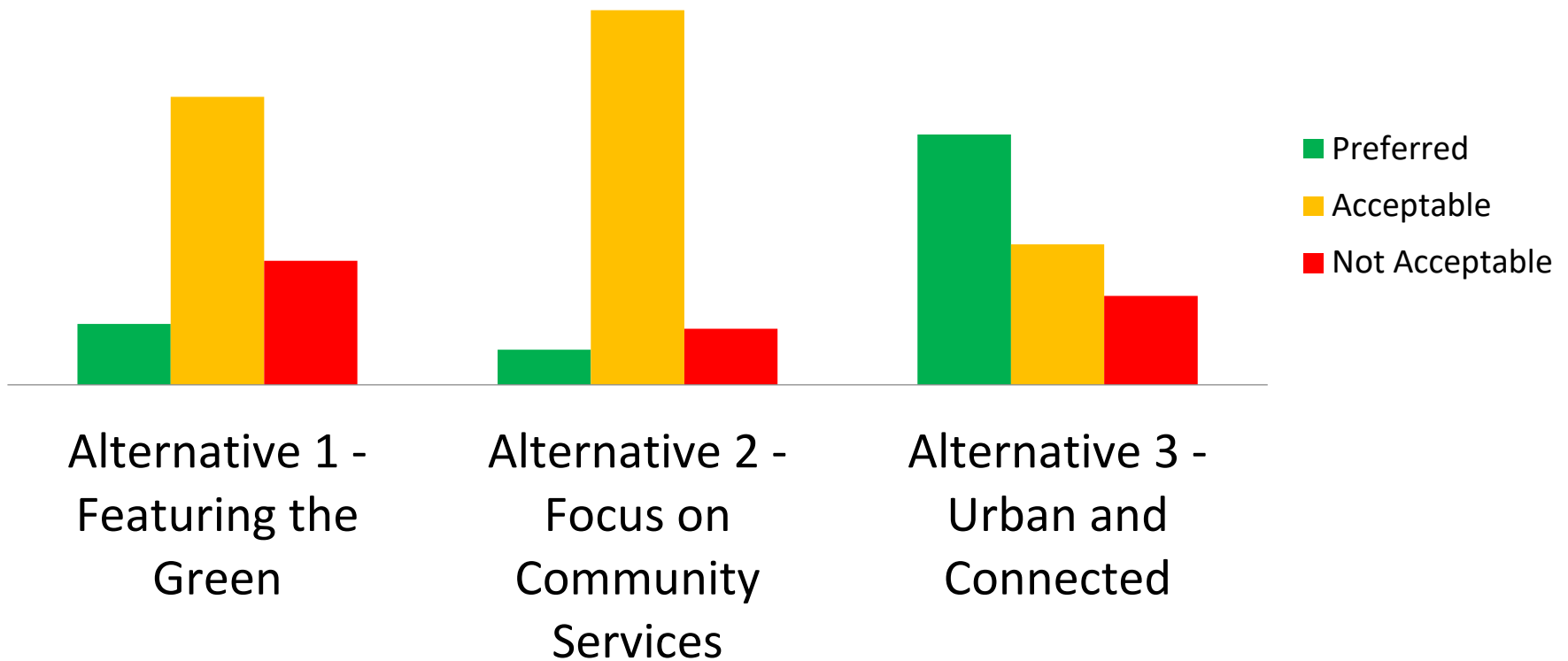
Vibrant and Urban



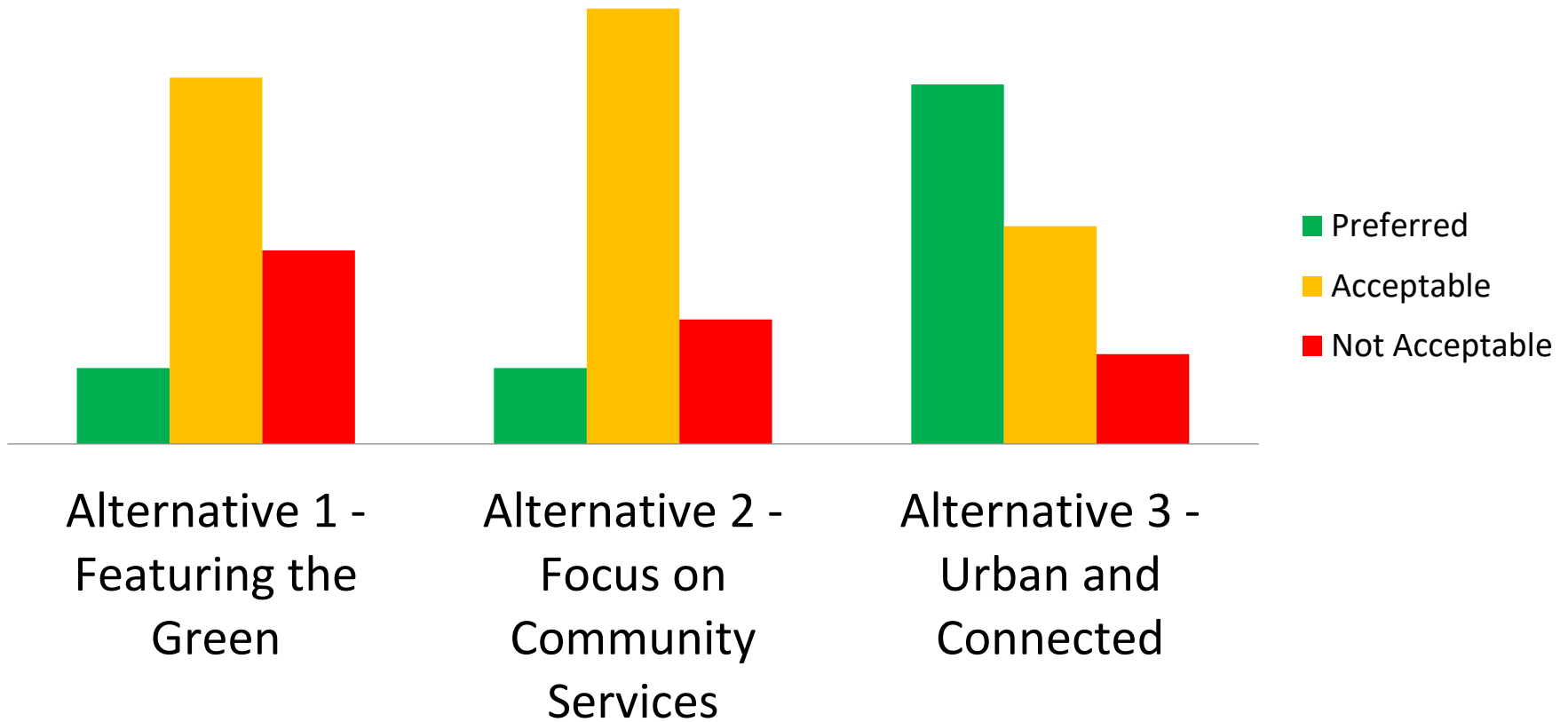
Green and Resilient



Interconnected and Interwoven



Balanced and Liveable



What we heard

- Road locations and alignments
 - Grid network
 - Natural Heritage System crossings
 - Concerns related to single loaded roads
- Additional trails, including to employment lands
- Road through Cultural Heritage Landscape and Natural Heritage System

What we heard

- Location and number of mixed-use and neighbourhood commercial
- Location of community park
- General support for collocating dry stormwater management, parks and schools
- Rural-urban transition, especially along Victoria Road
- Importance of Natural Heritage System including landform
- General support for green gateway
- Integrate safe options active transportation

What we heard

- Rolling Hills
 - Concern about showing any redevelopment
 - Support for some development along Clair Road
 - If developed there are no schools and parks shown. Should more density be added along roads?
 - Concern about economic impacts

PRELIMINARY

Preferred Community Structure

Day 3 – April 5, 2018

PRELIMINARY – April 5, 2018

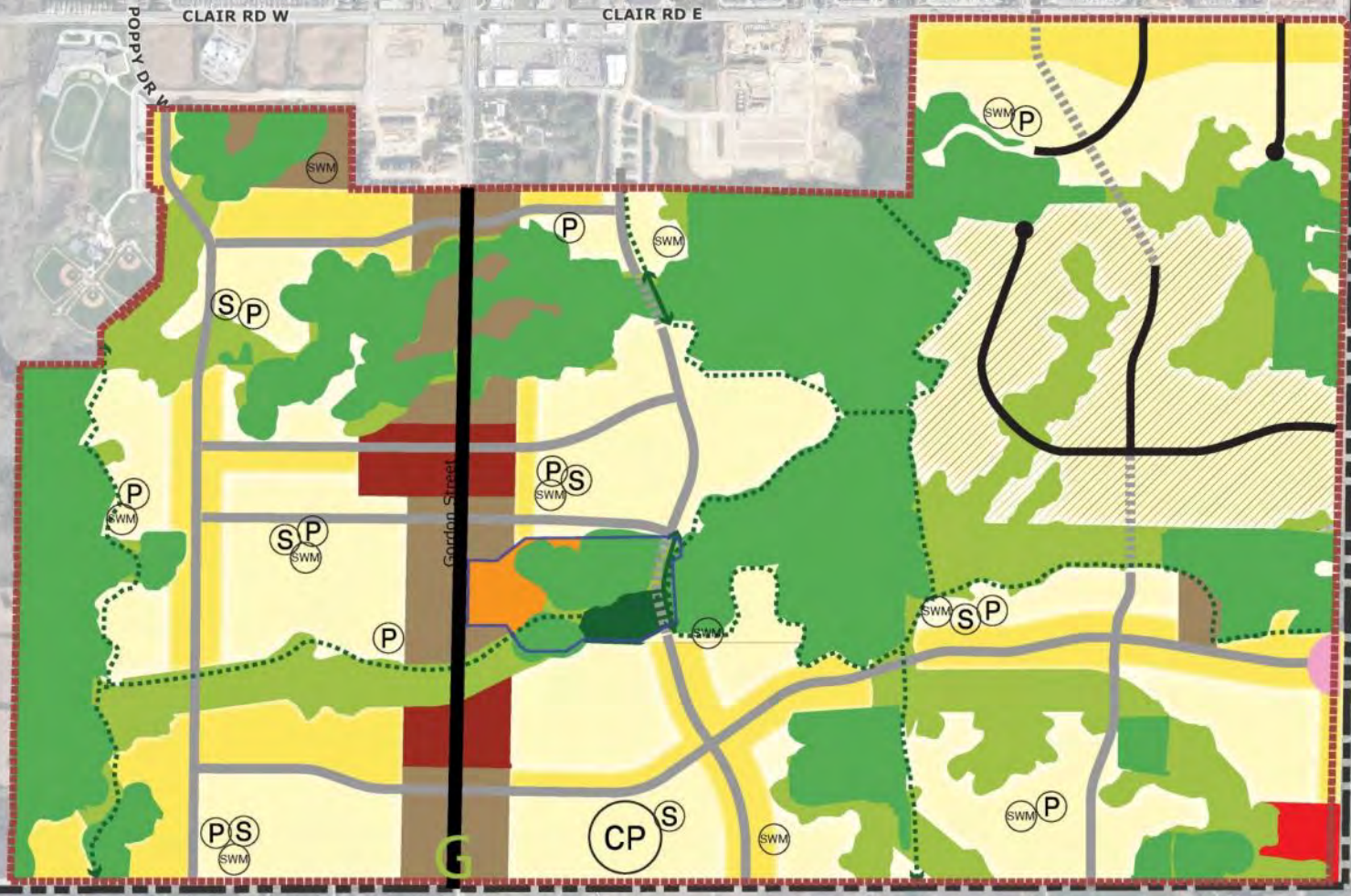
Clair-Maltby Preliminary Preferred Concept

April 5 2018

- Legend**
- Clair-Maltby Secondary Plan Boundary
 - Cultural Heritage Landscape
 - Urban-Rural Transition Zone
 - Gordon St. Corridor
 - Existing Street Network
 - Proposed Street and Cycling Network
 - Potential Street Connection
 - Proposed Trail Network
 - Potential Active Transportation Link
 - Neighbourhood Park
 - Community Park
 - Elementary School
 - Stormwater Management
 - Gateway

- Natural Heritage System**
- May Permit Essential Transportation Infrastructure
 - Does Not Permit Transportation Infrastructure

- Land Use**
- Low Density (Residential)
 - Medium Density (Residential)
 - High Density (Residential)
 - Mixed Use
 - Neighbourhood Commercial
 - Service Commercial
 - Reserve Lands
 - Open Space



What we heard on April 5th

- Continues to be differing public opinions on:
 - Rolling Hills
 - The north-south collector road on the east side of Gordon Street
 - Community Park
- Minor modifications to locations of land uses
- Changes to Neighbourhood/Convenience Commercial
- Consistent approach to Victoria Road
- Number of potential school locations

Preferred Community Structure

April 9, 2018

Clair-Maltby
Preliminary Preferred Concept

April 9 2018

Legend

-  Clair-Maltby Secondary Plan Boundary
-  Cultural Heritage Landscape
-  Urban-Rural Transition Zone
-  Gordon St. Corridor



Streets and Trails

-  Existing Street Network
-  Proposed Street and Cycling Network
-  Future Street Connection
-  Road Link Assessment Area
-  Proposed Trail Network
-  Potential Active Transportation Link

Parks, Schools, and Features

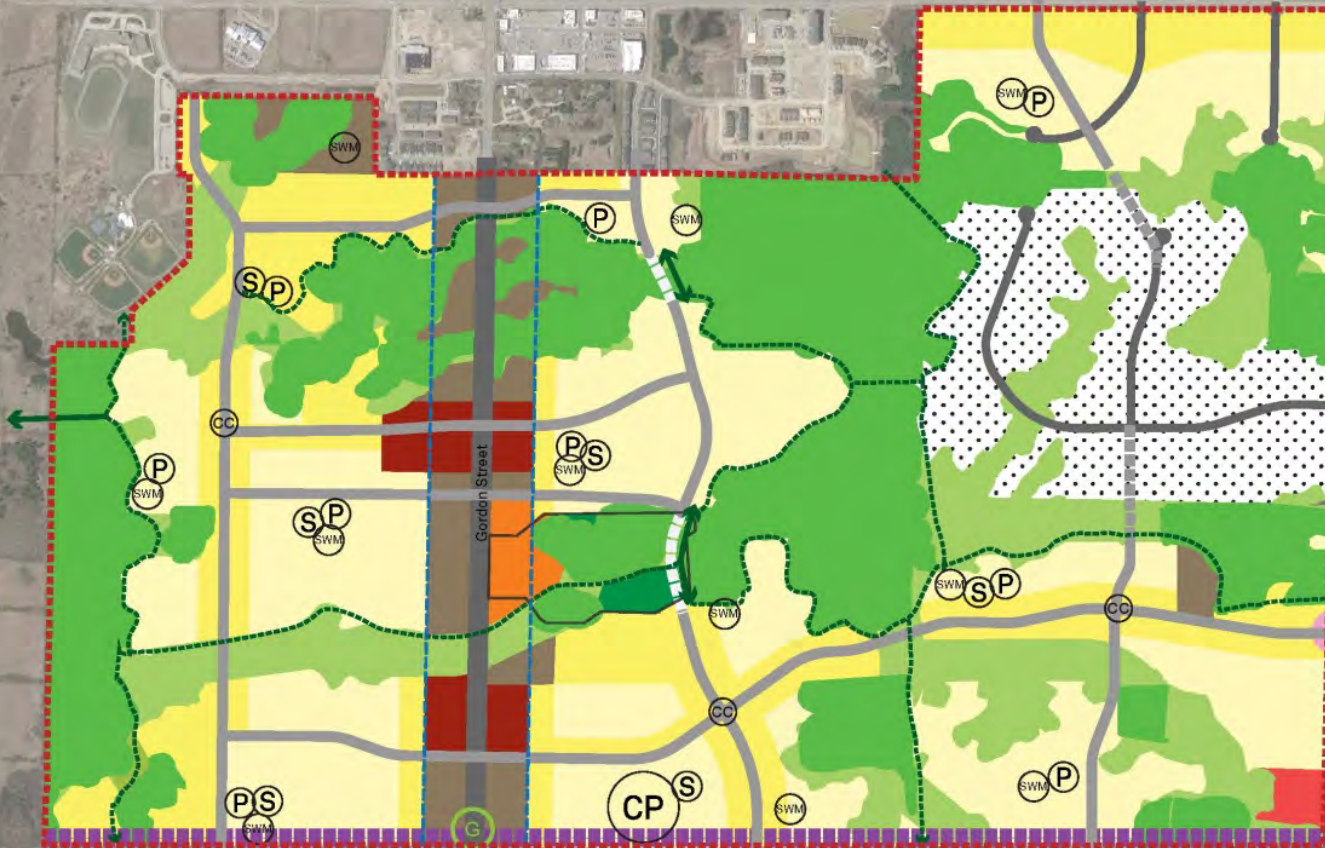
-  Neighbourhood Park
-  Community Park
-  Elementary School
-  Stormwater Infiltration Areas
-  Convenience Commercial Area
-  Gateway

Natural Heritage System

-  May Permit Essential Transportation Infrastructure
-  Does Not Permit Transportation Infrastructure

Land Use

-  Low Density (Residential)
-  Medium Density (Residential)
-  High Density (Residential)
-  Mixed Use
-  Neighbourhood Commercial
-  Service Commercial
-  Mixed Office / Commercial
-  Reserve Lands
-  Open Space



Next Steps

June 5, 2018	Preferred Community Structure to COW for decision
June 25, 2018	Preferred Community Structure to Council for decision
Q3 2018 – Q2 2019	Phase 3 of the project <ul style="list-style-type: none">• Planning Act process including additional Community Engagement• Detailed environmental/servicing work



WELCOME

Thank you for attending tonight's Open House

The materials presented today are the products of a week-long design charette.

1 Open House

4:30 - 6:30 pm

2 Council Presentation

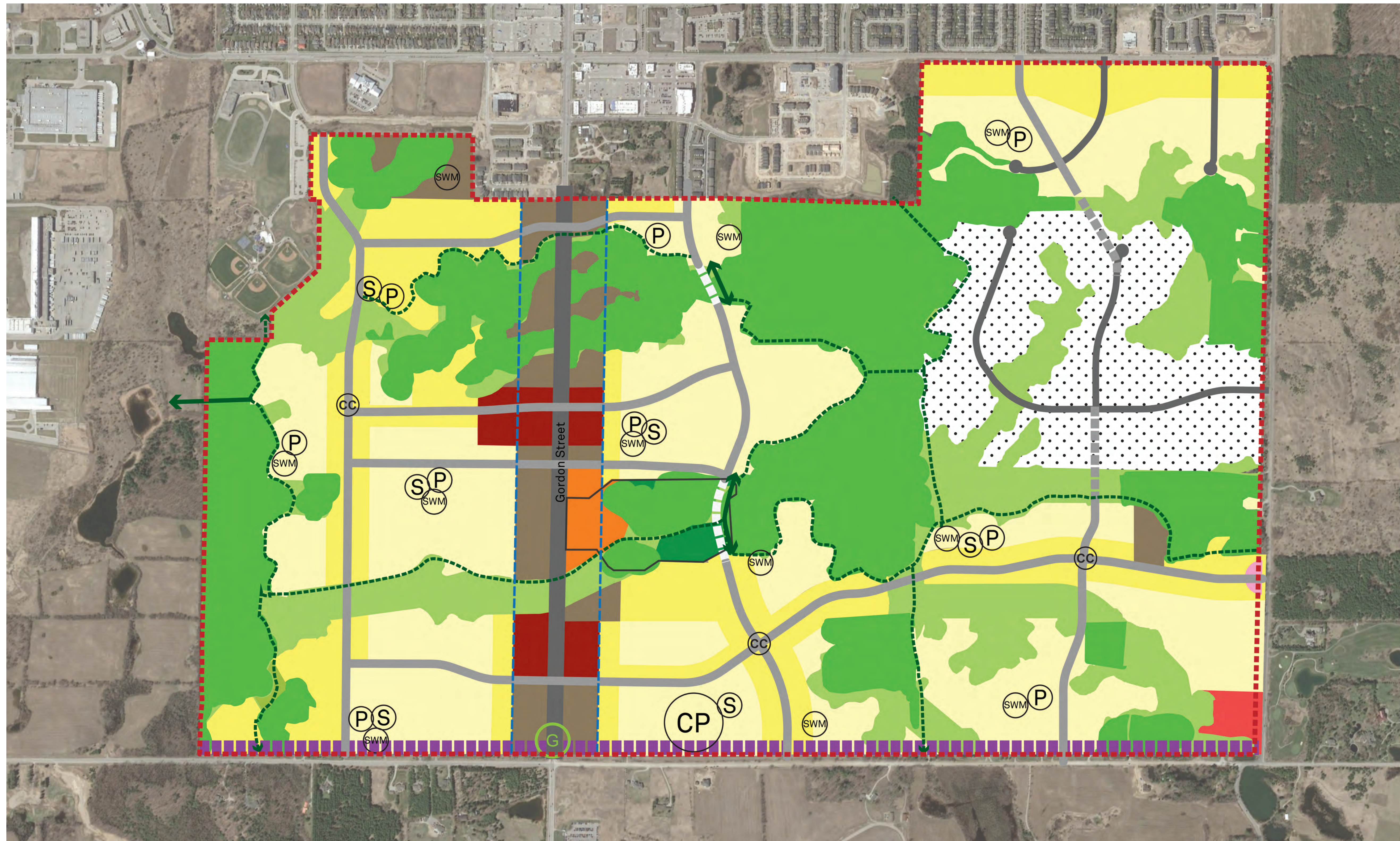
6:30 pm

Contact Us

Stacey Laughlin, MCIP, RPP
Senior Policy Planner
Planning, Urban Design and Building Services
stacey.laughlin@guelph.ca

Arun Hindupur, M.Sc., P.Eng.
Supervisor, Infrastructure Engineering
Engineering and Capital Infrastructure Services
arun.hindupur@guelph.ca

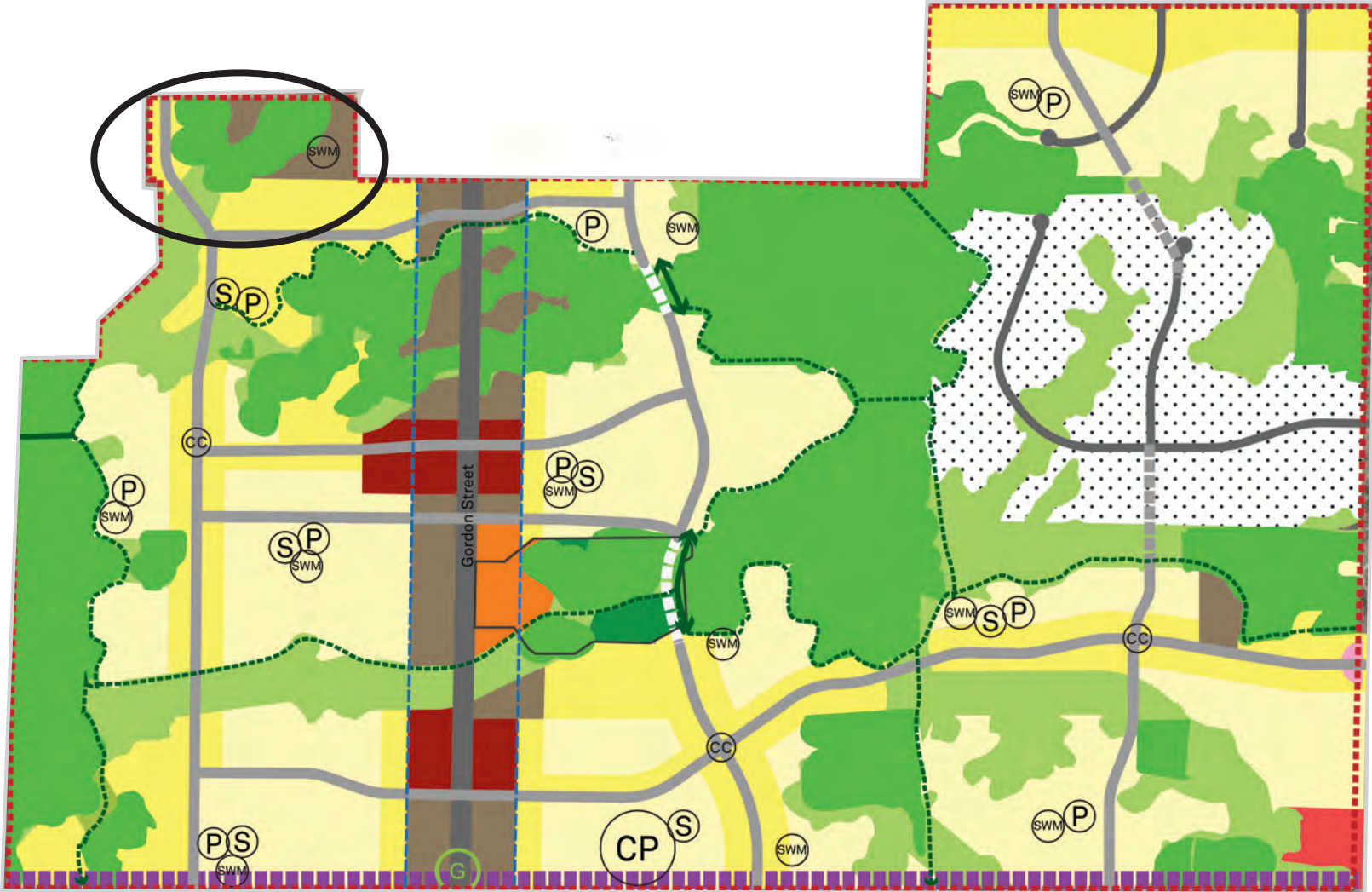
PRELIMINARY PREFERRED COMMUNITY STRUCTURE



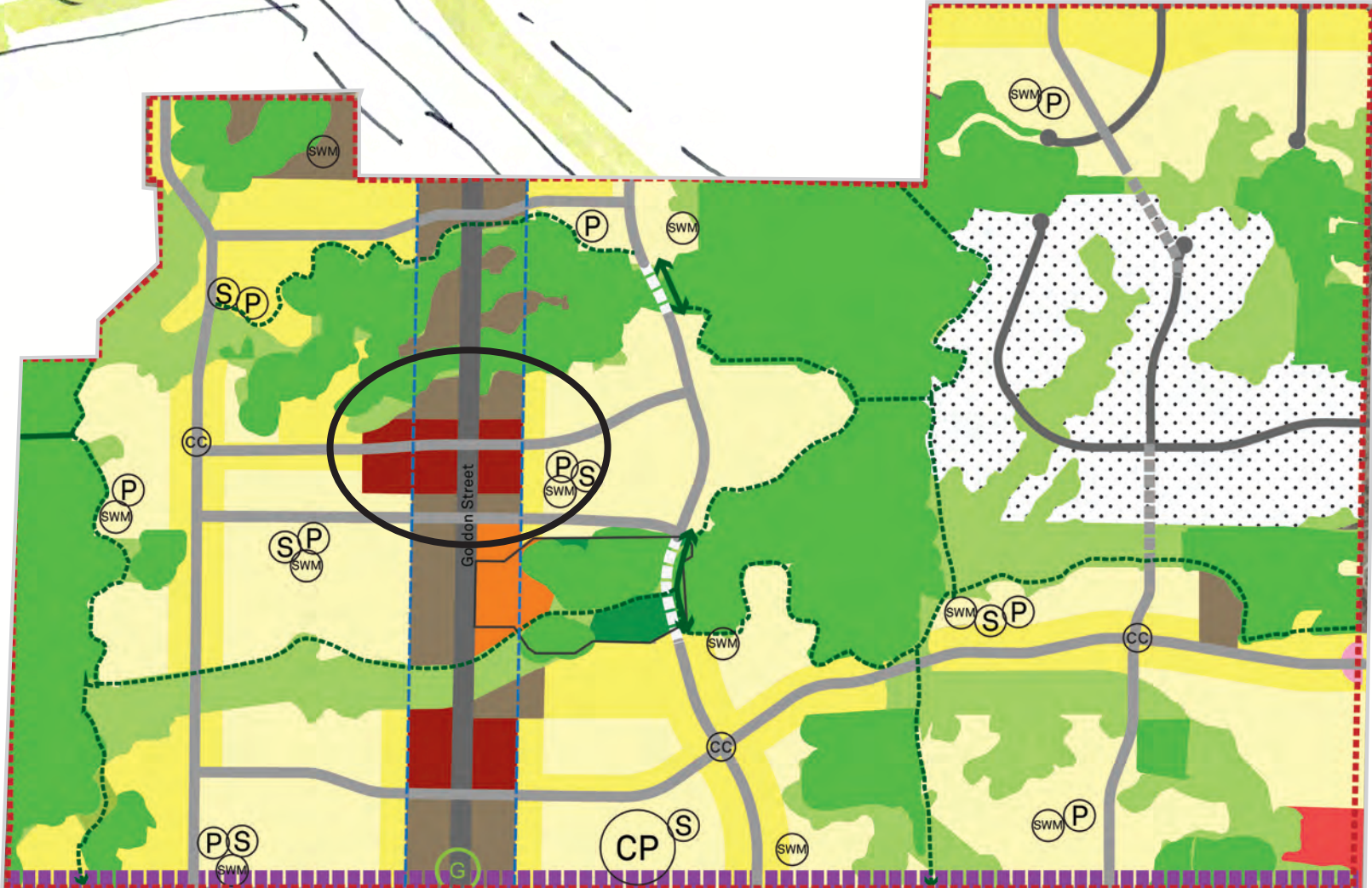
LEGEND

- Clair-Maltby Secondary Plan Boundary
- Cultural Heritage Landscape
- Urban-Rural Transition Zone
- Gordon St. Corridor
- Streets and Trails**
- Existing Street Network
- Proposed Street and Cycling Network
- Future Street Connection
- Road Link Assessment Area
- Proposed Trail Network
- Potential Active Transportation Link
- Parks, Schools, and Features**
- (P) Neighbourhood Park
- (CP) Community Park
- (S) Elementary School
- (SWM) Stormwater Infiltration Areas
- (CC) Convenience Commercial Area
- (G) Gateway
- Natural Heritage System**
- May Permit Essential Transportation Infrastructure
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- Land Use**
- Low Density (Residential)
- Medium Density (Residential)
- High Density (Residential)
- Mixed Use
- Neighbourhood Commercial
- Service Commercial
- Mixed Office / Commercial
- Reserve Lands
- Open Space

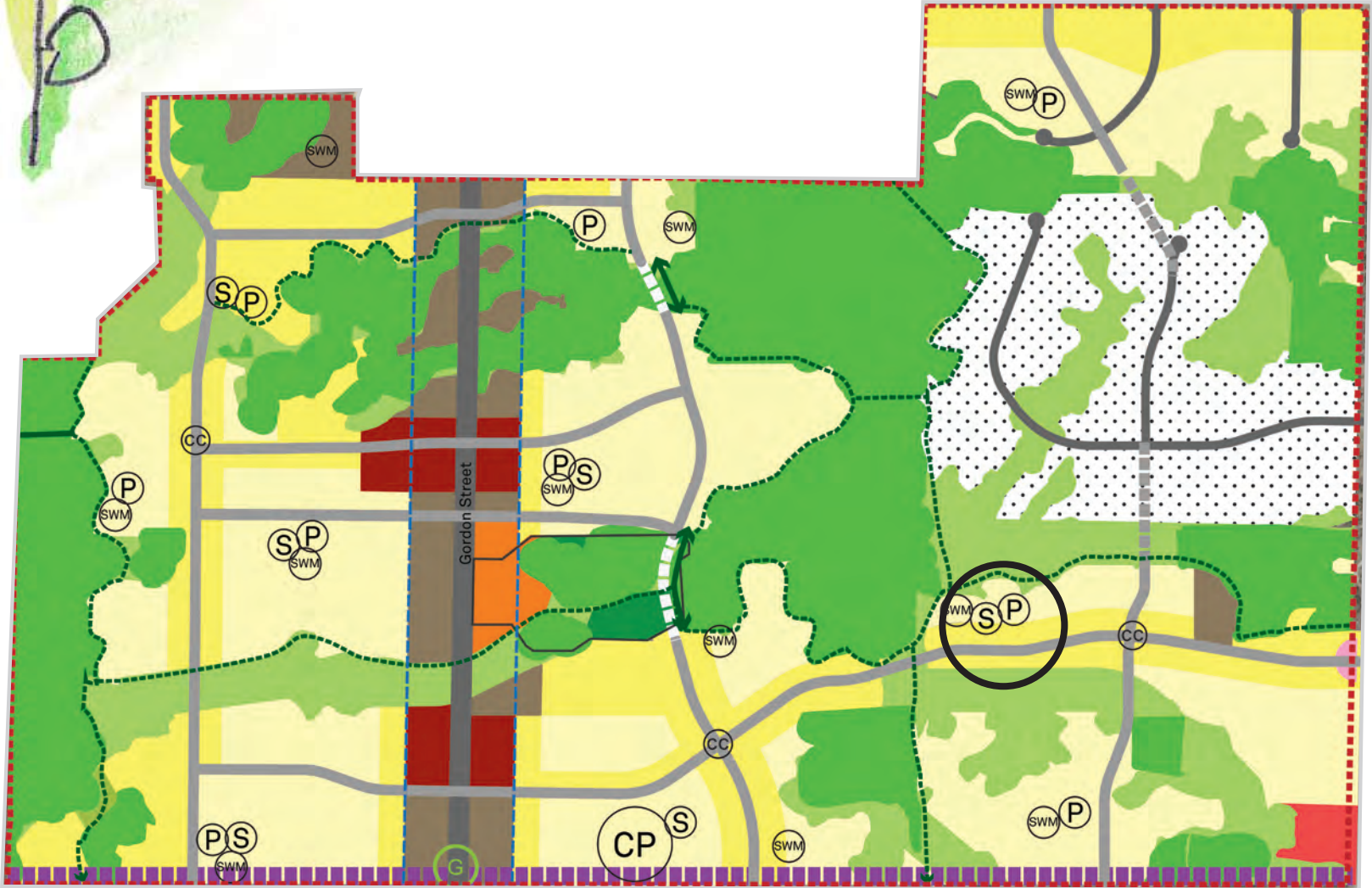
CONNECTIONS TO THE COMMUNITY



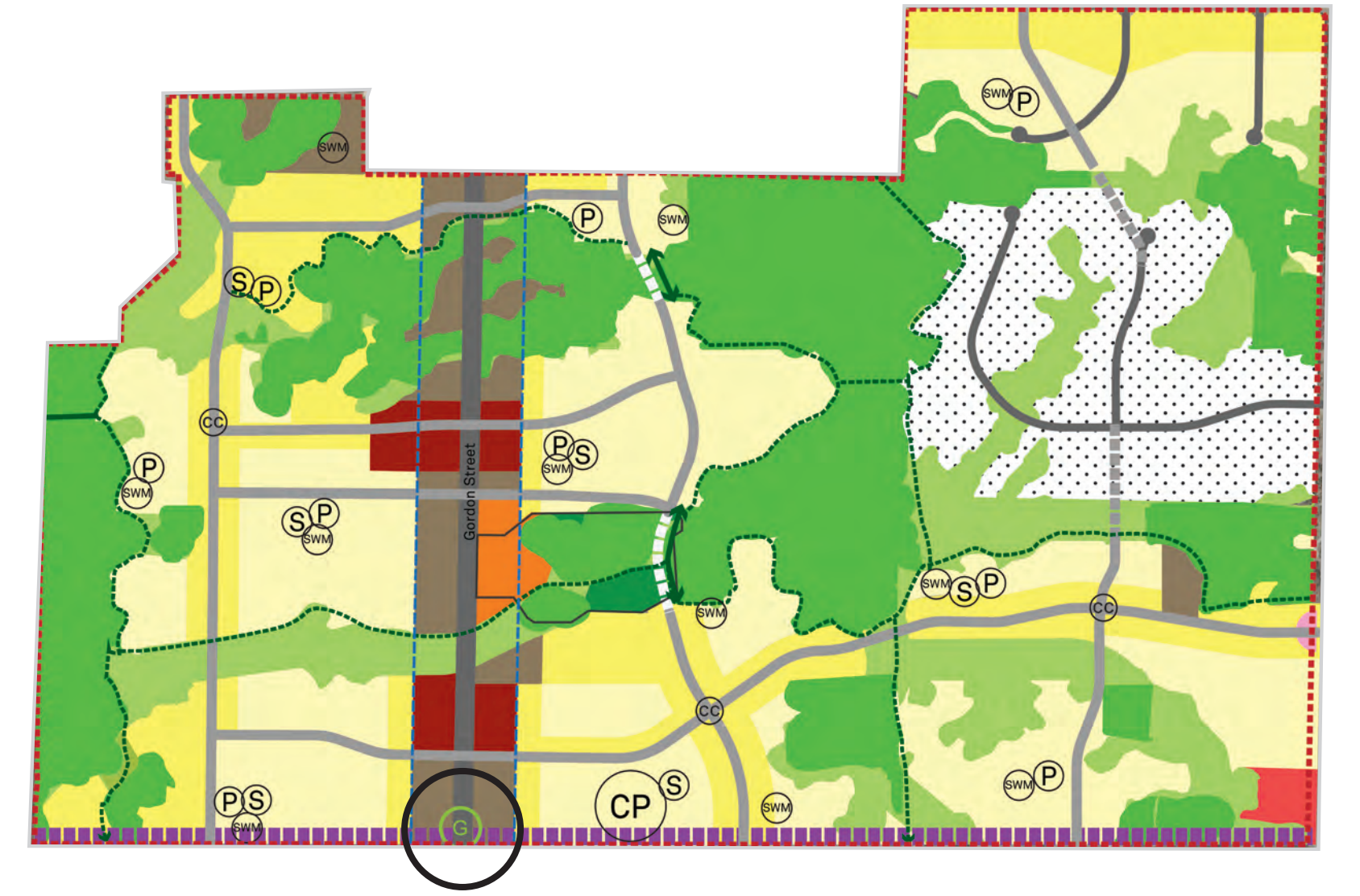
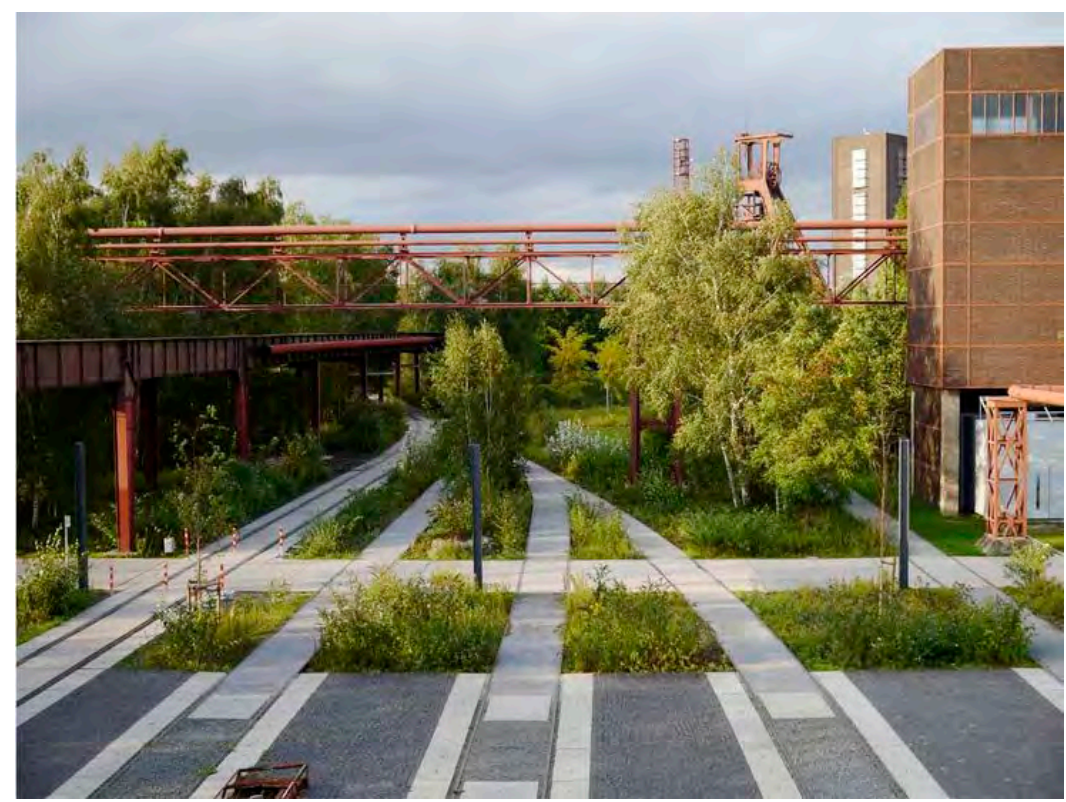
GORDON STREET



RESPECTING NATURAL HERITAGE



GREEN GATEWAY



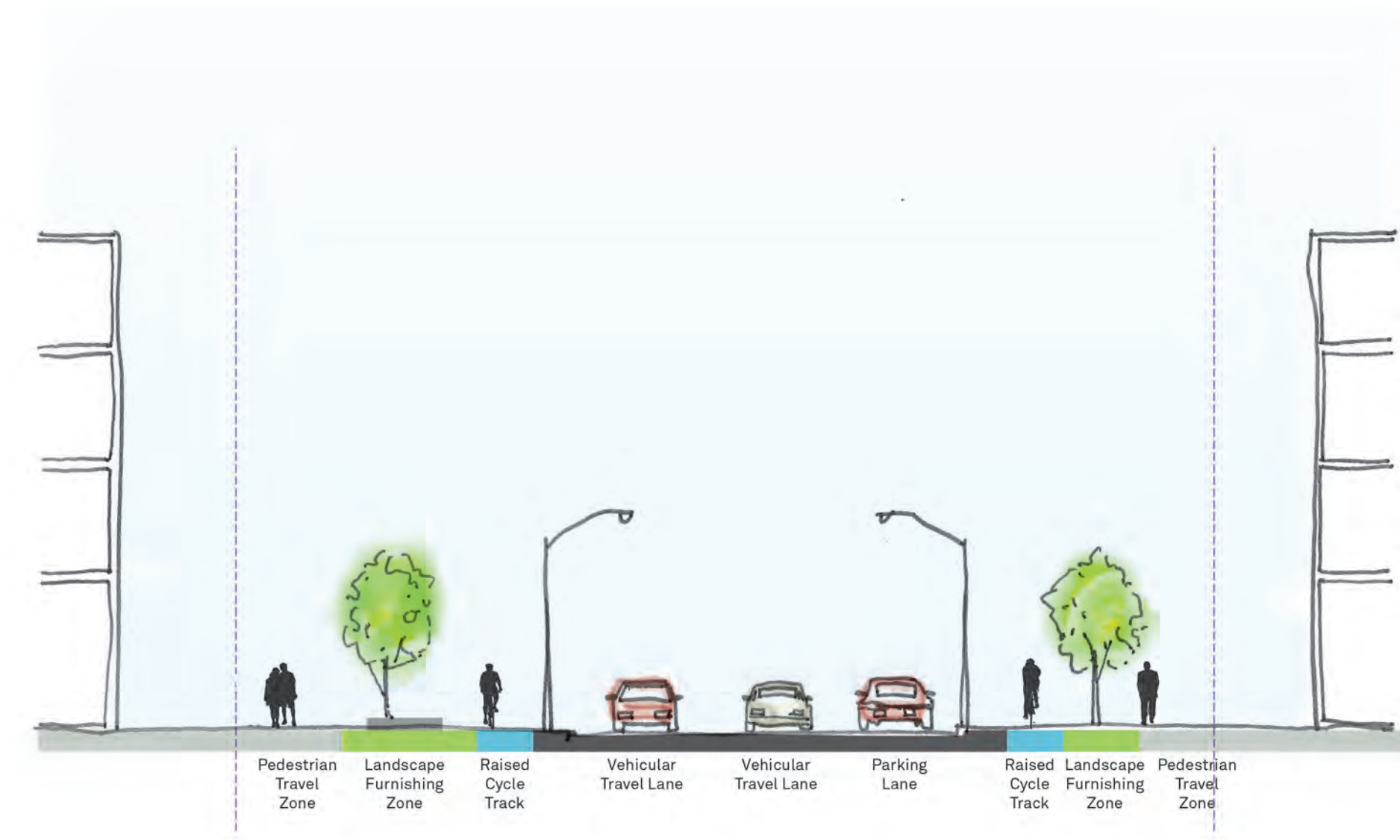
STREETS AND BLOCKS

What do you envision for Clair Maltby? Place the stickers provided on images that you like, or use the Post-It Notes for suggestions not shown in the precedent images below.

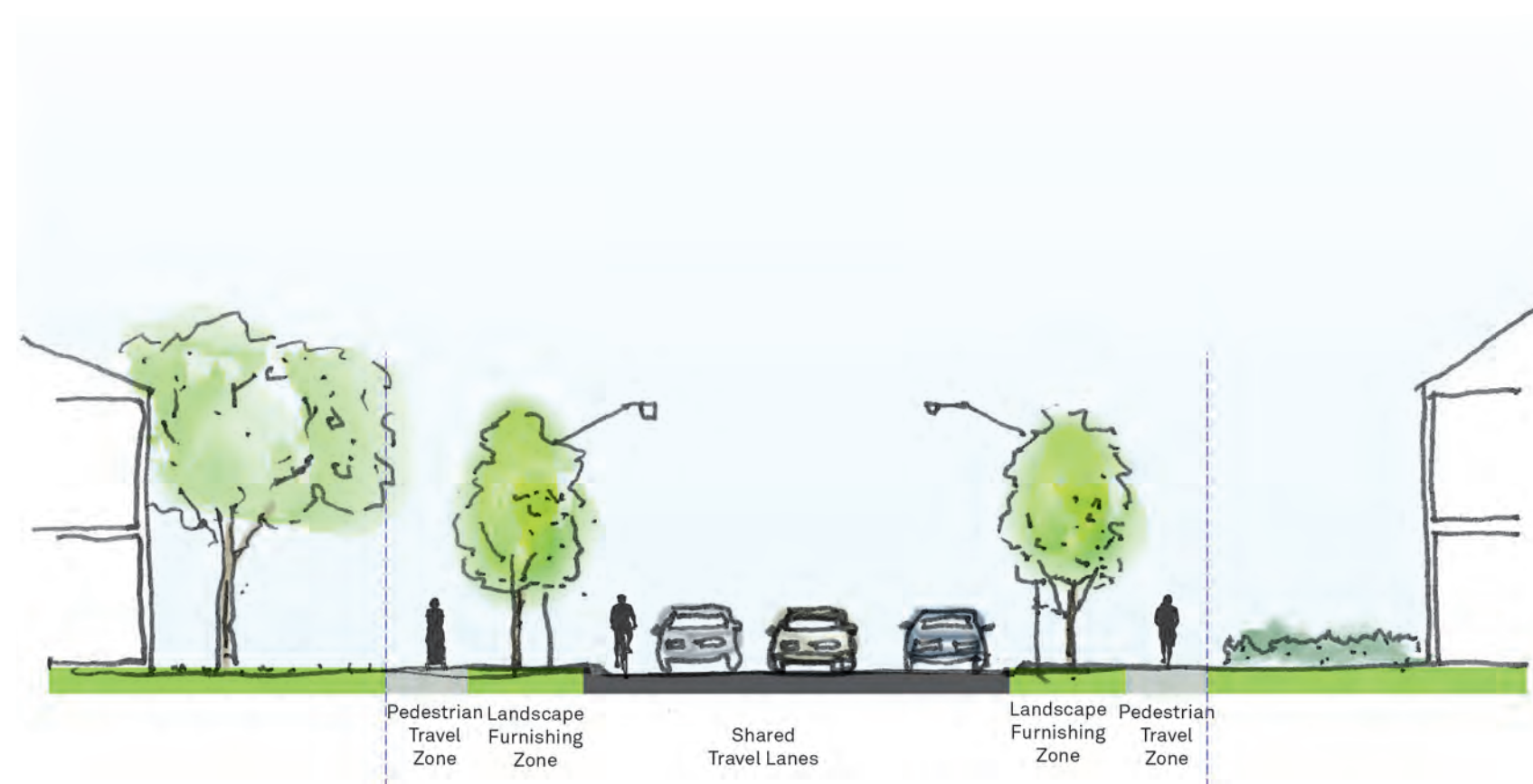
Gordon Street



Collector Street Option



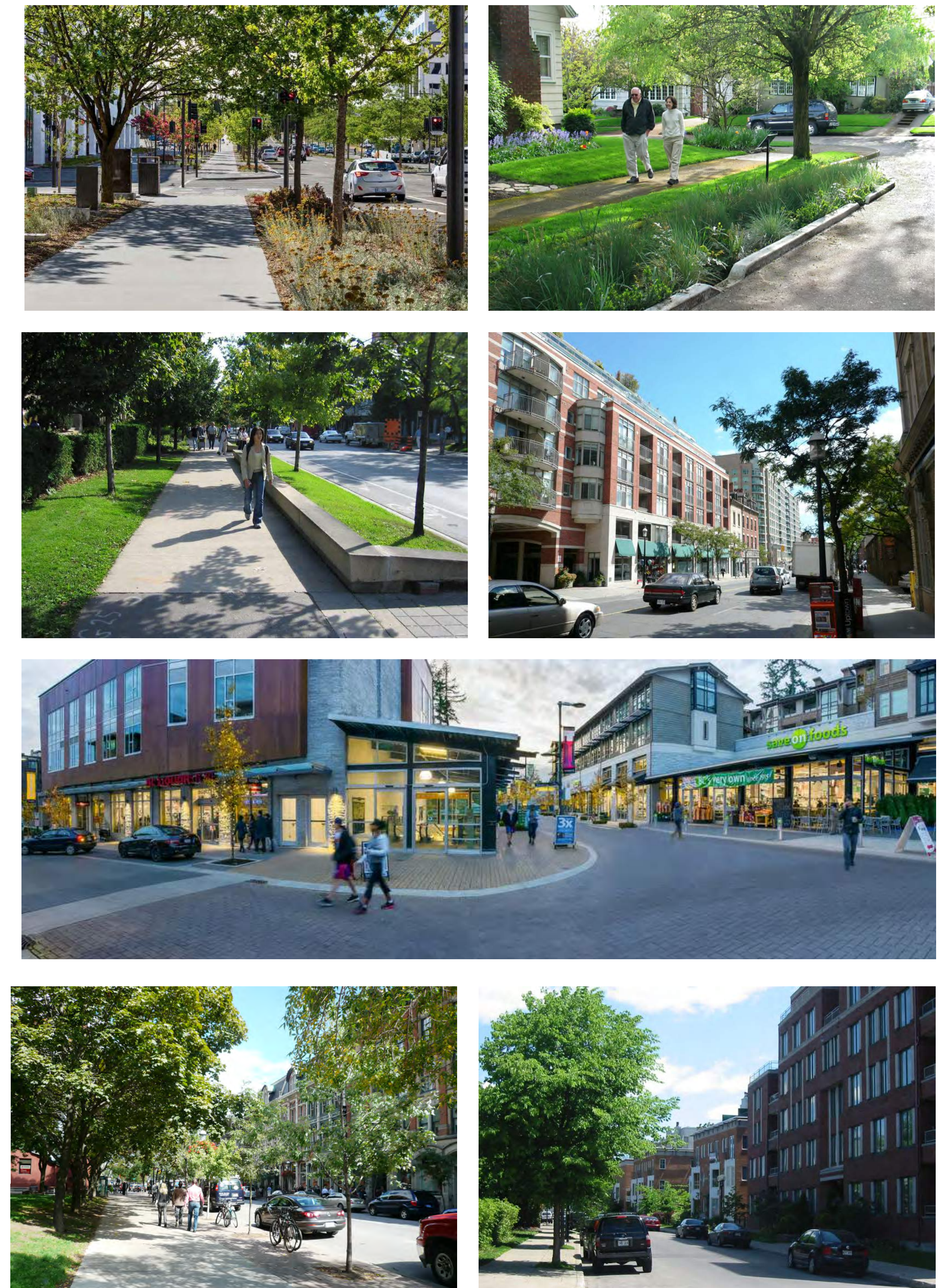
Typical Local Street



Typical Trail



Preliminary Street Sections



OPEN SPACE

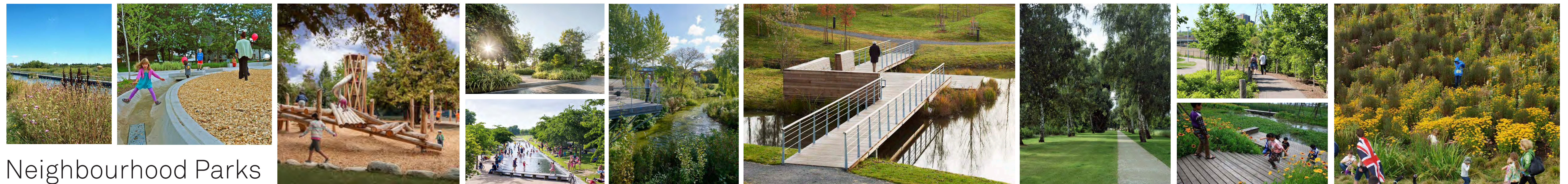
What do you envision for Clair Maltby? Place the stickers provided on images that you like, or use the Post-It Notes for suggestions not shown in the precedent images below.



Natural Heritage Areas



Parkettes



Neighbourhood Parks



Community Parks

BUILT FORM

What do you envision for Clair Maltby? Place the stickers provided on images that you like, or use the Post-It Notes for suggestions not shown in the precedent images below.



Residential



Mixed Use



Neighbourhood Commercial

GREEN ELEMENTS

What do you envision for Clair Maltby? Place the stickers provided on images that you like, or use the Post-It Notes for suggestions not shown in the precedent images below.



Green Infrastructure



Green Links



Cycling Trails and Multi Use Paths

Date of Notice: September 7, 2018

Information Session: Comprehensive Environmental Impact Study – Phase 1 and 2 Characterization Report

Clair-Maltby Secondary Plan and Master Environmental Servicing Plan

September 26, 2018

6:30-8:30 p.m.

Council Chambers, City Hall

1 Carden Street, Guelph

Members of the community, interested stakeholders and members of Environmental Advisory Committee, River Systems Advisory Committee, Clair-Maltby Community Working Group and Clair-Maltby Technical Advisory Group, are invited to attend this information session to learn more about the Phase 1 and 2 Characterization Report for the Comprehensive Environmental Impact Study (CEIS).

Attendees will have the opportunity to ask questions of clarification following a presentation by the City's project team.

The Phase 1 and 2 Characterization Report is a technical document that summarizes the project team's current understanding of the Natural Heritage System, as well as surface and ground water interaction in the Clair-Maltby area. This report is part of the Comprehensive Environmental Impact Study for this project.

The report will be available for review on **September 10, 2018** on <https://guelph.ca/plans-and-strategies/clair-maltby-secondary-plan/cm-documents/>. It can also be found on the project webpage, guelph.ca/clair-maltby, under 'documents'.

For more information

Visit guelph.ca/clair-maltby for additional project details.

Arun Hindupur, M.Sc., P.Eng., Supervisor, Infrastructure Engineering
Engineering and Capital Infrastructure Services

519-822-1260 extension 2282

clair-maltby@guelph.ca



Clair-Maltby

Transform. Connect. Community.

Information Session:

**Comprehensive Environmental Impact Study (CEIS)
Phase 1 and 2 Characterization Report**

September 26, 2018



September 26, 2018

CEIS Phase 1 and 2 Characterization Report

1. Introductions
2. Secondary Plan Process Update
3. CEIS Overview / MESP Integration
4. CEIS Phase 1 and 2 Characterization Report
 - Hydrogeology;
 - Surface Water;
 - Natural Heritage; and
 - Significant Landform
5. MESP Overview
6. Next Steps / Timing – Schedule
 - CEIS Impact Assessment
 - MESP
 - Secondary Plan



Clair-Maltby

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1. Introductions

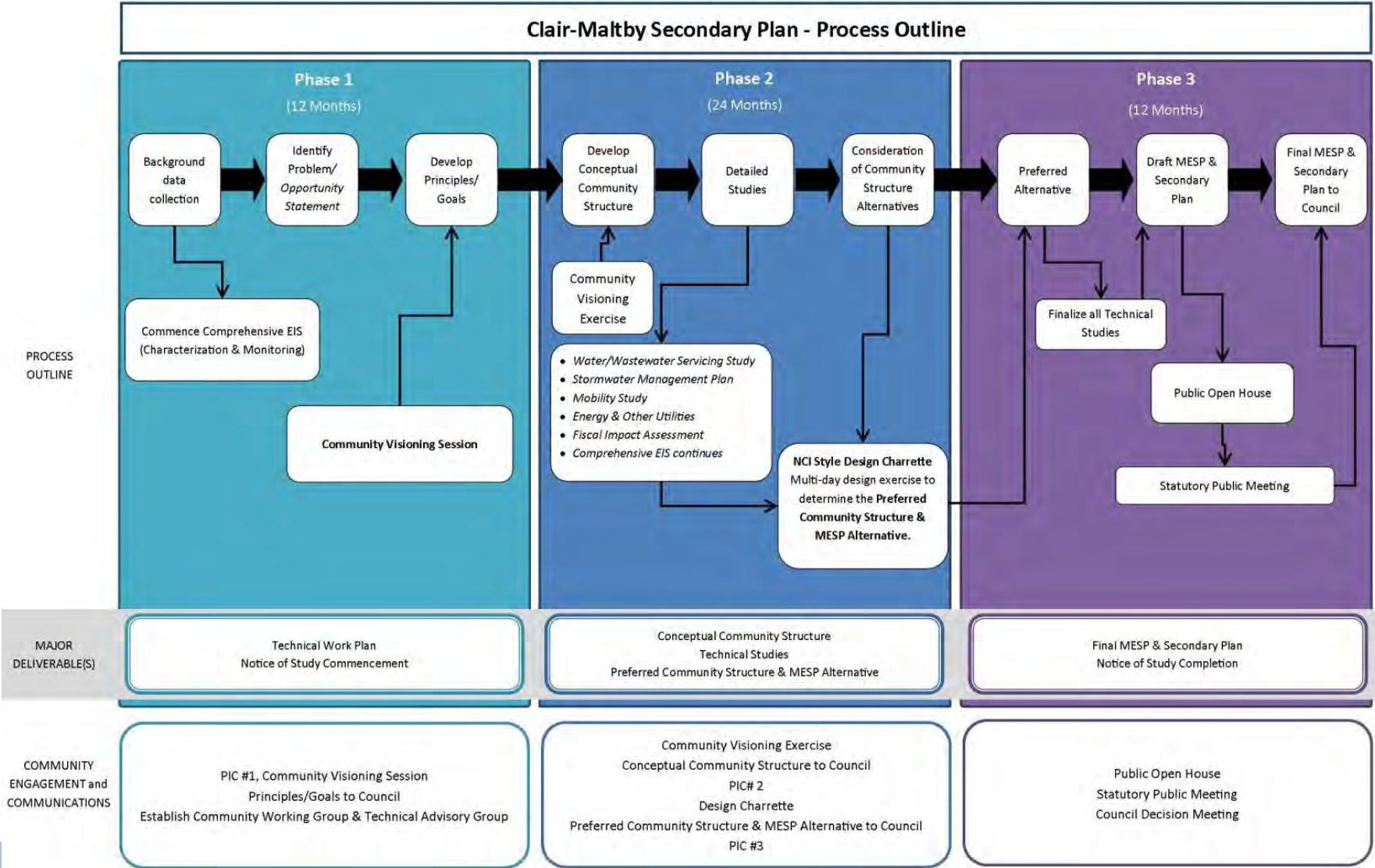


Clair-Maltby

Transform. Connect. Community.

2. Secondary Plan Process Update

2. Secondary Plan Process Update: Study Components



2. Secondary Plan Process Update

April 3-6 & 9, 2018	Planning & Design Charrette
June 2018	Council approval of the Preferred Community Structure (as the basis for Ph3)
September 2018	Ph 1 and 2 Characterization Report Information Session
Q4 2018 – Q3 2018	Phase 3 Project Work



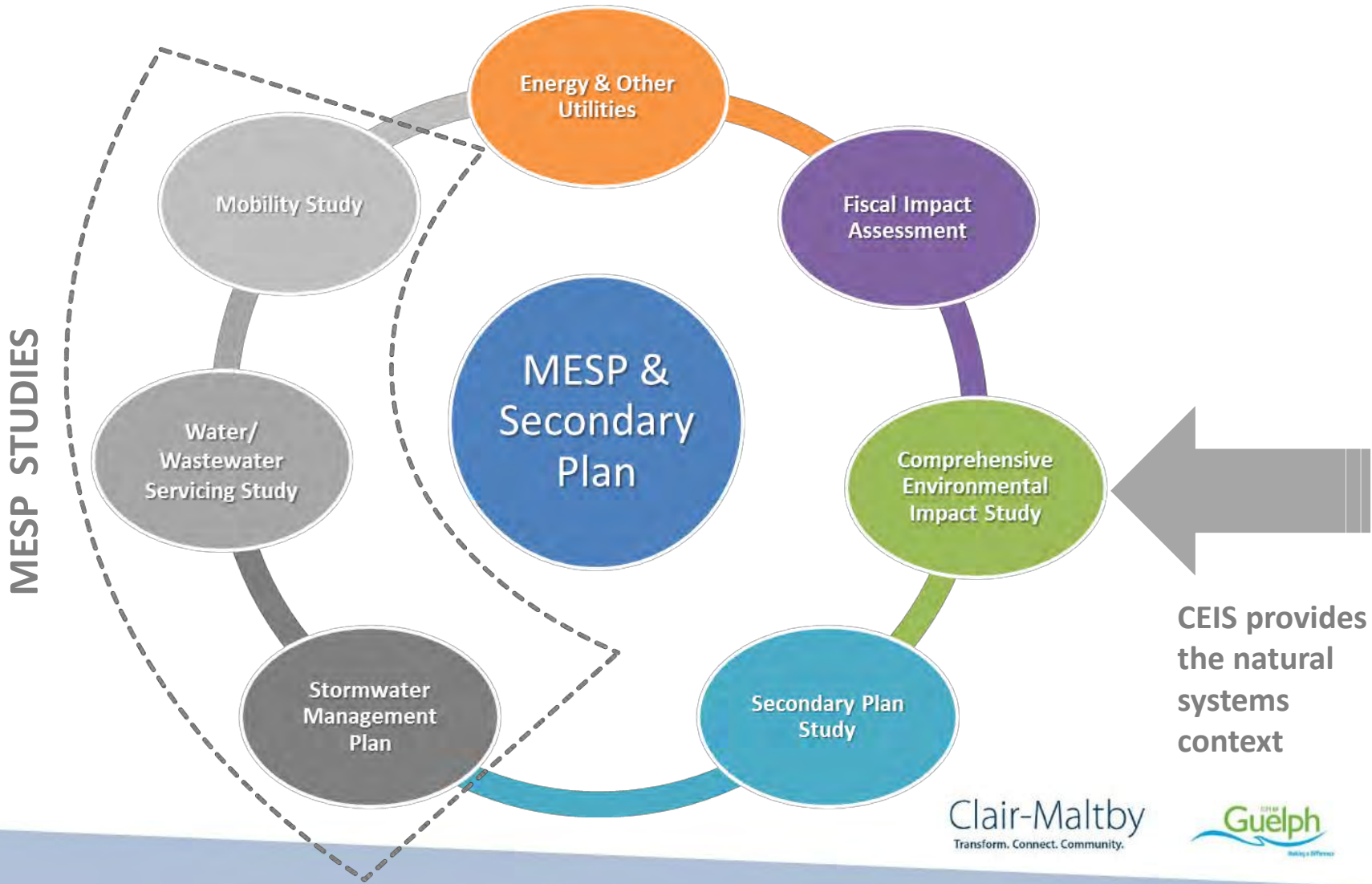


Clair-Maltby

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3. CEIS Overview / MESP Integration

3. CEIS Overview / MESP Integration: Study Components



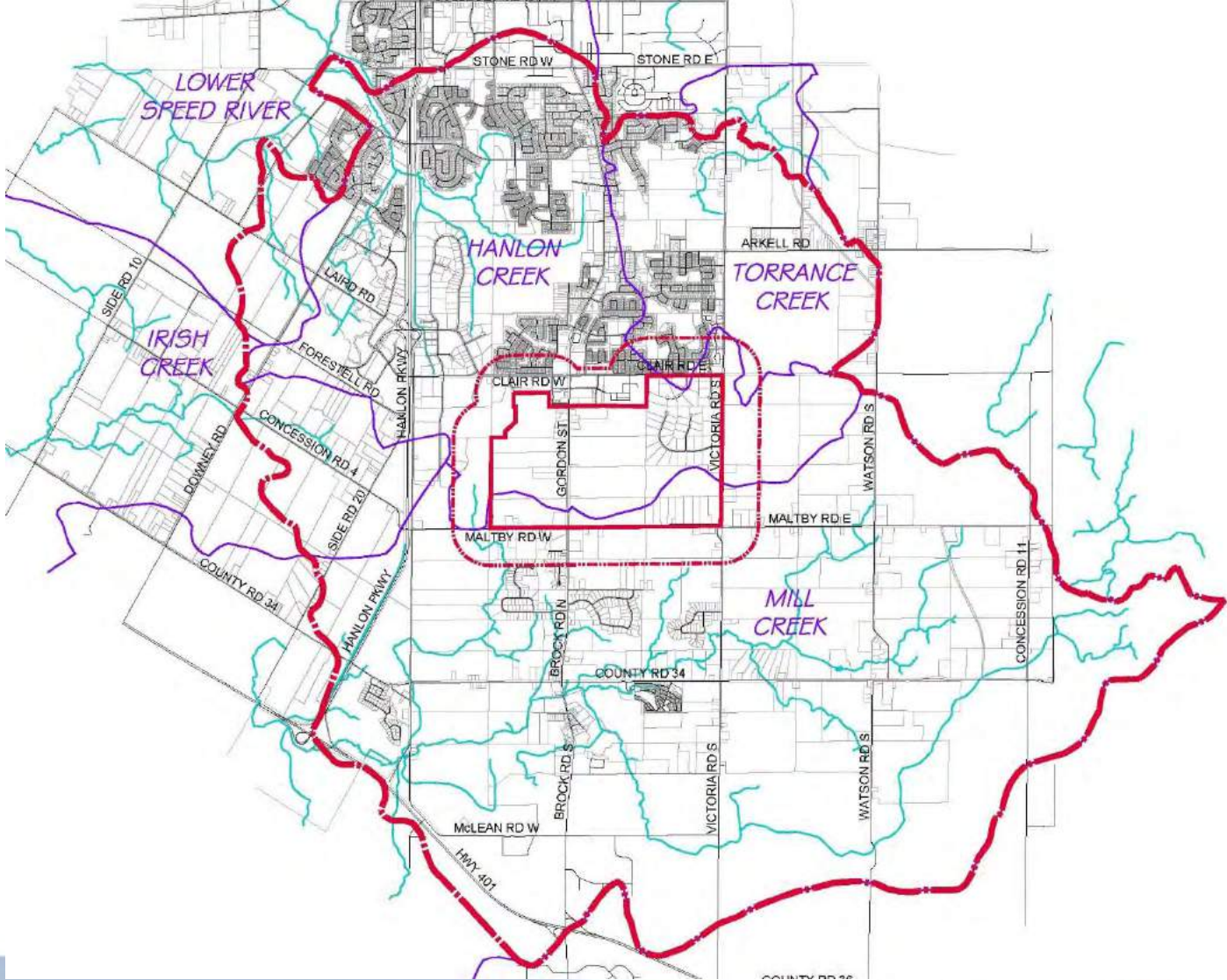
3. CEIS Overview / MESP Integration:

CEIS Study Area

Secondary Plan Area (SPA)

Primary Study Area (PSA)

Secondary Study Area (SSA)



3. CEIS Overview / MESP Integration:

Key CEIS Tasks

- Phases 1 and 2:
 - Verification / refinement / assessment of environmental features and functions
 - Assessment of the role of water in the study areas to support natural systems (groundwater/surface water)
 - Constraints and opportunities definition
- Phase 3:
 - Assessment of impacts associated with different community structure options
 - Establishment of integrated management strategies

3. CEIS Overview / MESP Integration: CEIS Approach

- Review of background information
- Multi-year monitoring and field studies
 - 2016, 2017, 2018 (ongoing)
- Modelling of surface and groundwater
- Refinement / Update of Natural Heritage System
 - Building on existing NHS approved in 2014
- Agency and stakeholder consultation

3. CEIS Overview / MESP Integration: Existing Natural Heritage System (NHS)



2001 Official Plan, September 2014 Consolidation

3. CEIS Overview / MESP Integration: **CEIS Disciplines Involved**

- Groundwater (Hydrogeology)
- Surface water (Hydrology / Hydraulics)
- Natural Heritage
 - Landform (Geology)
 - Terrestrial
 - Aquatic



Clair-Maltby

Transform. Connect. Community.

4. CEIS Phase 1/2 Characterization Report

4. CEIS Phase 1/2 Characterization Report: Discipline by Discipline Summary of:

- Objective / Purpose
- 2016 / 2017 Field Work
- Ongoing 2018 Field Work
- Summary of Findings
- Input to Community Structure alternatives
- Integration considerations

4. CEIS Phase 1/2 Characterization Report:

Hydrogeology: Objective / Purpose

Hydrogeological characterization to establish baseline conditions within the SPA and PSA

Field program contributes to water balance, helps identify constraints and opportunities, and establishes ongoing monitoring locations

Integrated modelling to quantify components of the existing and future conditions water budgets, assess impacts to surface and groundwater, and assess alternative management options

4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Project Specific Field Work

17 boreholes/wells
(9 locations)

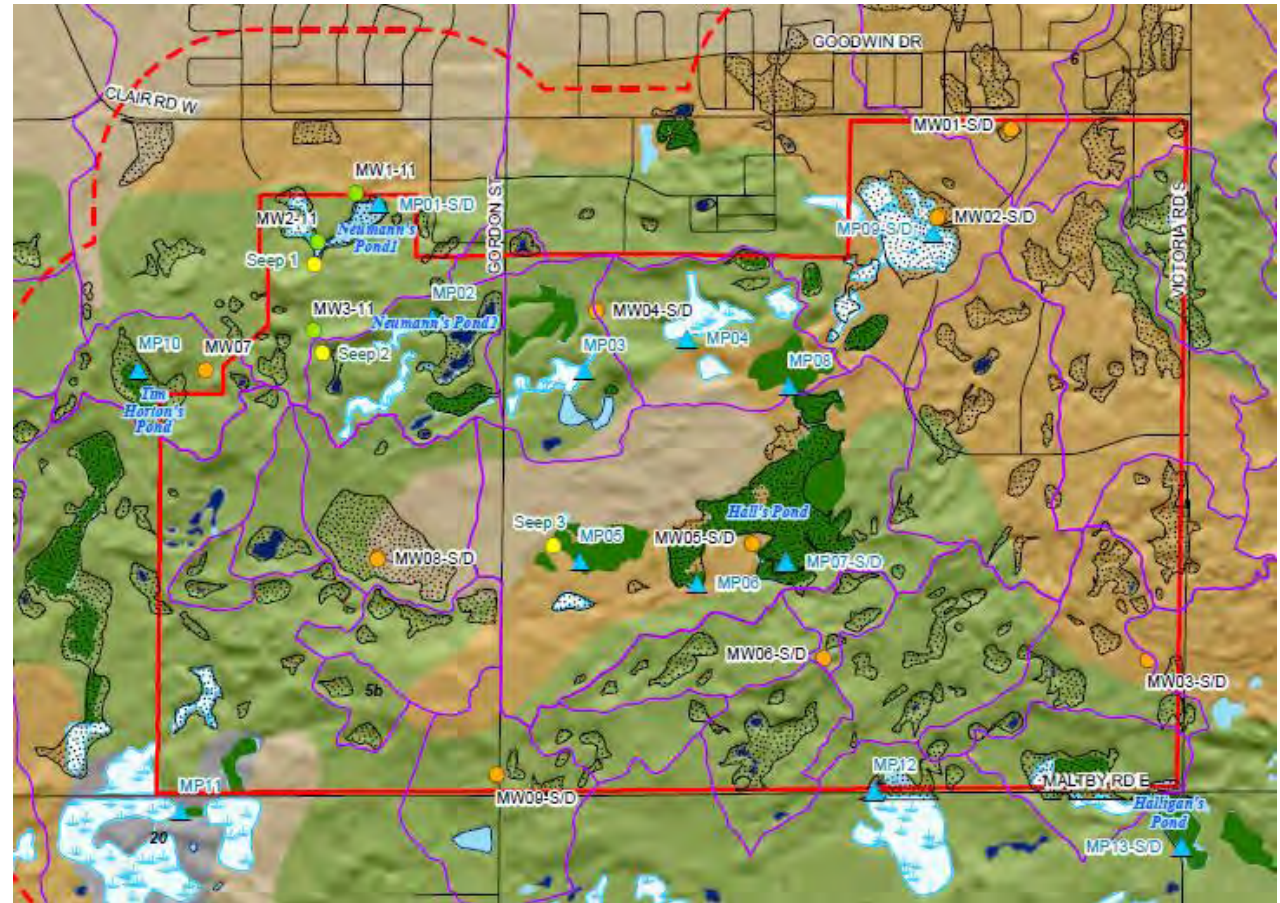
18 drivepoint wells
(14 locations)

Groundwater levels
(continuous/manual)








Water quality
(3 events)

Baseflow
(27 locations)

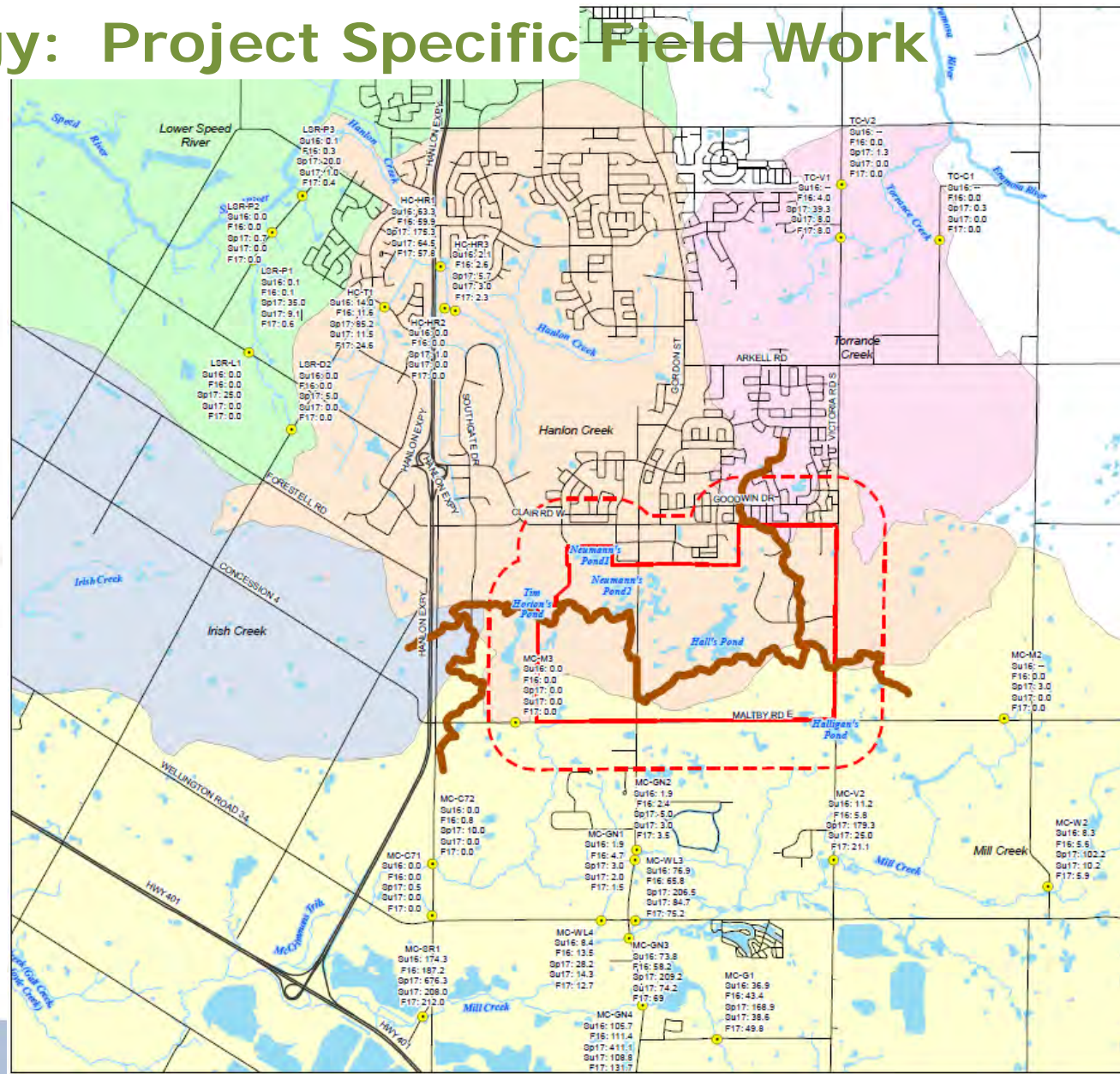
Seeps and springs



4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Project Specific Field Work

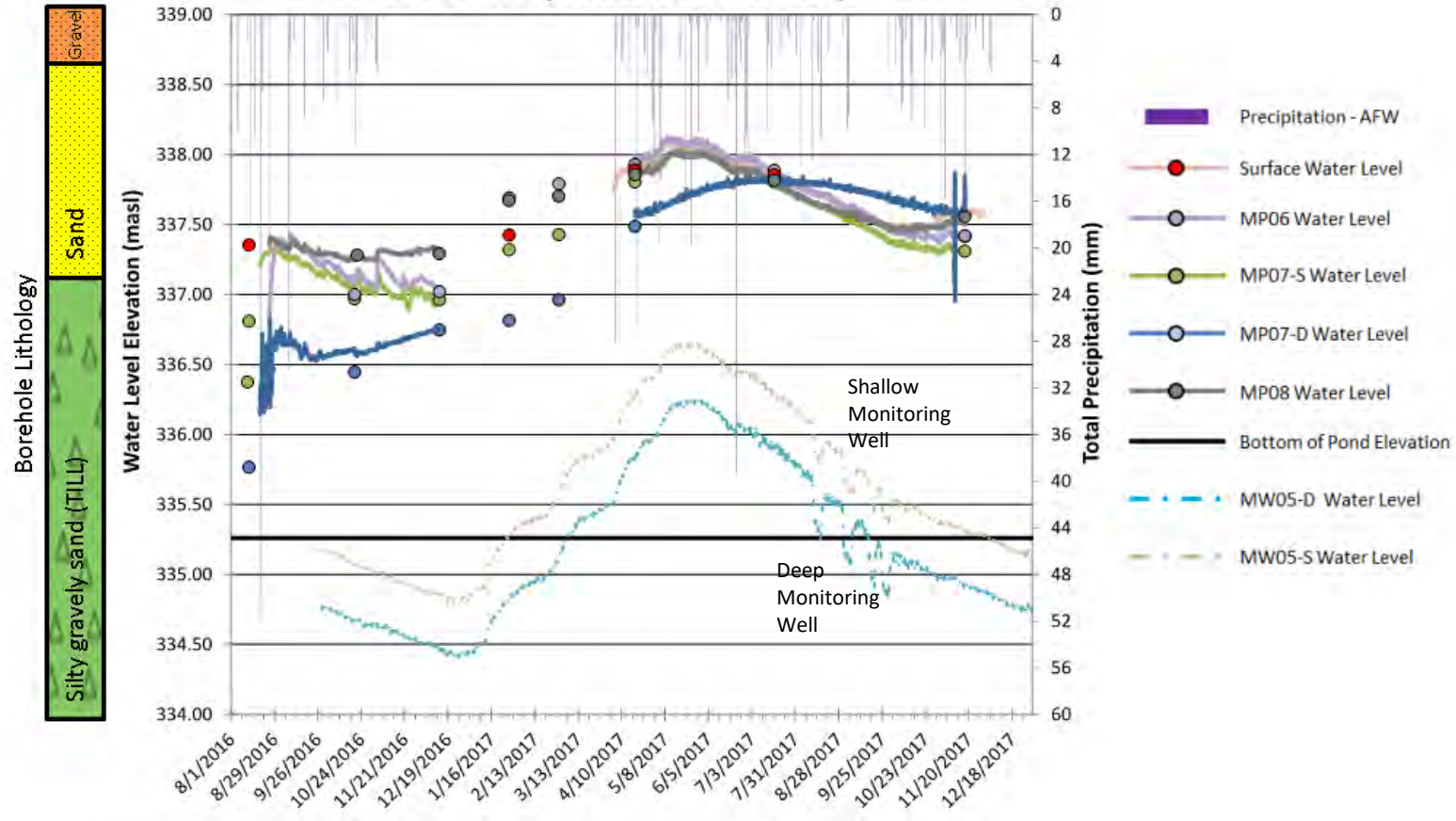
-  Primary Study Area Boundary
-  Secondary Plan Area Boundary
-  Water Body
-  Watercourse
-  Updated Subwatershed Boundary (Wood PLC, 2018)
-  Highway
-  Road
-  Spot Flow Location
- Subwatershed**
-  Hanlon Creek
-  Irish Creek
-  Lower Speed River
-  Mill Creek
-  Torrance Creek

HC-D2	Spot Flow Location
Su16:0	Summer 2016 (Aug.30/31, Sept. 1) Flow Rate (L/s)
F16:0	Fall (Nov.9/10) Flow Rate (L/s)
Sp17:0	Spring 2017 (May 10/11) Flow Rate (L/s)
Su17:0	Summer 2017 (Aug.16) Flow Rate (L/s)
F17:0	Fall (Nov. 29) Flow Rate (L/s)



4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings

Clair-Maltby Secondary Plan
 Long Term Water Level Monitoring
 Hall's Pond (Stations Combined)

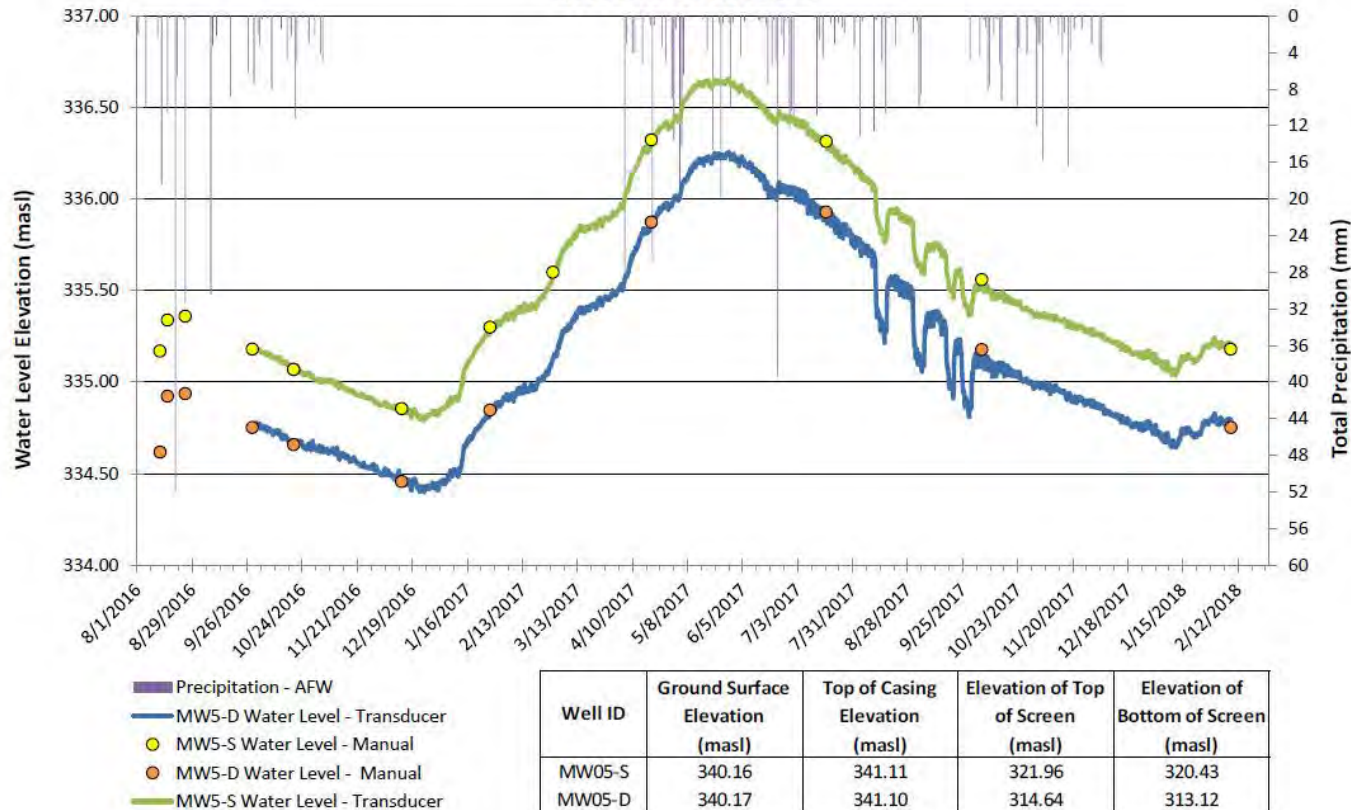


Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.



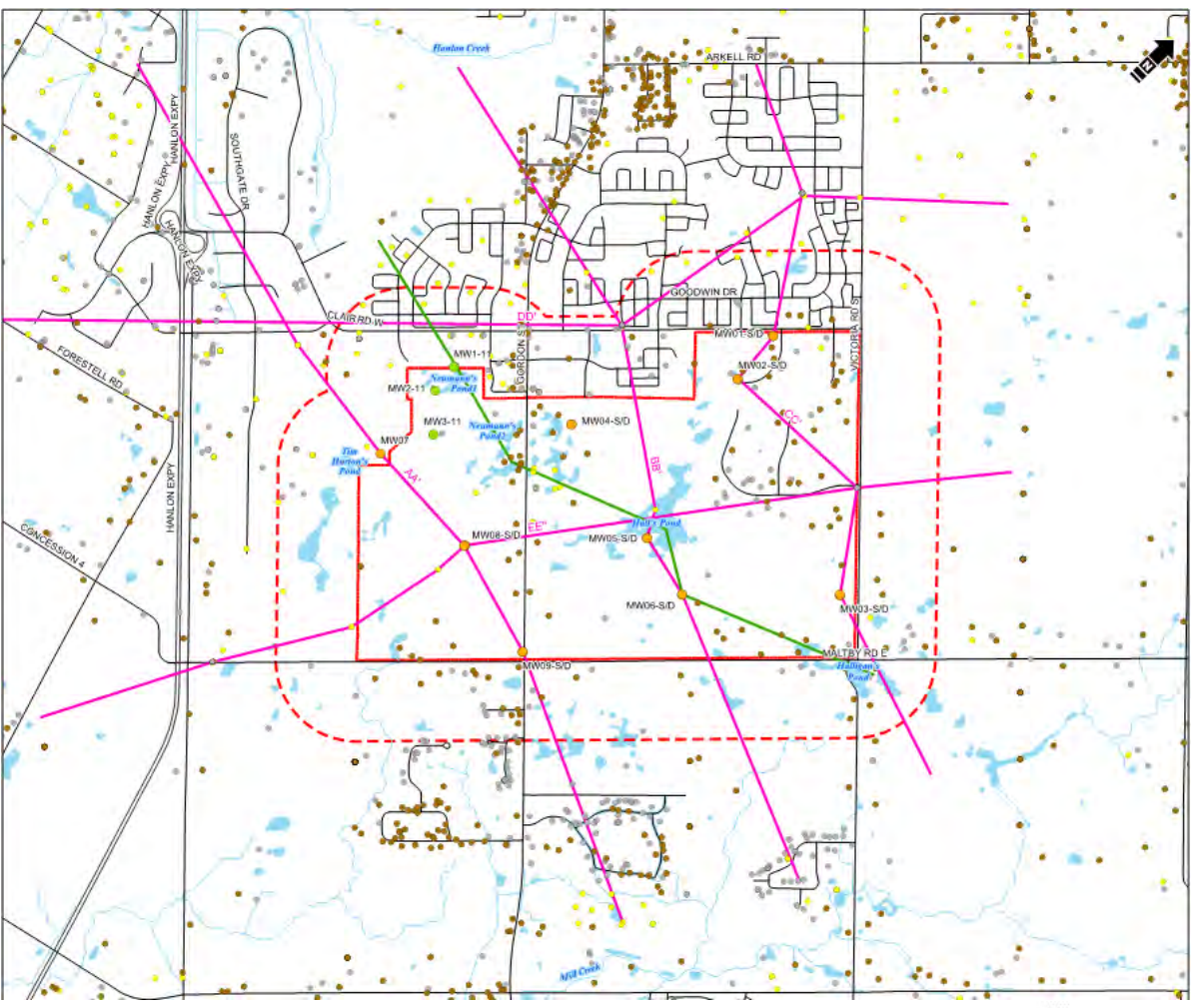
4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings

Clair-Maltby Secondary Plan
Long Term Groundwater Level Monitoring
MW5-D & MW5-S



Precipitation - AFW: Data set from rain gauge installed by AMEC Foster-Wheeler at 500 Maltby Rd. E.

4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings



All Available Borehole Information

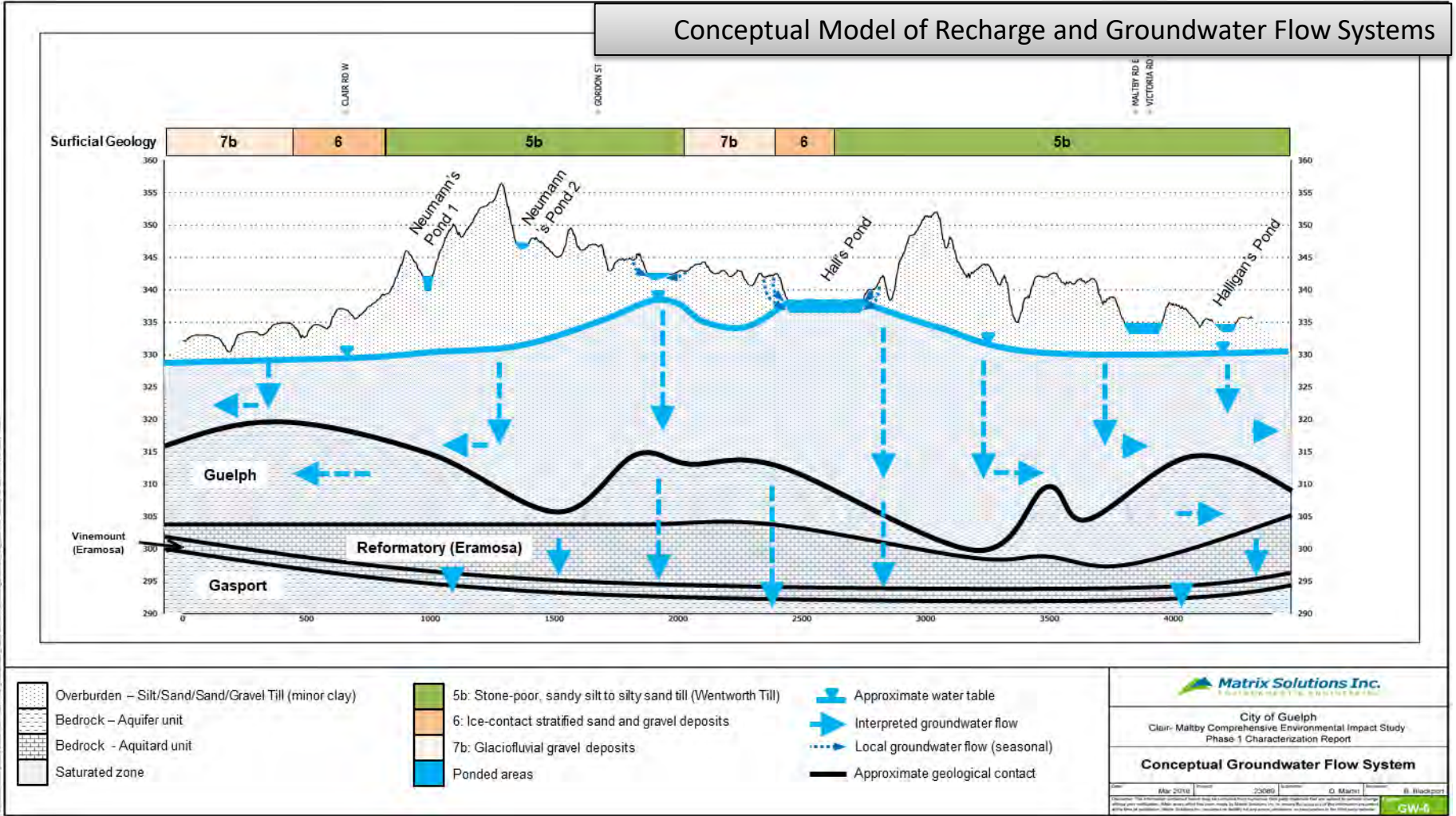
- Primary Study Area Boundary
- Secondary Plan Area Boundary
- Water Body
- Watercourse
- Highway
- Road
- Geological Cross Section Location
- Conceptual Groundwater Flow System Cross Section
- Monitoring Well (Matrix)
- Monitoring Well (132 Clair Rd)
- Municipal Well
- Consultant Well
- GPW Well
- WWIS Well

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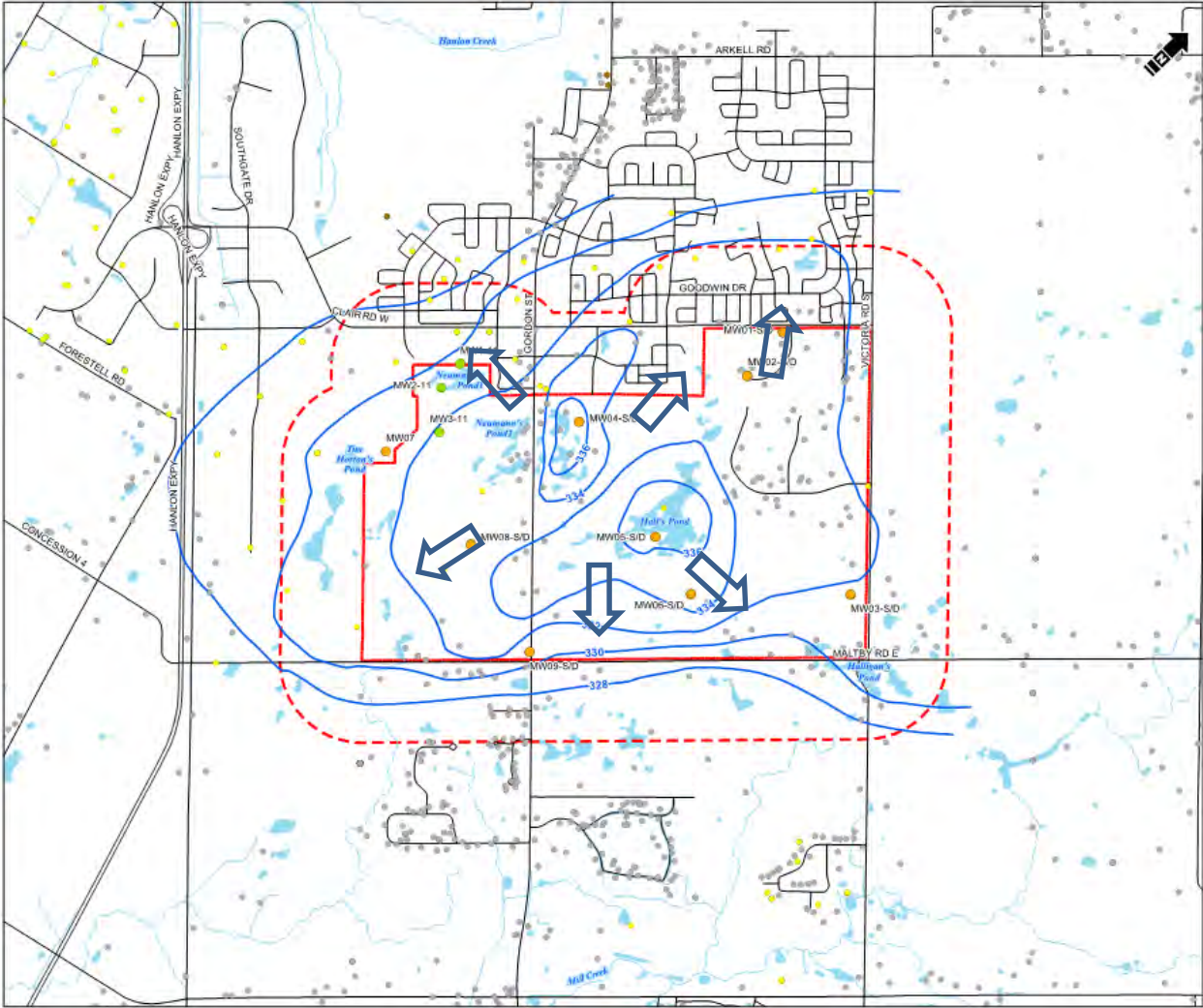


4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings

Conceptual Model of Recharge and Groundwater Flow Systems



4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings



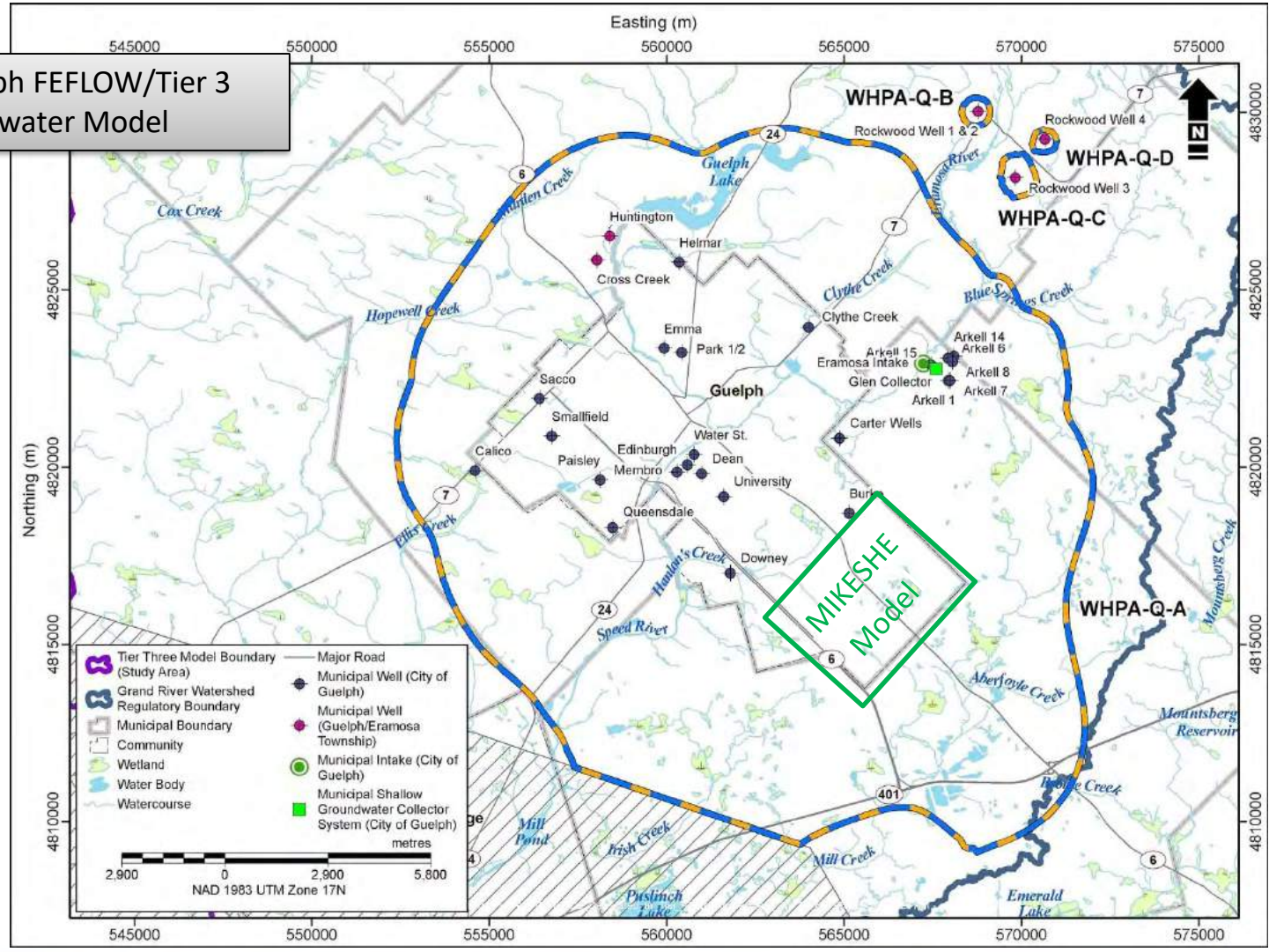
Interpreted Water Table and Generalized Groundwater Flow Directions

- Primary Study Area Boundary
- Secondary Plan Area Boundary
- Water Body
- Watercourse
- Water Table Elevation Contour (2m)
- Highway
- Road
- Monitoring Well (Matrix)
- Monitoring Well (132 Clair Rd.)
- Consultant Well
- GPW Well
- WWIS Well

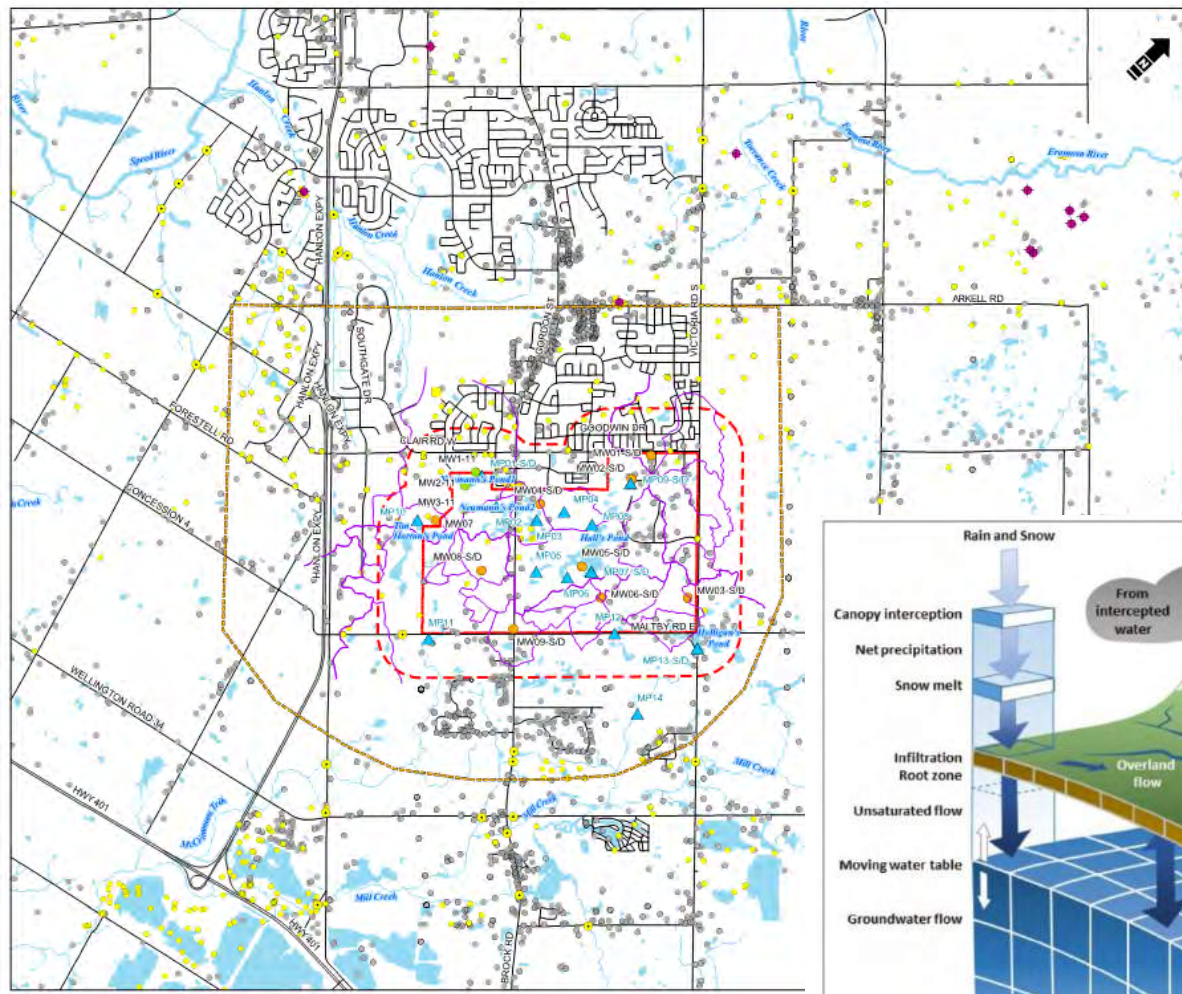
General groundwater flow direction

4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings Tier 3 Model

City of Guelph FEFLOW/Tier 3
Groundwater Model



4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings



Integrated Surface Water-Groundwater Model Domain

- Secondary Plan Area Boundary
- Primary Study Area Boundary
- MIKE SHE Model Domain
- Subcatchment
- Water Body
- Watercourse
- Highway
- Road
- Mini Piezometer
- Spot Flow Location
- Monitoring Well (Matrix)
- Monitoring Well (132 Class RW)
- Surface Water Flow (Beacon)
- Municipal Well
- Consultant Well
- WWIS Well

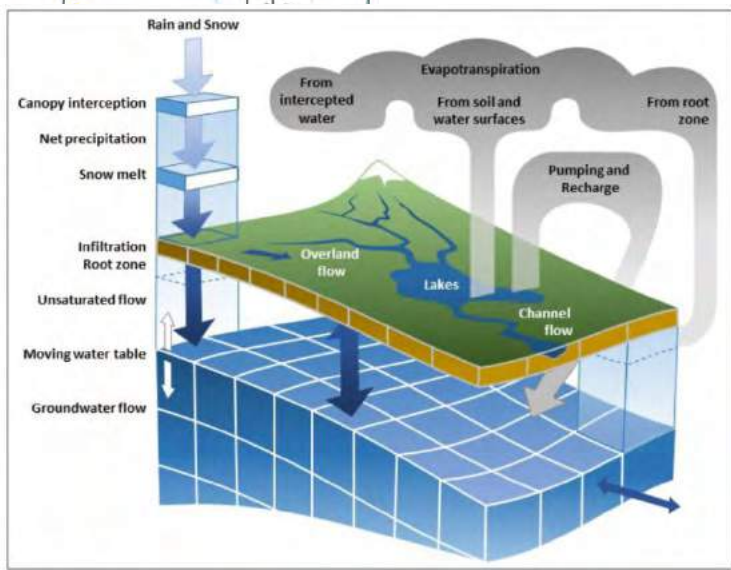
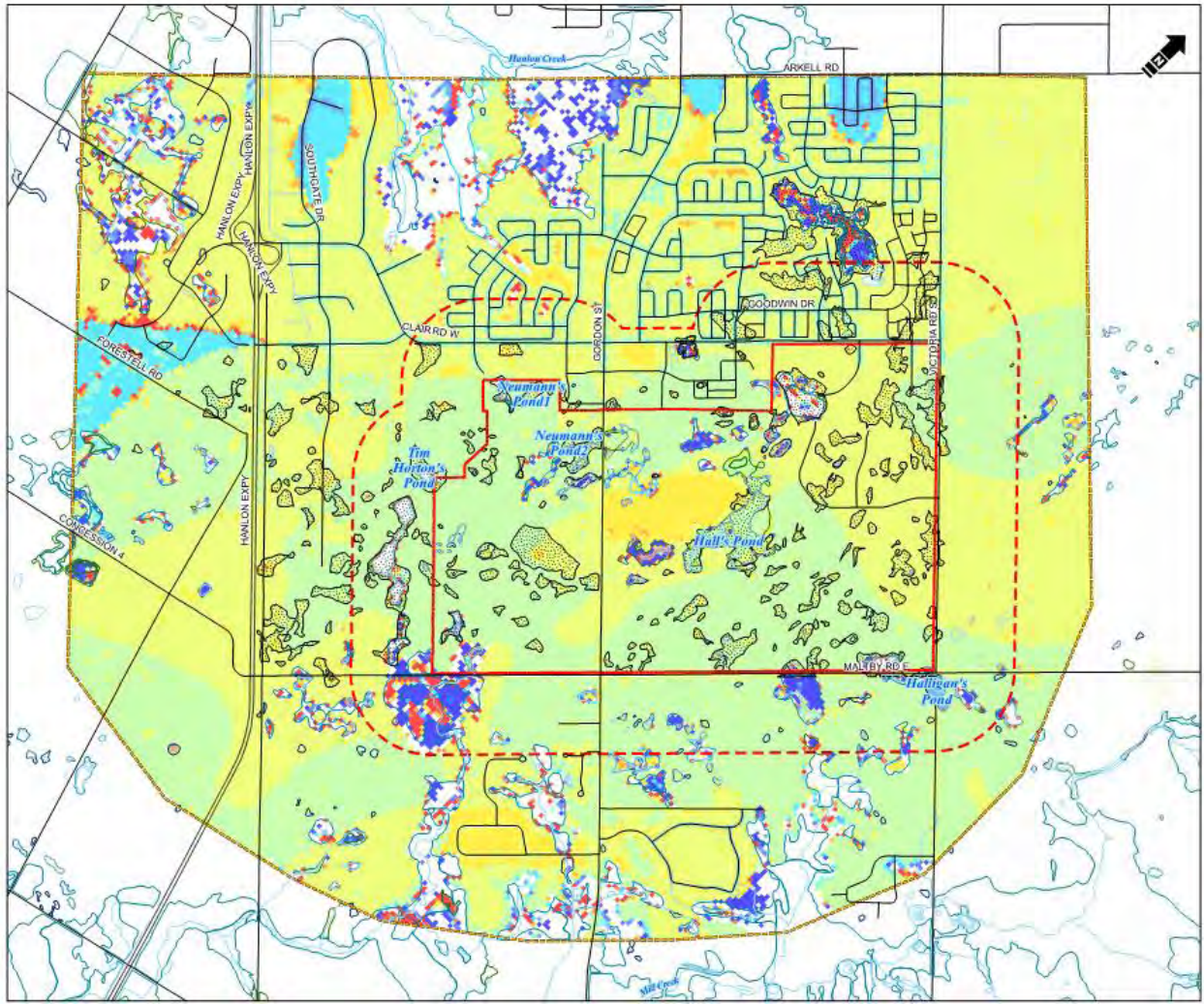


Figure B1 MIKE SHE Hydrologic Process Diagram

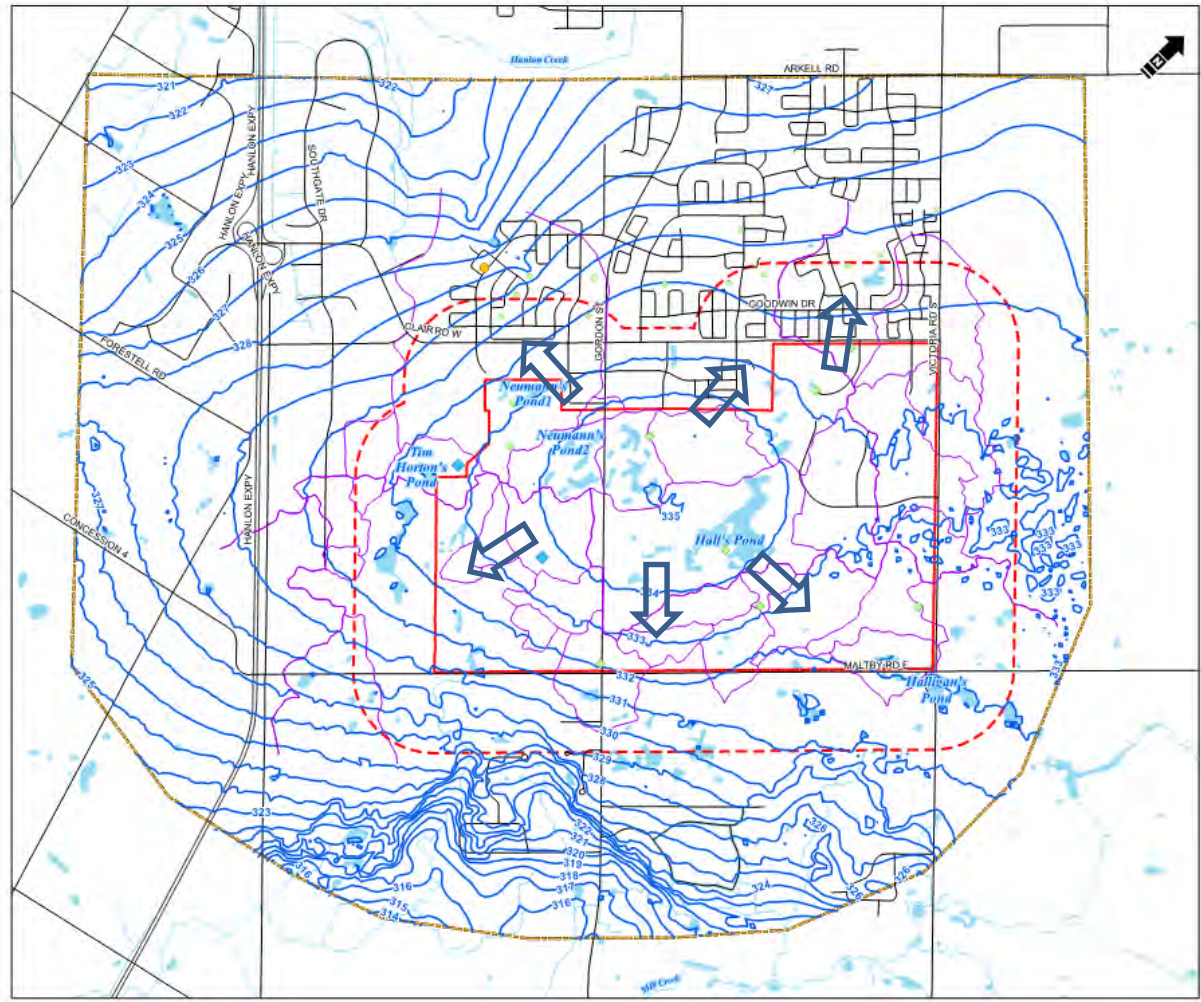
4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings



Simulated Average Annual Recharge

- Primary Study Area Boundary
 - Secondary Plan Area Boundary
 - MIKE SHE Model Domain
 - Closed Depression
 - Fen
 - Bog
 - Swamp
 - Marsh
 - Open Water
 - Unknown Wetland
 - Water Body
 - Watercourse
 - Highway
 - Road
- Groundwater Recharge (mm/year)**
- 0 - 50
 - 50 - 100
 - 100 - 150
 - 150 - 200
 - 200 - 250
 - 250 - 300
 - 300 - 350
 - 350 - 400
 - 400 - 450
 - 450 - 500
 - > 500

4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings



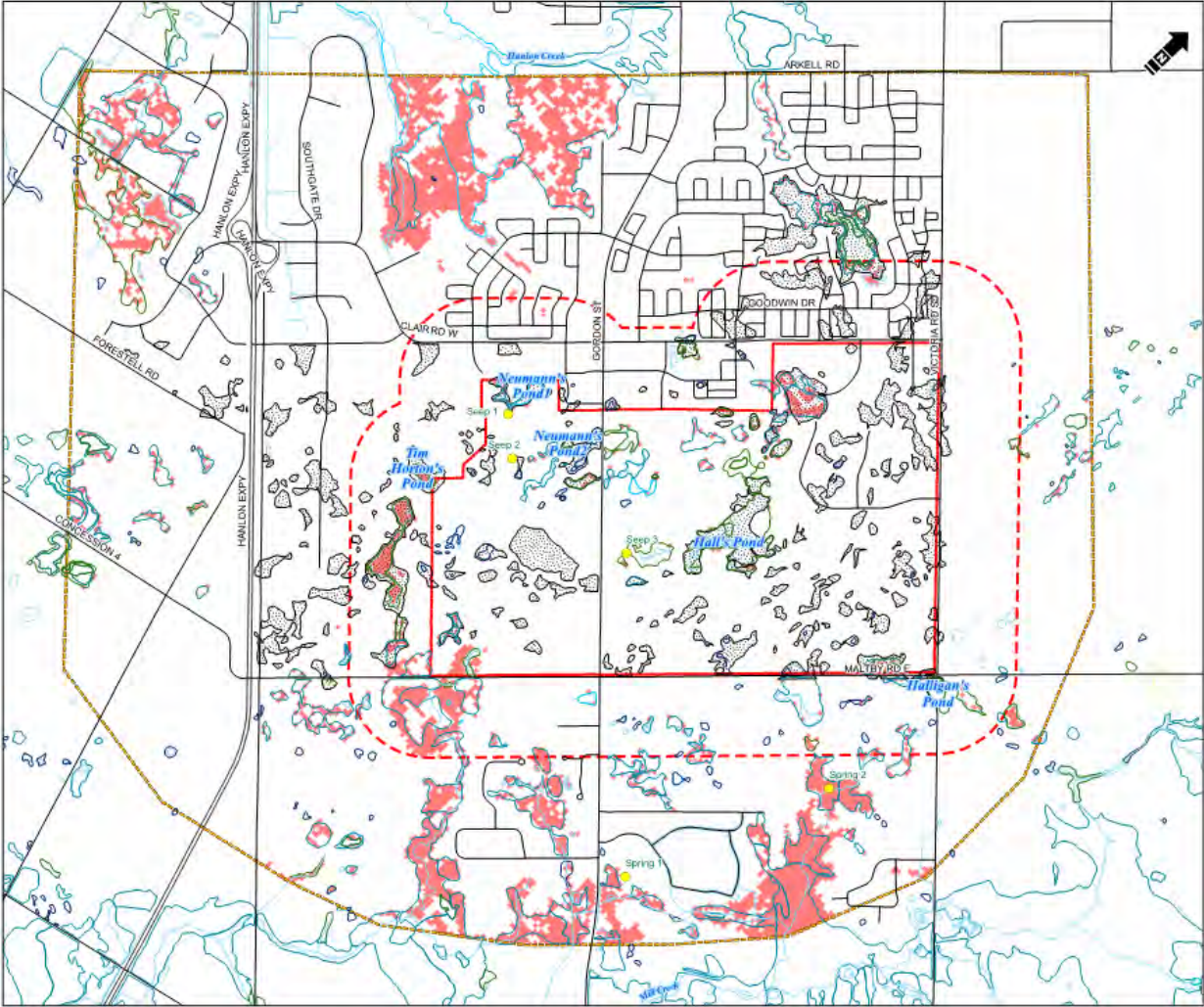
Simulated Water Table & General
Flow Directions



General simulated
groundwater flow
direction

4. CEIS Phase 1/2 Characterization Report:

Hydrogeology: Summary of Findings

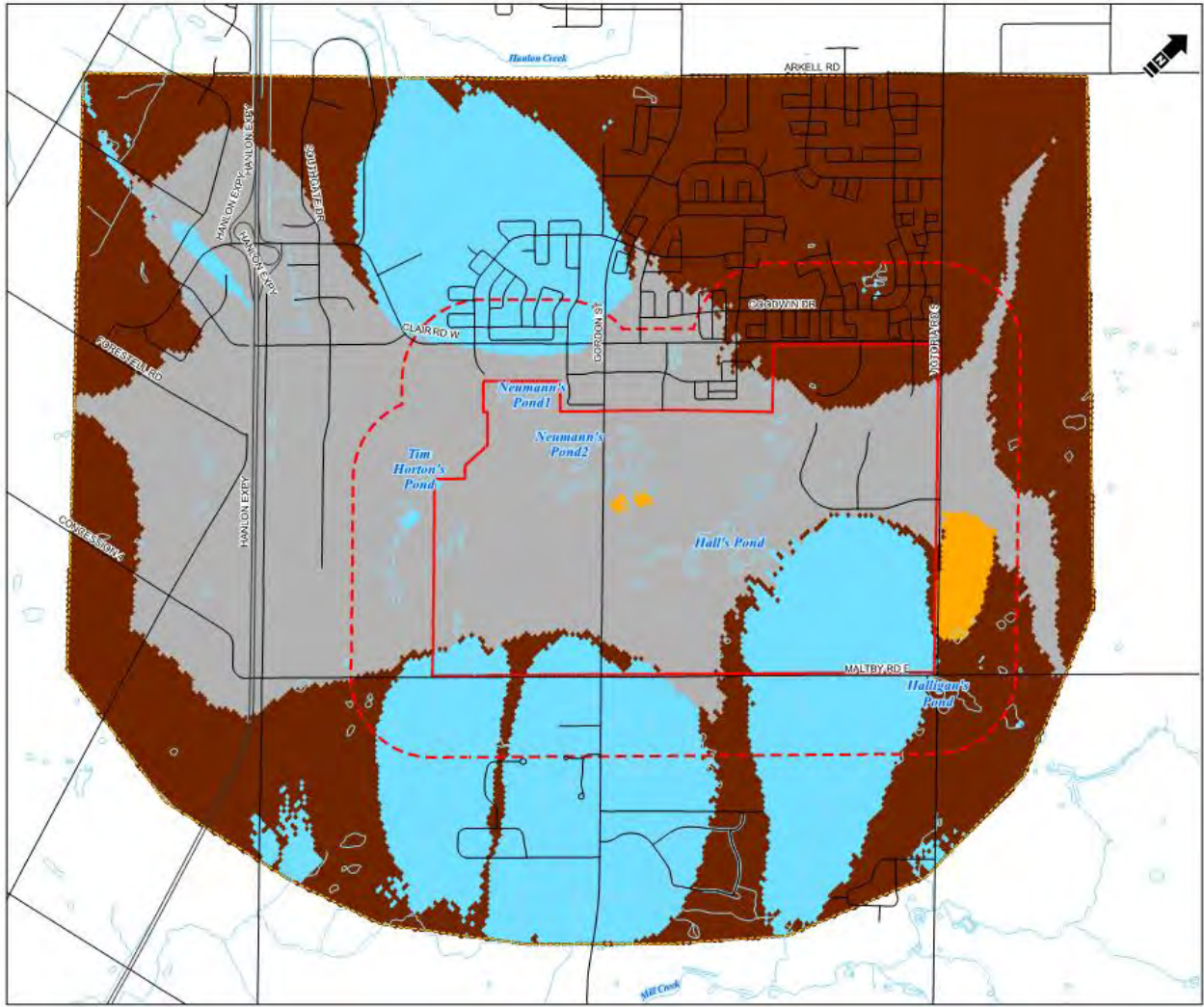


Simulated Average Annual Discharge to Surface Water

- Primary Study Area Boundary
- Secondary Plan Area Boundary
- MIKE SHE Model Domain
- Closed Depression
- Groundwater Discharge
- Fern
- Bog
- Swamp
- Marsh
- Open Water
- Unknown Wetland
- Water Body
- Watercourse
- Highway
- Road
- Observed Seep and Spring

4. CEIS Phase 1/2 Characterization Report:

Hydrogeology: Summary of Findings



Simulated Recharge – Discharge Linkage – Where does recharge go?

- Primary Study Area Boundary
- Secondary Plan Area Boundary
- MIKE SHE Model Domain
- Water Body
- Watercourse
- Highway
- Road
- Particle Track**
 - Vertical Groundwater Flow Out (Across Vinemount Formation)
 - Lateral Groundwater Flow Out (Overburden and Bedrock)
 - Captured by Pumping Well
 - Discharge to Streams and Water Bodies

4. CEIS Phase 1/2 Characterization Report:

Hydrogeology: Summary of Findings

Simulated Water Budget 2003-2017

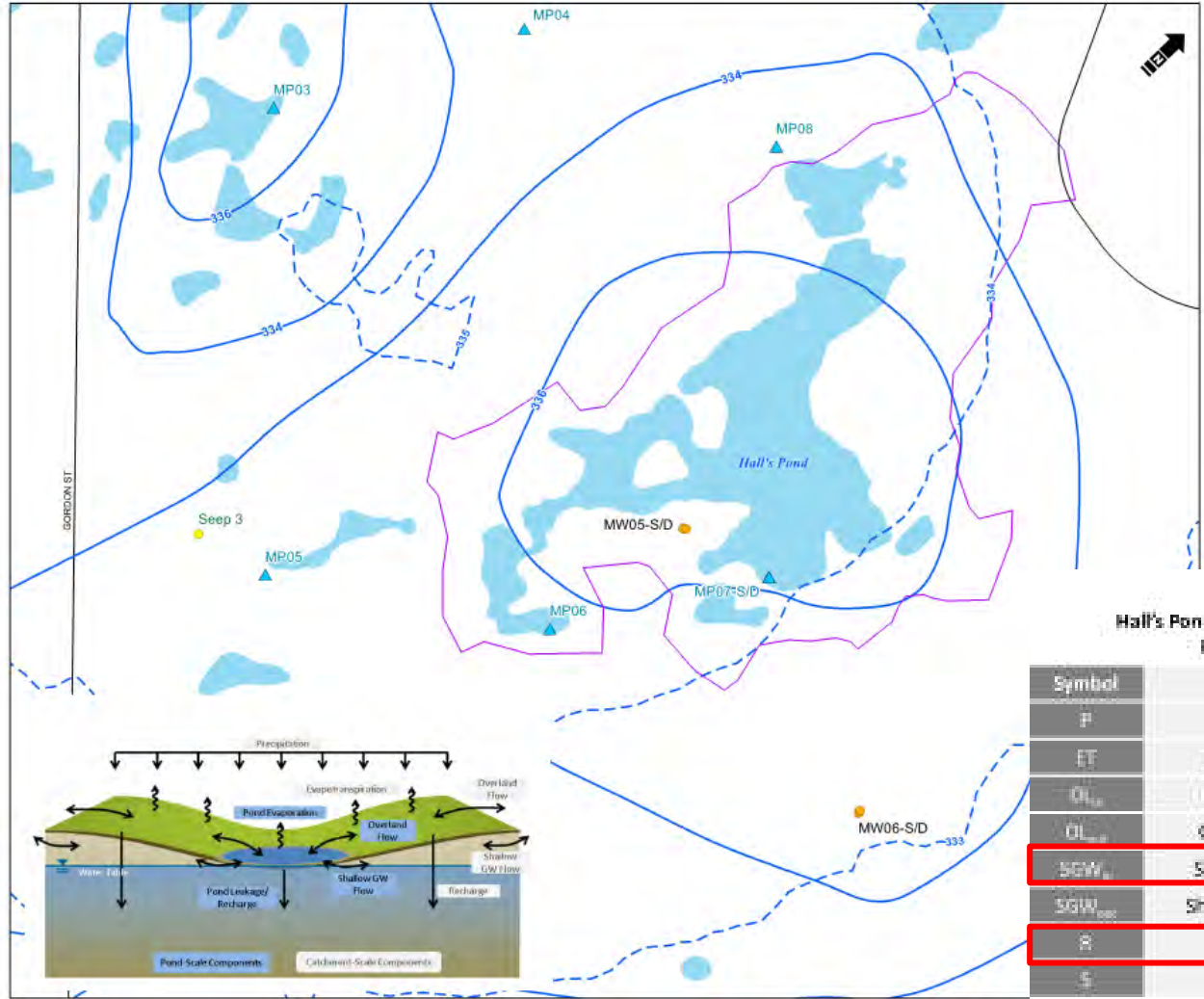
Table 4.2.4 Average Annual Water Budget (2003-2017, mm-year)

Area/Catchment	Precipitation	Evapotranspiration	Overland Flow In	Overland Flow Out	Lateral Groundwater Flow				Vertical Groundwater Flow		Pumping	Change in Storage
					Overburden		Bedrock Above Vinemount		Regional Bedrock Aquifer			
					Inflow	Outflow	Inflow	Outflow	Inflow	Outflow		
SSA Model Domain	-801	480	0	108	-35	126	-17	44	0	99	2	-7
Mill Creek	-801	498	-1	188	-41	36	-140	194	-1	66	7	-6
Hanlon Creek	-801	472	0	86	-19	60	-42	186	0	64	0	-7
Torrance Creek	-801	450	0	60	-48	95	-233	421	0	58	0	-4

Table 4.2.5 Average Annual Groundwater Recharge (2003-2017)

Area/Catchment	Groundwater Recharge (mm/year)
SSA Model Domain	325
Mill Creek	338
Hanlon Creek	326
Torrance Creek	302

4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings



Hall's Pond Water Balance

- Hall's Pond Subcatchment
- Water Body
- Water Table Elevation Contour (2m)
- Simulated Head Contour (1m)
- Road
- Mini Plazometer
- Monitoring Well (Matrix)
- Monitoring Well (132 Clair Rd.)
- Observed Seep and Spring

Hall's Pond Average Annual Simulated Water Balance (2003-2017)
 $P - ET + (OL_{in} - OL_{out}) + (SGW_{in} - SGW_{out}) + R = \Delta S$

Symbol	Subcatchment-Scale		Pond-Scale	
P	Precipitation	801	Precipitation	801
ET	Evapotranspiration	509	Evaporation	543
OL _{in}	Overland Flow (In)	3	Overland Flow (In)	71
OL _{out}	Overland Flow (Out)	1	Overland Flow (Out)	52
SGW _{in}	Shallow GW Flow (In)	3	Shallow GW Flow (In)	4
SGW _{out}	Shallow GW Flow (Out)	3	Shallow GW Flow (Out)	1
R	Recharge	299	Recharge	286
ΔS	Storage Change	-5	Storage Change	-6

*All values reported in mm.

4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Summary of Findings

Existing Groundwater Quality

- Consistent Ca-Mg Carbonate Groundwater Similar Age
- Groundwater Isotopes gw age less than 50 years old
- Elevated chloride and nitrate, typical of road salt and agricultural practices

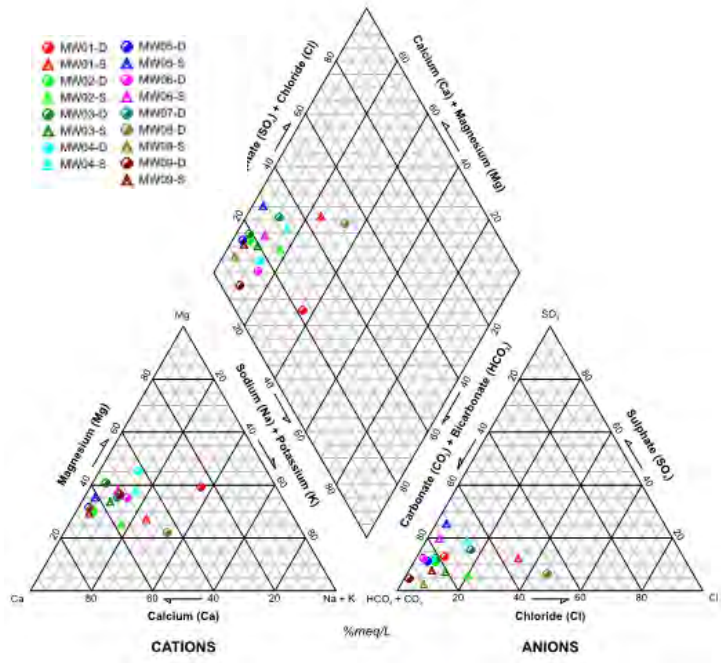


TABLE C2

Groundwater Quality Results - Routine Parameters

City of Guelph
Clair - Maltby Master Environmental Servicing Plan (MESF) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Temp at lab °C	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Fe mg/L	Mn mg/L	Cl mg/L	SO ₄ mg/L	NO ₃ -N mg/L	NO ₂ -N mg/L	TKN mg/L	Alkalinity-T mg/L	HCO ₃ mg/L	Hardness-T mg/L	TDS mg/L
MW06-S	19-Oct-16	23089161019005	7.53	602	8.7	69.2	29.7	13	2.2	0.012	0.0453	9.21	55.6	<0.010	<0.020	0.28	282	282	295	351
MW06-S	19-Apr-17	23089170419011	8.08	616	2.4	99.5	39.5	5.2	1.78	0.79	0.121	8.23	70.5	<0.010	<0.020	<1.5	316	316	411	404
MW06-S	04-Oct-17	23089171004009	8.01	625	3.3	73.3	31	10.6	1.45	0.589	0.0452	11.4	76.4	<0.010	<0.020	<0.15	271	271	311	400
MW07-D	19-Oct-16	23089161019001	7.44	696	8.7	79.3	30.7	17.1	1.55	0.024	0.0787	39.6	47.4	0.028	0.318	<0.15	276	276	325	386
MW07-D	19-Apr-17	23089170419015	7.99	682	2.4	77.7	27.9	13.2	1.4	0.021	0.0654	32.4	42.1	0.012	0.125	<0.15	281	281	309	413
MW07-D	10-Oct-17	23089171010001	8.12	701	4.7	76.4	29	18	1.65	0.028	0.0696	40.4	41.2	<0.010	0.578	0.19	285	285	310	416
MW08-D	19-Oct-16	23089161019002	7.23	1180	8.7	105	30.5	88.3	3.18	<0.010	0.0434	189	32	<0.050	1.49	0.51	336	336	388	639
MW08-D	19-Apr-17	23089170419014	7.88	1180	2.4	100	28.8	85.2	3.37	<0.010	0.0191	167	29.5	0.015	1.51	<1.5	354	354	369	718
MW08-D	05-Oct-17	23089171005004	8.09	1180	3.3	101	29.3	88.6	3.42	<0.010	0.021	170	29.9	0.014	1.31	<0.15	321	321	374	663
MW08-S	19-Oct-16	23089161019003	7.25	569	8.7	77.7	22.8	1.7	1.29	<0.010	0.00707	14.4	4.79	<0.010	1.04	0.76	288	288	288	295
MW08-S	19-Apr-17	23089170419013	7.78	664	2.4	92	24.2	3.74	0.87	<0.010	0.0013	13.5	5.89	<0.010	1.81	<1.5	354	354	329	385
MW08-S	05-Oct-17	23089171005005	7.93	656	3.3	95.1	24.6	3.25	0.744	<0.010	0.00133	15.9	4.95	<0.010	4.19	0.15	321	321	339	352
MW09-D	21-Oct-16	23089161021001	7.56	445	12	54.4	22.3	12.1	1.08	0.024	0.0367	2.79	7.88	<0.010	<0.020	0.48	237	237	228	272
MW09-D	19-Apr-17	23089170419017	8.12	469	2.4	53.9	20.8	10.1	0.997	0.06	0.0581	3.06	4.98	<0.010	<0.020	0.84	294	294	220	312
MW09-D	04-Oct-17	23089171004008	7.98	466	3.3	59.8	21.8	7.31	0.99	0.084	0.0581	2.56	4.55	<0.010	<0.020	0.29	264	264	239	278
MW09-S	21-Oct-16	23089161021002	7.28	583	12	89.3	23.4	4.69	3.34	<0.010	0.00469	14.1	16.9	<0.010	7	1.91	260	260	319	346
MW09-S	19-Apr-17	23089170419016	7.96	659	2.4	89.1	23.5	5.71	3.63	<0.010	0.00068	19.9	15	<0.010	7.17	1.16	338	338	319	430
MW09-S	04-Oct-17	23089171004007	7.88	620	3.3	87.2	23.9	5.41	4.35	0.109	0.00058	14.7	17	<0.010	7.09	<1.5	283	283	316	376

TABLE C3

Groundwater Quality Results - Dissolved Metals

City of Guelph
Clair - Maltby Master Environmental Servicing Plan (MESF) and Secondary Plan (SP)

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cs mg/L	Cr mg/L	Co mg/L	Cu mg/L	Pb mg/L	Li mg/L	Mn mg/L	Ni mg/L	P mg/L
MW01-D	20-Oct-16	23089161020003	0.007	0.00024	0.00763	0.0345	<0.0010	<0.00050	0.078	<0.00010	<0.00010	<0.00050	0.00022	0.00059	<0.00050	0.002	0.00453	0.00152	<0.050
MW01-D	19-Apr-17	23089170419003	<0.0050	0.00015	0.0127	0.049	<0.0010	<0.00050	0.072	<0.00010	<0.00010	<0.00050	0.00042	0.00069	<0.00050	0.002	0.00312	0.00245	<0.050
MW01-D	04-Oct-17	23089171004003	<0.0050	0.00017	0.00876	0.044	<0.0010	<0.00050	0.065	<0.00011	<0.00010	<0.00050	0.00072	0.00104	<0.00050	0.005	0.00293	0.00291	<0.050
MW01-S	20-Oct-16	23089161020004	<0.0050	<0.00010	0.00012	0.0573	<0.0010	<0.00050	0.021	0.000195	<0.00010	<0.00050	<0.00010	0.00129	0.00018	0.002	0.000284	0.00082	<0.050
MW01-S	19-Apr-17	23089170419004	<0.0050	<0.00010	0.00011	0.056	<0.0010	<0.00050	0.019	0.000183	<0.00010	<0.00050	<0.00010	0.00143	0.00026	0.002	0.000425	0.00069	<0.050
MW01-S	04-Oct-17	23089171004004	<0.0050	<0.00010	0.00014	0.0609	<0.0010	<0.00050	0.021	0.000192	<0.00010	<0.00050	<0.00010	0.00051	0.000214	0.002	0.000578	0.00157	<0.050
MW02-D	20-Oct-16	23089161020002	<0.0050	0.00046	0.0194	0.0901	<0.0010	<0.00050	0.015	<0.00010	<0.00010	<0.00050	0.00137	0.00056	0.000163	0.002	0.00136	0.00619	<0.050
MW02-D	19-Apr-17	23089170419002	<0.0050	<0.00010	0.0049	0.0885	<0.0010	<0.00050	<0.010	<0.00010	<0.00010	<0.00050	0.00059	<0.00020	0.000281	0.002	0.000484	0.003	<0.050
MW02-D	04-Oct-17	23089171004001	<0.0050	<0.00010	0.00358	0.0906	<0.0010	<0.00050	<0.010	<0.00010	<0.00010	<0.00050	0.00028	0.0004	0.000126	0.002	0.000396	0.00154	<0.050
MW02-S	20-Oct-16	23089161020001	0.0064	0.00049	0.023	0.0647	<0.0010	<0.00050	0.028	<0.00010	<0.00010	<0.00050	0.003	0.00056	0.000266	0.001	0.00192	0.0126	<0.050
MW02-S	19-Apr-17	23089170419001	0.0052	0.00013	0.0315	0.0482	<0.0010	<0.00050	0.019	<0.00010	<0.00010	<0.00050	0.00182	0.00023	0.000366	0.002	0.000928	0.00841	<0.050
MW02-S	04-Oct-17	23089171004002	0.0093	0.00011	0.0197	0.0471	<0.0010	<0.00050	0.02	<0.00010	<0.00010	<0.00050	0.00101	0.00063	0.000066	0.002	0.000821	0.00491	<0.050
MW03-D	20-Oct-16	23089161020005	<0.0050	<0.00010	0.00238	0.0806	<0.0010	<0.00050	<0.010	<0.00010	<0.00010	<0.00050	0.00013	0.00032	<0.00050	0.002	0.000905	<0.0050	<0.050
MW03-D	19-Apr-17	23089170419006	<0.0050	<0.00010	0.00244	0.0778	<0.0010	<0.00050	<0.010	<0.00010	<0.00010	<0.00050	<0.00010	0.00082	<0.00050	0.002	0.000864	<0.0050	<0.050
MW03-D	10-Oct-17	23089171010003	<0.0050	<0.00010	0.00233	0.0787	<0.0010	<0.00050	<0.010	<0.00010	<0.00010	<0.00050	<0.00010	0.00042	<0.00050	0.003	0.000809	<0.0050	<0.050

Ontario Drinking Water Quality Standards* 6.5 - 8.5 ⁵⁰ NS NS NS NS 200 ⁵⁰ NS 0.3 ⁴⁰ 0.05 ⁴⁰ 250 ⁴⁰ 500 ⁴⁰ 1 ^{MAC} 10 ^{MAC} NS 30 - 500 ⁵⁰ NS 80 - 100 ⁵⁰ 500 ⁴⁰

4. CEIS Phase 1/2 Characterization Report:

Hydrogeology: Input to Community Structure Alternatives

- Wetlands and Ponds supported primarily by runoff from areas within existing NHS adjacent to the features
- Wetlands and Ponds provide recharge to the groundwater flow system. Many are perched but Halls Pond is an example of a feature which is in contact with water table but recharges groundwater system
- Groundwater discharge to wetlands is small to negligible
- Groundwater recharge primarily through vertical infiltration in SPA
- Most Closed depression areas have higher than average infiltration and recharge
- Most areas in SPA have moderate to high permeability and large depth to water table provides good opportunity for infiltration of stormwater
- Closed depressions represent existing opportunity for stormwater infiltration

4. CEIS Phase 1/2 Characterization Report:

Hydrogeology: Integration Considerations

- Conceptual Model provides functional context and linkages between surface water, groundwater and NHS
 - Key Characteristics
 - Thick unsaturated zone away from wetlands
 - Moderate to High Permeability
 - Moderate to High Infiltration Capacity
 - Key Functions
 - Groundwater discharge to creeks (regionally)
 - Wetland recharge to groundwater system
 - Recharge to bedrock production aquifer

4. CEIS Phase 1/2 Characterization Report:

Hydrogeology: Integration Considerations

- Infiltration: should be maintained to provide existing recharge and the opportunity to enhance infiltration without unacceptable increases to groundwater levels that would impact wetland areas or surface water consideration
- Groundwater flow: maintain flow divide in SPA to maintain contributions to discharge areas and bedrock production aquifer
- Closed Depressions: maintain above average infiltration of these areas and opportunity for stormwater management based on existing function
- Wetlands/Ponds: maintain overall hydrologic function (runoff from adjacent areas) within local subcatchments to preserve range and timing of water levels associated with these features.

4. CEIS Phase 1/2 Characterization Report: Hydrogeology: Integration Considerations

- Infrastructure trenches: should be designed to minimize water table lowering and redirection of shallow flows in areas of shallow water table depth
- Recharge Water Quality: best management practices for infiltration water should be implemented to maintain existing groundwater quality

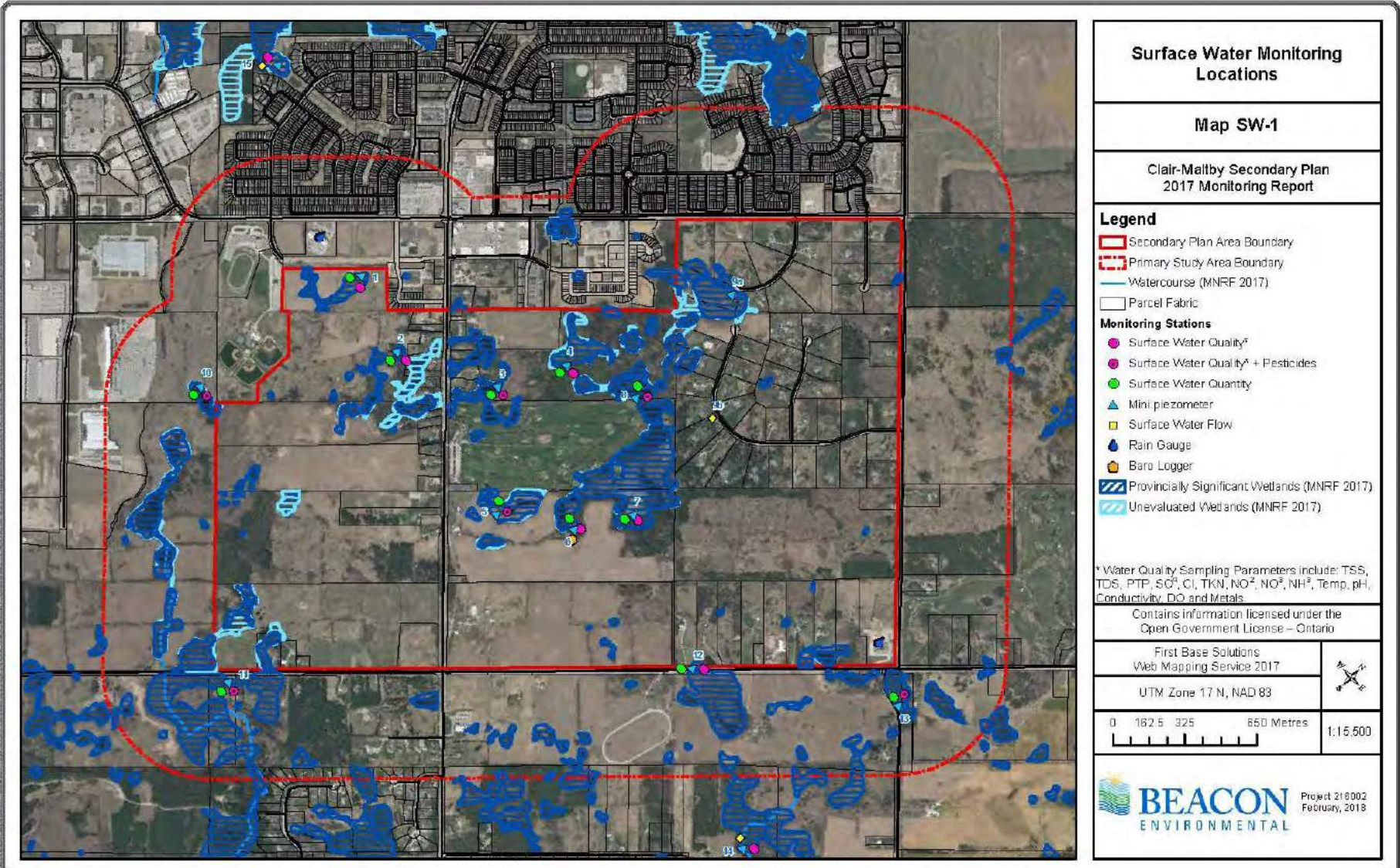
4. CEIS Phase 1/2 Characterization Report:

Surface Water: Objective / Purpose

- Need to define runoff characteristics (peak, volume) in the study area
 - Headwaters of Mill, Hanlon and Torrance Creeks
- Assist in the definition of the role of water in supporting natural systems functionality
- Fundamental component of Stormwater Management Plan development



4. CEIS Phase 1/2 Characterization Report: Surface Water: Field Work



4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings (Rainfall)

Monthly Precipitation Totals for 2016 and 2017 and Climate Normals (mm)

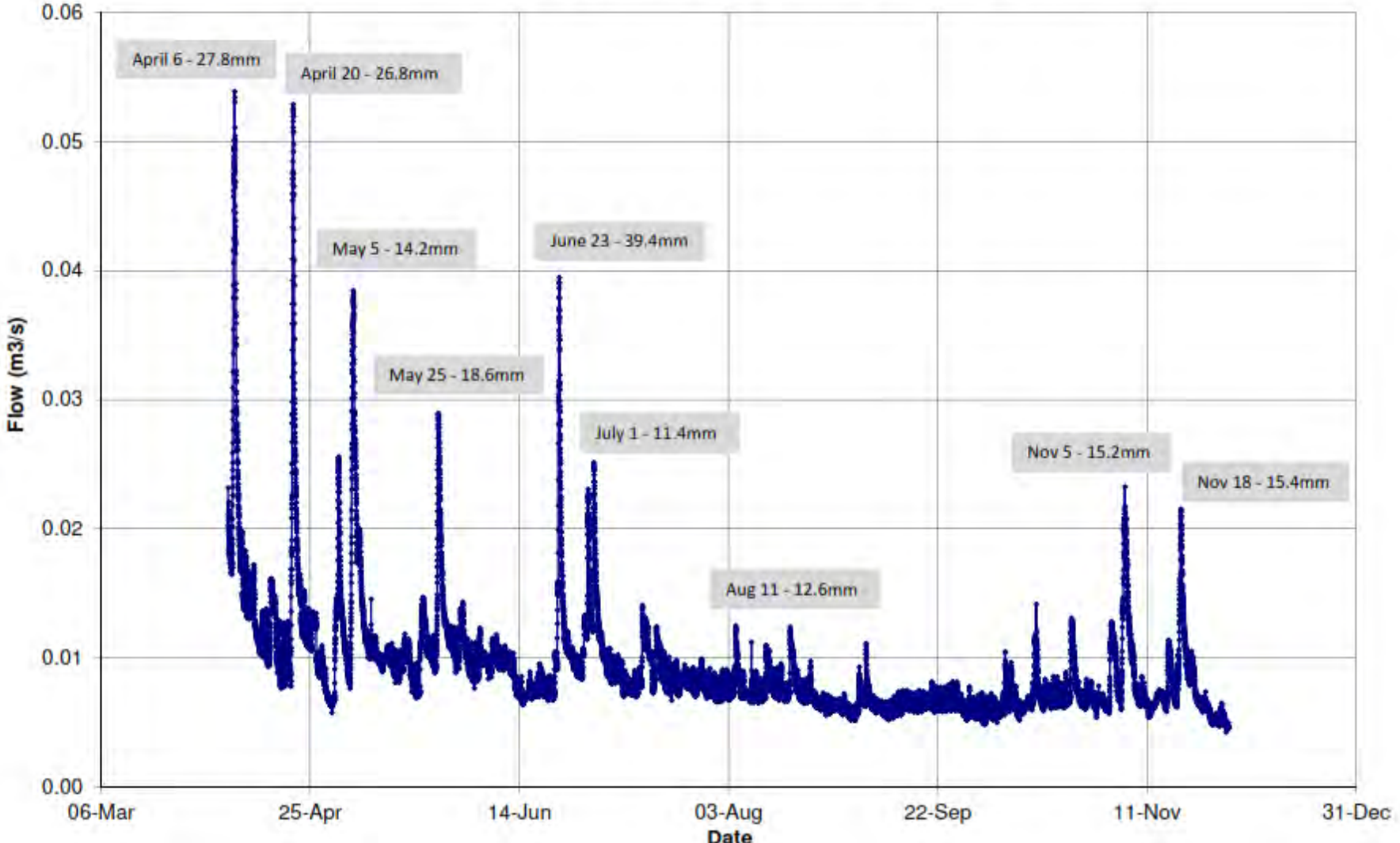
Month	2016 & 2017 Total ²	1981-2010 Climate Normal ¹	Percent Difference ²
2016			
April	57.8 (NA)	74.5	-22.42% (NA)
May	57.3 (NA)	82.3	-30.38% (NA)
June	53.0 (NA)	82.4	-35.68% (NA)
July	102.4 (NA)	98.6	+3.85% (NA)
August	152.6 (134.4)	83.9	+81.88% (+60.19%)
September	77.1 (58.2)	87.8	-12.19% (-33.71%)
October	85.8 (43.8)	67.4	+27.30% (-35.01%)
November	55.6 (40)	87.1	-36.17% (-54.08%)
December	90.1 (NA)	71.2	+26.54% (NA)
TOTAL	731.7 (NA)	735.2	-0.48% (NA)
April	57.8 (NA)	74.5	-22.42% (NA)
2017			
April	92.0 (NA)	74.5	+23% (NA)
May	120.5 (107.2)	82.3	+46% (+30%)
June	117.8 (94.6)	82.4	+43% (+15%)
July	35.5 (37.4)	98.6	-64% (-62%)
August	68.1 (51.6)	83.9	-19% (-38%)
September	55.5 (23.8)	87.8	-37% (-73%)
October	85.8 (56.2)	67.4	+27% (-17%)
November	96.1 (69.8)	87.1	+10% (-20%)
December	55.6 (NA)	71.2	-22% (NA)
TOTAL	726.9 (NA)	735.2	-1% (NA)

1. From Environment Canada Waterloo Wellington Airport

2. First value is based on Environment Canada's Elora RCS gauge, value in brackets is based on Clair Maltby Project gauge

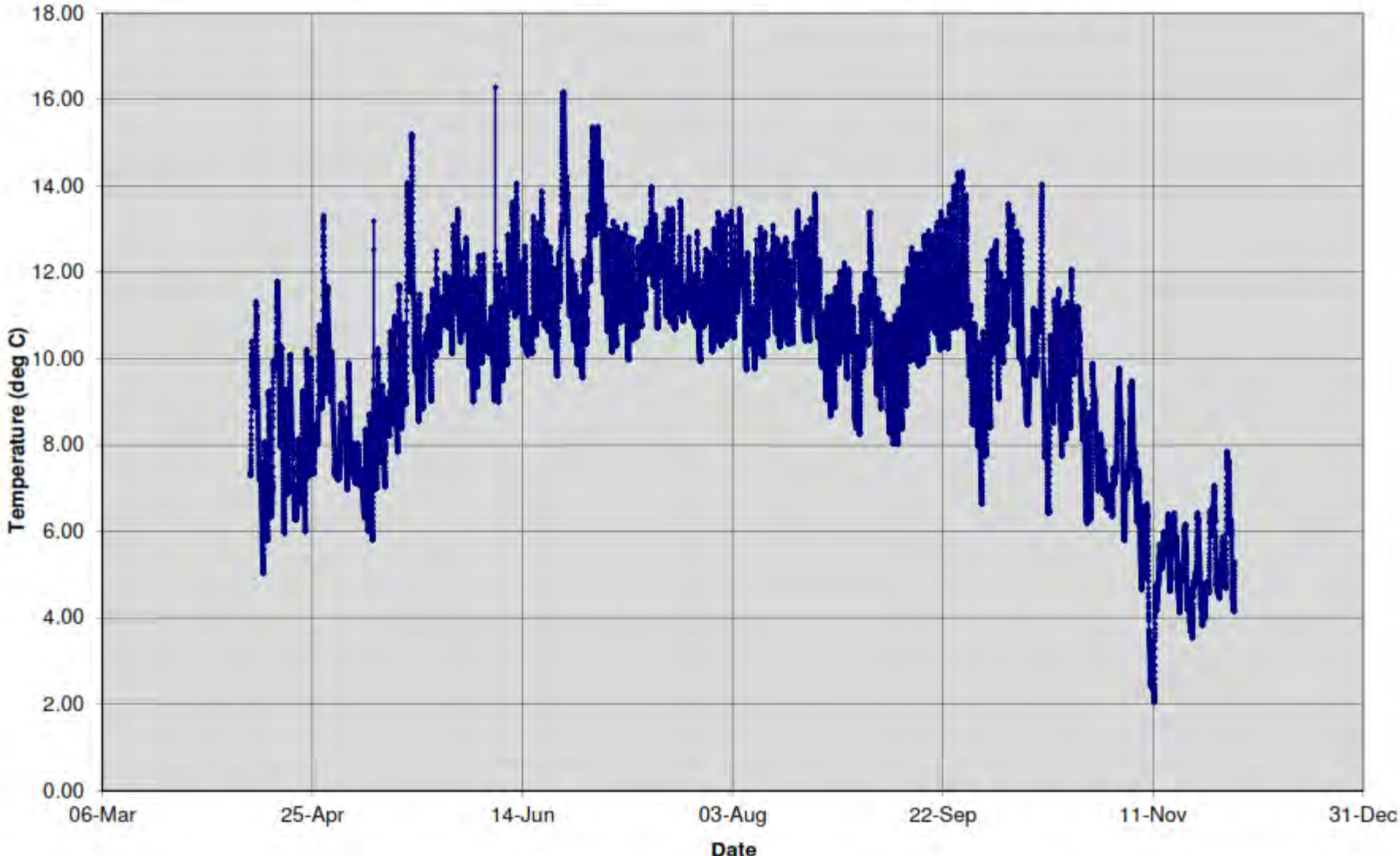
4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings – Surface Flow

Station 14 (Hammersley) Estimated Flows for 2017



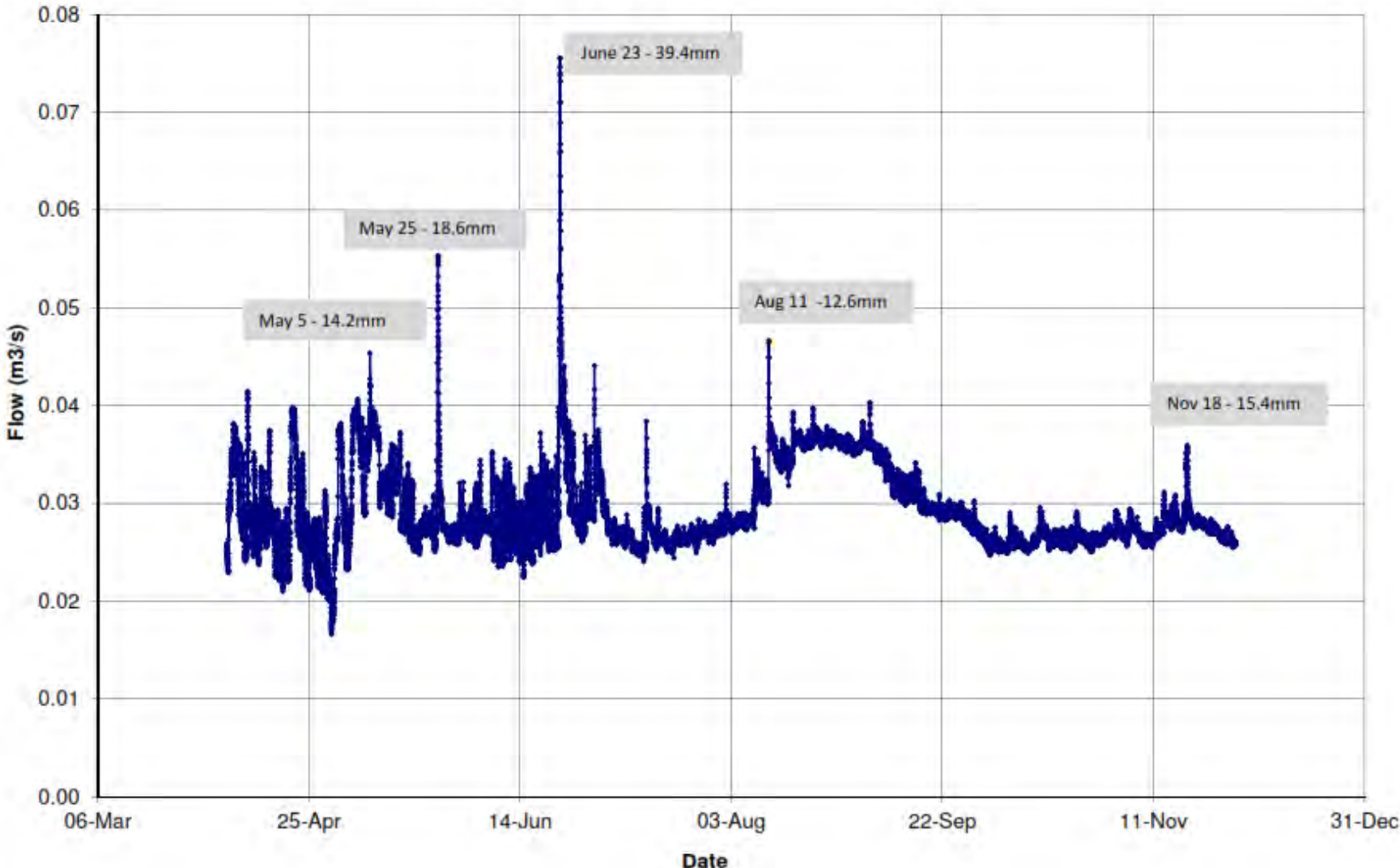
4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings – Temperature

Station 14 (Hammersley) Recorded Temperature for 2017



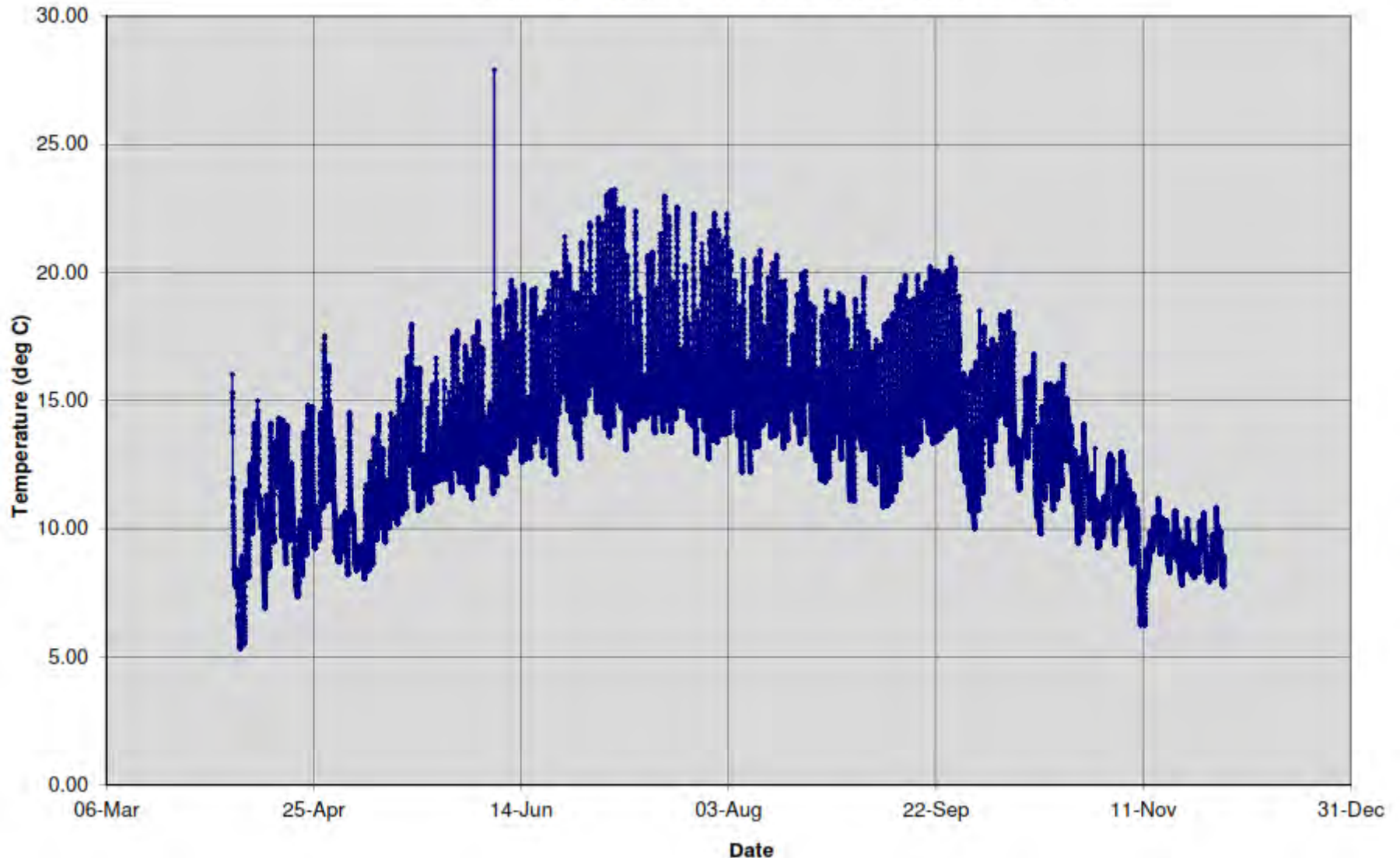
4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings – Surface Flow

Station 15 (Hanlon) Estimated Flows for 2017



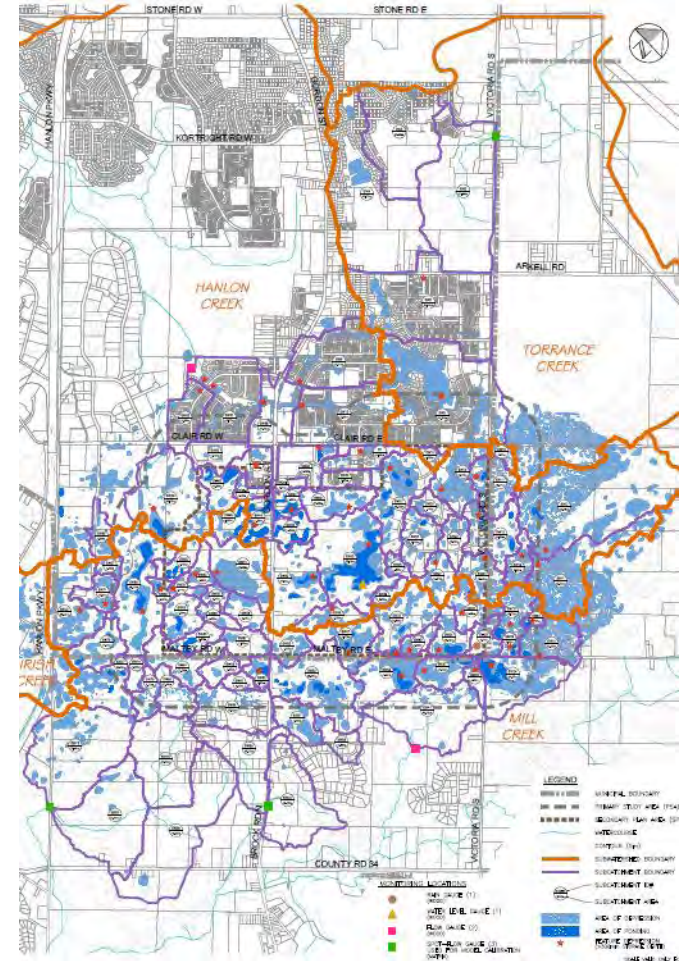
4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings – Temperature

Station 15 (Hanlon) Recorded Temperature for 2017

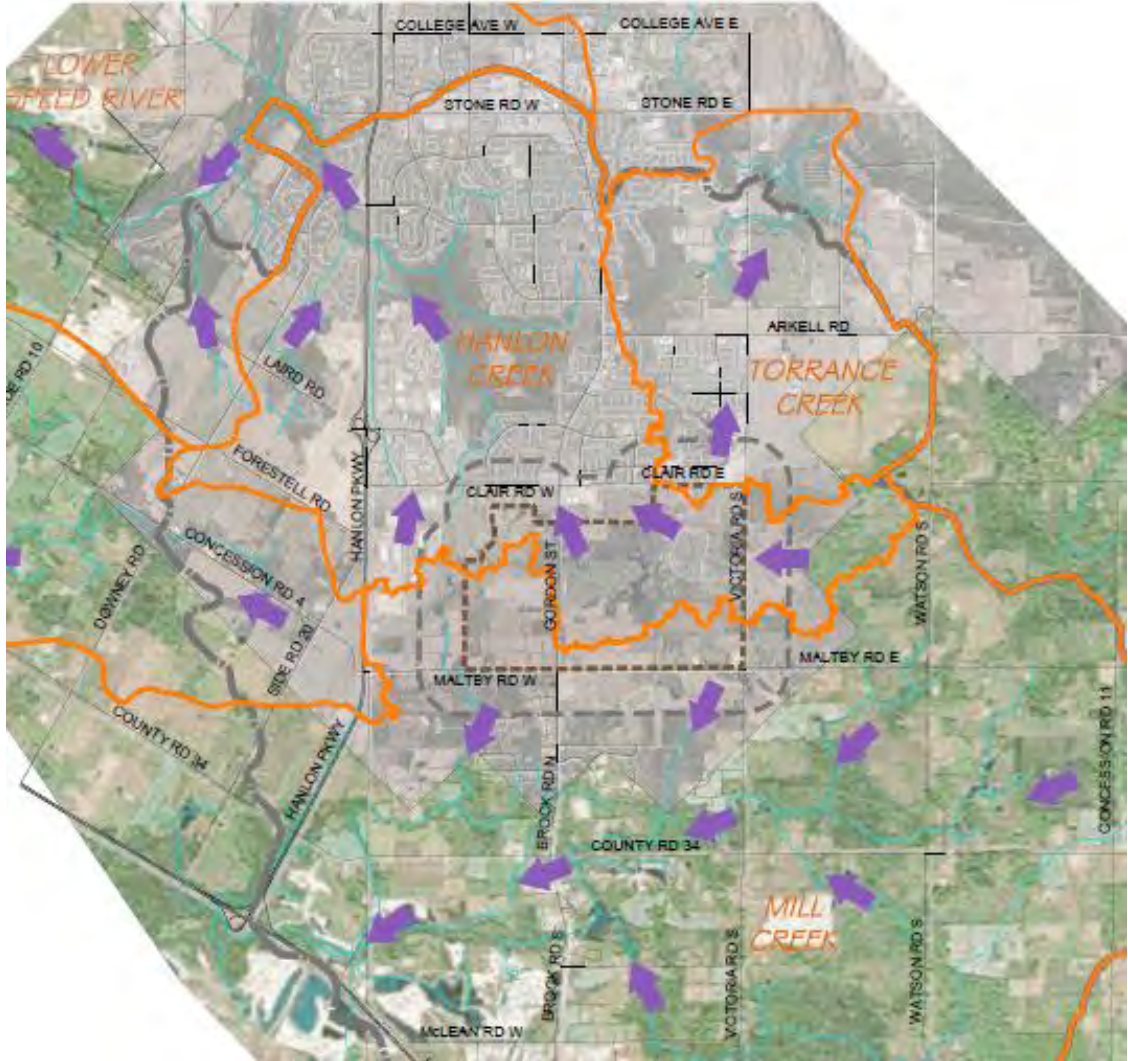


4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings - Hydrology

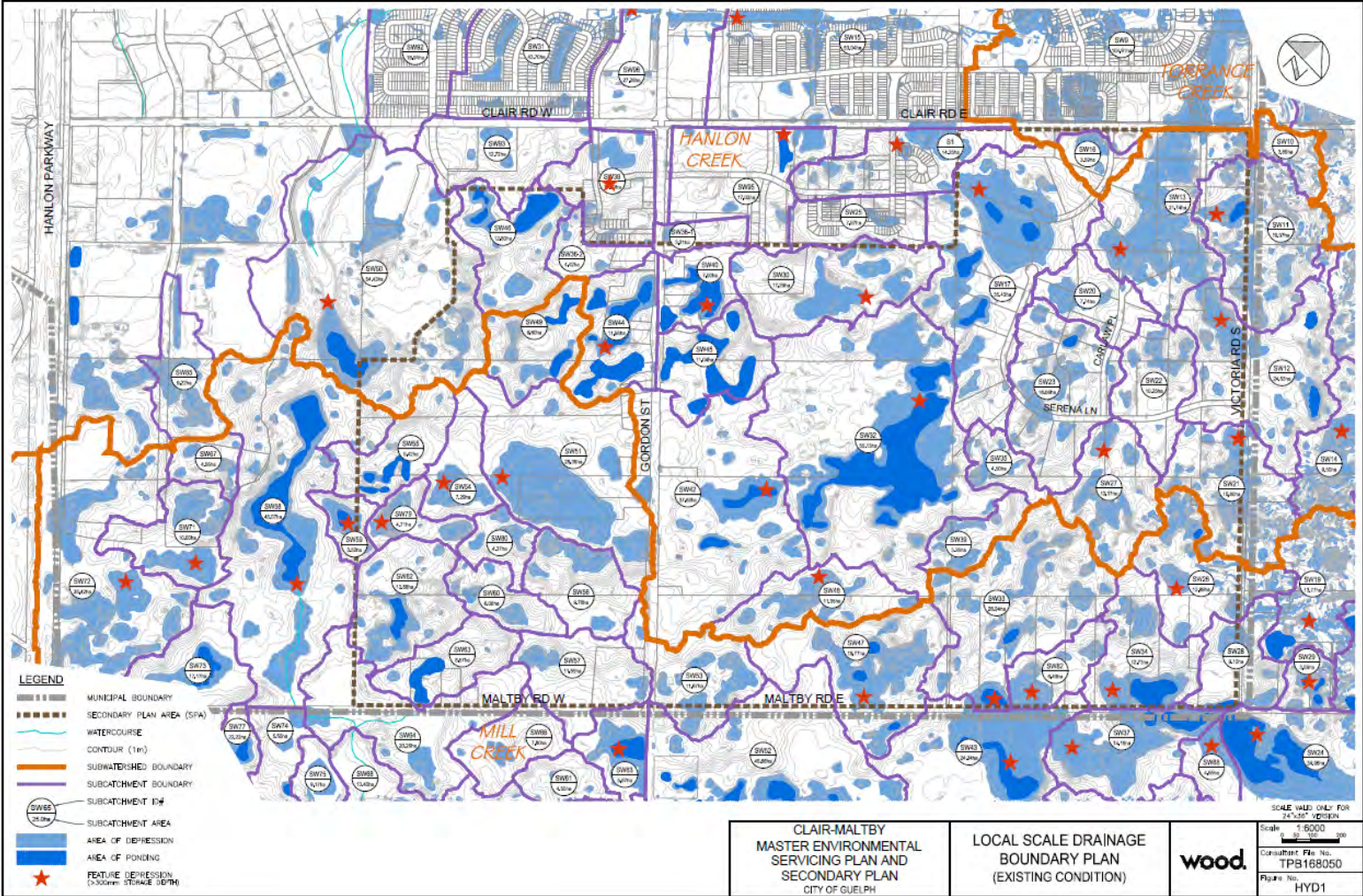
- PCSWMM hydrologic model built on 2012 digital elevation model
- Subcatchments developed to Hanlon Creek, Mill Creek and Torrance Creek to the monitoring locations
- Depressional features (<300mm capture) incorporated into subcatchment depression storage; (>300 mm capture) used storage elements with overflow.
- Model validation to the 2016 to 2017 monitoring period results, requiring changes to baseflow, impervious coverages and increased infiltration in greenways



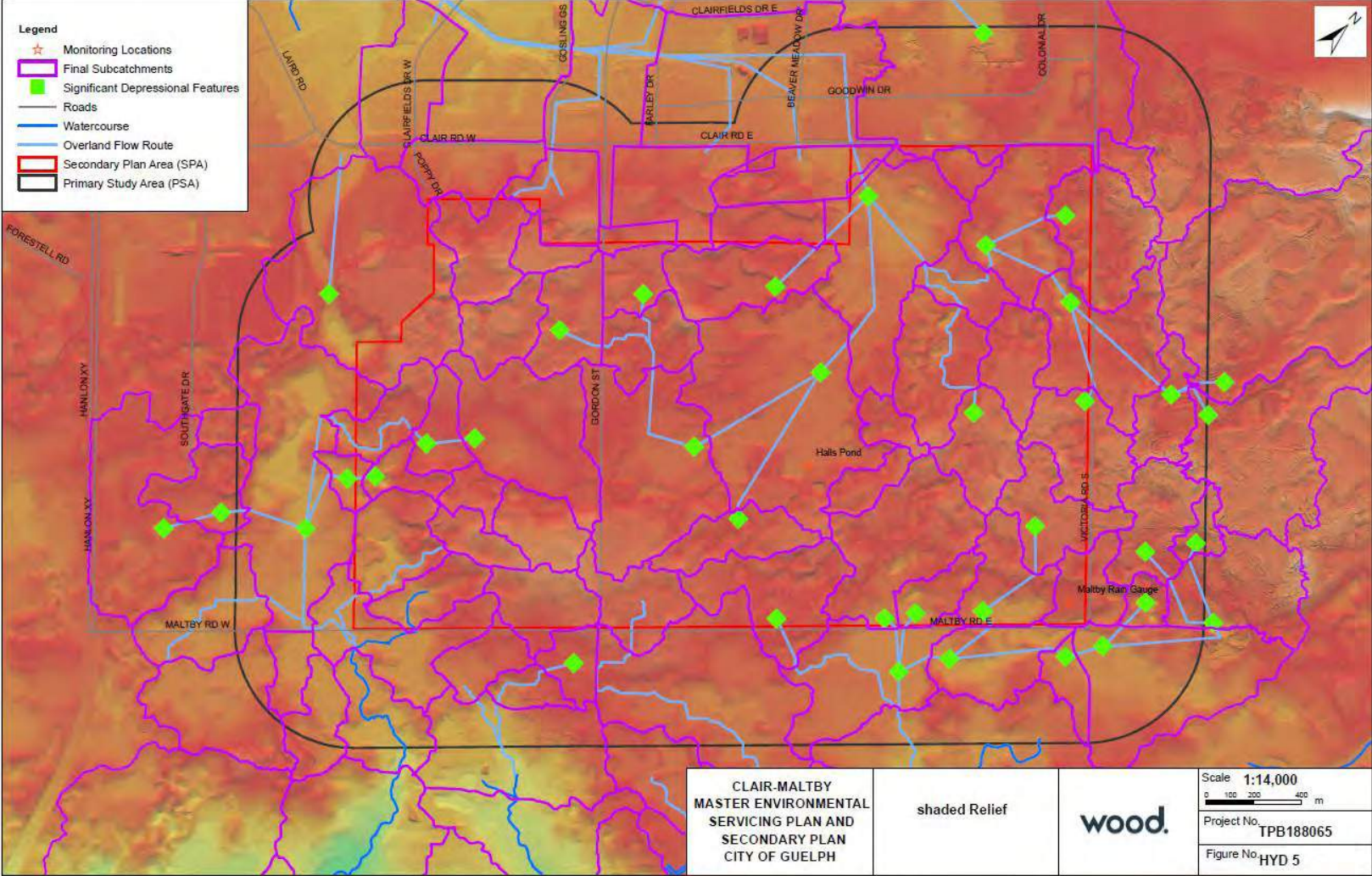
4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings - Hydrology



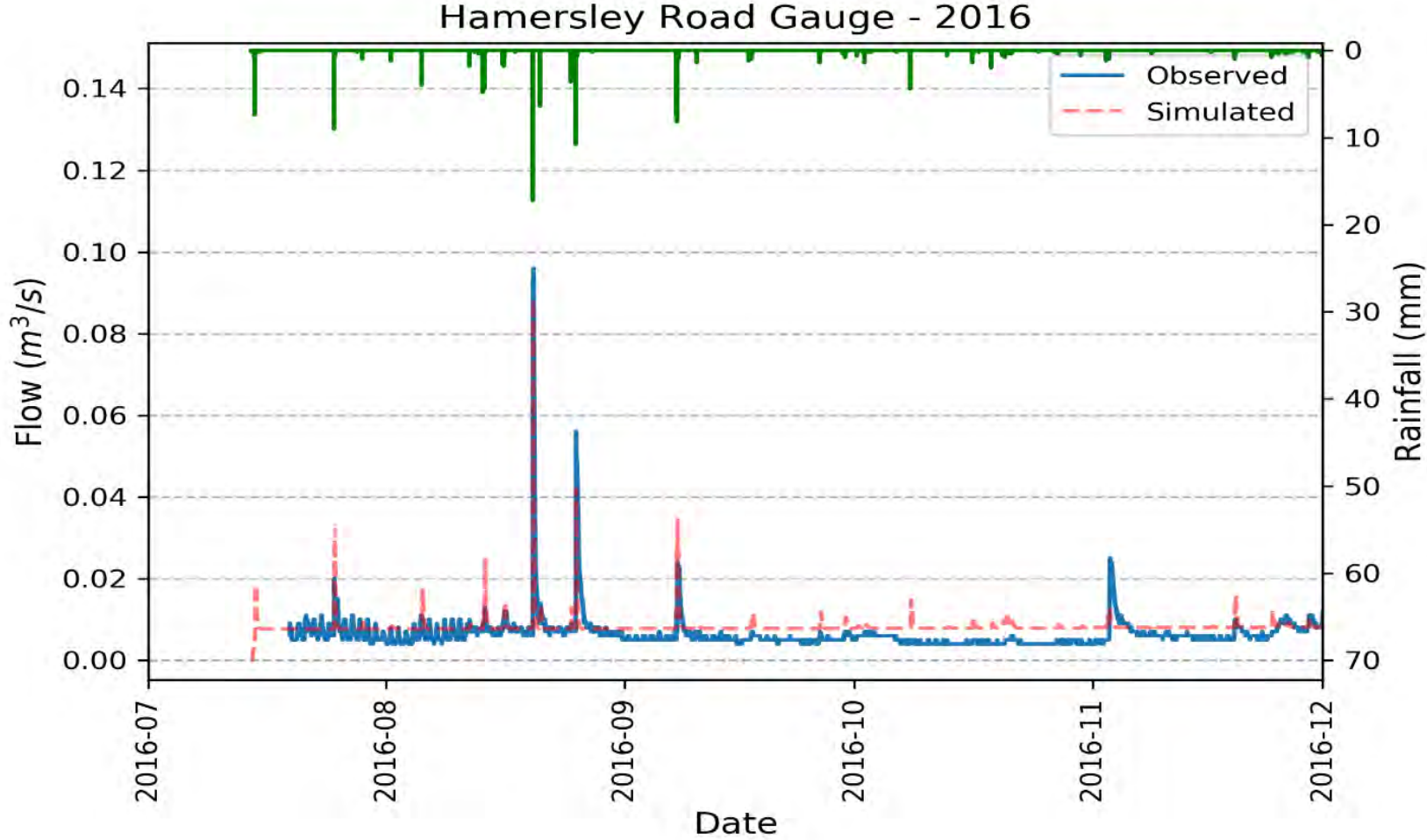
4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings - Hydrology



4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings - Hydrology

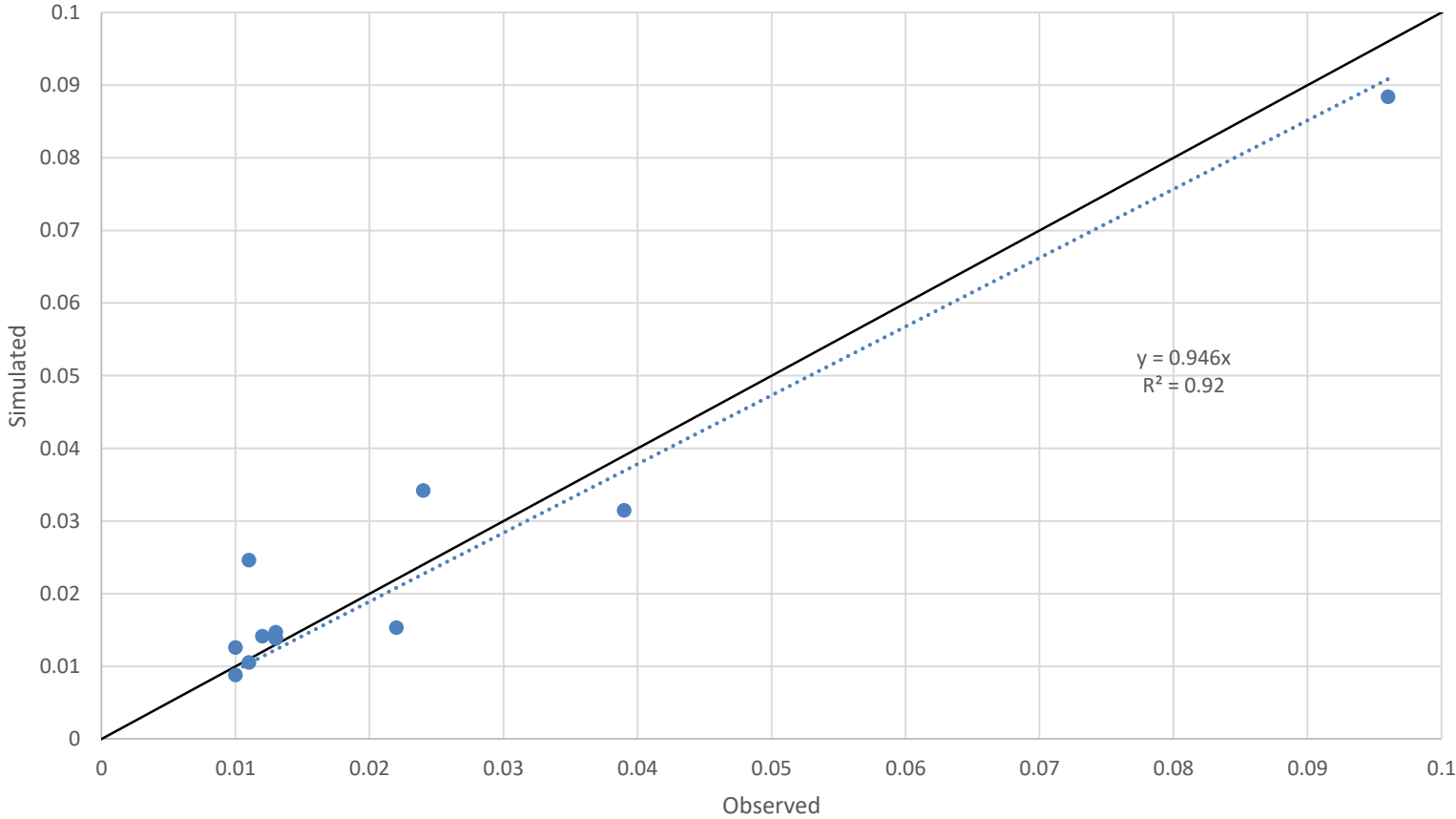


4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings - Hydrology



4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings - Hydrology

Hamersley Road Gauge - Maximum Flow (m³/s)



4. CEIS Phase 1/2 Characterization Report: Surface Water: Summary of Findings - Hydrology

- Validated PCSWMM hydrologic model used to determine:
 - Design and frequency peak flows and water balance (surface based)
 - 100 Year frequency flows 1.55 m³/s and 0.48 m³/s for Hanlon Creek and Mill Creek monitoring sites (flows are extremely low)
 - Flows within Hanlon and Mill Creek are low, but have baseflow from contributing groundwater discharge
 - 93% to 97% precipitation either infiltrates or evaporates
 - 95%+/- infiltration within depressional features
 - Only 7 out of 47 significant depressional features (>300 mm capture) exhibited a discharge over 67 years of simulation period

4. CEIS Phase 1/2 Characterization Report: Surface Water: Input to Community Structure Alternatives

- There are 47 significant depressional features with over 300 mm of storage
- Depressional features (dry, ponds, wooded areas and wetlands) infiltrate most precipitation
- Surface water contributions to wetlands are significant, with groundwater contributions being minor (see Hydrogeology Section)
- Significant depressional features discharge for only infrequent and significant storm events
- Mill Creek and Hanlon Creek have low frequency flows
- Baseflow relies on groundwater discharge
- Most of the area has moderate to high infiltrative soils
- The depressional areas provide an opportunity for infiltration of stormwater runoff

4. CEIS Phase 1/2 Characterization Report:

Surface Water: Integration Considerations

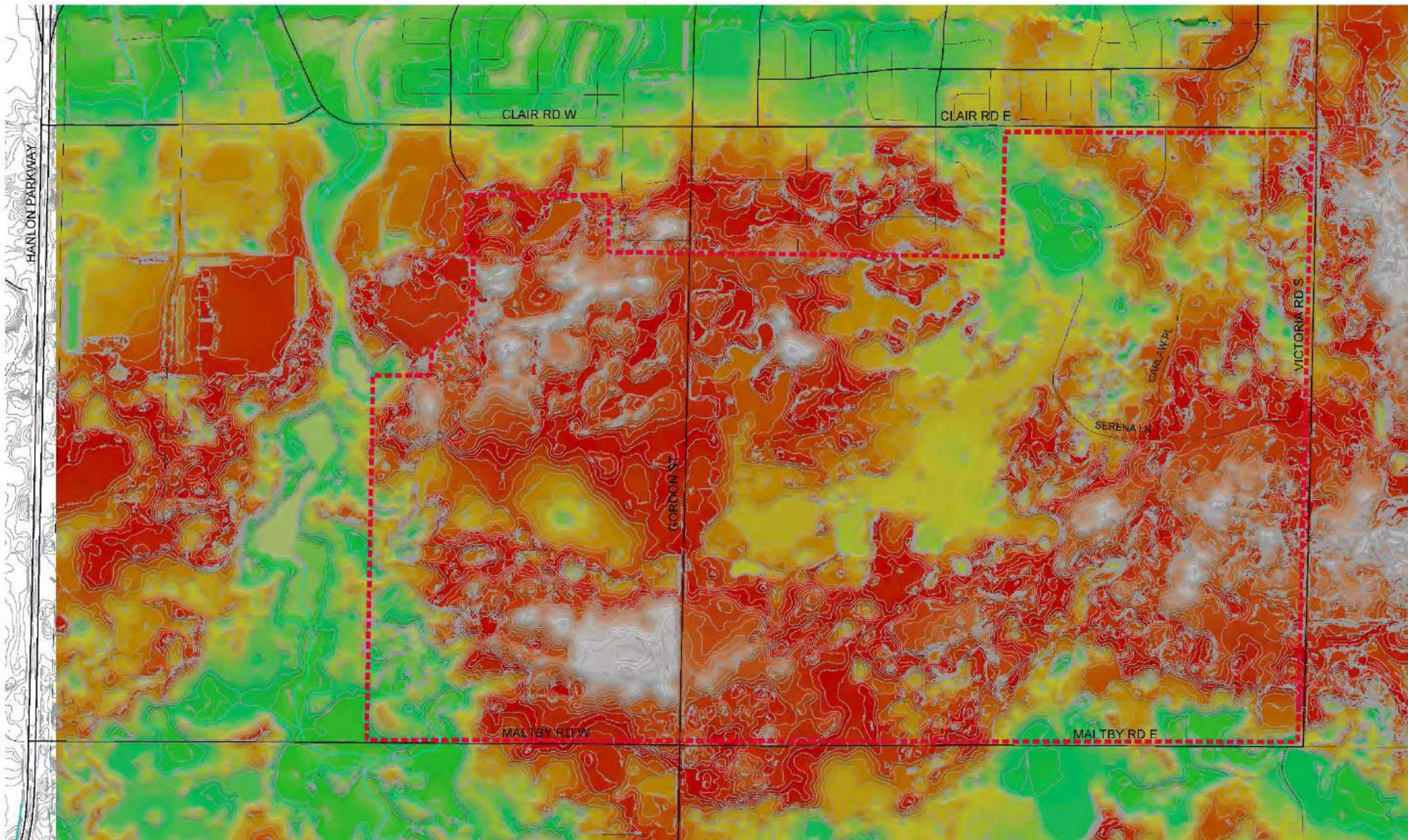
- Stormwater quantity controls to be integrated with sustainable planning approach for the NHS terrestrial units, based on the existing unit water balance
- Replicate existing overland drainage to wetlands and woodlots
- Stormwater management and drainage systems to manage the increased rate and volume of runoff from future development resulting in no increase in peak flows and runoff volumes to watercourses
- As part of the stormwater management system, source, conveyance and end-of-pipe measures that promote infiltration, should be implemented

4. CEIS Phase 1/2 Characterization Report:

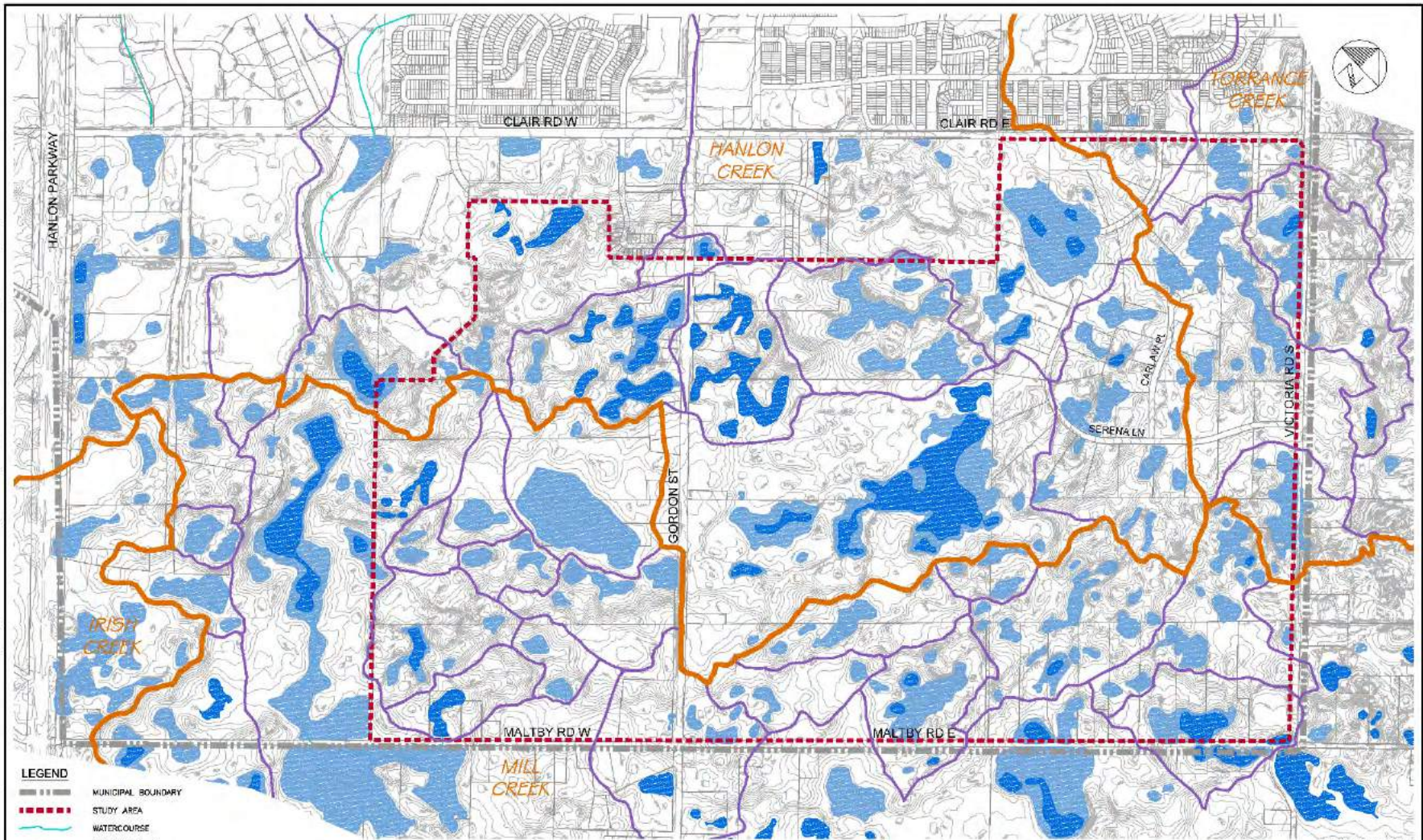
Surface Water: Integration Considerations

- The significant infiltration function of depressional features should either be preserved or replicated within stormwater management measures
- The stormwater management system should appropriately maintain and if possible augment baseflows, and mitigate thermal impacts from future development

4. CEIS Phase 1/2 Characterization Report: Preliminary Stormwater Management Considerations



4. CEIS Phase 1/2 Characterization Report: Preliminary Stormwater Management Considerations



- LEGEND**
- MUNICIPAL BOUNDARY
 - STUDY AREA
 - WATERCOURSE
 - CONTOUR (1m)
 - WATERSHED BOUNDARY
 - SUBCATCHMENT BOUNDARY
 - AREA OF DEPRESSION
 - AREA OF PONDING

CLAIR-MALTBY
MASTER ENVIRONMENTAL
SERVICING PLAN AND
SECONDARY PLAN
CITY OF GUELPH

LOCAL SCALE
DRAINAGE BOUNDARY
PLAN



SCALE VALID ONLY FOR
24"x36" VERSION
Scale 1:6000
1" = 300'
Consultant File No.
TPB168050
Figure No.
W1

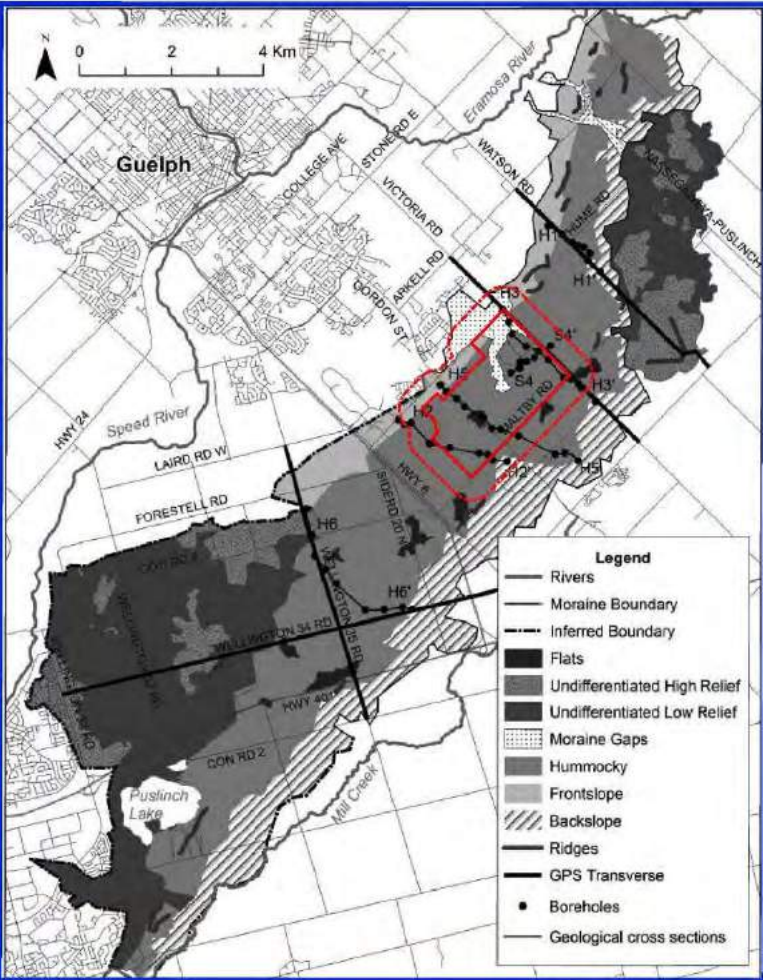
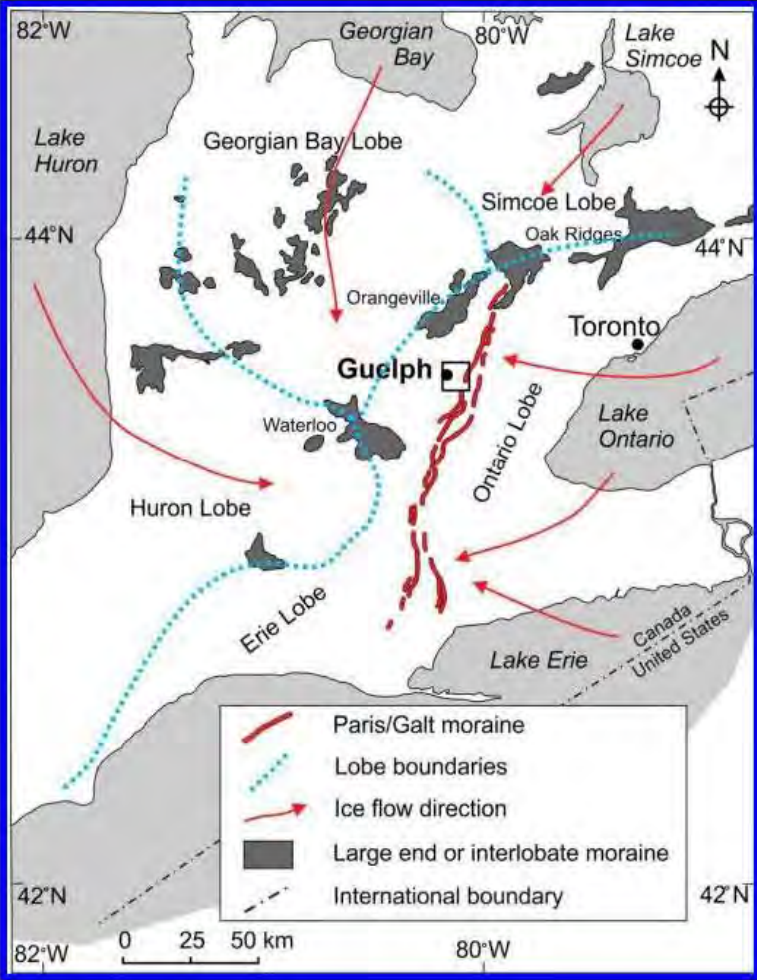
4. CEIS Phase 1/2 Characterization Report: Significant Landform: Objectives / Purpose



- Significant Landform already defined and identified as part of the City's NHS
- No technical update being done to Significant Landform mapping as part of CEIS
- CEIS work to focus on approaches for integration of these features into the Secondary Plan through design and policy



4. CEIS Phase 1/2 Characterization Report: Significant Landform: Context



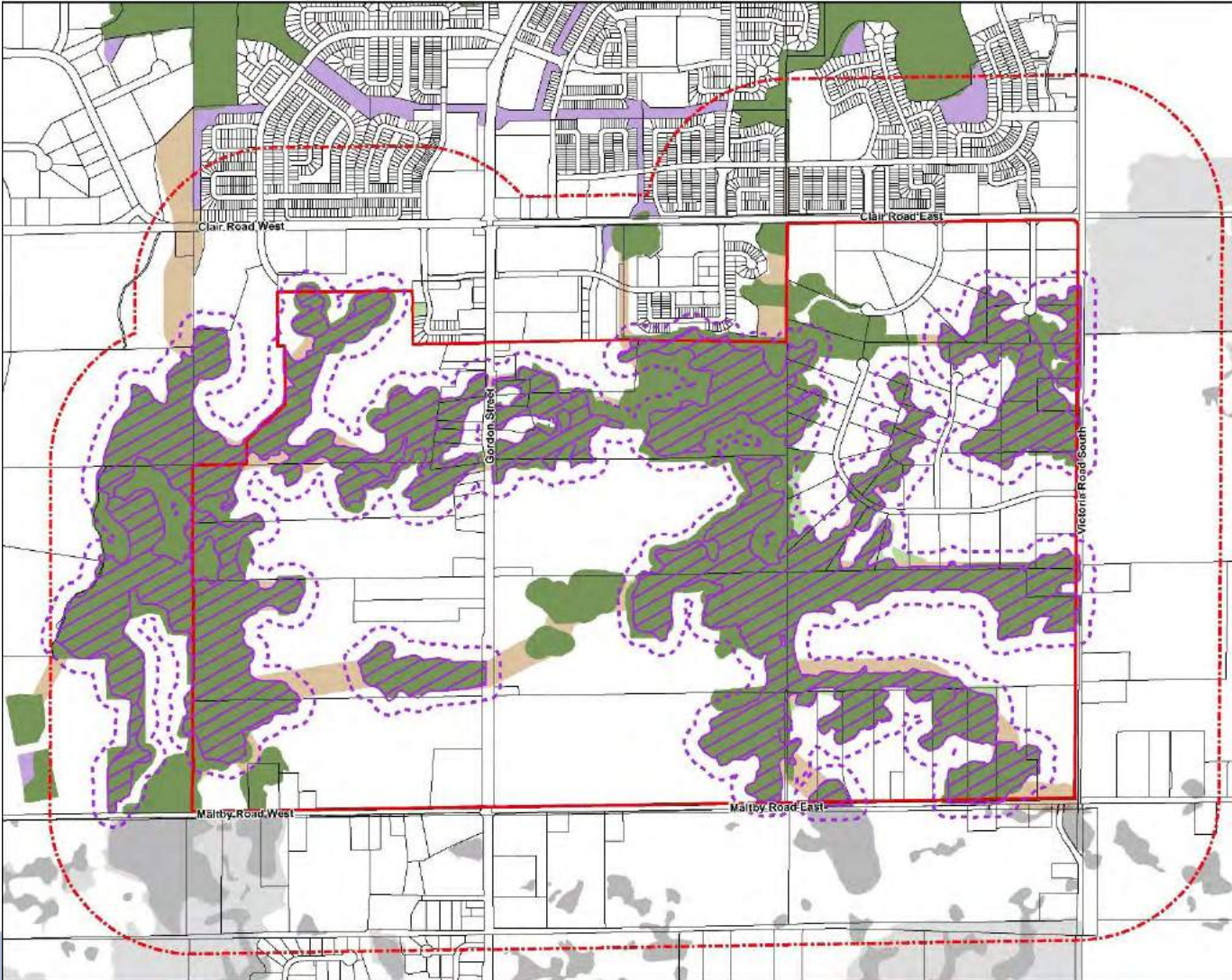
4. CEIS Phase 1/2 Characterization Report: Significant Landform: Policy

Criterion for Significant Landform Designation (City of Guelph Official Plan):

Hummocky Topography of the Paris Galt Moraine that exhibits slope concentrations where:

- the slope is 20% or greater,*
- and located in association with closed depressions identified by the GRCA, and*
- in close proximity to other Significant Natural Areas of the Natural Heritage System.*

4. CEIS Phase 1/2 Characterization Report: Significant Landform: Mapping



4. CEIS Phase 1/2 Characterization Report:

Significant Landform: Input to Community Structure Alternatives

- **ROADS AND TRAILS:** Refinements to new primary road and trail alignments with consideration for Significant Landform and the topography of the area as a whole
- **WATER BALANCE:** Recognition that closed depressions outside of the NHS present opportunities for infiltration of clean / treated water
- **CONNECTIVITY:** Recognition that the linear nature of the Significant Landform can help support both natural heritage and active transportation connections

4. CEIS Phase 1/2 Characterization Report: Significant Landform: Integration Considerations

- NHS: Significant Landform is integrally tied to the NHS and therefore any refinements to other NHS components must also consider Significant Landform
- WATER MANAGEMENT: The topography, soils and surficial geology in the SPA currently determine how the area drains as well as its role in contributing baseflows to systems outside the SPA
- CONNECTIVITY: Roads, trails and other infrastructure requirements need to be sited with consideration for maintaining the character and connectivity of the NHS

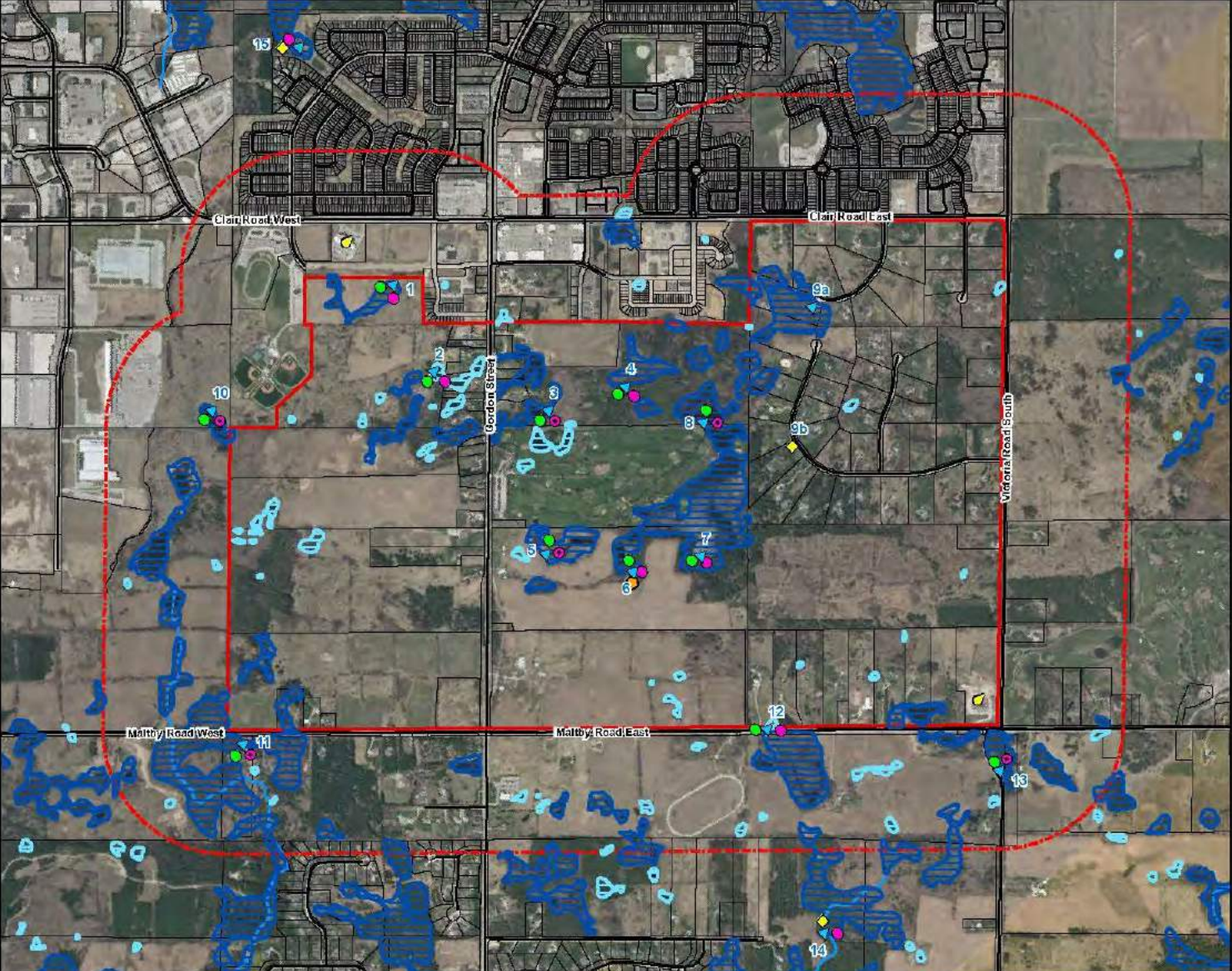
4. CEIS Phase 1/2 Characterization Report:

Natural Systems: Objective / Purpose

- Confirm and refine components of the Natural Heritage System (NHS), with an emphasis on Ecological Linkages and Significant Wildlife Habitat
- Develop and implement an approach for reviewing the status of wetlands in consultation with the City, GRCA and MNR
- Work with the intergrated team to develop a better understanding of how surface and groundwater support Natural Heritage System functions



4. CEIS Phase 1/2 Characterization Report: NHS: Field Work – Wetland Water Levels & Quality



Surface Water Monitoring Locations	
Map SW-1	
Clair-Maltby Secondary Plan Phase 1 and 2 Characterization Report	
Legend	
	Secondary Plan Area
	Primary Study Area
	Watercourse (MNRF 2017)
	Parcel Fabric
Monitoring Stations	
	Surface Water Quality*
	Surface Water Quality* + Pesticides
	Surface Water Quantity
	Mini-piezometer
	Rain Gauge
	Baro Logger
	Provincially Significant Wetlands (MNRF 2017)
	Unevaluated Wetlands (MNRF 2017)
* Water Quality Sampling Parameters include: TSS, TDS, PTP, SO ₄ , Cl, TKN, NO ₂ , NO ₃ , NH ₃ , Temp, pH, Conductivity, DO and Metals.	
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First Base Solutions Web Mapping Service 2017	
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Project 216002 August, 2018	

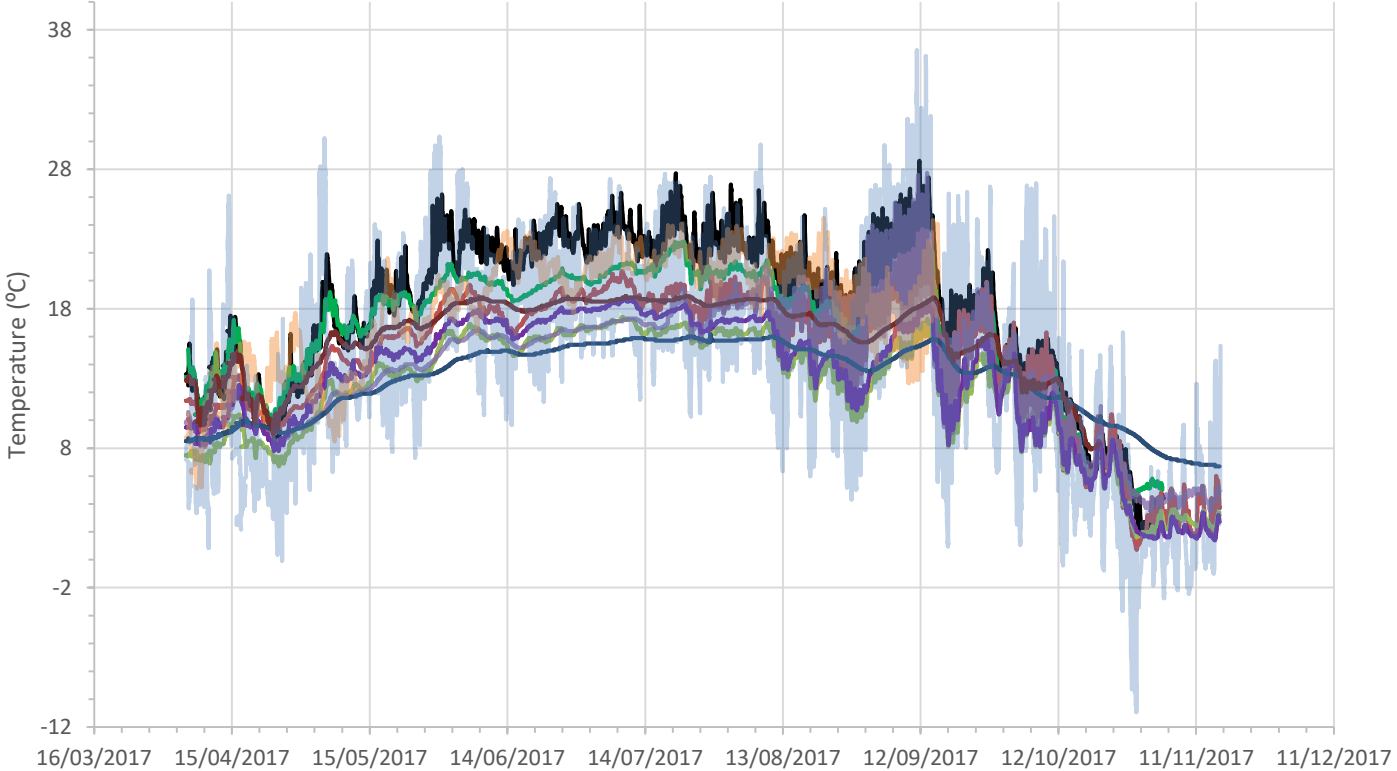
4. CEIS Phase 1/2 Characterization Report: NHS: Findings – Wetland Water Levels & Quality



- Standing water in all wetlands sampled from April to November 2017
- Levels generally showed expected seasonal pattern: peak in spring and gradual decline over the summer with a small rebound in fall
- Lab samples screened against PWQO, CDWQ and CEQG guidelines
 - Recurring exceedances included: Ammonia, Total Phosphorus and Aluminum
 - Zinc exc. in two Mill Creek SWS Stations
 - Some Chloride exc. at stations near roads

4. CEIS Phase 1/2 Characterization Report: NHS: Findings – Wetland Temperature 2017 Hanlon Creek Watershed Stations (9)

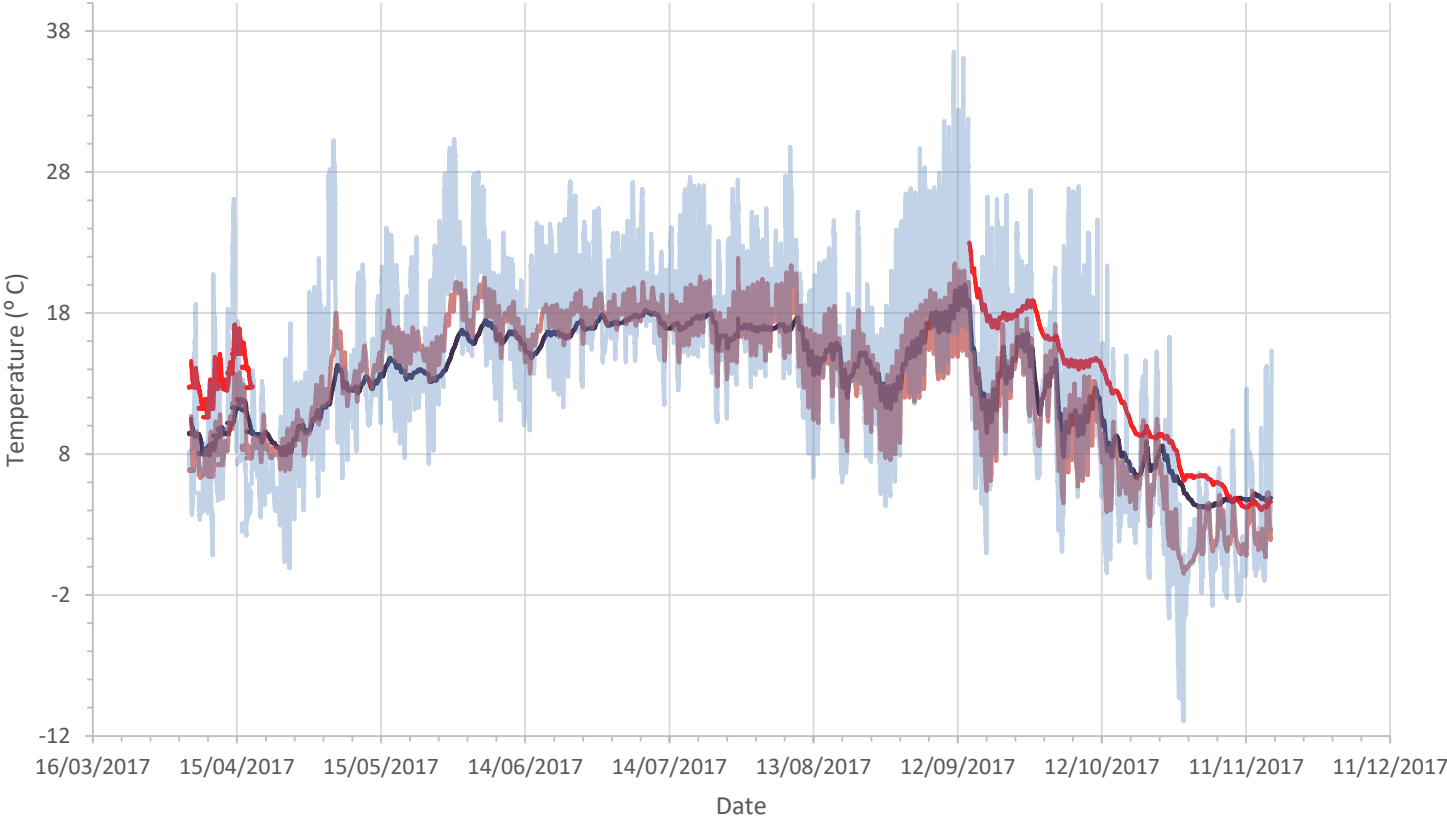
Wetland Station Surface Water Temperatures - Hanlon Creek SWS



- STN 1*
- STN 2*
- STN 3
- STN 4
- STN 5
- STN 6
- STN 7
- STN 8
- STN 10
- Air Temperature

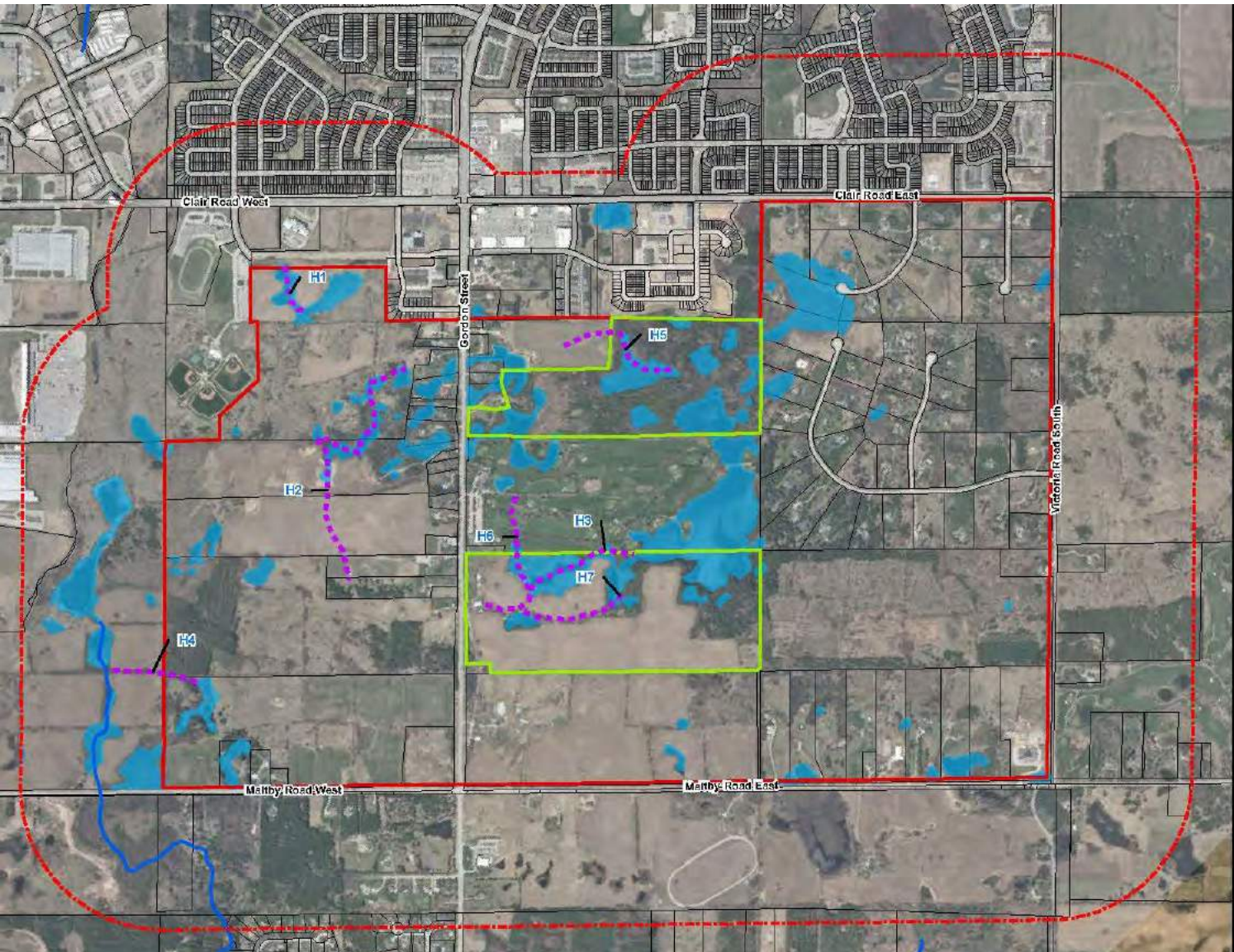
4. CEIS Phase 1/2 Characterization Report: NHS: Findings – Wetland Temperature 2017 Mill Creek Watershed Stations (3)

Wetland Station Surface Water Temperatures - Mill Creek SWS



— STN 11 — STN 12 — STN 13 — Air Temperature

4. CEIS Phase 1/2 Characterization Report: NHS: Field Work – Headwater Features Assessment



Scoped Headwater Drainage Feature Assessment (Potential HDFs)

Map NH-4A

Clair-Matby Secondary Plan
Phase 1 and 2 Characterization Report

Legend

- Secondary Plan Area Boundary
- Primary Study Area Boundary
- Parcel Fabric
- Access Provided for HDF Assessment
- ELC Wetland Communities and Ponds (Beacon 2017)
- Potential Headwater Drainage Feature (HDF) (Beacon 2018)
- Watercourse (MNRF 2017)

City of Guelph: Secondary Plan Area Boundary, 2016

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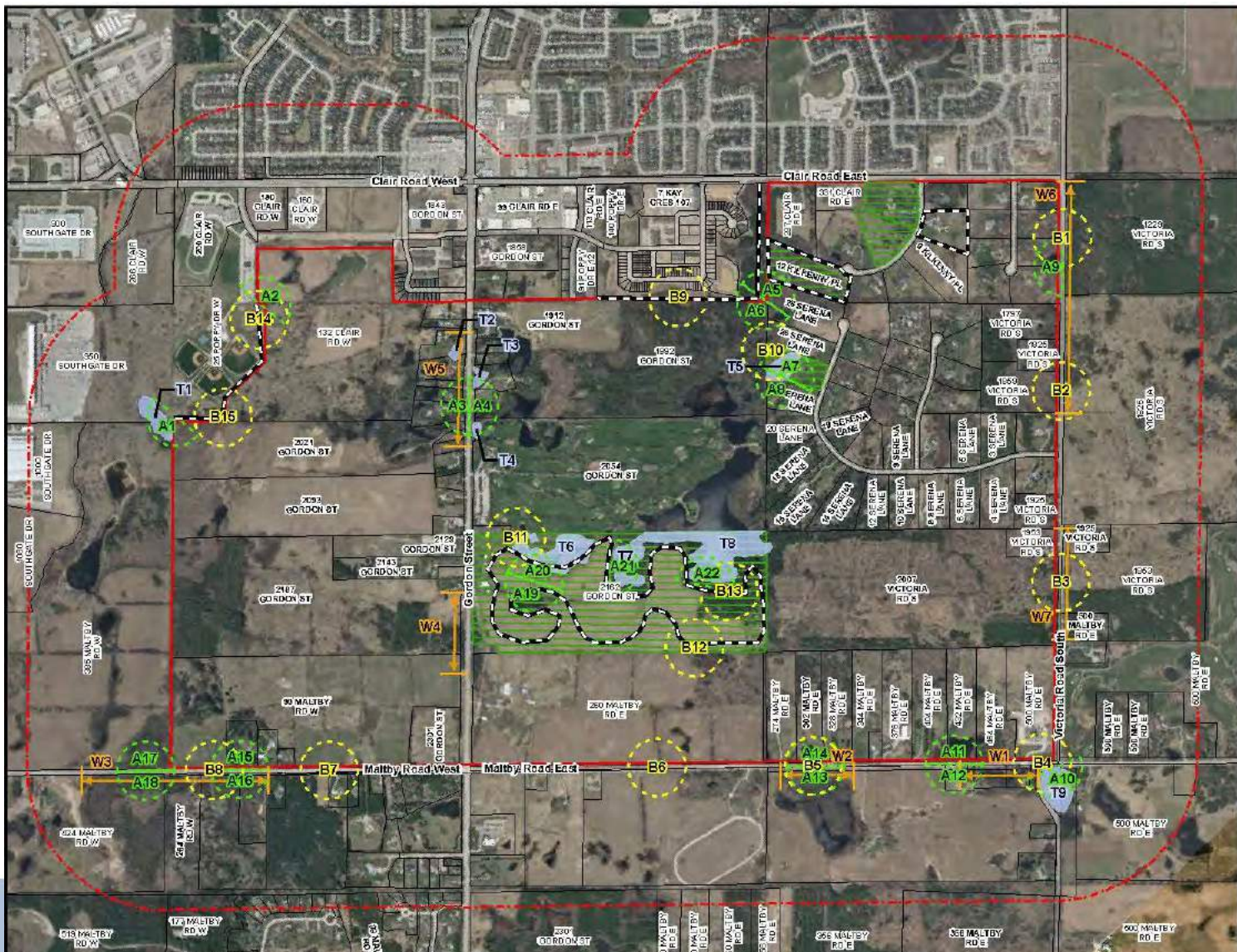
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Web Mapping Service 2017

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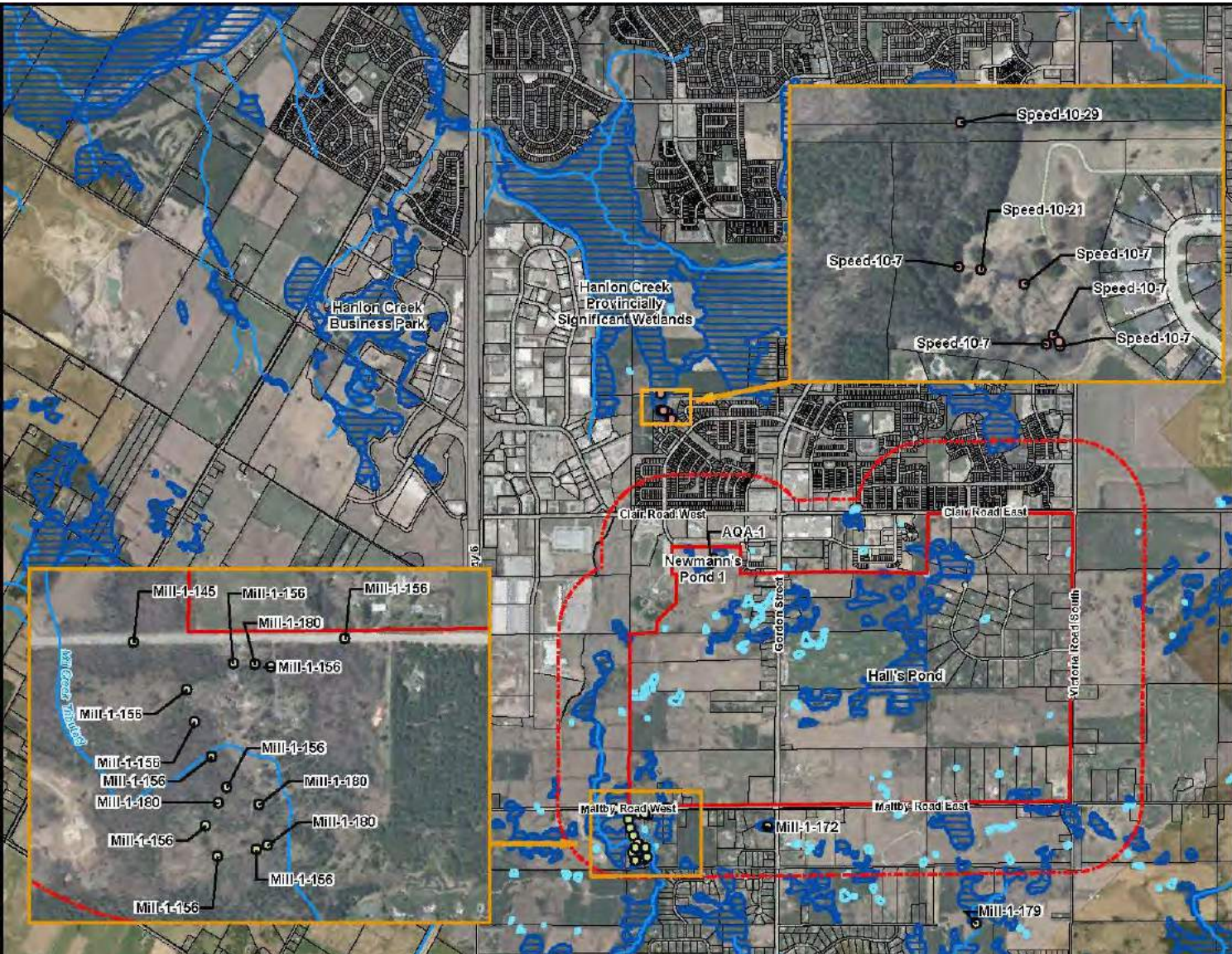
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4. CEIS Phase 1/2 Characterization Report: NHS: Field Work – Terrestrial Ecology



Terrestrial Monitoring Locations	
Map NH-2	
Clair-Malty Secondary Plan 2017 Monitoring Report	
Legend	
	Secondary Plan Area Boundary
	Primary Study Area Boundary
	Site Specific Vegetation Assessments
	A1 Amphibian Monitoring Stations (22)
	B1 Breeding Bird Stations (15)
	Basking Turtle Monitoring Stations (8)
	Winter Wildlife Transects (5)
	Road Wildlife Transects (7)
<small>Beacon Environmental Watercourse, Amphibian Monitoring Stations, Breeding Bird Stations, Basking Turtle Monitoring Stations, Winter Wildlife Transects, Wildlife Road Transects, Primary Study Area Boundary, 2016. City of Ouellet, Secondary Plan Area Boundary, Parcel Fabric, 2016; Ministry of Natural Resources and Forestry, Wetland, 2016.</small>	
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4. CEIS Phase 1/2 Characterization Report: NHS: Findings – Fisheries



Scoped Fisheries Assessment

Map NH-3

**Clair-Maltby Secondary Plan
Phase 1 and 2 Characterization Report**

Legend

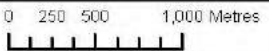
- ▭ Primary Study Area
- ▭ Secondary Plan Area
- Watercourse (MNR 2017)
- Harlon Creek (MNR 1999)
- Mill Creek (MNR 2010-2012)
- Aquafor Beech Limited Data (2012)
- Wetlands**
- ▨ Provincially Significant Wetlands (MNR 2017)
- ▨ Unevaluated Wetlands (MNR 2017)

Beacon Environmental; Watercourse, Primary Study Area Boundary, 2015;
City of Guelph; Secondary Plan Area Boundary, Parcel Fabric, 2015;
Ministry of Natural Resources and Forestry; Harlon Creek, Mill Creek;
Aquafor Beech Limited; Sample Data, 2011

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Web Mapping Service 2017

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Project 216002
August, 2018

4. CEIS Phase 1/2 Characterization Report:

NHS: Findings – Fisheries

Hanlon Creek Watershed

- Watercourses immediately north of the SPA historically supported, and appear to continue to support, a coolwater thermal regime

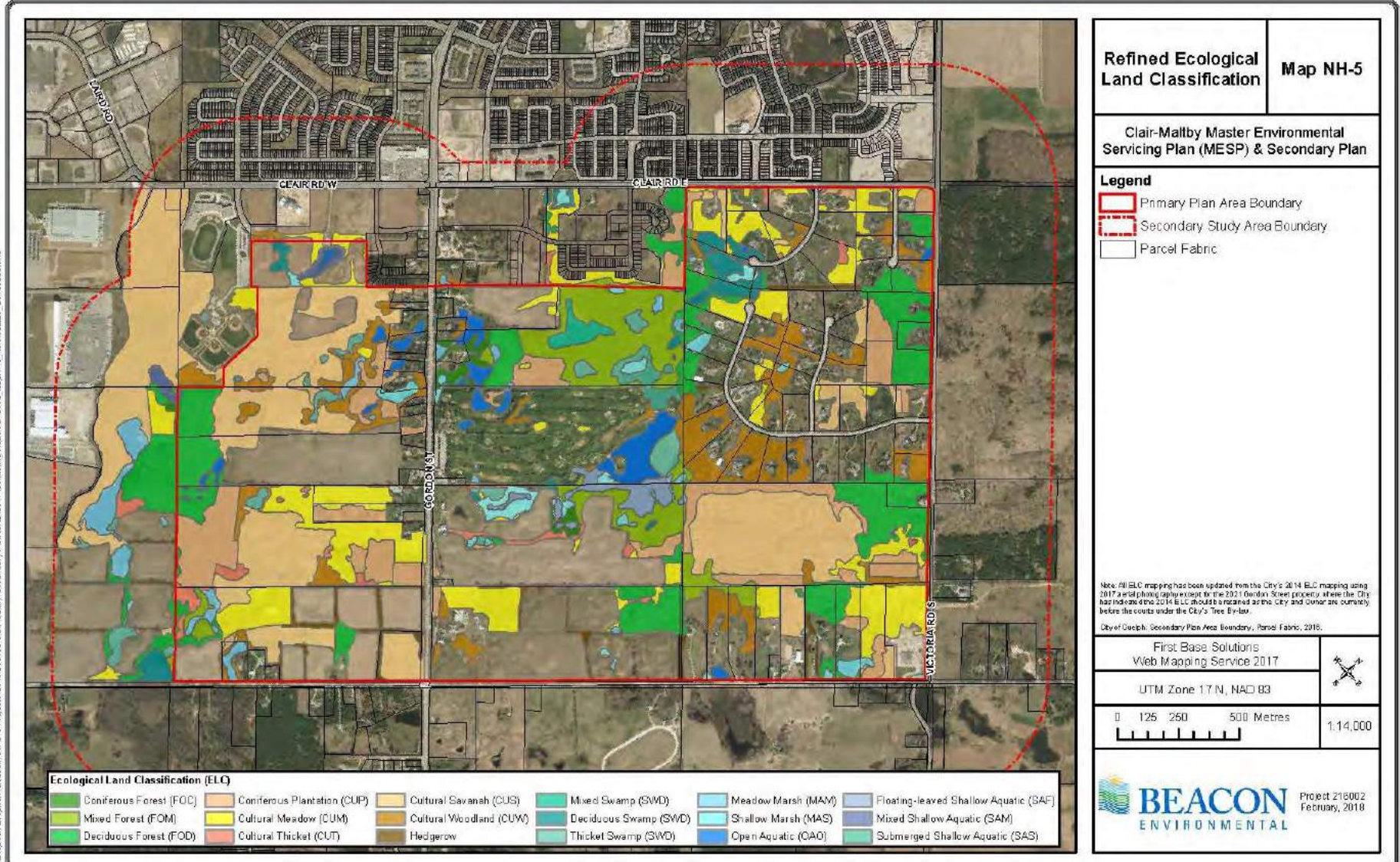
Mill Creek Watershed

- Watercourses immediately south of the SPA historically supported, and appear to continue to support, a coldwater thermal regime

Secondary Plan Area (SPA)

The Regional groundwater flow that emerges from the SPA is thought to provide for groundwater discharge to both the Hanlon and Mill Creek systems that is key to supporting baseflows and maintaining the coolwater and coldwater regimes in these systems.

4. CEIS Phase 1/2 Characterization Report: NHS: Findings – Vegetation Community Mapping



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4. CEIS Phase 1/2 Characterization Report: NHS: Analysis – Refinements to Wetland Mapping

1. Consulted with MNRF and GRCA
2. Reviewed MNRF wetland mapping, GRCA wetland mapping and City wetland mapping
3. Updates based on current vegetation mapping
4. Wetlands recommended to be added as Provincially Significant where they (a) are in the 2014 NHS and/or (b) have a surface hydrologic connection to an existing PSW
5. Other ponds / wetlands identified for future review
6. Mapping from previous OPA 42 settlements respected
7. Refinement work still in progress where access has been provided in 2018

4. CEIS Phase 1/2 Characterization Report: NHS: Analysis – Refinements to Wetlands Mapping



**Refinements to City
Significant Wetland Mapping**

Map NH-6

Clair-Maltby Secondary Plan
Phase 1 and 2 Characterization Report

Legend

- Primary Plan Area Boundary
- Secondary Study Area Boundary
- Parcel Fabric

MNR Provincial Wetlands

- Proposed MNR Provincial Wetlands to Remain (Beacon, 2018)
- Proposed Additions to MNR Provincial Wetlands (Beacon, 2018)
- Proposed Other Wetlands > 0.5 ha to MNR Provincial Wetlands (Beacon, 2018)
- Proposed Removals from MNR Provincial Wetlands (Beacon, 2018)

Other Wetlands ≤ 0.5 ha

- Proposed Additions from Other Wetlands ≤ 0.5 ha (Beacon, 2018)
- Proposed Removals from Other Wetlands ≤ 0.5 ha (Beacon, 2018)
- Proposed Removals from LIO Unevaluated Wetlands ≤ 0.5 ha (Beacon, 2018)

Wetland Buffers

- MNR Provincial Wetland 30 m Buffer
- Locally Significant / Other Wetlands 15 m Buffer

City of Guelph Natural Heritage System (2014)

- Significant Natural Areas
- Natural Areas
- Ecological Linkages
- Restoration Areas

City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, Existing Natural Heritage System, 2014

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	Project 216002 May, 2018 Draft #1
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4. CEIS Phase 1/2 Characterization Report: NHS: Analysis – Refinements to Woodland Mapping

1. Consulted with City
2. Reviewed current City mapping and policies for Significant Woodlands and Cultural Woodlands
3. Updates based on current vegetation mapping except where previous OPA 42 settlements needed to be respected
4. Refinement work still in progress where access has been provided in 2018

4. CEIS Phase 1/2 Characterization Report: NHS: Analysis – Refinements to Woodlands Mapping



**Refinements to
City Woodlands Mapping
and Current City NHS**

Map NH-8

Clair-Maltby Secondary Plan
Phase 1 and 2 Characterization Report

Legend

- Primary Plan Area Boundary
- Secondary Study Area Boundary
- Parcel Fabric

Proposed Additions

- Proposed Additions to Significant Woodlands (Beacon 2018)
- Proposed Additions to Cultural Woodlands (Beacon 2018)

Proposed Transition

- Proposed Transition from Cultural Woodlands to Significant Woodlands (Beacon 2018)
- Proposed Transition from Significant Woodlands to Cultural Woodlands (Beacon 2018)

Woodlands (City of Guelph 2014)

- Significant Woodlands
- Cultural Woodlands
- 10m Buffer from Existing and Proposed Woodlands

City of Guelph Natural Heritage System (2014)

- Significant Natural Areas
- Natural Areas
- Ecological Linkages
- Restoration Areas

City of Guelph: Primary Plan Area, Parcel Fabric, Natural Heritage System, 2018

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May, 2018
Draft #1

4. CEIS Phase 1/2 Characterization Report: NHS: Findings – Vegetation Communities & Plants



- SPA currently 72% natural and successional vegetation communities
 - 10% wetland (including swamp)
 - 16% upland forest
 - 46% cultural / successional
- 467 species of plants
 - One Species at Risk – Butternut
 - 20 locally significant plant species (County) mainly associated with the wetlands

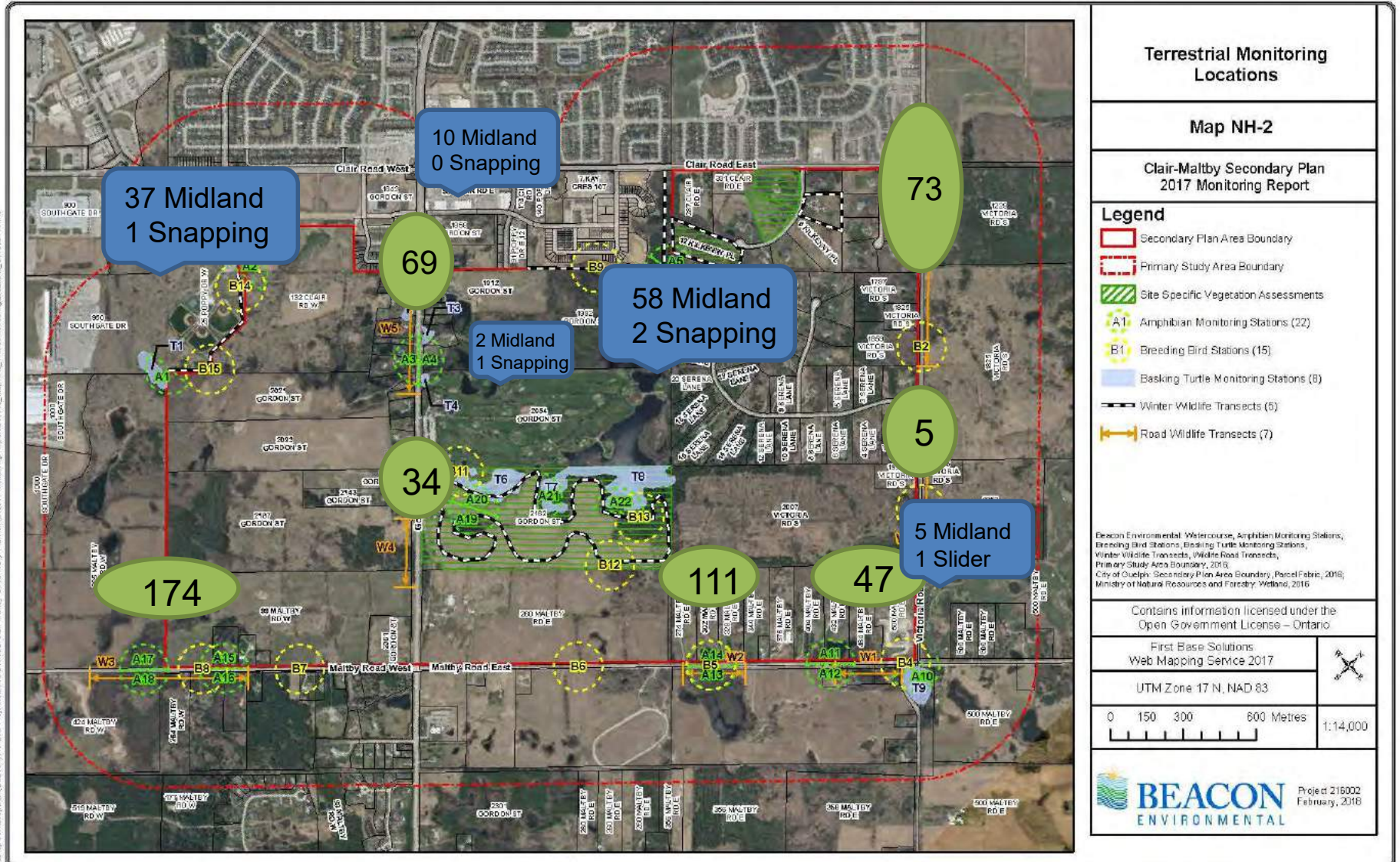
4. CEIS Phase 1/2 Characterization Report:

NHS: Findings – Wildlife



- Species reflective of mix of woodland and wetland pockets with some meadows and farmed lands
- BIRDS: 112 species
 - 6 Species at Risk and 42 species significant and/or rare in the County
- AMPHIBIANS: 10 species
 - 7 species of frog, 1 species of toad, 1 species of salamander (Blue-spotted - 2 obs), 1 newt
 - 3 species of turtle, 4 species of snake
- MAMMALS: range of common mammals including deer and coyote

4. CEIS Phase 1/2 Characterization Report: NHS: Findings – Turtle Basking & Frog Movement



4. CEIS Phase 1/2 Characterization Report: NHS: Analysis – Significant Wildlife Habitat (SWH)

1. Updates based on current vegetation mapping combined with species data collected
2. Used current Provincial guidance – SWH Criteria for Ecoregion 6E – to identify Candidate and Confirmed SWH; still requires site-specific verification
3. SWH mapping is based on new information collected as part of this study so OPA 42 mapping does not apply to this NHS component
4. Refinement work still in progress where access has been provided in 2018

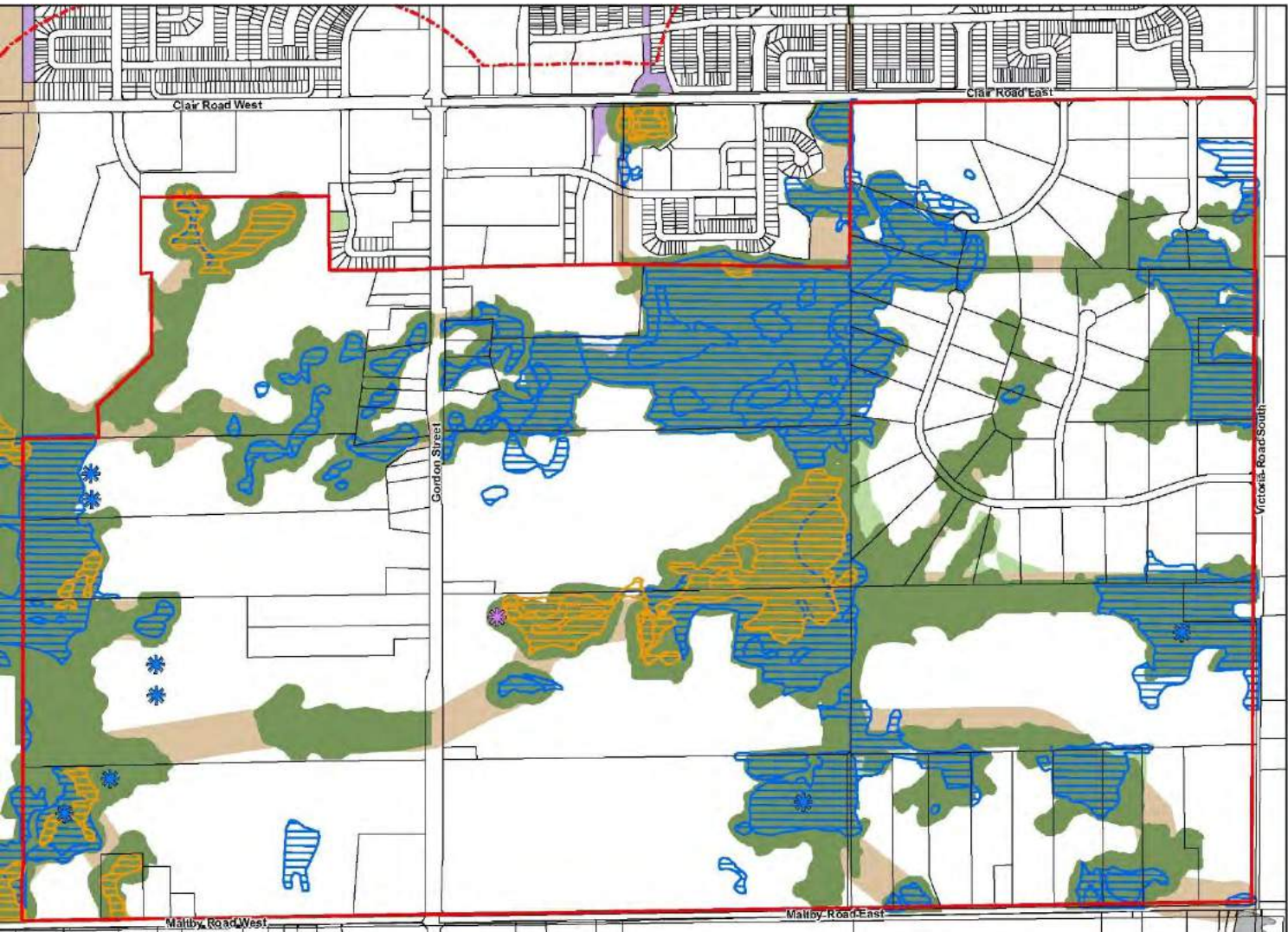
4. CEIS Phase 1/2 Characterization Report:

NHS: Summary of Significant Wildlife Habitat (SWH)

<p>A. Seasonal Concentration Areas (15 types)</p>	<ul style="list-style-type: none"> • Aquatic Waterfowl Stopover & Staging Areas • Raptor Wintering Areas • Bat Maternity Colonies • Turtle Wintering Areas (Candidate and Confirmed) • <i>Reptile Hibernaculum</i> • <i>Colonially-Nesting Bird Habitat – Trees & Shrubs</i> • <i>Deer Winter Congregation Areas</i>
<p>B. Rare Vegetation Communities & Specialized Habitat for Species (15 types)</p>	<ul style="list-style-type: none"> • Other Rare Vegetation Communities (1 SWT3-4 unit) • <i>Waterfowl Nesting Area</i> • <i>Bald Eagle and Osprey Habitat</i> • <i>Turtle Nesting Areas</i> • Seeps and Springs (one Confirmed) • Amphibian Breeding Habitat - Woodland & Wetland (Candidate and Confirmed)
<p>C. Habitats of Species of Conservation Concern (5 types)</p>	<ul style="list-style-type: none"> • <i>Marsh Bird Breeding Habitat</i> • <i>Shrub/Early Successional Bird Breeding Habitat</i> • <i>Terrestrial Crayfish</i> • <i>Special Concern and Rare Species</i>
<p>D. Animal Movement Corridors (2 types)</p>	<ul style="list-style-type: none"> • <i>Amphibian Movement Corridors</i>

4. CEIS Phase 1/2 Characterization Report:

NHS: Analysis – SWH Mapping



Preliminary Significant Wildlife Habitat (SWH) and Current City NHS

Map NH-10

Clair-Maltby Secondary Plan Phase 1 and 2 Characterization Report

Legend

- Secondary Plan Area Boundary (SPA)
- Primary Study Area Boundary (PSA)
- Candidate Amphibian Breeding Habitat (Wetland)

Significant Wildlife Habitat

- Candidate SWH – Presence and Extent To Be Verified *
- Confirmed SWH
- Candidate SWH – Presence To Be Verified
- Confirmed SWH (based on ELC polygon(s))
- Halligan's Pond**

City of Guelph Natural Heritage System (2014)

- Significant Natural Areas
- Natural Areas
- Ecological Linkages
- Restoration Areas

* Several Candidate SWH areas are shown approximately with asterisks; site-specific study will be needed to capture the best and most representative analysis in the SPA.

** Halligan's pond could be considered Candidate SWH for amphibian breeding, waterfowl, songcover and turtle wintering but has not been mapped as such as it is outside the City of Guelph.

City of Guelph, Secondary Plan Summary, Parcel Edition, 2016

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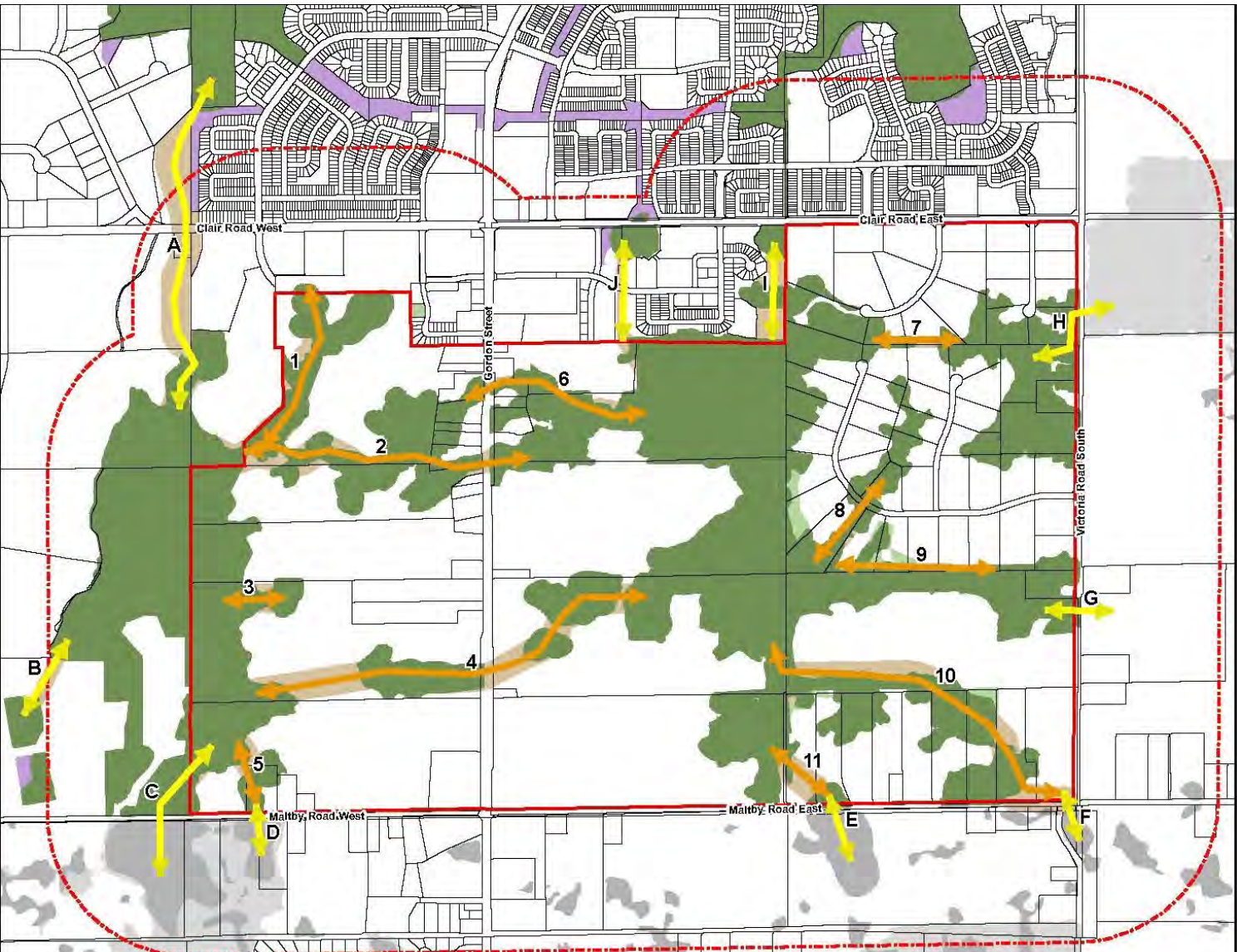
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4. CEIS Phase 1/2 Characterization Report:

NHS: Analysis – Ecological Linkages



Ecological Linkages	
Map NH-11	
Clair-Maltby Secondary Plan Phase 1 and 2 Characterization Report	
Legend	
	Secondary Plan Area Boundary
	Primary Study Area Boundary
	Ecological Linkages within the PSA
	Ecological Linkages within the SPA
City of Guelph Natural Heritage System (2014)	
	Ecological Linkages
	Significant Natural Areas
	Natural Areas
	Restoration Areas
Wildlife Crossings	
	Amphibian Crossings
	Deer Crossings
	Other Wildlife Crossing Opportunities
<small>* Several Candidate SWH areas are shown approximately with asterisks. Site-specific study will be needed to capture the best and most representative area(s) in the SPA.</small>	
<small>** Halligan's pond could be considered Candidate SWH for amphibian breeding, waterfowl stopover and turtle wintering but has not been mapped as such as it is outside the City of Guelph.</small>	
<small>City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.</small>	
Contains information licensed under the Open Government License – Ontario	
First Base Solutions Web Mapping Service 2017	
UTM Zone 17 N, NAD 83	
1:14,000	
Project 216002 August, 2018	

4. CEIS Phase 1/2 Characterization Report: NHS: Input to Community Structure Alternatives

- NHS: As the NHS as it was approved in 2014 it already has informed the siting of roads, trails and adjacent land uses, and will continue to do so
- NHS FEATURE UPDATES AND REFINEMENTS:
 - The Ph 1/2 CEIS presented Draft 1 of the NHS feature updates and refinements.
 - Draft 2 will be further refined based on additional information from the agencies, City, landowners and stakeholders.
 - The Draft 2 NHS will form the basis for further Community Structure Alternatives

4. CEIS Phase 1/2 Characterization Report: NHS: Integration Considerations

- WETLANDS: Results from the shallow groundwater monitoring need to be considered in conjunction with results from the wetland surface water monitoring to better understand functional relationships
- CONNECTIVITY: Roads, trails and other infrastructure requirements need to be sited with consideration for maintaining the character and connectivity of the NHS
 - Where amphibian and reptile movement “hotspots” have been identified across existing roads, opportunities for mitigation measures should be flagged as part of road improvements



Clair-Maltby

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5. MESP Overview

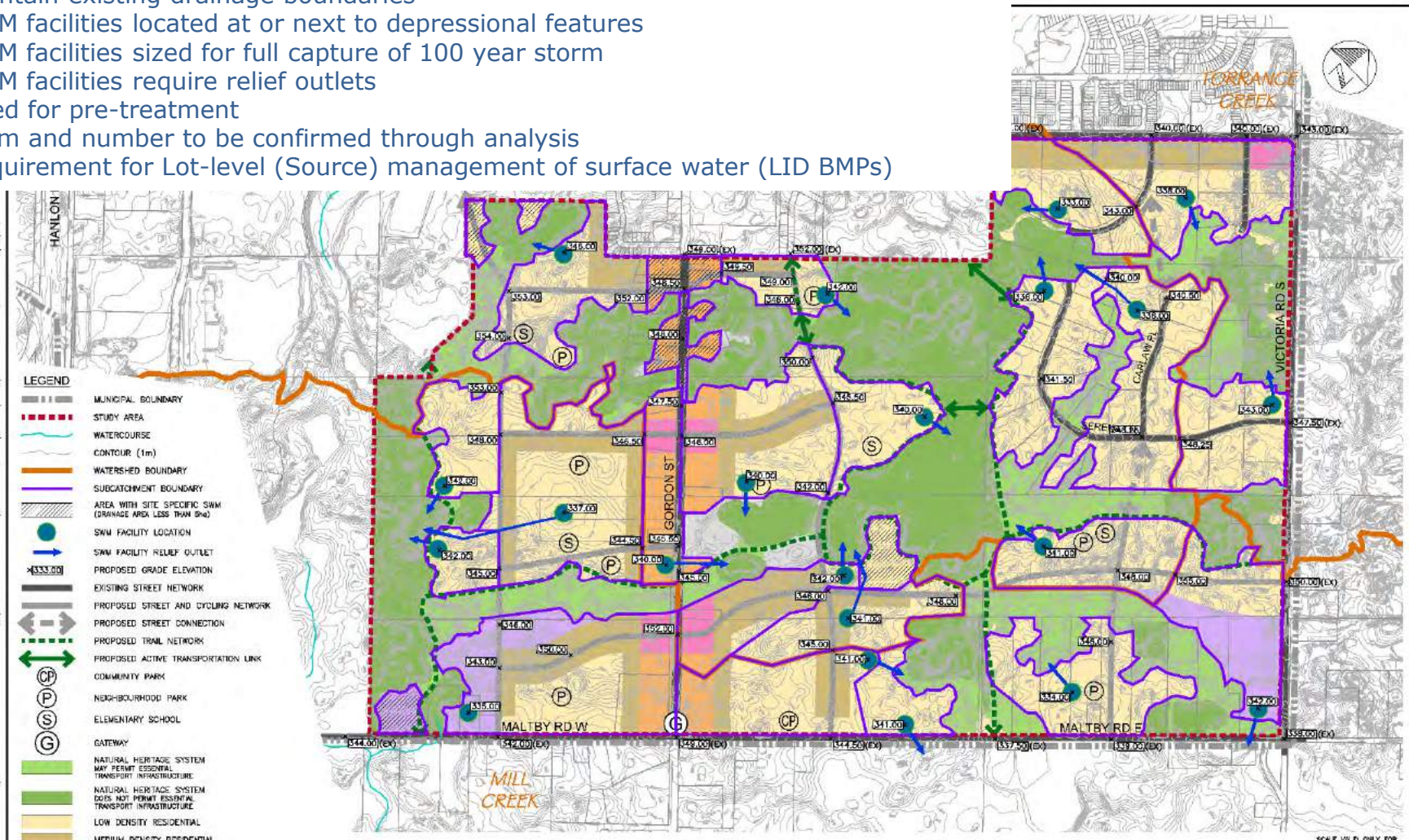
5. MESP Overview:

1. Stormwater
2. Water / Wastewater
3. Transportation / Mobility

5. MESP Overview

Stormwater Management Plan

- Maintain existing drainage boundaries
- SWM facilities located at or next to depressional features
- SWM facilities sized for full capture of 100 year storm
- SWM facilities require relief outlets
- Need for pre-treatment
- Form and number to be confirmed through analysis
- Requirement for Lot-level (Source) management of surface water (LID BMPs)



CLAIR-MALTBY
 MASTER ENVIRONMENTAL
 SERVICING PLAN AND
 SECONDARY PLAN
 CITY OF GUELPH

PRELIMINARY CONCEPTUAL
 STORMWATER MANAGEMENT
 AND GRADING PLAN

amec
 foster
 wheeler

Scale 1:6000
 0 50 100 200

Consultant File No.
 TPB168050

Figure No.
 W2

SCALE VALID ONLY FOR
 24'x36' SECTION

5. MESP Overview:

Water

Water Servicing Concept

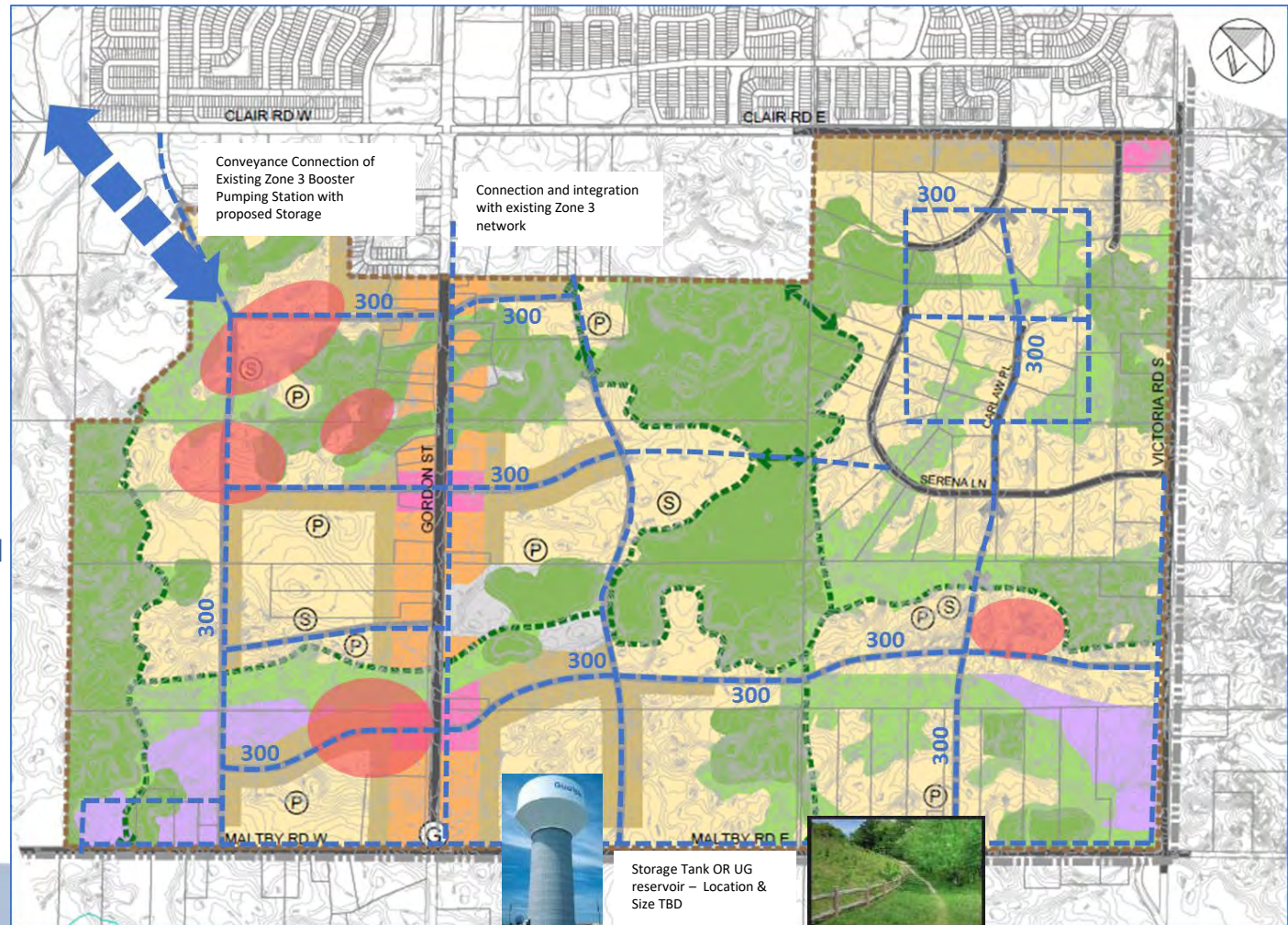
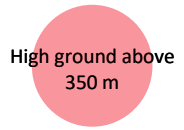
Extension of Zone 3 distribution with 300 mm watermains on all roads.

Configuration to be looped to avoid introduction of dead ends

Zone 3 Storage (Elevated or In-ground Alternatives to be Considered), preferred location in the higher ground

High ground above 350 m in parts of the development will be serviced at minimum allowable pressure (280 Kpa) rather than minimum preferred serviced pressure (350 Kpa) with current configuration of Zone 3 - HGL = 388 m

Conveyance Connection required from Existing Booster Pumping Station - 400 mm - 600 mm.



5. MESP Overview: Wastewater

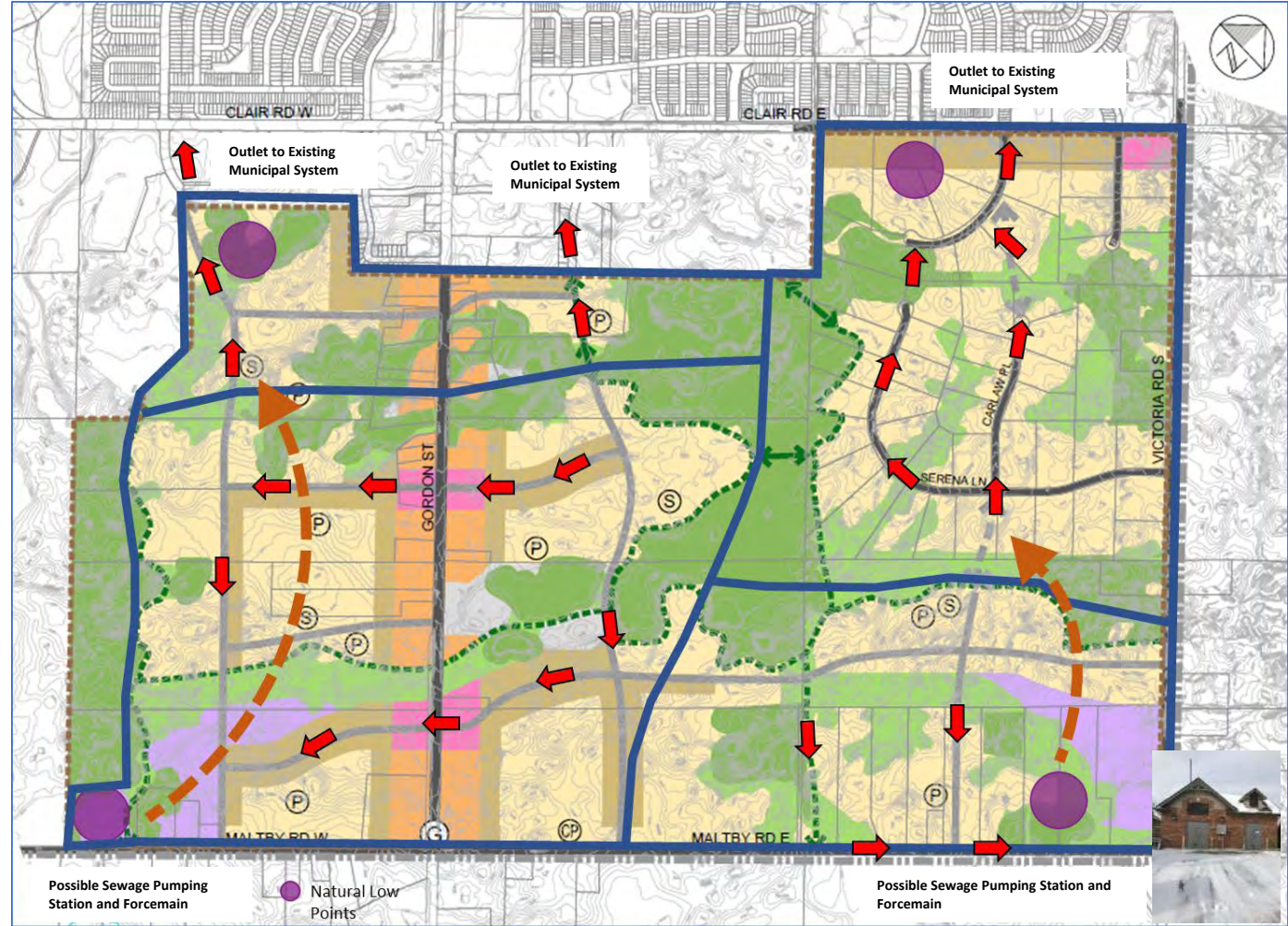
Internal Sanitary Servicing Concept

Conceptual Sewersheds shown to service proposed lands with existing topographic constraints

Sewershed Configuration may be refined with phasing and ultimate land use

One or more Sewage Pumping Stations (SPSs) will be required with the proposed land use

External Servicing Upgrades will be required to provide Capacity from CMSP lands to Guelph WWTP



5. MESP Overview:

Mobility

Street Network Considerations

- Collector Street network should:
 - provide flexibility, permeability, and continuity;
 - support transit service operations;
 - support multi-modal transportation;
 - enhance connectivity for all travel modes.
- LEED ND Neighbourhood Development Street Layout Goals
 - Provide robust and frequent connectivity internal to the neighbourhood, and to adjacent neighbourhoods.

6. Next Steps / Timing - Schedule:

CEIS

- Evaluate impact of proposed Community Structure Plan on
 - Surface Water
 - Groundwater
 - Natural Heritage System
 - Landforms
- Impact to land uses, servicing and management strategies
- Q3/Q4 2018

6. Next Steps / Timing - Schedule:

MESP

- Develop preliminary servicing concepts
- Assess alternatives
- Fulfil Environmental Assessment Act requirements
 - Consultation
 - Reasonable range of alternatives
- Q4 2018 / Q1 2019

6. Next Steps / Timing - Schedule: Secondary Plan

Q4 2018	Public Workshops to inform policy development
Q1 2019	Prepare Draft Secondary Plan
Q2 2019	Completion of Technical Studies Public Open House & PIC #3 Statutory Public Meeting
Q3 2019	Recommended Secondary Plan & Final MESP to Council



Thank You

November 14, 2018

Clair-Maltby Secondary Plan and Master Environmental Servicing Plan

Public Workshop: Secondary Plan Policy Directions

Join us for a Public Workshop about the Clair-Maltby Secondary Plan

Tuesday, December 4, 2018

1:30-4 p.m. or 6:30-9 p.m.

Salvation Army Guelph Citadel

1320 Gordon Street, Guelph

Policy Development Workshop

At this workshop, participate in focused conversations and discussion to help establish and refine the policy directions that will inform the creation of the secondary plan for the Clair-Maltby area. The final secondary plan will become part of the City's Official Plan.

A Draft Policy Directions report will be available no later than Monday, November 26 on guelph.ca/clair-maltby. This draft report will summarize key draft directions for future policies based on what we've heard through the project so far. Your input, ideas and comments at the public workshop will inform the final Policy Directions report.

Agenda

- Welcome and introduction
- Presentation of the draft policy directions
- Visual preference survey with instant polling
- Workshop exercise to addressing the following topics:
 - Land Use and Parks
 - Built Form, Urban Design and Cultural Heritage Resources
 - Mobility and Trails
 - Natural Heritage
 - Stormwater, Water and Wastewater Servicing
 - Energy
- Next steps

How to participate

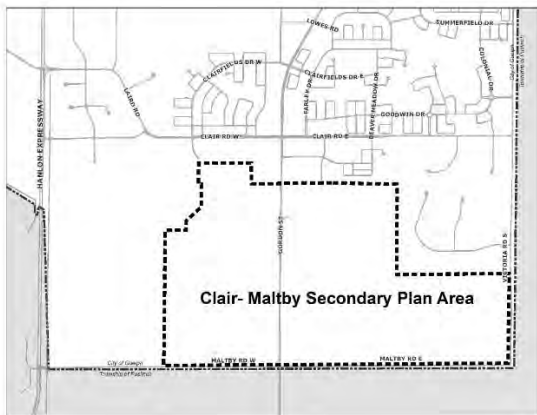
Register to attend either the 1:30 to 4 p.m. or 6:30 to 9 p.m. session by **Thursday, November 29** on [eventbrite.com](https://www.eventbrite.com). Registration is free. If you require assistance with registration, contact Planning Services at 519-837-5616 extension 2459.

Unable to attend?

- Email your comments to clair-maltby@guelph.ca
- Participate in the online conversation at haveyoursay.guelph.ca/ from **December 5 through January 2**.

The Project

The City has initiated the Clair-Maltby Secondary Plan and Master Environmental Servicing Plan (MESP) Study to plan the last unplanned Greenfield area of the City. The study area is approximately 414 hectares and is generally located between Clair Road and Maltby Road in the southeast corner of Guelph.



For more information

[guelph.ca/clair-maltby](https://www.guelph.ca/clair-maltby)

For questions or comments, to be added to the project mailing list or if you require this document to be provided in an alternative format as per the *Accessibility for Ontarians with Disabilities Act* (2005), please contact:

Stacey Laughlin, MCIP, RPP
Senior Policy Planner
Planning, Urban Design and Building
Services
519-822-1260 extension 2327
stacey.laughlin@guelph.ca

Arun Hindupur, M.Sc., P.Eng.
Infrastructure Planning Engineer
Engineering and Capital Infrastructure
Services
519-822-1260 extension 2282
arun.hindupur@guelph.ca

Information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act*. With the exception of personal information, all comments will become part of the public record.



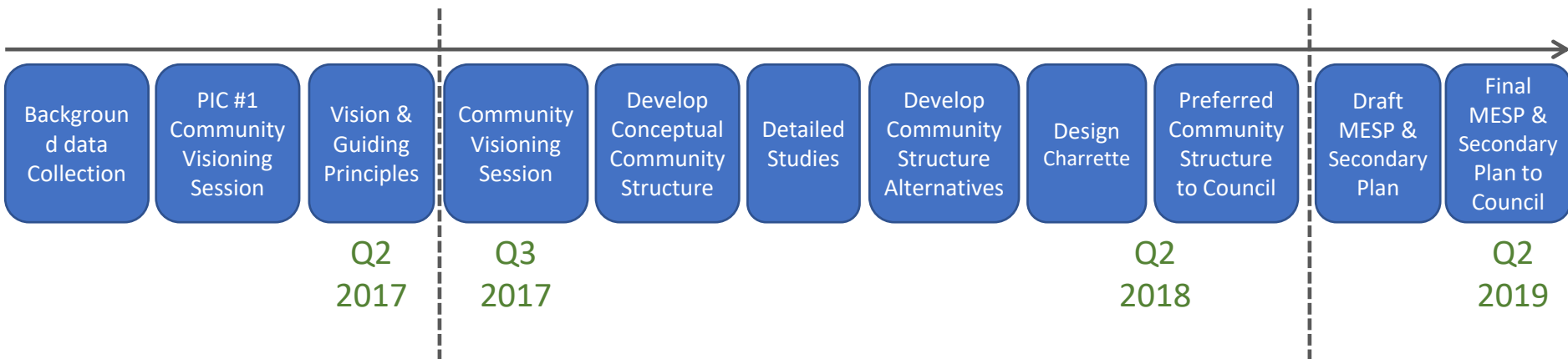
Clair-Maltby Secondary Plan Draft Directions

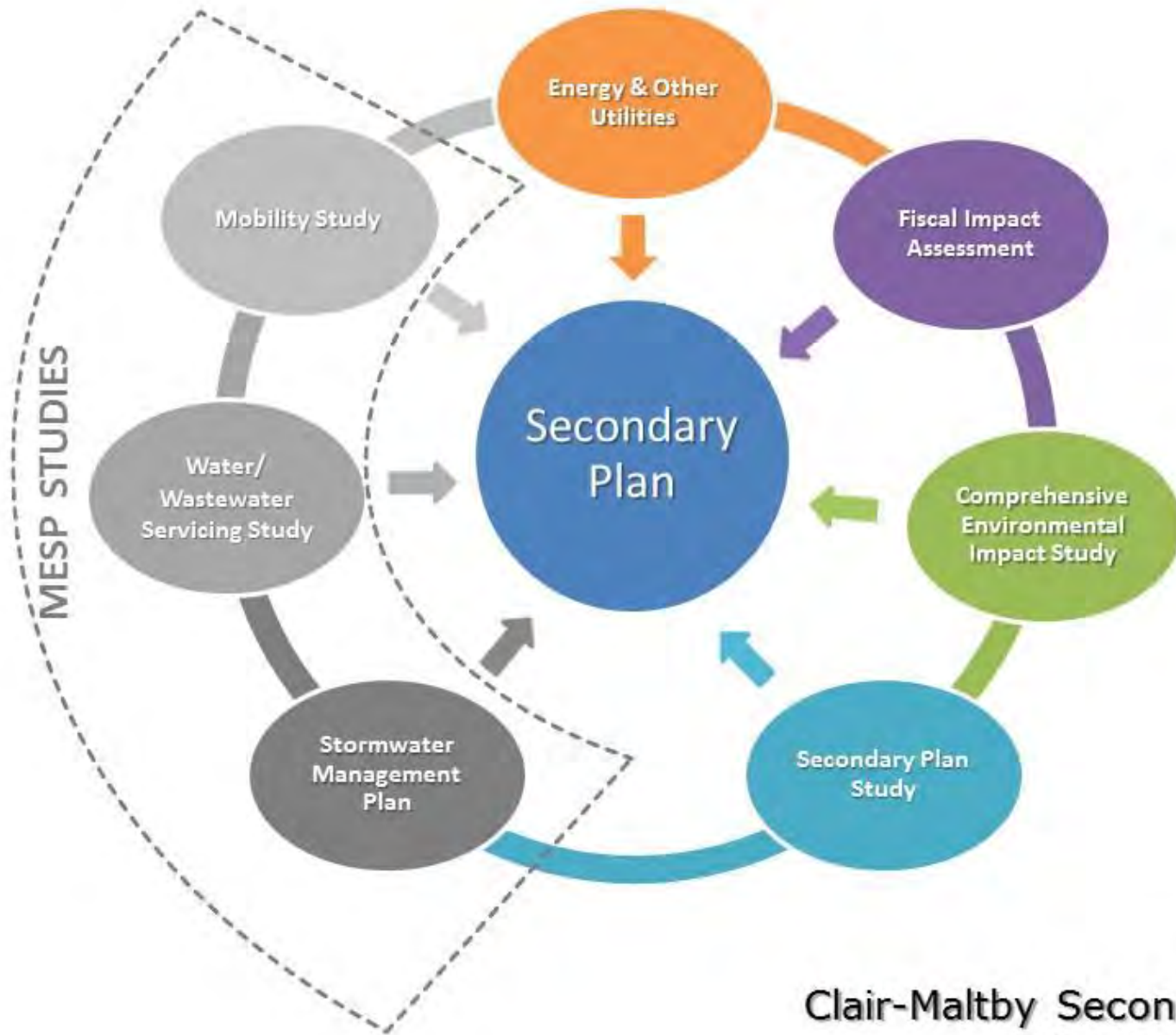
December 4 Public Workshop

Agenda

1. Welcome & Introductions
2. Project & Draft Directions Overview
3. Visual Preference Survey
4. World Café discussions
5. Closing and Next Steps

The Secondary Plan Process





Clair-Maltby Secondary Plan
Process Diagram

Clair-Maltby Vision



Vision

Clair-Maltby will be a **vibrant, urban** community that is integrated with Guelph's southern neighbourhoods, as well as having strong connections to Downtown, employment areas and the rest of the City.

The Natural Heritage System and the Paris Moraine provide the framework for the balanced development of **interconnected and sustainable neighbourhoods**.

The area will be primarily **residential in character** with a **full range and mix of housing types** and a variety of other uses that **meet the needs of all residents**.

A **system of parks, open spaces and trails** will be interwoven throughout to provide opportunities for active and passive recreation.

Guiding Principles



Vibrant and Urban



Green and Resilient



Healthy and Sustainable



Interconnected and Interwoven



Balanced and Liveable



Vibrant and Urban

Vibrant and Urban

Create identifiable urban neighbourhoods that are pedestrian oriented and human-scaled.

Promote forward-thinking and innovative design that integrates new development into the rolling topography, while conserving significant cultural heritage resources.



Green and Resilient

Green and Resilient

Protect, maintain, restore, and where possible, improve water resources and the Natural Heritage System.

Support resiliency and environmental sustainability through measures such as energy efficiency, water conservation and green infrastructure.



Healthy and Sustainable

Healthy and Sustainable

Design the community for healthy, active living.

Provide a mix of land uses including a diversity of housing choices at appropriate densities with appropriate municipal services to ensure long-term sustainable development which is fiscally responsible.



Interconnected and Interwoven

Establish a multi-modal mobility network that provides choice and connects neighbourhoods to each other and the rest of the City.

Create a network of parks, open spaces and trails to provide opportunities for active and passive recreation, as well as active transportation choices.

Interconnected and Interwoven



Balanced and Liveable

Balanced and Liveable

A valued and livable community which reflects the right balance between protecting the environment and fostering a healthy, equitable and complete community.

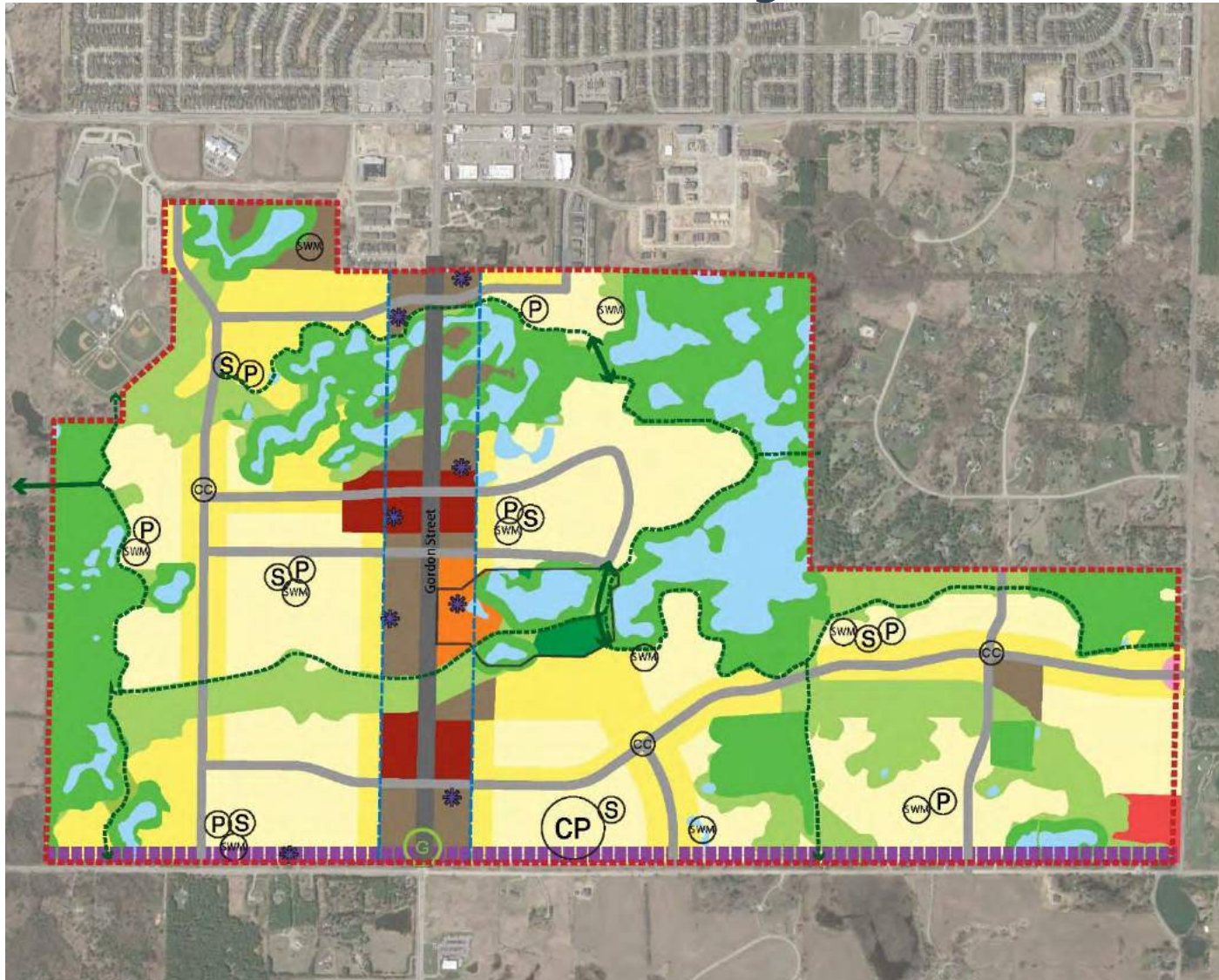
Community Structure

Clair- Maltby will be an **urban village** comprised of:

- Gordon Street Corridor, including an Urban Village Core;
- surrounding residential neighbourhoods;
- Natural Heritage System and the Paris Moraine; and,
- a system of parks and open spaces.



Preferred Community Structure



Legend

- Clair-Maltby Secondary Plan Boundary
- Cultural Heritage Landscape
- Urban-Rural Transition Zone
- Gordon St. Corridor

Streets and Trails

- Existing Street Network
- Proposed Street and Cycling Network
- Proposed Trail Network
- Potential Active Transportation Link

Parks, Schools, and Features

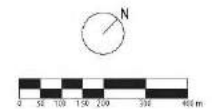
- Potential Neighbourhood Park
- Potential Community Park
- Potential Elementary School
- Potential Stormwater Infiltration Areas
- Convenience Commercial Area
- Gateway
- Cultural Heritage Resource

Natural Heritage System

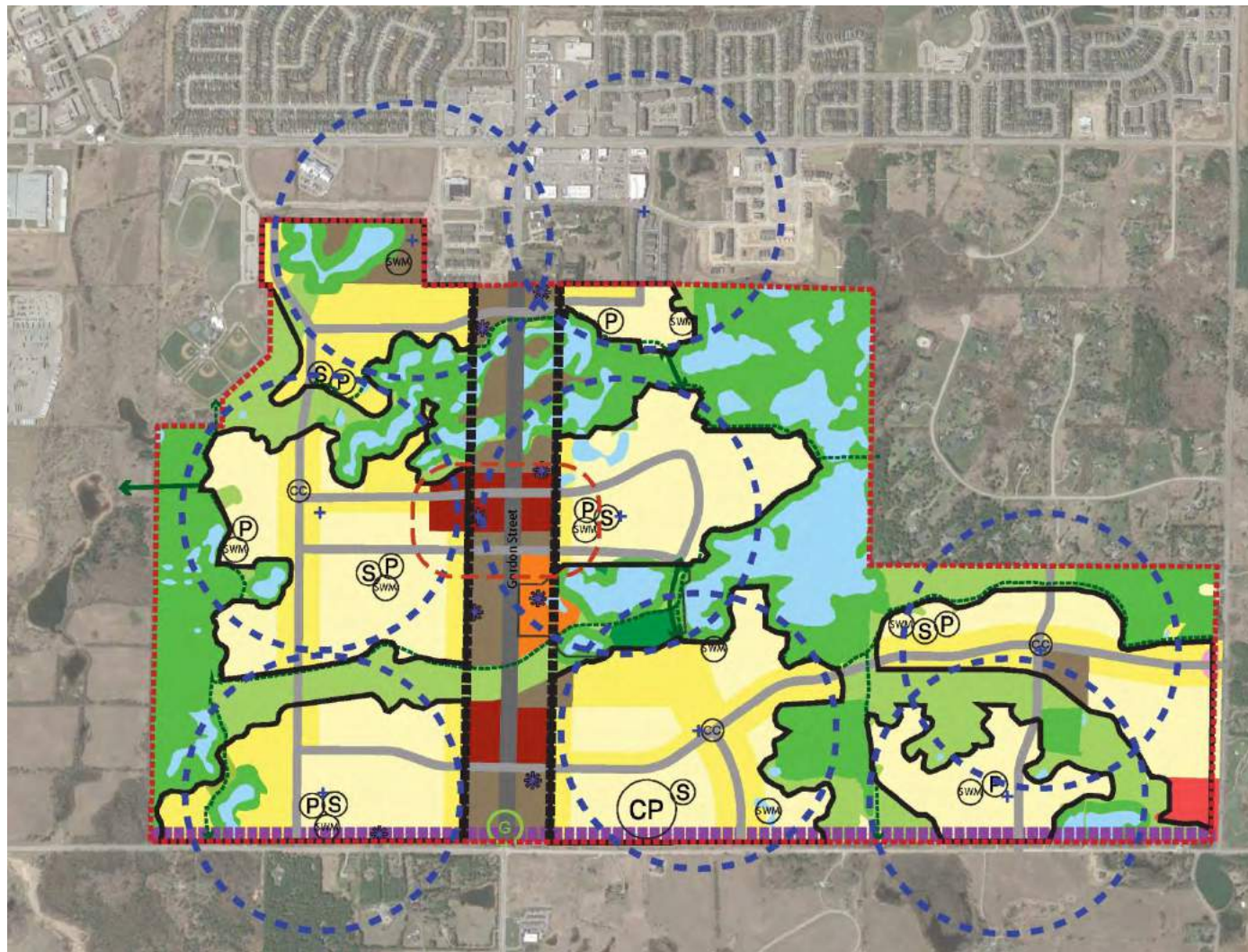
- May Permit Essential Transportation Infrastructure
- Does Not Permit Transportation Infrastructure
- Wetlands (MNRF 2017)

Land Use

- Low Density (Residential)
- Medium Density (Residential)
- High Density (Residential)
- Mixed Use
- Neighbourhood Commercial
- Service Commercial
- Mixed Office / Commercial
- Open Space



Proposed Neighbourhood Structure



November 2018

Legend

-  Clair-Maltby Secondary Plan Boundary

- Streets and Trails**
-  Existing Street Network
-  Proposed Collector Road and Cycling Network
-  Proposed Trail Network
-  Potential Active Transportation Link

- Parks, Schools, and Features**
-  Potential Neighbourhood Park
-  Potential Community Park
-  Potential Elementary School
-  Potential Stormwater Infiltration Areas
-  Convenience Commercial Area
-  Gateway
-  Cultural Heritage Resource
-  Cultural Heritage Landscape
-  Urban-Rural Transition Zone

- Natural Heritage System**
-  May Permit Essential Transportation Infrastructure
-  Does Not Permit Transportation Infrastructure
-  Wetlands (MNRF 2017)

- Land Use**
-  Residential Neighbourhood
-  Gordon St. Corridor Neighbourhood Boundary
-  400m Residential Neighbourhood Walking Circles
-  Urban Village Core

Structuring Elements



Key Directions: Protecting the Natural Heritage System (NHS)

The existing NHS Official Plan policies will apply including:

- Environment first approach;
- Protection of the NHS including adjacent lands, buffers, study requirements, wildlife crossing locations urban forest, and natural heritage stewardship and monitoring; and,
- Environmental study requirements.



Key Directions: Protecting the Natural Heritage System (NHS)

Additional Clair-Maltby specific policy may need to be developed related to:

- Protection of the Paris Moraine;
- Achievement of an appropriate water balance and infiltration target;
- Balance of views and access to NHS; and,
- Incorporation of wildlife crossings in the development of future roads.

Key Directions: Protecting our Cultural Heritage Resources

- Identify, conserve and celebrate cultural heritage resources
- Development in and around cultural heritage resources will protect the cultural heritage value and integrity



Key Directions: Water and Wastewater Servicing and Stormwater Management

- Integrate innovative stormwater management, water conservation and reuse, and other green infrastructure practices
- Balance innovative stormwater management with source water protection considerations
- Ensure development and infrastructure design is fiscally responsible in long and short term.
- Phasing of development will ensure compact, orderly development and minimize
- Implement as per the recommendations of the Master Environmental Servicing Plan

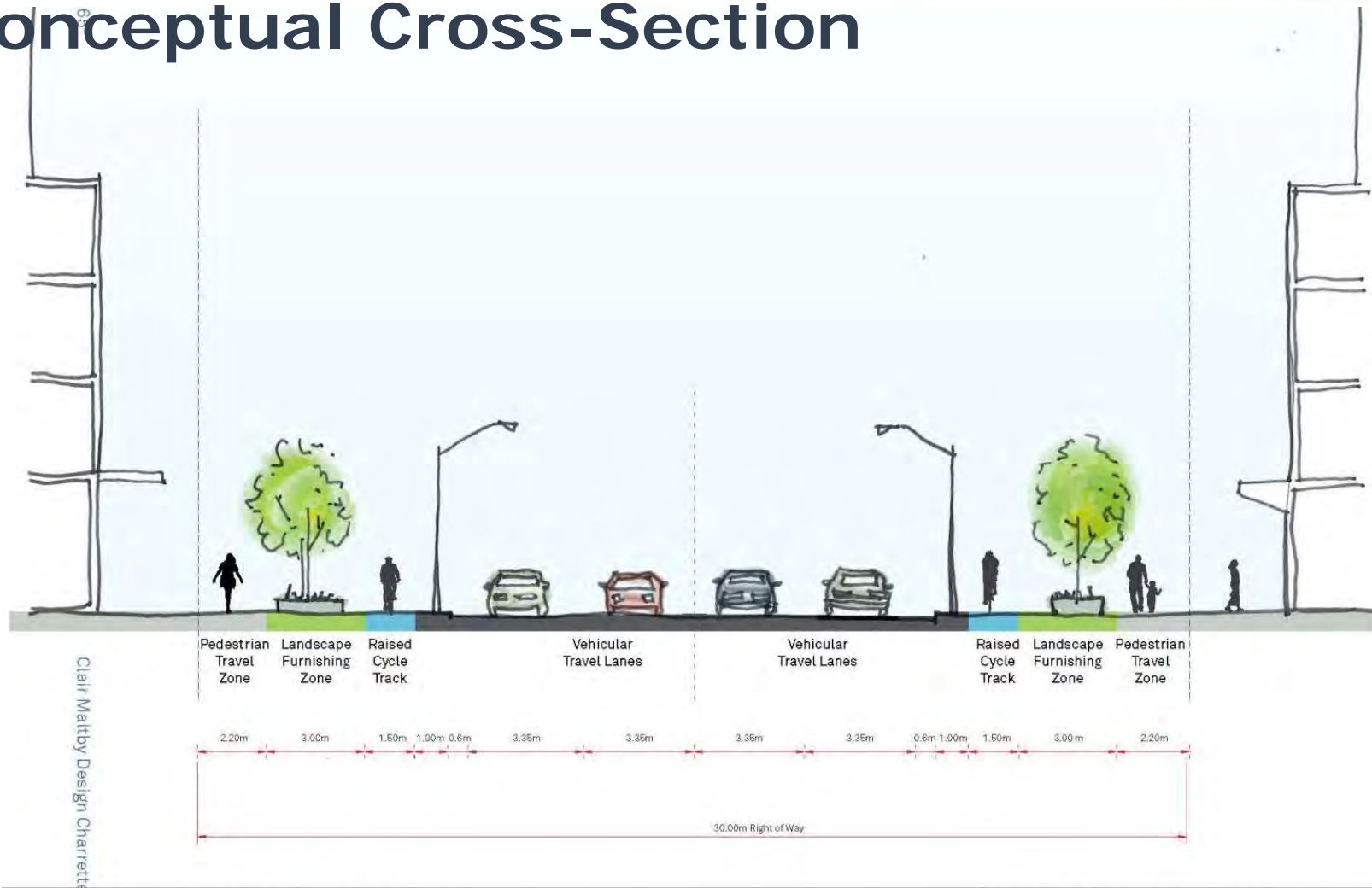


Key Directions: Mobility and Trails

- Walking, cycling and transit will be attractive and efficient modes of transportation
- Meet or exceed the city-wide modal share
- Modified grid system with fine-grained block structure
- Accept a constrained level of vehicular service to create a more pedestrian oriented environment
- Extend transit system throughout Clair-Maltby and plan for a transit hub and future higher order transit on Gordon Street



Conceptual Cross-Section



Gordon Street Arterial Road
30 m ROW - Raised Cycle Track

Clair-Maltby Secondary Plan
Scale 1:150
BrookMcIlroy/

Conceptual Cross-Section

BrookMcIlroy



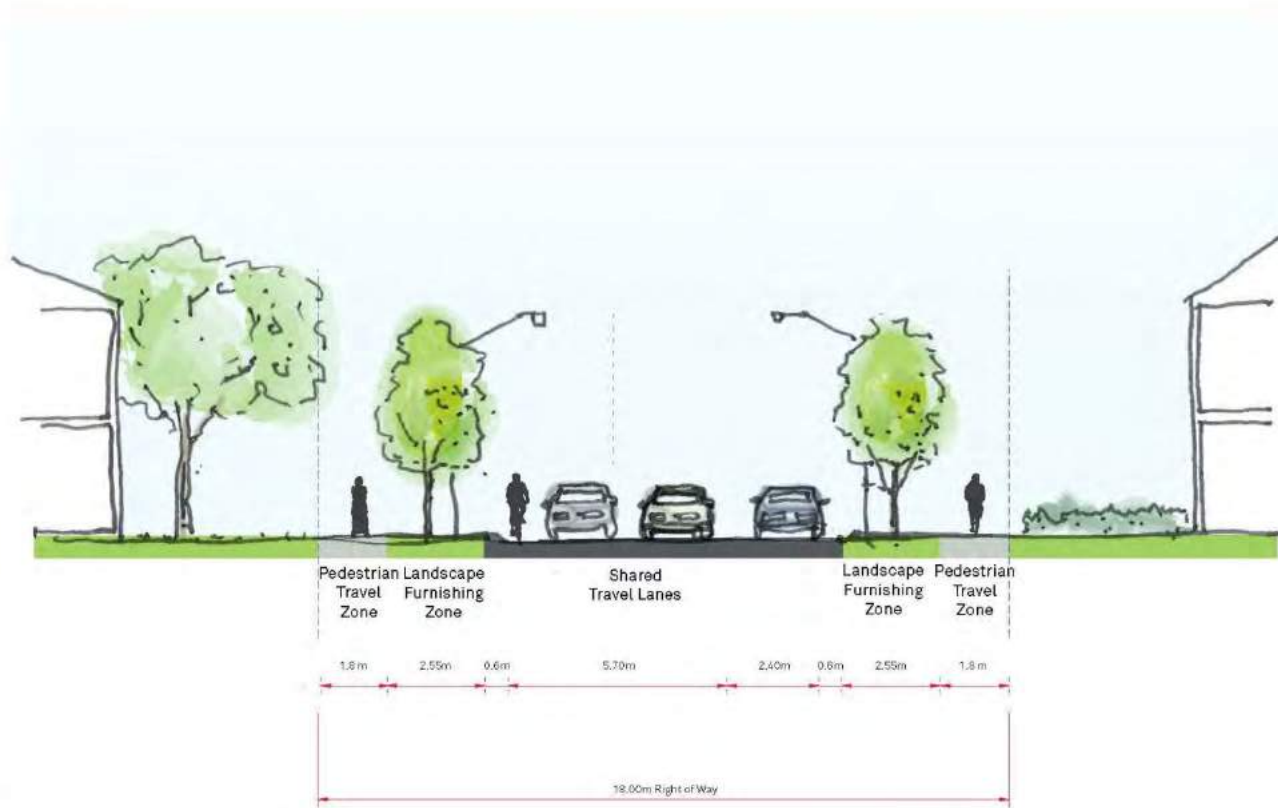
Collector Road
26 m ROW - Parking Lane and Raised Cycle Track

Clair-Maltby Secondary Plan
Scale 1:150
BrookMcIlroy/

Clair-Maltby
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Conceptual Cross-Section



Clair Maltby Design Charrette

Local Road
18 m ROW - Shared Travel Lanes and On Street
Parking

Clair-Maltby Secondary Plan
Scale 1:150
BrookMcIlroy/

Clair-Maltby
Transform. Connect. Community.



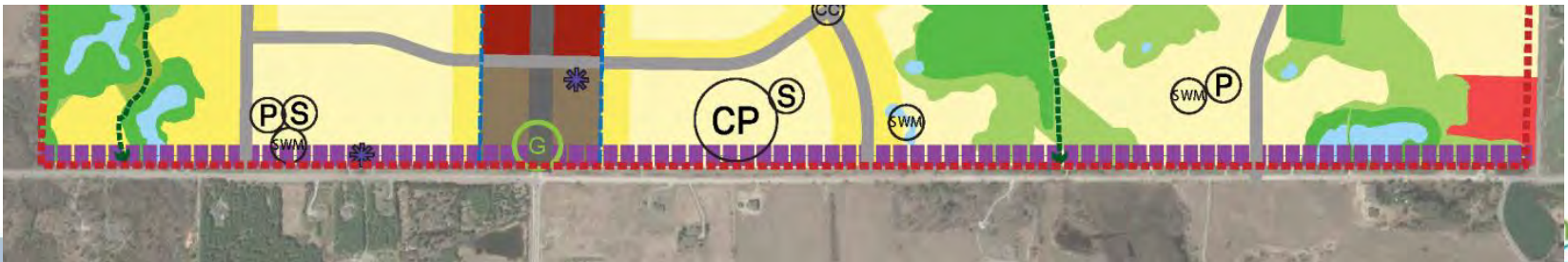
Key Directions: Land Use

- Create an Urban Village Core that provides a central focus for the area and contains a Main Street area.
- Create an integrated compact and mixed use corridor with high density development along Gordon Street. Provide opportunities for commercial amenities and community services within walking distance for residents.
- Achieve a minimum population of 15,000 to meet the requirements of the Provincial Growth Plan.



Key Directions: Land Use

- Achieve transit supportive densities with human-scaled built form
- Meet the City-wide target for affordable housing of 30%
- Design a green gateway into the City that contributes to our community image and may include elements such as a linear green space, public art, a multi-use path and connections to the Community Park
- Encourage uses that generate pedestrian traffic on the ground floor in commercial, mixed use and high density residential areas
- The urban-rural transition will have a minimum depth of 60 metres, with buildings having a maximum height of 3 storeys



Key Directions: Land Use

- **Residential Areas** provide for a full range and mix of housing
- Low density residential areas development will have:
 - Density of 20-60 units per hectare;
 - Maximum height of 4-6 storeys with the tallest buildings on collector roads or at intersections



Key Directions: Land Use

- Medium density residential areas:
 - Density of 40-100 units per hectare;
 - Minimum height of 2 storeys; and,
 - Maximum height of 6 storeys.
- High density residential areas:
 - Density of 100-200 units per hectare;
 - Minimum Floor Space Index of 1.5;
 - Minimum height of 4 storeys on Gordon St. and 3 storeys elsewhere; and,
 - Maximum height of 14-18 storeys with taller buildings considered in strategic locations.



Key Directions: Parks

- Establish a network of parks, open spaces and trails with a variety of recreation spaces
- A neighbourhood park within within a 5-10 minute walk for all future residents
- Neighbourhood Parks = 1 hectare minimum
- Community Park = 10 hectares minimum
- Minimum total parkland for Clair-Maltby = 18 hectares.
- Opportunities to increase the parkland should be explored.



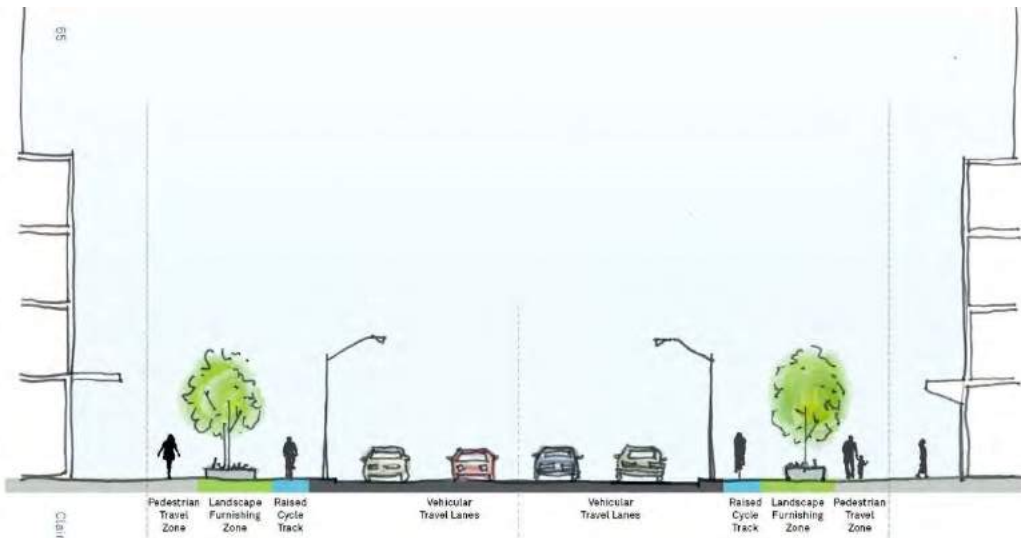
Key Directions: Built Form and Urban Design

- Promote the development of inspiring, meaningful and memorable places that reinforce Guelph as a historic, beautiful and innovative City with new public spaces for gathering and recreation and:
 - Compact walkable neighbourhoods;
 - Healthy neighbourhood design principles;
 - Building and site design which responds sensitively to variable topography while achieving highly walkable built form;



Key Directions: Built Form and Urban Design

- **Gordon Street Corridor** will be a transit supportive and multi-modal corridor that incorporates high-quality design and also highlights and celebrates the significant pockets of open space, NHS and cultural heritage resources along it



Key Directions: Built Form and Urban Design

- The **Urban Village Core** will be highly pedestrian oriented and contain predominately mixed use buildings. Other features include:
 - Upgraded streetscape elements;
 - On-street parking;
 - Taller buildings;
 - Building design which promotes sunlight, views and privacy;
 - A Main Street as an anchor for the area with buildings which contribute to a pedestrian oriented environment and a centrally located square as a focal point.

Key Directions: Built Form and Urban Design

- **Residential Neighbourhoods** will be designed to:
 - Be centred around a neighbourhood focal point such as neighbourhood-scale mixed use, parks and/or community facilities;
 - Carefully consider the interface with the NHS and the open space system;



Key Directions: Energy and Climate Change

- Contribute to the City's goal of being a Net Zero Carbon community by 2050
- City facilities will strive towards having 100% of their energy supplied by renewable source by 2050
- To mitigate risks to property, infrastructure, human health and the environment arising from climate change there will be increased reliance on green infrastructure
- Maintenance, restoration and improvement of the NHS will abate climate impacts
- Reduce the amount of energy used for transportation through community design



Key Directions: Phasing and Finance

- The Fiscal Impact Assessment will be approved by Council.
- Phasing of development will be considered as part of the secondary plan.
- The City will consider options to ensure the provision and/or funding of growth related or shared services in accordance with the Fiscal Impact Assessment and related City policies.
- Landowners may be encouraged to enter into private cost sharing agreement(s) and/or trustee arrangements that address the provision and/or funding of certain local services and infrastructure facilities.

World Café

- 3 rounds of conversation
- You will have 20 min during the FIRST ROUND ONLY to provide feedback on the draft actions
- You will have 15 min during ROUNDS 2 and 3
- At the end of each round you can move onto another table – or stay and continue to work at the same table
- After 3 rounds, you will have 10 minutes to circulate, view results and add any final thoughts to responses

Conversation Tables

- Land use
- Parks and cultural heritage resources
- Built form/urban design policies
- Mobility & Trails
- Natural Heritage System
- Stormwater and Water/Wastewater Servicing
- Energy

Questions

1) Review the directions

2) Work through the questions

- Which ideas and potential directions do you like most?
- What issues need further consideration? What would you change or clarify?
- Are there any important issues that you feel are not addressed by the Draft Directions document? Is there something new you would add?

Café Etiquette

- ✓ Write down your ideas
- ✓ Focus on what matters
- ✓ Listen to understand
- ✓ Contribute your thinking
- ✓ Speak you mind & heart
- ✓ Link & connect ideas
- ✓ Listen for insights & ask deeper questions
- ✓ It's OK to change tables
- ✓ Play, doodle and draw!

World Café Agenda

1. Café Conversations Round 1 (20 min)
2. Café Conversations Round 2 (15 min)
3. Café Conversations Round 3 (15 min)
4. Review (10 min)

Next Steps

Phase 3 (Q3 2018 – Q2 2019)

- Detailed technical work including modelling and analysis
- Policy development
- Community Engagement

CEIS

- continue monitoring
- assess impacts based on preferred community structure
- develop mitigation and restoration recommendations
- finalize CEIS as a whole

Water, Wastewater, SWM

- Develop and evaluate alternative solutions
- Create or update models for study area
- Recommend preferred options and prepare MESP project file

Fiscal Impact Assessment

- Prepare fiscal impact model based on the preferred community structure

Next Steps

Phase 3 (Q3 2018 – Q2 2019)

Mobility

- Complete technical studies based on preferred community structure
- Finalize mobility network planning study
- Finalize traffic impact study

Energy & Other Utilities

- Evaluate the MESP alternatives which are based on the preferred community structure
- Prepare final report

Secondary Plan

- Prepare draft secondary plan including policies and land use plan based on the preferred community structure as refined by the results of the technical input
- Undertake further community engagement
- Prepare a final secondary plan

Thank you

March 8, 2019

Clair-Maltby Secondary Plan

Information session: Planning for growth while protecting the moraine, water resources and natural heritage resources

March 28, 2019

7-9 p.m.

Council Chambers, City Hall
1 Carden Street, Guelph

You are invited to join members of the community, interested stakeholders and members of the Environmental Advisory Committee, River Systems Advisory Committee, Clair-Maltby Community Working Group and Clair-Maltby Technical Advisory Group at this information session to learn more about technical work that has been undertaken to date as part of the Clair-Maltby Secondary Plan.

Agenda

- Dave Belanger, the City's Water Supply Program Manager, will describe how the [Grand River Source Water Protection Plan](#) and the [City's Water Supply Master Plan](#) inform the Secondary Plan process
- Guelph's MPP, Mike Schreiner, will discuss how proposed [Bill 71- An Act to Conserve the Paris Galt Moraine](#) works with the Secondary Plan to protect the Paris Galt Moraine
- The Secondary Plan Project Team will present the Comprehensive Environmental Impact Study (CEIS) Phase 3 Impact Assessment

You will have the opportunity to ask questions for clarification following each speaker.

Additional Information

The Phase 3 Impact Assessment is a technical document that assesses the

potential impacts of the planned future development to the local and neighbouring environmental systems and features. The report also establishes preliminary management requirements. The findings of the assessment will inform refinements to the land use concept and establish recommended management strategies.

The CEIS Year 3 Monitoring Report will be also be available on March 12, 2019 at <https://guelph.ca/plans-and-strategies/clair-maltby-secondary-plan/cm-documents/>. It can also be found on the project webpage, guelph.ca/clair-maltby/, under 'documents'.

Master Environmental Servicing Plan (MESP) update

The following technical reports are now posted on the project webpage at <https://guelph.ca/plans-and-strategies/clair-maltby-secondary-plan/cm-documents/>:

- Wastewater Servicing – Existing Conditions Design Criteria & Level of Service Objectives Report
- Wastewater Servicing – Alternative Servicing Strategies Development Report
- Water Servicing – Existing Conditions Design Criteria & Level of Service Objectives Report
- Water Servicing – Alternative Servicing Strategies Development Report
- Transportation Master Plan Study

For more information

Visit guelph.ca/clair-maltby for additional project details.

Stacey Laughlin, MCIP, RPP, Senior Policy Planner
Planning and Building Services
519-822-1260 extension 2327

Arun Hindupur, M.Sc., P.Eng., Supervisor, Infrastructure Engineering
Engineering and Transportation Services
519-822-1260 extension 2282

clair-maltby@guelph.ca



**Phase 3 – Impact Assessment and
Preliminary Management Strategies**

Clair-Maltby

Transform. Connect. Community.

Presentation Outline

1. Project Background and Process
2. Study Area Characterization
3. Impact Assessment
4. Preliminary Management Approach and Strategies



Clair-Maltby

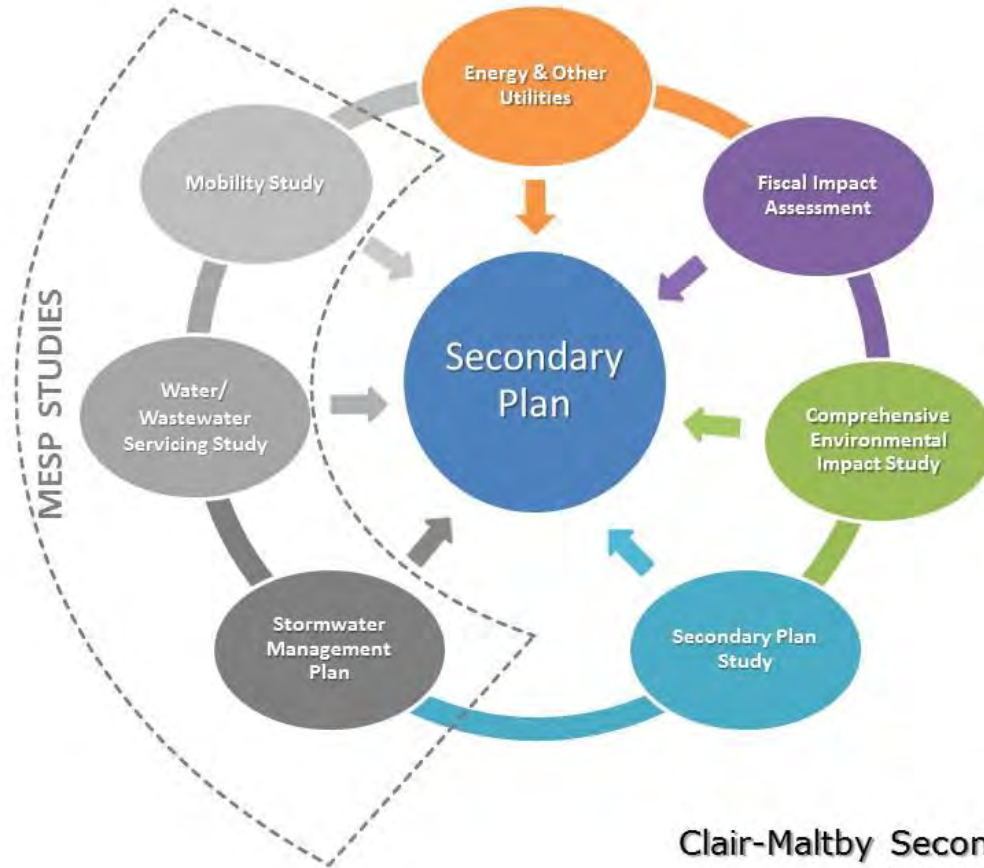
Transform. Connect. Community.

1. Project Background and Process



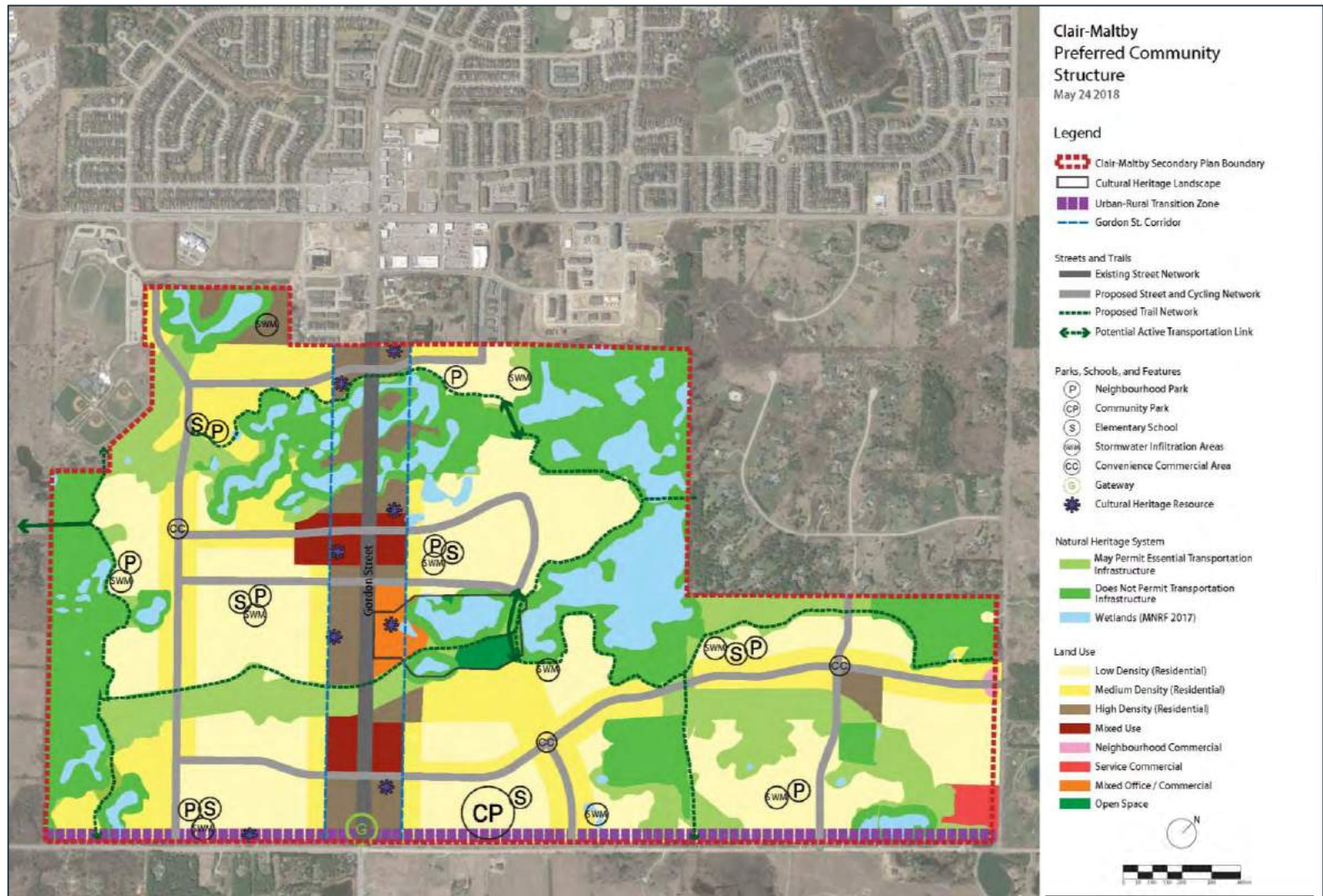
1. Project Background and Process

Integrated Study Relationship



Clair-Maltby Secondary Plan
Process Diagram

1. Project Background and Process – Preferred Community Structure – June, 2018



1. Project Background and Process

Study Scales

Secondary Plan Area (SPA)

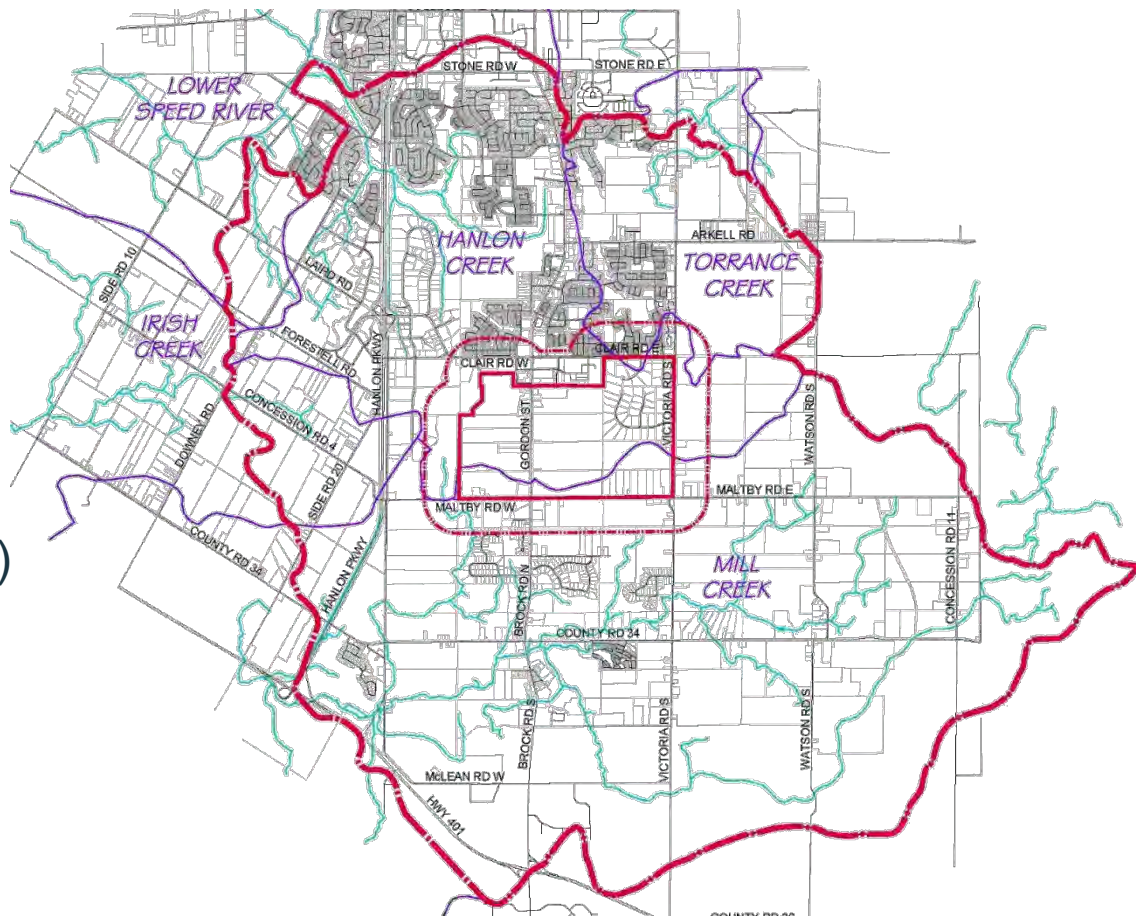
536 ha

Primary Study Area (PSA)

1127 ha

Secondary Study Area (SSA)

9624 ha



1. Project Background and Process

Key CEIS Tasks

- Phases 1 and 2
 - Verification / refinement / assessment of environmental features and functions
 - Assessment of the role of water in the study areas to support natural systems (groundwater / surface water)
 - Constraints and opportunities definition
- Phase 3
 - Assessment of impacts associated with preliminary community structure
 - Establishment of preliminary integrated management strategies
 - Input to land use refinement

1. Project Background and Process

Study Approach

- Review of background information
- Multi-year monitoring and field studies
 - 2016, 2017, 2018
 - *Meteorology*
 - *Surface Water*
 - *Ground Water*
 - *Natural Systems*
- Modelling of surface and groundwater
- Agency and stakeholder consultation



Clair-Maltby

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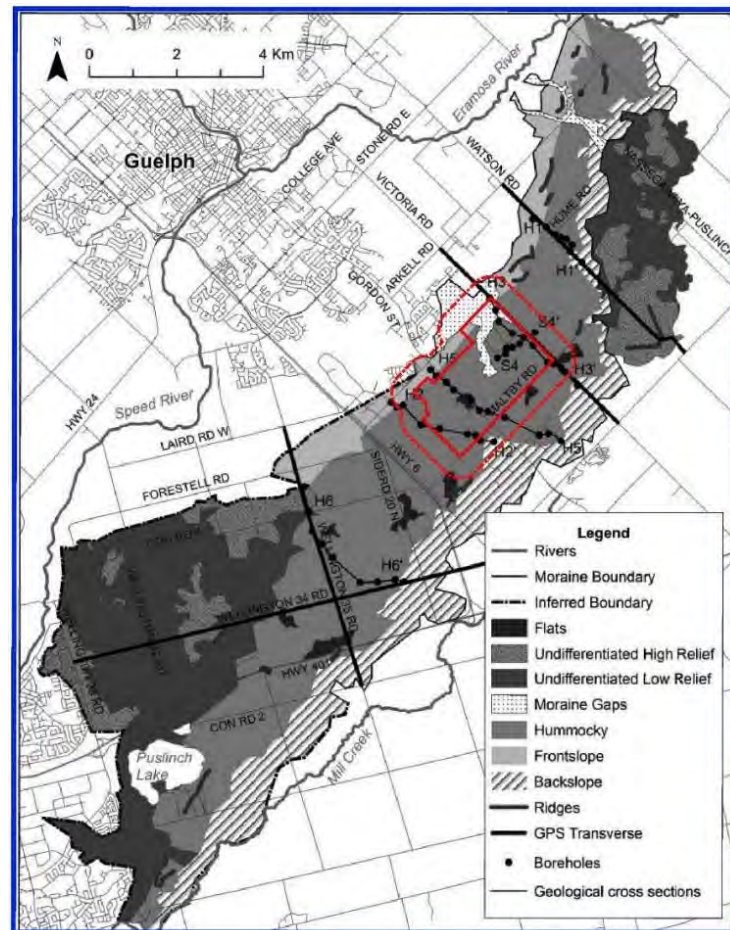
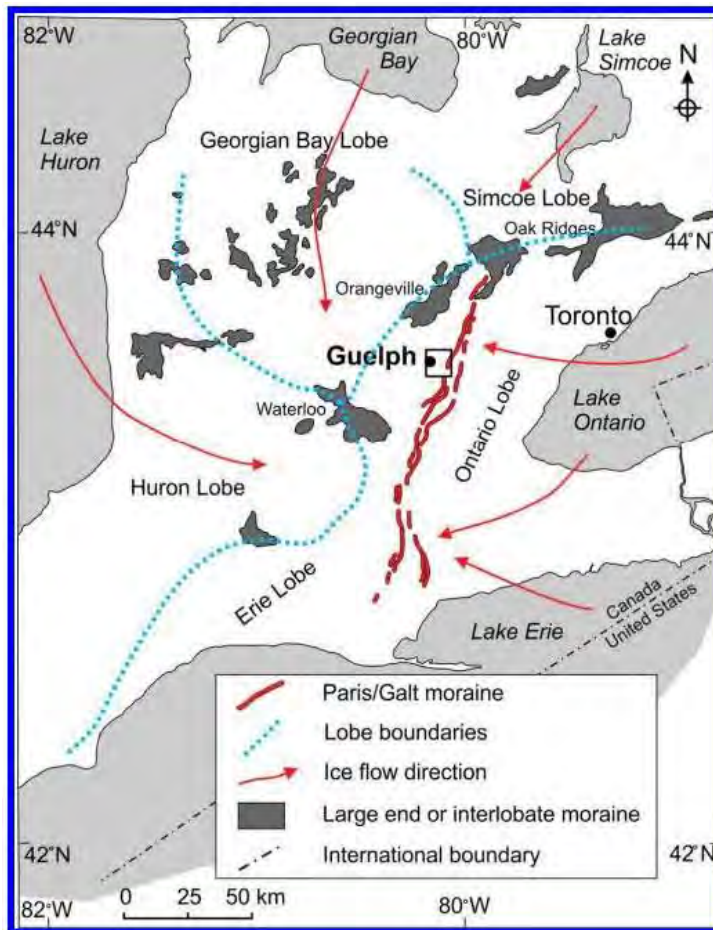
2. Study Area Characterization

wood.

CITY OF
Guelph
Making a Difference

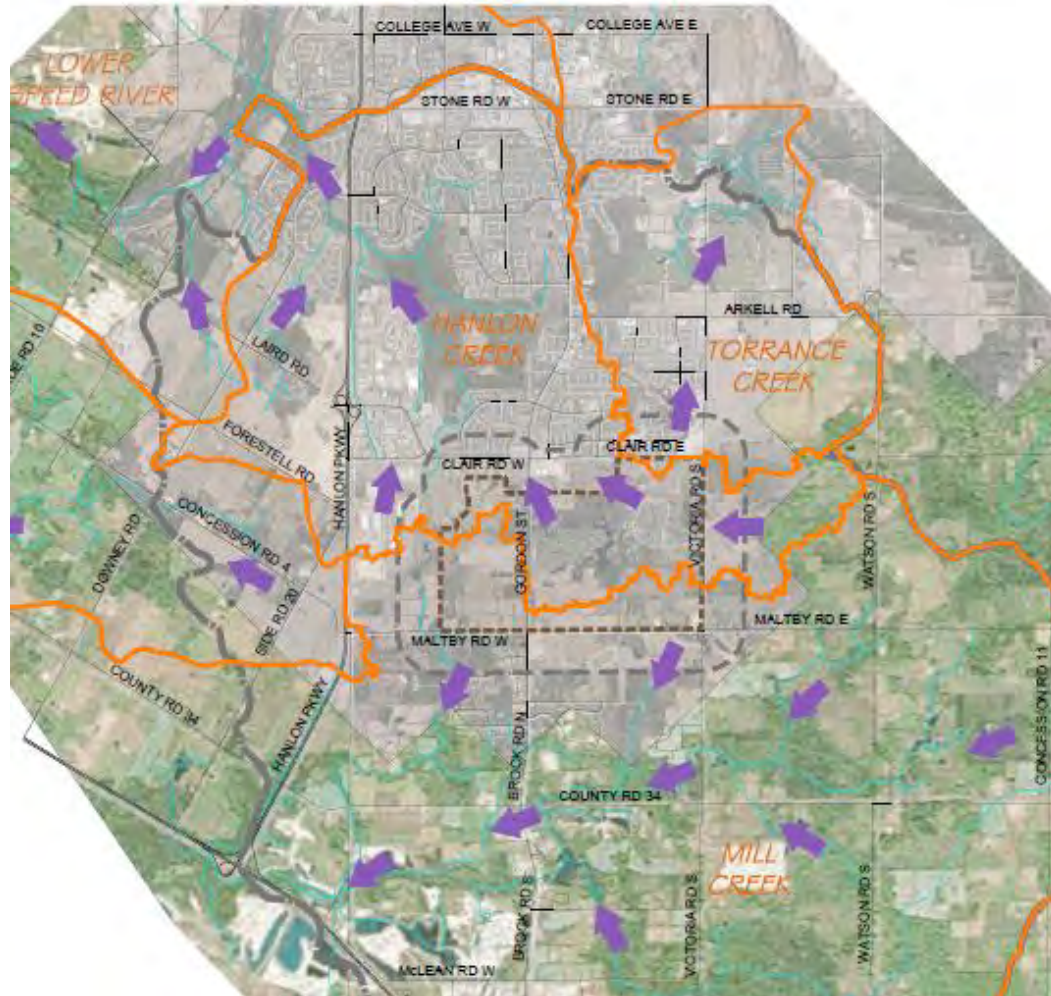
2. Study Area Characterization – Existing Conditions

Landform: *Paris Galt Moraine and Paris Moraine*



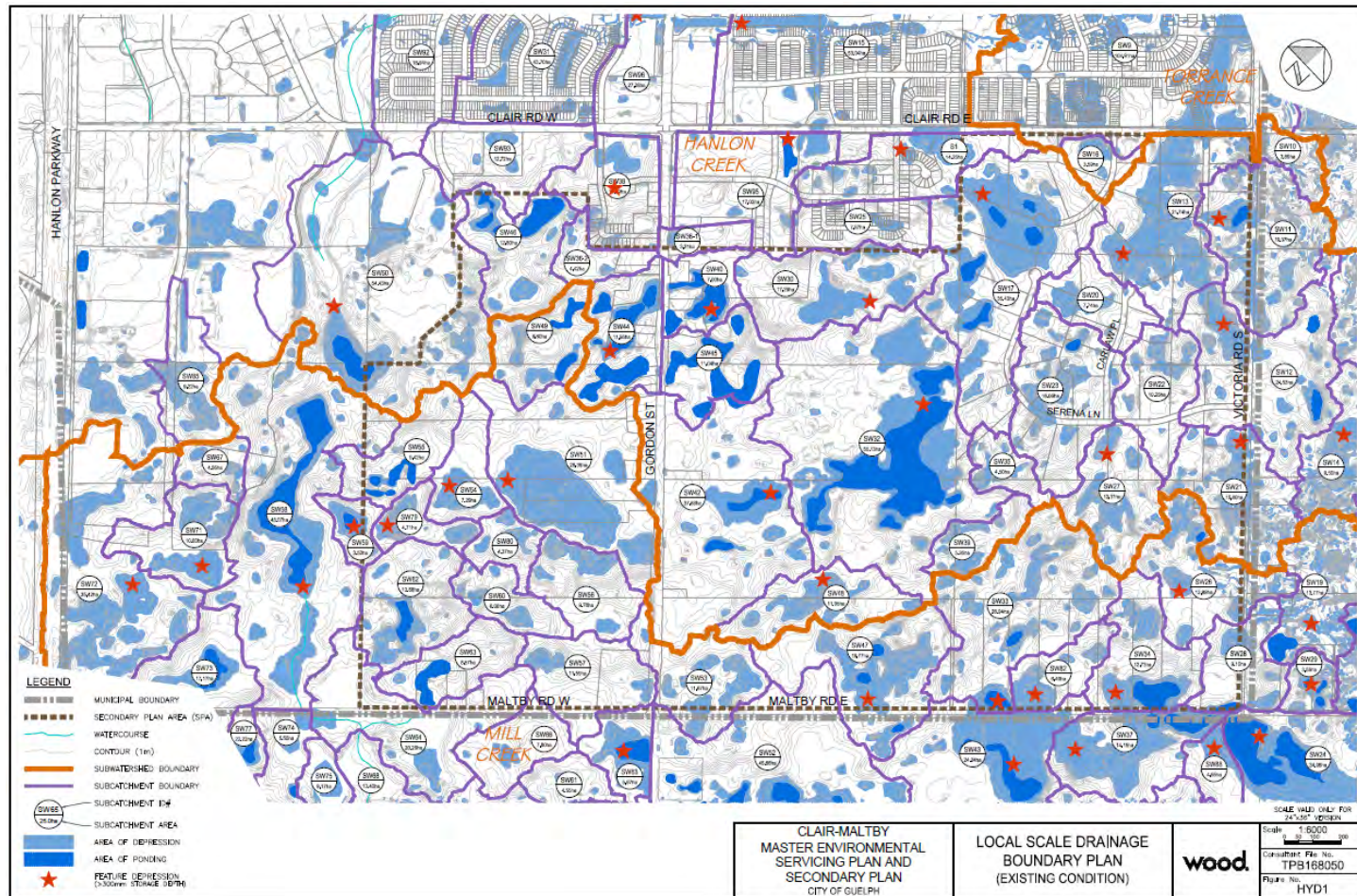
2. Study Area Characterization

Surface Water: *Headwaters of Mill, Torrance, Hanlon Watersheds*



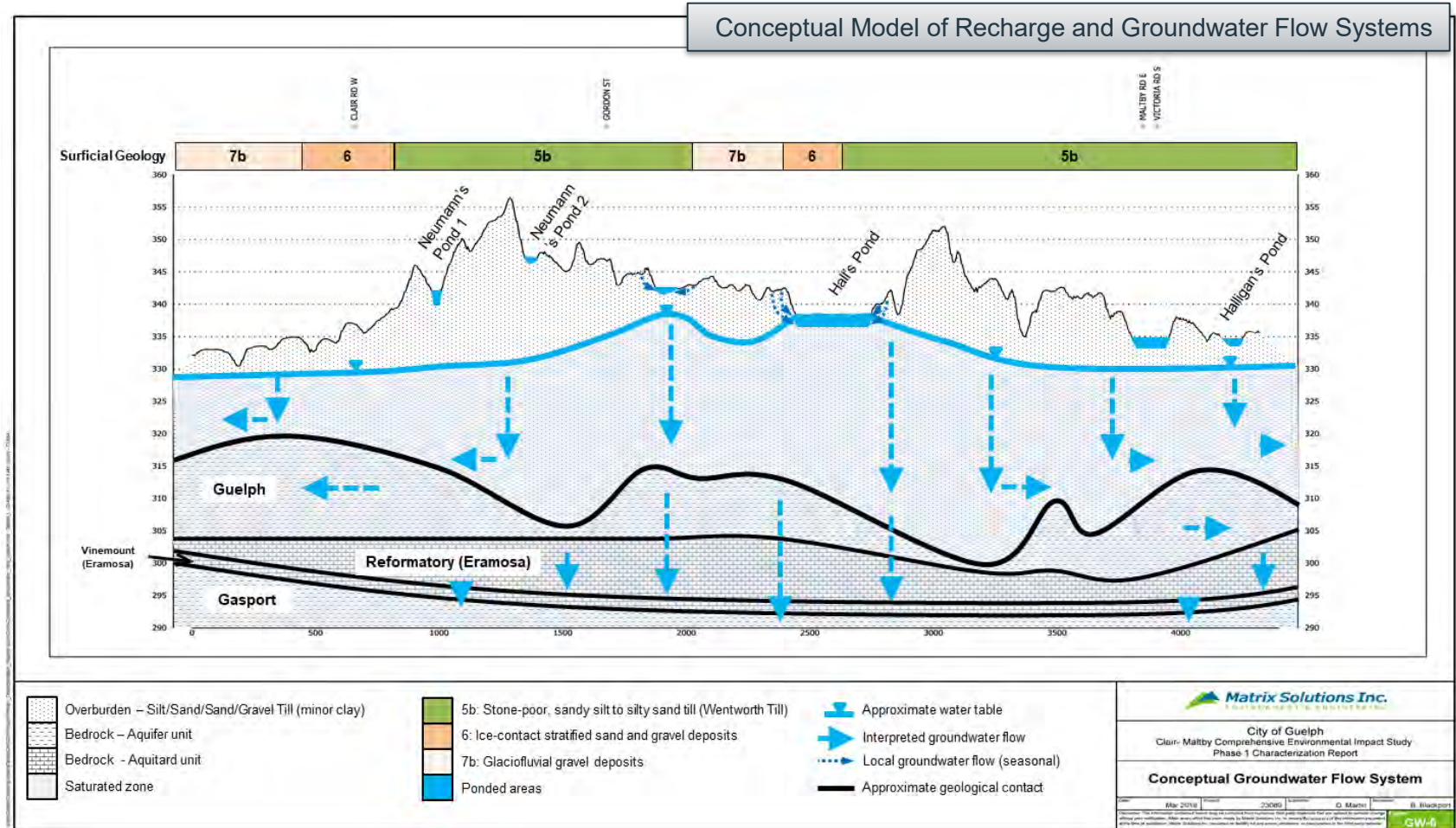
2. Study Area Characterization

Surface Water: Numerous Wet / Dry Depressions



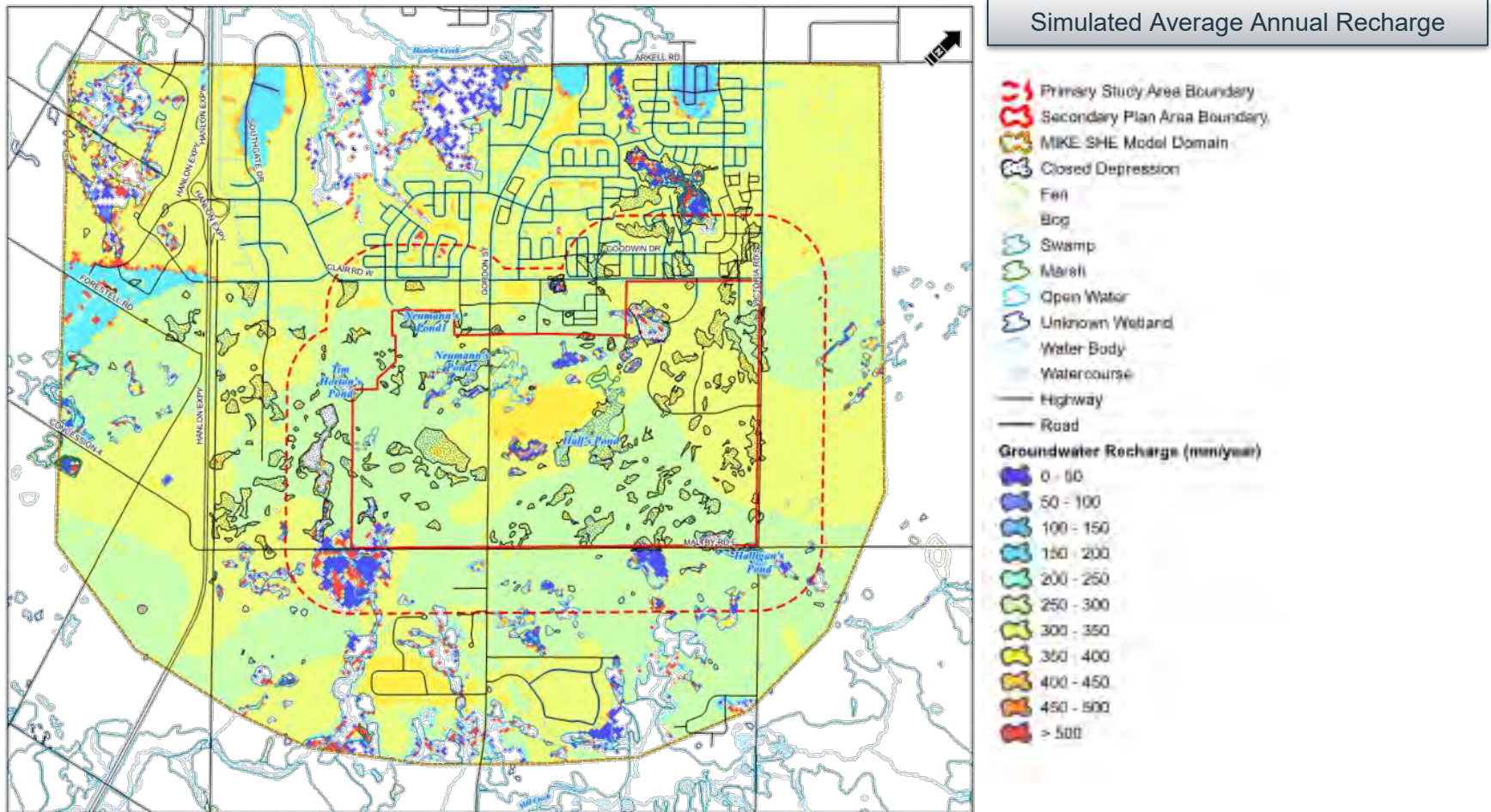
2. Study Area Characterization

Hydrogeology: *Surface Water Interaction with Shallow / Deep Systems*



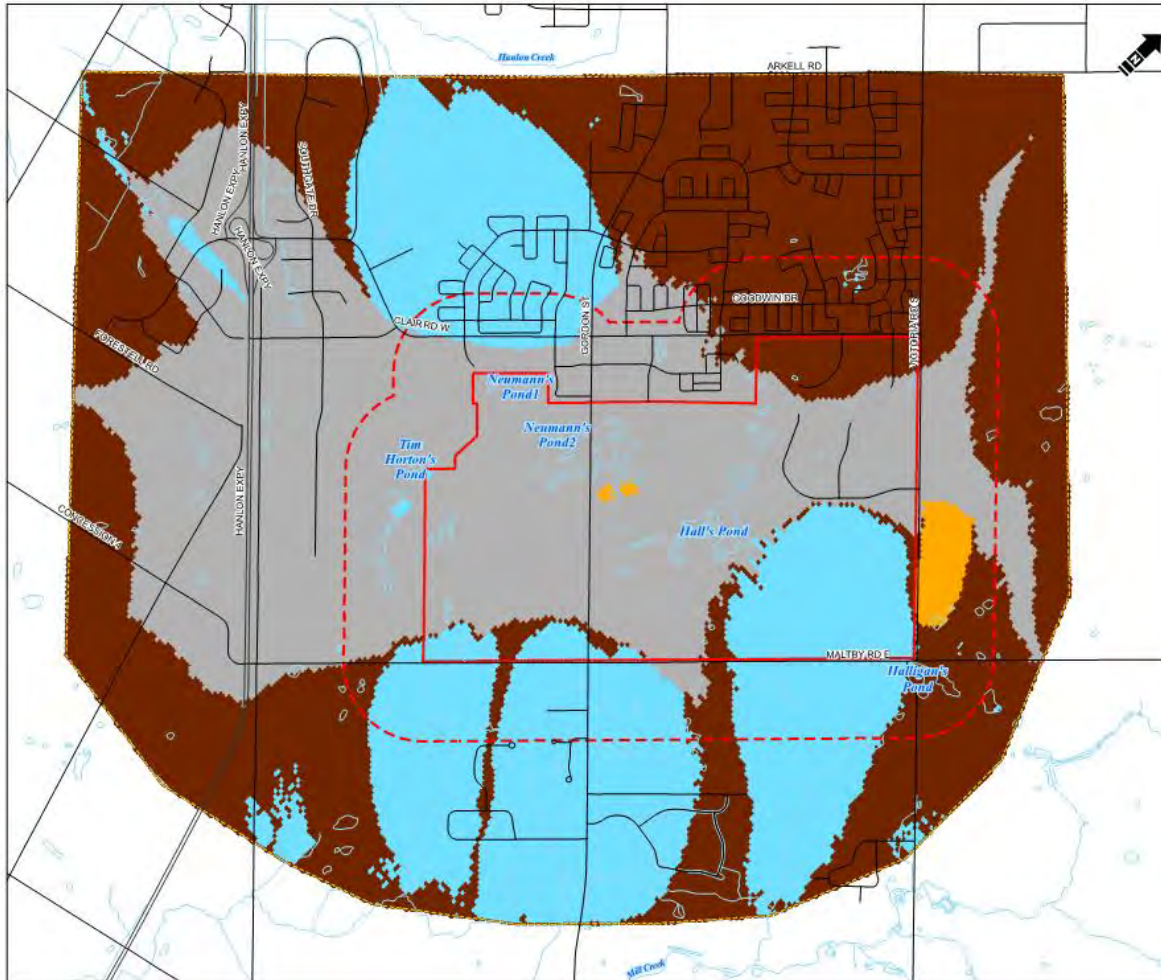
2. Study Area Characterization

Hydrogeology: *Significant Annual Recharge (250-400 mm/year)*



2. Study Area Characterization

Hydrogeology: *Where does recharge go?*

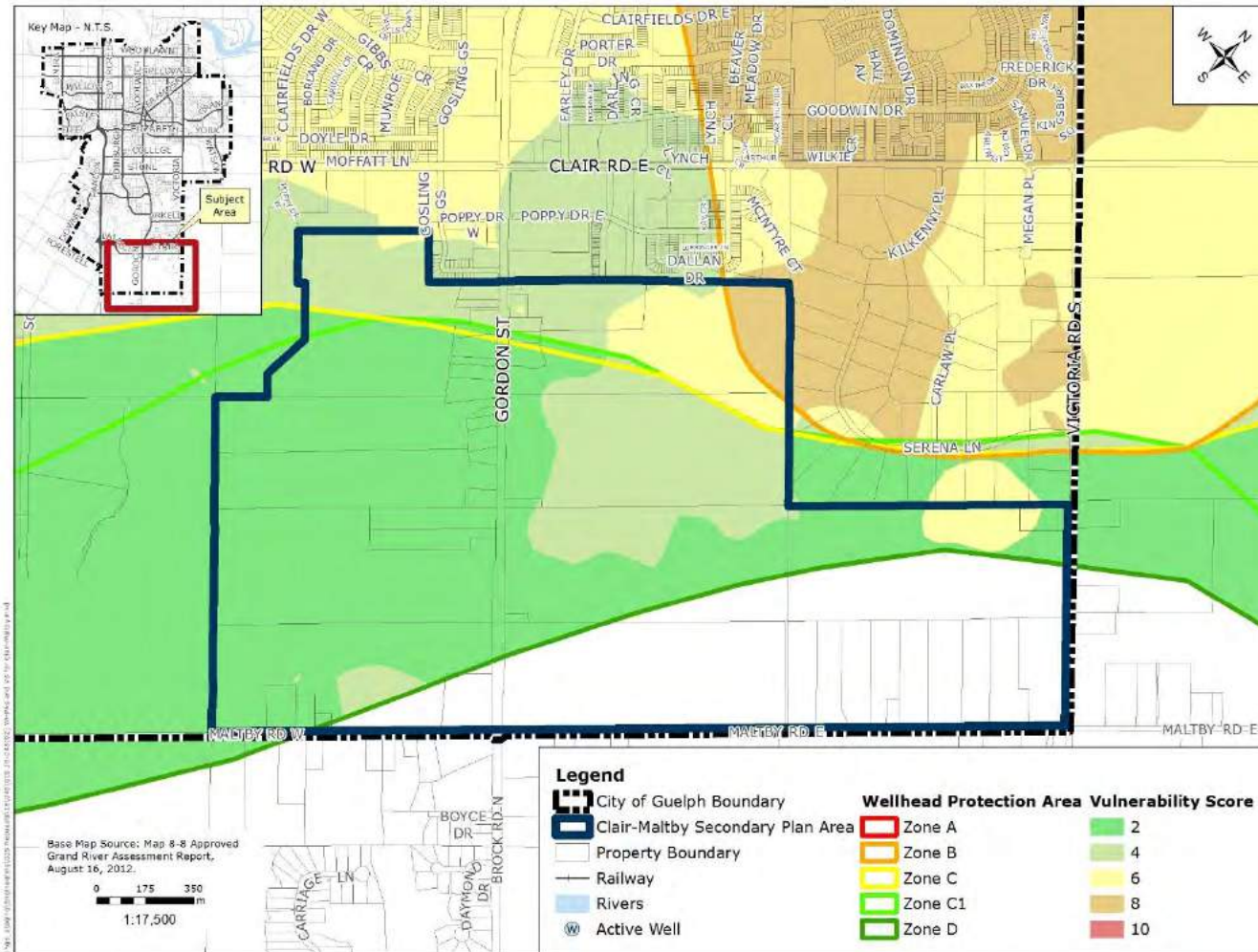


Simulated Recharge – Discharge Linkage – Where does recharge go?

- Primary Study Area Boundary
- Secondary Plan Area Boundary
- MIKE SHE Model Domain
- Water Body
- Watercourse
- Highway
- Road
- Particle Track**
 - Vertical Groundwater Flow Out (Across Vinimount Formation)
 - Lateral Groundwater Flow Out (Overburden and Bedrock)
 - Captured by Pumping Well
 - Discharge to Streams and Water Bodies

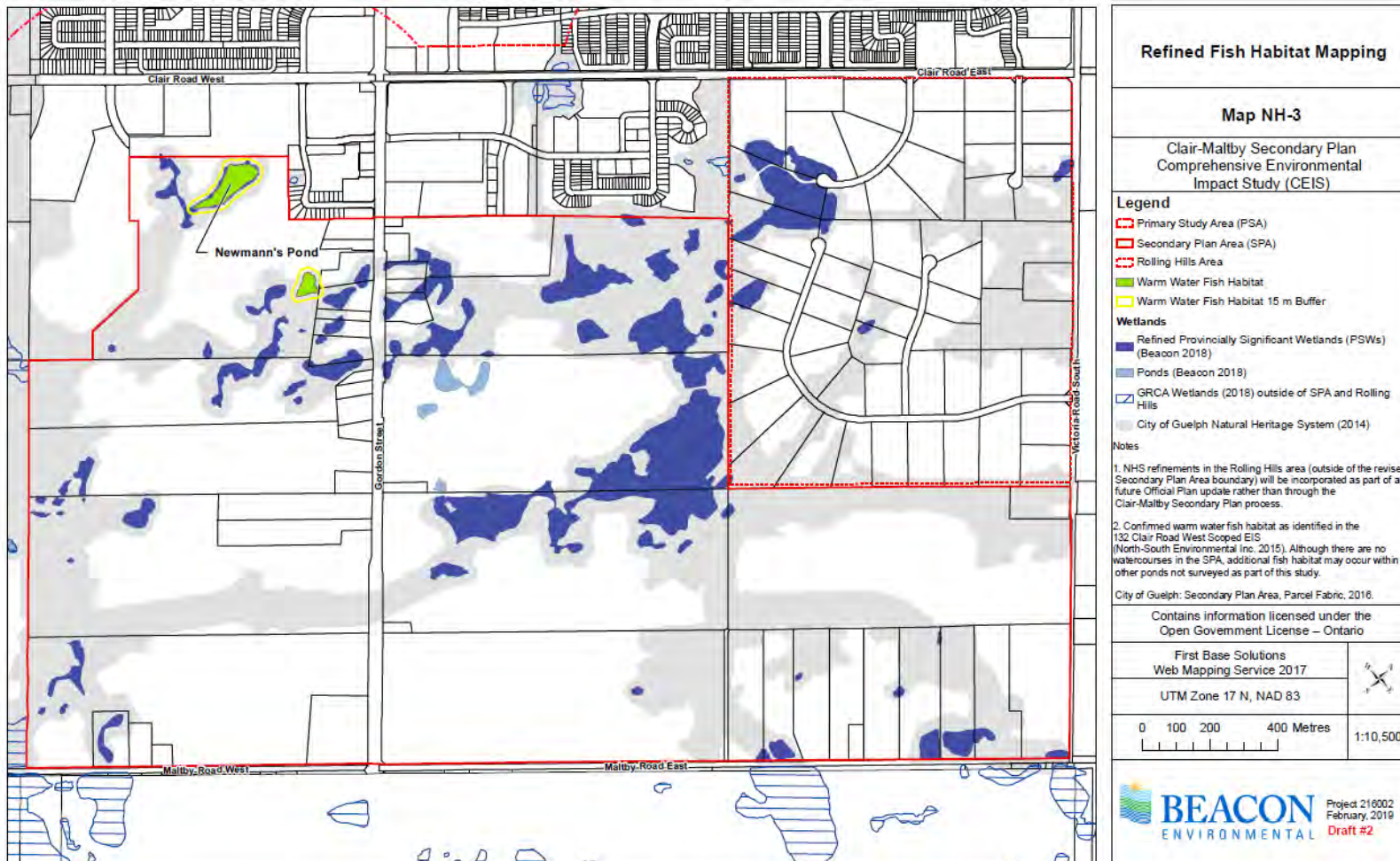
2. Study Area Characterization

Hydrogeology: Groundwater Vulnerability



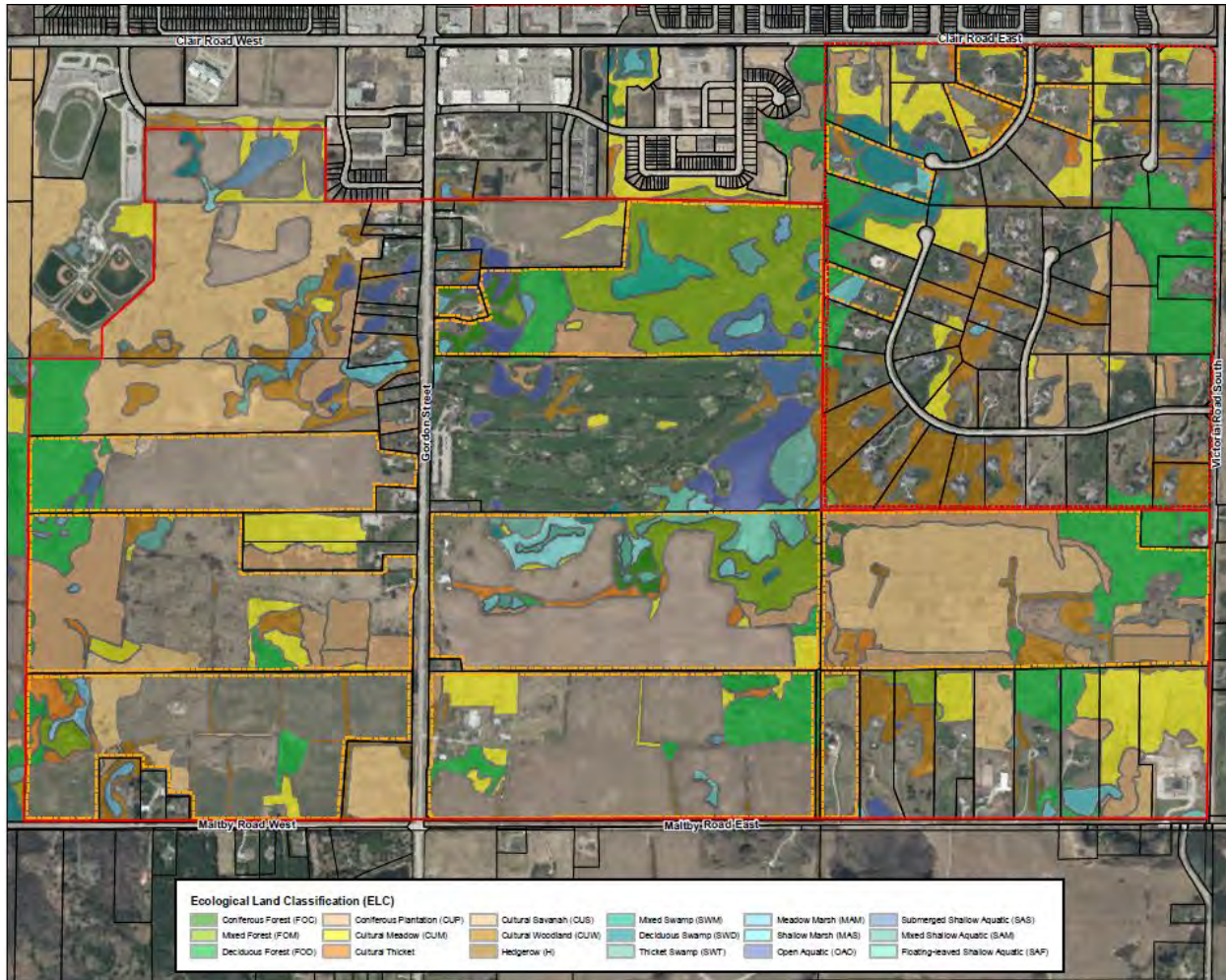
2. Study Area Characterization

NHS Findings: *Surface Water Features and Fish Habitat*



2. Study Area Characterization

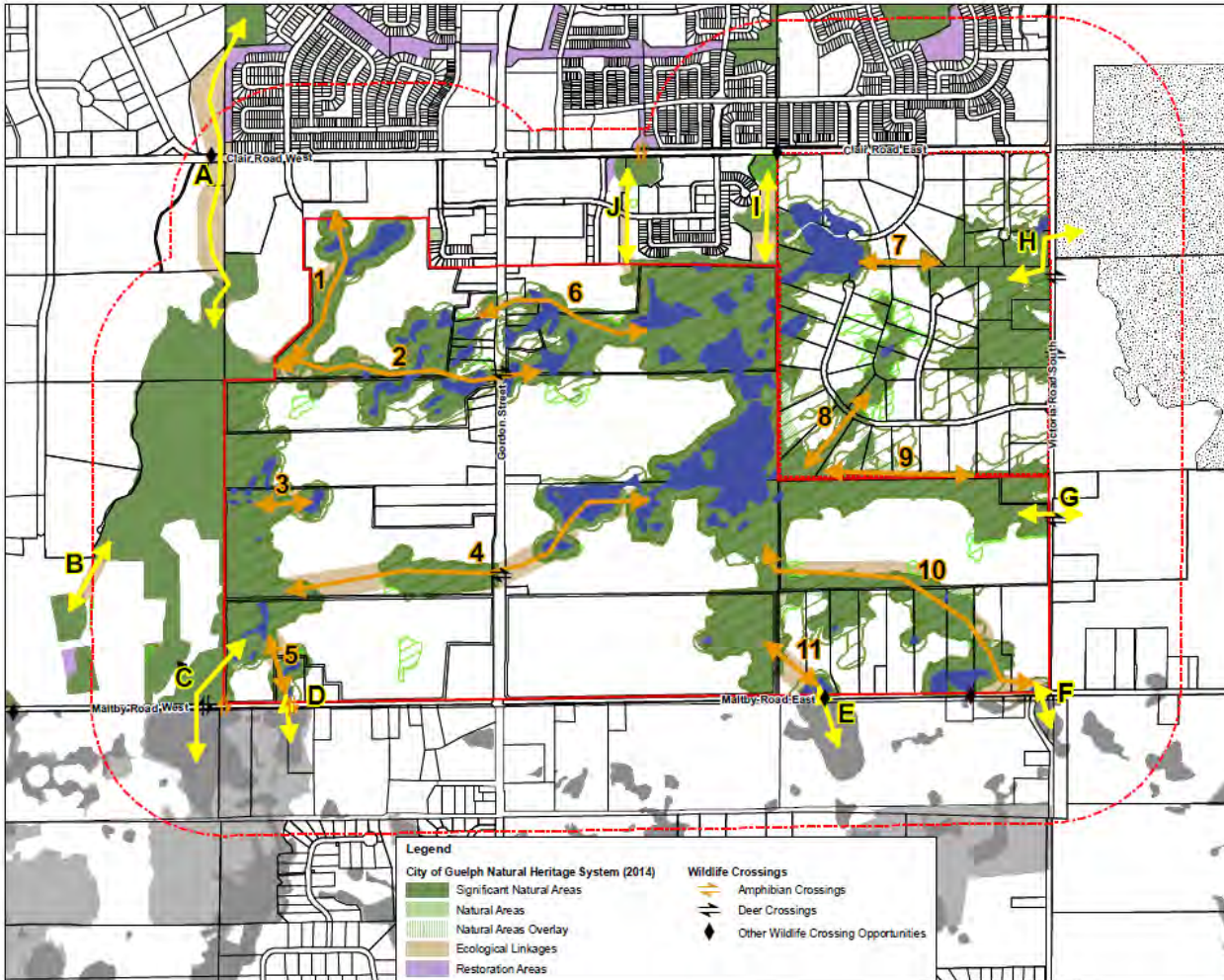
Natural Environment: *Wetlands, Woodlands and Wildlife*



Refined Ecological Land Classification	Map NH-5
Clair-Maltby Secondary Plan 2018 Monitoring Report	
Legend	
 	Primary Study Area (PSA)
 	Secondary Plan Area (SPA)
 	Rolling Hills Community
 	Access to Field Verify ELC Provided
 	Parcel Fabric
<small>Note: All ELC mapping has been updated from the City's 2014 ELC mapping using 2017 aerial photography except for the 2021 Gordon Street property where the City has indicated the 2014 ELC should be retained as the City and Owner are currently before the courts under the City's Tree By-law. City of Guelph: Secondary Plan Area Boundary, Parcel Fabric, 2016.</small>	
First Base Solutions Web Mapping Service 2017	
UTM Zone 17 N, NAD 83	
0 100 200 400 Metres 	1:10,500
 Project 216002 March, 2019	

2. Study Area Characterization

Natural Environment: *Ecological Linkages and Connectivity*



Ecological Linkages Assessment	
Map NH-11	
Clair-Maltby Secondary Plan Comprehensive Environmental Impact Study (CEIS)	
Legend	
<ul style="list-style-type: none"> Primary Study Area (PSA) Secondary Plan Area (SPA) Rolling Hills Community Ecological Linkages within the PSA Ecological Linkages within the SPA 	
Refined Natural Heritage System	
<ul style="list-style-type: none"> Significant Natural Areas Natural Areas Overlay 	
County of Wellington Greenlands System	
<ul style="list-style-type: none"> Core Greenlands Greenlands 	
<ul style="list-style-type: none"> Paris Moraine Earth Science ANSI (MNR 2016) 	
Notes	
1. NHS refinements in the Rolling Hills area (outside of the revised Secondary Plan Area boundary) will be incorporated as part of a future Official Plan update rather than through the Clair-Maltby Secondary Plan process.	
Contains information licensed under the Open Government License – Ontario	
First Base Solutions Web Mapping Service 2017	
UTM Zone 17 N, NAD 83	
0 125 250 500 Metres	1:15,000
Project 216002 February, 2019 DRAFT #2	



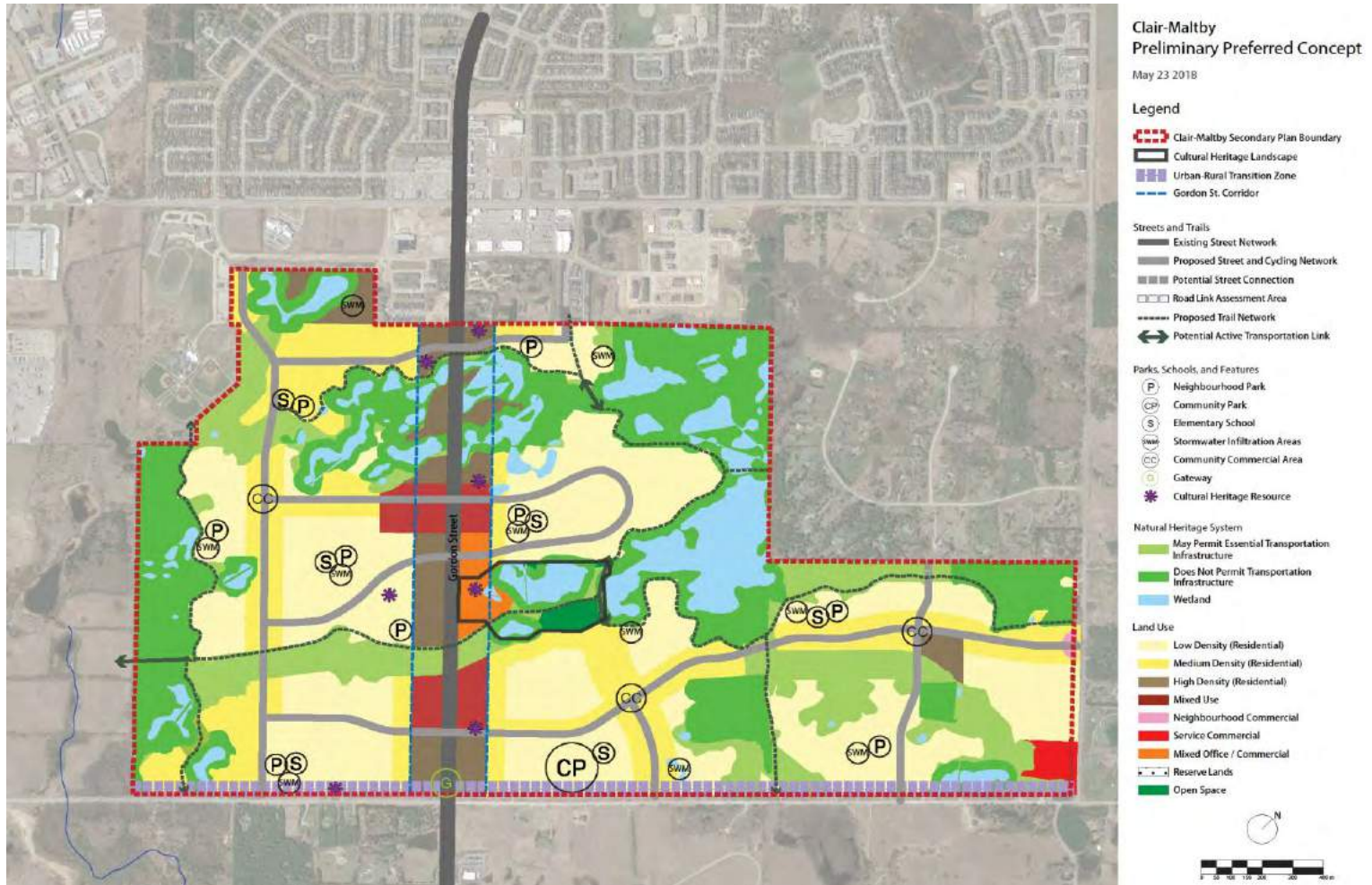
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3. Impact Assessment

3. Impact Assessment

Land Use Plan – Preliminary Preferred Community Structure



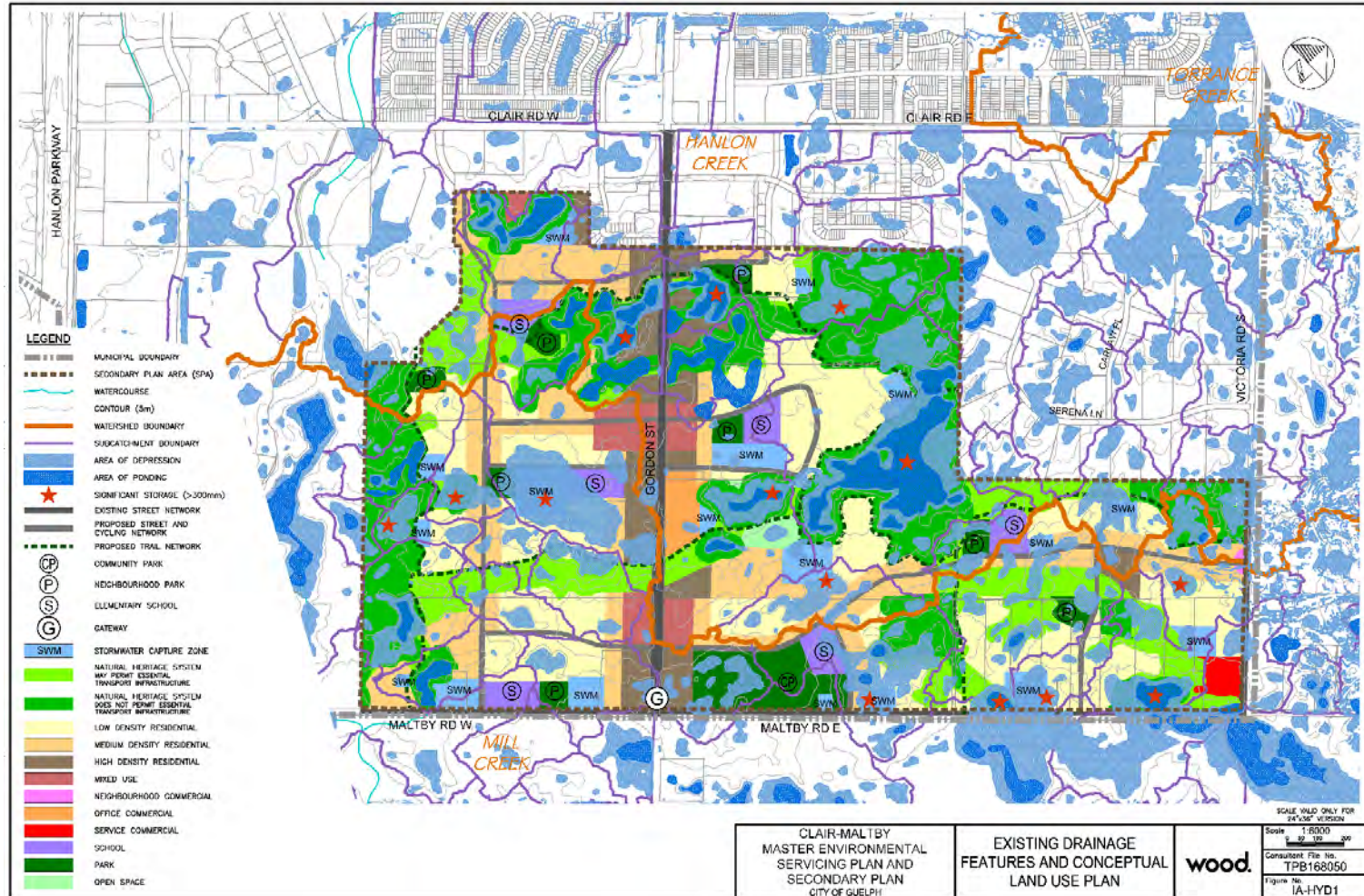
3. Impact Assessment

Land Use Plan – Schools, Parks, SWCA dimensioned



3. Impact Assessment

Surface Water – depressional overlay



3. Impact Assessment

Surface Water – *analytical approach*

- Existing conditions PCSWMM hydrologic model used to assess proposed land use plan
- NHS areas and associated depressional areas maintained within PCSWMM model
- Catchment slopes (1-5%) determined based on maintaining existing grades and setting based grades for surface water capture areas
- Soil parameterization maintained as per existing conditions
- Proposed land use impervious coverages established, while existing land use coverage maintained

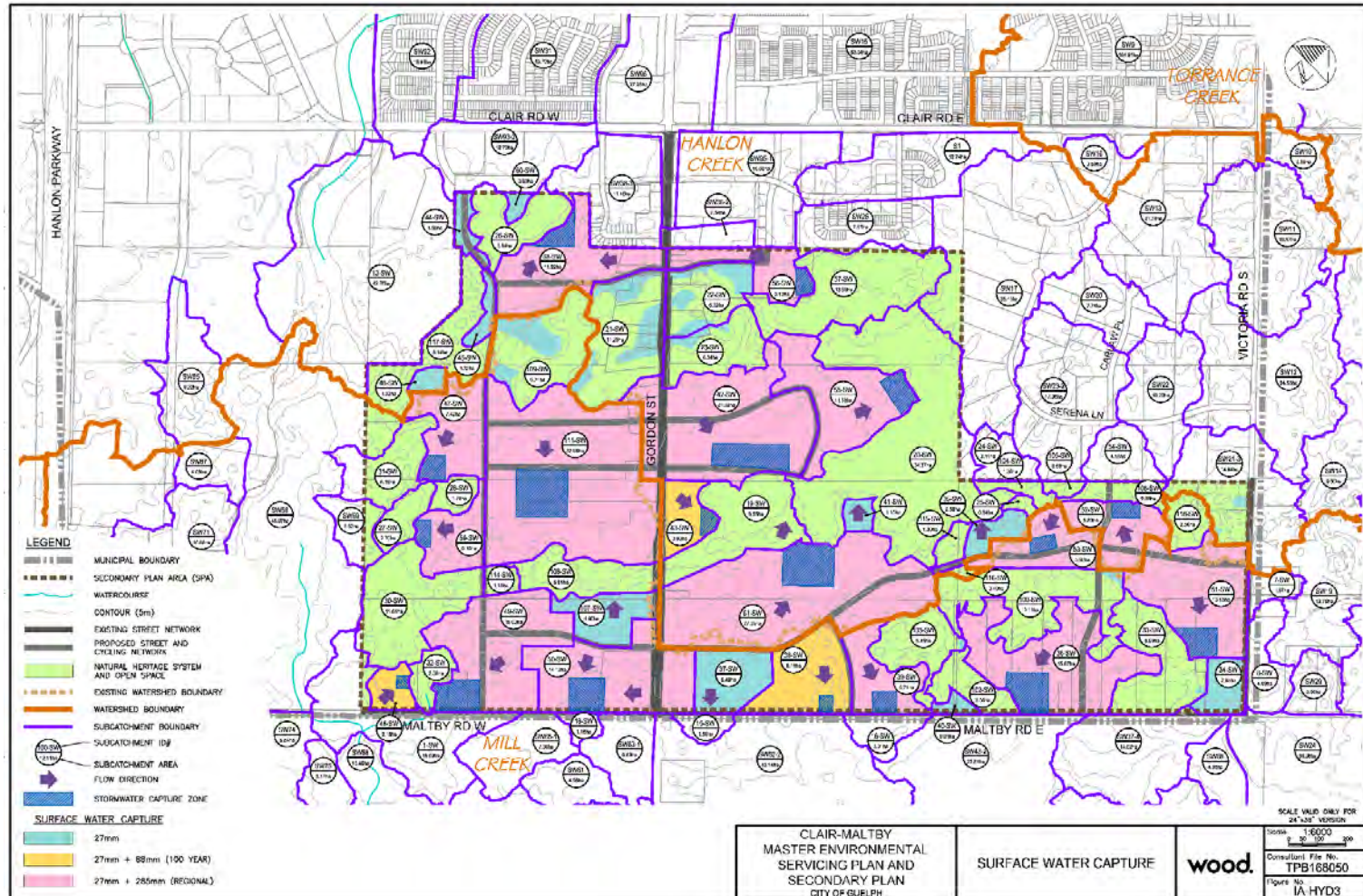
3. Impact Assessment

Surface Water: *Impervious Coverages*

Proposed Land Use Impervious Coverages		
Land Use Types	Total Imperviousness (%)	Routing Over Pervious (%)
Mixed Use	88	0
Office Commercial	85	0
Neighbourhood Commercial	85	0
Service Commercial	85	0
School	65	40
High-density Residential	80	0
Medium density Residential	70	30
Low-density Residential	65	40
ROW (Local / Collector)	65	0
ROW (Arterial)	75	0
Park (Neighbourhood)	20	25
Park (Community)	35	25
Open Space	10	100
Natural Heritage	5	100
Stormwater Management	10	100

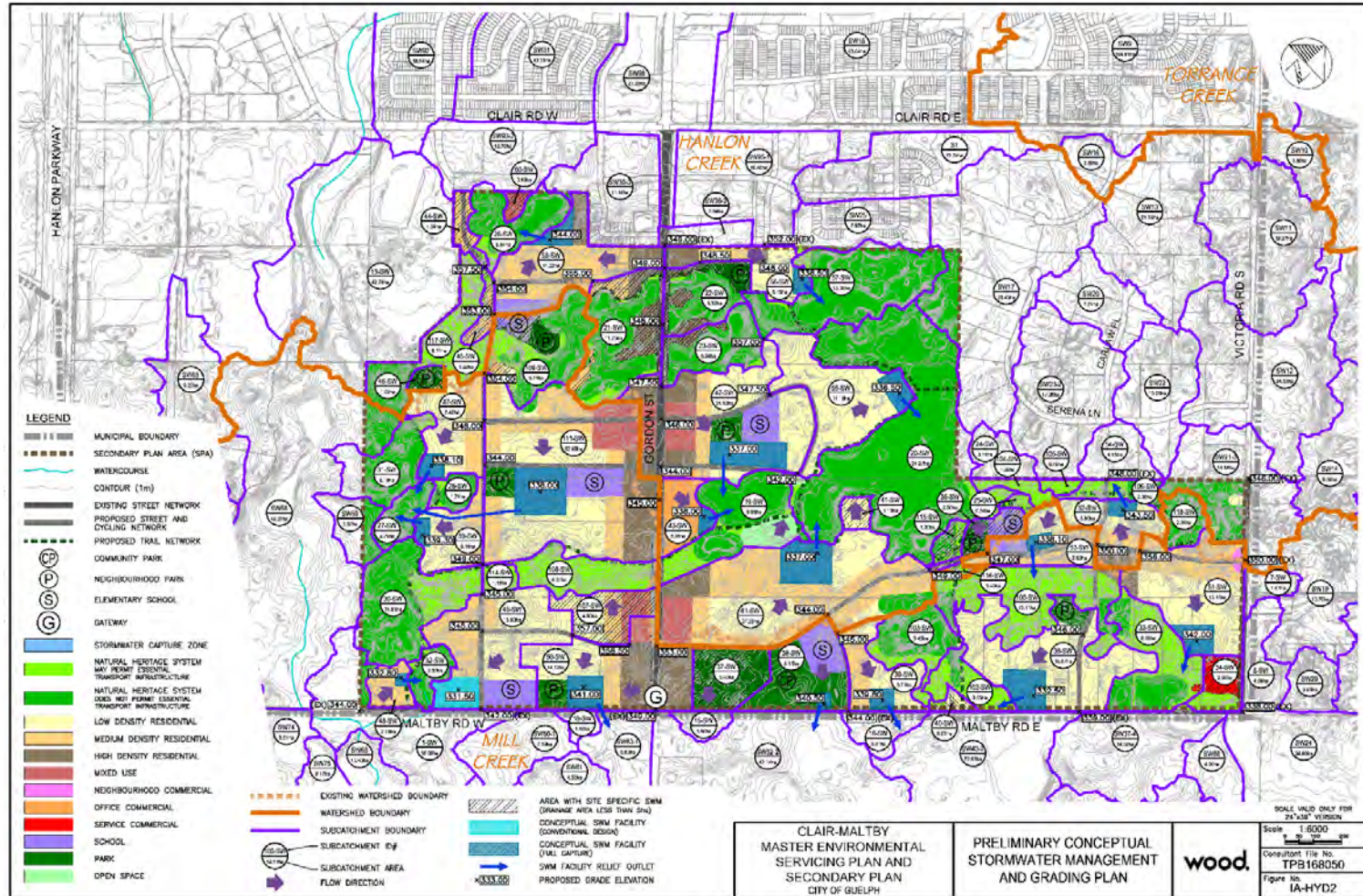
3. Impact Assessment

Surface Water: Assumed future drainage areas



3. Impact Assessment

Surface Water: SWM Layout and Grading



3. Impact Assessment

Surface Water

- PCSWMM hydrologic model used to:
 - Set existing flow targets (Hanlon / Mill)
 - Size surface water capture areas (SWCA)
 - Simulate distributed surface water management (capture at-source)

- Results show:
 - SWCA (8-11% of DA) – Regional / 100 year
 - Flow Targets met (external)
 - Surface water budget met (validated with both PCSWMM and MIKE SHE)

3. Impact Assessment

Groundwater Assessment

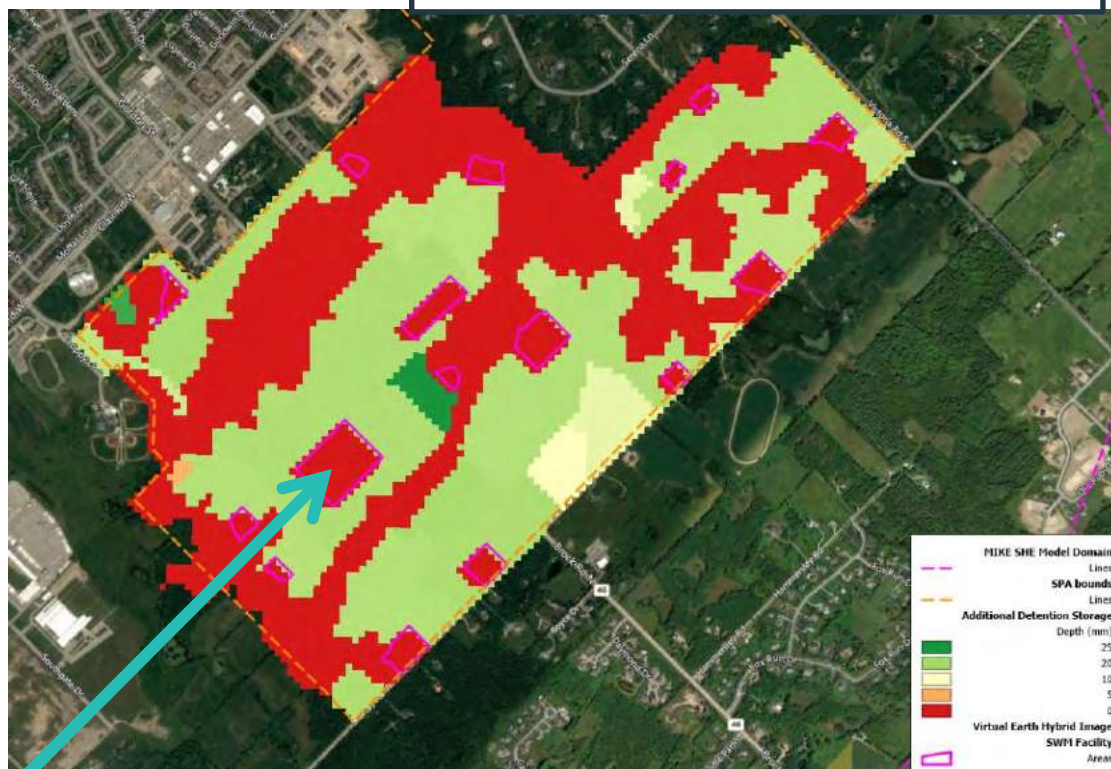
- MIKE SHE modelling:
 - Existing and proposed land use conditions
 - Simulate future land use with SWCA and distributed capture (at source)
- Metrics used include :
 - Groundwater flow directions
 - Groundwater discharge to Hanlon, Torrance, Mill Creek
 - Groundwater discharge to wetlands outside the SPA and one within the SPA.
 - Deep recharge to the bedrock aquifer, supplying Guelph municipal wells

3. Impact Assessment

Hydrogeology: *Impact Simulation Approach*

- Additional Detention Storage (LID BMPs) in new catchments
- Revised vegetation, surface roughness, directly connected impervious fractions
- Updated runoff routing to SWCA in new catchments

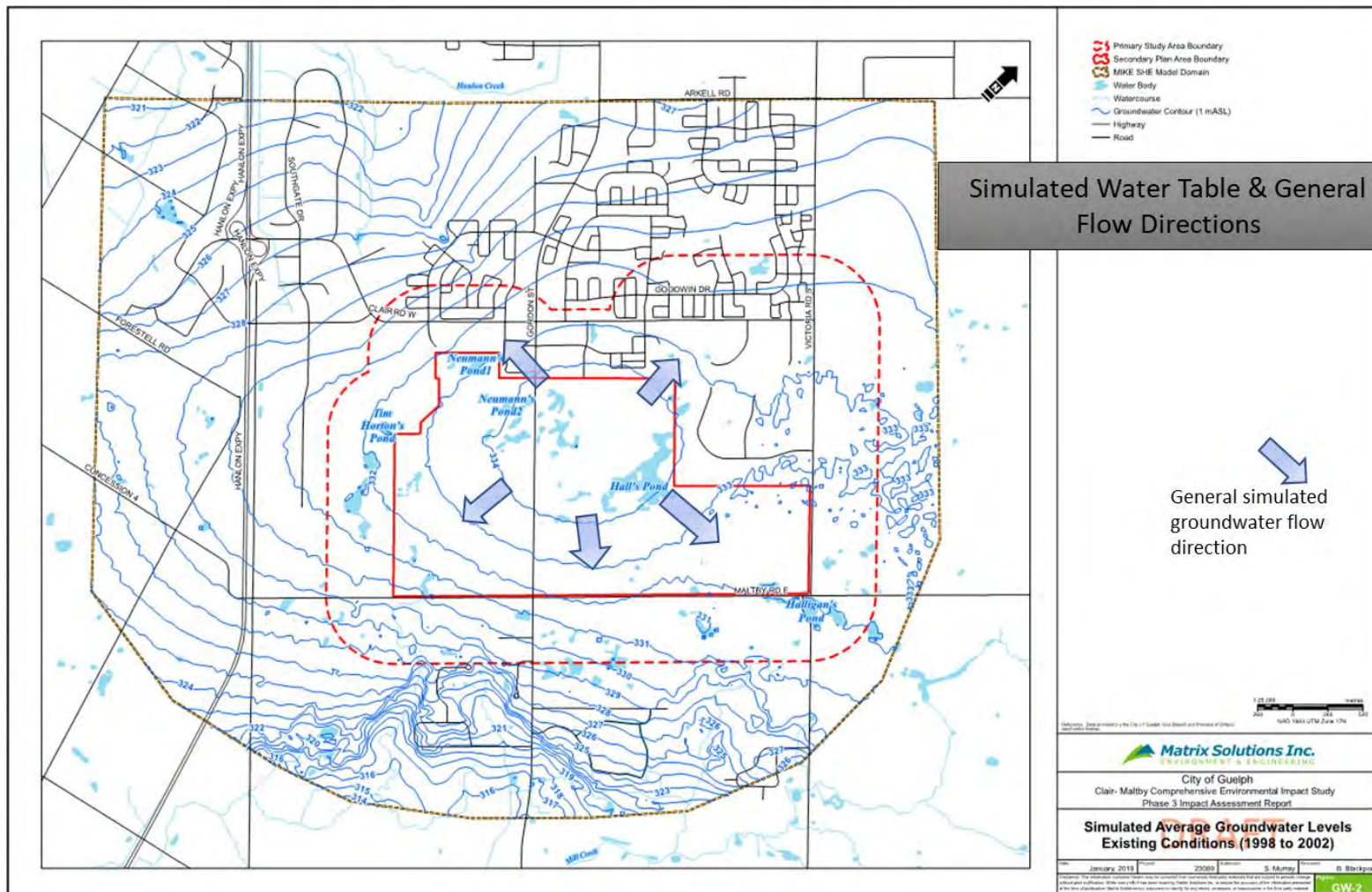
Additional Detention Storage added to new catchments



SWM Facility

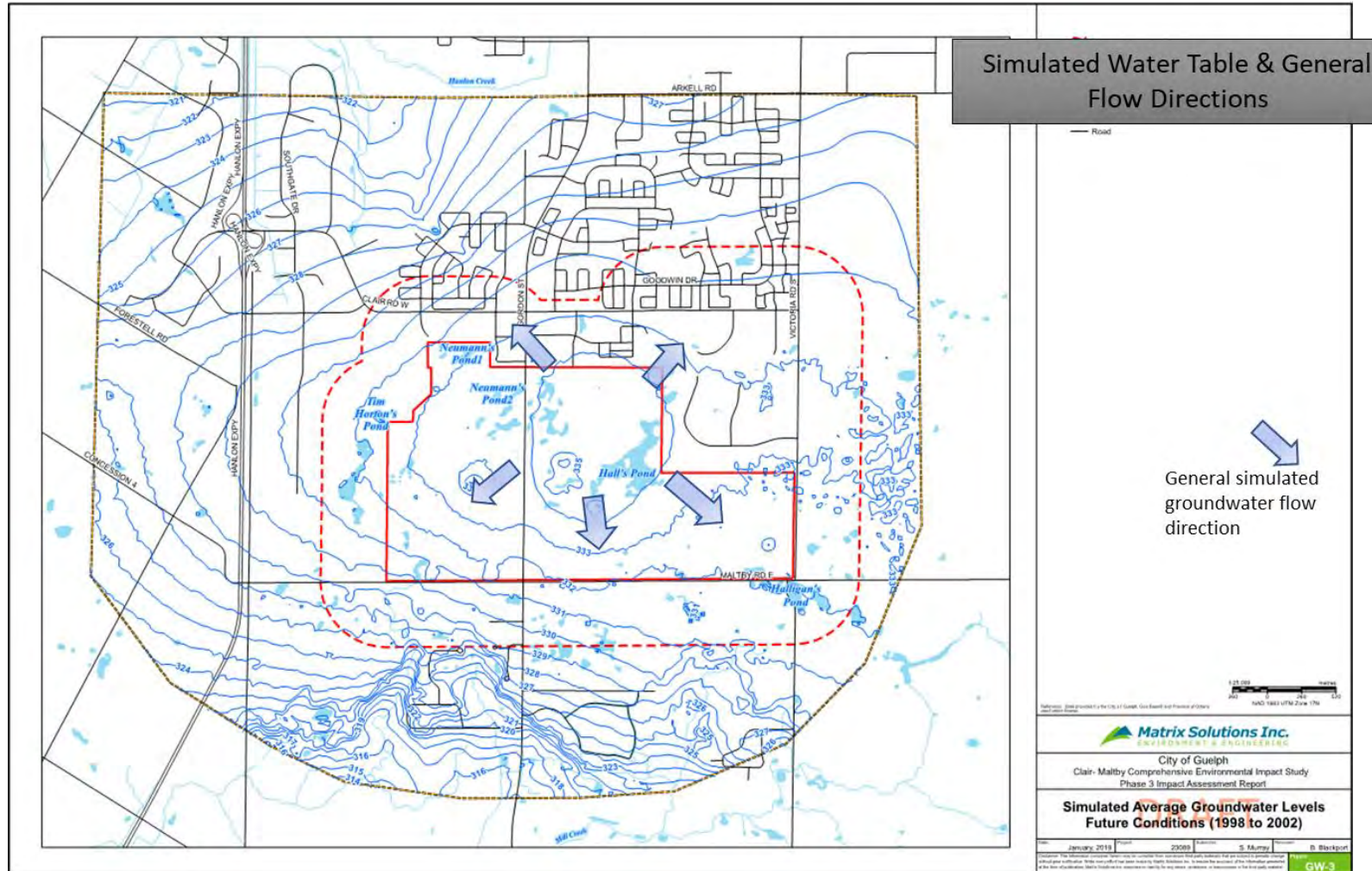
3. Impact Assessment

Hydrogeology: Existing Groundwater Flow



3. Impact Assessment

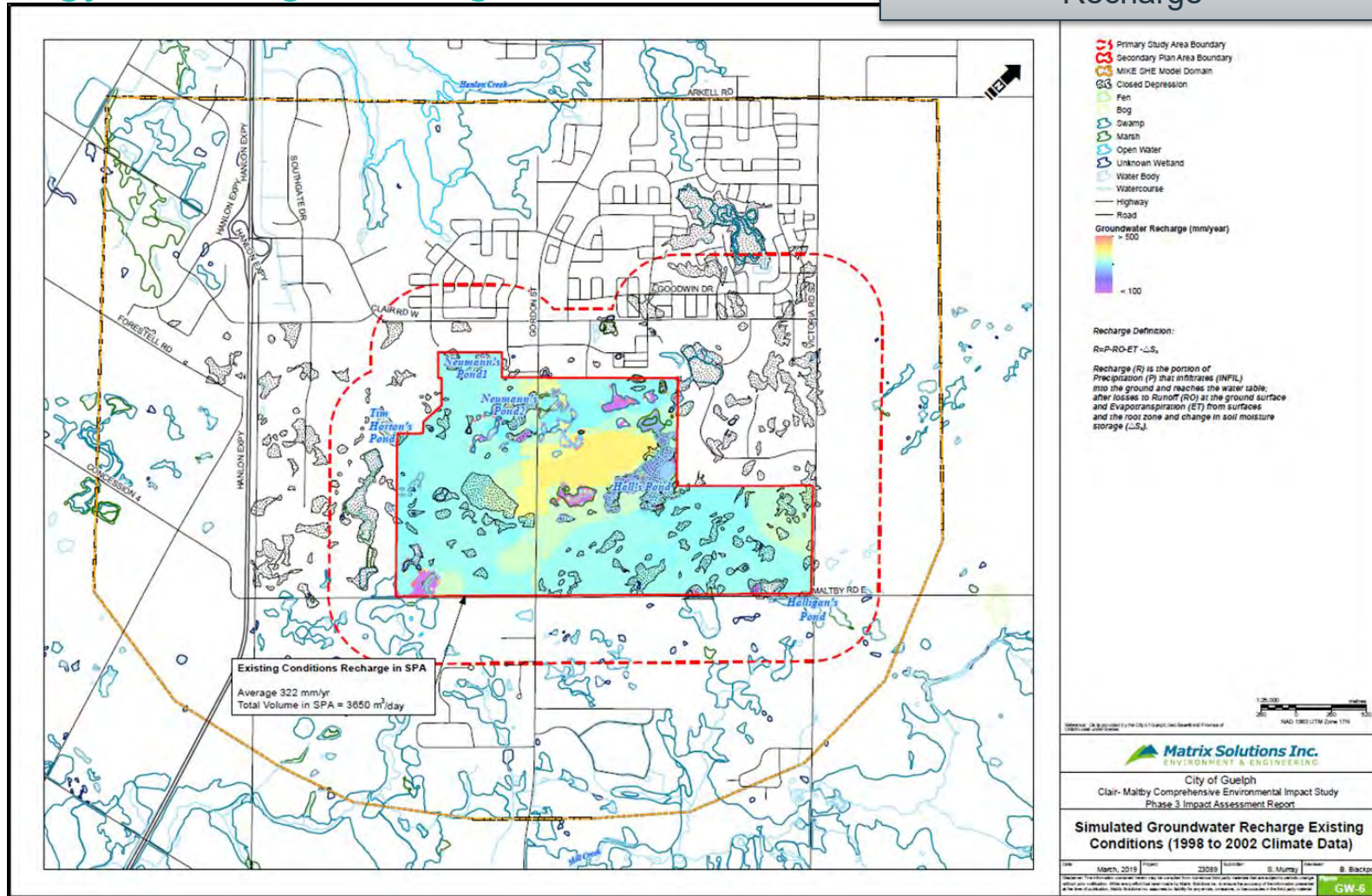
Hydrogeology: Future Groundwater Flow



3. Impact Assessment

Hydrogeology: Existing Recharge

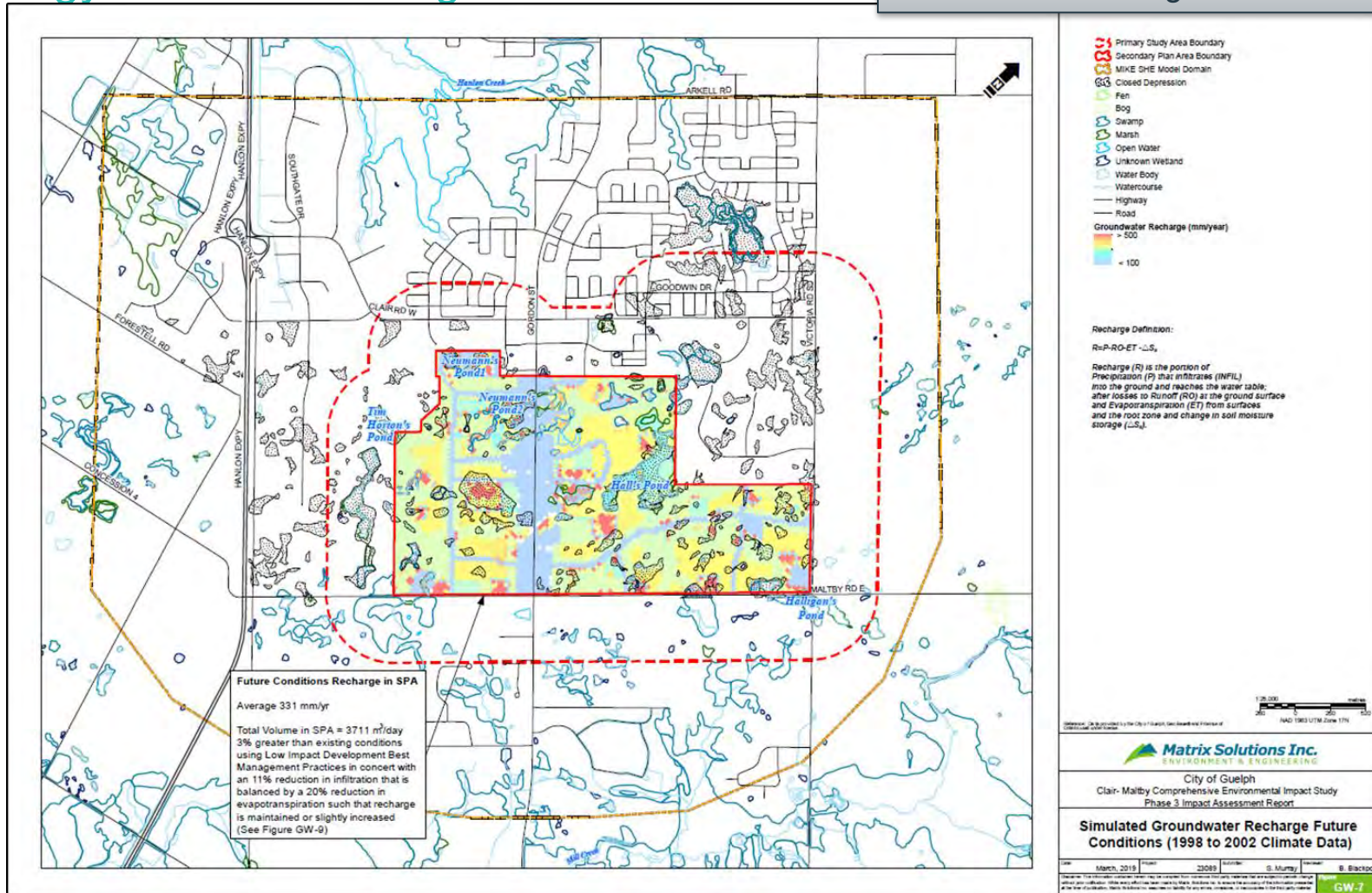
Simulated Average Annual Recharge



3. Impact Assessment

Hydrogeology: Future Recharge

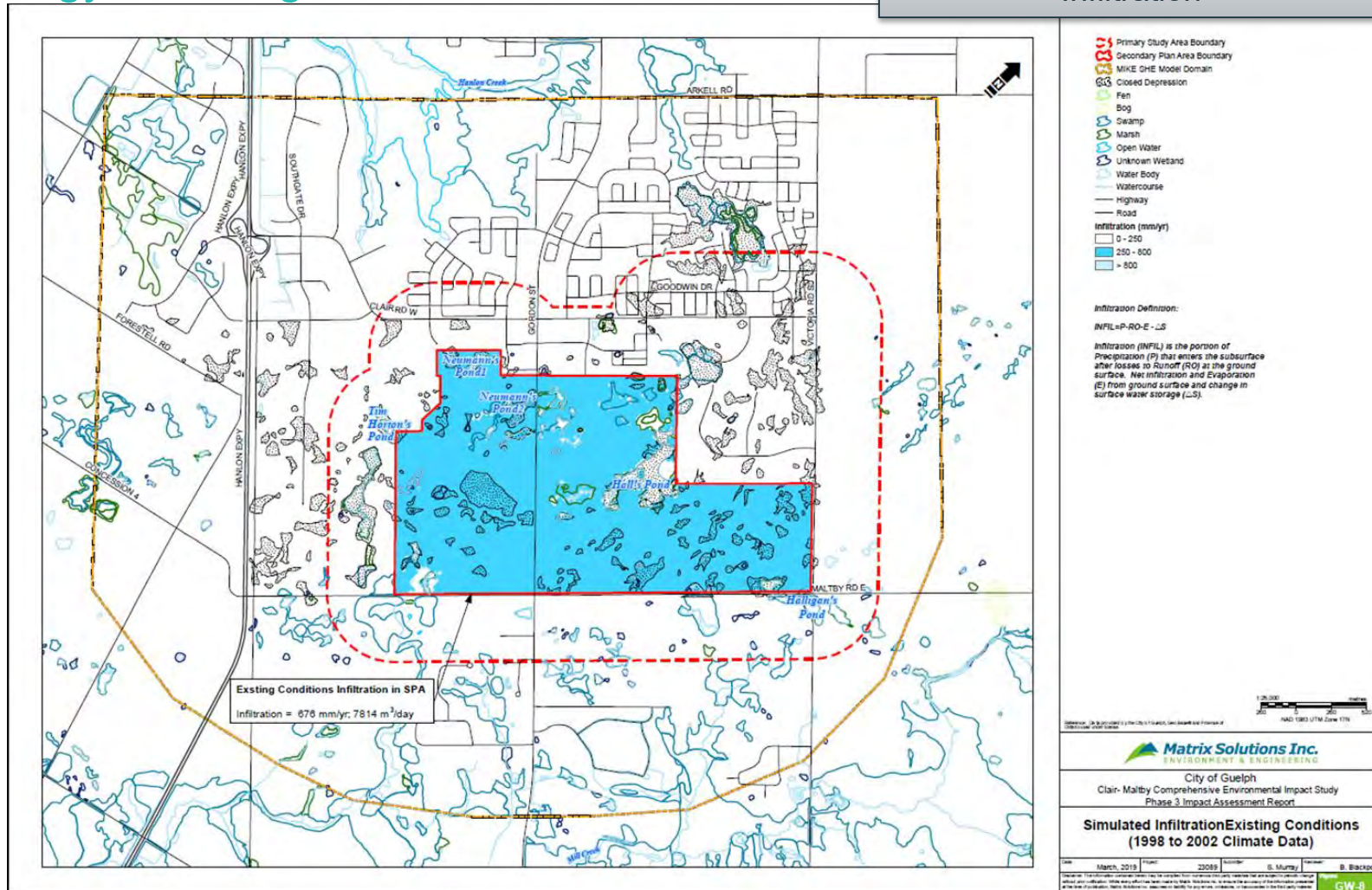
Simulated Average Annual Recharge



3. Impact Assessment

Hydrogeology: Existing Infiltration

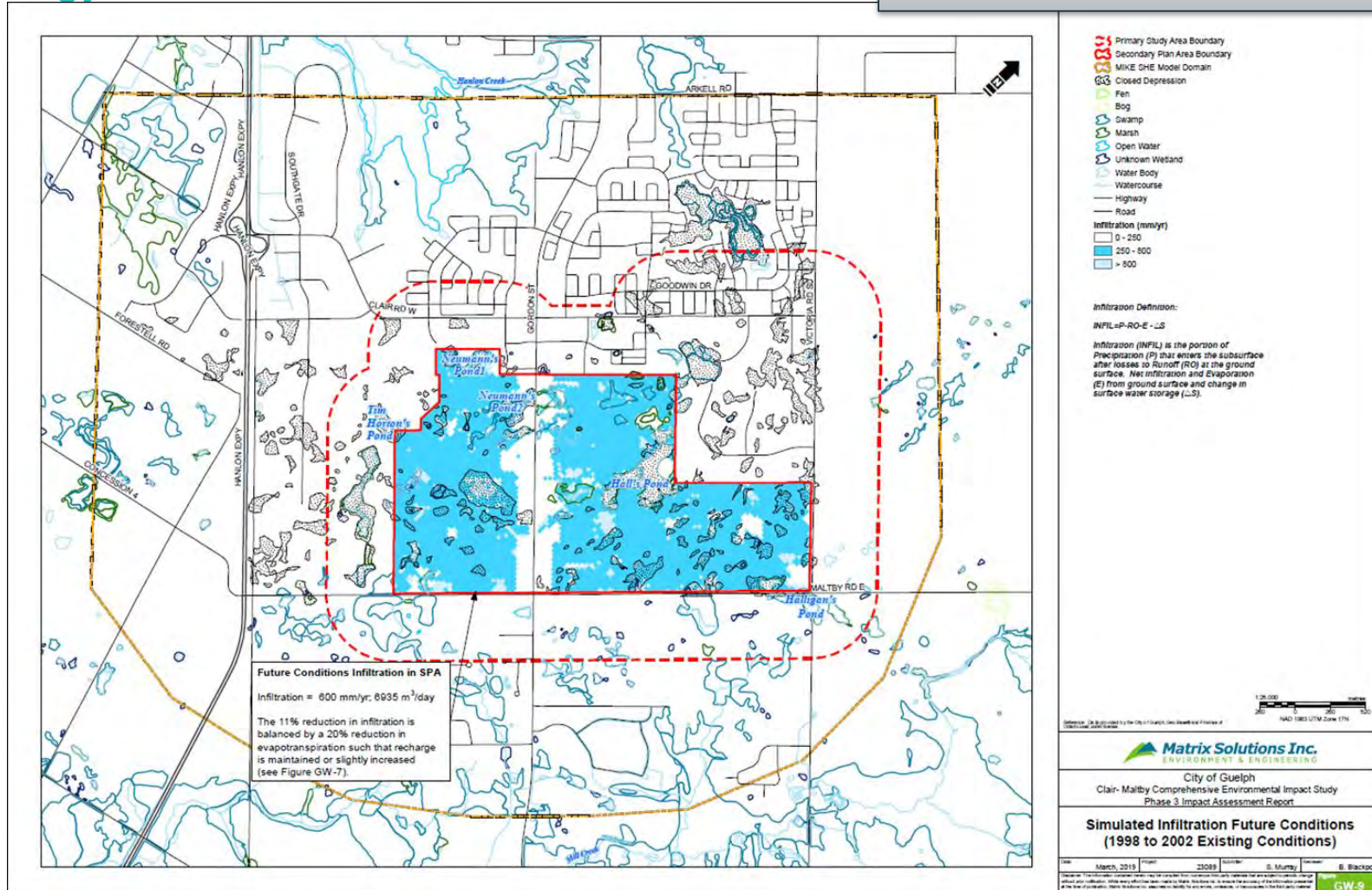
Simulated Average Annual Infiltration



3. Impact Assessment

Hydrogeology: Future Infiltration

Simulated Average Annual Infiltration



3. Impact Assessment

Hydrogeology: Summary

- **Maintained:**
 - Recharge to bedrock aquifer (flux out of the bottom of the model)
 - Groundwater flow directions and depth to water
 - Groundwater discharge to Hanlon, Torrance, Mill Creek
 - Groundwater discharge to wetlands outside the SPA, associated with Hanlon, Torrance and Mill Creek, including the area west of the SPA but east of the Hanlon
- **Potential Increases:**
 - Runoff increase into the Halls, Halligan, Neumann ponds, negligible (~2 cm increase in pond water level), not expected to influence hydroperiod
 - Further refinement to management strategy part of next round of assessment
- **Opportunities for Refinement.**
 - Potential to further optimize capture and still maintain function

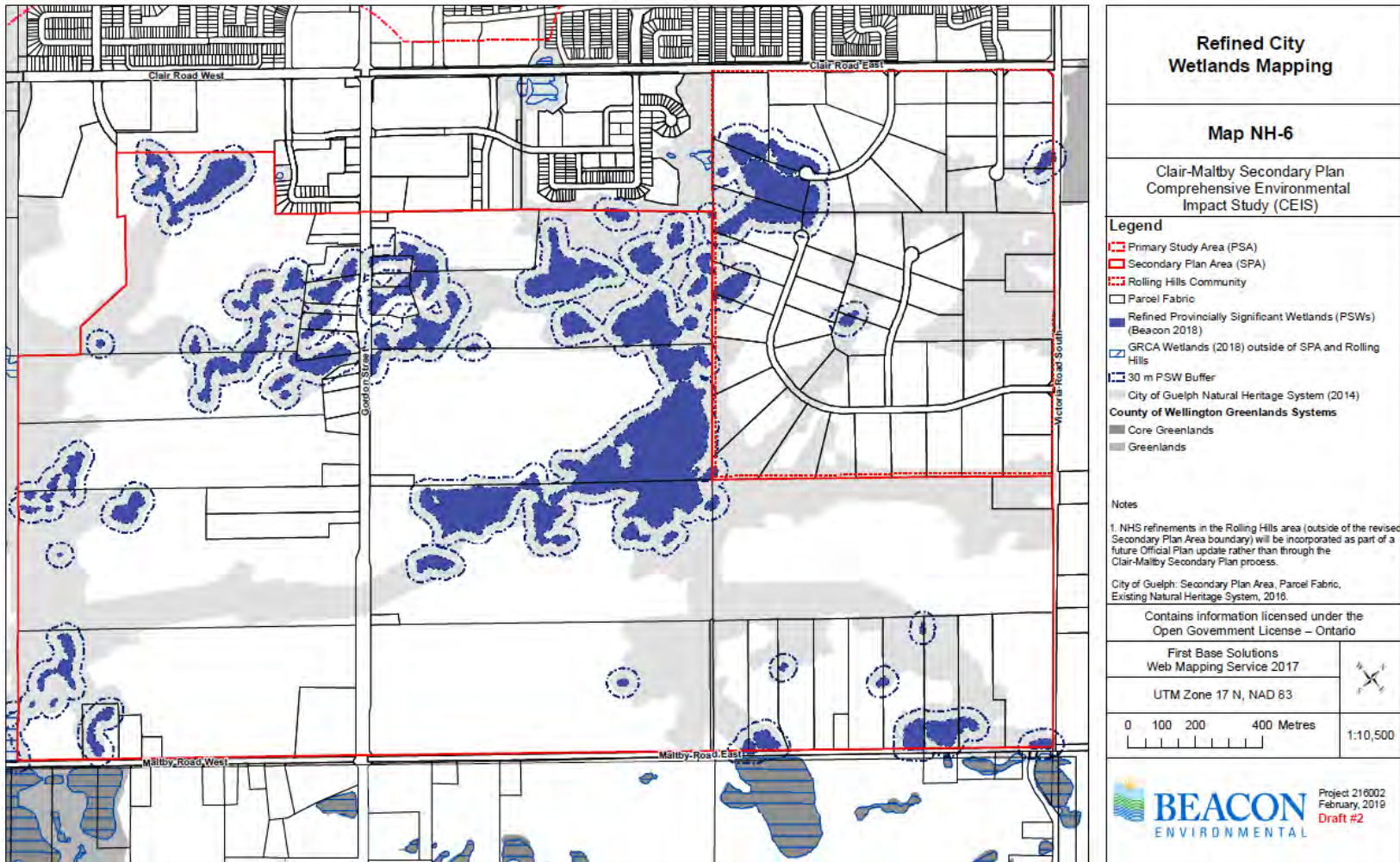
3. Impact Assessment

Natural Heritage System

- Refinement of Significant Wetlands and other Wetlands
- Refinement of Woodland areas
- Significant Wildlife Habitat
- Significant Landform
- Refinement of Ecological Linkages and Wildlife Crossings
- Input to Community Structure

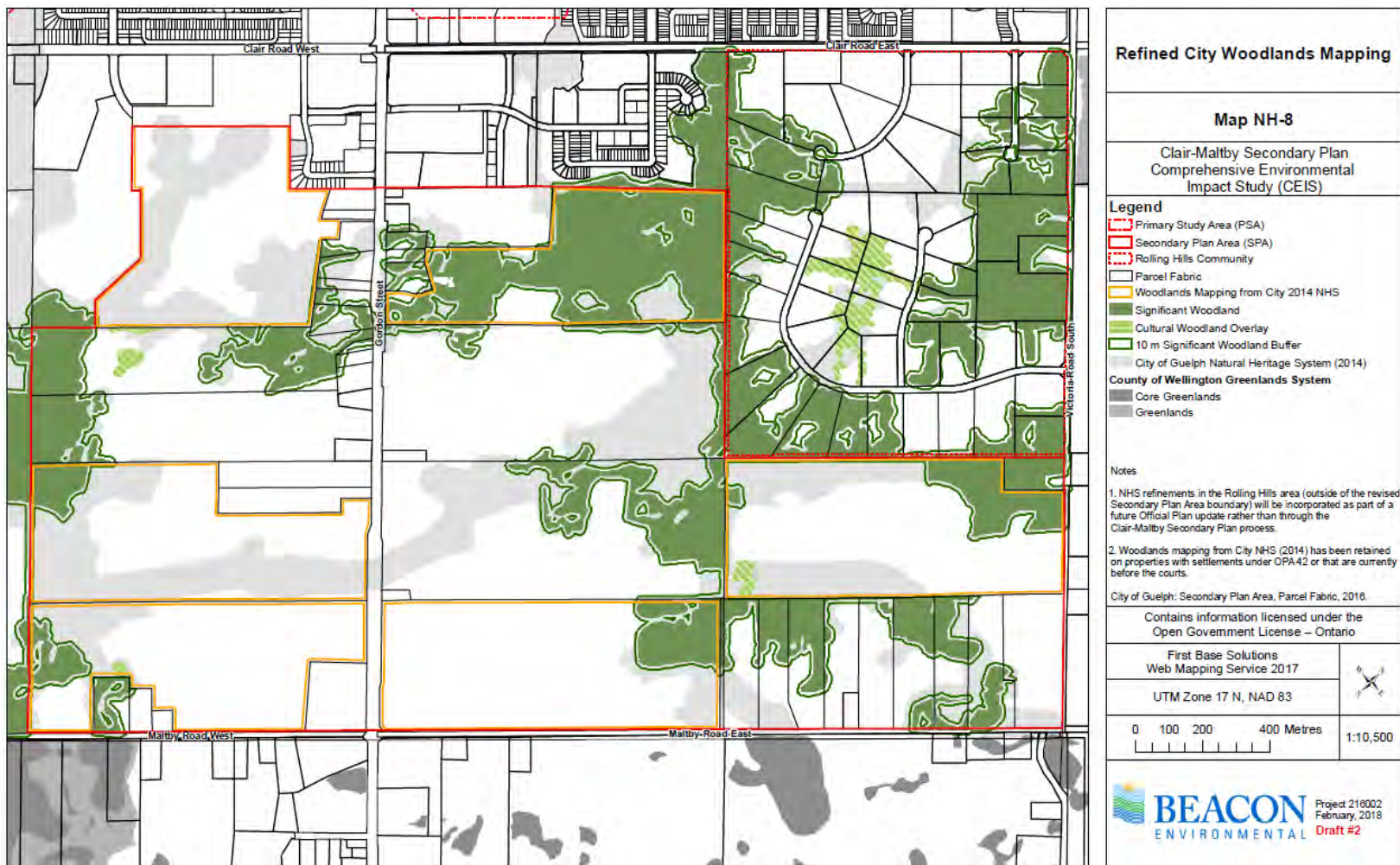
3. Impact Assessment

NHS Findings: Integrated Refined Wetlands Mapping



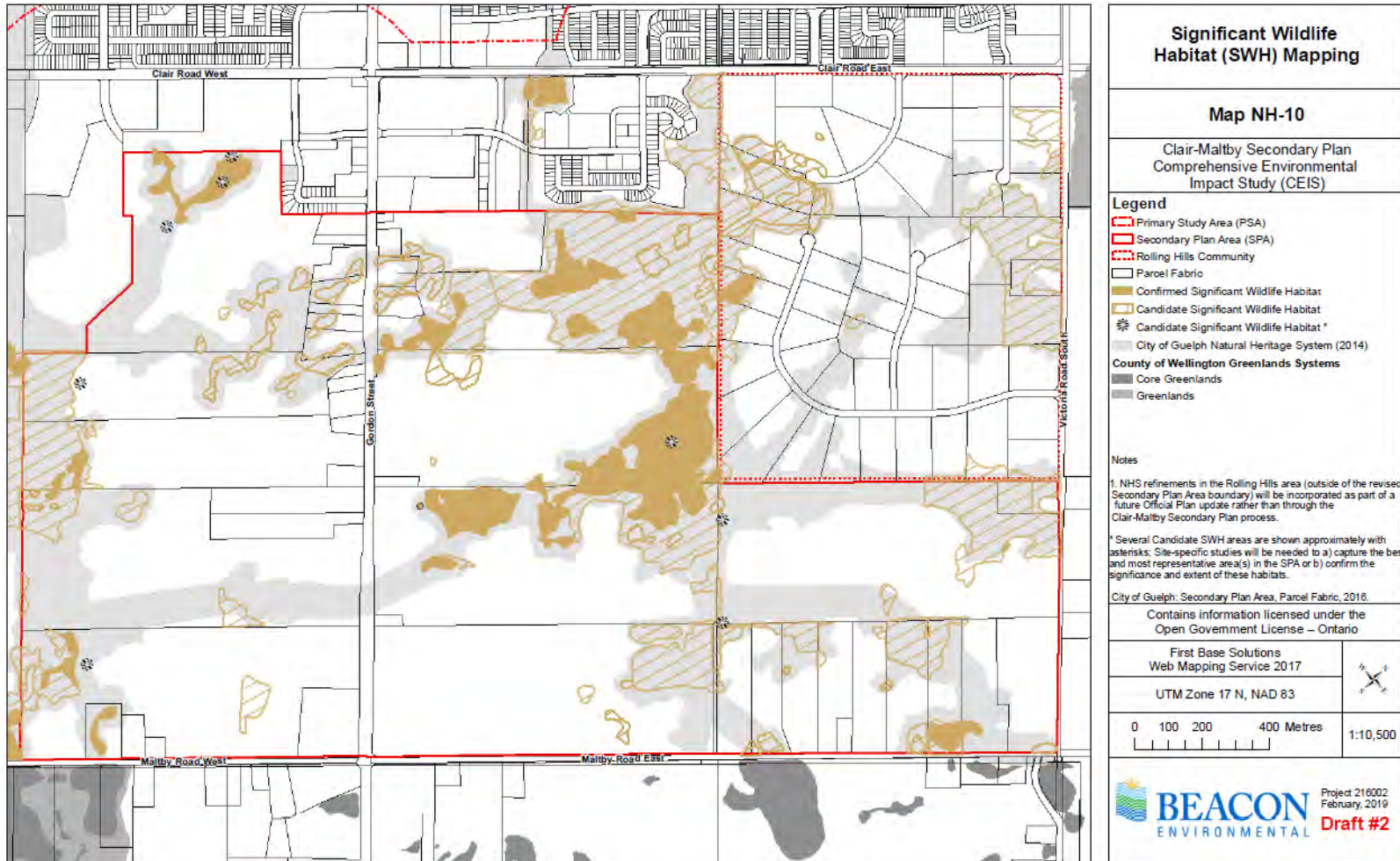
3. Impact Assessment

NHS Findings: Refined Woodlands Mapping



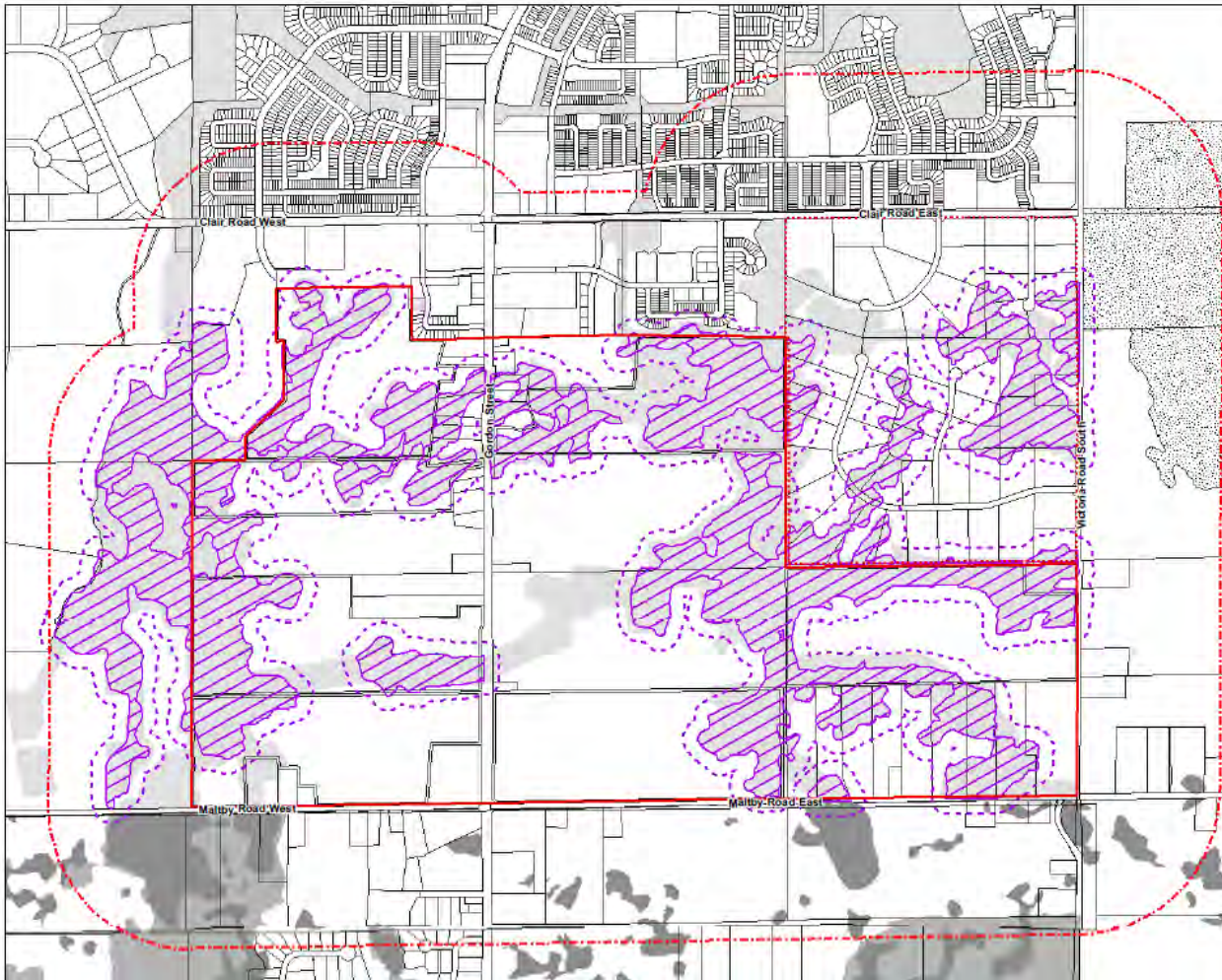
3. Impact Assessment

NHS Findings: Simplified Significant Wildlife Habitat



3. Impact Assessment

NHS Findings: Significant Landform



Significant Landform	
Map NH-13	
Clair-Malby Secondary Plan Comprehensive Environmental Impact Study (CEIS)	
Legend	
	Primary Study Area (PSA)
	Secondary Plan Area (SPA)
	Rolling Hills Community
	Significant Landform (City of Guelph 2014)
	Significant Landform (2014) 50 m Adjacent Lands Setback
	Paris Moraine Earth Science ANSI (MNR 2018)
	City of Guelph Natural Heritage System (2014)
County of Wellington Greenlands Systems	
	Core Greenlands
	Greenlands
Notes	
1. NHS refinements in the Rolling Hills area (outside of the revised Secondary Plan Area boundary) will be incorporated as part of a future Official Plan update rather than through the Clair-Malby Secondary Plan process.	
City of Guelph: Secondary Plan Area, Parcel Fabric, 2016.	
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First Base Solutions Web Mapping Service 2017	
UTM Zone 17 N, NAD 83	
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	Project 218002 February, 2019 Draft #2

3. Impact Assessment

Input to Community Structure: NHS Refinements



3. Impact Assessment

Input to Community Structure: NHS Refinements (Areas)

NHS Component	2014 NHS in the SPA (ha)	Refined NHS in the SPA (ha)	2014 NHS in Rolling Hills (ha)	Refined NHS in Rolling Hills (ha)
Significant Natural Areas	160.22	173.87	40.96	63.05
Natural Areas Overlay	0.76	4.31	1.58	3.74
Linkages	14.01	11.19	1.19	0.93
TOTALS	174.99	189.37 (14.38 net gain)	43.73	67.72 (23.99 net gain)



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4. Preliminary Management Approach and Strategies

4. Preliminary Management Approach and Strategies

Summary of Findings

- a. Flows within Hanlon and Mill Creek are low, but have baseflow from contributing groundwater discharge
- b. 93% to 97% precipitation either infiltrates or evaporates / transpires
- c. There are 47 significant depressional features with over 300 mm of storage depth
- d. Only 7 out of 47 significant depressional features (>300 mm capture) exhibited a discharge over 67 years of simulation period
- e. Surface water contributions to wetlands are significant

4. Preliminary Management Approach and Strategies

SWM Considerations

1. No on-site watercourses hence traditional 'post- to pre-' runoff targets not appropriate
2. Modelling (groundwater and surface water) has shown strong connections between surface water capture / infiltration and linkage to wetlands
3. Depressional capture of surface runoff is distributed / widespread
4. Infiltration water feeds both local ecosystems and potable aquifers



4. Preliminary Management Approach and Strategies

Stormwater Management System: *Planning Principles*

- a. 'Maintain' existing drainage boundaries
- b. 'Preserve' topography
- c. Define primary / core locations for stormwater runoff capture (SWCA)
- d. Size systems for full capture / retention of design event (100 year / Regional Storm) plus *climate change* buffer
- e. Provide relief overflow to adjacent natural features in the event of major storm beyond design capacity and to offer added resiliency for *climate change*

4. Preliminary Management Approach and Strategies

Stormwater and Groundwater Management System: *Planning Principles*

- f. Provide pre-treatment upstream of designated capture systems:
 - Separate ‘clean’ water from ‘dirty’ water
 - Oil/Grit Separators for roadways
 - Vegetated filters prior to discharge to capture zones (lined) – *treatment train*
- g. Distributed LID BMPs throughout to mimic current condition (Public / Private Realm) – further build *Climate Change* resiliency
- h. Site porous land uses adjacent / near capture zones (schools, parks, linkages) to provide buffer / resiliency

4. Preliminary Management Approach and Strategies

Groundwater Management System: *Planning Principles*

- a. Maintain groundwater flow directions and gradients
- b. Maintain groundwater discharge to Hanlon, Torrance and Mill Creeks
- c. Maintain groundwater discharge to wetlands outside SPA and one (1) within the SPA
- d. Maintain deep recharge to bedrock aquifer, supplying Guelph municipal wells

4. Preliminary Management Approach and Strategies

Natural Heritage System: *Planning Principles*

Aquatic Habitats

- a. Protect fish habitat in accordance with applicable Federal regulations
- b. Protect, conserve, mitigate or maintain headwater drainage features in accordance with City and GRCA policies with consideration for relevant guidelines

Protected Species Habitat and Specialized Habitats

- c. Protect habitat for Provincially Endangered and Threatened species in accordance with the *Endangered Species Act (2007)* and in consultation with the appropriate Ministry
- d. Protect confirmed habitat for Significant Wildlife Habitat and habitat of locally significant species in accordance with the City of Guelph's policies with consideration for applicable Provincial guidance

4. Preliminary Management Approach and Strategies

Natural Heritage System: *Planning Principles (continued)*

Terrestrial Habitats (including Wetlands)

- e. Protect Significant Wetlands, Significant Woodlands, Other Wetlands, Cultural Woodlands and their buffers in accordance with applicable Provincial, GRCA and City policies
- f. Ensure pre-development area-specific water balances within each catchment are maintained to sustain feature hydrology
- g. Ensure the water quality of all protected wetlands is maintained or improved
- h. Pursue opportunities to enhance local biodiversity through naturalization

Significant Landform

- i. Ensure no net loss of designated Significant Landform areas
- j. Protect the functional characteristics of Significant Landform areas (including associated drainage and natural heritage functions)
- k. Integrate Significant Landform into the community such that its visual uniqueness is not negatively impacted

4. Preliminary Management Approach and Strategies

Natural Heritage System: *Planning Principles (continued)*

Ecological Linkages and Connectivity

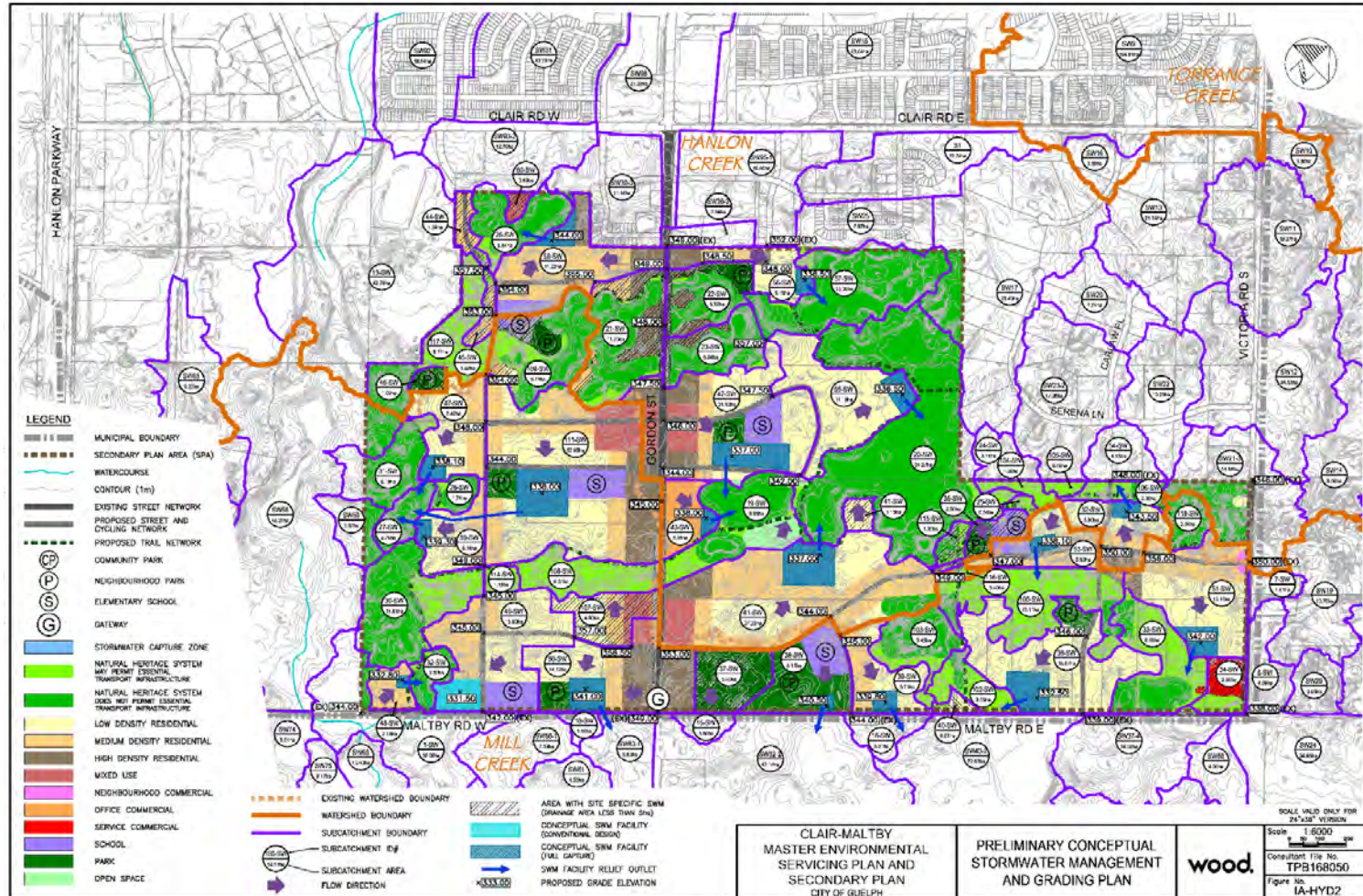
- l. Maintain connections between and among Significant Natural Areas and protected Natural Areas in accordance with Provincial and City policies, and also considering connectivity to natural areas outside the City
- m. Pursue opportunities to support and enhance local biodiversity and connectivity through restoration, naturalization and implementation of measures to provide for safe wildlife movement across roads

Minimize and manage encroachments into the NHS by:

- n. Having a sensitively designed trail system that balances access and connectivity with NHS protection
- o. Committing to ongoing stewardship education and engagement
- p. Implementing strategies intended to manage encroachments (e.g., fencing, dog parks, etc.) as the Secondary Plan is implemented

4. Preliminary Management Approach and Strategies

Proposed Conditions



Questions?

Wrap up and Next Steps

- Technical information to inform amendments to the Preferred Community Structure
- May 13 - Planning Council
 - Final Directions Report
 - Project Timelines

From: Arun Hindupur
Sent: Wednesday, August 28, 2019 11:37 AM
To: 'TREVOR DICKINSON' <tdickinson@rogers.com>
Subject: RE: CONFIRMED - Meeting to Discuss Clair-Maltby

Hi Professor,

Thanks for the kind words.

I'm glad you found it informative and I too got a better appreciation for the value of providing a different perspective in terms of a more effective way at communicating and packaging the data to tell a meaningful story.

Please don't hesitate to reach out if you have any questions or concerns.

Thanks,
Arun

Arun Hindupur, M.Sc., P.Eng. | Supervisor, Infrastructure Engineering
Engineering and Transportation Services
City of Guelph

T 519-822-1260 x 2282 | F 519-822-6194
E arun.hindupur@guelph.ca

guelph.ca

From: TREVOR DICKINSON <tdickinson@rogers.com>
Sent: Monday, August 26, 2019 3:59 PM
To: Arun Hindupur <Arun.Hindupur@guelph.ca>
Subject: Re: CONFIRMED - Meeting to Discuss Clair-Maltby

Arun,

Heartfelt thanks for arranging the meeting today.
I found it quite informative, and hope that the discussion helped others in the group also.

Sincerely,
Trevor

On Monday, August 26, 2019, 12:35:40 p.m. EDT, Arun Hindupur <Arun.Hindupur@guelph.ca> wrote:

From: W.Trevor Dickinson <wdickins@uoguelph.ca>
Sent: Thursday, June 6, 2019 4:33 PM
To: Arun Hindupur <Arun.Hindupur@guelph.ca>
Subject: Re: Claire Maltby

Arun,

I am still looking for monthly or seasonal summary pictures of:

surface runoff and groundwater recharge
for the land-locked depressional areas and the upland mini-watershed catchment areas
for the present land use conditions and the final developed conditions.

e.g

When does surface runoff occur now - into depressions, and into the streams?

When does recharge occur now? Where?

When will surface runoff occur after development - into depressions, and into the streams?

When will recharge occur after development? Where?

In other words, how does the hydrologic picture change? For which months and seasons does the picture remain about the same, if that indeed occurs? And for which months and seasons does the picture become very different?

What then are the ramifications?

That in a nutshell is the crux of the matter, and annual water balances don't cut it!

Sorry to be such a pest! But I would love to see a decent hydrologic study of this area - and I think the public is entitled to one!

Sincerely,
Trevor Dickinson
Professor Emeritus
University of Guelph

From: Arun Hindupur <Arun.Hindupur@guelph.ca>

Sent: Thursday, June 6, 2019 1:20 PM

To: W.Trevor Dickinson

Subject: RE: Claire Maltby

Hi Professor,

My apologies but I'm still not sure if we are referring to the same documentation? For example, Section 2.0 (page 6) of the report below provides a lengthy discussion of the characterization of the study area and Section 4.0. (Page 50) provides a discussion on the associated impact assessment under a development scenario.

<https://guelph.ca/wp-content/uploads/19-03-06-CMSP-Phase-3-Impact-Assessment-CEIS-UPDATE-08-Mar-19.pdf>

Below are screen shots of the sections in the report which I reference above. As you will see there is a considerable amount of text and discussion which goes beyond tables, numbers and computer output.

2.0 Summary of Phase 1/2 Characterization and Integration

2.1 Synopsis of Discipline Findings

The Phase 1/2 Characterization and Integration Report provided the existing conditions findings from each discipline and integrated the discipline specific findings to established guidance in developing and assessing various Conceptual Community Structures. The following provides a summary of key information from the Phase 1/2 Characterization discipline findings:

2.1.1 Hydrology

The purpose of developing hydrologic and hydraulic models for urbanizing subwatersheds is to provide a better understanding of the operative factors which influence the amount and movement of water in the system, both under existing land use and proposed future land use conditions. By developing representative numerical models, which reasonably predict seasonal and storm-based runoff response, the impacts of proposed future urbanization can be better quantified and thereby appropriate management strategies can be established in the future, as part of integrated management plans.

2.1.1.1 Drainage Systems

The Clair-Maltby SPA is located within the headwaters of the Torrance Creek Subwatershed, the Hanlon Creek Subwatershed and the Mill Creek Subwatershed, within the mid portion of the Grand River Watershed. The approximate contributing drainage areas within each Subwatershed within the Clair-Maltby SPA are summarized in Table 2.1.1.

Subwatershed	Approximate Total Drainage Area (ha)	Percentage of the Clair Maltby SPA (%)
Torrance	5.24	1.0
Hanlon	320.90	60.0
Mill	209.17	39.0
Total Area	535.31	100

The lands within the Hanlon Creek Subwatershed generally drain overland to the northwest corner of the Clair-Maltby SPA. As per the Torrance Creek Subwatershed, the lands within the Hanlon Creek Subwatershed represent the headwaters of that subwatershed. Within the Hanlon Creek Subwatershed, the area within the Clair-Maltby SPA is also characterized by depressional features that result in little to no overland runoff to the defined watercourse system located north of the Clair-Maltby SPA; instead drainage is largely conveyed from the Clair Maltby SPA to the open watercourse via groundwater contributions.

The lands within the Mill Creek Subwatershed represent the headwaters of that Subwatershed and discharge toward the open watercourse system located south of Maltby Road South. The Mill Creek Subwatershed has a significant number of depressional features that contribute to the local ground water system (Figure HYD1).

2.1.1.2 Field Monitoring

To understand and assess the Clair Maltby study area's unique surface water / ground water system and associated natural features character...



4.0 Phase 3 Impact Assessment

A detailed assessment of the Preferred Community Structure (ref. Figure 3.3) has been completed to determine the potential impacts of the future development to the local and neighbouring environmental systems and features, and to establish preliminary management requirements accordingly, as detailed in the following sections. The key findings of this assessment serve as input to the refinement process to update and finalize the Preferred Community Structure and ultimately establish the recommended management strategies.

4.1 Hydrology (Surface Water)

The Preferred Community Structure includes various land uses (distributed throughout the SPA). Four (4) land uses, namely Neighbourhood Parks (P), Community Parks (CP), schools (S) and stormwater infiltration areas or surface water capture areas (SWCA) have been provided as general locations within the Community Structure (i.e., through corridors). To establish future drainage patterns, the preliminary location of parks and schools has been refined and sized based on the guidance from the City of Guelph. In accordance with the guidance from the City each park or school site would be sized generally as per the following:

- Neighbourhood Park: 1 ha/park
- Community Park: 10 ha
- School: 2 ha/ school

Both parks and schools have been located as indicated in the Preferred Community Structure and then adjusted slightly based on existing topography, connections of the land use to the NHS and connections to the community via the proposed road network. The remaining land uses include residential (low, medium and high density), mixed use, commercial (neighbourhood), office and service) and the natural heritage system.

Surface Water Capture Areas (SWCA) have been located based on the initial location within the Preferred Community Structure and then adjusted based on maintaining and preserving drainage areas and drainage patterns. SWCAs where possible have been located adjacent to the NHS and the more porous land uses (i.e. parks and schools and linkages with lower impervious coverages). The SWCAs will be dry during non-precipitation events, as such there is the potential to integrate and enhance the public usage (i.e. recreational) of SWCAs by being located adjacent to (i.e. these uses parks and schools). The locations for SWCA have also considered the most significant depressional features which currently provide 300 mm or greater runoff capture, and when feasible have been located within those depressional features. To maintain existing drainage patterns and hydrologic functions, the SWCAs have been located at, or near, existing drainage outlets to the NHS, or at the low points within the existing hummocky topography. The Preferred Community Structure with the parks, schools and SWCAs spatially laid out is provided in Figure LU1. The SWCA and associated other stormwater management measures would need to be evaluated through an EA process prior to the preferred stormwater management strategy being selected.

Hydrologic Impact Assessment

The validated PCSWMM existing condition hydrologic model prepared for the Phase 1 and 2 Characterization Report provides the base model from which to assess the Preferred Community Structure. In order to develop a preliminary drainage area plan, first the existing drainage boundaries and depressional features have been overlaid on the Preferred Community Structure (ref. Figure 1A-4(VDI)) and then proposed

Perhaps I'm missing something but please let me know if this content is not what you are looking for.

Thanks,
Arun

From: W.Trevor Dickinson <wdickins@uoguelph.ca>
Sent: Thursday, June 6, 2019 11:38 AM
To: Arun Hindupur <Arun.Hindupur@uoguelph.ca>
Subject: Re: Claire Maltby

Arun,

Yes, I have seen and reviewed the documents to which you referred. They include volumes of tables and numbers,

but no clear summary tables or graphs relating to the questions that I raised. In other words, there are pages upon pages of computer output, with no clear discussion of the results or conclusions.

I'm sorry, but such a report is of very little use to readers, be they members of city council, lay members of the public or hydrologic scientists.

Sincerely,
Trevor Dickinson
Professor Emeritus
University of Guelph

From: Arun Hindupur <Arun.Hindupur@guelph.ca>
Sent: Thursday, June 6, 2019 11:24 AM
To: W.Trevor Dickinson
Subject: RE: Claire Maltby

Hello Professor,

Sorry for delayed response. We did receive your email and have been discussing your questions with our consulting team. Just out of curiosity, in your email from May 14th, you mentioned that *"....I have had great difficulty finding adequate attention paid to such questions in the reports that have been prepared to date."*. I just want to confirm that you have access and have consulted the all the relevant documents prepared for the study which can be found through the following link:

<https://guelph.ca/plans-and-strategies/clair-maltby-secondary-plan/cm-documents/>

Specifically, Task A: Comprehensive Environmental Impact Study (CEIS) has a number of documents that I think may address the questions you have posed.

If you still have questions after reviewing this material, please reach out and we can chat further.

Regards,
Arun

Arun Hindupur, M.Sc., P.Eng. | Supervisor, Infrastructure Engineering
Engineering and Transportation Services
City of Guelph

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guelph.ca

From: W.Trevor Dickinson <wdickins@uoguelph.ca>

Sent: Thursday, June 6, 2019 11:02 AM

To: Arun Hindupur <Arun.Hindupur@uoguelph.ca>

Subject: Claire Maltby

Arun,

Quick question: Were you, or someone else, planning on getting back to me regarding the list of questions that I sent to you on May 14th?

Many thanks for giving this matter your consideration.

Trevor Dickinson
Professor Emeritus
University of Guelph

Appendix F

Halls Pond Assessment

A large, light gray curved shape, resembling a thick arc or a partial circle, is positioned in the lower half of the page. It starts from the left edge and curves towards the bottom right corner, framing the text above it.

MEMORANDUM

TO: Stacey Laughlin, MCIP, RPP, City of Guelph

CC: Ron Scheckenberger, M.Eng., P.Eng., Wood plc
Steve Chipps, P.Eng., Wood plc
Margot Ursic, M.Sc., Beacon Environmental
Rob Aitken, B.Sc., Beacon Environmental
Bill Blackport, M.Sc., P.Geo., Blackport and Associates

FROM: Steve Murray M.Sc., P.Eng., Matrix Solutions Inc.
Daron Abbey, M.Sc., P.Geo., Matrix Solutions Inc.

SUBJECT: Halls Pond Water Level Uncertainty Analysis and Mitigation Measures

DATE: May 11, 2021

VERSION: 2.0

The following memo summarizes the findings of the Halls Pond Water Level Uncertainty Analysis and Mitigation Measures work plan undertaken by the project team as supplemental work in support of the Clair-Maltby Comprehensive Environmental Impact Study (CEIS) on behalf of the City of Guelph over the fall of 2020 and early winter 2021.

1 INTRODUCTION

The Clair-Maltby Secondary Plan (CMSP) area is located within the hummocky headwaters of several watersheds on the Paris Moraine. Due to its topography and geology, the primary surface water features across the areas are isolated wetlands of various sizes scattered across the CMSP area. While all wetlands can be impacted by urbanization directly through physical modification (e.g., grading, filling), isolated wetlands are particularly sensitive to changes within the surface water catchment and/or areas contributing groundwater to the wetland.

Urbanization tends to change the hydrologic regime of the wetland by increasing stormwater runoff and decreasing groundwater recharge, while also increasing pollutant loading, thereby reducing water quality. Changes in the hydrologic regime of wetlands can impact their vegetative structure and composition as well as their biological functions (e.g., amphibian breeding grounds, etc.) as well as some of the associated functions in the adjacent areas (e.g., waterbird nesting areas; TRCA 2011).

The hydrology of wetlands tends to vary naturally over the course of the season and can also vary from year to year depending on the climactic conditions. To maintain the biological functions of wetland areas, changes in the hydrologic regime (i.e., quantities, frequency, and quality of water inputs and outputs) due to urbanization must be managed to maintain the hydroperiod (i.e., length of time and portion of the year a wetland holds ponded water) comparable to its pre-urbanization condition. Specifically,

Maintaining hydrological regimes and hydroperiods means the volume, duration, frequency, timing and spatial distribution of water does not cause a negative impact to wetlands, their ecological functions, and the larger natural heritage system (TRCA 2011).

For this project, the future conditions (i.e., urbanized) scenario was simulated using the MIKE SHE model, first in relation to the Initial Preferred Community Structure (May 2018) and then using the Updated Preferred Community Structure (May 2019). The initial long term (2003-2017) simulations undertaken using the Updated Preferred Community Structure found that, in general, pre- and post-development conditions were comparable from a surface/groundwater perspective with the proposed management measures. However, one unexpected and somewhat localized impact that was identified from the wetland water balance assessments was a projected slow but cumulative increase in water levels for the Halls Pond provincially significant wetland (PSW) complex in the center of the CMSP area. The modelling predicted that water levels in the Halls Pond PSW could increase as much as 26 cm over a 15-year period.

In addition, the Updated Preferred Community Structure (May 2019) was further refined with the primary update being the confirmed location of the Community Park in the lands immediately adjacent to the Halls Pond PSW as part of the Final Preferred Community Structure (March 2020).

The projected water level increases combined with the revised location of the Community Park in the same catchment, together were considered significant enough to warrant supplemental analyses that would (a) focus on the Halls Pond catchment while also refining the various parameters being input to the model (including the new location for the Community Park) to increase the understanding of the wetland water level dynamics, and (b) explore and test a range of potential mitigation measures applied to this catchment to confirm how best to mitigate any residual impacts.

The additional analyses specific to the Halls Pond catchment involved intensive multi-disciplinary and iterative work over 2020 (as described in this memo).

2 OVERVIEW OF THE MODELLING WORK UNDERTAKEN

As described in Phase 1, 2, and 3 of the CEIS an integrated surface water-groundwater model was developed and calibrated using the MIKESHE modelling software and applied to assess and compare existing or “pre-development” conditions with the anticipated Future or post-development conditions following implementation of the Preferred Community Structure as identified through the study process.

The modelling required the creation of an existing conditions or pre-development scenario calibrated to observed conditions (e.g., groundwater levels and wetland surface water levels) to simulate time-varying conditions based on existing land use and climate data for the period of 2003 through 2017 (i.e., Existing Conditions Model). The model domain encompasses the broader Primary Study Area (i.e., the Secondary Plan Area plus a 500 m zone around it), and represents surface water and groundwater processes, including wetlands and watercourses outside the CMSP area but still within the broader Secondary Study Area.

Future Conditions simulations were completed for the Initial Preferred Community Structure (Iteration 1 -May 2018) and Updated Preferred Community Structure (Iteration 2 - May 2019).Future conditions simulated represented 1) land use changes (e.g., changes to extent of imperviousness, grading and vegetation), and (2) stormwater management alternatives (e.g., LID BMP source controls and locations of Storm Water Capture Areas [SWCAs]).

For the Initial and Updated PCS simulations, impacts to the groundwater function (i.e., recharge, depth to groundwater, groundwater discharge to streams outside the CMSP area) and to wetland water balances within the CMSP area were assessed by comparing the future conditions to the existing conditions. Impacts to the hydrologic regime of wetlands was assessed for the three largest wetlands holding ponded water throughout the year across the CMSP area (i.e., Halls, Neumann's and Halligan's Ponds) by examining both: (a) changes in the simulated wetland water balance and (b) the potential for impacts to the hydroperiod of each of those features based on changes in the wetland water levels.

Although the Initial PCS, which was based on a shorter duration (i.e., 5 years rather than 15) did not identify any significant impacts in under future conditions, the Updated PCS (second iteration) projected a cumulative increase in the Halls Pond average annual water level of about 26 cm over the course of the 15-year simulation period (2003-2017) based on the Updated Preferred Community Structure (PCS) and the proposed stormwater management approach. The change in water level was attributed primarily to increased groundwater discharge to Halls Pond and decreased leakage from the Pond.

Some small increases in Neumann's Pond average annual water levels were projected in the Initial and Updated PCS iterations of the impact assessment. However, it is anticipated that these relatively minor increases could however be mitigated through the implementation of refined grading to help manage the volume of increased surface water flows from the adjacent developed lands during a given event. Therefore, no additional work was required in this catchment.

However, the larger projected increase in the Halls Pond average annual water levels over time has the potential to increase both the areal extent of ponding and the hydroperiod of ponded area associated with Halls Pond despite the pre- and post-development water balances being comparable. Therefore, supplemental work providing a more area-specific assessment in the Halls Pond catchment was undertaken to try and resolve this new and unexpected issue.

This memo describes additional MIKE SHE model simulations that were undertaken with more detailed, area-specific input parameters and analysis of simulated difference between the existing and future conditions of Halls Pond hydrologic regime and hydroperiod supporting the biological functions of the wetland. The simulations incorporated revised land use changes of the Final Preferred Community Structure (Iteration 3 - May 2020) and the relative effectiveness of different measures/strategies to mitigate a potential increase in water levels under future conditions.

The modelling assessment of the Final PCS was divided into two phases to (a) evaluate the various factors contributing to the wetland water level increases on an area-specific basis and (b) explore the effectiveness of different management approaches to mitigate any projected impacts and support the maintenance of the pre-development hydroperiod of Halls Pond.

- Phase 1: Phase 1A involved updates to the model used in Updated PCS (iteration 2) to reflect the Final Preferred Community Structure (iteration 3) (approved May 2020) including the location of the Community Park and evaluate the effect on Halls Pond water levels and hydroperiod.
- Phase 1: Phase 1B consisted of a site-specific evaluation of model assumptions influencing the simulated existing and future hydroperiod of Halls Pond. The set of simulations tested how changes in key model inputs have the potential, in isolation and in combination with other parameters, to influence the water levels and hydroperiod of Halls Pond. The inputs tested were wetland buffer extent of grassed / herbaceous versus treed vegetation, pond bathymetry, pond subsurface material properties, and impervious conductivity adjustment.
- Phase 2: evaluated the ability of different management scenarios, in isolation or in combination, able to sustain average wetland water levels and hydroperiod under post-development conditions. The management scenarios adopted the refined parameters identified in Phase 1 (including refined wetland bathymetry and buffer zone vegetation to further test and refine the stormwater management approach near Halls Pond. Additional strategies simulated included: the relocation of identified storm water capture areas (referred to as SWCAs), expanded naturalized buffers, increased low impact development (LID) best management practice (BMP) capture volumes, and changes to SWCA drainage area.

In the final combined management scenario, the simulated change in water balance for the wetland provides insight to or context for how the hydrologic regime (inflows and outflows) is expected to change under future conditions. The potential impacts to Halls Pond water levels and hydroperiod were assessed based on: the simulated changes in average annual water levels (volume alone), monthly pond levels (volume, duration and timing), and duration and frequency with which areas within the mapped wetland and its associated 30 m buffer are ponded (duration/frequency/spatial distribution).

3 PHASE 1A - COMMUNITY PARK UPDATE

Figure GW-1 shows the simulated groundwater levels for existing and future conditions (Iteration 2 - Updated PCS) highlighting the groundwater level mounding around the SWCAs thought to be contributing to Halls Pond water level increases under future conditions. Also shown on the Figure GW-1 is the location of the Community Park approved by Council (May 2020) that is part of the Final Preferred Community Structure within the CMSP). These park lands were previously represented as medium density residential lands with a SWCA in the first two iterations (Initial PCS and Updated PCS).

In this initial phase of the Halls Pond impact assessment the new Community Park location and removal of the SWCA in the new park area was simulated using MIKESHE with all other inputs to the future conditions simulation unchanged from iteration 2 (i.e. same stormwater management approach in other land uses). Updating the location of the park and the associated stormwater measures in the park, resulted in a small reduction of projected average annual water level increase from 26 cm in the second iteration to 24 cm (reduced by 2 cm) in Halls Pond over a 15-year period.

4 PHASE 1B - UNCERTAINTY ANALYSIS

The following describes the model inputs that were modified one at a time to assess impacts on average annual pond level to inform a refined combined management scenario in Phase 2.

4.1 Consideration of Naturalized Buffers

Vegetation parameters used in naturalized wetland buffers (e.g., rooting depths, leaf area indices) in the vicinity of Halls Pond influence the rate of evapotranspiration. Increased evapotranspiration rates from changes in vegetation parameters might reduce pond level increases by consuming water otherwise discharging to the pond. The refined configuration of a wetland buffer and the modelled representation of this area and the adjacent Moraine Ribbon is shown Figure GW-2.

Vegetation representation around Halls Pond was refined from the previous modelling (which assumed the buffers would be lawn) to assume the 30 m buffers to the wetlands would be naturalized with woody and herbaceous vegetation that would mature and contribute to evaporation over time. This parameter was evaluated to determine how sensitive the predicted pond level increases would be to changes in vegetation types. To address this question the project team conducted a review of the vegetation characteristics and representation in the MIKE SHE model. A revised vegetation profile for the planned wetland buffer (i.e., 30 m wide) adjacent to the wetland was included. This revised vegetation profile assumed about 75% cover with trees and shrubs and 25% cover with grasses and other herbaceous plants.

Overall evapotranspiration rates increased in the vicinity of the pond by 1% and resulted in a decrease in future pond water levels by 0.03 m compared to the Updated PCS impact assessment (Iteration 2).

4.2 Halls Pond Bathymetry Refinement

The bathymetry of Halls Pond was evaluated to determine the sensitivity of Halls Pond water level increases to the geometry of the pond itself. The geometry of Halls Pond in terms of its overall volume, slope of the pond bottom and perimeter all influence the change in ponded water under land use changes. The original representation of Halls Pond bathymetry was approximated, based on historical data, aerial photographs, and limited field observations, as actual bathymetric data could not be collected due to the lack of access. This approximation was appropriate for the impact and water balance assessment at the CMSP area-wide scale.

The original representation of Halls Pond resembled a simple “bathtub” shape with near vertical sides (shown in the dark blue lines on Figure GW-5). In future conditions additional groundwater discharge and runoff to the pond resulted in elevation increases as the vertical sides prevented lateral spreading and the ‘bathtub’ was not full. Average annual water level changes alone simple bathymetry did not provide enough detail to assess the potential changes in hydroperiod (frequency, duration, extent of ponding) but provided a good indicator for the potential impact warranting the more detailed analysis based on refined bathymetry.

A refined representation of Halls Pond bathymetry was developed through closer examination of wet and dry year air photographs since 2006 supplemented by field observations of pond conditions at a few accessible locations, site photographs, and four years of water level data from stations at the southern and northern ends of the wetland complex. The wet and dry year aerial photographs and field observations provided a visual understanding of the distribution of duckweed vegetation within Halls Pond. Duckweed is known to grow at depths up to 3 m (Leng et al., 1999). Figure GW-4 shows the refined bathymetry that was informed by areas with and without duckweed growth.

A map of the revised estimated average depths of Halls Pond under existing conditions is presented in Figure GW-5 along with three cross sections which illustrate the changes in bathymetry from the original representation and the refined representation. The refined bathymetry is shallower overall, has more

gradual slope transitions in the south and southwest areas, and deeper pockets within the northern portion of the pond.

The revised bathymetry was represented in the MIKESHE model by updated top surface elevations (topography). Other model parameters such as vegetation, overland flow and unsaturated and saturated properties were updated to be consistent with the refined bathymetry of Halls Pond.

Simulation of the existing conditions with the refined bathymetry resulted in a new base/existing conditions average annual water level within Halls Pond of 337.38 m asl, compared to 337.03 m asl originally. The increase in existing conditions ponded level is due to reduced overall pond volume and depth when compared to the original existing conditions model. Both of these water levels are consistent with average pond levels monitored as part of the monitoring program and long-term average values. The calibration of the existing conditions model with this bathymetry revision is as good or slightly better than the original based on comparison of simulated and observed pond level and groundwater levels.

Simulation of the future conditions with the refined bathymetry resulted in a substantially smaller average annual pond level increase compared to the original bathymetry. The refined bathymetry future conditions average annual water level was 337.45 m (or a pond level increase of 0.07 m) compared to the refined existing conditions water level. The original bathymetry water level increase under future conditions was 0.26 m.

The smaller increase in ponded water level under future conditions with the revised bathymetry is attributable to:

- more gradual slopes within the south and southwest portions of the pond allowing spreading of water laterally during wet periods
- reduced surface area of the sides of the pond (as in shallower) resulting in less groundwater discharge to the pond and increased recharge in the Halls Pond catchment (from 295 to 201 mm/year)
- more gradual slopes and a larger overall ponded area footprint promoting more leakage through the bottom of the pond during wet periods

Further evaluation of the water balance of Halls Pond catchment under future conditions demonstrated that while overland and subsurface inflows were predicted to increase, these increases were largely compensated for by increases in subsurface outflows and evapotranspiration and no change in overland storage is present (see Table A).

4.3 Subsurface Material Properties

Subsurface material properties (e.g., hydraulic conductivity, porosity) in the vicinity of Halls Pond were evaluated to determine the sensitivity of pond levels to changes in these properties. The hydraulic conductivity and porosity of materials have been interpreted from drilling and testing in wells at two locations around the pond and available surficial mapping, including correlation with more distant wells, which has been informed/tested by water level calibration. These material properties influence the position of the groundwater water table and the rates of discharge and recharge which occur to features within the NHS including Halls Pond.

In the case of Halls Pond and other wetlands in the study area, a low hydraulic conductivity layer is interpreted at the base of the pond from the accumulation of fine sediments. This layer which was identified in the existing conditions modelling as critical to the occurrence of ponding at Halls Pond. A set of alternative hydraulic conductivity values were evaluated which increased the conductivity of the sediment deposits by a factor of 5 and 10 times to evaluate the effect on predicted water levels and Halls Pond. In both scenarios the Halls Pond wetland slowly drained into the surrounding subsurface materials because of these conductivity increases. These results support the highly critical nature of a low conductivity layer present at the base of these wetland features and support the low conductivity value used in the existing conditions model. Any significant increases to the hydraulic conductivity values result in a model which does not represent ponding at Halls Pond and is therefore not calibrated in this area.

4.4 Initial Conditions

The initial conditions of the model define the amount of water stored within the model domain at the start of simulation. These include subsurface water levels or moisture content and surface water levels (e.g., in wetlands, lakes, and rivers). The initial conditions applied in the model were evaluated to determine if using different initial conditions affected the predicted changes in water levels at Halls Pond. A period of model equilibration from initial conditions to those dynamically determined by climate was applied in previous modelling to mitigate initial conditions bias. The existing conditions model was run through a full simulation period (1996-2017) and the final conditions of that simulation formed the initial conditions of the impact assessment scenarios for both existing and future conditions scenarios. In this way both scenarios start from the same condition for impact assessment.

The simulated climate conditions run from September 1996 to 2017 but the impact assessment was focused on the period of 2003-2017. The initial 6.25 years were not considered as they are less consistent with current land use and this also reduced the potential for initial conditions bias. To further address any potential initial conditions bias the model scenarios were initiated from the same initial condition and were run for a full simulation period (September 1996-2017) and the final conditions of the previous run are used to initiate the second full simulation period. Finally, as before the initial 6.25 years from September 1996 to December 2002 are not considered in the impact analysis as before. This provides more than 27 years of equilibration time for the model before impacts are assessed. In previous scenarios the initial conditions were taken from a previous existing conditions model in 2017 which represented a relatively dry period. The water levels simulated in Halls Pond were evaluated and the conditions simulated in 2008 were found to represent a more average condition as compared to those previously used. A future conditions scenario was evaluated using 2008 conditions as the initial conditions and the two climate cycles approach designed to eliminate initial conditions bias. The results of this scenario showed Halls Pond water levels approaching impact levels like those simulated with the previous initial condition within the first climate cycle, 1996-2017, of the model. This result demonstrates that the substantial warm up period provided by the two full climate cycles is sufficient to remove any initial conditions bias in the predicted impacts to Halls Pond.

4.5 Impervious Areas - Conductivity Adjustment

In the future conditions scenario, the vertical conductivity of soils in the developed areas was reduced to account for increased imperviousness in developed land areas. (This adjustment is described in detail in Appendix B - Hydrogeology (Groundwater) of Iteration 2 of the CEIS).

The vertical conductivity adjustment was established conservatively with respect to the assumed reduction in infiltration rates and generation of runoff associated with development. However, this adjustment may underestimate the efficacy of the LID BMPs planned for the CMSP area. The sensitivity of the pond level increase to the vertical conductivity was assessed by varying this value.

A less conservative impervious vertical conductivity adjustment (higher conductivity) may allow for more recharge to occur on the urban lands through natural processes and source controls and reduce the amount of runoff to SWCAs. This in turn may potentially result in a more diffuse groundwater recharge which would then reduce the projected increase in groundwater levels in proximity to Halls Pond and the associated pond level increases.

To evaluate this possibility, the impervious conductivity adjustment was changed so that impervious areas were represented by a hydraulic conductivity value 10 times larger than previously used (1E-08 m/s vs. 1E-09 m/s) when adjusting conductivity values. This scenario resulted in water level increases to Halls Pond which were approximately 3 cm lower on average than water level increases to Halls Pond compared to the 2nd iteration. Given that a substantial increase in the conductivity associated with impervious areas has yielded only a limited change in pond level increases and may be less conservative with respect to efficacy of source control for maintaining recharge in developed areas original representations were used in subsequent simulations.

4.6 Phase 1 Summary

Table B summarizes all the methods and learnings from all Phase 1 scenarios. A revised existing conditions scenario was created by incorporating the refined bathymetry estimate to the previous existing conditions scenario. Model parameters such as vegetation, overland flow and unsaturated and saturated flow properties were updated to be consistent with the refined bathymetry and extent of Halls Pond.

The results of the uncertainty scenarios provide insights on how model inputs may affect water levels and hydroperiod of Halls Pond and are summarized below and in Table B.

- The equilibration of multiple climate cycle approach to minimizing initial conditions effects in the simulated was demonstrated to have no effect on predicted water level increase at Halls Pond.
- Increasing the vertical conductivity of materials at the base of Halls Pond was not supported by the available field observations as higher conductivities resulted in the pond being fully dry year-round in the existing conditions simulation.
- Wetland buffer vegetation refinements showed a small benefit of increasing evapotranspiration and reducing the simulated average annual pond level increase under future conditions.
- Reducing imperviousness associated with developed areas shows a small reduction in water level increases but results in a less conservative approach with respect to source control.
- Finally, a refined bathymetry estimate for Halls Pond results in a more representative hydroperiod (natural expansion and contraction with wet and dry periods) and reduces predicted water level increases in Halls Pond under future conditions and is more likely to maintain the existing conditions hydroperiod.

5 PHASE 2 HALLS POND WATER LEVEL MANGEMENT AND MITIGATION

Phase 2 of the assessment evaluates the effectiveness of combined management scenarios designed to mitigate predicted pond level increase and maintain the simulated existing conditions hydroperiod of Halls Pond. The management scenarios adopted the best representation of the refined wetland bathymetry in Phase 1 and insights on alternative vegetation buffers to further test and refine the stormwater management provided approach near Halls Pond. Additional strategies simulated the relocation of the SWCAs, expanded naturalized buffers, increased LID/BMP capture volume, SWCA drainage area change, and a combination of these methods.

The following describes the strategies simulated to identify the best management approaches to maintain Halls Pond hydroperiod under future conditions while still meeting the other objectives for the CMSP area. A summary of the findings of the Phase 2 simulations is provided in Table B.

5.1 SWCA Relocation

Groundwater level mounding associated with SWCAs located in areas of shallow depth to water table adjacent to Halls Pond were interpreted to be contributing to the simulated future pond level increase. The relocation of the SWCAs to areas with a larger depth to water table under existing conditions (i.e., areas with more available soil storage volume) could reduce predicted increases in future pond levels.

Several locations for relocation of the SWCAs were considered that are farther away from Halls Pond, with deeper water tables and higher infiltrations rates, but still located downslope of the development areas providing runoff.

A proof-of-concept simulation of SWCA relocation was conducted which tested routing of all flow directed to the SCWAs in subcatchments 42 and 61 out of the model, preventing recharge at the SWCAs (Figure GW-6). This scenario demonstrated the relocation to be an effective strategy as the water levels of Halls Pond were maintained at or below existing conditions. While actual relocation would not be expected to have as dramatic an effect (as groundwater recharge will still occur at the SWCAs) the results of this scenario supported the further testing of the SWCA relocation management strategy.

The SWCA relocation management strategy was further evaluated as part of the combined management scenario. The subcatchments directly adjacent to Halls Pond (42 and 61) were evaluated to determine alternative locations for their SWCAs which would maximize distance from Halls Pond, maximize depth to groundwater, and maintain stormwater runoff routing and catchment grading requirements. The revised SWCA locations and resulting updated PCS are shown in Figure GW-6.

5.2 Expanded Vegetative Buffers

The 30 m wide naturalized buffers were included to maximize evapotranspiration within the combined scenarios. The naturalized buffers were simulated at about 75% tree and shrub cover and 25% grass and herbaceous cover was shown to have some benefit to mitigating future increases in pond water levels in Phase 1B.

5.3 Increased LID/BMP Capture Volume

Management scenarios were simulated where the LID/BMP source control capture rate were varied in the subcatchment adjacent to Halls Pond from 5 to 20 to 35 mm. The simulations provided insight on the effectiveness of different levels of capture to mitigate water level increases at Halls Pond as part of the combined management scenario. Increasing capture from the 20 mm simulated in iteration 2 to 35 mm reduced future pond level increases by less than 1 cm. The simulated reduction in capture to 5 mm had minimal impact on the pond level future pond level increases by less than 1 cm.

5.4 SWCA Drainage Area Changes

The functional grading plan was evaluated to determine the extent to which the drainage areas contributing to the SWCAs in the vicinity of Halls Pond could be reduced by Wood. Through this analysis it was determined that the contributing areas had already been minimized to the degree that was possible and further reductions were not feasible.

5.5 Combined Management Scenario

A combined management scenario was simulated based on the refined bathymetry and final PCS (Community Park Update) which incorporated the following mitigation measures:

- expanded vegetated buffer surrounding Halls Pond
- relocated SWCAs in subcatchment 42 and 61
- a refined stormwater drainage configuration in subcatchment 42

The stormwater drainage was refined within subcatchment 42 so that the north two thirds of the drainage area routed runoff in excess of LID/BMP capacity to the north edge of the relocated SWCA and the remaining south third of the drainage area routed excess runoff to the south edge of the SWCA. Directing the larger proportion of the drainage area to the north of the SWCA serves to move groundwater level increases further away from Halls Pond that are associated with the SWCA.

The combined management scenario was evaluated in terms of its effectiveness at maintaining existing average annual pond levels and the existing hydroperiod for Halls Pond. The evaluation compared the average water levels at Halls Pond, monthly water levels, the frequency of ponded water at Halls Pond and the surrounding buffer area as well as the water budgets of the Halls Pond Catchment.

This combined scenario results in an average water level increase at Halls Pond of approximately 4 cm for the period of 2003-2017 (337.38 vs. 337.42 m) compared to existing conditions (depth/volume). The monthly variation of water levels (duration/frequency) in Halls Pond of 2003-2017 is maintained as presented in Figure A.

Frequency analysis of the ponded water levels at Halls Pond and a buffer area of 42.5 m which captures the area of the wetland vegetative buffer and the Ribbon Park (where present) is presented in Figure 8. The results of the ponding frequency analysis indicate that the spatial location and frequency of ponding at Halls Pond and surrounding areas is maintained within the combined management approach. A comparison of water levels under existing and future conditions (PCS) along cross sections at Halls Pond is presented in Figure 5. The cross-sections demonstrate the minimal change in footprint/extent pond

conditions (Level/spatial location). Finally, a comparison of the water budgets of the Halls Pond catchment in existing conditions and future conditions (PCS) is presented in Table A.



FIGURE A Mean Monthly Water Levels at Halls Pond (2003-2017)

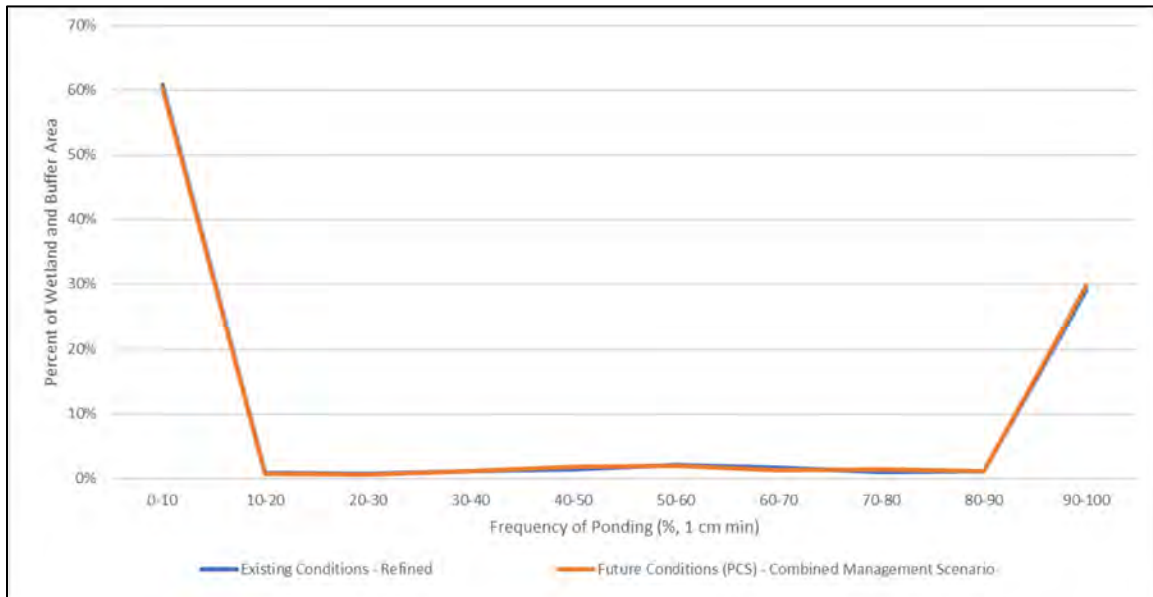


FIGURE B Halls Pond and Buffer Area Ponding Frequency >1 cm (2003-2017)

TABLE A Combined Management Scenario - Average Annual Water Budget 2003-2017

Water Budget Component	Annual Average 2003-2017 (mm/year)	
	Existing Conditions	Future Conditions
Precipitation	794	794
Evapotranspiration	497	501
Overland Flow In	5	15
Overland Flow Out	4	5
Subsurface Flow In	137	141
Subsurface Flow Out	447	457
Overland Storage Change	3	3
Subsurface Storage Change	10	10

Note: recharge increases from 295 mm/year to 301 mm/year.

A review of the simulated Halls Pond water balance between existing and future conditions represented in the combined scenario shows minimal change in the hydrologic regime. Additional overland inflow is simulated in future conditions, attributed to the smaller catchments contributing to Halls Pond which permit runoff to the NHS. The increased runoff is mitigated through increases in evapotranspiration and groundwater recharge. Overall, the water budget comparison results are consistent with the limited changes in water levels indicated by analysis of ponding water level and frequency. The combination of water level and water budget change comparison indicate that the combined management scenario is effective at mitigating water level changes and maintaining hydroperiod at Halls Pond.

Varying LID/BMP capacities of 5, 20, and 35 mm capture in catchments adjacent to Halls Pond were evaluated for this scenario but differences in pond level increases were limited to approximately 1 cm with 35 mm providing the most benefit and 5 mm providing the least benefit. Given concerns regarding the constructability of 35 mm and the limited benefit, a 20 mm capture is recommended.

As part of the combined management scenario model updates to the topography near Neumann's was updated to be more reflective of future grading and the increased overland runoff predicted in Iteration 2 of the CEIS is mitigated. As a result of this the predicted pond level change at Neumann's Pond is now approximately less than 4 cm in the combined management scenario and not interpreted to impact the hydroperiod of the Neumann's Pond.

TABLE B Summary of Uncertainty Analysis and Management Scenario Findings

Simulation	Methods	Learnings	Pond Level Increase Compared to Existing Conditions*
Phase 1A/B - Community Park and Uncertainty Analysis			
Community Park Refinement	Future Land Use under the Final Preferred Community Structure updated to reflect the approved Community Park location. Previously, park area was medium density residential. Storm water capture area (SWCA) was removed from the Halls Pond catchment and low impact development (LID) best management practice (BMP) source controls were increased to capture 100-year storm events and encourage diffuse recharge.	Increased evapotranspiration and reduced recharge in the Halls Pond catchment and resulted in reduced water level increases by about 2 cm.	24 cm **
Vegetation Refinement	Existing vegetation mapping in Halls Pond vicinity was reviewed and a vegetated buffer of 30 m around Halls Pond, designed to increase evapotranspiration was developed. This wetland buffer was comprised of 25% grasses / herbaceous and 75% trees and shrubs (woody).	This largely wooded wetland buffer was shown to increase evapotranspiration rates over time and reduce water level increases by about 2 cm.	23 cm **
Bathymetry Update	Access to Halls pond central area was not provided at any time during this study. Original estimated bathymetry assumed Halls Pond was generally shaped like a shallow bathtub. Closer analysis of air photos since 2006 at different times of the year and of the extent of aquatic vegetation cover provided a basis for a more refined estimate of depths resulting in a more hummocky bathymetry and an overall shallower, smaller pond volume based on more gently sloped pond margins in south and southwest compared to the original coarser estimate.	The refined bathymetry resulted in existing conditions with an average annual water level increase at Halls Pond of 35 cm due to refinement of pond bathymetry. Still representative as a long-term average water level based on 2016-2019 water level monitoring. Pond is more hummocky below water surface than originally assumed. Better representation of existing hydroperiod including increase in ponded area footprint (lateral spreading) in wet periods and less groundwater inflow to the pond.	N/A
		With the refined bathymetry, under Future Conditions with Final Preferred Community Structure land uses and mitigation the projected increase is much less.	7 cm ***

Simulation	Methods	Learnings	Pond Level Increase Compared to Existing Conditions*
Subsurface Material Properties	Increases in hydraulic conductivity of fine-grained sediments conceptualized at the base of Halls Pond were evaluated at factors of 5x and 10x to determine if less impacts to Halls Pond might occur with more pervious materials at the Pond bottom.	These scenarios resulted in Halls Pond draining and under Existing Conditions, but did not correlate with observed conditions, and therefore provided support for the low conductivity value used in the current model.	N/A Pond dries up**
Impervious Areas Conductivity Adjustment	Evaluated decreasing hydraulic conductivity reductions in developed areas, designed to account for increase imperviousness, by a factor of ten.	This change resulted in reduced water level increases by about 2 cm..	23 cm***
Phase 2 - Halls Pond Water Level Management and Mitigation			
SWCA Relocation	Subcatchments directly adjacent to Halls Pond were evaluated to determine alternative locations for their SWCAs (see Figure GW-6) to maximize distance from Halls Pond, depth to groundwater and still maintain feasibility in terms of stormwater runoff and catchment grading. A revised PCS configuration with relocated SWCAs was constructed and was evaluated as part of the combined management scenario. The feasibility of this management method was established in a proof-of-concept scenario which routed runoff to SWCAs adjacent to Halls Pond out of the model.	In this scenario Halls Pond water levels were maintained at or below Existing Conditions levels.	See combined scenario
Naturalized buffers	Under the previous modelling conducted at a coarser scale, the planned 30 m buffers to the wetlands were assumed to be lawn. Under the refined modelling, the wetland buffer was assumed to be naturalized with woody and herbaceous vegetation, as anticipated.	Naturalized buffers increase evapotranspiration and provide some reduction in water level increases over time as the vegetation matures. This mitigation was incorporated as part of the combined management scenario.	See combined scenario
Increased LID BMP capture volume	Evaluated effect of LID/BMP capture increasing from 20 to 35 mm in subcatchments adjacent to Halls Pond.	This had no effect on the long-term water level increases in the Halls Pond catchment.	~26 cm***
SWCA Drainage Area change	Evaluation of the contributing drainage areas to the SWCAs adjacent to Halls Pond and the functional grading plan.	No alterations of the contributing drainage area were practical.	Not a feasible option

Simulation	Methods	Learnings	Pond Level Increase Compared to Existing Conditions*
Combined Management Scenario	A combined management scenario with the Final Preferred Community Structure with SWCA relocation and naturalized buffers was evaluated.	This scenario resulted in a cumulative average water level increase of approximately 4 cm relative to existing condition and a frequency of ponding and catchment water balance similar to Existing Conditions.	4 cm***

*Average annual pond level increases under Updated Future Conditions (second iteration) resulted in a cumulative increase of 26 cm after 15 years.

**Compared to original bathymetry existing conditions simulation.

*** Compared to revised bathymetry existing conditions simulations

6 RECOMMENDED MANAGEMENT STRATEGY

The supplemental work described in this memo ultimately found that a combination of more refined modelling inputs and analysis along with changes to both naturalization and stormwater management approaches were able to mitigate the previously projected long-term water level increases. The supplemental simulations provided the Wood Team and the City with a greater understanding of the wetland hydrologic regime/dynamics. The additional understanding supports increased confidence in the effectiveness of the proposed management measures to maintain the biological functions of Halls Pond under the Final Preferred Community Structure (March 2020) for the Clair-Maltby Secondary Plan.

The modelled SWCA and source controls of the combined management scenario demonstrate strategies designed to mitigate potential water budget deficits, balance land use constraints, and development densities. Further this scenario adequately mitigates the predicted water level increases at Halls Pond supporting the maintenance of existing pond hydroperiod and aquatic and terrestrial habitat in the vicinity of Halls Pond.

A series of recommendations for measures to help avoid, minimize, and manage potential negative impacts to the NHS at the Secondary Plan scale are included in here:

- Site-specific studies:
 - ✦ As part of the implementation of the Secondary Plan, site-specific impacts will need to be addressed as part of area or site-specific studies undertaken as part of the development process. These studies should consider the functional insights provided in this report when designing site-specific SWCA and source controls after confirming site-specific conditions (e.g., infiltration capacities).
- Ongoing monitoring:
 - ✦ Ongoing observation of surface water levels in key wetlands within the SPA (e.g., Halls Pond), and groundwater levels in the SPA is recommended to provide data to avoid, manage, or minimize potential impacts to the NHS. This could occur through continuing to monitor the observation locations created as part of the Field Program.
 - ✦ Reviewing aerial imagery is recommended as a supplemental form of impact monitoring to evaluate potential changes in wetland extent and additional changes in aquatic and terrestrial habitat.
- Final Preferred Community Structure:
 - ✦ The Final PCS enables relocation of SWCAs to increase distance from Halls Pond, increases depth to groundwater, and maintains constructability regarding grading in subcatchments 42 and 61 is recommended, as described in Phase 2 of this document.
 - ✦ The final location of Community Park west of Halls Pond had minimal ability to mitigate impacts to the Halls Pond water levels without other management measures.

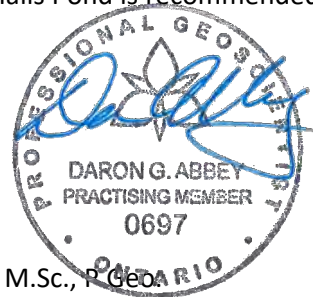
- Naturalized Vegetative Buffer:
 - ✦ An enhanced 30 m vegetative buffer along the border of Halls Pond is recommended to increase evapotranspiration and reduce pond impacts.

MATRIX SOLUTIONS INC.

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Water Resources Engineer

SM/vc
Attachments

Reviewed by



Daron Abbey, M.Sc., P. Geos.
Practice Lead, Geosciences

May 11, 2021

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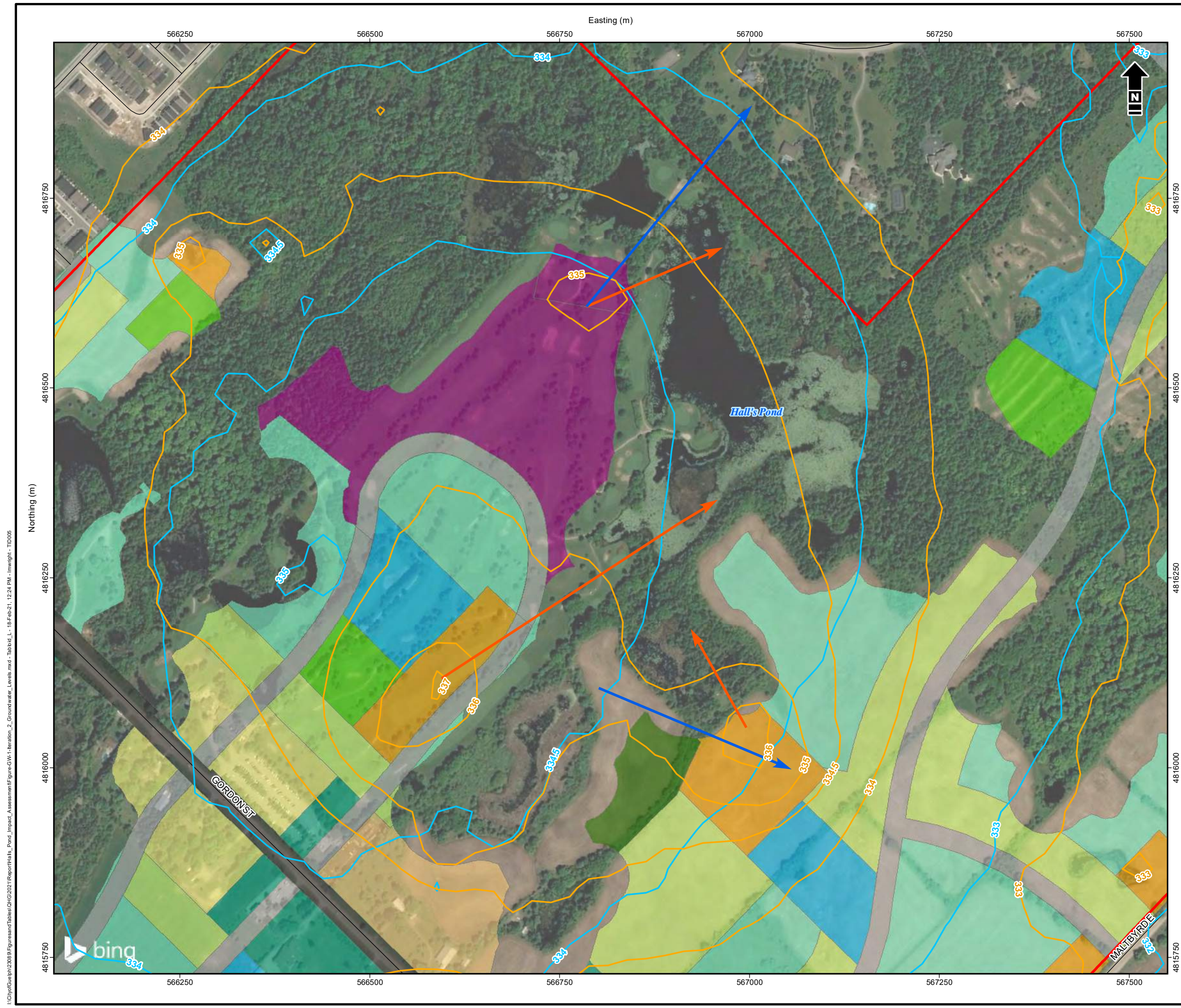
VERSION CONTROL

Version	Date	Issue Type	Filename	Description
V0.1	20-Feb-2021	Draft	20389-528 Halls Pond Tech Memo LR 2021-02-20 draft V0.1.docx	Issued to contributors
V1.0	24-Feb-2021	Final	20389-528 Halls Pond Tech Memo M 2021-02-24 final V1.0.docx	Issued to contributors
V2.0	11-May-2021	Final revised	20389-528 Halls Pond Tech Memo M 2021-05-11 final V2.0.docx	Issued to contributors

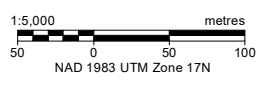
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- Secondary Plan Area Boundary
- Road
- Groundwater Flow Direction - Existing Conditions
- Groundwater Flow Direction - Future Conditions
- Future Land Use**
- Community Park
- Existing Roads
- Future Road
- High Density
- Low Density
- Medium Density
- Mixed Use
- Neighbourhood Commercial
- Office Commercial
- Open Space
- Park
- Storm Water Catchment Area
- School
- Service Commercial
- Simulated Groundwater Level - Existing Conditions**
- 1m Contour (2003-2017)
- Simulated Groundwater Level - Future Conditions**
- 1m Contour (2003-2017)



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 Halls Pond Water Level Uncertainty Analysis and Mitigation Measures

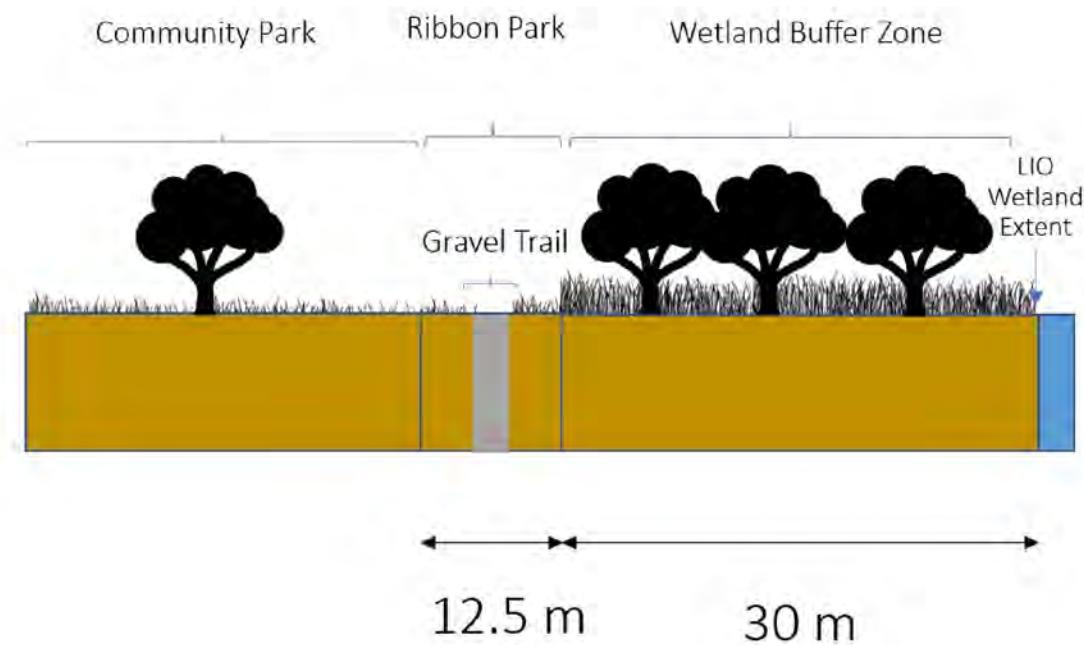
**Simulated Groundwater Levels -
 Existing vs. Future Conditions
 (PCS Iteration 2)**

Date: February 2021 Project: 23089 Submitter: S. Murray Reviewer: D. Abbey

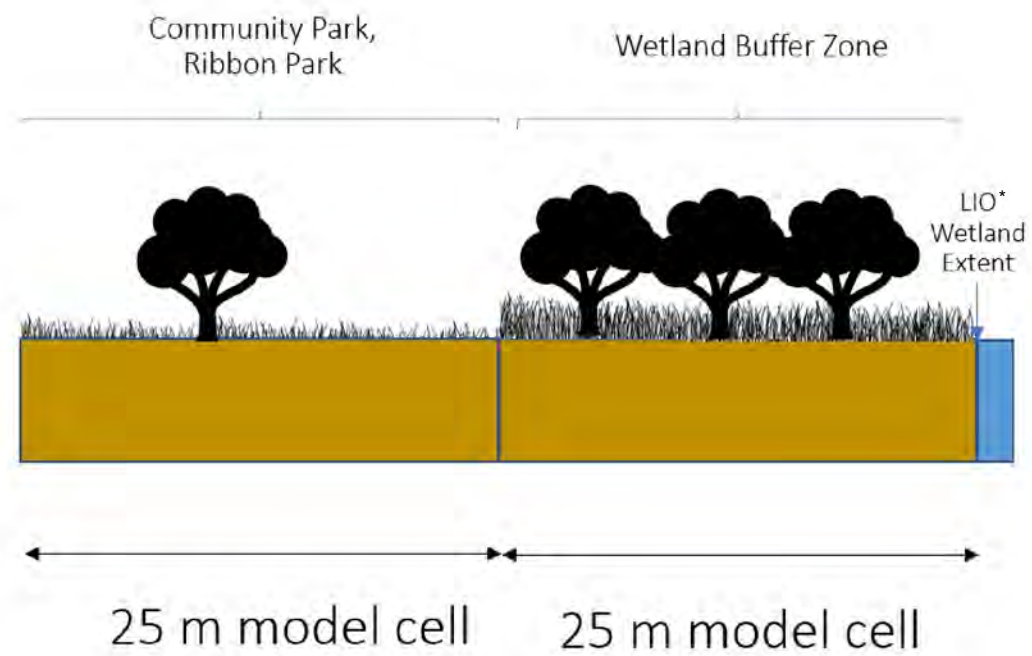
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Physical System



Modelled System



Physical System Description: A wetland buffer zone of 30 m with 25% grass and 75% tree cover planting is adjacent to the wetland. Adjacent to the buffer area is the 12.5 m Ribbon Park and then the community park.

Modelled System Description: The wetland buffer zone is represented by a model cell adjacent to the wetland. Vegetation properties in this cell were updated with an area weighted representation of properties for 25% Grass and 75% trees. Adjacent to this the Ribbon Park and Community Park are represented by a 25 m cell with park vegetation characteristics.

* Land Information Ontario

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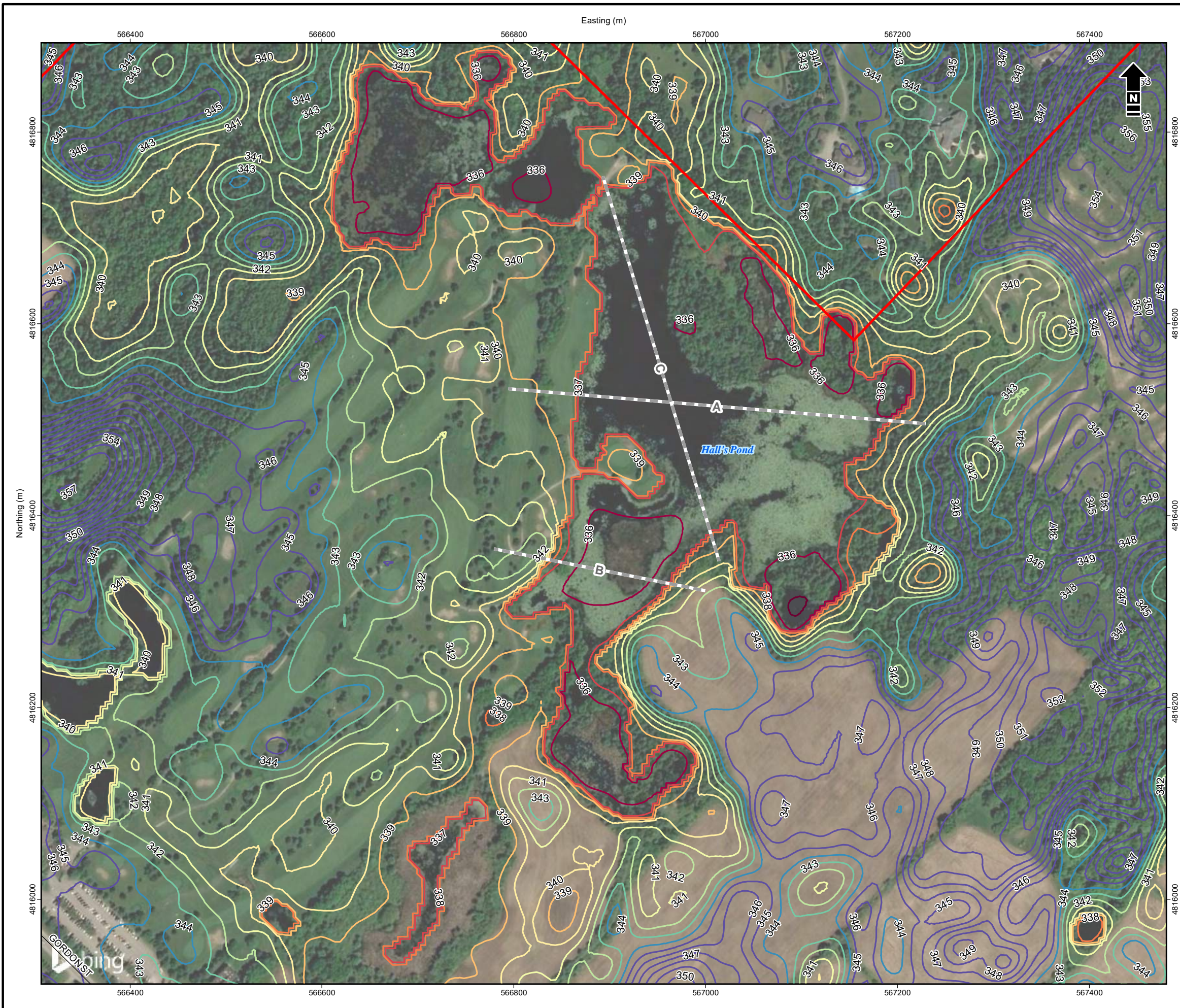


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Clair- Maltby Comprehensive Environmental Impact Study
Halls Pond Water Level Uncertainty Analysis and Mitigation Measures

Vegetation Refinement

Date: February 2021 Project: 23089 Submitter: S. Murray Reviewer: D. Abbey

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- Secondary Plan Area Boundary
- Bathymetry Cross Section
- Road
- Elevation Contour (m asl)**
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- 336
- 337
- 338
- 339
- 340
- 341
- 342
- 343
- 344
- 345+



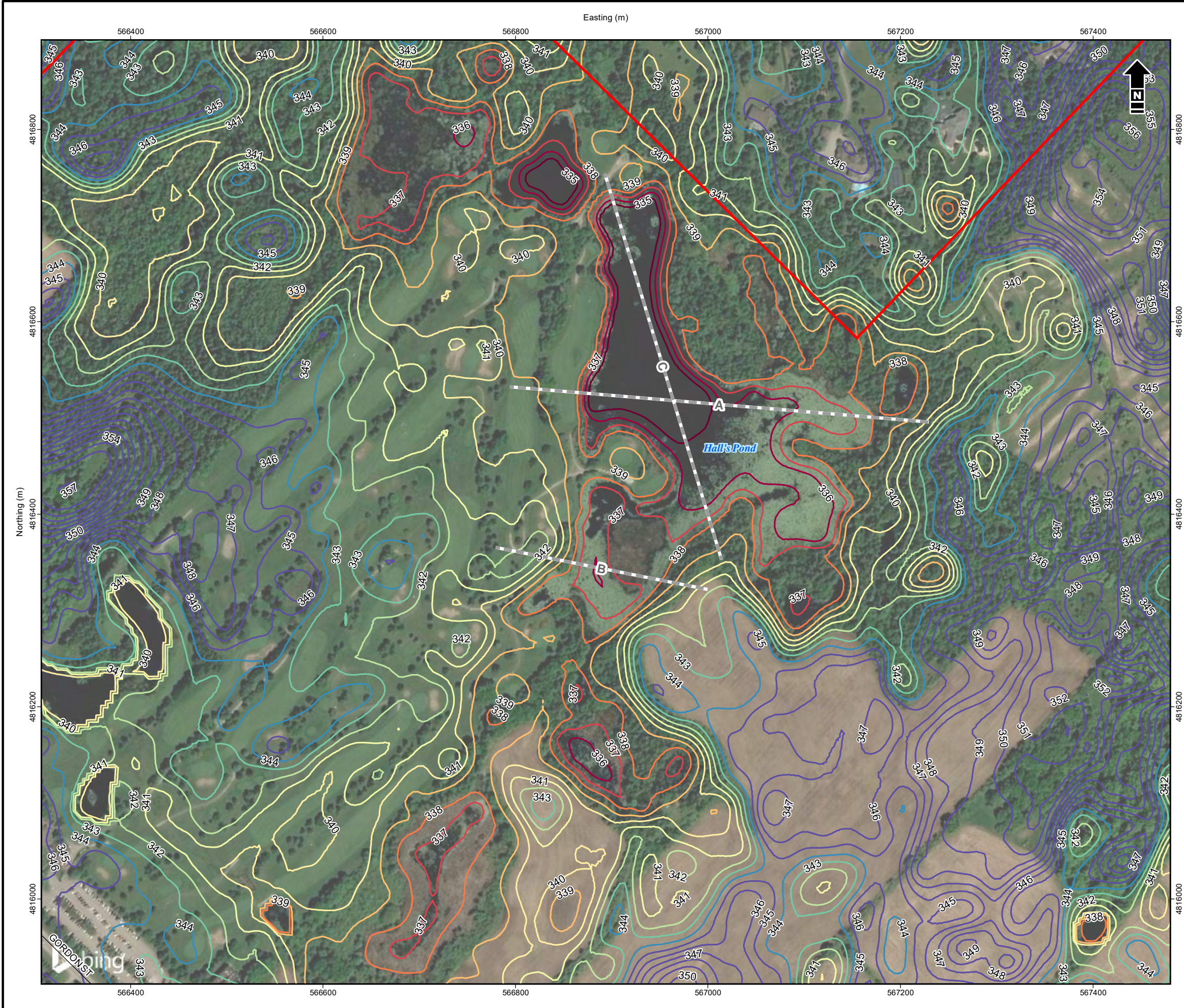
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Halls Pond Bathymetry - Original

Date: February 2021	Project: 23089	Submitter: S. Murray	Reviewer: D. Abbey
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- Secondary Plan Area Boundary
- Bathymetry Cross Section
- Road
- Elevation Contour (m asl)**
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- 336
- 337
- 338
- 339
- 340
- 341
- 342
- 343
- 344
- 345+



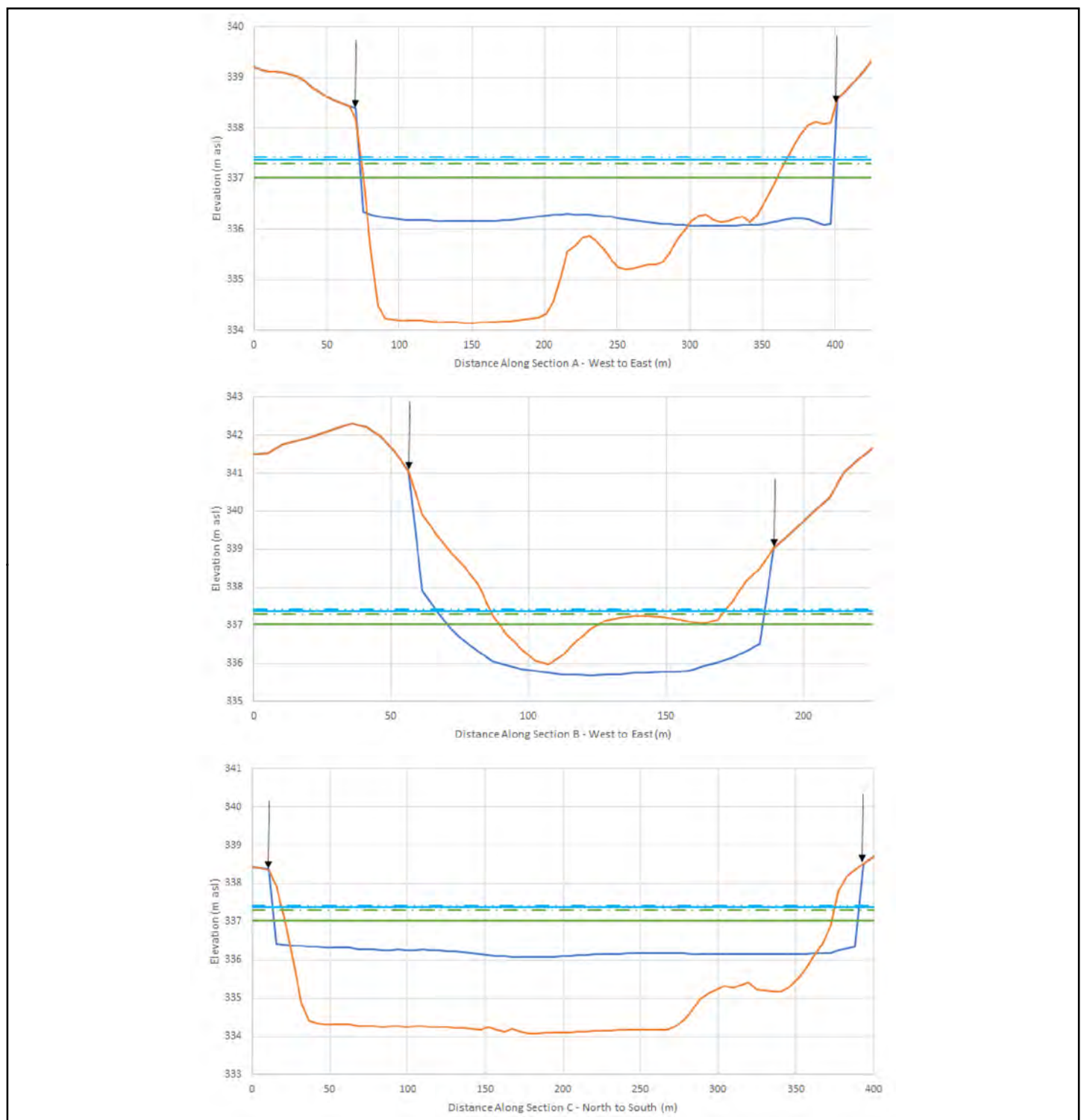
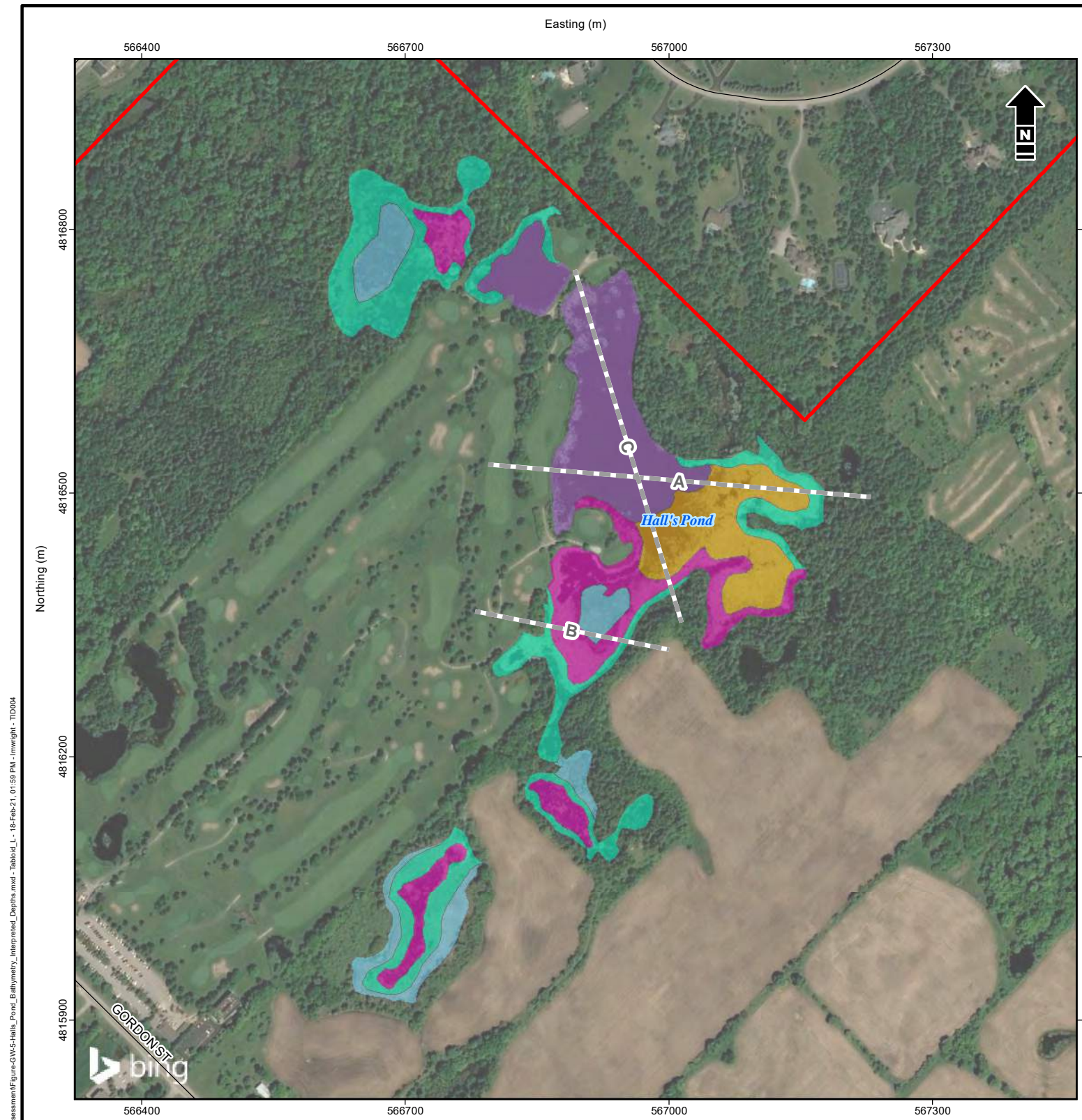
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 Halls Pond Water Level Uncertainty Analysis and Mitigation Measures

Halls Pond Bathymetry - Refined

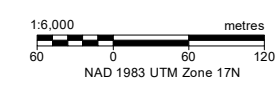
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- Secondary Plan Area Boundary
- Bathymetry Cross Section
- Road
- Bathymetry - Interpreted Depth**
- 0-0.5 m
- 0-1 m
- 1-2 m
- 2-3 m
- > 3 m
- Original Bathymetry
- Refined Bathymetry
- Existing Conditions, Original Bathymetry - Average Water Level
- Existing Conditions, Refined Bathymetry - Average Water Level
- Future Conditions, Original Bathymetry (Iteration 2) - Average Water Level
- Future Conditions, Refined Bathymetry (Combined Management Scenario) - Average Water Level
- Approximate Mapped Wetland Extent (Land Information Ontario)



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Clair- Maltby Comprehensive Environmental Impact Study
Halls Pond Water Level Uncertainty Analysis and Mitigation Measures

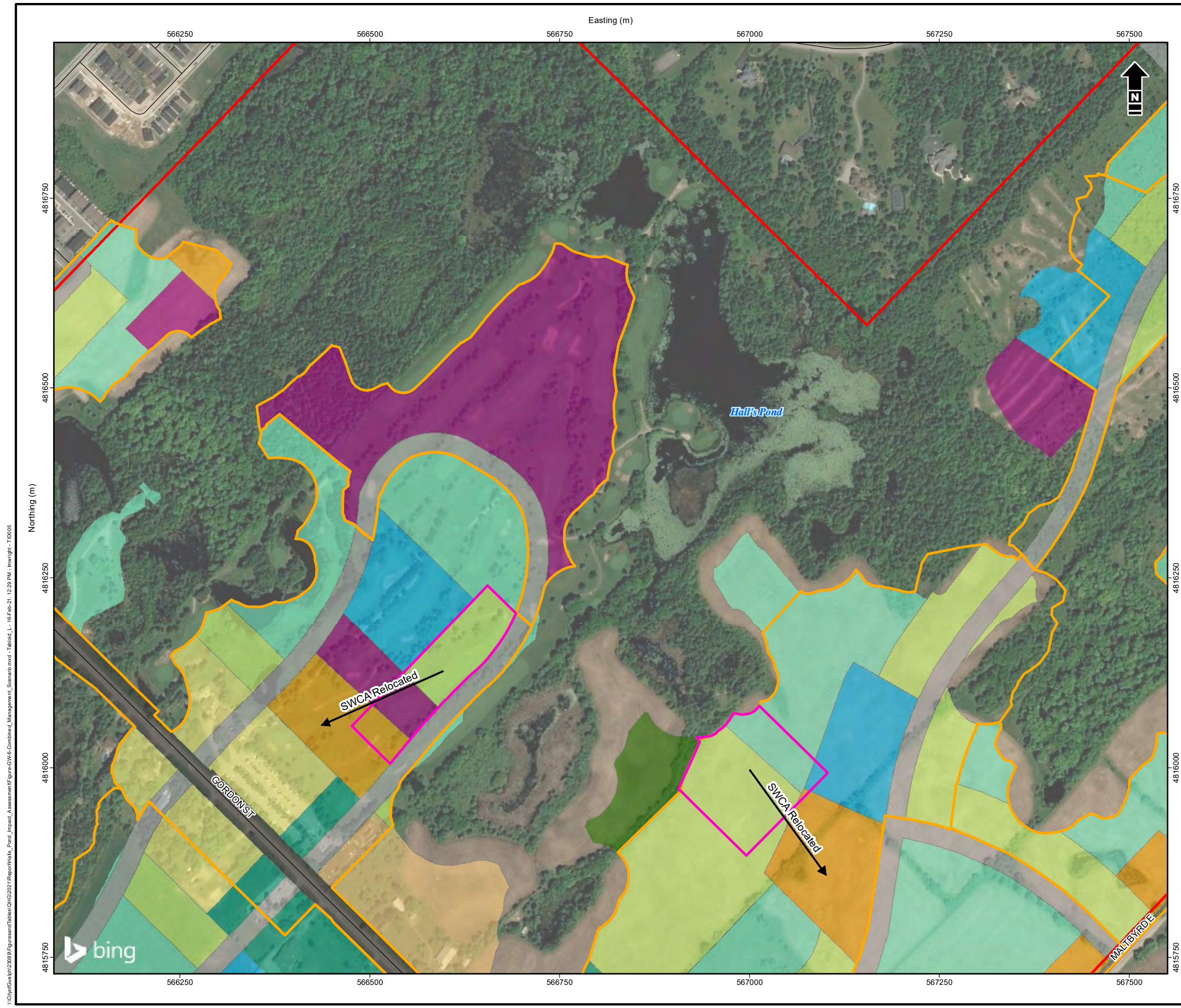
Halls Pond Bathymetry - Interpreted Depths

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- Secondary Plan Area Boundary
 - Development Subcatchment
 - Previous SWCA Location
 - SWCA Relocation Arrow
 - Road
- Future Land Use**
- Community Park
 - Existing Roads
 - Future Road
 - High Density
 - Low Density
 - Medium Density
 - Mixed Use
 - Neighbourhood Commercial
 - Office Commercial
 - Open Space
 - Park
 - School
 - Service Commercial

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1:5,000 metres
 50 0 50 100
 NAD 1983 UTM Zone 17N



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Combined Management Scenario

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