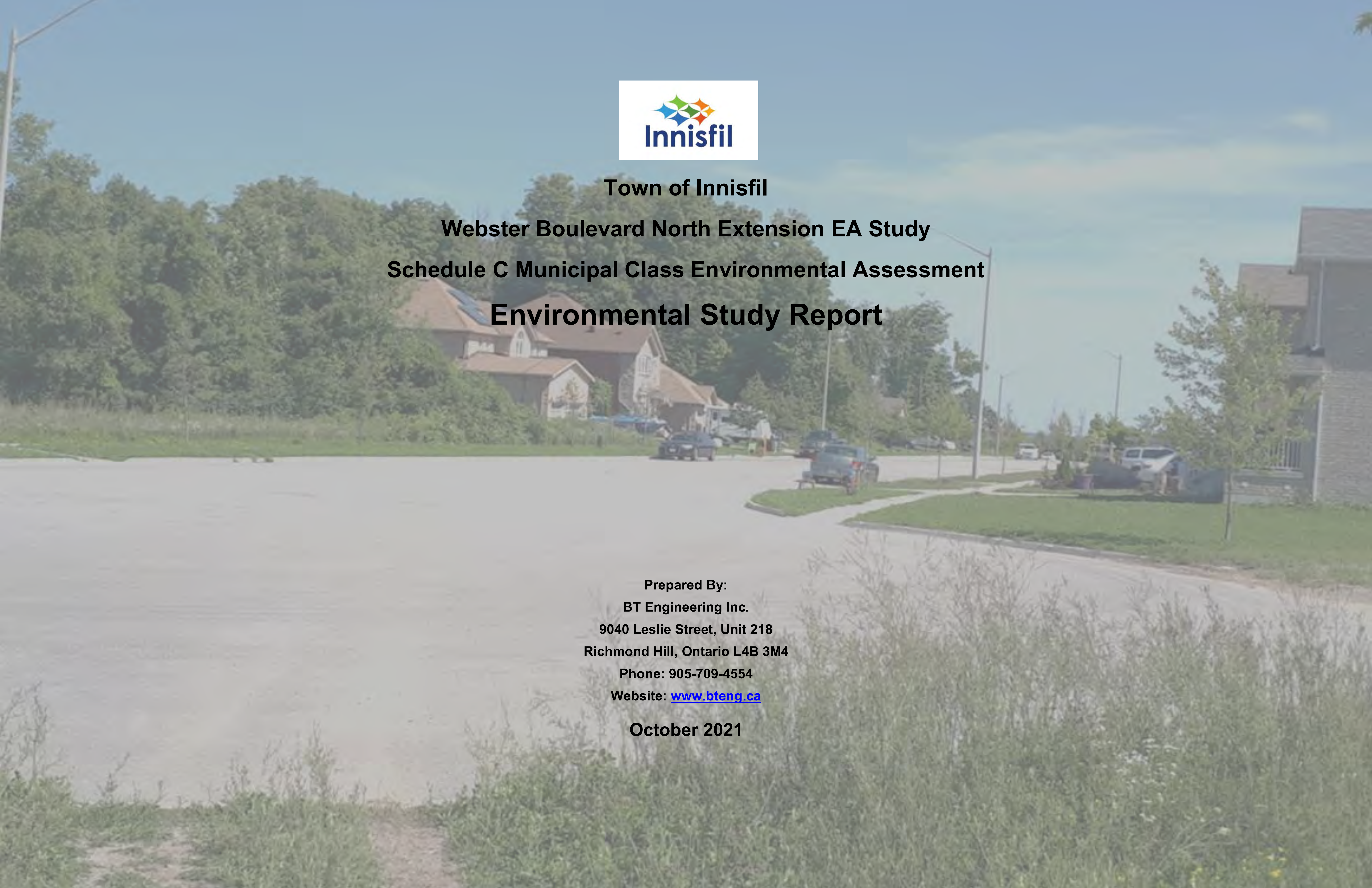

Town of Innisfil

Webster Boulevard North Extension EA Study

Schedule C Municipal Class Environmental Assessment

Environmental Study Report

Prepared By:

BT Engineering Inc.

9040 Leslie Street, Unit 218

Richmond Hill, Ontario L4B 3M4

Phone: 905-709-4554

Website: www.bteng.ca

October 2021

Town of Innisfil Webster Boulevard North Extension EA Study

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October 2021

Prepared by:

Steve Taylor, P.Eng., M.Eng., CVS-Life, Project Manager
BT Engineering Inc.

Darcie Dillon, P.Eng., Assistant Project Manager
BT Engineering Inc.

Executive Summary

E1 EA PROJECT

The Town of Innisfil has conducted a Municipal Class Environmental Assessment (EA) Study for the planning of the extension of Webster Boulevard from the existing terminus to 20th Sideroad. This Study has developed and evaluated alternatives for the alignment, intersection, cross sections and traffic calming measures for the Recommended Plan to address the needs of the Study Area.

E1.1 Study Area

The Study Area is located within in the Town of Innisfil (Town), as illustrated in **Figure E1** and includes an intersection at 20th Sideroad.

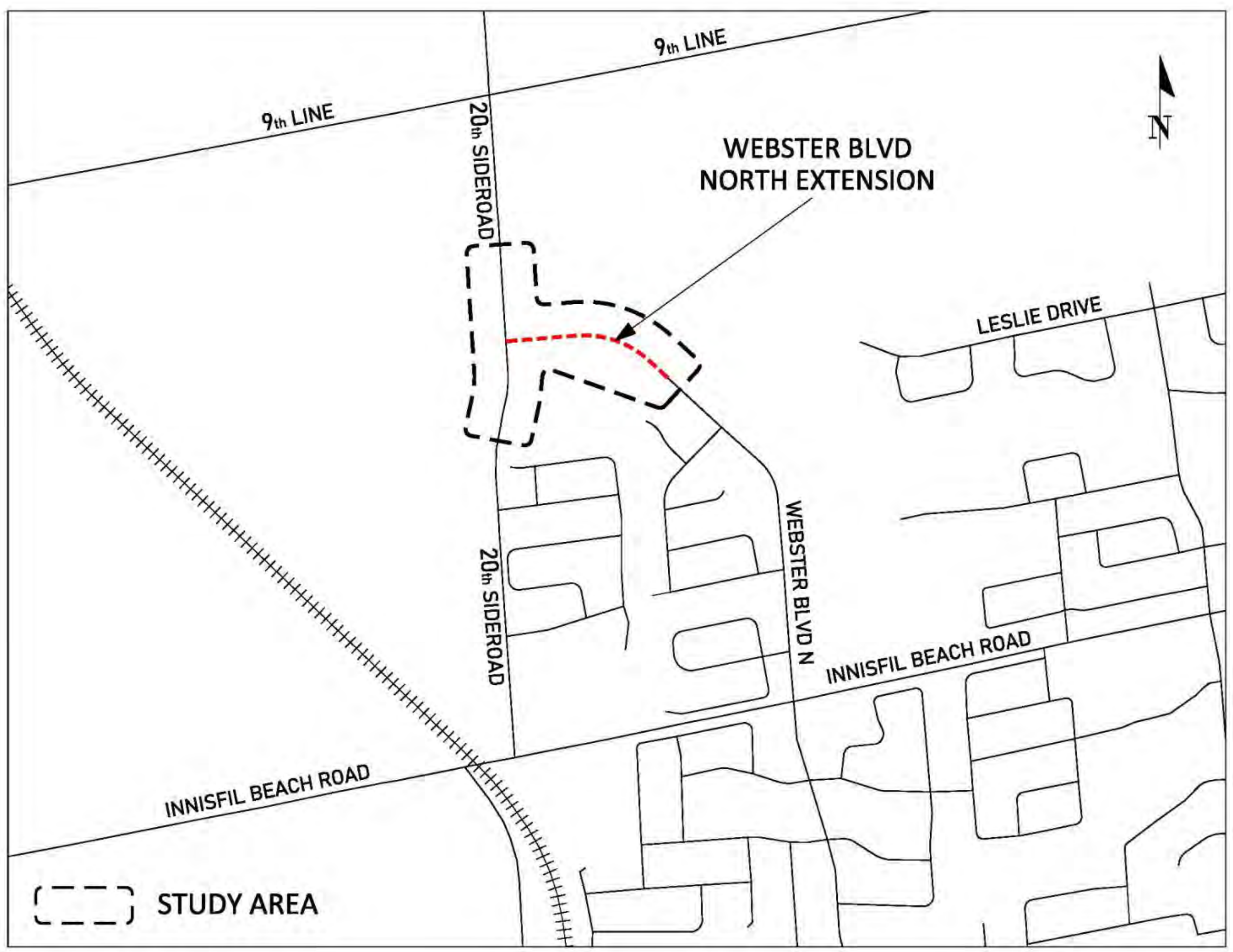

Figure E1: Study Area

E1.2 Consultation

The study was carried out in consultation with Town staff, external agencies, the public, property owners and technical specialists. The consultation included the following:

- Two (2) Public Open Houses (POHs)
- Draft and Final Study Design Report posted to the Town's website
- Liaison with external agencies

Positive feedback was received on the Technically Preferred Alternative through this consultation. Refinements were made based on this input.

This Environmental Study Report will be available to the public, stakeholders and agencies for a 30-day review period from November 8 to December 7, 2021. The study completion notice was posted on the Town website on October 28, 2021 and advertised on October 28 and November 11, 2021 in the Innisfil Journal.

E1.3 Indigenous Peoples Engagement

The study included Indigenous Peoples engagement. Each Indigenous Peoples community was offered a meeting separate from the public events. No meetings were requested by the Indigenous Peoples communities. An Indigenous Peoples log is included in **Section 3.5.**

E2 MUNICIPAL CLASS EA PROCESS

This study was undertaken to satisfy the Ontario Environmental Assessment (EA) Act following the Municipal Class EA (2015) process for a Schedule C project based on the scope, complexity and estimated capital cost of the project. The Class EA document specifies the procedures required to plan specific transportation projects according to an approved planning process.

The study approach followed the Ministry of the Environment, Conservation and Parks' (MECP) five guiding principles for EA studies, namely:

- Consider all reasonable alternatives;
- Provide a comprehensive assessment of the environment;
- Utilize a systematic and traceable evaluation of net effects;
- Undertake a comprehensive public consultation program; and
- Provide clear and concise documentation of the decision-making process and public consultation program.

The Class EA Process was undertaken in a series of phases commencing with problem identification and culminating in the filing of an Environmental Study Report (ESR). The Planning and Design Process for the Municipal Class EA is illustrated in **Figure E2**. The Class EA process includes an evaluation of all reasonable alternatives and the selection of a preferred alternative(s) with acceptable effects (including avoidance and mitigation of any residual effects) on the natural and social/cultural environments. With the completion of the ESR, the Schedule C EA process has completed four of the five phases.

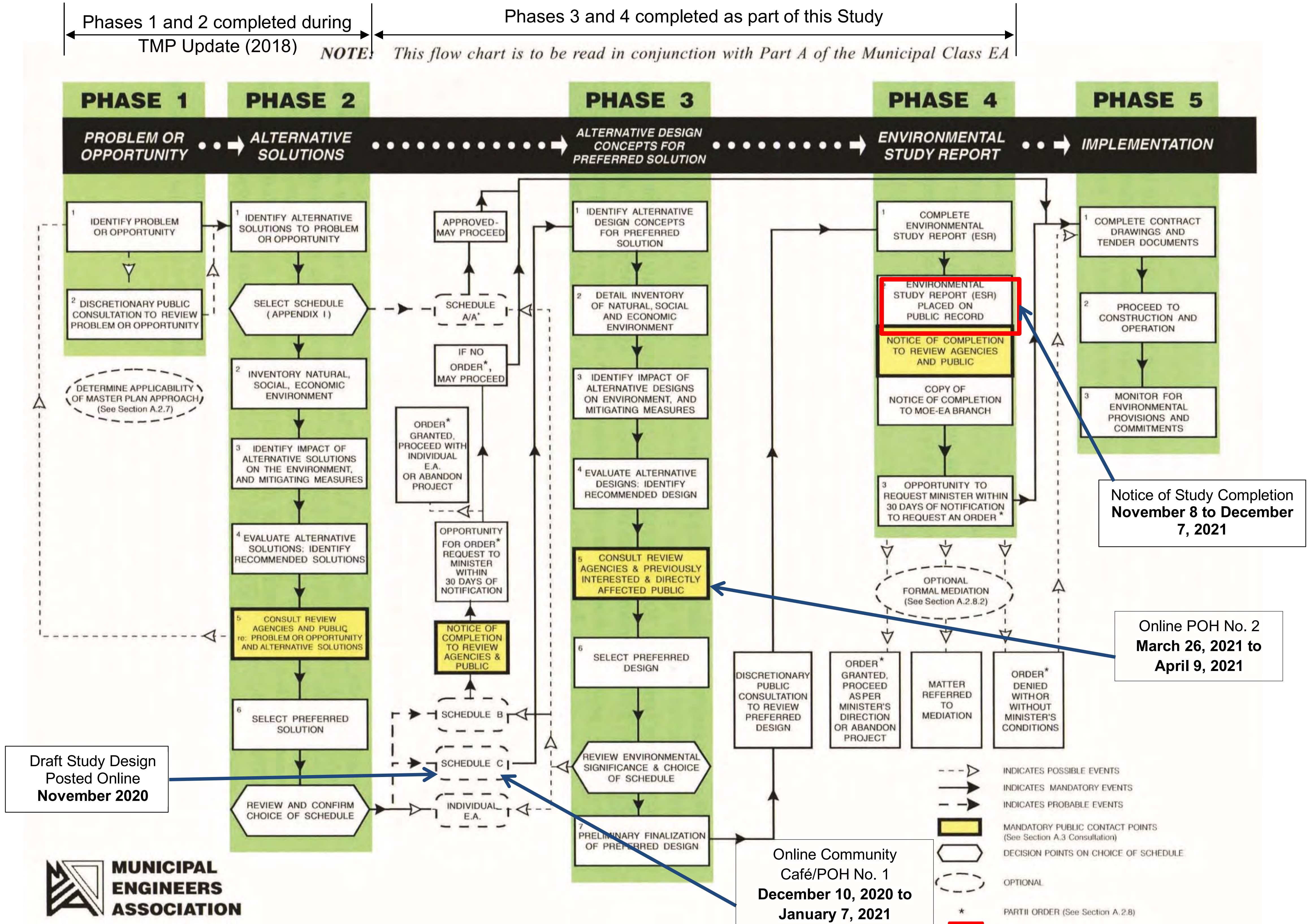

Figure E2: Municipal Class EA Planning and Design Process

This Schedule C project involved the following Phases[1].

Phase 1: Identify the Problem
Phase 2: Alternative Solutions
Phase 3: Alternative Design Concepts for Preferred Solution
Phase 4: Environmental Study Report
Phase 5: Implementation (Future Phase)

The project will be approved for design and construction if no written concerns are submitted during the 30 day Environmental Study Report review period.

E3 ANALYSIS AND EVALUATION

Based on the existing conditions and built environment, several alignment, intersection, cross section and traffic calming alternatives were developed for the boulevard extension and connection to 20th Sideroad.

E3.1 Planning Solution Alternatives

Four (4) planning solution alternatives were investigated:

- Alternative 1 – Base Case (incorporates planned road improvements by the Ministry of Transportation Ontario and Simcoe County only)
- Alternative 2 – Current Plans (further to Alternative 1, includes constructing the planned Town improvements from the 2013 Transportation Master Plan (TMP) and 2018 Updated TMP and the Trails Master Plan)
- Alternative 3 – Balanced Approach (further to Alternative 2, invests in new roads and road improvement projects, and Travel Demand Management measures including Demand Responsive Transit, Bike-share, EcoMobility1 Hubs and Zoning By-law revisions)
- Alternative 4 – Aggressive Approach (further to Alternative 3, invests in fixed-route transit)

The evaluation of Planning Alternatives, as defined in the TMP, recommended carrying forward Alternative 3 (Balanced Approach) and Alternative 4 (Aggressive Approach).

E3.2 Alignment Alternatives

Three (3) alignment alternatives were investigated:

- Alternative 1 – TMP alignment south of the heritage property (connection to 20th Sideroad)
- Alternative 2 – TMP alignment shifted northerly adjacent to heritage property (connection to 20th Sideroad)
- Alternative 3 – Connection to 9th Line

E3.3 Intersection Alternatives

Two (2) intersection alternatives were investigated:

- Alternative 1 – Signalized Intersection
- Alternative 2 – Roundabout

E3.4 Cross Section Alternatives

Six (6) cross section alternatives were investigated:

- Alternative 1A – Rural 2-lane cross section with bike lanes (26.0 m ROW)
- Alternative 1B – Alternative 1A with buffered* bike lanes (30.0 m ROW)
- Alternative 2A – Urban 2-lane cross section with bike lanes, a sidewalk and a multi-use trail (MUT) (26.0 m ROW)
- Alternative 2B – Alternative 2A with buffered* bike lanes (30.0 m ROW)
- Alternative 3A – Urban 2-lane cross section with median, bike lanes, a sidewalk and a MUT (30.0 m ROW)
- Alternative 3B – Alternative 3A with buffered* bike lanes (32 m ROW)

* “Buffered” denotes a bike lane separated from the paved vehicle lane by a grassed boulevard area.

E3.5 Traffic Calming Alternatives

Four (4) traffic calming alternatives were investigated:

- Alternative 1 – Do Nothing
- Alternative 2 – Vertical Deflections (speed humps/cushions)
- Alternative 3 – Horizontal Deflections (chicane)
- Alternative 4 – Horizontal Deflections (teardrop/asymmetrically tapered median bulb-out)

[1] Municipal Class Environmental Assessment, Municipal Engineers Association, 2015.

E4 TECHNICALLY PREFERRED ALTERNATIVES (TPA'S)

The Technically Preferred Alternative (TPA) was presented to the public at POH No. 2. The TPA includes the following elements:

- Alignment Alternative 2 (North Alignment) – provides improved land use plan and greater roadway safety.
- Intersection Alternative 2 (Roundabout Alternative) – provides improved traffic operation and safety.
- Cross Section Alternative 3A - divided urban cross section provides greater safety and follows Complete Streets design approach of providing separate spaces for all modes of travel.
- Asymmetrical Median Bulb-out Traffic Calming Alternative – provides a traffic calming measure at the entry to the existing residential area, facilitates pedestrian crossings of the street for a link to the Leslie Street trail, and provides an opportunity for greening the corridor in the median.

E5 RECOMMENDED PLAN

The Recommended Plan is a combination of the TPA and refinements based on comments heard from the public at POH No. 1 and 2.

E6 NEXT STEPS

At the end of the 30-day ESR review period, should there be no objections to the project, the Town may proceed with design and construction of the Recommended Plan, subject to availability of funding and construction priorities of Council.

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1.0 INTRODUCTION

The Town of Innisfil has conducted a Municipal Class Environmental Assessment (EA) for the planning of the extension of Webster Boulevard from the existing terminus to 20th Sideroad. The Transportation Master Plan (TMP) Update (2018) for the Town of Innisfil has included the extension of Webster Boulevard North as a major collector road in the Recommended Transportation Strategy to provide for further development. The TMP recommended that the Webster Boulevard North Extension be completed by 2031.

This Study has developed and evaluated alternatives for the alignment, intersection alternatives, cross section alternatives and traffic calming alternatives to address the needs of the Study Area. A Design Criteria for the roadway and intersection geometry was prepared and is in **Appendix A.**

This Study was undertaken as a Schedule C (Municipal) Class EA. Phases 1 and 2 of the Municipal Class Environmental Assessment (2015) were completed during the TMP and this EA Study completed Phases 3 and 4. The Study established the need and justification for the project, considered all alternatives and proactively involved stakeholders and the public in defining a Recommended Plan for the Webster Boulevard North extension.

Council approved the accelerated timeframe for the completion of the Webster Boulevard North extension.

1.1 Study Area

The Study Area is located in Alcona in the Town of Innisfil and is illustrated on **Figure 1**. Technical investigations and environmental inventories were focused within the Study Area and the area where construction is anticipated to occur.

The Orbit project, Innisfil's newest master-planned community at 6th Line near 20th Sideroad, has been approved. The Orbit project will include new retail and office space, residential housing, and more.

1.2 Background

The Town of Innisfil's population is projected to grow significantly from approximately 36,600 people to about 71,400 people by 2041. The projected population growth includes significant planned developments in the short term including Big Bay Point, Sandy Cove, Alcona, and Lefroy. Major employment growth is also expected in the Town, specifically in the Innisfil Heights Expansion Area and the 6th Line Hospital Campus. The future Innisfil GO station, located east of 20th Sideroad on 6th Line, is also expected to have an impact on growth in the Town.

The 2018 TMP Update discusses the Ontario Growth Plan for Simcoe County and identifies the settlement of Alcona as a Primary Settlement Area. Alcona is expected to see the highest population growth in the area, with new homes being developed south of Alcona in an area known as "Sleeping Lion". An extension of Webster Boulevard North as a major collector road has been identified as a means to provide for further development.

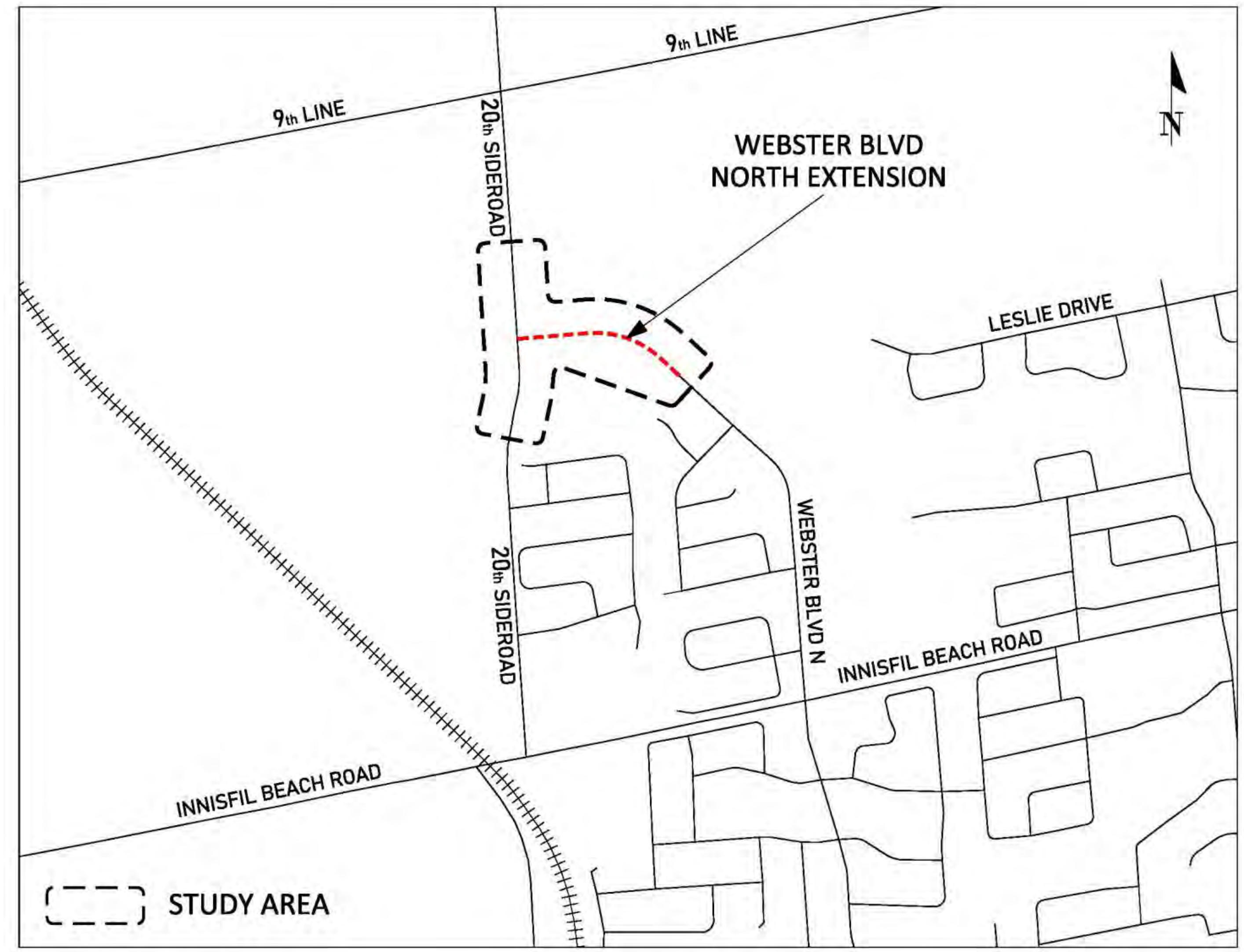

Figure 1: Study Area

1.3 Problem Statement

The Problem and Opportunity Statement identified in the Innisfil TMP Study is as follows:

> "The Town of Innisfil is characterized by distinct communities which are spread out and not well-connected. The majority of travel in the Town is by car.
>
> By 2041 the Town's population and employment numbers are expected to double. Without a balanced transportation strategy, Innisfil residents will experience increases in traffic congestion which will impact their quality of life.
>
> Future opportunities to improve the transportation network have been identified in the Town, through the recently completed Trails Master Plan, new GO station planned at 6th Line and a new demand-responsive transit service."[2]

By capitalizing on the identified needs and opportunities, the Town will achieve its transportation vision:

> "Innisfil's transportation system connects people and communities, fosters healthy living, and operates innovatively and efficiently across the Town as an environmentally and financially sustainable, resilient system ready for the future."

The TMP defined planning alternatives, including the Webster Boulevard North Extension, to address the Problem and Opportunity Statement.

[2] Town of Innisfil Transportation Master Plan Update

2.0 CLASS EA PROCESS

This Class EA followed the Schedule C requirements under the Planning and Design process of the "Municipal Class Environmental Assessment", as amended in 2015. The study was initiated by publishing a Study Commencement Notice and draft Study Design document that described the proposed work plan, public consultation, Indigenous Peoples engagement and process to be followed to meet the requirements of the Municipal Class EA process. The Study Design report, included in **Appendix B**, was initially circulated in draft form for public and agency comments, then amended and finalized based on input from the public. The Final Study Design report reflects the modified work program.

2.1 Class Environmental Assessment Process

This document specifies the procedures required to plan specific projects according to an approved planning process. This is a self-assessment process that includes mandatory public consultation and documentation.

The EA has examined alternatives for the following components of the extension of Webster Boulevard: alignments; intersection type; cross sections and traffic calming measures.

The approach to the study followed the MECP's five guiding principles for EA studies, namely:

- Consider all reasonable alternatives;
- Provide a comprehensive assessment of the environment;
- Utilize a systematic and traceable evaluation of net effects;
- Undertake a comprehensive public consultation program; and
- Provide clear and concise documentation of the decision-making process and public consultation program.

The Class EA process includes an evaluation of all reasonable alternatives and the selection of a preferred alternative(s) with acceptable effects (including avoidance and mitigation of any residual effects) on the natural and social/cultural, economic and technical environments.

The Municipal Class EA process is illustrated on **Figure 2.**

This study will only be completed to the end of the Municipal EA process (i.e. Phase 4) with implementation (Phase 5) to be completed at a later date by the Town.

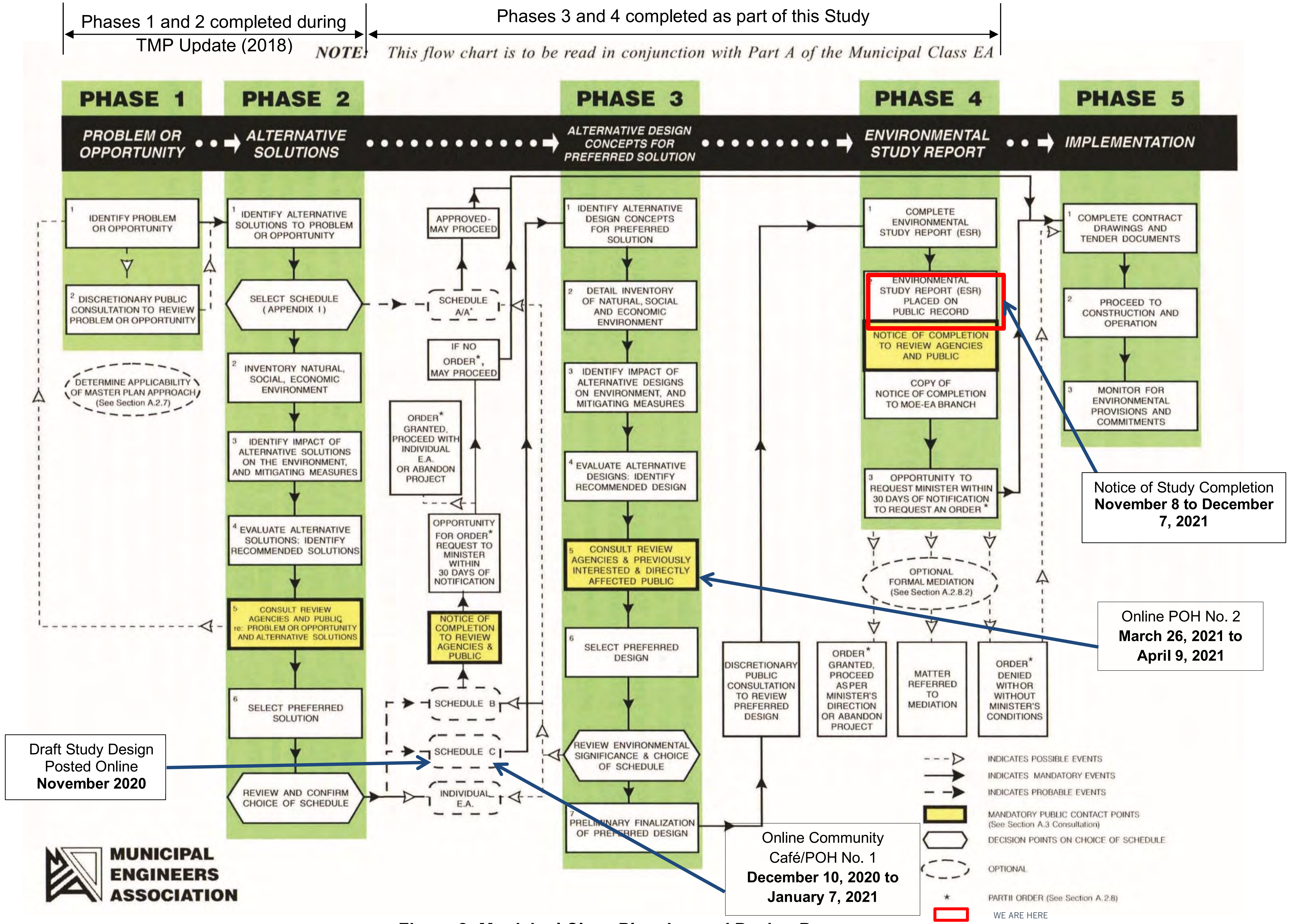

Figure 2: Municipal Class Planning and Design Process

3.0 CONSULTATION PROGRAM

The following sections provide a summary of the consultation activities held during the study.

3.1 Notices

Notices for the Study were published on the Town of Innisfil website, https://www.getinvolvedinnisfil.ca/websterblvd and in print as follows:

- Study Commencement and Notice of POH No. 1/Community Café – Innisfil Journal: Monday, November 23, 2020
- POH No. 2 – Innisfil Journal: March 4 and March 18, 2021
- Notice of Filing of Study Completion – Innisfil Journal: October 28 and November 11, 2021

See **Appendix C** for copies of the Notice of Study Commencement and POH No. 1/Community Café, Notice of POH No. 2 and the Notice of Filing of Study Completion.

3.2 Contact List

A public/agency mailing list was developed at the start of the study and was updated throughout the study. The mailing list advised stakeholders and agencies at key milestones. See **Section 3.4** for the list of stakeholders contacted.

3.3 Public Meetings

Two (2) online POH's were held during the study to present the project, the assessment of opportunities, and the preliminary alternatives. These meetings were an integral component of the study – seeking input and comments from the local road users/stakeholders. Town of Innisfil and consultant staff were available to respond to any verbal comments/questions by phone call or email during the online POH events.

At the time of the POH's, the Province of Ontario implemented restrictions on public gatherings to deal with the COVID-19 pandemic, and therefore public consultation relied on web-based communications.

3.3.1 Online POH No. 1/Community Café

The first public event was a joint Community Café and POH No. 1 event held online. The online Community Café was held on Thursday, December 10, 2020 from 6:30 pm to 8:00 pm and the online POH No. 1 was held from Thursday, December 10, 2020 to Thursday, January 7, 2021.

Notices were mailed to all property owners within the Study Area inviting them to attend the POH, and a POH Notice was published in the Innisfil Journal on Thursday, November 26, 2020 and Thursday, December 10, 2020. See **Figure 3** for a map of the broader Study Area mailing list.

Figure 3: Map of Broader Study Area Mailing List

The meeting presented information on the Municipal Class EA Process, background studies, Study Area issues, environmental inventories, preliminary design alternatives, and next steps.

The online Community Café process followed the principles of the "World Café" philosophy; namely, that people want to talk together about issues that matter, and that that as we talk together, we are able to collectively achieve greater wisdom. People have the capacity to work together and can collectively be creative and insightful when actively engaged in meaningful conversations at the commencement of a project. The Community Café is a simple yet effective conversational method for fostering dialogue, accessing collective intelligence and creating innovative possibilities for action. The six Café principles are:

1. Set the context;
2. Explore questions that matter;
3. Encourage everyone's contributions;
4. Connect diverse perspectives;
5. Listen together for insights; and
6. Share collective discoveries.

The Community Café was an informal event that facilitated conversation by providing participants with a comfortable and welcoming environment.

The event was organized to create a network of dialogue about issues that matter to the community. Each conversation was chosen to reflect the most important parameters of the project, and to determine the desired goals of the participants. Four topics were provided as discussion points to reflect the actual concerns of the community. A group discussion between participants allowed key ideas and perspectives to be exchanged, which provided new insights to the project.

The Café facilitator led the online discussion to provide a neutral voice and encourage all participants to contribute to the conversation and to remain focused on the topic being discussed. Exhibits were posted online for the duration of the online event.

The Community Café event began with an introductory presentation, which is provided in **Appendix C**. Following the project introduction, the process and objectives of the Community Café event were explained. The participants were encouraged to stay in the virtual meeting to begin discussion on the applicable topic. The four topics that were chosen to be discussed during the event were:

- Safety – Pedestrians/Cyclists
- Traffic Operations
- Intersection Design
- Environmental

The public representatives were encouraged to provide input/feedback.

Six (6) people registered for the Community Café and three (3) people attended the virtual meeting. Each person was encouraged to voice any issues or concerns. A total of five (5) comment sheets were received during the comment period.

See **Appendix C** for a copy of the Community Café/POH No. 1 Summary Report and comment sheets.

3.3.2 POH No. 2

The second POH was held online from Friday, March 26, 2021 to Friday, April 9, 2021. Stakeholders and the general public were invited to the event.

Notices were mailed to all property owners within the Study Area inviting them to attend the POH, and a POH Notice was publicized in the Innisfil Journal on Thursday March 4, 2021 and Thursday, March 18, 2021. See **Figure 3** for a map of the broader Study Area mailing list.

Exhibits were posted online to present the results of the analysis and evaluation of alternatives, culminating in the presentation of the preliminary Recommended Plan and description of next steps.

A total of three (3) comment sheets were received during the comment period.

See **Appendix C** for a copy of the POH No. 2 Summary Report and comment sheets.

3.4 Stakeholder Consultation

All agencies or groups that may have had an interest in the project or any documentation to contribute to the study were contacted at the start of the Class EA for their input. The following ministries, agencies and stakeholders were invited to attend the two POH meetings:

- Alcona Beach Club Inc.
- Association Franco-Ontarienne Des Conseils Scolaires Catholiques
- Barrie Collingwood Railway
- Barrie Cycling Club
- Bell Canada
- BonSecour Track and Trail Snowmobile Club
- City of Barrie
- City of Barrie Fire and Emergency Services
- Conseil Scolaire Viamonde
- Cookstown and District Chamber of Commerce
- County of Simcoe
- County of Simcoe Paramedic Services

- Degrassi Cove Association
- Enbridge Gas
- Environment Canada
- Georgian College
- Greater Innisfil Chamber of Commerce
- Hydro One Network Inc.
- Infrastructure Ontario
- Innisfil District Association
- Innisfil Fire Rescue Services
- Innisfil Heritage Committee
- InnPower
- Lake Simcoe Region Conservation Authority
- Metrolinx/GO Transit
- Ministry of Environment, Conservation and Parks, Barrie District Office
- Ministry of Environment, Conservation and Parks
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources and Forestry, Midhurst District Office
- Ministry of Tourism Culture and Sport
- Ministry of Transportation
- Ontario Federation of Agriculture
- Ontario Ministry of Agriculture, Food and Rural Affairs
- Ontario Provincial Police, Operational Policy and Strategic Planning Bureau
- Pratt Development
- Rogers Communications
- Royal Victoria Regional Health Centre
- Simcoe County District School Board
- Simcoe County Historical Association
- Simcoe County Police Services - North Division, Operational Policy and Strategic Planning Bureau
- Simcoe County Student Transportation Consortium
- Simcoe Muskoka Catholic District School Board
- Simcoe Muskoka District Health Unit
- Town of Innisfill
- Transport Canada
- General Public

Appendix D includes select correspondence received from interested individuals, ministries and agencies. Selected correspondence refers to correspondence that contains comments and information relevant to the project (versus letters of acknowledgement with no comments).

3.5 Indigenous Peoples Engagement

The following Indigenous Peoples communities and agencies were contacted at the start of the study, and at each POH for their input, and will be contacted at the Study Completion and advised of the ESR public review period.

- Aamjiwnaang First Nation
- Alderville First Nation
- Beausoleil First Nation
- Chippewas of Georgina Island
- Chippewas of Rama First Nation
- Curve Lake First Nation
- Georgian Bay Métis Council
- Haudenosaunee Confederacy Chiefs Council
- Hiawatha First Nation
- Huron-Wendat Nation
- Metis Nation of Ontario
- Mississaugas of Scugog Island First Nation
- Mississaugas of the Credit First Nation
- Moon River Metis Council
- Moose Deer Point First Nation
- Six Nations of the Grand River
- Wahta Mohawks (Mohawks of Gibson)
- Wasauksing First Nation
- Williams Treaties Coordinator

An offer to meet separately from the public events with each community was extended; however, no community accepted the offer. Further, no communities chose to respond to the three points of contact and notification.

3.6 Technical Advisory Committee

At the study initiation, a Technical Advisory Committee (TAC) was established which included representatives from the Town of Innisfil, County of Simcoe, Lake Simcoe and Region Conservation Authority (LSRCA), and BT Engineering Inc. (consulting staff). As listed in **Table 1,** the TAC members included:

Table 1: TAC Members

Town of Innisfil	
Suzanna Nilsson	Project Manager
Steven Montgomery	Senior Planner
Amber Leal	Capital Project Manager
InnPower	
Tony Mendicino	Electrical Engineering Technologist
County of Simcoe	
Greg McGrath	Construction Superintendent
Julie Scruton	Manager, Transportation Construction
Christian Meile	Director, Transportation and Engineering
Lake Simcoe and Region Conservation Authority	
Taylor Stevenson	Senior Environmental Regulations
BT Engineering Inc.	
Steve Taylor	BTE Project Manager
Darcie Dillon	Assistant Project Manager
Stephen Brook	Traffic Engineering
Gord Bell	Environmental Lead
Rudi Warme	Natural Environment
Zachery Wells	Natural Environment

4.0 EXISTING CONDITIONS

Much of the Study Area has been disturbed in the past by grading and excavation activities, and an informal construction laneway leads from the current Webster Boulevard cul-de-sac to an abandoned sand pit in the northwest section. A desktop review of the Study Area found it to be bounded to the south and east by two natural heritage system corridors, each containing tributaries to Leonard's Creek and pockets of unevaluated wetlands. Two residential homes are located immediately north of the sand pit. Agricultural fields occupy the remainder of the Study Area. The existing conditions of the natural and built environment, land use and property, and socio-economic environment in the Study Area are described in this chapter.

4.1 Natural Environment

4.1.1 Wetlands/Terrestrial Environment

Woodlands in the Study Area were found to be a mixture of mature poplar, shrub willow, and dense White Cedar. Poplar dominated woodlands, which are identified as unevaluated wetland in Provincial mapping, occur along the south boundary as a large woodlot, and to the north as a tree line screening a residence on 20th Sideroad from the pit. These poplar woodlands/swamps are successional and contain no significant features Species at Risk (SAR) that could be observed at the time of the site visit. Eastern White Cedar dominated conifer woodland is found to the northeast along the valleylands of headwater tributaries of Leonard's Creek. The Natural Environment Memorandum is in **Appendix E**.

4.1.2 Aquatic Environment

A small watercourse (Leonard's Creek, with nearby Lake Simcoe at its outlet) flows across abandoned sand pit from the edge of a wooded area and wetland pocket in the southwest which appears to be the source area, as indicated on **Figure 4**. The water was flowing clear and cold at a small culvert on the pit access laneway, and this reach of stream would appear to support good quality fish habitat. The upper portion of the 0.5 m wide channel flows through meadow before it enters a dense growth of cedars. Within this easterly wooded area, a tributary from the northwest joins the main channel. LSRCA background documents identify the Leonard's Creek Subwatershed as providing a mixture of cool and cold-water fish habitat.

As the proposed boulevard extension will occur over the Leonard's Creek tributary, work has the potential to result in serious harm to fish or fish habitat and DFO involvement will be triggered in the form of a Request for Review. Based on the anticipated limited extent of in-water work required, an Authorization under the *Fisheries Act* is not anticipated. Detailed aquatic habitat assessments and fish community surveys should be undertaken at the location of the existing culvert crossing during detailed design to confirm background information available through LSRCA background documents. The Natural Environment Memorandum is in **Appendix E**.

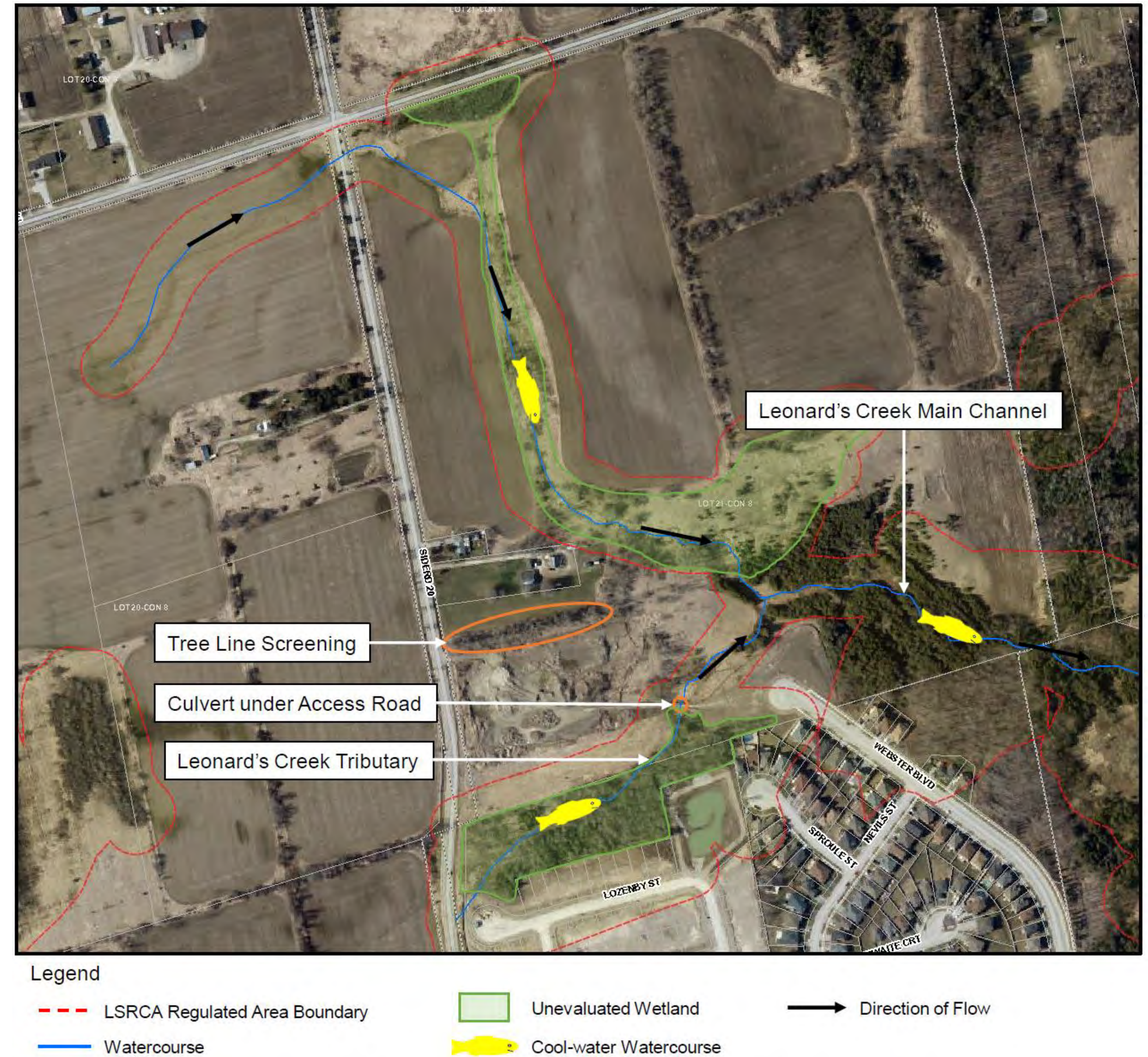

Figure 4: Natural Environmental Existing Conditions

4.1.3 Species at Risk

Based on the initial reconnaissance visit, the desktop review of available information and habitats present in the Study Area, it has been determined that there is a potential for Species at Risk (SAR) to be present in the Study Area. Specifically, the Eastern Wood-Pewee (*Contopus virens*) (Special Concern (SC)) may utilize the poplar woodland in the south part of the Study Area, Eastern Meadowlark (*Sturnella magna*) (Threatened (THR)) may nest in adjacent grassland fields, and Butternut trees (*Juglans cinerea*) (Endangered (END)) have been observed in the Leonard's Beach (Alcona North) Secondary Plan Area. Blanding's Turtle (*Emydoidea blandingii*) (END) was also identified in a review of online databases. However, habitat was not observed within the Study Area. Further surveys in appropriate seasons would be needed to confirm the presence/absence of these SAR and any others in the Study Area. These surveys should be undertaken as part of detailed design and not during the EA, as it is unknown when construction would take place. If permits and/or registration under the ESA are required, surveys would have to be up-to-date and consider SAR listings and protocols at that time.

It is anticipated that disturbance to potential SAR habitat would be limited and can be largely mitigated without the need for permits under the ESA.

The Natural Environment Site Reconnaissance memorandum is included in **Appendix E**.

4.2 Social Environment

4.2.1 Cultural Heritage

BRAY Heritage completed a Heritage Resource Assessment for Alcona North in 2011. The heritage potential for 2351 20th Sideroad was determined to be medium for the house and low for the landscape (contextual value). The recommendations of this study are not expected to have any adverse impacts on the property or building. See the Heritage Resource Assessment report in **Appendix F**.

4.2.2 Archaeology

A Stage 1 Archaeological Assessment was conducted within the Study Area. The assessment was undertaken in accordance with the Standards and Guidelines for Consultant Archaeologists (2011) to determine whether there was potential for the discovery of archaeological resources within the Study Area. The Stage 1 background study included a review of current land use, historic and modern maps, past settlement history for the area, and a consideration of topographic and physiographic features, soils, and drainage. It also involved a review of previously registered archaeological resources within 1 km of the project area, and previous archaeological assessments within 50 m of the project area. The background study indicated that the property had potential for the recovery of archaeological resources. The following recommendations were made:

- The grassed areas within the Study Area, as shown on Map 13 of **Appendix G** (0.15 ha; 3.2%), are not obviously disturbed and retain archaeological potential. These areas will require Stage 2 assessment. In keeping with provincial standards, the unploughable land is recommended for test pit survey, using a 5 m transect interval.
- The agricultural field within the project area, as shown on Map 13 (Appendix G) (0.29 ha; 6.1%), is not obviously disturbed and retains archaeological potential. This area will require Stage 2 assessment. In keeping with provincial standards, the ploughable land is recommended for pedestrian survey, using a 5 m transect interval. As per Section 2.1.2, Standard 1.f (MTC 2011:32), if the project area within the agricultural field is less than 10 m wide, it can be assessed via test pit survey.

A Stage 2 Archaeological Assessment was conducted within the limits of archaeological potential identified in the Stage 1 Archaeological Assessment. At the time of the assessment, ploughing of the agricultural field was not feasible; if required, further field review can be completed following purchase of the lands by the municipality. No further studies are recommended.

The Stage 1 and Stage 2 Archaeology documentation are provided in **Appendix G**.

4.2.3 Noise and Vibration

The Webster Boulevard North extension is expected to increase traffic volumes on Webster Boulevard by approximately 3,000 vehicles/day. Where no dominant noise source currently exists or is projected to exist in the future, as a Guideline a Class 2 (suburban) area is assumed to be 50 dBA as per MECP's NPC-205 and NPC-233. Noise levels are expected to increase by less than 5 dBA with or without the project in 2024 or 2034, and are less than 65 dBA and therefore the consideration of the provision of mitigation is not required. The effect of the project will have minor changes in sound levels.

The Noise Memorandum is included in **Appendix H**.

4.2.4 Air Quality

Air Quality is composed of two components, emission gases and particulate matter released from vehicular traffic, from both cars and trucks. In the study area, there are no other sources of emissions and particulate matter other than vehicular traffic. This connection will minimize current out-of-the-way travel within a major residential subdivision for those travelling north to the 9th Line and Barrie area. The long-term transition to electrical vehicles is expected to lead to reduced emissions gasses with commuters being the leaders in opting for electrical vehicles. In addition, the trend towards working from home and flexible work week is expected to further reduce need for daily vehicular travel.

Emission Gases

20th Sideroad – In the study area, the prevailing westerlies, across the farm field and low traffic volumes will disperse the emissions before reaching existing and future residential receivers.

Webster Boulevard – The prevailing westerlies blowing down Webster Boulevard will disperse emissions into the Protected Natural Environmental area to the east of the Boulevard during the times of commuter travel.

20th Sideroad – Webster Boulevard Intersection

- Tee-Intersection with Webster Stop Condition - This design will create commuter vehicle emissions associated with vehicles idling, and emissions associated with subsequent vehicle acceleration.
- Traffic signals - This design will create commuter vehicle and truck emissions associated with stop and go traffic and vehicles idling at red lights on both roads, and the emissions associated with subsequent vehicle acceleration.
- Roundabout - This design will result in the lowest commuter and truck vehicle emissions by eliminating vehicles idling and acceleration, since roundabouts are based on a continuous flow of traffic.
- Emission mitigation - All three designs will allow the planting of upwards of 89 trees and 37 shrubs in the boulevards and median that will act as carbon sinks. The roundabout allows 21 of the 89 trees around the perimeter, as opposed to the right-of-way on the 20th Sideroad if a Tee-intersection or traffic signals are used.

Particulate Matter

Not widely recognized is the particulate matter generated during the operations of vehicles. However, the EPA has recognized the generation of particulate matter as a significant air quality issue. The particulate matter is composed of brake pad and disks/drums and tire wear (rubber) generated with the stopping action of vehicles. The more severe the stopping action, the greater the particulate matter generated. A moving vehicle does not generate particulate matter. Based on the manner in which particulate matter is generated, the air quality of the intersection alternatives can be compared.

20th Sideroad – Webster Boulevard Intersection

- Tee-Intersection with Webster Stop Condition - This design will create particulate matter associated with low speed vehicles stopping.
- Traffic signals - This design will produce significantly more particulate matter, given the higher volume of cars, trucks and heavy trucks on the 20th Sideroad requiring stop-and-go operations (brakes). In addition, the speed on the 20th Sideroad is posted higher than Webster Boulevard, resulting in heavier braking for amber/red lights.
- Roundabout - This design will result in the lowest generation of particulate matter by providing continuous traffic flow and eliminating the need for the stop condition.
- Particulate matter - The roundabout design minimizes the generation of particulate matter. An Environmental Protection Agency study of 50 "Connected Cities" has shown a 14-15% drop in particulate matter due to traffic flow not stopping at traffic signals. "Connected Cities" are cities that have stop lights that communicate with specially equipped vehicles to govern their speed to receive continuous green lights.[3]

Air Quality Summary - Combined Effects

Emission gases impact to sensitive residential receivers are anticipated to be minimal due to a combination of low traffic volumes, the separation distances of the residences from the roadway generation locations, the dispersion effect and orientation of Webster Boulevard to the prevailing westerly winds, and the design allowing the planting of a significant number of trees. The use of a roundabout will minimize the creation of emission gasses normally associated with intersection traffic.

Particulate matter impacts to sensitive residential receivers are anticipated to be minimal with the recommendation of a roundabout with continuous traffic flow.

4.3 Technical Investigations

4.3.1 Geotechnical

The geotechnical investigation was completed to confirm the existing subsurface conditions and provide geotechnical design and construction recommendations for the proposed road extension. A borehole investigation was completed on October 14, 2020, to assess subsurface conditions at the site. A total of four boreholes, designated as BH101-20 through BH104-20, were advanced. All of the boreholes were terminated at depths ranging from 3.5 m to 5.0 m below ground surface (mbgs). Locations of the boreholes are shown on Figure 1 of **Appendix I**. The investigation did not identify any geotechnical issues with the project.

4.3.2 Hydrogeological

The purpose of the hydrogeological assessment was to obtain subsurface information regarding soil and groundwater conditions in the Study Area in support of design and construction recommendations for the proposed road extension.

The subsurface conditions of the Study Area were found to consist of glacial till deposits comprised of predominantly sand with gravel to silty sand. Groundwater levels in the Study Area ranged from 1.33 metres below ground surface (mbgs) to 3.27 mbgs. Hydraulic testing of the

[3] www.Autoline.tv , Autoline This Week, April13, 2021, #2509, "How Would You Like To Drive And Only Get Green Traffic Lights?"

monitoring wells indicated that the hydraulic conductivity of the shallow water bearing soils ranged between 1.03 x 10^{-7} m/s and 1.16 x 10^{-5} m/s. Preliminary construction dewatering rates ranged between 7 m^3/day and 73 m^3/day. The Zone of Influence (ZOI) was estimated to extend up to 72 m from the trench excavation. It was recommended that the ZOI and anticipated dewatering rates should be updated upon review of detailed development plans. Based on the study recommendations for the roadway design, no works are expected to occur below groundwater levels.

The Hydrogeological document is provided in **Appendix J**.

4.3.3 Drainage

The assessment of existing drainage conditions is based on a site visit conducted on November 29, 2020, background information provided by the Town, and documentation available on the Lake Simcoe Region Conservation Authority (LSRCA) and the Simcoe County websites. A Stormwater Management Report was completed by GHD in 2015 for a residential subdivision located south of the Study Area and it is included in **Appendix K**.

The Study Area is located within the Leonard's Creek Subwatershed. The watercourse that will eventually cross the proposed Webster Boulevard extension is a small tributary of Leonard's Creek. It is recommended that the tributary be conveyed by a 1600 mm CSP culvert or, alternatively, a 2400 mm by 1200 mm concrete box culvert. The Culvert Assessment memo is in **Appendix L**.

4.3.4 Traffic

The forecast traffic demand on the new link is associated with drivers who will avoid the traffic delays at the Innisfil Beach Road/20th Sideroad intersection. The secondary traffic at the new intersection and Webster Boulevard North will be associated with development on lands in the Study Area. The TMP forecast the demand on the collector road is 3,000 veh/day.

4.3.5 Municipal Servicing

As part of the Innisfil Master Servicing Plan Update (Master Plan) completed by C.C. Tatham & Associates Limited (July 13, 2018), both watermain and sanitary sewer servicing will be upgraded through the project area.

<u>Watermain</u>: A proposed 600 mm diameter distribution watermain will be installed on 20th Sideroad through the project area (see **Figure 5**). Commercial and/or residential development in the area will be serviced either directly from the distribution main or via a localized feedermain that would be constructed in addition to the recommended plan.

If a localized feedermain is constructed, it should be sized to potential development considering both water and fire flows for commercially zoned properties.

Fire protection and servicing to individual properties would be completed to Town of Innisfil standards.

<u>Sanitary Sewer</u>: There are currently no long term plans to install critical sanitary sewer infrastructure through the project area as it currently falls outside the settlement areas and there are plans to decommission existing Sewage Pumping Station (SPS) #7 as shown in **Figure 6**.

Commercial and/or residential development in the area will need to either tie into the existing sanitary sewer network or new connections planned to connect to future gravity and forcemain pipes.

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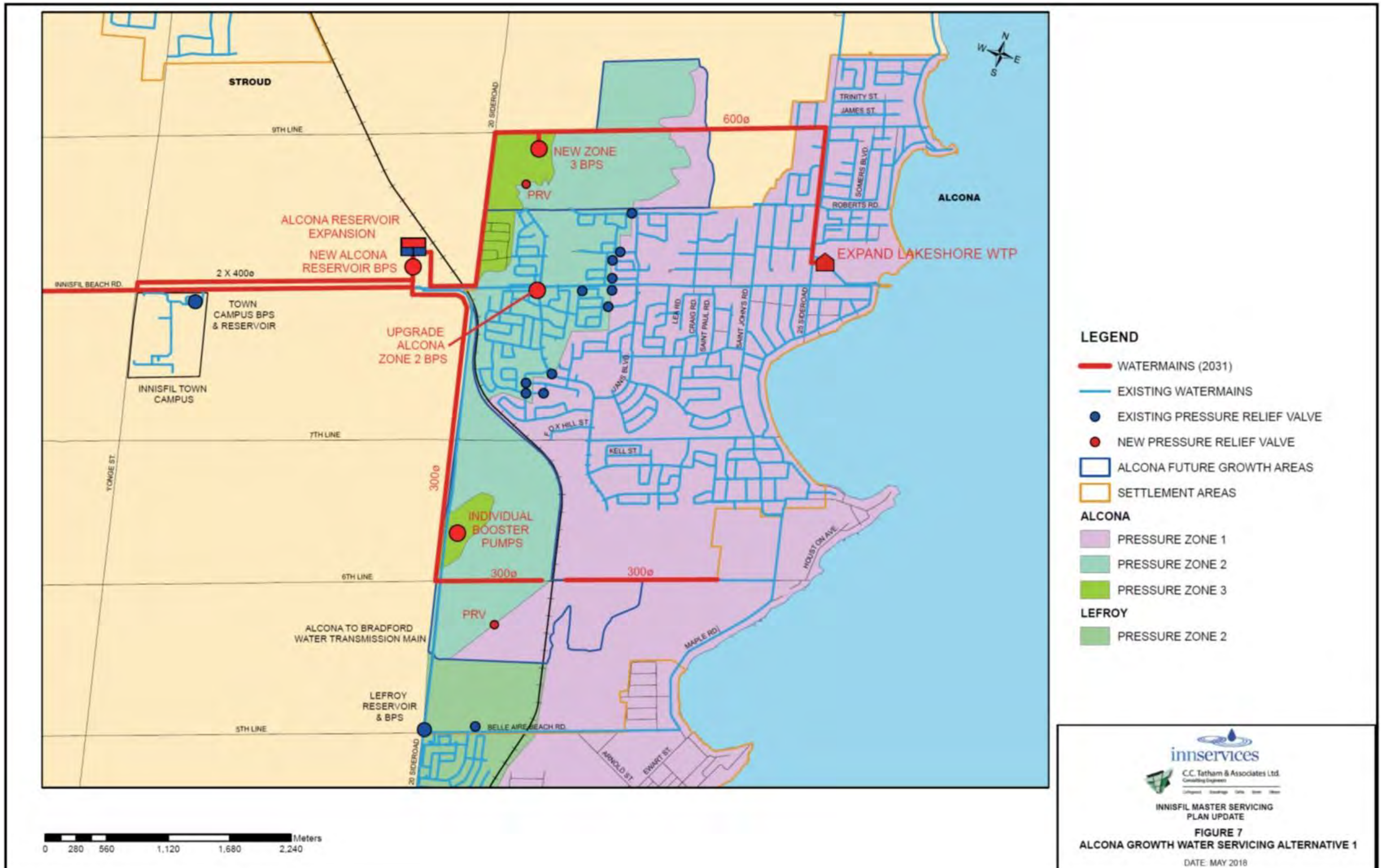


Figure 5: Innisfil Master Servicing Plan Update – Figure 7

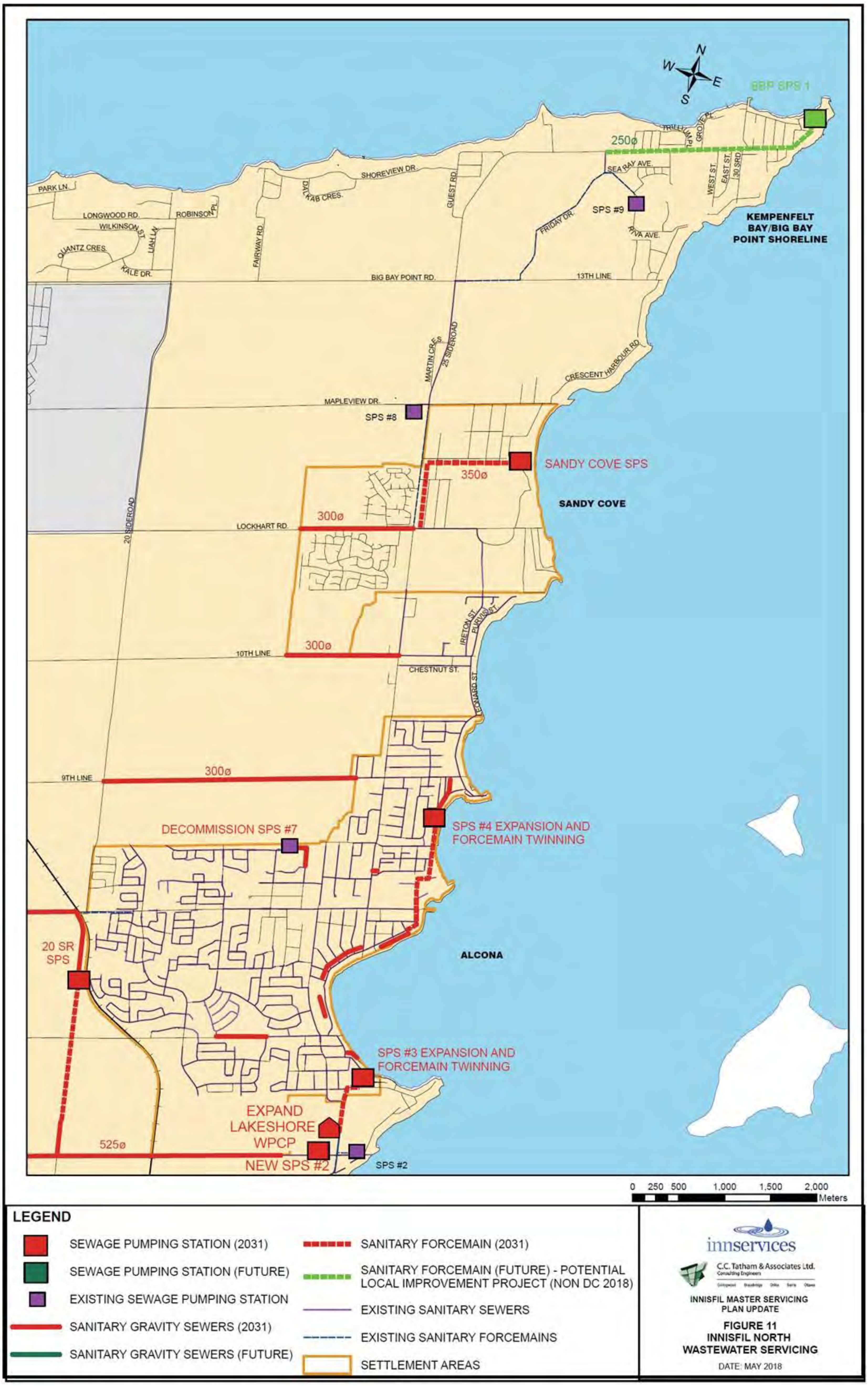


Figure 6: Innisfil North Wastewater Servicing Plan – Figure 11

4.4 Existing Land Use

The constructed portion of Webster Boulevard is located within the Primary Settlement Area of Alcona, while the proposed north extension is outside of the Alcona Community and in an Agricultural Area. This area immediately north of the Alcona Settlement Area is also designated a Highly Vulnerable Aquifer and is situated within Natural Heritage System Corridor abutting a Key Natural Heritage Feature to the east.

4.4.1 Town of Innisfil Official Plan (2018)

The Town of Innisfil Official Plan (OP) is the key planning document to "enhance place making, community character and social connections in [the] Town and to guide municipal actions and other Town master planning processes"[4]. Within the current OP, there are two schedules and two appendices specific to land use and associated requirements for the Study Area:

- Schedule A – Municipal Strategy (Primary Settlement Area, Countryside)
- Schedule B – Land Use (Rural Area, Key Natural Heritage Feature, Agricultural Area)
- Appendix 10 – Significant Woodlands
- Appendix 14 – Highly Vulnerable Aquifers

Alcona is the Town's only Settlement Area and is identified in the Growth Plan for the Greater Golden Horseshoe (2017) and the County of Simcoe Official Plan as accommodating a significant portion of forecasted population growth.

If development is proposed on lands adjacent to a Key Natural Heritage Feature or Key Hydrologic Feature, the proposed development must demonstrate consistency with the Provincial Policy Statement, Growth Plan and Lake Simcoe Protection Plan. Significant Woodland is a component of a Key Natural Heritage Feature and is defined as any woodland greater than four (4) hectares or any woodland containing one (1) hectare or more wholly or partially within 30 m of a permanent stream. A number of additional definitions are included in the OP, Section 23.3.128.

Highly Vulnerable Aquifers, though not explicitly defined in the OP, require that particular care be taken to avoid the potential for development and associated construction to impact groundwater or surface water holdings.

[4] Town of Innisfil Official Plan (2018)

5.0 ANALYSIS AND EVALUATION OF ALTERNATIVES

The analysis and evaluation process is a central requirement of the Class EA process and involves a 2-step process for decision-making. The initial assessment is the assessment of Planning Solutions, which considers different approaches to address the problem. The second step is the evaluation of preliminary design alternatives. These two steps in the analysis and evaluation process are described in the following sections.

5.1 Assessment of Alternative Planning Solutions

The TMP considered and did not carry forward the "Do Nothing" alternative based on the need to define an integrated transportation and land use plan. Four (4) Alternative Planning Solutions were considered for the Webster Boulevard North Extension during the Town's TMP:

- Alternative 1 – Base Case: Incorporates planned road improvements by the Ministry of Transportation Ontario (MTO) and Simcoe County only.
- Alternative 2 – Current Plans: Further to Alternative 2, includes constructing the planned Town improvements from the 2013 TMP and the Trails Master Plan.
- Alternative 3 – Balanced Approach: Further to Alternative 3, invests in new roads and road improvement projects, and Travel Demand Management measures including Demand Responsive Transit, Bike-share, EcoMobility1 hubs and Zoning By-law revisions.
- Alternative 4 – Aggressive Approach: Further to Alternative 4, invests in fixed-route transit.

The evaluation of Planning Alternatives selects the alternative(s) that best address the Problem and Opportunity Statement. The evaluation of Planning Alternatives, as defined in the TMP, recommended carrying forward Alternative 3 (Balanced Approach) and Alternative 4 (Aggressive Approach).

5.2 Generation and Evaluation of Preliminary Design Alternatives

A number of preliminary design alternatives were considered which would improve traffic operations through the study area to meet existing and future traffic demand. A "long list" of reasonable alternatives was generated to address the identified needs of the Study Area.

A range of operational improvement alternatives was considered to provide site specific solutions to existing and future transportation and safety concerns. The alternatives were categorized under four groups of preliminary design alternatives:

- Alignment Alternatives
- Intersection Alternatives
- Cross Section Alternatives
- Traffic Calming Alternatives

These groups of alternatives are summarized below:

5.2.1 Alignment Alternatives

Although the TMP identified a general alignment for the road extension, this EA Study has investigated three (3) alignment alternatives:

- Alternative 1 – TMP alignment south of the heritage property (connection to 20th Sideroad)
- Alternative 2 – TMP alignment shifted northerly adjacent to heritage property (connection to 20th Sideroad)
- Alternative 3 – Connection to 9th Line (added alternative based on public comments during POH No. 1)

The alignment alternatives are shown in **Figure 7**.

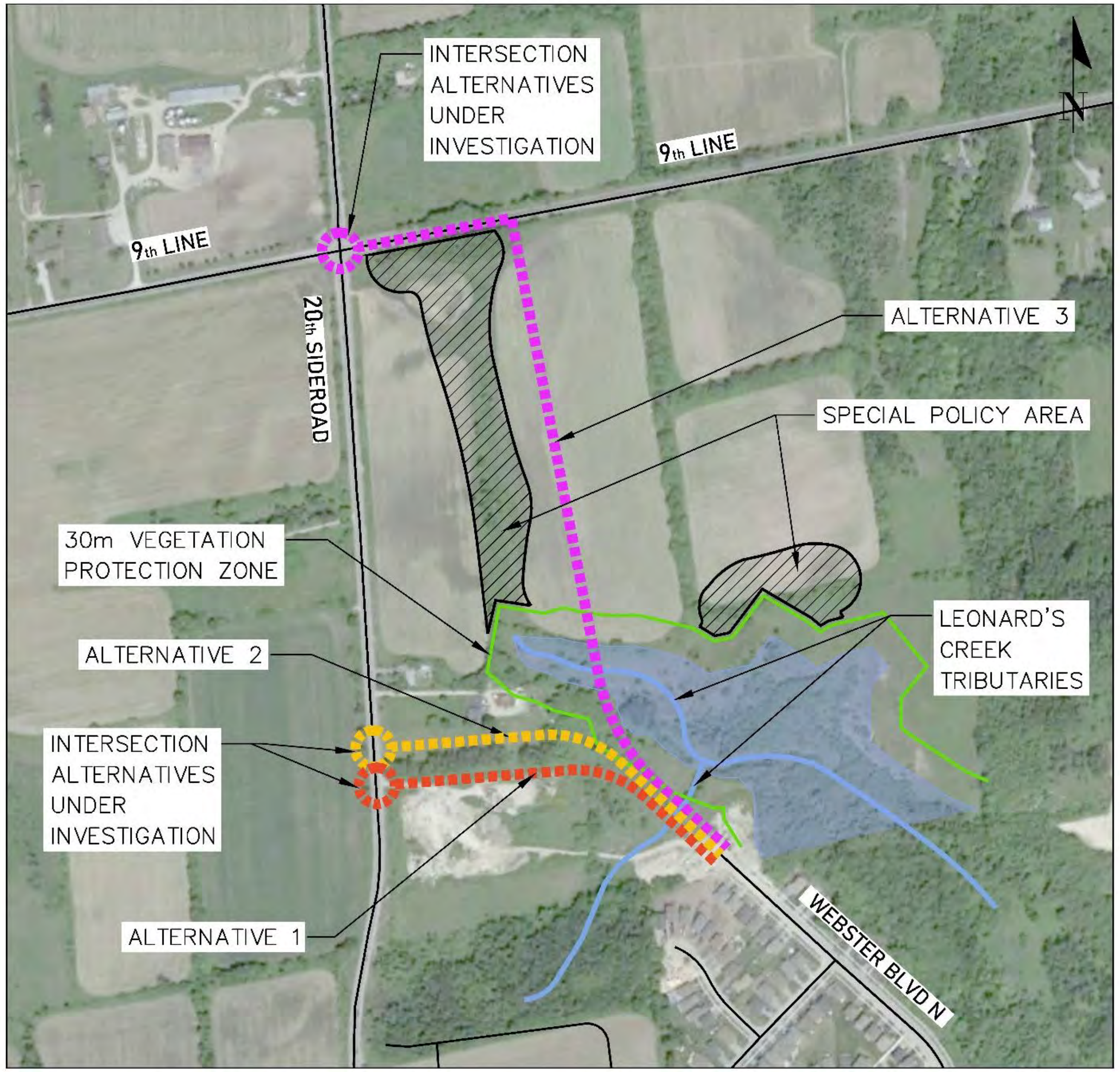


Figure 7: Alignment Alternatives

5.2.2 Intersection Alternatives

Two (2) intersection alternatives were investigated:

- Alternative 1 – Signalized Intersection
- Alternative 2 – Roundabout Intersection

The intersection alternatives are shown in **Figure 8** and **Figure** 9.

5.2.3 Cross Section Alternatives

Six (6) cross section alternatives were investigated:

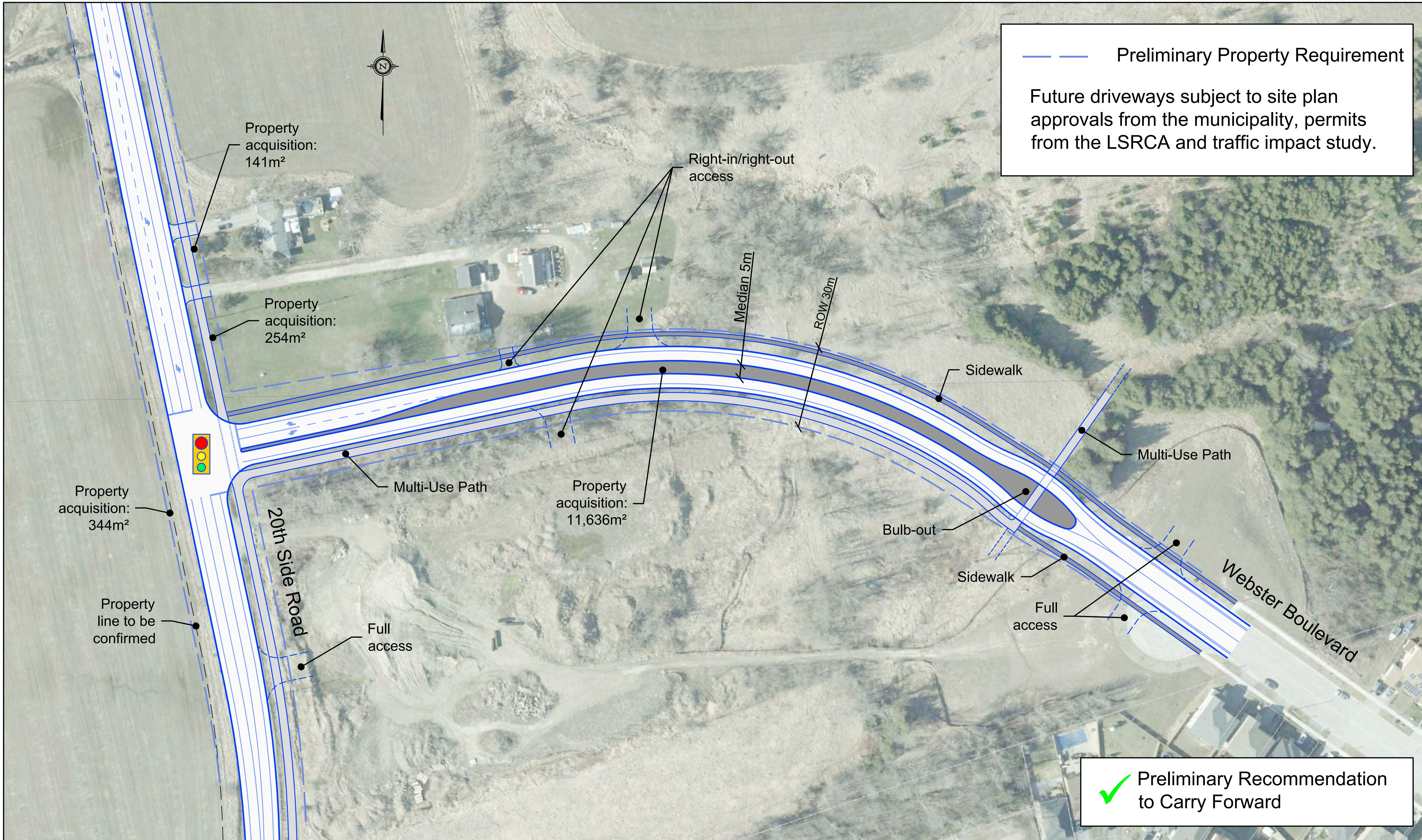
- Alternative 1A – Rural 2-lane cross section with bike lanes (26.0 m ROW)
- Alternative 1B – Alternative 1A with buffered bike lanes (30.0 m ROW)
- Alternative 2A – Urban 2-lane cross section with bike lanes, a sidewalk and an MUT) (26.0 m ROW)
- Alternative 2B – Alternative 2A with buffered bike lanes (30.0 m ROW)
- Alternative 3A – Urban 2-lane cross section with median, bike lanes, a sidewalk and a MUT (30.0 m ROW)
- Alternative 3B – Alternative 3A with buffered bike lanes (32 m ROW)

The cross section alternatives are shown in **Figure 10** and **Figure** 11.

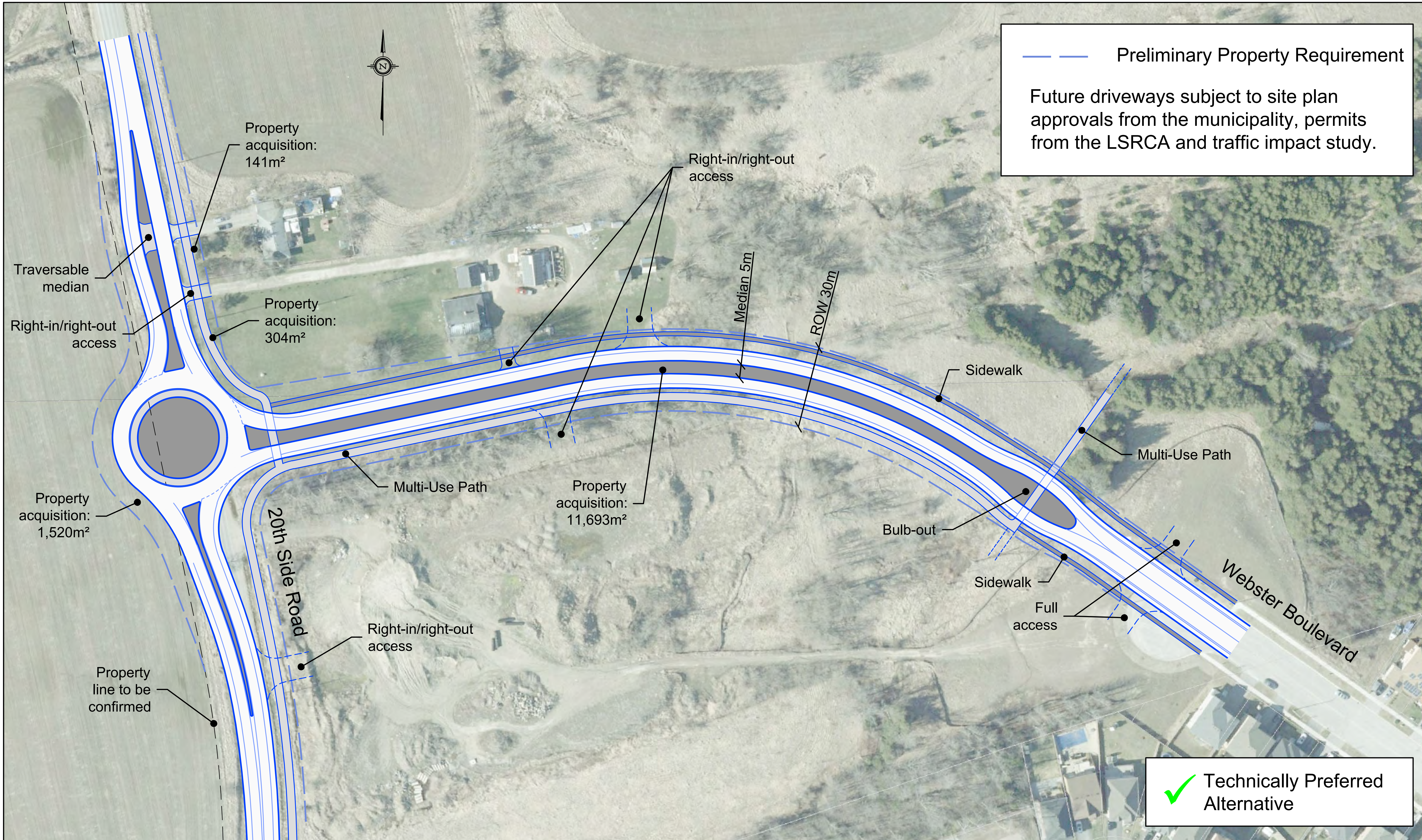
5.2.4 Traffic Calming Alternatives

Four (4) traffic calming alternatives were investigated:

- Alternative 1 – Do nothing
- Alternative 2 – Vertical deflections: speed humps / cushions
- Alternative 3 – Horizontal deflections: chicanes
- Alternative 4 – Horizontal deflections: teardrop / asymmetrically tapered median bulb-out



BTE 20-021 2021-10-19 Scale 1:1250	**Figure 8** **Webster Boulevard North Extension** Alternative A: Conventional Intersection	BT ENGINEERING BTE



BTE 20-021
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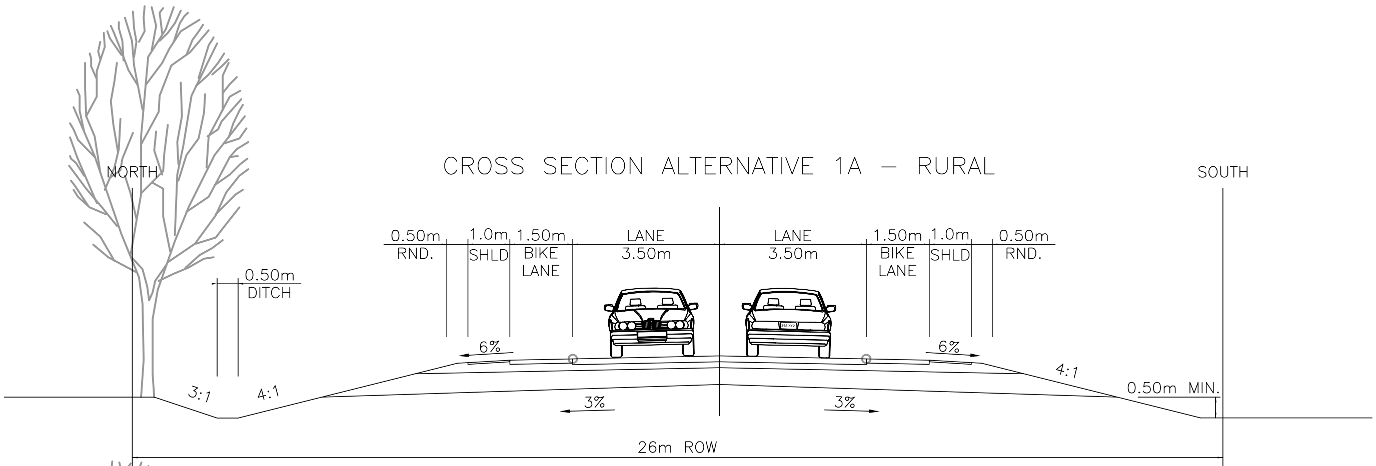
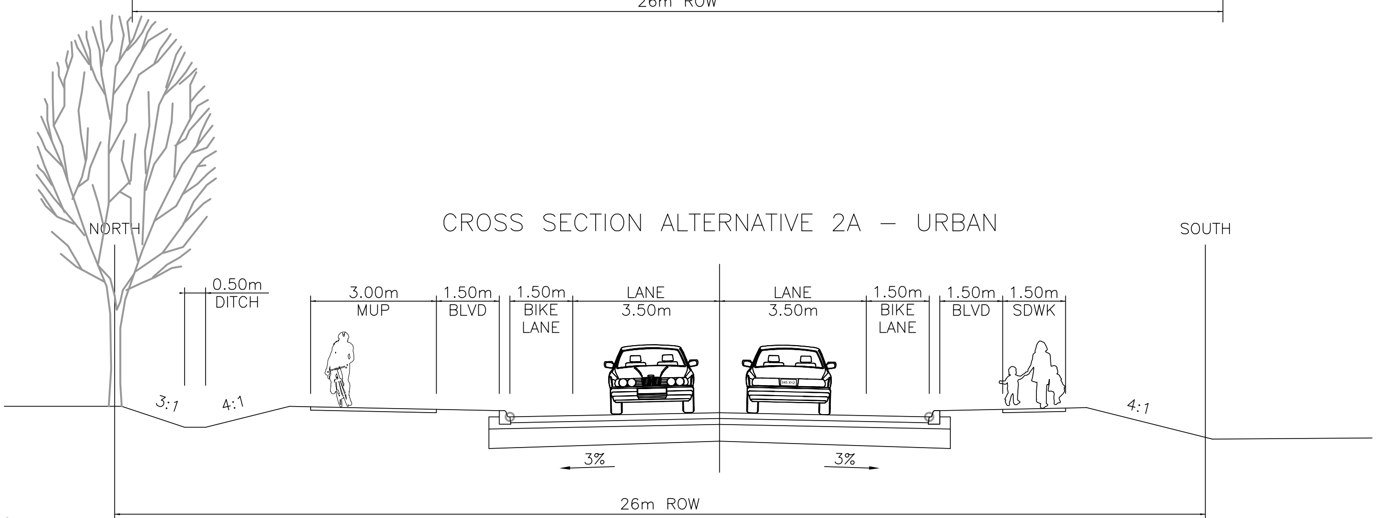
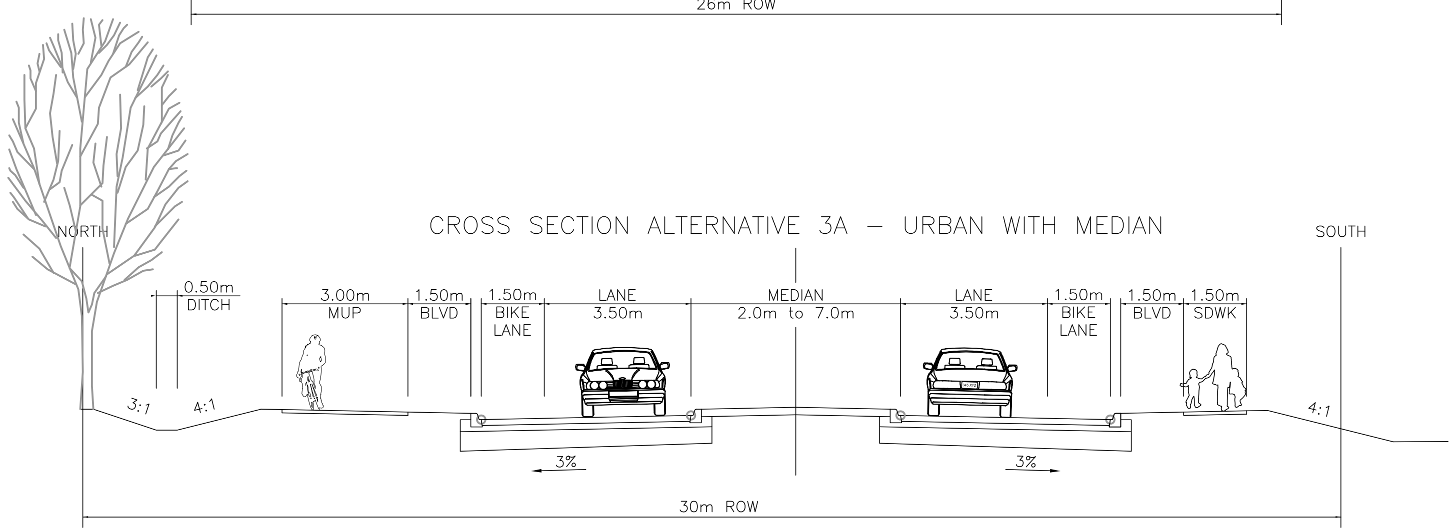
Figure 9
Webster Boulevard North Extension
Alternative B: Roundabout

BT ENGINEERING
BTE

Figure 10 - Cross Section Alternatives 1A, 2A and 3A

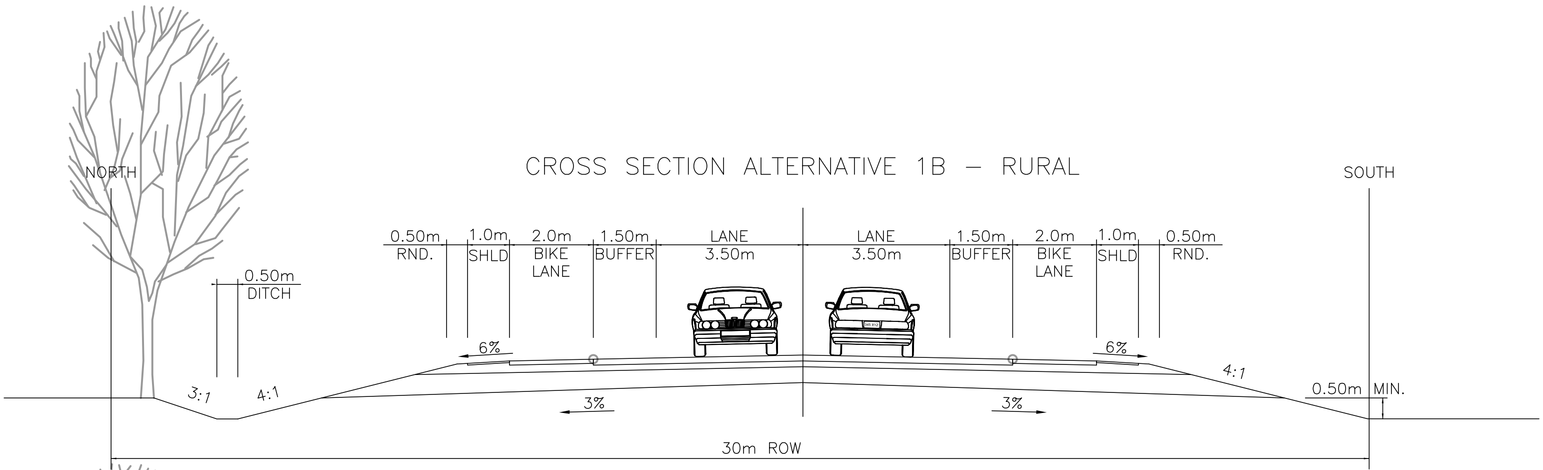


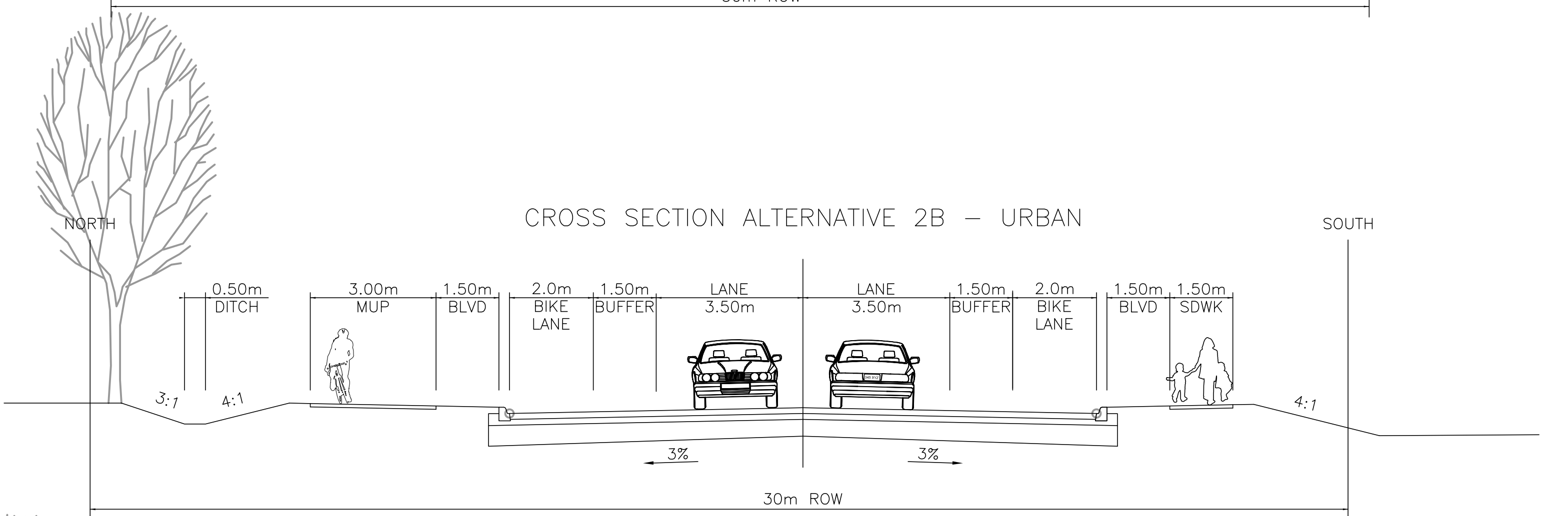


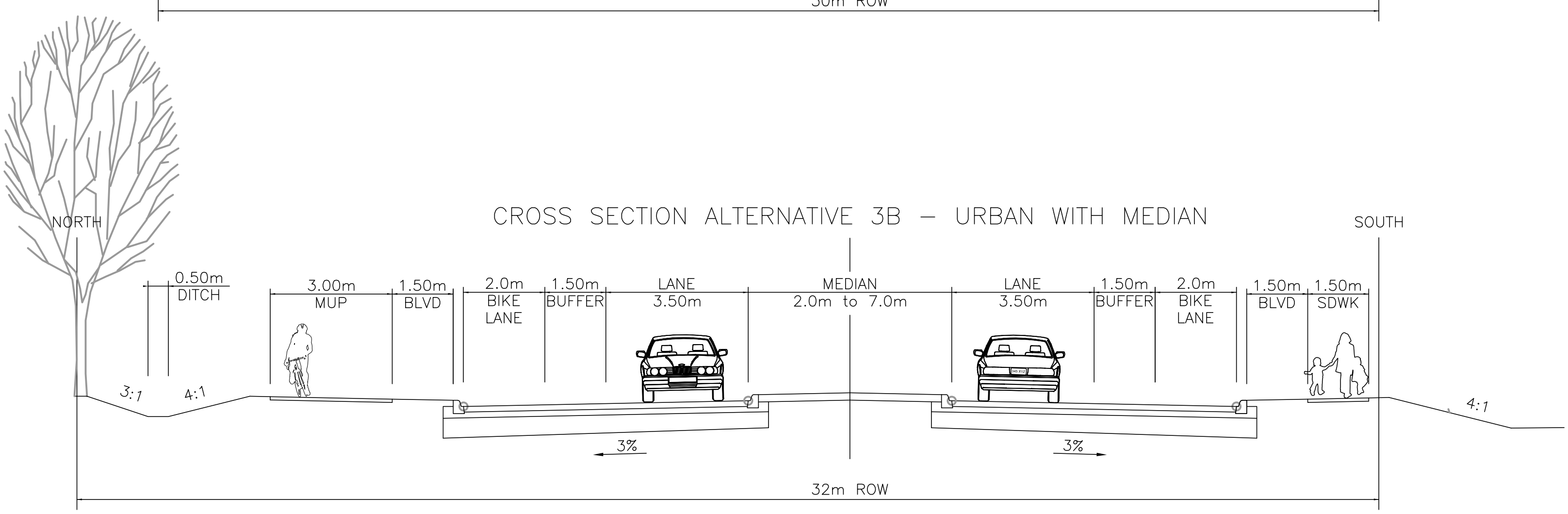


* 3.00m MUP or 1.50m SDWK

Figure 11 - Cross Section Alternatives 1B, 2B and 3B







* 3.00m MUP or 1.50m SDWK

5.3 Qualitative Assessment

There are various methods available for the assessment and evaluation of alternatives, each with advantages and disadvantages. In situations where there are a limited number of alternatives to be compared and/or a limited number of evaluation criteria, the qualitative method is an effective evaluation methodology.

The alternatives are evaluated by relative comparison to each other, using the rating scale and symbols illustrated on **Table 2**. There is no absolute measure of effect, but the effects are categorized into one of three levels.

The selection of a preferred alternative is based on a subjective comparison and ranking of alternatives. This also includes a qualitative assessment of which sub-factors are considered the most important in the decision-making process.

Table 2: Rating Symbols

Relative Rating	Symbol
Good in comparison	✓
Neutral in comparison	–
Poor in comparison	✘

5.3.1 Evaluation Criteria

The alternatives were evaluated qualitatively using five factor groups:

- Transportation
- Natural Environment
- Social Environment
- Land Use and Property
- Cost

Each factor group included a list of sub-factors to determine the difference between alternatives, such as traffic operations or impacts to property owners. The preferred alternatives will provide the best overall balance between safety, life cycle costs and other environmental, cultural, socio-economic and land use planning objectives.

5.4 Coarse Screening

A coarse screening of the long list of Preliminary Design Alternatives was undertaken to determine which alternatives would be carried forward for detailed analysis and evaluation. Alignment Alternative 3 – Connection to 9th Line was coarse screened from the evaluation by the Technical Advisory Committee because it has significant impacts to the natural environment and has a higher construction cost.

5.5 Evaluation of Alignment Alternatives

The evaluation of the alignment alternatives is summarized in **Table 3**.

Alignment 2 (North) is the Technically Preferred Alternative as it provides greater safety for an intersection location on 20th Sideroad and provides the greatest utilization for the adjacent development lands. Any visual intrusion to adjacent residential properties will be mitigated.

In addition, implementing this network connection defers the timeline for major improvements to the 20th Sideroad/ Innisfil Beach Road intersection.

5.6 Evaluation of Intersection Alternatives

The evaluation of the intersection alternatives is summarized in **Table 4**.

The roundabout alternative is recommended to provide improved safety compared to traffic signals.

The improved operation and safety performance of the roundabout intersection control is considered to outweigh the increased property required to implement the alternative. In addition, the roundabout slows traffic and provides improved safety in accessing driveways close to the intersection.

5.7 Evaluation of Cross Section Alternatives

Of the six (6) cross section alternatives considered, Alternative 3A is recommended based on the following:

- Median provides traffic calming measures and limits left-turn movements which result in traffic delays and reduced safety;
- MUT is recommended on the south where largest number of pedestrian and cyclist trips will be;
- Provides opportunity for traffic calming elements with a bulb-out to the south; and
- Median allows staged crossing for possible future multi-use pathway MUT crossing from south woodlot trail to future Leslie Drive trail connection.

The MUT provides cyclists some separation from traffic; therefore, additional ROW for buffered bike lanes is not required (i.e. Alternative 3B).

5.8 Evaluation of Traffic Calming Alternatives

The evaluation of the intersection alternatives is summarized in **Table 5**.

The teardrop/asymmetrically tapered median bulb-out provides a traffic calming measure for the community as well as providing improved safety for pedestrians and cyclists (refuge when crossing).

Table 3: Evaluation of Alignment Alternatives			
Criterion	**Do Nothing (Baseline)**	**Alignment 1 (South)**	**Alignment 2 (North)**
Transportation – Traffic Operations	✗	✓	✓
Transportation – Safety including Access to Commercial Lands	✗	-	✓ Greater separation from horizontal curves on 20th Sideroad.
Transportation – Safety for Pedestrians and Cyclists	-	✓	✓
Transportation – Neighbourhood Connectivity	✗	✓	✓
Environmental – Terrestrial Environment (Maintain Hedgerow)	✓	✓	✗ Removes hedgerow vegetation – no significant vegetation identified. This vegetation would be removed by either the road or future land development.
Environmental – Terrestrial Environment (Woodlot)	Equal - no measurable differences		
Environmental – Aquatic Environment	Equal - no measurable differences		
Social Environment – Cultural Heritage	✗	✓	✗ Closer proximity to a non-designated heritage residential property.
Social Environment – Archaeological Potential	Equal - no measurable differences		
Land Use and Property – Maximizes Utilization of Commercial/Residential Development Lands (input provided by developer)	✗	✗	✓
Land Use and Property – 2351 20th Sideroad (South Property) (input provided by land owner)	✗	✓ Decreased visual intrusion but less access to municipal services.	✗ Increased visual intrusion but greater access to municipal services.
Land Use and Property – 2355 20th Sideroad (North Property) (input provided by land owner)	✗	✗	✓ Preference identified by property owner for proximity to municipal services and for future development.
Land Use and Property – Agricultural (Farmland)	✓	-	-
Cost – Capital Cost	✓ Lowest capital cost but does not support the deferral of improvements to 20th Sideroad that can be achieved with the extension.	-	-
Recommendation	✗	✗	✓

Table 4: Evaluation of Intersection Control Alternatives		
Criterion	**Signalized**	**Roundabout**
Transportation – Traffic Operations (Long Term Level of Service)	✗ Increased delays resulting from traffic signal operations.	✓ Reduced overall intersection delay by sharing available time (gaps) to all vehicles entering the intersection.
Transportation – Traffic Operations (Traffic Staging during Construction)	- Traffic maintained through construction zone on existing alignment.	✓ Offset roundabout design allows significant portion of construction within greenfield.
Transportation – Safety	- Greater frequency and severity of collision events.	✓ Estimated reduction of 2/3 of collisions for vehicles entering the intersection and low severity collisions based on low operating speeds.
Transportation – Safety for Pedestrians and Cyclists	- Major movements of pedestrians occur in the north-south direction crossing the sideroad. With traffic signals, pedestrians or cyclists may choose to cross on the red phase, or when pedestrians are crossing on a green phase there is potential for (1) conflict with southbound left-turning vehicles and (2) westbound right-turning vehicles.	✓ Major movements of pedestrians occur in the north-south direction crossing the sideroad and improved safety will be provided by giving pedestrians priority over vehicular traffic.
Environmental – Terrestrial Environment	No measurable differences	
Social Environment – Cultural Heritage	No measurable differences	
Land Use and Property – Residential	- 395 m²	- 445 m²
Land Use and Property – Agricultural (Farmland)	✓ 348 m²	✗ 1,520 m²
Land Use and Property - Ability to Provide Access to Future Residential and Commercial Property	✗ Left-turn lanes inhibit the ability to provide access in close proximity to 20th Sideroad.	✓ Allows entrances to be in closer proximity to 20th Sideroad.
Land Use and Property – Ability to Offset Intersection to West (provides greater separation from 20th Sideroad intersection to residential and commercial driveways)	✗ Requires centre of intersection to match existing centreline of 20th Sideroad.	✓ Allows shift of centre of 20th Sideroad intersection to the west.
Cost – Capital Cost	-	-
Recommendation	✗	✓

Table 5: Evaluation of Traffic Calming Alternatives				
Criterion	**Do Nothing (Baseline)**	**Vertical Deflections (speed humps/cushions)**	**Horizontal Deflections (chicane)**	**Horizontal Deflections (teardrop / asymmetrically tapered median bulb-out)**
Transportation – Traffic Operations	✗	✓	✓	✓
Transportation – Safety including Access to Residential Properties	✗	✓	✓	✓
Transportation – Safety for Pedestrians and Cyclists	✗	✓	✗	✓
Transportation – Neighbourhood Connectivity	✗	✓	✓	✓
Natural Environmental – Terrestrial (provide means for wildlife passage)	✗	✗	✗	✓
Social Environment – Noise	✗	✗	✓	✓
Transportation – Access to Development	NA	-	-	✓
Recommendation	✗	✗	✗	✓

6.0 RECOMMENDED PLAN

6.1 Description of Technically Preferred Plan

The Recommended Plan includes the following elements:

- Alignment Alternative 2 (North Alignment) - provides improved land use plan and greater roadway safety.
- Intersection Alternative B (Roundabout Alternative) - provides improved traffic operation and safety.
- Cross Section Alternative 3A - divided urban cross section provides greater safety and follows Complete Streets design approach of providing separate spaces for all modes of travel.
- Asymmetrical Median Bulb-out Traffic Calming Alternative - provides a traffic calming measure at the entry to the existing residential area, facilitates pedestrian crossings of the street for a link to the Leslie Street trail, and provides an opportunity for greening the corridor in the median.

The Recommended Plan is shown in **Section 9.0**. The electrical brief for the pole layout is in **Appendix M**.

7.0 EFFECTS, MITIGATION MEASURES AND COMMITMENTS TO FUTURE WORK

Stakeholders, agencies and the public in the Study Area submitted questions and concerns throughout the study process.

Key issues have been identified and commitments to future work are summarized in **Table 6**.

Identified mitigation measures reflect commitments by the Town of Innisfil to mitigate environmental effects. Effects on the environment were considered in accordance with the Municipal Class EA process.

Table 6: Summary of Issues/Effects, Proposed Mitigation and Commitments to Future Work			
No.	**Issue**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures / Commitment to Future Work**
1.0	**Property Impacts**		
1.1	Impacts to Local Property Owners	Potential for loss of land or reduction in quality of life.	Consultation with property owners has been ongoing. Compensation for property to be purchased will be negotiated with property owners after the 30-day public review period for the ESR.
1.2	2351 20th Sideroad driveway access	Limited access due to driveway proximity to roundabout	Provision of a second driveway access off Webster Boulevard North extension to be reviewed by the Town of Innisfil's Operations group.
1.3	2355 20th Sideroad driveway access	Limited access due to driveway proximity to roundabout	Traversable median to provide full north and south access to the property.
1.4	Access to future development lands	Entrance access to future development lands	A total of three right-in/right-out and two full movement accesses have been identified on the Recommended Plan. Access locations will be confirmed during future development plans and Traffic Impact Studies.
1.5	Median from 20th Sideroad to the median bulb-out	The median limits access and requires more property	A 5.0 m median has been provided as a traffic calming measure. U-turns are permissible at the median bulb-out and the roundabout, and the width of the median allows the provision for a future left-turn lane, if warranted in the future.
2.0	**Indigenous Peoples Rights and Treaties**		
2.1	Infringement on Indigenous Lands or Cultural Areas	Possible negative impacts to potentially contested lands or lands with important cultural significance.	Indigenous Peoples communities have been provided the Stage 1 and Stage 2 Archaeological Assessment documents and were consulted throughout the study. In the event that there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, a Part II Order request may be requested.
3.0	**Natural, Social and Cultural Environment**		
3.1	Water Quality	Decrease in water quality in Leonard's Creek from stormwater runoff.	The effects of water runoff from the new road are not expected to increase significantly. Lake Simcoe Regional Conservation Authority requirements will be met.
3.2	Wetlands and Woodlots	Negative impacts to nearby wetlands and woodlots resulting from development.	The new road avoids impacts to both the woodlot and unevaluated wetland.
3.3	Wildlife Passage	Construction of the extension may reduce wildlife passage potential.	Opportunities for wildlife passage that provide refuge when crossing the road are being investigated for small wildlife through the culvert and for large wildlife at the median bulb-out. Additional consultation with Lake Simcoe Region Conservation Authority is required.
3.4	Permits and Approvals	Requirements for environmental permits and approvals.	Permits form LSRCA, MECP, MNRF and DFO will be obtained during detail design based on the final contract drawings. Construction will abide by applicable timing windows for in-water work (March 15 – July 15) and vegetation clearing.
3.5	Species at Risk	Impacts to SAR and loss of habitat.	Several SAR are known to occur in the Study Area and have been identified in previous studies, including the Eastern Wood-Pewee (Special Concern) and Butternut tree (Endangered). Unevaluated wetlands in the Study Area could provide local habitats for

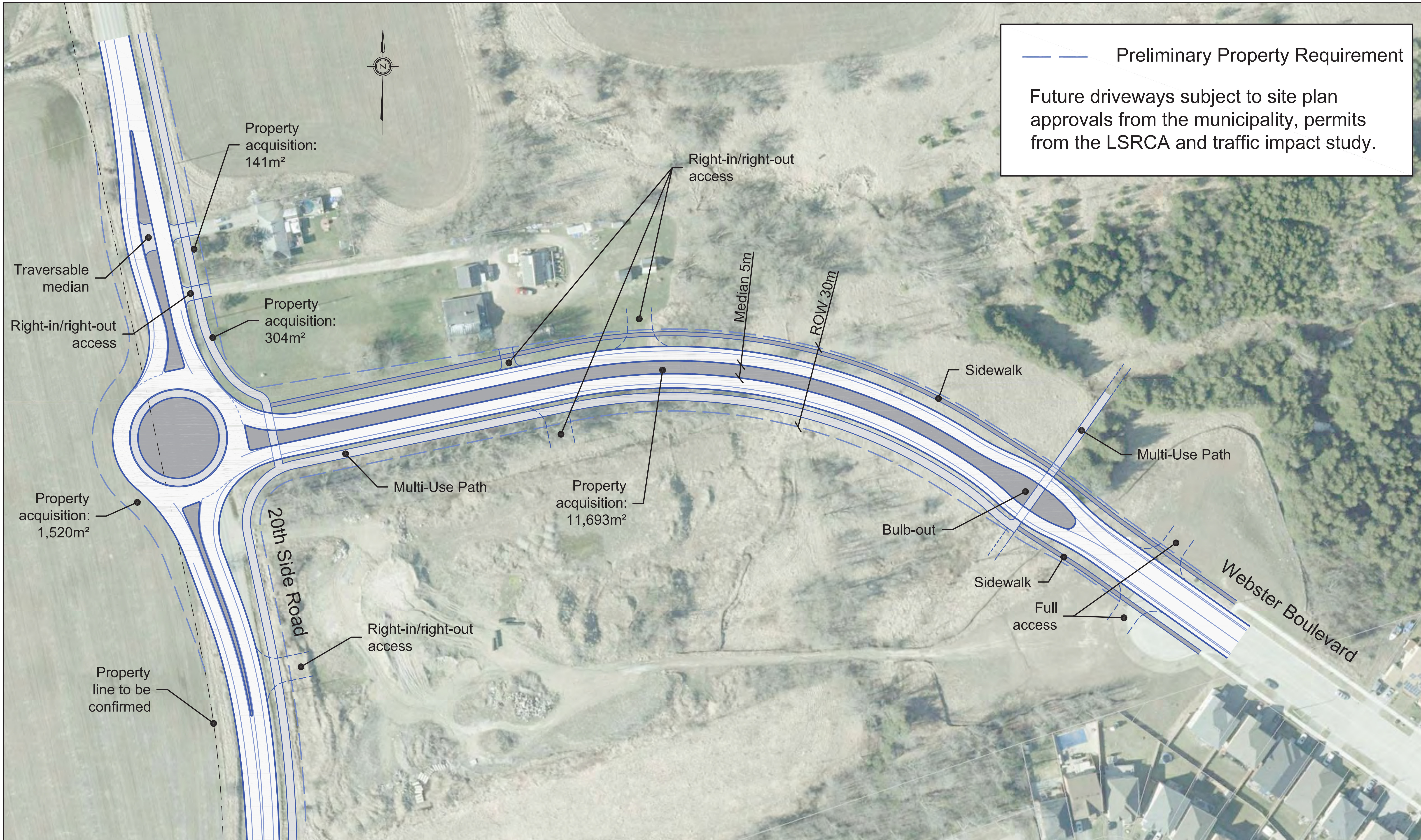
Table 6: Summary of Issues/Effects, Proposed Mitigation and Commitments to Future Work			
No.	**Issue**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures / Commitment to Future Work**
			amphibian species. The Eastern Wood-Pewee may utilize the poplar woodland in the south part of the Study Area. Butternut trees were observed in the Leonard's Beach (Alcona North) Secondary Plan Area. Further surveys in appropriate seasons will be needed to confirm the presence/absence of these SAR and any others in the Study Area during Detail Design.
3.6	Climate Change, Surface Water and Flood Protection	Potential for increase in flooding or negative contribution to climate change.	Sizing of the culvert will be defined in detail design to accommodate future flood levels. Active transportation improvements have been included.
3.7	Air Quality and Greenhouse Gas Emissions	Potential for decreased air quality and negative contribution to greenhouse gas emissions.	The construction of the road extension will decrease vehicle kilometers travelled by eliminating out-of-way travel to Innisfil Beach Road. In addition, the roundabout control will eliminate stop-and-go traffic (braking). Both measures will decrease emissions and particulates generated. These improvements are supportive of reducing greenhouse gas emissions.
3.8	Archaeological Impacts	Potential for negative impacts on areas of archaeological potential.	A Stage 1 Archaeological Assessment and Stage 2 Archaeological Assessment have been completed and no further investigations are required. At the time of the Stage 2 Archaeological Assessment, ploughing of the agricultural field was not feasible; if required, further field review can be completed following purchase of the lands by the municipality.
3.9	Areas of Contamination	Potential impacts on the natural environment if contaminated areas are encountered during construction.	The Study Area is considered to have low potential for contamination based on previous and current land uses.
3.10	Planning and Policy		The Town of Innisfil is within the "A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020)" area. The project adheres to the Town of Innisfil Official Plan and TMP growth plans for the Alcona Settlement Area by supporting the growth plan.
3.11	Source Water Protection	The Study Area is within a Highly Vulnerable Aquifer.	No profile change will require a cut greater than 2 m, and therefore no long-term impact to the groundwater elevation is anticipated. Detail Design and stormwater management will be carried out in accordance with the Source Water Protection policies and requirements of the LSRCA.
3.12	Groundwater	Impact to existing groundwater levels or quality.	A hydrogeological assessment was completed and monitoring wells were outfitted for three of the four geotechnical boreholes. No impact to the groundwater or any well water supplies are anticipated. A Permit to Take Water may be required during construction for the Leonard's Creek tributary crossing.
3.13	Contaminated Soils	Soils moved/removed during construction may be contaminated.	No known current or historical waste disposal sites are in the Study Area.
4.0	**Construction**		
4.1	Dewatering, Sediment and Erosion Controls	Potential for negative impacts to the surrounding areas resulting from construction dewatering and sediment management.	These plans will be developed during detail design, where applicable, in accordance with the *Ontario Water Resources Act* and Ontario Regulation 387-04.

Table 6: Summary of Issues/Effects, Proposed Mitigation and Commitments to Future Work			
No.	**Issue**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures / Commitment to Future Work**
4.2	Noise and Vibration	Potential for elevated noise levels and vibration during construction might impacts local residents.	The construction of the road extension is not expected to generate additional traffic volumes and therefore no noise level increases are expected. By-laws for construction noise and vibration will be followed by the contractor.
4.3	Excess Materials Management	Management of excess construction soil.	An Excess Materials Management Plan will be prepared during detail design in accordance with the On-Site and Excess Soil Management (O. Reg. 406.19).
4.4	Servicing and Facilities	Facilities that release emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies or stores, transports or disposes of waste must have an Environmental Compliance Approval.	No facilities are proposed.
4.5	Mitigation and Monitoring	Environmental standards and commitments for construction and operations to be met.	Contractors will be made aware of all environmental considerations outlined in this ESR and as part of the detail design contract documentation. Mitigation measures are referenced in this report and will be provided to contractors.

8.0 FUTURE ACTIVITIES

Following a 30-day public review period of the ESR (with no objections) and obtaining Class EA clearance, this project, or any individual element of this project, may proceed to detail design and construction by the Town after obtaining the necessary environmental permits and approvals and subject to availability of funding and construction priorities. Mitigation measures listed in **Section 7.0** are to be incorporated during detailed design and construction, as appropriate.

9.0 PLATES



BTE 20-021
2021-07-02
Scale 1:1250

Plate 1: Recommended Plan
Webster Boulevard North Extension

BT ENGINEERING
BTE

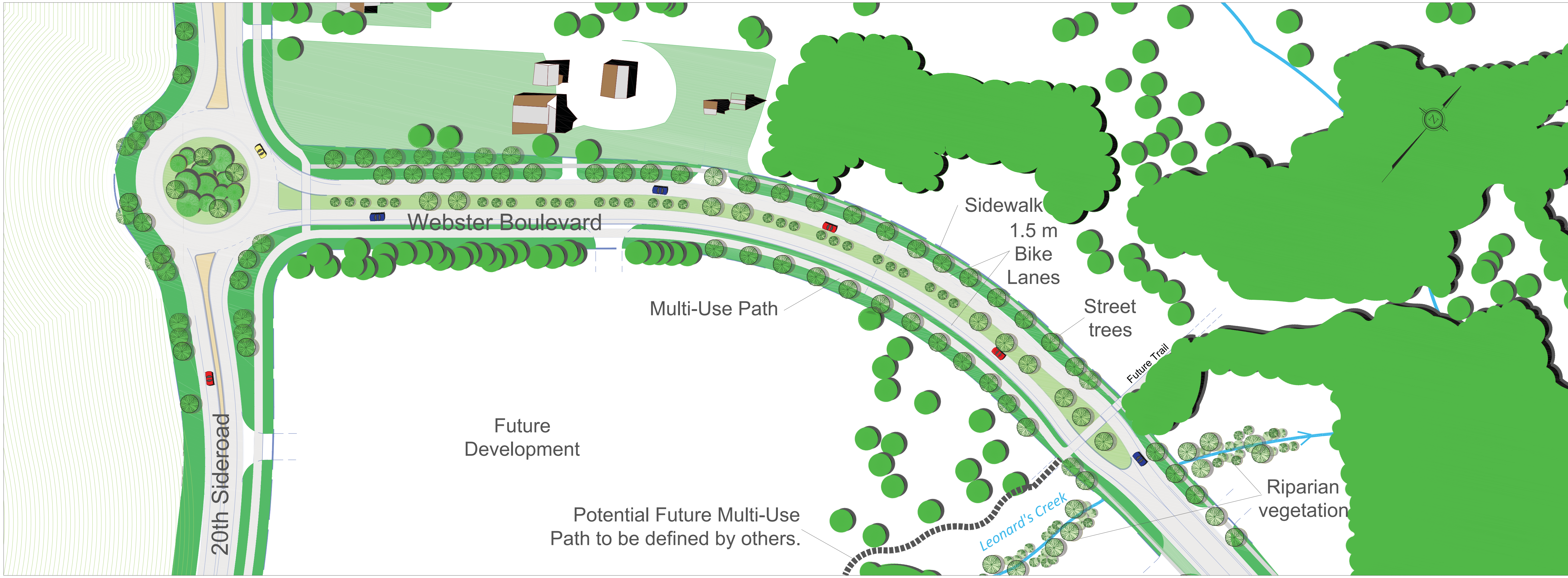


Plate 2: Landscape Plan
Town of Innisfil
Webster Boulevard North Extension

April 2021 NTS

BT ENGINEERING
BTE

BTE 20-021 2021-06-29 Scale 1:1250	**Plate 3: Electrical Layout Plan** **Webster Boulevard North Extension**	BT ENGINEERING BTE

Glossary of Terms

- **AADT** — Annual Average Daily Traffic – the average 24-hour, two-way traffic per day for the period from January 1st to December 31st.
- **Alignment** — The vertical and horizontal position of a road.
- **Alternative** — Well-defined and distinct course of action that fulfils a given set of requirements. The EA Act distinguishes between alternatives to the undertaking and alternative methods of carrying out the undertaking.
- **Alternative Planning Solutions** — Alternative ways of solving problems or meeting demand (Alternatives to the Undertaking).
- **Alternative Design Concepts** — Alternative ways of solving a documented transportation deficiency or taking advantage of an opportunity. (Alternative methods of carrying out the undertaking).
- **Alternative Project** — Alternative Planning Solution, see above.
- **Bump-Up** — The act of requesting that an environmental assessment initiated as a class EA be required to follow the individual EA process. The change is a result of a decision by the proponent or by the Minister of Environment to require that an individual environmental assessment be conducted.
- **Canadian Environmental Assessment Act (CEAA)** — The CEAA applies to projects for which the federal government holds decision-making authority. It is legislation that identifies the responsibilities and procedures for the environmental assessment.
- **Class Environmental Assessment Document** — An individual environmental report documenting a planning process which is formally submitted under the EA Act. Once the Class EA document is approved, projects covered by the class can be implemented without having to seek further approvals under the EA Act provided the Class EA process is followed.
- **Class Environmental Assessment Process** — A planning process established for a group of projects in order to ensure compliance with the Environmental Assessment (EA) Act. The EA Act, in Section 13 makes provision for the establishment of Class Environmental Assessments.
- **Compensation** — The replacement of natural habitat lost through implementation of a project, where implementation techniques and other measures could not alleviate the effects.
- **Corridor** — A band of variable width between two locations. In transportation studies a corridor is a defined area where a new or improved transportation facility might be located.
- **COS** — Contamination Overview Study
- **CPR** — Canadian Pacific Railway
- **Criterion** — Explicit feature or consideration used for comparison of alternatives.
- **CTMP** — Comprehensive Transportation Master Plan
- **Cumulative Effects Assessment** — Cumulative Effects Assessment assesses the interaction and combination of the residual environmental effects of the project during its construction and operational phases on measures to prevent or lessen the predicted impacts with the same environmental effects from other past, present, and reasonably foreseeable future projects and activities.
- **Detail Design** — The final stage in the design process in which the engineering and environmental components of preliminary design are refined and details concerning, for example, property, drainage, utility relocations and quantity estimate requirements are prepared, and contract documents and drawings are produced.
- **DFO** — Department of Fisheries and Oceans.
- **EA** — Environmental Assessment
- **EA Act** — Ontario Environmental Assessment Act (as amended by S.O. 1996 C.27), RSO 1980.

• **Environment**	• Air, land or water, • Plant and animal life, including human life, • The social, economic and cultural conditions that influence the life of humans or a community, • Any building structure, machine or other device or thing made by humans, • Any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities, or • Any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.
• **Environmental Effect**	A change in the existing conditions of the environment which may have either beneficial (positive) or detrimental (negative) effects.
• **ESR**	Environmental Study Report. The final documentation for Schedule C project, defining the project, consultation process, preferred solution and mitigation measures.
• **Evaluation**	The outcome of a process that appraises the advantages and disadvantages of alternatives.
• **Evaluation Process**	The process involving the identification of criteria, rating of predicted impacts, assignment of weights to criteria, and aggregation of weights, rates and criteria to produce an ordering of alternatives.
• **External Agencies**	Include Federal departments and agencies, Provincial ministries and agencies, conservation authorities, municipalities, Crown corporations or other agencies other than MTO.
• **Factor**	A category of sub-factors.
• **General Arrangement**	Structural plan of the bridge and proposed works including elevations and cross-sectional views of the bridge.
• **Individual Environmental Assessment**	An environmental Assessment requiring the submission of a document for approval by the Minister, pursuant to the EA Act and which is neither exempt from the EA Act nor covered by a Class EA approval.
• **MECP**	Ministry of the Environment, Conservation and Parks.
• **Mitigating Measure**	A measure that is incorporated into a project to reduce, eliminate or ameliorate detrimental environmental effects.
• **Mitigation**	Taking actions that either remove or alleviate to some degree the negative impacts associated with the implementation of alternatives.
• **MNRF**	Ministry of Natural Resources and Forestry.
• **MHSTCI**	Ministry of Heritage, Sport, Tourism and Culture Industries.
• **MTO**	Ministry of Transportation Ontario.
• **MUT**	Multi- Use Trail
• **Planning Alternatives**	Planning alternatives are “alternative methods” under the EA Act. Identification of significant transportation engineering opportunities while protecting significant environmental features as much as possible.
• **Planning Solutions**	That part of the planning and design process where alternatives to the undertaking and alternative routes are identified and assessed. Also described as “Alternative Project” under the federal EA Act.
• **POH**	Public Open House.
• **Project**	A specific undertaking planned and implemented in accordance with the Class EA including all those activities necessary to solve a specific problem.
• **Proponent**	A person or agency that carries or proposes to carry out an undertaking, or is the owner or person having charge, management, or control of an undertaking.
• **Public**	Includes the general public, interest groups, associates, community groups, and individuals, including property owners.

• **Realignment**	Replacement or upgrading of an existing roadway on a new or revised alignment.
• **Recommended Plan**	That part of the planning and design process, during which various alternative solutions are examined and evaluated including consideration of environmental effects and mitigation; the recommended design solution is then developed in sufficient detail to ensure that the horizontal and vertical controls are physically compatible with the proposed site, that the requirements of lands and rights-of-way are satisfactorily identified, and that the basic design criteria or features to be contained in the design, have been fully recognized and documented in sufficient graphic detail to ensure their feasibility.
• **Route Alternatives**	Location alternatives within a corridor.
• **Screening**	Process of eliminating alternatives from further consideration, which do not meet minimum conditions or categorical requirements.
• **Sub-factor**	A single criterion used for the evaluation. Each sub-factor is grouped under one of the factors.
• **Technical Advisory Committee**	The Advisory Committee will include the County, Township, Conservation Authority and Consultant. It will act as the decision-making body for the study recommendations.
• **TMP**	Transportation Master Plan
• **Traceability**	Characteristics of an evaluation process which enables its development and implementation to be followed with ease.
• **Undertaking**	In keeping with the definition of the Environmental Assessment Act, a project or activity subject to an Environmental Assessment.
• **World Café**	A philosophy that people want to talk together about issues that matter, and that as people talk together we are able to collectively achieve greater wisdom. The World Café event is an effective conversational meeting to foster dialogue, access collective intelligence and create innovative possibilities for action.

Disclaimer

All personal information has been removed, including names and addresses, in accordance with the *Freedom of Information and Protection of Privacy Act*.

Appendix A

Design Criteria

BTE PROJECT NO: 20-021
ROAD NAME: Webster Boulevard North
TYPE OF PROJECT: Major Collector Road Extension

LOCATION: Town of Innisfil

LENGTH: 300-400 m (subject to selection of the Technically Preferred Corridor Alternative)

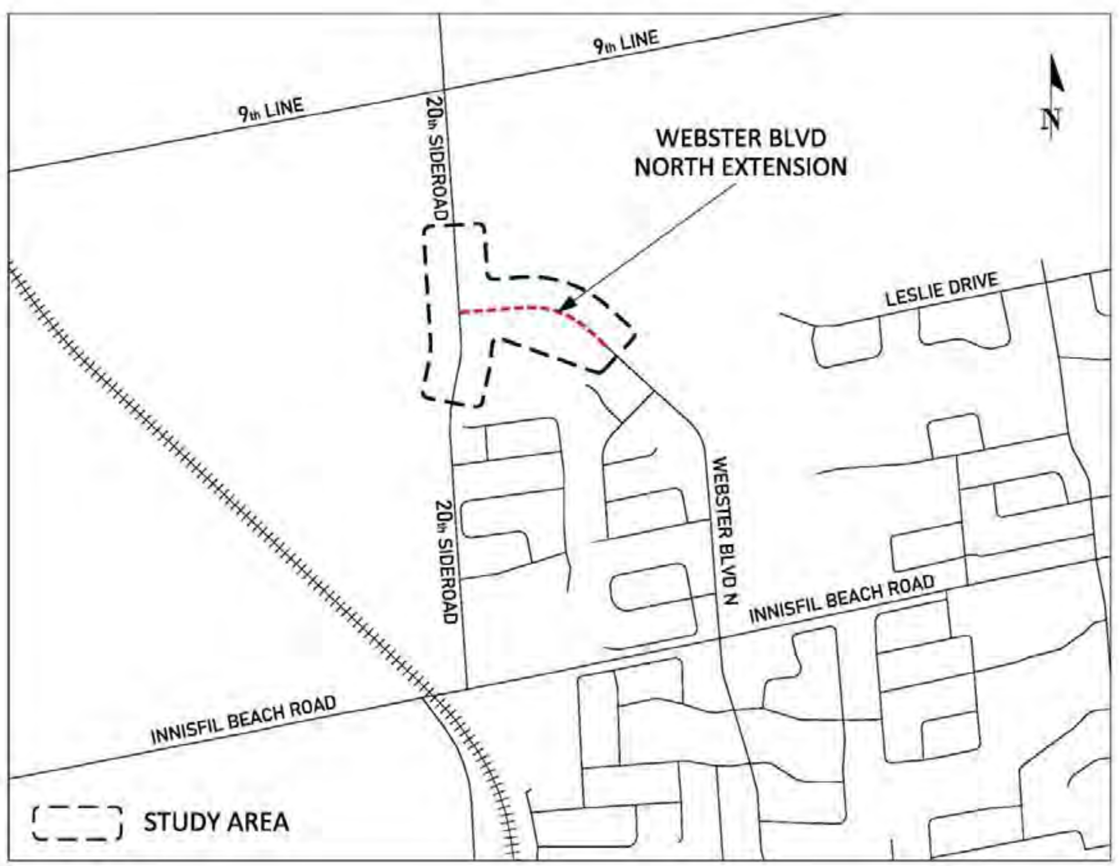
LIMITS: Existing Webster Boulevard North terminus to 20th Sideroad

General

This Design Criteria has been created using a combination of the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads, MTO Geometric Design Standards for Ontario Highways, Town of Innisfil standards, the Ontario Traffic Manuals (OTM) and the MTO Hydraulic Design Guide.

Project Location

Figure 1: Project Location



BT ENGINEERING BTE PRELIMINARY DESIGN CRITERIA

BTE PROJECT NO: 20-021
ROAD NAME: Webster Boulevard North
TYPE OF PROJECT: Major Collector Road Extension

Table 1: Design Criteria

Webster Boulevard North Extension

Design Criteria	Existing Standard (South of Terminus)	Design Standard (Innisfil Standards and TAC)	Proposed Standard
Road Classification:	Major Collector	Major Collector	Major Collector
Design Speed:	70 km/h	70 km/h	70 km/h
Posted Speed:	50 km/h	50 km/h	50 km/h
Design AADT:	1000	5000[1]	5000
Design Truck Percentage:	1%	1%	1%
Minimum Horizontal Curve Radius:	200 m	200 m	200 m
Minimum Stopping Sight Distance:	105 m	105 m	105 m
Maximum Superelevation:	4%	4%	4%
Maximum Grade:	6%	6%	6%
Minimum ‘K’ Value - Crest:	Varies	17	17
Minimum ‘K’ Value - Sag:	Varies	23	23
Travel Lane Width:	3.5 m	3.5 m	3.5 m
Other Cross Section Elements:			
Boulevard Width	N/A	N/A	N/A
Shoulder Width:	N/A	N/A	N/A
Right-of-Way Width:	26 m	26 m	26 m
Sight Distance Triangle:	N/A	15 x10 m	15 x10 m
Minimum Shoulder Rounding:	N/A	N/A	N/A
Minimum Bike Lane Width:	N/A	1.5 - 1.8 m	1.5 – 1.8 m
Minimum Sidewalk Width:	N/A	1.5 m	1.5 m
Minimum Multi-Use Path Width:	N/A	3.0 m	3.0 m

[1] Design Year 2040

PRELIMINARY DESIGN CRITERIA

BTE PROJECT NO: 20-021
ROAD NAME: Webster Boulevard North
TYPE OF PROJECT: Major Collector Road Extension

Table 2: Roundabout, High-Speed Approach

20th Sideroad Approaches

Design Criteria	Existing Design	Design Standard	Proposed Standard
Design Vehicle		WB 20.5 / Large Combine (TBD)	WB 20.5 / Large Combine (TBD)
Inscribed Diameter:	N/A	40 – 48 m	Single lane: 45 - 48 m
Entry Radius:	N/A	16 – 35 m	30 m
Exit Radius:	N/A	≥ 30 m	60 m
Circulatory Lane Width:	N/A	6.5 m –	Single lane: 6.5 m
Truck Apron Width:	N/A	1.0 – 4.5 m	Single lane: 2.5 m
Minimum Entry/Exit Width: (measured to face of curb, 400 mm beyond the edge of asphalt)	N/A	5.5 m	Single lane: 5.5 m
Length of Splitter Island:	N/A	60 – 120 m	100 m
Reverse Curve Radius:	N/A	185 m (DS = 60 km/h)	185 m
Maximum Entering Speed, single-lane roundabout:	N/A	35 – 42 km/h	40 km/h
Maximum Entering Speed, double-lane roundabout:	N/A	≤ 50 km/h	50 km/h
Truck Apron Cross-Slope:	N/A	1%	1%
Circulatory Lane Cross-Slope:	N/A	2%	2%
Entry/Exit Lane Cross-Slope:	N/A	2 – 4%	2%
Other Cross Section Elements:			
Multi-Use Path Width:	N/A	3.0 m	3.0 m

PRELIMINARY DESIGN CRITERIA

BTE PROJECT NO: 20-021
ROAD NAME: Webster Boulevard North
TYPE OF PROJECT: Major Collector Road Extension

Table 3: Roundabout, Low-Speed Approach

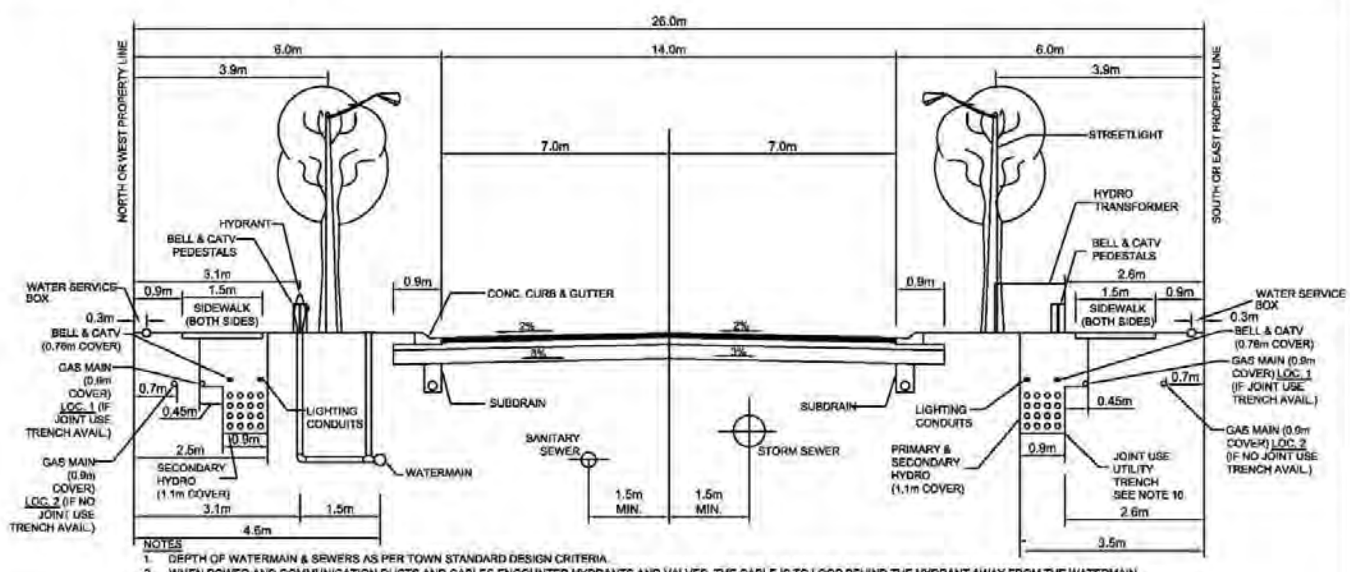
Webster Boulevard North Approach

Design Criteria	Existing Design	Design Standard	Proposed Standard
Inscribed Diameter:	N/A	40 – 48 m	Single lane: 45 m
Entry Radius:	N/A	16 – 35 m	20 m
Exit Radius:	N/A	≥ 30 m	40 m
Circulatory Lane Width:	N/A	6.5 m –	Single lane: 6.5 m
Truck Apron Width:	N/A	1.0 – 4.5 m	Single lane: 2.5 m
Minimum Entry/Exit Width: (measured to face of curb, 400 mm beyond the edge of asphalt)	N/A	5.5 m	5.5 m
Length of Splitter Island:	N/A	≥ 30 m	Single lane: 30 m
Maximum Entering Speed:	N/A	35 – 42 km/h	40 km/h
Truck Apron Cross-Slope:	N/A	1%	1%
Circulatory Lane Cross-Slope:	N/A	2%	2%
Entry/Exit Lane Cross-Slope:	N/A	2 – 4%	2%
Other Cross Section Elements:			
Multi-Use Path Width:	N/A	3.0 m	3.0 m

PRELIMINARY DESIGN CRITERIA

Date: November 4, 2020

BTE PROJECT NO:	**ROAD NAME**:	**TYPE OF PROJECT:**
20-021	Webster Boulevard North	Major Collector Road Extension



NOTES
1. DEPTH OF WATERMAIN & SEWERS AS PER TOWN STANDARD DESIGN CRITERIA.
2. WHEN POWER AND COMMUNICATION DUCTS AND CABLES ENCOUNTER HYDRANTS AND VALVES, THE CABLE IS TO LOOP BEHIND THE HYDRANT AWAY FROM THE WATERMAIN.
3. PAVEMENT STRUCTURE TO BE INSTALLED IN ACCORDANCE WITH SECTION 2.4.2 PAVEMENT DESIGN. THE FOLLOWING IS A MINIMUM PAVEMENT STRUCTURE AND MAY BE GREATER IN ACCORDANCE WITH GEOTECHNICAL REPORT:
   - 40mm SURFACE COURSE ASPHALT.
   - 100mm BASE COURSE ASPHALT (TO BE PLACED IN 2 - 50mm LIFTS).
   - 150mm GRANULAR 'A'.
   - 450mm GRANULAR 'B'. *

* TOWN DOES PERMIT THE USE OF TYPE I AND TYPE II MEETING OPSS.MUNI 1010.

4. THE BOULEVARDS REQUIRE A MINIMUM OF 300mm OF TOPSOIL & NURSERY SOD.
5. TREES TO BE PLACED IN LOCATIONS APPROVED BY THE TOWN.
6. LOCALIZED GRADING AROUND TRANSFORMER TO MAINTAIN A LEVEL TRANSFORMER PLATFORM.
7. TELECOMMUNICATIONS PEDESTALS ARE TO BE LOCATED ON THE NON-OPENING SIDE OF A TRANSFORMER OR SWITCH GEAR.
9. ALL SIDEWALK IS TO BE CONSTRUCTED ON A PROPERLY COMPACTED FOUNDATION OF A MINIMUM OF150mm OF GRANULAR 'A'.
10. DESIGNER TO CONTACT TOWN BEFORE INITIATING DESIGN OF UTILITIES TO CONFIRM USE OF I.T. DUCTS WITHIN THE JOINT USE UTILITY TRENCH.

Innisfil

URBAN MAJOR COLLECTOR ROAD
26.0m ROAD ALLOWANCE
14.0m PAVEMENT WIDTH

DRAWN: A&A | APR'D:
SCALE: N.T.S. | DATE: JUNE 2011

NO.	REVISIONS	APR'D	DATE
2	REVISED NOTES	TOI	MAY 2019
2	REVISED NOTES	TOI	APRIL 2018
1	REVISED NOTES AND WATER SERVICES	TOI	APRIL 2015

METRIC
ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED

TOISD
204

Appendix B

Study Design Report

BT ENGINEERING

Final Study Design Report

Webster Boulevard North Extension Environmental Assessment Study

February 2021

Submitted by:

BT Engineering Inc.
9040 Leslie Street, Unit 218
Richmond Hill, ON L4B 3M4

Revision History

Revision	Date	Description of Major Change

Table of Contents

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List of Tables

1.0 INTRODUCTION

The Study Design Report is the initial consultation step in the Town of Innisfil's Environmental Assessment (EA) Study, for the planning of the extension of Webster Boulevard from the existing terminus to 20th Sideroad. The study will follow the Municipal Class Environmental Assessment (2015). For the purposes of this undertaking, the Town of Innisfil is the proponent responsible for the planning, design and implementation of future improvements as defined in the Municipal Class Environmental Assessment and under the *Environmental Assessment Act* 2020. This Study Design Report is the initial public, agency and stakeholder consultation document for the study and presents the following:

- Proposed Problem and Opportunity Statement;
- Planning Alternatives and Preliminary Design Alternatives;
- Initial coarse screening to identify reasonable alternatives to be carried forward for further study;
- Public, agency and Indigenous Peoples consultation program;
- Evaluation process (to compare alternatives); and
- Description of study documentation and post-study steps.

The draft Study Design Report was circulated at the initiation of the study to appropriate agencies, and was presented to the Technical Advisory Committee, and to the general public by posting the document on the Town's website for the first Public Open House (POH). The circulation of the draft report is intended to solicit early input on the planning process. Following the first POH, the Study Design Report is now finalized including revisions based on input received, and will be posted on the Town's website as the Final Study Design Report.

Included in this document is a proposed consultation program for obtaining input from potentially interested and affected persons during this study. Consultation is undertaken early in the study to identify interested persons, government agencies, and Indigenous Peoples community groups, and establish how they can be engaged in the study.

This study will be completed as a Schedule C project under the Municipal Class EA. The study will evaluate all reasonable cross sections and 20th Sideroad intersection alternatives considering transportation, natural, social and cultural environments, land use and property, and cost.

At the time of release of the Final Study Design Report, the Province of Ontario has implemented a State of Emergency requiring measures to deal with the COVID-19 pandemic, and therefore the distribution of materials is relying on web-based communications with the public. Conventional public events may be conducted during subsequent stages of the study.

1.1 Study Area

The Study Area, as illustrated in **Figure 1**, is located in Alcona in the Town of Innisfil.

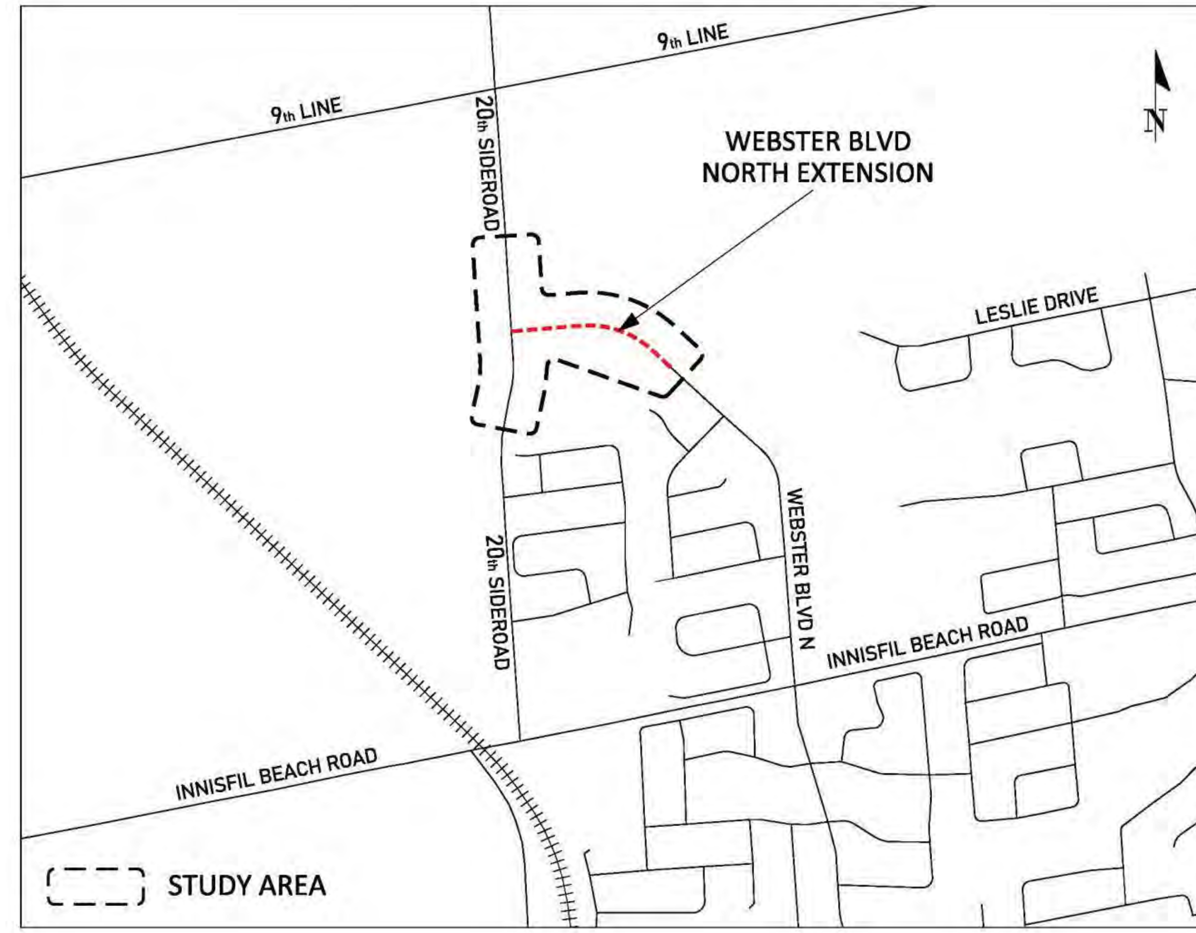

Figure 1: Study Area

1.2 Project Orientation

For the purposes of this study, the new extension is described as an east-west road.

1.3 Study Process

This study will address all four Phases of a Schedule C Municipal Class EA Study to determine a final Recommended Plan. **Section 5.0** describes the proposed approach for the study in detail and **Figure 2** describes the Phases to be addressed during this study.

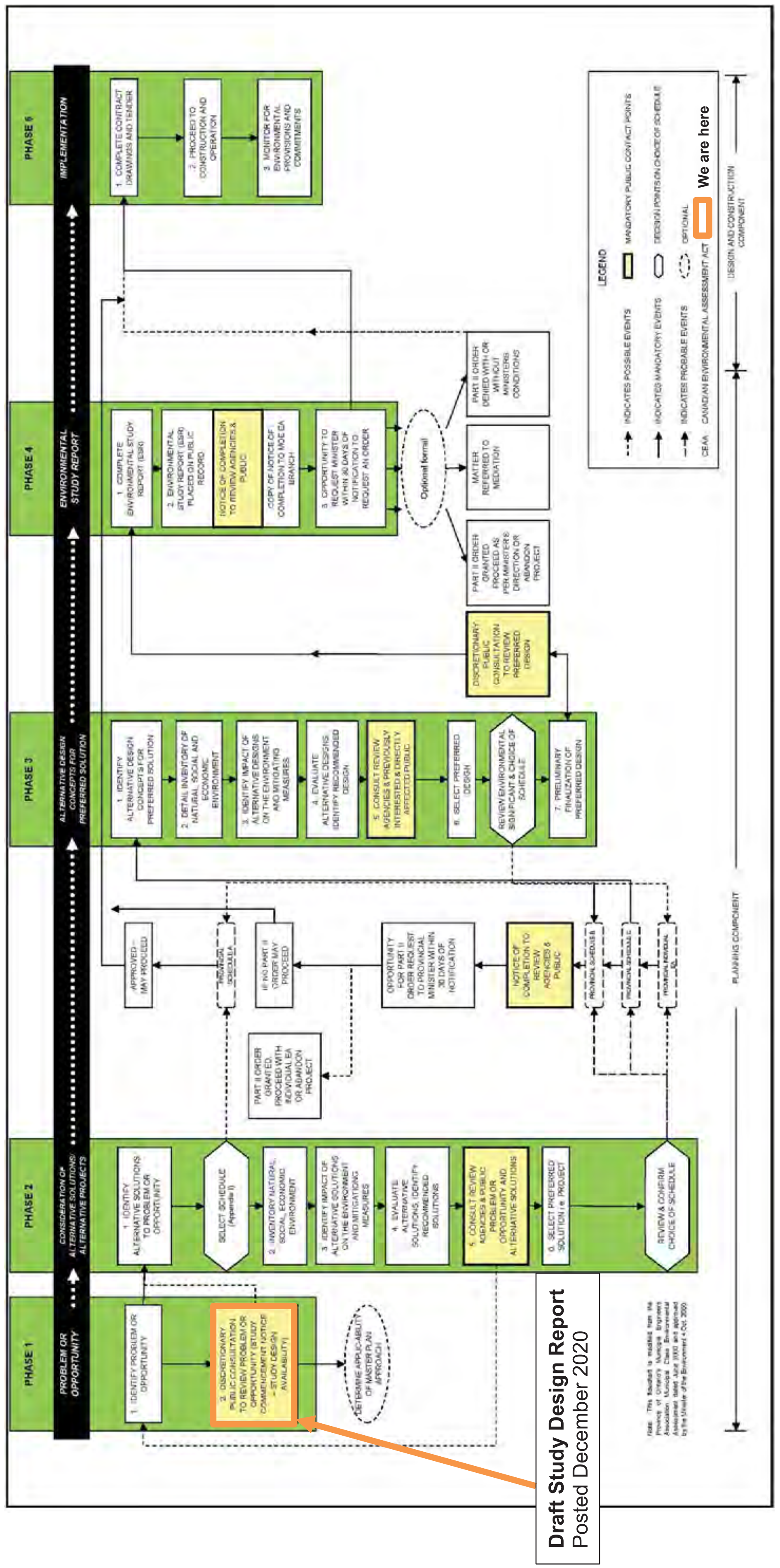

Figure 2: Municipal Class EA Process

2.0 BACKGROUND

2.1 Study Background

The 2018 Transportation Master Plan (TMP) Update discusses the Ontario Growth Plan for Simcoe County and identifies the settlement of Alcona as a Primary Settlement Area. Alcona is expected to see the highest population growth in the area, with new homes being developed south of Alcona in an area known as "Sleeping Lion". The TMP for the Town of Innisfil has included the extension of Webster Boulevard North as a major collector road in the Recommended Transportation Strategy to provide for further development. The TMP recommended that the Webster Boulevard North Extension be completed by 2031 (see ID No. 43 in **Figure 3**).

ID	Road	From	To	Improvement Type
Medium-term Improvements (2022 to 2031)				
9	9th Line	25th Sideroad	Leonard Street	Paved Shoulders
27	20th Sideroad	Big Bay Point Road	9th Line	Reconstruction
28	20th Sideroad	Big Bay Point Road	9th Line	Paved Shoulders
29	20th Sideroad	9th Line	5th Line	Multi-use trail
30	20th Sideroad	5th Line	3rd Line	Multi-use trail
31	20th Sideroad	3rd Line	Innisfil / Bradford Boundary	Paved Shoulders
32	Killarney Beach Road / 4th Line	John Street	Yonge Street	Urbanization
33	Killarney Beach Road	20th Sideroad	Ewart Street	Urbanization
34	Killarney Beach Road	Ewart St	Lake Simcoe	Paved Shoulders
35	Willard Ave	Leslie Drive	Innisfil Beach Road	Urbanization
36	Adullam Ave	Lebanon Drive	Innisfil Beach Road	Urbanization
37	6th Line	County Road 27	County Road 53 / 5th Sideroad	Reconstruction
38	6th Line	County Road 53 / 5th Sideroad	20 Sideroad	Reconstruction
39	6th Line	County Road 53 / 5th Sideroad	20th Sideroad	Paved Shoulders
40	7th Line	10 Sideroad	Yonge Street	Reconstruction
41	7th Line	Yonge Street	20 Sideroad	Reconstruction
42	7th Line	20th Sideroad	Webster Blvd	Urbanization
66	7th Line	Webster Blvd	St Johns Road	Urbanization
43	Webster Blvd North Extension	Existing north limit of Webster Blvd	20th Sideroad	New Construction
45	Innisfil Beach Road Grade Separation			New Construction
46	20th Sideroad (bypass) with Grade Separation			Studies

Figure 3: Town of Innisfil's Recommended Transportation Improvements by 2031

2.2 Background Studies

2.2.1 Official Plan (Our Place)

The Town of Innisfil Official Plan (Our Place) is a guiding document to enhance place making, community character and social connections in the Town, and guide municipal actions and other Town Master Planning processes. The vision of the Town is to strengthen the sense of place and belonging.

The goals of the Town include three key focus areas: Connect, Grow and Sustain. Alcona is the Town's Primary Settlement Area as shown in **Figure 4**. The Webster Boulevard North extension, as shown in **Figure 5**, is outside the current settlement boundary of the Alcona Community and is in an Agricultural Area (**Figure 6**) and a Highly Vulnerable Aquifer (**Figure 7**).

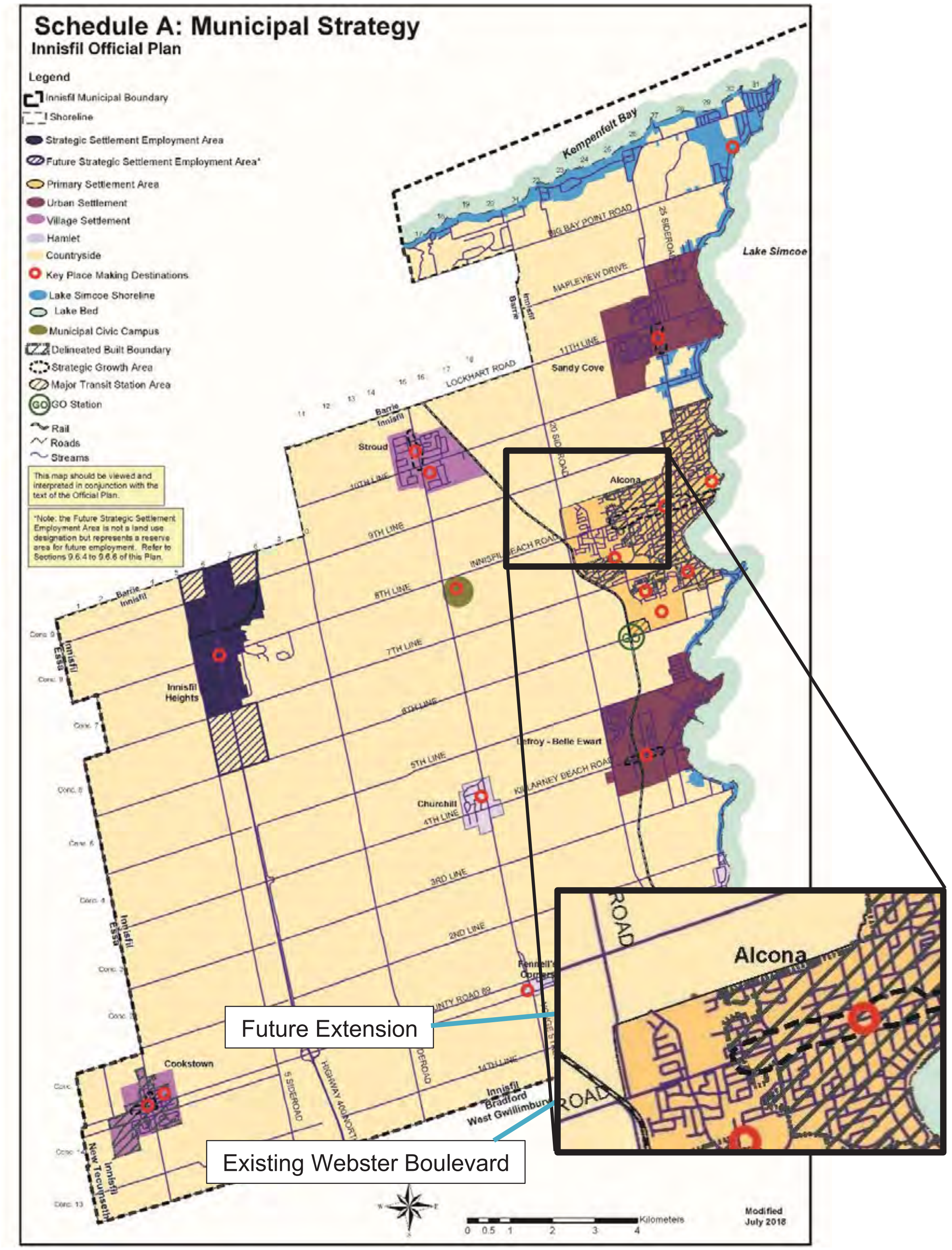

Figure 4: Schedule A: Municipal Strategy (Town of Innisfil Official Plan)
[Modified to illustrate the future extension and existing Webster Boulevard]

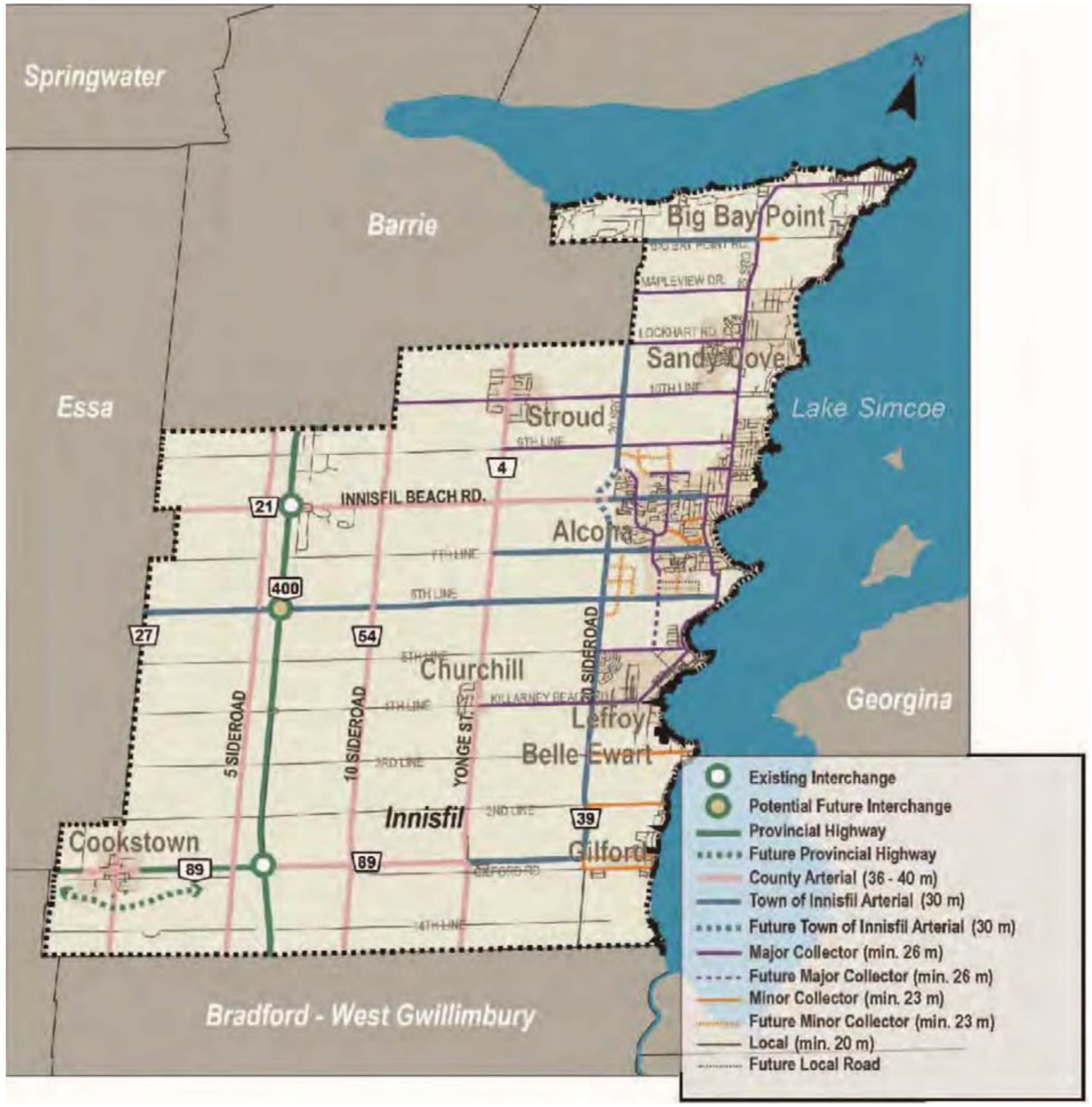

Figure 5: Schedule C: Transportation Network – Roads (Town of Innisfil Official Plan)

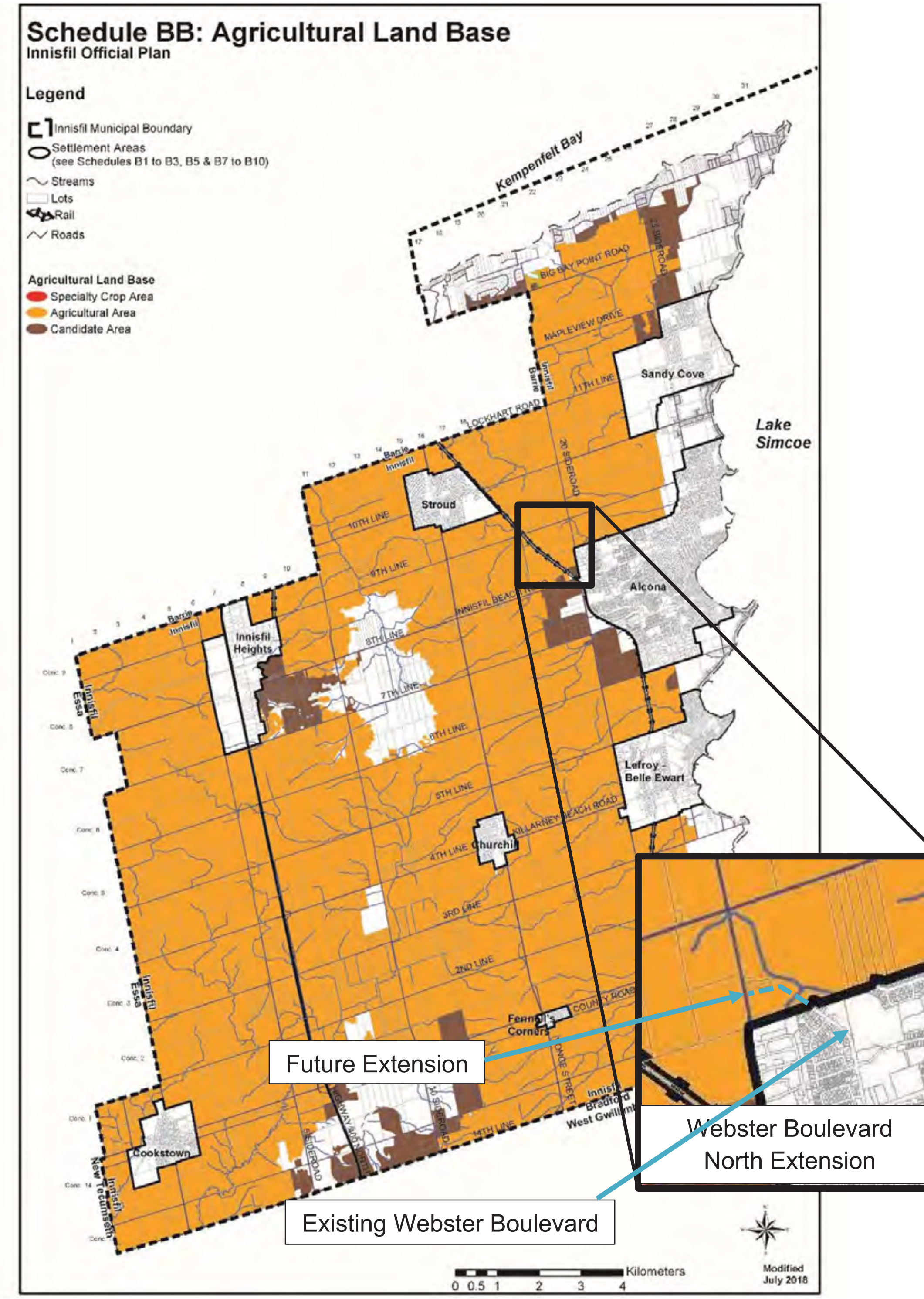

Figure 6: Schedule BB: Agricultural Land Base (Town of Innisfil Official Plan)
[Modified to illustrate the future extension and existing Webster Boulevard]

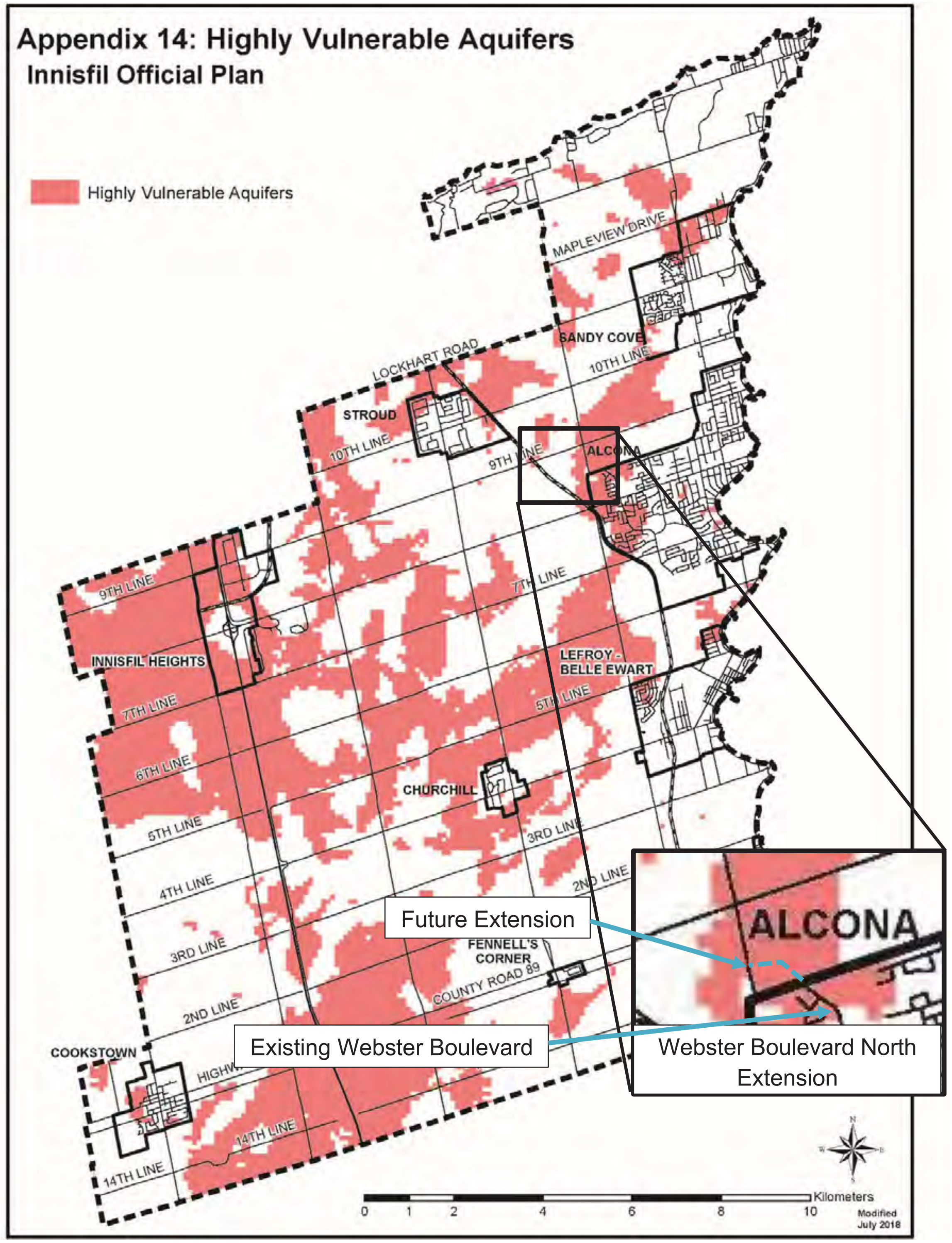

Figure 7: Highly Vulnerable Aquifers
[Modified to illustrate the future extension and existing Webster Boulevard]

2.2.2 Town of Innisfil Transportation Master Plan

The Town of Innisfil's population is projected to grow significantly from approximately 36,600 people to about 71,400 people by 2041. The projected population growth includes significant planned developments in the short term including Big Bay Point, Sandy Cove, Alcona, and Lefroy. Major employment growth is also expected in the Town, specifically in the Innisfil Heights Expansion Area and the 6th Line Hospital Campus. The future Innisfil GO station, located east of 20th Sideroad on 6th Line, is also expected to have an impact on growth in the Town.

In addition, the City of Barrie has plans to grow significantly in the Annexed Lands, which are projected to grow from greenfield today to approximately 40,800 population and 10,400 employment by 2031. The Town's various existing and potential future settlement and employment areas and the Barrie Annexed Lands are illustrated in **Figure 8**.

The TMP identifies future opportunities to improve the transportation network, including the Webster Boulevard North extension and the 20th Sideroad realignment at Innisfil Beach Road; see **Figure 9** for the recommended revisions to the Town of Innisfil Official Plan. It also identifies the lands to the north of the existing Alcona Community (which includes the future Webster Boulevard North extension) as a potential settlement expansion area.

Figure 8: Town of Innisfil TMP Exhibit B: Future Growth Areas

Figure 9: Exhibit D: Recommended Revisions to Official Plan Schedule C (Town of Innisfil TMP)

[Modified to enlarge the Webster Boulevard Study Area]

3.0 NEED AND JUSTIFICATION

3.1 Problem and Opportunity Statement

The Problem and Opportunity Statement identified in the Innisfil TMP Study is as follows:

> "The Town of Innisfil is characterized by distinct communities which are spread out and not well-connected. The majority of travel in the Town is by car.
>
> By 2041 the Town's population and employment numbers are expected to double. Without a balanced transportation strategy, Innisfil residents will experience increases in traffic congestion which will impact their quality of life.
>
> Future opportunities to improve the transportation network have been identified in the Town, through the recently completed Trails Master Plan, new GO station planned at 6th Line and a new demand-responsive transit service."[1]

By capitalizing on the identified needs and opportunities, the Town will achieve its transportation vision:

> "Innisfil's transportation system connects people and communities, fosters healthy living, and operates innovatively and efficiently across the Town as an environmentally and financially sustainable, resilient system ready for the future."

The TMP defined planning alternatives, including the Webster Boulevard North Extension, to support the Problem and Opportunity Statement.

4.0 TRAFFIC

Traffic forecasts will be made of future travel demand on the new link to the end of the Official Plan time horizon. These forecasts will consider the timing of the future 20th Sideroad realignment. The proposed extension of Webster Boulevard will improve access to the existing area developments while, in the shorter term, also providing relief to the intersection of 20th Sideroad and Innisfil Beach Road. The future realignment of 20th Sideroad is expected to ultimately relieve the traffic demand on Webster Boulevard by increasing the operational capacity of the 20th Sideroad/Innisfil Beach Road intersections.

5.0 PROPOSED EA STUDY APPROACH

The planning for the Webster Boulevard North extension will follow the EA process for Schedule C projects as described in the Municipal Class EA. The Study Design Report presents an initial description of the problem, potential design alternatives and the process/steps to complete the study. This approach provides for early input from agencies and the public and allows agencies to comment on the process and technical work programs at the study initiation. This document will continue to be described as a draft report and will be updated as comments are provided by the public, Indigenous communities and agencies.

[1] Town of Innisfil Transportation Master Plan Update

Town of Innisfil – Webster Boulevard North Extension EA Study
Final Study Design Report
February 2021

The Study Design Report will be finalized after POH No. 1 and posted as final on the study's website. The Municipal Class EA Process is illustrated in **Figure 2**.

5.1 Purpose of the Study Design Report

The purpose of this Study Design Report is to:

- Describe the study process that the Town proposes to follow for the study and provide for early consultation in the EA process.
- Document, for stakeholder review and comment, the preliminary planning decisions that have been made with respect to:
  - Transportation needs;
  - Preliminary identification and screening of Planning Alternatives; and
  - Further work to be undertaken.
- Provide a baseline in moving the study forward following the assessment of stakeholder comments. These may include agency, Indigenous community and public comments on the study activities and alternatives expected to be evaluated.

6.0 CONSULTATION PROGRAMS

Consultation will take place throughout the study and the consultation program will comply with the requirements of the *Freedom of Information and Protection of Privacy Act 2009,* and the obligations stipulated in the *Accessibility for Ontarians with Disabilities Act (2005).*

The public and agency consultation program for this study will include the following:

- Public Notices;
- Draft and Final Study Design Reports;
- External communications/presentations with stakeholders, including ministries, agencies, Indigenous Peoples communities, municipalities and members of the public;
- Two (2) Public Open Houses; and
- Town of Innisfil website to provide information to the public.

6.1 Public Consultation

The consultation process will involve all potential stakeholders at all key study milestones. This will include, but is not necessarily limited to the public, community associations, private property owners, businesses and interest groups.

6.1.1 Study Website

The EA Study will use the Town's website (www.getinvolvedinnisfil.ca) to post information and allow the public to monitor the study progress. The following will be posted to the website: Notices for the Study Commencement and Completion; POH's; Draft and Final Study Design Report; Environmental Study Report submission; public information updates; and how to submit comments.

6.1.2 Public Notices

Notices will be published in the local newspaper InnisfilToday for the study commencement and the POH's. Each notice will announce the date, time and location, identify key information to be presented, request input from interested and affected parties, and invite the public to the POH. Finally, a Notice of Study Completion will be published announcing the commencement of the 30-day public review period for the Environmental Study Report.

6.1.3 Public Meetings

Formal public consultation in the form of two POH's will be conducted at a local and accessible location. Notices of all POH's will be published in the local newspaper along with letters mailed out to agencies, stakeholders, Indigenous Communities and utilities.

With respect to public involvement, the work program proposes the following key meetings:

- POH No. 1 will present:
  - The project goals;
  - Problem and Opportunity Statement;
  - Draft Study Design Report (containing the Work Plan);
  - Assessment of Planning Alternatives;
  - Desktop environmental inventories (constraint mapping); and
  - Generation and assessment of Preliminary Design Alternatives (including cross sections and intersections).
- POH No. 2 will present:
  - Detailed environmental inventories for Preliminary Design Alternatives;
  - Evaluation of Preliminary Design Alternatives to select the Technically Preferred Plan;
  - Mitigation Plan; and
  - Property Protection Plan.

At the time of preparing this Study Design Report, the Town is following Provincial recommendations for restricting social gatherings in light of the COVID-19 pandemic, reflecting the need to keep residents safe by staying home and limiting exposure to COVID-19. Plans for community engagement events will be customized as required to address these restrictions. The EA team will work with the Ministry of Environment, Conservation and Parks to modify the engagement format to be mindful of the prevailing community restrictions, while still meeting the EA Act requirements.

6.2 Stakeholder Consultation

6.2.1 Municipal and Agency Consultation

Municipal consultation will be maintained during the study through a Technical Advisory Committee. Meetings will be held at key milestones. Technical Advisory Committee

participation will include as a minimum, representatives from the Town of Innisfil, Lake Simcoe Region Conservation Authority and Simcoe County.

6.2.2 External Agencies and Regulatory Agencies

The following agencies will be on a study mailing list, which will be updated and maintained throughout the study:

- Ministry of Environment, Conservation and Parks
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Ministry of Natural Resources and Forestry
- Ministry of Agriculture, Food and Rural Affairs
- Ministry of Indigenous Affairs
- Crown-Indigenous Relations and Northern Affairs Canada
- Ministry of Community and Social Services
- Ministry of Municipal Affairs and Housing
- Ministry of Energy, Northern Development and Mines
- Ministry of Infrastructure
- Ministry of Community Safety and Correctional Services
- Department of Fisheries and Oceans
- Ontario Provincial Police

6.2.3 Indigenous Peoples Consultation

The Town of Innisfil has a constitutional duty to consult with Indigenous Peoples with traditional land use or interests within the Study Area. Clear, effective and timely consultation with Indigenous Peoples is essential to ensure the success of the project. This will include:

- Identification of interested/affected Indigenous Peoples early in the decision-making process;
- Distribution and notification of relevant project-related information, including the Class EA process, environmental inventories, potential alternatives and impacts;
- Early identification of concerns and issues;
- Understanding of potential risk and impacts of the Study on Indigenous Peoples' interests;
- Development of mutually acceptable solutions involving Indigenous Communities; and
- Ensuring regulatory compliance throughout the Class EA process.

Indigenous Communities will be consulted during the Study and offered, at their request, meetings with their communities.

6.2.4 Issues/Concerns and Approaches for resolving Concerns

Recognizing that the stakeholders who are expected to participate in this study may have differing views, values, opinions and interests, and that consensus is not always possible, the Town, as the proponent of the study, will consider various means to identify and address issues in a fair and balanced way. This will include the identification of issues through early consultation and using an evaluation process that compares differing values and recommends a balanced solution.

Issues to be considered by the study include:

Transportation

- Provision of active modes of transportation
- Minimizing out-of-way travel
- Traffic demands and the diversion of traffic from 20th Sideroad to Webster Boulevard
- Opportunities for traffic calming measures to control travel speeds on Webster Boulevard
- Providing improved traffic operation and safety
- Design consistency of cross sections and intersections

Environmental

- Avoidance of significant natural, social or cultural environmental features in the Study Area
- Recognition of Indigenous Peoples' interests
- Provide mitigation for noise sensitive land uses as required

Economic

- Accommodating movement of farm machinery and commercial vehicles at intersections/ roundabouts

Planning

- Integrating transportation and land use plans (Alcona Community Secondary Plan)
- Integration with future land use plans outside the current expansion area

7.0 ALTERNATIVE PLANNING SOLUTIONS (PLANNING ALTERNATIVES)

7.1 Description of Alternative Planning Solutions (Planning Alternatives)

Alternative Planning Solutions represent alternative ways or methods of addressing the problem to be solved by the project. These reflect different strategies and include the "Do Nothing" approach (maintaining the status quo). Following the assessment of Alternative Planning Solutions, those alternatives judged to address the Problem Statement will be carried forward and will form the Recommended Planning Solution. The Recommended Planning Solution will provide the best overall balance between transportation performance, safety, and life cycle costs, and environmental, cultural, socio-economic, and land use planning objectives.

The Town's TMP identified four planning alternatives other than the "Do Nothing" alternative:

1. Base Case: incorporates planned road improvements by the Ministry of Transportation Ontario and Simcoe County only;
2. Current Plans: further to Alternative 1, includes constructing the planned Town improvements from the 2013 TMP and the Trails Master Plan;
3. Balanced Approach: further to Alternative 2, invests in new roads and road improvement projects, and Travel Demand Management measures including Demand Responsive Transit, Bike-share, EcoMobility1 hubs and Zoning By-law revisions; and
4. Aggressive Approach: further to Alternative 3, invests in fixed-route transit.

The evaluation of Planning Alternatives selects the alternative(s) that best address the Problem and Opportunity Statement. The evaluation of Planning Alternatives, as defined in the TMP, recommended carrying forward Alternative 3 (Balanced Approach) and Alternative 4 (Aggressive Approach), as shown in **Figure 10**.

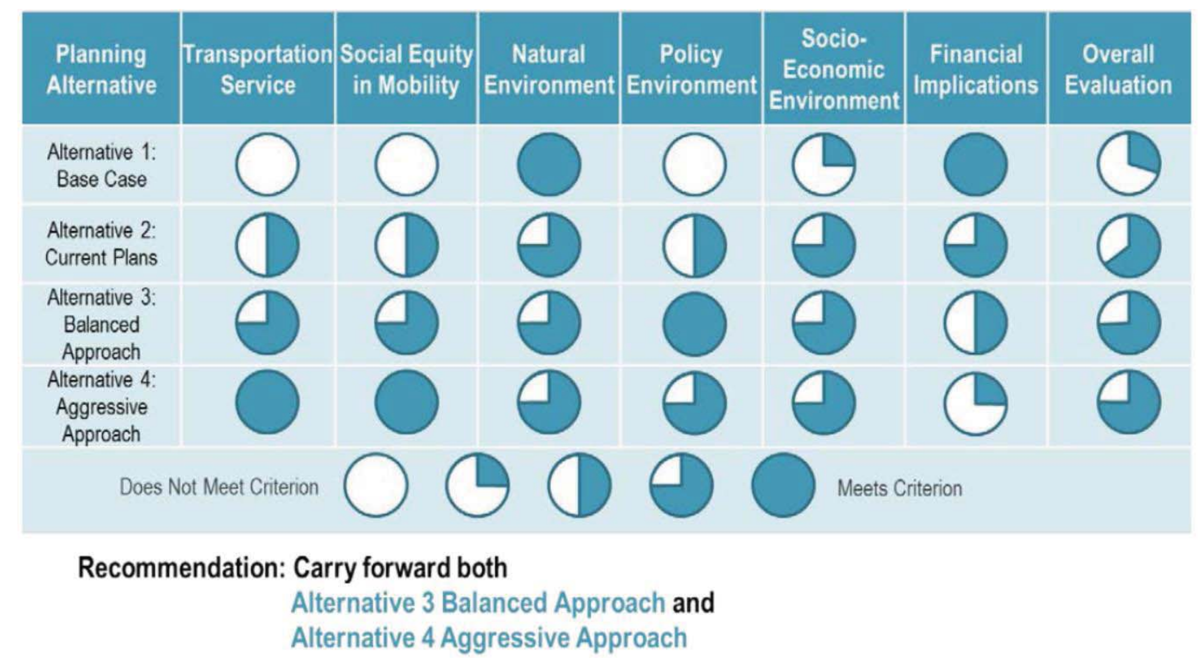

Figure 10: Evaluation of Planning Alternatives

The Preliminary Recommended Planning Alternatives (Alternatives to the Undertaking) are summarized in the TMP and will be presented at the first POH for public and stakeholder feedback.

The TMP proposes road improvements for short-, medium- and long-term improvements and includes the Webster Boulevard North extension as a medium-term road improvement project (Alternative 3).

8.0 PRELIMINARY DESIGN ALTERNATIVES

This section describes Preliminary Design Alternatives for implementing the recommended Planning Alternative to extend Webster Boulevard northerly from the existing terminus to 20th Sideroad. The EA will identify the preferred alignment, intersection treatments and cross section alternatives for the Webster Boulevard North extension. The alternatives will be developed and evaluated, and presented to the public for comments. The alternatives carried forward for evaluation may include refinements or sub-alternatives based on the comments received and the identified environmental factors and effects.

Alignment Alternatives

Although the TMP has identified a general alignment for the road extension, this EA Study will investigate three (3) alignment alternatives:

- **Alternative 1:** TMP alignment (connection to 20th Sideroad)
- **Alternative 2:** TMP alignment shifted northerly adjacent to heritage property (connection to 20th Sideroad)
- **Alternative 3:** Connection to 9th Line

Cross Section Alternatives

The study will consider a 2-lane urban cross section including on-street parking facilities, raised cycle tracks or bicycle lanes, and raised median.

Intersection Alternatives

The study will consider conventional intersection or roundabout intersection control.

8.1 Evaluation of Alternatives

For the evaluation of the Corridor Alternatives, the study will utilize a qualitative evaluation methodology.

Sample Global Factor and Local Sub-factor evaluation criteria include:

1. Global Evaluation Factors: Traffic and Transportation; Natural Environment; Social and Cultural Environment; Land Use and Property; and Cost.
2. Local Sub-factor Criteria (under each Global Evaluation Factor) may include: temporary or permanent property impacts; loss of fish habitat; noise; built heritage resource impacts; emergency response; and capital cost.

9.0 WORK PROGRAM

The major elements of the work program are described in the following sections.

Task 1: Project Start-Up and Study Design Report: Upon initiation of the project, a meeting was held to: review the study scope, budget and schedule; establish membership, meeting dates and the role of the Technical Advisory Committee; and prepare all required agreements. The Notice of Study Commencement will be prepared for the Town to place in

the local newspaper and on their website. BTE will hand deliver the notice to adjacent property owners on Webster Boulevard North and in the vicinity of 20th Sideroad intersection and will mail out notices to the study mailing list.

Task 2: Information Gathering: The collection and organization of the data necessary for the analysis, evaluation and design activities will include a review of all study materials including:

- Gather available reports, drawings, other data relating to the Alcona North collector road network development;
- Review the Official Plan and TMP Update; and
- Review information obtained and consider in proceeding with the study.

Task 3: Traffic Study: A Traffic Study will be completed with a Complete Streets approach considering the needs of pedestrians, cyclists, motorists and Innisfil's microtransit services. The traffic analysis will assess existing and future traffic demand to the end of the Official Plan time horizon. The study will provide recommendations for: intersection control, pedestrian crossings, spacing of intersections with local streets, and roadway cross section requirements (lane requirements, sidewalks and/or multi-use paths, continuation of existing bicycle lanes or transition to raised cycle tracks and potential traffic calming measures). The traffic assessment will provide input to the transportation evaluation criteria for comparing alternatives.

Task 4: Technical Investigations:

Property: Property requirements will be identified for the roadway extension. Permission to Enter agreements will be obtain prior to field visits. A preliminary acquisition plan will be prepared, including consultation records with property owners during the EA Study.

Utilities: A composite utility plan will be prepared through a secondary source review as well as coordination with utility companies to identify existing above- and below-ground utilities in the corridor. Relocations will be identified on the Recommended Plan and communicated with the impacted utility companies.

Drainage and Stormwater Management: The drainage and stormwater management plan will be developed for the Recommended Plan. Stormwater management measures will be assessed and evaluated to meet the design criteria approved by the Town and Lake Simcoe Region Conservation Authority. Preliminary design of the recommended drainage and stormwater management measures will be included in the Recommended Plan.

Geotechnical Investigations: Five (5) boreholes will be advanced along the proposed extension alignment and will be checked for groundwater and caving prior to backfilling. Monitoring wells will be installed in 3 of the boreholes to measure the groundwater level and for the hydrogeological study. On completion of the site investigation and laboratory testing program, a geotechnical report will be prepared. The report will include a description of the site location and topography, a description of the subsurface boreholes and sampling program, a summary of subsurface conditions throughout the site, including groundwater level and depth to bedrock if applicable, the results of the in-situ and laboratory testing, a plan showing the site and the locations of the boreholes and associated logs. Recommendations will be provided for all relevant geotechnical parameters including excavation and bedding/backfill, subgrade suitability, re-use of in-situ material for backfill, pavement design, etc.

Hydrogeological Study: Single Well Hydraulic Tests will be completed at three monitoring wells as part of the geotechnical investigation. The Single Well Hydraulic Tests are completed by monitoring water level response to an instantaneous change in head (water level). The hydraulic conductivity of the water bearing soil will be determined.

A groundwater sample will be collected from one of the monitoring wells and analyzed for general water quality parameters.

The hydrogeological assessment report will include a review of available information pertaining to the site, characterization of hydrogeological conditions, groundwater elevations, groundwater inflow rates and a water balance assessment.

The presence of Highly Vulnerable Aquifers and Source Water Protection Policies will be addressed. Accordingly, recommendations for potential Low Impact Development features will also be included.

Survey: The collection of all topographic information will be completed within the proposed right-of-way. Topographic features will be collected within the proposed right-of-way for a minimum of 120 m on either side of the 20th Sideroad intersection. Boundary concerns will not be addressed by the topographic survey. An Ontario Land Surveyor will be required to undertake any of the legal survey works.

Design Criteria: Design Criteria for the road extension will be developed based on Transportation Association of Canada (TAC) and Town standards. We will prepare the design criteria sheet for review by the Town and Simcoe County road departments.

Task 5: Environmental Inventories

Archaeology Assessment: The Stage 1 archaeological assessment will be conducted in accordance with the technical standards, as defined in the Standards and Guidelines for Consultant Archaeologists, 2011, set out by the Ministry of Heritage, Sport, Tourism and Culture Industries, and with the Ontario Heritage Act, R.S.O. 1990, c. 0.18.

A Stage 1 archaeological assessment analyses the archaeological potential of a property based on its recorded historical uses and its potential for nineteenth century and earlier occupations of Indigenous and non-Indigenous origin. The objectives of a Stage 1 background study are: 1) to provide information about the property's geography, history, previous archaeological fieldwork and current land condition; 2) to evaluate in detail the

property's archaeological potential which will support recommendations for Stage 2 property assessment for all or parts of the property if warranted; and, 3) to recommend appropriate strategies for Stage 2 property assessment.

Cultural Heritage: The purpose of the work for the Cultural Heritage component of the EA process is to undertake identification, documentation and evaluation of the heritage resources in the Study Area. The Alcona North Heritage Resource Assessment identified one property on 20th Sideroad with low heritage potential for the landscape and medium potential for the house. Based on the alignment of the extension to the south of the existing tree line on the property, it is expected that the completion of the Ministry of Heritage, Sport, Tourism and Culture Industries Criteria for Evaluation Potential for Build Heritage Resources and Cultural Heritage Landscape Checklist will result in a screening the Study Area.

Natural Heritage: This assessment will include a desktop review of available information to identify natural features in the study area. Sources of information will include the Ministry of Natural Resources and Forestry Make-A-Map: Natural Heritage Areas geographic tool, Ministry of Natural Resources and Forestry Land Information Ontario (LIO) geographic layers, the Town's Official Plan, previously completed reports including the Existing Conditions Study completed for the Alcona North Secondary Plan, available aerial photography, and consultation with applicable agencies (i.e. Ministry of Natural Resources and Forestry, and Ministry of Environment, Conservation and Parks). A site visit will be conducted to document existing conditions, including Ecological Land Classification (ELC) of any vegetation communities, potential habitat for Species at Risk and other natural features in the study area. Constraint mapping and a summary of all information will be produced to assist the Project Team and Technical Advisory Committee in the determination of a preferred alternative.

Noise Assessment: The existing noise sensitive land uses will be documented in the Environmental Study Report. A noise impact assessment will be undertaken using STAMSON software to determine the proposed impacts and mitigation requirements for any recommended roadway improvements. A noise impact assessment will be prepared, using the Ministry of Transportation Ontario's Environmental Guide for Noise.

Social Environment Inventory and Impact Assessment: The existing land uses will be documented in the Existing Conditions Report and considered in the evaluation of alternatives.

Economic Environment Inventory and Impact Assessment: No economic environment inventory and impact assessment is recommended to be completed as part of this study based on the Official Plan and zoning indicating future residential land use adjacent to the Study Area.

Task 6: Community Café/POH No. 1: The first public event will be held as a joint Community Café/ POH. The Community Café uses the methodology of a World Café event. The joint

Community Café/POH No. 1 event will present the draft Study Design Report, summarize the TMP Update recommendations and present the preliminary alternatives to the public. The Community Café is planned to occur as a web-based event with pre-registration of participants.

Task 7: Confirmation of Preferred Planning Alternative(s): The consideration of all reasonable alternatives is a guiding principle for EA studies. Planning alternatives and a preliminary analysis and evaluation are shown in **Section 7.0**.

Task 8: Development, Analysis and Evaluation of Design Alternatives: A long list of active transportation, cross section, alignment and intersection design alternatives will be generated through discussions with the Town, Technical Advisory Committee members, agencies and the public. The alternatives will be evaluated using a qualitative methodology to determine the Technically Preferred Alternative(s) and will consider evaluation criteria including, but not limited to: transportation (safety, traffic operations, active transportation); environmental (natural, socio-economic, cultural); land use and property; and cost.

Task 9: POH No. 2: POH No. 2 will present the Technically Preferred Plan and recommendations for the extension including mitigation measures.

Task 10: Environmental Study Report: The preparation of the draft and final report will follow the format and content for an Environmental Study Report for a Schedule C Municipal Class EA to be submitted to Ministry of Environment, Conservation and Parks in accordance with the Municipal Class Environmental Assessment document requirements. The Environmental Study Report will document the study methodology, findings, public involvement and recommendations. A draft version will be submitted to the Town and to external review agencies who request a draft prior to the preparation of the final document. A presentation will be made to Town Council and a notice will be prepared for the Town to place in the local newspaper, Town website, and distributed to the study mailing list either by email or by Canada Post.

10.0 DRAFT STUDY SCHEDULE

A draft schedule for this Study is shown below in **Table 1**. The POH meetings will be scheduled to avoid the Christmas and summer vacation periods.

Table 1: Draft Study Schedule

Task	Date
Project Initiation Meeting	September 2020
Information Gathering	Fall 2020
Draft Study Design	October/November 2020
Study Commencement Notice/ Notice of Community Café/ POH No. 1	November 2020
Traffic Impact Study	Fall 2020
Environmental Inventories	Fall 2020
Community Café/POH No. 1	Fall 2020/Winter 2021
Technical Investigations	Winter 2021
Development, Analysis and Evaluation of Design	Winter 2021
POH No. 2	Spring 2021
Preparation of Environmental Study Report	Summer 2021
Town Review of Environmental Study Report	Summer 2021
30-day Public Review Period	Fall 2021

GLOSSARY OF TERMS

• **AADT**	Annual Average Daily Traffic – the average 24-hour, two-way traffic per day for the period from January 1st to December 31st.
• **Alignment**	The vertical and horizontal position of a road.
• **Alternative**	Well-defined and distinct course of action that fulfils a given set of requirements. The EA Act distinguishes between alternatives to the undertaking and alternative methods of carrying out the undertaking.
• **Alternative Project**	Alternative Planning Solutions, see above.
• **Bump-Up**	The act of requesting that an environmental assessment initiated as a class EA be required to follow the individual EA process. The change is a result of a decision by the proponent or by the Minister of Environment to require that an individual environmental assessment be conducted.
• **Canadian Environmental Assessment Act (CEAA)**	The CEAA applies to projects for which the federal government holds decision-making authority. It is legislation that identifies the responsibilities and procedures for the environmental assessment.
• **Class Environmental Assessment Document**	An individual environmental report documenting a planning process which is formally submitted under the EA Act. Once the Class EA document is approved, projects covered by the class can be implemented without having to seek further approvals under the EA Act provided the Class EA process is followed.
• **Class Environmental Assessment Process**	A planning process established for a group of projects in order to ensure compliance with the Environmental Assessment (EA) Act. The EA Act, in Section 13 makes provision for the establishment of Class Environmental Assessments.
• **Corridor**	A band of variable width between two locations. In transportation studies a corridor is a defined area

	where a new or improved transportation facility might be located.
• **Criterion**	Explicit feature or consideration used for comparison of alternatives.
• **Cumulative Effects Assessment**	Cumulative Effects Assessment assesses the interaction and combination of the residual environmental effects of the project during its construction and operational phases on measures to prevent or lessen the predicted impacts with the same environmental effects from other past, present, and reasonably foreseeable future projects and activities.
• **Detail Design**	The final stage in the design process in which the engineering and environmental components of preliminary design are refined and details concerning, for example, property, drainage, utility relocations and quantity estimate requirements are prepared, and contract documents and drawings are produced.
• **DFO**	Department of Fisheries and Oceans.
• **EA**	Environmental Assessment
• **EA Act**	Ontario Environmental Assessment Act, RSO 1990 c. E.18 (as amended July 21, 2020).
• **Environment**	• Air, land or water, • Plant and animal life, including human life, • The social, economic and cultural conditions that influence the life of humans or a community, • Any building structure, machine or other device or thing made by humans, • Any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities, or • Any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

• **Environmental Effect**	A change in the existing conditions of the environment which may have either beneficial (positive) or detrimental (negative) effects.
• **ESR**	Environmental Study Report. The final documentation for a Schedule C project, defining the project, consultation process, preferred solution and mitigation measures.
• **Evaluation**	The outcome of a process that appraises the advantages and disadvantages of alternatives.
• **Evaluation Process**	The process involving the identification of criteria, rating of predicted impacts, assignment of weights to criteria, and aggregation of weights, rates and criteria to produce an ordering of alternatives.
• **External Agencies**	Include Federal departments and agencies, Provincial ministries and agencies, conservation authorities, municipalities, Crown corporations or other agencies other than MTO.
• **Factor**	A category of sub-factors.
• **General Arrangement**	Structural plan of the bridge and proposed works including elevations and cross sectional views of the bridge.
• **Individual Environmental Assessment**	An environmental Assessment requiring the submission of a document for approval by the Minister, pursuant to the EA Act and which is neither exempt from the EA Act nor covered by a Class EA approval.
• **MECP**	Ministry of the Environment, Conservation and Parks.
• **MHSTCI**	Ministry of Heritage, Sport, Tourism and Culture Industries.
• **Mitigating Measure**	A measure that is incorporated into a project to reduce, eliminate or ameliorate detrimental environmental effects.

• **Mitigation**	Taking actions that either remove or alleviate to some degree the negative impacts associated with the implementation of alternatives.
• **MNRF**	Ministry of Natural Resources and Forestry.
• **MTO**	Ministry of Transportation Ontario.
• **NSA**	Noise Sensitive Areas
• **OP**	Official Plan
• **Planning Alternatives**	Planning alternatives are "alternative planning solutions" under the EA Act. Identification of significantly different transportation engineering opportunities while protecting significant environmental features as much as possible.
• **Preliminary Design Alternatives**	Preliminary Design Alternatives are "alternative methods " of carrying out the selected planning solution while maximizing social and transportation benefits while protecting significant environmental features as much as possible.
• **Project**	A specific undertaking planned and implemented in accordance with the Class EA including all those activities necessary to solve a specific problem.
• **Proponent**	A person or agency that carries or proposes to carry out an undertaking, or is the owner or person having charge, management, or control of an undertaking.
• **Public**	Includes the general public, interest groups, associates, community groups, and individuals, including property owners.
• **POH**	Public Open House.
• **Realignment**	Replacement or upgrading of an existing roadway on a new or revised alignment.
• **Recommended Plan**	That part of the planning and design process, during which various alternative solutions are examined and evaluated including consideration of environmental

	effects and mitigation; the recommended design solution is then developed in sufficient detail to ensure that the horizontal and vertical controls are physically compatible with the proposed site, that the requirements of lands and rights-of-way are satisfactorily identified, and that the basic design criteria or features to be contained in the design, have been fully recognized and documented in sufficient graphic detail to ensure their feasibility.
• **SAR**	Species At Risk
• **Screening**	Process of eliminating alternatives from further consideration, which do not meet minimum conditions or categorical requirements.
• **SDR**	Study Design Report.
• **Sub-factor**	A single criterion used for the evaluation. Each sub-factor is grouped under one of the global factors.
• **TAC**	Technical Advisory Committee. The TAC will include the approving agencies and Consultant. It will act as the decision-making body for the study recommendations.
• **TIS**	Traffic Impact Study
• **TMP**	Transportation Master Plan
• **TPA**	Technically Preferred Alternative
• **TPP**	Technically Preferred Plan
• **Traceability**	Characteristics of an evaluation process which enables its development and implementation to be followed with ease.

Appendix C

Record of Consultation – Commencement/POH 1, POH 2, and Completion

BT ENGINEERING

Innisfil

Community Café/POH No. 1 Summary Report

Town of Innisfil Webster Boulevard North Extension Environmental Assessment Study

January 2021

Submitted by:
BT Engineering Inc.
9040 Leslie Street, Unit 218
Richmond Hill, ON L4B 3M4
905-709-4554

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1.0 INTRODUCTION

The Town of Innisfil has initiated an Environmental Assessment (EA) Study for the extension of Webster Boulevard North to 20th Sideroad. The Study is evaluating alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the Transportation Master Plan (TMP).

The Study Area is located in the Town of Innisfil, as illustrated in **Figure 1**.

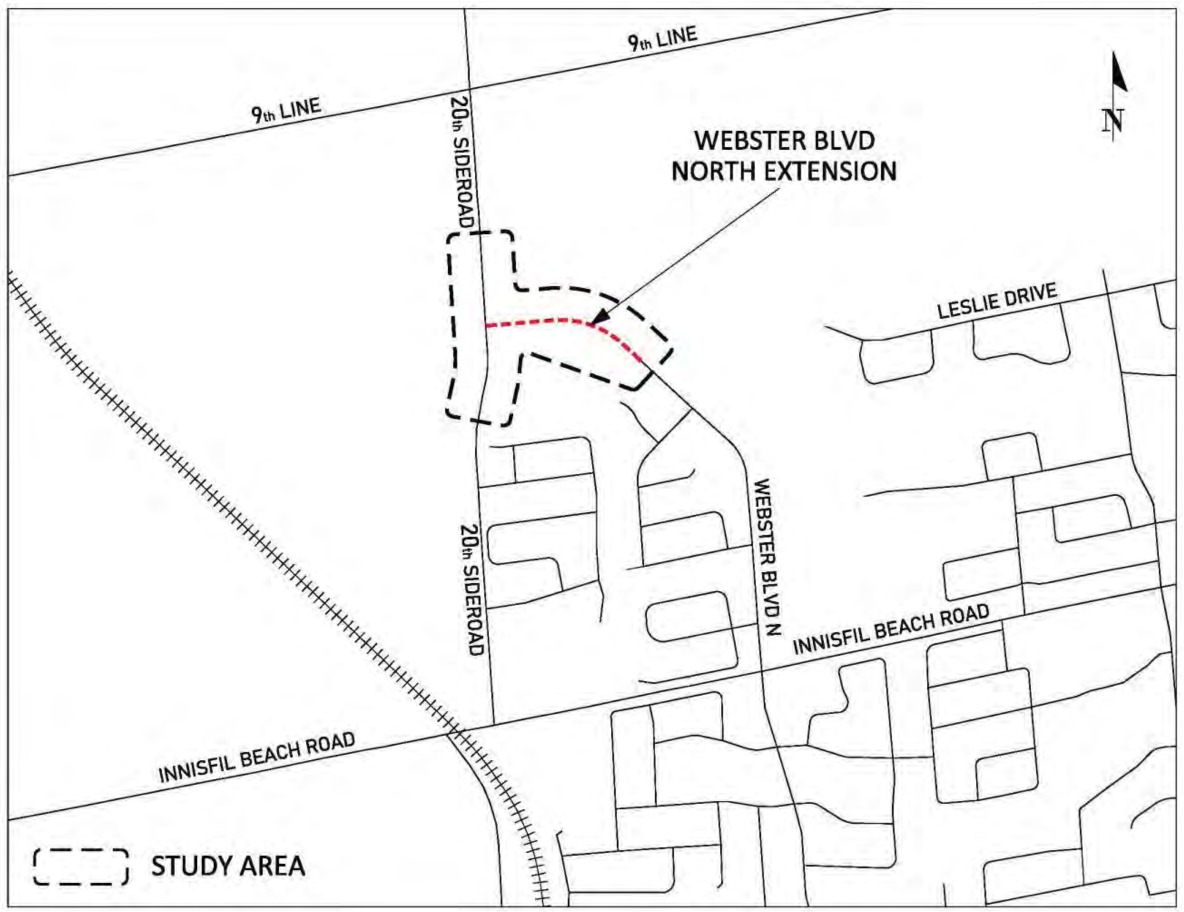


Figure 1: Study Area

This report summarizes the Community Café event and online Public Open House (POH) No. 1.

2.0 BACKGROUND

At the time of the Community Open House event/POH No. 1, the Province of Ontario has implemented measures to deal with the COVID-19 pandemic, including restrictions on public gatherings. The event was therefore held online, and the distribution of materials is relying on web-based communications with the public. Conventional public events may be conducted during subsequent stages of the study.

The first public meeting was held as an online Community Café event/POH No. 1 as follows:

Community Café Event Date:	Thursday, December 10, 2020
Time:	6:00 pm – 7:00 pm
Location:	Zoom Meeting (Online)

POH No. 1 was hosted on the Town of Innisfil's website and material was posted online from **Thursday, December 10, 2020** to **Thursday, January 7, 2021**. People were encouraged to submit comments by email or by phone during this timeframe.

Six (6) people registered for the Community Café and three (3) people attended the virtual meeting. Each person was encouraged to voice any issues or concerns.

2.1 Community Café Process

Exhibits were posted on the Town's website in advance of the Community Café event. The Community Café/POH No. 1 exhibits are in **Appendix A**. Consultant and Town staff attended the online event and a short presentation was given to present the materials posted online**.**

The Community Café process follows the principles of the "World Café" philosophy; namely, that people want to talk together about issues that matter, and that that as we talk together, we are able to collectively achieve greater wisdom. People have the capacity to work together and can collectively be creative and insightful when actively engaged in meaningful conversations. The Community Café is a simple yet effective conversational method for fostering dialogue, accessing collective intelligence and creating innovative possibilities for action. The six Café principles are:

1. Set the context;
2. Explore questions that matter;
3. Encourage everyone's contributions;
4. Connect diverse perspectives;
5. Listen together for insights; and
6. Share collective discoveries.

The Community Café was an informal event that facilitated conversation by providing participants with a comfortable and welcoming environment.

The event was organized to create a network of dialogue about issues that matter to the community. Each conversation was chosen to reflect the most important parameters of the project, and to determine the desired goals of the participants. Four topics were provided as discussion points to reflect the actual concerns of the community. A group discussion between participants allowed key ideas and perspectives to be exchanged, which provided new insights to the project.

The Café facilitator led the online discussion to provide a neutral voice and encourage all participants to contribute to the conversation and to remain focused on the topic being discussed.

The Community Café event began with an introductory presentation, which is provided in **Appendix B**. Following the project introduction, the process and objectives of the Community Café event were explained. The participants were encouraged to stay in the virtual meeting to begin discussion on the applicable topic. The four topics that were chosen to be discussed during the event included the following:

1. Safety – Pedestrians/Cyclists
2. Traffic Operations
3. Intersection Design
4. Environmental

3.0 PUBLIC AND AGENCY CONSULTATION

One of the key aspects of the project is to provide the public, interested parties, affected agencies and stakeholders with the opportunity for input. In order to ensure this objective is met, a public and agency notification program was undertaken. The program includes a number of communication mechanisms, discussed in the following sections. A draft Study Design Report is available on the Town's website and was available at the event for public review.

3.1 Newspaper Notice

Notice of the joint Community Café/POH No. 1 was advertised in the local newspaper (Innisfil Journal) on Thursday, November 26, 2020 and Thursday, December 10, 2020. Letters were sent out to the mailing list to agencies, stakeholders and utilities. Notices were also sent out by mail to local residents within the Study Area. Copies of the newspaper notices are in **Appendix C**.

3.2 Agency and Stakeholder Contacts

The combined Notice of Study Commencement and Community Café was issued in advance of the event to agencies, stakeholders and interest groups including:

- Alcona Beach Club Inc.
- Association Franco-Ontarienne Des Conseils Scolaires Catholiques
- Barrie Cycling Club
- BonSecour Track and Trail Snowmobile Club
- City of Barrie
- City of Barrie Fire and Emergency Services
- Conseil Scolaire Viamonde
- Cookstown and District Chamber of Commerce
- County of Simcoe
- County of Simcoe Paramedic Services
- Degrassi Cove Association
- Environment Canada
- Georgian College
- Greater Innisfil Chamber of Commerce
- Infrastructure Ontario
- Innisfil District Association
- Innisfil Fire Rescue Services
- Innisfil Heritage Committee
- Lake Simcoe Region Conservation Authority
- Metrolinx/GO Transit
- Ministry of Environment, Barrie District Office
- Ministry of Environment, Conservation and Parks
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources and Forestry, Midhurst District Office
- Ministry of Tourism Culture and Sport
- Ministry of Transportation
- Ontario Federation of Agriculture
- Ontario Ministry of Agriculture, food and Rural Affairs
- Ontario Provincial Police, Operational Policy and Strategic Planning Bureau
- Royal Victoria Regional Health Centre
- Simcoe County District School Board

- Simcoe County Historical Association
- Simcoe County Police Services - North Division, Operational Policy and Strategic Planning Bureau
- Simcoe County Student Transportation Consortium
- Simcoe Muskoka Catholic District School Board
- Simcoe Muskoka District Health Unit
- Transport Canada
- Bell Canada
- Barrie Collingwood Railway
- Enbridge Gas
- Hydro One Network Inc.
- InnPower
- InnServices Inc.
- Rogers Communications
- Pratt Development

3.3 Indigenous Peoples

The following Indigenous Peoples groups were contacted:

- Aamjiwnaang First Nation
- Alderville First Nation
- Beausoleil First Nation
- Chippewas of Georgina Island
- Chippewas of Rama First Nation
- Curve Lake First Nation
- Georgian Bay Métis Council
- Haudenosaunee Confederacy Chiefs Council
- Hiawatha First Nation
- Huron-Wendat Nation
- Metis Nation of Ontario
- Mississaugas of Scugog Island First Nation
- Mississaugas of the New Credit First Nations
- Moon River Metis Council
- Moose Deer Point First Nation
- Six Nations of the Grand River
- Wahta Mohawks (Mohawks of Gibson)
- Wasauksing First Nation

An offer to meet separately from the event with the communities was extended; however, no community expressed an interest at this time.

4.0 COMMENTS

A total of five (5) comment sheets were received during the comment period. Copies of the comments, excluding personal information, are provided in **Appendix D**. The results of the comments and discussions are summarized in the following sections.

4.1 Summary of Written Comments

The results of the written comments received during the subsequent comment period are summarized below in **Table 1**.

Table 1: Summary of Written POH No. 1 Comments

Comment	Number of Respondents
Concern for aesthetics/views from residential properties	1
Support for future commercial development	2
Request for municipal service hook-up to residential properties	1
Traffic volumes on 20th Sideroad are high which makes it difficult to get in/out of existing driveways	1
Propose a connection from Webster Boulevard North to 9th Line	2
Support for Alignment 2 to accommodate future development and protect environment	1

5.0 COMMUNITY CAFÉ TOPIC DISCUSSIONS

Topics of conversation were provided for discussion. Each topic had several associated questions; however, the conversation often diverged from the given questions. This allowed for the conversation to flow freely and created an encouraging environment for everyone at the event to contribute ideas and perspectives. It also provided the participants an opportunity to direct the conversation to questions that are relevant to their actual concerns.

The following pages summarize the ideas and comments expressed during the event. All of the comments are listed based on the discussion topics of the tables.

The discussion presented in this report represents the opinions of the public and stakeholders. These discussions will be used as input by the Technical Advisory Committee for subsequent steps in developing the alternatives.

Readers of this report are cautioned that the recorded ideas and discussions are unsubstantiated and may or may not be feasible and require development. They do, however, represent the best effort to identify the issues and alternatives for the project that are consistent with the values of the public/ stakeholders in attendance.

5.1 Safety – Pedestrians/Cyclists

Key Questions:

1. What are the main safety concerns on Webster Boulevard? At the intersections?
2. Is the sidewalk width appropriate?
3. How should cycling be accommodated in the corridor?

Comments:

- Riding bikes on Webster Boulevard is dangerous;
- There should be a separate path to ride bikes;
- Bike lanes are not preferred, and people are not using the existing bike lanes;
- Bike lanes are less safe for children in comparison to on off street path;
- Cars travel fast and are loud on Webster Boulevard;
- Additional traffic on Webster Boulevard may cause more issues;
- Sidewalk widths may be appropriate;
- Preference for sidewalk on one side and multi-use path on the other; and
- Concern for safety of kids playing on the street.

5.2 Traffic Operations

Key Questions:

1. With future neighbourhood commercial land uses designated for lands bordering the street nearing 20th Sideroad, is parking appropriate on the extension?

2. Are driving speeds on Webster Boulevard appropriate?
3. Are there concerns for cut-through traffic from 20th Sideroad to avoid the Innisfil Beach Road intersections?
4. Are there any concerns with pedestrian or vehicular connections northerly to the Alcona North lands (beyond the current Alcona Settlement Area boundary)?

Comments:

- Parking on the street is not preferred if parking can be accommodated in lots for commercial lands;
- Some street parking will be needed where residential houses are planned;
- No parking on new extension near new 20th Sideroad intersection;
- Speeds on Webster Boulevard North are too high and lower speeds are desirable;
- Concern for cut through traffic on the new extension;
- People were trying to use Webster Boulevard during construction on Innisfil Beach Road but were caught at the dead-end;
- Preference to minimize short cutting;
- Preference for a park/active transportation link between the Webster Boulevard North extension and future Leslie Street extension;
- Support for future link from the existing paths in woodlot to the Leslie Street extension; and
- Pedestrian crossing at the future link between Webster Boulevard North and the Leslie Street extension.

5.3 Intersection Design

Key Questions:

1. Are there concerns for implementing traffic signals at the new intersection with 20th Sideroad?
2. Are there concerns for implementing a roundabout at the new intersection with 20th Sideroad?

Comments:

- Roundabouts provide a free-flowing movement and share “green time” between all legs
- Property is available for a roundabout.

5.4 Environmental

Key Questions:

1. What environmental concerns are there from the community for the natural areas being crossed by the project?

Comments:

- Prefer Alternative 1 (alignment to the south) to maintain the tree line;
- Concern for fencing along existing properties;
- Need to consider the residential wells; and
- Consider the lot between the residential properties and road/development opportunities.

6.0 SUMMARY OF COMMENTS

The following provides a summary of the comments and creative ideas provided at the Community Café /POH No. 1 event:

1. Concern for existing travel speeds on Webster Boulevard which will only increase with the new planned extension to 20th Sideroad.
2. Concern for safety of cyclists and pedestrians with a preference for a multi-use path on at least one side.
3. Support for roundabout and traffic calming on Webster Boulevard.
4. Support for the future connection and new commercial development.

Appendix A

Community Café Exhibits

Welcome!
Town of Innisfil
Webster Boulevard North Extension Environmental Assessment Study

Welcome to the first online Public Open House for the Webster Boulevard North Extension Environmental Assessment Study.

At the present time, the Province of Ontario has implemented a State of Emergency requiring measures to deal with the COVID-19 pandemic, and has restricted public gatherings. As a result, this Public Open House is relying on web-based communications.

Should you have any questions regarding the materials or any other aspect of the study, or if you would like to review any of the background reports, contact either of the following by **January 7, 2021**:

Steve Taylor
Consultant Project Manager
Email: steve.taylor@bteng.ca
Phone: 905-709-4554

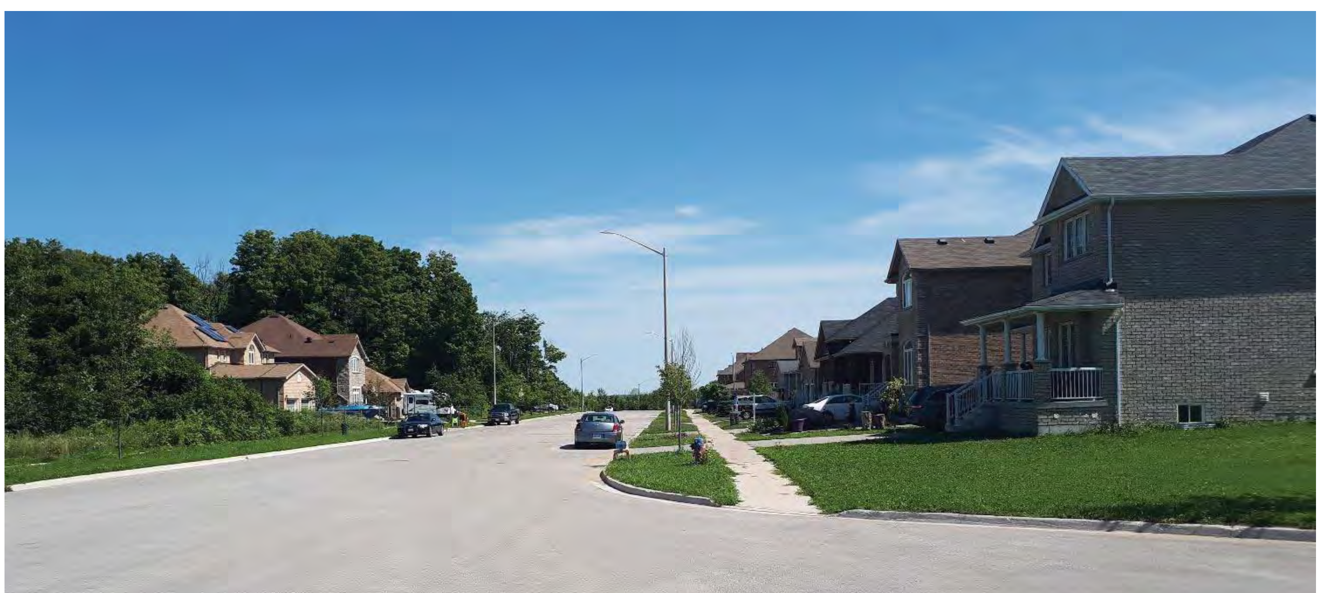
Suzanna Nilsson
Town of Innisfil Project Manager
Email: snilsson@innisfil.ca
Phone: 705-436-3740 ext. 3260

There is an opportunity at any time during the Class EA process for interested persons to provide written input. Any comments received will be collected under the *Environmental Assessment Act* and, with the exception of personal information, will become part of the public record.

Purpose of Public Open House No. 1

The purpose of this meeting is to:

- Present the Draft Study Design Report
- Obtain comments on the scope of the Environmental Assessment
- Obtain comments on the proposed consultation program
- Provide a timeline of upcoming steps
- Provide preliminary recommendations
- Provide the public with an opportunity to provide comments



Introduction

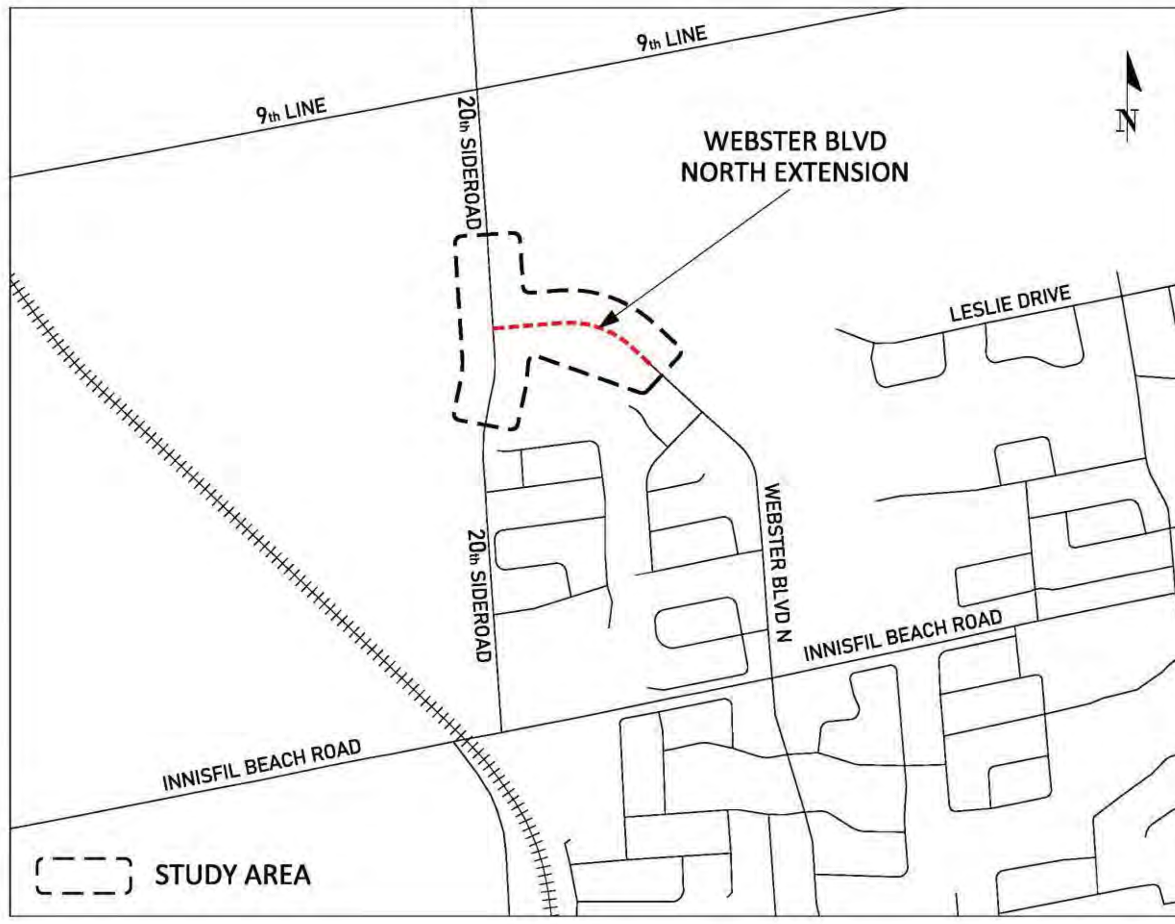
The Town of Innisfil has retained BT Engineering Inc. to undertake an Environmental Assessment Study for the extension of Webster Boulevard from the existing terminus to 20th Sideroad. The Study will evaluate alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the Transportation Master Plan.

The Town is completing Phases 1 to 4 of the Municipal Class Environmental Assessment. Phases 1 and 2 have been completed by the Transportation Master Plan Update and will be summarized in this study. Phases 3 and 4 will subsequently be completed by developing and evaluating alternative designs for the Preferred Planning Solution and completing the Environmental Study Report, while proactively involving the public and stakeholders in defining a recommended plan for improvements.

This Study is being completed as a Schedule C undertaking, based on the range of anticipated effects. A Draft Study Design Report describing the study process has been made available for agency and public comments and is available on the Resources Link on the website.

Study Area

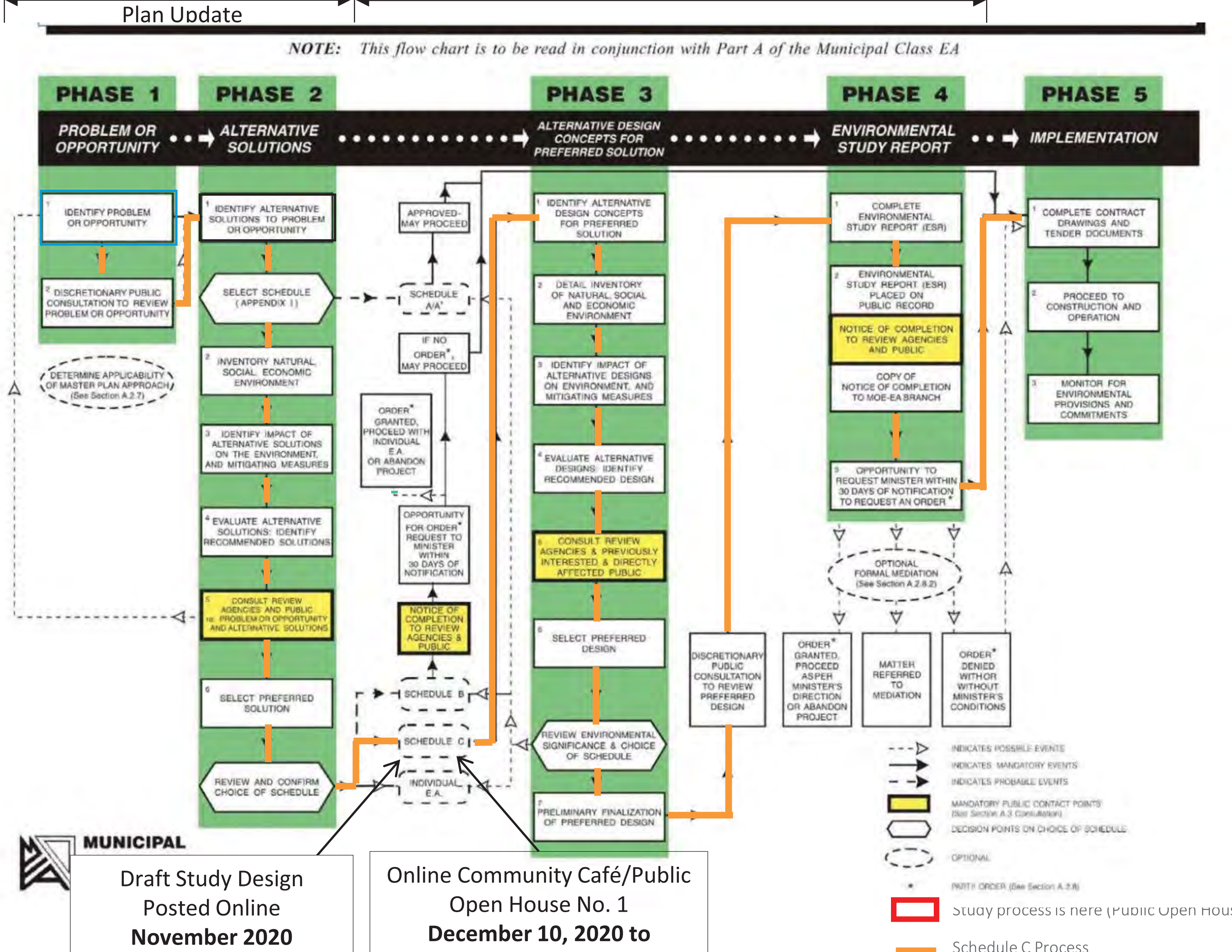
The Study Area comprises the area for the location of the Webster Boulevard North alignment alternatives within the Town of Innisfil.



Municipal Class Environmental Assessment

Phases 1 and 2 completed during Transportation Master Plan Update

Phases 3 and 4 to be completed during this EA Study



Background Studies

The following studies have been completed that are relevant to this study:

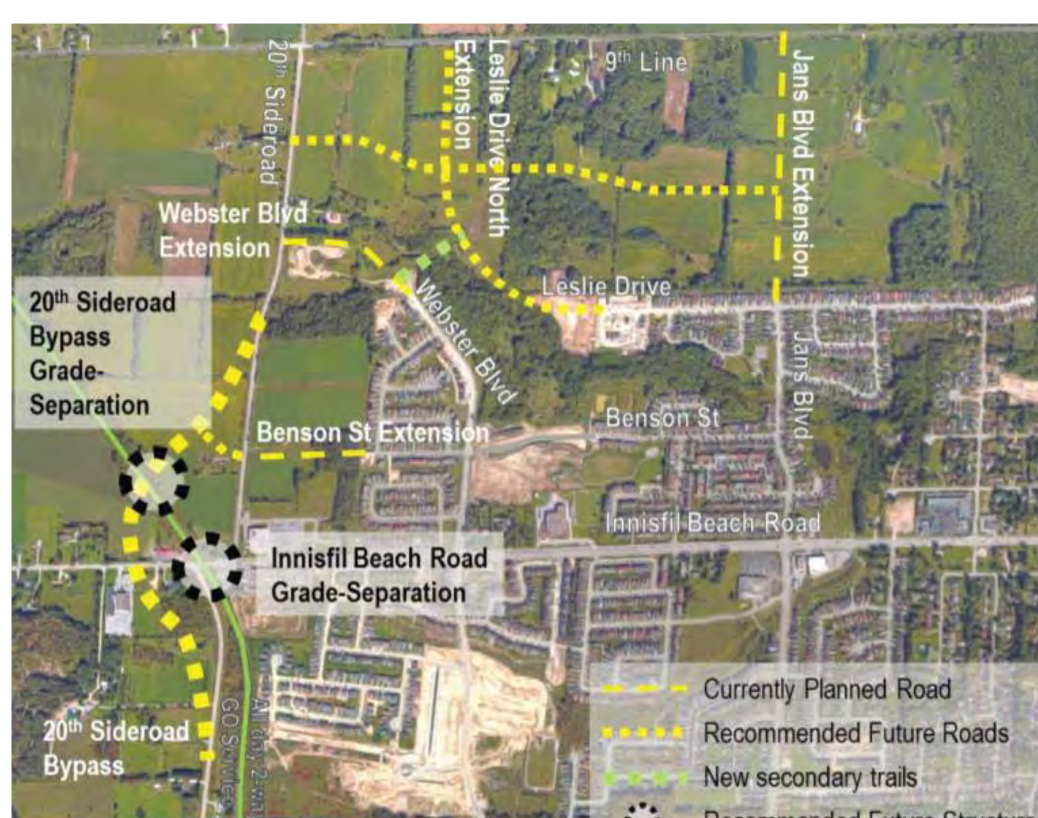
- **Town of Innisfil Transportation Master Plan Update** 2018 – Recommends the Extension of Webster Boulevard to 20th Sideroad as a Medium-term Improvement (by 2031)
- **Town of Innisfil Official Plan** 2018 – identifies the proposed extension of Webster Boulevard as a Future Major Collector Road

These reports are available online for review upon request. Please contact the identified Project Managers to arrange for review.

Transportation Master Plan Update Road Improvements in Alcona North

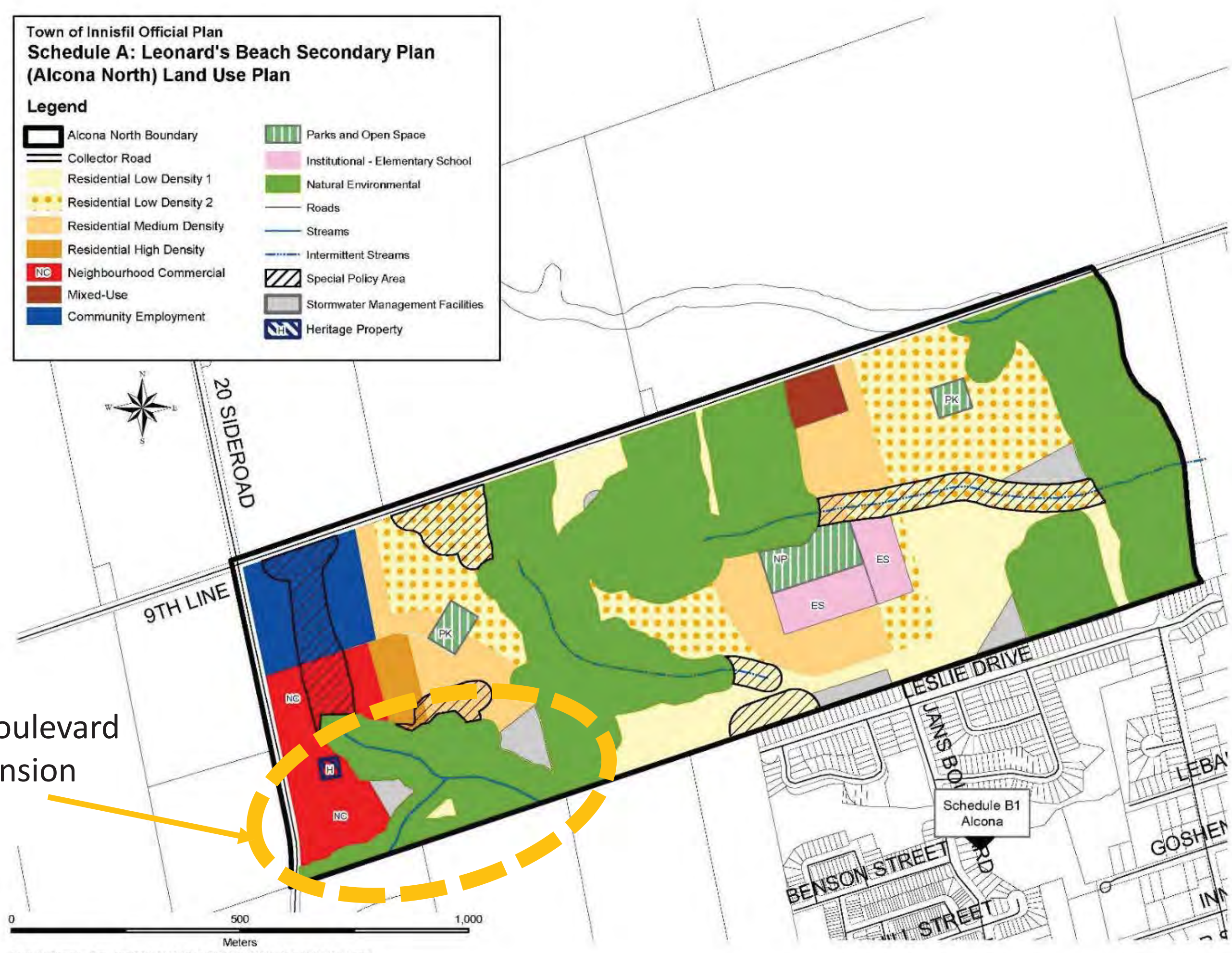
The Transportation Master Plan Update describes road improvements in Alcona North, illustrated to the right. The recommended improvements include the 20th Sideroad Bypass grade-separation to address safety concerns at the GO Rail crossings and improve the operations of the 20th Sideroad and Innisfil Beach Road intersections. This will also alleviate cut-through traffic on the Webster Boulevard North Extension (when constructed).

The Transportation Master Plan Update also recommended active transportation improvements including: the provision of cycling lanes on Webster Boulevard; and a secondary trail from Webster Boulevard to a future Leslie Drive extension.



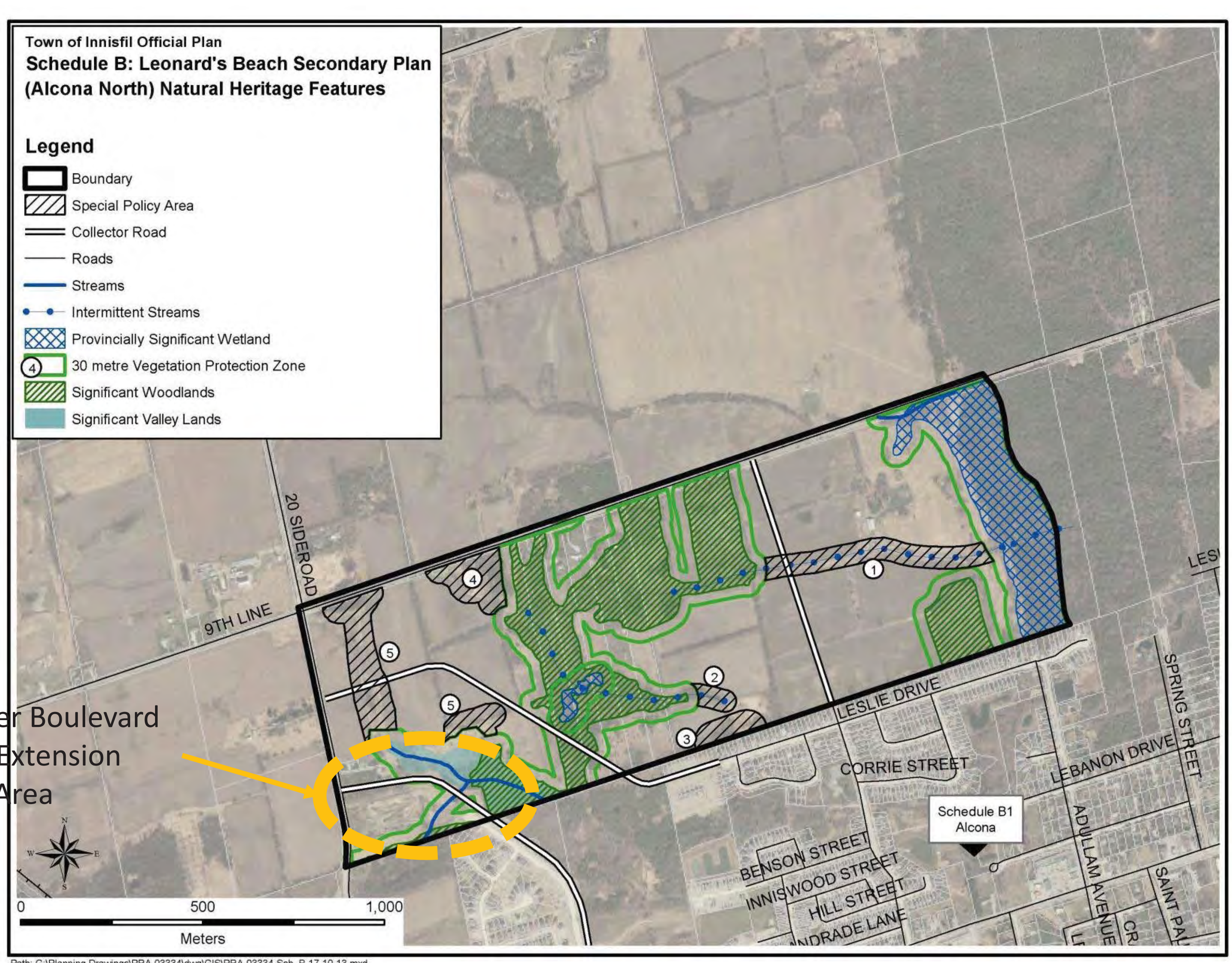
Source: Transportation Master Plan Update (Exhibit 8-2 Road Improvements in Alcona North)

Draft Official Plan Amendment
Schedule A (Lands Beyond Current Alcona Settlement Boundary)



Webster Boulevard
North Extension
Study Area

Draft Official Plan Amendment
Schedule B



Webster Boulevard
North Extension
Study Area

Problem and Opportunity Statement

The Problem and Opportunity Statement identified in the Innisfil Transportation Master Plan Update Study is as follows:

> "The Town of Innisfil is characterized by distinct communities which are spread out and not well-connected. The majority of travel in the Town is by car.
>
> By 2041 the Town's population and employment numbers are expected to double. Without a balanced transportation strategy, Innisfil residents will experience increases in traffic congestion which will impact their quality of life.
>
> Future opportunities to improve the transportation network have been identified in the Town, through the recently completed Trails Master Plan, new GO station planned at 6th Line and a new demand-responsive transit service."

By capitalizing on the identified needs and opportunities, the Town will achieve its transportation vision.

Traffic

The proposed extension of Webster Boulevard will improve connections between communities within Innisfil while, in the shorter term, also providing relief to the intersection of 20th Sideroad and Innisfil Beach Road. Traffic projections prepared as part of the Transportation Master Plan Update projected that the proposed extension would carry an average of approximately 2,000 to 2,500 vehicles/day. The future realignment of 20th Sideroad, by increasing the operational capacity of the 20th Sideroad and Innisfil Beach Road intersections, will result in some traffic diversion, reducing the volume of traffic on the proposed Webster Boulevard Extension to less than 1,000 vehicles/day.

Alternative Planning Solutions (Planning Alternatives)

Alternatives Planning Solutions (Planning Alternatives) represent alternative ways or methods of addressing the problem to be solved by the project.

The Town's Transportation Master Plan Update identified four planning alternatives other than the "Do Nothing" alternative:

1. Base Case: incorporates planned road improvements by the Ministry of Transportation Ontario and Simcoe County only;
2. Current Plans: further to Alternative 1, includes constructing the planned Town improvements from the 2013 Transportation Master Plan and the Trails Master Plan;
3. Balanced Approach: further to Alternative 2, invests in new roads and road improvement projects, and Travel Demand Management measures including Demand Responsive Transit, Bike-share, EcoMobility1 hubs and Zoning By-law revisions; and
4. Aggressive Approach: further to Alternative 3, invests in fixed-route transit.

The Transportation Master Plan Update proposes road improvements for short-, medium- and long-term improvements and includes the Webster Boulevard North extension as a medium-term road improvement project (Alternative 3).

Alternative Planning Solutions (Planning Alternatives)

	Planning Alternative	Transportation Service	Social Equity in Mobility	Natural Environment	Policy Environment	Socio-Economic Environment	Financial Implications	Overall Evaluation
X	Alternative 1: Base Case	○	○	●	○	◔	●	◔
X	Alternative 2: Current Plans	◑	◑	◕	◑	◕	◕	◕
✓	Alternative 3: Balanced Approach	◕	◕	◕	●	◕	◑	◕
✓	Alternative 4: Aggressive Approach	●	●	◕	◕	◕	◔	◕

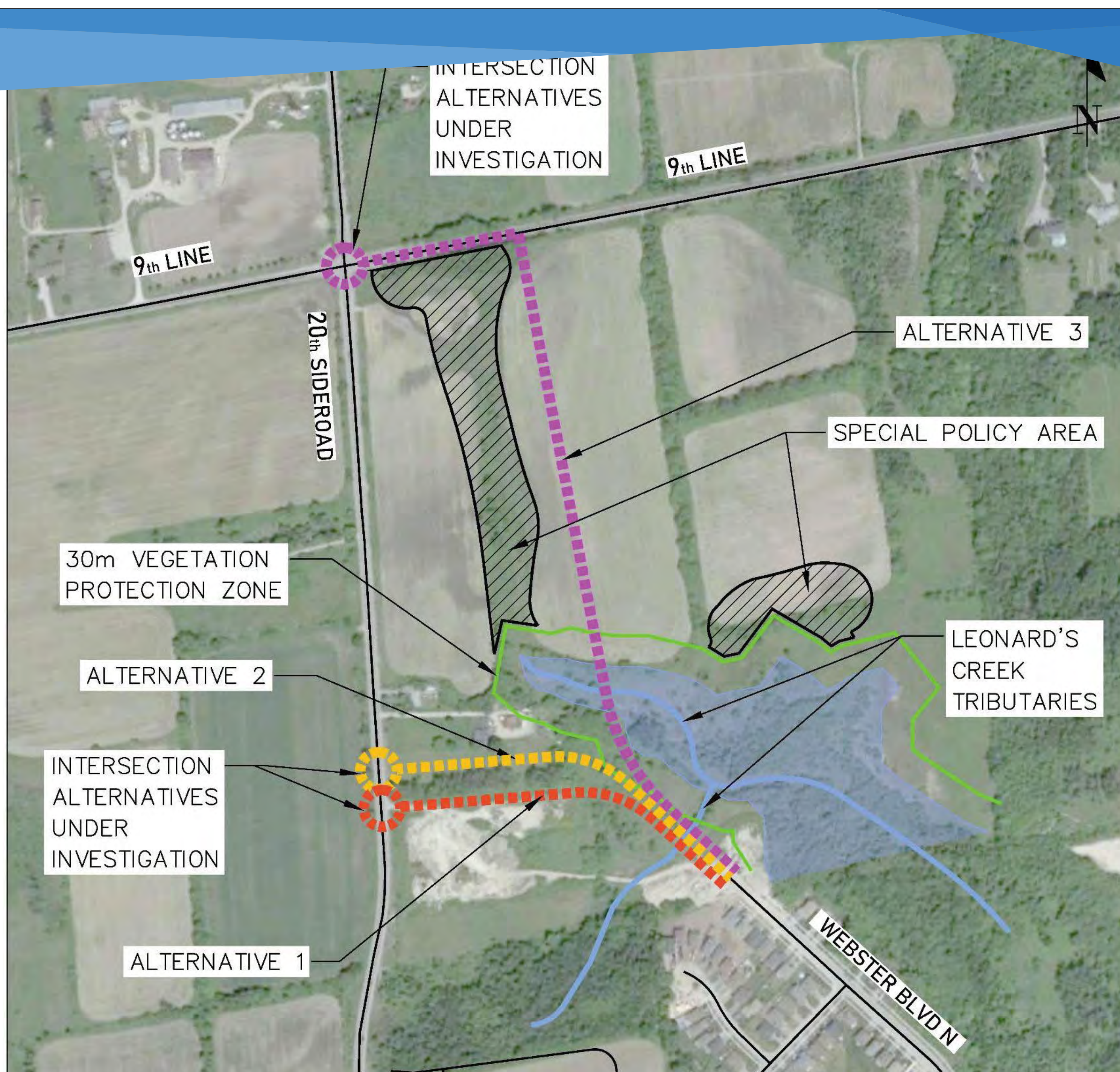
Does Not Meet Criterion ○ ◔ ◑ ◕ ● Meets Criterion

Recommendation: Carry forward both
Alternative 3 Balanced Approach and
Alternative 4 Aggressive Approach

Preliminary Design Alternatives
Alignment Alternatives

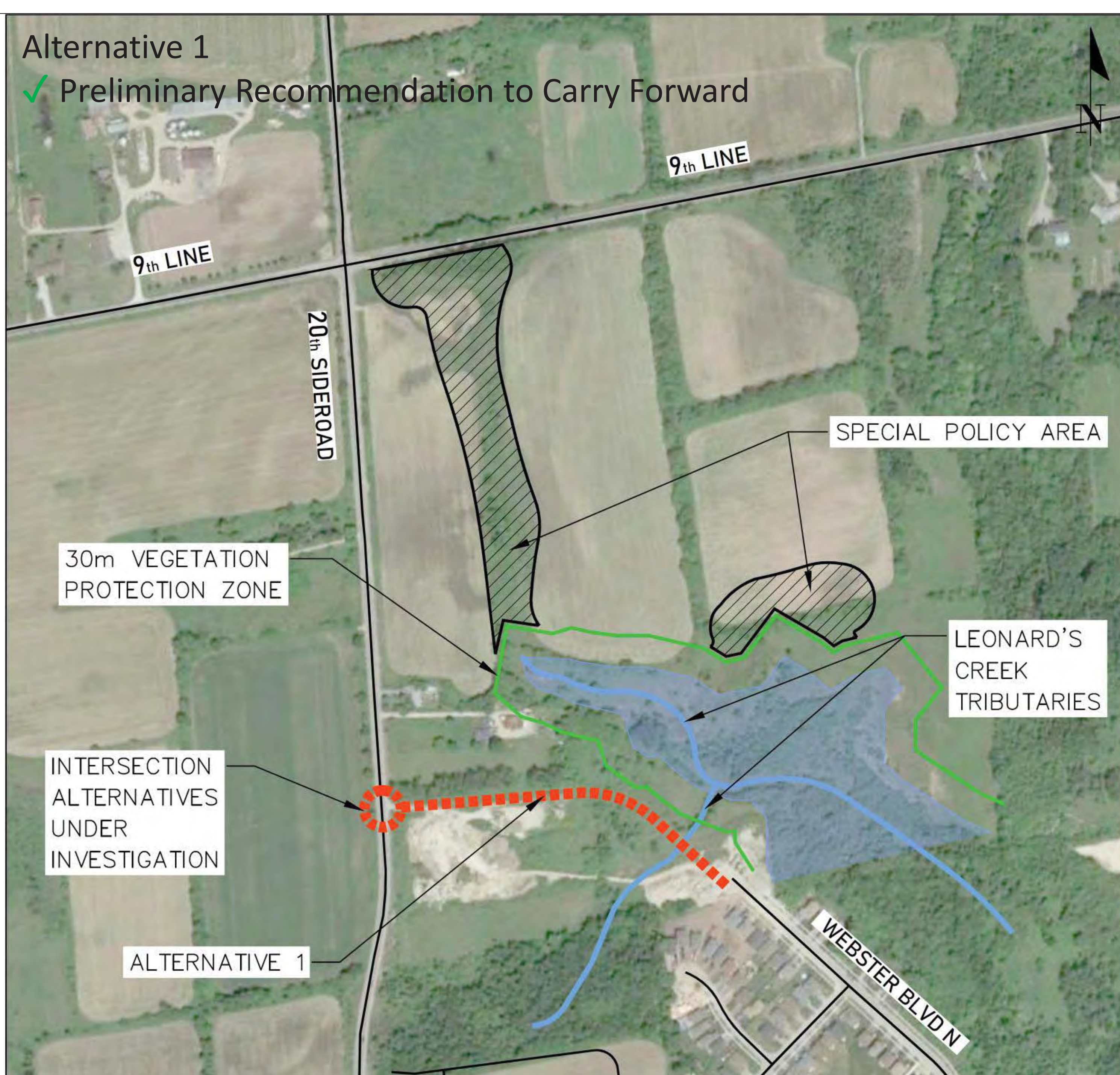
Although the Transportation Master Plan Update has identified a general alignment for the road extension, this Environmental Assessment Study has investigated three (3) alignment alternatives:

- Alternative 1: Transportation Master Plan Update alignment (connection to 20th Sideroad)
- Alternative 2: Transportation Master Plan Update alignment shifted northerly adjacent to heritage property (connection to 20th Sideroad)
- Alternative 3: Connection to 9th Line (alternative suggested by the public)



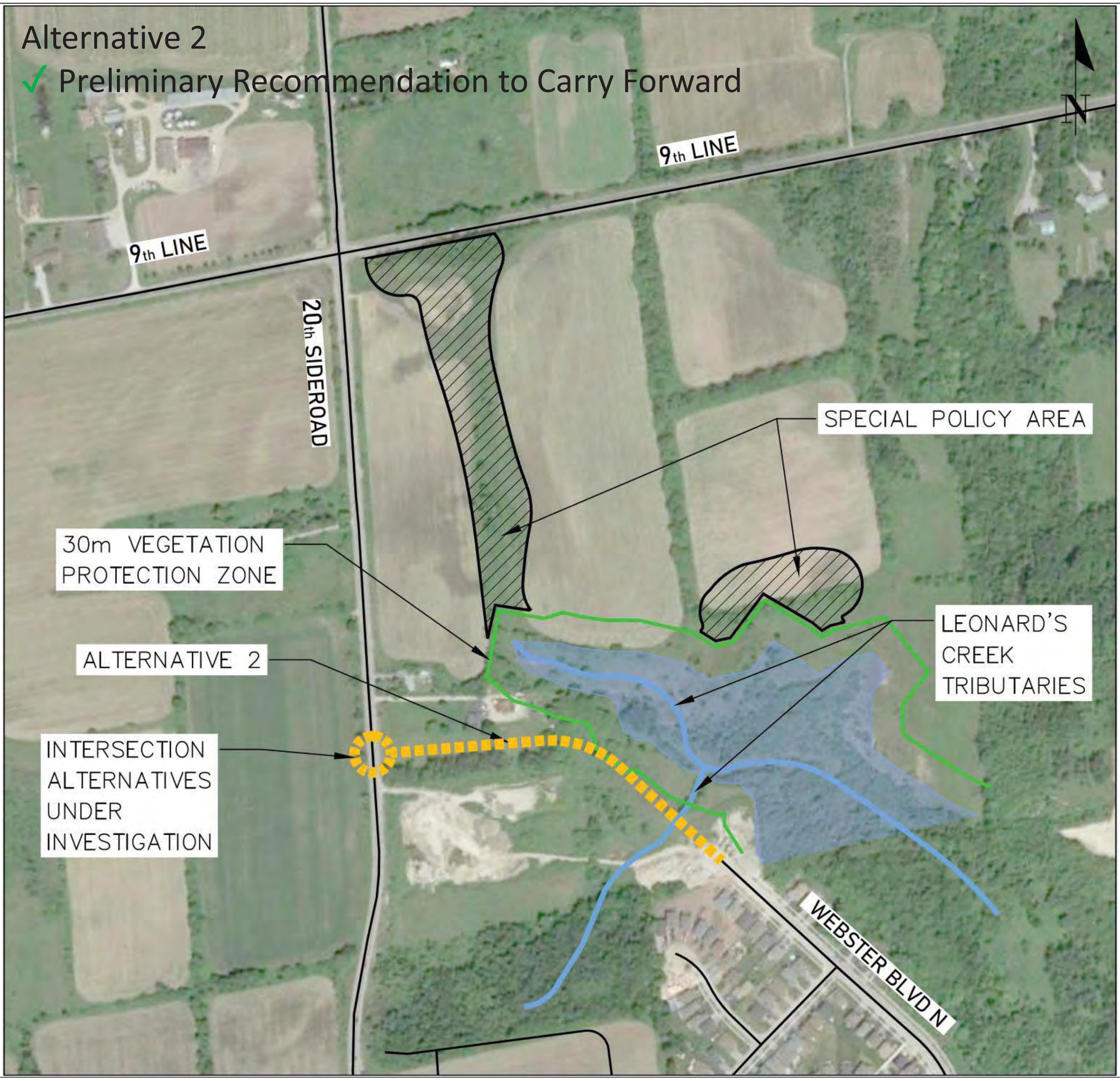
Preliminary Design Alternatives
Coarse Screening of Alignment Alternatives

The Technical Advisory Committee has completed a preliminary coarse screening of the alignment alternatives. Alternative 3 (Connection to 9th Line) has significantly higher environmental impacts (crosses the Leonard's Creek tributaries twice) and has higher capital costs (longer road) compared to Alternative 1 and Alternative 2. The Technical Advisory Committee provided a preliminary recommendation to coarse screen Alternative 3 from further consideration.



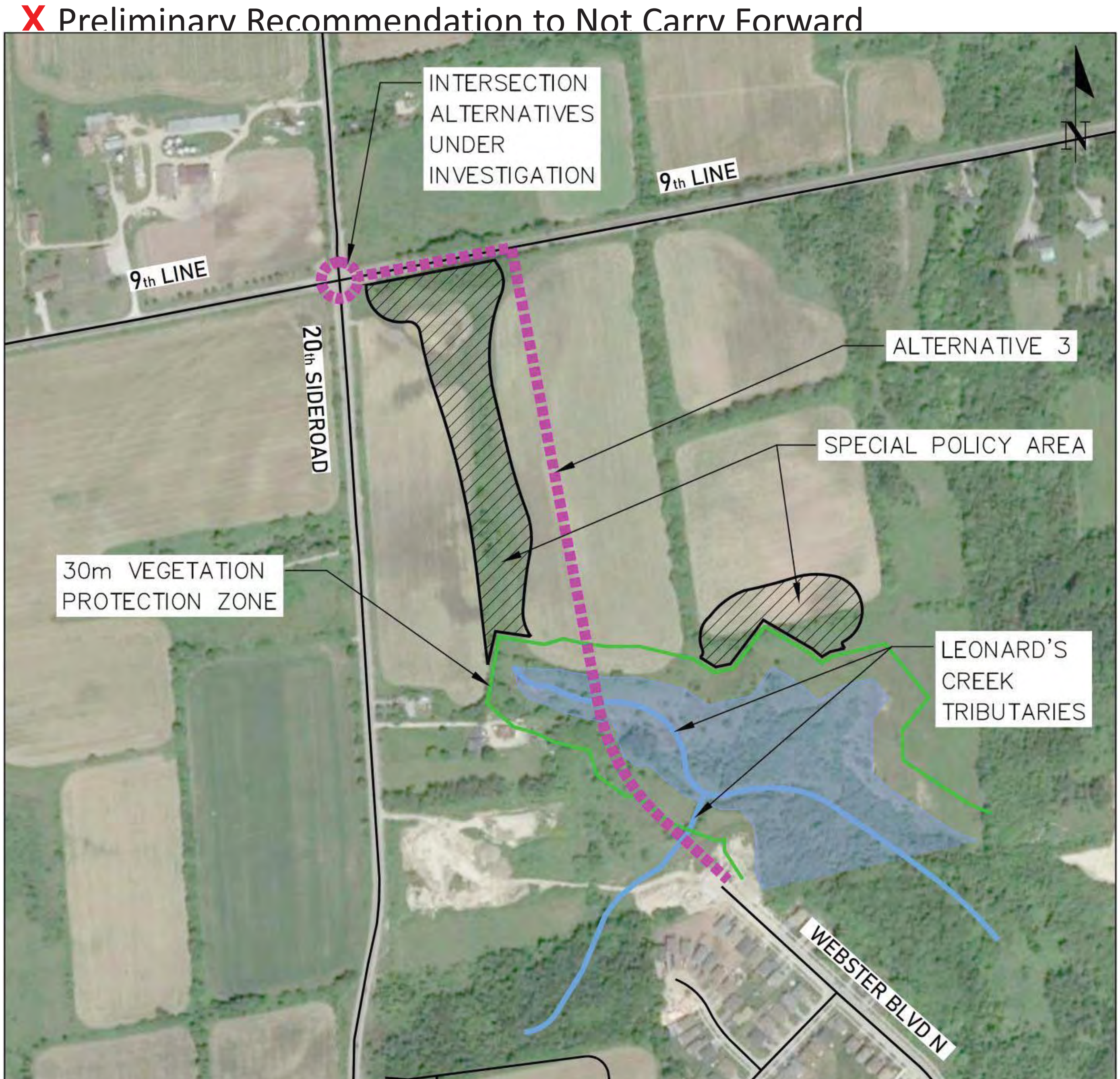
Alternative 2

✓ Preliminary Recommendation to Carry Forward



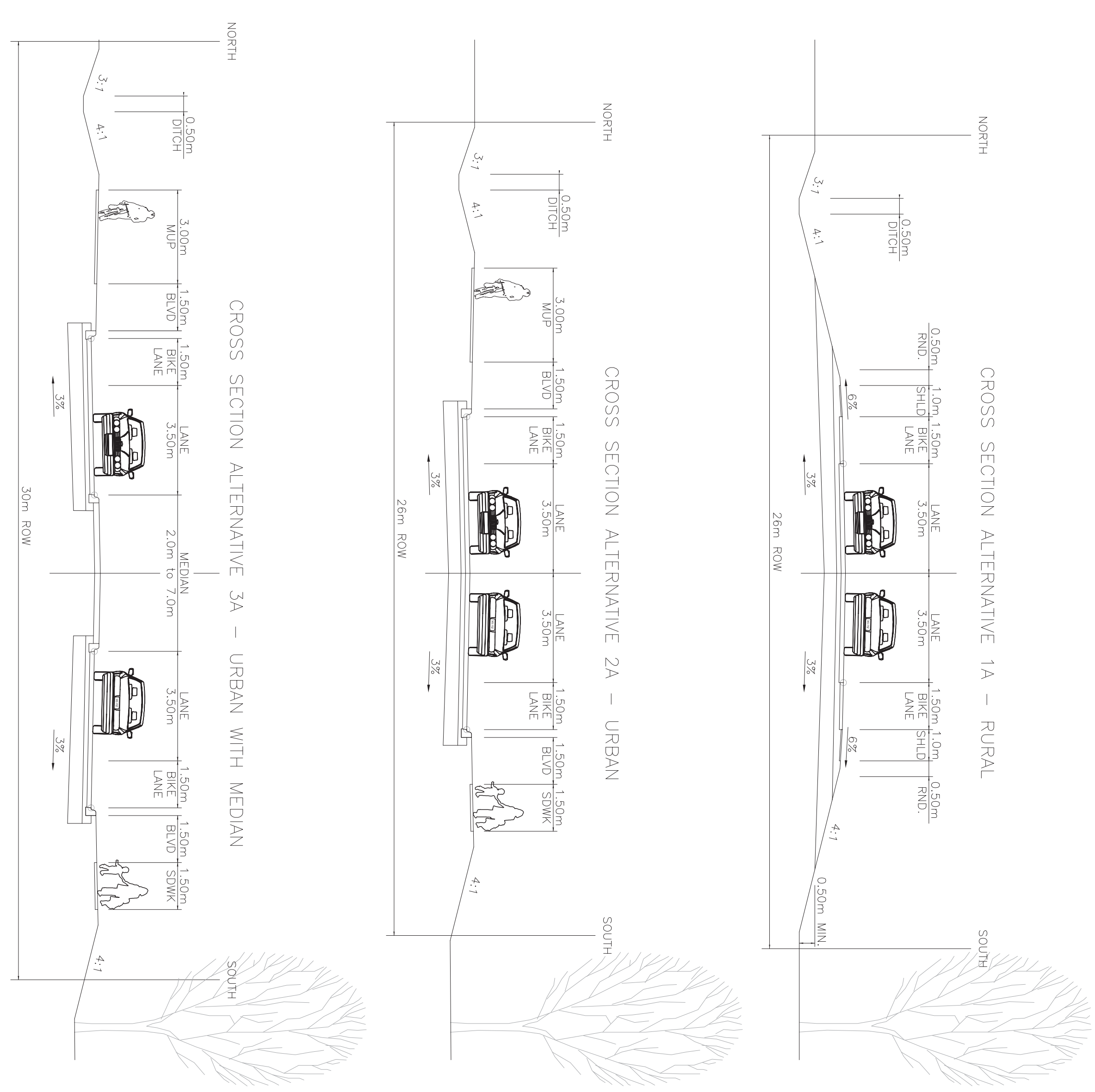
Alternative 3

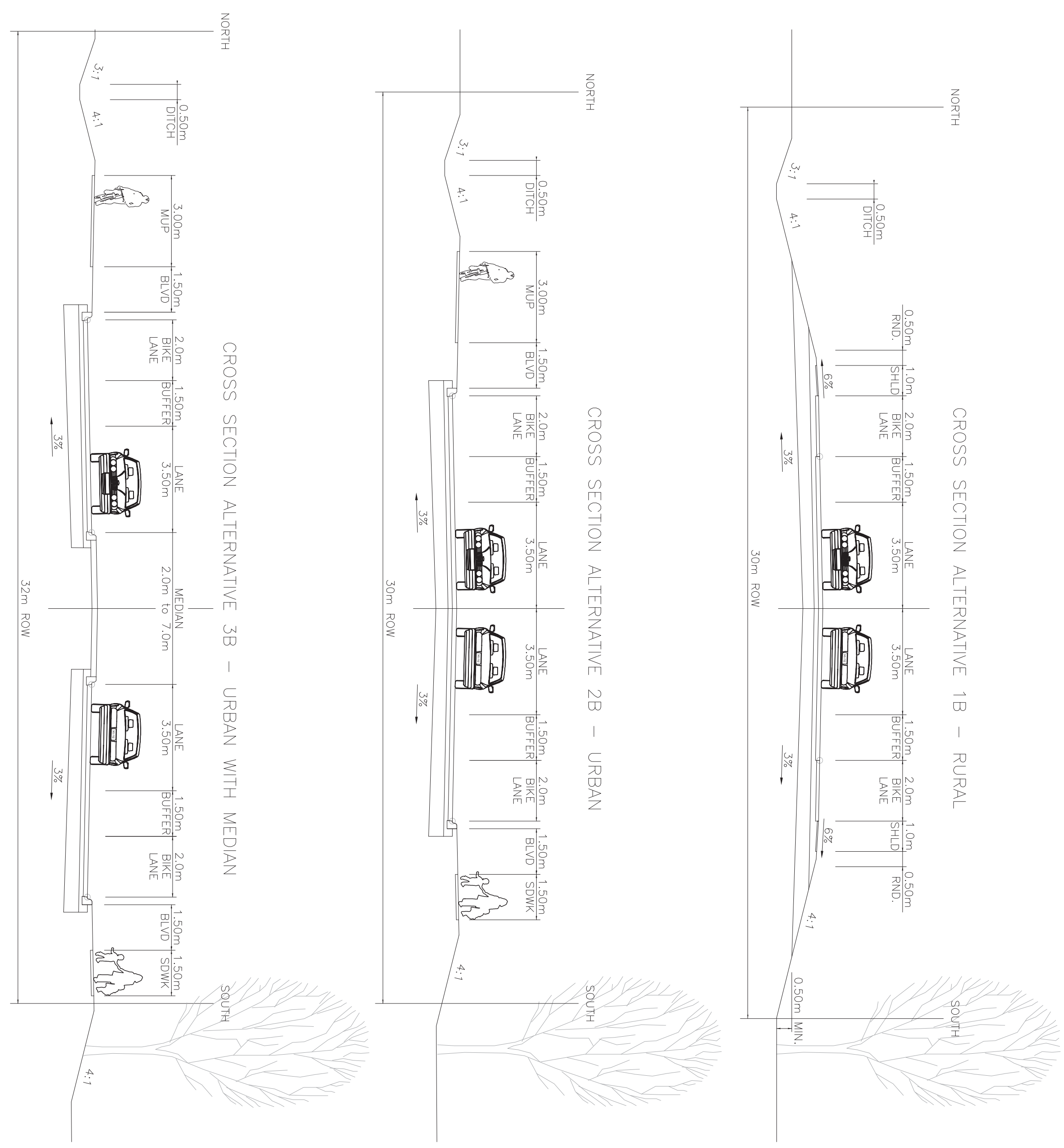
X Preliminary Recommendation to Not Carry Forward



Preliminary Design Alternatives
Cross Section Alternatives

The study will consider 2-lane rural and urban cross sections including on-street parking facilities, multi-use pathway/bicycle lanes and a raised median. These alternatives are illustrated on the following exhibits.



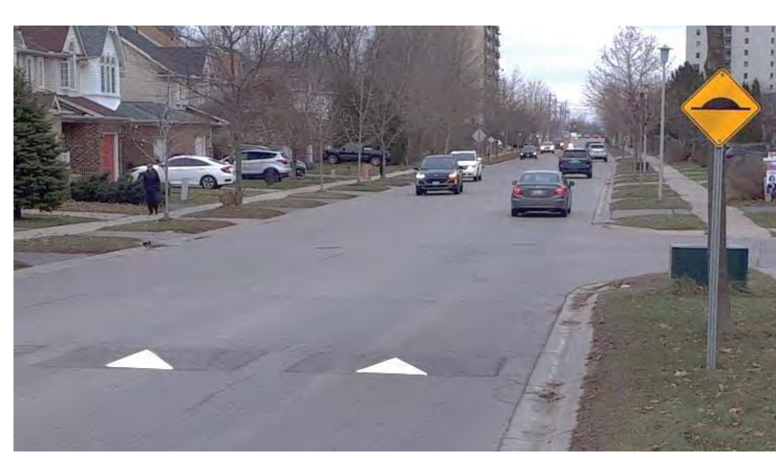


Preliminary Design Alternatives
Traffic Calming

To control traffic speeds along Webster Boulevard and improve safety for pedestrians and cyclists, a variety of potential traffic calming measures will be considered.

Some Potential Traffic Calming Measures could typically include:

i. Vertical deflections such as:
   - Speed humps/cushions, or
   - Raised crosswalks



ii. Narrowing the roadway by:
   - Reducing lane widths, or
   - Providing a centre median

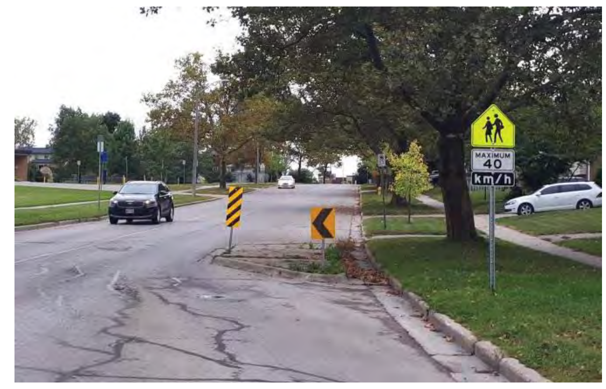
Preliminary Design Alternatives
Traffic Calming Measures

Potential Traffic Calming Measures could typically include:

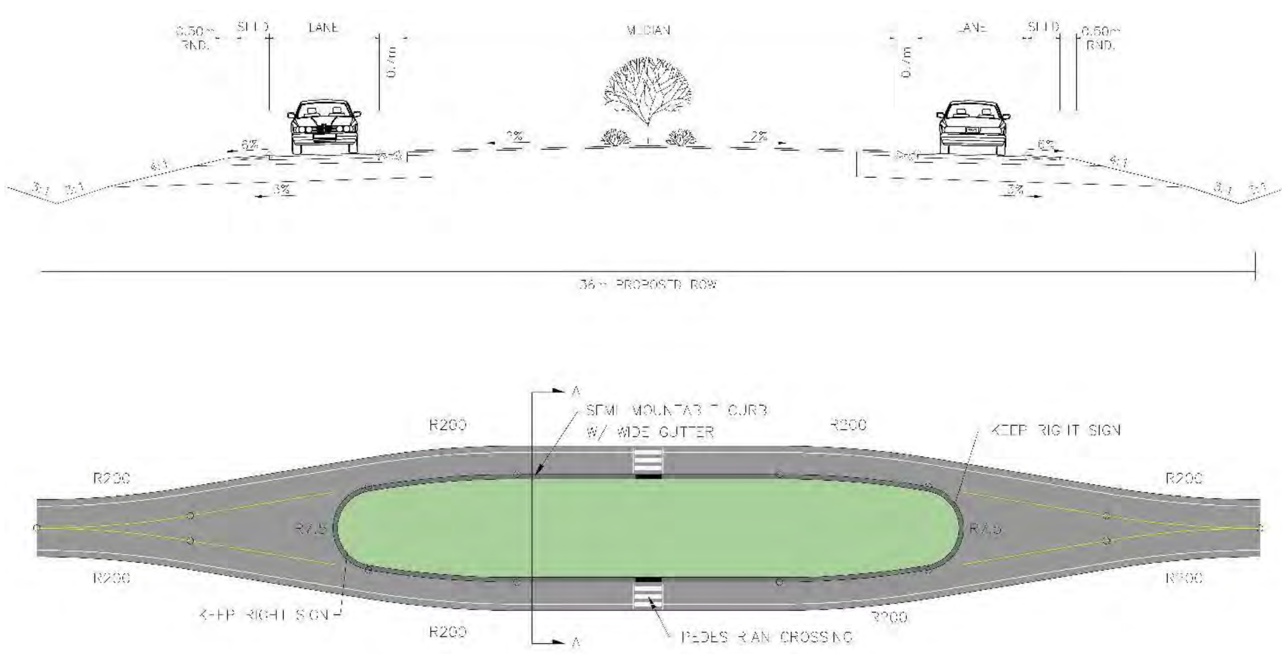
iii. Horizontal deflections

- Use of chicanes, or
- Median bulb-outs

Chicane



Median Bulb-out



Preliminary Design Alternatives
Intersection Alternatives

A conventional intersection (potential traffic signals) or roundabout control will be investigated at the intersection with 20th Sideroad. The alternatives are illustrated on the following exhibits.

NOTE: The alignment has not yet been defined and the alternatives may be shifted to the north on Alignment Alternative 2.

BTE 20-021
2020-11-19
Scale 1:1250

Webster Boulevard North Extension
Alternative A: Conventional Intersection

BT ENGINEERING BTE

BTE 20-021
2020-11-19
Scale 1:1250

Webster Boulevard North Extension
Alternative B: Roundabout

BT ENGINEERING BTE

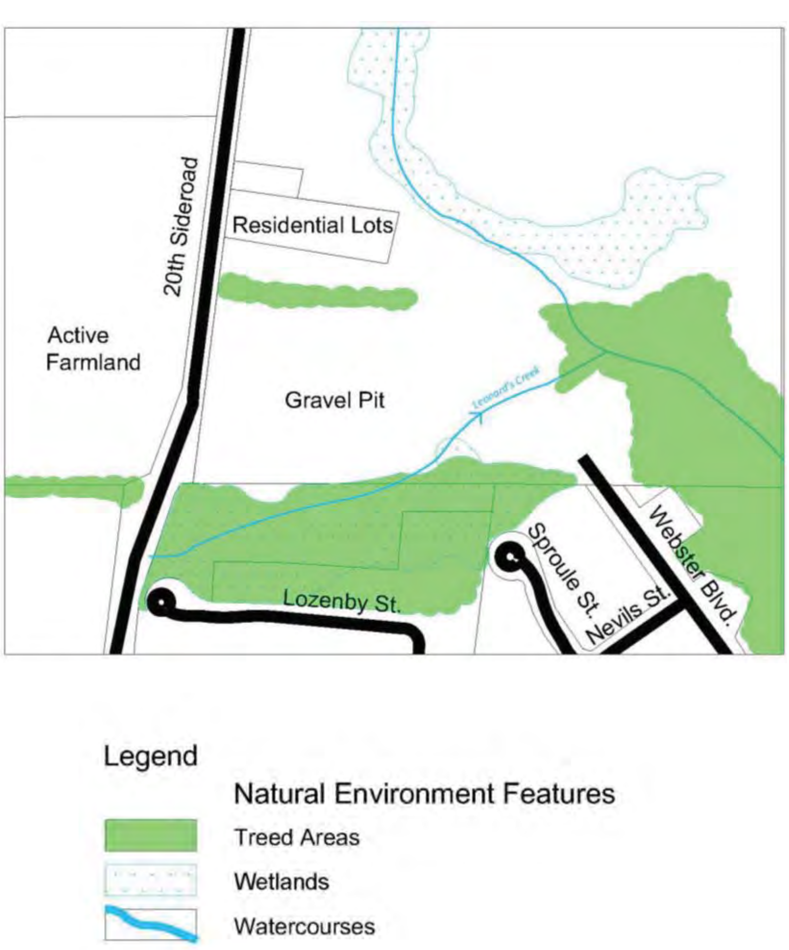
Environmental Reconnaissance

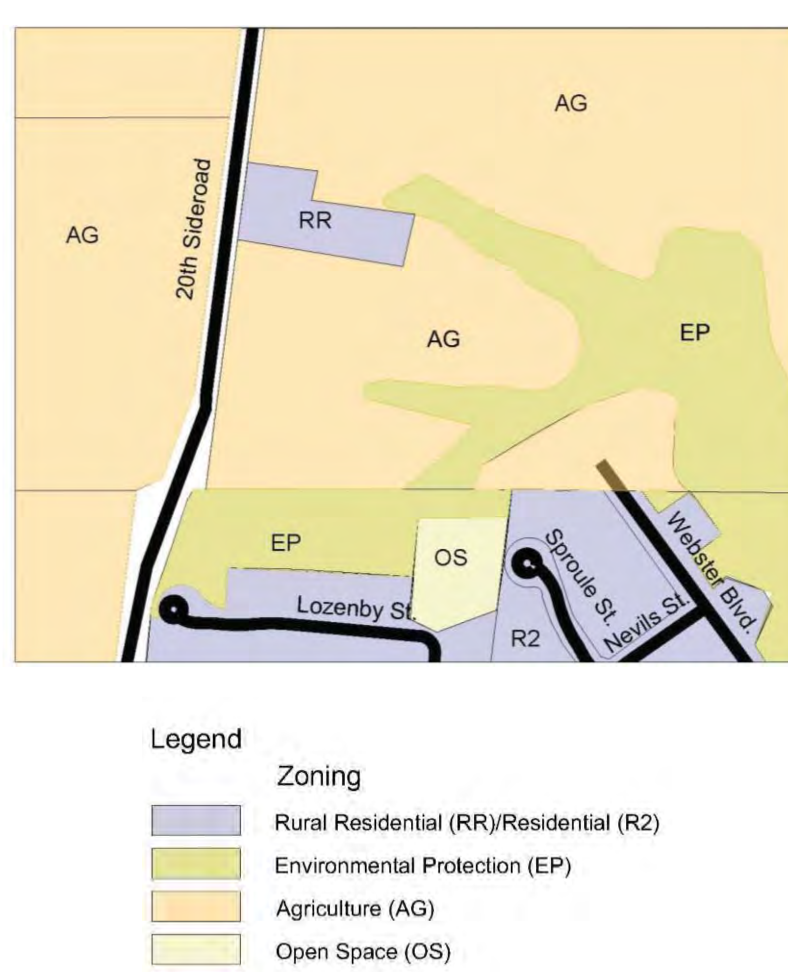
- Leonard's Creek flows easterly across the property from a wooded area and wetland. The currently considered alignment for the Webster Boulevard extension would cross a narrow band of forb meadow marsh associated with the channel.
- The Creek water was clear and cold, and unless there are downstream obstructions, this reach of stream would appear to support good quality fish habitat. It appears the flow is permanent.


Leonard's Creek tributary source as it emerges from the woodlot


A clearly defined channel was apparent at a culvert under the laneway leading to the sand pit

Constraint Mapping and Zoning





Next Steps

Following this Public Open House we will:

- Review all online Public Open House No. 1 comments and prepare a Summary Report
- Review all online Community Café comments and prepare a Summary Report
- Complete traffic analysis
- Carry out environmental inventories and technical investigations
- Evaluate and select the Technically Preferred Alternatives
- Host Public Open House No. 2 – Winter 2021
- Review all Public Open House No. 2 comments and prepare a Summary Report
- Develop refinements to the Technically Preferred Alternatives (if required)
- Prepare the Environmental Study Report
- Initiate 30-day public review period of the Environmental Study Report

Your Involvement

How can you remain involved in the Study?

- Request that your name/e-mail be added to the Study Mailing List
- Provide an online comment
- Contact the Town's representative or the consultant at any time. Contact information is available on the next exhibit.

Thank you for your participation in this online Public Open House.

Your input into this study is valuable and appreciated.

All information is collected in accordance with the *Freedom of Information and Protection of Privacy Act.*

For More Information Please Contact:

Steve Taylor BT Engineering Inc. Consultant Project Manager Email: steve.taylor@bteng.ca Phone: 905-709-4554	Suzanna Nilsson Town of Innisfil Project Manager Email: snilsson@innisfil.ca Phone: 705-436-3740 ext. 3260

Please submit any questions or comments to the contacts listed above by **January 7, 2021**.

Appendix B

Community Café Presentation

Webster Boulevard North Extension Online Community Café

DECEMBER 10, 2020

BT ENGINEERING BTE

Meeting Agenda

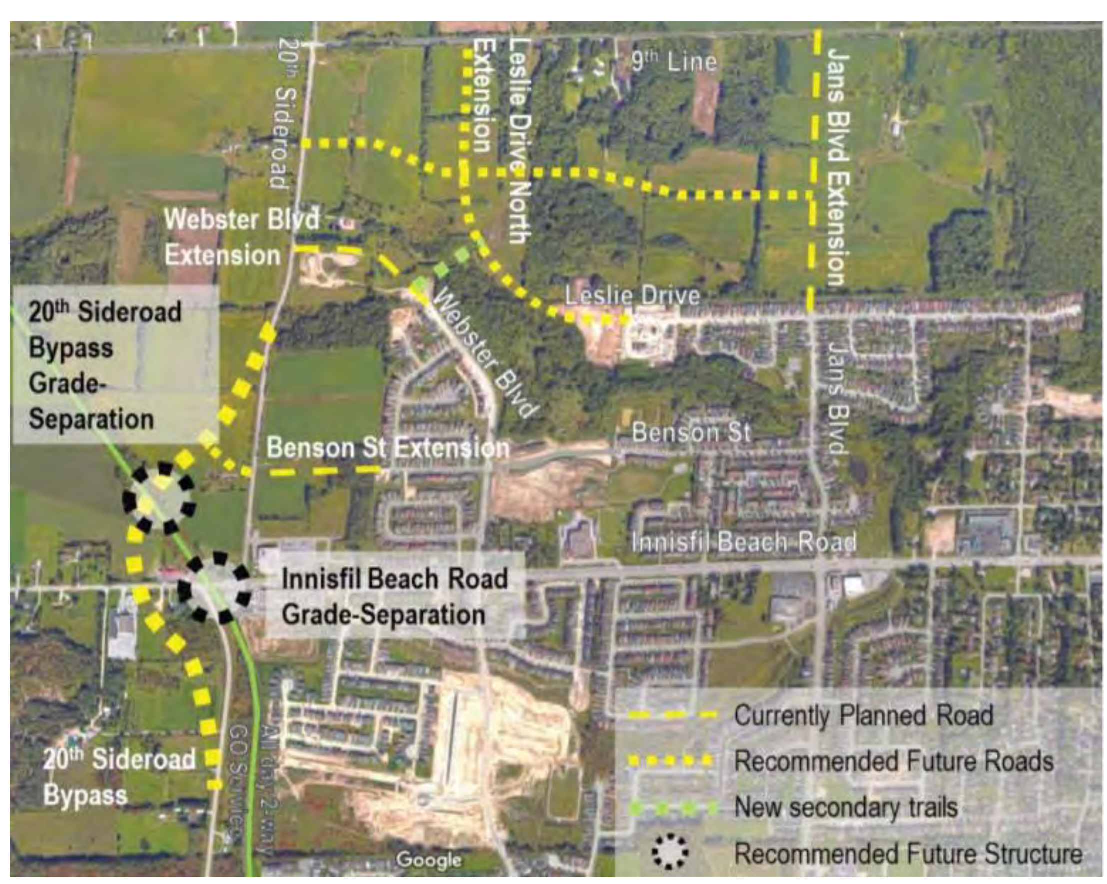
- Project Introduction
- Community Café
- Café Roundtable Discussions: Safety – Pedestrians/ Cyclists
- Café Roundtable Discussions: Traffic Operations
- Café Roundabout Discussions: Intersection Design
- Café Roundabout Discussion: Environmental
- Final Wrap-up

Project Introduction

Project Introduction

This Study will be undertaken as a Schedule C Municipal Class Environmental Assessment to define the extension of Webster Boulevard and 20th Sideroad/ Webster Boulevard intersection.

The Study will be documented in an Environmental Study Report (ESR).

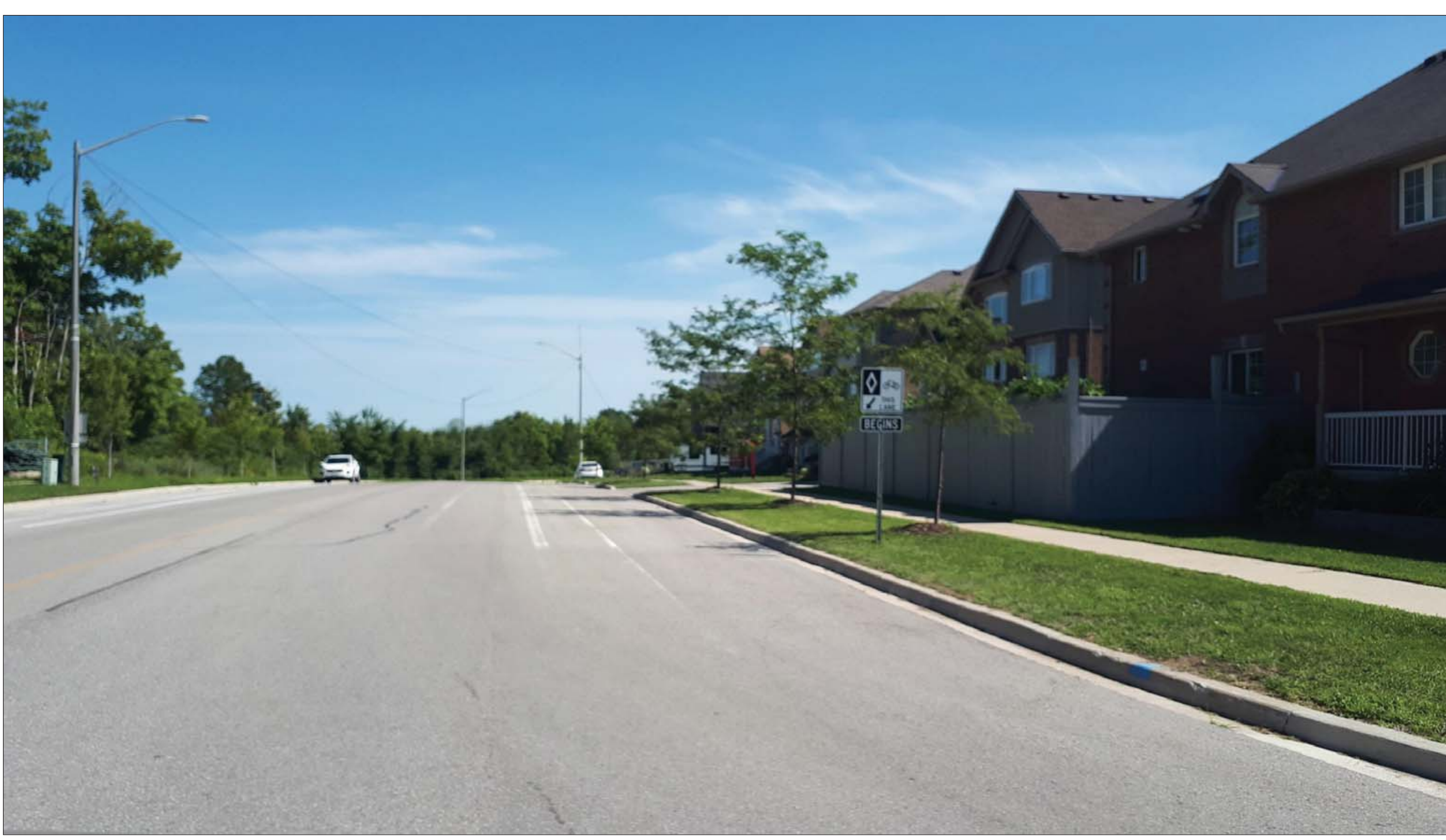


Source: Transportation Master Plan Update (Exhibit 8-2 Road Improvements in Alcona North)


Webster Blvd
Nevis St
Sproule St
20th Sideroad
Google Earth
© 2020 Google

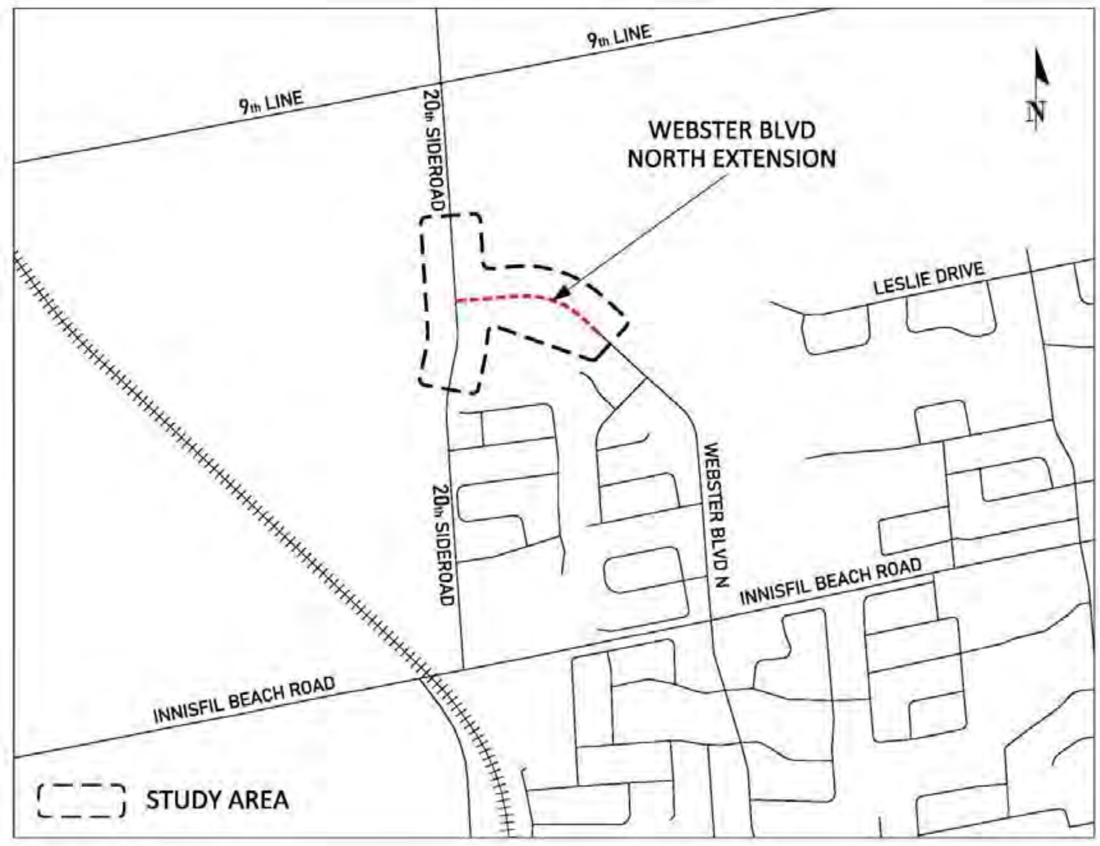

Jans Blvd.
Ferguson St.
Webster Blvd
Sproule St
Gibson St.
20 Srd


Sproule St
Lozenby St


BEGINS


MAXIMUM
80
BEGINS

Study Area

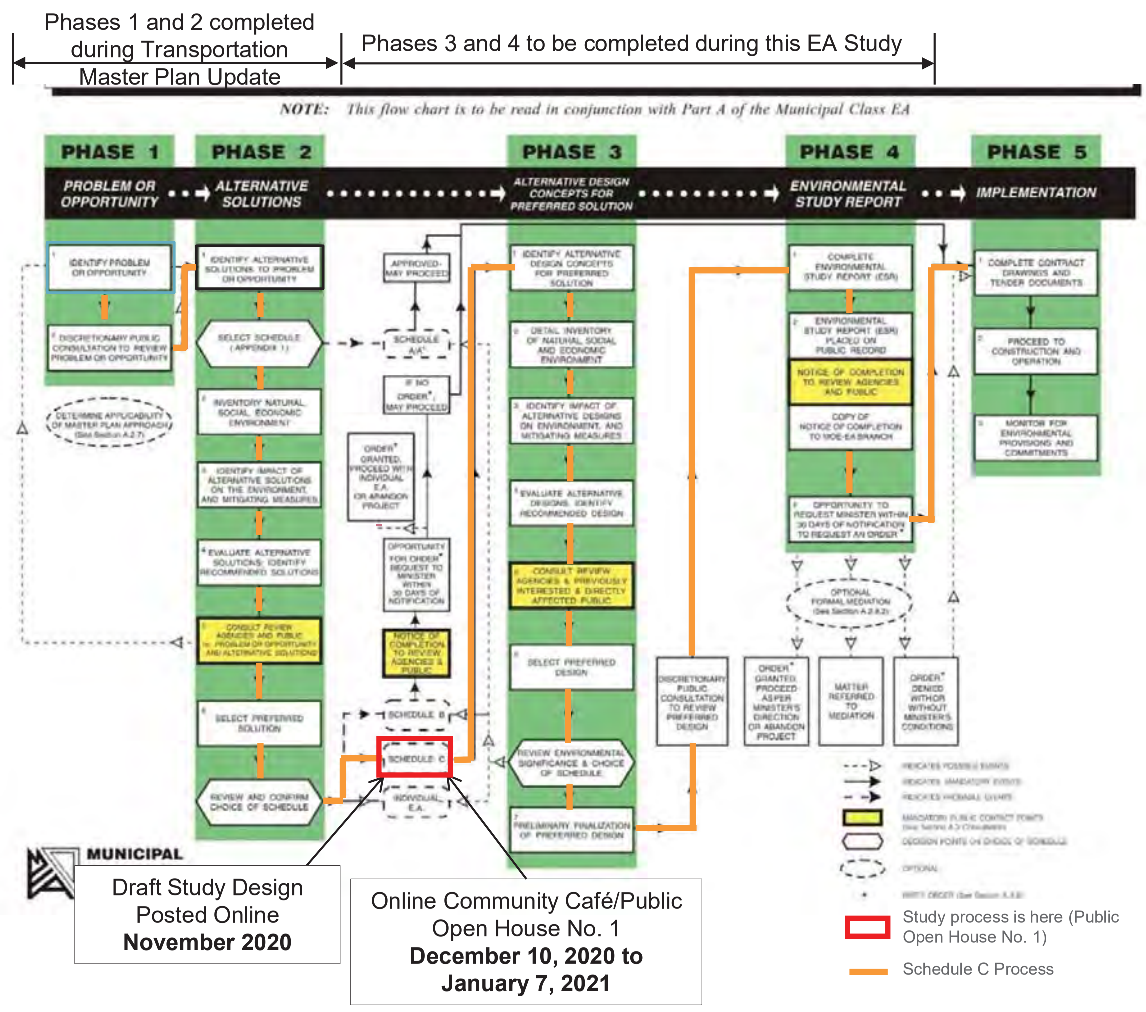


Environmental Assessment Approach

- This Study will be conducted as a Schedule C EA Study, based on the range of anticipated effects, and will meet the requirements of the Municipal Class EA process.
  - Reconstruction of new roads or other linear paved facilities (e.g. HOV lanes) > $2.4 M

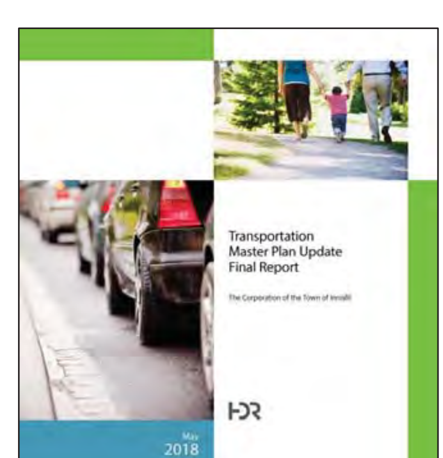
Municipal Class EA Process

Schedule C Study



Background Information

- The Town of Innisfil's Transportation Master Plan identified the Webster Boulevard extension to 20th Sideroad and completed Phases 1 and 2 of this Municipal Class EA
- The 20th Sideroad bypass will be examined as part of a separate future study to reduce cut-through traffic using Webster Boulevard
- Webster Boulevard is to be designated as a Major Collector



Study Design

- A Draft Study Design document has been prepared to describe the study’s process and work plan
- The Draft Study Design is available for review on the Town’s website:

https://www.getinvolvedinnisfil.ca/websterblvd

The Study

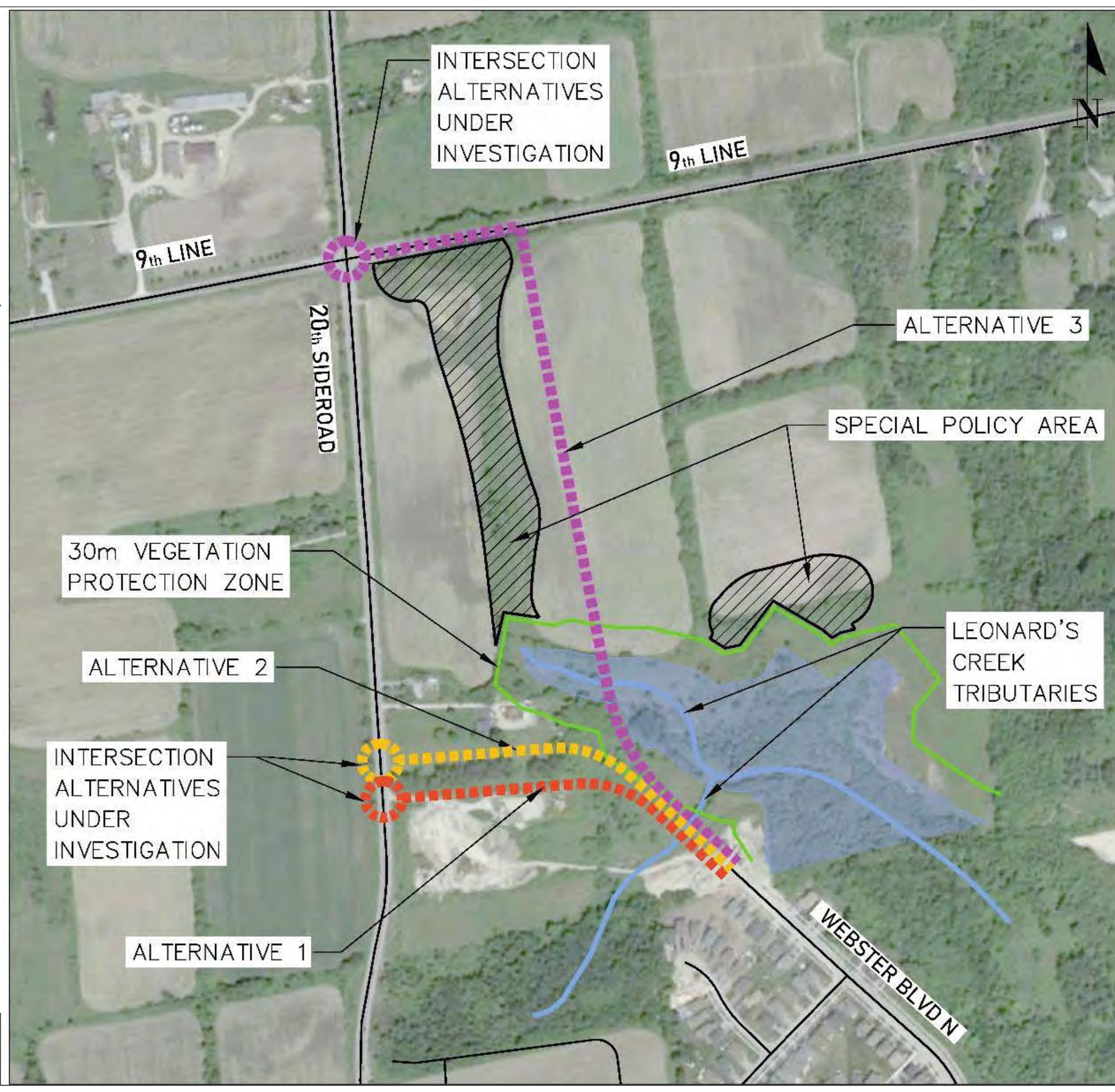
- **Phase 1:** Establish Need and Justification (completed during 2018 TMP)
- **Phase 2:** Assessment of Planning Solutions (completed during 2018 TMP)
- **Phase 3:** Assessment of Preliminary Design Alternatives
  - Engagement of public and stakeholders in decision-making process
  - Environmental inventories to establish baseline to compare alternatives
- **Phase 4:** Environmental Study Report
  - Achieve EA clearance for the project
  - Long range property protection of corridor

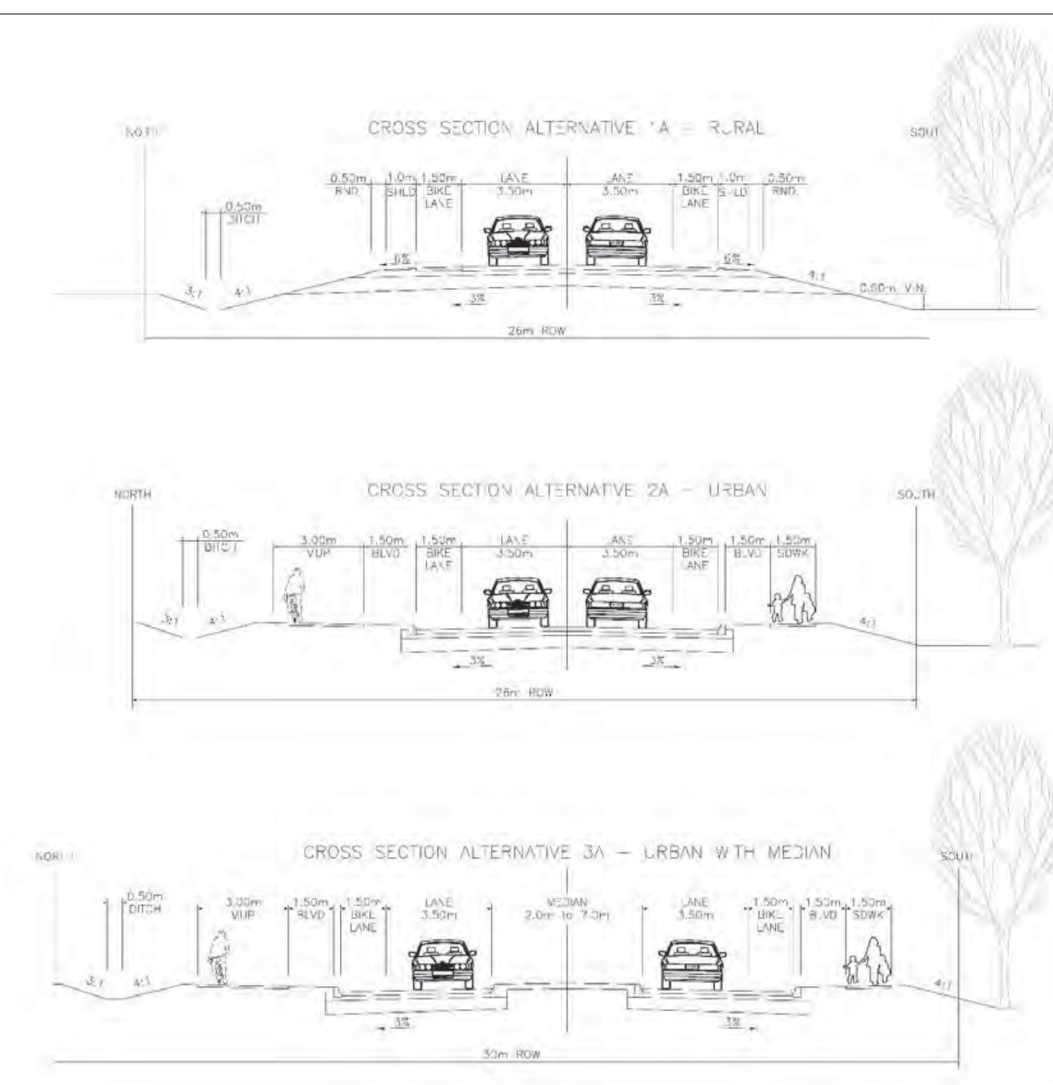
Consultation

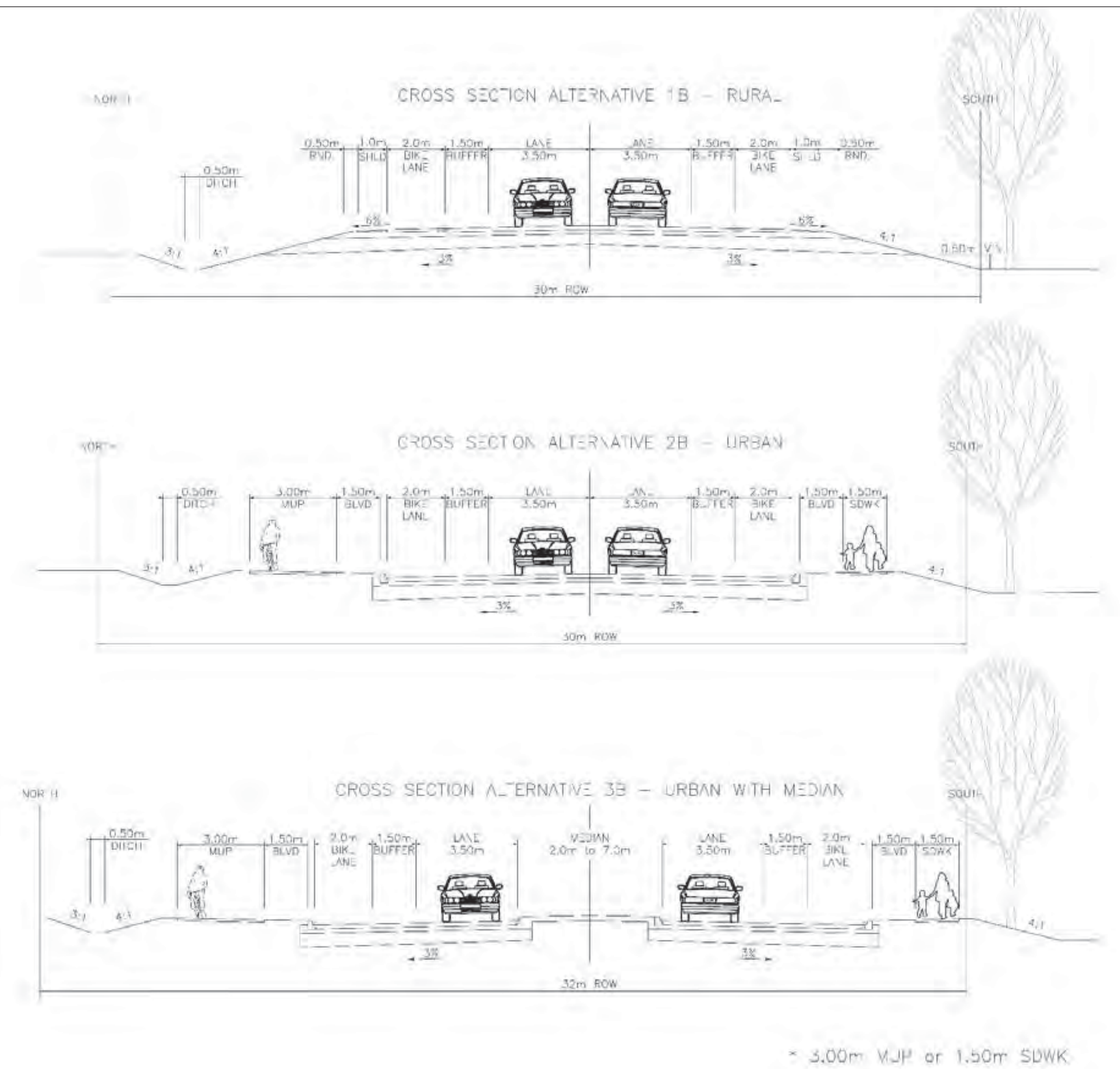
Agency Consultation	Meetings at key milestones
Public Consultation	Two Public Open Houses and one Community Café Town Website Stakeholder Meetings
Indigenous Peoples Engagement	Offer to meet at milestones
Ongoing Activities	Maintaining mailing list Newspaper Notices Town Website

Preliminary Design Alternatives

- Alignment Alternatives
  - Alternative 1: TMP alignment (connection to 20th Sideroad)
  - Alternative 2: TMP alignment shifted northerly adjacent to heritage property (connection to 20th Sideroad)
  - Alternative 3: Connection to 9th Line (coarse screened from evaluation)
- Cross Section Alternatives
  - Traffic calming opportunities
  - Active transportation alternatives
- Intersection Alternatives
  - Signalized
  - Roundabout


INTERSECTION ALTERNATIVES UNDER INVESTIGATION
9th LINE
9th LINE
20th SIDEROAD
ALTERNATIVE 3
SPECIAL POLICY AREA
30m VEGETATION PROTECTION ZONE
LEONARD'S CREEK TRIBUTARIES
ALTERNATIVE 2
INTERSECTION ALTERNATIVES UNDER INVESTIGATION
ALTERNATIVE 1
WEBSTER BLVD N
N


CROSS SECTION ALTERNATIVE 1A – RURAL
CROSS SECTION ALTERNATIVE 2A – URBAN
NORTH
SOUTH
CROSS SECTION ALTERNATIVE 3A – URBAN WITH MEDIAN
* 3.00m VUP or 1.50m SDWK



BTE 20-021
2020-11-19
Scale 1:1250

Webster Boulevard North Extension
Alternative A: Conventional Intersection

BT ENGINEERING BTE

BTE 20-021
2020-11-19
Scale 1:1250

Webster Boulevard North Extension
Alternative B: Roundabout

BTE

Study Stages

1. Needs analysis and presentation of Draft Study Design Report (SDR)
2. Environmental inventories and technical investigations to be used as input for the evaluation
3. Analysis and evaluation of cross section alternatives
4. Selection of Recommended Plan – preferred alignment and consideration of refinements and mitigation for the Recommended Plan
5. Preliminary Design of Recommended Plan

Study Schedule

Task	Date
Project Initiation Meeting	September 2020
Information Gathering	Fall 2020
Draft Study Design	October 2020
Study Commencement Notice/ Notice of CC/POH No. 1	November 2020
Traffic Impact Study	Fall 2020
Environmental Inventories	Fall 2020
Community Café/POH No. 1	December 2020
Technical Investigations	Winter 2021
Development, Analysis and Evaluation of Design Alternatives	Winter 2021
POH No. 2	Spring 2021
Preparation of ESR	Summer 2021
Town Review of ESR	Summer 2021
30-day Public Review Period	Fall 2021

Community Café

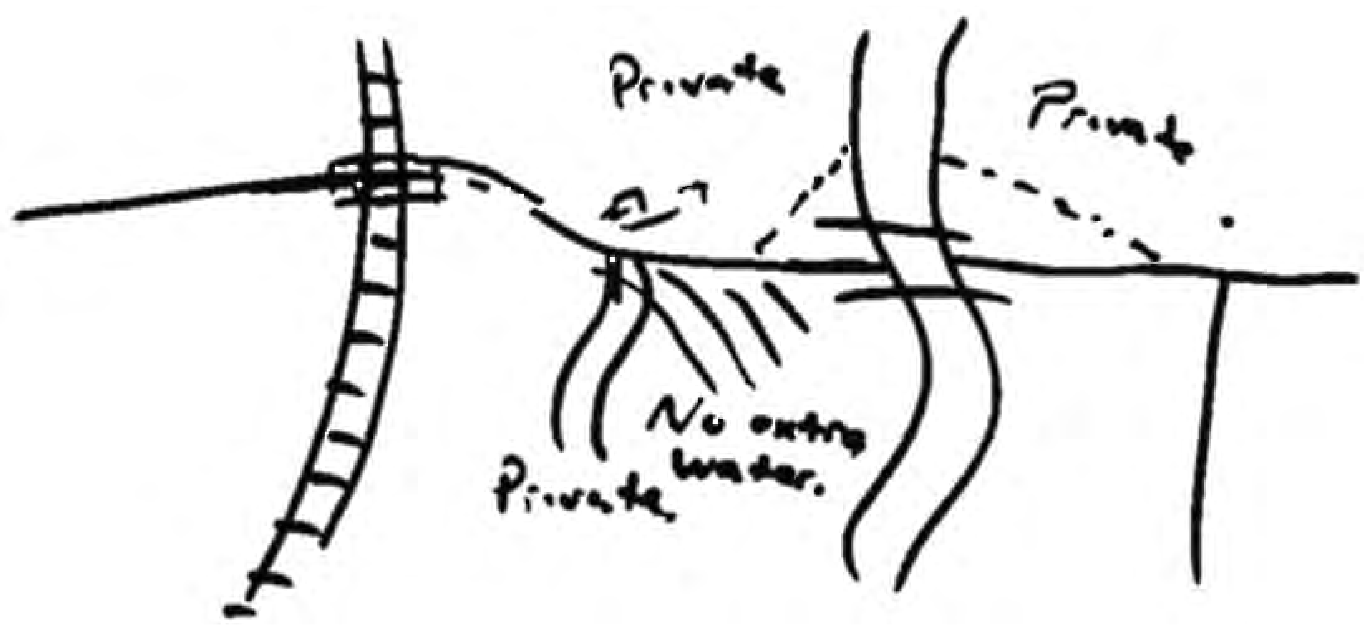
Community Café Process

- Participants will be divided into small groups to allow conversations and dialogue
- At the conclusion of a discussion period, participants will be asked to change tables and mix between topics
- Participants are free to sit out a session
- A recorder person will make notes of the discussion of problems and potential solutions, and pose questions to generate discussion

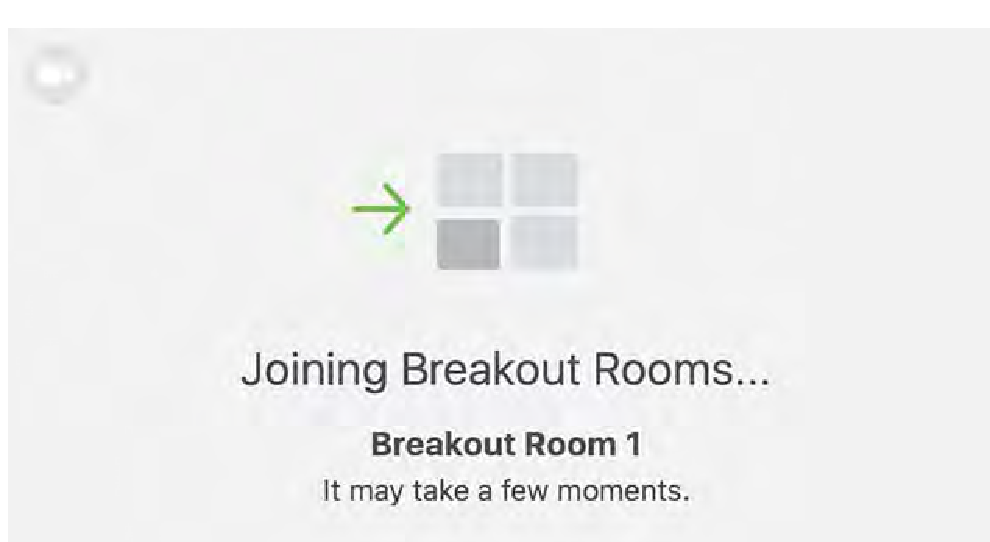
Café Approach

- Focus on dialogue between neighbours
- We are here to listen to your values and priorities
- Informal discussion of topics
- Encouraged to doodle sketches
- Build consensus of perspectives
- Records will be kept of discussions

Sample Doodle



Small Group Discussions



Tonight's Café Discussion Topics

- Safety - Pedestrians/Cyclists
- Traffic Operations (cars/trucks)
- Intersection Design
- Environmental

Appendix C

Newspaper Notice

BT ENGINEERING

Notice of Study Commencement and Public Open House No. 1/Community Café
Town of Innisfil
Webster Boulevard North Extension Environmental Assessment

INTRODUCTION

The Town of Innisfil has retained BT Engineering Inc. to undertake an Environmental Assessment (EA) Study for the extension of Webster Boulevard from the existing terminus to 20th Sideroad. The Study will evaluate alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the Transportation Master Plan (TMP).

STUDY PROCESS

The Webster Boulevard North Extension EA Study is being conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015). The Transportation Master Plan (TMP) has previously completed Phases 1 and 2 of the Class EA and this Study will review the previously completed phases and complete Phases 3 and 4. The Study will consider all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and proactively involve the public, stakeholders and Indigenous Peoples communities.

PUBLIC CONSULTATION

A draft Study Design Report is available on the Town's website at:
https://www.getinvolvedinnisfil.ca/websterblvd
The draft Study Design Report describes the study background, approach, process, alternatives and consultation program.

An online Public Open House (POH) No. 1/Community Café event will be held to help define the study scope and issues. To register for the Community Café, please contact Steve Taylor or Suzanna Nilsson. The online POH/Community Café will be held as follows:

Online Community Café Event	Online Public Open House No. 1
Date: **December 10, 2020** Time: **6:00 pm to 8:00 pm** (one night only) Location: Register by email to be sent the Zoom Link	Date: exhibits will be posted online from **December 10, 2020 to January 7, 2021** Location: Online (https://www.getinvolvedinnisfil.ca/websterblvd)

We request that POH No. 1 comments be sent to Steve Taylor or Suzanna Nilsson by January 7, 2021. However, there is an opportunity at any time during the Class EA process for interested persons to provide comments. Early identification of individual and group concerns greatly aids in addressing these concerns. All information will be collected in accordance with the Freedom of Information and Protection of Privacy Act (2009). With the exception of personal information, all comments will become part of the public record. Persons will be advised of future communication opportunities by electronic notice in addition to newspaper public notices.

For more information, to register for the Community Café, or if you wish to be removed from or placed on the study's mailing list, contact either:

Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc.
9040 Leslie Street, Unit #218, Richmond Hill, ON L4B 3M4
Tel: 905-709-4554
Email: steve.taylor@bteng.ca

Suzanna Nilsson, P.Eng.
Project Manager
Town of Innisfil
2101 Innisfil Beach Road, Innisfil, Ontario L9S 1A1
Tel: 705-436-3740 ext. 3260
Email: snilsson@innisfil.ca

This notice issued on November 23, 2020.

Notice of Study Commencement and Public Open House No. 1/Community Café
Town of Innisfil
Webster Boulevard North Extension Environmental Assessment

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Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc.
9040 Leslie Street, Unit #218, Richmond Hill, ON L4B 3M4
Tel: 905-709-4554
Email: steve.taylor@bteng.ca

Suzanna Nilsson, P.Eng.
Project Manager
Town of Innisfil
2101 Innisfil Beach Road, Innisfil, Ontario L9S 1A1
Tel: 705-436-3740 ext. 3260
Email: snilsson@innisfil.ca

This notice issued on November 23, 2020.

Appendix D

Comment Sheets

From: [redacted]
Sent:

[redacted]

[redacted]

[redacted]

[redacted]
Partner
9040 Leslie Street, Unit 218
Richmond Hill, Ont. L4B 3M4
[redacted]
[www.bteng.ca]www.bteng.ca

Virus-free. www.avg.com

Innisfil comment sheet

Steve Taylor <steve.taylor@bteng.ca>
on behalf of
[redacted]
Fri 2020-12-11 3:01 PM
To: [redacted]

[redacted] resident

Comments:

Has a house close to the project.

[redacted]

Like the idea of the project.

Rural residential property . Could be a better use as commercial on the north. He would be ok with this. [redacted] Supports northern alignment.

Bad no getting out of driveway.

Ok for sale and relocating.

Wants municipal servicing.

Creates a larger lot on the south side.

Steve

Steve Taylor P.Eng., M.Eng., CVS-LIFE, P.E.
President
9040 Leslie Street Unit 218
Richmond Hill, Ont. L4B 3M4
[redacted]
[www.bteng.ca]www.bteng.ca

RE: Webster Boulevard Extension

Steve Taylor <steve.taylor@bteng.ca>
on behalf of
[redacted]
Thu 2020-12-03 1:14 PM
To: [redacted]
Cc: [redacted]

Based on the initial comments received to date the EA has documented if the Study Area should be expanded. The recommendations being presented to date provide a technical recommendation not to carry forward the northerly alignment. It has been considered but not recommended to be carried forward.

This does not preclude a future study from a connection from the north down to this new link but at this time it is not recommended. Of course the purpose of the online Open House is to hear back feedback on the investigations and technical conclusions to date.

Steve

Steve Taylor P.Eng., M.Eng., CVS-LIFE, P.E.
President
9040 Leslie Street Unit 218
Richmond Hill, Ont. L4B 3M4
[redacted]
[www.bteng.ca]www.bteng.ca

From: [redacted]
Sent: December 3, 2020 11:03 AM
To: Steve Taylor
Cc: [redacted]
Subject: RE: Webster Boulevard Extension

Hi Steve

We are in receipt of the attached “Notice of Commencement-Webster Extension EA”. Just a technical question, is the Study area the only area you look at, or can an EA provide a recommendation outside the study area ? I’m just not sure how that process works, if you could clarify. The obvious reason in asking is the importance that the future extension of Leslie be considered.

Pleas use our October 16th 2020 email, below, as our initial official comments.

Any update on below would be appreciated, although it may be premature still.

Thanks
[redacted]

From: Steve Taylor <steve.taylor@bteng.ca>
Sent: Monday, October 19, 2020 8:48 AM
To: [redacted]
Cc: [redacted]
Subject: RE: Webster Boulevard Extension

Thanks [redacted]

Let me table this to our project team and get back to you. I think a connection to the north is possible from a transportation perspective but there may be other issues that I do not know of. We will report back.
Steve

BT ENGINEERING
BTE

Steve Taylor P.Eng., M.Eng., CVS-LIFE, P.E.
President
9040 Leslie Street Unit 218
Richmond Hill, Ont. L4B 3M4
[redacted]
[www.bteng.ca]www.bteng.ca

From: [redacted]
Sent: October 16, 2020 5:14 PM
To: Steve Taylor
Cc: [redacted]
Subject: RE: Webster Boulevard Extension

Hi Steve

We definitely feel a provision for the future connection of Leslie is important at this stage, including a provision of Webster to the 9th line.

To step back a bit, Leslie was originally to connect to Webster, in the existing subdivision to the South (attached is a visual). This was not feasible, in any way, as it would have gone through a large wetland & large valley, in this location. Since this change, we've seen many alignment concepts (including our own), as to how this will evolve.

Further to your graphic, the attached Concept (Webster-Leslie Alignment-with Land Use-Figure 1-Oct 16 2020) generally illustrates how we envision the ultimate road network to look. As an example, a portion of Webster & Leslie could be constructed, if the Town's short term goal was to get traffic to the 20th.

We'd be happy to set up a meeting (video/conference call) to discuss the merits of this alignment. Quite honestly, we've seen many alignments over the years in this area, even our own Schedule B doesn't make sense, with Leslie & Webster both going to the 20th. We are just looking towards a practical solution that would accommodate the entire area now…… and in the future, upon the extension of Leslie.

Thanks
[redacted]

From: [redacted]
Sent: December 16, 2020 1:31 PM
To: steve.taylor@bteng.ca
Subject: Webster extension to 20 Sideroad

4

Hi Steve,

The last time we discussed this connection – which should have been a development condition when the adjacent subdivision was approved, we weren't sure whether Leslie would connect directly to 9th Line, or Webster to Leslie that would connect to 20th, or Leslie to Webster that would connect to 20th. I couldn't see two intersections with 20th so close together for the volume of traffic that will flow through any of these configurations.

Are these several potential alignments to be included in this EA?

Have a safe and merry Christmas.

[redacted]

5

[redacted]

January 25, 2021

Town of Innisfil
2101 Innisfil Beach Road
Innisfil, ON L9S 1A1

To Whom It May Concern:

Re: Webster Boulevard Extension
Our File No: PRA-03334

We represent [redacted] who own lands [redacted] upon which the extension of Webster Boulevard is proposed. To assist in the evaluation of the preferred route of the extension, we have provided background information as well as information supporting the alignment proposed by the Owner.

[redacted] developed the Maplewalk subdivision (Webster Boulevard) which was registered in 2007 [redacted]. Webster Boulevard currently terminates in a temporary cul-de-sac at the north limit of the Alcona settlement are boundary. The Town desires to extend Webster Boulevard in order to provide an alternative collector road that would reduce the traffic congestion at the intersection of Innisfil Beach Road and the 20th Sideroad.

On behalf of the Owner we have prepared a plan that illustrates the proposed alignment of the extension of Webster Boulevard. The alignment follows the geometry of the current right-of-way, and then angles westerly to connect with the 20th Sideroad immediately south of 2351 20th Sideroad. The proposed new intersection would be located approximately 500 metres south of the 9th Line, and approximately 900 metres north of Innisfil Beach Road.

The proposed alignment would minimize environmental impacts that would otherwise occur if Webster Boulevard was extended to the north, and would not hinder the efficient and orderly development of lands to the south of the extension (proposed medium/high density residential and stormwater management), and north of the extension (commercial/mixed use).

We look forward to the review and circulation of these applications and if you have any questions or require additional information, please contact me.

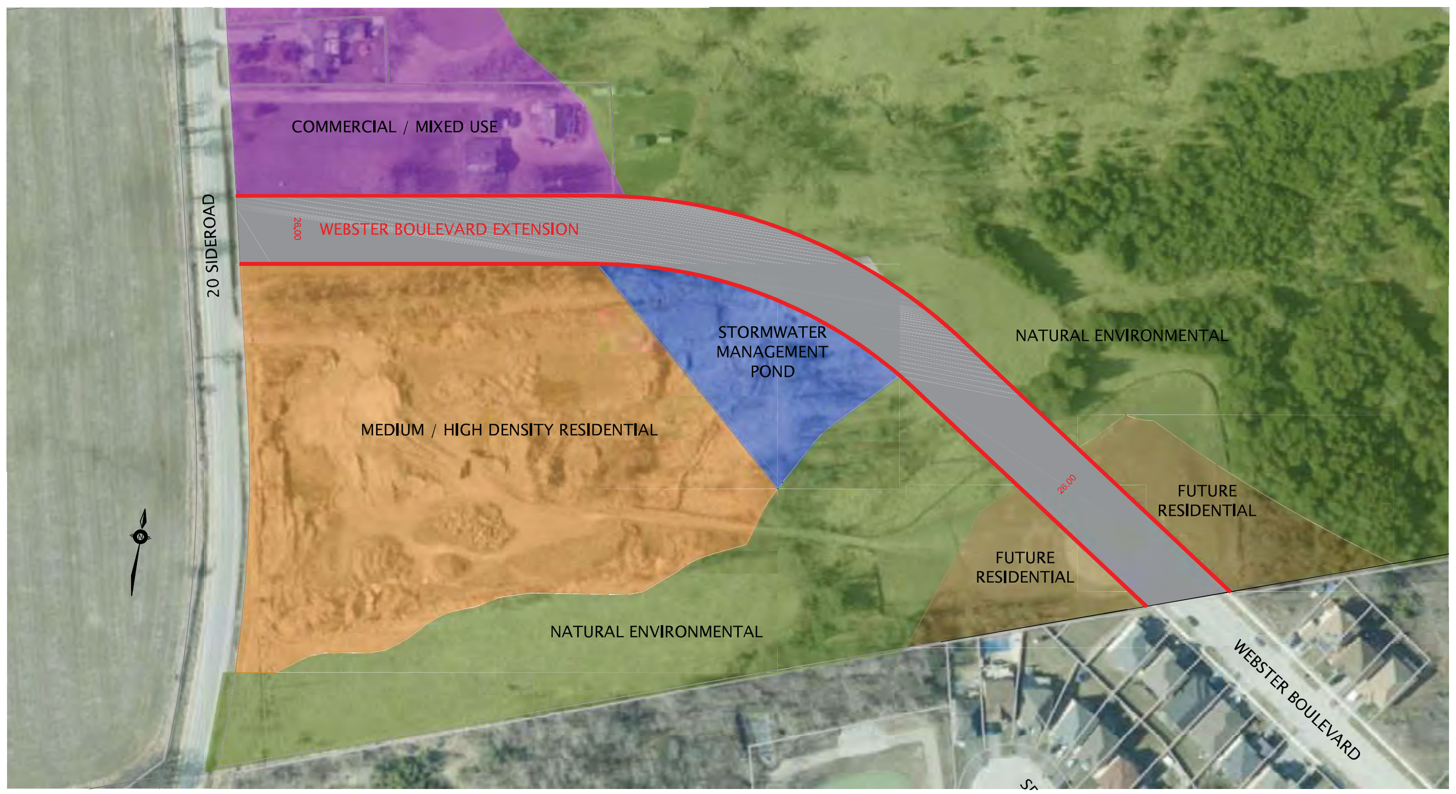
Sincerely,

[redacted]

c. [redacted]

5

Webster Boulevard Extension Sketch



Proposed Webster Boulevard Extension (26.0m Right of Way)

Natural Environmental:
Draft Schedule A: Alcona North Land Use Plan

Future Commercial / Mixed Use

Future Medium/High Density Residential

Proposed Stormwater Management Pond

Future Residential

Webster Boulevard Extension Sketch	
Date Issued: Jan. 26, 2021	
Drawn By: [redacted]	Checked By: [redacted]
Drawing Name: PRA-03334-W-CP-1.dwg	

Innisfil

POH No. 2 Summary Report

Town of Innisfil Webster Boulevard North Extension Environmental Assessment Study

April 2021

Submitted by:
BT Engineering Inc.
9040 Leslie Street, Unit 218
Richmond Hill, ON L4B 3M4
905-709-4554

Table of Contents

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1.0 INTRODUCTION

The Town of Innisfil is conducting an Environmental Assessment (EA) Study for the extension of Webster Boulevard North to 20th Sideroad. The Study has evaluated alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the Transportation Master Plan (TMP).

The Study Area is located in the Town of Innisfil, as illustrated in **Figure 1**.

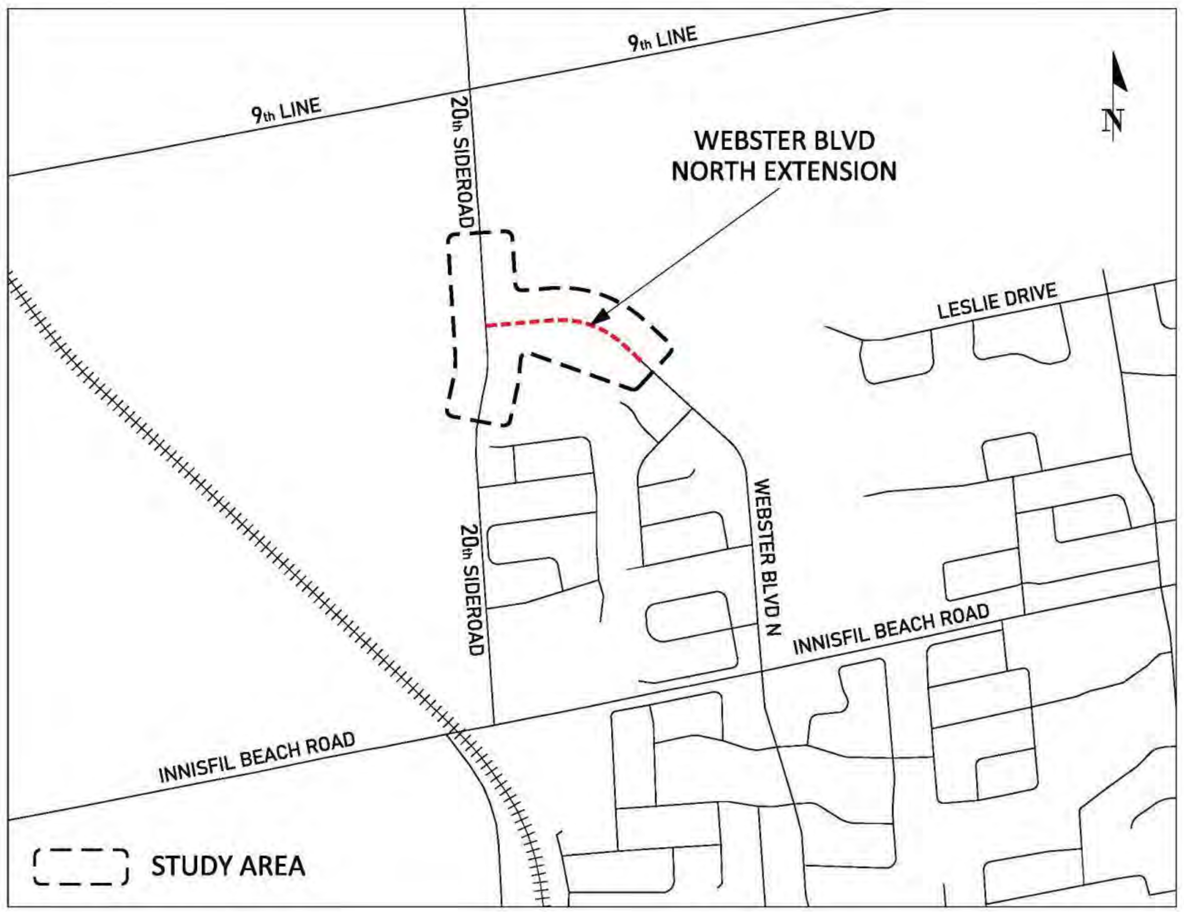


Figure 1: Study Area

This report summarizes the online Public Open House (POH) No. 2.

2.0 BACKGROUND

At the time of POH No. 2, the Province of Ontario has implemented measures to deal with the COVID-19 pandemic, including restrictions on public gatherings. The event was therefore held online, and the distribution of materials is relying on web-based communications with the public.

POH No. 2 was hosted on the Town of Innisfil's website and material was posted online from **Friday, March 26, 2021** to **Friday, April 9, 2021**. People were encouraged to submit comments by email or by phone during this timeframe. A copy of the POH exhibits is provided in **Appendix A**.

3.0 PUBLIC AND AGENCY CONSULTATION

One of the key aspects of the project is to provide the public, interested parties, affected agencies and stakeholders with the opportunity for input. In order to ensure this objective is met, a public and agency notification program was undertaken. The program includes a number of communication mechanisms, discussed in the following sections. The Study Design Report was finalized following POH No. 2, which is available on the Town's website and was available at the event for public review.

3.1 Newspaper Notice

Notice of the POH No. 2 was advertised in the local newspaper (Innisfil Journal) on Thursday, March 4, 2021 and Thursday, March 18, 2021. Letters were sent out to the mailing list to agencies, stakeholders and utilities. Notices were also sent out by mail to local residents within the Study Area. Copies of the newspaper notices are in **Appendix B**.

3.2 Agency and Stakeholder Contacts

The Notice of POH No. 2 was issued in advance of the event to agencies, stakeholders and interest groups including:

- Alcona Beach Club Inc.
- Association Franco-Ontarienne Des Conseils Scolaires Catholiques
- Barrie Cycling Club
- BonSecour Track and Trail Snowmobile Club
- City of Barrie
- City of Barrie Fire and Emergency Services
- Conseil Scolaire Viamonde
- Cookstown and District Chamber of Commerce
- County of Simcoe
- County of Simcoe Paramedic Services
- Degrassi Cove Association
- Environment Canada
- Georgian College
- Greater Innisfil Chamber of Commerce
- Infrastructure Ontario
- Innisfil District Association
- Innisfil Fire Rescue Services
- Innisfil Heritage Committee
- Lake Simcoe Region Conservation Authority
- Metrolinx/GO Transit
- Ministry of Environment, Barrie District Office
- Ministry of Environment, Conservation and Parks
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources and Forestry, Midhurst District Office
- Ministry of Tourism Culture and Sport
- Ministry of Transportation
- Ontario Federation of Agriculture
- Ontario Ministry of Agriculture, food and Rural Affairs
- Ontario Provincial Police, Operational Policy and Strategic Planning Bureau
- Royal Victoria Regional Health Centre
- Simcoe County District School Board

- Simcoe County Historical Association
- Simcoe County Police Services - North Division, Operational Policy and Strategic Planning Bureau
- Simcoe County Student Transportation Consortium
- Simcoe Muskoka Catholic District School Board
- Simcoe Muskoka District Health Unit
- Transport Canada
- Bell Canada
- Barrie Collingwood Railway
- Enbridge Gas
- Hydro One Network Inc.
- InnPower
- InnServices Inc.
- Rogers Communications
- Pratt Development

3.3 Indigenous Peoples

The following Indigenous Peoples groups were contacted:

- Aamjiwnaang First Nation
- Alderville First Nation
- Beausoleil First Nation
- Chippewas of Georgina Island
- Chippewas of Rama First Nation
- Curve Lake First Nation
- Georgian Bay Métis Council
- Haudenosaunee Confederacy Chiefs Council
- Hiawatha First Nation
- Huron-Wendat Nation
- Metis Nation of Ontario
- Mississaugas of Scugog Island First Nation
- Mississaugas of the New Credit First Nations
- Moon River Metis Council
- Moose Deer Point First Nation
- Six Nations of the Grand River
- Wahta Mohawks (Mohawks of Gibson)
- Wasauksing First Nation

An offer to meet separately from the event with the communities was extended; however, no community expressed an interest at this time.

4.0 COMMENTS

A total of three (3) comment sheets were received during the comment period. Copies of the comments, excluding personal information, are provided in **Appendix C**. The results of the comments and discussions are summarized in the following sections.

4.1 Summary of Written Comments

The results of the written comments received during the subsequent comment period are summarized below in **Table 1**.

Table 1: Summary of Written POH No. 2 Comments

Comment	Number of Respondents
Support for the preferred alignment	1
Support for roundabout control	1
Request to minimize property acquisition	1
Request to provide additional access to Webster Boulevard North Extension from future development	1
Request to provide depressed median to access residential driveway	1
Concern for school bus stopping	1
Are stop signs added to roundabouts?	1
Privacy fencing for residential properties in close proximity to the new extension	1
When will the project be constructed	1
Request for additional information on the parkette	1

5.0 CONCLUSIONS

The study recommendations were supported by the public. The comments received reflect site specific issues for adjacent property owners. Mitigation measures to address the specific comments will be reviewed by the Technical Advisory Committee.

Appendix A

POH No. 2 Exhibits

Welcome!

Town of Innisfil

Webster Boulevard North Extension Environmental Assessment Study

Welcome to the second online Public Open House for the Webster Boulevard North Extension Environmental Assessment Study.

At the present time, the Province of Ontario has implemented measures to deal with the COVID-19 pandemic and has restricted public gatherings. As a result, this Public Open House is relying on web-based communications.

Should you have any questions regarding the materials or any other aspect of the study, or if you would like to review any of the background reports, contact either of the following by **April 9, 2021**:

Steve Taylor
Consultant Project Manager
Email: steve.taylor@bteng.ca
Phone: 905-709-4554

Suzanna Nilsson
Town of Innisfil Project Manager
Email: snilsson@innisfil.ca
Phone: 705-436-3740 ext. 3260

There is an opportunity at any time during the Class EA process for interested persons to provide written input. Any comments received will be collected under the *Environmental Assessment Act* and, with the exception of personal information, will become part of the public record.

Purpose of Public Open House No. 2

The purpose of this meeting is to present/provide the following:

- Overview of the EA process
- Summary of preliminary alternatives
- Traffic Analysis
- Environmental Reconnaissance
- Evaluation and selection of the Technically Preferred Alternatives
- Effects and mitigation of the Technically Preferred Plan
- Timeline of upcoming steps
- Provide the public with an opportunity to provide comments

Introduction

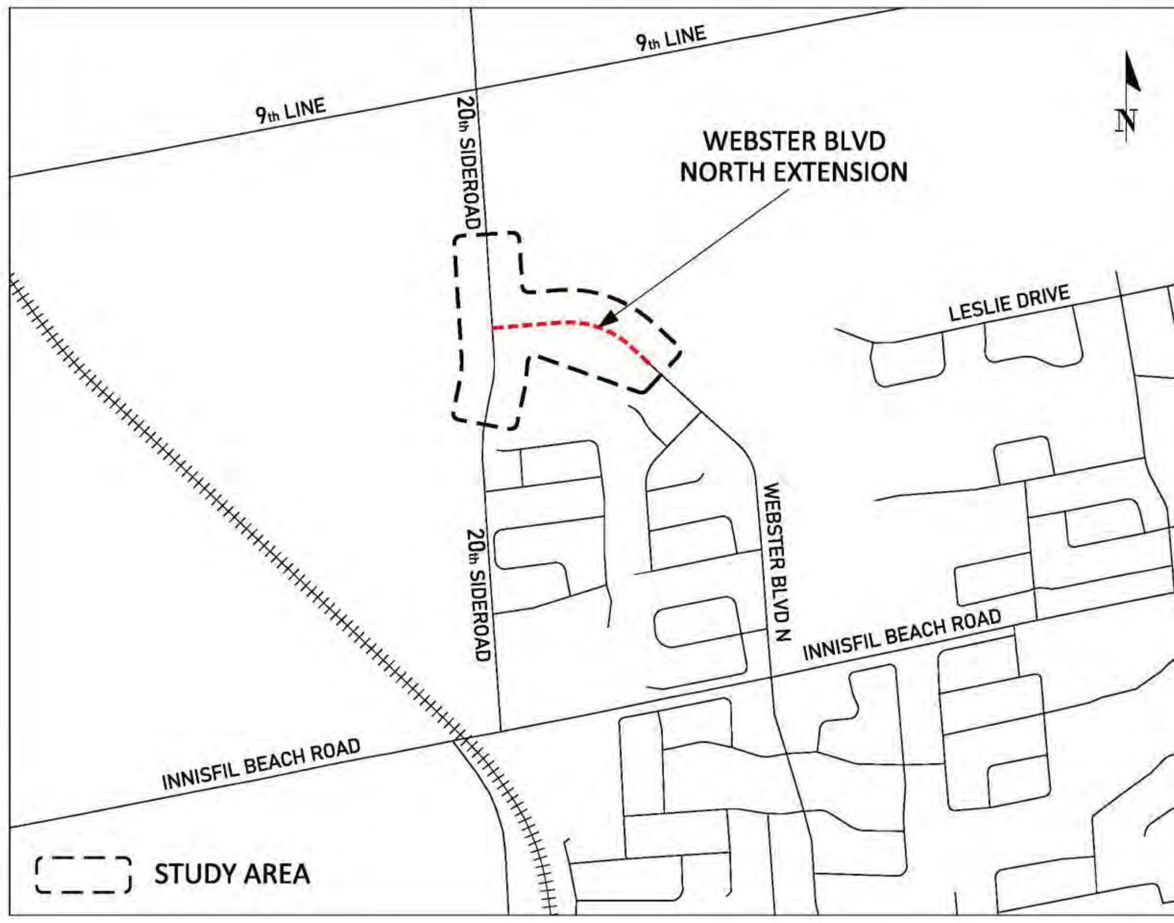
The Town of Innisfil has retained BT Engineering Inc. to undertake an Environmental Assessment Study for the extension of Webster Boulevard from the existing terminus to 20th Sideroad. The Study will evaluate alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the Transportation Master Plan.

The Town is completing Phases 1 to 4 of the Municipal Class Environmental Assessment. Phases 1 and 2 have been completed by the Transportation Master Plan Update and will be summarized in this study. Phases 3 and 4 will subsequently be completed by developing and evaluating alternative designs for the Preferred Planning Solution, while proactively involving the public and stakeholders in defining a recommended plan for improvements. The Study will be documented in an Environmental Study Report.

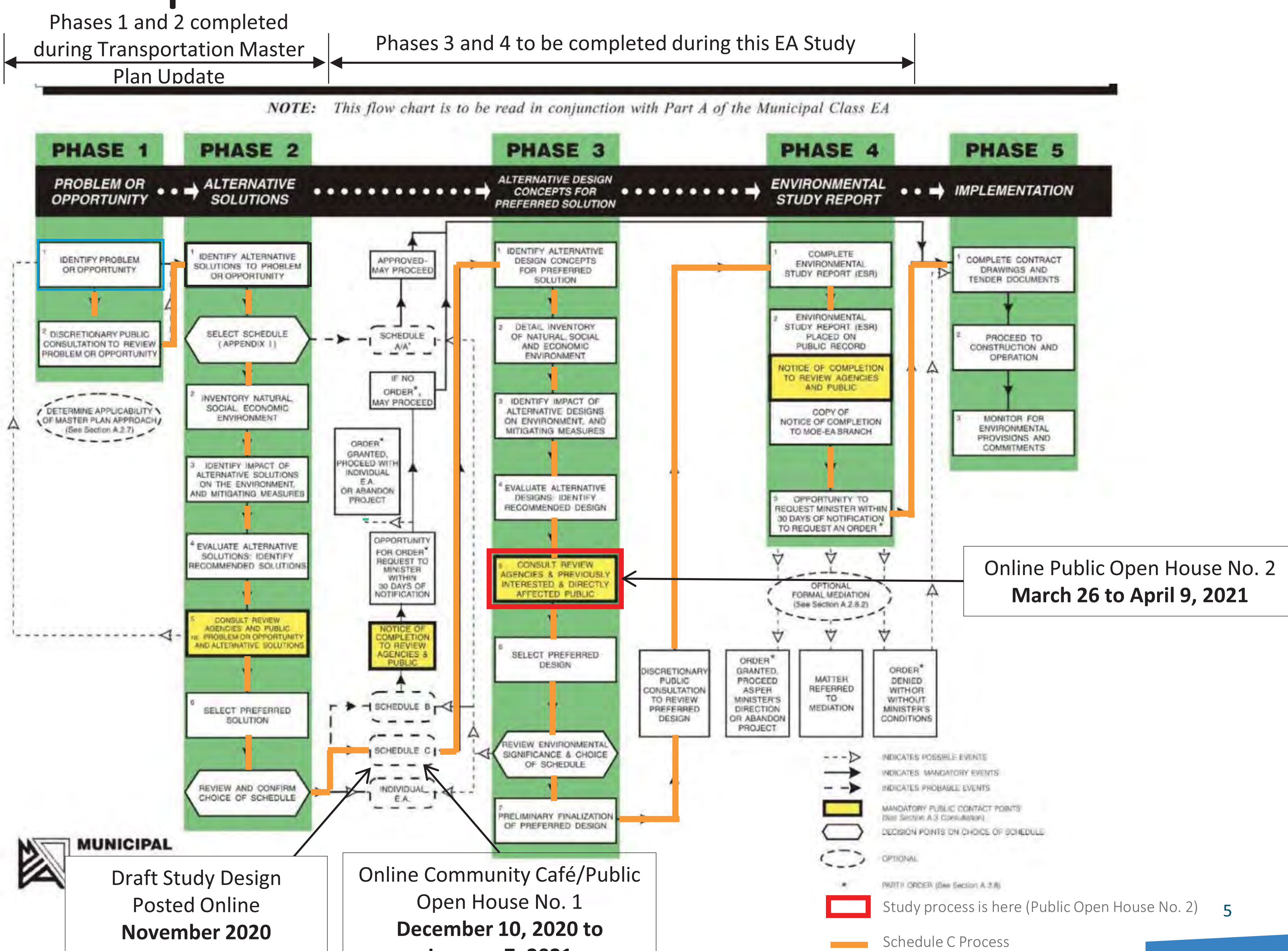
This Study is being completed as a Schedule C undertaking, based on the range of anticipated effects. The Study Design Report describing the study process was updated following Public Open House No.1 and is available on the Resources Link on the website.

Study Area

The Study Area comprises the area for the location of the Webster Boulevard North alignment alternatives in the Town of Innisfil.



Municipal Class Environmental Assessment

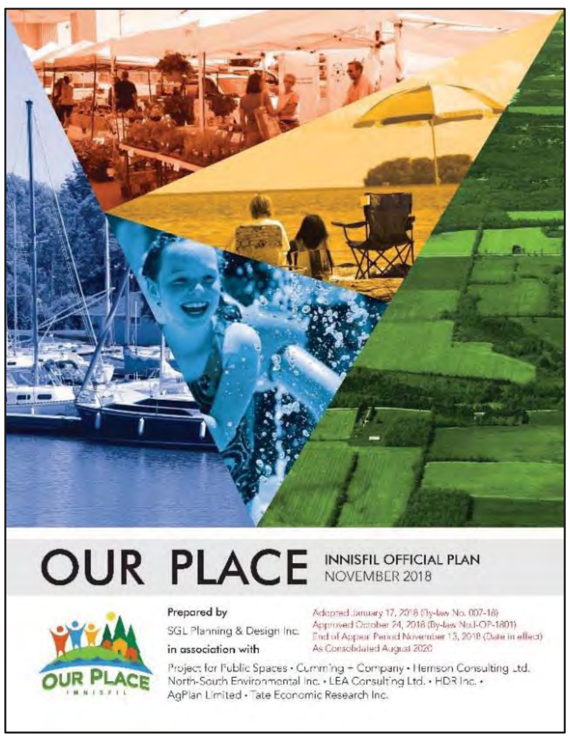


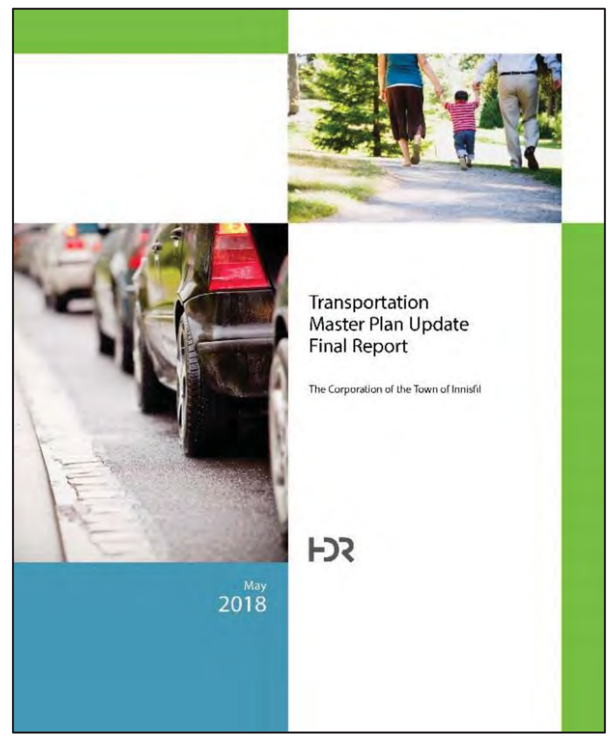
Background Studies

The following studies have been completed that are relevant to this study:

- **Town of Innisfil Transportation Master Plan Update** 2018 – Recommends the Extension of Webster Boulevard to 20th Sideroad as a Medium-term Improvement (by 2031)
- **Town of Innisfil Official Plan** 2018 – Identifies the proposed extension of Webster Boulevard as a Future Major Collector Road

These reports are available online for review upon request. Please contact the identified Project Managers to arrange for review.

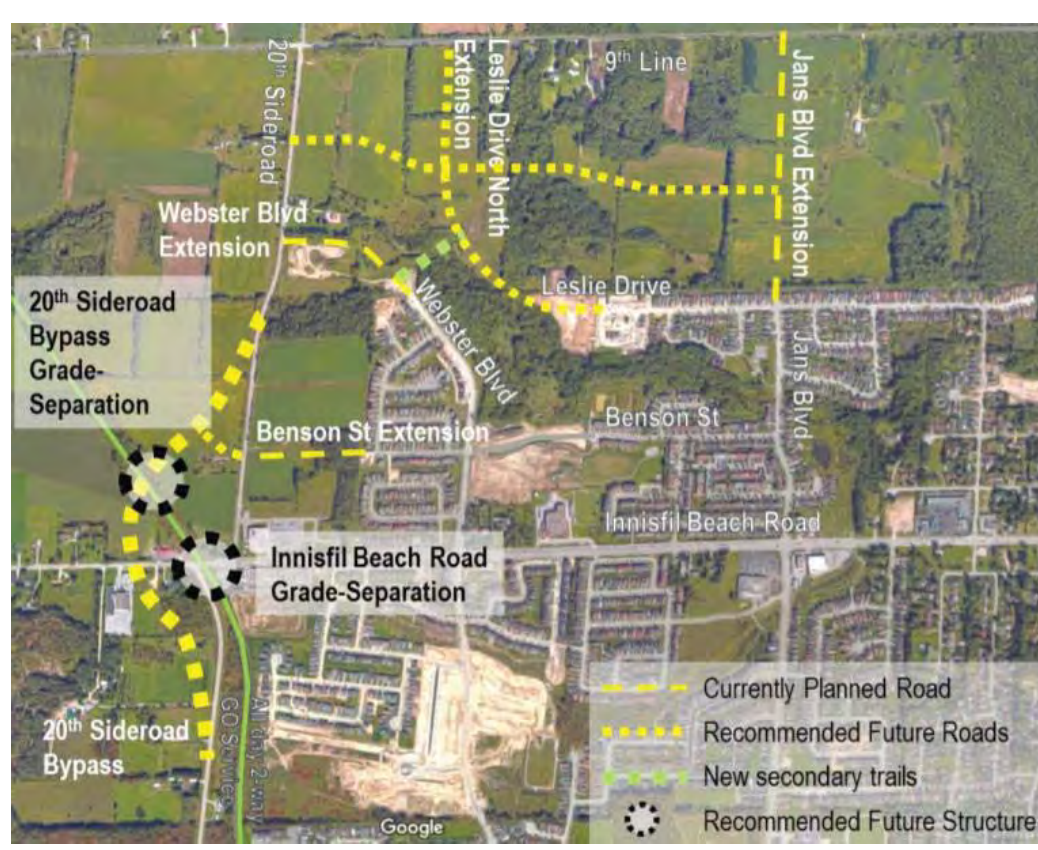




Transportation Master Plan Update Road Improvements in Alcona North

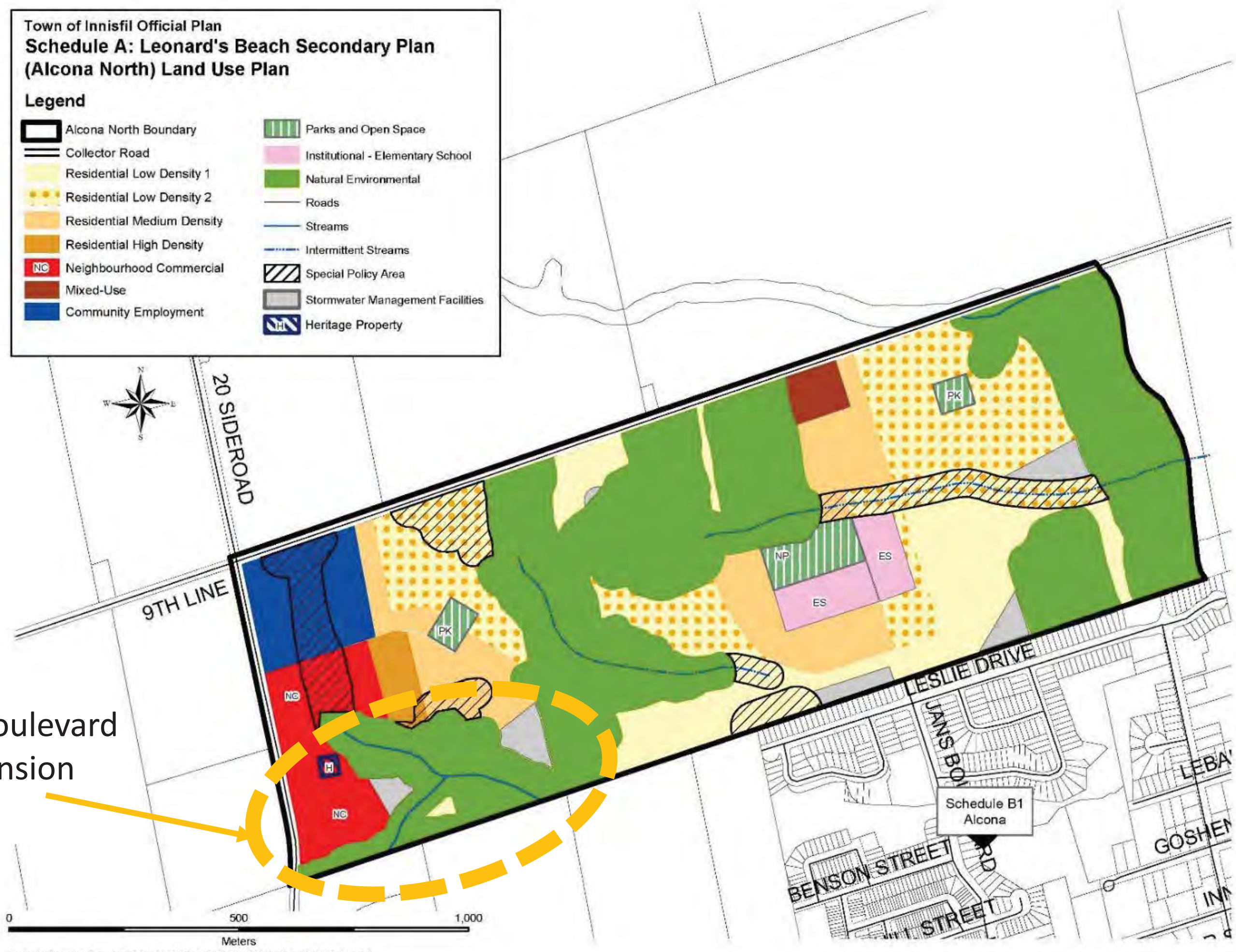
The Transportation Master Plan Update describes road improvements in Alcona North, illustrated to the right. The recommended improvements include the 20th Sideroad Bypass grade separation to address safety concerns at the GO Rail crossings and improve the operations of the 20th Sideroad and Innisfil Beach Road intersections. This will also alleviate cut-through traffic on the Webster Boulevard North Extension (when constructed).

The Transportation Master Plan Update also recommended active transportation improvements, including: the provision of cycling lanes on Webster Boulevard, and a secondary trail from Webster Boulevard to a future Leslie Drive extension.



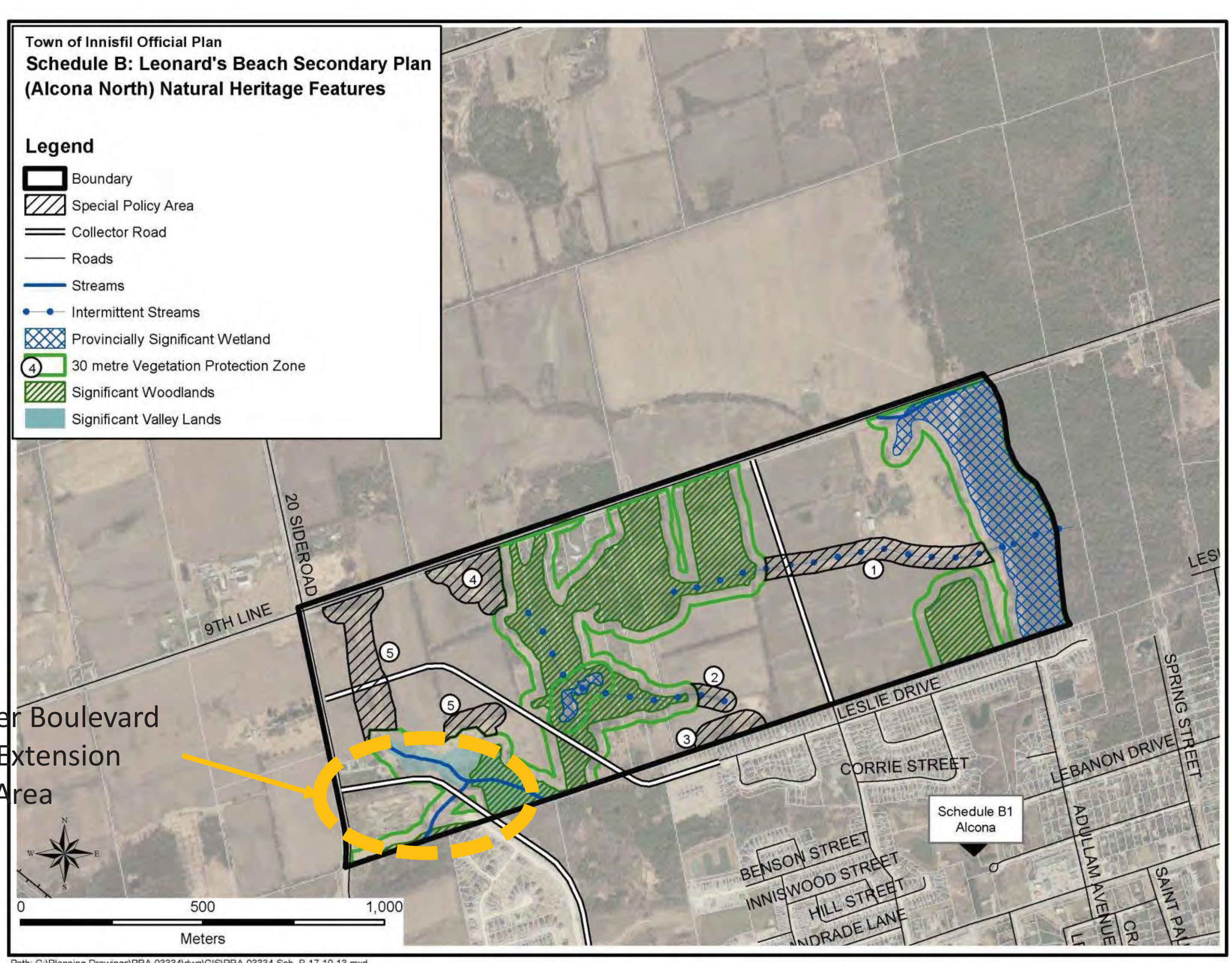
Source: Transportation Master Plan Update (Exhibit 8-2 Road Improvements in Alcona North)

Draft Official Plan Amendment
Schedule A (Lands Beyond Current Alcona Settlement Boundary)



Webster Boulevard North Extension Study Area

Draft Official Plan Amendment
Schedule B



Webster Boulevard North Extension Study Area

Problem and Opportunity Statement

The Problem and Opportunity Statement identified in the Innisfil Transportation Master Plan Update Study is as follows:

> "The Town of Innisfil is characterized by distinct communities which are spread out and not well-connected. The majority of travel in the Town is by car.
>
> By 2041 the Town's population and employment numbers are expected to double. Without a balanced transportation strategy, Innisfil residents will experience increases in traffic congestion which will impact their quality of life.
>
> Future opportunities to improve the transportation network have been identified in the Town, through the recently completed Trails Master Plan, new GO station planned at 6th Line and a new demand-responsive transit service."

By capitalizing on the identified needs and opportunities, the Town will achieve its transportation vision.

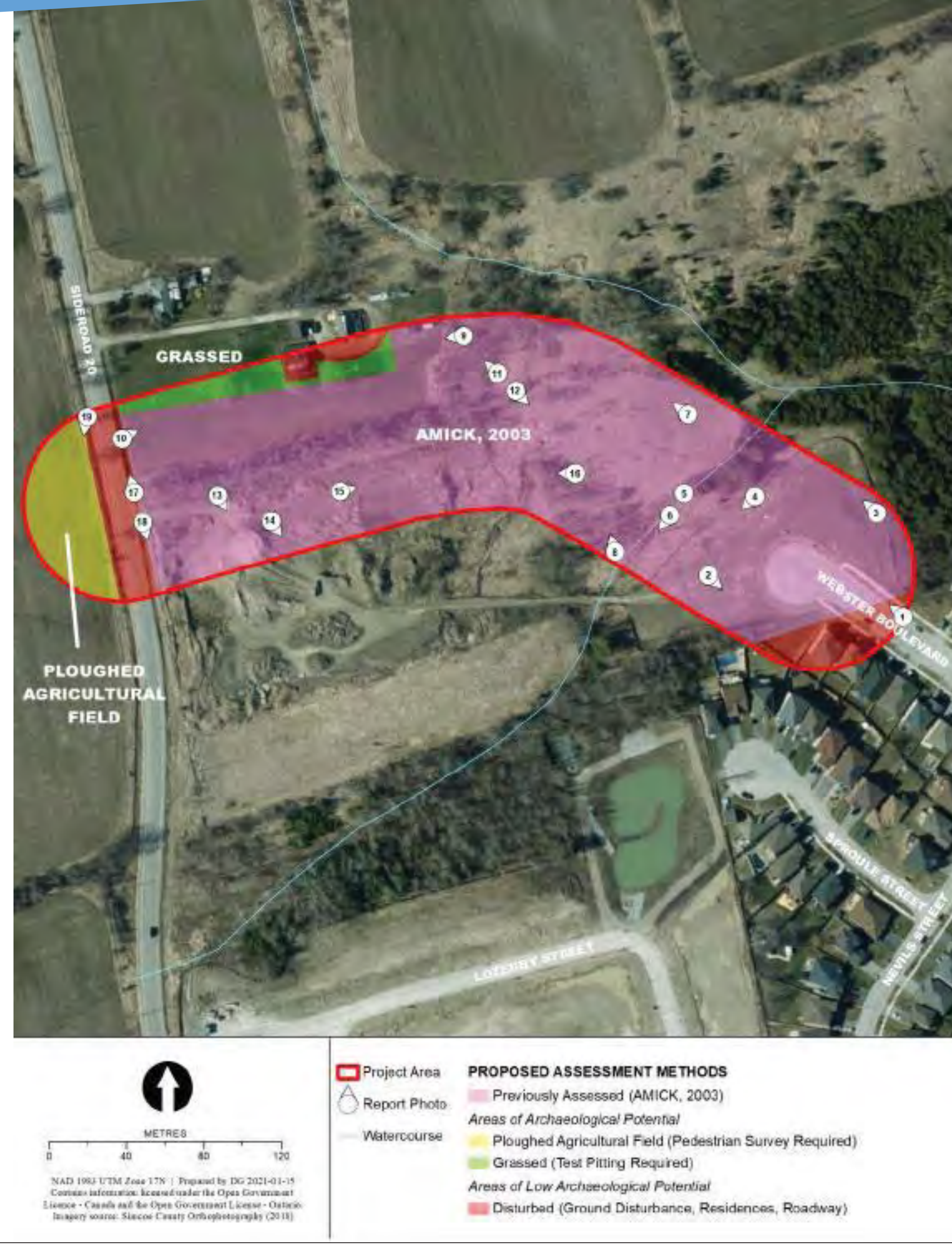
Traffic

The proposed extension of Webster Boulevard will improve connections between communities within Innisfil while, in the shorter term, also providing relief to the intersection of 20th Sideroad and Innisfil Beach Road. Traffic projections prepared as part of the Transportation Master Plan Update projected that the proposed extension would carry an average of approximately 2,500 to 3,000 vehicles/day. The link will provide a benefit by deferring the need for the 20th Sideroad realignment.

Stage 1 Archaeology Assessment

Stage 1 Archaeology Assessment was conducted in fall 2020. Recommendations include a Stage 2 assessment of grassed areas (green) and agricultural field (yellow).

The Stage 1 Archaeology Assessment Report is available on request.



Geotechnical Investigations

A geotechnical investigation was completed in fall 2020. The subsurface soil and groundwater conditions included topsoil/ organic fill, sand and silt.

Groundwater may be encountered during construction which would necessitate a Permit To Take Water Project Registration, depending on the volume of water displaced from the site.

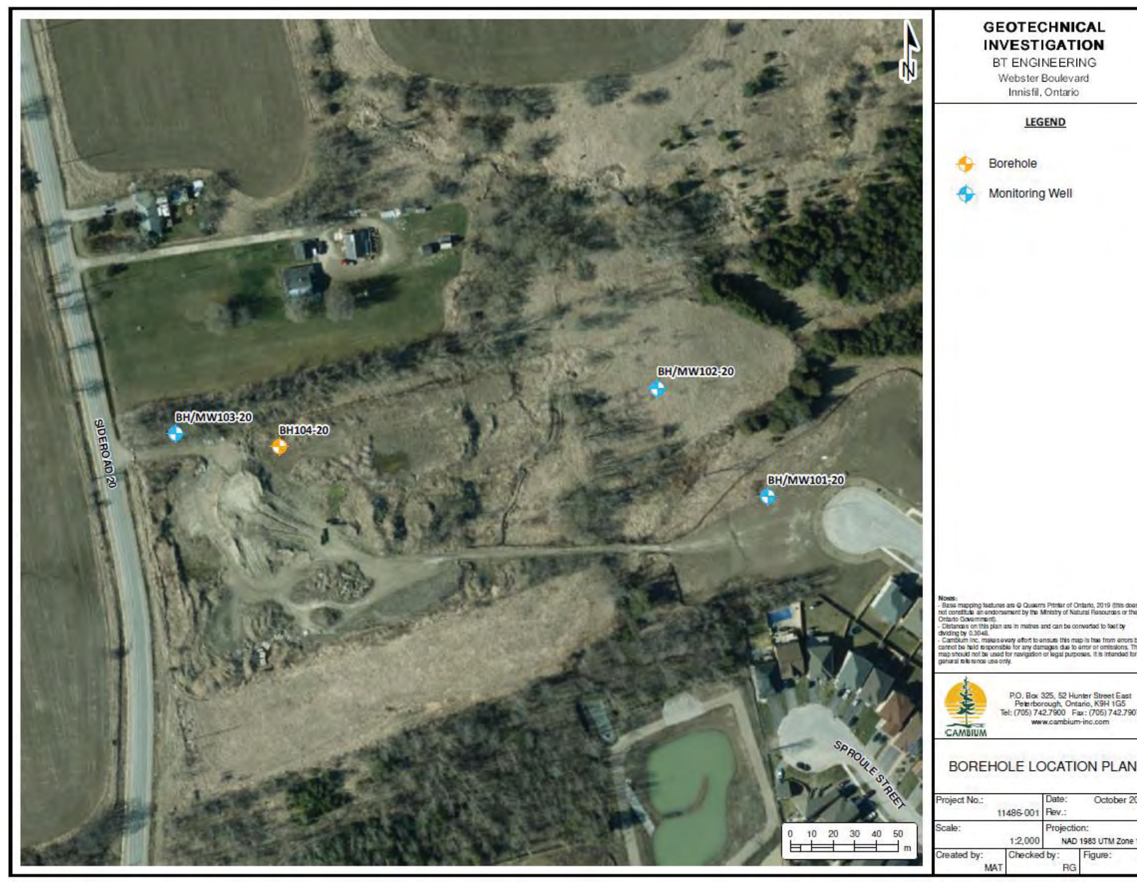
The detailed Geotechnical Report is available on request.

Hydrogeological Investigations

A hydrogeological study was completed in fall 2020. Three of the four boreholes completed as part of the geotechnical assessment were outfitted as monitoring wells to determine the static groundwater elevation at the site.

The Webster Boulevard North extension is within a Highly Vulnerable Aquifer area; however, no profile change will require cut greater than 2 m and therefore no long-term impact to the groundwater elevation is anticipated. The storm water management will be designed in accordance with the Lake Simcoe Conservation Authority requirements for this aquifer classification.

The detailed hydrogeology report is available on request.



Summary of Preliminary Design Alternatives

Four (4) groups of Preliminary Design Alternatives were evaluated as part of this EA Study, including:

Alignment Alternatives

- Alternative 1: Transportation Master Plan Update alignment (connection to 20th Sideroad)
- Alternative 2: Transportation Master Plan Update alignment shifted northerly adjacent to property (connection to 20th Sideroad)
- Alternative 3: Connection to 9th Line (alternative suggested by the public)

Intersection Alternatives

- A conventional signalized intersection
- Roundabout control

Cross Section Alternatives

- 2-lane rural and urban cross sections

Traffic Calming Alternatives

- Horizontal and vertical deflection traffic calming measures will be investigated. These alternatives are illustrated on the following exhibits

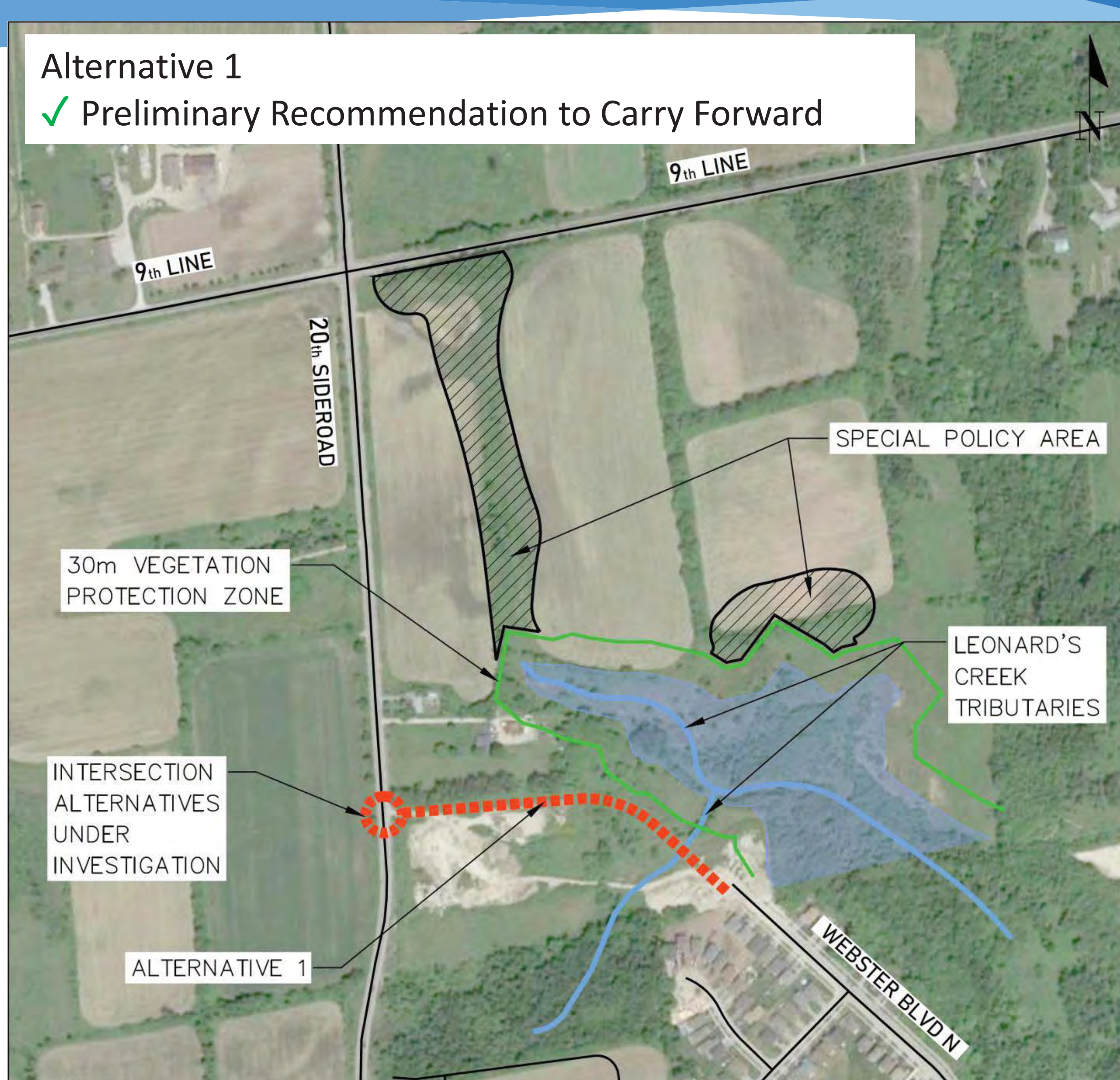
The evaluation of alternatives is shown on the following exhibits. The Analysis and Evaluation Report is available on request.

Evaluation of Alignment Alternatives

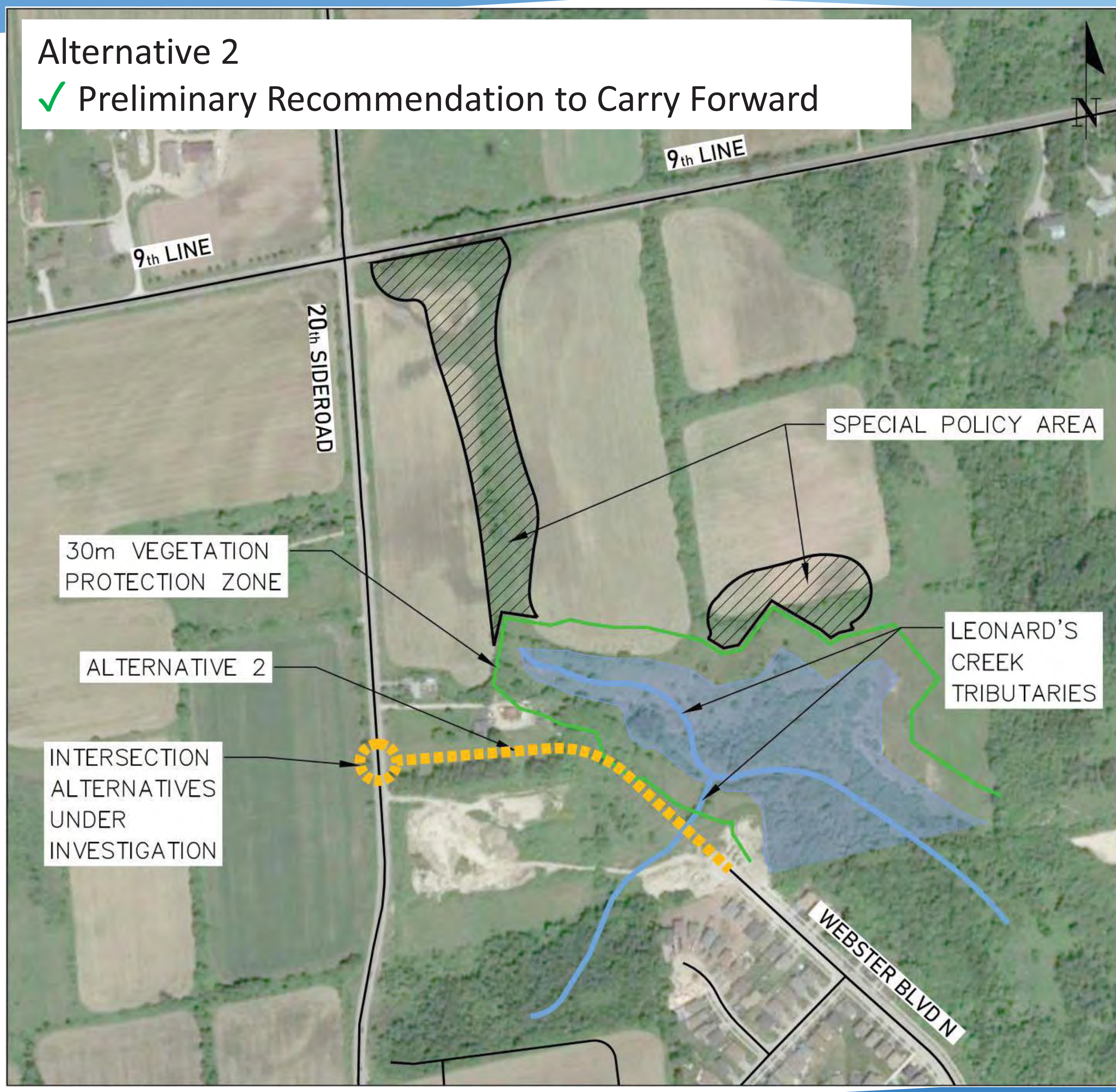
Although the Transportation Master Plan Update has identified a general alignment for the road extension, this Environmental Assessment Study has investigated three (3) alignment alternatives:

- ✓ Alternative 1: TransportationMaster Plan Update alignment (connection to 20th Sideroad)
- ✓ Alternative 2: TransportationMaster Plan Update alignment shifted northerly adjacent to property (connection to 20th Sideroad)
- X Alternative 3: Connection to 9th line (alternative suggested by the public)

Alignment Alternative 3 was coarse screened from evaluation due to higher environmental impacts and higher capital cost. This coarse screening was shown at POH No. 1. The alignment alternatives and evaluation of alternatives are illustrated on the following exhibits.



Alternative 2
✓ Preliminary Recommendation to Carry Forward

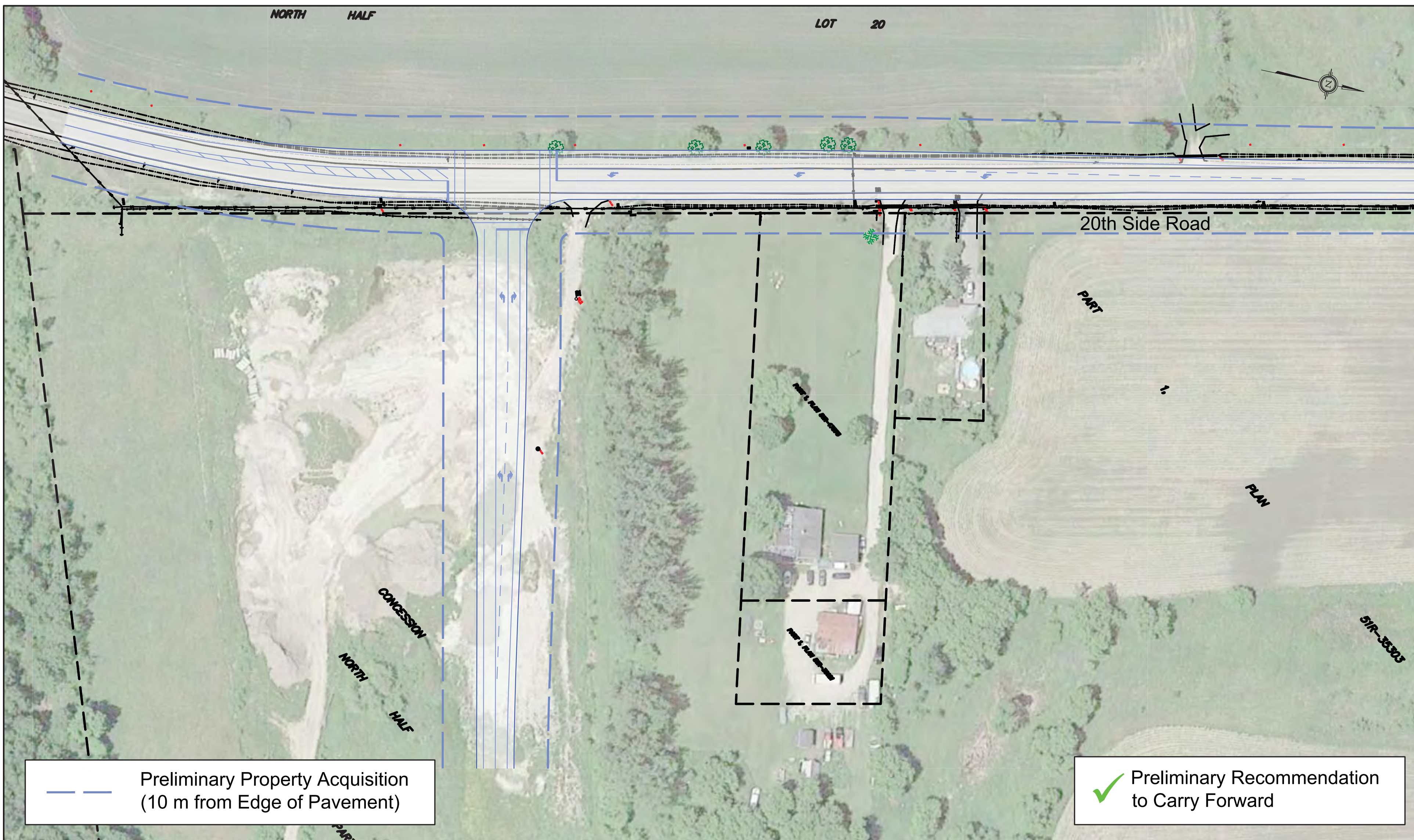


Evaluation Alignment Alternatives

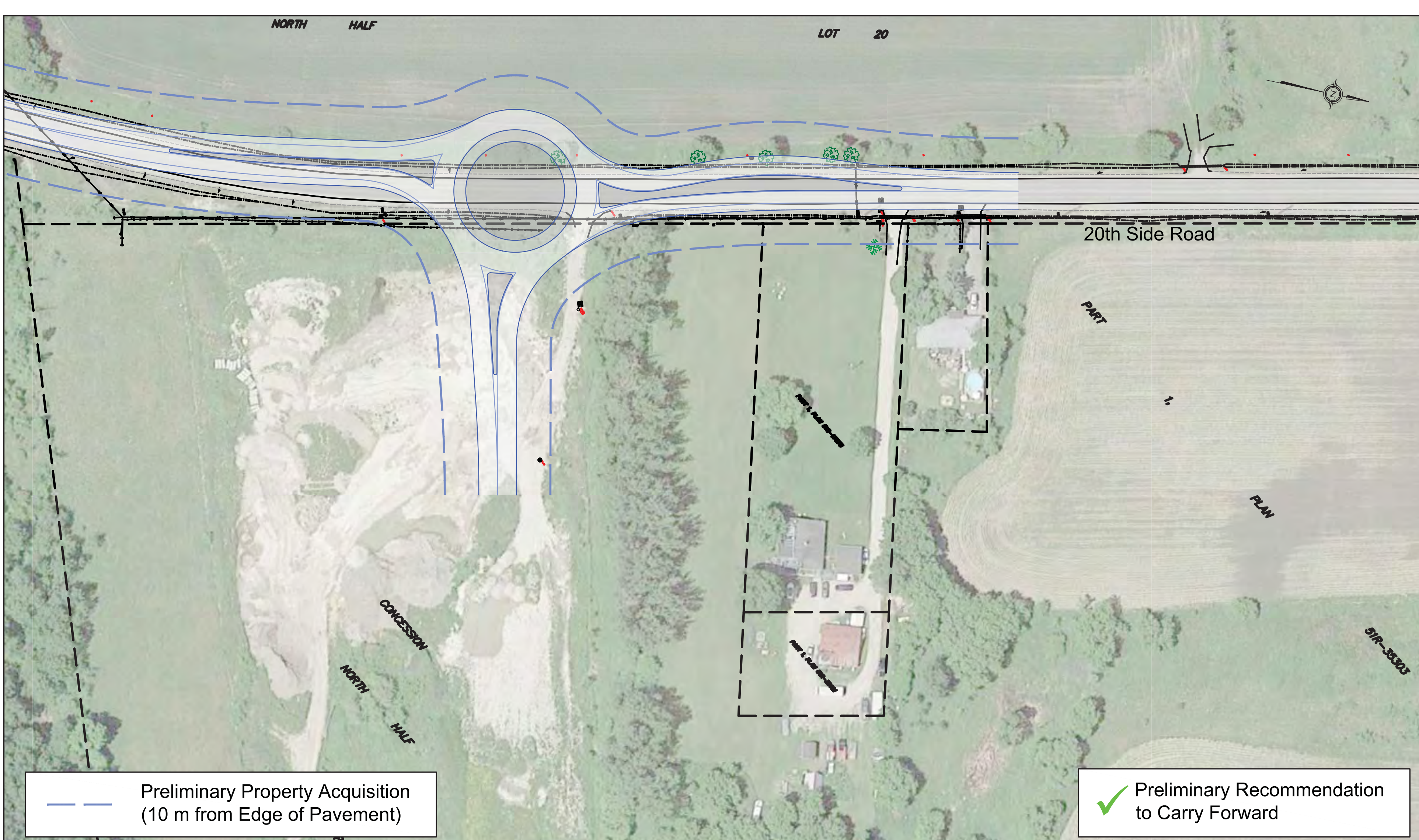
Criterion	Do Nothing (Baseline)	Alignment 1 (South)	Alignment 2 (North)
Transportation – Traffic Operations	X	✓	✓
Transportation – Safety including Access to Commercial Lands	X	-	✓
Transportation – Safety for Pedestrians and Cyclists	-	✓	✓
Transportation – Neighbourhood Connectivity	X	✓	✓
Environmental – Terrestrial Environment (Maintain Hedgerow)	✓	✓	X
Environmental – Terrestrial Environment (Woodlot)	Equal - no measurable differences		
Environmental – Aquatic Environment	Equal - no measurable differences		
Social Environment – Cultural Heritage	X	✓	X
Social Environment – Archaeological Potential	Equal - no measurable differences		
Land Use and Property – Maximizes Utilization of Commercial/Residential Development Lands	X	X	✓
Land Use and Property – 2351 20th Sideroad (South Property) (input provided by land owner)	X	✓	X
Land Use and Property – 2355 20th Sideroad (North Property) (input provided by land owner)	X	X	✓
Land Use and Property – Agricultural (Farmland)	✓	-	-
Cost – Capital Cost	✓	-	-
Recommendation	X	X	✓

Legend:	X - Poor Performance	- Neutral Performance	✓ - Good Performance

The Analysis and Evaluation Report provides additional detail for the evaluation of alternatives and is available upon request.



BTE 20-021 2020-11-19 Scale 1:1000	**Webster Boulevard North Extension** Alternative A: Conventional Intersection	BT ENGINEERING BTE



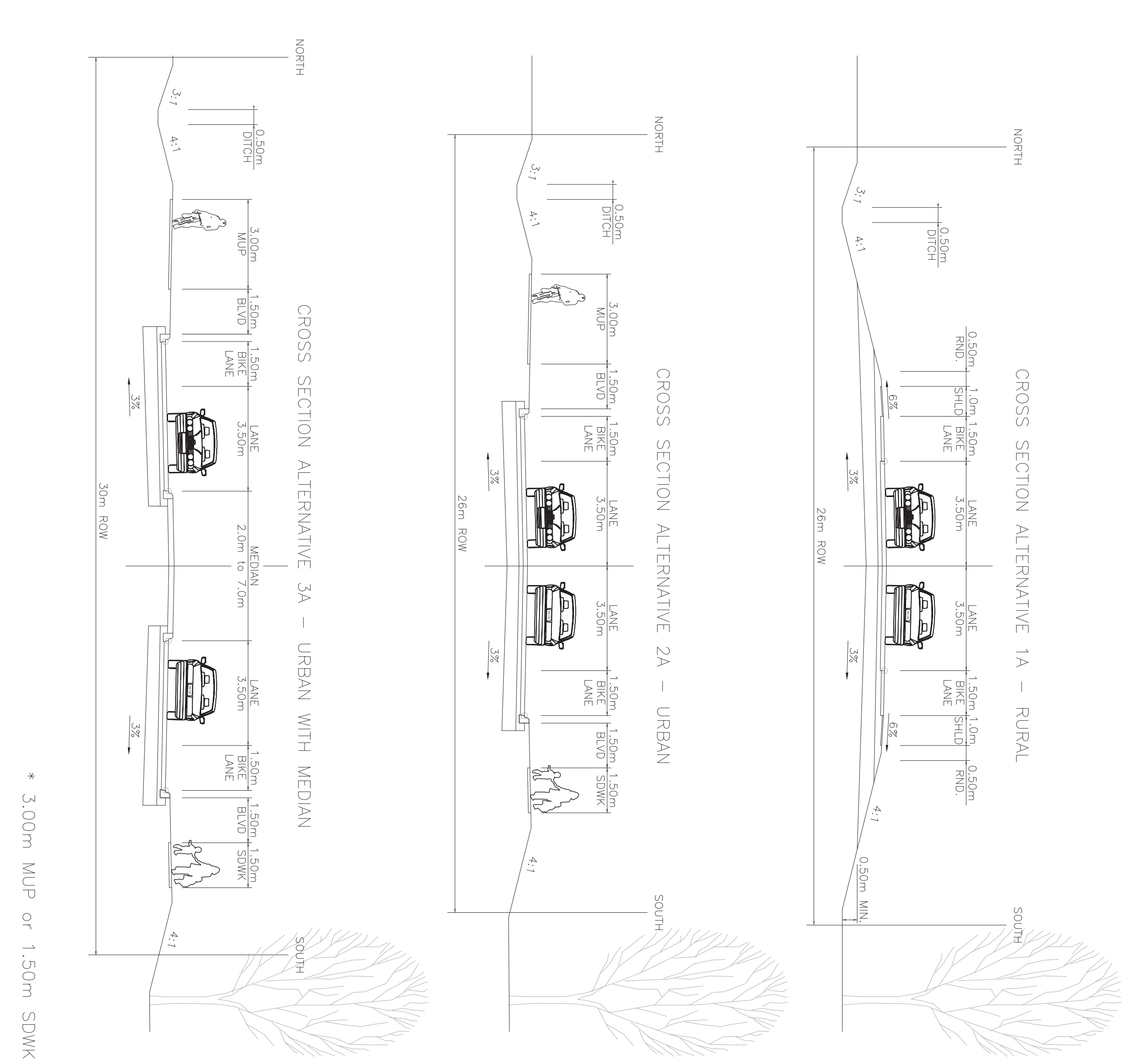
BTE 20-021 2020-11-19 Scale 1:1000	**Webster Boulevard North Extension** Alternative B: Roundabout	BT ENGINEERING BTE

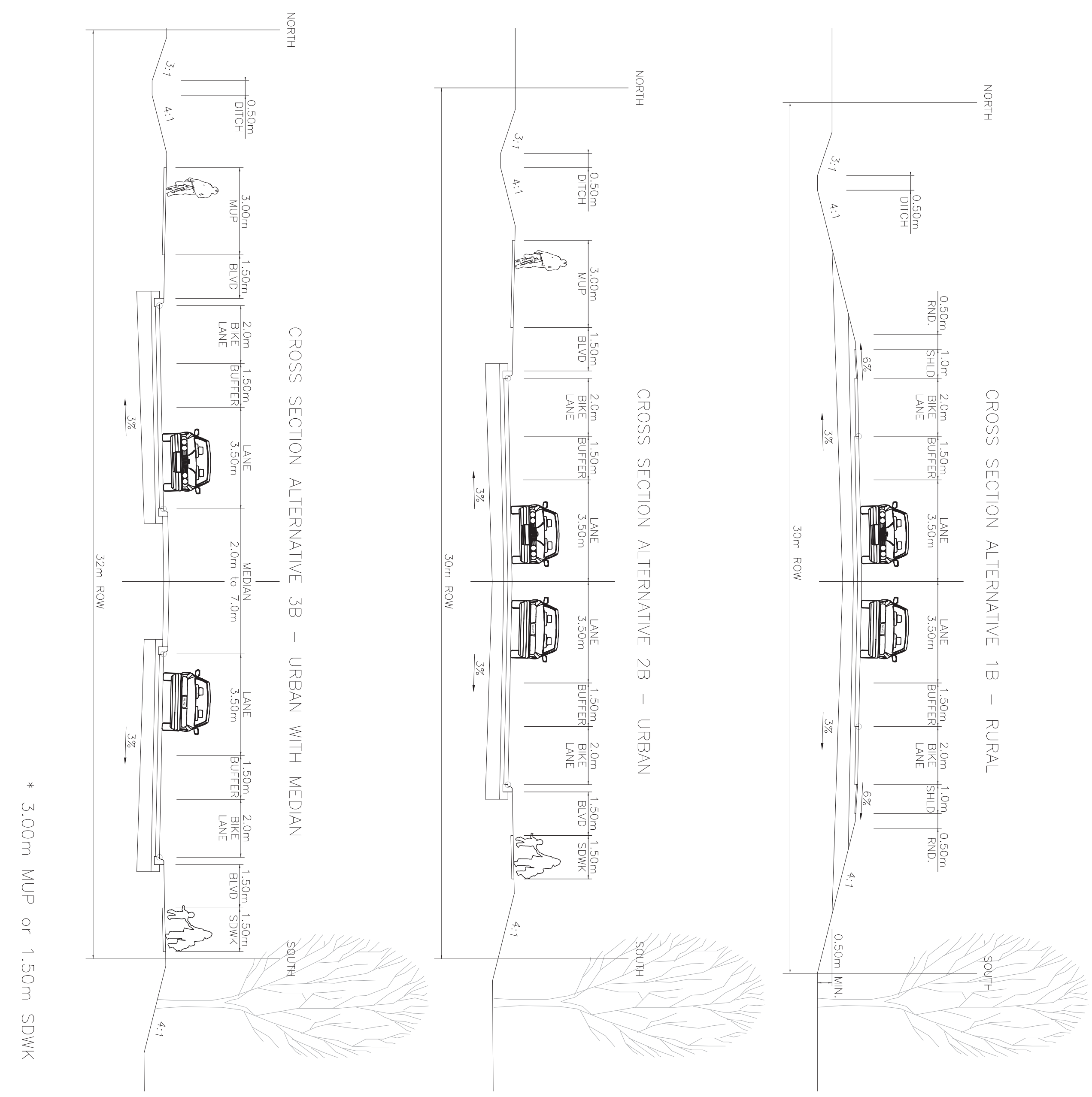
Evaluation Intersection Alternatives

Criterion	Traffic Signals	Roundabout
Transportation – Traffic Operations (Long Term Level of Service)	✗	✓
Transportation – Traffic Operations (Traffic Staging during Construction)	-	✓
Transportation – Safety	-	✓
Transportation – Safety for Pedestrians and Cyclists	-	✓
Environmental – Terrestrial Environment	No measurable differences	
Social Environment – Cultural Heritage	No measurable differences	
Land Use and Property – Residential	-	-
Land Use and Property – Agricultural (Farmland)	✓	✗
Land Use and Property - Ability to Provide Access to Future Residential and Commercial Property	✗	✓
Land Use and Property – Ability to Offset Intersection to West	✗	✓
Cost – Capital Cost	-	-
Recommendation	✗	✓

Legend:	✗ - Poor Performance	- Neutral Performance	✓ - Good Performance

The Analysis and Evaluation Report provides additional detail for the evaluation of alternatives and is available upon request.





Evaluation of Cross Section Alternatives

Six (6) cross section alternatives were evaluated. **Alternative 3A is recommended based on the following:**

- Median provides traffic calming measures and limits left-turn movements causing traffic delays and reduced safety;
- MUP is recommended on the south where largest number of pedestrian and cyclist trips will be;
- Provides opportunity for traffic calming elements with a bulb-out to the south;
- Median allows staged crossing for future MUP crossing fromsouth woodlot trail to future Leslie Drive trail connection; and
- MUP provides cyclists some separationfrom traffic; therefore, additional ROW required for buffered bike lanes is not required (i.e. Alternative 3B).

Traffic Calming Alternatives

Some potential Traffic Calming Measures could typically include:

Vertical deflections such as:

- Speed humps/cushions, or
- Raised crosswalks

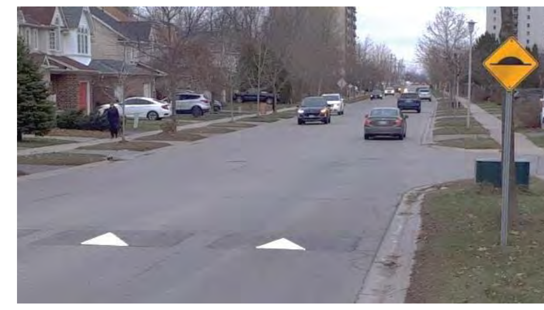
Narrowing the roadway by:

- Reducing lane widths, or
- Providing a centre median

Horizontal deflections such as:

- Use of chicanes, or
- Median bulb-outs

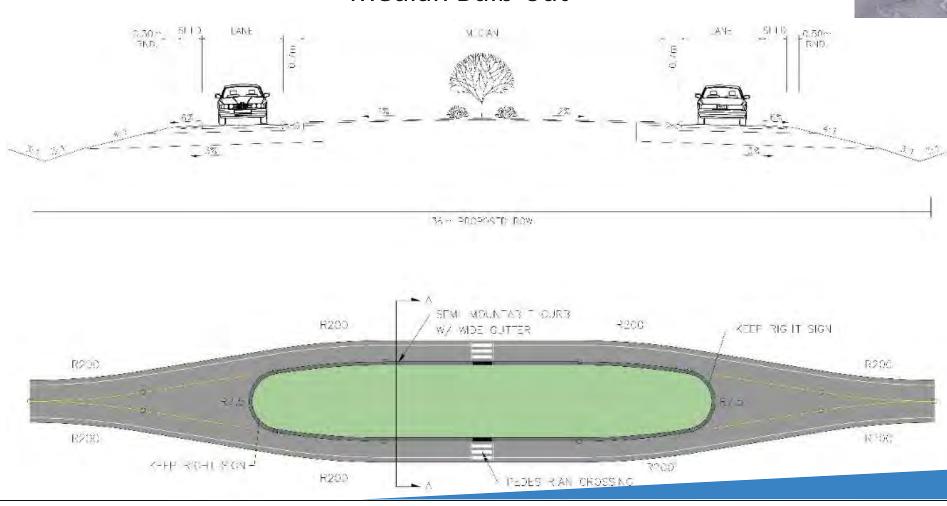
Vertical Deflections (Speed Humps)



Narrowing Roadway (Median)

Chicane

Median Bulb-out



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Evaluation Traffic Calming Alternatives

Criterion	Do Nothing (Baseline)	Vertical Deflections (speed humps/cushions)	Horizontal Deflections (chicane)	Horizontal Deflections (teardrop/asymmetrically tapered median bulb-out)
Transportation – Traffic Operations	X	✓	✓	✓
Transportation – Safety including Access to Residential Properties	X	✓	✓	✓
Transportation – Safety for Pedestrians and Cyclists	X	✓	X	✓
Transportation – Neighbourhood Connectivity	X	✓	✓	✓
Natural Environmental – Terrestrial (provide means for wildlife passage)	X	X	X	✓
Social Environment – Noise	X	X	✓	✓
Transportation – Access to Development	NA	-	-	✓
Recommendation	X	X	X	✓

Legend:	X - Poor Performance	- Neutral Performance	✓ - Good Performance

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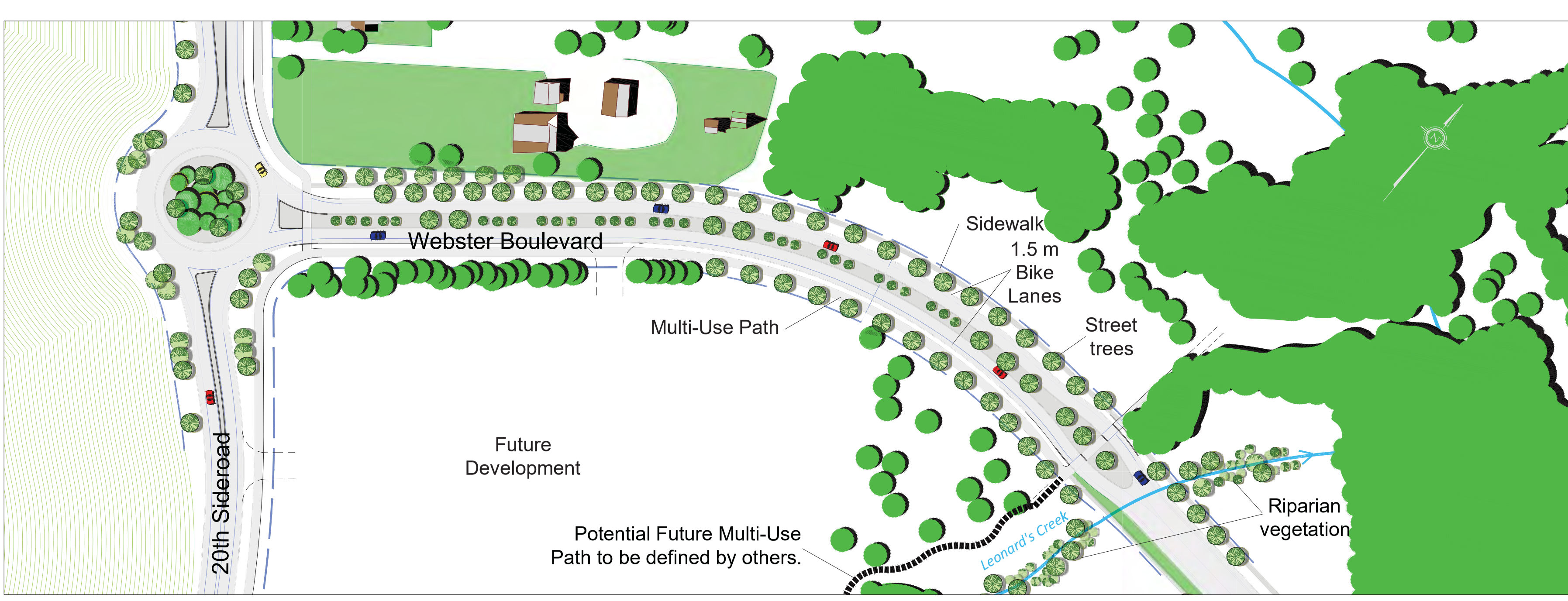
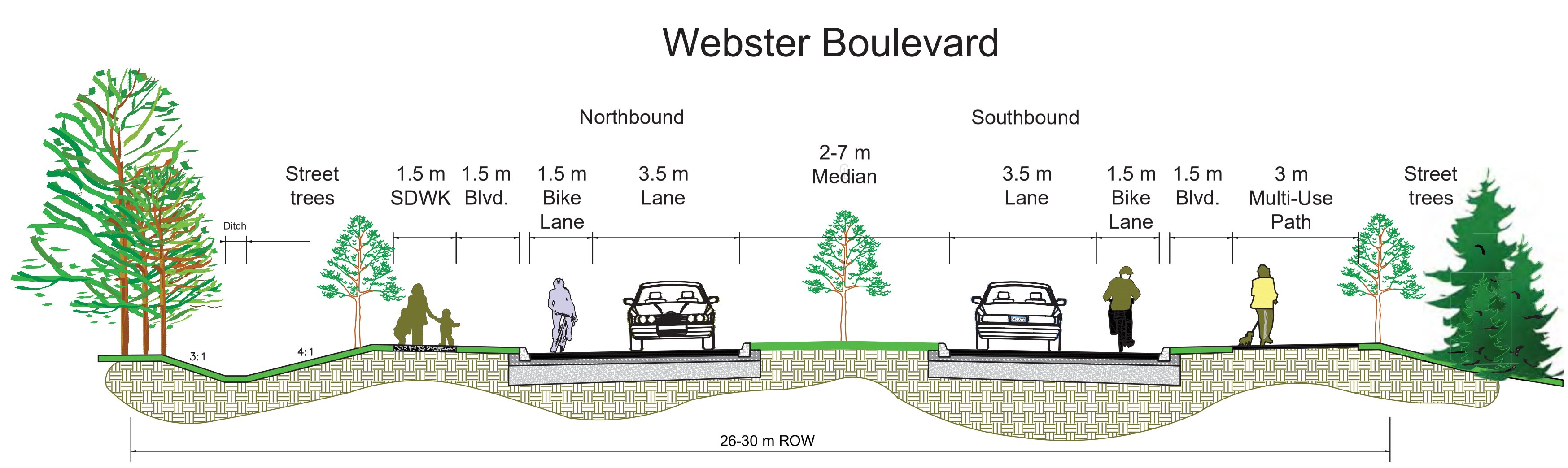
BTE 20-021
2021-03-10
Scale 1:1250

Webster Boulevard North Extension
Alternative B: Roundabout



Town of Innisfil
Webster Boulevard Extension
Technically Preferred Plan
March 2021 NTS



Town of Innisfil
Webster Boulevard Extension
Technically Preferred Cross Section
March 2021 NTS

BT ENGINEERING BTE

Effects and Mitigation Table

Potential Issue and Effects	Proposed Mitigation Measure/Commitment for Future Work
Decrease in water quality in Leonard's Creek from stormwater runoff.	The effects of water runoff from the new road are not expected to increase significantly.
Impacts to the woodlot and unevaluated wetlands.	The new road avoids impacts to both the woodlot and unevaluated wetland.
Provision for wildlife passage under the Webster Boulevard extension.	Opportunities for wildlife passage are being investigated for small wildlife through the culvert and large wildlife at the median bulb-out that provide refuge when crossing the road. Additional consultation with Lake Simcoe Region Conservation Authority is required.
Permits and approvals for the construction works.	Permits with LSRCA, MECP, MNRF and DFO will be obtained during detail design based on the final contract drawings.
In-water works during construction impacting the watercourse.	Construction will abide by applicable timing windows for in-water work (March 15 – July 15) and vegetation clearing.
Impacts to Species at Risk and loss of habitat.	Several SAR are known to occur in the Study Area and have been identified in previous studies, including the Eastern Wood-Pewee (Special Concern) and Butternut tree (Endangered). Unevaluated wetlands in the Study Area could provide local habitats for amphibian species. The Eastern Wood-Pewee may utilize the poplar woodland in the south part of the Study Area. Butternut trees were observed in the Leonard's Beach (Alcona North) Secondary Plan Area. Further surveys in appropriate seasons would be needed to confirm the presence/absence of these SAR and any others in the Study Area.
Climate Change and Flood Protection	Sizing of the culvert will be defined in detail design to accommodate future flood levels. Active transportation improvements have been included.
Impacts to property owners	Consultation with property owners has been ongoing. Compensation for property will be negotiated with property owners.

Effects and Mitigation Table

Potential Issue and Effects	Proposed Mitigation Measure/Commitment for Future Work
Air Quality and Greenhouse Gas Emissions.	The construction of the road extension is not expected to generate additional traffic volumes and therefore air quality changes and greenhouse gas emissions are not anticipated to increase.
Dewatering plans, excavation and sediment control plans, spill prevention plans, and stormwater management plans.	These plans will be developed during detail design, where applicable, in accordance with the Ontario Water Resources Act and Ontario Regulation 387-04.
Noise and vibration during construction.	The construction of the road extension is not expected to generate additional traffic volumes and therefore no noise level increases are expected. By-laws for construction noise and vibration will be followed by the contractor.
Archaeological impacts.	A Stage 1 Archaeological Assessment has identified the need for a Stage 2 archaeological assessment.
Areas of contamination.	The Study Area is considered to have low potential for contamination based on previous and current land uses.
Indigenous Peoples Rights and Treaties.	Indigenous Peoples communities will be informed of test pitting required for a Stage 2 Archaeological Assessment and will be invited to participate in the investigation. A summary of the Indigenous Peoples history in the area will be included in the Environmental Study Report. In the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, a Part II Order request may be requested.
Impacts to Highly Vulnerable Aquifers	No profile change that will require cut greater than 2 m.

Next Steps

Following this Public Open House we will:

- Review all Public Open House No. 2 comments and prepare a Summary Report
- Develop refinements to the Technically Preferred Alternatives (if required)
- Prepare the Environmental Study Report
- Initiate 30-day public review period of the Environmental Study Report

How can you remain involved in the Study?

- Request that your name/e-mail be added to the Study Mailing List
- Provide an online comment
- Contact the Town's representative or the consultant at any time. Contact information is available on the next exhibit.

Thank you for your participation in this online Public Open House.

Your input into this study is valuable and appreciated.

All information is collected in accordance with the *Freedom of Information and Protection of Privacy Act.*

For More Information Please Contact:

Steve Taylor BT Engineering Inc. Consultant Project Manager Email: steve.taylor@bteng.ca Phone: 905-709-4554	Suzanna Nilsson Town of Innisfil Project Manager Email: snilsson@innisfil.ca Phone: 705-436-3740 ext. 3260

Please submit any questions or comments to the contacts listed above by **April 9, 2021.**

Appendix B

Newspaper Notice

Innisfil

Notice of Public Open House No. 2
Town of Innisfil
Webster Boulevard North Extension Environmental Assessment

INTRODUCTION
The Town of Innisfil has retained BT Engineering Inc. to undertake an Environmental Assessment (EA) Study for the extension of Webster Boulevard from the existing terminus to 20th Sideroad. The Study has evaluated alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the Town of Innisfil Transportation Master Plan.

STUDY PROCESS
The Webster Boulevard North Extension EA Study is being conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015). The Transportation Master Plan previously completed Phases 1 and 2 of the Class EA; this Study has reviewed the previously completed phases and will complete Phases 3 and 4. The Study has considered all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and has proactively involved the public, stakeholders and Indigenous Peoples communities.

PUBLIC CONSULTATION

Study Design Report
The Study Design Report was finalized following Public Open House No. 1 and describes the study background, approach, process, alternatives and consultation program. The Final Study Design Report is available on the Town's website at: https://www.getinvolvedinnisfil.ca/websterblvd

Public Open House No. 2
Public Open House (POH) No. 2 will be held to present the Technically Preferred Plan and Effects and Mitigation Plan. The online POH will be held as follows:

> **Online Public Open House No. 2**
> **Date: Exhibits will be posted online from March 26 to April 9, 2021**
> **Location: Online at:** https://www.getinvolvedinnisfil.ca/websterblvd

COMMENTS
We request that POH No. 2 comments be sent to Steve Taylor or Suzanna Nilsson by **April 9, 2021**.

However, there is an opportunity at any time during the Class EA process for interested persons to provide comments. Early identification of individual and group concerns greatly aids in addressing these concerns. All information will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* (2009). With the exception of personal information, all comments will become part of the public record. Persons will be advised of future communication opportunities by electronic notice on the Town Website, in addition to newspaper public notice.

For more information, or if you wish to be removed from or placed on the study's mailing list, please contact either:

Steve Taylor, P.Eng., EA Project Manager
BT Engineering Inc.
9040 Leslie Street, Unit #218 • Richmond Hill, ON L4B 3M4
Tel: 905-709-4554
Email: steve.taylor@bteng.ca

Suzanna Nilsson, P.Eng., Project Manager
Town of Innisfil
2101 Innisfil Beach Road • Innisfil, Ontario L9S 1A1
Tel: 705-436-3740 ext. 3260
Email: snilsson@innisfil.ca

Innisfil

Notice of Public Open House No. 2
Town of Innisfil
Webster Boulevard North Extension Environmental Assessment

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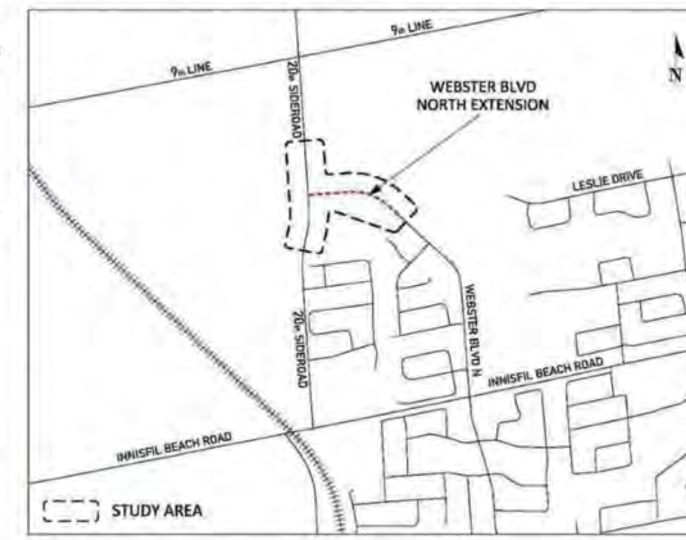

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BT Engineering Inc.
9040 Leslie Street, Unit #218 • Richmond Hill, ON L4B 3M4
Tel: 905-709-4554
Email: steve.taylor@bteng.ca

Suzanna Nilsson, P.Eng., Project Manager
Town of Innisfil
2101 Innisfil Beach Road • Innisfil, Ontario L9S 1A1
Tel: 705-436-3740 ext. 3260
Email: snilsson@innisfil.ca

Appendix C

Comment Sheets

BT ENGINEERING

BTE

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS

April 9, 2021

Suzanna Nilsson
Town of Innisfil Project Manager
2101 Innisfil Beach Road
Innisfil, ON L9S 1A1

Steve Taylor
Consultant Project Manager

Dear Ms. Nilsson and Mr. Taylor:

Re: Webster Boulevard Extension Environmental Assessment Comments
Crisdawn Construction Inc.
[redacted]

We represent [redacted] who own lands located [redacted] upon which the extension of Webster Boulevard is proposed. We are writing to provide comments in response to your Environmental Assessment Study Class EA notice.

The Owner supports the technically preferred alternative, and they ask that you consider the following:

1. Please review all reasonable alternatives to minimize land needs.
2. In the absence of any traffic/transportation technical reasons, please reduce the length of the median to approximately 1/3rd its current length. For discussion purposes we ask that you consider terminating the median at the east property limit of 2351 20th Sideroad.
3. Please consider reducing the width of the median on Webster, similar to the widths of the medians on the 20th Sideroad.
4. Please review the opportunities for additional ROW reductions due to redundancy of having both on-street bike land and MUP. For example, could the MUP be reduced to a 1.5m sidewalk? This not only reduces ROW but provide less confusion regarding cyclist routing. Refer to Figure 1.
5. Please incorporate the bike lane into the roundabout. The Owner's engineer has found that typically bike lanes get bumped up and squeezed onto the boulevard to go around the roundabout in conjunction with the pedestrian crossing. Refer to Figure 1.
6. Request three additional access points as shown on the attached plan.

The Owner reserves the right to review and provide input into the detailed designs that will be prepared for the Webster Boulevard extension. Input could include such matters as grading and potentially incorporating servicing within the Webster ROW to accommodate future development and avoiding impacts within a newly constructed road. We ask that you provide us with detailed design information as soon as it is available.

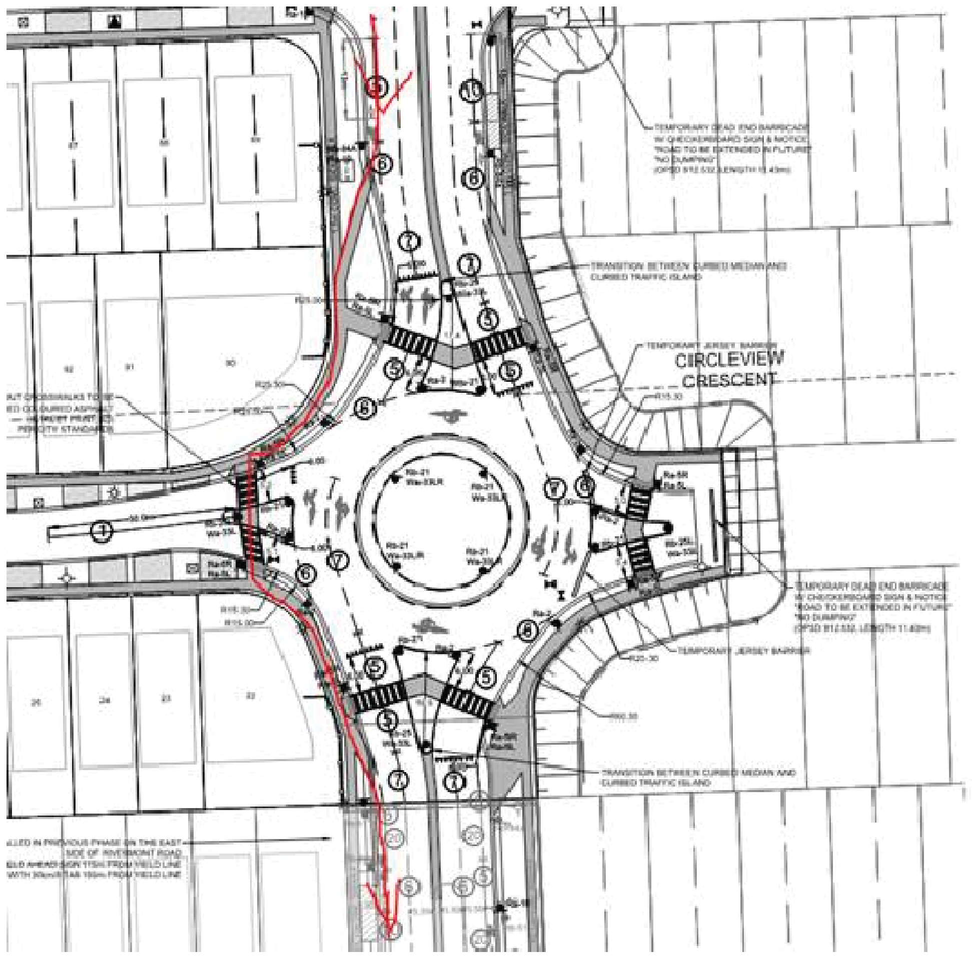
We look forward to the review of these comments and if you have any questions or require additional information, please contact me.

Sincerely,

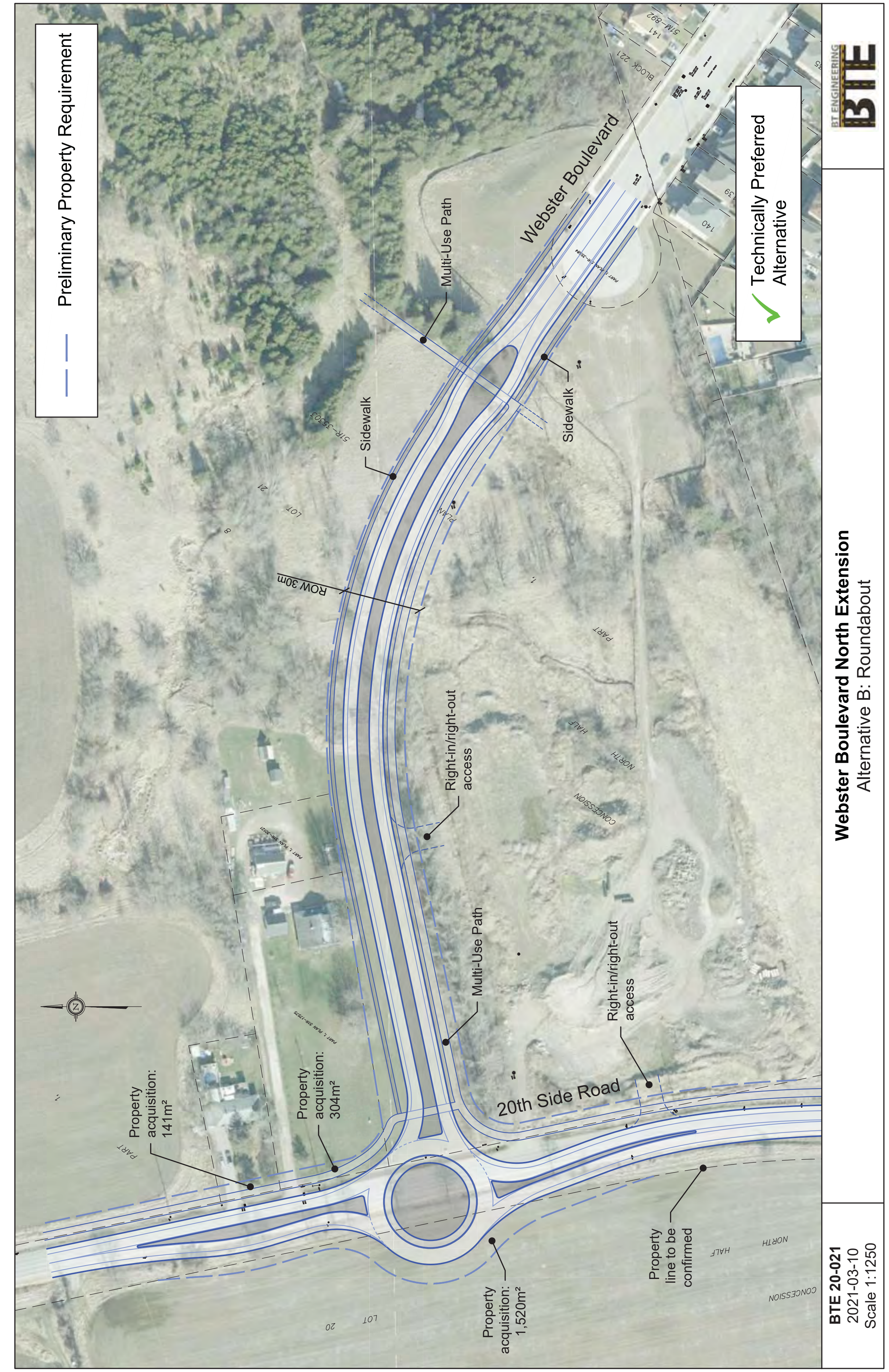
[redacted]

c. [redacted]

Figure 1: Brampton Roundabout Designed by RJ Burnside



[redacted]



[redacted]

[EXTERNAL]

Where would one find information on the park that was to be built within the study area of the Webster extention.

Thanks in advance for the info.

[redacted]

Sent from my Samsung Galaxy smartphone.

Re: Open House No.2 Innisfil Webster Boulevard Environmental Assessment - Public Notice

[redacted]

Fri 2021-04-09 11:22 AM

To: [redacted]

Good morning Steve,

Thank you for contacting me regarding the Second Public Open House.

After viewing the exhibits which look very nice, my husband and I have a few questions.

1. property has 1 exit to 20th sideroad. With the addition of the median, we are forced to turn right. We would like to know if an additional exit/entry facing Webster could be added?

2. [redacted] I am very concern about cars presently refusing to stop when the school bus signaling to stop. In the afternoon drop-off is done on the west side of 20th Sideroad (across our property). With the enlargement and new median, 20th sideroad will become a danger [redacted] specially with cars already refusing to stop. A new entry/exit to our property on Webster might be an option for the bus drop-off and pick-up (This will have to be discussed with the bus company)

3. We have noticed a cross path on Webster before the roundabout going from north to south of 20th Sideroad. Will a stop sign be added?

4. Alternative B - Road and noise being very close to a fence will be needed for privacy. We would like to know who will cover the cost for a fence.

5. What is the estimate beginning and completion of this project?

Thank you,

[redacted]

Appendix D

Select Correspondence

Town of Innisfil, MEA Class EA Webster Blvd. North Extension,Commencement Notification Nov 27 2020

[redacted]
Tue 2021-07-13 3:14 M
[redacted]

3 attachments (3 MB)

Town of Innisfil, MEA Class EA,Webster Blvd. North Extension, Commencement.xlsx; 20-021 Innisfil Webster Blvd N Commencement OH and CC Notice Nov 19-20 QC.pdf; 20-021 Innisfil Webster Blvd Extension Study Design Report Nov 19-20 QC.pdf;

From: Gord Bell [mailto:gord.bell@bteng.ca]
Sent: November 27, 2020 11:02 AM
To: eanotification.cregion@ontario.ca
Cc: snilsson@innisfil.ca; 'Steve Taylor'; Darcie Dillon; 'Brenda Badham'; gord.bell@bteng.ca
Subject: Town of Innisfil, MEA Class EA Webster Blvd. North Extension,Commencement Notification Nov 27 2020

In accordance with MECP notification of project commencement, please find attached the following; MECP Project Information form and media Notice of Study Commencement. In addition, the draft Study Design has been also attached for your review and comment. The study team look forward to MECP's identification of Indigenous Peoples to be contacted. This will ensure the project's list of Indigenous Peoples has not missed any Community. The draft Study Design acknowledges the involvement of Indigenous Peoples but does not list them. In accordance with normal practise, this list is contained in the Indigenous Peoples Consultation Plan, an internal document.

BT ENGINEERING
BTE

Gord Bell
Senior Environmental Planner
937 Lincoln Drive
Kingston, Ont. K7M 4Z3
E-Mail: gord.bell@bteng.ca
Phone: 613-384-2438
[www.bteng.ca]www.bteng.ca

RE: Webster connection to 20 Sideroad

Suzanna Nilsson <snilsson@innisfil.ca>
Mon 2021-06-14 9:31 AM
To: [redacted]
Cc: Steve Taylor (Toronto) <steve.taylor@bteng.ca>; Darcie Dillon <darcie.dillon@bteng.ca>; Suzanna Nilsson <snilsson@innisfil.ca>

Good morning Stan,

Thank you for your comment on the Webster Extension EA. It has been forwarded to the EA consultant for inclusion in the Environmental Study Report. You are correct that both Leslie and Jans should be extended as well. These projects have been identified in the Town's Transportation Master Plan and the Secondary Plan for the area. The exact timing of their completion is unknown at this time.

Kind Regards,

Suzanna Nilsson, P.Eng.
Development Engineer
705-436-3740 Ext. 3260 | 1-888-436-3710 (toll free)

From: [redacted]
Sent: June 12, 2021 11:04 AM
To: Suzanna Nilsson <snilsson@innisfil.ca>
Subject: Webster connection to 20 Sideroad

[EXTERNAL]

Alternative plans for distributing traffic more evenly (part of a Porous Grid strategy) should include the planned extension of Jans north to 9th Line, and Leslie to 20th/Webster or 9th Line.

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS

June 15, 2021

Suzanna Nilsson
Town of Innisfil Project Manager
2101 Innisfil Beach Road
Innisfil, ON L9S 1A1

Steve Taylor
Consultant Project Manager

Dear Ms. Nilsson and Mr. Taylor:

Re: Webster Boulevard Extension Environmental Assessment (3rd Comment Letter)
Crisdawn Construction Inc.
Our File No: PRA-03334

We represent Crisdawn Construction Inc., who own lands located at the southeast corner of the 9th Line and 20th Sideroad upon which the extension of Webster Boulevard is proposed. We are writing further to the comment letters I provided previously on January 25th and April 9, 2021 and Steve Taylor's response of May 10, 2021.

We ask that you consider the following additional comments/requests in response to the May 10th letter:

1. **Webster Boulevard Median:** That the proposed median on Webster Boulevard terminate a maximum of 15 metres south-east of the proposed Multi-Use Path so as not to interfere with the potential extension of lots fronting onto Webster Boulevard up to the 30 metre setback from the watercourse.

2. **Webster Boulevard Access Points**: In point 6 of your letter, you ask that the future development on the lands be described that would use these entrances. Based on agreements previously signed with the Town and County concerning these lands, Crisdawn Construction Inc. expects that the boundary of Alcona will be expanded to the 9th Line which would permit a variety of urban commercial and residential land uses that would be subject to a detailed secondary plan. In the interim, it is essential that access points on both sides of the creek be provided to the lands for maintenance (i.e. lawn/weed control), and for future technical studies (i.e. geotechnical, hydrogeological, environmental, etc).

   We ask that the entrances shown in my April 9th letter be included in the EA document at this time. With respect to your proposed wording, future development on the lands should be subject to a traffic study and LSRCA and Town approval; however, we fail to understand the difficulty in providing for suitable access points to an existing property that is now going to be bisected by the Webster Boulevard extension.

We look forward to the review of these additional comments and if you have any questions or require additional information, please contact me.

Sincerely,
THE JONES CONSULTING GROUP LTD.

Ray Duhamel, M.C.P., MCIP, RPP
Partner

c. Don Pratt & Hugh Johnston

BT ENGINEERING
BTE

June 30, 2021
BTE File: 20-021

[redacted]
229 Mapleview Drive, Unit 1
Barrie, ON
L4N 0W5

Re: Webster Boulevard North Extension EA, Comment Response Letter
File No. PRA-03334

Dear [redacted]

Thank you for your comments/requests in response to BTE's May 10, 2021 letter. We are providing the following responses to your letter dated June 15, 2021.

ID No.	Comment	Response
1	**Webster Boulevard Median:** That the proposed median on Webster Boulevard terminate a maximum of 15 metres south-east of the proposed multi-use path so as not to interfere with the potential extension of lots fronting onto Webster Boulevard up to the 30 metre setback from the watercourse.	The EA commits that the termination of the median will accommodate driveways to future lots fronting onto Webster Boulevard. The driveway locations and median termination will be finalized in consideration of the land use plans for these lots.
2	**Webster Boulevard Access Points:** in point 6 of your letter, you ask that the future development on the lands be described that would use these entrances. Based on agreements previously signed with the Town and County concerning these lands, Crisdawn Construction Inc. expects that the boundary of Alcona will be expanded to the 9th Line which would permit a variety of urban commercial and residential land uses that would be subject to a detailed secondary plan. In the interim, it is essential that access points on both sides of the creek be provided to the lands for maintenance (i.e. lawn/weed control), and for future technical studies (i.e. geotechnical, hydrogeological, environmental, etc.). We ask that the entrances shown in my April 9th letter be included in the EA document at this time. With respect to your	Entrances are being shown on the Recommended Plan that can accommodate interim access to land to the north and south of Webster Boulevard. The driveway locations will be subject to further land use planning during the Secondary Planning phase. The EA commits to flexibility for access locations subject to serviceability studies during future land use planning.

	proposed wording, future development on the lands should be subject to a traffic study and LSRCA and Town approval; however, we fail to understand the difficulty in providing for suitable access points to an existing property that is now going to be bisected by the Webster Boulevard extension.	

Should you require any further assistance with this project please do not hesitate to contact us. The commitments contained in this letter will be included in the Environmental Study Report (ESR).

Yours truly,

Steve Taylor, P.Eng., M.Eng., CVS-Life
Consultant Project Manager, BT Engineering Inc.

cc: Suzanna Nilsson, Town of Innisfil Project Manager

Appendix E

Natural Environment Memorandum

BT ENGINEERING

9040 Leslie Street, Unit 218
Richmond Hill, ON L4B 3M4

MEMORANDUM

TO:	File	REPORT DATE:	October 21, 2020 (Revised November 23, 2020)
CC:	Steve Taylor, Darcie Dillon, BTE	BTE PROJECT #:	20-021
SUBJECT:	Webster Boulevard North Extension EA Town of Innisfil		
	Site Inspection – October 8, 2020		

An inspection of the project site immediately north of the Webster Boulevard North cul-de-sac for a proposed connection route to the 20th Sideroad was conducted on the morning of October 8, 2020. The Study Area is shown on **Figure 1– Study Area**, although the aerial photo is somewhat dated with most of the disturbance areas now overgrown. Much of the surrounding area has been disturbed in the past with grading and excavation activities, and an informal laneway leads to an abandoned sand pit in the northwest section.

The purpose of the inspection was to undertake a general review of the Study Area to identify and record natural environment features including possible fish habitat, wetlands and Species at Risk (SAR) habitats that may be impacted by the road extension.

Representative photographs of the Webster Boulevard North extension area are attached, including a photo index in **Attachment 2**.

Figure 1: Study Area

Aquatic Features

A small watercourse (Leonard's Creek, with nearby Lake Simcoe at its outlet) flows across the property from the edge of a wooded area and wetland pocket in the southwest which appears to be the source area, as indicated on **Figure 2– Natural Areas Mapping**. The water was flowing clear and cold at a small culvert on the pit access laneway, and this reach of stream would appear to support good quality fish habitat. The upper portion of the 0.5 m wide channel flows through meadow before it enters a dense growth of cedars. Within this easterly wooded area, a tributary from the northwest joins the main channel.

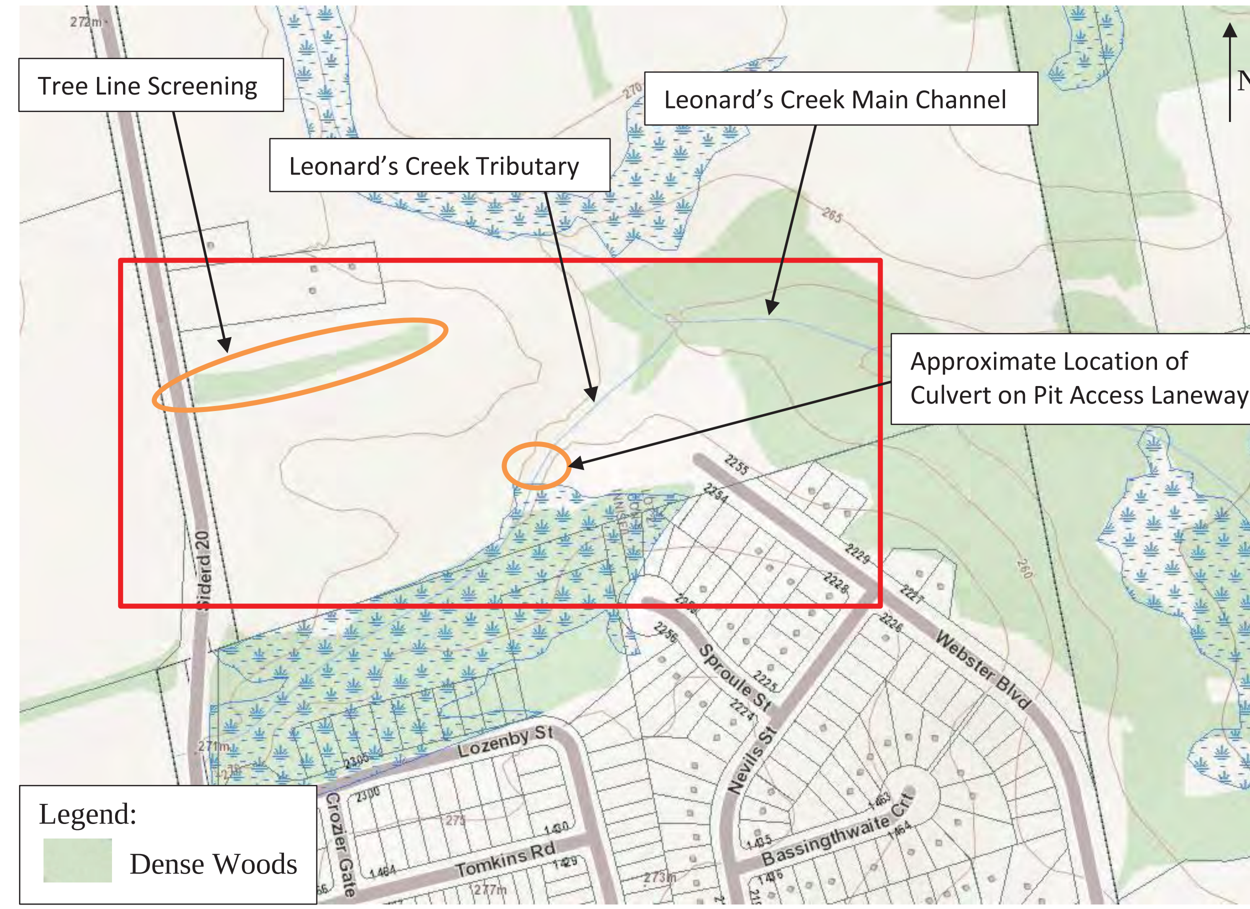


Figure 2: Natural Features

Terrestrial Features

Woodlands in the Study Area were found to be a mixture of mature poplar, shrub willow, and dense White Cedar. Poplar dominated woodlands, which are identified as unevaluated wetland in Provincial mapping, occur along the south boundary as a large woodlot, and to the north as a tree line screening a residence on 20th Sideroad from the pit. These poplar woodlands/swamps are successional and contain no significant features (i.e. SAR) that could be observed at the time of the site visit. Eastern White Cedar dominated conifer woodland is found to the northeast along the valleylands of headwater tributaries of Leonard's Creek.

The preferred alternative alignment for Webster Boulevard will cross a narrow band of forb meadow marsh associated with a small Leonard's Creek headwater channel, which continues northeast/east to a convergence with another headwater tributary from the north. The remainder of the area includes the previously described pit area, which contains cultural meadow and small pockets of scrub thickets and treed areas.

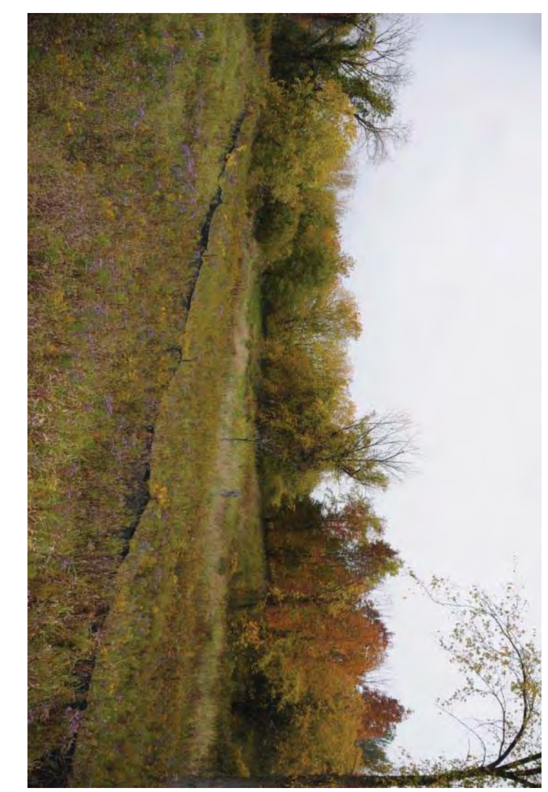
Several SAR are known to occur in the Study Area and have been identified in previous studies, including the Eastern Wood-Pewee (Special Concern) and Butternut tree (Endangered). Unevaluated wetlands in the Study Area could provide local habitats for amphibian species. The Eastern Wood-Pewee may utilize the poplar woodland in the south part of the Study Area. Butternut trees were observed in the Leonard's Beach (Alcona North) Secondary Plan Area. Further surveys in appropriate seasons would be needed to confirm the presence/absence of these SAR and any others in the Study Area.

Per: Rudi Warmé, P.Eng., Biological Engineer
Kyle Fleming, Terrestrial Ecologist

Attachment: 1. Site Photos
2. Photo Index

Attachment 1 – Site Photographs

View of the study area looking northwesterly (above). Looking south towards Webster Boulevard North cul-de-sac (below)

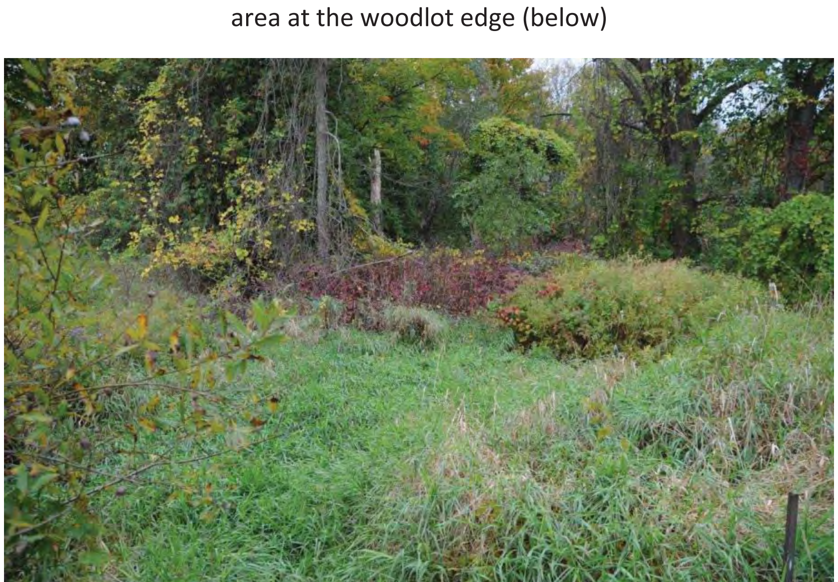


Leonard's Creek as it emerges from the woodlot (above). The channel enters a cedar grove where it merges with a tributary channel (below). Canary grass/forb wetland identifies the channel course

The laneway continues through the pit and connects with 20th Sideroad paralleling a row of Poplar (above and below)

Laneway connection with 20th Sideroad and cultivated lands across the road (above). A jog in the road can be seen to the south (below)

A clearly defined channel was apparent at a culvert under the laneway leading to the sand pit (above). Clear, cold water was flowing from this wet area at the woodlot edge (below)



A remnant laneway from earlier activities on the site leads to a worked-out sand pit (above) and rock pile (below)

An informal crossing immediately downstream of the tributary connection to the main channel of Leonard's Creek (above) and an adjacent wet forb meadow (below)

The channel flows down a rocky incline beneath the cedars before connecting with the main channel. It is difficult to determine whether fish passage is available

View north on 20th Sideroad (above). A farm residence is in the centre distance (below)

An identified heritage home (above) is located north of the row of poplars. A possible corridor extension is proposed immediately north of the poplars and adjacent to the heritage home (below)

Attachment 2 - Photo Index

Appendix F

Cultural Heritage Evaluation Report

ALCONA NORTH HERITAGE RESOURCE ASSESSMENT

NOVEMBER 15, 2011

FINAL REPORT

PREPARED FOR:

The Town of Innisfil

PREPARED BY:

BRAY Heritage

TABLE OF CONTENTS

ALCONA NORTH HERITAGE RESOURCE ASSESSMENT

Final Report

1 Introduction

1.1 STUDY PURPOSE AND FORMAT

Bray Heritage was retained by the Town of Innisfil to prepare a cultural heritage resource assessment as part of the Alcona North Secondary Plan study. The area contained within the Secondary Plan ("study area") has not been fully assessed for cultural heritage resources. Although AMICK Consultants prepared a Stage 1 archaeological assessment of the study area (March 2004) that identified areas of archaeological potential (including the known First Nations settlement Brassington site in Lot 23), their report made only passing reference to other types of cultural heritage resources. Their report provided historical information on properties within the study area as well as mapping of existing and former buildings and landscape elements, based on analysis of air photos and historical mapping.

The purpose of the report is to augment the Stage 1 archaeological assessment and identify and assess any *built heritage* or *cultural heritage landscape* resources that may exist in the Secondary Plan area, and to provide strategies for their conservation in the context of planning for the proposed redevelopment. Definitions of these terms are found in Section 2, below.

The following report contains an inventory and evaluation of buildings and landscapes in the agricultural lands slated for redevelopment. The Alcona North Secondary Plan area lies between the 8th and 9th line, east of Sideroad 20, and encompassing Lots 21 through 23 in the north half of Concession 8, Town of Innisfil, Simcoe County.

1.2 METHODOLOGY

The study is based on a combination of field survey and a review of existing documentation. Bray Heritage conducted field work in the study area in October, 2010. Buildings and landscapes were identified and photographed from the edge of the public roadway – a "windshield survey" – and properties were not examined at close range. For buildings, there was no detailed assessment of exterior or interior condition or building fabric. Landscapes were traversed where access lanes or trails permitted.

Several local histories provided background information on several of the properties, including historical photographs. Members of the Innisfil Historical Society contributed information on specific properties for which little other information existed. The AMICK study provided detailed land registry and census information for occupants of each property: this report summarizes their findings, where relevant to determining heritage value.

2 Heritage Planning Policies

2.1 PROVINCIAL CONSERVATION POLICIES

The purpose of planning for conservation of cultural heritage resources is to manage change in ways that keep and enhance those resources. In Alcona North, buildings and landscapes identified as having heritage value should be conserved and incorporated within new development, not only to commemorate key elements of the Town's history, but also to add variety, quality and, thus, value to the new development.

Heritage resource conservation is a requirement of Provincial planning legislation. Beginning with the over-arching planning policy, the 2005 Provincial Policy Statement (PPS), Section 2, Wise Use and Management of Resources, Sub-section 2.6, Cultural Heritage and Archaeology, states that:

> *2.6.1 Significant built heritage resources and significant cultural heritage landscapes shall be conserved.*

Key defined terms in this statement are described in the PPS as follows:

> *"Built heritage resource" means one or more buildings, structures, monuments, installations or remains associated with architectural, cultural, social, political, economic, or military history, and identified as being important to a community. These resources may be identified through designation or heritage conservation easement under the Ontario Heritage Act, or listed by local, provincial or federal jurisdictions.*

> *"Cultural heritage landscape" means a defined geographical area of heritage significance, which has been modified by human activities and is valued by a community. It involves a grouping(s) of individual heritage features such as structures, spaces, archaeological sites and natural elements, which together form a significant type of heritage form, distinctive from that of its constituent elements or parts. Examples may include, but are not limited to, heritage conservation districts designated under the Ontario Heritage Act, and villages, parks, gardens, battlefields, main streets and neighbourhoods, cemeteries, trailways and industrial complexes of cultural heritage value.*

> *"Significant" means, in regard to cultural heritage and archaeology, resources that are valued for the important contribution they make to our understanding of the history of a place, an event, or a people.*

This clause, and the defined terms within it, instructs municipalities to ensure the protection of valued parts of their domain. Significance has been taken to mean properties that have been listed on a municipal heritage register as properties of interest, or designated under Part IV or Part V of the *Ontario Heritage Act*. This mandate for conservation is reiterated by the *Ontario Planning Act* in which Section 2(d) reiterates the substance of the PPS statement. This section of the *Act* not only supports individual planning actions under the *Act* but also the policy statements, such as the PPS, issued under the *Act*.

2.2 TOWN OF INNISFIL HERITAGE POLICIES

The Town of Innisfil Official Plan (2006; OMB approved 2009/10) has specific policies for conservation of cultural heritage resources. Section 6: Cultural Heritage and Archaeology, contains the general goal "to protect cultural heritage resources which are important to the identity and character of the Town." Policy objectives speak to the need for identification, conservation and use of cultural heritage resources. The policies cover both those resources on the Town Heritage Register and those identified "through a heritage or archaeological analysis." The Plan goes on to require, as a condition of any Secondary Plan study, that "a heritage consultant shall be retained to identify buildings considered to be significant cultural heritage resources and significant cultural heritage landscapes and add these to the register" (6.9).

3 Inventory and Evaluation of Built Heritage Resources and Cultural Landscapes

3.1 GENERAL DESCRIPTION OF THE SECONDARY PLAN AREA

The Alcona North study area is an upland portion of the series of glacial terraces that slope eastwards towards Lake Simcoe. From 20th Sideroad, into Lot 21, the landscape is a series of small fields bordered by hedgerows of mature deciduous trees. Lot 22 has smaller fields located amongst regenerating forest. Small stream courses traverse both lots flowing to the southeast. Lot 23 is mostly gently sloping ground at the top of a significant slope – the former Lake Algonquin shoreline – at the bottom of which is a larger streamcourse flowing southeast. In this Lot are larger fields with mature hedgerows, and a large woodlot in the southeast corner.

Innisfil Township developed once the Penetanguishene Road gave access north from the early settlements along the north shore of Lake Ontario. Lands along the west side of Lake Simcoe were surveyed in 1820 and the first settlers began arriving soon after. The Alcona North study area developed later than lands closer to main roads or the shoreline, beginning in the 1830s. The development pattern was one of individual farmsteads, usually of at least 100 acres, spread along the developing road network. No permanent settlements developed here. Most of the subject properties within the study area appear to have been owner-operated farms at least until after the Second World War, after which time they began to be consolidated into larger farm operations and, eventually, sold for development.

One distinguishing feature of early development in this part of Innisfil is the role of the so-called "Dalhousie" settlers. These were a group of Scottish weavers from the Glasgow area who were strong supporters of the Reform movement in Britain in the 1830s. Frustrated by the lack of political reform at home, a group of families opted to emigrate to Canada in hopes of gaining more political freedom. They initially settled in Dalhousie Township in Lanark County but the land there is generally unsuited to farming and they moved on to Innisfil. One of these families, the Jacks, settled in the subject area and, through purchase and inter-marriage with other nearby families, eventually became one of the largest local landowners.

3.2 PRELIMINARY EVALUATION OF HERITAGE SIGNIFICANCE

Since the time of the AMICK study in 2004, the Town of Innisfil has completed a Heritage Register of properties of cultural heritage interest. No properties within the Alcona North study area appear on the current list. The following inventory addresses other built heritage resources and cultural landscapes that have potential heritage value. Some properties have already had some assessment in the AMICK report in terms of estimated date of construction and history of property ownership; this study updates and expands that work.

The rating system used here uses the same three categories as that used by Unterman McPhail in their 2006 assessment of cultural heritage resources in lands that are now included in the Alcona South Secondary Plan area, with modifications to reflect the presence of the Town's Heritage Register. In this system, a High rating indicates that the property should be designated under the *Ontario Heritage Act*; a Medium rating indicates that the property should be listed and considered for designation, if further research warrants it, and; a Low rating still indicates contextual value that contributes to the character of the area in which the property is situated, and thus the property should be considered for conservation if possible.

Areas of archaeological potential have not been assessed in this study. As noted in AMICK study (2004), the entire study area has moderate to high potential for as-yet-undiscovered archaeological remains; moderate for post-contact European types and high for pre-contact aboriginal. The Brassington site (North ½ of Concession 8, Lot 23) has already been identified as a significant First Nations archaeological resource. Stage 2 archaeological assessment of the study area is being undertaken as part of a separate study and the Brassington site will warrant more detailed archaeological analysis and conservation strategies.

3.3 BUILT HERITAGE AND CULTURAL LANDSCAPE HERITAGE RESOURCES IDENTIFIED WITHIN THE SECONDARY PLAN AREA

20TH SIDEROAD, EAST

Built Heritage Feature 1 – 2351 20th Sideroad

Built Heritage Feature - BHF 1

Street Address: *2351 20th Sideroad*

Lot: N ½ 21 Concession: 8 (Former Township of Innisfil)

2351 20TH SIDEROAD, AERIAL VIEW (SIMCOE COUNTY MAPPING)

Feature Type: Residence

Construction Period: Early 20th century

Construction Material: Frame, stuccoed

No. of Storeys: 1 ½

Roof Type/Material: Gable, asphalt shingle

Architecture Type: Vernacular, Gothic Revival

Alterations/Additions: Bay windows, shed dormer, outbuildings

HISTORICAL ASSOCIATIONS:

According to research into land registry and census records conducted by AMICK in their 2004 report (p. 24), the Crown Patent for the North Half of Lot 21, Concession 8 was issued to William McCullough, an Irish Protestant, on January 5, 1836. The other property transaction listed shows its sale to Alexander McCullough on October 22, 1839. The earliest year for tax assessment in the area, 1858, lists the McCulloughs as owners of the property. Although the 1861 census does not list the property, the 1871 Census notes 4 structures on the property and the 1891 Census shows a one storey frame house with ten rooms. This may be the structure described above.

OTHER COMMENTS: Associated with the early settlement period of Innisfil Township, landscape much altered from what may have been the original farm complex setting

HERITAGE RATING: Medium for house; Low for landscape (contextual value)

9TH LINE, SOUTH SIDE

Built Heritage Feature 2 – 1187 9th Line

Built Heritage Feature - BHF 2

Street Address: No. 1187 9th Line

Lot: N ½ 23 Concession: 8 (Former Innisfil Township)

1187 9TH LINE, AERIAL VIEW (SIMCOE COUNTY MAPPING)

Feature Type: Residence

Construction period: Early 20th century

Construction material: Frame

No. of Storeys: 2

Roof Type/Material: Hip gable (main block), shed (addition), asphalt shingle

Architecture type: Vernacular, Edwardian foursquare

Alterations/Additions: Much altered, one storey addition

HISTORICAL ASSOCIATIONS:

According to land registry and census information in the AMICK (2004) report (p. 25), the Crown Patent for the north half of Lot 23 was issued to Elizabeth Lount on March 13, 1822. It is likely that the land remained undeveloped until purchased by Joseph Goodfellow of Innisfil on July 12, 1860, since all previous transactions involved non-residents. The 1861 Census shows the Goodfellow family occupying a log shanty, but by the 1871 Census there are 5 properties shown. Joseph Goodfellow is shown as owner on the Census records until 1892, after which his son William Goodfellow is shown.

According to interview records found in a local history (Innisfil Historical Society, 2006, p. 149), Joseph and his brother Robert had adjoining farms (Robert's to the south of the subject property) and had log houses on the property by the 1860s. Joseph and his wife moved to Barrie in 1882 and sold the property to their oldest son, William. The interviewee (Mrs. Isabel (Goodfellow) Jacks, grand-daughter of Joseph), states that the original farmhouse (construction and design not noted) burned to the ground in 1925 and that the current house on the property was built and ready for occupation by 1927. The farm stayed in the Goodfellow family at least into the late 1950s: William's widow sold to her son Roy in 1952, and his son John lived on the farm until it was sold (date of sale not recorded here).

OTHER COMMENTS: part of one of the last surviving farmsteads in this study area, site contains cultural heritage landscape and archaeological resources. It has associations with one of the early families in Innisfil.

HERITAGE RATING: Low (BHF 2); High (CLU 1)

Cultural Heritage Landscape 1

Cultural Heritage Landscape CHL 1

Feature Type: Farm Complex

Associated Cultural Heritage Resources: Tree-lined entrance drive, mature hedgerows, streamcourse, woodlot, Brassington archaeological site (Iroquoian village)

Integrity: Good (trees on entrance drive beginning to deteriorate from age); new outbuildings have replaced former barn (lost to fire)

TREE-LINED ENTRANCE DRIVE

ROADSCAPES AND VIEWSCAPES

The study area still retains much of its rural character. 9th Line has a rural cross section, with gravel shoulders, open ditches, and mature trees lining the road, along with fences. Views east along this route show the terraced topography leading down to Lake Simcoe, and views near the eastern edge of the study area reveal views of the lake itself.

Views within the lands, particularly in Lots 21 and 22, show a traditional pattern of small fields bordered by mature deciduous trees in hedgerows.

3.4 PRELIMINARY EVALUATION OF HERITAGE POTENTIAL

Aside from the significant archaeological site, the cultural heritage resources of the study area are generally of contextual value. BHF 2 remains a working farm complex with a tenanted farmhouse, and BHF 1 is a modernized rural residence set in a manicured landscape. Due to the extent of modifications to this building, it is difficult to determine, from a roadside visual survey, to what extend original material remains and, thus, the age of the structure. On CLU 1 there are historical associations with occupation by early European families and by First Nations. 9th Line remains a rural road with most of its visual features intact.

4 Assessment of the Proposed Development

Schedule B16 of the proposed Secondary Plan for Alcona North (July 22, 2011 draft) shows the proposed distribution of land uses and the proposed approach to conservation of natural heritage resources. Cultural heritage resources are not included on this schedule but conservation objectives for such resources are addressed in policy text. Of relevance to cultural heritage resource conservation are Section 15.1.2 (l), which states general objectives, and Section 15.5, which provides policies for each type of cultural heritage resource. Section 15.9.4 outlines general objectives for addressing archaeological potential.

The proposed development will substantially alter the existing rural setting. Any remaining farms will be removed, the rural cross-section of 9th Line will be changed once it is widened as a collector road, and new low and medium density mixed use development will establish an urban character. Retained elements of the existing rural setting include woodlots, watercourses, hedgerows and views along the axis of the existing concession roads.

5 Conservation and Development Strategies

As stated in the Town of Innisfil Official Plan policies, the intent is to conserve significant cultural heritage resources and integrate them within new development. This can be easier said than done. What often works best is to ensure that landmark buildings are retained in situ, with their mature surrounding landscape intact, as character defining elements for new development. In addition, key landscapes and views should form the framework for new development by highlighting the visual qualities of the existing landscape. Using important aspects of the existing setting adds value to new neighbourhoods and provides design cues for new buildings and settings.

The following are heritage planning objectives for Alcona North:

- To integrate significant built heritage resources (farmhouses) into new development;
- To protect and incorporate within new development, where possible and feasible, surviving elements of the rural agricultural landscape (tree lines, fences, hedgerows, woodlots) associated with identified roadscapes and cultural landscapes.

Strategies for achieving these objectives include the following:

- Existing mature hedgerows dividing fields should be considered for retention and used to form a framework for development, where possible and feasible.

The July 22, 2011 Draft Secondary Plan for Alcona North contains policies supporting these objectives. Section 15.1.2 (I) provides the overall objective to "protect significant archaeological sites, significant built heritage resources and significant cultural heritage landscapes." Specific heritage conservation policies are contained in Section 15.5 Cultural Heritage: these policies generally support the objectives described above.

Based on the assessment of cultural heritage resources contained in this study, the following are recommendations to be considered for incorporation in the final Secondary Plan:

- Mapping in the Secondary Plan schedules should include the cultural heritage resources described in this study (e.g. on Schedule B16).

- Mapping and specification of the boundary of the Brassington Archaeological site, situated within CLU 1 at 1187 9th Line, is needed. The draft Secondary Plan schedules B16 and C4 appear to show a park on the approximate site of this significant First Nations archaeological resource. The exact location of the archaeological site and its extent must be determined before the final location and size of the proposed park, and the surrounding developable area, is confirmed. This information must be provided by an archaeological assessment conducted by a licensed archaeologist. Recommendations from that assessment will inform the detailed configuration of the layout for that development parcel. Designation of the site as a cultural heritage landscape under Part IV of the *Ontario Heritage Act* is also recommended. However, the site is a First Nations site and confidentiality protocols for such sites must be observed when undertaking mapping. This usually entails preparation of two maps; one for publication showing an area of archaeological potential, and another for internal use only showing the site boundaries and buffer zone.
- Depending upon the recommendations of the archaeological assessment, the archaeological resources of the site may also warrant further protection via a covenant or easement on title, registered with the Ontario Heritage Trust. Section 15.9.4 of the draft Secondary Plan should have additional policy text to address this known archaeological site. It is also assumed that First Nations consultation regarding the impact of the proposed development on the archaeological site will be undertaken.
- The proposed highway commercial area should integrate BHF 1 (rated Medium in this study) and locate the proposed collector road so as to avoid impacting this building.

Appendix 1: Historical References

Hunter, A.F. (1909) *A History of Simcoe County*. Barrie: The County Council.

Innisfil Historical Society (2006) *Farms of Innisfil: Challenges, Chores and Changes*. Altona, Manitoba: Friesens Corporation.

Township of Innisfil (1951) *Innisfil Township Centennial, 1850-1950: A Record of 100 Years of Progress (Historical Review)*. Barrie: Barrie Examiner.

Appendix G

Stage 1 and 2 Archaeological Reports

BT ENGINEERING
BTE

Stage 1 Archaeological Assessment
Municipal Class EA
Proposed Webster Boulevard North Extension
20th Sideroad to Webster Boulevard
Part of Lot 21, Concession 8
Former Geographic Township of Innisfil, Town of Innisfil
Simcoe County, Ontario

Submitted to

BT Engineering
9040 Leslie Street, Unit #218
Richmond Hill, ON, L4B 3M4

and

The Ontario Ministry of Heritage, Sport, Tourism and Culture Industries

Prepared by

Timmins Martelle Heritage Consultants Inc.

@ the Museum of Ontario Archaeology
1600 Attawandaron Road, London, ON N6G 3M6
Phone: (519) 641-7222 Fax: (519) 641-7220

Archaeological License: Matthew Beaudoin, Ph.D., P324
Our File: 2020-175
PIF Number: P324-0564-2020

February 2021
Original report submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries
16 February 2021

Executive Summary

A Stage 1 archaeological assessment was conducted as part of the Municipal Class EA for the proposed extension of Webster Boulevard to 20th Sideroad in the Town of Innisfil, Ontario. The project area is roughly 4.6 ha (11.5 ac) in size and located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. The Stage 1 project area consists of a roughly 350 m long by 50 m wide corridor to be used to determine the final route alignment. Timmins Martelle Heritage Consultants Inc. (TMHC) was contracted to undertake the Stage 1 assessment, which was conducted in accordance with the provisions of the *Environmental Assessment Act*. The purpose of the assessment was to determine whether there was potential for the discovery of archaeological resources within the project area.

The Stage 1 background study included a review of current land use, historic and modern maps, past settlement history for the area, and a consideration of topographic and physiographic features, soils, and drainage. It also involved a review of previously registered archaeological resources within 1 km of the project area, and previous archaeological assessments within 50 m of the project area. The background study indicated that the property had potential for the recovery of archaeological resources due the proximity (within 300 m) to:

1) watercourse (an unnamed stream);
2) reported archaeological sites (Popham map); and,
3) 19th century transportation routes (20th Sideroad).

Based on the information compiled in the background study and property inspection, the following recommendations are made:

1) The grassed areas within the project area, as shown on Map 13 (0.15 ha; 3.2%), are not obviously disturbed and retain archaeological potential. These areas will require Stage 2 assessment. In keeping with provincial standards, the unploughable land is recommended for test pit survey, using a 5 m transect interval.

2) The agricultural field within the project area, as shown on Map 13 (0.29 ha; 6.1%), is not obviously disturbed and retain archaeological potential. This area will require Stage 2 assessment. In keeping with provincial standards, the ploughable land is recommended for pedestrian survey, using a 5 m transect interval. As per Section 2.1.2, Standard 1.f (MTC 2011:32), if the project area within the agricultural field is less than 10 m wide it can be assessed via test pit survey.

3) The portions of the project area consisting of existing structures, paved roads, ditches and previous ground disturbance have been previously disturbed (0.42 ha; 9.0%) and are considered to no longer retain archaeological potential (Map 13).

These areas have been photo-documented and no further assessment work is recommended.

4) The portions of the project area previously assessed by AMICK in 2003 meet current MHSTCI standards, and no further archaeological assessment is recommended (3.81 ha; 81.0%) (Map 7, Map 13).

5) If the project area is changed to incorporate lands not addressed in this report, additional archaeological assessment may be required.

These recommendations are subject to the conditions laid out in Section 7.0 of this report and to the MHSTCI review and acceptance of this report into the Ontario Public Register of Archaeological Reports.

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Project Personnel

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Acknowledgements

TMHC would like to acknowledge the assistance of the following individuals:

Darcie Dillon *Partner*
BT Engineering Inc.

Steve Taylor *President*
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Stage 1 Archaeological Assessment
Municipal Class EA
Proposed Webster Boulevard North Extension
20th Sideroad to Webster Boulevard
Part of Lot 21, Concession 8
Former Geographic Township of Innisfil,
Town of Innisfil
Simcoe County, Ontario

1.0 PROJECT CONTEXT

1.1 Development Context

1.1.1 Introduction

A Stage 1 archaeological assessment was conducted as part of the Municipal Class EA for the proposed extension of Webster Boulevard to 20th Sideroad in the Town of Innisfil, Ontario. The project area is roughly 4.6 ha (11.5 ac) in size and located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. The Stage 1 project area consists of a roughly 350 m long by 50 m wide corridor to be used to determine the final route alignment. Timmins Martelle Heritage Consultants Inc. (TMHC) was contracted to undertake the Stage 1 assessment, which was conducted in accordance with the provisions of the *Environmental Assessment Act*. The purpose of the assessment was to determine whether there was potential for the discovery of archaeological resources within the project area.

All archaeological assessment activities were performed under the professional archaeological license of Matthew Beaudoin, Ph.D. (P324) and in accordance with the 2011 *Standards and Guidelines for Consultant Archaeologists* (MTC 2011). Permission to commence the study was given by Darcie Dillon of BT Engineering Inc.

1.1.2 Purpose and Legislative Context

The *Ontario Heritage Act* (R.S.O. 1990) makes provisions for the protection and conservation of heritage resources in the Province of Ontario. Heritage concerns are recognized as a matter of provincial interest in Section 2.6.2 of the *Provincial Policy Statement* (PPS 2020) which states:

> *development* and *site alteration* shall not be permitted on lands containing *archaeological resources* or *areas of archaeological potential* unless *significant archaeological resources* have been *conserved*.
>
> In the PPS, the term *conserved* means:
>
> the identification, protection, management and use of *built heritage resources*, *cultural heritage landscapes* and *archaeological resources* in a manner that ensures their cultural heritage value or interest is retained. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment and/or heritage impact assessment that has been approved, accepted or adopted by the relevant planning authority and/or decision-maker. Mitigative measures and/or alternative development approaches can be included in these plans and assessments.

The Environmental Assessment Act provides for the protection and conservation of the environment. In this case, the environment is widely defined to cover "cultural heritage" resources. Section 5(3)(c) of the Act stipulates that heritage resources to be affected by a proposed undertaking be identified during the environmental screening process. Within the EA process, the purpose of a Stage 1 background study is to determine if there are known cultural resources within the proposed project area, or potential for such resources to exist. Subsequently, it can act as a planning tool by identifying areas of concern that, where possible, could be avoided to minimize environmental impact. It is also used to determine the need for a Stage 2 field assessment involving the search for archaeological sites.

2.0 STAGE 1 ARCHAEOLOGICAL ASSESSMENT

2.1 Research Methods and Sources

A Stage 1 overview and background study was conducted to gather information about known and potential cultural heritage resources within the project area. According to the *Standards and Guidelines*, a Stage 1 background study must include a review of:

- an up-to-date listing of sites from the Ontario's Past Portal for 1 km around the project area;
- reports of previous archaeological fieldwork within a radius of 50 m around the project area;
- topographic maps at 1:10,000 (recent and historical) or the most detailed scale available;
- historic settlement maps (e.g., historical atlas, surveys);
- archaeological management plans or other archaeological potential mapping (when available); and
- commemorative plaques or monuments on or near the project area.

For this project, the following activities were carried out to satisfy or exceed the above requirements:

- a database search was completed through the Ministry of Heritage, Sport, Tourism and Culture Industries' (MHSTCI) Past Portal system that compiled a list of registered archaeological sites within 1 km of the project area (completed October 21, 2020);
- a review of known prior archaeological reports for the project area and adjacent lands was undertaken (note: the MHSTCI currently does not keep a publicly accessible record of archaeological assessments carried out in the Province of Ontario, so a complete inventory of prior assessment work nearby is not available);
- Ontario Base Mapping (1:10,000) was reviewed through ArcGIS and mapping layers provided by geographynetwork.ca; detailed mapping provided by the client was also reviewed; and
- historic maps and records related to post-1800 land settlement were studied.

Simcoe County has recently completed an archaeological management plan (ASI 2019), within which portions of the project area are shown as having archaeological potential. There are no heritage plaques within 300 m of the project area.

Additional sources of information were also consulted, including modern aerial photographs, local history accounts, soils and physiographic data provided by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), and both 1:50,000 (Natural Resources Canada) and finer scale topographic mapping.

When compiled, background information was used to create a summary of the characteristics of the project area, in an effort to evaluate its archaeological potential. The Province of Ontario (MTC 2011 – Section 1.3.1) has defined the criteria that identify archaeological potential as:

- previously identified archaeological sites;
- water sources;
  - primary water sources (lakes, rivers, streams, creeks);
  - secondary water courses (intermittent streams and creeks, springs, marshes, swamps);
  - features indicating past water sources (e.g., glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in topography, shorelines of drained lakes or marshes, cobble beaches);
  - accessible or inaccessible shoreline (e.g., high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh);
- elevated topography (e.g., eskers, drumlins, large knolls, plateau);
- pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground;
- distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases; there may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings;
- resource areas, including:
  - food or medicinal plants (e.g., migratory routes, spawning areas, prairie);
  - scarce raw materials (e.g., quartz, copper, ochre or outcrops of chert);
  - early settler industry (e.g., fur trade, logging, prospecting, mining);
- areas of early 19th-century settlement. These include places of early military or pioneer settlement (e.g., pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches and early cemeteries. There may be commemorative markers of their history, such as local, provincial, or federal monuments or heritage parks.
- early historical transportation routes (e.g., trails, passes, roads, railways, portage routes);
- property listed on a municipal register or designated under the *Ontario Heritage Act* or that is a federal, provincial, or municipal historic landmark or site; and
- property that local histories or informants have identified with possible archaeological sites, historical events, activities or occupations.

In southern Ontario (south of the Canadian Shield), any lands within 300 m of any of the features listed above are considered to have potential for the discovery of archaeological resources.

Typically, a Stage 1 assessment will determine potential for Indigenous and historic era sites independently. This is due to the fact that lifeways varied considerably during these eras so that criteria used to evaluate potential for each type of site also vary.

It should be noted that some factors can also negate the potential for discovery of intact archaeological deposits. Subsection 1.3.2 of the *Standards and Guidelines* indicates that archaeological potential can be removed in instances where land has been subject to extensive and deep land alterations that have severely damaged the integrity of any archaeological resources. Major disturbances indicating removal of archaeological potential include, but are not limited to:

- quarrying;
- major landscaping involving grading below topsoil;
- building footprints; and
- sewage and infrastructure development.

Some activities (agricultural cultivation, surface landscaping, installation of gravel trails, etc.) may result in minor alterations to the surface topsoil but do not necessarily affect or remove archaeological potential. It is not uncommon for archaeological sites, including structural foundations, subsurface features and burials, to be found intact beneath major surface features such as roadways and parking lots. Archaeological potential is, therefore, not removed in cases where there is a chance of deeply buried deposits, as in a developed or urban context or floodplain where modern features or alluvial soils can effectively cap and preserve archaeological resources.

2.2 Project Context: Archaeological Context

2.2.1 Project Area: Overview and Physical Setting

The project area is located between Webster Boulevard and 20th Sideroad north of Innisfil Beach Road in the Town of Innisfil, ON. The project area consists of a roughly 350 m long by 50 m wide corridor to assist in the planning of the eventual road alignment (Maps 1 to 3). The project area measures approximately 4.6 ha (11.5 ac) in size and is located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario and consists of Webster Boulevard, an open field, soil stockpile area, manicured lawn, 20th Sideroad and agricultural fields.

The project area falls within the Peterborough Drumlin Field, a rolling till plain covering an area of approximately 1,750 m^2 extending from Hastings County in the east to Simcoe County in the west (Map 4; Chapman and Putnam 1984:169-171). The region contains approximately 3,000 drumlins and a number of drumlinoid hills and eskers. Most of the drumlins in this field are orientated on an axis leading from the northeast to the southwest due to the direction of glacial ice movements over the till plain. South of Lake Simcoe, the inter-drumlin zones contain sand plains. The eskers within the Peterborough Drumlin Field contain gravel deposits that have been continually exploited as sources of road construction material (Chapman and Putnam 1984:169-170). Specifically, the project area falls within a till plain. There is a Glacial Lake Algonquin Beach located roughly 1 km to the east of the subject property.

Three soil types are present within the project area; Bondhead Sandy Loam in the west, and Smithfieldy Silty Clay Loam and Sargent Gravelly Sandy Loam in the east (Map 5). Bondhead sandy loam is a well-drained soil developed on till (Hoffman et al. 1962:27). Smithfieldy Silty Clay Loam is an imperfectly drained soil developed on calcareous, varved, silt loam and clay parent material (Hoffman et al. 1962:29). Sargent Gravelly Sandy Loam is a well-drained soil developed on pale brown parent material of outwash gravel material (Hoffman et al. 1962:28).

The project area lies within the Lake Simcoe drainage basin (Map 6). A large wetland is mapped south of the project area adjacent to the project area. An unnamed stream runs southwest-northeast through the project area and along the northeast edge of the project area.

2.2.2 Summary of Registered or Known Archaeological Sites

According to Ontario’s Past Portal maintained by the MHSTCI, there are three registered archaeological sites within 1 km of the project area (Table 1); however, upon detailed review two sites (BbGv-44 and BbGv-45) are further than 1 km away. The third site (BbGv-37) is mapped approximately 300 m southeast of the project area; however, based on the site information provided in PastPortal this site is actually located on Lot 1, Concession 9 over 11 km west of the project area.

There are two sites (BbGv-40 and BbGv-41) that were identified as located on the south half of Lot 21, Concession 8, and were within 1 km of the project area. These sites did not show up on the MHSTCI site data search, but are described in Section 2.2.3 of this report.

In addition to the registered archaeological sites, there are also known unregistered sites in the area. In the 1950s, Robert Popham (1950:82) identified 64 Indigenous village sites in Innisfil Township (10 post-contact, 32 Indigenous and 22 of undetermined age). Popham was working with detailed but unpublished data collected by Andrew F. Hunter, who travelled throughout old Huronia on his bicycle in search of Huron sites. Popham's map of Huron sites in Innisfil Township (1950:83) shows three archaeological assessments within 1 km of the project area, and the closest is located in the northwest corner of Lot 21, Concession 8., which is roughly 200 m to the northwest of the project area.

Table 1: Registered Archaeological Sites within 1 km of the Project Area

Borden Number	Site Name	Time Period	Site Type
BbGv-45	John Gordon	Post-Contact	Euro-Canadian
BbGv-44	John McConkey	Post-Contact	Euro-Canadian
BbGv-37	Kloosterman 1	Post-Contact	

2.2.3 Summary of Past Archaeological Investigations Within 50 Metres

During the course of this study, three previous archaeological investigations within 50 m of the project area were identified. However, it should be noted that the MHSTCI currently does not provide an inventory of archaeological assessments to assist in this determination.

Stage 1 & 2 Archaeological Assessment Loblaw's Properties Ltd. & Alcona Capital Properties Inc. – Archaeologix Inc. 2014 (SD Map 1)

In 2004, Archaeologix Inc. conducted a Stage 1 & 2 archaeological assessment for a proposed 50.5 acre development on part of Lot 21, Concession 8, Town of Innisfil. The Stage 2 assessment consisted of pedestrian survey and test pitting at a 5 m interval. Two archaeological sites were identified during the assessment: BbGv-40 and BbGv-41. BbGv-40 consisted of mid-19th century domestic material and was recommended for Stage 3 assessment. BbGv-41 consisted of mid to late 19th century domestic material that was not recommended for further assessment. Both sites are located roughly 600 m south of the current project area. The results of the Stage 1 and 2 assessment are presented in a report entitled *Archaeological Assessment (Stages 1 & 2) Application for Consent, Loblaws Properties Ltd. & Alcona Capital Properties Inc. Part of Lot 21, Concession 8, Town of Innisfil, Simcoe County, Ontario* (Archaeologix Inc. 2014, Licensee Jim Wilson, PIF P001-204).

Stage 1 & 2 Archaeological Assessment of D.G. Pratt Construction Subdivision – AMICK Consultants 2003 (Map 7)

In 2003, AMICK Consultants conducted a Stage 1 & 2 archaeological assessment for a proposed subdivision on the north half of Lot 21, Concession 8, Town of Innisfil. The Stage 2 assessment consisted of pedestrian survey and test pitting at a 5 m interval. No archaeological material was recovered during the Stage 2 assessment. The results of the Stage 1 and 2 assessments are presented in a report entitled *Report on the 2003 Stage 1-2 Archaeological Assessment of the D.G. Pratt Construction Subdivision, Part of North Half of Lot 21, Concession 8, Innisfil Township, County of Simcoe* (AMICK 2003, Licensee Marilyn Cornies, PIF P038-043).

Stage 1 to 3 Archaeological Assessment of the Alcona North Subdivision – AMICK Consultants 2004

In 2003, AMICK Consultants conducted a Stage 1 & 2 archaeological assessment for a proposed subdivision on the south half of Lot 21, Concession 8, Town of Innisfil. At least one site was documented, and a Stage 3 assessment was conducted. Unfortunately, we were unable to obtain a copy of this report for review. The report is entitled *Report on the 2003 Stage 1-3 Archaeological Assessment of the Alcona North Subdivision, Part of South Half of Lot 21, Concession 8, Innisfil Township, County of Simcoe* (AMICK 2004, Licensee Marilyn Cornies, PIF P038-042).

2.2.4 Dates of Archaeological Fieldwork

The property inspection was completed on November 27, 2020 by Kelly Gostick (R1189) under overcast and cool weather conditions.

2.3 Project Context: Historical Context

2.3.1 Indigenous Settlement in Simcoe County

There is archaeological evidence of Indigenous settlement in Simcoe County since the time of glacial retreat some 12,000 years ago through to the modern era. Although our knowledge of past Indigenous land use in the area is incomplete, using province-wide and region-specific data, it is possible to provide a basic summary of Indigenous settlement in Southern Ontario. The following sections provide a basic textual summary of the known general cultural trends and archaeological periods, and a tabular summary appears in Table 2.

Table 2: Cultural Chronology for Indigenous Settlement in the Simcoe County

Period			Time Range (circa)	Diagnostic Features	Complexes
Paleo	Early		9000 - 8400 B.C.	fluted projectile points	Gainey, Barnes, Crowfield
	Late		8400 - 8000 B.C.	non-fluted and lanceolate points	Holcombe, Hi-Lo, Lanceolate
Archaic	Early		8000 - 6000 B.C.	serrated, notched, bifurcate base points	Nettling
	Middle		6000 - 2500 B.C.	stemmed, side & corner notched points	Brewerton, Otter Creek, Stanly/Neville
	Late		2000 - 1800 B.C.	narrow points	Lamoka
			1800 - 1500 B.C.	broad points	Genesee, Adder Orchard, Perkiomen
			1500 - 1100 B.C.	small points	Crawford Knoll
	Terminal		1100 - 950 B.C.	first true cemeteries	Hind
Woodland	Early		950 - 400 B.C.	expanding stemmed points, Vinette pottery	Meadowood
	Middle		400 B.C. - A.D. 500	dentate, pseudo-scallop pottery	Saugeen
	Transitional		A.D. 500 – 900	first corn, cord-wrapped stick pottery	Princess Point
	Late		A.D. 900 - 1300	first villages, corn horticulture, longhouses	Glen Meyer, Pickering
			A.D. 1300 - 1400	large villages and houses	Uren, Middleport, Lalonde
			A.D. 1400 - 1650	tribal emergence, territoriality, first Europeans	Petun -Tionontati, Huron-Wendat, Odawa, Nipissing
Contact		Indigenous	A.D. 1700 - present	treaties, mixture of Indigenous & Settler items	Anishinaabe
		Settler	A.D. 1796 - present	English goods, homesteads	European settlement, pioneer life

Paleo Period

The first human populations to inhabit Ontario came to the region between 12,000 and 10,000 years ago, coincident with the end of the last period of glaciation. Climate and environmental conditions were significantly different then they are today; local environs would not have been welcoming to anything but short-term settlement. Termed Paleo by archaeologists, Ontario's first peoples would have crossed the landscape in small groups (i.e., bands or family units) searching for food, particularly migratory game species. In this area, caribou may have provided the staple of Paleo diet, supplemented by wild plants, small game, birds and fish. Given the low density of populations on the landscape at this time and their mobile nature, Paleo sites are small and ephemeral. They are usually identified by the presence of distinctive fluted projectile points, usually manufactured on high quality raw materials, including Onondaga chert from the Niagara Escarpment and Collingwood chert from Blue Mountains. Paleo sites

have commonly been found in association with relic glacial lakeshores throughout Ontario.

Archaic Period

The archaeological record of early Indigenous life in Southern Ontario indicates a change in lifeways beginning circa 10,000 years ago at the start of what archaeologists call the Archaic Period. Archaic populations are better known than their Paleo predecessors, with numerous sites found throughout Ontario. The characteristic projectile points of early Archaic populations appear similar in some respects to early varieties and are likely a continuation of early trends. Archaic populations continued to rely heavily on game, particularly caribou, but diversified their diet and exploitation patterns with changing environmental conditions.

A seasonal pattern of warm season river or lakeshore settlements and interior cold weather occupations has been documented in the archaeological record. Since the large cold weather mammal species that formed the basis of the Paleo subsistence pattern became extinct or moved northward with the onset of warmer climate, Archaic populations had a more varied diet, exploiting a range of plant, bird, mammal, and fish species. Reliance on specific food resources like fish, deer, and nuts becomes more pronounced through time and the presence of more hospitable environs and resource abundance led to the expansion of band and family sizes. In the archaeological record, this is evident in the presence of larger sites and aggregation camps, where several families or bands would come together in times of resource abundance. The coniferous forests of earlier times were replaced by stands of mixed coniferous and deciduous trees by about 6,000 years ago. The transition to more productive environmental circumstances led to a rise in population density. As a result, Archaic sites become more abundant over time. Artifacts typical of these occupations include a variety of stemmed and notched projectile points, chipped stone scrapers, ground stone tools (e.g., celts, adzes) and ornaments (e.g., bannerstones, gorgets), bifaces or tool blanks, animal bone and waste flakes, a by-product of the tool making process. Recent research has also documented the use of substantial semi-subterranean houses by the latter part of this period.

Early, Middle and Transitional Woodland Periods

Significant changes in cultural and environmental patterns are witnessed in the Early, Middle and Transitional Woodland periods (ca. 950 B.C. to A.D. 1,000). Occupations became increasingly more permanent in this period, culminating in major semi-permanent villages by roughly 1000 years ago. Archaeologically, one of the most significant changes by Woodland peoples is the appearance of artifacts manufactured from modeled clay and the emergence of more sedentary villages. The earliest pottery was crudely made by the coiling method and early house structures were simple oval enclosures. The Early and Middle Woodland Periods in Ontario are also characterized by the appearance of objects, raw materials, and tool forms from the Mississippi and Ohio

River valleys, as well as the development and elaboration of burial traditions, including the construction of commemorative mounds.

The Late Woodland

Beginning circa A.D. 1,000, the archaeological record in Southern and South-central Ontario documents the emergence of more substantial, semi-permanent settlements and the adoption of corn horticulture. These developments are most often associated with Iroquoian-speaking populations, the ancestors of the Wendat (Huron), Tionontati (Petun or Tobacco Nation) and Attawandaron (Neutral) nations, who were known to have resided in the province upon the arrival of the first European explorers and missionaries. Iroquoian villages incorporated a number of longhouses, multi-family dwellings that contained several families related through the female line. Precontact Late Woodland sites may be identified by a predominance of well-made pottery decorated with various simple and geometric motifs, triangular projectile points, clay pipes and ground stone artifacts. Sites post-dating European contact are recognized through the appearance of various items of European manufacture. The latter include materials acquired by trade (e.g., glass beads, copper/brass kettles, iron axes, knives and other metal implements) in addition to the personal items of European visitors and Jesuit missionaries (e.g., finger rings, stoneware, rosaries, glassware).

Historically, the Lake Simcoe environs formed part of the territory of the Wendat (Huron), a confederacy of groups that included the Attignawantan or Bear Nation of the Penetang Peninsula, the Tahontaenrat or Deer or White Lodge Nation of the southern village of Scanonaenrat, the Attigneenongnahac or People of the Cord (or Net) in the area of the Mount St. Louis Ridge, the Arendahronon or Rock Nation in the vicinity of Bass Lake and Lakes Couchiching and Simcoe and, after A.D. 1637, the Ataronchronon or People Who Dwelt Beyond the Fens, from the area associated with Northern Huronia near the mouth of the Wye and Sturgeon Rivers (JR 1959 13:61; 15:39, 17:87-89; 19:125, 167; 20:21). Numerous Wendat village and camp sites have been identified throughout Simcoe County, including near Barrie and Orillia where recent CRM investigations have occurred in advance of major urban and infrastructure expansion. These and earlier research-based investigations have revealed significant evidence of earlier populations whose settlement and material culture patterns are similar to Middle Late Woodland groups elsewhere in Ontario, or include unique ceramic “high collared” variants known as Lalonde that raise question regarding both *in situ* development of local Wendat populations and earlier migrations from points south and east of their late-16th and early-17th century settlement area.

The northernmost Iroquoian groups in Ontario – the Wendat and Tionontati - were heavily decimated by the mid-17th century by European-derived epidemic diseases and inter-tribal warfare. This encouraged a mass northern exodus of remnant Iroquoian populations out of historic Huronia.

The project area falls within the Lake Simcoe-Nottawasaga Purchase (Treaty no. 18) signed between the Crown and the Chippewas. The treaty was signed October 17, 1818 and covers a large tract of land between Lake Simcoe and Lake Huron. According to Surtees (1984:75-76), the Crown agent, William Claus, and the delegation of Chippewa chiefs led by Chief Musquakie (Yellowhead) agreed that in return for the land the Crown would provide an annuity of 1,200 pounds. Surtees (1984:76) notes that although hunting, fishing and other subsistence activities were not recorded as discussed, that Musquakie had asked that the Crown also encourage a doctor to settle in the area. This consideration was not included in the formal treaty document (Canada 1891[1992]). Treaty no. 18 is represented as a provisional agreement on the Williams Treaty First Nations’ website (https://williamstreatiesfirstnations.ca/pre-confederation-treaties/, accessed January 8, 2020) which notes that no known confirmatory surrender exists. It should also be noted that Indigenous oral accounts and written British accounts about treaties and negotiations may differ (see Williams 2018 for the Mississauga perspective of Treaty no. 20 – Rice Lake also signed in 1818).

2.3.2 19th Century and Municipal Settlement

Historically the project area falls within part of Lot 21, Concessions 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. A brief discussion of 19th century municipal settlement in these places and their historical predecessors is provided below, as a means of providing general context for understanding former land use and identifying features signaling archaeological potential.

Simcoe County

The lands that would become Simcoe County were obtained by the British Crown in 1818, when a 600,000 ha parcel encompassing parts of the current Simcoe, Grey and Dufferin counties was ceded by the Ojibway (Chippewa) (Anderson and Anderson 1984:40). Following this, plans were made to have the lands surveyed and opened for receiving immigrants. The County of Simcoe was officially formed in 1821. Some of its townships were surveyed as early as 1819, while others waited almost two decades longer (Anderson and Anderson 1984:18).

Township of Innisfil

Innisfil Township was first surveyed in 1820 and at that time incorporated the southwestern shore of Lake Simcoe, from West Gwillimbury northward to Kempenfelt Bay and Vespra (H. Belden & Co. 1881:14). Settlement was enhanced by the clearing of cedar swamps to make way for trails, roadways and the construction of homesteads. European settlement was slow until after 1831 when the area saw an influx of half-pay officers from the British army and navy (Hunter 1893:4). The population grew significantly shortly thereafter with the arrival of immigrants from Scotland and Northern Ireland. From this point on, the region underwent rather rapid expansion with the building of schools, churches, grist mills and postal outlets. The first sawmill in the area was established in Tollendal by George McMullen in 1823 (Innisfil Township Council 1951:7). Prior to this first influx of European settlers, the area had also been an important military thoroughfare, as ships made their way down the Nottawasaga River and along Kempenfelt Bay, where personnel could be dispatched along the military trail leading from the Bay to Penetanguishine (Hunter 1909:68).

A number of archival sources allow for a consideration of dates of settlement within the current project area. Sources considered include a listing by Hunter (1909) of settlers in Innisfil Township who arrived by 1837, land registry records, Irwin's Simcoe County Directory and Gazetteer for 1872-73, Hogg Map for the year 1871 (Map 9) and Belden's illustrated atlas for the year 1881 (Map 10).

Hunter's 1909 listing of early settlers in Innisfil Township indicates that the lot was not settled by 1837. The 1872 Gazetteer indicates the lot was inhabited by John Bruce (f) and William Ness (f). Land registry records indicate that the Crown Patent for the north half of Lot 21, Concession 8 was granted to William McCullough in 1836 and for the south half of the lot was granted to Thomas Wood also in 1836.

Review of Historic Maps and Imagery

The 1871 Hogg Map of Simcoe County (Map 9) shows that the north half of Lot 21 was occupied by A. McCullough and the south half was divided and occupied by W. Ness and J. Bruce. No structures are depicted on this map, but 20th Sideroad and Innisfil Beach Road are both depicted as open at that time. The 1881 historic atlas map (Map 10) does not show an owner associated with the lot, nor any structures on the lot. The Northern Railway is now present, running northwest to southeast approximately 300 m from the project area. It is acknowledged that the 1881 map shows few structures within the project area or the surrounding area. However, this is not necessarily a reflection of actual conditions at the time. Many atlases required a subscription to be paid to be illustrated in its pages, and so it is that many families simply chose not to subscribe.

Modern aerial photographs of Innisfil provide further information relevant to the historical development of the project area. A 2008 aerial (Map 11) illustrates that the southeast portion of the project area surrounding Webster Boulevard had been previously disturbed by grading and topsoil removal relating to construction of Webster Boulevard. The area south of the project area had been subject to topsoil stripping for the construction of a subdivision. The soil stockpile area is present at this time in the western portion of the project area. A 2016 aerial (Map 12) illustrates that the southeast portion of the project area now contains Webster Boulevard, sidewalks and residential structures. An area adjacent to Webster Boulevard appears to have been used as a staging area for machinery. The soil stockpile area in the western portion of the project area has been expanded by this time.

3.0 STAGE 1 PROPERTY INSPECTION

As the project area was in proximity to several features signaling archaeological potential, a Stage 1 property inspection was conducted to observe current conditions and evaluate the parcel's integrity.

The property inspection was conducted on November 27, 2020 in overcast and cool weather conditions. The weather conditions allowed for good visibility for the inspection of the surface features. The property inspection began at the northeast portion of the project area and proceeded counter-clockwise around the project area, and involved the recording and photo-documentation of the field conditions.

The southeast portion of the project area consists of Webster Boulevard, sidewalks, above and below ground utilities (Image 1), residential structures and an area of previous disturbance (Image 2). The grassed area northeast of Webster Boulevard is steeply sloped (Image 3) and had been previously disturbed (Maps 7 and 8). An undisturbed grassed area is present southeast of the stream (Image 4). A small stream and associated wetland are present northwest of Webster Boulevard (Images 5 and 6).

Northwest of the stream is a steeply sloped grassed area (Images 7 and 8). West of the sloped area consists of a residential property and a soil stockpile area. The residential property contains two structures and a large area of manicured lawn (Images 9 and 10). An open grassed area is also present east of the residential property (Images 11 and 12). A tree line separates the residential property from the soil stockpile area. The soil stockpile area consists of numerous large piles of soil and laneways throughout (Images 13 to 16). A ditch and above ground utilities are present adjacent to 20th Sideroad (Images 17 and 18).

The western portion of the project area consists of a ditch, right-of-way and agricultural field on the west side of 20th Sideroad (Image 19).

The results of our Stage 1 archaeological assessment, as well as the location and orientation of report photographs, are presented on Map 13. Map 14 depicts these results on the proponent mapping. The unaltered proponent map for the property is presented as Map 3.

Table 3: Documentary Records

Field Notes and Field Maps	Dated November 27, 2020
Photo Catalogue	Dated November 27, 2020 (48 digital photos)
Location of Records	1600 Attawandaron Road, London, Ontario N6G 3M6

4.0 ANALYSIS AND CONCLUSIONS

As noted in Section 2.1, the Province of Ontario has identified numerous factors that signal the potential of a property to contain archaeological resources. The Stage 1 background study included a review of current land use, historic and modern maps, registered archaeological sites and previous archaeological studies, past settlement history for the area and a consideration of topographic and physiographic features, soils and drainage. According to the map-based review and background research, potential for the discovery of archaeological sites is indicated by the proximity (within 300 m) to:

1) watercourse (an unnamed stream);
2) reported archaeological sites (Popham map); and,
3) 19th century transportation routes (20th Sideroad).

As the project area contained several features signaling archaeological potential, a Stage 1 property inspection was conducted to evaluate the current conditions of the project area and determine if any areas of archaeological potential remained intact within the project area. The Stage 1 property inspection visually confirmed that portions of the project area have witnessed prior disturbance, primarily relating to existing structures, paved roads and ditches (0.42 ha; 9.0%). The majority of the project area (3.81 ha; 81.0%) was previously subject to an archaeological assessment. As such, no further Stage 2 assessment is recommended for these lands. The remainder of the project area consisting of grassed land and an agricultural field is not obviously disturbed and retains archaeological potential and Stage 2 survey is recommended (0.44 ha; 9.3%). A 5 m transect interval is recommended to achieve the provincial standard.

5.0 RECOMMENDATIONS

Based on the information compiled in the background study and property inspection, the following recommendations are made:

1) The grassed areas within the project area, as shown on Map 13 (0.15 ha; 3.2%), are not obviously disturbed and retain archaeological potential. These areas will require Stage 2 assessment. In keeping with provincial standards, the unploughable land is recommended for test pit survey, using a 5 m transect interval.

2) The agricultural field within the project area, as shown on Map 13 (0.29 ha; 6.1%), is not obviously disturbed and retain archaeological potential. This area will require Stage 2 assessment. In keeping with provincial standards, the ploughable land is recommended for pedestrian survey, using a 5 m transect interval. As per Section 2.1.2, Standard 1.f (MTC 2011:32), if the project area within the agricultural field is less than 10 m wide it can be assessed via test pit survey.

3) The portions of the project area consisting of existing structures, paved roads, ditches and previous ground disturbance have been previously disturbed (0.42 ha; 9.0%) and are considered to no longer retain archaeological potential (Map 13). These areas have been photo-documented and no further assessment work is recommended.

4) The portions of the project area previously assessed by AMICK in 2003 meet current MHSTCI standards, and no further archaeological assessment is recommended (3.81 ha; 81.0%) (Map 7, Map 13).

5) If the project area is changed to incorporate lands not addressed in this report, additional archaeological assessment may be required.

These recommendations are subject to the conditions laid out in Section 7.0 of this report and to the MHSTCI review and acceptance of this report into the Ontario Public Register of Archaeological Reports.

6.0 SUMMARY

A Stage 1 archaeological assessment was conducted as part of the Municipal Class EA for the proposed extension of Webster Boulevard to 20th Sideroad in the Town of Innisfil, Ontario. The project area is roughly 4.6 ha (11.5 ac) in size and located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. The Stage 1 project area consists of a roughly 350 m long by 50 m wide corridor to be used to determine the final route alignment. The background research indicated that the project area was in proximity to features signaling archaeological potential and a Stage 1 property inspection was undertaken. The Stage 1 property inspection visually confirmed that portions of the project area have witnessed prior disturbance, primarily relating to existing structures, paved roads and ditches (0.42 ha; 9.0%). The majority of the project area (3.81 ha; 81.0%) was previously subject to an archaeological assessment. As such, no further Stage 2 assessment is recommended for these lands. The remainder of the project area consisting of grassed land and an agricultural field is not obviously disturbed and retains archaeological potential, and Stage 2 survey is recommended (0.44 ha; 9.3%).

7.0 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MHSTCI, a letter will be issued by the Ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

Should previously undocumented (i.e., unknown or deeply buried) archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* requires that any person discovering human remains must notify the police or coroner and Dr. Crystal Forrest, the Registrar of Burial Sites, War Graves, Abandoned Cemeteries and Cemetery Closures, Ontario Ministry of Government and Consumer Services. Her telephone number is 416-212-7499 and her e-mail address is Crystal.Forrest@ontario.ca.

8.0 BIBLIOGRAPHY

AMICK
2003 *Report on the 2003 Stage 1-2 Archaeological Assessment of the D.G. Pratt Construction Subdivision, Part of North Half of Lot 21, Concession 8, Innisfil Township, County of Simcoe* (AMICK 2003, Licensee Marilyn Cornies, PIF# P038-043). Report on file with the MHSTCI.

Anderson, Allan and Betty Tomlinson Anderson, eds.
1984 *Tecumseth Township: The Unforgettable Past*. Belleville: Mika Publishing Co.

Archaeologix
2014 *Archaeological Assessment (Stages 1 & 2) Application for Consent, Loblaws Properties Ltd. & Alcona Capital Properties Inc. Part of Lot 21, Concession 8, Town of Innisfil, Simcoe County, Ontario*. Licensee Jim Wilson, PIF P001-204. Report on file with the MHSTCI.

Archaeological Services Inc. (ASI)
2019 *County of Simcoe Archaeological Management Plan.*

Canada
1891 *Indian Treaties and Surrenders*. Volume 1: Treaties 1-138. Reprinted 1992. Fifth House Publishers, Saskatoon, SK.

Chapman L.J. and D.F. Putnam
1984 *The Physiography of Southern Ontario*. Third Edition. Ontario Ministry of Natural Resources: Ontario.

H. Belden & Company
1881 *Illustrated Historical Atlas of Simcoe County, Ontario*. Offset Edition, 1970.

Hoffman, D.W., R.E. Wicklund, and N.R. Richards
1962 *Soil Survey of Simcoe County, Ontario*. Report No. 29 of the Ontario Soil Survey. Research Branch, Canada Department of Agriculture and the Ontario Agricultural College.

Hogg, John
1871 *Hogg's Map of the County of Simcoe. Compiled and Published by John Hogg.*

Hunter, Andrew F.
1893 *Lake Simcoe and Its Environs.* Barrie: Office of the Barrie Examiner.

1909 *A History of Simcoe County. Volume II.* T.H. Best Printing Co. Ltd. Reprinted by the Historical Committee of Simcoe County in 1948.

Innisfil Township Council
1950 *A Record of 100 Years of Progress Historical Review.* Innisfil Township Centennial 1850-1950. Barrie.

Irwin, W.H.
1873 *Irwin's Simcoe Directory*. Reprinted in 1985 as *Gazetteer and Directory of the County of Simcoe including the District of Muskoka and the Townships of Mono and Mulmur for 1872-3* by the East Georgian Historical Foundation. Elmvale. Generation Press.

J.D. Barnes and First Base Solutions (SWOOP)
2010 Southwestern Ontario Ortho Imagery Project – Imagery for Southwestern Ontario.

Jesuit Relations (JR) = Thwaites, Reuben Gold, ed.
1959 *The Jesuit Relations and Allied Documents: Travels and Explorations of the Jesuit Missionaries in New France 1610-1791*. New York: Pageant Book Company.

Ministry of Natural Resources (MNR) & J.D. Barnes First Base Solutions
2010 Southwestern Orthoimagery Project – Mr. Sid Tiles for Southwestern Ontario.

Ministry of Northern Development and Mines (MNDM)
2007 *Physiography of Southern Ontario*. Chapman, L.J. and D.F. Putnam, authors. GIS map data layer distributed by the Ontario Geological Survey as Miscellaneous Release – Data (MRD) 228. Queen's Printer for Ontario.

Ministry of Tourism and Culture (MTC; now Ministry of Heritage, Sport, Tourism and Culture Industries)
2011 *Standards and Guidelines for Consultant Archaeologists.* Toronto.

Natural Resources Canada (NRC)
2012 *Barrie, Ontario*. 1:50,000 Scale Topographic Map. Section 31/D05 Electronic version.

Ontario Department of Mines and Northern Affairs
1972 *Physiography of the Southwest Portion of Southern Ontario*. Map 2225. Ontario.

Ontario Fundamental Dataset, Ministry of Natural Resources (2012) and CanVec Geospatial Database (2012)
2013 Base Mapping for the Province of Ontario.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
2006 GIS Layers for Soils and Physiography in the Province of Ontario.

Popham, Robert E.
1950 Late Huron Occupations of Ontario: An Archaeological Survey of Innisfil Township. *Ontario History* XLII(2):81-90.

Surtees, R.J.
1984 *Indian Land Surrenders in Ontario 1763-1867*. Indian Affairs and Northern Development, Government of Canada, Ottawa.

Williams, Doug (Gidigaa Migizi)
2018 *Michi Saagig Nishnaabeg: This is Our Territory*. ARP Books, Winnipeg, MB.

9.0 IMAGES

Image 1: Webster Boulevard and Utilities (looking northwest)

Image 2: Previously Disturbed Area (looking southeast)

Image 3: Grassed and Steeply Sloped Area (looking northwest)

Image 4: Grassed Area Southeast of Stream (looking southwest)

Image 5: Stream

Image 6: Stream and Wetland (looking southwest)

Image 7: Steeply Sloped Area (looking northwest)

Image 8: Steeply Sloped Area (looking north)

Image 9: Residential Property and Manicured Lawn (looking west)

Image 10: Manicured Lawn (looking east)

Image 11: Open Grassed Area (looking northwest)

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Image 13: Previously Disturbed Area – Soil Stockpile (looking southeast)

Image 14: Previously Disturbed Area – Soil Stockpile (looking southeast)

Image 15: Previously Disturbed Area – Soil Stockpile (looking east)

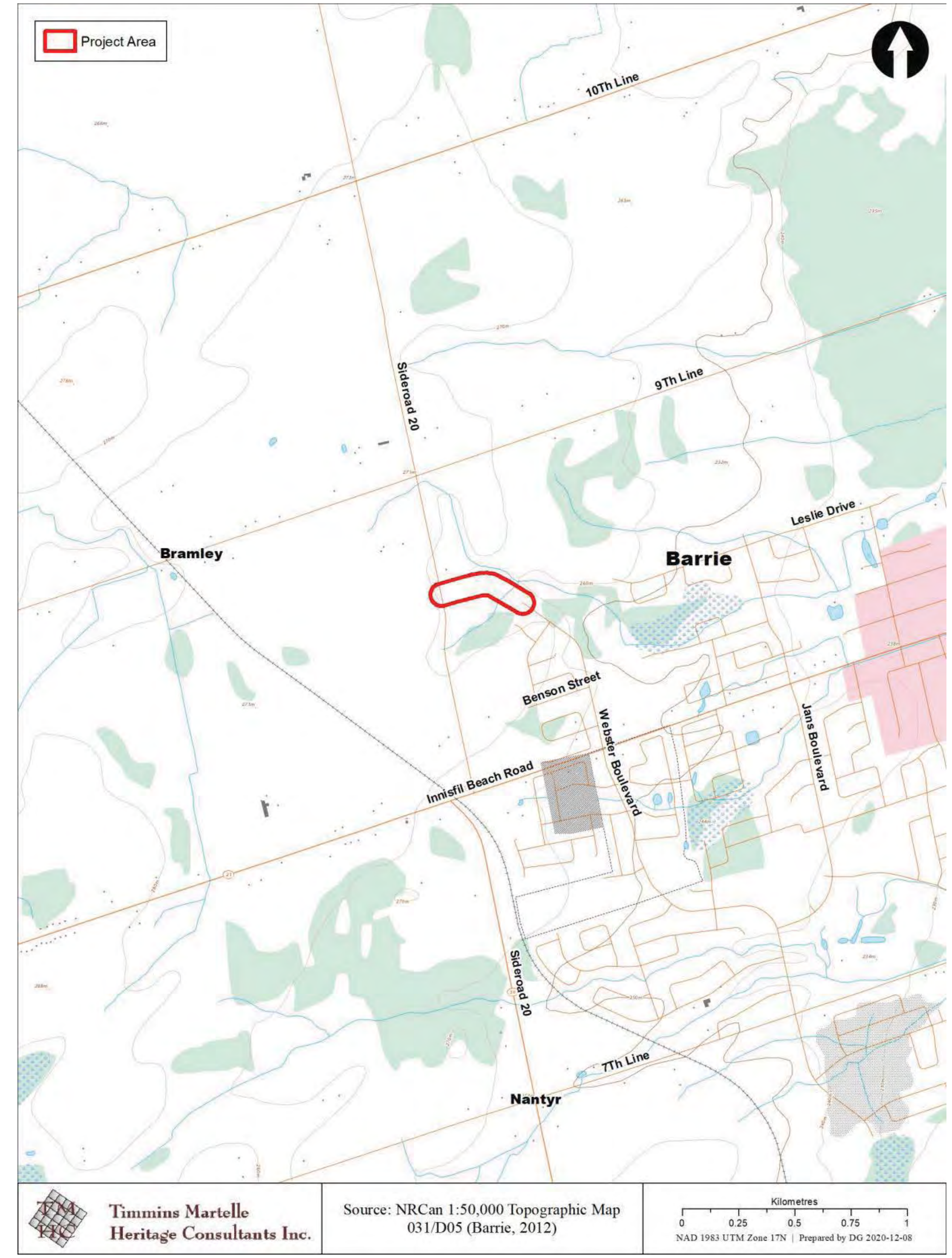
Image 16: Previously Disturbed Area – Soil Stockpile (looking west)

Image 17: Ditch and Above Ground Utilities (looking north)

Image 18: Ditch and Above Ground Utilities (looking south)

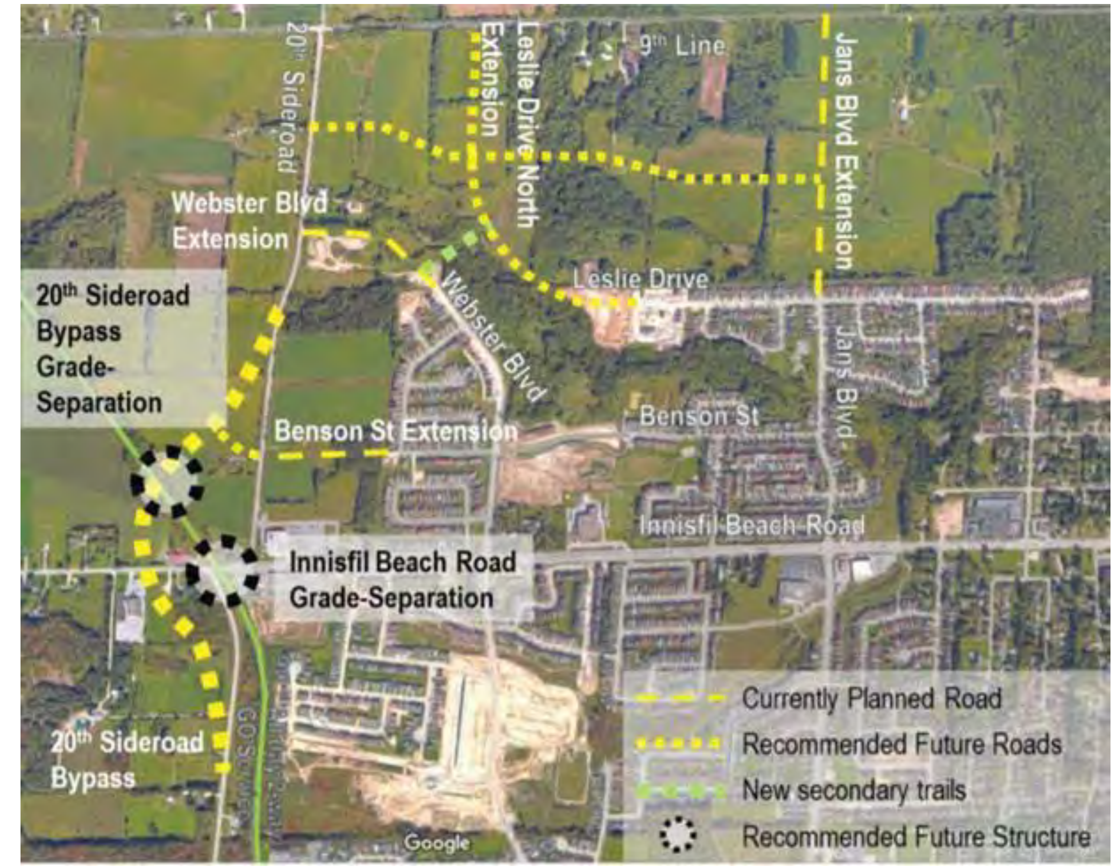
Image 19: Ditch and Agricultural Field (looking southwest)

10.0 MAPS

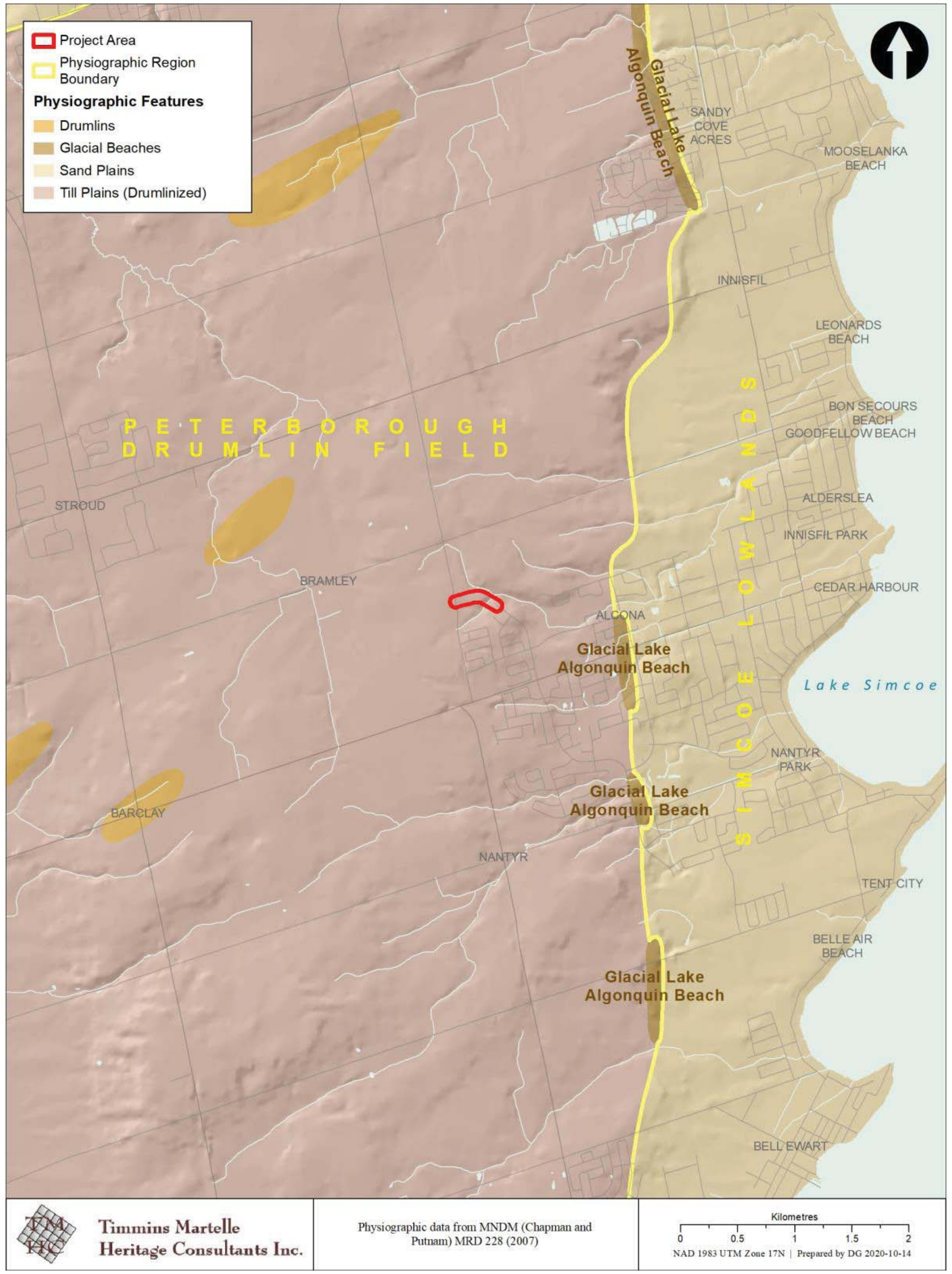


Map 1: Location of the Project Area in Innisfil, ON

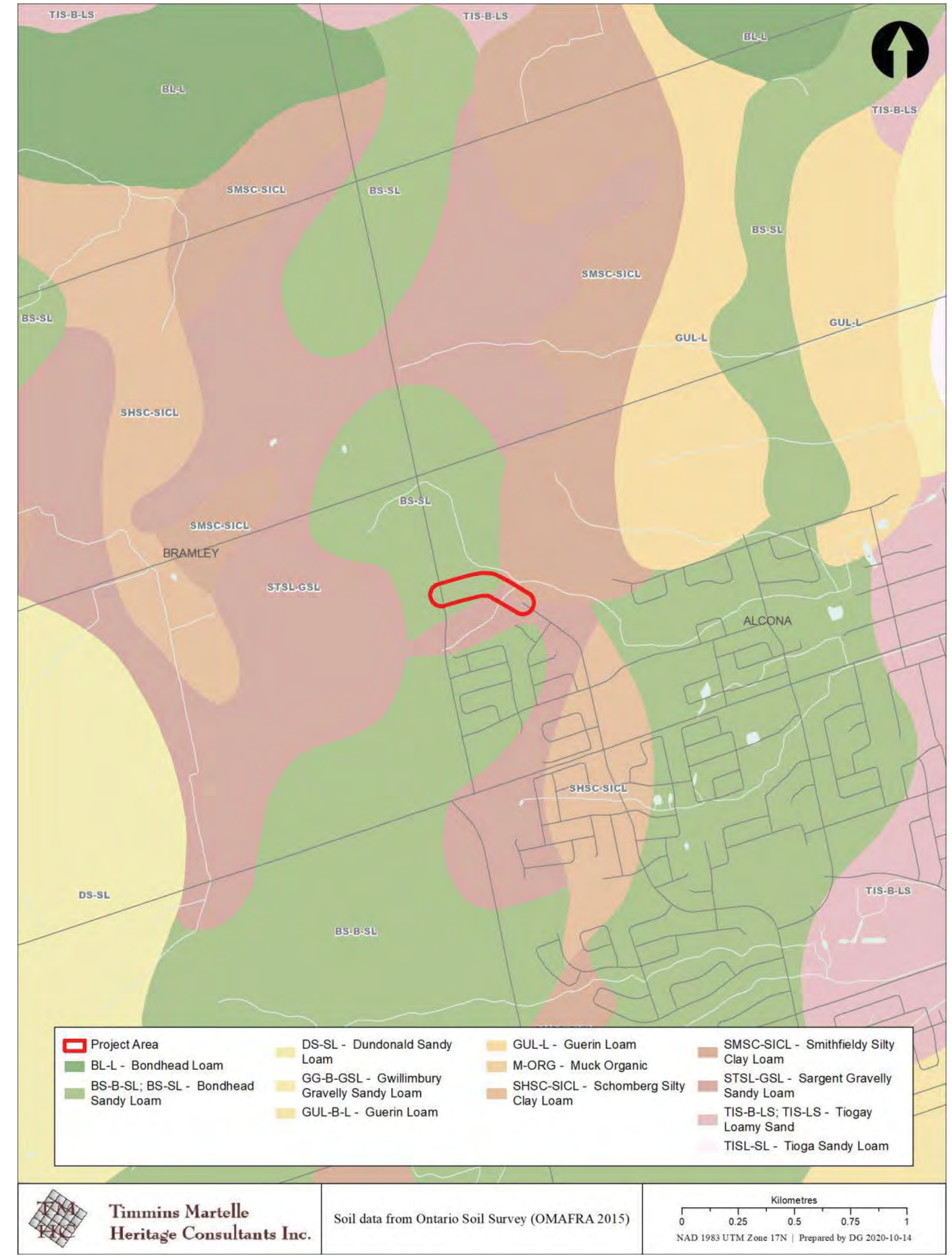
Map 2: Aerial Photograph Showing the Location of the Project Area in Innisfil, ON



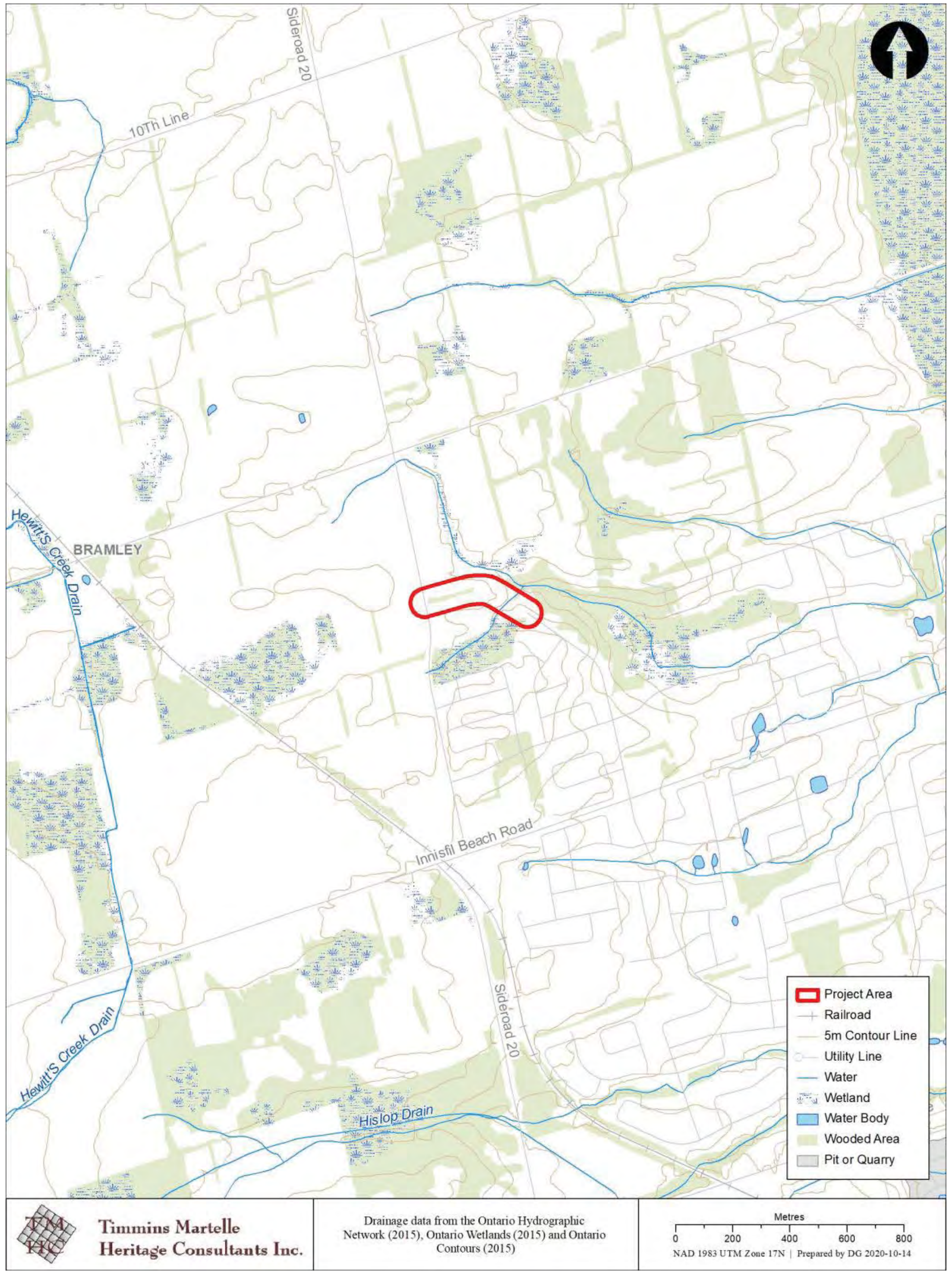
Map 3: Unaltered Proponent Map



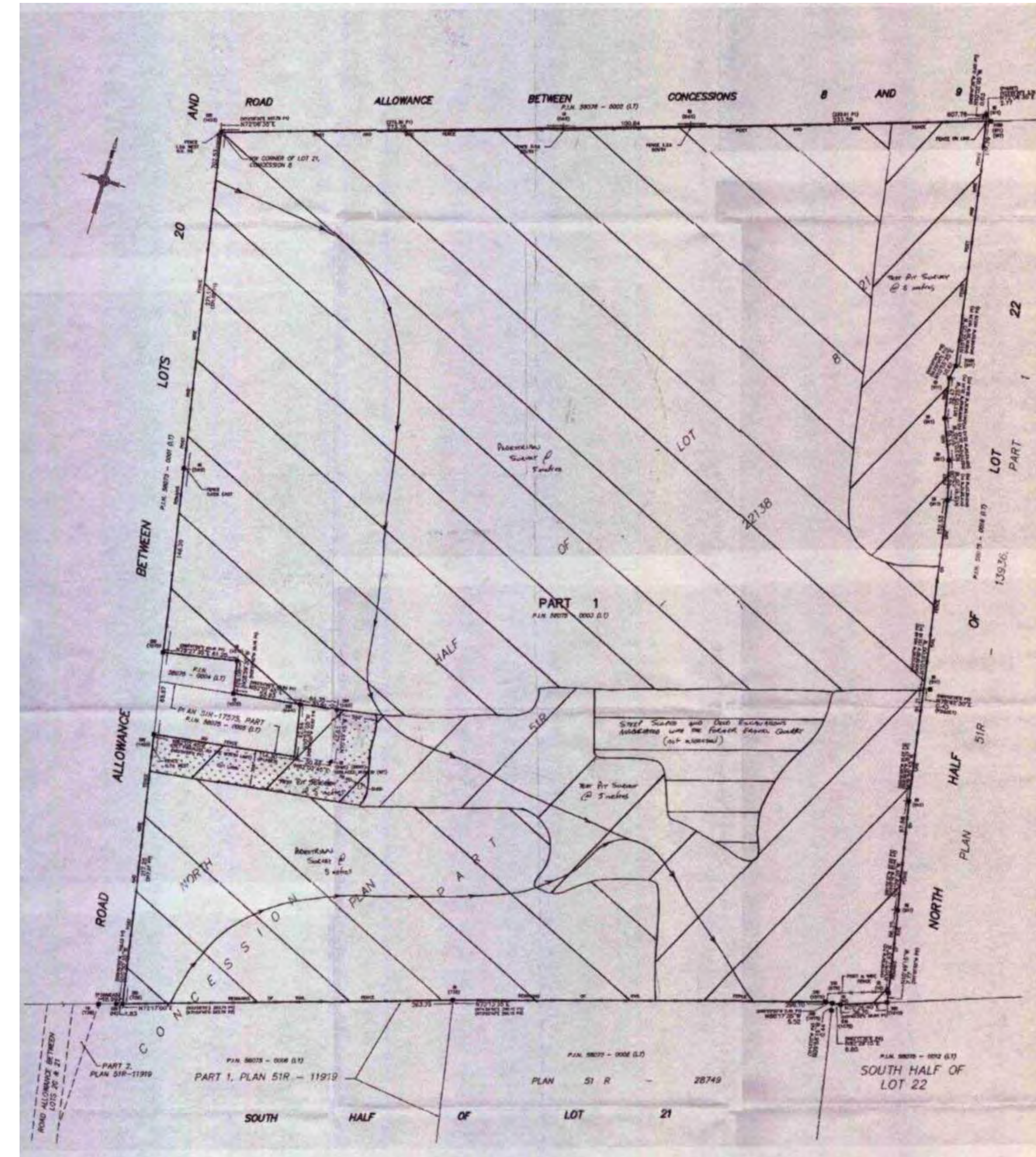
Map 4: Physiography within the Vicinity of the Project Area



Map 5: Soils within the Vicinity of the Project Area

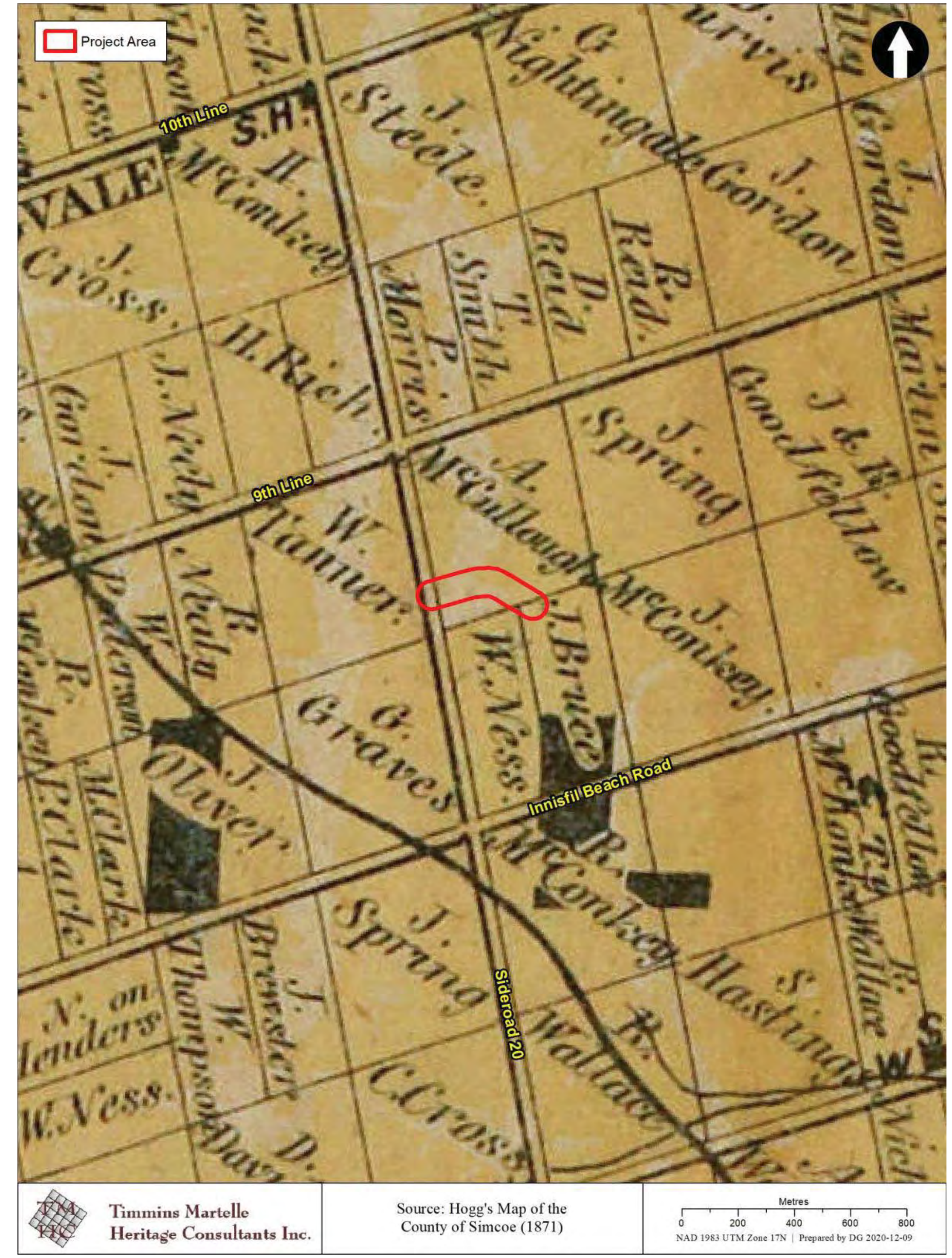


Map 6: Drainage within the Vicinity of the Project Area

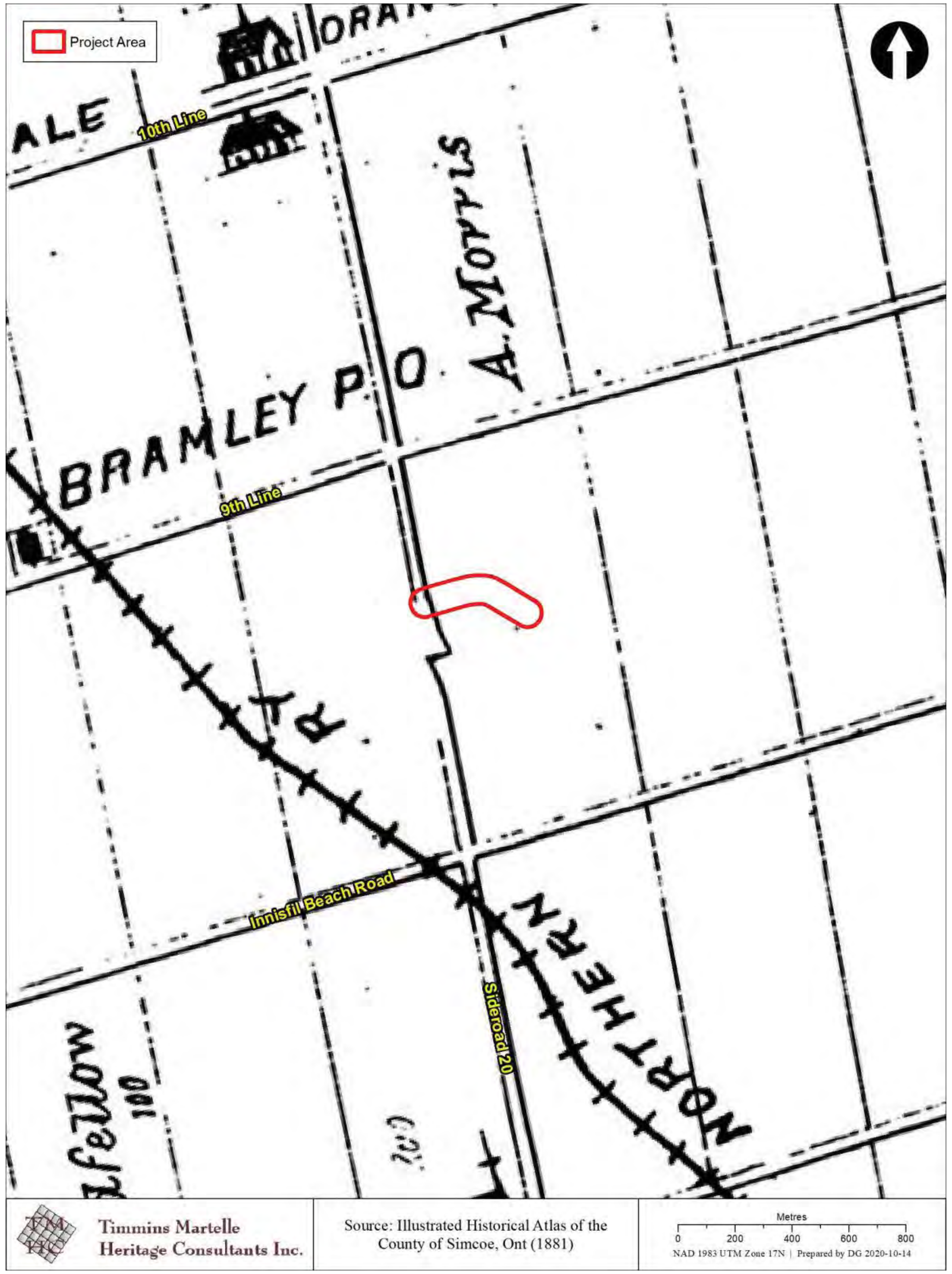


Map 7: AMICK (2003) Stage 1 and 2 Previous Assessment

Map 8: Areas of Previous Assessment



Map 9: Location of the Project Area Shown on 1871 Hogg Map of Simcoe County



Map 10: Location of the Project Area Shown on 1881 Illustrated Historical Atlas Map

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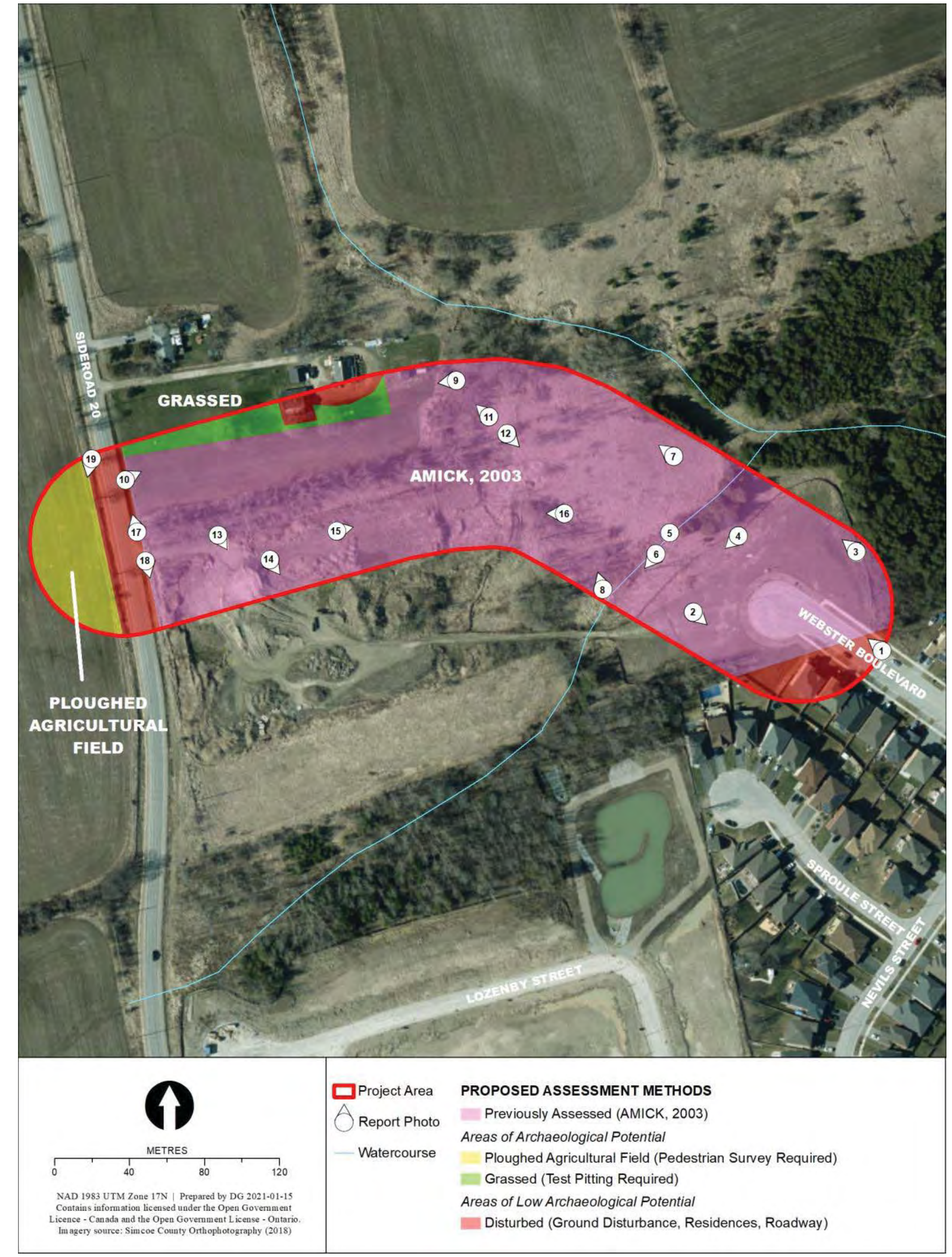

Map 13: Areas of Archaeological Potential

Map 14: Areas of Archaeological Potential on Proponent Map

Stage 2 Archaeological Assessment
Municipal Class EA
Proposed Webster Boulevard North Extension
20th Sideroad to Webster Boulevard
Part of Lot 21, Concession 8
Former Geographic Township of Innisfil, Town of Innisfil
Simcoe County, Ontario

Original Report

Submitted to:
Ministry of Heritage, Sport, Tourism and Culture Industries

Prepared for:
BT Engineering
9040 Leslie Street, Unit 218
Richmond Hill, ON, L4B 3M4

Prepared by:
TMHC Inc.
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Licensee:	Matthew Beaudoin, Ph.D., P324
PIF No:	P324-0635-2021
Project No:	2020-176
Dated:	July 9, 2021

EXECUTIVE SUMMARY

A Stage 2 archaeological assessment was conducted as part of the Webster Boulevard North Extension Municipal Class Environmental Assessment (EA), which is aimed at planning for the proposed extension of Webster Boulevard from the north termination of the road to 20th Sideroad in the Town of Innisfil, Ontario. The project area is roughly 2.66 hectares (6.57 acres) in size and is located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. A Stage 1 archaeological assessment was completed for the project in 2020 by TMHC and determined that a portion of the project area had archaeological potential and required a Stage 2 assessment. Based on the preliminary design, the Stage 2 project area consists of a roughly 375 m long by 40 m wide corridor from Webster Road to 20th Sideroad, and a roughly 290 m long by 40 m wide corridor along 20th Sideroad. TMHC was contracted to undertake the Stage 2 assessment by BT Engineering Inc. on behalf of the Town of Innisfil, which was conducted in accordance with the provisions of the *Environmental Assessment Act* and the *Provincial Policy Statement* (PPS 2020).

The Stage 2 fieldwork was conducted on June 22, 2021 and consisted of a test pit survey of the grassed, low-lying scrub/brush, and field portions of the project area, employing a 5 m transect interval (13.5%; 0.36 ha). A further 21.1 % (0.56 ha) of the project area had been subject to deep and extensive land alterations that had removed archaeological potential. These lands were photo-documented. Finally, 65.4 % (1.74 ha) of the project area had been previously assessed and no further work was required. As such, the project area should be considered free of archaeological concern and no further archaeological assessment is recommended.

All work met provincial standards and no archaeological material was documented during the assessment. As such, the subject property should be considered free of archaeological concern and no further archaeological assessment is recommended.

Our recommendations are subject to the conditions laid out in Section 4.0 of this report and to the MHSTCI' review and acceptance of this report into the provincial registry.

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PROJECT PERSONNEL

Project Manager	Matthew Beaudoin, Ph.D. (P324)
Project Administrator	Kellie Theaker
Health and Safety Coordinator	Amanda DiLoreto-Bendek, M.A. (R317)
Fieldwork Coordination	Johnathan Freeman, M.A. (P274)
Field Director	Amelia Pilon, M.A. (R1265)
Field Technician	Sean Graziano, B.A.
	Rebecca Harbottle, B.A.
	Christopher Moore, B.A.
GIS Mapping	David Gostick, B.A.
Report Writer	Katelyn Mather, M.A. (R443)
	Amanda Parks, M.A. (P450)
Senior Review	Matthew Beaudoin, Ph.D. (P324)

ACKNOWLEDGEMENTS

Darcie Dillon	Partner
	BT Engineering Inc.
Steve Taylor	President
	BT Engineering Inc.

TERRITORIAL ACKNOWLEDGEMENT

The project area is located on the traditional lands of the Anishinaabek (Ah-nish-in-a-bek), Huron-Wendat, and Haudenosaunee (Ho-den-no-show-nee) peoples, on lands connected with the Nottawasaga Purchase (Treaty #18) of 1818 and the Dish with One Spoon Covenant Wampum. This land continues to be home to diverse Indigenous peoples (e.g., First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors of our society.

ABOUT TMHC

Established in 2003, with a head office in London, Ontario, TMHC provides a broad range of archaeological assessment heritage planning and consultation services throughout the Province of Ontario, founded on over forty years of progressive and responsible experience. We provide consulting services for Indigenous communities, municipal heritage planning and training, public outreach and educational programs, and have established specialties in community engagement, cemetery investigations, faunal analysis and ground penetrating radar surveys. Since TMHC's inception, we have evolved with the needs of our clients, the demands of the regulatory environment, and the growth in the industry.

Since 2004, TMHC has held retainers with Infrastructure Ontario (formerly the Ontario Realty Corporation), Hydro One, the Ministry of Transportation and the City of Hamilton. Presently, TMHC was successfully added to the Infrastructure Ontario, Ministry of Transportation, Hydro One, Metrolinx, and Niagara Parks retainers. In addition, TMHC has successfully managed a wider variety of highly sensitive, large, and complicated projects and have a proven track record in successfully managing and navigating them to completion. In 2013, TMHC earned the Ontario Archaeological Society's award for Excellence in Cultural Resource Management.

KEY STAFF BIOS

Matthew Beaudoin, PhD., Principal, Manager – Archaeological Assessments

Matthew Beaudoin received a Ph.D. in Anthropology from Western University in 2013 and became a Principal at TMHC in 2019. During his archaeological career, Matthew has conducted extensive field research and artifact analysis on Indigenous and Settler sites from Labrador and Ontario. In addition, Matthew has also conducted ethnographic projects in Labrador. Since joining TMHC in 2008, Matthew has been involved with several notable projects, such as the Imperial Oil's Waterdown to Finch Project, the Camp Ipperwash Project, and the Scugog Island Natural Gas Pipeline Project.

Matthew is an active member of the Canadian Archaeological Association, the Ontario Archaeological Association, the Ontario Historical Society, the World Archaeology Congress, the Council for Northeastern Historical Archaeology, the Society for American Archaeology, and the Society for Historical Archaeology.

Amanda Parks, MA., Manager – Environmental Assessments, Archaeology Division

Amanda Parks received her Master's Degree in Archaeology from Western University in 2018. Amanda has worked in the field of cultural resource management for more than 15 years and during that time has participated in numerous Stage 1-4 archaeological assessments in a variety of roles: project manager, field director, report writer, artifact analyst, and engagement specialist. Amanda has worked regularly with Indigenous communities throughout Ontario, engaging for archaeological projects, environmental assessments, and property management plans. She has established good working relationships with communities by focusing on a collaborative approach to the protection and documentation of archaeological sites.

Amanda Parks is a member of the Ontario Archaeological Society and holds a Professional Licence with the Ministry of Heritage, Sport, Tourism, and Culture Industries.

STATEMENT OF QUALIFICATIONS AND LIMITATIONS

The attached Report (the "Report") has been prepared by Timmins Martelle Heritage Consultants Inc. (TMHC) for the benefit of the Client (the "Client") in accordance with the agreement between TMHC and the Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents TMHC's professional judgment in light of the Limitation and industry standards for the preparation of similar reports;
- may be based on information provided to TMHC which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and section thereof should not be read out of such context; and
- was prepared for the specific purposes described in the Report and the Agreement.

TMHC shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. TMHC accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

TMHC agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but TMHC makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Except (1) as agreed to in writing by TMHC and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

TMHC accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of TMHC to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

QUALITY INFORMATION

Report prepared by:

Amanda Parks, M.A. (P450)

Manager of Environment Assessment – Archaeology Division

Report reviewed by:

Matthew Beaudoin, Ph.D. (P324)

Principal/Manager of Archaeological Assessment

1 PROJECT CONTEXT

1.1 Development Context

1.1.1 Introduction

An archaeological assessment was conducted as part of the Webster Boulevard North Extension Municipal Class Environmental Assessment (EA), which is aimed at planning for the proposed extension of Webster Boulevard from the north termination of the road to 20th Sideroad in the Town of Innisfil, Ontario. The project area is roughly 2.66 hectares (6.57 acres) in size and is located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. A Stage 1 archaeological assessment was completed for the project in 2020 by TMHC and determined that a portion of the project area had archaeological potential and required a Stage 2 assessment. Based on the preliminary design, the Stage 2 project area consists of a roughly 375 m long by 40 m wide corridor from Webster Road to 20th Sideroad, and a roughly 290 m long by 40 m wide corridor along 20th Sideroad. TMHC was contracted to undertake the Stage 2 assessment by BT Engineering Inc. on behalf of the Town of Innisfil, which was conducted in accordance with the provisions of the *Environmental Assessment Act* and the *Provincial Policy Statement* (PPS 2020). The purpose of the assessment was to determine whether any archaeological resources were present within the project area.

All archaeological assessment activities were performed under the professional archaeological license of Matthew Beaudoin, Ph.D. (P324) and in accordance with the 2011 *Standards and Guidelines for Consultant Archaeologists* (MTC 2011). Permission to commence the study was given by Darcie Dillon of BT Engineering Inc.

1.1.2 Purpose and Legislative Context

The *Ontario Heritage Act* (R.S.O. 1990) makes provisions for the protection and conservation of heritage resources in the Province of Ontario. Heritage concerns are recognized as a matter of provincial interest in Section 2.6.2 of the *Provincial Policy Statement* (PPS 2020) which states:

> *development* and *site alteration* shall not be permitted on lands containing *archaeological resources* or *areas of archaeological potential* unless *significant archaeological resources* have been *conserved*.

In the PPS, the term conserved means:

> the identification, protection, management and use of *built heritage resources, cultural heritage landscapes* and *archaeological resources* in a manner that ensures their cultural heritage value or interest is retained. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment and/or heritage impact assessment that has been approved, accepted or adopted by the relevant planning authority and/or decision-maker. Mitigative measures and/or alternative development approaches can be included in these plans and assessments.

The Environmental Assessment Act provides for the protection and conservation of the environment. In this case, the environment is widely defined to cover "cultural heritage" resources. Section 5(3)(c) of the Act stipulates that heritage resources to be affected by a proposed undertaking be identified during the environmental screening process. Within the EA process, the purpose of a Stage 2 field assessment is to determine if there are any archaeological sites within the project area.

1.2 Project Context: Archaeological Context

1.2.1 Project Area: Overview and Physical Setting

The project area consists of a roughly 375 m long by 40 m wide corridor from Webster Road to 20th Sideroad, and a roughly 290 m long by 40 m wide corridor along 20th Sideroad in the Town of Innisfil, ON. Measuring approximately 2.66 hectares (6.57 acres), the project area is located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Simcoe County. From east to west the general environs include Webster Boulevard and its right-of-way (ROW), an open field of scrub/brush, a soil stockpile area, manicured lawn fronting 20th Sideroad, 20th Sideroad and its ROW, and an agricultural field.

The project area falls within the Peterborough Drumlin Field, a rolling till plain covering an area of approximately 1,750 m2 extending from Hastings County in the east to Simcoe County in the west (Map 3; Chapman and Putnam 1984:169-171). The region contains approximately 3,000 drumlins and a number of drumlinoid hills and eskers. Most of the drumlins in this field are orientated on an axis leading from the northeast to the southwest due to the direction of glacial ice movements over the till plain. South of Lake Simcoe, the inter-drumlin zones contain sand plains. The eskers within the Peterborough Drumlin Field contain gravel deposits that have been continually exploited as sources of road construction material (Chapman and Putnam 1984:169-170). Specifically, the project area falls within a till plain.

Three soil types are present within the project area: Bondhead Sandy Loam in the west, and Smithfieldy Silty Clay Loam and Sargent Gravelly Sandy Loam in the east (Map 4). The majority of the project area contains Bondhead sandy loam, a well-drained soil developed on till (Hoffman et al. 1962:27). Smaller portions of project area contain Smithfieldy Silty Clay Loam, an imperfectly drained soil developed on calcareous, varved, silt loam and clay parent material (Hoffman et al. 1962:29), and Sargent Gravelly Sandy Loam, a well-drained soil developed on pale brown parent material of outwash gravel material (Hoffman et al. 1962:28).

The project area lies within the Lake Simcoe drainage basin (Map 5). A large wetland is mapped south of the project area adjacent to the project area. An unnamed stream runs through the project area and along the northeast edge of the project area.

1.2.2 Summary of Registered or Known Archaeological Sites

According to Ontario's Past Portal maintained by the MHSTCI, there are three registered archaeological sites within 1 km of the project area (Table 1); however, upon a more detailed review, two of the sites (BbGv-44 and BbGv-45) are further than 1 km away. The third site (BbGv-37) is mapped approximately 300 m southeast of the project area; however, based on the site information provided in PastPortal this site is actually located on Lot 1, Concession 9 over 11 km west of the project area.

Table 1: Registered Archaeolgocial Sites within 1 km of the Subject Property

Borden Number	Site Name	Time Period	Affinity	Site Type	Status
BbGv-37	Kloosterman 1	Post-Contact			No Further CHVI
BbGv-44	John McConkey	Post-Contact	Euro-Canadian	scatter	Further CHVI
BbGv-45	John Gordon	Post-Contact	Euro-Canadian	scatter	Further CHVI

TMHC has identified a further two sites (BbGv-40 and BbGv-41) that are located within 1 km of the project area that did not appear within PastPortal search. These sites are described in Section 1.2.3 of this report.

Several unregistered sites are also located within 1 km of the project area. In the 1950s, Robert Popham (1950:82) identified 64 Indigenous village sites in Innisfil Township. Popham was working with detailed but unpublished data collected by Andrew F. Hunter, who travelled throughout old Huronia on his bicycle in search of Huron sites. Popham's map of Huron sites in Innisfil Township (1950:83) shows three archaeological sites within 1 km of the project area, and the closest is located in the northwest corner of Lot 21, Concession 8, which is roughly 200 m northwest of the project area.

1.2.3 Summary of Past Archaeological Investigations within 50 m

During the course of this study, four previous archaeological investigations within 50 m of the project area were identified. However, it should be noted that the MHSTCI currently does not provide an inventory of archaeological assessments to assist in this determination.

1.2.3.1 Stage 1 & 2 Archaeological Assessment of D.G. Pratt Construction Subdivision (Map 6)

In 2003, AMICK Consultants conducted a Stage 1 & 2 archaeological assessment for a proposed subdivision on the north half of Lot 21, Concession 8, Town of Innisfil. The Stage 2 assessment consisted of pedestrian survey and test pitting at a 5 m interval. No archaeological material was recovered during the Stage 2 assessment. The results of the Stage 1 and 2 assessments are presented in a report entitled *Report on the 2003 Stage 1-2 Archaeological Assessment of the D.G. Pratt Construction Subdivision, Part of North Half of Lot 21, Concession 8, Innisfil Township, County of Simcoe* (AMICK 2003; Licensee Marilyn Cornies, PIF P038-043).

1.2.3.2 Stage 1 to 3 Archaeological Assessment of the Alcona North Subdivision

In 2003, AMICK Consultants conducted a Stage 1 & 2 archaeological assessment for a proposed subdivision on the south half of Lot 21, Concession 8, Town of Innisfil. At least one site was documented, and a Stage 3 assessment was conducted. Unfortunately, we were unable to obtain a copy of this report for review. The report is entitled *Report on the 2003 Stage 1-3 Archaeological Assessment of the Alcona North Subdivision, Part of*

South Half of Lot 21, Concession 8, Innisfil Township, County of Simcoe (AMICK 2004; Licensee Marilyn Cornies, PIF P038-042).

1.2.3.3 Stage 1 & 2 Archaeological Assessment Loblaw's Properties Ltd. & Alcona Capital Properties Inc. (SD Map 1)

In 2004, Archaeologix Inc. conducted a Stage 1 & 2 archaeological assessment for a proposed 50.5 ac development on part of Lot 21, Concession 8, Town of Innisfil. The Stage 2 assessment consisted of pedestrian survey and test pitting at a 5 m interval. Two archaeological sites were identified during the assessment: BbGv-40 and BbGv-41. BbGv-40 consisted of mid-19th-century domestic material and was recommended for Stage 3 assessment. BbGv-41 consisted of mid-to-late 19th-century domestic material that was not recommended for further assessment. Both sites are located roughly 600 m south of the current project area. The results of the Stage 1 and 2 assessment are presented in a report entitled *Archaeological Assessment (Stages 1 & 2) Application for Consent, Loblaws Properties Ltd. & Alcona Capital Properties Inc. Part of Lot 21, Concession 8, Town of Innisfil, Simcoe County, Ontario* (Archaeologix Inc. 2014; Licensee Jim Wilson, PIF P001-204).

1.2.3.4 Stage 1 Archaeological Assessment – Proposed Webster Boulevard North Extension (Map 7)

A Stage 1 archaeological assessment was conducted in 2020 by TMHC as part of the Municipal Class EA for the proposed extension of Webster Boulevard to 20th Sideroad in the Town of Innisfil, Ontario. The project area is located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. The background research indicated that the project area was in proximity to features signaling archaeological potential and a Stage 1 property inspection was undertaken. The Stage 1 property inspection visually confirmed that portions of the project area have witnessed prior disturbance, primarily relating to existing structures, paved roads, and ditches. Numerous previous archaeological assessments were noted within the project area, none of which recommended further archaeological assessment. As these previous projects meet current MHSTCI Standards and Guidelines, no further Stage 2 assessment was recommended for these lands. The remainder of the project area consisted of grassed land and an agricultural field that were found to retain archaeological potential. A Stage 2 survey was recommended. The report docuemtning this work is entitled *Stage 1 Archaeological Assessment: Municipal Class EA, Proposed Webster Boulevard North Extension, 20th Sideroad to Webster Boulevard, Part of Lot 21, Concession 8, Former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario* (TMHC 2021; Licensee Matthew Beaudoin, PIF P324-0564-2020).

1.2.4 Dates of Archaeological Fieldwork

The Stage 2 fieldwork was conducted on June 22, 2021, in sunny and warm weather conditions under the direction of Amelia Pilon, M.A. (R1265).

1.3 Project Context: Historical Context

1.3.1 First Peoples Settlement in Simcoe County

The previous Stage 1 assessment report (TMHC 2021) provided a detailed summaries of past Indigenous settlement in the general vicinity of the project area. As such, the same information is not repeated here. A summary of the themes and temporal periods of Indigenous settlement is provided in Table 2.

Table 2: Chronology of Indigenous Settlement in the Simcoe County Area

Period		Time Range (circa)	Diagnostic Features	Archaeological Complexes
Paleo	Early	9000-8400 BCE	fluted projectile points	Gainey, Barnes, Crowfield
	Late	8400-8000 BCE	non-fluted and lanceolate points	Holcombe, Hi-Lo, Lanceolate
Archaic	Early	8000-6000 BCE	serrated, notched, bifurcate base points	Nettling
	Middle	6000-2500 BCE	stemmed, side & corner notched points	Brewerton, Otter Creek, Stanly/Neville
	Late	2000-1800 BCE	narrow points	Lamoka
		1800-1500 BCE	broad points	Genesee, Adder Orchard, Perkiomen
		1500-1100 BCE	small points	Crawford Knoll
	Terminal	1100-950 BCE	first true cemeteries	Hind
Woodland	Early	950-400 BCE	expanding stemmed points, Vinette pottery	Meadowood
	Middle	400 BCE-500 CE	dentate, pseudo-scallop pottery	Saugeen
	Transitional	500-900 CE	first corn, cord-wrapped stick pottery	Princess Point
	Late	900-1300 CE	first villages, corn horticulture, longhouses	Glen Meyer, Pickering
		1300-1400 CE	large villages and houses	Uren, Middleport
		1400-1650 CE	tribal emergence, territoriality, first Europeans	Petun -Tionontati, Huron-Wendat, Odawa, Nipissing
Contact	Indigenous	1700 CE-present	treaties, mixture of Indigenous & European items	Anishinaabe
	Settler	1796 CE-present	industrial goods, homesteads	pioneer life, municipal settlement

1.3.2 Treaty History

The project area falls within the Lake Simcoe-Nottawasaga Purchase (Treaty no. 18).

The south shore of Kempenfelt Bay forms part of the northeastern boundary of the Lake Simcoe-Nottawasaga Purchase (Treaty no. 18) signed between the Crown and the Chippewas. The treaty was signed October 17, 1818 and covers a large tract of land between Lake Simcoe and Lake Huron. According to Surtees (1984:75-76), the Crown agent, William Claus, and the delegation of Chippewa chiefs led by Chief Musquakie (Yellowhead) agreed that in return for the land the Crown would provide an annuity of 1,200 pounds. Surtees (1984:76) notes that although hunting, fishing and other subsistence activities were not recorded as discussed, that Musquakie had asked that the Crown also encourage a doctor to settle in the area. This consideration was not included in the formal treaty document (Canada 1891[1992]). Treaty no. 18 is represented as a provisional agreement on the Williams Treaty First Nations' website which notes that no known confirmatory surrender exists. It should also be noted that Indigenous oral accounts and written British accounts about treaties and negotiations may differ (see Williams 2018 for the Mississauga perspective of Treaty no. 20 – Rice Lake also signed in 1818).

1.3.3 Nineteenth-Century and Municipal Settlement

Historically the project area falls within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Simcoe County, Ontario. A brief discussion of 19th-century municipal settlement in these places and their historical predecessors is provided below, as a means of providing general context for understanding former land use and identifying features signaling archaeological potential.

The lands that would become Simcoe County were obtained by the British Crown in 1818, when a 600,000 ha parcel encompassing parts of the current Simcoe, Grey and Dufferin counties was ceded by the Ojibway (Chippewa) (Anderson and Anderson 1984:40). Following this, plans were made to have the lands surveyed and opened for receiving immigrants. The County of Simcoe was officially formed in 1821. Some of its townships were surveyed as early as 1819, while others waited almost two decades longer (Anderson and Anderson 1984:18).

Innisfil Township was first surveyed in 1820 and at that time incorporated the southwestern shore of Lake Simcoe, from West Gwillimbury northward to Kempenfelt Bay and Vespra (H. Belden & Co. 1881:14). Settlement was enhanced by the clearing of cedar swamps to make way for trails, roadways and the construction of homesteads. European settlement was slow until after 1831 when the area saw an influx of half-pay officers from the British army and navy (Hunter 1893:4). The population grew significantly shortly thereafter with the arrival of immigrants from Scotland and Northern Ireland. From this point on, the region underwent rather rapid expansion with the building of schools, churches, grist mills and postal outlets. The first sawmill in the area was established in Tollendal by George McMullen in 1823 (Innisfil Township Council 1951:7). Prior to this first influx of European settlers, the area had also been an important military thoroughfare, as ships made their way down the Nottawasaga River and along Kempenfelt Bay, where personnel could be dispatched along the military trail leading from the Bay to Penetanguishine (Hunter 1909:68).

A number of archival sources allow for a consideration of dates of settlement within the current project area. Sources considered include a listing by Hunter (1909) of settlers in Innisfil Township who arrived by 1837, land registry records, Irwin's Simcoe County Directory and Gazetteer for 1872-73, Hogg Map for the year 1871 (Map 8) and Belden's illustrated atlas for the year 1881 (Map 9).

Hunter's 1909 listing of early settlers in Innisfil Township indicates that the lot was not settled by 1837. The 1872 Gazetteer indicates the lot was inhabited by John Bruce (f) and William Ness (f). Land registry records indicate that the Crown Patent for the north half of Lot 21, Concession 8 was granted to William McCullough in 1836 and for the south half of the lot was granted to Thomas Wood also in 1836.

The 1871 Hogg Map of Simcoe County (Map 8) shows that the north half of Lot 21 was associated with A. McCullough. No structures are depicted on this map, but 20th Sideroad and Innisfil Beach Road are both depicted as open at that time. Belden's 1881 Illustrated Atlas map (Map 9) does not show an owner associated with either lot, nor any structures. The Northern Railway is now present, running northwest to southeast approximately 300 m from the project area. It is acknowledged that the 1881 map shows few structures within the project area or the surrounding area. However, this is not necessarily a reflection of actual conditions at the time. Many atlases required a subscription to be paid to be illustrated in its pages, and so it is that many families simply chose not to subscribe.

2 STAGE 2 ARCHAEOLOGICAL ASSESSMENT

2.1 Field Methods

All fieldwork was undertaken in good weather and lighting conditions. No conditions were encountered that would hinder the identification or recovery of artifacts. The property boundaries were determined in the field based on proponent mapping, landscape features, and GPS co-ordinates.

The project area was comprised of manicured grassed lands, low-lying scrub/brush, and an agricultural field. The portion of the project area within the agricultural field (west of 20th Sideroad) mostly measured less than 10 m in width, with the exception of a small, centrally located area that is required for a proposed roundabout that extended to a maximum of 20 m into the agricultural field. The agricultural field was inspected upon arrival and while it had been ploughed and weathered for planting, surface visibility was below 80% due to existing bean crops and debris from previous crops (Images 1 and 2). As the portion of the project area within the active agricultural fields beyond the 10 m width was small (less than 0.1 ha) it was decided in the field to walk over the area at a reduced interval to identify any surface artifacts that might be visible and then test pit the area at a 5 m transect interval.

As a result, the grassed, low-lying scrub/brush, and agricultural field portions of the project area were subject to a standard test pit assessment, employing a 5 m transect interval (13.5%; 0.36 ha; Images 3 to 5). Test pits measuring at least 30 cm (shovel-width) were excavated through the first 5 cm of subsoil with all fill screened through 6 mm hardware cloth. Once screening was finished, the stratigraphy in the test pits was examined and then the pits were backfilled as best as possible, tamped down by foot and shovel and re-capped with sod. Test pitting extended up to 1 m from all standing features, including trees and buildings, when present. It was anticipated that when cultural material was found, the test pit survey would be intensified (reduced to 2.5 m) to determine the size of the site. If not enough archaeological materials were recovered from the intensification test pits, a 1 m^2 test unit would be excavated atop of one of the positive test pits to gather additional information. The test pits contained roughly 40 cm of brown sandy loam soil over yellow sandy loam subsoil (Image 6).

As per Section 2.1, Standard 2 of the *Standards and Guidelines* (MTC 2011:28-29), certain physical features and deep land alterations are considered as having low archaeological potential and are thus exempt from the standard test pit survey. Approximately 21.1% (0.56 ha) of the project area was disturbed, consisting of the existing paved roadways and paved and gravel driveway entrances to adjacent residential properties (Images 7 to 9).

Finally, roughly 65.4% (1.74 ha) of the project area was previously assessed and did not require further assessment (AMICK 2003).

Map 10 illustrates the Stage 2 field conditions and assessment methods; the location and orientation of all photographs appearing in this report are also shown on this map. Map 11 presents the Stage 2 results on the proponent mapping. An unaltered proponent map is provided as Map 12.

2.2 Record of Finds

No archaeological materials or sites were identified during the Stage 2 archaeological assessment of the project area. Table 3 provides an inventory of the documentary records generated during this project.

All files are currently being stored at the TMHC corporate office located at 1108 Dundas Street, Unit 105, London, ON, N5W 3A7.

Table 3: Documentary Records

Date	Field Notes	Field Maps	Digital Images
June 22, 2021	Digital and hard copies	Digital and hard copies	29 Images

2.3 Analysis and Conclusions

A Stage 2 field assessment was carried out in keeping with the MHSTCI' *Standards and Guidelines* (MTC 2011). The test pit survey did not result in the documentation of archaeological resources. As such, the project area should be considered free of archaeological concern.

2.4 Recommendations

All work met provincial standards and no archaeological material was documented during the assessment. As such, the project area should be considered free of archaeological concern and no further archaeological assessment is recommended.

Our recommendations are subject to the conditions laid out in Section 4.0 of this report and to the MHSTCI' review and acceptance of this report into the provincial registry.

3 SUMMARY

A Stage 2 archaeological assessment was conducted as part of the Webster Boulevard North Extension Municipal Class Environmental Assessment (EA), which is aimed at planning for the proposed extension of Webster Boulevard from the north termination of the road to 20th Sideroad in the Town of Innisfil, Ontario. The project area is roughly 2.66 hectares (6.57 acres) in size and is located within part of Lot 21, Concession 8, in the former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario. Approximately 13.5% (0.36 ha) of the project area was subject to a test pit survey at a 5 m interval and no archaeological resources were encountered. A further 21.1% (0.56 ha) of the project area had been subject to deep and extensive land alterations that had removed archaeological potential. These lands were photo-documented. Finally, 65.4% (1.74 ha) of the project area had been previously assessed and no further work was required. As such, the subject property should be considered free of archaeological concern and no further archaeological assessment is recommended.

4 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the MHSTCI as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MHSTCI, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the Ontario Heritage Act.

Should previously undocumented (i.e., unknown or deeply buried) archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act.*

The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and Crystal Forrest, A/Registrar of Burial Sites, Ontario Ministry of Government and Consumer Services. Her telephone number is 416-212-7499 and e-mail address is Crystal.Forrest@ontario.ca.

5 BIBLIOGRAPHY

AMICK

2003 *Report on the 2003 Stage 1-2 Archaeological Assessment of the D.G. Pratt Construction Subdivision, Part of North Half of Lot 21, Concession 8, Innisfil Township, County of Simcoe* (Licensee Marilyn Cornies, PIF P038-043). Report on file with the MHSTCI.

2004 *2003 Stage 1-3 Archaeological Assessment of the Alcona North Subdivision, Part of South Half of Lot 21, Concession 8, Innisfil Township, County of Simcoe.* (Licensee Marilyn Cornies, PIF P038-042). Report on file with the MHSTCI.

Anderson, A. and B. Tomlinson Anderson, eds.

1984 *Tecumseth Township: The Unforgettable Past*. Belleville: Mika Publishing Co.

Archaeologix

2004 *Archaeological Assessment (Stages 1 & 2) Application for Consent, Loblaws Properties Ltd. & Alcona Capital Properties Inc. Part of Lot 21, Concession 8, Town of Innisfil, Simcoe County, Ontario* (Licensee Jim Wilson, PIF P001-204). Report on file with the MHSTCI.

Archaeological Services Inc. (ASI)

2019 *County of Simcoe Archaeological Management Plan.*

Canada

1891 *Indian Treaties and Surrenders. Volume 1: Treaties 1-138*. Reprinted 1992. Saskatoon, SK.: Fifth House Publishers,

Chapman L.J. and D.F. Putnam

1984 *The Physiography of Southern Ontario*. Third Edition. Ontario Ministry of Natural Resources: Ontario.

Government of Ontario

1990b *Ontario Heritage Act, R.S.O. 1990. (c. 0.18).* Online: Publications Ontario. Website Link. Accessed: February 16, 2021.

1990c *Environmental Assessment Act, R.S.O. 1990, c.E.18.* Online: Publications Ontario. Website Link. Accessed: April 24, 2021.

H. Belden & Company

1881 *Illustrated Historical Atlas of Simcoe County, Ontario*. Reprinted edition.

Hoffman, D.W., R.E. Wicklund, and N.R. Richards

1962 *Soil Survey of Simcoe County, Ontario. Report No. 29 of the Ontario Soil Survey*. Research Branch, Canada Department of Agriculture and the Ontario Agricultural College.

Hunter, A.F.

1893 *Lake Simcoe and Its Environs*. Barrie: Office of the Barrie Examiner.

1909 *A History of Simcoe County. Volume II.* T.H. Best Printing Co. Ltd. Reprinted by the Historical Committee of Simcoe County in 1948.

Innisfil Township Council

1950 *A Record of 100 Years of Progress Historical Review*. Innisfil Township Centennial 1850-1950. Barrie.

Irwin, W.H.

1873 *Irwin's Simcoe Directory*. Reprinted in 1985 as *Gazetteer and Directory of the County of Simcoe including the District of Muskoka and the Townships of Mono and Mulmur for 1872-3* by the East Georgian Historical Foundation. Elmvale: Generation Press.

J.D. Barnes and First Base Solutions (SWOOP)

2010 Southwestern Ontario Ortho Imagery Project – Imagery for Southwestern Ontario.

Ministry of Natural Resources (MNR) & J.D. Barnes First Base Solutions

2010 Southwestern Orthoimagery Project – Mr. Sid Tiles for Southwestern Ontario.

Ministry of Northern Development and Mines (MNDM)

2007 *Physiography of Southern Ontario*. Chapman, L.J. and D.F. Putnam, authors. GIS map data layer distributed by the Ontario Geological Survey as Miscellaneous Release – Data (MRD) 228. Queen's Printer for Ontario.

Ministry of Tourism and Culture (MTC; now Ministry of Heritage, Sport, Tourism and Culture Industries)

2011 *Standards and Guidelines for Consultant Archaeologists*. Toronto.

Natural Resources Canada (NRC)

2012 *Barrie, Ontario*. 1:50,000 Scale Topographic Map. Section 31/D05 Electronic version.

Ontario Department of Mines and Northern Affairs

1972 *Physiography of the Southwest Portion of Southern Ontario*. Map 2225. Ontario.

Ontario Fundamental Dataset, Ministry of Natural Resources (2012) and CanVec Geospatial Database (2012)

2013 Base Mapping for the Province of Ontario.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)

2006 GIS Layers for Soils and Physiography in the Province of Ontario.

Ontario Ministry of Municipal Affairs and Housing (OMMAH)

2020 *Provincial Policy Statement, 2020*. Queen's Printer for Ontario.

Popham, R.E.

1950 Late Huron Occupations of Ontario: An Archaeological Survey of Innisfil Township. *Ontario History* XLII(2):81-90.

Surtees, R.J.

1984 *Indian Land Surrenders in Ontario 1763-1867*. Indian Affairs and Northern Development, Government of Canada, Ottawa.

Timmins Martelle Heritage Consultants Inc. (TMHC)

2021 *Stage 1 Archaeological Assessment: Municipal Class EA, Proposed Webster Boulevard North Extension, 20th Sideroad to Webster Boulevard, Part of Lot 21, Concession 8, Former Geographic Township of Innisfil, Town of Innisfil, Simcoe County, Ontario.* (Licensee Matthew Beaudoin, PIF P324-0564-2020). Report on file with the MHSTCI.

Williams, D. (Gidigaa Migizi)

2018 *Michi Saagig Nishnaabeg: This is Our Territory*. ARP Books, Winnipeg, MB.

6 IMAGES

Stage 2 Archaeological Assessment
Proposed Webster Boulevard North Extension, Town of Innisfil, ON

Image 1: Agricultural Field Under Crop

Looking South

Image 2: Poor Surface Visibility

Image 3: Test Pit Survey in Progress within Agricultural Field

Looking Northwest

Image 4: Test Pit Survey in Progress within Low-Lying Scrub/Brush

Looking Southwest

Stage 2 Archaeological Assessment
Proposed Webster Boulevard North Extension, Town of Innisfil, ON

Image 5: Test Pit Survey in Progress within Manicured Lawn

Looking West

Image 6: Typical Test Pit

Image 7: Gravel Driveway and Sideroad 20 ROW

Looking South

Image 8: Gravel Driveway

Looking West

Stage 2 Archaeological Assessment
Proposed Webster Boulevard North Extension, Town of Innisfil, ON

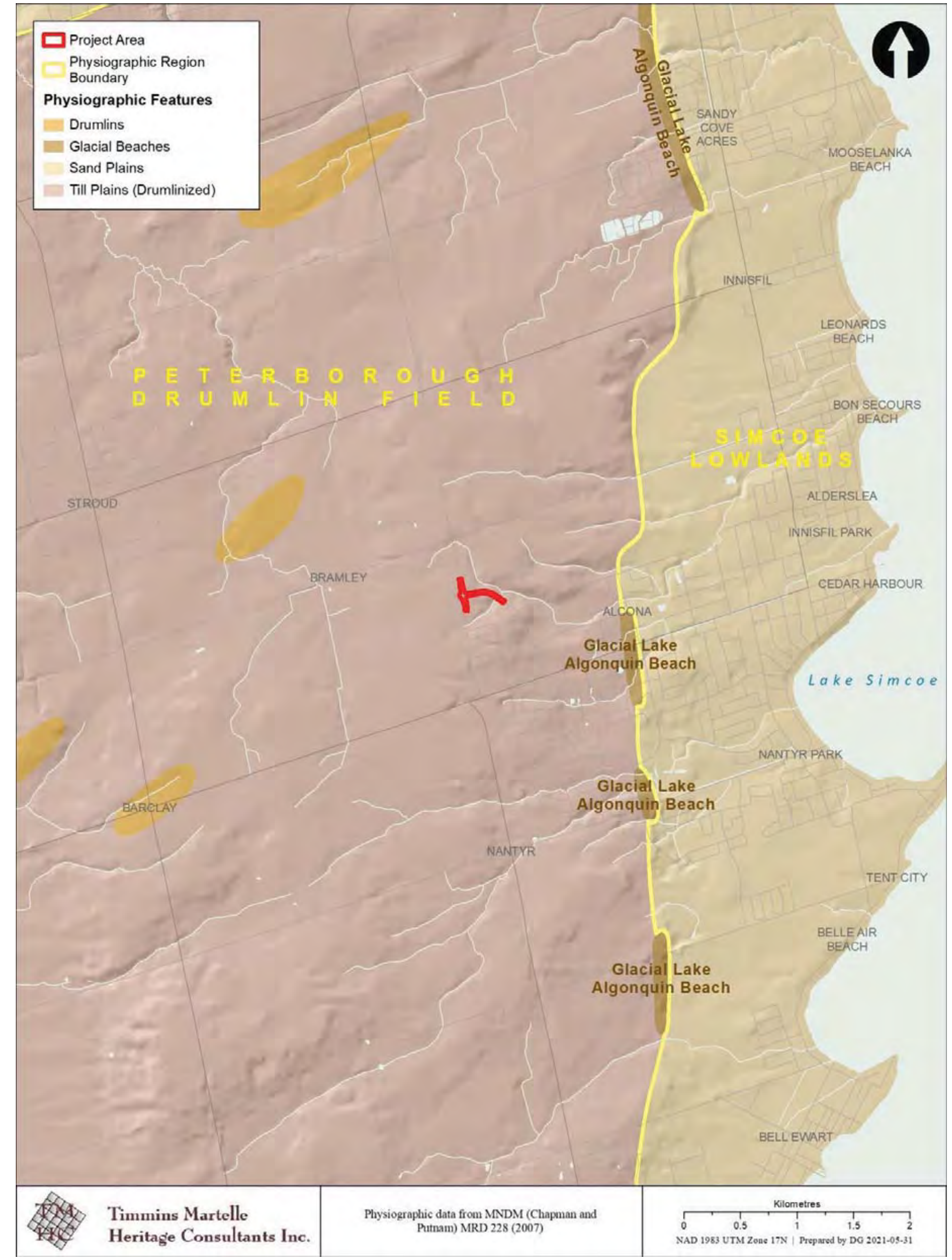
Image 9: Paved Driveway

Looking West

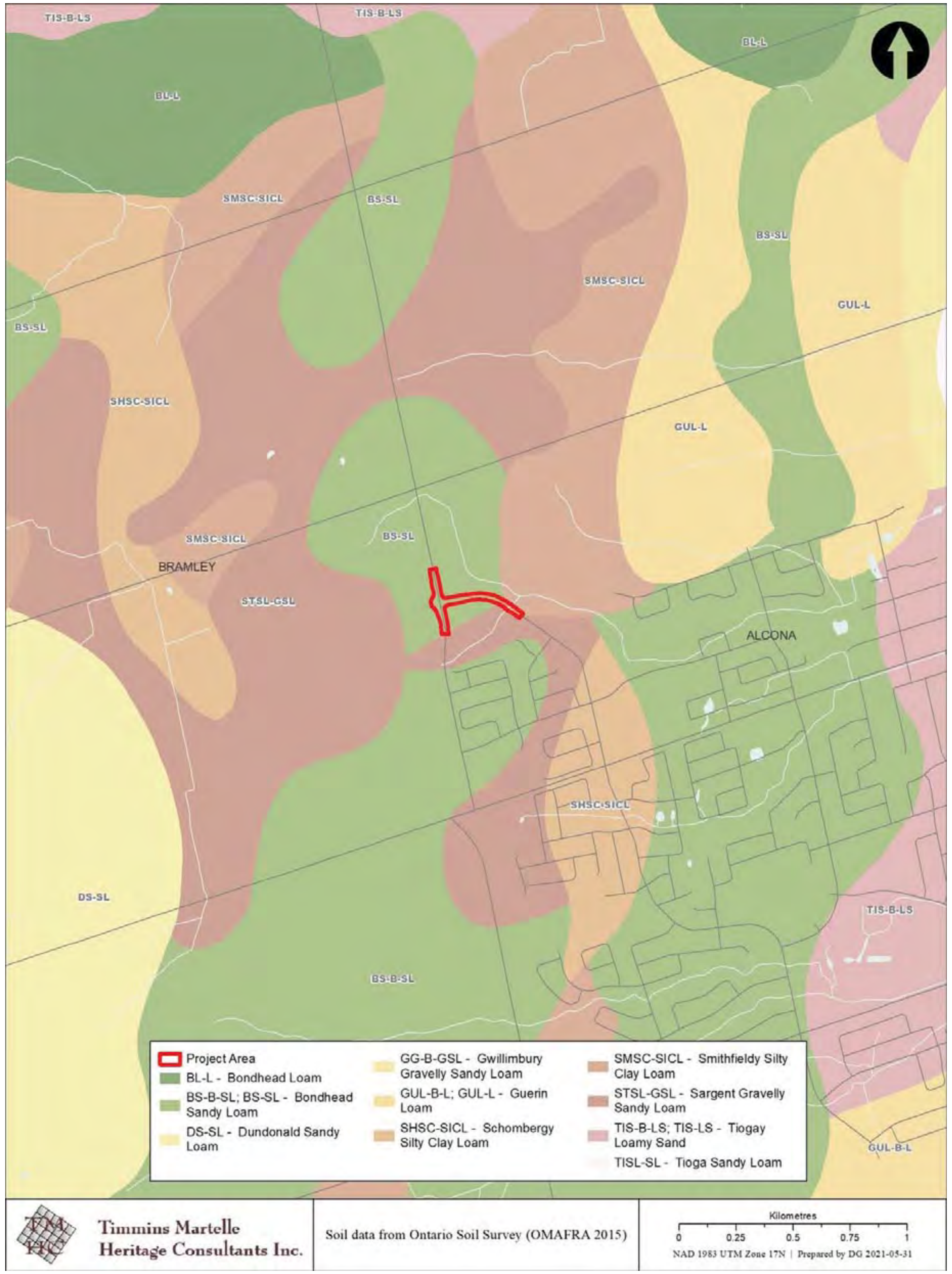
7 MAPS

Map 1: Location of the Project Area in Innisfil, ON

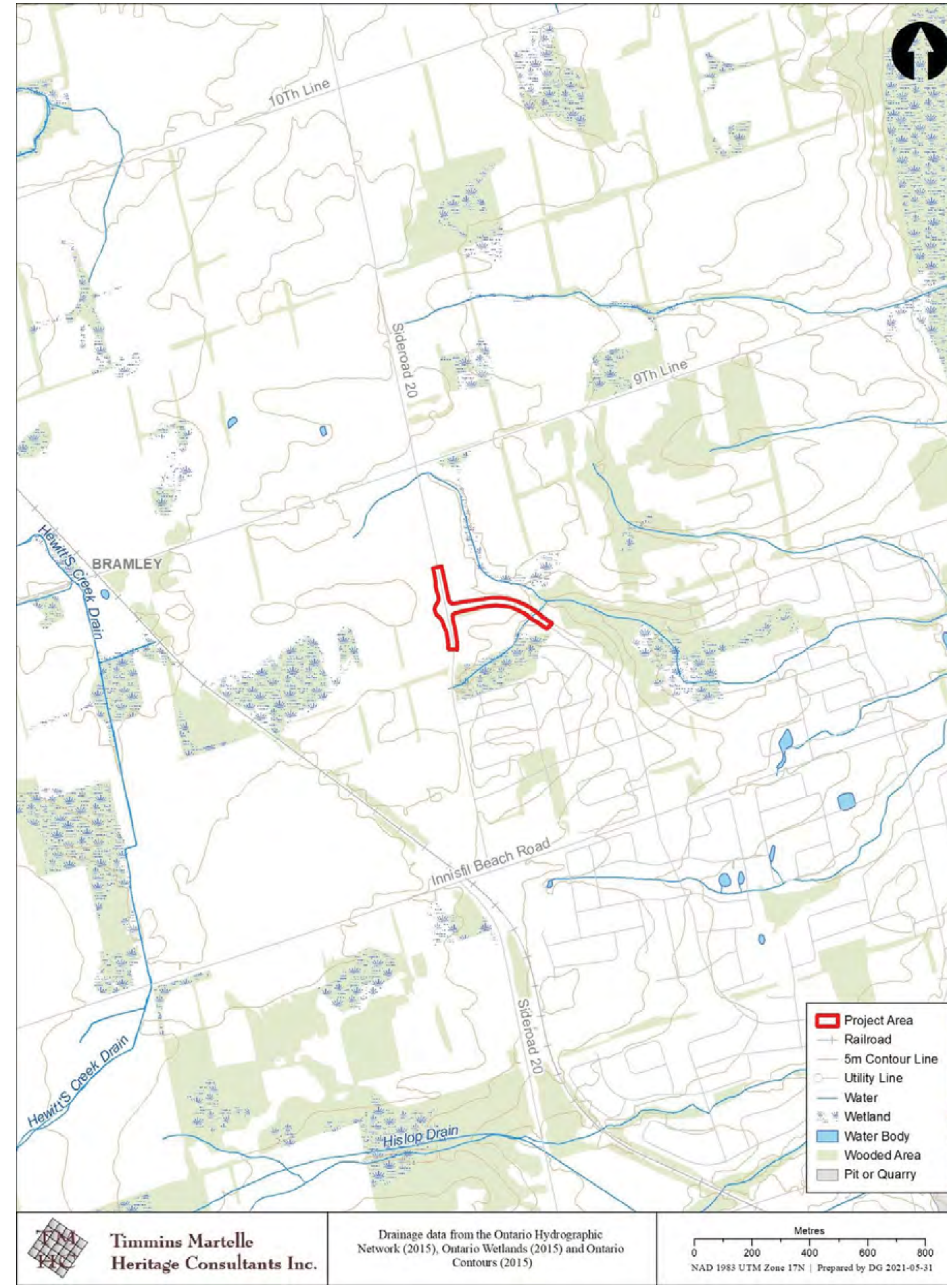
Map 2: Aerial Photograph Showing the Location of the Project Area



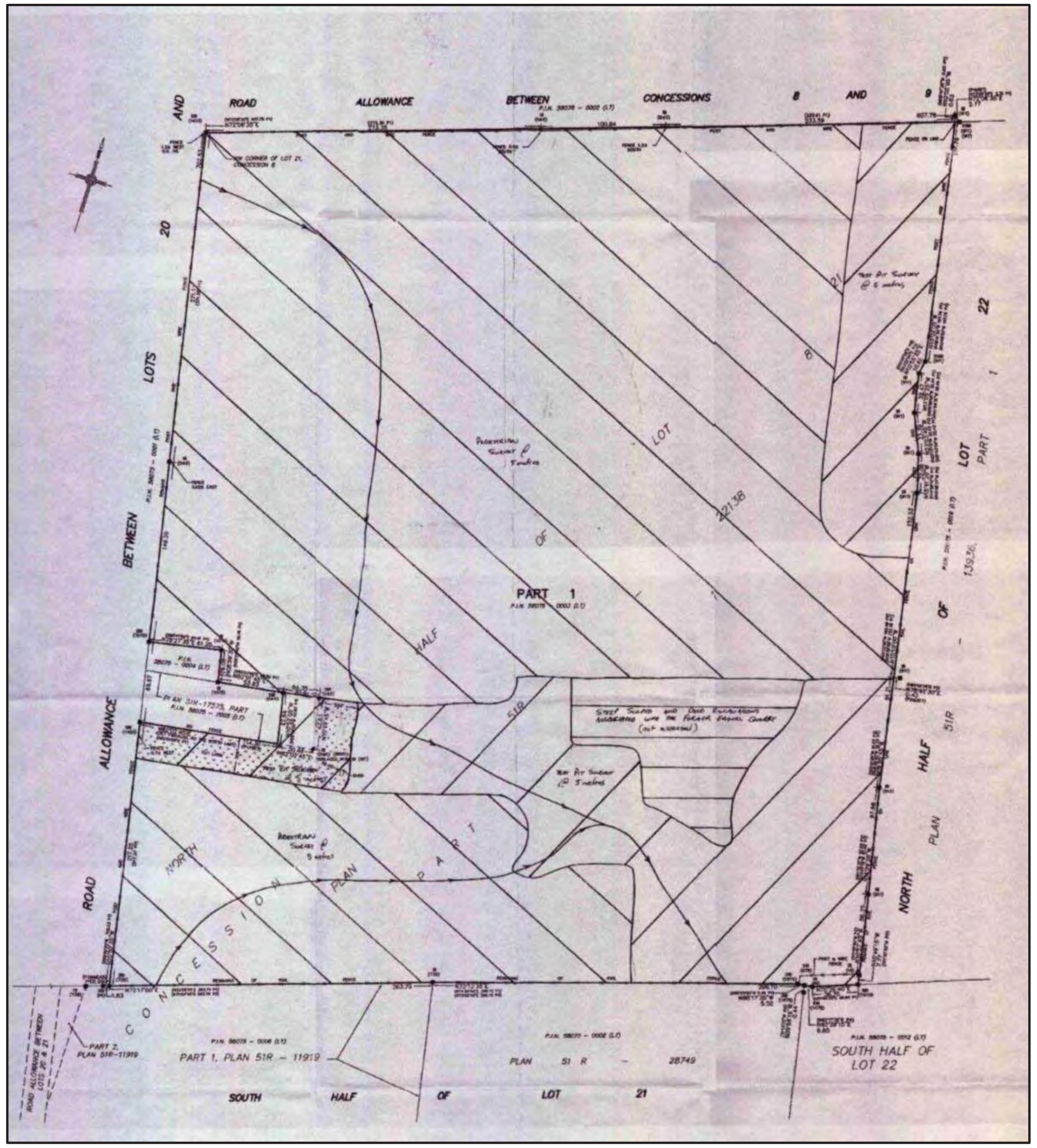
Map 3: Physiography Within the Vicinity of the Project Area



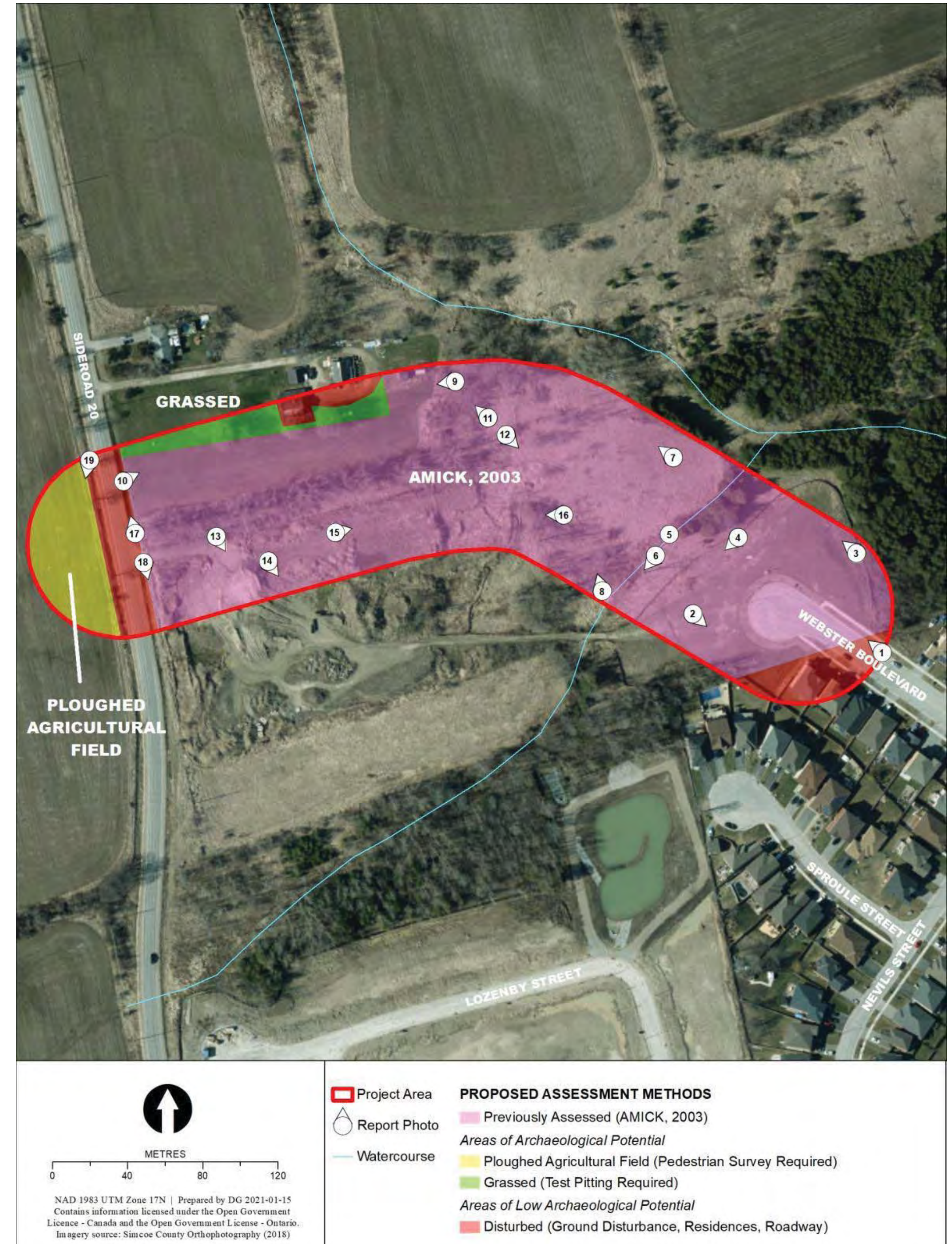
Map 4: Soils Within the Vicinity of the Project Area



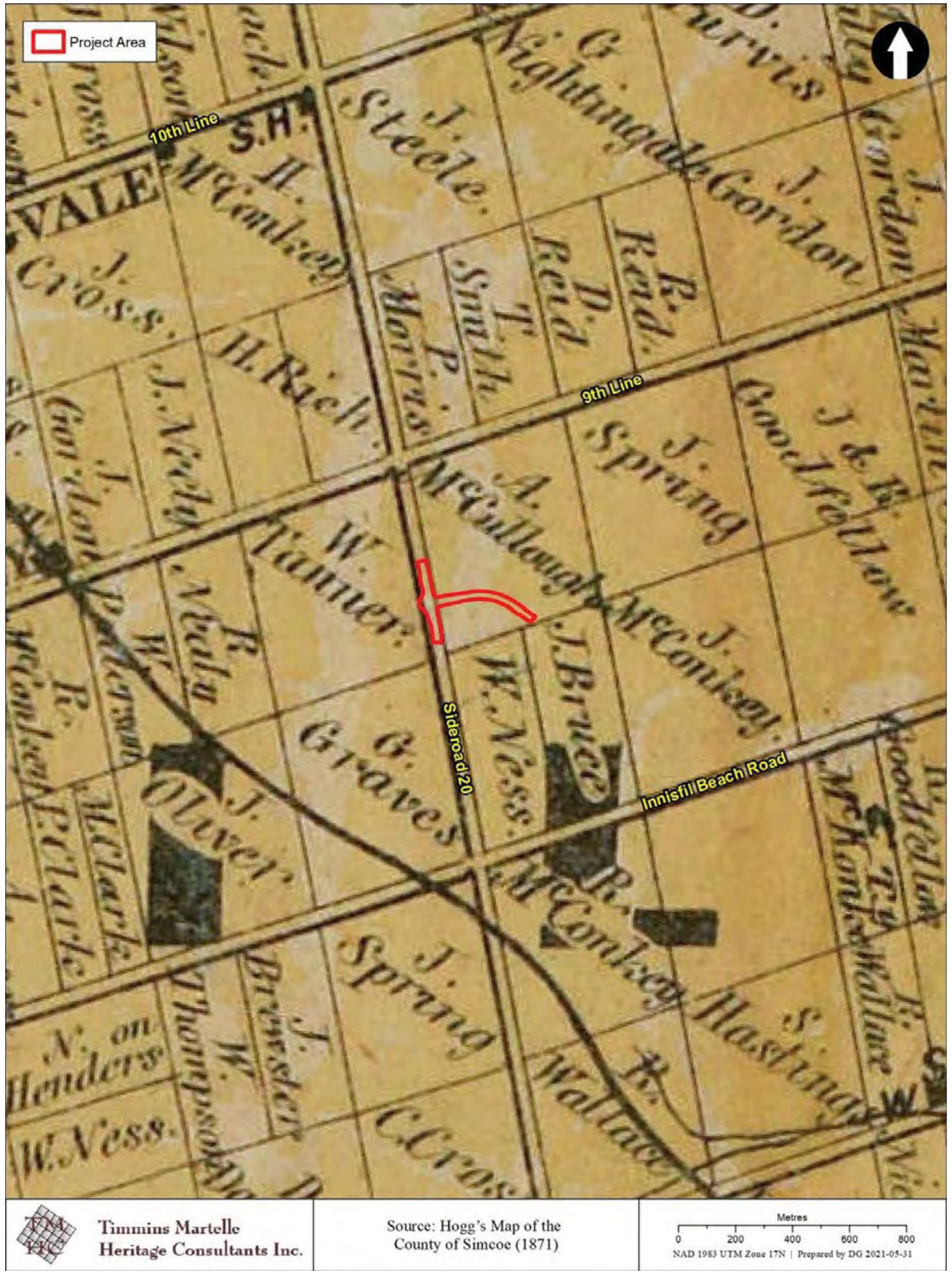
Map 5: Drainage Within the Vicinity of the Project Area



Map 6: AMICK (2003) Stage 1 and 2 Previous Assessment



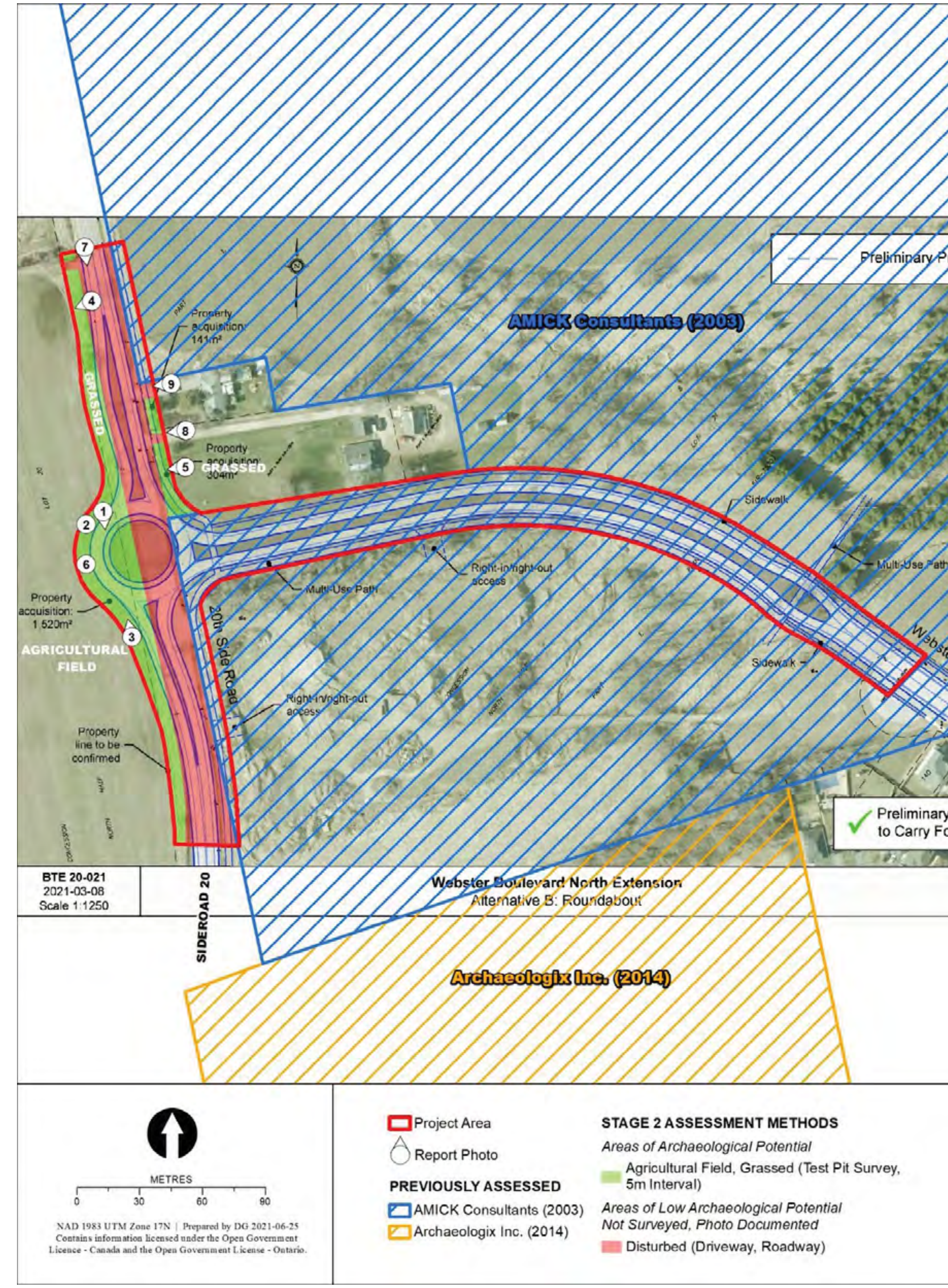
Map 7: TMHC (2021) Stage 1 Assessment Results



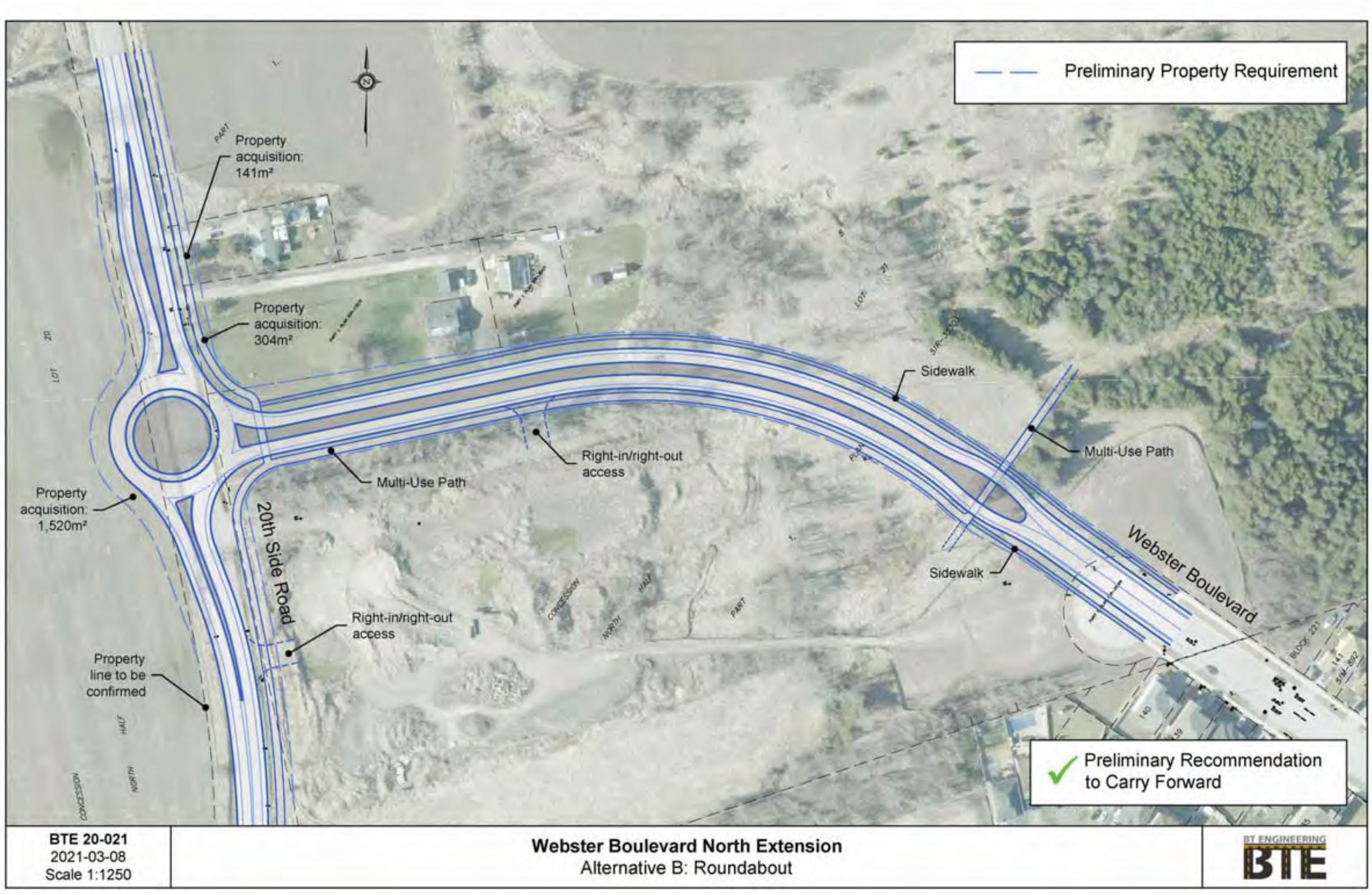
Map 8: Location of the Project Area Shown on 1871 Hogg's Map of Simcoe County

Map 9: Location of the Project Area Shown on 1881 Illustrated Historical Atlas Map

Map 10: Stage 2 Field Conditions and Assessment Results



Map 11: Stage 2 Field Conditions and Assessment Results Shown on Proponent Mapping



Map 12: Unaltered Proponent Mapping

Appendix H

Noise Memorandum

BT ENGINEERING
BTE
9040 Leslie Street, Unit 218
Richmond Hill, ON L4B 3M4
905-709-4554

TECHNICAL MEMORANDUM

TO:	File	**DATE:**	July 9, 2021
FROM:	Steve Taylor, P.Eng./Darcie Dillon, P.Eng.	**PROJECT #:**	20-021
PROJECT:	Webster Boulevard North Extension Environmental Assessment Study		
SUBJECT:	Noise Assessment		

1. INTRODUCTION

The purpose of this technical memorandum is to review the noise impacts to residential properties from vehicular sources from the proposed extension of Webster Boulevard North to 20th Sideroad. There are no rail or air sources of noise. The Study Area is in **Figure 1**.

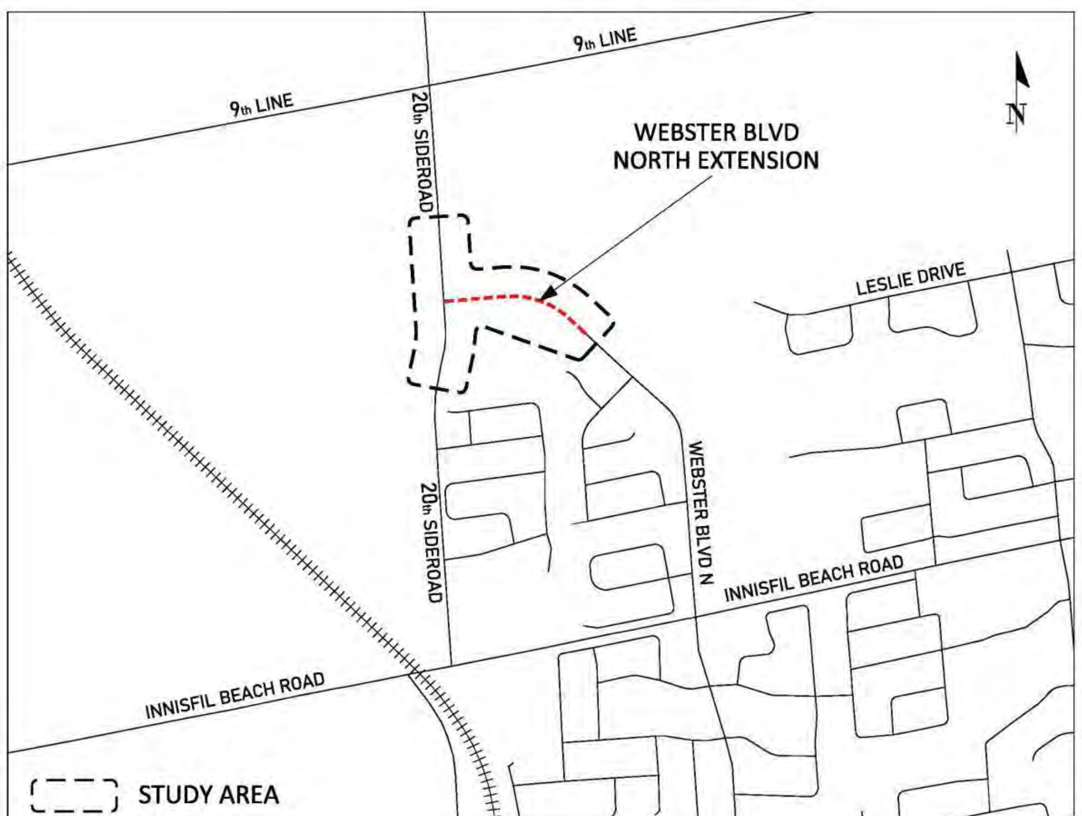


Figure 1: Study Area

The proposed extension will connect the existing terminus of Webster Boulevard to 20th Sideroad. The existing residential properties are considered noise sensitive land uses and require an acoustic assessment to determine the effects of vehicular traffic noise on the residents.

A mitigation assessment is carried out for any receiver sites where the proposed roadworks will result in a noise level increase of greater than 5 dBA or a noise level above 65 dBA, 10 years after construction (2034). Mitigation (noise control) measures will be considered within the right-of-way for noise sensitive receivers.

2. METHODOLOGY

The assessment was conducted within the Study Area to determine the impact to noise sensitive areas (NSA's) and what mitigations measures, if any, should be incorporated into the design.

The assessment was performed in accordance with MECP and MTO Noise Guidelines, MTO/MECP Noise Protocol, and MTO's Environmental Guide for Noise, which are used for the planning of new roadways adjacent to noise sensitive land uses. These guidelines specify the equivalent sound level criteria for indoor and outdoor amenity areas.

STAMSON 5.04 was used to calculate the noise levels for the Outdoor Living Area (OLA). The general overall procedure outlined in this report and the noise assessment included:

- Identification of the noise sources and Noise Sensitive Areas (NSA's) within the Study Area.
- Establishment of receiver sites in the NSA's.
- Prediction of future roadway traffic volumes (2024 horizon for road construction).
- Prediction of the equivalent sound levels for the 2034 horizon planning year.
- A comparison of noise abatement alternatives (if required) and consideration of the need for noise mitigation measures.

3. TRAFFIC INPUT DATA

<u>Webster Boulevard North Extension</u>

Traffic volumes for the new Webster Boulevard North extension were obtained from the traffic analysis completed as part of the Environmental Assessment Study. Traffic growth is estimated at 2% per year. The volumes were used to assess impacts of the earliest planned construction of the road extension (2024). The AADT volumes are illustrated in **Table 1.** A 90/10 daytime/nighttime split for traffic volumes was used.

Table 1: Webster Boulevard Traffic Input Data

	AADT		
	2024 (Existing) and 2034 (Without the Project)	**2024 (With the Project)**	**2034 (With the Project)**
Webster Boulevard North	960	3020	3656

Webster Boulevard North is currently a 2-lane major collector roadway with a posted speed of 50 km/h near the site. The road extension is also planned to be a 2-lane major collector roadway.

20th Sideroad

Traffic volumes for 20th Sideroad were obtained from previous traffic counts completed in 2017; see **Appendix A**. Traffic growth is estimated at 2% per year. The AADT volumes are illustrated in **Table 2**. A 90/10 daytime/nighttime split for traffic volumes was used.

Table 2: 20th Sideroad Traffic Input Data

	AADT		
	2017 Traffic Counts	**2024 (Without and With the Project)**	**2034 (Without and With the Project)**
20th Sideroad	4200	4824	5881

20th Sideroad is currently a 2-lane arterial roadway with a posted speed of 80 km/h near the site. The road extension is also planned to be a 2-lane major collector roadway.

Additional input to the STAMSON model included:

- The intermediate ground surface (hard surface reflects sound, soft surface absorbs sound);
- Distance, in metres, from the source to the receiver, using the centreline of the road as the source;
- The angle at which the receiver (apartment) intercepts the source (roadway), measured relative to the perpendicular line between the source and the receiver;
- Receiver height (standard is 1.5 m above ground level during the daytime and 4.5 m above ground level during the nighttime);
- Posted speed limit – the posted speed limit is 50 km/h for Webster Boulevard and 80 km/h for 20th Sideroad within the study limits;
- Depth of woods (0-30 m, 30-60 m, 60 m or more);
- Roadway grade (slope);
- Topography (hills, flatlands); and
- Existing attenuation due to shielding from barriers (natural or man-made).

4. ANALYSIS OF SOUND LEVELS

Year 2024 16-hour equivalent daytime sound levels and 8-hour nighttime sound levels for the receiver site, calculated using the STAMSON noise software program, are shown in **Table 3**. Year 2034 16-hour equivalent daytime sound levels and 8-hour nighttime sound levels for the receiver site with and without the project are shown in

Table 4.

Table 3: Existing Sound Levels from Traffic Sources

Receiver Site	Year 2024 Day-time (16 h) (Without the Project)	Year 2024 Night-time (8 h) (Without the Project)	Year 2024 Day-time (16 h) (With the Project)	Year 2024 Night-time (8 h) (With the Project)
R1	43.2	42.2	47.6	42.2

Table 4: Future Projected Sound Levels from Traffic Sources with and without the Project

Receiver Site	Year 2034 Day-time (16 h) (Without the Project)	Year 2034 Night-time (8 h) (Without the Project)	Year 2034 Day-time (16 h) (With the Project)	Year 2034 Night-time (8 h) (With the Project)
R1	43.6	42.2	48.4	42.8

These sound levels are representative of comparative changes only. The ambient suburban sound levels from all other sources are forecast to be in the order of 50 dBA (with or without the project).

5. CONCLUSIONS

Where no dominant noise source currently exists or is projected to exist in the future, as a guideline a Class 2 (suburban) area is assumed to be 50 dBA as per MECP's *NPC-205* and *NPC-233*. Noise levels are expected to increase by less than 5 dBA with or without the project in 2024 or 2034, and sound levels are less than 65 dBA; therefore the provision of mitigation is not required. The project will have only a minor effect on sound levels.

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Appendix A

Traffic Volumes for 20th Sideroad
from 2017 Traffic Counts

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Morning Peak Diagram

Specified Period		One Hour Peak	
From:	6:30:00	**From:**	8:00:00
To:	9:30:00	**To:**	9:00:00

Municipality: Innisfil
Site #: 1712800003
Intersection: Innisfil Beach Rd & Webster Blvd
TFR File #: 2
Count date: 3-May-17

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Innisfil Beach Rd runs W/E

North Leg Total: 106
North Entering: 69
North Peds: 24
Peds Cross: ⋈

Heavys	0	0	0	0
Trucks	1	0	1	2
Cars	35	8	24	67
Totals	36	8	25	

Heavys	0
Trucks	4
Cars	33
Totals	37

East Leg Total: 1016
East Entering: 609
East Peds: 30
Peds Cross: ⧗

Webster Blvd

Heavys	Trucks	Cars	Totals
0	27	775	802

Innisfil Beach Rd

Cars	Trucks	Heavys	Totals
6	0	0	6
548	16	0	564
36	3	0	39
590	19	0	

N
W E
S

Heavys	Trucks	Cars	Totals
0	3	17	20
0	11	309	320
0	9	65	74
0	23	391	

Innisfil Beach Rd

Cars	Trucks	Heavys	Totals
392	15	0	407

Webster Blvd

Peds Cross: ⧗
West Peds: 38
West Entering: 414
West Leg Total: 1216

Cars	109
Trucks	12
Heavys	0
Totals	121

Cars	192	10	59	261
Trucks	10	1	3	14
Heavys	0	0	0	0
Totals	202	11	62	

Peds Cross: ⋈
South Peds: 22
South Entering: 275
South Leg Total: 396

Comments

Ontario Traffic Inc

Afternoon Peak Diagram

Specified Period
From: 15:30:00
To: 18:30:00

One Hour Peak
From: 16:30:00
To: 17:30:00

Municipality: Innisfil
Site #: 1712800003
Intersection: Innisfil Beach Rd & Webster Blvd
TFR File #: 2
Count date: 3-May-17

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Innisfil Beach Rd runs W/E

North Leg Total: 150
North Entering: 48
North Peds: 12
Peds Cross: ⋈

Heavys	0	0	0	0
Trucks	1	0	0	1
Cars	17	7	23	47
Totals	18	7	23	

Heavys	0
Trucks	0
Cars	102
Totals	102

East Leg Total: 1351
East Entering: 494
East Peds: 3
Peds Cross: ⧗

Webster Blvd

Heavys	Trucks	Cars	Totals
0	15	569	584

Cars	Trucks	Heavys	Totals
15	0	0	15
424	11	0	435
43	1	0	44
482	12	0	

Innisfil Beach Rd

N
W E
S

Heavys	Trucks	Cars	Totals
0	0	80	80
0	13	780	793
0	2	179	181
0	15	1039	

Innisfil Beach Rd

Cars	Trucks	Heavys	Totals
843	14	0	857

Webster Blvd

Peds Cross: ⧗
West Peds: 6
West Entering: 1054
West Leg Total: 1638

Cars	229
Trucks	3
Heavys	0
Totals	232

Cars	128	7	40	175
Trucks	3	0	1	4
Heavys	0	0	0	0
Totals	131	7	41	

Peds Cross: ⋈
South Peds: 14
South Entering: 179
South Leg Total: 411

Comments

Ontario Traffic Inc

Total Count Diagram

Municipality: Innisfil
Site #: 1712800003
Intersection: Innisfil Beach Rd & Webster Blvd
TFR File #: 2
Count date: 3-May-17

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Innisfil Beach Rd runs W/E

North Leg Total: 795
North Entering: 378
North Peds: 47
Peds Cross: ⋈

Heavys	0	0	0	0
Trucks	7	0	2	9
Cars	216	47	106	369
Totals	223	47	108	

Heavys	0
Trucks	13
Cars	404
Totals	417

East Leg Total: 6320
East Entering: 3199
East Peds: 61
Peds Cross: ⧗

Webster Blvd

Heavys	Trucks	Cars	Totals
1	103	3973	4077

Cars	Trucks	Heavys	Totals
48	3	0	51
2862	70	0	2932
206	10	0	216
3116	83	0	

Innisfil Beach Rd

N
W E
S

Heavys	Trucks	Cars	Totals
0	6	308	314
0	62	2741	2803
1	25	697	723
1	93	3746	

Innisfil Beach Rd

Cars	Trucks	Heavys	Totals
3047	74	0	3121

Webster Blvd

Peds Cross: ⧗
West Peds: 60
West Entering: 3840
West Leg Total: 7917

Cars	950
Trucks	35
Heavys	1
Totals	986

Cars	895	48	200	1143
Trucks	26	4	10	40
Heavys	1	0	0	1
Totals	922	52	210	

Peds Cross: ⋈
South Peds: 44
South Entering: 1184
South Leg Total: 2170

Comments

Ontario Traffic Inc
Traffic Count Summary

Intersection: Innisfil Beach Rd & Webster Blvd | **Count Date:** 3-May-17 | **Municipality:** Innisfil

North Approach Totals							South Approach Totals					
	Includes Cars, Trucks, & Heavys					North/South Total Approaches		Includes Cars, Trucks, & Heavys				
Hour Ending	Left	Thru	Right	Grand Total	Total Peds		Hour Ending	Left	Thru	Right	Grand Total	Total Peds
7:00:00	3	3	44	50	0	149	7:00:00	86	9	4	99	0
8:00:00	14	4	63	81	3	278	8:00:00	167	4	26	197	0
9:00:00	25	8	36	69	24	344	9:00:00	202	11	62	275	22
16:00:00	14	9	34	57	3	256	16:00:00	160	11	28	199	1
17:00:00	21	1	17	39	4	204	17:00:00	127	7	31	165	6
18:00:00	21	18	18	57	9	227	18:00:00	120	6	44	170	14
Totals:	98	43	212	353	43	1458		862	48	195	1105	43

East Approach Totals							West Approach Totals					
	Includes Cars, Trucks, & Heavys					East/West Total Approaches		Includes Cars, Trucks, & Heavys				
Hour Ending	Left	Thru	Right	Grand Total	Total Peds		Hour Ending	Left	Thru	Right	Grand Total	Total Peds
7:00:00	7	269	3	279	0	355	7:00:00	1	56	19	76	0
8:00:00	17	549	5	571	1	825	8:00:00	19	184	51	254	4
9:00:00	39	564	6	609	30	1023	9:00:00	20	320	74	414	38
16:00:00	49	574	8	631	8	1273	16:00:00	45	469	128	642	4
17:00:00	34	391	5	430	7	1394	17:00:00	84	722	158	964	6
18:00:00	51	409	17	477	10	1462	18:00:00	83	720	182	985	6
Totals:	197	2756	44	2997	56	6332		252	2471	612	3335	58

Calculated Values for Traffic Crossing Major Street

Hours Ending:	0:00	0:00	7:00	8:00	9:00	16:00	17:00	18:00
Crossing Values:	0	0	98	190	306	197	168	175

Ontario Traffic Inc

Count Date: 3-May-17 **Site #:** 1712800003

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Heavys - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
6:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45:00	2	2	1	1	28	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00:00	3	1	3	2	44	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	4	1	3	0	53	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	7	3	4	1	74	21	1	1	0	0	1	1	0	0	0	0	0	0	1	1
7:45:00	9	2	4	0	94	20	1	0	0	0	3	2	0	0	0	0	0	0	1	0
8:00:00	16	7	7	3	103	9	1	0	0	0	4	1	0	0	0	0	0	0	3	2
8:15:00	20	4	10	3	117	14	1	0	0	0	4	0	0	0	0	0	0	0	3	0
8:30:00	25	5	12	2	125	8	1	0	0	0	4	0	0	0	0	0	0	0	19	16
8:45:00	36	11	14	2	129	4	2	1	0	0	5	1	0	0	0	0	0	0	24	5
9:00:00	40	4	15	1	138	9	2	0	0	0	5	0	0	0	0	0	0	0	27	3
9:15:00	43	3	18	3	145	7	2	0	0	0	5	0	0	0	0	0	0	0	27	0
9:30:00	45	2	19	1	157	12	2	0	0	0	5	0	0	0	0	0	0	0	30	3
9:33:14	45	0	19	0	160	3	2	0	0	0	5	0	0	0	0	0	0	0	30	0
15:30:00	45	0	19	0	160	0	2	0	0	0	5	0	0	0	0	0	0	0	30	0
15:45:00	50	5	23	4	165	5	2	0	0	0	6	1	0	0	0	0	0	0	30	0
16:00:00	54	4	24	1	171	6	2	0	0	0	6	0	0	0	0	0	0	0	30	0
16:15:00	56	2	25	1	176	5	2	0	0	0	6	0	0	0	0	0	0	0	30	0
16:30:00	65	9	25	0	179	3	2	0	0	0	6	0	0	0	0	0	0	0	30	0
16:45:00	69	4	25	0	183	4	2	0	0	0	6	0	0	0	0	0	0	0	34	4
17:00:00	75	6	25	0	188	5	2	0	0	0	6	0	0	0	0	0	0	0	34	0
17:15:00	83	8	30	5	190	2	2	0	0	0	6	0	0	0	0	0	0	0	35	1
17:30:00	88	5	32	2	196	6	2	0	0	0	7	1	0	0	0	0	0	0	42	7
17:45:00	91	3	38	6	200	4	2	0	0	0	7	0	0	0	0	0	0	0	43	1
18:00:00	96	5	43	5	205	5	2	0	0	0	7	0	0	0	0	0	0	0	43	0
18:15:00	101	5	44	1	208	3	2	0	0	0	7	0	0	0	0	0	0	0	46	3
18:30:00	105	4	47	3	216	8	2	0	0	0	7	0	0	0	0	0	0	0	47	1
18:31:44	106	1	47	0	216	0	2	0	0	0	7	0	0	0	0	0	0	0	47	0

Ontario Traffic Inc

Count Date: 3-May-17 Site #: 1712800003

Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Heavys - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
6:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45:00	3	3	140	140	1	1	0	0	5	5	0	0	0	0	0	0	0	0	0	0
7:00:00	6	3	264	124	3	2	1	1	5	0	0	0	0	0	0	0	0	0	0	0
7:15:00	8	2	414	150	4	1	1	0	8	3	0	0	0	0	0	0	0	0	1	1
7:30:00	11	3	534	120	4	0	2	1	11	3	0	0	0	0	0	0	0	0	1	0
7:45:00	16	5	684	150	5	1	2	0	13	2	1	1	0	0	0	0	0	0	1	0
8:00:00	22	6	804	120	7	2	2	0	14	1	1	0	0	0	0	0	0	0	1	0
8:15:00	28	6	948	144	8	1	3	1	23	9	1	0	0	0	0	0	0	0	2	1
8:30:00	34	6	1085	137	10	2	3	0	26	3	1	0	0	0	0	0	0	0	4	2
8:45:00	40	6	1224	139	13	3	5	2	28	2	1	0	0	0	0	0	0	0	13	9
9:00:00	58	18	1352	128	13	0	5	0	30	2	1	0	0	0	0	0	0	0	31	18
9:15:00	72	14	1502	150	14	1	5	0	33	3	1	0	0	0	0	0	0	0	32	1
9:30:00	82	10	1639	137	16	2	5	0	39	6	2	1	0	0	0	0	0	0	33	1
9:33:14	83	1	1658	19	17	1	5	0	39	0	2	0	0	0	0	0	0	0	36	3
15:30:00	83	0	1658	0	17	0	5	0	39	0	2	0	0	0	0	0	0	0	36	0
15:45:00	94	11	1788	130	19	2	6	1	46	7	2	0	0	0	0	0	0	0	38	2
16:00:00	105	11	1908	120	20	1	7	1	48	2	2	0	0	0	0	0	0	0	39	1
16:15:00	114	9	1992	84	20	0	8	1	54	6	2	0	0	0	0	0	0	0	40	1
16:30:00	121	7	2090	98	20	0	9	1	56	2	2	0	0	0	0	0	0	0	45	5
16:45:00	130	9	2199	109	23	3	9	0	58	2	2	0	0	0	0	0	0	0	45	0
17:00:00	136	6	2286	87	25	2	10	1	61	3	2	0	0	0	0	0	0	0	46	1
17:15:00	149	13	2403	117	31	6	10	0	62	1	2	0	0	0	0	0	0	0	48	2
17:30:00	164	15	2514	111	35	4	10	0	67	5	2	0	0	0	0	0	0	0	48	0
17:45:00	176	12	2602	88	36	1	10	0	68	1	2	0	0	0	0	0	0	0	53	5
18:00:00	187	11	2687	85	41	5	10	0	69	1	3	1	0	0	0	0	0	0	56	3
18:15:00	198	11	2769	82	45	4	10	0	70	1	3	0	0	0	0	0	0	0	61	5
18:30:00	206	8	2852	83	47	2	10	0	70	0	3	0	0	0	0	0	0	0	61	0
18:31:44	206	0	2862	10	48	1	10	0	70	0	3	0	0	0	0	0	0	0	61	0

Ontario Traffic Inc

Count Date: 3-May-17 Site #: 1712800003

Interval Time	Passenger Cars - South Approach						Trucks - South Approach						Heavys - South Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		South Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
6:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45:00	42	42	0	0	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
7:00:00	84	42	8	8	4	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0
7:15:00	122	38	8	0	10	6	3	1	2	1	2	2	0	0	0	0	0	0	0	0
7:30:00	161	39	10	2	16	6	4	1	2	0	2	0	0	0	0	0	0	0	0	0
7:45:00	205	44	11	1	22	6	4	0	2	0	2	0	0	0	0	0	0	0	0	0
8:00:00	249	44	11	0	28	6	4	0	2	0	2	0	0	0	0	0	0	0	0	0
8:15:00	302	53	15	4	36	8	6	2	2	0	3	1	0	0	0	0	0	0	0	0
8:30:00	348	46	15	0	44	8	9	3	2	0	4	1	0	0	0	0	0	0	3	3
8:45:00	401	53	20	5	66	22	12	3	3	1	5	1	0	0	0	0	0	0	15	12
9:00:00	441	40	21	1	87	21	14	2	3	0	5	0	0	0	0	0	0	0	22	7
9:15:00	488	47	22	1	94	7	16	2	3	0	5	0	0	0	0	0	0	0	22	0
9:30:00	527	39	22	0	99	5	18	2	3	0	5	0	0	0	0	0	0	0	22	0
9:33:14	530	3	22	0	100	1	18	0	3	0	6	1	0	0	0	0	0	0	22	0
15:30:00	530	0	22	0	100	0	18	0	3	0	6	0	0	0	0	0	0	0	22	0
15:45:00	556	26	29	7	111	11	19	1	4	1	7	1	0	0	0	0	0	0	23	1
16:00:00	595	39	31	2	113	2	20	1	4	0	7	0	0	0	0	0	0	0	23	0
16:15:00	631	36	33	2	118	5	21	1	4	0	7	0	0	0	0	0	0	0	23	0
16:30:00	654	23	34	1	125	7	21	0	4	0	8	1	0	0	0	0	0	0	24	1
16:45:00	692	38	38	4	136	11	22	1	4	0	9	1	0	0	0	0	0	0	29	5
17:00:00	719	27	38	0	142	6	23	1	4	0	9	0	0	0	0	0	0	0	29	0
17:15:00	754	35	40	2	157	15	24	1	4	0	9	0	0	0	0	0	0	0	33	4
17:30:00	782	28	41	1	165	8	24	0	4	0	9	0	0	0	0	0	0	0	38	5
17:45:00	808	26	43	2	174	9	24	0	4	0	10	1	0	0	0	0	0	0	42	4
18:00:00	837	29	44	1	185	11	25	1	4	0	10	0	0	0	0	0	0	0	43	1
18:15:00	863	26	46	2	192	7	25	0	4	0	10	0	1	1	0	0	0	0	43	0
18:30:00	894	31	47	1	200	8	26	1	4	0	10	0	1	0	0	0	0	0	44	1
18:31:44	895	1	48	1	200	0	26	0	4	0	10	0	1	0	0	0	0	0	44	0

Ontario Traffic Inc

Count Date: 3-May-17 Site #: 1712800003

Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Heavys - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
6:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45:00	1	1	22	22	7	7	0	0	2	2	2	2	0	0	0	0	0	0	0	0
7:00:00	1	0	54	32	17	10	0	0	2	0	2	0	0	0	0	0	0	0	0	0
7:15:00	2	1	86	32	31	14	0	0	4	2	2	0	0	0	0	0	0	0	1	1
7:30:00	8	6	128	42	46	15	2	2	7	3	4	2	0	0	0	0	0	0	1	0
7:45:00	10	2	165	37	54	8	2	0	8	1	4	0	0	0	0	0	0	0	1	0
8:00:00	18	8	228	63	66	12	2	0	12	4	4	0	0	0	0	0	0	0	4	3
8:15:00	21	3	317	89	93	27	2	0	13	1	6	2	0	0	0	0	0	0	4	0
8:30:00	23	2	397	80	102	9	3	1	16	3	11	5	0	0	0	0	0	0	7	3
8:45:00	30	7	453	56	113	11	4	1	20	4	13	2	0	0	0	0	0	0	34	27
9:00:00	35	5	537	84	131	18	5	1	23	3	13	0	0	0	0	0	0	0	42	8
9:15:00	42	7	601	64	153	22	5	0	28	5	15	2	0	0	0	0	0	0	42	0
9:30:00	46	4	670	69	167	14	5	0	36	8	15	0	0	0	0	0	0	0	42	0
9:33:14	47	1	683	13	171	4	5	0	38	2	15	0	0	0	0	0	0	0	42	0
15:30:00	47	0	683	0	171	0	5	0	38	0	15	0	0	0	0	0	0	0	42	0
15:45:00	61	14	811	128	209	38	5	0	38	0	16	1	0	0	0	0	1	1	46	4
16:00:00	80	19	991	180	254	45	5	0	38	0	17	1	0	0	0	0	1	0	46	0
16:15:00	101	21	1135	144	286	32	5	0	42	4	19	2	0	0	0	0	1	0	50	4
16:30:00	115	14	1314	179	322	36	6	1	45	3	22	3	0	0	0	0	1	0	50	0
16:45:00	138	23	1501	187	361	39	6	0	47	2	23	1	0	0	0	0	1	0	52	2
17:00:00	163	25	1699	198	406	45	6	0	52	5	23	0	0	0	0	0	1	0	52	0
17:15:00	177	14	1881	182	450	44	6	0	57	5	23	0	0	0	0	0	1	0	53	1
17:30:00	195	18	2094	213	501	51	6	0	58	1	24	1	0	0	0	0	1	0	56	3
17:45:00	218	23	2263	169	539	38	6	0	59	1	24	0	0	0	0	0	1	0	56	0
18:00:00	246	28	2410	147	586	47	6	0	61	2	25	1	0	0	0	0	1	0	58	2
18:15:00	270	24	2555	145	627	41	6	0	62	1	25	0	0	0	0	0	1	0	59	1
18:30:00	305	35	2725	170	692	65	6	0	62	0	25	0	0	0	0	0	1	0	60	1
18:31:44	308	3	2741	16	697	5	6	0	62	0	25	0	0	0	0	0	1	0	60	0

Appendix I

Geotechnical Report

BT ENGINEERING

BTE

Geotechnical Investigation Report

Webster Boulevard North Extension to 20th Sideroad, Town of Innisfil, Ontario

Cambium Reference No.: 11486-001

July 20, 2021

Prepared for: BT Engineering

Cambium Inc.

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Facsimile: (705) 742.7907

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1.0 INTRODUCTION

Cambium Inc. (Cambium) was retained by BT Engineering (Client) to complete a geotechnical investigation in support of Municipal Class Environmental Assessment (Class EA) Schedule ‘‘C” study for the Webster Boulevard North Extension to 20th Sideroad in the Town of Innisfil, Ontario (the Site). It is understood that the proposed extension will include the roadway construction and possible underground services. Design drawings for the proposed extension were not provided to us at the time of preparation of this report. However, based on correspondence with the Client, the proposed roadway extension will be a 4-lane (two in each direction) roadway with a 2 m wide concrete median. The recommendations included for any underlying services may have to be revised when more details are available.

The geotechnical investigation was requested to confirm the existing subsurface conditions and provide geotechnical design and construction recommendations for the proposed road extension. A Site Plan, including borehole locations, is included as Figure 1 of this report.

2.0 METHODOLOGY

2.1 BOREHOLE INVESTIGATION

A borehole investigation was completed on October 14th, 2020, to assess subsurface conditions at the Site. A total of four boreholes, designated as BH101-20 through BH104-20, were advanced. All of the boreholes were terminated at depths ranging from 3.5 m to 5.0 m below ground surface (mbgs). Boreholes are numbered consecutively from east to west. Locations of the boreholes are shown on Figure 1.

The borehole locations and elevations were surveyed by A.R. (Sandy) Wakeling Surveying Technical Services. The borehole UTMs and elevations are provided on the borehole logs in Appendix A.

Drilling and sampling was completed using a track-mounted drill rig, under the supervision of a Cambium Geotechnical Analyst. The boreholes were advanced to the pre-determined depths by means of continuous flight hollow stem augers with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) N values were recorded as the number of blows required to drive a split spoon (SS) sampler 305 mm into the soil using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. Soil samples were collected at 0.75 m intervals from 0 to 3 m and at 1.5 m intervals after 3 m. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, laboratory testing, and storage. Open boreholes were checked for groundwater and general stability prior to backfilling.

Three boreholes, BH101-20, BH102-20 and BH103-20 were outfitted with monitoring wells in order to measure static groundwater levels at the Site.

Borehole logs are provided in Appendix A. Site soil and groundwater conditions are described and geotechnical recommendations are discussed in the following sections of this report.

2.2 PHYSICAL LABORATORY TESTING

Physical laboratory testing, including four (4) sieve and hydrometer analyses (LS-702, 705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Natural moisture content testing (LS-701) was completed on all retrieved soil samples. Results are presented in Appendix B and are discussed in Section 3.0.

3.0 SUBSURFACE CONDITIONS

The subsurface soil and groundwater conditions encountered in the boreholes are presented on the attached Borehole Logs in Appendix A. The stratigraphic boundaries indicated on the logs are inferred from non-continuous samples and observations of drilling resistance and typically represent a transition from one soil type to another, sometime gradually. The boundaries should not be interpreted to represent exact planes of geologic change. The subsurface conditions have been confirmed in a series of widely spaced boreholes, and will vary between and beyond the borehole locations.

3.1 TOPSOIL / ORGANIC FILL

Boreholes BH102-20, BH103-20, and BH104-20 encountered a layer of topsoil from the surface. The thickness of the organic fill measures an average 760 mm. The organic fill was described as black to brown sand with trace gravel, trace silt and some organics. The natural moisture content of the topsoil ranged from 9.6% to 16.2%. Tests on organic content were not part of the scope of this project.

3.2 SAND

A deposit of sand was encountered from the surface of BH101-20. The sand extends to a depth of about 1.5 mbgs. The sand deposit is composed of brown sand with some gravel, some silt, occasional cobbles, and contains organics. The deposit is likely fill material.

SPT N-values recorded in the sand measure 13 and 12 blows per 305 mm of penetration (bpf), indicative of a compact relative density.

3.3 SAND AND SILT

Native deposits of sand and silt were encountered underlying the sand in BH101-20 and underlying the topsoil in BH102-20 through BH104-20. The deposits were encountered at depths ranging from 0.7 to 1.5 mbgs and extended to the termination depths of this investigation.

The sand and silt range in composition from grey to grey brown sandy silt to sand and silt, with trace to some clay and trace gravel.

SPT N-values recorded within the sands and silts range from 12 to over 50 bpf, indicative of a compact to very dense relative density.

Laboratory particle size distribution analysis was completed for four samples of the sands and silts, taken from the boreholes and depths provided in Table 1 in order to identify the soil texture based on the Unified Soil Classification System (USCS). The laboratory results are also provided in Appendix B.

Table 1 Particle Size Distribution – Sand and Silt Soils

BH	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	% Moisture content
BH101-20 SS 3	1.5 – 2.0	Sandy silt with some clay and trace gravel	1	28	60	11	12.5
BH102-20-SS 2	0.8-1.2	Sand and Silt with some clay and trace gravel	1	46	41	12	14.2
BH102-20-SS 5	3 – 3.5	Silt and Sand with some clay	0	36	1	13	11.3
BH103-20 SS 2	0.8 – 1.2	Sand and Silt with some clay and trace gravel	6	45	36	13	8.9

3.4 GROUNDWATER

Groundwater (free water) and caving was noted in borehole BH104-20 immediately following drilling. Monitoring wells were installed in boreholes, BH101-20, BH102-20, and BH103-20. The groundwater levels in monitoring wells were measured on October 22, 2020 and are summarized in Table 2.

The moisture content of the soils generally ranged from 8.9% to 16.2%. It should be noted that soil moisture and groundwater levels at the Site may fluctuate seasonally and in response to climatic events.

Table 2 Ground Water and Caving Observations

Date	Borehole ID	Borehole Elevation (m)	Depth to Wet Soils During Investigation (mbgs)*	Depth to Confirmed Groundwater (mbgs)	Ground Water Elevation (mASL)	Caving Depth (mbgs)
October 14, 2020	BH101-20	263.96				
	BH102-20	264.12				
	BH103-20	269.48				
	BH104-20	268.85	1.2		267.65	2.9
October 22, 2020	BH101-20	263.96	/A	3.27	260.69	N/A
	BH102-20	264.12	/A	3.38	261.64	/A
	BH103-20	269.48	/A	2.68	268.15	/A

4.0 GEOTECHNICAL CONSIDERATIONS

The following discussion and recommendations are based on the factual data obtained from this investigation and are intended for use by the owner and the design engineer. Contractors bidding or providing services on this project should review the factual data and determine their own conclusions regarding the construction methods and scheduling.

This report is based on the assumption that the design features relevant to the geotechnical analysis will be completed in accordance with applicable codes, standards, and guidelines of practice. If there are changes to the site development features, or there is any significant variations in the subsurface conditions that are found before or during construction, Cambium should be retained to review the implications of these changes with respect to the contents of this report.

4.1 SITE PREPARATION

The existing topsoil and any organic materials encountered should be excavated and removed from beneath the proposed roadway and extending a horizontal distance of 2 m from the edge of the pavement and/or drainage swales.

The exposed subgrade must be proof-rolled and inspected by a qualified geotechnical engineer prior to placement of any granular fill. Any loose/soft soils identified at the time of proof-rolling should be sub-excavated and removed. The excavations created through the removal of these materials should be backfilled with approved engineered fill consistent with the recommendations provided below.

The cohesionless soils encountered at this site can be very unstable if they are wet or below the groundwater table. Such conditions are common in the spring and late fall. Increasing the thickness of the imported granular fill or incorporating reinforcing geotextiles, may be required to prevent severe rutting during construction.

4.2 FROST PENETRATION

Based on climate data and design charts, the maximum frost penetration depth below the surface at the site is estimated at 1.5 mbgs. Any services should be located below this depth or be appropriately insulated.

4.3 EXCAVATIONS AND BACKFILL

All excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). The generally dense to very dense silty sand soils may be classified as Type 3 soils above the groundwater table in accordance with OHSA. Type 3 soils may be excavated with side slopes no steeper than 1H:1V are required to grade. Below the groundwater table, the soils may be classified as Type 4 soils and must be excavated with unsupported side slopes no steeper than 3H:1V. Alternatively, the sides of the excavations can be fully supported (shored) to allow for near vertical excavations.

Excavation side slopes should be protected from exposure to precipitation and associated ground surface runoff and should be inspected regularly for signs of instability. If localized instability is noted during excavation or if wet conditions are encountered, the side slopes should be flattened or supported as required to maintain safe working conditions).

4.4 GROUNDWATER CONTROL

The groundwater table was encountered across the site and appeared to vary in depth as measured in the monitoring wells. The groundwater levels measured at the property on October 22, 2020 vary between 260.7 mASL and 268.2 mASL. The ground water level is likely located at approximately 261± mASL with perched water to be anticipated in the upper deposits.

If groundwater is encountered during construction, it should be manageable with filtered sumps and pumps. A Permit to Take Water (PTTW) or registration in the Environmental Activity and Sector Registry (EASR) may be required depending on the volume of water displaced from the site. Excavation work, particularly any trench excavation, should be carried out in sections in order to control the daily volume of seepage. The elevation of the groundwater table will vary due to seasonal conditions and in response to heavy precipitation events. In order to minimize predictable water issues and costs, it is recommended that excavation and in-ground construction be performed in drier seasons.

4.5 BACKFILL AND COMPACTION

Topsoil or soils containing organic material are not appropriate for reuse as grade raise fill or pavement structure for the proposed roadway. Provided the existing soils are free of contamination, the excavated sands and silts may be appropriate for reuse as backfill up to the underside of the pavement structure, provided that the moisture content of these materials is within 2% of the optimum to ensure adequate compaction, and that the material is only used below frost penetration depth of 1.5 m below proposed grade. Soils with elevated moisture could be put aside to dry, or mixed with dryer earth borrow. Alternatively, materials of higher moisture content could be wasted and replaced with imported material which can be readily compacted. Geotechnical inspections and testing of engineered fill are required to confirm acceptable quality.

Any engineered fill should be placed in maximum lifts of 300 mm and be compacted to a minimum of 100% of standard Proctor maximum dry density (SPMDD), as confirmed by nuclear densometer testing. Trench backfill consisting of earth borrow can be compacted to a minimum of 95% of the SPMDD value. If native soils from the site are not used as engineered fill, imported material for engineered fill should consist of clean, non-organic soils, free of chemical contamination or deleterious material. The moisture content of the engineered fill will need to be close

enough to optimum at the time of placement to allow for adequate compaction. Consideration could be given to using a material meeting the specifications of OPSS.MUNI 1010 Granular B Type I or II, or an approved equivalent. Buried utility backfill material should consist of free-draining imported granular material. Most of the native site soils are too fine-grained to provide proper drainage, and as such this should be accomplished using well graded Granular B Type 1 material complying with OPSS 1010.

The backfill material, if any, in the upper 300 mm below the pavement subgrade elevation should be compacted to 100% of SPMDD in all areas.

4.6 SITE SERVICING

The bedding requirements for any site services could be in accordance with OPSD 0802.0310 for rigid pipes in overburden (Type 3) excavations. The pipe bedding material should consist of at least 150 mm of a Class B bedding such as that meeting OPSS.MUNI 1010 Granular A.

In areas where unsuitable material (such as earth fill material) exists below the pipe subgrade level, or where the subgrade becomes disturbed due to construction activities, the unsuitable/disturbed material should be removed and replaced with a subbedding layer of compacted granular material, such as that meeting OPSS.MUNI 1010 Granular B Type II. To provide adequate support for the pipe in areas where subexcavation of material is required below design subgrade level, the excavations should be sized to allow a 1 horizontal to 2 vertical spread of granular material down and out from the bottom of the pipe.

Cover material, from pipe spring line to at least 300 mm above the top of the pipe, should consist of OPSS.MUNI 1010 Granular A.

The use of clear crushed stone as bedding or subbedding material should not be permitted. The subbedding, bedding and cover materials should be compacted in maximum 200 mm thick lifts to at least 98% of the SPMDD.

The recommendations for the underground services should be reviewed by Cambium following the detailed design phase and updated if required.

4.7 PAVEMENT DESIGN

4.7.1 SUBGRADE PREPARATION

The performance of the pavement is dependent upon proper subgrade preparation. All topsoil and organic materials should be removed down to native subgrade. The subgrade should be proof rolled and inspected by a Geotechnical Engineer. Any areas where boulders, rutting, or appreciable deflection is noted should be subexcavated and replaced with suitable fill. The fill should be compacted to at least 98% of SPMDD.

The most severe loading conditions on pavement subgrades may occur during construction, and subgrades may become disturbed due to construction operations. The pavement structure provided may not be adequate due to the presence of localized disturbed sections and it may be necessary to increase the thickness of the subbase and/or incorporate a woven geotextile separator between the subgrade surface and the granular subbase. The requirement for an increase in the pavement structure and/or incorporating geotextile will be evaluated by Cambium personnel during proof roll inspections.

4.7.2 ANTICIPATED TRAFFIC VOLUMES

Following discussion with the Town of Innisfil (Town), the Webster Boulevard extension will be revised as a major collector roadway. The traffic study is still ongoing at the time of writing this report, however the Client has indicated that the anticipated Average Annual Daily Traffic (AADT) should be estimated at 3,000 for design purposes. It is assumed that 5 % of the traffic volume will be commercial vehicles.

4.7.3 DESIGN INPUTS

Using an average Truck Factor of 3.0 equivalent Single Axle Loads (ESALs) per truck, the anticipated 20 year ESAL count is taken as 1,200,000 at 2% annual growth.

According to Tables 8-4 and 8-5 of MTO report MI-183, for roadways considered as major collector roads, the following AASHTO 93 design inputs were used to determine the required pavement structure capacity.

- Initial Serviceability, PSI = 4.4
- Terminal Serviceability, PSI = 2.2
- Overall Standard Deviation, 0.49
- Design Reliability, 85 %
- Design Subgrade Modulus, 30 MPa

The required Structural Number (SNreq) to resist the anticipated vehicle loading was calculated to be 102 mm.

4.7.4 PAVEMENT STRUCTURE

The recommended pavement structure should meet the Ministry standards and the Town of Innisfil's (Town) Engineering Design Standards and Specifications, as a minimum, consist of the pavement layers identified in the Minimum Pavement Thickness Column in Table 3. Following confirmation from the Town of Innisfil, the recommended pavement structure assumes that the proposed road would be classified as a major collector road, if this is not the case Cambium should be contacted to review and update the pavement recommendations. The subgrade must also be prepared as described in the preceding section.

Table 3 Recommended Minimum Pavement Structure

Pavement Layer	Design Pavement (SN_{req} = 102 mm)[1]	Minimum Pavement Thickness[2]
Surface Course Asphalt	40 mm HL3 or Superpave 12.5 mm	40 mm HL3 or Superpave 12.5 mm
Binder Course Asphalt	60 mm HL4, HL8 or Superpave 19 mm	100 mm HL4, HL8 or Superpave 19 mm
Granular Base	150 mm OPSS 1010 Granular A	150 mm OPSS 1010 Granular A
Granular Subbase	400 mm OPSS 1010 Granular B	450 mm OPSS 1010 Granular B Type II[3]

[1] For information purposes only
[2] Minimum Pavement Thickness for a Major Collector Roadway per the Town of Innisfil Engineering Design Standards and Specifications Manual, Revision 6, May 2020
[3] Granular B Type I produced from naturally deposited sand, gravel, and cobbles, or quarried bedrock may be permitted subject to written permission by the Town
[4] Material and thickness substitutions must be approved by the Design Engineer.

Granular layers should be placed in 150 mm thick maximum loose lifts and compacted to at least 100% of SPMDD. The granular materials specified should conform to OPSS standards, as confirmed by appropriate materials testing.

4.7.5 PAVEMENT TRANSITIONS

Existing asphaltic concrete should be neatly saw cut at pavement transition areas. The joints should tack coat in accordance to OPSS.MUNI 310 requirements. In order to avoid differential frost heaving where granular thicknesses vary between different pavements, a gradual frost taper should be provided.

4.7.6 PAVEMENT DRAINAGE

The final asphalt surface should be sloped at a minimum of 2% to shed runoff. The subgrade, subbase, and base should be shaped and crowned corresponding with the surface grade.

4.8 DESIGN REVIEW AND INSPECTIONS

Cambium should be retained to complete testing and inspections during construction operations to examine and approve subgrade conditions, placement and compaction of fill materials, granular base courses, and asphaltic concrete.

We should be contacted to review and approve design drawings, prior to tendering or commencing construction, to ensure that all pertinent geotechnical-related factors have been addressed. It is important that onsite geotechnical supervision be provided at this site for excavation and backfill procedures, deleterious soil removal, subgrade inspections and compaction testing.

If there are changes to the project scope and development features, these interpretations made of the subsurface information, for geotechnical design parameters, advice, and comments relating to constructability issues and quality control may not be complete for the project. Cambium should be retained to conduct further review to interpret the implications of such changes with respect to this report.

5.0 CLOSING

We trust that the information contained in this report meets your current requirements. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (705) 719-0700.

Respectfully submitted,

CAMBIUM INC.

Blasco Vijayabaskaran, P.Eng.
Geotechnical Engineer/Project Manager

Rob Gethin, P.Eng.
Group Manager – Geotechnical Services

SEB/RLG/bv/fj

Appended Figures

Appendix A
Borehole Logs

Peterborough
Barrie
Oshawa
Kingston
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CAMBIUM

Log of Borehole: BH/MW101-20

Client: BT Engineering
Contractor: Walker Drilling
Location: Webster Boulevard, Innisfil, ON
Project Name: Geotechnical Investigation: Webster Blvd Extension
Method: Hollow Stem Augers
UTM: 17T, 613691 m E, 4907962 m N
Project No.: 11486-001
Date Completed: October 14, 2020
Elevation: 263.96 mASL

SUBSURFACE PROFILE

Depth (m)	Elevation (m)
0	
1	263
2	262
3	261
4	260
5	259
6	258

Description
Sand: Brown sand, some gravel, some silt, some organics, occasional cobbles, compact, moist
-less cobbles, less organics
Sandy Silt: Grey sandy silt, some clay, trace gravel, compact, moist
-dense
-trace clay
Borehole terminated at 5.0 mbgs

SAMPLE

Number	Type	% Recovery	SPT (N)
1	SS	95	13
2	SS	50	12
3	SS	95	13
4	SS	5	41
5	SS	80	40
6	SS	85	48

% Moisture: 25 50 75
SPT (N): 10 20 30 40

Well Installation: Monument, Cap, Bentonite Plug, PVC Standpipe, Sand Pack, PVC Screen, Cap

Remarks:
Top of Standpipe (TOS) elevation: 265.24 mASL. Groundwater measured at 3.27 mbgs (260.69 mASL) on October 22, 2020

GSA SS3:
1% Gravel
28% Sand
60% Silt
11% Clay

Logged By: CM **Input By:** CM

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CAMBIUM

Log of Borehole: BH/MW102-20

Client: BT Engineering
Contractor: Walker Drilling
Location: Webster Boulevard, Innisfil, ON
Project Name: Geotechnical Investigation: Webster Blvd Extension
Method: Hollow Stem Augers
UTM: 17T, 613640 m E, 4908012 m N
Project No.: 11486-001
Date Completed: October 14, 2020
Elevation: 264.12 mASL

SUBSURFACE PROFILE

Depth (m)	Elevation (m)
0	264
1	263
2	262
3	261
4	260
5	259
6	

Description
Topsoil: Black topsoil, some sand, trace gravel, trace silt, very loose, moist
Sand and Silt: Brown sand and silt, some clay, trace gravel, compact, moist
-grey
-brown
Silt and Sand: Brown silt and sand, some clay, compact, moist
-very dense
Borehole terminated at 5.0 mbgs

SAMPLE

Number	Type	% Recovery	SPT (N)
1	SS	40	2
2	SS	55	12
3	SS	70	16
4	SS	75	16
5	SS	80	21
6	SS	100	50/ 230 mm

% Moisture: 25 50 75
SPT (N): 10 20 30 40

Well Installation: Monument, Cap, Bentonite Plug, PVC Standpipe, Sand Pack, PVC Screen, Cap

Remarks:
Top of Standpipe (TOS) elevation: 265.02 mASL. Groundwater measured at 2.48 mbgs (261.64 mASL) on October 22, 2020

GSA SS2:
1% Gravel
46% Sand
41% Silt
12% Clay

GSA SS5:
0% Gravel
36% Sand
51% Silt
13% Clay

Logged By: CM **Input By:** CM

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CAMBIUM

Log of Borehole: BH/MW103-20

Client: BT Engineering
Project Name: Geotechnical Investigation: Webster Blvd Extension
Project No.: 11486-001
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 14, 2020
Location: Webster Boulevard, Innisfil, ON
UTM: 17T, 613417 m E, 4907991 m N
Elevation: 269.48 mASL

SUBSURFACE PROFILE	SAMPLE					
Description	Number	Type	% Recovery	SPT (N)	Well Installation	Remarks
Topsoil: Black topsoil, some sand, occasionaly cobbles, compact, moist	1	SS	85	15	Monument; Cap; Bentonite Plug; PVC Standpipe	Top of Standpipe (TOS) elevation: 270.83 mASL. Groundwater measured at 1.33 mbgs (268.15 mASL) on October 22, 2020
Sand and Silt: Brown sand and silt, some clay, trace gravel, occasional cobbles, compact, moist	2	SS	80	19		GSA SS2: 6% Gravel 45% Sand 36% Silt 13% Clay
Silty Sand: Grey silty sand, some gravel, trace clay, compact, moist	3	SS	75	19		
Sand: Brown sand, some gravel, trace silt, trace clay, dense, wet	4	SS	75	31	Sand Pack	
-grey	5	SS	60	38	PVC Screen	
-some silt	6	SS	55	50/ 150 mm	Cap	
Borehole terminated at 5.0 mbgs						

Elevation (m): 269, 268, 267, 266, 265, 264
Depth: 0, 1, 2, 3, 4, 5, 6
% Moisture: 25 50 75
SPT (N): 10 20 30 40

Logged By: CM **Input By:** CM

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CAMBIUM

Log of Borehole: BH104-20

Client: BT Engineering
Project Name: Geotechnical Investigation: Webster Blvd Extension
Project No.: 11486-001
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 14, 2020
Location: Webster Boulevard, Innisfil, ON
UTM: 17T, 613465 m E, 4907985 m N
Elevation: 268.85 mASL

SUBSURFACE PROFILE	SAMPLE					
Description	Number	Type	% Recovery	SPT (N)	Well Installation	Remarks
Topsoil: Brown silty sand, trace gravel, trace clay, some organics, dense, moist	1	SS	100	33		
Sand: Brown sand, trace gravel, trace silt, compact, moist	2	SS	55	14		
	3	SS	70	20		
-wet	4	SS	40	30		
	5	SS	90	43		
Borehole terminated at 3.5 mbgs						Caving measured at 2.9 mbgs, groundwater observed at 1.2 mbgs upon completion

Elevation (m): 268, 267, 266, 265
Depth: 0, 1, 2, 3, 4
% Moisture: 25 50 75
SPT (N): 10 20 30 40

Logged By: CM **Input By:** CM

Appendix B

Physical Laboratory Testing Results

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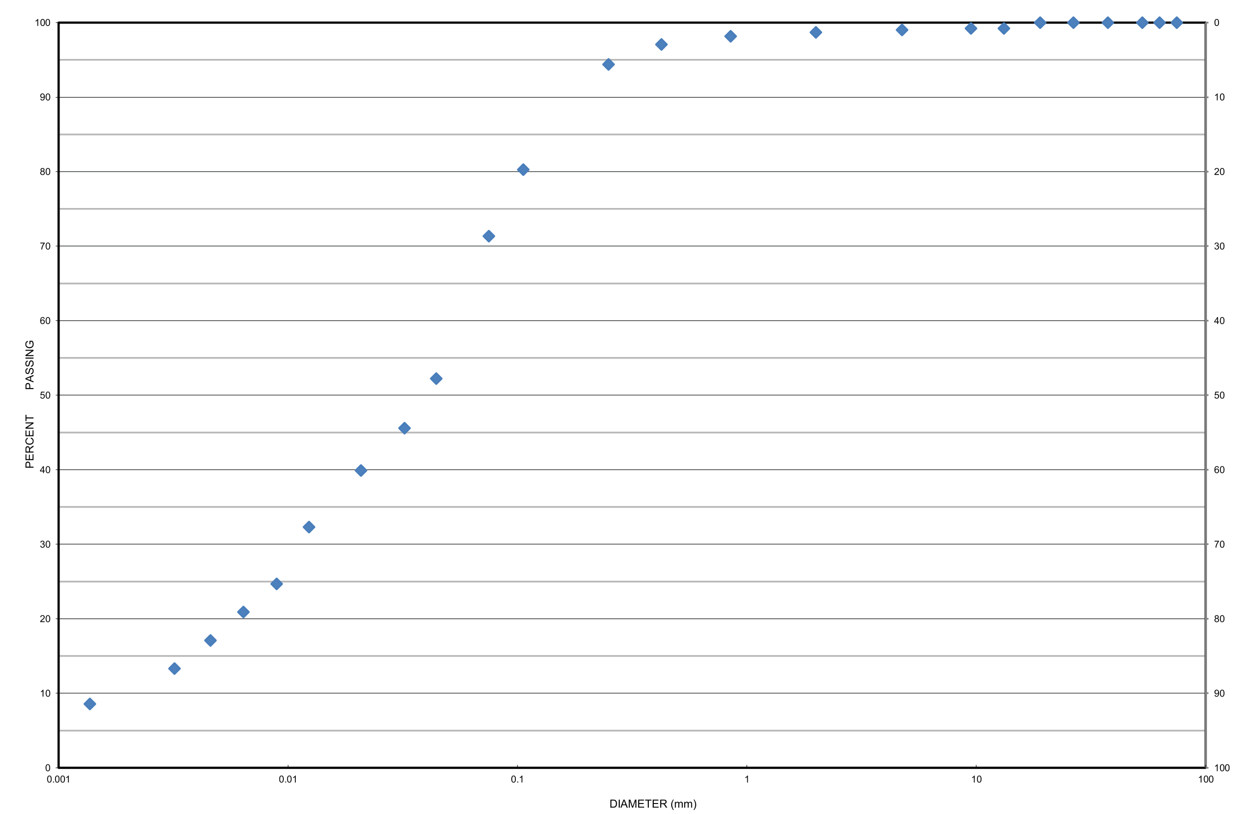
CERTIFIED BY CCIL

Grain Size Distribution Chart

Project Number: *11486-001* **Client:** *BT Engineering*
Project Name: *Innisfil Webster Boulevard Extension*
Sample Date: *October 14, 2020* **Sampled By:** *Chris Malliaros - Cambium Inc.*
Location: *BH 101-20 SS 3* **Depth:** *1.5 m to 2 m* **Lab Sample No:** *S-20-0920*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-20	SS 3	1.5 m to 2 m	1	28	60	11	12.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt some Clay trace Gravel	ML	0.0550	0.0120	0.0018	30.56	1.45

Additional information available upon request

Issued By: (Senior Project Manager) *Date Issued:* *November 4, 2020*

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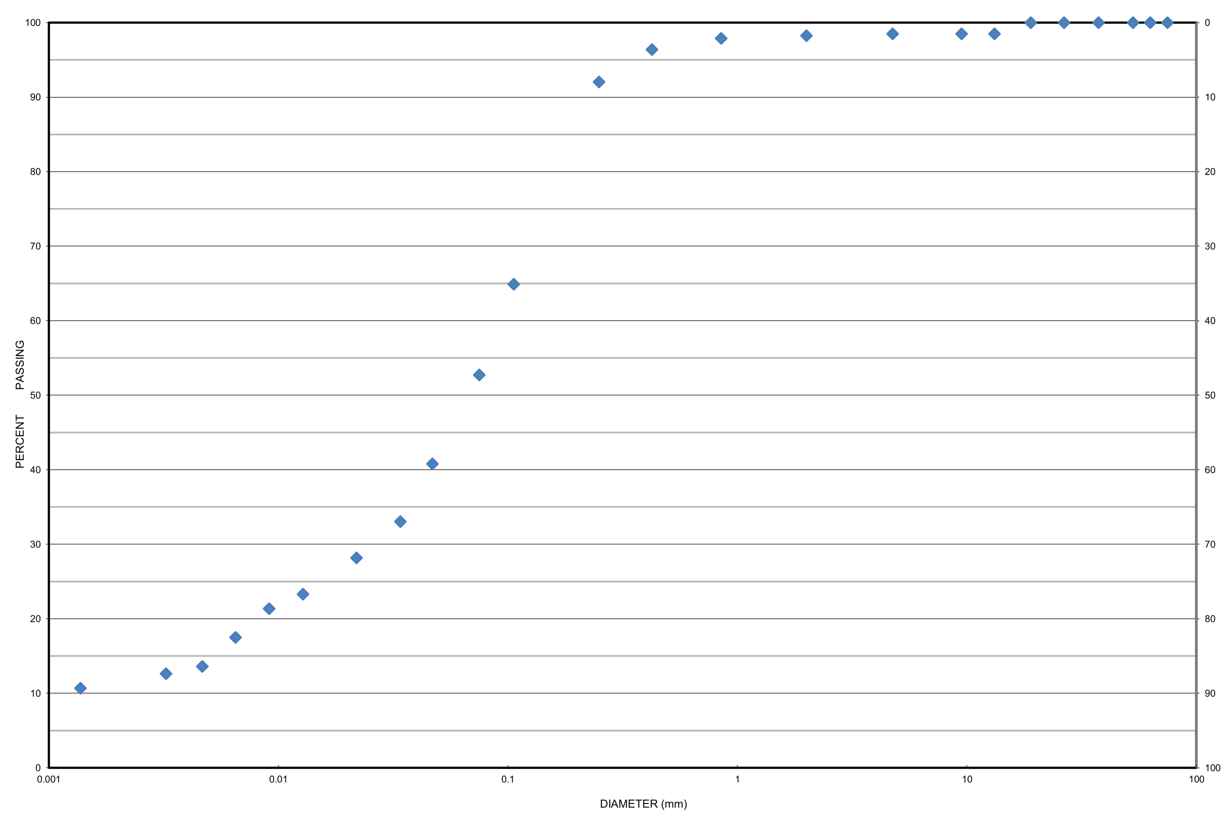
Form: L6V.2 - Grad.Hydo

CAMBIUM

Grain Size Distribution Chart

Project Number: *11486-001* **Client:** *BT Engineering*
Project Name: *Innisfil Webster Boulevard Extension*
Sample Date: *October 14, 2020* **Sampled By:** *Chris Malliaros - Cambium Inc.*
Location: *BH 102-20 SS 2* **Depth:** *0.8 m to 1.2 m* **Lab Sample No:** *S-20-0923*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-20	SS 2	0.8 m to 1.2 m	1	46	41	12	14.2

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Clay trace Gravel	ML	0.091	0.026	0.000	-	-

Additional information available upon request

Issued By: (Senior Project Manager) *Date Issued:* *November 4, 2020*

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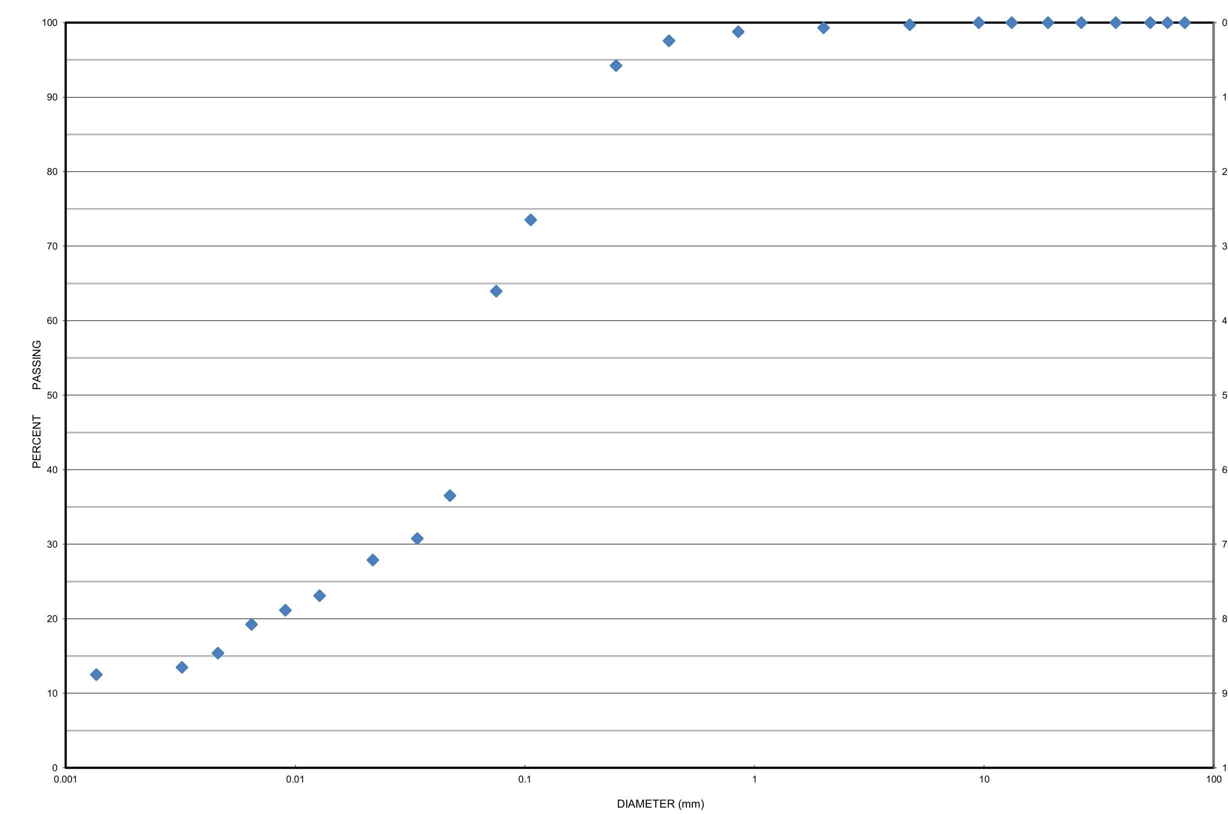
Grain Size Distribution Chart

Project Number: *11486-001* **Client:** *BT Engineering*
Project Name: *Innisfil Webster Boulevard Extension*
Sample Date: *October 14, 2020* **Sampled By:** *Chris Malliaros - Cambium Inc.*
Location: *BH 102-20 SS 5* **Depth:** *3 m to 3.5 m* **Lab Sample No:** *S-20-0921*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-20	SS 5	3 m to 3.5 m	0	36	51	13	11.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt and Sand some Clay	ML	0.070	0.030	0.000	-	-

Additional information available upon request

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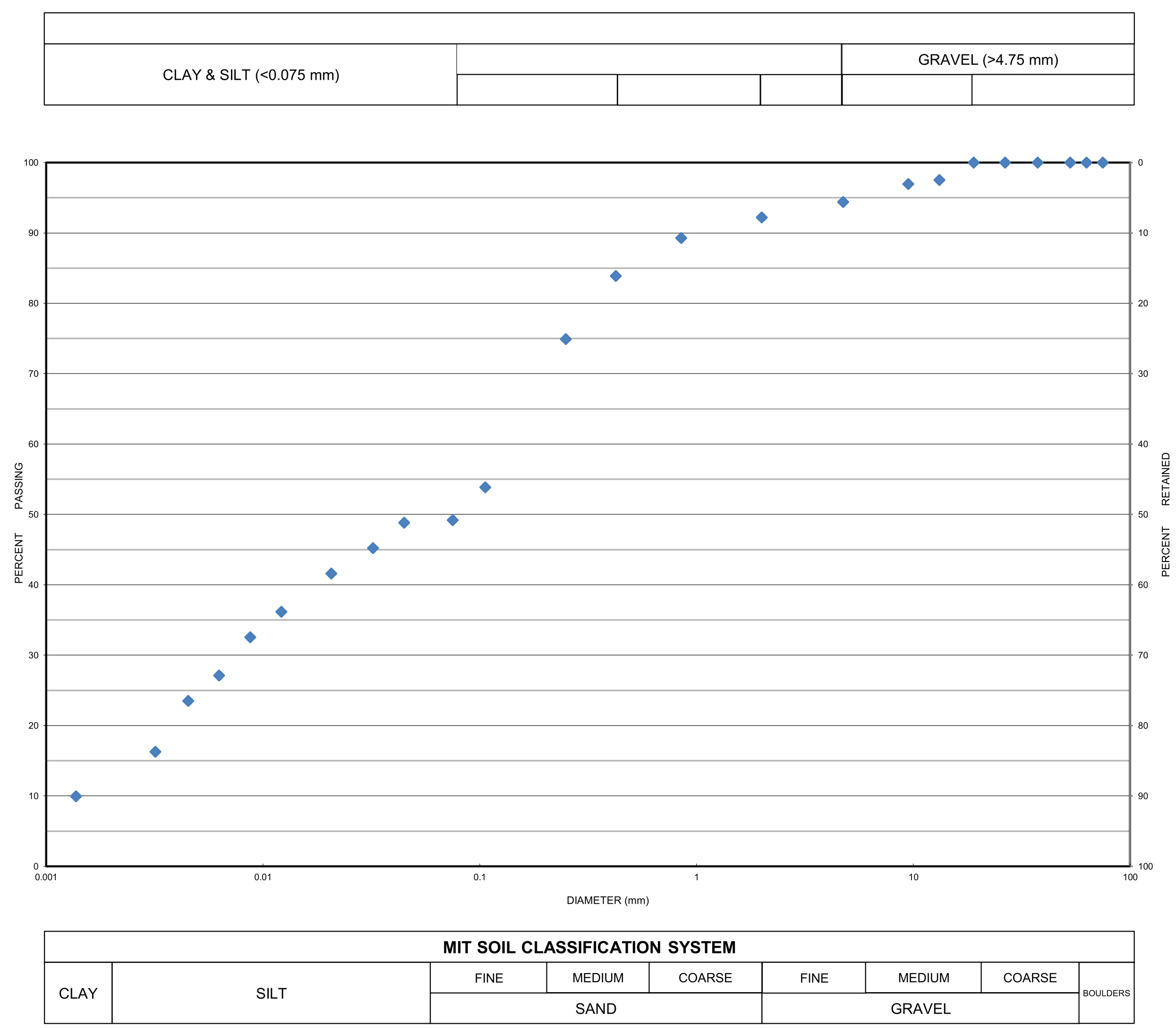
Grain Size Distribution Chart

Project Number: 11486-001 **Client:** BT Engineering
Project Name: Innisfil Webster Boulevard Extension
Sample Date: October 14, 2020 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 103-20 SS 2 **Depth:** 0.8 m to 1.2 m **Lab Sample No:** S-20-0922



Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 103-20	SS 2	0.8 m to 1.2 m	6	45	36	13	8.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Clay trace Gravel	SM	0.1450	0.0075	0.0015	96.67	0.26

Additional information available upon request

Issued By: (Senior Project Manager) *Date Issued:* *November 4, 2020*

Appendix J

Hydrogeological Report

Hydrogeological Assessment, Webster Boulevard North Extension to 20th Sideroad, Town of Innisfil, Ontario

February 16, 2021

Prepared for:
BT Engineering

CAMBIUM

Cambium Reference: 11486-001

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Peterborough | Barrie | Oshawa | Kingston

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Hydrogeological Assessment, Webster Boulevard North Extension to 20th Sideroad, Town of Innisfil, Ontario
BT Engineering
Cambium Reference: 11486-001
February 16, 2021

1.0 Introduction

BT Engineering (Client) retained Cambium Inc. (Cambium) to complete a hydrogeological assessment in support of Municipal Class Environmental Assessment (Class EA) Schedule ""C"study for Webster Boulevard North Extension to 20th Sideroad in the Town of Innisfil (the Site). Specific Site boundaries were not available for review as part of this assessment. As such, the Site is considered the area between the north end of Webster Boulevard and Sideroad 20.

The purpose of this assessment was to obtain subsurface information regarding soil and groundwater conditions at the Site in support of design and construction recommendations for the road extension.

The scope of work for this investigation has been developed based on the proposal request, the nature of the development, and our experience and knowledge of completing supporting studies for Municipal infrastructure projects.

2.0 Methodology

This section outlines the methodology followed to complete the hydrogeological assessment.

2.1 Drilling Program

A borehole investigation was completed on October 14, 2020, to assess subsurface conditions at the Site. A total of four boreholes, designated as BH101-20 through BH104-20, were advanced throughout the Site. All of the boreholes were terminated at depths ranging from 3.5 m to 5.0 m below ground surface (mbgs).

The borehole locations and elevations were surveyed using a Sokkia RTK GPS system. The elevations were adjusted based on a site specific benchmark provided by Dino Astri Surveying Ltd. The borehole UTM coordinates and elevations are provided on the borehole logs in Appendix A. Borehole locations are shown on Figure 1.

Drilling and sampling was completed using a track-mounted drill rig, under the supervision of a Cambium Geotechnical Analyst. The boreholes were advanced to pre-determined depths by means of continuous flight hollow stem augers with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon (SS) sampler 305 mm into the soil using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. Soil samples were collected at 0.75 m intervals from 0 to 3 m and at 1.5 m intervals after 3 m. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, laboratory testing, and storage. Open boreholes were checked for groundwater and general stability or caving prior to backfilling.

Three boreholes, BH101-20, BH102-20, and BH103-20 were outfitted as monitoring wells in order to determine the static groundwater elevation at the Site. Borehole logs are provided in Appendix A.

2.2 Physical Laboratory Testing

Physical laboratory testing, including four (4) sieve and hydrometer analyses (LS-702, 705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Results are presented in Appendix B and are discussed in Section 3.0.

2.3 Hydrogeological Field Tasks

On October 22, 2020 Cambium staff visited the Site to complete Single Well Hydraulic Tests (SWHTs) on the monitoring wells. The SWHTs were completed by inducing an instantaneous change in groundwater head in the well and monitoring water level recovery. Water level recovery was monitored using an automated water level logging device, and validated with manual measurements. The hydraulic conductivity of water bearing units screened in each well was estimated using AquiferTest Pro™ software, the results of which are attached in Appendix C and are discussed further in Section 4.1.

One groundwater sample was collected from well MW103-20 and analyzed for a general suite of organic and inorganic parameters. The sample was submitted to Caduceon Laboratories in Barrie, Ontario (Caduceon) for analysis. Caduceon is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Samples were stored at a temperature between 0 °C and 10 °C prior to and during transport to Caduceon. The groundwater analyses results are attached in Appendix D.

In-situ infiltration testing was attempted on October 22 and December 9, 2020. The shallow subsurface soils were saturated and/or frozen during both Site visits; as such in-situ infiltration testing could not be completed.

3.0 Geological and Hydrogeological Setting

The topography of the Site generally slopes down to the east, towards a small drainage course. The drainage course is oriented northeast/southwest and collects drainage from other areas of the Site. Runoff is conveyed eastwards through the drainage course and delivered to a series of larger surface water systems that flow eastward to Lake Simcoe.

The Site is located in the physiographic region known as Peterborough Drumlin Field. The Peterborough Drumlin Field is approximately 4,530 km2 n area and extends from Hastings County in the east to Simcoe County in the west. This physiographic region contains approximately 3,000 drumlins in addition to many other drumlinoid hills and surface flutings of the till sheet. In general, the drumlins are composed of sand, gravel and boulder till and are separated by low-lying wetlands areas composed of fine-grained soils (Chapman, L.J. and D.F. Putnam, 1984).

According to Map 2556 of the Ontario Geological Survey (Barnett, P.J.,Cowan, W.R. and Henry, A.P., 1991), the following soils are located in the in the area of the Site:

- Till consisting of gravel/cobbles, sandy silt to silty sand-textured till on Paleozoic Terrain.
- Ice-contact stratified deposits consisting of sand and gravel, minor silt, clay and till.

According to the *Bedrock Geology of Ontario, southern sheet*; Ontario Geological Survey, Map 2544, scale 1:1,000,000 (Ontario Geological Survey, 1991), the bedrock in the area of the Site consists of limestone of the Simcoe Group, Lindsay Formation.

3.1 Results of Subsurface Investigation

The subsurface conditions at the site consist of glacial till deposits, predominantly sand with gravel to silty sand. These soils were encountered throughout the boreholes to the termination depths ranging from 3.5 mbgs to 5.0 mbgs. The boreholes were terminated in native soils and bedrock was not encountered within the investigation depths.

The borehole locations are shown on Figure 1 and the individual soil units are described in detail below and provided in detail on the borehole logs in Appendix A.

3.1.1 Grain Size Analyses

Laboratory particle size distribution analyses were completed on three samples of the native soil taken from the boreholes and depths shown in Table 1. The grain size distribution results are provided in Appendix B.

Table 1 Particle Size Distribution Results

orehole	Depth mbgs	Material	%Gravel	%Sand	%Silt	%Clay
BH101-20	1.5 - 2.0	Sandy silt with some clay and trace silt	1	28	60	11
BH102-20	0.8 - 1.2	Silty Sand with some clay and trace gravel	1	46	41	12
BH102-20	3 - 3.5	Silty Sand with some clay	0	36	51	13
BH103-20	0.8 - 1.2	Sandy silt with some clay and trace gravel	6	45	36	13

3.1.2 Estimated Infiltration Rates

The shallow soil samples (i.e., those collected within 2.0 mbgs) were assigned a T-Time based upon their grain size distribution. The document titled *Supplementary Guidelines to the Ontario Building Code 1997* (Ontario Ministry of Municipal Affairs and Housing, 1997) was referenced to determine infiltration rates based upon previously established relationships with T-Times. The estimated infiltration rates of the shallow surficial soils are listed below:

- BH101-20 (depth 1.5 - 2.0 mbgs) - 24 mm/hr
- BH102-20 (depth 0.8 - 1.2 mbgs) - 20 mm/hr
- BH103-20 (depth 0.8 - 1.2 mbgs) - 20 mm/hr

The infiltration rate of the surficial soils ranged from 20 mm/hr to 24 mm/hr. These infiltration rate estimates should be confirmed with in-situ testing (if in-situ infiltration rates are required).

In-situ infiltration testing was attempted as part of this assessment. However, the testing could not be completed successfully due to saturated/frozen soil conditions. In-situ infiltration testing should be completed at a later date (during drier times of the year) during the detailed design stage of any stormwater management and/or Low Impact Development measures.

3.2 Water Well Records

The Ministry's Water Well Information System (WWIS) was accessed to review water well records mapped within 500 m of the presumed route of the extension. There were eight water wells records mapped within 500 m of the extension (as shown on Figure 2).

Two of the water well records outline installations of drilled supply wells, and two well records outline installations of dug supply wells. Two water well records indicate that the well installation was abandoned due to a lack of water. One well record outlines a monitoring well installation. One well record did not contain any information.

Overburden soils were generally recorded as fine grained silt and clay sediments. Confined units of sand and gravel were intercepted by those wells installed for water supply. Bedrock contact was not recorded on any of the well records reviewed as part of this assessment.

The drilled wells ranged in depth between 25 mbgs and 33 mbgs, and encountered viable aquifers at depths of 25 mbgs and 31 mbgs (respectively). Static water levels ranged from 20 mbgs to 30 mbgs. The flow rate of the drilled wells ranged from 7 gallons per minute to 15 gallons per minute.

The dug wells ranged in depth between 11 mbgs and 15 mbgs, and encountered viable aquifers at depths of 10 mbgs and 15 mbgs (respectively). Static water levels ranged from 2 mbgs to 4 mbgs. The flow rate of the dug wells ranged from 3 gallons per minute to 4 gallons per minute.

3.3 Vulnerable and Regulated Areas

As per the Lake Simcoe Region Conservation Authority (LSRCA) mapping, there are regulated areas located within the southern and eastern portions of the development area.

As per the Ministry of the Environment, Conservation and Parks (Ministry) Source Water Protection Information Atlas (SPIA), the Site is within the following areas:

Hydrogeological Assessment, Webster Boulevard North Extension to 20th Sideroad, Town of Innisfil, Ontario
BT Engineering
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February 16, 2021

- Highly Vulnerable Aquifer
- Intake Protection Zone 3

The Town of Innisfil and the LSRCA will review the proposed development and the above identified areas to determine compatibility. LSRCA and SPIA mapping is provided in Appendix E.

3.4 Hydrogeological Conditions

The monitoring wells installed on-site intercepted a shallow overburden aquifer. Available water well information indicates that there is at least one deeper aquifer unit that local private wells have intercepted. The degree of hydraulic connectivity between the shallow overburden aquifer and the deeper aquifer (or aquifers) is not known. The depth to bedrock (or the presence of bedrock aquifers in the area) could not be confirmed.

Water levels were measured from the monitoring wells on October 2, 2020. The water levels ranged from 1.33 mbgs to 3.27 mbgs. Groundwater elevations range from 268.15 masl to 260.69 masl. Groundwater flow within the shallow overburden at the Site is anticipated to be eastwards. Water level and elevation information is outlined in Table 2.

Table 2 Groundwater Level and Elevation Information

Well		BH101-20	BH102-20	H104-20
Top of Pipe Elevation (masl) (1)		265.24	265.02	270.83
Ground Surface Elevation (masl) (1)		263.96	264.12	269.48
Depth (mbgs) (2)		4.60	4.60	4.60
Stick-up (m)		1.28	0.90	1.35
Oct 22, 2020	Water Level (mbgs) (2)	3.27	2.48	1.33
	Groundwater Elev.(masl) (1)	260.69	261.64	268.15

1. *metres relative elevation (relative to local Site benchmark)*
2. *metres below ground surface*

4.0 Results

This section presents the results of the SWHTs and the groundwater quality sampling.

4.1 Single Well Hydraulic Tests

SWHTs were completed on wells MW101-20, MW102-20 and MW103-20 on October 22, 2020. The data generated from the bail tests was processed by AquiferTest Pro™ software, the results of which are summarized in Table 3.

The hydraulic conductivity results of the SWHTs ranged between 1.03×10^{-7} m/s and 1.16×10^{-5} m/s. Monitoring wells MW101-20 and MW102-20 were installed in soils ranging in texture from sandy silt to silt and sand. Monitoring well MW103-20 was installed primarily in sand, with some silty sand near surface. The hydraulic conductivity results are similar to those outlined in literature (J.P.Powers, 2007) (Fetter, 2001). The hydraulic testing results are attached in Appendix C.

Table 3 SWHT Results

Test #	MW101-20	MW102-20	MW103-20
Slug Test 1	3.18×10^{-7} m/s	1.03×10^{-7} m/s	1.00×10^{-5} m/s
Slug Test 2	3.51×10^{-7} m/s	4.91×10^{-6} m/s	1.10×10^{-5} m/s
Slug Test 3	3.30×10^{-7} m/s	3.20×10^{-7} m/s	1.16×10^{-5} m/s

4.2 Groundwater Quality

The groundwater sample collected from well BH103-20 was analyzed for general organic and inorganic parameters (see Appendix D). The results of the groundwater analyses were compared against the Provincial Water Quality Objectives (PWQO) (Ministry of the Environment, 1994). Those parameters reported at concentrations in excess of PWQO criteria are outlined in Table 4.

The total concentrations of phosphorus and several metals were reported greater than their corresponding PWQO criteria. It is likely that the concentrations of most of the parameters reported in excess of PWQO can be reduced to acceptable limits by the use of settling tanks, ponds and/or filtration techniques. A sample of the discharge water (after treatment) should be collected to confirm treatment effectiveness. Further, the water should be treated to the level

appropriate for the receiver (it was assumed herein that discharge water would be directed to ground surface, the ultimate receiver being surface water systems located on and off-site).

The discharge treatment system should be designed and operated by qualified individuals.

Table 4 Groundwater Quality Exceedances of PWQO

Parameter	Concentration – MW103-20 (mg/L)	PWQO Criteria (mg/L)
Total Phosphorus	**18**	0.01
Total Boron	**0.326**	0.2
Total Cadmium	**0.000184**	0.001
Total Cobalt	**0.0137**	0.0009
Total Copper	**0.0321**	0.005
Total Iron	**181**	0.3
Total Lead	**0.0136**	0.001
Total Vanadium	**0.0293**	0.006
Total Zinc	**2.26**	0.02

1. *PWQO criteria include existing and interim values*

5.0 Construction Dewatering – Preliminary Estimates

Detailed development plans of the Webster Boulevard Extension were not available for review at the time this document was prepared. Available information indicates that the sanitary sewer at the north end of Webster Boulevard was installed to a depth of approximately 7 mbgs (and below an elevation of approximately 259 masl).

It was assumed that the extension of Webster Boulevard would include a trench excavation to install utilities and other infrastructure to a depth of 7 mbgs. The maximum length the trench that will be open at any one time was assumed to be 50 m. The depth to groundwater ranged from 1.33 mbgs to 3.27 mbgs. As a conservative measure it was assumed that groundwater levels would be 1 mbgs. It was assumed that the water level would require lowering to 1 m below the bottom of the trench excavation (i.e., 7 m of drawdown).

The high and low hydraulic conductivities of the water bearing soils derived from the SWHTs (1.03×10^{-7} m/s and 1.16×10^{-5} m/s, respectively), were included in the dewatering calculations to establish a range of anticipated dewatering rates.

Note: the monitoring wells included in this assessment did not extend below the elevation of 259 masl. The need to install additional monitoring wells for testing should be confirmed once detailed development plans are available for review.

To calculate inflow into the excavation, the methods outlined in the Construction Dewatering and Groundwater Control (J.P.Powers, 2007) were utilized.

The estimated groundwater inflow rate into the trench excavation ranged between 7 m3/day and 73 m3/day. Dewatering calculations are attached as Appendix F.

The dewatering estimates are provided to guide the detailed design process in terms of permitting needs and dewatering impacts; these should be updated once detailed development plans are available for review.

5.1.1 Zone of Influence

The dewatering calculations include estimates of the horizontal distance away from the walls of each excavation where the influence of water withdrawal will be negligible (i.e., the length to zero drawdown (Kyrieleis, W., Sichardt, W, 1930)). The area included within the length of zero drawdown from the excavation is the zone of influence (ZOI). The length to zero drawdown from the trench excavation extended from 7 m to 72 m from the walls of the trench excavation.

The ZOI should be updated once detailed development plans are available. Once the ZOI is updated, sensitive receptors found within the ZOI (such as private supply wells) should be investigated to determine if they would be at risk from dewatering activities at the Site, and to develop appropriate monitoring and mitigation plans.

6.0 Recommendations

The monitoring wells included in this assessment did not extend below the elevation of 259 masl. The installation elevation of infrastructure (and the elevation of the bottom of the trench) will be confirmed once detailed design plans are prepared. The adequacy of using the monitoring wells included in this assessment should be compared against the detailed design plans. Installing additional monitoring wells should be considered at that time to identify the hydraulic characteristics of deeper sediments if plans indicate excavations below the investigated depths.

The dewatering estimates and ZOI calculations outlined herein should be revised to consider detailed design plans (and information generated from any new wells installed at the Site). Once the ZOI is updated, sensitive receptors found within the ZOI (such as private supply wells) should be investigated to determine if they would be at risk from dewatering activities at the Site. Where risks are identified, appropriate monitoring and mitigation plans should be developed accordingly.

A sample of the discharge water (after treatment) should be collected to confirm treatment effectiveness. Further, the water should be treated to the level appropriate for the receiver (it was assumed herein that discharge water would be directed to ground surface, the ultimate receiver being surface water systems located on and off-site). The discharge treatment system should be designed and operated by qualified individuals.

In-situ infiltration testing could not be completed due to saturated/frozen soil conditions. In-situ infiltration testing should be completed at a later date (during drier times of the year), particularly when considering the detailed design of any stormwater management and/or Low Impact Development measures.

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7.0 Conclusions

BT Engineering retained Cambium to complete a hydrogeological assessment in support of Municipal Class Environmental Assessment (Class EA) Schedule ""C" study for Webster Boulevard North Extension to 20th Sideroad in the Town of Innisfil.

The subsurface conditions at the Site consist of glacial till deposits predominantly sand with gravel to silty sand. Groundwater levels at the Site ranged from ranged from 1.33 mbgs to 3.27 mbgs. Hydraulic testing of the monitoring wells indicate that the hydraulic conductivity of the shallow water bearing soils ranged between 1.03 x 10^{-7} m/s and 1.16 x 10^{-5} m/s. Preliminary construction dewatering rates ranged between 7 m3/dayand 73 m3/day.The ZOI was estimated to extend up to 72 m from the trench excavation.

The ZOI and anticipated dewatering rates should be updated upon review of detailed development plans. In addition, the need for additional work (i.e., infiltration testing, additional well installations, review of sensitive receptors, etc.) should be determined when detailed development plans area available for review.

7.1 Closing

If you have any questions regarding this report please contact the undersigned at 705-742-7900.

Respectfully submitted,

Cambium Inc.

PROFESSIONAL GEOSCIENTISTS
C.M.
Feb 16 2021
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2676
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8.0 References

Armstong, D.K. and Carter, T.R. (2010). *The subsurface Paleozoic stratigraphy of southern Ontario.* Ontario Geological Survey, Special Volume 7.

Barnett, P.J.,Cowan, W.R. and Henry, A.P. (1991). Quaternary geology of Ontario, southern sheet; Ontario.

Chapman L.J. and D.F. Putnam. (1984). *The Physiography of Southern Ontario: Ontario Geological Survey, Special Volume 2.*

Chapman, L.J. and D.F. Putnam. (1984). *The Physiography of Southern Ontario: Ontario Geological Survey, Special Volume 2.*

Fetter, C. (2001). *Applied Hydrogeology (4th Edition).*

J.P.Powers, A. C. (2007). *Construction Dewatering and Groundwater Control, New Methods and Applications.*

Kyrieleis, W., Sichardt, W. (1930). *Grundwasserabsenkung bei Fundierungsarbeiten.* Berlin: Springer.

OGS. (2019). *Bedrock Geology of Ontario, southern sheet; Ontario Geological Survey, scale 1:250 000.*

OGS. (2019). Ontario's Quaternary Geology at a compilation scale of 1:1 000 000.

Ontario Geological Survey. (1991). Bedrock Geology of Ontario, Southern Sheet, Map 2544, scale 1:1,000,000.

Ontario Ministry of Municipal Affairs and Housing. (1997). Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions, Toronto, Ontario.

9.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

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The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work or reports.

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When preparing reports, Cambium considers applicable legislation, regulations, governmental guidelines and policies to the extent they are within its knowledge, but Cambium is not qualified to advise with respect to legal matters. The presentation of information regarding applicable legislation, regulations, governmental guidelines and policies is for information only and is not intended to and should not be interpreted as constituting a legal opinion concerning the work completed or conditions outlined in a report. All legal matters should be reviewed and considered by an appropriately qualified legal practitioner.

Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

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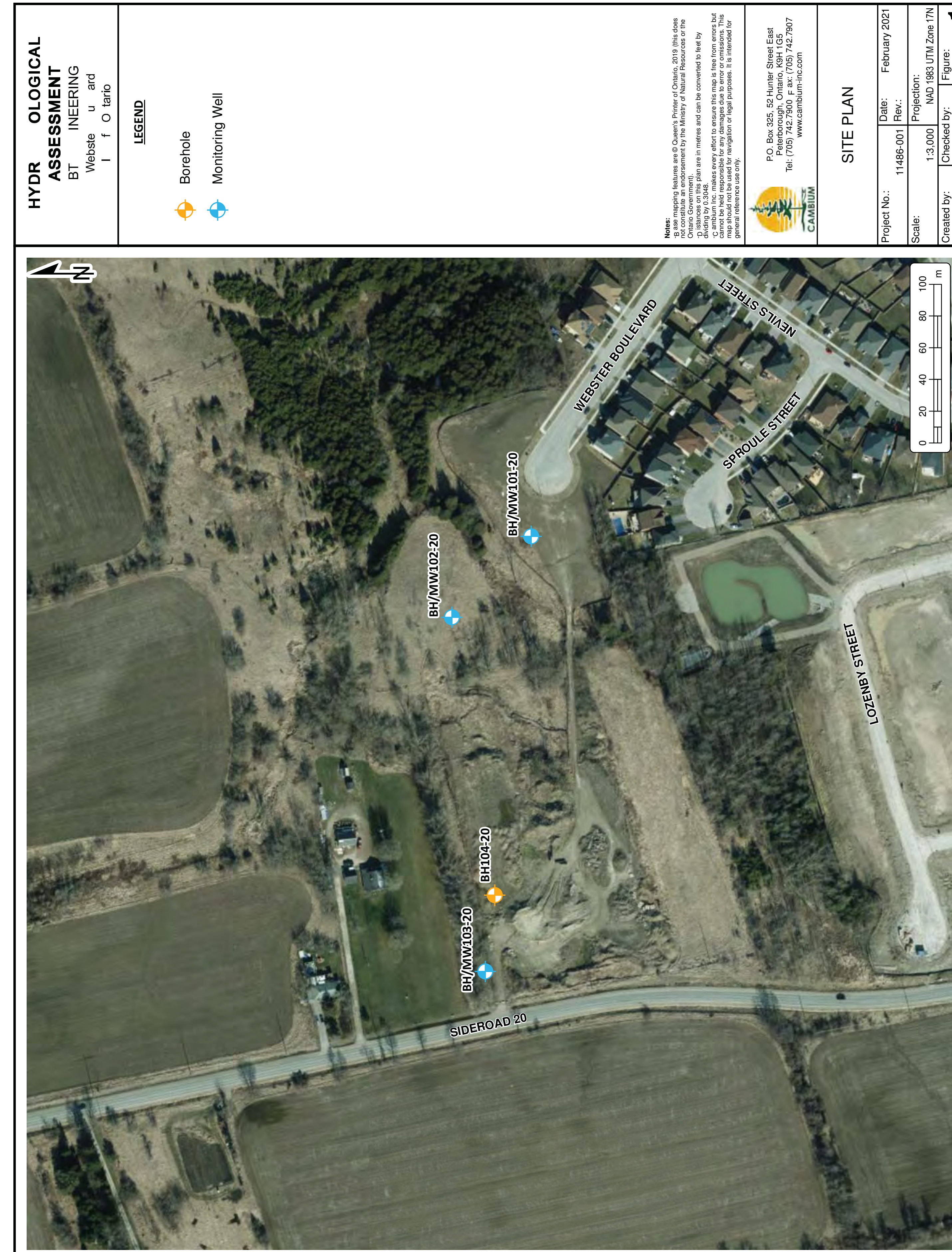
Limitation of Liability

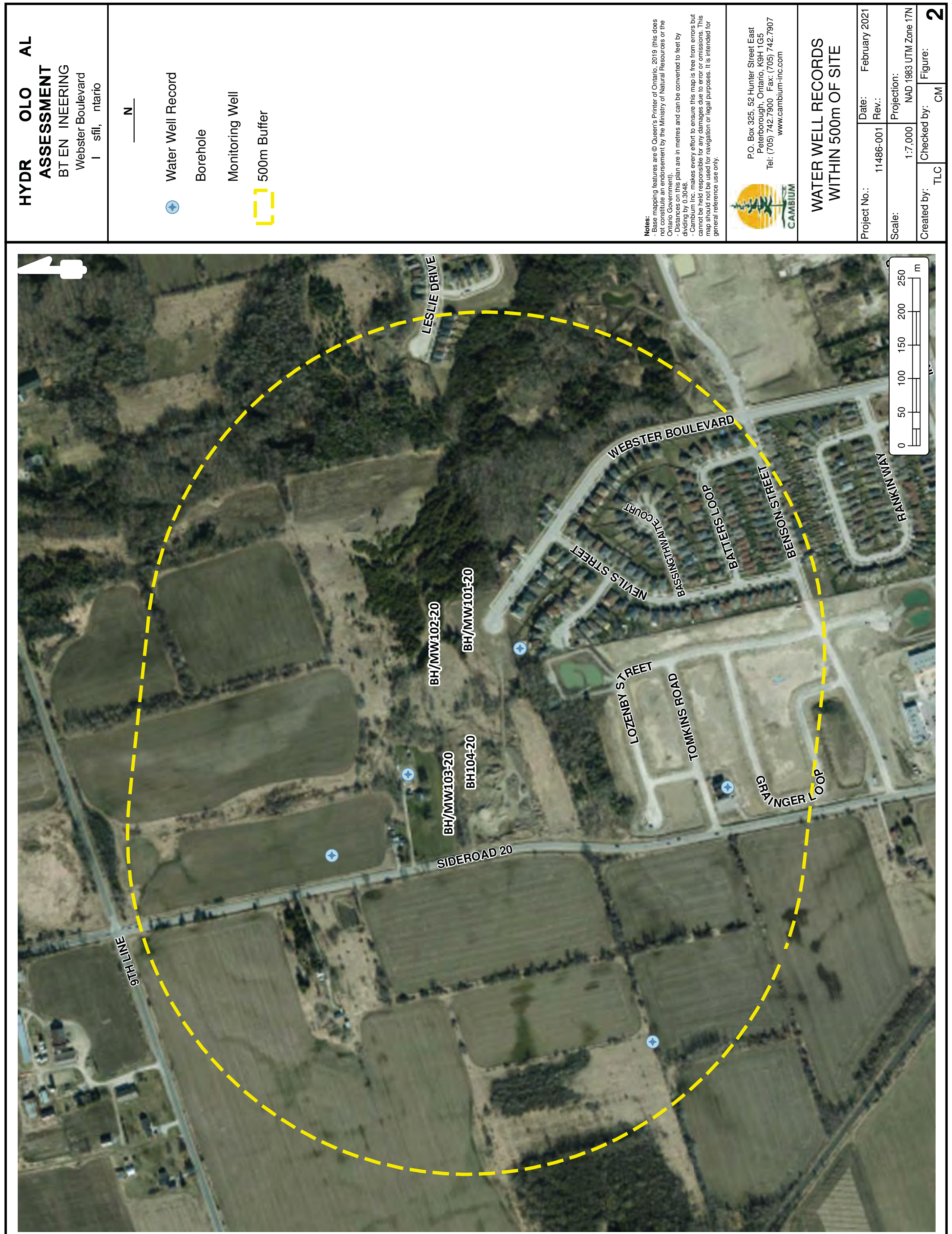
Potential liability to the client arising out of the report is limited to the amount of Cambium's professional liability insurance coverage. Cambium shall only be liable for direct damages to the extent caused by Cambium's negligence and/or breach of contract. Cambium shall not be liable for consequential damages.

Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.

Appended Figures





Appendix A

orehole Logs

CAMBIUM

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Oshawa
Kingston
T: 866-217-7900
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Log of Borehole: H/MW101-20

Page 1 of 1

Client: BT Engineering
Project Name: Geotechnical Investigation: Webster Blvd Extensior
Project No.: 11486-001
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 14, 2020
Location: Webster Boulevard, Innisfil, ON
UTM: 17T, 613691 m E, 4907962 m N
Elevation: 263.96 mASL

SU SURFACE PROFILE | SAMPLE

Elevation (m)	Depth	Description	Number	Type	' Recovery	SPT (N) / DCPT
	0	Sand: Brown sand, some gravel, some silt, occasional cobbles, with organics, compact, moist	1	SS	95	13
263	1		2	SS	50	12
		Sandy Silt: Grey sandy silt, some clay, trace gravel, compact, moist	3	SS	95	13
262	2	-dense	4	SS	5	41
261	3		5	SS	80	40
260	4	-trace clay	6	SS	85	48
259	5	Borehole terminated at 5.0 mbgs				
258	6					

' Moisture: 25 50 75
SPT (N) / DCPT: 10 20 30 40

Well Installation: Monument, Cap, Bentonite Plug, PVC Standpipe, Sand Pack, PVC Screen, Cap

Remarks:
Top of Standpipe (TOS) elevation: 265.24 mASL. Groundwater measured at 3.77 mbgs (260.69 mASL) on October 22, 2020

GSA SS3:
1% Gravel
28% Sand
60% Silt
11% Clay

Logged By: CM **Input By:** CM

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Log of Borehole: H/MW102-20

Page 1 of 1

Client: BT Engineering
Project Name: Geotechnical Investigation: Webster Blvd Extensior
Project No.: 11486-001
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 14, 2020
Location: Webster Boulevard, Innisfil, ON
UTM: 17T, 613640 m E, 4908012 m N
Elevation: 264.12 mASL

SU SURFACE PROFILE | SAMPLE

Elevation (m)	Depth	Description	Number	Type	' Recovery	SPT (N) / DCPT
264	0	Topsoil: Black sandy silt, trace gravel, with orgamics, very loose, moist	1	SS	40	2
263	1	Sand and Silt: Grey brown sand and silt, some clay, trace gravel, compact, moist	2	SS	55	12
			3	SS	70	16
262	2		4	SS	75	16
261	3		5	SS	80	21
260	4	-very dense	6	SS	100	50/ 230 mm
259	5	Borehole terminated at 5.0 mbgs				
	6					

' Moisture: 25 50 75
SPT (N) / DCPT: 10 20 30 40

Well Installation: Monument, Cap, Bentonite Plug, PVC Standpipe, Sand Pack, PVC Screen, Cap

Remarks:
Top of Standpipe (TOS) elevation: 265.02 mASL. Groundwater measured at 2.48 mbgs (261.64 mASL) on October 22, 2020

GSA SS2:
1% Gravel
46% Sand
41% Silt
12% Clay

GSA SS5:
0% Gravel
36% Sand
51% Silt
13% Clay

Logged By: CM **Input By:** CM

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Log of Borehole: H/MW103-20

Client: BT Engineering
Project Name: Geotechnical Investigation: Webster Blvd Extension
Project No.: 11486-001
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 14, 2020
Location: Webster Boulevard, Innisfil, ON
UTM: 17T, 613417 m E, 4907991 m N
Elevation: 269.48 mASL

SU SURFACE PROFILE		SAMPLE					
Depth (m)	Description	Number	Type	' Recovery	SPT (N) / DCPT	Well Installation	Remarks
0	Topsoil: Black clayey silt, some sand, occasional cobbles, with organics, compact, moist	1	SS	85	15	Monument; Cap; Bentonite Plug; PVC Standpipe	Top of Standpipe (TOS) elevation: 270.83 mASL. Groundwater measured at 1.33 mbgs (268.15 mASL) on October 22, 2020
	Sand and Silt: Grey brown sand and silt, some clay, trace gravel, occasional cobbles, compact, moist	2	SS	80	19		GSA SS2: 6% Gravel 45% Sand 36% Silt 13% Clay
		3	SS	75	19		
	-dense	4	SS	75	31	Sand Pack; PVC Screen	
		5	SS	60	38		
	-very dense	6	SS	55	50/ 150 mm	Cap	
5.0	Borehole terminated at 5.0 mbgs						

Elevation scale (m): 269, 268, 267, 266, 265, 264; Depth scale: 0, 1, 2, 3, 4, 5, 6
Moisture: 25 50 75; SPT (N) / DCPT: 10 20 30 40

Logged By: CM **Input By:** CM

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Log of Borehole: H104-20

Client: BT Engineering
Project Name: Geotechnical Investigation: Webster Blvd Extension
Project No.: 11486-001
Contractor: Walker Drilling
Method: Hollow Stem Augers
Date Completed: October 14, 2020
Location: Webster Boulevard, Innisfil, ON
UTM: 17T, 613465 m E, 4907985 m N
Elevation: 268.85 mASL

SU SURFACE PROFILE		SAMPLE					
Depth (m)	Description	Number	Type	' Recovery	SPT (N) / DCPT	Well Installation	Remarks
0	Topsoil: Brown silty sand, trace gravel, trace clay, with organics, dense, moist	1	SS	100	33		
	Sand and Silt: Brown sand and silt, trace gravel, compact, moist	2	SS	55	14		
		3	SS	70	20		
	-wet	4	SS	40	30		
		5	SS	90	43		
3.5	Borehole terminated at 3.5 mbgs						Caving measured at 2.9 mbgs, groundwater observed at 1.2 mbgs upon completion

Elevation scale (m): 268, 267, 266, 265; Depth scale: 0, 1, 2, 3, 4
Moisture: 25 50 75; SPT (N) / DCPT: 10 20 30 40

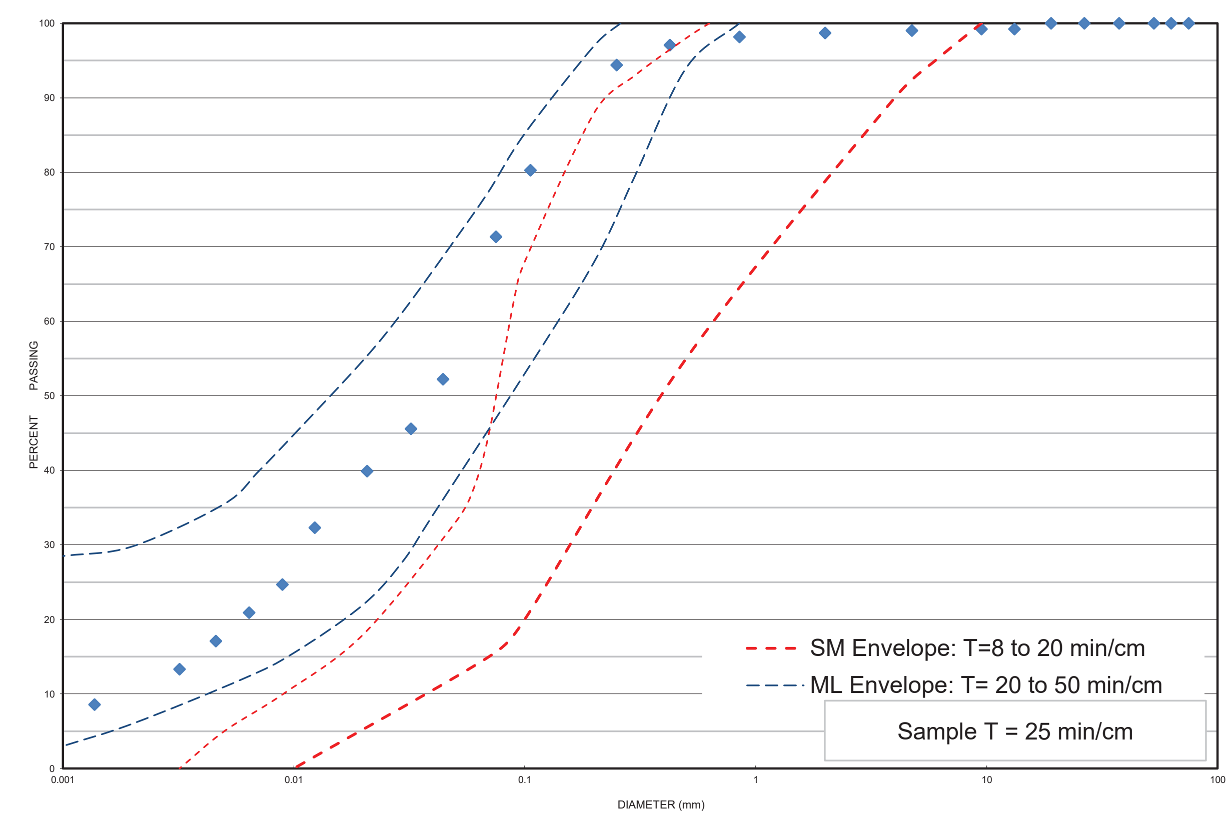
Logged By: CM **Input By:** CM

Appendix
Grain Size Analyses

Grain Size Distribution Chart

Project Number:	11486-001	**Client:**	BT Engineering		
Project Name:	Innisfil Webster Boulevard Extension				
Sample Date:	October 14, 2020	**Sampled By:**	Chris Malliaros - Cambium Inc.		
Location:	BH 101-20 SS 3	**Depth:**	1.5 m to 2 m	**Lab Sample No:**	S-20-0920

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-20	SS 3	1.5 m to 2 m	1	28	60	11	12.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt some Clay trace Gravel	ML	0.0550	0.0120	0.0018	30.56	1.45

Additional information availabe upon request

Issued By: (Senior Project Manager) Date Issued: January 27, 2021

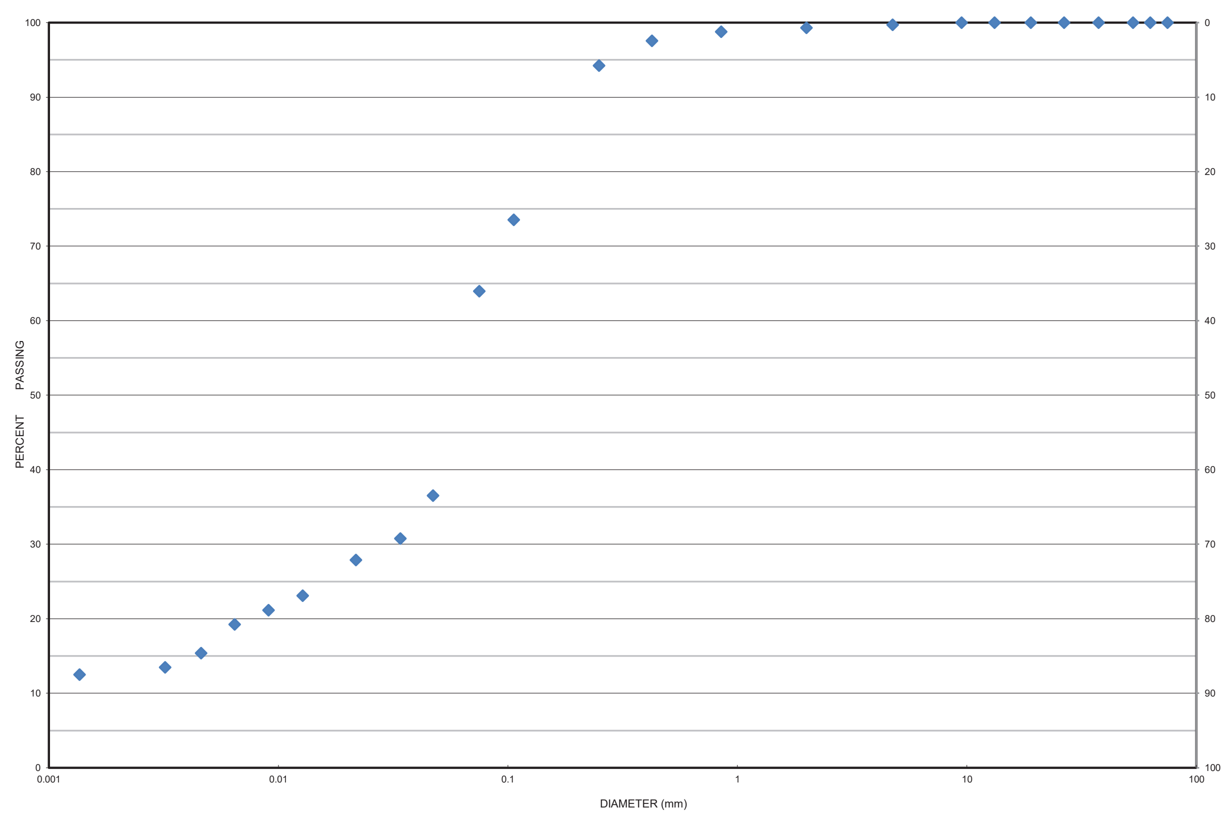
Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
194 Sophia St.| Peterborough | ON | K9H 1E5

Form: L6V.2 - Grad.Hydo

Grain Size Distribution Chart

Project Number:	*11486-001*	**Client:**	*BT Engineering*		
Project Name:	*Innisfil Webster Boulevard Extension*				
Sample Date:	*October 14, 2020*	**Sampled By:**	*Chris Malliaros - Cambium Inc.*		
Location:	*BH 102-20 SS 5*	**Depth:**	*3 m to 3.5 m*	**Lab Sample No:**	*S-20-0921*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-20	SS 5	3 m to 3.5 m	0	36	51	13	11.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt and Sand some Clay	ML	0.070	0.030	0.000	-	-

Additional information available upon request

Issued By: (Senior Project Manager) *Date Issued:* *November 4, 2020*

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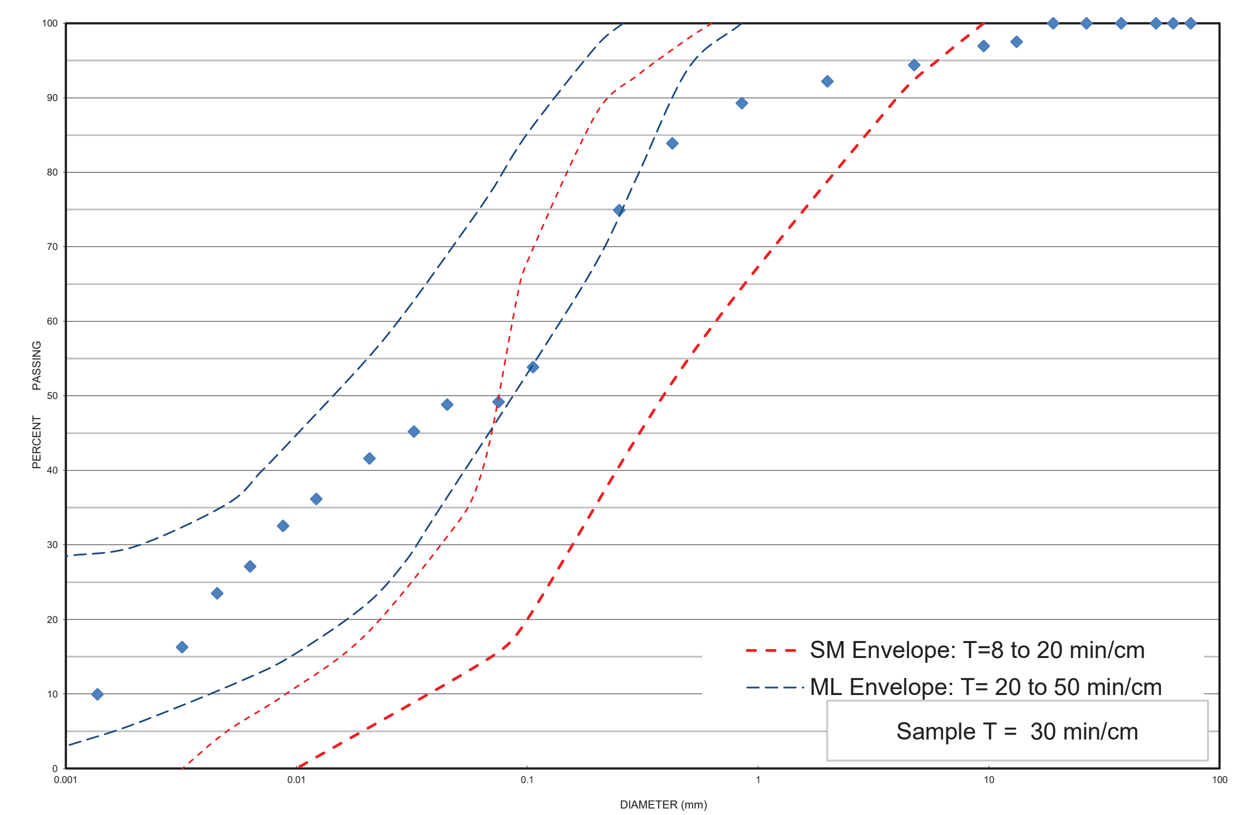
194 Sophia St. | Peterborough | ON | K9H 1E5

Form: L6V.2 - Grad.Hydo

Grain Size Distribution Chart

Project Number:	*11486-001*	**Client:**	*BT Engineering*		
Project Name:	*Innisfil Webster Boulevard Extension*				
Sample Date:	*October 14, 2020*	**Sampled By:**	*Chris Malliaros - Cambium Inc.*		
Location:	*BH 103-20 SS 2*	**Depth:**	*0.8 m to 1.2 m*	**Lab Sample No:**	*S-20-0922*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 103-20	SS 2	0.8 m to 1.2 m	6	45	36	13	8.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Clay trace Gravel	SM	0.1450	0.0075	0.0015	96.67	0.26

Additional information availabe upon request

Issued By: (Senior Project Manager) *Date Issued:* *January 27, 2021*

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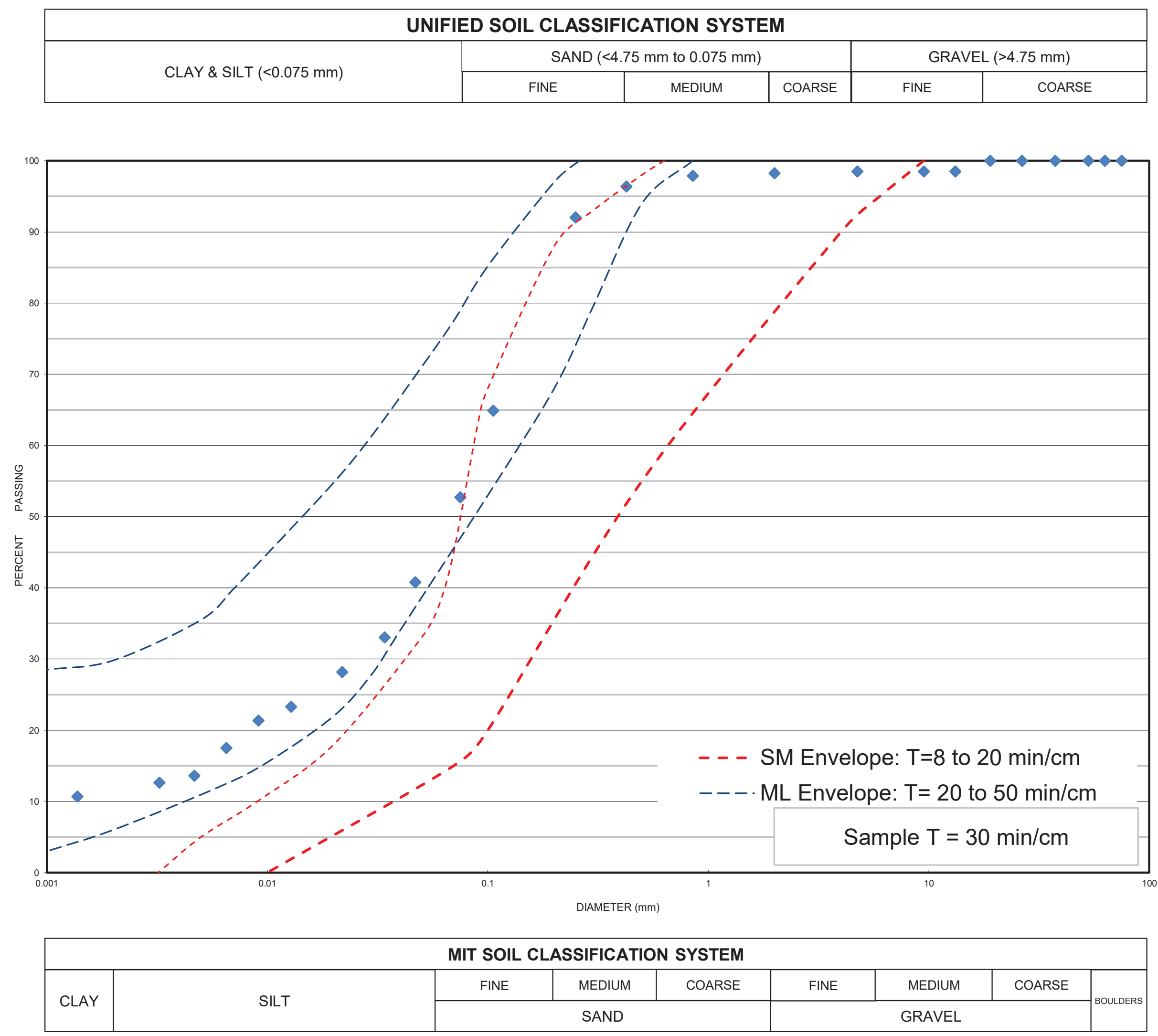
194 Sophia St.| Peterborough | ON | K9H 1E5

Form: L6V.2 - Grad.Hydo

Grain Size Distribution Chart

Project Number: 11486-001 **Client:** BT Engineering
Project Name: Innisfil Webster Boulevard Extension
Sample Date: October 14, 2020 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 102-20 SS 2 **Depth:** 0.8 m to 1.2 m **Lab Sample No:** S-20-0923



Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-20	SS 2	0.8 m to 1.2 m	1	46	41	12	14.2

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Clay trace Gravel	ML	0.091	0.026	0.000	-	-

Additional information availabe upon request

Issued By: (Senior Project Manager) *Date Issued:* January 27, 2021

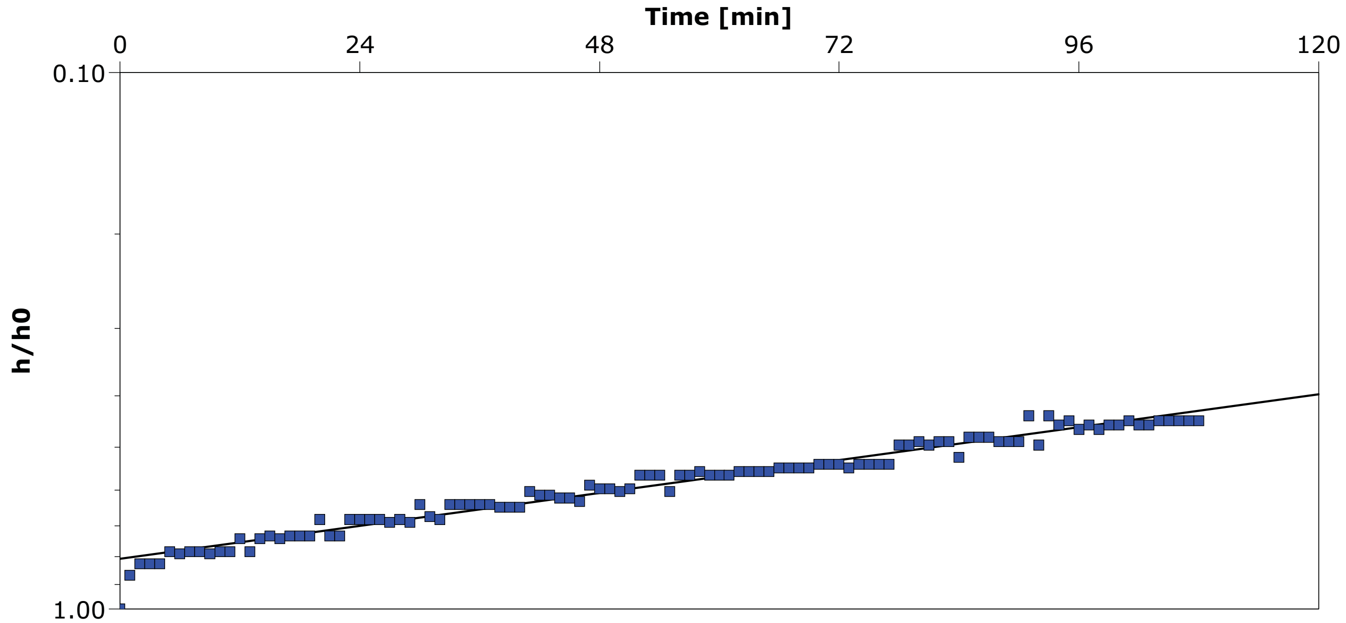
Appendix C

Aquifer Test^{TM} Results

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

Slug Test Analysis Report
Project: Hydrogeological Assessment
Number: 11486-001
Client: BT Engineering

Location: Webster Boulevard, Innisfil, ON	Slug Test: MW101-20 Test 1	Test Well: MW101-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW101-20 Test 1	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		



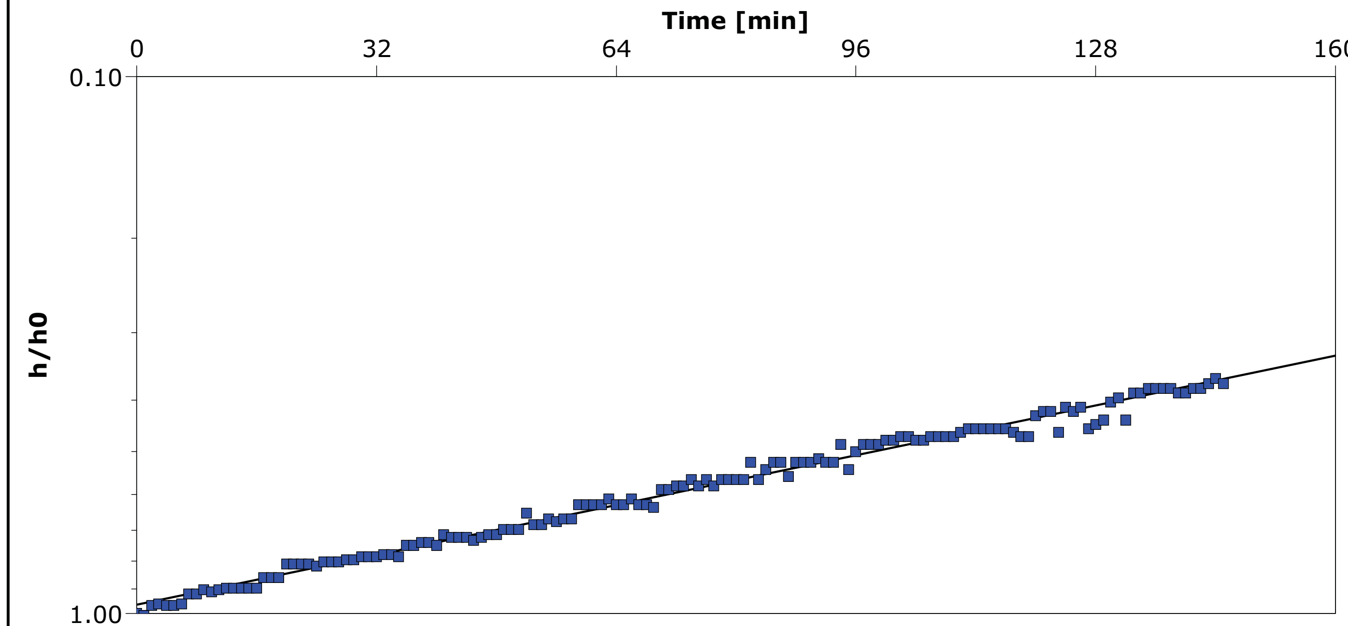
Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-20	3.18×10^{-7}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

Slug Test Analysis Report
Project: Hydrogeological Assessment
Number: 11486-001
Client: BT Engineering

Location: Webster Boulevard, Innisfil, ON	Slug Test: MW101-20 Test 2	Test Well: MW101-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW101-20 Test 2	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-20	3.61×10^{-7}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

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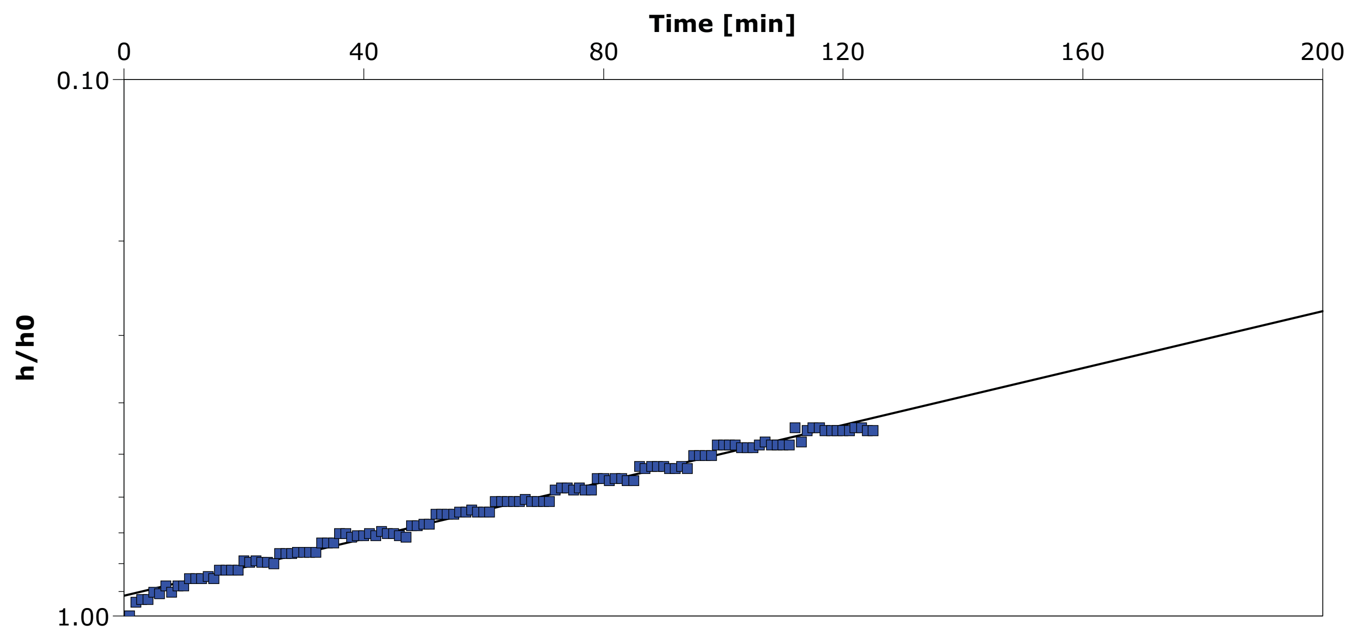
Slug Test Analysis Report
Project: Hydrogeological Assessment
Number: 11486-001
Client: BT Engineering

Location: Webster Boulevard, Innisfil, ON	Slug Test: MW101-20 Test 3	Test Well: MW101-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW101-20 Test 3	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		



Calculation using Hvorslev

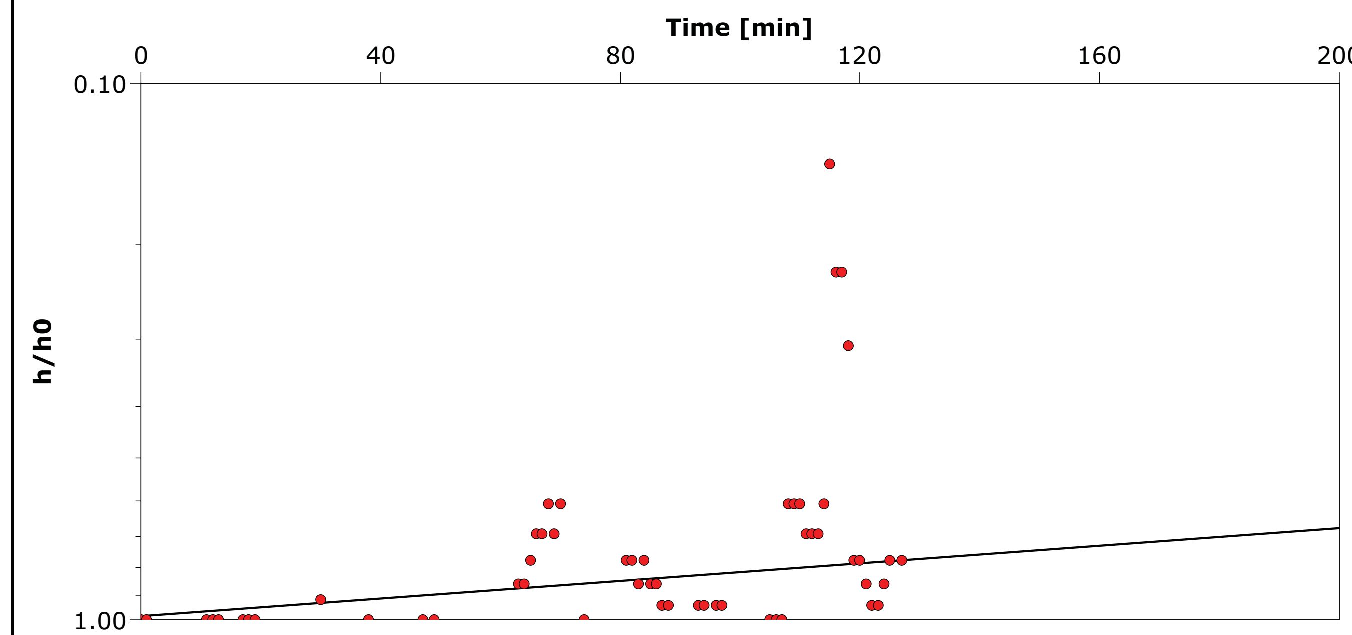
Observation Well	Hydraulic Conductivity [m/s]	
MW101-20	3.30×10^{-7}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

CAMBIUM

Slug Test Analysis Report
Project: Hydrogeological Assessment
Number: 11486-001
Client: BT Engineering

Location: Webster Boulevard, Innisfil, ON	Slug Test: MW102-20 Test 1	Test Well: MW102-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW102-20 Test 1	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		



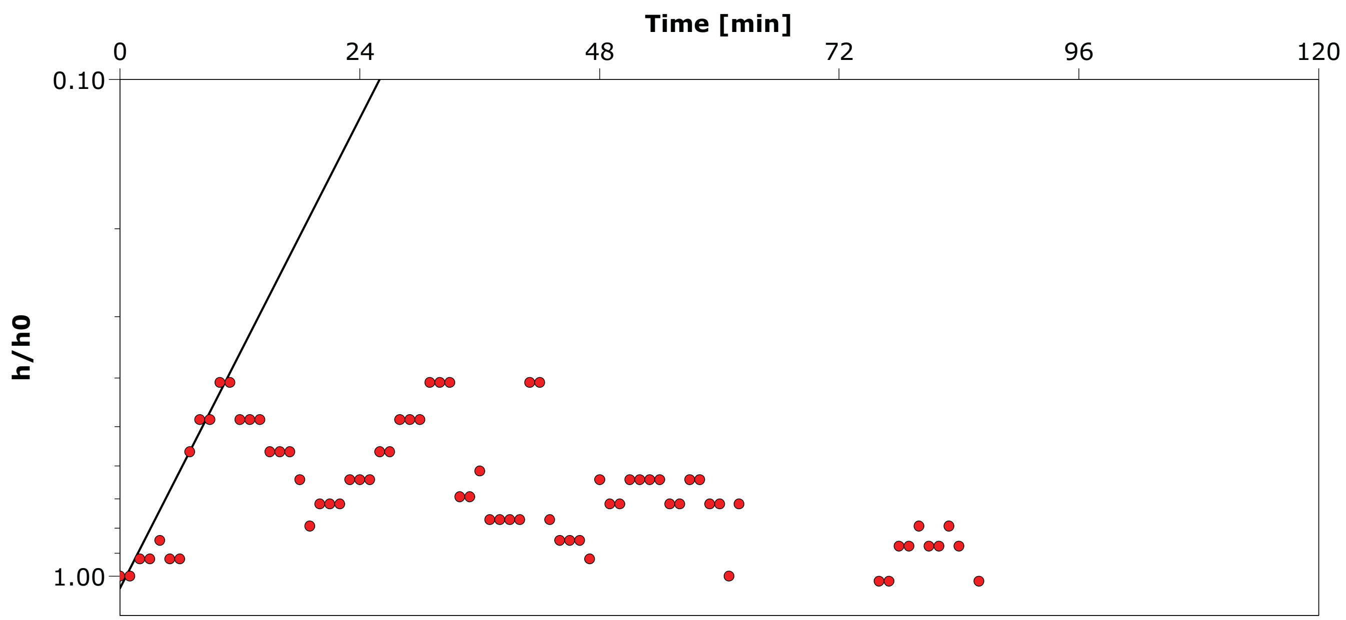
Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW102-20	1.03×10^{-7}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

Slug Test Analysis Report
Project: Hydrogeological Assessment
Number: 11486-001
Client: BT Engineering

Location: Webster Boulevard, Innisfil, ON	Slug Test: MW102-20 Test 2	Test Well: MW102-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW102-20 Test 2	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		



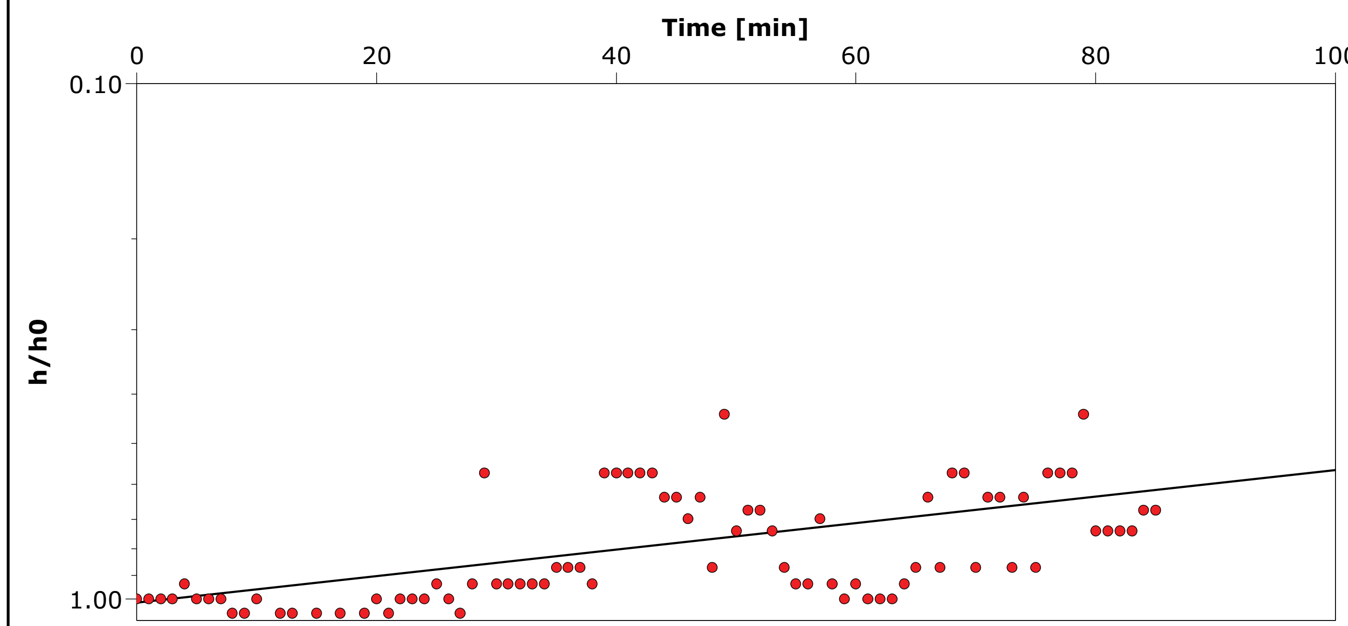
Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW102-20	4.91×10^{-6}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

Slug Test Analysis Report
Project: Hydrogeological Assessment
Number: 11486-001
Client: BT Engineering

Location: Webster Boulevard, Innisfil, ON	Slug Test: MW102-20 Test 3	Test Well: MW102-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW102-20 Test 3	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		

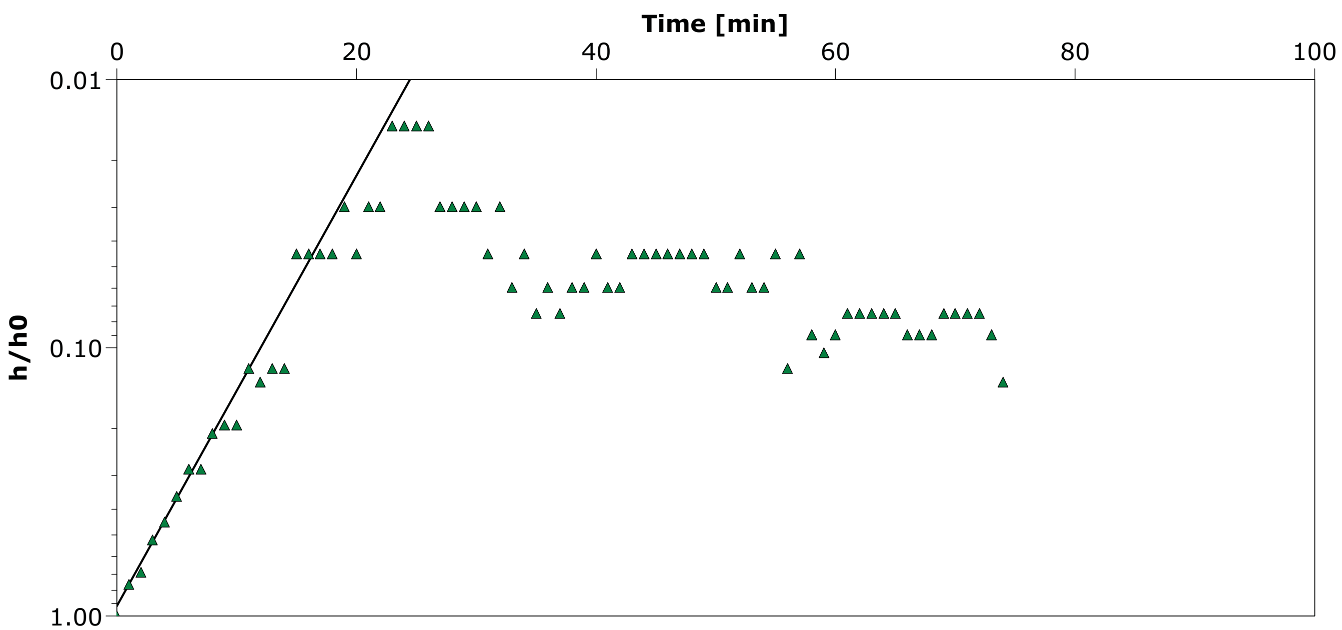


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW102-20	3.20×10^{-7}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

Slug Test Analysis Report		
Project: Hydrogeological Assessment		
Number: 11486-001		
Client: BT Engineering		
Location: Webster Boulevard, Innisfil, ON	Slug Test: MW103-20 Test 1	Test Well: MW103-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW103-20 Test 1	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		

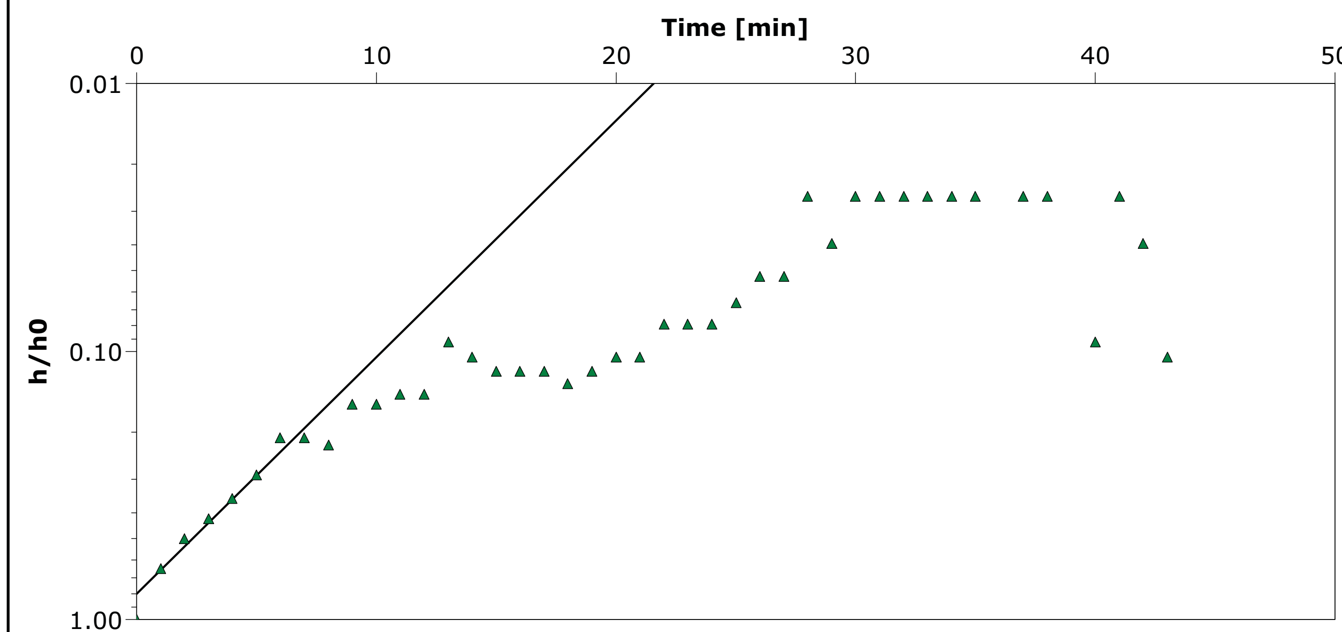


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW103-20	1.00×10^{-5}	

Cambium Inc.
52 Hunter St. East
Peterborough, Ontario
K9L1S1

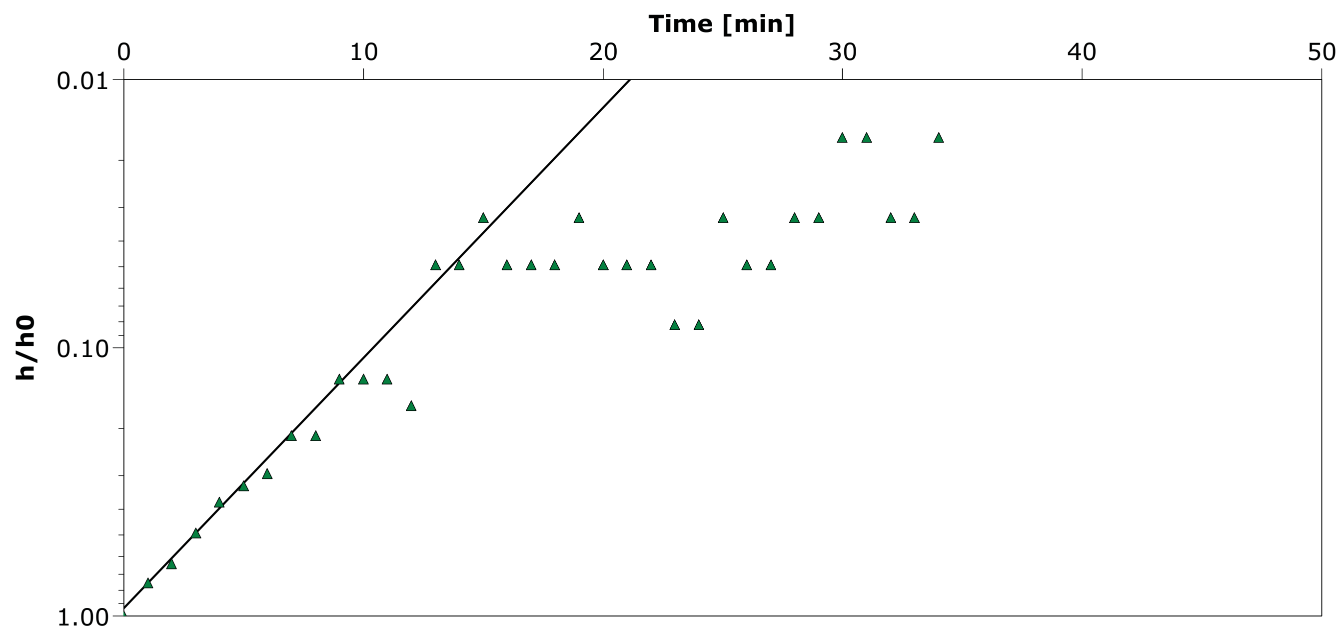
Slug Test Analysis Report		
Project: Hydrogeological Assessment		
Number: 11486-001		
Client: BT Engineering		
Location: Webster Boulevard, Innisfil, ON	Slug Test: MW103-20 Test 2	Test Well: MW103-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW103-20 Test 2	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW103-20	1.10×10^{-5}	

Cambium Inc. 52 Hunter St. East Peterborough, Ontario K9L1S1		**Slug Test Analysis Report**
		Project: Hydrogeological Assessment
		Number: 11486-001
		Client: BT Engineering
Location: Webster Boulevard, Innisfil, ON	Slug Test: MW103-20 Test 3	Test Well: MW103-20
Test Conducted by: Chris Malliaros		Test Date: 10/22/2020
Analysis Performed by: Elysha Pecena	MW103-20 Test 3	Analysis Date: 11/25/2020
Aquifer Thickness: 4.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]
MW103-20	1.16×10^{-5}

Appendix D
Certificate of Analysis

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: --- **REPORT No. B20-33458**

Rev. 1

Report To:
Cambium Environmental
PO Box 325, 52 Hunter Street East
Peterborough ON K9H 1G5 Canada
Attention: Cameron MacDougall

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 23-Oct-20
DATE REPORTED: 27-Jan-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11486-001
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Alkalinity (as CaCO3)	1	Holly Lane	SYL	30-Oct-20	A-ALK-03 (o)	SM 2320B
Conductivity	1	Holly Lane	SYL	30-Oct-20	A-COND-02 (o)	SM 2510B
Anions	1	Holly Lane	bco	02-Nov-20	A-IC-01 (o)	SM4110C
Anions	1	Holly Lane	bco	03-Nov-20	A-IC-01 (o)	SM4110C
Nitrogen - Ammonia (N)	1	Kingston	SHU	28-Oct-20	A-NH3-001 (k)	SM4500-NH3-H
pH	1	Holly Lane	SYL	30-Oct-20	A-PH-01 (o)	SM 4500H
Sulphide	1	Kingston	US	28-Oct-20	A-S2	SM4500-S2
A - Wet Chem	1	Kingston	KD	06-Nov-20	A-TPTKN-001 (N)(k)	E3199A.1
A - Wet Chem	1	Kingston	KD	06-Nov-20	A-TPTKN-001 (P)(k)	E3199A.1
A - Wet Chem	1	Kingston	SHU	29-Oct-20	A-TPTKN-001 (P)(k)	E3199A.1
Total Suspended Solids	1	Kingston	LSE	28-Oct-20	A-TSS-001 (k)	SM2540D
Turbidity	1	Holly Lane	LMG	30-Oct-20	A-TURB-01 (o)	SM 2130
Phenolics (4-aap)	1	Kingston	TK	04-Nov-20	C-PHEN-01 (k)	MOEE 3179
Metals - ICP-OES	1	Holly Lane	AHM	02-Nov-20	D-ICP-01 (o)	SM 3120
Metals - ICP-OES	1	Holly Lane	AHM	30-Oct-20	D-ICP-01 (o)	SM 3120
Metals - ICP-MS	1	Holly Lane	TPR	06-Nov-20	D-ICPMS-01 (o)	EPA 200.8

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: --- **REPORT No. B20-33458**

Rev. 1

Report To:
Cambium Environmental
PO Box 325, 52 Hunter Street East
Peterborough ON K9H 1G5 Canada
Attention: Cameron MacDougall

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 23-Oct-20
DATE REPORTED: 27-Jan-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11486-001
WATERWORKS NO.

	Client I.D.		BH103-20				PWQO	
	Sample I.D.		B20-33458-1				Interim PWQO	PWQO
	Date Collected		22-Oct-20					
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		7.86					8.5
Conductivity @25°C	µmho/cm	1	1970					
Alkalinity(CaCO3) to pH4.5	mg/L	5	309					
Hardness (as CaCO3)	mg/L	1	10900					
Chloride	µg/L	500	400000					
Fluoride	µg/L	100	< 100					
Nitrite (N)	µg/L	100	200					
Nitrate (N)	µg/L	100	1700					
Nitrate + Nitrite (N)	µg/L	100	1900					
Sulphate	µg/L	1000	89000					
Total Suspended Solids	mg/L	3	15000					
Turbidity	NTU	0.1	24700					
Sulphide	µg/L	10	< 10000					
Ammonia (N)-Total	µg/L	10	90					
Total Kjeldahl Nitrogen	µg/L	100	4100					
Organic Nitrogen	µg/L	100	4000					
Phosphorus-Total	µg/L	10	**18000**					10
Phenolics	µg/L	2	< 1					1
Calcium	µg/L	20	4010000					
Magnesium	µg/L	20	204000					
Potassium	µg/L	100	29700					
Sodium	µg/L	200	127000					
Antimony	µg/L	0.1	< 0.1					20

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	Client I.D.		BH103-20				PWQO	
	Sample I.D.		B20-33458-1				Interim PWQO	PWQO
	Date Collected		22-Oct-20					
Parameter	**Units**	**R.L.**						
Arsenic	µg/L	0.1	4.5				100	5
Barium	µg/L	1	1970					
Beryllium	µg/L	2	5					11
Bismuth	µg/L	20	< 20					
Boron	µg/L	5	**326**				200	
Cadmium	µg/L	0.015	**0.184**				0.1	0.2
Chromium	µg/L	1	30					
Cobalt	µg/L	0.1	**13.7**					0.9
Copper	µg/L	0.1	**32.1**					5
Iron	µg/L	5	**181000**					300
Lead	µg/L	0.02	**13.6**				1	5
Manganese	µg/L	1	8740					
Molybdenum	µg/L	0.1	0.5					40
Nickel	µg/L	0.2	21.4					25
Selenium	µg/L	1	2					100
Silver	µg/L	0.1	< 0.1					0.1
Strontium	µg/L	1	4880					
Thallium	µg/L	0.05	0.19					0.3
Tin	µg/L	50	< 50					
Titanium	µg/L	5	6360					
Uranium	µg/L	0.05	1.39					5
Vanadium	µg/L	0.1	**29.3**					6
Zinc	µg/L	5	**2260**				20	30

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	Client I.D.		BH103-20				PWQO	
	Sample I.D.		B20-33458-1				Interim PWQO	PWQO
	Date Collected		22-Oct-20					
Parameter	**Units**	**R.L.**						

1. Elevated RL due to sample matrix interference
2. Revised report to remove duplicate parameter

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

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Lab Manager

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SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11486-001
WATERWORKS NO.

Summary of Exceedances

Interim PWQO		
BH103-20	Found Value	Limit
Zinc (µg/L)	2260	20
Lead (µg/L)	13.6	1
Cadmium (µg/L)	0.184	0.1
Boron (µg/L)	326	200

Provincial Water Quality Objectives		
BH103-20	Found Value	Limit
Zinc (µg/L)	2260	30
Vanadium (µg/L)	29.3	6
Phosphorus-Total (µg/L)	18000	10
Lead (µg/L)	13.6	5
Iron (µg/L)	181000	300
Copper (µg/L)	32.1	5
Cobalt (µg/L)	13.7	0.9

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

CBurke
Christine Burke
Lab Manager

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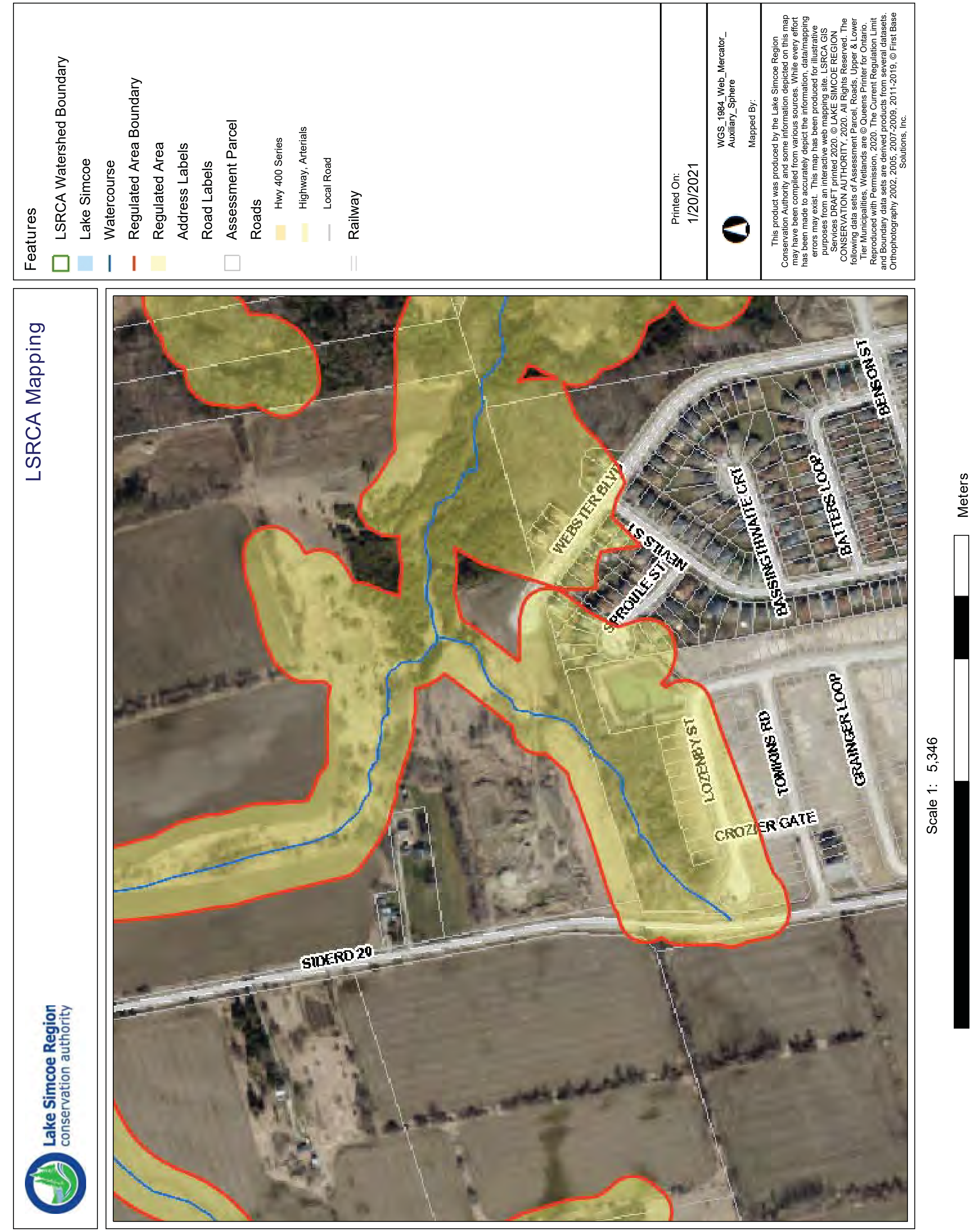
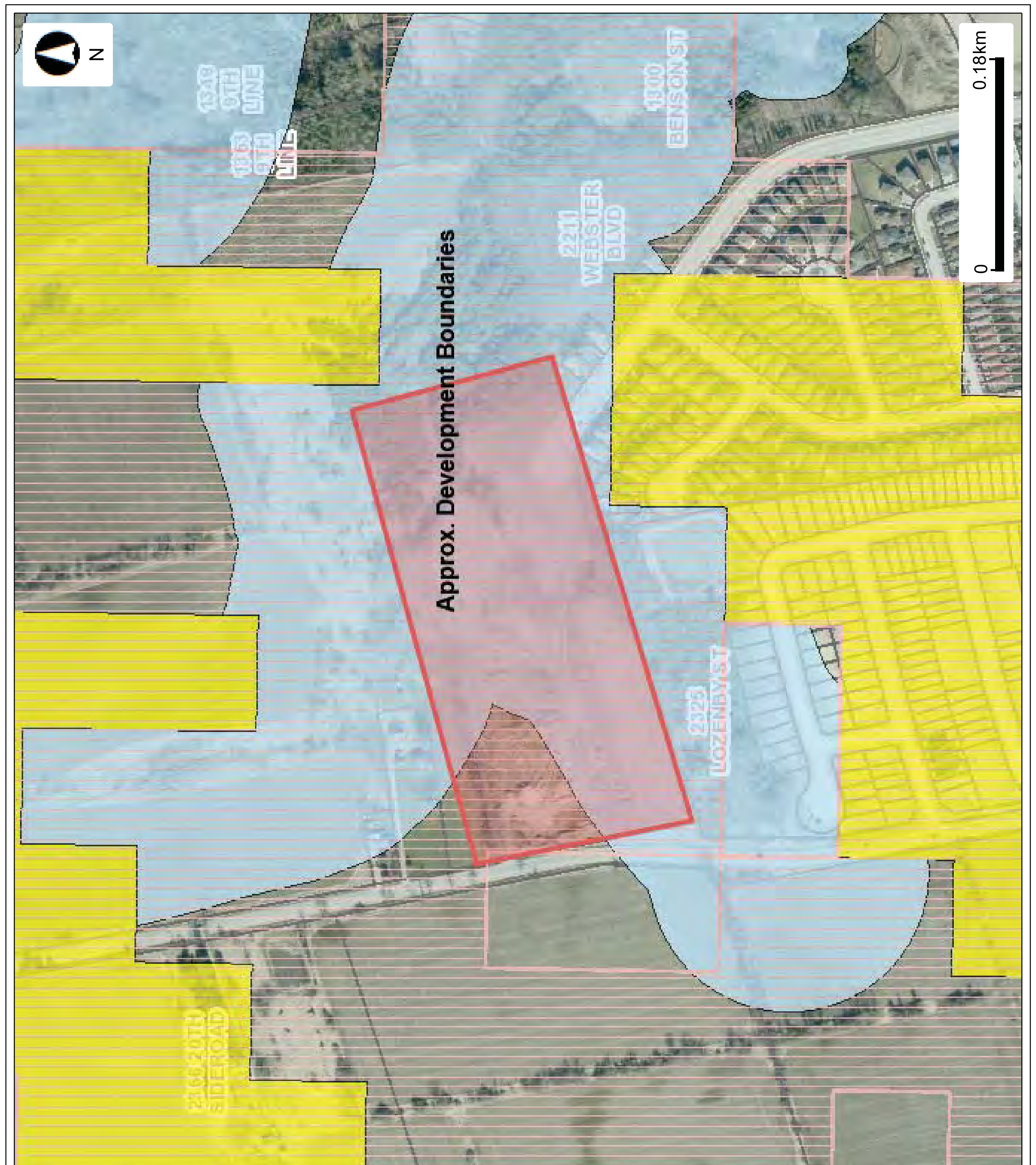
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Appendix E
SPIA and LSRCA Mapping



SPIA Mapping



This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Map Created: 1/20/2021
Map Center: 44.31618 N, -79.5752 W

Ontario

Appendix F
Dewatering Estimates

CAMBIUM

Tr ch xcavatio Dewat in

Sce ario as um)	De h bg)	L (x) (m)	Static (m)	Dewat level (m)	Drawd wn (m)	Co uctivit (K) ( )	L Drawd wn 0) (m)	imat I w L in	w ay (ay)
High K	7	50	1	8	7	1.16E-05	72	51	73
Low K	7	50	1	8	7	1.03E-07	7	5	7

High Hydraulic Conductivity	1.16E-05
Low Hydraulic Conductivity	1.03E-07

Drawd wn	3000*((DRAWDOWN))*(HYD AULIC CON UCTIVITY^0.5)
(H^2-h^2)	((AQUIFER THICKNESS-STATIC LEVEL)^2)-((AQUIFER THICKNESS-DEWATERED LEVEL)^2)
imat w	(LENGTH OF TRENCH)x(((HYD AULIC CON UCTIVITY(H^2-h^2))/((3.34x10^{-5})x(LENGTH OF 0m AW OW)

Appendix K

Stormwater Management Report and Addendum (GHD, 2015)

BT ENGINEERING BTE

Alcona Capital Properties Inc.

Alcona Capital Properties Residential Subdivision

Town of Innisfil

Stormwater Management Report

revised November 2015

Table of contents

Table index

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Appendices

1. Introduction and background

GHD Limited (formerly Sernas Associates) has been retained by Urban Ecosystems Limited (UEL) to address the stormwater management for the proposed development of the Alcona Capital Properties Inc. lands. The subject area is located north of 8th Line (Innisfil Beach Road), east of 20th Sideroad Road and west of the existing Pratt Alcona North Subdivision, in the Town of Innisfil. The study site is located within the expanded Alcona Secondary Plan development area and the associated Watercourse 3 and 4 catchments.

The proposed development will consist of a residential development with the proposed stormwater management (SWM) provided by two stormwater management facilities. The proposed stormwater management approach will account for the storm drainage set out in the previously approved SWM report (Loblaws Properties Limited, Proposed Food Store, Innisfil Beach road and 20th Sideroad, Design Brief Engineering Report, Updated March 25, 2009) prepared by Odan/Detech Group Inc.

The proposed development lands have a total area of approximately 15.1 ha. The proposed residential development will consist of approximately 13.0 ha of single family and semi-detached units (including two pond blocks). Approximately 7.5 ha of the proposed residential subdivision will drain south to Bon Secour Creek (Watercourse WC 4) through the proposed south pond and 5.5 ha will drain north to Leonard's Creek (Watercourse WC 3) through the proposed north pond.

There is no external drainage directly entering the site although the north part of the development is located within the LSRCA Generic Regulation area. All development, including the SWM facility (north pond) is located adjacent to but outside the Generic Regulation limits. A copy of the LSRCA Generic Regulation limits for the area is included in **Appendix A**.

The site topography east of Simcoe County Road 56 splits the north from south into the two drainage catchments by an existing ridge. The area to the north drains directly to Leonard's Creek (WC 3). The south area drains through both the Innisfil Hydro Station to the Innisfil Beach Road drainage system, and the adjoining subdivision, to feed Bon Secour Creek (WC 4).

Figure 1 – Site Location Plan shows the site (Alcona Capital Properties Residential Development) relative to the local roads.

1.1 Background information

Loblaw Properties Limited, Proposed Food Store, Innisfil Beach Road and 20th Sideroad, Design Brief Engineering Report, Town of Innisfil, updated March 25, 2009, prepared by ODAN/DETECH Group Inc.

This report deals with the development of the Loblaw's property north of Innisfil Beach Road, adjacent to the Alcona Capital development. The flows generated by this development and the associated future expansion to the north discharge to the Innisfil Beach Road storm system. Part of the proposed Alcona Capital development is associated with the modelled catchment of this report.

The Visual OTTHYMO model prepared for this development has been updated to reflect the breakdown of the drainage catchment under existing and future developed conditions.

Figure 1 Site Location Plan

Geotechnical Investigation, Proposed Development, 20th Sideroad & Innisfil Beach Road, Innisfil Beach Road, May 21, 2004, prepared by Toronto Inspection Limited

This report details the soil conditions and groundwater associated with the site. Soils identified as topsoil overlaying deposits of clayey silt, sand, sandy silt and sandy silt till. Groundwater was identified as associated with sand and gravel deposits located above the almost impermeable till deposits underlying the site.

Hydrogeological Investigation for Alcona Capital Properties, Part of Lot 8, Concession 21, Innisfil, ON, December 2010, prepared by Cole Engineering

This report is a follow up to the geotechnical report and focuses on the hydrogeologic characteristics of the property. Water balance issues are also discussed.

Functional Servicing Report, Alcona Capital Properties Inc. Proposed Residential Subdivision, Town of Innisfil, December 2009, prepared by Urban Ecosystems Limited

This Functional Servicing Report (FSR) deals with the overall servicing of the development and will be submitted in conjunction with this SWM report as part of the overall submission package.

Master Servicing and Drainage Study, Alcona Secondary Plan Area, Town of Innisfil, September 1995, prepared by Cumming Cockburn Limited

The Master Servicing and Drainage Study identifies how to provide the required servicing as well as the handling and control of surface runoff. This document acts as a policy document in proposed works. Applicable SWM criteria have been included in Appendix A.

Engineering Design Standards and Specifications, Town of Innisfil – Section 4.6 – Stormwater Management Facilities, June 2011

The Engineering Design Standards provides minimum requirements associated with the design of SWM facilities and the associated SWM report. The main recommendations applicable to the proposed SWM pond are outlined below:

- Water quality controls – provide “Enhanced” level of quality control will comply with criteria set out in Ministry of Environment’s Stormwater Management Planning and Design Manual, March 2003;
- Water quantity controls – post-development peak flows do not exceed pre-development levels for storm events up to and including the 1:100 year event;
- Low Impact Development (LID) – promote at-source control of post-development runoff through use of LIDs;
- Nutrient Management Strategy – mitigate and reduce phosphorus contributions from new developments where possible.

Lake Simcoe Region Conservation Authority Generic Mapping

The generic mapping obtained from the LSRCA website identifies the regulatory limits through the site. Generic Map 23 covers the drainage catchment associated with this development. A copy of the generic mapping, covering the relevant portion of Map 61 and identifying these limits, is included in **Appendix A**.

Lake Simcoe Region Conservation Authority (LSRCA) Technical Guidelines for Stormwater Management Submissions, November 2010

The Technical Guidelines provide minimum requirements associated with the design of SWM facilities and the associated SWM report.

Lake Simcoe Protection Plan, July 2009, prepared by Government of Ontario

This document outlines measures necessary to protect/improve the Lake Simcoe Watershed.

Infiltration Testing Report for Proposed Alcona Capital Residential Subdivision, October 2015, prepared by Cole Engineering

This report is a follow up to the hydrogeological investigation and focuses on the establishing infiltration rates on the property to assist the design of the proposed rain gardens to address the water balance deficit.

2. Storm drainage

2.1 Existing site conditions

The FSR prepared by Urban Ecosystems Limited identified that the lands generally drain from west to east with a grade differential ranging from 7 to 10 metres. The drainage is divided into north and south catchment areas. Under the existing conditions, there are two drainage catchments associated with the development that drain north to WC3 and south to the Innisfil Beach Road ditch (associated with WC4). These features are identified on the LSRCA Generic Mapping, Map 61 (see reduced section of Map 61 in **Appendix A**).

2.1.1 Leonard's Creek (WC3)

WC3 receives existing flows from the site area north of the natural divide by overland flow. A tributary of this watercourse passes across the north boundary of the site; however the north limit of the development does not intrude into the stream valley or associated woodlot. There are no other drainage features on the northern part of the development site.

Based on the updated topographic mapping, the drainage area at the proposed outlet to WC3 is approximately 5.90 ha. The existing conditions catchment (ID 110) is shown on **Figure 2**.

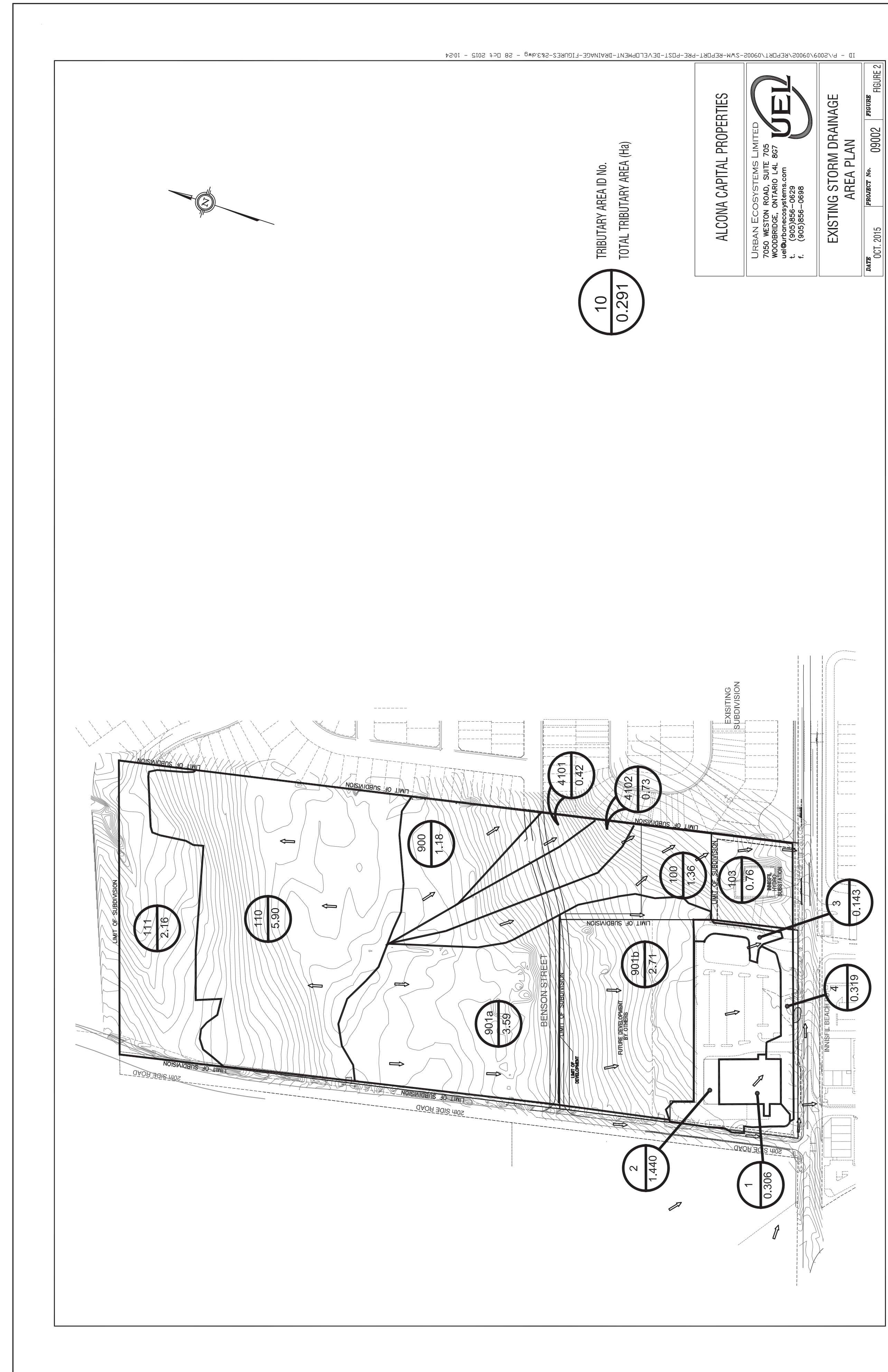
2.1.2 Bon Secour Creek (WC4)

The south catchment is located east of 20th Sideroad, west of the existing Pratt Alcona North residential subdivision and immediately north of the existing Loblaw's property and the neighbouring Innisfil Hydro sub-station. Approximately 4.95 ha of the proposed development currently drains overland to the south where it discharges to the Innisfil Beach Road drainage ditch along the east boundary of the Innisfil Hydro property.

Totten Sims Hubicki and Associates (TSH) prepared modelling associated with the Pratt Alcona North subdivision, which identified 10.63 ha draining south to Innisfil Beach Road and an additional 2.33 ha (1.18 + 0.42 + 0.73) being picked up along the rear lots of their subdivision. The 10.63 ha draining to Innisfil beach Road included the Loblaw's property, the Innisfil Hydro sub-station and the Alcona Capital Lands. A copy of the TSH plan is included in **Appendix A**.

The Odan/Detech Group prepared additional modelling for the Loblaw's property as part of their food store development. This model included only part of the Alcona Capital Properties area, which impacted their development.

The existing conditions catchments (IDs 100 and 901a) of the Alcona Capital Properties that drain south to the proposed outlet to WC4 is approximately 4.95 ha and is shown on **Figure 2**.



2.1.3 Hydrologic modelling

The OTTHYMO hydrologic model developed for the Loblaw's development was updated to model the existing drainage catchment based on the updated catchment data. The model parameters were based on the approved values adjusted to reflect the updated catchment area data and the model was run for the 2 year to 100 year design storm for the 4 hour Chicago and 12 hour SCS rainfall distributions using the Barrie WPCC station rainfall data.

Table 1 shows the estimated Alcona Capitals Properties pre-development flows for the proposed development area to both WC3 and WC4. Copies of the output summary files and the predevelopment schematic are attached in **Appendix B**. **Table 2** provides existing flow rates for entire WC3 and for WC4 at Innisfil Beach Road and at BMP 4C2.

Table 1 Existing flow rates – Site Only

Design storm	Flow rates (m^3/s)			
	4 hr Chicago		12 hr SCS	
	WC3 (5.90 ha)	WC4 (4.95 ha)	WC3 (5.90 ha)	WC4 (4.95 ha)
	NHYD 110	NHYD 19	NHYD 110	NHYD 19
2 yr	0.06	0.06	0.11	0.10
5 yr	0.11	0.11	0.19	0.17
10 yr	0.15	0.15	0.26	0.23
25 yr	0.21	0.20	0.35	0.30
50 yr	0.26	0.24	0.42	0.36
100 yr	0.31	0.28	0.49	0.42
Regional	0.78	0.64	-	-

Table 2 Existing flow rates

Design storm	Flow rates (m^3/s)				
	4 hr Chicago		12 hr SCS		
	WC3 (28.45 ha)	WC4 @ IBR (10.63 ha)	WC3 (28.45 ha)	WC4 @ IBR (10.63 ha)	WC4 @ BMP 4C2 (168.28 ha)
	NHYD 1	NHYD 22	NHYD 1	NHYD 22	NHYD 9585*
2 yr	0.12	0.16	0.21	0.23	1.82
5 yr	0.23	0.25	0.38	0.37	2.63
10 yr	0.31	0.33	0.52	0.47	4.15
25 yr	0.42	0.43	0.70	0.61	4.99
50 yr	0.52	0.50	0.85	0.72	-
100 yr	0.62	0.59	1.00	0.83	9.02
Regional	2.72	1.31	-	-	19.96

* **Note:** From the Stantec OTTHYMO model.

2.2 Proposed drainage conditions

The drainage areas used in the updated OTTHYMO model will consist of the proposed developed areas associated with proposed outlets to WC3 and Innisfil Beach Road (WC4). The model for the area draining south will also account for the Loblaw's property and the Innisfil Hydro sub-station lands. The proposed drainage areas are identified below and shown on **Figure 3**.

2.2.1 Leonard's Creek (WC3)

The area draining north will only need to account for 5.29 ha draining to WC3 through the proposed north pond. The proposed drainage catchments draining north will consist of the following:

- 4.66 ha associated with proposed Alcona Capital Properties residential development (sub-catchment 210); and
- 0.63 ha associated with the proposed north pond (sub-catchment 211).

The total drainage to the proposed pond will be 5.29 ha compared to 5.90 ha identified in the existing drainage model. This small diversion will be accounted for in the south pond model. The pond is proposed to discharge directly to WC3.

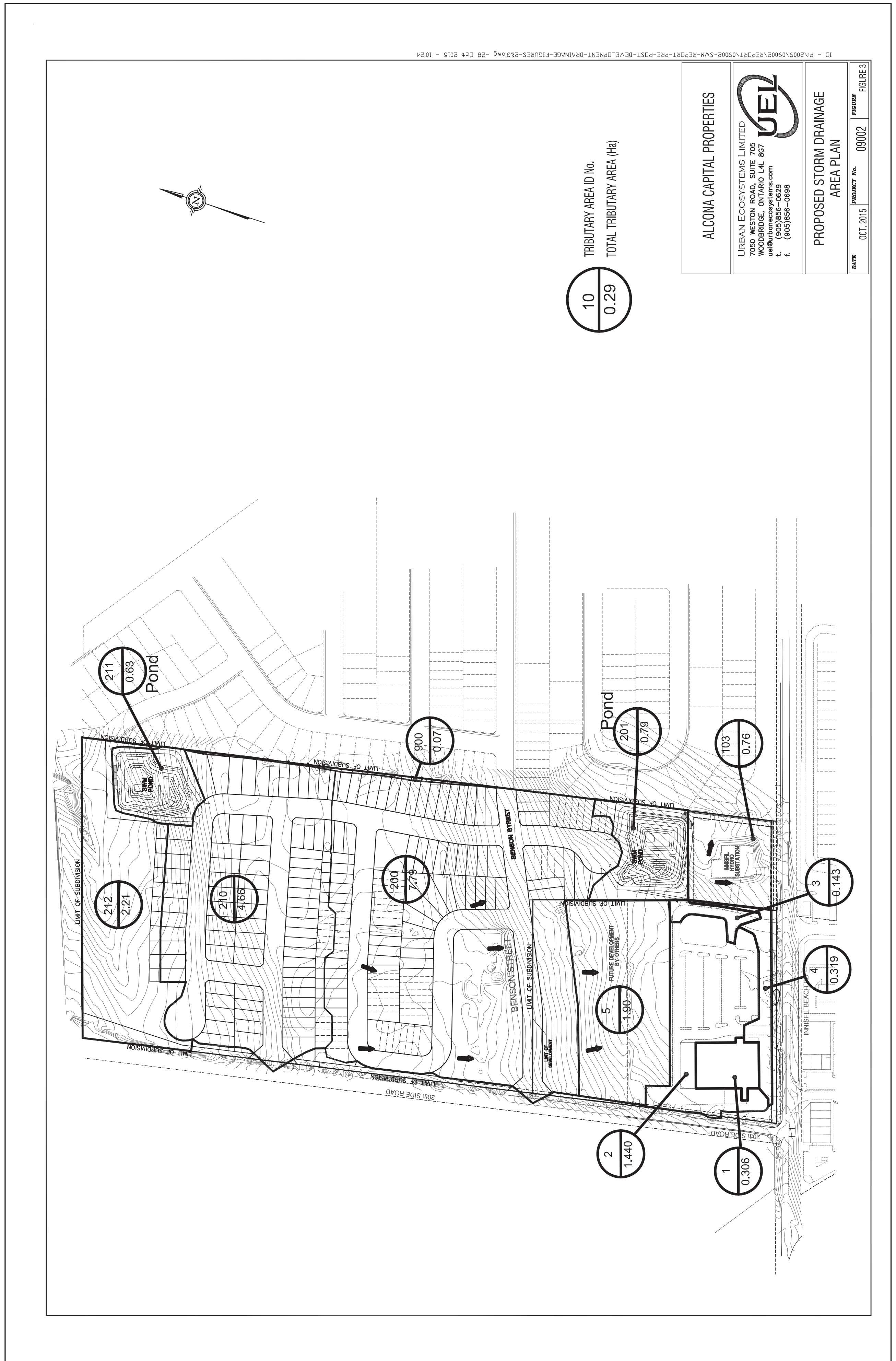
2.2.2 Bon Secour Creek (WC4)

The catchment draining south includes the two areas originally accounted for in the Loblaw's development (Odan/Detech model) and the additional area draining to the rear lot swale associated with the Pratt Alcona North residential subdivision (TSH model). The proposed drainage catchments draining south to Innisfil Beach Road will consist of the following:

- 2.21 ha associated with the existing Loblaw's Food Store (sub-catchments 1, 2, 3 and 4);
- 1.90 ha associated with the future expansion of the Loblaw's site (sub-catchment 5);
- 0.76 ha associated with the Innisfil Hydro sub-station (sub-catchment 103);
- 7.79 ha associated with proposed Alcona Capital Properties residential development (sub-catchment 200) which includes the potential townhouse lots (2.71 – 1.90 = 0.81 ha) from the Loblaw's site on the south side of Benson Street; and
- 0.79 ha associated with the proposed south pond (sub-catchment 201).

The total drainage area to the south pond will be 8.58 ha. This accounts for the small diversion (0.60 ha) from the WC3 catchment. As noted previously, a SWM facility (south pond) will be constructed to provide SWM controls (quality, quantity and erosion control) for the proposed Alcona Capital Properties development draining to WC4.

A small drainage area primarily consisting of rear yards drains onto the adjoining subdivision (sub-catchment 900, 0.07 ha). This area is much smaller than the 2.33 ha identified in the TSH report discussed in Section 2.1.2. Analysis of the storm drainage plans for the adjoining subdivision indicates that the original 2.33 ha of existing lands have been accommodated within the storm design (**Appendix A**). Since the drainage area has been reduced to 0.07 ha, no issues are anticipated for the existing subdivision.



2.2.3 Hydrologic Modelling

Table 3a summarizes the uncontrolled peak flows for both north and south catchments for the 2 year to 100 year design storms under the 4 hour Chicago and the 12 hour SCS distributions.

Table 3a Comparison of existing and proposed uncontrolled flow rates

Design storm	Existing flow rates (m^3/s)				Proposed uncontrolled flow rates (m^3/s)			
	4 hr Chicago		12 hr SCS		4 hr Chicago		12 hr SCS	
	WC3 (5.90 ha)	WC4 (4.95 ha)	WC3 (5.90 ha)	WC4 (4.95 ha)	WC3 (5.29 ha)	WC4 (8.58 ha)	WC3 (5.29 ha)	WC4 (8.58 ha)
	NHYD 110	NHYD 19	NHYD 110	NHYD 19	NHYD 10	NHYD 19	NHYD 10	NHYD 19
2 yr	0.06	0.06	0.11	0.10	0.50	0.80	0.43	0.70
5 yr	0.11	0.11	0.19	0.17	0.69	1.13	0.64	1.06
10 yr	0.15	0.15	0.26	0.23	0.83	1.35	0.78	1.29
25 yr	0.21	0.20	0.35	0.30	1.00	1.62	0.96	1.60
50 yr	0.26	0.24	0.42	0.36	1.14	1.85	1.10	1.83
100 yr	0.31	0.28	0.49	0.42	1.28	2.09	1.24	2.07

As can been seen from **Table 3b** below, the proposed flow rates from the uncontrolled area draining to the Pratt Alcona North property (sub-catchment 900) are less than those under existing conditions (from sub-catchments 900, 4101 and 4102).

Table 3b Comparison of existing and proposed flows for uncontrolled areas to Alcona East

Design storm	Flow rates (m^3/s)			
	4 hr Chicago		12 hr SCS	
	EX.	PR.	EX.	PR.
	NHYD 21	NHYD 21	NHYD 21	NHYD 21
2 yr	0.04	0.01	0.06	0.01
5 yr	0.07	0.01	0.11	0.01
10 yr	0.09	0.01	0.14	0.01
25 yr	0.12	0.01	0.18	0.01
50 yr	0.14	0.02	0.22	0.02
100 yr	0.17	0.02	0.25	0.02

3. Stormwater management

For the proposed development, the total catchment draining to Watercourse 3 will consist of approximately 5.29 ha of proposed residential development. The development limits for this area are set to not intrude into the existing stream valley and all development will discharge through the proposed pond to the existing stream channel.

The total catchment draining to Watercourse 4 will consist of approximately 8.58 ha of proposed residential development, the existing Loblaw's development (including future expansion) and the Innisfil Hydro lands. This catchment drains to the existing Innisfil Beach Road major/minor drainage system which discharges to Watercourse 4. The proposed pond will only control flows from the proposed residential development, with the Loblaw's lands providing their own control and the Innisfil Hydro lands discharging uncontrolled. Approximately 0.07 ha of the development, primarily rear yards, will drain into the adjoining subdivision where it has been accommodated within its stormwater management plan.

As noted above, for the proposed residential development, two stormwater management facilities (North Pond and South Pond) are to be constructed, and service the following drainage areas:

- Proposed 5.29 ha of residential development, including the pond block, and draining to the proposed North Pond, eventually discharging to Watercourse 3; and
- Proposed 8.58 ha of residential development, including the pond block and the potential townhouse lots from the Loblaw's site, and draining to the proposed South Pond, eventually discharging to the Innisfil Beach Road drainage system and then to Watercourse 4.

The minor and major drainage systems of the subdivision are split towards the north and south as shown on **Figure 3**. The proposed ponds will be sized based on the proposed development.

The proposed SWM facilities (North and South Ponds) will be designed to provide quality and quantity control for the proposed residential subdivision.

3.1 Criteria

The design criteria for the SWM facility is listed below and has been established by the Town of Innisfil, the Lake Simcoe Region Conservation Authority (LSRCA) and the MOE Stormwater Management Practices Planning and Design (SWMP) Manual (1994, updated 2003):

- Quality Control – Provide an "Enhanced" level of control for protection of the receiving watercourse and downstream areas in accordance with the SWMP manual (minimum 80% total suspended solids removal).
- Erosion Control – The greater volume generated by either the 40 m^3/ha requirement set out in the MOE SWMP manual or the runoff from the 25 mm 4 hour Chicago storm shall govern the sizing of the facility for extended detention. Extended detention draw-down time should be in the 24 to 48 hour range.
- Quantity Control – Limit post development peak flows to pre-development release rates for design storms ranging from 2 year to 100 year. These controls will take into consideration the 4 hour Chicago and the 12 hour SCS rainfall distributions for the 2 year to 100 year design storms.

- Water Balance – Make every feasible effort to maintain pre-development infiltration and evapotranspiration rates to the receiving watercourses.
- Phosphorus Removal – A target of "zero" increase in phosphorus loading from pre-development to post-development conditions.

3.2 Quality control

As per the design criteria identified for the development in Section 2.2, Enhanced (Level 1) quality control is proposed to be provided using two SWM facilities (North and South ponds). Table 3.2 of the MOEE Stormwater Management Planning and Design Manual, March 2003 (SWMP Manual) and the Town of Innisfil Design Standards were used in the design of these SWM facilities.

The permanent pool volume calculations are based on the contributing drainage from the proposed developments associated with each pond. This contributing drainage area with an assumed 60% imperviousness results in a quality storage requirement of 198 m^3/ha, which includes the allowance of 40 m^3/ha for extended detention.

3.2.1 North Pond (WC3)

The contributing drainage catchment for this pond is 5.29 ha, which includes the pond block area. Using an imperviousness of 60% for the development described above, a permanent pool storage volume of 718 m^3 would be required. The permanent pool has water surface elevation of 266.80 m with a maximum depth of 2.0 m (EL 264.80 m). The sediment forebay has a depth of 2.0 m deep with a bottom elevation of 264.80 m. Thus the permanent pool will be set at 266.80 m with 2,014 m^3 of available storage volume, which satisfies the permanent pool storage requirement set out in the MOE SWMP manual.

3.2.2 South Pond (WC4)

The contributing drainage catchment for this pond is 8.58 ha, which includes the pond block area and 0.81 ha from the potential townhouse lots from the Loblaw's site. Using the same imperviousness for the development (60%), the required permanent pool storage volume is 1,235 m^3. The permanent pool has a water surface elevation of 259.50 m with a maximum depth of 2.0 m (EL 257.50 m) in the sediment forebay. The main pond cell has a pond bottom at EL 257.50 m at a depth of 2.0 m, and an outlet plunge pool at a depth of 2.0 m (bottom EL 257.50 m). Thus the permanent pool will be set at 259.50 m with 621 m^3 of available storage volume, which satisfies the permanent pool storage requirement set out in the MOE SWMP manual.

3.3 Erosion control

3.3.1 Hydrologic modelling

The OTTHYMO hydrologic model was used to establish the post-development runoff from the proposed development. Post-development drainage area boundaries considered for the model are shown on **Figure 3**. Drainage area numbers and the respective areas are tabulated in **Table 4**, including the external areas west of 20th Side Road. Supporting calculations for modelling parameters are included in **Appendix B**.

Table 4 Model drainage area details

Area ID	Description	Area (ha)
	WC 3 – Alcona Capital Development North	
1000	External Drainage	20.39
210	North Development Residential	4.66
211	North Pond Block	0.63
212	Environmental (Watercourse) Block	2.21
	WC 4 – Loblaw's and Hydro Station	
1	Loblaw's Building	0.31
2	Loblaw's Parking	1.44
3	Loblaw's Landscaping to Innisfil Hydro	0.14
4	Loblaw's Landscaping to 8th Line	0.32
5	Loblaw's Future Expansion Area	1.90
103	Innisfil Hydro Substation	0.76
	WC 4 – Alcona Capital Development South	
200	South Development Residential	7.79
201	South Pond Block	0.79
	WC 4 – To Adjoining Development	
900	South Development Residential Uncontrolled Rear Yards	0.07

The active storage requirement for extended detention storage is the greater of 40 m^3/ha or the calculated storage required to provide the required erosion control. Modelling of the 4 hour, 25 mm Chicago design storm event calculated the following required extended detention volumes:

- 718 m^3 for the north pond with a maximum release rate of 0.01 m^3/s (866 m^3 provided)
- 1,235 m^3 for south pond with a maximum release rate of 0.01 m^3/s (1,291 m^3 provided)

For the north pond this results in required extended detention storage of 136 m^3/ha, based on the 5.29 ha catchment area. For the south pond the required extended detention storage will be 144 m^3/ha based on the contributing catchment of 8.58 ha. Since these volumes are both greater than 40 m^3/ha criteria, the 25 mm storm was the governing criteria in generating the extended detention volumes for both ponds. The erosion control volume can therefore be provided between 266.80 m and 267.10 m in the north pond and between 259.50 m and 260.10 m in the south pond. **Table 5** presents a summary of the requirements and the provided storage.

Table 5 Criteria for water quality treatment

Pond	Area	Required Erosion / Water Quality Treatment	
		Active Storage*	Permanent Pool
North Pond	5.29 ha (60% Imp.)	Max. release rate of 0.01 m^3/s (718 m^3)	158 m^3/ha (838 m^3)
South Pond	8.58 ha (60% Imp.)	Max. release rate of 0.01 m^3/s (1,235 m^3)	148 m^3/ha (1,360 m^3)

Note: * Active storage release rate for quality control based on the 25 mm 4 hr Chicago design storm event and OTTHYMO.

3.3.2 North Pond (WC3)

A 675 mm diameter reverse-slope pipe will provide a bottom draw outlet from the main pond cell. The inlet of the reverse-sloped pipe (invert EL 265.10 m) is to be placed on concrete piers placed 0.30 m above the pond bottom within the plunge pool. The release rates for extended detention will be controlled by a 100 mm diameter orifice located within the quality control maintenance hole. The orifice will have an invert elevation of 266.80 m and will provide a peak release rate of 13 l/s for the erosion control portion of the total storage.

The quality control manhole will be fitted with a 100 mm diameter orifice plate, to be installed on an internal weir wall. The outlet pipe will discharge to a naturalized channel which discharge directly to WC3. The peak release rate will be 0.013 m^3/s, with an extended drawdown time of 30 hours to address the required erosion control detention (see **Appendix C**).

The pond is to be constructed in an area of sandy silt till, identified in borehole BH-3, from the Report on Geotechnical Investigation, Proposed Development, 20th Sideroad & Innisfil Beach Road, Innisfil, Ontario, May 21, 2004 prepared by Toronto Inspection Limited. This borehole is in the general area of the proposed SWM facility and extends to depths well below the proposed bottom of the pond. Groundwater was not encountered at BH-3. The geotechnical report identifies that this sandy silt was dense to very dense at elevations consistent with the bottom of the pond. A liner for the permanent pool may be required; this will need to be confirmed at the time of construction by a geotechnical engineer.

Details of the proposed north stormwater management facility are indicated on **Figure 4**.

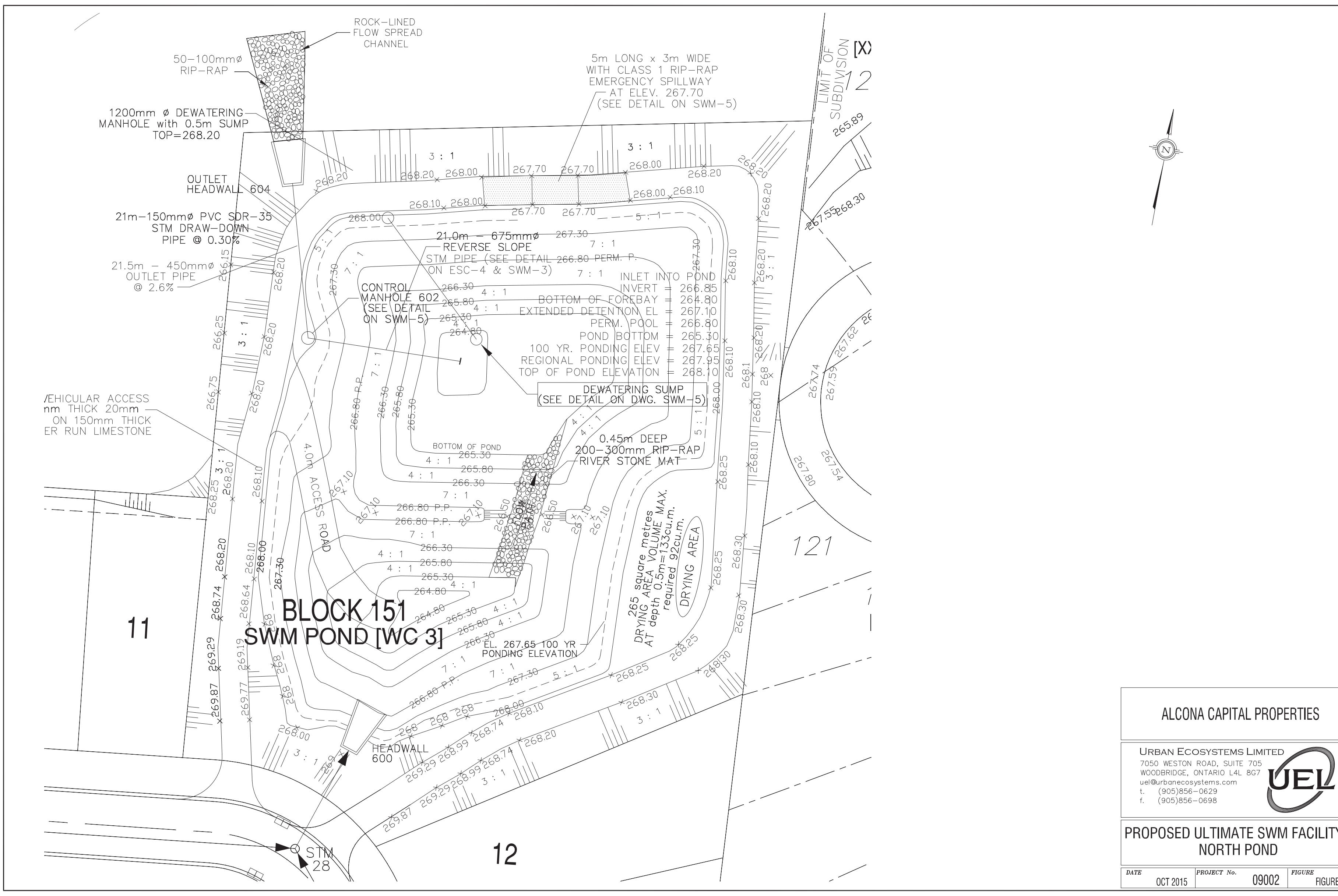
3.3.3 South Pond (WC4)

A 750 mm diameter reverse-slope pipe will provide a bottom draw outlet from the main pond cell. The inlet of the reverse-sloped pipe (invert EL 257.80 m) is to be placed on concrete piers placed 0.30 m above the pond bottom within the plunge pool. The release rates for extended detention will be controlled by a 100 mm diameter orifice located within the quality control maintenance hole. The orifice will have an invert elevation of 259.50 m and will provide a peak release rate of 22 L/s for the erosion control portion of the total storage.

The quality control manhole will be fitted with a 100 mm diameter orifice plate, to be installed on an internal weir wall. The outlet pipe will convey flows through an easement in the Innisfil Hydro property directly to the Innisfil Beach Road storm sewer system. The peak release rate will be 0.022 m^3/s, with an extended drawdown time of 36 hours to address the required erosion control detention (see **Appendix C**).

The pond is to be constructed in an area of sandy silt till, identified in the adjacent to borehole BH-7, from the Report on Geotechnical Investigation, Proposed Development, 20th Sideroad & Innisfil Beach Road, Innisfil, Ontario, May 21, 2004 prepared by Toronto Inspection Limited. This borehole is in the general area of the proposed SWM facility and extends to depths well below the proposed bottom of the pond. Groundwater was not encountered at BH-3. The geotechnical report identifies that this sandy silt was dense to very dense at elevations consistent with the bottom of the pond. A liner for the permanent pool may be required; this will need to be confirmed at the time of construction by a geotechnical engineer.

Details of the proposed south stormwater management facility are indicated on **Figure 5**.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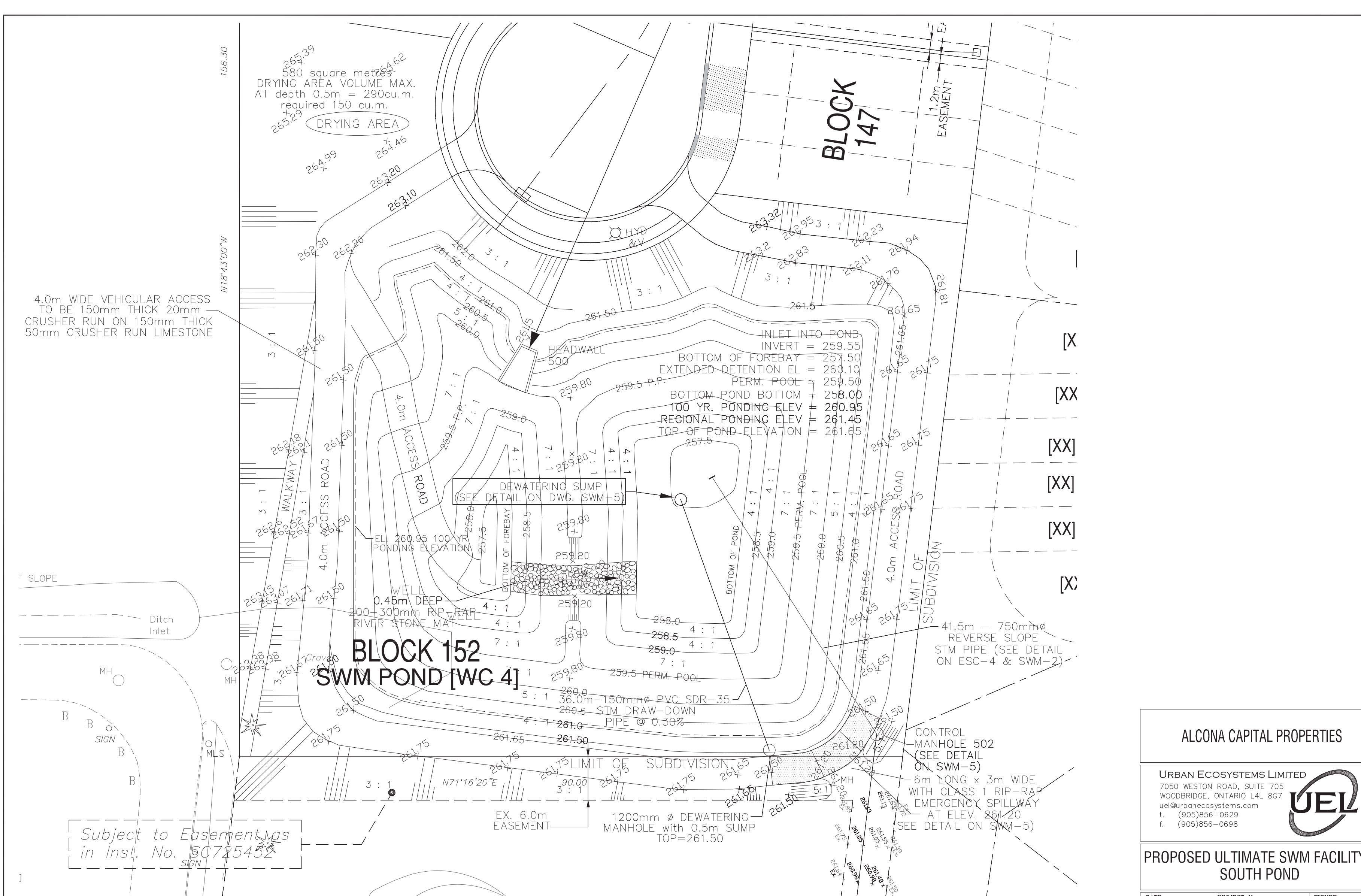
PROPOSED ULTIMATE SWM FACILITY
NORTH POND
DATE OCT 2015
PROJECT No. 09002
FIGURE 4
BLOCK 151
SWM POND [WC 3]
INLET INTO POND
INVERT = 266.85
BOTTOM OF FOREBAY = 264.80
EXTENDED DETENTION EL = 267.10
PERM. POOL = 266.80
POND BOTTOM = 265.30
100 YR. PONDING ELEV = 267.65
REGIONAL PONDING ELEV = 267.95
TOP OF POND ELEVATION = 268.10
ROCK-LINED FLOW SPREAD CHANNEL
50-100mmø RIP-RAP
1200mm ø DEWATERING MANHOLE with 0.5m SUMP TOP=268.20
OUTLET HEADWALL 604
21m-150mmø PVC SDR-35 STM DRAW-DOWN PIPE @ 0.30%
21.5m - 450mmø OUTLET PIPE @ 2.6%
5m LONG x 3m WIDE WITH CLASS 1 RIP-RAP EMERGENCY SPILLWAY AT ELEV. 267.70 (SEE DETAIL ON SWM-5)
21.0m - 675mmø REVERSE SLOPE STM PIPE (SEE DETAIL ON ESC-4 & SWM-3)
CONTROL MANHOLE 602 (SEE DETAIL ON SWM-5)
DEWATERING SUMP (SEE DETAIL ON DWG. SWM-5)
0.45m DEEP 200-300mm RIP-RAP RIVER STONE MAT
265 square metres DRYING AREA VOLUME MAX. AT depth 0.5m = 133cu.m. required 92cu.m.
DRYING AREA
EL. 267.65 100 YR PONDING ELEVATION
HEADWALL 600
4.0m ACCESS ROAD
LIMIT OF SUBDIVISION
STM 28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PROPOSED ULTIMATE SWM FACILITY
SOUTH POND
DATE OCT 2015
PROJECT No. 09002
FIGURE 5
BLOCK 152
SWM POND [WC 4]
BLOCK 147
INLET INTO POND
INVERT = 259.55
BOTTOM OF FOREBAY = 257.50
EXTENDED DETENTION EL = 260.10
PERM. POOL = 259.50
BOTTOM POND BOTTOM = 258.00
100 YR. PONDING ELEV = 260.95
REGIONAL PONDING ELEV = 261.45
TOP OF POND ELEVATION = 261.65
580 square metres DRYING AREA VOLUME MAX. AT depth 0.5m = 290cu.m. required 150 cu.m.
DRYING AREA
4.0m WIDE VEHICULAR ACCESS TO BE 150mm THICK 20mm CRUSHER RUN ON 150mm THICK 50mm CRUSHER RUN LIMESTONE
HEADWALL 500
DEWATERING SUMP (SEE DETAIL ON DWG. SWM-5)
EL. 260.95 100 YR PONDING ELEVATION
0.45m DEEP 200-300mm RIP-RAP RIVER STONE MAT
36.0m-150mmø PVC SDR-35 STM DRAW-DOWN PIPE @ 0.30%
41.5m - 750mmø REVERSE SLOPE STM PIPE (SEE DETAIL ON ESC-4 & SWM-2)
CONTROL MANHOLE 502 (SEE DETAIL ON SWM-5)
6m LONG x 3m WIDE WITH CLASS 1 RIP-RAP EMERGENCY SPILLWAY AT ELEV. 261.20 (SEE DETAIL ON SWM-5)
1200mm ø DEWATERING MANHOLE with 0.5m SUMP TOP=261.50
EX. 6.0m EASEMENT
1.2m EASEMENT
LIMIT OF SUBDIVISION
4.0m ACCESS ROAD
WALKWAY
Subject to Easement as in Inst. No. SC725452

3.4 Quantity control

3.4.1 North Pond (WC3)

As noted above, the proposed pond has a bottom elevation of 264.80 m in the main cell with a permanent pool elevation of 266.80 m and an extended detention ponding elevation of 267.10 m. A sediment forebay has been included at the entrance to the pond to address water quality requirements with a bottom elevation of 264.80 m and 2.0 m permanent pool depth. The north pond layout is shown on **Figure 4**.

The flow in excess of 4 hour, 25 mm design storm event level will be discharged through the 100 mm diameter low flow orifice in combination with a 0.60 m wide rectangular weir located within the outlet control maintenance hole. This orifice/weir combination will control storm runoff from the development to a maximum peak discharge of 0.20 m^3/sec with an active storage requirement of 2,300 m^3 (EL. 267.65 m) for the 12 hour SCS 100 year design storm event. The north pond will discharge directly to a tributary of WC3 through a proposed rip-rap lined dispersion channel.

The pond outlet was designed based on the stage-storage-discharge values designed to control post-development flows to pre-development peak levels. The stage-storage-discharge curve for the north pond is included in the pond design calculations provided in **Appendix C**.

An OTTHYMO model was used to establish the post-development runoff from the proposed development to determine the maximum water level of the pond and the peak discharges. Drainage area details are shown in **Figure 3**. **Table 6** provides the pond release rates and storage requirements for all the design storm events.

Table 6 North pond release rates and storage requirements

Design Storm	Pond Performance					
	4 hr Chicago			12 hr SCS		
	Discharge (m^3/s)	Storage (m^3)	Water Level (m)	Discharge (m^3/s)	Storage (m^3)	Water Level (m)
	NHYD 200	NHYD 200		NHYD 200	NHYD 200	
25 mm	0.01	600	267.05	-	-	-
2 yr	0.01	800	267.15	0.01	1,100	267.25
5 yr	0.01	1,300	267.30	0.03	1,400	267.35
10 yr	0.04	1,500	267.35	0.06	1,600	267.40
25 yr	0.06	1,600	267.40	0.11	1,900	267.50
50 yr	0.08	1,800	267.45	0.16	2,100	267.55
100 yr	0.11	1,900	267.50	0.20	2,300	267.65

Table 7 on the following page tabulates the peak flows discharging from the site for the existing and proposed conditions for all design storms. **Table 8** then summarizes the total peak flows to WC3.

Table 7 Existing and Proposed flow rates – Site only

Design Storm	Flow Rates (m^3/s)			
	4 hr Chicago		12 hr SCS	
	EX.	PR.	EX.	PR.
	NHYD 110	NHYD 200	NHYD 110	NHYD 200
2 yr	0.06	0.01	0.11	0.01
5 yr	0.11	0.01	0.19	0.03
10 yr	0.15	0.04	0.26	0.06
25 yr	0.21	0.06	0.35	0.11
50 yr	0.26	0.08	0.42	0.16
100 yr	0.31	0.11	0.49	0.20

Table 8 Existing and Proposed flow rates – WC3

Design Storm	Flow Rates (m^3/s)			
	4 hr Chicago		12 hr SCS	
	EX.	PR.	EX.	PR.
	NHYD 1	NHYD 11	NHYD 1	NHYD 11
2 yr	0.12	0.11	0.21	0.17
5 yr	0.23	0.20	0.38	0.31
10 yr	0.31	0.28	0.52	0.44
25 yr	0.42	0.40	0.70	0.61
50 yr	0.52	0.51	0.85	0.76
100 yr	0.62	0.61	1.00	0.90

3.4.2 South Pond (WC4)

As noted in the previous section, the proposed pond has a bottom elevation of 258.00 m in the main cell (257.50 m in the outlet plunge pool), a permanent pool elevation of 259.50 m and an extended detention ponding elevation of 260.10 m. A sediment forebay has been included at the entrance to the pond to address water quality requirements with a bottom elevation of 257.50 m and 2.0 m permanent pool depth. The south pond layout is shown on **Figure 5**.

The flow in excess of 4 hour, 25 mm design storm event level will be discharged through the 100 mm low flow orifice in combination with a 0.11 m wide rectangular weir located within the outlet control manhole. This orifice/weir combination will control storm runoff from the development to a maximum peak discharge of 0.20 m^3/s with an active storage requirement of 4,100 m^3 (EL. 260.95 m) for the 12 hour SCS 100 Year design storm event. The south pond will be conveyed via a 450 mm diameter pipe through a proposed easement on the east side of the Innisfil Hydro property to the existing catchbasin manhole at Innisfil Beach Road.

The pond outlet was designed based on the stage-storage-discharge values designed to control post-development peak flows to below pre-development levels. The stage-storage-discharge curve for the south pond is included in the pond design calculations provided in **Appendix C**.

An OTTHYMO model was used to establish the post-development runoff from the proposed development to determine the maximum water level of the pond and the peak discharges. Drainage area details are shown in **Figure 3**. **Table 9** on the following page provides the pond release rates and storage requirements for all the design storm events.

The reduction in post-development flows to below pre-development levels was done to meet the release target of 0.247 m^3/s allocated within the revised Innisfil Beach Road storm sewer system. The maximum release rate from the South Pond was set to take into account the 5 year flow rate from the Hydro lands (0.089 m^3/s) contributing to the Innisfil Beach Road target.

Table 9 South pond release rates and storage requirements

Design Storm	Pond Performance					
	4 hr Chicago			12 hr SCS		
	Discharge (m^3/s)	Storage (m^3)	Water Level (m)	Discharge (m^3/s)	Storage (m^3)	Water Level (m)
	NHYD 3333	NHYD 3333		NHYD 3333	NHYD 3333	
25 mm	0.01	1,100	260.00	-	-	-
2 yr	0.02	1,500	260.15	0.04	1,700	260.20
5 yr	0.05	2,000	260.30	0.07	2,300	260.40
10 yr	0.07	2,300	260.40	0.10	2,700	260.55
25 yr	0.10	2,700	260.55	0.14	3,300	260.70
50 yr	0.12	3,000	260.60	0.17	3,700	260.80
100 yr	0.14	3,400	260.75	0.20	4,100	260.95

Peak flows discharging from the site for the proposed and existing conditions are tabulated below in **Table 10** for all design storms. **Table 11** summarizes peak flows at Innisfil Beach Road as well as at BMP 4C2 (from the Stantec OTTHYMO model).

Table 10 Existing and Proposed flow rates – Site only

Design Storm	Flow Rates (m^3/s)			
	4 hr Chicago		12 hr SCS	
	EX.	PR.	EX.	PR.
	NHYD 19	NHYD 3333	NHYD 19	NHYD 3333
2 yr	0.06	0.02	0.10	0.04
5 yr	0.11	0.05	0.17	0.07
10 yr	0.15	0.07	0.23	0.10
25 yr	0.20	0.10	0.30	0.14
50 yr	0.24	0.12	0.36	0.17
100 yr	0.28	0.14	0.42	0.20

Table 11 Existing and Proposed flow rates – WC 4

Design Storm	@ Innisfil Beach Road				@ BMP 4C2	
	4 hr Chicago		12 hr SCS		12 hr SCS	
	EX.	PR.	EX.	PR.	EX.	PR.
	NHYD 22	NHYD 22	NHYD 22	NHYD 22	NHYD 9585	NHYD 9585
2 yr	0.16	0.15	0.23	0.18	1.82	1.77
5 yr	0.25	0.21	0.37	0.28	2.63	2.59
10 yr	0.33	0.26	0.47	0.37	4.15	4.09
25 yr	0.43	0.32	0.61	0.48	4.99	4.92
50 yr	0.50	0.40	0.72	0.57	N/A	
100 yr	0.59	0.45	0.83	0.67	9.02	8.97

3.5 Water balance

A hydrogeological investigation (December 2010, **Appendix A**) had been completed by Cole Engineering in which had been determined that the underlying soils are predominately sandy loams from the Guerin, Bondhead and Sargent series. The Bondhead and Sargent series have good drainage while the Guerin series have imperfect drainage. A review of the borehole records show that groundwater levels are approximately 1.3 m to 3.5 m below ground surface. Cole Engineering also completed infiltration testing at the site to establish potential infiltration (or percolation) rates for the underlying soils. Testing results in the corresponding Report (October 2015, **Appendix A**) show that the infiltration rates on site range between 22 to 51 mm/hour.

The hydrogeological investigation report also indicated that annual pre-development infiltration rate for the development is 25,516 m^3/yr while the estimated post-development rate is 14,221 m^3/yr, therefore leading to a deficit of 11,295 m^3/yr. As soil conditions are conducive to the application of infiltration measures, it is proposed to implement rain gardens within the site to mitigate the loss of infiltration under post-development conditions. By capturing and infiltrating the first 16 millimetres (mm) of a rainfall event, the rain gardens are expected to address the infiltration deficit and are described in further detail in the subsequent paragraphs.

In order to meet the infiltration deficit, a number of lot-level rain gardens are proposed to infiltrate the required amount of runoff. The rain gardens are proposed on single-family residential lots and will receive runoff from the roof area, driveway, and a portion of the grassed areas. Therefore the drainage area to each rain garden on a typical single-family residential lot (325 m^2) is expected to be approximately 60% (or 195 m^2), and is assumed to have an imperviousness of 75%. With a footprint of 10 m^2, a depth of 1 m and assuming a 40% void space ratio of the infill material, each rain garden will have a storage capacity of approximately 4 m^3.

Based on the storage volume in each rain garden (4 m^3) and its contributing drainage area (195 m^2), approximately 16 mm of rainfall are expected to be captured in each rain garden. This rainfall depth accounts for approximately 86% of the total annual rainfall occurrence (**Figure 1b** in **Appendix D**). Therefore based on a total annual precipitation amount of 826 mm (**Table 1** in **Appendix D**), each rain garden is expected to capture 711 mm of rainfall, or 139 m^3 of runoff volume on an annual basis.

Based on these assumptions approximately 82 rain gardens will be required in order to address the annual water balance deficit of 11,295 m^3/year. This represents approximately 60% of the proposed 138 single-family residential lots. This estimate assumes a smaller lot size (and hence a smaller drainage area) and is therefore conservative. Should some rain gardens be implemented on the larger lots (with larger footprints and drainage areas), it is expected that the required number of rain gardens will be lower. For detailed calculations, please refer to **Appendix D**.

In addition to addressing the water balance deficit, the proposed lot-level rain gardens will also function as part of a treatment train as a form of source control, in conjunction with the proposed stormwater management facilities which function as end-of-pipe controls.

3.6 Phosphorus Removal

Due to high phosphorus levels in Lake Simcoe, the Lake Simcoe Protection Plan and the LSRCA guidelines have set a target of “zero” increase in phosphorus loading from pre-development to post-development conditions.

LSRCA requires a Phosphorus Loading Study be completed for all new major developments. As such, the Lake Simcoe Phosphorus Loading Development Tool ("Tool") was utilized to create a phosphorus budget for the development. The phosphorus budget shows a 10% increase in phosphorus loading when comparing post-development to pre-development levels as the site is changing from primarily cropland into low density residential. When mitigation measures in the form of wet detention ponds are implemented, phosphorus loadings are reduced further to an ultimate 59% net reduction in loading. The budget tool output and the calculation to determine the phosphorus removal efficiency are provided in **Appendix E**.

4. Erosion control during construction

Sediment and erosion control practices during construction will include, but are not limited to, standard control devices such as sediment fencing, mud mats, catchbasin buffers and rock-fill check dams as required. The proposed stormwater facilities will be utilized for sediment control during construction. The facilities can provide sufficient volume to comply with the Erosion & Sediment Control Guidelines for Urban Construction. The guidelines state a minimum of 125 m^3/ha of permanent pool storage and 125 m^3/ha of active storage should be provided for ponds sized at 4:1 length to width. Based on the proposed development areas the following volumes are required:

- For the north pond, 5.29 ha, the total required volume is 1,324 m^3 (662 m^3 each for permanent and active storage); and
- For the south pond, 8.58 ha, the total required volume is 2,146 m^3 (1,073 m^3 each for permanent and active storage).

The proposed ponds provide the following storage volumes that can be utilized during construction:

- For the north pond, 5.29 ha, the volume provided is 4,584 m^3 (2,014 m^3 for permanent and 2,570 m^3 of active storage assuming a 0.3 m freeboard); and
- For the south pond, 8.58 ha, the volume provided is 6,878 m^3 (1,621 m^3 for permanent and 4,835 m^3 of active storage assuming a 0.3 m freeboard).

Detailed erosion control drawings showing the erosion control measures to be implemented for the site development contributing to both SWM ponds will be provided at the detailed design stage. It is proposed to construct the ultimate low flow outlets for both the SWM facilities in conjunction with the pond excavation to provide sediment control during construction of the site.

5. Conclusion and recommendations

The stormwater management for the Alcona Capital Properties Residential subdivision and the associated catchments can be accomplished by the following:

- Stormwater quality control will be provided for the north development with the proposed SWM Facility (North Pond) located adjacent to the northeast corner of the development, adjacent to the tributary of WC3.
- Stormwater quality control will be provided for the south development with the proposed SWM Facility (South Pond) located immediately north of the Innisfil Hydro Substation and east of the Loblaw's development.
- The proposed new facilities will be discharging through a naturalized channels to the either the adjacent tributary (north pond) or conveyed through the Innisfil Hydro lands to the Innisfil Beach Road sewer system.
- Infiltration measures (i.e. lot-level rain gardens) in the north and south portions of the development will be used to address the annual water balance deficit of 11,295 m^3/yr.
- Implementation of remedial measures for phosphorus control results in a 59% reduction in phosphorus loading.
- Sediment control during construction will utilize the proposed SWM facilities in lieu of a separate temporary sediment control ponds.

The new stormwater management facilities will provide:

North Pond (WC3)

- Enhanced (Level 1) water quality control with erosion control;
- 2,014 m^3 of permanent pool and 992 m^3 of extended detention storage volumes;
- Extended detention draw down time of 30 hours;
- 2.0 m depth at permanent pool level in the sediment forebay and 2.0 m depth in the outlet plunge pool to provide thermal impact mitigation; and
- An outlet consisting of a 100 mm orifice and a 600 mm concrete weir will provide control of all post development release rates to less than predevelopment levels.

South Pond (WC4)

- Enhanced (Level 1) water quality control with erosion control;
- 1,621 m^3 of permanent pool and 1,391 m^3 of extended detention storage volumes;
- Extended detention draw down time of 36 hours;
- 2.0 m depth at permanent pool level in the sediment forebay and 2.0 m depth in the outlet plunge pool to provide thermal impact mitigation; and
- An outlet consisting of a 100 mm orifice and a 110 mm concrete weir will provide control of all post development release rates to less than predevelopment levels.

This report provides detail of the measures to we implemented to meet all the required stormwater management criteria associated with the proposed development and the proposed SWM facilities identified as North Pond and South Pond.

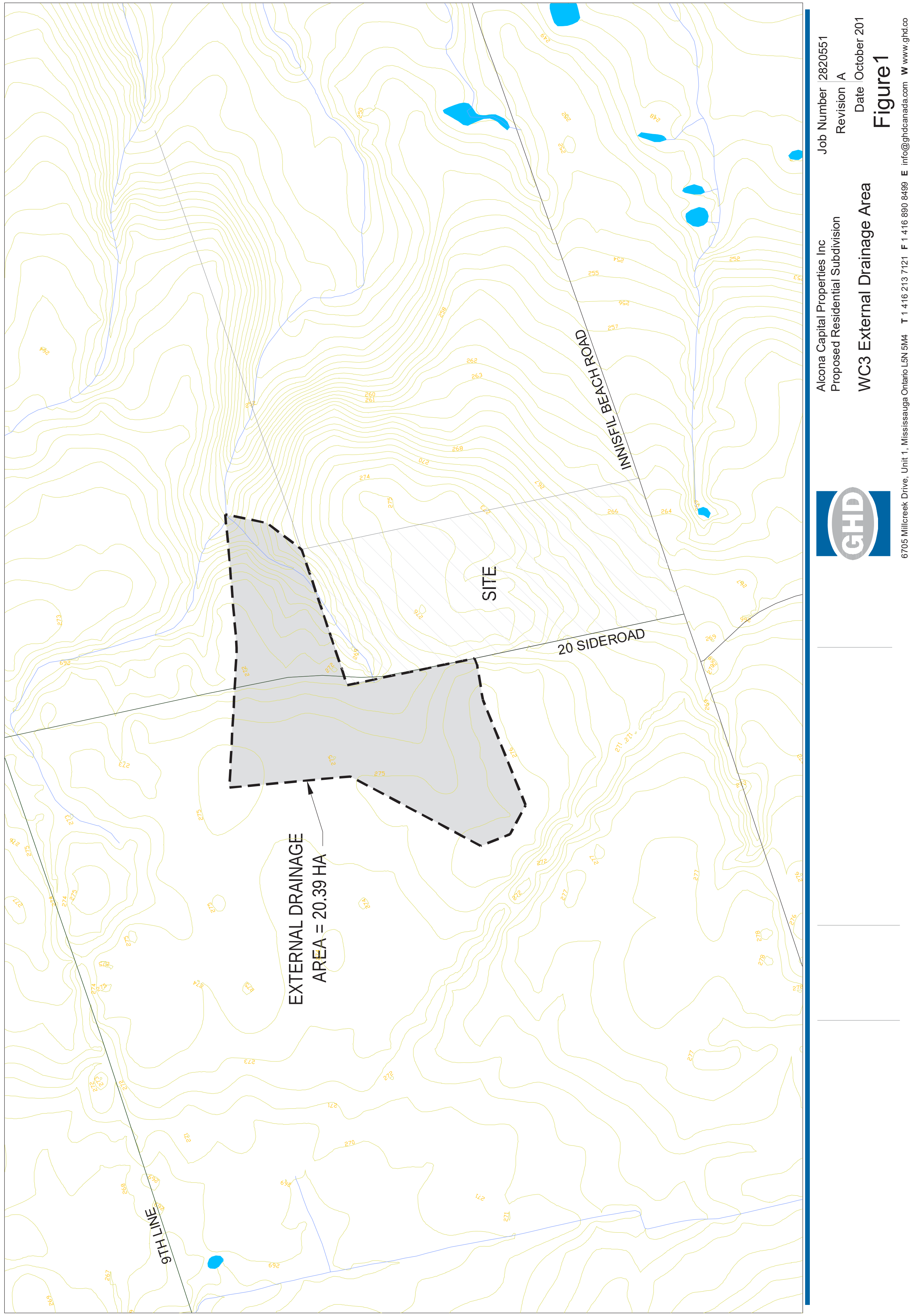
Respectfully submitted,
GHD Limited

Ken Chow, P. Eng.
Senior Water Resources ngineer
905 814 4359

Auryn Soares, B.A.Sc. (Eng.)
Water Resources nalyst
905 814 4337

Appendices

Appendix A – Supporting Documentation



STORM DRAINAGE & STORM WATER MANAGEMENTs

Storm water management for the site will follow the guidelines outlined by The Town of Innisfil Master N Servicing and Drainage Plan for the Alcona Secondary Plan Area, and recommendations discussed with N the Town of Innisfil and Ainley Consulting Engineers. TSH has prepared a stormwater management N report for the lands to the east which includes the subject site in its modelling. Drainage area boundaries N used in the TSH report will be considered in the evaluation of the proposed site. N

It is proposed to outlet the sites minor storm flows to the proposed storm sewers located within the N intersection of the main entrance to the site. Major storm flows will discharge overland towards IBR. N See proposed servicing plans by Odan/Detech for details. N

Since Nthe Nsubject Nsite does Nnot Nlie Ninto a Ndesignated Nstorm Nwater Nquantity Ncontrol facility, Npost N development flows will be required to match pre development flow rates for the 2, 5, 10, 25 and 100 year N storm events. N

Predevelopment Flows

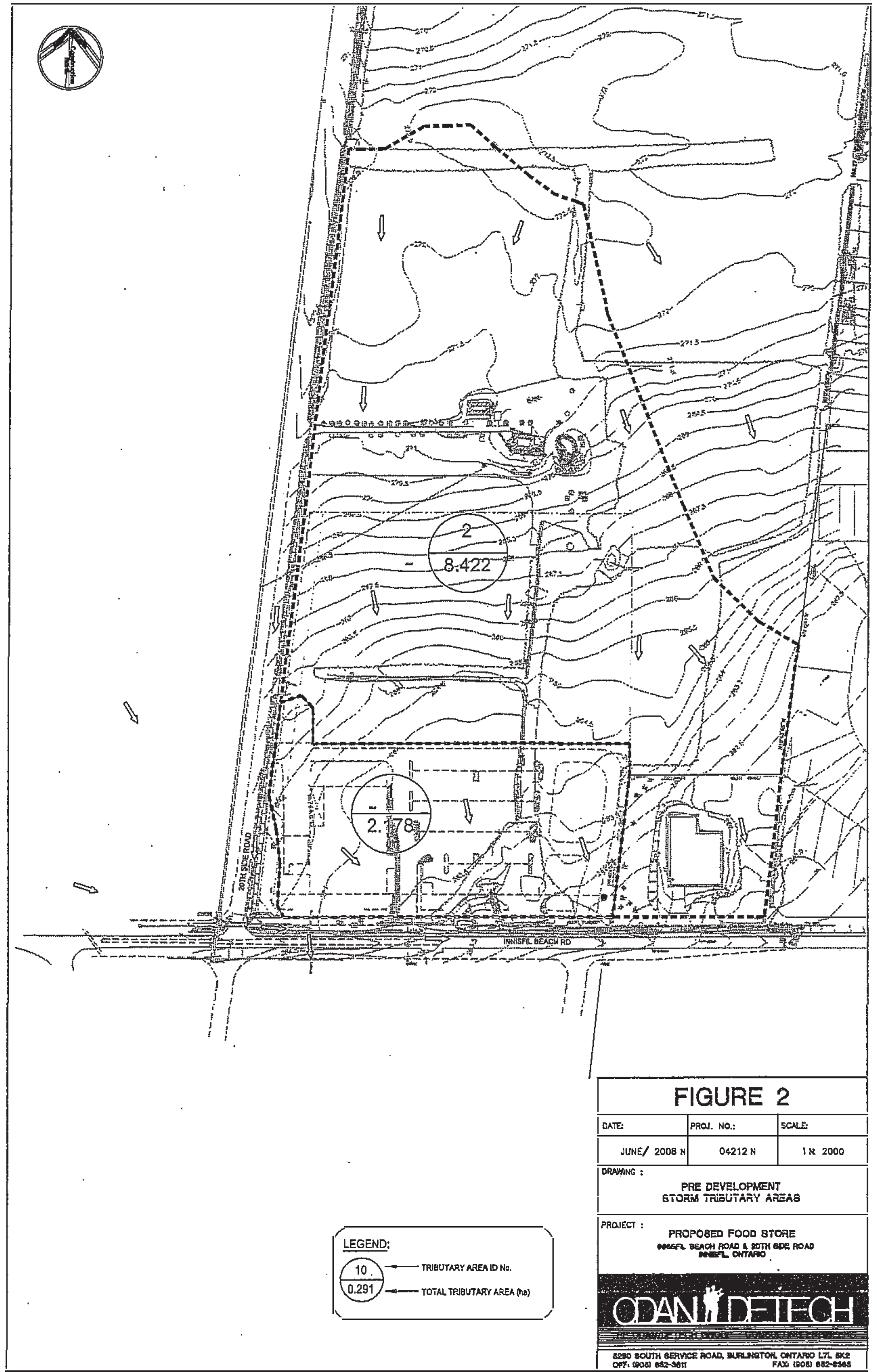
In Norder Nto Nensure Nthat Nthe Ntotal Nflow Nto Nthe Nditch Non Nthe Nnorth Nside Nof NBR does Nnot Nexceed N predevelopment levels, the total area drainage area contributing flows to the ditch must be considered in N the pre-development and post development analysis. N

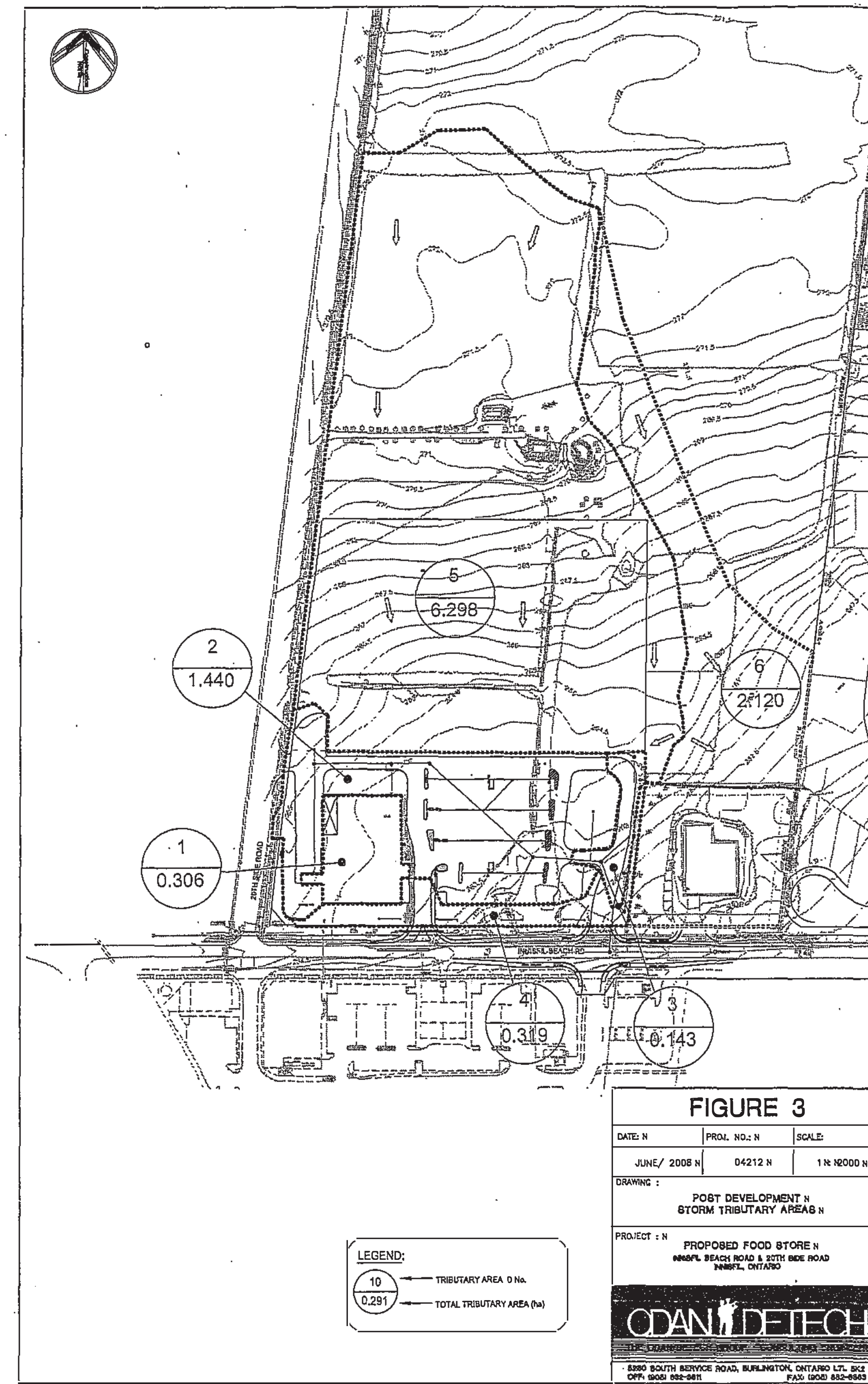
In TSH's SWM report the total drainage area contributing to the ditch is 10.60 ha which includes the LPL N lands (See Figure 1 in Appendix A). Visual Otthymo 2.0 was used to evaluate the flows contributing the N ditch for the 12 hour SCS Storm Type II and the 4 hour Chicago distribution for the 2, 5, 10, 25, and 100 O year storm events. The single event design storm intensities for SCS storm were derived from total N precipitation volumes obtained from the Bloor Street meteorologic station. N

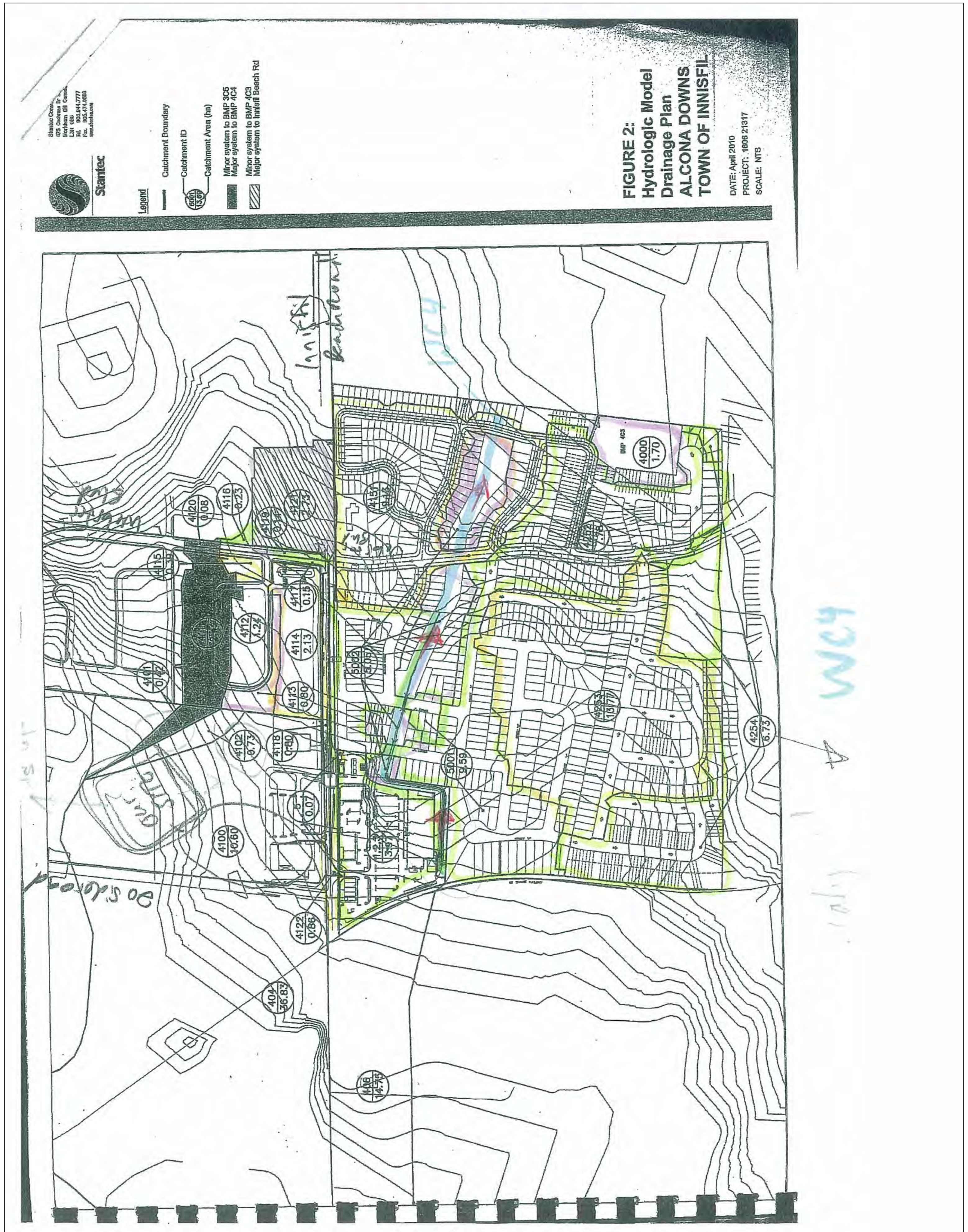
To determine the existing flows to the ditch, the Nashyd method was used using the same parameters N used in TSH's report. The following Table 1 and 2 summarizes the predevelopment parameters used and N the existing flow analysis respectively. N

TABLE 1 O Pre Development Parameters –sUltimate Conditionss	
Area (ha)	10.60 O
CN O	73 O
Initial Abstraction (I_a) N	1.5 O
Tp (hrs)	0.520 O

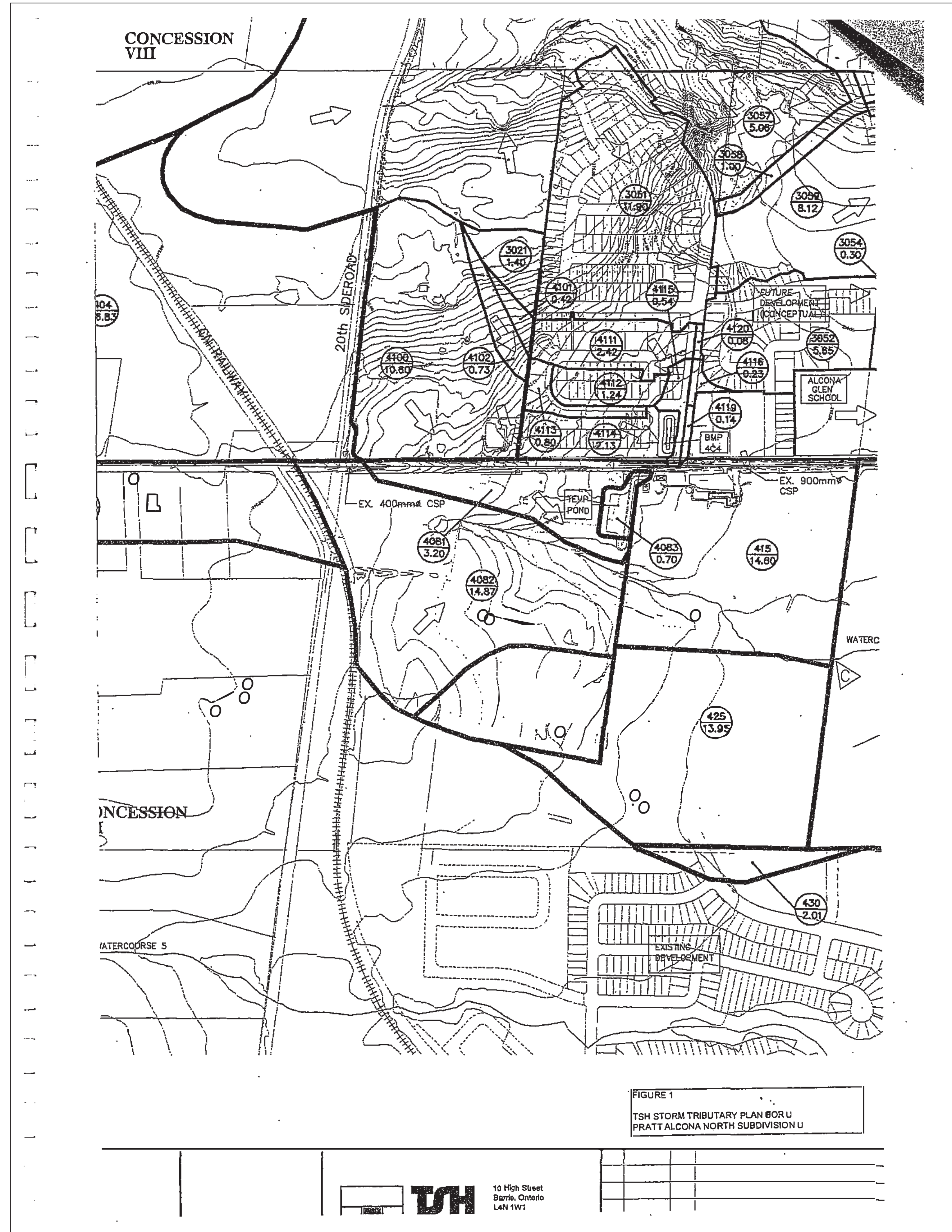
Refer to Appendix "A" for excerpts from TSH report *Ultimate Development Otthymo Parameters –O Watercourse 4* and *Ultimate Development OTTYMO Input Parameters.* O


2
8.422
1
2.178
INNISFIL BEACH RD
FIGURE 2
DATE:
PROJ. NO.:
SCALE:
JUNE/ 2008
04212
1 : 2000
DRAWING :
PRE DEVELOPMENT
STORM TRIBUTARY AREAS
PROJECT :
PROPOSED FOOD STORE
LEGEND:
10
0.291
TRIBUTARY AREA ID No.
TOTAL TRIBUTARY AREA (ha)
ODAN DETECH
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO L7L 5K2


5
6.298
2
1.440
6
2.120
1
0.306
4
0.319
3
0.143
FIGURE 3
DATE:
PROJ. NO.:
SCALE:
JUNE/ 2008
04212
1 : 2000
DRAWING :
POST DEVELOPMENT
STORM TRIBUTARY AREAS
PROJECT :
PROPOSED FOOD STORE
LEGEND:
10
0.291
TRIBUTARY AREA ID No.
TOTAL TRIBUTARY AREA (ha)
ODAN DETECH
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO L7L 5K2



Stantec
Legend
Catchment Boundary
Catchment ID
Catchment Area (ha)
Minor system to BMP 3C5
Major system to BMP 4C4
Minor system to BMP 4C3
Major system to Innisfil Beach Rd
FIGURE 2:
Hydrologic Model
Drainage Plan
ALCONA DOWNS
TOWN OF INNISFIL
DATE: April 2010
PROJECT: 1606 21317
SCALE: NTS
WC4
4000
1.70
4100
10.80
4102
8.73
4116
0.23
4254
6.73
404
35.83



CONCESSION
VIII
20th SIDEROAD
CN RAILWAY
3057
5.06
3058
1.00
3051
11.90
3059
8.12
3054
0.30
3021
1.40
4101
0.42
4115
8.54
FUTURE
DEVELOPMENT
(CONCEPTUAL)
4120
0.08
3052
5.85
4111
2.42
4116
0.23
4100
10.80
4102
0.73
4112
1.24
ALCONA
GLEN
SCHOOL
4119
0.14
4113
0.80
4114
2.13
BMP
4C4
EX. 400mmø CSP
TEMP
POND
EX. 900mmø
CSP
4081
3.20
4083
0.70
415
14.60
4082
14.87
WATERC
425
13.95
CONCESSION
430
2.01
WATERCOURSE 5
EXISTING
DEVELOPMENT
FIGURE 1
TSH STORM TRIBUTARY PLAN FOR U
PRATT ALCONA NORTH SUBDIVISION U
TSH
10 High Street
Barrie, Ontario
L4N 1W1

Ultimate Development Ottbymo Parameters O
Watercourse 4 O

Sub Catchment G ID	Area (ha)	CN O	TIMP	XIMP	Tp (hrs.) O	Initial Abstraction G	
						Pervions O Area G	Impervious G Area G
1.0.	1.96.	60			0.20.	1.5.	
101.	2.03	73.	0.70.	0.70.		1.50.	0.80.
102.	4.20.	73.	0.36.	0.25.		1.50.	0.80.
103.	1.70.	73.	0.36.	0.25.		1.50.	0.80.
104.	.39.	73.	0.70.	0.70.		1.50.	0.80.
200.	5.75.	73.	0.36.	0.25.		1.50.	0.80.
201.	0.51.	73.	0.70.	0.70.		1.50.	0.80.
202.	0.43	73.	0.70.	0.70.		1.50.	0.80.
203.	1.20.	60.			0.20.	1.50.	
04.	36.83.	73.			0.41.	1.50.	
406.	14.75.	64.			0.35.	1.50.	
4000.	1.20.	62.	0.50.	.50.		1.50	0.80.
100.	10.60.	73.			0.52.	1.50.	
4101.	0.42.	73.			0.24.	1.50.	
102.	0.73.	73.			0.34.	1.50.	
4111.	2.42.	80.	0.45.	0.30.		1.50.	0.80.
4112.	.24	80.	0.45.	0.30.		1.50.	0.80.
4113	0.80	80	0.45	0.30		1.50	0.80
4114	2.13	80	0.45	0.30		1.50	0.80
4115	0.39	80	0.45	0.30		1.50.	0.8.
4116	0.23	80. O	0.36.	0.30		1.50	0.80
4117	0.15	80	0.77	0.65		1.50	0.80.
4118	0.80	80	0.60	0.50		1.50.	0.80
4119	0.14	80.	0.77.	0.65.		1.50.	0.80.
4120.	0.08.	8.	0.69.	0.58.		1.50.	0.80.
4151.	13.50.	64.	0.50 O	0.35 O		1.50.	0.80.
4252.	8.09.	62.	0.57.	0.45.		1.50.	0.80.
4253.	5.23	62.	0.44.	0.30.		1.50.	0.80.
254.	6.00.	62.	0.30.	0.16.		1.50.	0.80.
4321.	10.23.	60.			0.74.	1.50.	
322.	15.18.	60.	0.45.	0.35.		1.50.	0.80
5001.	16.40.	64.	0.40.	0.30.		1.50.	0.80.
5002.	2.74	64.			0.20.	1.50 4.	
5006 4.	3.89	73.	0.36 O	0.25.		1.50.	0.80

Note: G1. Areas and parameters are as per A.M. Candaras Report, April 2003, for Innisbrook Heights and Green Acres developments, except as noted below. G
2. Catchment areas 100 to 4120 represent catchments areas 40 and 41 used in the MSDP and A.M. Candaras Reports. G These catchments areas have been revised to represent the development of Property No. 1 (Pratt Alcona North). G
3. .This scenario considers all lands from Pratt Alcona South to Innisbrook Heights, inclusive, as developed. G

given to the Lake Simcoe Region Conservation Authority recently approved "Watershed Development Policies" (Sept. 1994) document.

(iv) Fish Habitat

The policy regarding the protection of fish habitat comes under the jurisdiction of the federal Department of Fisheries and Oceans "Policy for the Management of Fish Habitat". The Ontario Ministry of Natural Resources enforces this policy through the federal provincial agreement. In summary, the policy states that there should be no net loss to fish habitat associated with any works.

(v) Wetlands

The Ontario Ministry of Natural Resources and the Ministry of Municipal Affairs protect, under the Planning Act, all provincially significant wetlands. The policy proposes that municipalities identify, in their Official Plan, and protect provincially significant wetlands. The municipality is also encouraged to identify, in their planning documents, "other" wetlands which may be of local significance and incorporate these in the detailed subdivision design. The "Alcona Secondary Plan" identifies those areas that are environmentally sensitive.

(vi) Woodlots

The protection of woodlots within Ontario is based on the Provincial Trees Act. Municipalities have, through the passing of bylaws, the power to prohibit the removal of trees. The Ministry of Natural Resources also provides advice through the municipal planning process on the appropriateness of development within woodlots. Moreover, the Simcoe County Tree Cutting bylaw protect wooded areas within the study area.

(vii) Stormwater Quality and Quantity Control

The Ministry of Natural Resources, Ministry of Environment and Energy, and the Conservation Authority, have policies that control the rate and/or quality of runoff from a developing area. In terms of quantity control, the policies are designed to ensure that the post-development outflows do not exceed those of the predevelopment level.

In May 1991, the two ministries jointly issued the "Interim Stormwater Quality Guidelines for New Development". The intent of this guideline was to ensure that stormwater runoff from new developments would not be discharged into any water body without first being treated.

In June 1994 the Ontario Ministry of Environment Energy issued a document entitled "Stormwater Management Practices, Planning, and Design Manual". Although this manual provides guidance in the design of stormwater management facilities it is recognized that agencies must not discourage the efforts of innovative designers.

5.2.2 Design Guidelines

(i) General

The Master Drainage Study being prepared for the Alcona Secondary Plan Area is based on conceptual landuse plans. As the various draft plans proceed through the planning process, it is anticipated that the landuse types, densities, road patterns, etc. will change. This will require that, at the site level approval stage, the hydrologic calculations undertaken as part of this drainage study be refined to better reflect the approved development plans. The recommended approach to the handling of surface runoff, as outlined in this report, would however, not change.

(ii) Water Quality Criteria

The Ministry of Natural Resources (MNR) and the Ministry of Environment and Energy (MOEE) have both published specific criteria regarding water quality. For the study area, the water quality criteria is based on protection of aquatic life. The primary focus of the MNR guidelines is the reduction in TSS concentrations and adoption of setbacks to regulate development, encroachment and the maintenance of existing cover along shorelines/streambanks where possible. The MOEE guidelines cover a wide variety of parameters with respect to aquatic habitat and human health objectives.

As stated in a previous section, some development plans have been prepared for the Secondary Plan Area. These plans, however, are conceptual and subject to change. For the current master drainage study, the primary concern of the agencies have been addressed in detail, namely no increase in suspended solids concentrations (e.g. control of first flush). Because the development plans are conceptual in nature, other concerns by the MNR, such as water temperatures, dissolved oxygen levels, lead and nutrients, cannot be explicitly addressed at this time. They would, however, be of interest when preparing the design details of each selected stormwater management facility. The current water quality requirements within the Lake Simcoe Watershed calls for Level 1 protection as per the 1994 MOEE Stormwater Management Practices Planning and Design Manual, 1994.

For the Secondary Plan Area, storage of the first flush (associated with a 25mm, 2 hour runoff event) for twenty-four hours represents the base level for erosion control.

(iii) Water Quantity

For quantity control, the Master Drainage Plan is to be designed to ensure that there are no increases to the peak outflows above that of the predevelopment condition. That includes all storms ranging from the frequent events (e.g. 2 year storm) to the

infrequent events (e.g., 100 year event). Where possible, flows should be overcontrolled in order to reduce the potential flood hazards that currently exist along the downstream banks of the study systems. Where a landowner is required to over-control peak outflows from their SWM facility, in the interest of providing increased downstream flood hazard protection, then consideration is to be given to adjusting allowable pond depths as opposed to the pond area.

The MNR requires also that the baseflows in the recipient watercourses not be impacted upon as a result of development. At the master drainage study level, general recommendations can be detailed to help maintain existing baseflow levels. Section 5.3 of this report identifies, based on a review of the hydrogeological features of the study area, those areas where infiltration practices should be encouraged. The implementation of such measures as the use of infiltration pits, discharging of roof leaders and other impervious areas onto grassed areas, reduced drainage slopes, etc. can all help to encourage infiltration. Their feasibility and design details must be addressed at the site level stage.

The Lake Simcoe Region Conservation Authority (LRCA) has adopted in accordance with the Provincial Policy the Hurricane Hazel event as the regulatory storm for Watercourse 3, 4, and 5. Their current regulations prohibit any new development within the flood hazard area unless the proponent of these activities obtain prior approval from the Conservation Authority. As part of the current investigation the flood hazard associated with the Hurricane Hazel event has been reassessed. The new flood levels and hazard limits have been defined on the 1:500 scale topographic mapping (refer to Section 4.0 for discussion). It is noted that an application has been made by the Town of Innisfil to reduce the Regulatory Flood Event along Watercourses 4 from Hurricane Hazel to the 100 year event. The technical data in support of that submission is provided in this report.

5.3 Hydrogeologic Considerations

5.3.1 Drainage - Groundwater Interaction

(i) Hydrogeological Factors Relating to Stormwater Best Management Practices (BMP)

The purpose of stormwater best management practices (BMP) is to minimize the impacts of urbanization on stormwater flow and infiltration, and to contain sediments and contaminants on site or within a portion of the watershed. There are a variety of specific impacts that need to be addressed in this general purpose, relating to the conditions in the watershed (e.g. flood control; baseflow maintenance; habitat protection), and a variety of options to select to address the issues (infiltration, wet or dry detention, vegetative covers).

TOWN OF INNISFIL
SWM Criteria

direction of the Town Engineer. Only chemical pressure grouting repair techniques will be considered acceptable.

2.2.10 Detention Facilities

Detention facilities shall be provided for both the major and minor systems as required to reduce runoff increases and to meet downstream flow constraints. Both wet and dry detention facilities may be considered. A wet facility is a permanent pond which provides storage in a freeboard allowance while a dry facility is a temporary storage site that may be used for othe purposes during dry weather.

Minor System Detention

Whe e storage is required to reduce post-development 5-year retu n frequency storm pipe flows to pre-development storm runoff rates o to meet downst eam flow constraints, land area set aside expressly for this storage where it is not part of a privately owned facility (i.e. roof top storage o otherwise incorporated into industrial/commercial lands) shall be designated as a "stormwater detention site" and dedicated by the Developer to the Town. It shall not be considered as part of the park system.

Major System Detention

Whe e detention facilities are designed to control runoff increases in the major system, storage may be considered in designated park areas. The area required, the duration and frequency of use of the site for storage o runoff shall be specified when multiple use of the site is considered (i.e. park and storm runoff detention). In all cases, the detention of runoff in multiple use facilities shall not occur more f equently than once in five years.

Dual System Detention

If the facility is used to control major and minor system runoff increases, the land area required to store the 5-year return frequency storm runoff increase shall be designated as part of the drainage system, while storage in excess of this may be obtained from adjacent designated park lands as an overflow o freeboard allowance.

Outlet Design

All detention facilities shall be provided with an outlet (overflow spillway) designed to accommodate a 100-year return frequency storm flow without a failure. Suitable erosion protection shall be provided downstream of the outlet for all flow conditions. Operation during spring snow melt or freezing conditions shall be investigated and any required changes will be incorporated.

Fencing

Stormwater treatment facilities are to be designed such that perimeter fencing is not required. Alternative screening mechanisms to maintain public safety within the vicinity of proposed facilities are to be considered through the use of gradual side slopes, safety shelves above and below the permanent pool, and natural barriers to discourage public access incorporated into the facility design. The M.O.E. Best Management Practices (2003 BMP) shall be applied to the design of stormwater management ponds.

Maintenance Access

The maintenance access to each facility shall be designed to ensure that there is sufficient spacing to allow for the long term maintenance of the facility. Consideration shall be required for access to key locations within the facility including but not limited to inlet and outlet structures, forebay structures, pond berms and overland flow areas. The pond layout is required to be designed to ensure that sufficient space is provided to provide turning areas and that the facility can be fully cleaned out by the equipment outlined in the maintenance manual. Consideration shall be given to providing sediment drying areas adjacent to the forebays to facilitate maintenance. Access paths shall not be less than 4 metres wide. Access paths are to be looped or adequate turn circles or Hammerhead turn areas provided.

Maintenance Manual

A detailed maintenance manual will be required as part of the design of each facility including inspection checklists, maintenance descriptions and projected frequency, and recommendations for facility cleanup.

Drainage and/or Stormwater Management Report

A Drainage and/or Stormwater Management Report setting out the existing and proposed drainage system shall be submitted for approval to the Town Engineer. The report may also have to be approved by the Ministries of the Environment and Natural Resources and the Conservation Authority.

The report shall include a plan showing the major overland system design. When the Rational Method is used, the relevant figures are to be entered on Storm Sewer Design Sheets. When computer modelling is used, the report shall indicate model parameters and assumptions used and to give outflow hydrographs and hydraulic grade line levels where applicable. This information shall included detailed calculations of soil parameters, time of concentration, impervious land area coverage, and initial abstraction parameters.

In cases where flows are diverted to adjacent watersheds, the drainage report shall show that the receiving system can accommodate the additional flows within the constraints applicable to the receiving system. The constraints include characteristics of the receiving watercourse both upstream and downstream of the diversion. The report shall also deal with the effects of the diversion on the original watercourse downstream of the diversion, including the need to satisfy the legal requirements of the riparian owners and the need if any to maintain base flow.

Design Flows

Potential increases in runoff rates resulting from new development shall be controlled as required by the Town. Where downstream constraints exist such as those established by the Town or the Conservation Authority, the drainage report shall demonstrate how runoff rates will be controlled to satisfy those constraints. In the absence of such constraints, the post-development flows from a 5-year return frequency storm generally shall not exceed the flows for pre-development conditions for the same storm at the outlet for the minor system unless it is demonstrated to the satisfaction of the Town Engineer that uncontrolled flows will have no adverse effects. Similarly for the major system post-development runoff from a 25-year return frequency storm generally shall not exceed the pre-development runoff for the same storm. Where physical constraints of the downstream watercourse have been identified for the pre-development condition, the Town may require over-control of runoff from the new development to help address the existing deficiencies.

2.3 Sanitary Sewer System

2.3.1 General

For subdivisions in which sanitary sewers are required, the sewer system is to be designed to carry domestic, commercial and industrial sewage for each area or subdivision under consideration. Flow is to be by gravity and pumping will be considered only where other alternatives are not possible and only with the approval of the Town Engineer.

If a pumping station is approved by the Town, it shall be designed in accordance with the MOE guidelines with standby power all to the satisfaction of the Town Engineer.

Service Area

The system shall be designed to service all areas within the subdivision to their maximum future development in accordance with the Town's Official Plan. Allowance shall be made for inflows from the appropriate adjacent subdivisions or areas and shall meet with the approval of the Town Engineer. Discharges of the system are to be into appropriate sewers and are to be approved by the Town Engineer. The exact location for connecting to sewers in adjacent subdivisions or areas shall be as approved by the Town Engineer.

Drains

All floor drains are to be connected to the sanitary sewer. Foundation drains and roof water leaders are not to be connected to the sanitary sewer.

2.3.2 Design Flows

The sewers shall be sized for maximum design flows plus an allowance for infiltration. Minimum velocities and slopes shall be determined for maximum design flows without infiltration.

The average daily domestic flow shall be taken as 450 litres/capita day.

STORM DESIGN SHEET (Metric)

Reference number : 2395.200

Design Storm Period: 5 Year

CODED BY: KC | CHECKED BY:

DATE: Sep-09 | PAGE 1O OF 1O

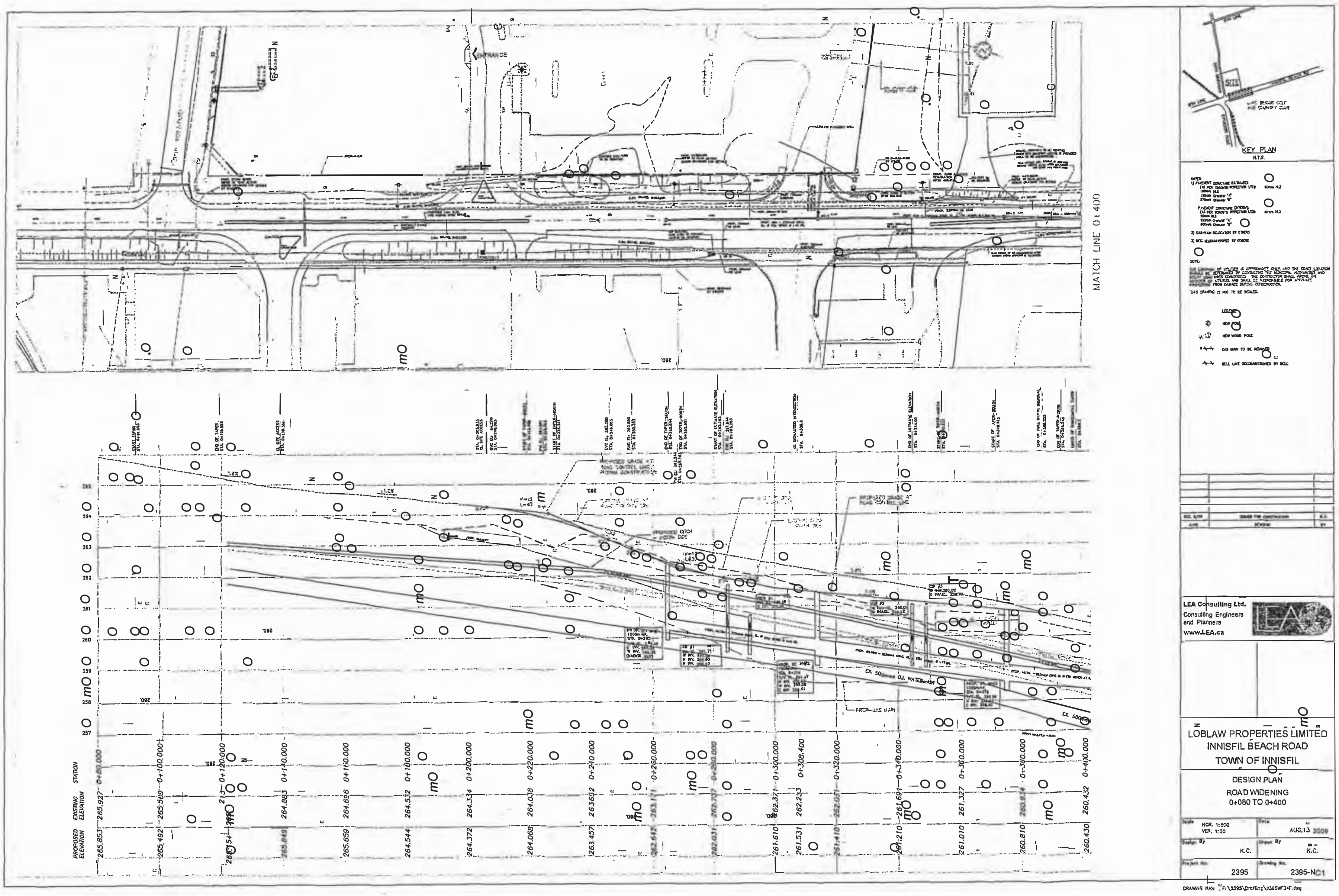
PROJECT DESC: IBR INTERM DRAINAGE

DRAINAGE AREA					RUNOFF DATA									OUTLET PIPE DA A							
FROM	Inv. Elev.	TO	Surf Elev.	Inv. Elev.	La m	Sa m/m	Tc min	I mm/hr	A Ha	Runoff Coeff. R	AR	Accum. AR	Q= 2.78AIR L/S	Type Pipe	Size m	L LENGTH PIPE(m)	FALL m	S SLOPE %O	Q L/s	V m/s	T min.O
1	260.24	2	262.49	259.55									107.00								
Site Storm Water Outlet Table 7 - Summary of Total flow from site (Design Brief Enginner Report, Odan/Detech Group, March 2009)														Prop.	0.375	49.00	0.69	1.40	207.44	1.88	0.43
Site	259.53	2	261.47	259.38			-	-	-	-	-	-	247.00								
														Prop.	0.450	15.10	0.15	1.00	285.09	1.79	0.14
2	259.38	3	260.86	258.59			0.43	77.00	0.45	0.51	0.23	0.23	403.23								
														Prop.	0.525	61.00	0.79	1.30	490.31	2.26	0.45
3	258.57	4	258.60	258.08			0.88	0.00	0.00	0.00	0.00	0.23	403.23								
														Prop.	0.525	55.00	0.50	0.90	407.97	1.88	0.49
3	258.08	OUTLET	258.60	257.97			1.37	0.00	0.00	0.00	0.00	0.23	403.23								
														Prop.	0.525	12.09	0.11	0.90	407.97	1.88	0.11

Detailed Tributary Area Calculations

Trib Area	mm2	m2	Ha	Unadjusted unoff Coeff.	Weighted unoff Coeff.
1	1550184370	1550.184	0.155018	0.3	0.046506
2	2584665564	2584.666	0.258467	0.9	0.23262
3	1448475999	1448.476	0.144848	0.3	0.043454
4 C	2254150870 C	2254.151	0.225415	0.3	0.067625
8	350504974.1 C	350.505 C	0.03505	0.9 C	0.031545
			0.818798		0.42175
		Adjsuted Runoff Coeff.			0.515084

Trib Area	mm2	m2	Ha	Unadjusted unoff Coeff.	Weighted unoff Coeff.
5	2.73E+09	2726.158	0.272616 C	0.3 C	0.081785
6	1.57E+09	1570.759	0.157076 C	0.9 C	0.141368
7 C	1.94E+08 C	193.632 C	0.019363 C	0.3 C	0.005809
			0.449055		0.228962
		Adjsuted Runoff Coeff.			0.509875



TOWN OF INNISFIL

IBR - Precinct 1 Reconstruction

STORM SEWER DESIGN CALCULATIONS

PROJECT: Innisfil Beach Road - Precinct 1

Project #: 209010

Calculated By: KWC

Checked By: TMK

Date: May 2011 (Updated Dec 2012)

DESIGN FREQUENCY	5 Year
INTENSITY =	at^b
a =	26.1
b =	-0.69
DESIGN "n" FACTOR	0.013

LOCATION				DRAINAGE AREA					RUNOFF			PIPE SELECTION						
From MH	Station	To MH	Station	Area ID	A Area (Ha)	C Composite	2.78*AC	CUMUL AC	CUMUL Tc (min)	I Rainfall (mm/hr)	Q (m3/s)	Dia (m)	Pipe Slope (%)	Q Full (m3/s)	Velocity Full (m/s)	Pipe Length (m)	Flow Time (min)	Fall (m)
FLOWS TO WEBSTER BLVD (5-YEAR DESIGN):																		
EXT (LPL m ComCercial Site)		STM MH 1A	0+170	(**Flows provided by Odan/Detech for LPL Catchment Area 4, Sept. 23, 2009)							**0.022**							
STM MH 1	0+170	STM MH 2	0+250	1, 2, 3, 4	0.372	0.85	0.88	0.88	15.0	67.9	**0.060**							
											0.082	0.300	1.40	**0.114**	1.62	80.0	0.8	1.12
STM MH 2	0+250	EX. STM MH 1	0+265								**0.082**	0.300	1.40	**0.114**	1.62	16.0	0.2	0.22
EX. STM MH 1	0+265	EX. STM MH 2	0+315	5, 6	0.193	0.85	0.46	1.34	16.0	65.0	**0.109**	0.375	1.47	**0.212**	1.92	49.0	0.4	0.72
EX. STM MH (LPL Commercial Site)	0+314	EX. STM MH 2	0+315	(**Flows provided by Odan/Detech for LPL site, September 23, 2009)							0.247							
EX. STM MH 2	0+315	EX. STM MH 3	0+375	, 8, 9	0.519	0.53	0.7	2.10	16.4	63.8	**0.404**	0.525	1.39	**0.507**	2.34	61.0	0.4	0.85
EX. STM MH 3	0+375	STM MH 4	0+415					2.10	16.8	62.7	**0.401**	0.525	2.30	**0.652**	3.01	40.5	0.2	0.93
EXT (From North of Dm Catchment Area 10)		STM MH 4	0+375		1.36	0.20	0.76	0.76	15.0	67.9	**0.051**							
STM MH 4	0+415	STM MH 5	0+485	10, 11	0.76	0.38	0.81	3.67	17.1	62.1	**0.497**	0.525	2.30	**0.652**	3.01	69.5	0.4	1.60
STM MH 5	0+485	STM MH 6	0+579	12, 13, 14, 15	0.40	0.85	0.94	4.60	17.5	61.2	**0.551**	0.525	2.30	**0.652**	3.01	94.0	0.5	2.16
STM MH 6	0+579	STM MH 7	0+673	16, 17	0.21	0.85	0.49	5.10	18.0	60.0	**0.575**	0.525	2.70	**0.706**	3.26	94.0	0.5	2.54
STM MH 7	0+673	EX. DICBMH	0+693	18, 19	0.20	0.85	0.48	5.57	18.5	58.9	**0.597**	0.600	2.80	**1.027**	3.63	21.8	0.1	0.61
EX. DICBMH	0+693	EX STM MH	0+710					5.57	18.6	58.7	**0.596**	0.600	1.03	**0.623**	2.20	16.5	0.1	0.17
EX STM MH (Pratt North)		EX STM MH	0+710	(**Flows taken from TSH Storm Sewer Design Sheet dated November 2006)							**1.025**							
EX STM MH	0+710	Alcona Downs									**1.621**							

NOTE: Alcona Downs design allows for a peak 5-year flow of 1.622 m^3/s being directed from Innisfil Beach Road and External Areas to EX STM MH.

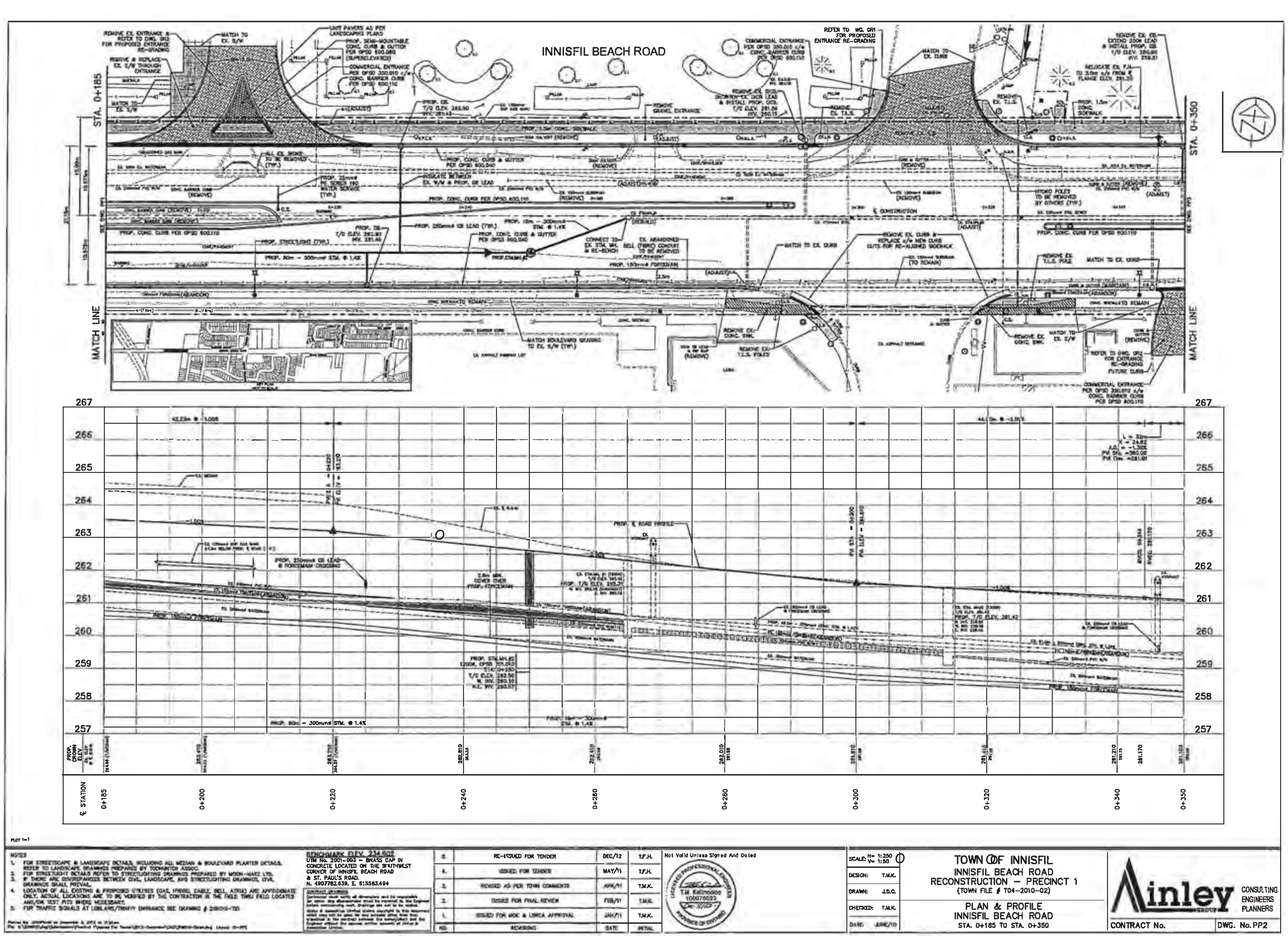
TOWN OF INNISFIL
IBR - Precinct 1 Reconstruction
STORM SEWER DESIGN CALCULATIONS

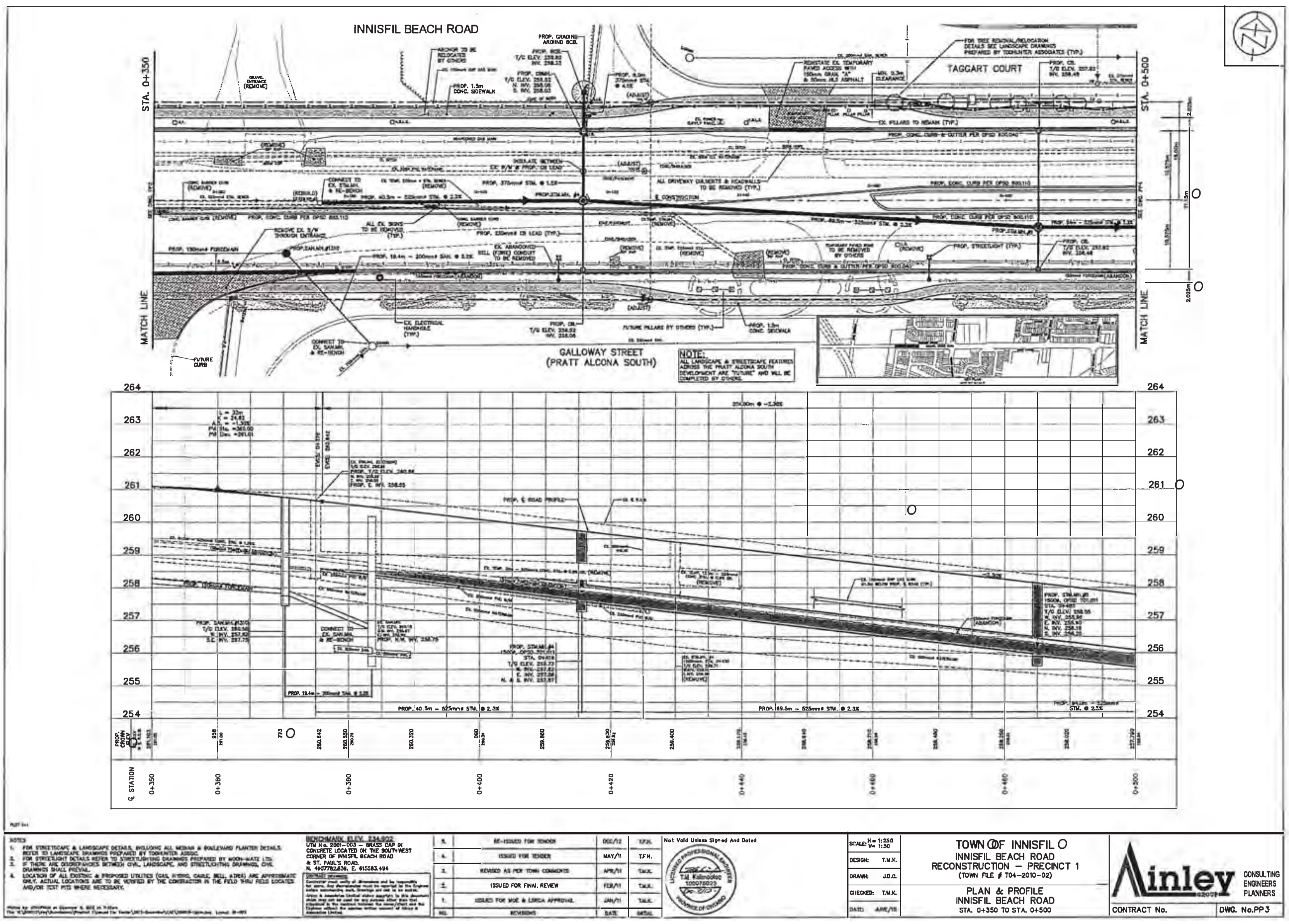
PROJECT: Innisfil Beach Road - Precinct 1
Project #: 2090107

Calculated By: KWC
Checked By: TMK
Date: May 2011 (Updated Dec 2012)

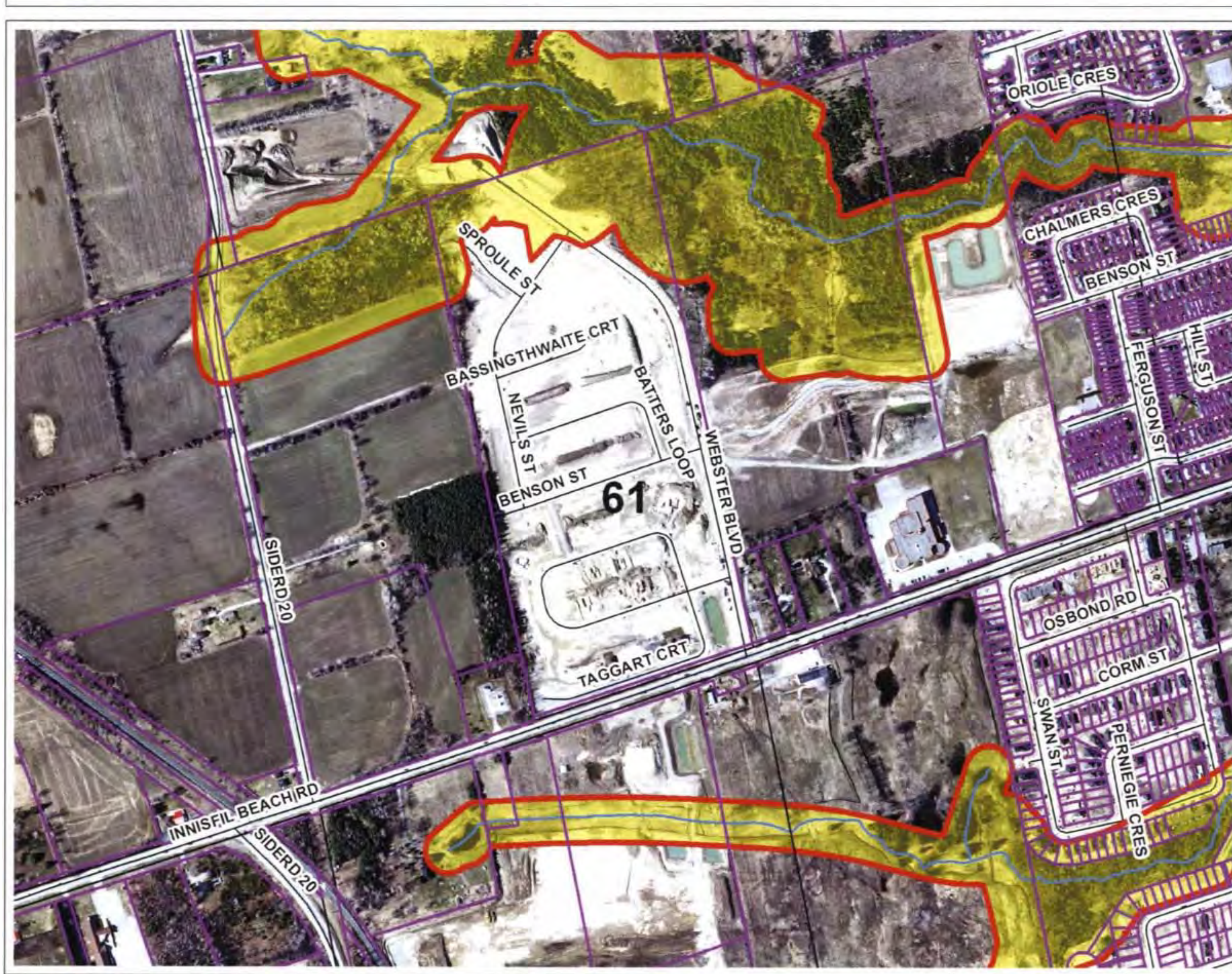
DESIGN FREQUENCY: 5 Year
INTENSITY = at^b
a = 26.1
b = -0.69
DESIGN "n" FACTOR: 0.013

LOCATION				DRAINAGE AREA					RUNOFF			PIPE SELECTION						
From MH	Station	To MH	Station	Area ID	A Area Ha	C Composite	2.78*AC	CUMUL AC	CUMUL Tc min	I Rainfall mm/hr	Q m3/s	Dia. m	Pipe Slope %	Q Full m3/s	Velocity Full m/s	Pipe Length m	Flow Time (min)	Fall m
FLOWS TO JOSEPH BLACK WAY (WEST) (5-YEAR DESIGN):																		
STM MH 8	0+767	STM MH 9	0+841	20, 21	0.87	0.72	1.72	1.72	15.0	67.9	**0.117**	0.450	1.50	**0.349**	2.20	74.0	0.6	1.11
STM MH 9	0+841	STM MH 10	0+874	22, 23	0.96	0.71	1.88	3.60	15.6	66.2	**0.239**	0.450	1.50	**0.349**	2.20	32.5	0.2	0.49
STM MH 11	0+905	STM MH 10	0+874	24b, 25	0.18	0.85	0.43	0.43	15.0	67.9	**0.029**	0.300	1.00	**0.097**	1.37	32.0	0.4	0.32
STM MH 10	0+874	EX DICBMH (Alcona owns)	0+874	24a	0.73	0.70	1.42	1.42	15.0	67.9	**0.097**							
											0.364	0.675	0.50	**0.594**	1.66	5.5	0.1	0.03
NOTE: Alcona Downs design allows for a peak 5-year flow of 0.453 m^3/s being directed from Innisfil Beach Road and External Areas to EX DICBMH.																		
FLOWS TO COLEMAN COURT (5-YEAR DESIGN):																		
STM MH 12	0+988	STM MH 13	1+075	26, 27, 28, 29	0.506	0.85	1.20	1.20	15.0	67.9	**0.081**	0.300	1.50	**0.118**	1.68	87.0	0.9	1.31
STM MH 13	1+075	STM MH 14	1+175	30, 31, 32, 33	0.302	0.85	0.71	1.91	15.9	65.4	**0.125**	0.375	1.00	**0.175**	1.59	100.0	1.0	1.00
STM MH 14	1+175	EX DICBMH	1+175	35, 35b	0.148	0.85	0.35	2.26	16.9	62.5	**0.141**	0.450	0.65	**0.230**	1.45	15.5	0.2	0.10
EX DICBMH	1+175	EX STM MH (Pratt 'Amico)		34, 35a	0.145	0.85	0.34	2.60	17.1	62.1	**0.161**	0.525	1.47	**0.521**	2.41	9.7	0.1	0.14





Alcona Capital Residential Development
Sernas Project No: 09389 S



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Printed On:
12/8/2009 :

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Scale 1 : 7,534

Meters

443 | 0 | 221 | 443

COLE ENGINEERING
Experience Enhancing Excellence

Hydrogeological Investigation

For **Alcona Capital Properties Inc.**
Part of Lot 8, Concession 21, Innisfil, ON

Project: E10-223
December 2010

COLE ENGINEERING
Experience Enhancing Excellence

December 16, 2010
Our Ref: E10-223

Mr. Neil Palmer
ARG Group Inc.
11 Creditstone Road
Vaughan, ON, L4K 1N3

Re: Hydrogeological Investigation for
Alcona Capital Properties Inc., Part of Lot 8, Concession 21, Innisfil, ON

Dear Mr. Palmer:

Cole Engineering Group Ltd. is pleased to submit the Hydrogeological Investigation report for Alcona Capital Properties Inc., Part of Lot 8, Concession 21, Innisfil, ON. The investigation includes a review of existing y. rogeological information for the study area, a characterization of the geological and hydrogeological setting, an assessment of potential impacts due to development and potential mitigation measures. Findings of our study are summarized in the following report.

Should you ave any questions or comments, please do not hesitate to contact the undersigned.

Yours truly,

COLE ENGINEERING GROUP LTD.

Tabitha

Tabitha Lee, M.A.Sc., P.Eng.
Project Manager
Environmental Sciences and Engineering

/tl/ar

Executive Summary

Cole Engineering Group Ltd. (Cole Engineering) was retained by Alcona Capital Properties Inc., (the "Client") to prepare a Hydrogeological Investigation for a proposed residential evelopment located at the north-east corner of 20th Sideroad and Innisfil Beach Road. The overall study area is irregular in shape and covers approximately 15.362 hectares. The subject site is located within the westerly limit of the Alcona Secondary Plan area boundary.

Overview of Geological and Hydrogeological Setting

The subject site is located to the west of Lake Simcoe, and falls within the Peterborough Drumlin Fields physiographic region. The regional topography undulates gently and slopes ownwards in an easterly direction, towards Lake Simcoe. The site falls within the Lake Simcoe Watershed, more specifically the Innisfil Creeks Watershed. Leonard's Creek is located at the northern edge of t. e property.

A geotechnical investigation was conducted to investigate the site-specific properties within the study area and monitoring wells were installed as part of a supplemental ydrogeological program, in order to obtain more information about the hydrogeological conditions on the site. Observed water levels ranged from 1.3 mbgs, to 3.5 mbgs. Typically, s. allow water levels can fluctuate up to 3 m due to seasonal variations. It is anticipate. that water levels observed in the shallow monitoring wells will ecrease during the summer months. In addition to the monitoring events, dataloggers were deployed at three locations, and continue to collect water levels every hour. The groundwater flow direction in the aquifer formation is generally in an easterly direction, towards Lake Simcoe. The groundwater flow direction underlying the site is in a south-easterly direction, mirroring the local topography.

Potential Impacts

In general, the proposed development will involve the installation of services at depths ranging from 3 m to 5 m below proposed grade with the exception of the connection to the local sanitary trunk at the south end of the site. The proposed local sanitary sewer connection will be at epths of approximately 9 m below proposed grade. It is anticipated t. at dewatering measures will be required to control water levels for both the nominal depth sanitary services and for the connection to the local sanitary sewer in the shallow aquifer (Algonquin Aquifer Complex) where coarse grained materials are encountered.

The rate of dewatering is expected to be greater than 50,000 L/day and a Permit to Take Water (PTTW) will be required during construction. During the etailed design stage, it will be necessary to refine the analysis of the hydrogeological conditions along the proposed servicing alignments.

A baseline water well inventory was conducted of residents within 500 m of the site and identified several rural properties dependent on groundwater for domestic supply. Dewatering or depressurization may result in a reduction in the water levels observed in the private wells surrounding t. e site; however, further analysis will need to be conducted during the design stage to determine the extent of dewatering and whether proactive mitigation for the wells may be warranted.

Recognized natural features identified on-site include Leonard's Creek which is not considered a groundwater dependent feature. Impacts to Leonar. 's Creek as a result of ewatering are not anticipated; however, water levels in the surrounding area may be lowered. Leonard's Creek and Bon Secour Creek which is located sout. of the site, may be affected by discharge from ewatering directed towards the creeks. Prior to construction, it will be necessary to prepare a ewatering discharge plan which assesses the quantity and quality of dewatering discharge as well as the assimilative capacity of the receiving water bodies.

Long-term impacts to the groundwater system are related to the potential reduction of infiltration entering the underlying aquifer units; the reduction of the shallow water table observed in the surface soils, the eventual introduction of road salting impacts, and the potential increase of run-off entering the creeks. The Town of Innisfil Official Plan indicates the subject site is located in a "Potential Major Groundwater Recharge Area".

The reduction of infiltration to the shallow overburden aquifer unit on-site as a result of the proposed development is unlikely to have a negative effect on the surface water features on-site and nearby the site, since both are likely surface water fed. The increase in run-off received by the creeks will not have a negative impact on their natural form or function. The estimated reduction of infiltration to the regional aquifer system as a result of the proposed development is small an. is not expected to have an influence on the overall function of the groundwater system in the Lake Simcoe Watersed.

Recommendations

To obtain a better understanding of the natural variability of the water levels, water level monitoring will continue for the period of a year to assess seasonal trends. At the end of the monitoring period, an update report will be provided to present measured water level ata.

During the etailed design stage, it will be necessary to refine the analysis of the hydrogeological conditions along the servicing alignments to estimate dewatering volumes. It is recommended that hydraulic testing, involving a pumping test, be conducted to better characterize the aquifer formation. The zone of influence and anticipated dewatering rates as a result of construction-related dewatering can be determined from the results of the hydraulic testing. The results will be used to prepare a PTTW Application for ewatering during construction. A dewatering permit should be obtained prior to the commencement of construction.

Long term impacts will need to be addressed by controlling the increase in run-off t. rough the stormwater management facilities such that it does not alter the nature of the surface water features adjacent to the site. The implementation of best management practices will be able to help increase the amount of infiltration to the aquifer system, and minimize the environmental impacts of the evelopment. A monitoring program for Leonard's Creek and surrounding natural features should be implemented to capture baseline conditions and to assist in determining targets for mitigation.

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APP NDICES

1.0 Introduction

Cole Engineering Group Ltd. (Cole Engineering) was retaine. by Alcona Capital Properties Inc., (the "Client") to prepare a Hydrogeological Investigation for a proposed residential evelopment located north-east of 20th Sideroad and Innisfil Beach Road. The location of the site is illustrated in **Figure 1**.

.1. Site Description

The subject site is an irregular shaped lot and is approximately 15.362 hectares in size. The subject site is located within the westerly limit of the Alcona Secondary Plan area boundary and is surrounded by agricultural land to the west and north (outside of the Alcona Secondary Plan area), and new residential developments to the east. The legal description of the property is Part of Lot 21, Concession 8, Innisfil, Ontario. A hydro station and property owned by Loblaws Inc. are located directly to the south of the site. Leonard's Creek, which runs in an easterly irection, is located at the northern edge of the site.

The site is located in the Innisfil Creeks Subwatershed, which itself falls within the Lake Simcoe Watershed. The subject lands generally drain towards Lake Simcoe, in a south-easterly irection. The site boundaries are shown in **Figure 1**.

.2. Objectives

This Hydrogeological Investigation was conducted in order to:

1. C. aracterize the existing geological and hydrogeological setting;
2. Identify local groundwater receptors;
3. Assess potential impacts as a result of the proposed development; and
4. Provide recommendations and management measures to mitigate potential impacts.

.3. Scope of Work

1.3.1. Task 1: Characterization of Existing Geological and Hydrogeological Setting

A conceptual understanding of the geological and hydrogeological system was eveloped through the review of existing reports, available geological information an. fiel. investigations. A total of seven (7) boreholes were drilled to depths ranging from 4.88 metres below ground surface (mbgs) to 11.28 mbgs. Four shallow (screened at 3.7-5 mbgs) and three deep (screened at 9.5-11.3 mbgs) monitoring wells were installed as part of the rilling program. Nested monitoring wells were installed to assess the potential for vertical gradients, and their contributions to the local and regional groundwater flow patterns. Data obtained in the field was used to comment on t. e current groundwater quantity and flow patterns of t. e local groundwater system.

1.3.2. Task 2: Baseline Water Well Survey

An understanding of typical groundwater usage in the area was obtained by:

- Querying MOE water well records within 1.5 km of the site;
- Taking an inventory of permitted water takers within 1.5 km of the site; and
- Conducting a door-to-door water well survey within 500 m of the site.

As part of the door-to-door survey, Cole Engineering staff asked residents about their current water well usage, and collected well-specific details. Information collected included the name and address of the owner, the well construction and if accessible, measurement of a 'static' water level at the time of the survey. Any additional information relevant to the survey was also collected. Where possible, a sample was taken and tested for various parameters, from untreated groundwater at the homeowners' property.

1.3.3. Task 3: Assessment of Potential Impacts

T. e hydrogeologic assessment evaluated the potential need for dewatering activities during the installation of services. Impacts to nearby residential wells and natural features were also assessed.

Temporary impacts to the groundwater system can occur during the construction phase as a result of the potential need to ewater during construction. Long-term impacts can occur due to alterations to the hydraulic properties of the site or permanent changes to the water balance.

A water budget analysis was conducted in order to quantify and characterize the contributions of each component of the hydrologic system based on existing conditions to achieve a baseline for sustainability and adaptive management objectives in the Innisfil Creeks Subwatershed. A post-development water balance was compared with the baseline water balance to assess impacts to the surface water system and the groundwater system on both a site-specific scale and also on a watershed/ground-watershed scale.

The potential impacts to the natural groundwater flow system that may result during, and post construction were evaluated including the relationship between the hydrogeological system and natural features in the study area that may be affecte.

Long term impacts were considered including the potential impacts of development on regional and local groundwater systems and their effects on existing well users and the natural environment.

1.3.4. Task 4: Recommendations and management measures

The risks associated with the potential impacts for the proposed development were evaluated to determine if there was an acceptable level of risk to the groundwater and surface water quality. Recommendations and mitigative measures to be considered both during construction and post-

development are suggested. Targets will need to be set and strategies implemented to mitigate the impact the hydrogeological impact of the evelopment.

.4. Proposed Development

It is our understanding that the proposed development consists of approximately 282 residential units, two Storm Water Management (SWM) pond blocks and open space blocks to be serviced by municipal water, sanitary and storm sewers. A conceptual plan of the proposed evelopment, prepared by Zelinka Priamo Ltd (ZPL) as part of the Draft Plan of Sub. ivision is provided in **Figure 2**. Urban Ecosystems Limited (UEL) has prepared conceptual designs for grading and utilities as part of the Functional Servicing Report. Of the two SWM ponds, one will be located at the north eastern corner of the property, and the second will be situated at the south eastern edge of the property. The two ponds will collect runoff from the northern and southern portions of the site respectively. The development is to be connected by an internal network of roa. s, with proposed access points at two points along 20th Sideroad, and one to Benson Dr. of the new development. Additional . etails are provided in the FSR.

2.0 Existing Site Conditions

2.1. Topography and Drainage

The subject site is located to the west of Lake Simcoe, and falls within the Lake Simcoe Region Conservation Authority's (LSRCA) jurisdiction. The regional topography undulates gently and slopes downwards in an easterly direction, towards Lake Simcoe. A regional topographic map is presented in **Figure 3**.

T. e site topography ranges in elevation from approximately 273 metres above sea level (masl) to 262 masl. The highest elevations are found near the central portion of the site, with elevations decreasing towards the northern and southern perimeters. A topographic survey for the site was prepared by Speight Van Nostrand and Gibson Ltd. and is presented in **Figure 4**.

The development is located within the Lake Simcoe Watershed, more specifically the Innisfil Creeks Watershed. Leonard's Creek is located at the northern edge of the property and runs in an easterly direction. For the purpose of the Water Balance calculations, it was assumed that surface water follows the local topography; the northern portion of t. e site drains to Leonard's Creek, while the southern portion drains towards the local topographical low at Innisfil Beach Rd. In addition, there is a catchbasin located on the north edge of the Loblaws property, which rains into the local storm sewer system.

2.2. Physiography

The .subject .site .is .located .with .the .Peterborough .Drumlin .Fields .physiographic .region. .The . regional area .was .formerly .flooded .by .Lake .Algonquin .and .as .such, .was .layered .with .sand, .silt . and .clay .(C. apman .and .Putnam, .1984). .Sand .and .clay .indicates .deposition .by .standing .water, . meaning .the .material .is .likely .fine .and .generally .has .poor .drainage. .The .Peterborough .Drumlin . Field .physiographic .region .consists .of .rolling .till .plains .with .numerous .drumlins, .which .extend . from Hastings County in the east to Simcoe County in the west. .Drumlinized till plains may vary . in texture and compaction, and recharge characteristics vary from good to poor. . **Figure 5** shows . the general physiography for the region. .

2.3. Surficial Soils

The .surface .deposits .are .primarily .of .glacial .origin .and .have .been .deposited .and .modified .by . glacial, .fluvial .and .lacustrine .processes .over .the .last .135,000 .years. .The .surficial .soils .on .site . consist .primarily .of .sand .and .silt .and .are .characterized .as .Grey-Brown .Podzolic .as .per .the . Ontario Soil Survey, .1955. .

Surface .soils .are .further .divided .in .to .a .'series' .and .'type' .depending .on .parent .material .and . surface texture. .Three soil series cover the subject site, the; Guerin, Bondhead and Sargent series. . **Figure 6** illustrates the surficial soil deposits in the regional area. .

The Guerin and Bondhead series are commonly associated with one another, both being formed . from .the .same .parent .material. .T. e .drainage .for .the .Bondhead .series .is .good, .and .the .soil .is . porous. . However, . the . bot. . series . are . susceptible . to . erosion . on . steep . slopes, . and . it . is . recommended .that .trees .generally .cover .these .areas. . Where .this .is .not .possible, .sustainable . practices should be undertaken to reduce soil loss. .

The .Sargent .series .commonly .have .a .soil .profile .that .is .thin .and .often .calcerous. .The .profile . consists of a .dark brown layer, .up to .15cm thick, underlain by a thin clay layer and up to .8 cm of . gravel in certain areas. T. e soils are low in natural fertility-.the steeper areas should generally be . forested (Ontario Soil Survey, .1955) A brief summary of each subtype of soil is presented in . **Table 1**.

Table 1 – Soil Subtypes

Symbol	Soil Series	Soil Type	Great Soil Group	Drainage	Topography Stoniness	Surface Reaction	Parent Materials
Gul	Guerin	Sandy Loam	Grey-Brown Podzolic	Imperfect	Moderately stony	Slightly acid	Sandy loam till
Bs	Bondhead	Sandy Loam	Grey-Brown Podzolic	Good	Smooth/ moderately sloping. Slightly stony	Slightly acid/ neutral	Sandy loam till
Stsl	Sargent	Sandy Loam	Grey-Brown Podzolic	Good	-	-	Till

2.4. Regional Geology and Hydrogeology

The . current . understanding . of . the . geologic . and . hydrogeologic . environment . was . based . on . scientific .work .conducted .for .the .South .Simcoe Municipal .Groundwater .Study, .(SSMGS) .and . the .Wellhead .Protection .Area .Study .conducted .for .the .Town .of .Innsifil, .2004. .The .regional . geology .and . ydrogeology . discussed . in . this . report . builds . on . information . obtained . from . the . above noted studies. .

The subject site is underlain by surficial till .deposits, the Newmarket Till, which is present at or . near ground surface in .some portions of .the .property. . **Figure 7** shows quaternary mapping .for . the .region. . This .unit .is .typically .a .massive, .frequently .over-consolidated, .stony .and .dense .silty . sand .iamicton. . A .series .of .water .bearing .zones .or .aquifer .units .have .been .identified .in .the . SSMGS. . The shallow surficial aquifer A1 .is found at elevations ranging from 250 to 230 near . the .study .area .and .corresponds .with .the .interpreted .Algonquin .Aquifer .Complex. . This .unit .is . often .used .to .provide . omestic .water .supply. . Three .other .water .bearing .zones, .interpreted .as . aquifers .A2, .A3, .and .A4 .underlie .the .site. . Each .is .separated .with .finer .grained .till .materials . which behave as confining units. .

A conceptual interpretation of the local . y. rostratigraphy is presented in .**Figure 8**. It suggests . that the aquifer A2 pinches out into a thin layer or is not present near the subject site. .

The bedrock underlying the study area ranges from .130 – .150 masl and is composed primarily of . the .S. adow Lake .Formation .and .the .Simcoe .Group. .The .Shadow .Lake .Formation .consists .of . basal arkose, red/green shale and is roughly .13 m thick at its maximum. The Simcoe Group is . primarily .composed .of .limestone .with .intermittent .layers .of .shale. .The .total .thickness .of .the . group is typically .150 – .180 m. **Figure 9** illustrates the bedrock geology in the regional area. .

The SSMGS interpreted regional groundwater levels observed in shallow wells, (<1.5m) (**Figure : 10**) an. . eeper .wells .(>30m) .(**Figure :11**) in .the .area .surrounding .the .subject .site. . The .results . reflect .the .general .understanding .of .the .area, . an. .show .that .groun. water .flows .in .a .south-. easterly direction towards Lake Simcoe. .

2.4.1. SGroundwater Recharge Area S

The .SSMGS identifies the subject site as an area .of groundwater recharge. . **Figure 12** illustrates . the .defined areas. . The Town of Innisfil outlines their intent to protect and maintain these areas:.

> *"Groundwater recharge and discharge areas are critical to the maintenance of aquifer well as contributing to stream baseflow and the maintenance of wetlands and associated plant and animal communities."* (Town . of . Innisfil . Official Plan, 2010) .

Areas of significant groundwater recharge can .have implications for .development and as such, it . will . be . necessary . to . ensure . the . ecological . and . hydrological . integrity . of . the . watershed . is . maintained. .

Results from the field investigation are used to better define the hydrologic form and function in the area, and the susceptibility of the aquifer to impacts from evelopment. The study area is considered an area of *medium aquifer vulnerability* which suggests the natural overburden materials ave some ability to retard contaminants from entering the groundwater system.

2.5. Local Geology and Hydrogeology

2.5.1. SPrevious Geotechnical Investigation S

Toronto Inspection Ltd. (TIL) was retained to carry out a geotechnical investigation on the subject site in May, 2004. The purpose of the investigation was to determine the subsoil and groundwater conditions affecting the design and construction of a residential evelopment.

Eight (8) boreholes were advanced across the site, with depths ranging from 6.2 - 6.6 mbgs. Water was encountered in three of the boreholes drilled, and in some cases at shallow depths (1.2 mbgs at BH2). The surficial material identified includes silt, sandy silt and topsoil. A copy of the investigation is presented in **Appendix A**

2.5.2. SHydrogeological Program and Monitoring Well Installation S

Seven (7) monitoring wells were installed as part of the hydrogeological program, in order to obtain more information about the hydrogeological conditions on the site. The locations of the monitoring wells are shown on **Figure 13A.** T. e monitoring wells were constructed using 2 inch diameter PVC and were screened at varying depths with a 10 slot screen. Well details are summarized in **Table 2**. Borehole logs are provided in **Appendix B**.

Table 2 – Well Details

WELL ID	Depth of Borehole (mbgs)	Ground Elevation (masl)	Screen Interval (mbgs)	Screened Material
MW-01S	10.36	264.15	3.96 – 5.49	Silt/sand
MW-01D	11.28	264.29	7.62 – 10.67	Sandy/silt
MW-02S	6.10	271.84	2.74 - 4.27	Sandy silt
MW-03S	4.88	270.63	2.74 – 4.27	Sandy silt
MW-04S	4.88	272.50	3.05 – 4.57	Sandy silt
MW-04D	10.68	272.54	7.62 – 10.67	Silty sand
MW-05D	9.14	270.52	6.10 9.14	Sandy silt

The underlying material is characteristic of glaciofluvial deposits and is somewhat eterogenous. The monitoring wells were installed at the various locations across the perimeter site to identify the key hydrostratigrap. y units underlying the site and to establish the range of fluctuation of the

water table and to screen a certain number of wells in the local aquifer. Geological cross sections interpreted from the borehole logs are provided in **Figure 13B.** :

2.5.3. : Water Levels S

Two rounds of water levels were conducted. The results from the monitoring are presented in **Table 3.** :

Table 3 – Monitoring Well Water Levels

Well ID	Ground Level	Stickup	Water Levels			
			5/26/2010		6/18/2010	
	(masl)	(m)	(mbgs)	(masl)	(mbgs)	(masl)
MW-01S 3	264.15 3	0.945 3	1.301 3	262.85 3	1.560 3	262.59 3
MW-01D 3	264.29 3	0.98 3	1.845 3	262.45 3	1.965 3	262.3 3
MW-02S 3	271.84 3	1.04 3	-3	-3	-3	-
MW-03S 3	270.63 3	0.981	3.224 3	267.41	3.462 3	267.17 3
MW-04S 3	272.50 3	1.021 3	2.051 3	270.45 3	2.677 3	269.82 3
MW-04D 3	272.54 3	0.941 3	2.384 3	270.16 3	2.908 3	269.63 3
MW-05D 3	270.52 3	0.888 3	1.888 3	268.63 3	2.099 3	268.42 3

Observed water levels ranged from 1.3 mbgs, at MW-01S, to 3.5 mbgs, at MW-03S. It can be seen that the water levels recorded on June 18th were all at lower elevations t. an t. ose recorded on May 26th. Typically, shallow water levels can fluctuate up to 3 m due to seasonal variations. It is anticipated that water levels observed in the shallow monitoring wells will ecrease during the summer months. MW-02S has been ry during both events. This may be due to a drop in water level due to seasonal fluctuations. It is recommended that the monitoring program be continued to better assess the change in the water table elevation.

In addition to the monitoring events, ataloggers were deployed at MW-01D, MW-01S and MW-04S. The loggers were programme. to take readings every 1 hour. Water level ydrographs from these dataloggers are presented in **Figure 14**. Water levels observed varied at most by 2m for the period observed.

2.5.4. : Local Hydrogeology S

The main aquifer unit identified at a depth which can affect the proposed servicing infrastructure for the development is the Algonquin Aquifer Complex. The Proposed Groundwater Monitoring Network for the Upper Nottawasaga River Drainage Basin report (The Nottawasaga Drainage Basin is located to the west of the Simcoe Drainage Basin) suggests that this layer contains fine to medium grained sand deposits, occurs at an elevation of 230 masl, and ranges from 8 to 25 m in thickness.

The extent of the geotechnical investigation was generally limited to the s. allow overburden materials and did not approach depths at which the Algonquin Aquifer Complex would be located.

2.5.5. Groundwater Flow Direction

The subject site is located within the Peterborough Drumlin Fields, which rises gently to the west. Lake Simcoe is situated to the east of the site, which is the topographic low. In general the groundwater flow mimics topography, as such, the regional groundwater flows in an easterly direction. On a local scale, groundwater appears to follow a south-easterly irection. **Figure 15** illustrates the interpreted direction of groundwater flow.

T. e water levels measured in deeper wells have lower elevations as compared to the elevations measured in shallow wells. This indicates a downward flow gradient, meaning that the area is a groundwater recharge zone.

2.5.6. Hydraulic Conductivity

The hydraulic conductivity values were estimated in six (6) monitoring wells to obtain an understanding of the in-situ hydraulic properties across the site. Rising-head hydraulic tests were conducted on the monitoring wells from May 26, 2010 to June 7, 2010. Rising head tests were not conducted in MW-02S due to low water levels.

A known volume of water was removed from the well and water levels were measured using a combination of manual readings and calibrated datalogger measurements until a minimum of 90% recovery had been achieved. Hydraulic conductivity calculations were performed using the Hvorslev method. The calculations are shown in **Appendix C.**

Estimated hydraulic conductivities are presented in **Table 4**. Most of the monitoring wells were screened in medium to fine, silty sand material. Overall, the hydraulic conductivities estimated are consistent with the types of materials observed on-site.

Table 4 Hydraulic Conductivities

Well ID	Screen Interval (mbgs)	Hydraulic Conductivity K (m/s)	Characteristic Materials
MW-01S	3.96-5.49	1.58E-07	Silt to sand
MW-01D	7.62-10.67	2.02E-07	Silt to sand
MW-03S	2.74-4.27	1.18E-06	Fine sand
MW-04S	3.05-4.57	6.49E-08	Silt to silty sand
MW-04D	7.62-10.67	3.24E-06	Fine sand
MW-05D	6.1-9.14	4.79E-08	Silt to silty sand

The s. allow overburden materials are heterogenous and range from silt to sand materials (borehole logs are available in Appendix A). This material is fairly permeable and will support some degree of recharge to the local aquifer units. This type of material offers limited protection against contaminants entering the underlying aquifers; however, it should be noted that up to 100m of till is identified underlying the coarse grained water bearing units which will act to retard contaminants.

2.5.7. Water Quality

Groundwater samples were collected from MW-01D and MW-04S on May 27, 2010 and analyzed by Maxxam Analytics for general inorganics, metals, and volatile organic compounds. The results were compared against the Ontario Regulation 153/04 Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Condition in coarse textured soils. With the exception of nitrites in MW-01D, all parameters met the applicable generic criteria and are typical of groundwater in the area. The standard for nitrites in drinking water is 1 mg/L, and the sample taken MW-01D was determined to be 2.3 mg/L. The nitrite level may be related to the type of land use which is mainly agriculture. It is a contaminant of concern due to its association with methemoglobinemia in infants. A summary of analytical results and laboratory analysis are provided in **Appendix D.**

3.0 Identification of Potential Receptors

As part of this program, potential groundwater receptors including natural ecosystem features dependent on groundwater and domestic or permitted water supply were identified. A searc. for potential receptors was conducted for an area of 1.5 km surrounding the site.

3.1. Groundwater Use

Groundwater use in the area surrounding the development is primarily used for domestic and private supply. The wells are completed in both the shallow overburden aquifer and the regional confined aquifer systems. **Figure 16** illustrates the location of Ministry of the Environment (MOE) Water Well Records and other local groundwater users.

3.1.1. Permitted Groundwater Users

A search of permitted groundwater users within 1.5 km of the study area was conducted. The MOE Permit To Take Water (PTTW) database identified one permitted groundwater user; The Corporation of the Township of Oro-Medonte. Upon further investigation, the well identified by the search was found to be located in Shanty Bay, roughly 11 km from the subject site. No other permitted groundwater users were found to be within 1.5 km of the study area.

The Township of Innisfil maintains 3 pumping wells (the Stroud Wellfield) in the north-east quadrant of Highway 11 and 10th Line. The subject site is outside of the 25-year capture zone of these wells.

3.1.2. Private Wells

A water well survey was conducted to gain a better understanding of the usage of the local aquifer system and to establish baseline conditions for nearby wells. A search of the available MOE water well records was conducted for a radius of 1.5 km around the site. Search results are provided .in .**Appendix E**. **:** The .search .results .indicate .that .approximately .295 .wells .have .been . drilled or dug in the area. . Based on MOE water well records search results, 69.3% of the wells . are completed within the shallow aquifer (0 mbgs to 30 mbgs), 20.5%.of the wells are completed . in water bearing units at intermediate . epth (30 mbgs to 70 mbgs) and .10.5% of the wells are . completed within the deep confined aquifer system (>70 mbgs), with the rest having no recorded . epths. .

A door-to-door water well survey was conducted for properties located within a 500 m radius of . the site, .during .the .week .of June .7th, 201.0. to .confirm .water .well .record .search .results .and .to . obtain .additional .information .about .the .water .wells. . A .notice .was .provided .to .inform .the . property .owners .of .the .hydrogeological .investigation. . Participation .was .requested .from .the . residents .on .a .voluntary .basis. . A .questionnaire .about .the .well .system .and .water .usage .was . provided, ground water levels were taken, and where accessible, groundwater was sampled. . In . the event that no .personal contact was made with the .resident, .a copy of the .notice .and a .self . addressed stamped envelope was provided so that residents could still complete the questionnaire . and participate in the baseline survey. . Further details regarding the well survey are provided in . **Appendix F**. **:**

The properties located in the residential .development to the east of the site use municipal water . supply .and .were .not .included .in .the .door-to-door .program. . A .total .of .twelve .(.12) .properties . were .surveyed .and .five .(5) .property .owners .participated. . Three .(3) .wells .were .sampled .for . microbial .and .general .inorganic .parameters, .including .nitrates, .nitrites .and .phosphorus. . To . maintain .sample .integrity, .the .samples .taken .from .untreated .water .sources. .**Table :5 ;**provides . details of the residential well sampling program. .

Table 5 Details of Residential Well Sampling

Address	Sample Number	Parameters	Exceedance
1340, Innisfil Beach Road	1	$NO_2/NO_3/PO_4$/Micro/Coliforms	No
2182, 20th Sideroad	2	N $_2/NO_3/PO_4$/Micro/Coliforms	No
2351, 20th Sideroad	3	N $_2/NO_3/PO_4$/Micro/Coliforms	Yes
2351, 20th Sideroad	4 (resample)	$NO_2/NO_3/PO_4$/Micro/Coliforms	Yes

Samples 1 .and 2 both met Ontario Drinking Water Standards (ODWS) for all tested parameters. . Exceedences .of: .*E.Coli*, fecal .coliforms, .background .microbes, .heterotrophic .plate .counts .and . total coliforms were identified in Sample 3. .To verify the results, a second sample was obtained . from .the .same .location. . The .second .sample .taken .recorded .no .occurrences .of .*E.Coli* or .fecal . coliforms; .however, .the .remainder .of .the .tested .parameters .were .all .above .the .regulated ."Not . Detectable" limit for Ontario's drinking water. The homeowner was notified of the water quality . results. .The results of the residential well water quality analysis are provided in **Appendix D**. **:**

3.2. Environmental Features

The .development .is .located .within .the .jurisdiction .of .the .LSRCA, .and .is .entirely .within .the . Innisfil Creeks Subwatershed. . The natural ecosystem features are illustrated in **Figure 17**. **:**

3.2.1. Surface Water Systems S

Leonard's Creek is located at the northern boundary of the site and is a warm water creek. . Bon . Secours .Creek .is .located .south .of .the .site, .and .is .at .its .closest .point .to .the .site .approximately . 1.90 m .away. . Both .streams .ave . headwaters .in .agricultural .areas .and .flow .east .through .urban . areas before entering Lake Simcoe. .

Leonar. 's .Creek .is .situated .in .a .topographic .low .and .is .mostly .fe. .by .surface .water .run-off. . Indicators .observed .on-site .suggest .that .this .creek .is .not .groundwater .ependant. . Downward . gradients observed on-site (at MW-01 .and MW-04) and Leonard's Creek is classified as a warm . water creek. .

3.2.2. : Natural Ecosystem Features S

The .surrounding .study .area .is .a .mix .of .residential .and .rural .properties. . A .hydro .station .and . commercial .property .are .located .to .the .south, .a .new .residential .development .is .located .to .the . east, and rural properties are located to the north and west of the evelopment. .

Leonard's Creek runs to the north of the site and is surrounded by a treed area. .A search on .the . Ministry .of Environment's Natural Heritage .Information Centre revealed no "Natural .Areas" .or . "Plant Communities" of concern within a .1. 5 km radius of the subject site. .

The Town of.Innisfil Official Plan designates the entire site as "Future Urban", which is intended . to .permit .primarily .residential .uses .subject .to .further .Official .Plan .amendment. . However, .the . Official Plan also identifies the north end of the site as "Other Wetlands" in Appendix .1: Natural . Areas, and the treed area as "Significant Woodlands" in Appendix 2: Natural Areas. .It is our . understanding .that .the client is currently in consultation with the .Town regarding a redesignation . of .the .subject .site .to .permit .the .proposed .residential .development. . The .policies .of .the ."Future . Urban" . esignation .require .that .any .development .application .examine, .among .other .t. ings, . floodplain and environmental impact of the proposed . evelopment. As such, it is assumed t. at . the .Official .Plan .Amen. ment .process .will .include .a .detailed .review .and .assessment .of .the . identified .features .to .determine .the .significance .of .these .features .in .relation .to .the .proposed . evelopment. .

4.0 Water Balance and the Groundwater Flow Regime

Understanding . and . quantifying . water . balance . components . is . of . particular . interest . when . considering .watershed .management .strategies.. . Land .use .changes . uring .urbanization .are .known . to . shift . the . water . balance . in . a . watershed, . more . specifically; . increasing . surface . runoff .and .

decreasing the amount of water recharge to underlying aquifers which may affect the water levels. Urbanization affects the both the movement of water and the speed at which it moves in to the watershed. The temporal and spatial differences can be significant in shallow, unconfined groundwater aquifer systems, where ground water supplies water to vegetation root zones. Post-development conditions will have a sizable impact on the overall water balance of the site due to the construction of impervious surfaces such as roofs, si. ewalks, and roads. This will impact the current groundwater and surface water distribution and function.

The water balance modelling system used was the Water Balance Analysis System (WABAS), developed by Cole Engineering Group Ltd. This model is based on the Stanford Waters. e. Model IV (SWM-IV), and computes a hydrologic water balance for rural and urbanized watersheds. It also incorporates other models and methods in its water balance calculations: the Guelph All-Weather Storm-Event Runoff (GAWSER) which is used to simulate snow accumulation and melt, US Soil Conservation Service (SCS) Curve Number (CN) method to calculate runoff, a modified version of the U.S. Agricultural Research Service (ARS) equation to calculate evapotranspiration, and Darcy's law to calculate infiltration. All algorithms and equations used in the model are shown in **Appendix G**. The model requires climate time series input of daily precipitation, average or maximum-minimum daily temperature, and measured pan evaporation. Physical basin parameters are also required as t. ey efine the surface and surficial properties of each catchment affecting the storage and movement of water from one stage to another. These include imperviousness, interception abstractions, vegetation, and surficial soil characteristics. T. e model can output a aily, mont. ly, annual, and overall average depth of precipitation (for rain and snow), evapotranspiration, run-off and groundwater infiltration.

4.1. Water Balance Methodology

Table 6 presents the approximate areas of the watershed and subwatershed that the site is located within, along with the estimated catchment areas.

Table 6 – Site Drainage Areas

Watershed	Watershed Area (ha)	Site Coverage (ha)	Site Coverage (% of Watershed)
Lake Simcoe	332,400	15.3	<0.01 %
Innisfil Creeks Subwatershed	10,715	15.3	0.14 %
North Catchment (Leonard's Creek)	6.8	6.8	<0.01 %
South Catchment (Storm water System)	8.5	8.5	<0.01 %

The site is located entirely within the Innisfil Creeks Subwatershed. For the purposes of this calculation, the site was ivided into a north and south catchment based on the topography on the site, as well as the known drainage features, which are Leonard's Creek to the north, and a itch to the south (**Figure 18**). This catchment area is based on surface water elineation. It is recognized that groundwater and surface watershed ivides do not necessarily coincide with each

ot. er, and due to site conditions, it is determined that the groundwater irection across the site goes in an easterly irection. As the surface water catchment properties affect the amount of infiltration, the site was delineated into north and south catchments in order to obtain a more accurate number for infiltration into the water table. Pre- and post-development water balances were carried out for these catchments. For the post-development condition, it was assumed that 1. a of woodlot in the north catchment would be preserved, and all other areas would be developed as medium density residential with 1/8 acre or smaller properties.

The study methodology includes the following steps, which are explained in more detail later in this investigation.

1. Collect climate information from the nearest gauges to the study area. Analyze the climate information to create a time series of continuous measured precipitation, temperature and evaporation ata. Apply data infill techniques to complete the time series using the next favourable gauge location and/or regression.
2. Collect watershed physical data from previous hydrologic stuies. P. ysical ata includes: basin boundaries and areas, soil information (soil types and properties: hydraulic conductivity, porosity, etc.), existing and future land uses and related imperviousness, vegetation types and area coverage.
3. Process the physical data to obtain basin-averaged water balance input parameters. Some assumptions are made of land use, soil, and vegetation information over basin boundaries.
4. Perform long-term modeling using complete climate series.
5. Summarize modeling results. Results are presented as overall average values for each of the main water budget components.

4.1.1. Climate Information

Daily precipitation, and average and min-max temperature data from 1983-2000 were obtained from the closest Environment Canada weather station with complete data (Shanty Bay Station, located approximately 10 km nort. of the site). Historical lake evaporation data was not available at this station, so it was taken from the Hamilton RGB station (in Burlington), Lindsay Frost, and Peterborough (Trent University). Operation of all three stations has ceased (1996 for the Hamilton RGB, Peterborough in 1995, and Lindsay Frost in 1984), and pan evaporation stations were shut down in winter periods, so an averaged seasonal evaporation function was erived.

4.1.2. Catchment Physical Data

Physical watershed input used by the WABAS program consists of catchment areas, land use, maximum abstraction storage, soil and vegetation information. The site watershed data was collected from field observations, Geographic Information Systems (GIS) surficial soil mapping, borehole logs, slug tests, and Google Earth orthoimagery. **Table 7** lists the physical basin parameters.

Table 7 – Physical Basin Parameters

Parameter	Description [Units]
AREA	Basin area [Hectares]
TIMP	Basin imperviousness [Fraction]
XIMP	Directly connected imperviousness [Fraction]
Z_IMP	Indirectly connected area efficiency [%]
IA_IMP	Depression storage/Interception Storage over impervious areas [mm]
IA_PER	Depression storage/Interception Storage over pervious areas [mm]
CN	Modified Soil Conservation Service (SCS) Curve Number [-]
VEG_K3	Watershed vegetation cover function [mm]
PO	Porosity [%]
G	Soil water drained by gravity [%]
K	Saturated hydraulic conductivity [mm/day]

Area

The site area was determined from the AutoCAD drawings and shown in **Table 6**. From site visits and orthoimagery, land use can be generalized as agricultural, interspersed with small woodlots. The total woodlot area was determined to be approximately 4 ha.

TIMP and XIMP

TIMP and XIMP are typically not measured directly but rather inferred based on typical urban design practices. **Table 8** presents the typical relation between the Land Use and Imperviousness. For this site, it is expected that the land will be developed into a residential area, but the woodlot will remain untouched.

Table 8 – Land Use – Imperviousness Relationship

Land Use*	Description	TIMP
1	Green Space	0%
2	Agricultural/Rural	1%
3	Low Density (Estate) Residential	20%
4	Institutional/Medium Density Residential	40%
5	High Density Residential/Highway	65%
6	Commercial/Industrial	90%

* Source: Viessman *et al*., 1977.

The directly connected area represents impervious areas draining into pervious areas. As discussed previously, WABAS applies a user-defined modifier to reflect the concentrated inflow points and lack of uniform water distribution. **Table 9** presents the typical relation between the TIMP and XIMP values.

Table 9 – Land Use – Directly Connected Imperviousness Relationship

Land Use*	Description	Percent of TIMP Directly Connected
1	Open Space	0%
2	Agricultural/Rural	0%
3	Low Density (Estate) Residential	50%
4	Institutional/Medium Density Residential	75%
5	High Density Residential/Highway	75%
6	Commercial/Industrial	100%

* Source: Viessman *et al*., 1977.

Z_IMP

The Z_IMP parameter modifies the XIMP by effectively reducing the indirectly connected impervious area runoff to the pervious areas. As indicated previously, the conditions at the boundary between impervious and pervious areas result in poorly-distributed water inputs. First, unlike precipitation which uniformly distributes the water over the pervious areas, runoff contributions from impervious lands is often concentrated at specific inflow points and continues along concentrated channels. This includes roof runoff discharging into residential backyards. Lot grading concentrates the flow into swales and out to the road. Rear-lot catchbasins have the same effect – efficient removal of surface runoff. Second, indirectly connected impervious areas are not always uniformly distributed over the entire basin and only provide inputs to a fraction of the pervious surfaces. The Z_IMP value of 0.2 was used in CEG's previous projects: the Duffins Creek watershed and Carruthers Creek watershed analysis as well as Beckett Farm watershed. This value corresponds to a measure of the proportion of the area covered by concentrated flow streams in rear lot swales as compared to the total pervious lot area.

IA_IMP and IA_PER

These values represent the maximum abstraction storage volumes. IA refers to 'Initial Abstraction', corresponding to the initial rainfall losses.

IA_IMP is the only source of losses from impervious areas. A standard value of 0.8 mm is used in the analysis.

IA_PER represents the interception and depression storage losses over pervious lands. This value is a calibration parameter. Typical values range from 1.5 mm for urban pervious areas (graded lands) to 8.0 mm over rural pervious areas.

The modified SCS CN method explicitly accounts for abstraction losses prior to estimating the soil absorption into the active hydrologic zone. Therefore, normally, water in IA_PER storage is not available for infiltration and leaves the surface through evaporation. However, WABAS provides the option of allowing some of the water in IA_PER to enter the surficial soil storage. This option has been provided to account for additional infiltration such as from internally-drained areas (areas without a surface outlet) and has been used for the site watershed analysis.

odified CN Number

Catchment-weighted .CN .numbers .are .calibration .parameters .used .by .the .WABAS .model .to . determine .t. e .range .of .soil .moisture .storage .within .the .active .hydrologic .soil .zone. . The .initial . CN .values .were .estimated .from .the .hydrologic .soil .group .coverage .and .land .use .within .eac. . basin. . Given .information .presented .in .Section .2.5.2, borehole .logs .and .field .observations, .it .is . appropriate to characterize the majority of the soil on the site as fine sandy loam. . As such, it can . be .assumed .that .the .entire .site .has .a .fine .sandy .loam .soil .texture. . This .is .generalized .as .Soil . Type .C, as .it has a .low hydraulic .conductivity. . However, .as .coarser sandy .pockets .exist .on-site . which ave . igher . hydraulic .conductivities; .Soil .Type .B .weightings .were .also .applied. .Woodlot . and . row . crop . CN . values . were . used . in . the . pre-development . condition, . and . woodlot . and . residential .CN .values .were .used .in .the .post-development .condition. .The .CN .values .used .in .the . area-weighted calculations for the site are found in **Table 10**.

Table 10 CN Values Used for Site

Land Cover	Hydrologic Condition	Soil Type	CN*
Woodlot	Fair	B	60
		C 3	73
Row crops (straight row)	Poor	B	81
		C 3	88
	Good	B	78
		C 3	85
Residential (with lot sizes 1/8 acre or less)	-	B	85
		C 3	90

* - Source: Viessman & Lewis, 1996 and Mays, 2005.

VEG_K3

The .VEG_K3 .is .t. e .'Evapotranspiration .Parameter' .dependent .on .the vegetation .coverage .over . the .basin. . The .evapotranspiration .parameter .is .a .function .of .the .watershed .cover .as .shown .in . **Table 11**.

Table 11 – vapotranspiration Parameter – Vegetation Cover Factor

Land Cover	VEG_K3 (mm)
Open land	5.08
Grassland	5.84
Light forest	7.11
Heavy forest	7.62
Agricultural	5.84
Meadow	5.84
Wetland	7.11
Fed. Airport Lands	5.84
Urban	5.08
Urban Open Space	5.08

*- Source: Viessman *et al.*, 1977.

The . values . in . **Table :11** are . used . to . produce . catchment-averaged . VEG_K3 . values . for . each . catchment .input into the WABAS system. .

PO, G and

Soil . characteristics . are . characterized . using . catchment-averaged: . porosity, . PO; . the . gravity-. drained .porosity, .G; .and .the .saturated .hydraulic .conductivity, .K. . Values .for .K .were .obtained . from . rising-head . tests, . discussed . in . Section . 2.5.6. . Values . for . PO . and . G . are . derived . from . Viessman *et al.* (1977) and are shown in **Table 12**.

Table 12 – Hydrologic Capacities of Soil Texture Classes

Soil Class	PO	G
Clay	18.8	7.3
Clay Loam	25.7	13.0
Loam	30.0	14.4
Sand	32.3	19.0
Sandy Loam	30.9	18.6
Silt Loam	31.3	11.4

*- Source: Viessman *et al.*, 1977.

Site Physical Input Su mary

The inputs to the WABAS model are summarized in **Table 13**.

Table 13 – Site Physical Input Summary

Basin Parameters	Pre-Development		Post Development	
	North	South	North	South
Area	6.8	8.5	6.8	8.5
Melt Method	1	1	1	1
Imperviousness	0.01	0.01	0.4	0.4
DC Imperviousness	0	0	0.75	0.75
Depth Storage	0.8	0.8	0.8	0.8
Time to Peak	1	1	1	1
Routing Coeff	1	1	1	1
Curve Number	75.5	78.8	84.4	87.5
So	75	75	75	75
IAPER	7	7	2.5	2.5
IAPERINF	0	0	0	0
Porosity	30.9	30.9	30.9	30.9

G	18.6	18.6	18.6	18.6
K	70.5	70.5	70.5	70.5
x_D	0.25	0.25	0.25	0.25
VEGK3	6.48	6.23	5.38	5.08
ZIMP	0.2	0.2	0.2	0.2

4.2. Comparison of Pre-Development and Post-Development Infiltration

For the purposes of this report, the effects of development on the groundwater were considered. The overall water balance data for fifteen (15) years was used for comparison, as it is expected that the groundwater system will not react to sporadic events and long term data would be more representative. The model results are shown in **Table 14.**:

Table 14 – Summary of WABAS Results

Catchment	Precipitation	Pre-Development			Post-Development		
		Runoff	GWI	ET	Runoff	GWI	ET
North	909	142	241	519	474	133	282
South	909	159	236	507	488	126	272

It is anticipate. that the reduction of infiltration from pre-development and post-development conditions will be approximately 108 mm/year for the north catchment and 110 mm/year for the south catchment. Run-off is expected to increase by 332 mm/year for the north catchment and by 329 mm/year for the south catchment. Surface runoff catchments change after development due to site gra. ing. Groundwater catchments are treated as remaining constant between the pre- and post-development analyses.

.0 Impacts and Mitigation

The groundwater conditions as currently observed are representative of baseline groundwater conditions. Proposed changes to facilitate future development of the site may impact the current groundwater conditions on a short term basis or permanently alter the groundwater system.

Short term impacts may be caused by:

- Dewatering during construction;
- Discharge of dewatering flow to surface water features; or
- Altering the drainage of the site during construction.

Long term impacts can be caused by:

- Reducing the amount of groundwater infiltration to the aquifer;
- The introduction of preferential pathways;

- Introduction of overburden material with . ifferent hydraulic properties; or
- Significant alteration to the local topography.

5.1. Short erm Impacts

Impacts anticipated during construction are mainly temporary in nature and they need to be managed to minimize environmental impacts. The hydraulic conductivity is generally consistent in the overburden materials on-site due to the nature of the glaciofluvial deposits. The materials range from silty sand to medium sand, some of which are highly water bearing. The water levels observed range from 1.3 mbgs to 3.5 mbgs. The water table is a subdued reflection of the topography, and appears deeper in locations where topograpic ig. s are present (i.e. at the north-west corner of the site, and in the centre of the site).

Site grading activities will affect the topography. It is expected that most of the proposed servicing will be installed at depths ranging from 3 m to 5 m below final grade. It is anticipated that dewatering measures will be required to control water levels for the nominal depth sanitary services in the shallow aquifer (Algonquin Aquifer Complex) where coarse grained materials are encountered.

A 200 mm sanitary sewer currently exists at the southern extent of the subject site, extending from the Hydro Station to the Loblaws property. The FSR, submitted by UEL in 2009, proposes that this sewer be connected to the new development to service the subject site. The existing sewer is at depths of approximately 9 mbgs in coarse grained material. The thickness of the till underlying this area is variable, and it may be necessary to depressurize the piezometric pressures exerted by the Algonquin Aquifer to facilitate construction. Dewatering is anticipated in order to control water levels during the construction phase and a PTTW will be required.

According to Section 34 of the Ontario Water Resources Act (OWRA), any groundwater taking greater than 50,000 L/day will require a PTTW from the Ontario MOE. The rate of ewatering for this site is expected to exceed the 50,000 L/. ay threshol. and therefore a PTTW will be required to facilitate the construction of the servicing for the site. During the etailed esign stage, it will be necessary to refine the hydrogeological analysis in locations where services will be installed.

5.1.1. Impacts due to Construction Dewatering S

Dewatering can result in a decline in the water level in the shallow unconfined aquifer. The decline in water levels can result in reduced available water for nearby groundwater takers.

To obtain a better understanding of the zone of impact (ZOI) which will occur due to ewatering, a pumping test is recommended to characterize the hydraulic properties of the materials where the sanitary sewer connection is needed at the southern extent of the property. T. is information will be required in order to obtain a PTTW for construction.

In general, the impacts associated with the construction of the shallow servicing should be limited to the immediate areas surrounding the excavation trenches. A review of final esign grades .will .be .con. ucte. .to .confirm .the .potential .need .for .dewatering .in .areas .where .coarser . pockets are identified and where high water levels are observed. .

Baseline .information .includes .water levels from a network of monitoring .wells, .piezometers, .an. . residential wells. .

5.1.2. : Water Well Users S

Dewatering .or .depressurization .may .result .in .a .reduction .in .the .water .levels .observed .in .the . municipal .and .private .wells .surrounding .the .site; .however, .further .analysis .will .need .to .be . conducted .during .t. e .design .stage .to .determine .the .zone .of .influence .and .whether .proactive . mitigation for t. e wells may be warranted. .

5:13. : Natural Ecosystem Features S

Impacts .to .Leonard's .Creek .as .a .result .of .dewatering .are .not .anticipated .since .the .creek .is . unlikely .to .be .groundwater .ependent; . however, .water .levels .in .the .surrounding .area .may .be . lowered. . Leonard's .Creek .and .Bon .Secour .Creek .which .is .located .south .of .the .site, .may .be . affected by discharge from ewatering . directed towards the creeks. . Impacts to the treed area and . the .wetland .area .identified .in .the .Innisfil .Official .Plan .are .also .not .anticipated .since .they .do .not . rely solely groundwater. .

To .minimize .potential .impacts .to .the .creeks .due .to .ewatering . ischarge .it .is .suggested .that . dewatering .be .conducted .during .the .warm .water .timing .window .for .construction .which .is .from . July . 1st to .March .31st. Prior .to .construction, . it .will .be .necessary .to .prepare .a .ewatering . discharge .plan .which .assesses .the .quantity .and .quality .of .ewatering . discharge .as .well .as .the . assimilative capacity of the receiving water bodies. .

5.2. Long Term Impacts

The .proposed .development .will .reduce .the .amount .of .permeable .surface area; .therefore, .long . term . impacts . to . the . regional . groundwater . system . may . result . from . the . reduced . amount . of . groundwater . infiltration . to . the . aquifers. . Evaluation . of . the . pre-development . and . post-. development .water .budgets .identified .the .reduction .of .infiltration. .As .identified .by .the .Innisfil . Official Plan, the subject site is located on a "Potential Major Groundwater Recharge Area". .

The .reduction .of .infiltration .to .the .shallow .overburden .aquifer .unit .on-site .as .a .result .of .the . proposed development is unlikely to have a negative effect on the surface water features on-site . an. .nearby .the site, .since .both .are .likely .surface .water .fed. . T. e .increase .in .run-off .received .by . the . creeks . will . not . impact . on . their . natural . form . or . function. . The . estimated . re. uction . of . infiltration to the regional aquifer system as a result of the proposed development is small and is . not expected to have an influence on the overall function of the groundwater system in the Lake . Simcoe .Watershed. .

The .installation .of site .services .in .coarse .graine. .units .allow .for .the .introduction .of .preferential . pathways .which .could .alter .the .natural .groundwater .levels. . Use .of .collars .or .other .methods .to . restrict the .movement .of groundwater .in .infrastructure .bedding .is recommended .to .preserve .the . natural groundwater flow regime. .

The .introduction .of .overburden material .with . ifferent .hydraulic properties .or .alterations .to .the . local topography can affect the existing groundwater system. .The proposed removal of surficial . soils at the southern edge of the property may result in problems such as groundwater seepage, or . potential issues in the future due to the high elevation of the groundwater levels in this area. .

Finally, .the .local .groundwater .quality .may .gradually .degrade .as .a .result .of .the .application .of . road salt along the public roadways. . The underlying aquitard appears extensive and will act to . retard the inputs to the regional aquifer. .

.0 Conclusion and Recommendations

The subject site is located to the west of Lake Simcoe, and falls within the Peterborough Drumlin . Fields physiographic region. .The regional topography undulates gently an. slopes . ownwar. s in . an .easterly .direction, .towards Lake Simcoe. .The site falls within the Lake Simcoe .Watershed, . more specifically the Innisfil Creeks Watershed. Leonard's Creek is located at the northern edge . of the property. .

A geotechnical investigation .was .conducted .to .investigate .the .site-specific .properties .within .the . study . area . and . monitoring . wells . were . installed . as . part . of . a . supplemental . ydrogeological . program, .in .order .to .obtain .more .information .about .the .hydrogeological .conditions .on .the .site. . Observed .water .levels .ranged .from .1.3 .mbgs, .to .3.5 .mbgs. . Typically, .shallow .water .levels .can . fluctuate up to 3 m due to seasonal .variations. .It is anticipated that .water levels .observed .in .the . shallow monitoring wells will ecrease . during the summer months. .In addition to the monitoring . events, .dataloggers .were .deployed .at .three .locations, .and .continue .to .collect .water .levels .every . hour. . The . groundwater . flow . direction . in . the . aquifer . formation . is . generally . in . an . easterly . direction, .towards .Lake .Simcoe. . The .groundwater .flow .direction .underlying .the .site .is .in .a . south-easterly direction, mirroring the local topography. .

Potential Impacts

In general, .the proposed development .will .involve .the .installation .of services at depths ranging . from 3 m to 5 m below proposed grade with the exception of the connection to the local sanitary . trunk at the south end of the site. . The proposed local sanitary sewer connection will be at epths . of approximately 9 m below proposed grade. . It is anticipated that dewatering measures will be . required . to . control . water . levels . for . both . the . nominal . depth . sanitary . services . and . for . the . connection .to .the .local .sanitary .sewer .in .the .shallow .aquifer .(Algonquin .Aquifer .Complex) . where coarse grained materials are encountered. .

The rate of dewatering is expected to be greater than 50,000 L/day and a Permit to Take Water . (PTTW) .will .be .required .during .construction. . During .the .etailed . design .stage, . it .will .be .

necessary to refine the analysis of the hy. rogeological conditions along the propose. servicing alignments.

A baseline water well inventory was conducted of residents within 500 m of the site and identified several rural properties dependent on groundwater for omestic supply. Dewatering or depressurization may result in a reduction in the water levels observed in the private wells surrounding the site; however, further analysis will need to be conducted during the design stage to etermine the extent of ewatering and whether proactive mitigation for the wells may be warranted.

Recognize. natural features i. entified on-site include Leonar. 's Creek which is not considered a groundwater epen. ent feature. Impacts to Leonard's Creek as a result of ewatering are not anticipated; however, water levels in the surrounding area may be lowered. Leonar. 's Creek and Bon Secour Creek which is located south of the site, may be affected by discharge from ewatering irecte. towards the creeks. Prior to construction, it will be necessary to prepare a ewatering discharge plan which assesses the quantity and quality of ewatering discharge as well as the assimilative capacity of the receiving water bodies.

Long-term impacts to the groundwater system are related to the potential reduction of infiltration entering the underlying aquifer units; the reduction of the shallow water table observed in the surface soils, the eventual introduction of road salting impacts, and the potential increase of run-off entering the creeks. The Town of Innisfil Official Plan indicates the subject site is located in a "Potential Major Groundwater Recharge Area".

The reduction of infiltration to the shallow overburden aquifer unit on-site as a result of the propose. evelopment is unlikely to have a negative effect on the surface water features on-site and nearby the site, since both are likely surface water fed. The increase in run-off received by the creeks will not have a negative impact on their natural form or function. The estimated reduction of infiltration to the regional aquifer system as a result of the proposed development is small and is not expected to have an influence on the overall function of the groundwater system in the Lake Simcoe Watershe.

Recommendations

To obtain a better understanding of the natural variability of the water levels, water level monitoring will continue for the perio. of a year to assess seasonal trends. At the en. of the monitoring perio. , an update report will be provided to present measured water level ata.

During the etailed esign stage, it will be necessary to refine the analysis of the hydrogeological conditions along the servicing alignments to estimate dewatering volumes. It is recommended that hydraulic testing, involving a pumping test, be conducted to better characterize the aquifer formation. The zone of influence and anticipated dewatering rates as a result of construction-related dewatering can be etermined from the results of the hydraulic testing. The results will be use. to prepare a PTTW Application for ewatering during construction. A ewatering permit should be obtained prior to the commencement of construction.

Long term impacts will nee. to be addressed by controlling the increase in run-off through the stormwater management facilities such that it oes not alter the nature of the surface water

features adjacent to the site. The implementation of best management practices will be able to help increase the amount of infiltration to the aquifer system, and minimize the environmental impacts of the evelopment. A monitoring program for Leonard's Creek and surrounding natural features should be implemented to capture baseline conditions and to assist in determining targets for mitigation.

7.0 References

Chapman, L.J. and Putnam, D.F., *Physiography of Southern Ontario*; Ontario Geological Survey, Miscellaneous Release-Data 228, 2007.

Chapman, L. J. and Putnam, D. F., *The Physiography of Southern Ontario*, 3rd e. , Ontario Geological Survey, Toronto: Ontario Ministry of Natural Resources, 1984.

Golder Associates, *South Simcoe Municipal Groundwater Study*, August 2004.

Golder Associates, *South Simcoe Municipal Groundwater Study. WHPA Town of Innisfil*, Appendix I, August 2004.

Greenland Int. and Louis Berger Group, *Pollutant Target Loads: Lake Simcoe and Nottawasaga River Basins,* June 2006.

Hewitt, D. F., *Paleozoic Geology of Southern Ontario*, Ontario Division of Mines, Toronto, 1972.

Lake Simcoe Region Conservation Authority, *Assimilative Capacity Studies for the Lake Simcoe Watershed and Nottawasaga River,* July 2006.

Mays, L.W., *Water Resources Engineering*, 2005 e. , 2005.

Natural Resources Canada, Mapping Services Branch, *Toporama Sheet 031d03*.

Ontario Geological Survey, *Bedrock Geology of Ontario Seamless Coverage Data Set 6*, 2005.

Ontario Geological Survey, Quaternary Geology, *Seamless Coverage of the Province of Ontario: Ontario Geological Survey, Data Set 14*, 1997.

Ontario Ministry of the Environment, *Water Well Information System Well Record Data Release Version 2.01*, Accessed April 2010, Queen's Printer for Ontario, 2010.

Singer, S.N., Price, A. and Cheng, A.K., *A Proposed Groundwater Monitoring Network for the Upper Nottawasaga River Drainage Basin,* Toronto 2001.

Sorensen Gravely Lowes Planning Associates, *Town of Innisfil Official Plan,* Adopted July 26, 2006, Approved by OMB May 2009 and March 2010.

Toronto Inspection Lt. , *Geotechnical Investigation Proposed Development 20th Sideroad and Innisfil Beach Rd., Innisfil, ntario,* May 2004.

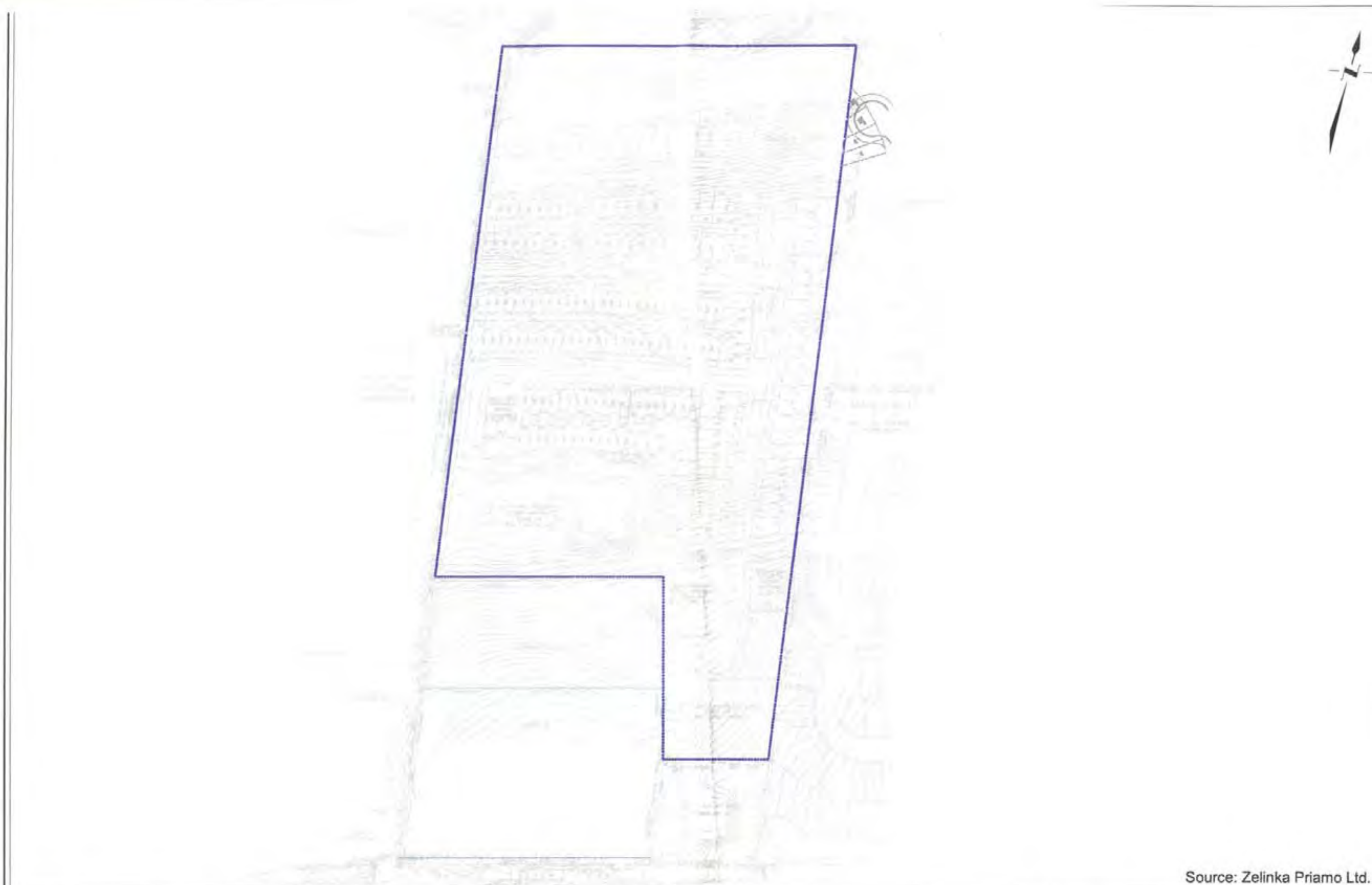
Urban Ecosystems Ltd., Functional Servicing Report for Alcona Capital Properties, December 2009.

Viessman, W. Jr., Knapp, J. W., Lewis, G. L. and Harbaugh, T.E., *Introduction to Hydrology*, 2nd ed., 1977.

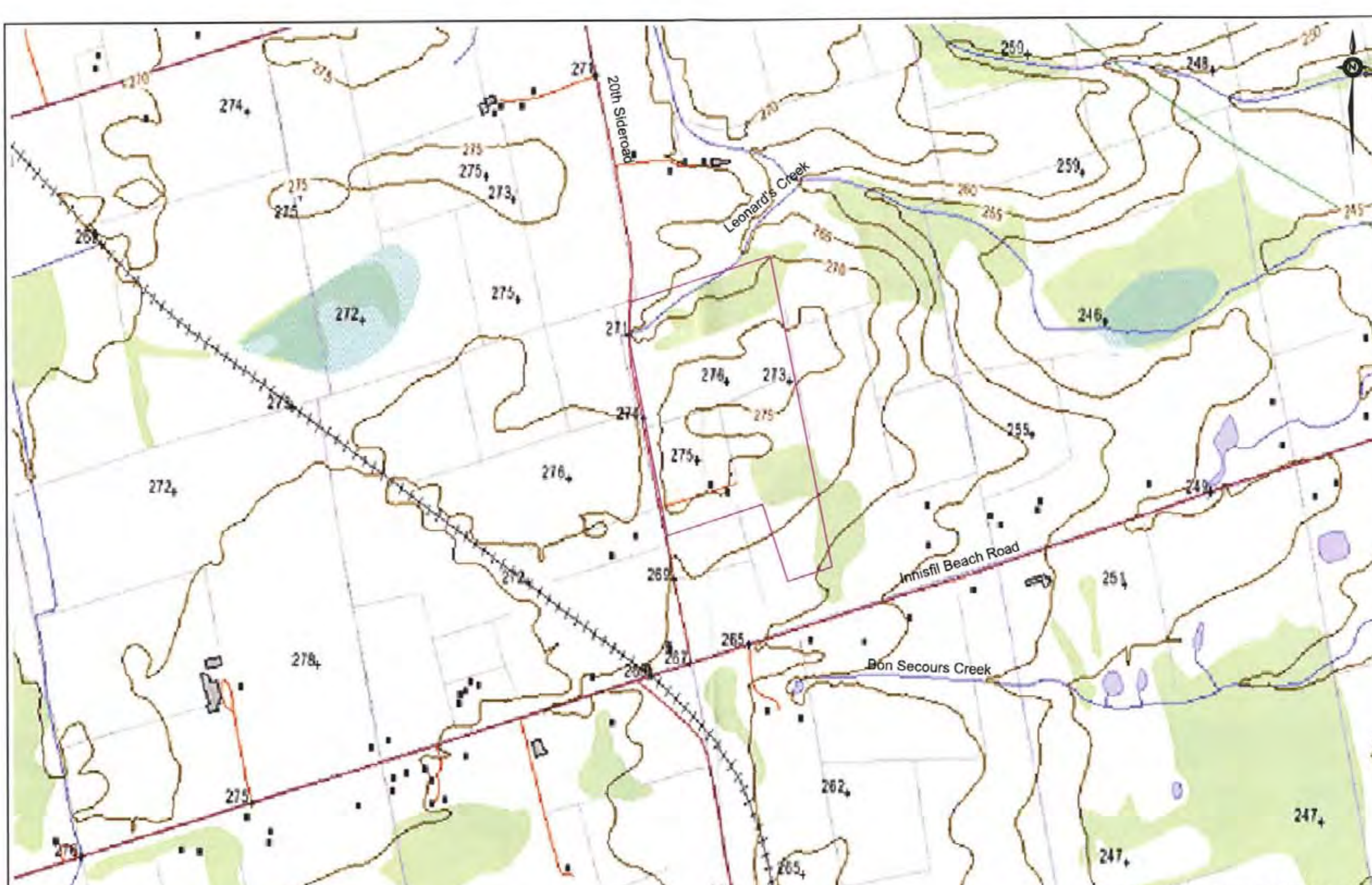
Viessman, W. Jr. and Lewis, G.L., *Introduction to Hydrology*, 4th ed., 1996.

COLE ENGINEERING

FIGURES



LEGEND Subject Site Boundary	Scale 0 – 130 metres	ALCONA CAPITAL PROPERTIES INC		Conceptual Plan
	COLE ENGINEERING	HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010	PROJ. No. E10-223 / FIGURE No: FIGURE 2



LEGEND Subject Site Boundary Water Body Woodlot	Scale 0 – 130 metres	ALCONA CAPITAL PROPERTIES INC		TOPOGRAPHY
	COLE ENGINEERING	HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010	PROJ. No. E10-223 / FIGURE No: FIGURE 3

Source: Speight Van Nostrand and Gibson Ltd.

LEGEND

Subject Site Boundary

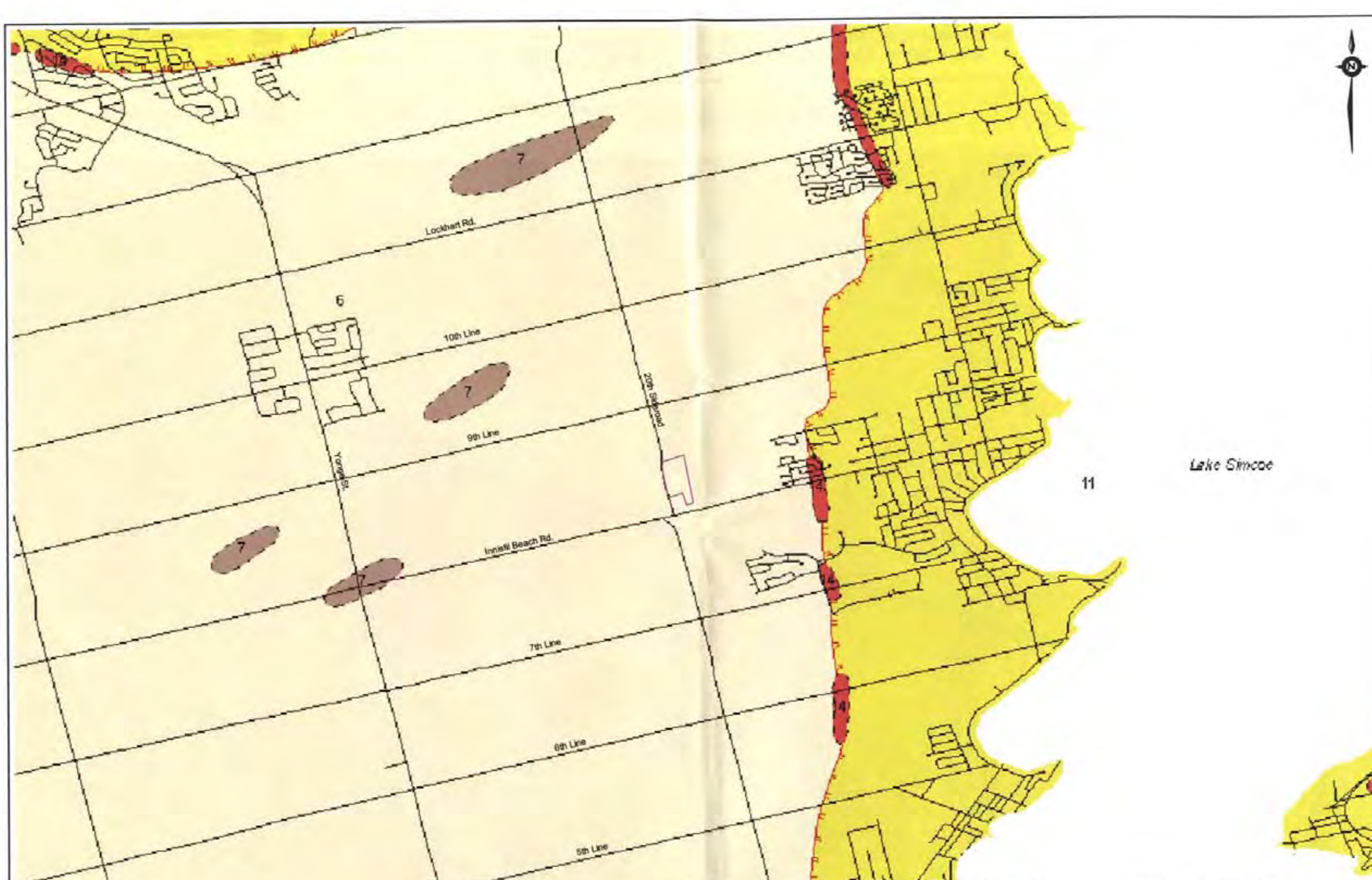
Scale 0 – 130 metres

ALCONA CAPITAL PROPERTIES INC

Topographic Survey

HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON

DATE:	PROJ. No.	FIGURE No:
JULY 2010	E10-223	FIGURE 4



Source: Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release-Data 228

LEGEND

Subject Site Boundary

Beaches

Drumlins

Till Moraines (Drumlinized)

Sand Plains

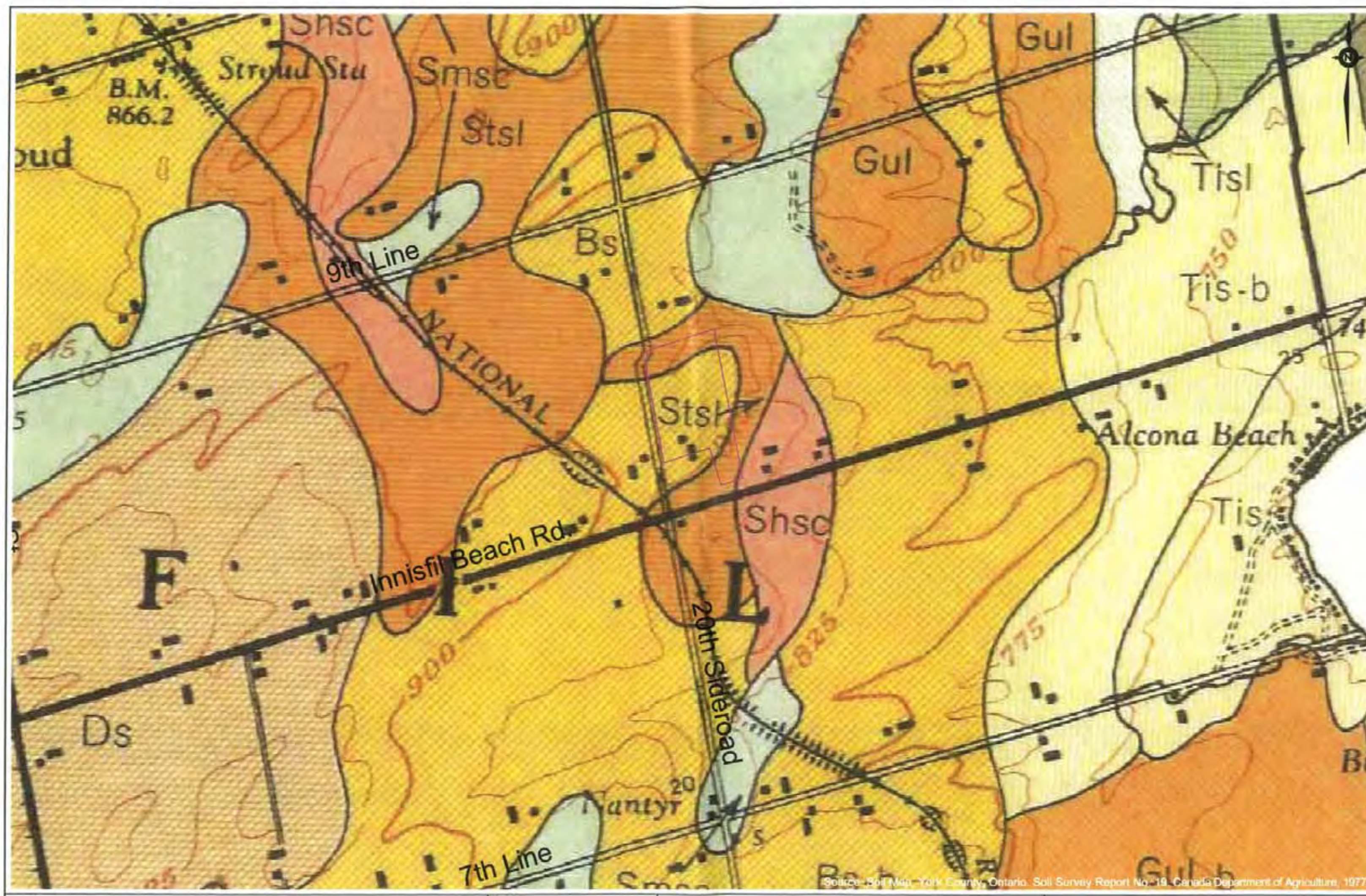
Scale 0 – 1.5 kilometers

ALCONA CAPITAL PROPERTIES INC

PHYSIOGRAPHY

HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON

DATE:	PROJ. No.	FIGURE No:
JUNE 2010	E10-223	FIGURE 5



LEGEND

Bondhead Sandy Loam (Bs)	Subject Site Boundary
Sargent Gravelly Sandy Loam	Dundonald Sandy Loam
Schomberg Silty Clay Loam (Shsc)	Tioga Loamy Sand (Tis)
Smithfield Silty Clay Loam (Smsc)	Guerin Loam (Gul)
	Alliston Sandy Loam

Scale 0 — 650 meters

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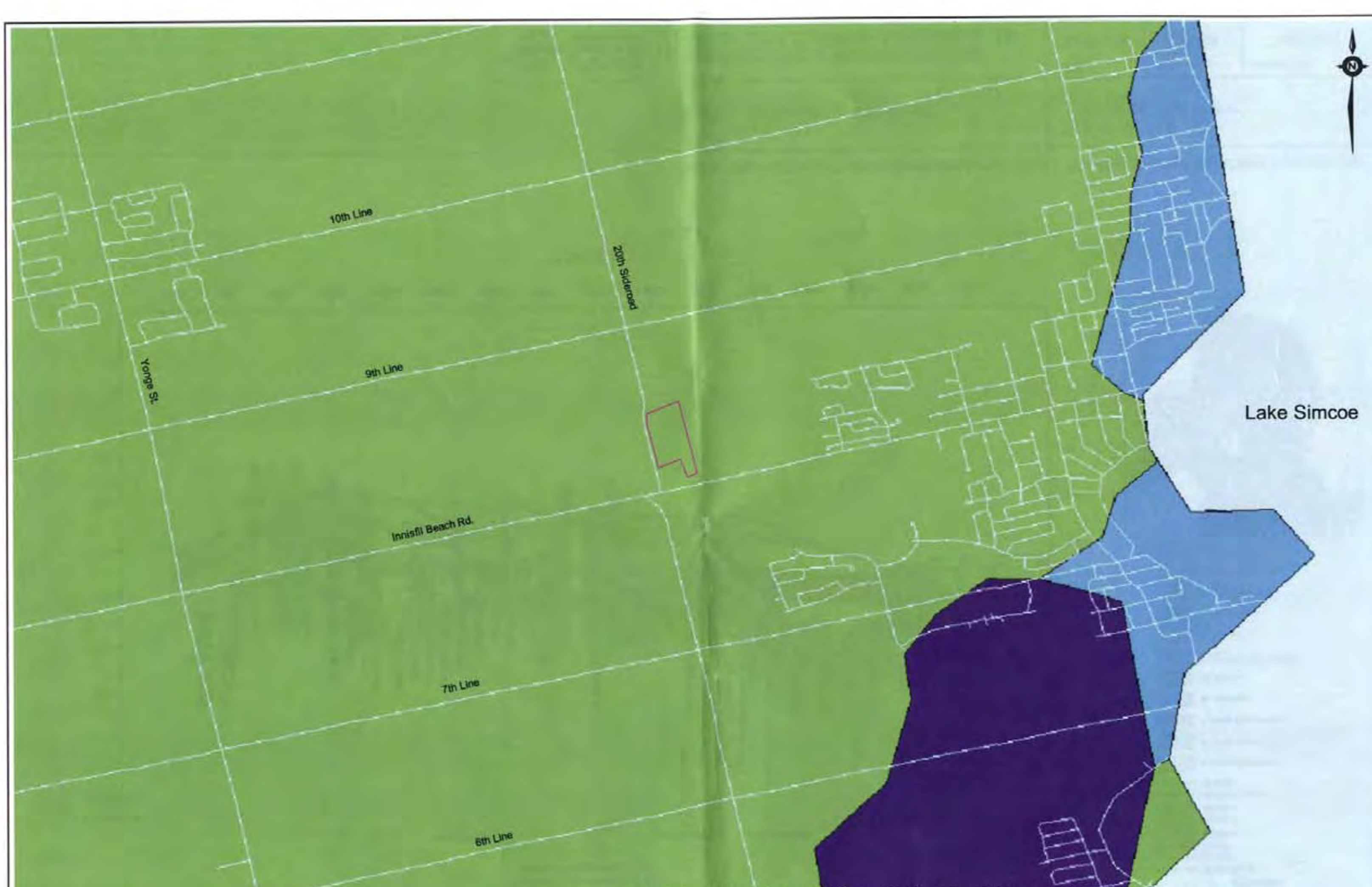
ALCONA CAPITAL PROPERTIES INC	SURFICIAL SOIL		
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JUNE 2010	PROJ. No. E10-223	FIGURE No: FIGURE 6



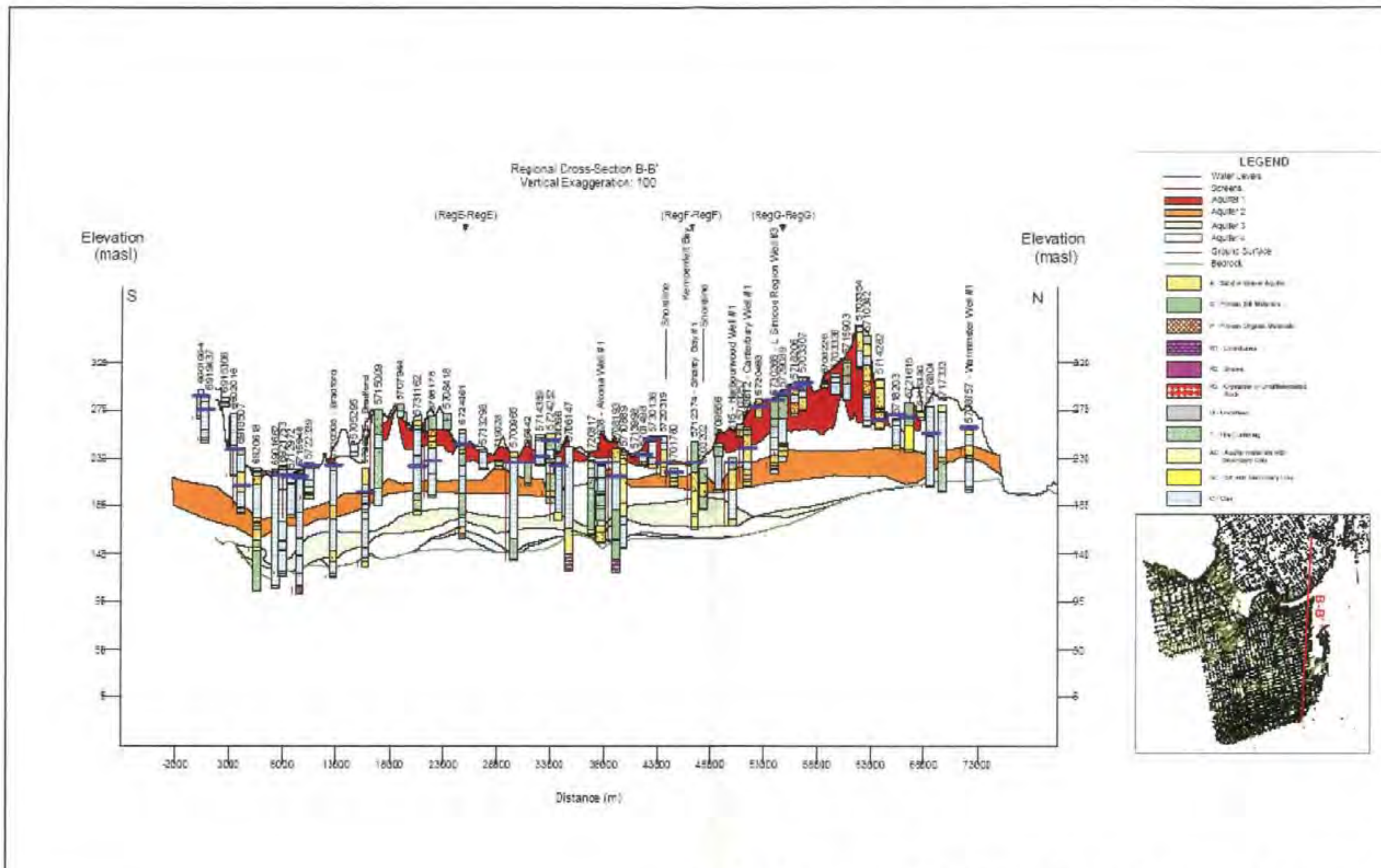
LEGEND

- Subject Site Boundary
- Kettleby Till
- Newmarket Till
- Glaciolacustrine Deposits

Scale 0 — 2.5 kilometers

COLE ENGINEERING — Experience Enhancing Excellence

ALCONA CAPITAL PROPERTIES INC	QUATERNARY		
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JUNE 2010	PROJ. No. E10-223	FIGURE No: FIGURE 7



Source: South Simcoe Groundwater Management Study - Waterloo Hydrogeologic/Dixon Hydrogeology

ALCONA CAPITAL PROPERTIES INC	Regional Cross Section	
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010	PROJ. No. E10-223	FIGURE No: FIGURE 8

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LEGEND
- Subject Site Boundary
- Ottawa Gp., Simcoe Gp., Shadow Lake Fm.

Scale 0 2.5 Kilometers

ALCONA CAPITAL PROPERTIES INC	BEDROCK GEOLOGY		
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010	PROJ. No. E10-223	FIGURE No: FIGURE 9

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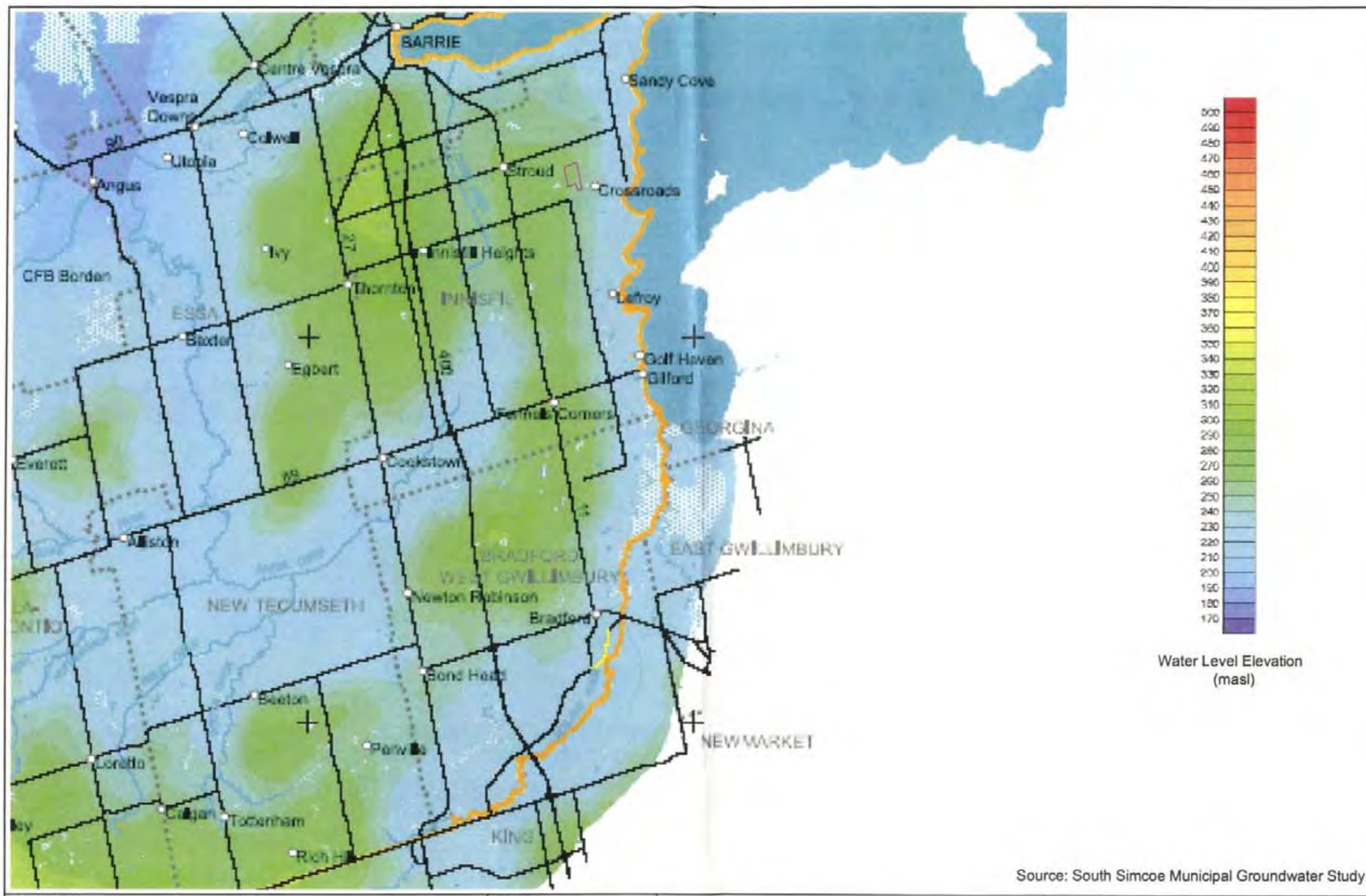

LEGEND

— Subject Site Boundary

SCALE NTS

ALCONA CAPITAL PROPERTIES INC

Shallow Water Level Elevations (Well Depth <15m)

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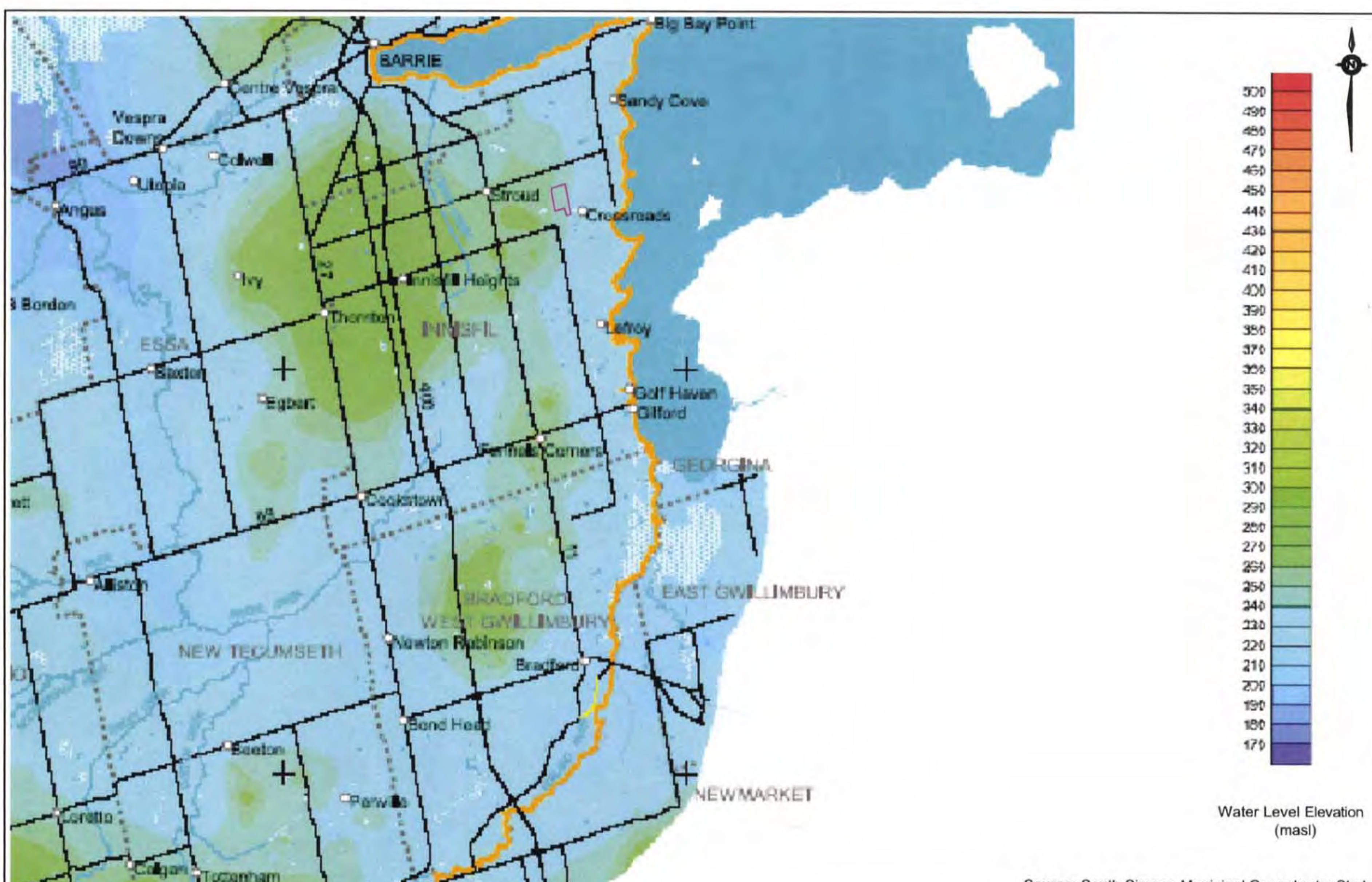
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON

DATE:	PROJ. No.	FIGURE No:
JULY 2010	E10-223	FIGURE 10



LEGEND

— Subject Site Boundary

SCALE NTS

ALCONA CAPITAL PROPERTIES INC

Deep Groundwater Level Elevation (Well Depth >30m)

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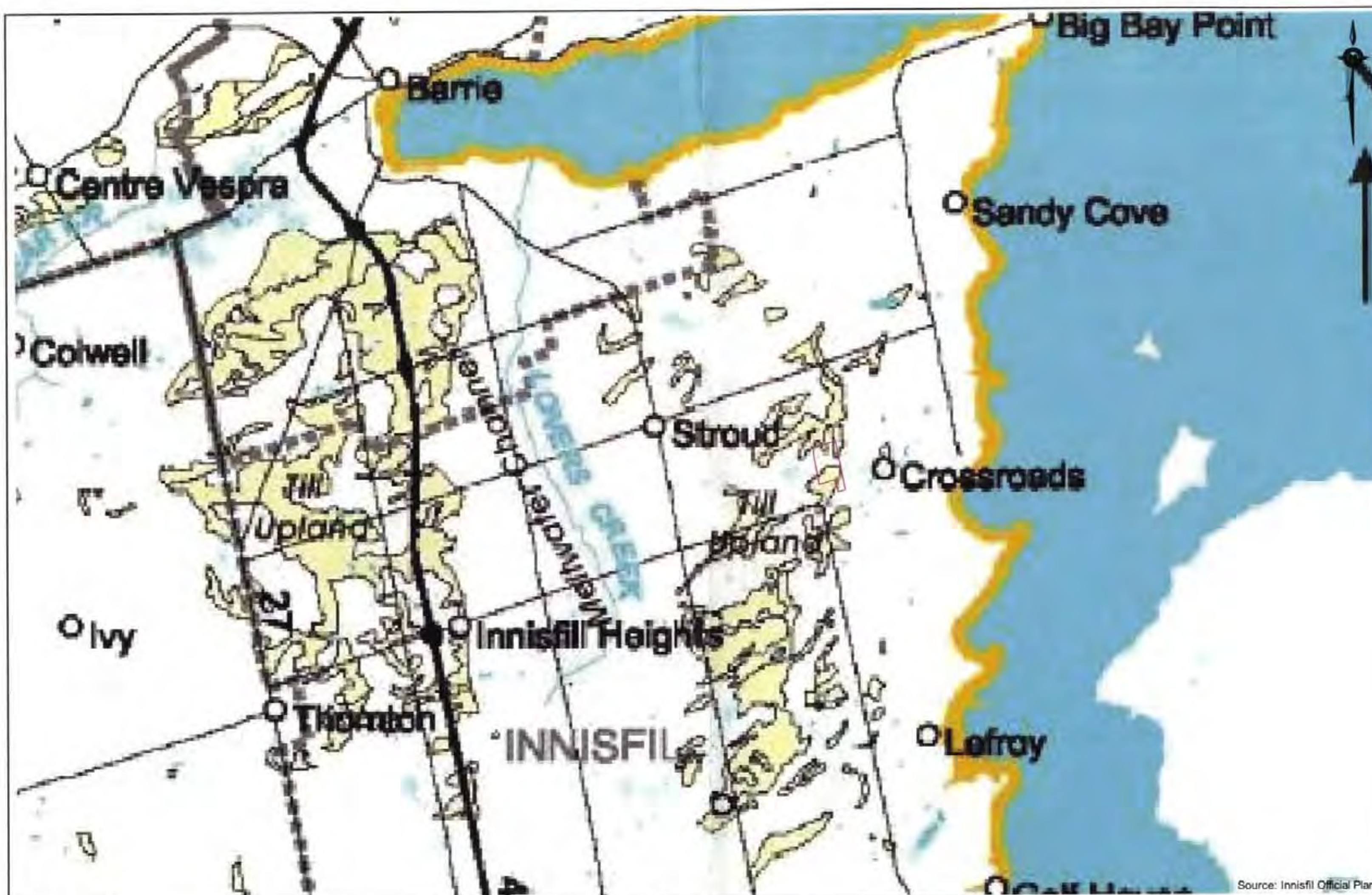
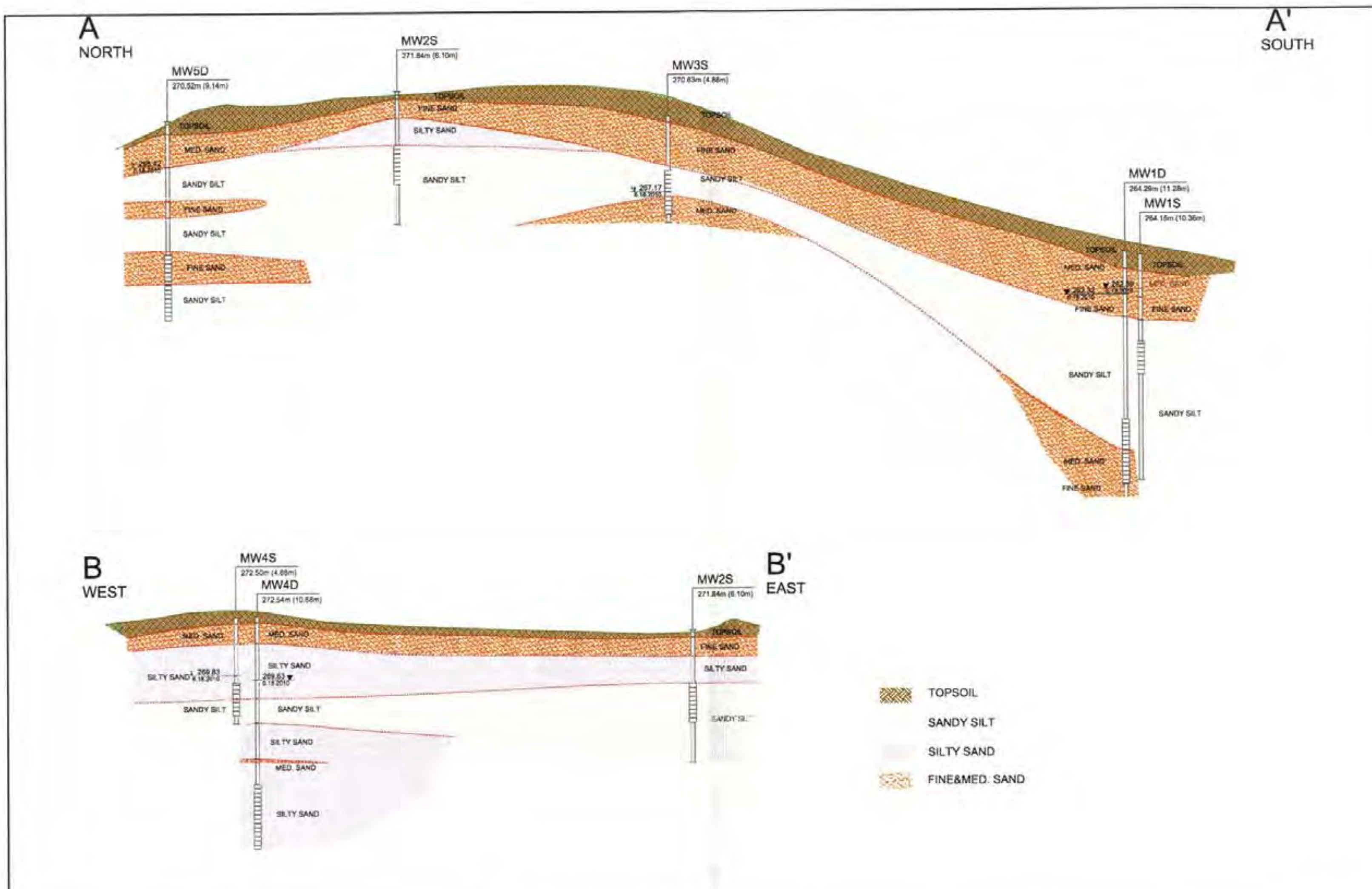
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON

DATE:	PROJ. No.	FIGURE No:
JULY 2010	E10-223	FIGURE 11



LEGEND	Scale		
Subject Site Boundary Major Potential Recharge Zones	NTS	ALCONA CAPITAL PROPERTIES INC	MAJOR POTENTIAL RECHARGE ZONES
	COLE ENGINEERING Experience Enhancing Excellence	HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010 / PROJ. No. E10-223 / FIGURE No: FIGURE 12

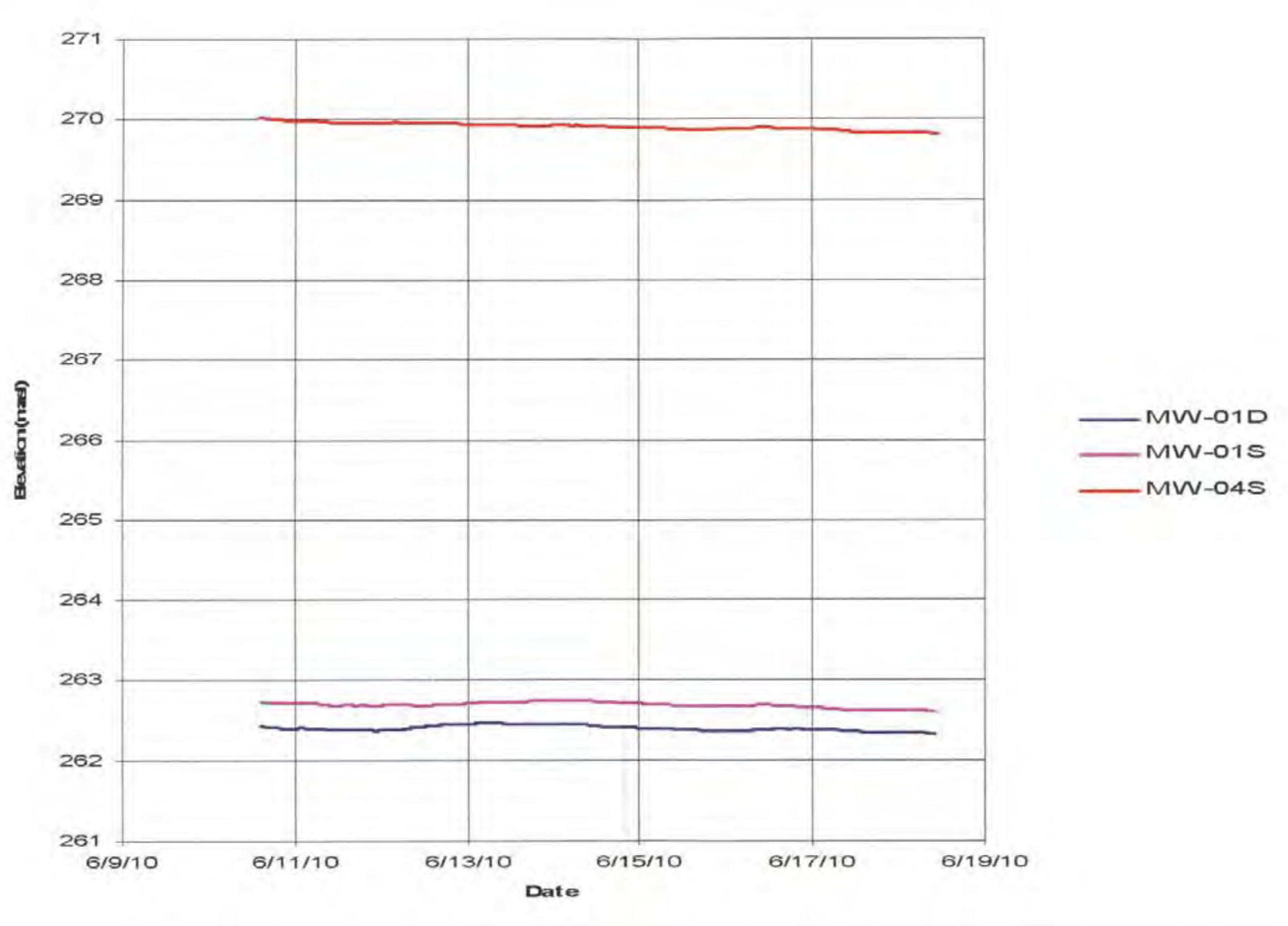
LEGEND	Scale		
Subject Site Boundary Cross Section Lines Water Well & ID	0 – 400 meters	ALCONA CAPITAL PROPERTIES INC	MONITORING WELL LOCATIONS
	COLE ENGINEERING Experience Enhancing Excellence	HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010 / PROJ. No. E10-223 / FIGURE No: FIGURE 13A



LEGEND

Existing Ground Level

Scale				
AS SHOWN	ALCONA CAPITAL PROPERTIES INC	CROSS SECTIONS A and B		
COLE ENGINEERING Experience Enhancing Excellence	HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010	PROJ. No. E10-223	FIGURE No: FIGURE 13B



	ALCONA CAPITAL PROPERTIES INC	WATER LEVEL HYDROGRAPHS		
COLE ENGINEERING Experience Enhancing Excellence	HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010	PROJ. No. E10-223	FIGURE No: FIGURE 14

Scale 0 300 meters

ALCONA CAPITAL PROPERTIES INC	GROUND WATER FLOW DIRECTION		
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JULY 2010	PROJ. No. E10-223	FIGURE No: FIGURE 15

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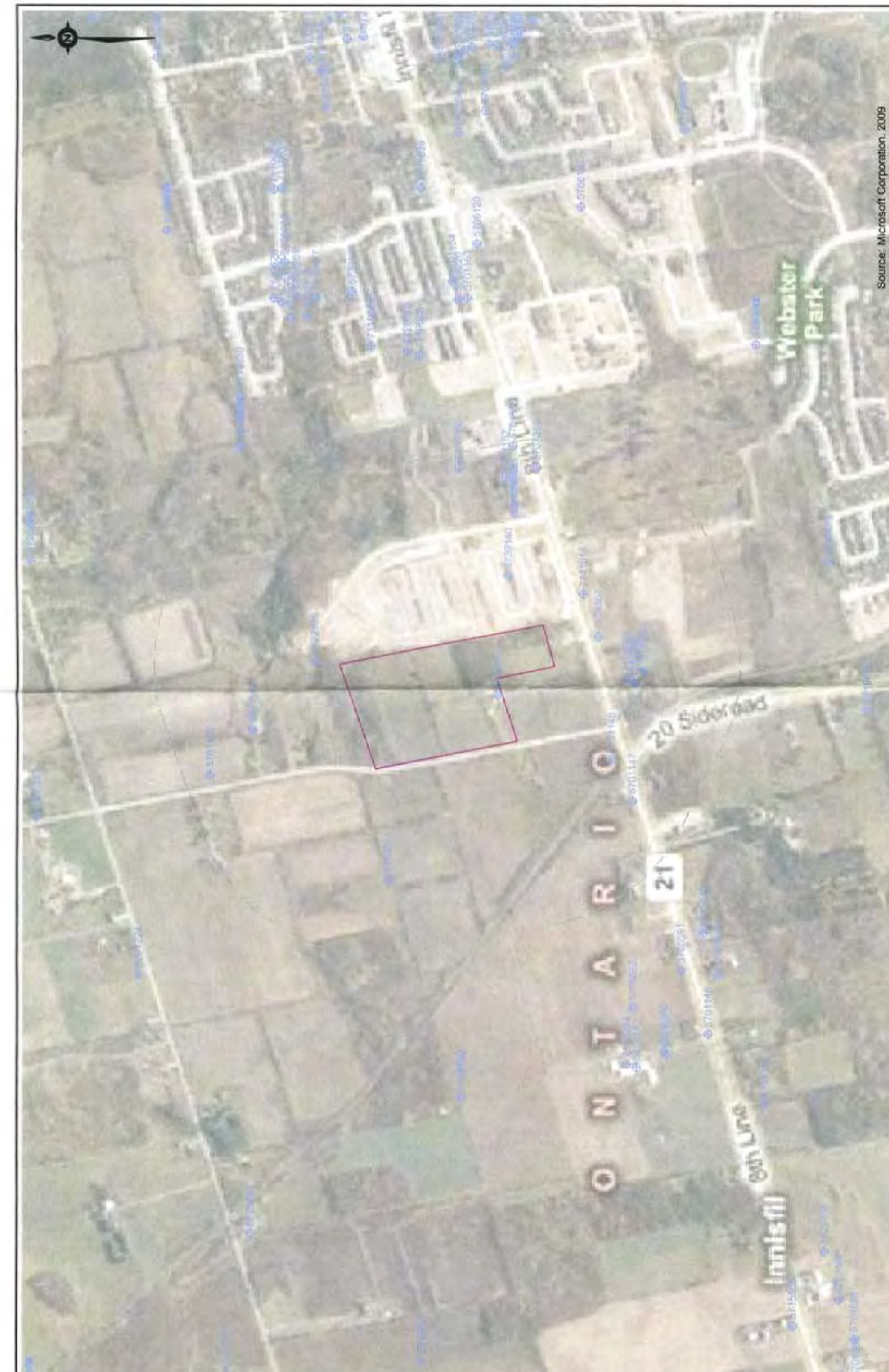

LEGEND
Subject Site Boundary
500 Meter Radius
Water Well & ID

Scale 0 400 meters

ALCONA CAPITAL PROPERTIES INC	MOE WATER WELLS & LOCAL GROUNDWATER USERS		
HYDROGEOLOGICAL INVESTIGATION FOR PART OF LOT 8, CONCESSION 21, INNISFIL, ON	DATE: JUNE 2010	PROJ. No. E10-223	FIGURE No: FIGURE 16

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ENGINEERING G

APPENDIX A

Borehole Logs

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Symbols and Abbreviations used on Borehole Logs

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)

- ASPHALT: Asphalt
- SW-SM: USCS Well-graded Sand with Silt
- CL: USCS Low Plasticity Clay
- CH: USCS High Plasticity Clay
- SHALE: Shale
- GW-GC: USCS Well-graded Gravel with Clay
- SC: USCS Clayey Sand
- CLS: USCS Low Plasticity Sandy Clay
- SP: USCS Poorly-graded Sand

SAMPLER SYMBOLS

- Grab Sample
- Standard Penetration Test
- Shelby Tube
- Rock Core
- Split Spoon

WELL CONSTRUCTION SYMBOLS

- Cement Seal: 1 pipe group, 1 pipe
- Bentonite Seal: 1 pipe group, 1 pipe
- Filter Pack: 1 pipe group, 1 pipe
- Slotted Pipe: 1 pipe group, 1 pipe
- Pipe Cap: 1 pipe group, 1 pipe
- Bentonite: Bottom of hole
- Cement: Bottom of hole

STANDARD PENETRATION RESISTANCE

(N VALUE) – The number of blows by a 63.6 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) Split Spoon Sampler for a distance of 300 mm (12 in.). For samples where full penetration is not achieved, the number of blows is reported over the sample penetration in millimeters (e.g. 50/75).

COHESIONLESS SOILS

Relative Density	*N Value*
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

COHESIVE SOILS

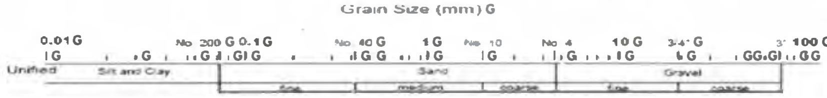
Consistency	*Cu(kPa)*	*N Value*
Very Soft	0 - 12	0 - 2
Soft	12 - 25	2 - 4
Firm	25 - 50	4 - 8
Stiff	50 - 100	8 - 15
Very Stiff	100 - 200	15 - 30
Hard	>200	>30

All sample descriptions included in this report follow the **Unified Soil Classification System** (USCS). Unless stated, samples are classified visually. Visual classification may not be accurate enough to provide precise grain sizing.

DESCRIPTORS FOR SOIL CLASSIFICATION (USCS)

	%
Trace (e.g. "trace sand")	1 - 10
Some (e.g. "some sand")	10 - 20
Adjective (e.g. "sandy")	20 - 35
And (e.g. "and sand")	35 - 50
Noun (e.g. "sand")	>50

Grain Size (mm)



Borehole logs are to be used for environmental purposes only.

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BOREHOLE NUMBER MW-01D

CLIENT	Alcona Capital Properties	PROJECT NAME	Hydrogeological Investigation for Part of Lot 21, Conc. 8
PROJECT NUMBER	E10-223	PROJECT LOCATION	N/E of IBR and 20th Sideroad, Innisfil, ON
DATE STARTED	17/5/10	COMPLETED	17/5/10
GROUND ELEVATION	264.29 m	HOLE SIZE	194 mm (Outer Dia.)
DRILLING CONTRACTOR	Profile Drilling	GROUND WATER LEVELS:	
DRILLING METHOD	Truck Mounted Rig, CME 65 4.25" Auger	AT TIME OF DRILLING	---
LOGGED BY	AR	CHECKED BY	TL
AT END OF DRILLING	---	AFTER DRILLING	---
NOTES	Sunny, wind, 15C		

Casing Top Elev: 265.1 (m)

DEPTH (m)	ELEV. (m)	MATERIAL DESCRIPTION	WELL DIAGRAM	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
0.00		Silty topsoil	Cement seal			
0.76	263.53	(SP-SM) medium SAND brown, moisture noted, no odour	Bentonite grout			
1.80	262.49	(SP-SM) medium SAND brown, moisture noted, no odour				
1.97	262.32	fine SAND dark brown, with trace of medium sand				
3.01	261.28	(ML) grey sandy SILT moist, with trace of gravel	50mm solid PVC pipe			
4.22	260.07	(ML) sandy SILT with layers of light brown				
5.43	258.86	(ML) grey sandy SILT moist				
6.63	257.66	(ML) grey sandy SILT very wet, with trace layers of gravel				
7.75	256.54	(ML) grey sandy SILT with sand and gravel interdispersed				
8.49	255.80	(ML) grey sandy SILT				
9.14	255.15	(SP-SM) grey medium SAND moist	50mm slotted PVC with sand fill	SS 1	32-40-50-5 (90)	

(Continued Next Page)

COLE TEMPLATE ALCONA BOREHOLE LOGS.GPJ GINT STD CANADA LAB.GDT 15/7/10

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BOREHOLE NUMBER MW-01D

CLIENT Alcona Capital Properties
PROJECT NUMBER E10-223
PROJECT NAME Hydrogeological Investigation for Part of Lot P21, Conc. 8 P
PROJECT LOCATION N/E of IBR and 20th Sideroad, Innisfil, ON P

DEPTH (ft)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION P	WELL DIAGRAM P	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
34			(SP-SM) grey medium SAND moist *(continued)*				
35 P			10.67 — 253.62				
36 P	11		(SP-SM) grey fine SAND moist P		SS 2P	15-23-27-P 21 (50) P	
37 P			11.28 — 253.01				

Bottom of borehole at 11.28 meters. P

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BOREHOLE NUMBER MW-01I

CLIENT Alcona Capital Properties
PROJECT NUMBER E10-223
DATE STARTED 5/5/10 COMPLETED 5/5/10
DRILLING CONTRACTOR Profile Drilling
DRILLING METHOD Powerprobe 9700 VTR Pro, 4.25" Auger
LOGGED BY AR CHECKED BY TL P
NOTES Sunny, wind gusts, 24C P
PROJECT NAME Hydrogeological Investigation for Part of Lot P21, Conc. 8 P
PROJECT LOCATION N/E of IBR and 20th Sideroad, Innisfil, ON P
GROUND ELEVATION 264.15 m P HOLE SIZE 194 mm (Outer Dia.)
GROUND WATER LEVELS:
AT TIME OF DRILLING ---
AT END OF DRILLING ---
AFTER DRILLING ---

Casing Top Elev: 1 265.27 (m)

DEPTH (ft)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION P	WELL DIAGRAM P	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
1			silty TOPSOIL P	Cement seal P	UD 1 P		
2 P			0.76 — 263.39				
3 P	1		(SP-SM) medium SAND brown, moisture noted, no odour P				
4 P							
5 P							
6 P			1.80 — 262.35		UD 2 P		
7 P	2 P		1.97 — 262.18 (SP-SM) medium SAND brown, moisture noted, no odour P	Bentonite grout P			
8 P			fine SAND P dark brown, with trace of medium sand P				
9							
10	3		3.01 — 261.14	50mm solid PVC pipe P	UD 3		
11 P			(ML) grey sandy SILT moist, with trace of gravel P				
12 P							
13 P	4 P						
14 P			4.22 — 259.93		UD 4		
15 P			(ML) sandy SILT with layers of light brown P				
16 P	5 P			50mm slotted PVC P with sand fill P			
17 P							
18 P			5.43 — 258.72		UD 5		
19 P			(ML) grey sandy SILT P moist P				
20	6 P						
21 P							
22 P			6.63 — 257.52	Backfilled with sand P and cuttings P	UD 6		
23 P	7 P		(ML) grey sandy SILT P very wet, with trace layers of gravel P				
24 P							
25 P							
26	8 P		7.75 — 256.40 (ML) grey sandy SILT P with sand and gravel interdispersed P		UD 7 P		
27							
28 P			8.49 — 255.66				
29 P	9 P		(ML) grey sandy SILT P		UD 8 P		
30			9.10 — 255.05				
31							
32	10						

(Continued Next Page)

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BOREHOLE NUMBER MW-01

CLIENT Alcona Capital Properties
PROJECT NAME Hydrogeological Investigation for Part of Lot 21, Conc. 8
PROJECT NUMBER E10-223
PROJECT LOCATION N/E of IBR and 20th Sideroad, Innisfil, ON P

DEPTH (ft)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
					UD 9		

Bottom of borehole at 10.36 meters. P

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BOREHOLE NUMBER MW-02S

CLIENT Alcona Capital Properties
PROJECT NAME Hydrogeological Investigation for Part of Lot 21, Conc. 8
PROJECT NUMBER E10-223
PROJECT LOCATION N/E of IBR and 20th Sideroad, Innisfil, ON P
DATE STARTED 5/5/10 **COMPLETED** 5/5/10
GROUND ELEVATION 271.84 m P **HOLE SIZE** 194 mm (Outer Dia.)
DRILLING CONTRACTOR Profile Drilling
GROUND WATER LEVELS:
DRILLING METHOD Powerprobe 9700 VTR Pro, 4.25" Auger
AT TIME OF DRILLING ---
LOGGED BY AR **CHECKED BY** TL
AT END OF DRILLING ---
NOTES Sunny, wind gusts, 24C P
AFTER DRILLING ---

Casing Top Elev: 272.87 (m)

Depth (m)	MATERIAL DESCRIPTION	Elevation (m)	WELL DIAGRAM	SAMPLE TYPE NUMBER
0.33	TOPSOIL dark brown with plant matter P	271.51	Cement seal P	UD P 1
1.22	fine SAND light brown, with trace of gravel P	270.62	Bentonite grout P	
2.44	(SP-SM) fine silty SAND P with trace of gravel P moisture noted P	269.40	50mm solid PVC P pipe P	UD P 2
3.66	(ML) fine sandy SILT P grey, moist, with traces of gravel P	268.18	50mm slotted PVC P with sand fill P	UD P 3
4.27	(ML) fine sandy SILT with gravel P greyish brown, dark brown and red layers P	267.57		UD P 4
4.88	fine sandy SILT P light brown, with traces of reddish sand P	266.96		UD P 5

Bottom of borehole at 6.10 meters. P

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BOREHOLE NUMBER MW-03S

CLIENT Alcona Capital Properties
PROJECT NAME Hydrogeological Investigation for Part of Lot 21, Conc. 8 P
PROJECT NUMBER E10-223
PROJECT LOCATION N/E of IBR and 20th P ON P
DATE STARTED 5/5/10 COMPLETED 5/5/10
GROUND ELEVATION 270.63 m P HOLE SIZE 194 mm P
DRILLING CONTRACTOR
GROUND WATER LEVELS:
DRILLING METHOD Powerprobe 9700 VTR Pro, 4.25" Auger
AT TIME OF DRILLING ---
LOGGED BY AR P CHECKED BY TL P
AT END OF DRILLING ---
NOTES Sunny, wind gusts, 24C P
AFTER DRILLING ---

DEPTH (ft)	DEPTH (m)	MATERIAL DESCRIPTION	Elev.	WELL DIAGRAM	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
				Casing Top Elev: 271.59 (m)			
		TOPSOIL P; dark brown, organic matter P	270.36	Cement seal P			
2 P		(SP) fine SAND; dark brown P			UD 1 P		
3 P							
4 P		(SP) fine SAND; moist, with layers of brown medium sand P	269.42				
5 P				Bentonite grout P			
6 P					UD 2 P		
7 P				50mm solid PVC P pipe P			
8 P	1.44	fine sandy SILT P; dense, brown	268.19				
9 P		(SP-SC) sandy SILT P; moist P; wet P					
10 P					UD 3 P		
11 P							
12 P	3.66	(SC-SM) medium SAND; with layers of course sand, and sandy silt P; wet P		50mm slotted PVC P with sand fill P			
13 P	4 P						
14 P					UD 4 P		
15 P							

Bottom of borehole at 4.88 meters. P

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BOREHOLE NUMBER MW-04D

CLIENT Alcona Capital Properties
PROJECT NAME Hydrogeological Investigation for Part of Lot 21, Conc. 8
PROJECT NUMBER E10-223
PROJECT LOCATION N/E of IBR and 20th Sideroad, Innisfil, ON P
DATE STARTED 17/5/10 COMPLETED 17/5/10
GROUND ELEVATION 272.54 m P HOLE SIZE 194 mm (Outer Dia.)
DRILLING CONTRACTOR
GROUND WATER LEVELS:
DRILLING METHOD Truck Mounted Rig, CME 65 4.25" Auger
AT TIME OF DRILLING ---
LOGGED BY AR P CHECKED BY TL P
AT END OF DRILLING ---
NOTES Sunny, no wind, 15C P
AFTER DRILLING ---

DEPTH (ft)	DEPTH (m)	Depth	MATERIAL DESCRIPTION	Elev.	WELL DIAGRAM	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
					Casing Top Elev: 273.47 (m)			
1		0.27	TOPSOIL; dark brown with silt P	272.27	Cement seal P			
2			(SP) medium light brown SAND; dry with traces of gravel and pebbles P					
3	1							
4		1.22	(SP-SM) silty SAND; dark brown, moist P; medium light brown SAND layer P	271.32				
5								
6								
7	2				50mm solid PVC P pipe P			
8								
9								
10	3		wetness P					
11								
12								
13	4	3.74	greyish brown sandy SILT; moist P	268.80	Bentonite grout P			
14								
15								
16	5	4.88	medium silty SAND; dark brown, with trace of gravel P	267.66		SS 1	19-23-33-26 (56)	
17								
18								
19								
20	6							
21		6.53	(SW) medium SAND P; wet	266.01		SS 2	27-47-47-31/-0.02	
22		6.66	(SP) silty SAND P; greyish brown, wet	265.88				
23	7							
24						SS 3		
25								
26	8					SS 4	45-50	
27		8.22		264.32				
28								
29	9							
30					50mm slotted PVC P with sand fill P			
31								
32	10							

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BOREHOLE NUMBER MW-04D

CLIENT Alcona Capital Properties
PROJECT NAME Hydrogeological Investigation for Part of Lot P21, Conc. 8 P
PROJECT NUMBER E10-223
PROJECT LOCATION N/E of IBR and 20th Bideroad, Innisfil, ON P

DEPTH (ft)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION P	WELL DIAGRAM P	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
34							
35 P							

Bottom of borehole at 10.68 meters. P

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BOREHOLE NUMBER MW-04S

CLIENT Alcona Capital Properties
PROJECT NAME Hydrogeological Investigation for Part of Lot P21, Conc. 8 P
PROJECT NUMBER E10-223
PROJECT LOCATION N/E of IBR and 20th Bideroad, Innisfil, ON P
DATE STARTED 5/5/10 **COMPLETED** 8/5/10 P
GROUND ELEVATION 272.5 m P **HOLE SIZE** 194 mm POuter Dia.)
DRILLING CONTRACTOR Profile Drilling
GROUND WATER LEVELS:
DRILLING METHOD Truck Mounted Rig, CME 65 4.25" Auger
AT TIME OF DRILLING ---
LOGGED BY AR **CHECKED BY** TL
AT END OF DRILLING ---
NOTES Light rain, windy, 10C P
AFTER DRILLING ---

DEPTH (ft)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION P	Elev.	WELL DIAGRAM P	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA (ppm)
1		0.27	TOPSOIL dark brown with silt P	272.23	Cement seal P	UD P 1 P		
2 P			(SP) medium light brown SAND P dry with traces of gravel aPd pebbles P					
3 P	1							
4 P		1.22		271.28				
5 P			(SP-SM) silty SAND P dark brown, moist P medium light brown SAND layer P		Bentonite grout P			
6 P						UD P 2 P		
7 P	2 P				50mm solid PVC P pipe P			
8 P								
9 P								
10	3					UD P 3 P		
11								
12 P		3.74		268.76				
13 P	4 P		greyish brown sandy SILT P moist becoming wet at 2.64m P		50mm slotted PVC with sand fill P			
14 P						UD P 4 P		
15 P								
16		4.88		267.62				

Bottom of borehole at 4.88 meters. P

COLE TEMPLATE ALCONA BOREHOLE LOGS.GPJ GINT STD CANADA LAB.GDT 15/7/10

.42

.6

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APPENDIX B

TIL Geotechnical Investigation

Toronto
Inspection Ltd.

GEO-ENVIRONMENTAL CONSULTANTS

REPORT O
GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT
20TH SIDE ROAD & INNISFIL BEACH ROAD
IN ISFIL, ONTARIO o

REPORT NO.: 04 OL 1038 T
REPORT DATE: MAY 21, 2004

PREPARED FOR

2018041 ONTARIO LIMITED
111 CREDITSTONE ROAD T
CONCORD, ONTARIO T
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silt till. Brief descriptions of the subsoils, encountered at the borehole locations, are as follows:

4.1 Fill

Surficial sod and topsoil, 150 to 300mm in thickness, was contacted at all the borehole locations. Underlying the topsoil at the borehole locations, except Borehole No. 1, a layer of fill was encountered. The fill consisted of sandy silt, clayey silt or silty sand mixed with topsoil and extended to depths of 0.5m to 1.1m below grade. It is our opinion that this material probably represents the reworked zone below the topsoil an has been identified as a fill on the borehole logs.

4.2 Clayey Silt

At the location of Borehole 1, a clayey silt deposit was contacted below the topsoil at a depth of 0.3m from grade. The clayey silt was weathered with layers of silty clay of low plasticity. Based on the Standard Penetration test results (N-values) of 7 to 18 blows per 0.3m penetration, the clayey silt deposit was firm to very stiff.

The natural moisture contents of soil samples, retrieved from this deposit, ranged from 30 to 27%, indicating moist to wet conditions.

4.3 Sand / Sand and Gravel

Underlying the fill at Boreholes 3, 4 and 5 locations, a sand deposit was encountered at depths of 0.5m to 0.8m from grade. The sand deposit was fine or fine to medium graine , with seams of sandy silt and extended to depths of 1.5m to 2.4m from the existing ground level.

Based on the N-values, in the range of 22 to 47 blows per 0.3m penetration, the relative density of the sand deposit was compact to dense. The natural moisture content of the soil samples, retrieved from the sand deposit, ranged from 7 to 18%, indicating moist to wet conditions.

A lower sand / sand and gravel deposit was encountered at the location of Boreholes 1 and 5, below a sandy silt till eposit, at depths of 5.5m from grade. The deposit at

Toronto Inspection Ltd.

Borehole 1 location was well graded with seams of sandy silt. At Borehole 5 location, the deposit was silty and fine grained with trace of coarse sand and gravel. Based on the N-values of 64 and 46 blows per 0.3m penetration, the lower sand /sand and gravel deposit was dense to very dense. The soil samples retrieved from this deposit was generally saturated. Although the moisture contents of the samples were in the range of 9 and 12%, this might not represent the true moisture of the deposit due to the possible draining of water from the sample after the sampling. Boreholes 1 an 5 were terminated in the sand / sand and gravel deposit at depths of 6.6m from grade. The lower limit of this deposit was not established.

4.4 Sandy Silt

A sandy silt deposit was contacted at the location of Borehole 8, below the fill at a depth of 1.1m from grade. The sandy silt deposit, with pockets of silty sand, extended to a depth of 1.4m from grade. Base on the N-value of 11 blows per 0.3m penetration, the sandy silt deposit was compact. The natural moisture content of the sample from this deposit was 13%, indicating moist conditions.

4.5 Sandy Silt Till

A sandy silt till deposit was encountered at all the borehole locations, below the fill, clayey silt, sand or sandy silt at depths of 0.6m to 2.4m from grade. The sandy silt till deposit consisted of a heterogeneous mixture of sand and silt, with layers of silty sand, trace of clay and gravel.

Boreholes 2, 3, 4, 6, 7 and 8 were terminated in the sandy silt till deposit at depths of 6.2m to 6.6m below the existing ground level and the lower limit of the till deposit was not established. At Boreholes 1 and 5, the till deposit extended to a depth of 5.5m from grade. Based on the N-values, in the range of 12 to more than 100 blows per 0.3m penetration, the till deposit was compact to depths of 1.0 to 2.5m from grade and became dense to very dense below this level.

The in-situ moisture content of the samples retrieved from the sandy silt till deposit ranged from 7 to 14%, indicating moist to damp conditions.

4.6 Groundwater

Seepage of groundwater was observed n some of the boreholes during the drilling and sampling p ocess. Upon the completion of drilling, free water was documented at the location of Boreholes 1, 2 and 5 at depths of 1.4m to 5.0m from grade. A wet cave- n was eco ded at the location of Borehole 5, at a depth of 5.5m from grade. No free water was recorded at the remaining boreholes upon completion of rilling.

Based on the fiel observations and the moisture content profile of the soil samples retrieved from the boreholes, t s our opinion that a groundwater condition exists n the sand/sand and gravel deposits. Although some of the boreholes were ry on completion, t is our opinion that some seepage of water can be anticipated from the sand seams if the holes/excavations are left open fo some time. In a dition, perched water might exist n the fill or sand deposit above the almost impermeable till eposit, depending on the time of the year.

The stabilised water level n the sand/sand and gravel depos t was not established n the boreholes. It may be subject to seasonal fluctuation.

5.0 RECOMMENDATIONS

We understand that the propose development will be a residential subdivision with paved roadways and residential houses with basements. Details of the roadways and site grading of the subdivision are not known at the time of this investigat on.

This report s fo preliminary design purpose only. A detailed investigation should be conducted after the layout of the subdivision and site g a ng plan is completed.

5.1 Foundation Design

The foundations for the proposed houses can be supported on conventional spread / strip footings founded on a native deposit of sand, sandy silt, clayey silt o sandy silt till. The depths of footings, soil type and the design bearing pressures for the foundations are shown below:

BOREHOLE NO.	DEPTH *	SOIL TYPE	RECOMMENDED DESIGN BEARING PRESSURE
1	.0m-2.0m below 2.0	clayey silt / till sandy silt till	200 kPa 400 kPa
2	1.0m -2.0m below 2.0	sandy silt till sandy silt till	200 kPa 400 kPa
3	1.0m -3.0m below 3.0	sand / till sandy silt till	200 kPa 400 kPa
4	1.0m -2.5m below 2.5m	sand sandy silt till	200 kPa 400 kPa
5	1.0m -1.8m below 1.8m	sand sandy silt till	200 kPa 400 kPa
6	1.0m -2.0m below 2.0	sandy silt till sandy silt till	200 kPa 400 kPa
7	1.2m-2.5m below 2.5	sandy silt till sandy silt till	200 kPa 400 kPa
8	1.2m-2.0m below 2.0	sandy silt / till sandy silt till	200 kPa 400 kPa

* measured from the existing ground level.

The total an ifferential settlement of the foundations, designed an built using the above recommended bearing pressures, would not exceed 20 and 15m respectively.

It should be noted that the above recommendations for the foundations have been analysed by ***T ronto Inspection Ltd.*** from the information obtaine at the borehole locations. The bearing material, the interpretation between the boreholes and the recommendations of this report must be checked through field inspection provided by ***T ronto Inspection Ltd.*** to validate the information for use uring the construction stage.

5.2 Lateral Earth Pressures

Where subsurface walls will retain unbalanced earth loads, the lateral soil pressure may be computed using the following equation:

$$P = K(\gamma H + q)$$

where P = lateral earth pressure kPa
K = lateral earth pressure coefficient 0.4
γ = Bulk unit weight of soil retained 21.00 kN/m³
H = Depth of wall below the finished grade m
q = Surcharge loads adjacent to the basement wall kPa

It is assumed that a free-draining granular backfill will be provided against the wall and that an effective perimeter tile drainage system will be incorporated to prevent the build up of hydrostatic pressure behind the walls as shown in Drawing No. 10. The drainage system should be on a positive grade leading to a frost free sump or outlet, and should be a minimum of 100 mm diameter perforated pipe surrounded by a geotextile filter fabric. Additionally, damp proofing of all subsurface walls is recommended. In order to minimise the infiltration of surface water, the final exterior grade level should be sloped away from the structure and the upper 600 mm backfill should comprise of low permeable clayey soils.

5.3 Subfloor Drainage

Based on the free water observations at the borehole locations, it is our opinion that there is no continuous g ound water within the anticipated founding depth of 3.5m to 5.0m below the existing ground level. However, perched groundwater conditions can be anticipated in the sand deposits. It is our opinion that the amount of water will not be great and can be handled during construction by installing filtered sumps as necessary in the excavation.

Subfloor drains will not be necessary under the slab on grade. However, if wet conditions are encountered at the slab-on-grade elevations, provision should be made to install the sub-floor drains. The decision on the requirement of the subfloor drains will be made at the time of construction.

Directly under the slab-on-grade, a minimum of 150 mm bedding of OPSS granular A o its equivalent should be used as a moisture barrier under the slab. The bedding should be compacted to at least 98% Standard Proctor maximum ry density.

5.4 Earthquake Consideration

The Ontario Building Code requires that all buildings be esigned to resist a

minimum earthquake force V, as given n the following expression:

$$V = v.S.I.F.W$$

From a geotechnical point of view, the factors of importance, v and F, at this s te can be taken as 0.05 and 1.0, respect vely. These values should be reviewed by the Structural Engineer.

5.5 Excavation and Backfilling

Excavations should comply with the Ontario Occupational Health and Safety Act. All excavation n soil deeper than 1.2 m, shoul be sloped back to a safe angle of less than 45°. A flatter slope of 3 horizontal to 1 vertical m ght be required r excavation into saturated fill or sandy soils.

Major groundwater problem s not anticipated r excavations to epths of upto 5.0m from the existing ground level. Slight seepage from perched water n the sand lying above the till deposit and/or thin sand seams in the silt till may be encountered. It s our opinion that the amount of water will not be great and can be handled by installing filtered sumps in the excavaton during construction. The accumulated water n sumps can be removed by pumping.

Organic free, on site excavated soil may be used for backfilling. The moisture content of most of the soil at the upper layer, within 1.5m from grade, appears to be higher than ts optimum mo sture content. Any saturated soils removed from the trenches will have to be allowed to ry sufficiently to the dry side of ts optimum, prior to placement. Unless this material can be dried out to a moisture content lower than the optimum moisture content, the use of this material should be limited to locations where the degree of compaction and the ultimate settlement will be of l ttle consequence. Topsoil and other compressible fill removed from the site may be reused n landscape areas, subject to approval of the landscape architect.

5.6 Pavement Construction

The following pavement design s based on an assumption that the subgrade soils will consist of organic free silt or sandy silt till materials wh ch are of medium to high frost susceptibility, and are generally fair to poor pavement materials.

			Light Duty	Heavy Duty
Asphaltic Concrete :		HL3 Surface Course	30 mm	40 mm
		HL8 Binder Course	40 mm	50 mm
Base:	OPSS Granular A		150 mm	150 mm
Sub-base:	OPSS Granular B		200 mm	400 mm

The above pavement design thicknesses are based on an assumption that the construction is carried out during the drier time of the year and that the subgrade is stable, not heaving under construction traffic. If the subgrade is wet and unstable, additional thickness of sub-base material may be required.

For any portion of the road which will be assumed by the Town, a minimum pavement design should be in accordance with the current Town of Innisfil standards and specifications.

Following site grading, the subgrade of pavement should be proof rolled using a heavy vibratory roller. Any soft spots revealed during the proof rolling should be subexcavated and replaced with an approved dry material and compacted to at least 98% of its SPMDD.

Provision should be made for the water to drain out of and not collect in the granular base courses for the pavement to function properly. Continuous perforated, OPSS 405, longitudinal drains, minimum diameter of 100mm, should be used as subdrains. The subdrains should be at least 800mm below the road pavement level and installed on a positive gradient to allow for a free flow of water. The backfill above the drains should comprise of free draining Granular B or its equivalent and should be continuous with the granular subbase of the pavement. If the site is uplifted with a free draining material to a minimum depth of 1.0m from the final grade, no sub-drain will be required.

Catch basins and manholes should be backfilled with OPSS Granular B material. The catch basins should be perforated just above the drain level and the weep holes should be screened with a filtered fabric. This will help drain the pavement structure as well as alleviate the differential movement of the catch basins or the manholes due to the frost action.

6.0 GENERAL STATEMENT OF LIMITATION

The comments and recommendations presented in this report are based on the subsoil and ground water conditions encountered at the borehole locations, indicated in the borehole location plan, and are intended for the guidance of the design engineer.

Although we consider this report to be representative of the subsurface conditions at the subject property, the soil and the ground water conditions between and beyond the borehole locations may differ from those encountered at the time of our investigation and may become apparent during construction. Any contractor bidding on, or undertaking the works, should decide on their own investigation and interpretations of the groundwater and the soil conditions between the borehole locations. Any use and / or the interpretation of the data presented in this report, and any decisions made on it by the third party are responsibility of the third parties. The responsibility of ***T r nto Inspection Ltd.*** is limited to the accurate interpretation of the soil and ground water conditions prevailing in the locations investigated and accepts no responsibility for the loss of time and damages, if any, suffered by the third party as a result of decisions or actions based on this report.

Yours very truly,
TORONTO INSPECTION LTD.

Bennet Sun, P. Eng.
Senior Geotechnical Engineer

Upkar S. Sappal, P.Eng.
Principal Engineer

Project No. 04 OL 1038

Log of Borehole 4

Dwg No. 5

Project: Proposed Development

Sheet No. 1 of 1

Location: Innisfil Beach Road and 20th Side Road, Innisfil, Ontario

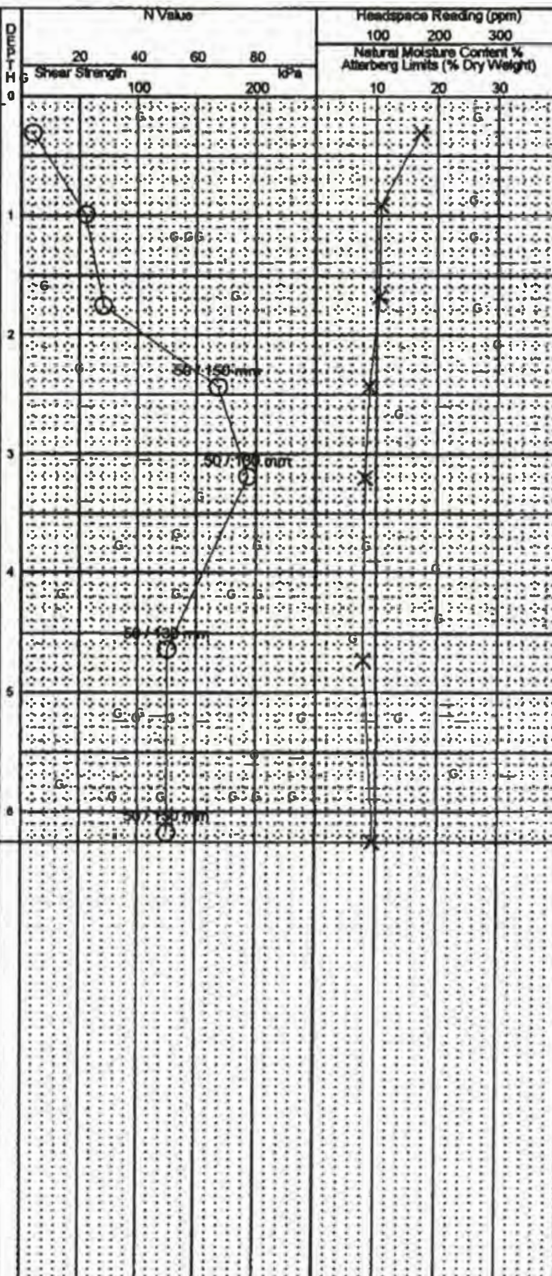
Date Drilled: 04/07/04

Drill Type: Track Mounted Drill Rig

Datum: Temporary

Auger Sample ⊠
SPT (N) Value ○ ⊠
Dynamic Cone Test
Shelby Tube ■
Field Vane Test S
Headspace Reading (ppm) ●
Natural Moisture ×
Plastic and Liquid Limit
Unconfined Compression % Strain at Failure ⊗
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		Ground Surface	99.41	0
		TOPSOIL	99.21	
		FILL - brown sandy silt, - pockets of topsoil, moist.	98.80	
		SAND - compact, - brown, - silty, fine to medium grained, - seams of sandy silt, - moist to damp.	96.97	
		SANDY SILT TILL - very dense, - greyish brown to grey, - seams of silty sand, - some gravel, - moist.	93.16	
		END OF BOREHOLE		



Natural Unit Weight kN/m3

LGBE3 INNISFILBEACHRD&20THSIDEROAD-R.GPJ 21/05/04

NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

Toronto Inspection Ltd.

Time	Water Level (m)	Depth to Cave (m)

Project No. 04 OL 1038

Log of Borehole 5

Dwg No. 6

Project: Proposed Development

Sheet No. 1 of 1

Location: Innisfil Beach Road and 20th Side Road, Innisfil, Ontario

Date Drilled: 04/07/04

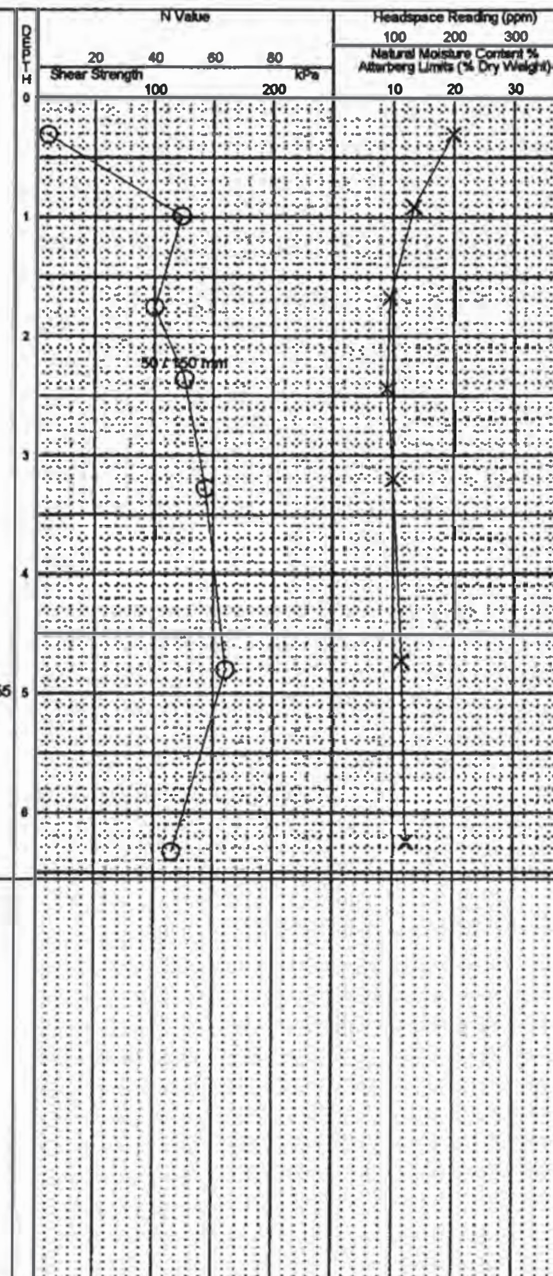
Drill Type: Track Mounted Drill Rig

Datum: Temporary

Auger Sample ⊠
SPT (N) Value ○ ⊠
Dynamic Cone Test
Shelby Tube ■
Field Vane Test S
Headspace Reading (ppm) ●
Natural Moisture ×
Plastic and Liquid Limit
Unconfined Compression % Strain at Failure ⊗
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		Ground Surface	99.58	0
		TOPSOIL	99.43	
		FILL - dark brown sandy silt, - pockets of topsoil, moist.	98.82	
		SAND - dense, brown, silty, fine grained, moist to damp.	98.06	
▼		SANDY SILT TILL - dense to very dense, brown to greyish brown, - seams of silty sand, - some gravel, - moist to damp, - wet at 4.5m.	94.55 / 94.09	
		SAND - dense, grey, silty, fine grained, - trace of coarse sand and gravel, - wet.	93.03	
		END OF BOREHOLE		

NOTE:
On completion:
- water level at 5.0m,
- borehole caved-in at 5.5m.



Natural Unit Weight kN/m3

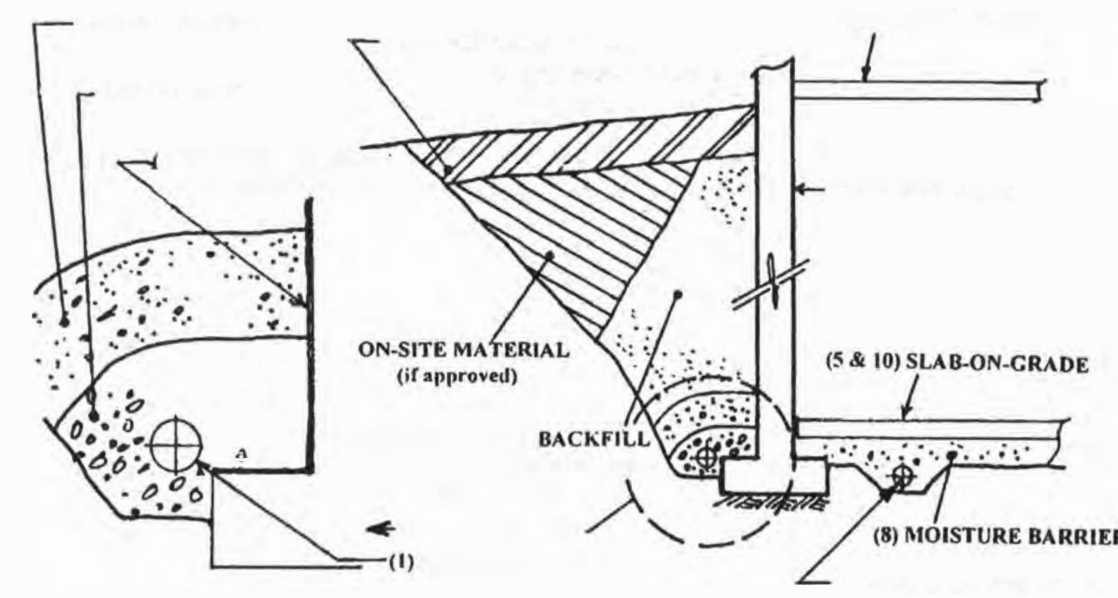
LGBE3 INNISFILBEACHRD&20THSIDEROAD-R.GPJ 21/05/04

NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

Toronto Inspection Ltd.

Time	Water Level (m)	Depth to Cave (m)

nto r


ON-SITE MATERIAL
(if approved)
BACKFILL
(5 & 10) SLAB-ON-GRADE
(8) MOISTURE BARRIER
(1)
A

Notes

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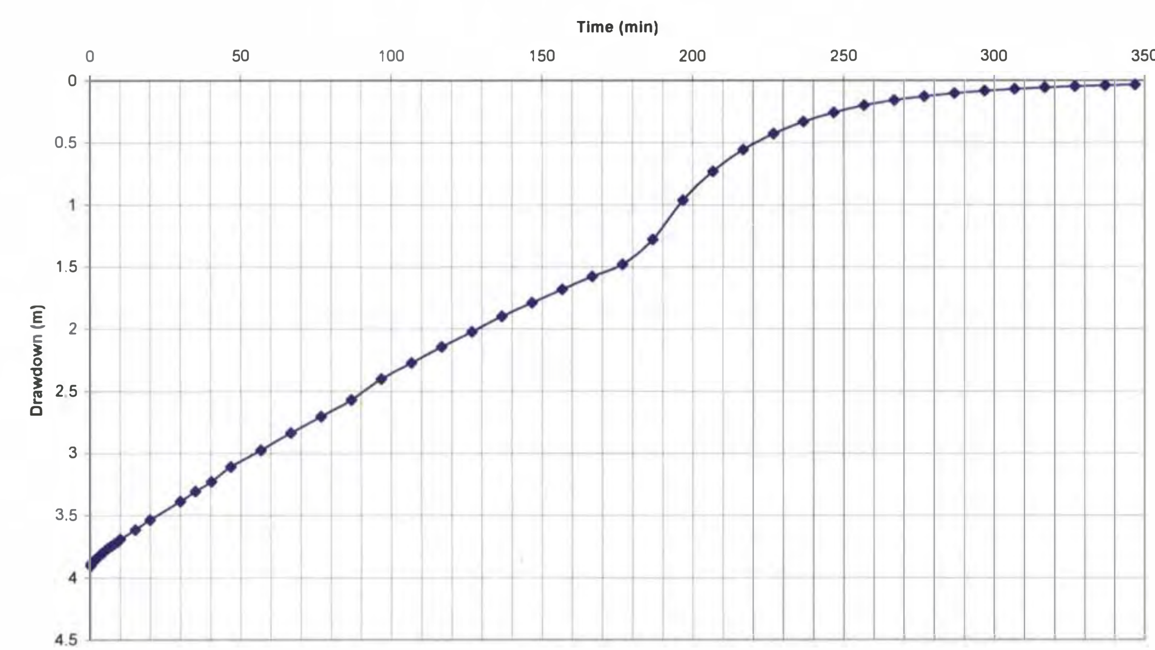
APPENDIX C

Hydraulic Conductivity Calculations

Hvorslev Test: MW-01S

Date:	6/7/2010		H:	4.122	m
Conducted By:	AC, AR, XX		Ho:	0.222	m
Well Depth:	6.44	mbtoc	To_early:	188.2	min
Stick Up:	0.82	m	To_late:	39.85	min
Initial Water Level:	1.77	mbtoc	K_early:	5.53E-08	m/s
Recovery:	100	%	K_late:	2.61E-07	m/s
L:	1.5	m	K_avg:	1.58E-07	m/s
R:	0.075	m			
r:	0.025	m			

MW-01S Drawdown Curve (100% Recovery)



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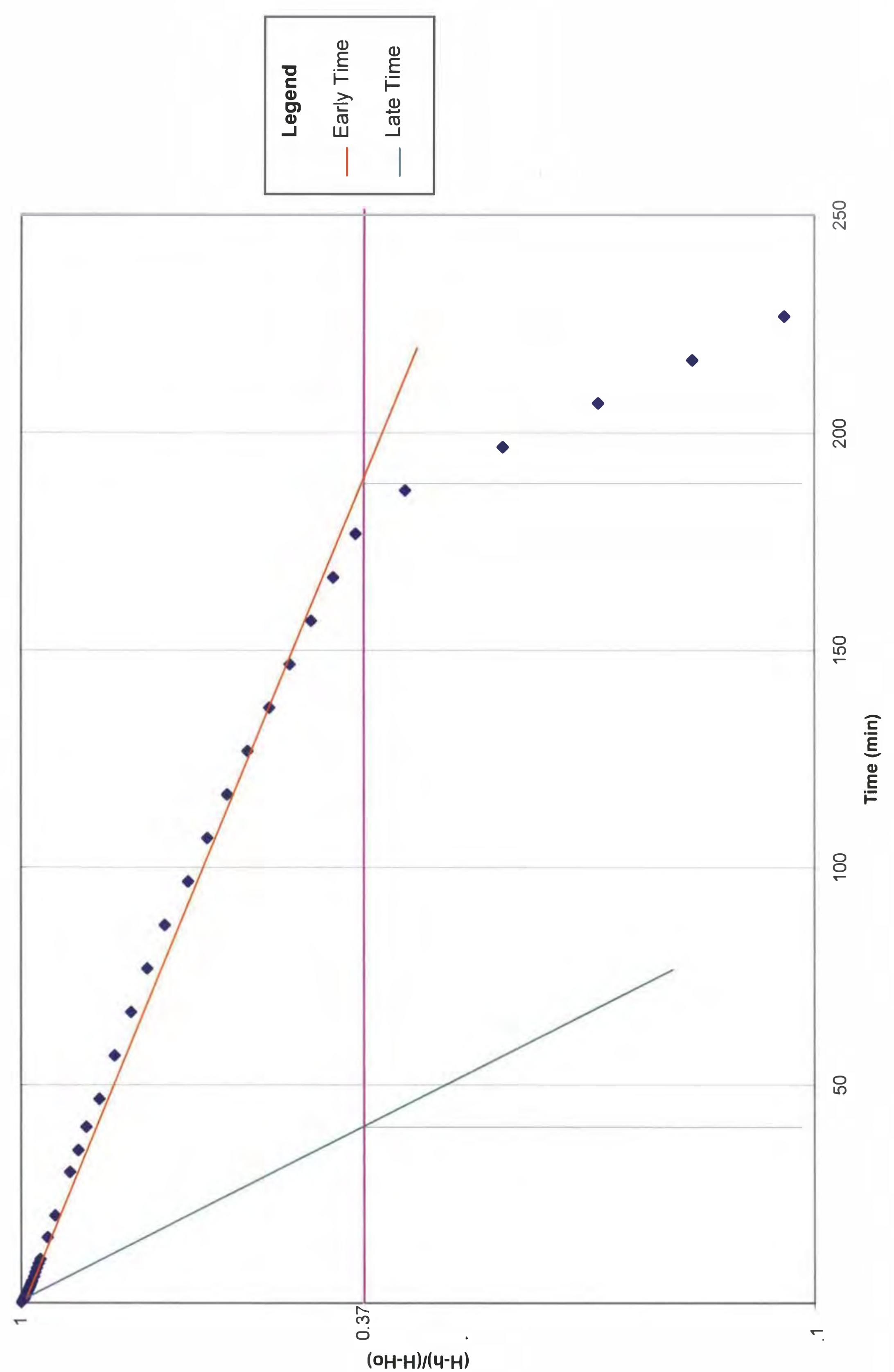
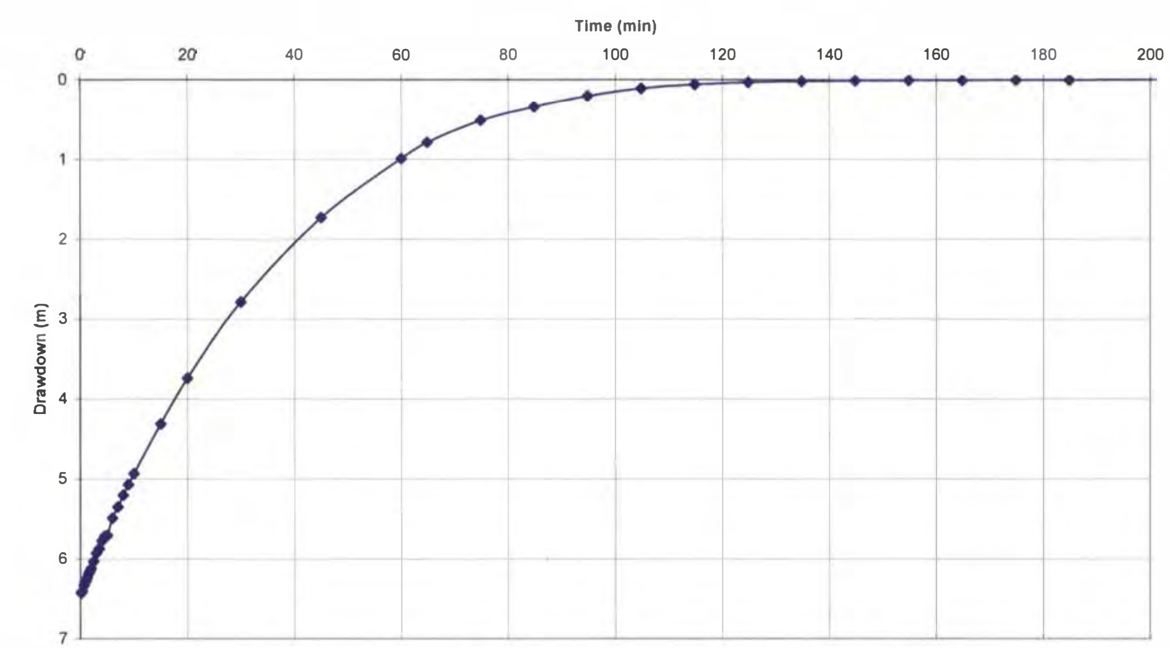
MW-01S Hvorslev Test v

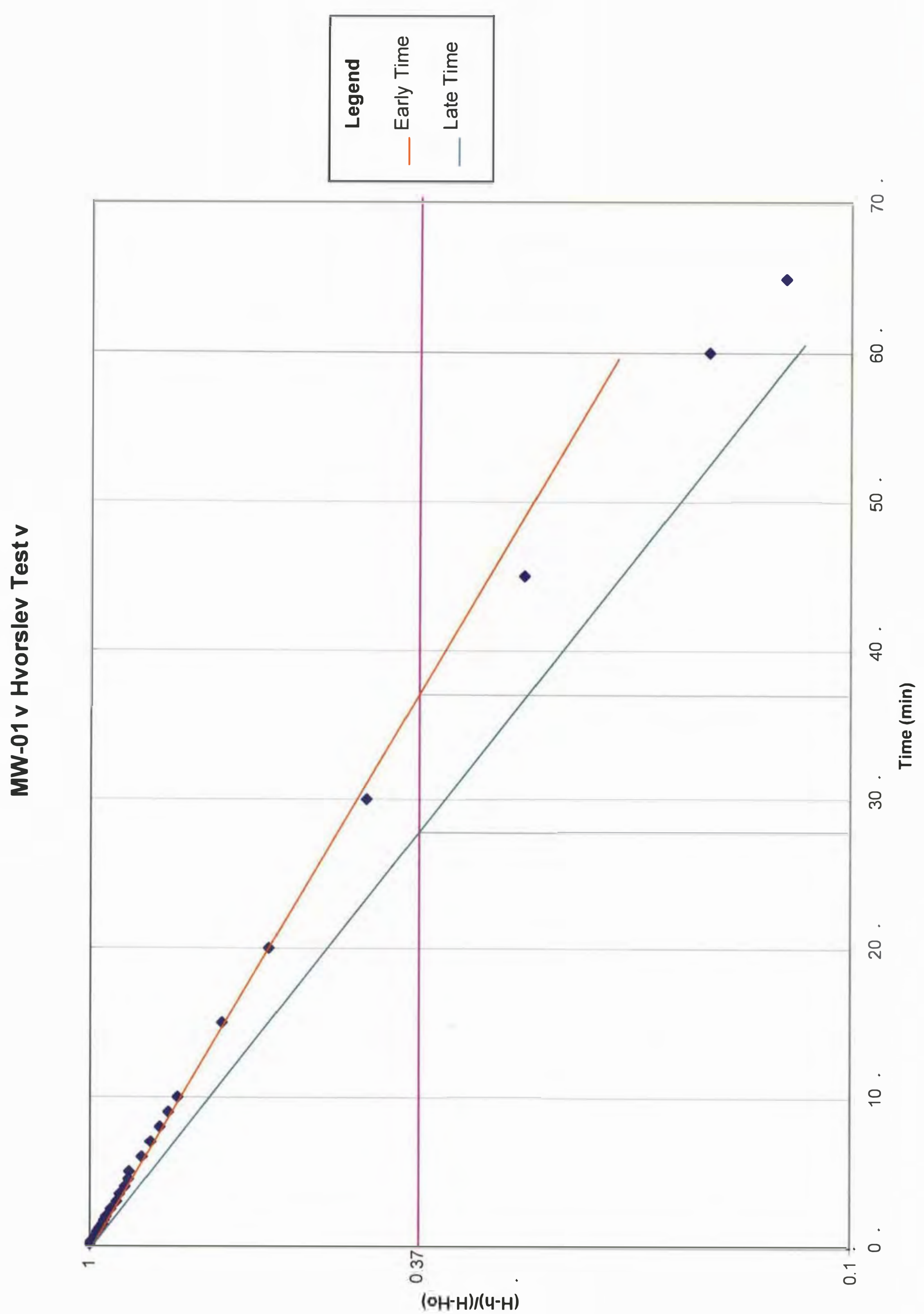


Hvorslev Test: MW-01D

Date::	5/27/2010:		H::	8.144:	m:
Conducted By::	AR, LA:		Ho::	1.72:	m:
Well Depth::	11.02:	mbtoc:	To_early::	27.8:	min:
Stick Up::	0.82:	m:	To_late::	37:	min:
Initial Water Level::	2.88:	mbtoc:	K_early::	2.30E-07:	m/s:
Recovery::	100:	%	K_late::	1:73E-07:	m/s:
L::	3:	m:	K_avg:	2.02E-07:	m/s:
R::	0.075:	m:			
r::	0.025:	m:			

MW-01D Drawdown Curve (100% Recovery)



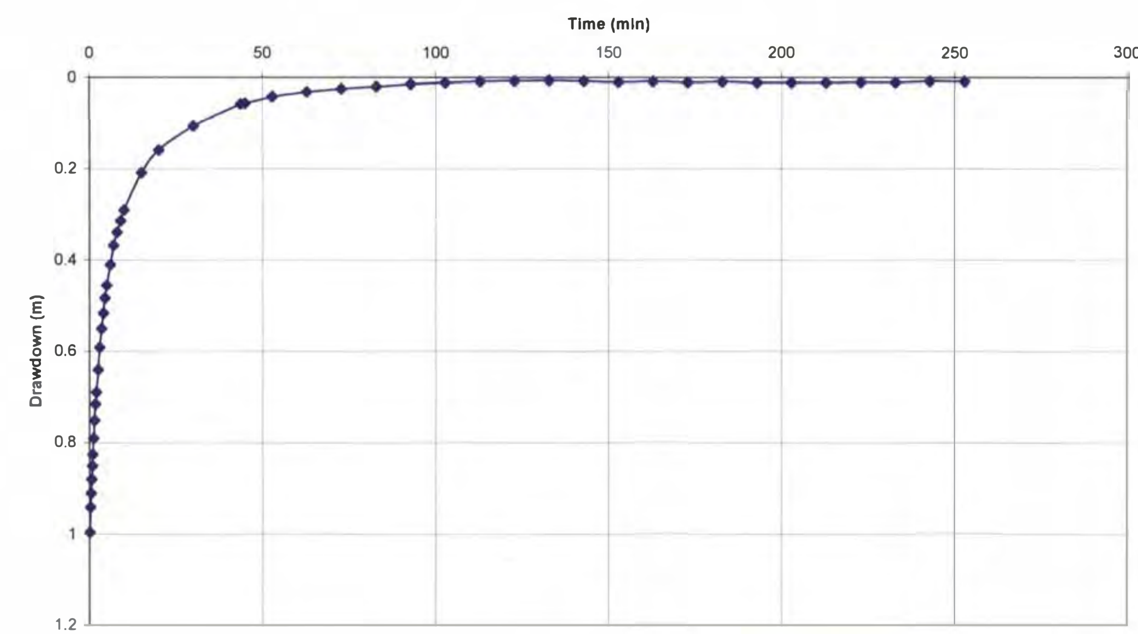


Hydrogeological Investigation for Alcona Capital Properties
Project No. E10-223
June 2010

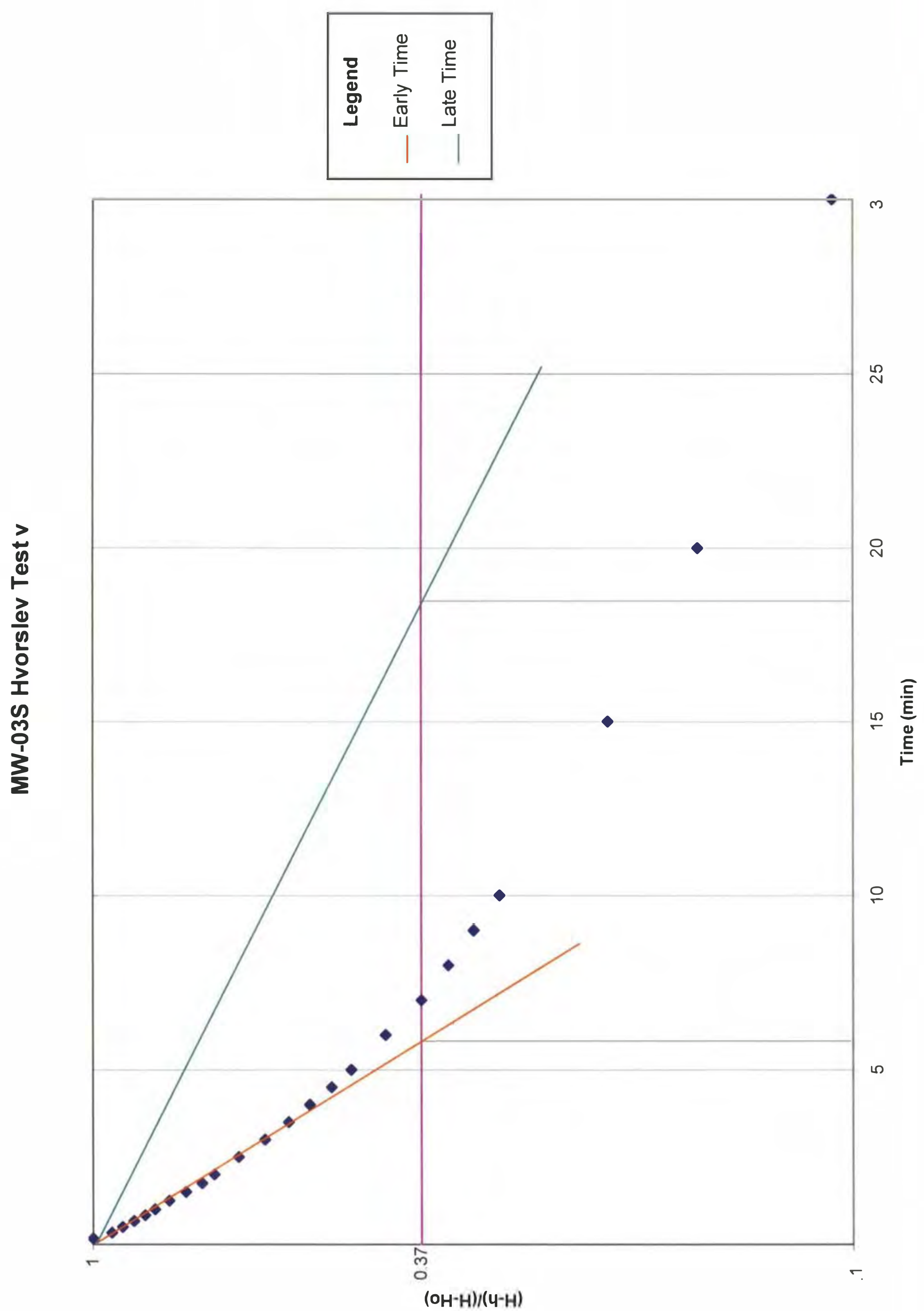
Hvorslev Test: MW-03S

Date:	5/26/2010		H:	1.335	m
Conducted By:	AC, AR		Ho:	0.34	m
Well Depth:	5.54	mbtoc	To_early:	5.8	min
Stick Up:	0.91	m	To_late:	18.5	min
Initial Water Level:	4.21	mbtoc	K_early:	1.79E-06	m/s
Recovery:	99.3	%	K_late:	5.62E-07	m/s
L:	1.5	m	K_avg:	1.18E-06	m/s
R:	0.075	m			
r:	0.025	m			

MW-03S Drawdown Curve (99.3% Recovery)



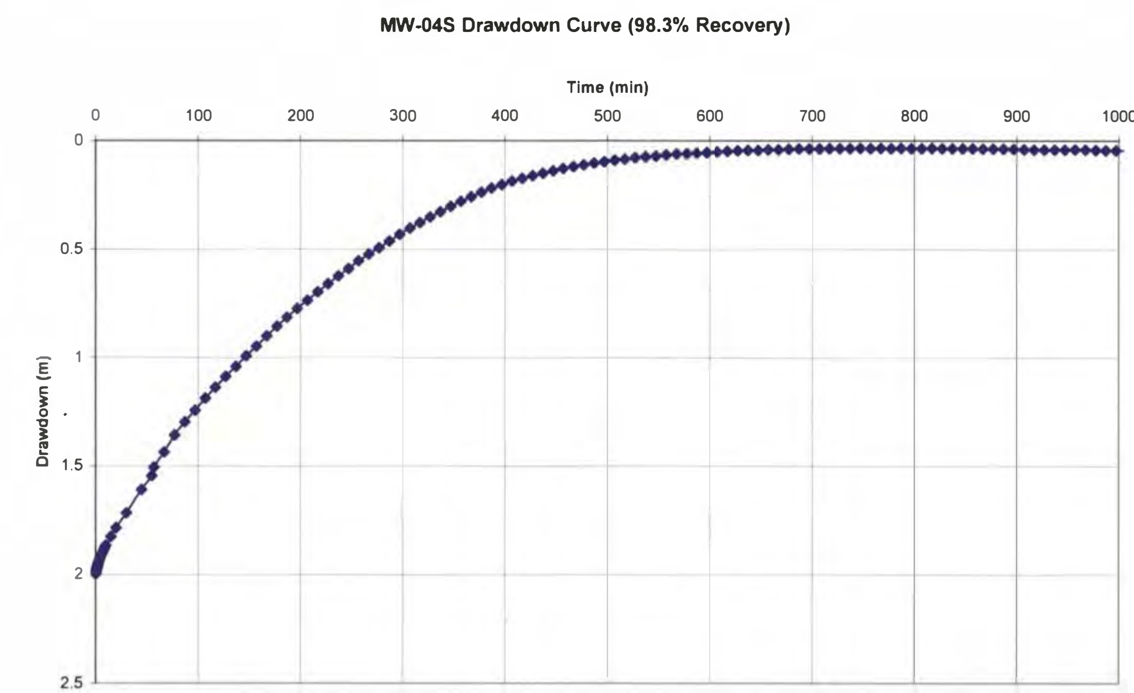
Hydrogeological Investigation for Alcona Capital Properties
Project No. E10-223
June 2010



Hydrogeological Investigation for Alcona Capital Properties
Project No. E10-223
June 2010

Hvorslev Test: MW-04S

Date::	5/27/2010:		H::	2.23:	m:
Conducted By::	AR, LA:		Ho::	0.233:	m:
Well Depth::	5.35:	mbtoc:	To_early::	204:	min:
Stick Up::	0.82:	m:	To_late::	132:	min:
Initial Water Level::	3.12:	mbtoc:	K_early::	5.10E-08:	m/s:
Recovery::	98.3:	%	K_late::	7.88E-08:	m/s:
L::	1.5:	m:	K_avg:	6.49E-08:	m/s:
R::	0.075:	m:			
r::	0.025:	m:			

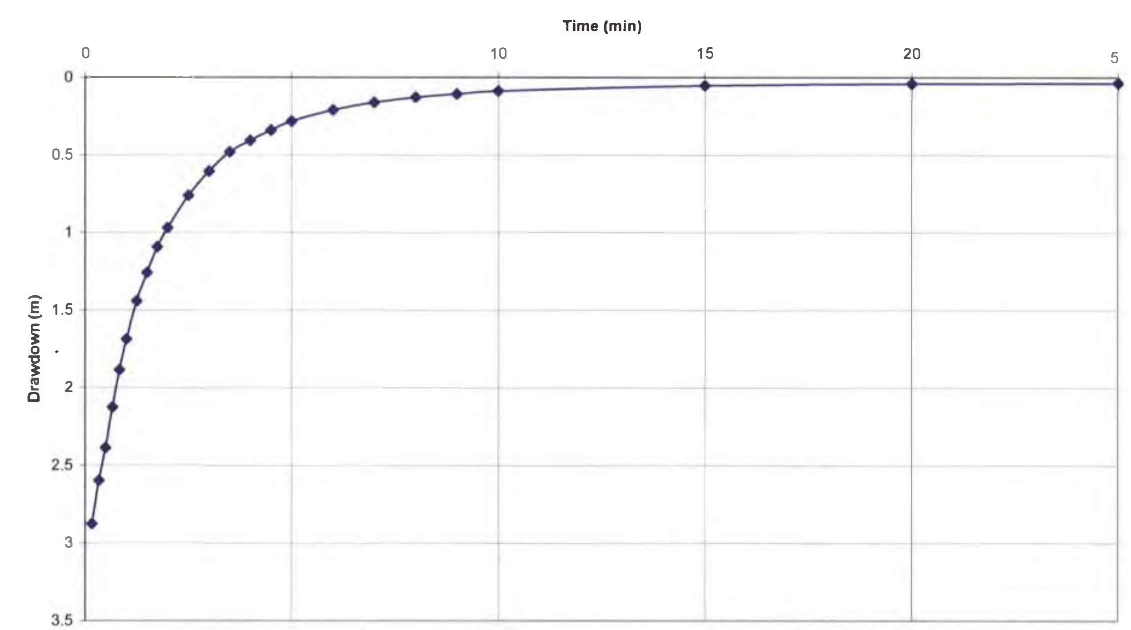


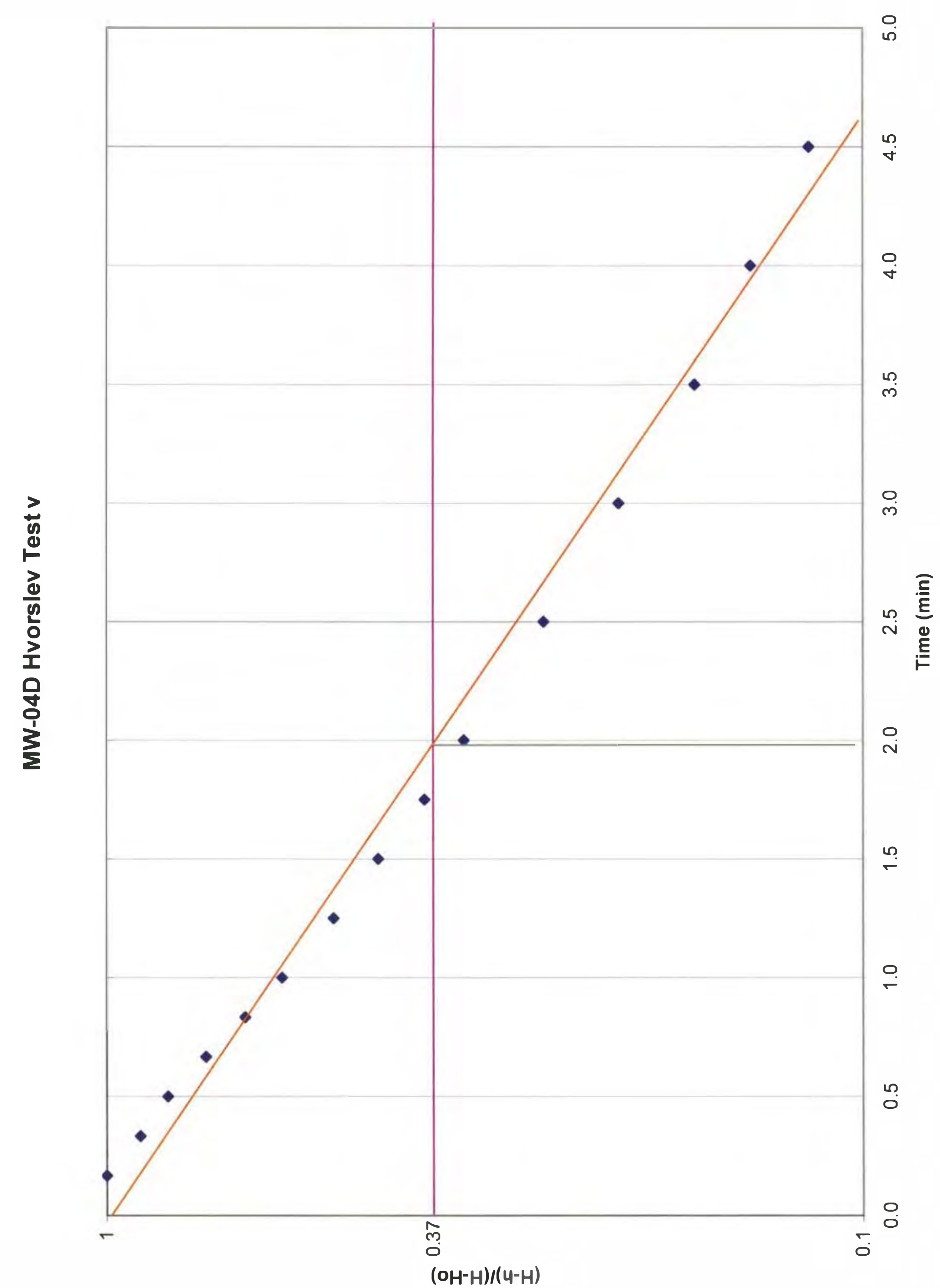
Hydrogeological Investigation for Alcona Capital Properties
Project No. E10-223
June 2010

Hvorslev Test: MW-04D

Date:	5/26/2010		H:	8.595	m
Conducted By:	AC, AR		Ho:	5.72	m
Well Depth:	11.92	mbtoc	To_early:	1.975	min
Stick Up:	0.78	m	To_late:	-	min
Initial Water Level:	3.33	mbtoc	K_early:	3.24E-06	m/s
Recovery:	98.8	%	K_late:	--	m/s
L:	3	m	K_avg:	3.24E-06	m/s
R:	0.075	m			
r:	0.025	m			

MW-04D Drawdown Curve (98.8% Recovery)





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Hydrogeological Investigation for Alcona Capital Properties
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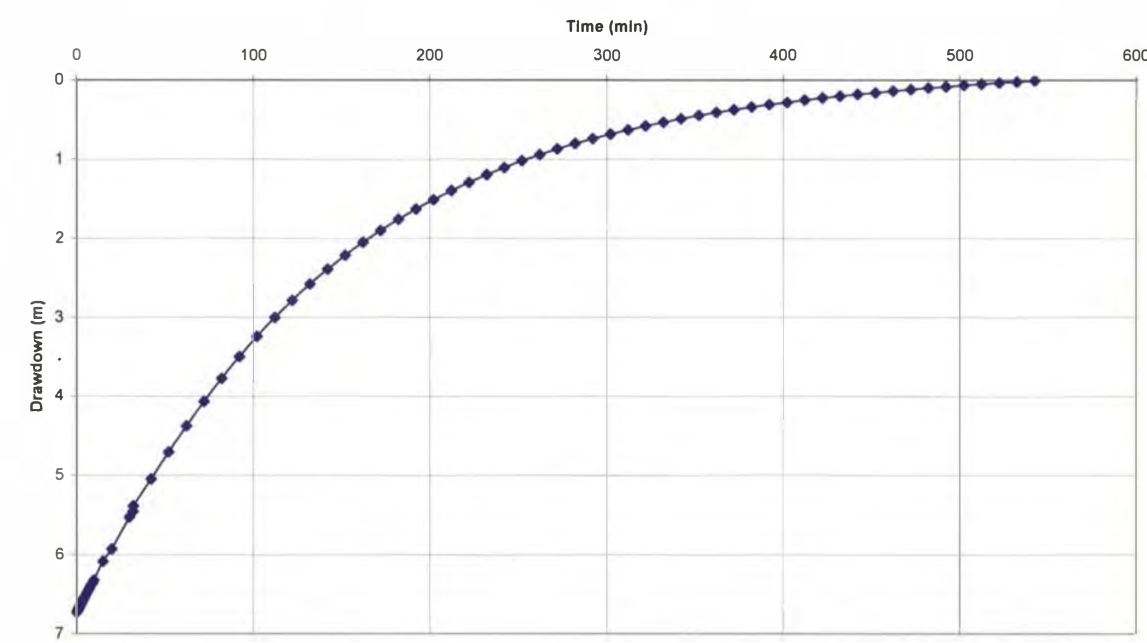
June 2010

Hvorslev Test: MW-05D

Date:	6/7/2010		H:	6.887	m
Conducted By:	AC, AR, XX		Ho:	0.16	m
Well Depth:	9.81	mbtoc	To_early:	144.8	min
Stick Up:	0.70	m	To_late:	124	min
Initial Water Level:	2.92	mbtoc	K_early:	4.42E-08	m/s
Recovery:	100	%	K_late:	5.16E-08	m/s
L:	3	m	K_avg:	4.79E-08	m/s
R:	0.075	m			
r:	0.025	m			

MW-05D Drawdown Curve (100% Recovery)



Hydrogeological Investigation for Alcona Capital Properties
Project No. E10-223
June 2010

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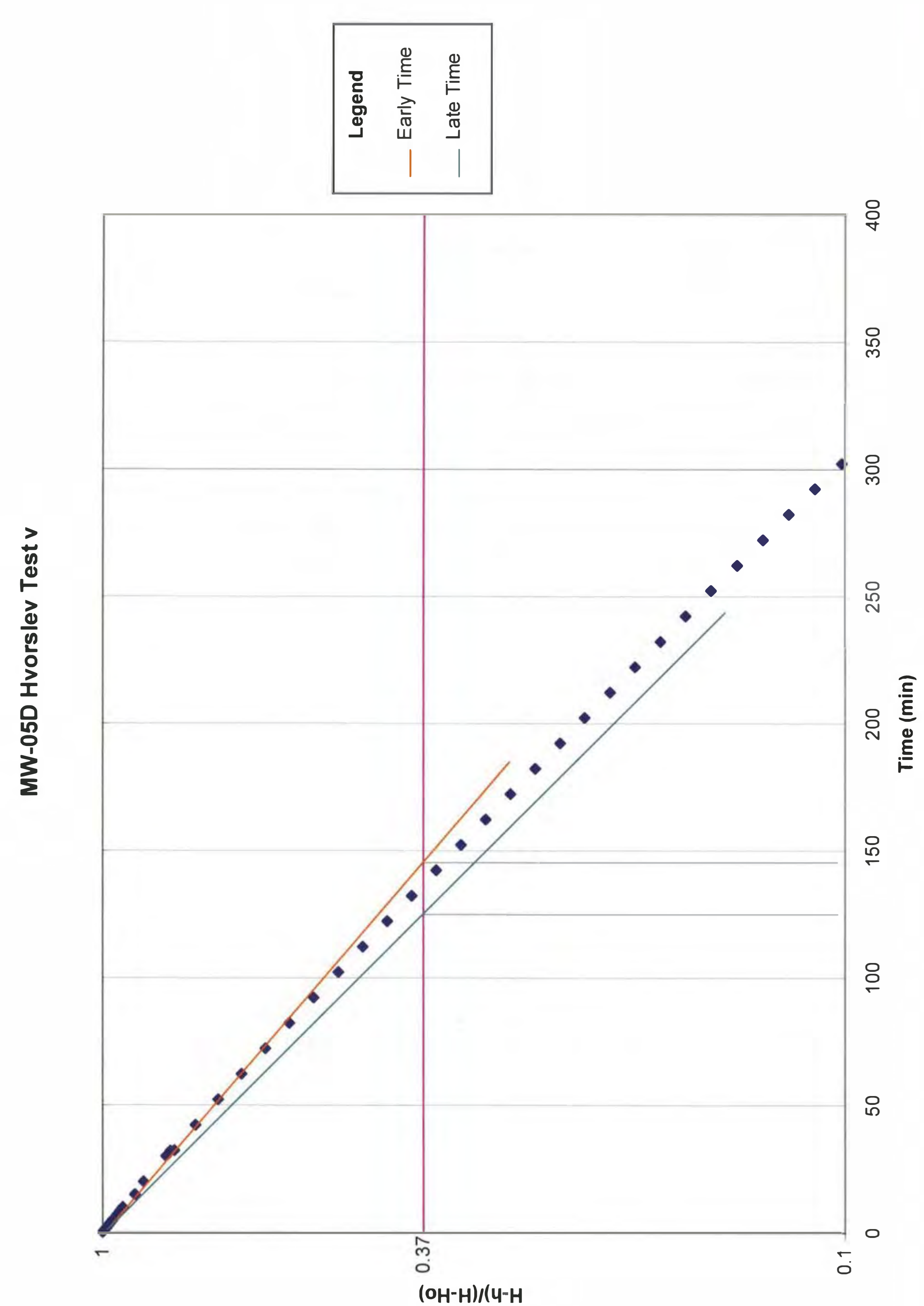

Hydrogeological Investigation for Alcona Capital Properties
Project No. E10-223
June 2010

APPENDIX D

Results of Water Quality Analysis

Hydrogeological Investigation for Alcona Capital Propertie
Project No. E10-223
December 2010

Your C.O.C. : 18329913, 183299-1

Attention: Tabitha Lee
COLE Engineering
70 Valleywood Dr.
Markham, ON
CANADA L3R 4T5

Report Date: 2010/06/07

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B068230
Received: 2010/05/28, 16:57

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Alkalinity	1	N/A	2010/06/03	CAM SOP-00448	SM 2320B
Alkalinity	1	N/A	2010/06/04	CAM SOP-00448	SM 2320B
Carbonate, Bicarbonate and Hydroxide	2	N/A	2010/06/05		
Chloride by Automated Colourimetry	2	N/A	2010/06/04	CAM SOP-00463	SM 4500 Cl E
Conductivity	1	N/A	2010/06/03	CAM SOP-00448	SM 2510
Conductivity	1	N/A	2010/06/04	CAM SOP-00448	SM 2510
Dissolved Organic Carbon (DOC)	2	N/A	2010/06/03	CAM SOP-00446	SM 5310 B
Hardness (calculated a CaCO3)	2	N/A	2010/06/07	CAM SOP 00102	SM 2340 B
Dissolved Metals by ICPMS	2	N/A	2010/06/04	CAM SOP-00447	EPA 6020
Ion Balance (% Difference)	2	N/A	2010/06/07		
Anion and Cation Sum	2	N/A	2010/06/07		
Ammonia-N	2	N/A	2010/06/04	CAM SOP-00441	US GS I-2522-90
Nitrate (NO3) and Nitrite (NO2) in Water (1)	2	N/A	2010/06/02	CAM SOP-00440	SM 4500 NO3I/NO2B
pH	1	N/A	2010/06/03	CAM SOP-00448	SM 4500H
pH	1	N/A	2010/06/04	CAM SOP-00448	SM 4500H
Orthophosphate	2	N/A	2010/06/04	CAM SOP-00461	SM 4500 P-F
Sat. pH and Langelier Index (@ 20C)	2	N/A	2010/06/07		
Sat. pH and Langelier Index (@ 4C)	2	N/A	2010/06/07		
Sulphate by Automated Colourimetry	2	N/A	2010/06/04	CAM SOP-00464	EPA 375.4
Total Di olved Solids (TDS calc)	2	N/A	2010/06/07		
Volatile Organic Compounds in Water	2	N/A	2010/06/04	CAM SOP-00226	EPA 8260 modified

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

../2

COLE Engineering

Maxxam Job #: B068230
Report Date: 2010/06/07

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

CHRISTINE MCLEAN, Project Manager
Email: christine.mclean@maxxamanalytics.com
Phone# (905) 817-5700

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required " ignatories", a per ection . 0.2 of ISO/IEC 1702 :2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

RESULTS OF ANALYSES OF WATER

Maxxam ID			GA3122		GA3123		
Sampling Date			2010/05/27		2010/05/27		
	Units	Criteria A	MW-01D	RDL	MW-04S	RDL	QC Batch
Calculated Parameters							
Anion Sum	me/L		6.63	N/A	6.72	N/A	2165182
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		173	1	294	1	216 79
Calculated TDS	mg/L		374	1	351	1	2165186
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	1	3	1	216 179
Cation Sum	me/L		6.30	N/A	6.91	N/A	216 182
Hardness (CaCO3)	mg/L		270	1	330	1	216 180
Ion Balance (% Difference)	%		2.5	N/A	1.35	N/A	2 6181
Langelier Index (@ 20C)	N/A		0.712		1.11		216 184
Langelier Index (@ 4C)	N/A		0.463		0.857		216518
Saturation pH (@ 20C)	N/A		7.40		6.95		216 184
Saturation pH (@ 4C)	N/A		7.65		7.20		216518
Inorganics							
Total Ammonia-N	mg/L		0.0	0.05	0.10	0.05	2168936
Conductivity	umho/cm		650	1	606	1	2169337
Dissolved Organic Carbon	mg/L		6.2	0.2	3.9	0.2	2169485
Orthophosphate (P)	mg/L		ND	0.01	ND	0.01	2169584
pH	pH		8.1		8.1		2169336
Dissolved Sulphate (SO4)	mg/L		85	1	21	1	2 69585
Alkalinity (Total as CaCO3)	mg/L		17	1	297	1	2 69310
Dissolved Chloride (Cl)	mg/L	**250**	39	1	12	1	2 69583
Nitrite (N)	mg/L	**1**	**2.3**	0.1	ND	0.01	2 66938
Nitrate (N)	mg/L	**10**	1	1	0.1	0.1	2 66938
Nitrate + Nitrite	mg/L		4	1	0.1	0.1	2 66938

N/A = Not Applicable
ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A: Ref. to Ontario Regulation 3/04 made under the Environmental Protection Act on May 2, 2004.
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition in coarse textured oils.
* = The sum of F and F2 must be less than 1000 ug/L
** = The sum of F3 and F4 must be less than 1000 ug/L

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B068230
Report Date: 20 0/06/07

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID			GA3122		GA3123		
Sampling Date			2010/05/27		2010/05/27		
	Units	Criteria A	MW-01D	RDL	MW-04S	RDL	QC Batch
Volatile Organics							
Acetone (2-Propanone)	ug/L	**3000**	350	30	ND	10	2165503
Benzene	ug/L	**5.0**	ND	0.3	0.1	0.1	2165503
Bromodichloromethane	ug/L	**5.0**	ND	0.3	ND	0.1	2165503
Bromoform	ug/L	**5.0**	ND	0.5	ND	0.2	2165503
Bromomethane	ug/L	**3.7**	ND	1	ND	0.5	2165503
Carbon Tetrachloride	ug/L	**5.0**	ND	0.3	ND	0.1	2165503
Chlorobenzene	ug/L	**30**	ND	0.3	ND	0.1	2165503
Chloroform	ug/L	**5.0**	ND	0.3	ND	0.1	2165503
Dibromochloromethane	ug/L	**5.0**	ND	0.5	ND	0.2	2165503
1,2-Dichlorobenzene	ug/L	**3.0**	ND	0.5	ND	0.2	2165503
1,3-Dichlorobenzene	ug/L	**630**	ND	0.5	ND	0.2	2165503
1,4-Dichlorobenzene	ug/L	**1.0**	ND	0.5	ND	0.2	2165503
1,1-Dichloroethane	ug/L	**70**	ND	0.3	ND	0.1	2165503
1,2-Dichloroethane	ug/L	**5.0**	ND	0.5	ND	0.2	2165503
1,1-Dichloroethylene	ug/L	**0.66**	ND	0.3	ND	0.1	2165503
cis-1,2-Dichloroethylene	ug/L	**70**	ND	0.3	ND	0.1	2165503
trans-1,2-Dichloroethylene	ug/L	**100**	ND	0.3	ND	0.1	2165503
1,2-Dichloropropane	ug/L	**5.0**	ND	0.3	ND	0.1	2165503
cis-1,3-Dichloropropene	ug/L	**1.4**	ND	0.5	ND	0.2	2165503
trans-1,3-Dichloropropene	ug/L		ND	0.5	ND	0.2	2165503
Ethylbenzene	ug/L	**2.4**	ND	0.3	ND	0.1	2165503
Ethylene Dibromide	ug/L	**1.0**	ND	0.5	ND	0.2	2165503
Methylene Chloride(Dichloromethane)	ug/L	**50**	ND	1	ND	0.5	2165503
Methyl Isobutyl Ketone	ug/L	**350**	ND	10	ND		2165503
Methyl Ethyl Ketone (2-Butanone)	ug/L	**350**	ND	10	ND		2165503
Methyl t-butyl ether (MTBE)	ug/L	**700**	ND	0.5	ND	0.2	2165503
Styrene	ug/L	**100**	ND	0.5	ND	0.2	2165503
1,1,1,2-Tetrachloroethane	ug/L	**5.0**	ND	0.3	ND	0.1	2165503
1,1,2,2-Tetrachloroethane	ug/L	**1.0**	ND	0.5	ND	0.2	2165503
Tetrachloroethylene	ug/L	**5.0**	ND	0.3	ND	0.1	2165503

ND = Not detected
RDL = Reportable Detection Limit s
QC Batch = Quality Control Batch s
Criteria A: Ref. to Ontario Regulation 1 3/04 made under the Environmental Protection Act on May12, 2004.
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition in coarse textured oils. s
* = The sum of F1 and F2 must be less than 1000 ug/L s
** = The sum of F3 and F4 must be less than 1000 ug/L

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Maxxam Job #: B068230
Report Date: 2010/06/07

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID			GA3122		GA3123		
Sampling Date			2010/05/27		2010/05/27		
	Units	Criteria A	MW-01D	RDL	MW-04S	RDL	QC Batch
Toluene	ug/L	**24**	0.6	0.5	ND	0.2	2165503
1,1,1-Trichloroethane	ug/L	**200**	ND	0.3	ND	0.1	2165503
1,1,2-Trichloroethane	ug/L	**5.0**	ND	0.5	ND	0.2	2165503
Trichloroethylene	ug/L	**50**	ND	0.3	ND	0.1	2165503
Vinyl Chloride	ug/L	**0.5**	ND	0.5	ND	0.2	2165503
p+m-Xylene	ug/L	**300**	ND	0.3	ND	0.1	2165503
o-Xylene	ug/L	**300**	ND	0.3	ND	0.1	2165503
Xylene (Total)	ug/L	**300**	ND	0.3	ND	0.1	2165503
Surrogate Recovery (%)							
4-Bromofluorobenzene	%		103		96		2165503
D4-1,2-Dichloroethane	%		106		106		2165503
D8-Toluene	%		95		95		2165503

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A: Ref. to Ontario Regulation 1 3/04 made under the Environmental Protection Act on May12, 2004.
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition in coarse textured soils.
* = The sum of F1 and F2 must be less than 1000 ug/L
** = The sum of F3 and F4 must be less than 1000 ug/L

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

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ivenr

COLE Engineering

Maxxam ob #: B068230
Report Date: 2010/06/07

Package 1	1.7°C

Each temperature i the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Sample GA3122-01: VOC Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit were adjusted accordingly.

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Maxxam Analytics

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COLE Engineering

Maxxam Job #: B068230
Report Date: 2010/06/07

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	ate	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2165503.	4-Bromofluorobenzene.	2010/06/03.	108.	70-.130.	109.	70-.130.	97.	%				
2165503.	D4-1,2-Dichloroethane.	2010/06/03.	102.	70-.130.	105.	70-.130.	107.	%				
2165503.	D8-Toluene.	2010/06/03.	97.	70-.130.	97.	70-.130.	94.	%				
2165503.	Acetone (2-Propanone)	2010/06/04.	81.	60-.140.	82.	60-.140.	ND, RDL=10.	ug/L	NC.	40.		
2165503.	Benzene.	2010/06/04.	116.	70-.130.	106.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Bromodichloromethane.	2010/06/04.	112.	70-.130.	102.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Bromoform.	2010/06/04.	118.	70-.130.	110.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	Bromomethane.	2010/06/04.	94.	60-.140.	85.	60-.140.	ND, RDL=0.5.	ug/L	NC.	40.		
2165503.	Carbon Tetrachloride.	2010/06/04.	130.	70-.130.	115.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Chlorobenzene.	2010/06/04.	107.	70-.130.	96.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Chloroform.	2010/06/04.	113.	70-.130.	103.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Dibromochloromethane.	2010/06/04.	109.	70-.130.	99.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	1,2-Dichlorobenzene.	2010/06/04.	104.	70-.130.	93.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	1,3-Dichlorobenzene.	2010/06/04.	106.	70-.130.	93.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	1,4-Dichlorobenzene.	2010/06/04.	111.	70-.130.	98.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	1,1-Dichloroethane.	2010/06/04.	109.	70-.130.	100.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	1,2-Dichloroethane.	2010/06/04.	109.	70-.130.	103.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	1,1-Dichloroethylene	2010/06/04.	110.	70-.130.	99.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	cis-1,2-Dichloroethylene	2010/06/04.	117.	70-.130.	107.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	trans-1,2-Dichloroethylene	2010/06/04.	118.	70-.130.	107.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	1,2-Dichloropropane	2010/06/04.	108.	70-.130.	99.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	cis-1,3-Dichloropropene	2010/06/04.	115.	70-.130.	105.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	trans-1,3-Dichloropropene	2010/06/04.	104.	70-.130.	94.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	Ethylbenzene	2010/06/04.	109.	70-.130.	97.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Ethylene Dibromide.	2010/06/04.	106.	70-.130.	99.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	Methylene Chloride (Dichloromethane)	2010/06/04.	121.	70-.130.	112.	70-.130.	ND, RDL=0.5.	ug/L	NC.	40.		
2165503.	Methyl Isobutyl Ketone.	2010/06/04.	94.	70-.130.	91.	70-.130.	ND, RDL=5.	ug/L	NC.	40.		
2165503.	Methyl Ethyl Ketone (2-Butanone)	2010/06/04.	88.	60-.140.	84.	60-.140.	ND, RDL=5.	ug/L	NC.	40.		
2165503.	Methyl t-butyl ether (MTBE)	2010/06/04.	113.	70-.130.	104.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	Styrene	2010/06/04.	116.	70-.130.	107.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	1,1,1,2-Tetrachloroethane.	2010/06/04.	109.	70-.130.	98.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	1,1,2,2-Tetrachloroethane.	2010/06/04.	97.	70-.130.	92.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	Tetrachloroethylene	2010/06/04.	111.	70-.130.	98.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Toluene.	2010/06/04.	106.	70-.130.	94.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	1,1,1-Trichloroethane.	2010/06/04.	117.	70-.130.	104.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	1,1,2-Trichloroethane.	2010/06/04.	98.	70-.130.	91.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	Trichloroethylene	2010/06/04.	118.	70-.130.	106.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	Vinyl Chloride.	2010/06/04.	106.	70-.130.	96.	70-.130.	ND, RDL=0.2.	ug/L	NC.	40.		
2165503.	p+m-Xylene	2010/06/04.	111.	70-.130.	99.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		
2165503.	o-Xylene	2010/06/04.	109.	70-.130.	99.	70-.130.	ND, RDL=0.1.	ug/L	NC.	40.		

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QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blan		RPD		QC Standard	
QC Batch	Parameter	ate	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2165503 .	Xylene (Total)	2010/06/04 .					ND, RDL=0.1 .	ug/L	NC .	40 .		
2166938 .	Nitrite (N)	2010/06/02 .	NC .	80 - 120 .	107 .	85 - 115 .	ND, RDL=0.01 .	mg/L	0.1 .	25 .		
2166938 .	Nitrate (N)	2010/06/02 .	91 .	80 - 120 .	105 .	85 - 115 .	ND, RDL=0.1 .	mg/L	NC .	25 .		
2166938 .	Nitrate + Nitrite .	2010/06/02 .					ND, RDL=0.1 .	mg/L	0.05 .	25 .		
2168936 .	Total Ammonia-N .	2010/06/04 .	103 .	80 - 120 .	101 .	85 - 115 .	ND, RDL=0.05 .	mg/L	NC .	25 .		
2169310 .	Alkalinity (Total as CaCO3)	2010/06/04 .					ND, RDL=1 .	mg/L	0.5 .	25 .	95 .	85 - 115 .
2169337 .	Conductivity	2010/06/04 .					ND, RDL=1 .	umho/cm .	0.2 .	25 .	101 .	85 - 115 .
2169485 .	Dissolved Organic Carbon .	2010/06/03 .	109 .	80 - 120 .	115 .	80 - 120 .	ND, RDL=0.2 .	mg/L	2.5 .	20 .		
2169583 .	Dissolved Chloride (Cl)	2010/06/04 .	104 .	75 - 125 .	106 .	80 - 120 .	ND, RDL=1 .	mg/L	1.6 .	20 .		
2169584 .	Orthophosphate (P)	2010/06/04 .	109 .	75 - 125 .	103 .	80 - 120 .	ND, RDL=0.01 .	mg/L	NC .	25 .		
2169585 .	Dissolved Sulphate (SO4)	2010/06/04 .	NC .	75 - 125 .	98 .	80 - 120 .	ND, RDL=1 .	mg/L	0.09 .	25 .		
2170439 .	Dissolved Aluminum (Al)	2010/06/04 .	102 .	80 - 120 .	103 .	90 - 110 .	ND, RDL=5 .	ug/L				
2170439 .	Dissolved Antimony (Sb)	2010/06/04 .	101 .	80 - 120 .	101 .	90 - 110 .	ND, RDL=0.5 .	ug/L				
2170439 .	Dissolved Arsenic (As)	2010/06/04 .	NC .	80 - 120 .	98 .	90 - 110 .	ND, RDL=1 .	ug/L	1.5 .	25 .		
2170439 .	Dissolved Barium (Ba)	2010/06/04 .	100 .	80 - 120 .	99 .	90 - 110 .	ND, RDL=5 .	ug/L				
2170439 .	Dissolved Beryllium (Be)	2010/06/04 .	104 .	80 - 120 .	105 .	90 - 110 .	ND, RDL=0.5 .	ug/L				
2170439 .	Dissolved Boron (B)	2010/06/04 .	101 .	80 - 120 .	101 .	90 - 110 .	ND, RDL=10 .	ug/L				
2170439 .	Dissolved Cadmium (Cd)	2010/06/04 .	102 .	80 - 120 .	102 .	90 - 110 .	ND, RDL=0.1 .	ug/L				
2170439 .	Dissolved Calcium (Ca)	2010/06/04 .	NC .	80 - 120 .	99 .	90 - 110 .	ND, RDL=200 .	ug/L	1.8 .	25 .		
2170439 .	Dissolved Chromium (Cr)	2010/06/04 .	100 .	80 - 120 .	101 .	90 - 110 .	ND, RDL=5 .	ug/L				
2170439 .	Dissolved Cobalt (Co)	2010/06/04 .	100 .	80 - 120 .	102 .	90 - 110 .	ND, RDL=0.5 .	ug/L				
2170439 .	Dissolved Copper (Cu)	2010/06/04 .	100 .	80 - 120 .	100 .	90 - 110 .	ND, RDL=1 .	ug/L				
2170439 .	Dissolved Iron (Fe)	2010/06/04 .	98 .	80 - 120 .	99 .	90 - 110 .	ND, RDL=100 .	ug/L				
2170439 .	Dissolved Lead (Pb)	2010/06/04 .	101 .	80 - 120 .	101 .	90 - 110 .	ND, RDL=0.5 .	ug/L				
2170439 .	Dissolved Magnesium (Mg)	2010/06/04 .	101 .	80 - 120 .	104 .	90 - 110 .	ND, RDL=50 .	ug/L	2.7 .	25 .		
2170439 .	Dissolved Manganese (Mn)	2010/06/04 .	102 .	80 - 120 .	103 .	90 - 110 .	ND, RDL=2 .	ug/L				
2170439 .	Dissolved Molybdenum (Mo)	2010/06/04 .	102 .	80 - 120 .	102 .	90 - 110 .	ND, RDL=1 .	ug/L				
2170439 .	Dissolved Nickel (Ni)	2010/06/04 .	100 .	80 - 120 .	101 .	90 - 110 .	ND, RDL=1 .	ug/L				
2170439 .	Dissolved Phosphorus (P)	2010/06/04 .	107 .	80 - 120 .	105 .	90 - 110 .	ND, RDL=100 .	ug/L				
2170439 .	Dissolved Potassium (K)	2010/06/04 .	99 .	80 - 120 .	100 .	90 - 110 .	ND, RDL=200 .	ug/L				
2170439 .	Dissolved Selenium (Se)	2010/06/04 .	101 .	80 - 120 .	103 .	90 - 110 .	ND, RDL=2 .	ug/L				
2170439 .	Dissolved Silicon (Si)	2010/06/04 .	102 .	80 - 120 .	103 .	90 - 110 .	ND, RDL=50 .	ug/L				
2170439 .	Dissolved Silver (Ag)	2010/06/04 .	98 .	80 - 120 .	98 .	90 - 110 .	ND, RDL=0.1 .	ug/L				
2170439 .	Dissolved Sodium (Na)	2010/06/04 .	100 .	80 - 120 .	101 .	90 - 110 .	ND, RDL=100 .	ug/L				
2170439 .	Dissolved Strontium (Sr)	2010/06/04 .	99 .	80 - 120 .	100 .	90 - 110 .	1, RDL=1 .	ug/L				
2170439 .	Dissolved Thallium (Tl)	2010/06/04 .	100 .	80 - 120 .	102 .	90 - 110 .	ND, RDL=0.05 .	ug/L				
2170439 .	Dissolved Titanium (Ti)	2010/06/04 .	97 .	80 - 120 .	100 .	90 - 110 .	ND, RDL=5 .	ug/L				
2170439 .	Dissolved Uranium (U)	2010/06/04 .	103 .	80 - 120 .	102 .	90 - 110 .	ND, RDL=0.1 .	ug/L				

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Validation Signature Page

Maxxam Job #: B068230

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

CRISTINA CARRIERE, Scientific Services

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC d7025:2005(E), signing the reportscFor Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics

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6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel (905) 817-5700 Toll-free 800-563-6266 Fax (905) 817-5779 www.maxxamanalytics.com

CHAIN OF CUSTODY

28-May-10 16:57
CHRISTINE MCLEAN
B068230
DKN ENV-930

Page of

Only:

BOTTLE ORDER #: S
183299

CHAIN OF CUSTODY #: S
C#183299-13-01

PROJECT MANAGER:

INVOICE INFORMATION:

Company Name: #24008 CMP Engineering
Contact Name: Tabitha Lee rk
Address: ~~400 Renfrew Dr., Suite 100~~ 70 Valleywood D
Markham ON L3R rk R6 rk
Phone: (416)987-6161 x365 Fax: (905)940-2064
Email:

REPORT INFORMATION (if differs from invoice):

Company Name S
Contact Name S
Address
Phone Fax
Email

PROJECT INFORMATION:

Quotation #
P.O. #
Project #
Project Name
Site #
Sampled By

REGULATORY CRITERIA

- MISA
- Reg. 153/04 S: PWQO; Table 1; ☒ Table 2; Table 3; Table 6; ☒ Residential/Parkland; Industrial/Commercial; Medium/Fine; ☒ Coarse
- Reg. 558
- Sewer Use: Sanitary; Storm; Combined
- Municipality: York
- Other (specify)
- Report Criteria on C of A?

SPECIAL INSTRUCTIONS S

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

ANALYSIS REQUESTED (Please be specific)

TURNAROUND TIME (TAT) REQUIRED:

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: Time Required:
Rush Confirmation Number: (call lab for #)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	Inorgs/Metals (DCAT)	VOC's	# of Bottles	Comments
1	S	MW-01D	27/05/2010		GW		✓	✓	✓	5	
2	S	MW-04S	27/05/2010		GW		✓	✓	✓	5	
3											
4											
5	S										
6											
7											
8											
9											
10											

*RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	# Jars Used and Not Submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Receipt	Custody Seal intact on Cooler?
			Asad Bhatti	2010/05/28	16:57		☐	10/4°C	☐ Yes ☐ No

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam S Yellow: Client S

Maxxam Analytics International Corporation o/a Maxxam Analytics

'10 MAY 28 16:57

Maxxam Analytics — Driven by Service and Science

Your C.O.C. #: 18329908, 183299-0 0

Attention: Tabitha Lee 0
COLE Engineering 0
70 Valleywood Dr. 0
Markham, ON 0
CANADA 0 L3R 4T5 0

Report Date: 2010/06/11

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B072911
Received: 2010/06/08, 08:16

Sample Matrix: Water 0
Samples Received: 1 0

Analyses	Quantity	Date 0 Extracted 0	Date 0 Analyzed	Laboratory Method 0	Method 0 Reference 0
Coliform/ E. coli, CFU/100mL 0	1 0	N/A 0	2010/06/08	CAM SOP-005v1 0	MOE E3407 0
Fecal coliform, (CFU/100mL) 0	1 0	N/A 0	2010/06/08	CAM SOP-00552 0	SM 9222D 0
Heterotrophic plate count, (CFU/mL) 0	1 0	N/A 0	2010/06/08	CAM SOP-00512 0	SM 9215 0
Nitrate (NO3) and Nitrite (NO2) in Water (1) 0	1 0	N/A 0	2010/06/10	CAM SOP-00440 0	SM 4500 NO3I/NO2B 0
Orthophosphate 0	1 0	N/A 0	2010/06/11	CAM SOP-00461 0	SM 4500 P-F 0

* RPDs calculated using raw data. 0The rounding of final results may result in the apparent difference. 0
* Results relate only to the items tested. 0

(10Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures. 0

Encryption Key 0

Please direct all questions regarding this Certificate of Analysis to your Project Manager. 0

CHRISTINE MCLEAN, Project Manager 0
Email: 0christine.mclean@maxxamanalytics.com 0
Phone# (905) 817-570 0

==
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Total cover pages: 1 0

Maxxam Analytics — Driven by Service and Science

COLE Engineering

Maxxam Job #: B072911
Report Date: 010/06/11

RESULTS OF ANALYSES OF WATER

Maxxam ID		GC6456		
Sampling Date		2010/06/07 018:30		
	Units L	**SAMPLE -LL**	**RDL L**	**QC Batch L**
Inorganics				
Orthophosphate (P)	mg/L	ND	0.01 0	2175836 0
Nitrite (N)	mg/L	ND	0.01 0	2174457
Nitrate (N)	mg/L	0.9	0.1 0	2174457
Nitrate + Nitrite	mg/L	0.9	0.1 0	2174457 0

MICROBIOLOGY (WATER)

Maxxam ID		GC6456		
Sampling Date		2010/06/07 018:30		
	Units L	**SAMPLE -1L**	**RDL L**	**QC Batch L**
Microbiological				
Fecal coliform 0	CFU/10 mL	0 0	N/A 0	2173317 0
Heterotrophic plate count 0	CFU/mL	0 0	N/A 0	2173206 0
Background	CFU/10 mL	0 0	N/A 0	2173168 0
Total Coliforms	CFU/10 mL	0 0	N/A 0	2173168 0
Escherichia coli 0	CFU/10 mL	0 0	N/A 0	2173168 0

N/A = Not Applicable
ND = Not detected 0
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch 0

Package 1	1.7°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
2173168	Background	2010/06/09							NC	N/A
2173168	Total Coliforms	2010/06/09							NC	N/A
2173168	Escherichia coli	2010/06/09							NC	N/A
2174457	Nitrite (N)	2010/06/10	108	80 - 120	109	85 - 115	ND, RDL=0.01	mg/L	NC	25
2174457	Nitrate (N)	2010/06/10	102	80 - 120	111	85 - 115	ND, RDL=0.1	mg/L	0.1	25
2174457	Nitrate + Nitrite	2010/06/10					ND, RDL=0.1	mg/L	0.1	25
2175836	Orthophosphate (P)	2010/06/11	107	75 - 125	102	80 - 120	0.01, RDL=0.01	mg/L	NC	25

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B072911

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

CRISTINA CARRIERE, Scientific Services

MARIA BONGOLAN, Team Leader

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Maxxam Analytics — Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel (905) 817-5700 Toll-free 800 563-6266 Fax (905) 817-5779 www.maxxamanalytics.com

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE INFORMATION:		REPORT INFORMATION (if differs from invoice):		PROJECT INFORMATION:		Laboratory Use Only:
Company Name	#24008 CMP Engineering	Company Name:		Quotation #:		MAXXAM JOB #:
Contact Name:	Tabitha Lee	Contact Name		P.O. #:		BOTTLE ORDER #: 183299
Address	~~100 Renfrew Dr., Suite 100~~ 70 VALLEYWOOD DR. Markham ON L3R ~~9R6~~ 4T5	Address:		Project #:		CHAIN OF CUSTODY #: C#183299-08-01
Phone:	(416)987-6161 x365 Fax (905)940-2064	Phone	Fax:	Project Name:		PROJECT MANAGER:
Email:		Email:		Site #:		
				Sampled By:		

REGULATORY CRITERIA: ☐ MISA Reg 153/04 ☐ PWQO ☐ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table 5 ☐ Residential/Parkland ☐ Industrial/Commercial ☐ Medium/Fine ☐ Coarse ☐ Reg 558 Sewer Use ☐ Sanitary ☐ Storm ☐ Combined Municipality ______ Other (specify) ODWS Report Criteria on C of A? ☐

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

SPECIAL INSTRUCTIONS

ANALYSIS REQUESTED (Please be specific)

8-Jun-10 08:16
CHRISTINE MCLEAN
B072911
AKP ENV-897

TURNAROUND TIME (TAT) REQUIRED:
PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.
Job Specific Rush TAT (if applies to entire submission)
Date Required: ______ Time Required ______
Rush Confirmation Number: ______ (call lab for #)

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water? (Y/N)	Metals Field Filtered? (Y/N)	General Inorg.	Microbial	# of Bottles	Comments
1	—	SAMPLE-1	JUNE 7, '10	6:30pm	GW	Y	-	X	X	2	
2											
3											
4											
5											
6											
7											
8											
9											
10											

'10 JUN 8 8:16

*RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	# Jars Used and Not Submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
Alexandra Chan Alexandra Chan	10/06/07	8:45pm	[illegible]	10/06/08	8:16		☐	2/2/1	☐ Yes ☐ No

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam Analytics — *Driven by Service and Science*

Your Project #: ELO-223 0
Site: 0 ALCONA 0
Your C.O.C. #: 0579382 0

Attention: Tabitha Lee 0
COLE Engineering 0
70 Valleywood Dr. 0
Markham, ON 0
CANADA 0 L3R 4T5 0

Report Date: 2010/06/17

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B074930
Received: 2010/06/10, 18:46

Sample Matrix: Water 0
Samples Received: 2 0

Analyses	Quantity	Date 0 Extracted 0	Date 0 Analyzed	Laboratory Method 0	Method 0 Reference 0
Coliform/ E. coli, CFU/100mL 0	2 0	N/A 0	2010/06/10	CAM SOP-00551 0	MOE E3407 0
Fecal coliform, 0CFU/100mL) 0	2 0	N/A 0	2010/06/10	CAM SOP-00552 0	SM 9222D 0
Heterotrophic plate count, (CFU/mL) 0	2 0	N/A 0	2010/06/10	CAM SOP-00512 0	SM 9215 0
Nitrate 0NO3) and Nitrite (NO2) in Water () 0	2 0	N/A 0	2010/06/15	CAM SOP-0 440 0	SM 4v NO3I/NO2B 0
Orthophosphate 0	**2 0**	**N/A 0**	**2010/06/17**	**CAM SOP-00461 0**	SM 4500 P-F 0

* RPDs calculated using raw data. 0The rounding of final results may result in the apparent difference. 0
* **Results relate only to the items tested.** 0

(10Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures. 0

Encryption Key 0

Please direct all questions regarding this Certificate of Analysis to your Project Manager. 0

CHRISTINE MCLEAN, 0Project 0Manager 0
Email: 0christine.mclean@maxxamanalytics.com 0
Phone# (905) 817-5700 0

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 0 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. 0For Service Group specific validation please refer to the Validation Signature Page. 0

Total cover pages: 1 0

Maxxam Analytics — *Driven by Service and Science*

Maxxam Job #: B074930
Report Date: 2010/06/17

COLE Engineering
Client Project #: ELO-223
Project name: ALCONA
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

Maxxam ID		GD5606 0	GD5607 0		
Sampling Date 0		2010/06/10 015:00 0	2010/06/10 03:35		
	Units	**SAMPLE 2**	**SAMPLE 3**	**RDL**	**QC Batch L**
Inorganics					
Orthophosphate (P)	mg/L	ND	0.01 0	.01	2178991 0
Nitrite (N)	mg/L	ND 0	ND 0	.01	2178427 0
Nitrate (N)	mg/L	1.6 0	1.6 0	.1	2178427 0
Nitrate0+ Nitrite	mg/L	1.6 0	1.6	.1	2178427

MICROBIOLOGY (WATER)

Maxxam ID		GD5606 0	GD5607 0		
Sampling Date		2010/06/10 015:00 0	2010/06/10 03:35		
	Units	**SAMPLE 2**	**SAMPLE 3**	**RDL**	**QC Batch**
Microbiological					
Fecal coliform 0	CFU/10 mL	0 0	6 0	N/A	2176148
Heterotrophic plate count 0	CFU/mL	1 0	470	N/A	2176147 0
Background	CFU/10 mL 0	0 0	>20 0	N/A	2176140 0
Total Coliforms	CFU/10 mL 0	0	>20	N/A	2176140 0
Escherichia coli 0	CFU/10 mL 0	0 0	6(1)	N/A 0	2176140 0

N/A = Not Applicable
ND = Not detected 0
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) - Values reported may be biased l0w due to overgrowth. 0

Maxxam Job #: B074930
Report Date: 010/06/1 7

COLE Engineering
Client Project #: ELO-223
Project name: ALCONA
Sampler Initials: AR

Package 1 0	10.0°C 0

Each temperature is the average of up to three cooler temperatures taken at receipt 0

GENERAL COMMENTS L

Maxxam Job #: B074930
Report Date: 01 0/06/17

COLE Engineering
Client Project #: ELO-223
Project name: ALCONA
Sampler Initials: AR

QUALITY ASSURANCE REPORT L

			Matrix Spike		Spiked Blank		Method Blank		D	
QC Batch	arameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
2176140 3	Background	2010/06/11 3							NC 3	N/A 3
2176140 3	Total Coliforms 3	2010/06/11 3							NC 3	N/A 3
2176140 3	Escherichia coli 3	2010/06/11 3							NC 3	N/A 3
2178427 3	Nitrite (N)	2010/06/15 3	110 3	80 3 120 3	108 3	85 - 115 3	ND,3RDL=0.01 3	mg/L	NC 3	25 3
2178427 3	Nitrate (N)	2010/06/15 3	108 3	80 - 120 3	109 3	85 - 115 3	ND 3RDL=0.1 3	mg/L	NC 3	25 3
2178427 3	Nitrate + Nitrite 3	2010/06/15 3					ND 3RDL=0.1 3	mg/L	NC 3	25 3
2178991 3	Orthophosphate (P)	2010/06/17 3	104 3	75 - 125 3	101 3	80 - 120 3	ND,3RDL=0.01 3	mg/L	NC 3	25 3

N/A = Not Applicable 3
RDL = Reportable Detection Limit 3
RPD = Relative Percent Difference 3
Matrix Spike: 3A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference. 3
Spiked Blank: 3A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery. 3
Method Blank: 3A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination. 3
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation. 3

Maxxam Analytics

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Validation Signature Page

Maxxam Job #: B074930

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

CRISTINA CARRIERE, Scientific Services

MARIA BONGOLAN, Team Leader

Maxima C. Hermanez

MAXIMA HERMANEZ, SENIOR ANALYST

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Maxxam Analytics inc 6740 Campobello Road, Mississauga, ON L5N 2L8 Phone: 905-817-5700 Fax: 905-817-5778

MICRO

CHAIN OF CUSTODY RECORD

Page 1 of 1

10-Jun-10 18:46
CHRISTINE MCLEAN
B074930
AKP ENV-977

INVOICE INFORMATION	
Company Name:	#2408 CMP Engineering
Contact Name:	Tabitha Lee
Address:	70 Valleywood Dr. Markham ON L3R4T5
Phone:	416-987-6161 (ext 365) Fax: 905-940-2064
Email:	

REPORT INFORMATION: Company Name: Contact Name: Address: Phone: Fax: Email:

PROJECT INFORMATION	
Quotation #:	—
P.O. #:	—
Project #:	E10-223
Project Name:	Alcona
Location:	
Sampled By:	AR / XX.

MAXXAM JOB NUMBER

CHAIN OF CUSTODY # 00579382

REGULATORY CRITERIA

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form.

☐ MISA Reg. 153 ☐ Table 1 ☐ Table 2 ☐ Table 3 Sewer Use ☐ Sanitary ☐ Storm ☒ Other ODWS specify Coarse medium

☐ PWQO ☐ Reg. 558

Reg. 153 ☐ 2004 ☐ 2011

Report Criteria on C of A? ☐

SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM.

ANALYSIS REQUESTED (Please be specific)

TURNAROUND TIME (TAT) REQUIRED

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS.

Regular (Standard) TAT: ☒ 5 to 7 Working Days

Rush TAT: Rush Confirmation #: (call Lab for #)

☐ 1 day ☐ 2 days ☐ 3 days

DATE Required:

TIME Required:

Please note that TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

	Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil, etc.)	Regulated Drinking Water? (Y / N)	Metals Field Filtered? (Y / N)	general/inorganic (nitrate, nitrite and phosphate)	microbial	Drinking Waterpackage (basic)	# of Cont.	COMMENTS / TAT COMMENTS
1	SAMPLE 2	06/10/2010	1500	GW	Y	—	X	X	X	2	
2	SAMPLE 3	06/10/2010	3:35PM	GW	Y	—	X	X	X	2	
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

'10 JUN 10 18:46

RELINQUISHED BY (Signature/Print)	RECEIVED BY (Signature/Print)	Date	Time
Xin Xu		06/10/2010	6:30PM
	NUWRAT	10/06/10	18:46

Laboratory Use Only: Temperature (°C) on Receipt: 10, 10, 10 °C — Condition of Sample on Receipt: ☐ OK ☐ S/F

*MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

ENVCOC-ONT-05/06 White: Maxxam Yellow: Mail Pink: Client

APPENDIX E

MOE Water Well Records

Hydrogeological Investigation for Alcona Capital Properties 0
Project No. E10-223 0
December 20100

Well Computer Print Out Data as of April 20 2010 © Queen's Printer, 2009 Page: il / 25

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR [3]s	CASING DIA [4]s	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 06(019)	17 1612998 4905439[W]	1962/11 1 4102	30 1	FR 0040 1	020 1/ 002 1/ 1:0	DO		5701053 1() BLUE CLAY 0040 1MSND 0048 1
INNISFIL TOWNSHIP CON 06(019)	17 1613114 4905443[W]	1971/10 1 3203	05 1	FR 0069 1	040 1/ 1 060 006 1/ 11:0	DO		5708514 1() PRDG 0047 1GREY CLAY 0067 1GREY CLAY SILT 0069 1GREY SAND 0070 1
INNISFIL TOWNSHIP CON 06(020)	17 1613684 4905623[W]	1972/06 1 3203	05 1	FR 0139 1	075 1/ 1 080 008 1/ 12:30	DO		5708932 1() BRWN LOAM 0002 1BRWN GRVL STNS 0019 1 BRWN CLAY GRVL 0026 1GREY CLAY 0045 1 GREY CLAY SAND STNS 0098 1GREY SAND CLAY 0128 1GREY CLAY GRVL 0139 1
INNISFIL TOWNSHIP CON 06(021)	17 1613852 4905718[W]	1959/12 1 1308	30 1	FR 0006 1	006 1/ / 1:0 1	PS		5701054 1() BRWN CLAY 0002 1BRWN MSND 0012 1BLUE CLAY MSND BLDR 0024 1
INNISFIL TOWNSHIP CON 06(021)	17 1613869 4905580[W] 1	1965/10 1 2514	06 1	FR 0144 1	068 1/ 1 085 010 1/ 11:30	DO		5701055 1() LOAM 0001 1BRWN CLAY MSND BLDR 0014 1 BLUE CLAY BLDR 0035 1MSND 0057 1MSND GRVL SILT 0110 1CLAY 0118 1GRVL MSND SILT 0143 1CSND 0144 1GRVL 0145 1
INNISFIL TOWNSHIP CON 06(022)	17 1614803 4905397[L]	1988/10 1 3903	06 112 1	FR 0175 1	019 1/ 1 087 250 1/ 124:0	MN	0175 20	5724252 1(26427) BRWN SAND GRVL LYRD 0020 1GREY CLAY STNS HARD 10046 1GREY CLAY DNSE 0076 1 GREY CLAY STNS HARD 10090 1GREY CLAY SOFT DNSE 0125 1GREY CLAY STNS HARD 1 0175 1GREY SAND GRVL LYRD 0195 1BRWN SAND CLAY LYRD 0198 1GREY CLAY STNS HARD 10213
INNISFIL TOWNSHIP CON 06(023)	17 1615380 4905592[L]	1990/02 1 4645	06 1	FR 0050 1	/ 1 040 008 1/ 12:30	DO	0046 04	5726783 1(72544) BRWN CLAY SILT 0010 1GREY CLAY SILT 0022 1GREY SILT CLAY SAND 0040 1BRWN SAND SILT 0050 1GREY CLAY SILT 0050 1
INNISFIL TOWNSHIP CON 06(023)	17 1615164 4906143[W]	1971/08 1 3203	05 1	FR 0175 1	030 1/ 1 180 004 1/ 12:0	DO	0192 03	5708266 1() PRDG 0021 1BRWN SAND GRVL 0026 1BLUE CLAY 0175 1GREY SAND SILT 0195 1
INNISFIL TOWNSHIP CON 06(023)	17 1615377 4905593[L]	2003/05 1 1467	05 1	FR 0158 1	005 1/ 1 118 006 1/ 12:30	DO	0158 04	5737825 1(250747) BRWN LOAM 0001 1BRWN CLAY SAND STNS 0018 1GREY CLAY 0119 1GREY SILT CLAY 0158 1GREY SAND GRVL 0161 1GREY CLAY 0162
INNISFIL TOWNSHIP CON 06(024)	17 1615764 4906343[W]	1970/07 1 3203	05 1	FR 0135 1	/ 1 060 005 1/ 11:0	DO	0157 03 1	5707405 1() BRWN LOAM 0001 1BRWN CLAY GRVL 0009 1 GREY CLAY GRVL 0018 1GREY CLAY 0046 1 GREY CLAY GRVL STNS 0088 1GREY CLAY 0134 1GREY SILT 0157 1MSND 0160 1
INNISFIL TOWNSHIP CON 07(006)	17 1615293 4907397[W]	1991/08 1 3413 1	24 130 1 30 1	FR 0030 1 FR 0055 1	015 1/ 1 036 1 / 1:0	DO		5728424 1(31988) BRWN CLAY HARD 10020 1GREY CLAY BLDR HARD 10030 1GREY MSND 0042 1GREY CLAY 0055 1GREY FSND 0056 1
INNISFIL TOWNSHIP CON 07(017)1	17 1612854 4906823[W] 1	1969/05 1 4608 1	30 1	FR 0012 1 FR 0027 1	012 1/ 1 022 1 / 11:0 1	DO 1		5706296 1() BRWN CLAY STNS 0018 1GREY CLAY STNS 0024 1GREY CSND 0028 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(017)1	17 16116191 4905755L 1	2001/06 1 4645 1	06 1	UK 0154 1	068 1/1 120 1 050 1/ 12:0 1	DO 1	0150 1 04 1	5736283 1(22548911 BLCK LOAM SOFT 0001 BRWN CLAY STNS HARD 10013 1GREY CLAY STNS HARD 10028 1 GREY CLAY SOFT 0134 BRWN SAND GRVL LOOS 0140 1BRWN SAND SILT LOOS 0154 1 RED SAND CLAY LYRD 0165 1
INNISFIL TOWNSHIP CON 07(017)1	17 16120141 4905223W 1	1984/07 1 3413 1	30 1B0 1 24 1	FR 0040 1	015 1/1 040 1 005 1/ 13:0 1	DO		5720102 1(11 LOAM 0002 BRWN CLAY 0018 BLUE CLAY 0040 CSND 0046 BLUE CLAY 0061 1
INNISFIL TOWNSHIP CON 07(01711	17 16117961 4905411W 1	1964/11 1 4102 1	30 1	FR 0031 1	008 1/1 004 1/ 1:0 1	DO		5701086 1(11 BRWN CLAY STNS 0016 1BLUE CLAY 0031 1 GRVL MSND 0035 1
INNISFIL TOWNSHIP CON 07(01811	17 16124641 4905523W 1	1971/07 1 2514 1	06 1	FR 0075 1	021 1/1 076 1 003 1/ 13:0 1	DO		5708283 1(11 GREY CLAY MSND GRVL 0020 1GREY CLAY 0126 1
INNISFIL TOWNSHIP CON 07(018)1	17 16118791 4906458W 1	1964/01 1 2514 1	06 105 1	FR 0450 1	090 1/1 200 1 015 1/ 13:0 1	ST DO	0450 1 03 1	5701088 1(11 PRDG 0018 MSND GRVL 0023 1FSND CLAY 0048 1GREY FSND 0275 1BLUE CLAY MSND 0280 1BLUE CLAY 0450 1CSND GRVL 0453 1
INNISFIL TOWNSHIP CON 07(018)1	17 16125071 4906699W 1	2002/10 1 2513 1	06 1	FR 0167 1	074 1/1 095 1 020 1/ 11:0 1	DO 1	0166 1 03 1	5737336 (246420) 1 BRWN SAND SILT BLDR 0031 1GREY SILT CLAY BLDR 0077 1GREY SILT CSND CLAY 0164 1BLCK FSND CSND 0169 1
INNISFIL TOWNSHIP CON 07(018)1	17 16122061 4905945L 1	1993/08 1 3413 1	30 124 1 30 1	FR 0052 1	018 1/1 050 1 050 1/ 12:0 1	DO 1		5730089 1(116628) 1 BRWN LOAM 0005 BRWN CLAY 0015 1GREY CLAY 0030 1GREY SAND 0035 1GREY CLAY 0052 1GREY SAND 0053 1GREY CLAY 0055 1
INNISFIL TOWNSHIP CON 07(01811	17 16117591 4906453W 1	1964/10 1 4608 1	30 1	FR 0032 1	015 1/1 002 1/ 1:0 1	DO 1		5701089 1(11 LOAM 0002 1 RED CLAY 0012 MSND CLAY 0032 1
INNISFIL TOWNSHIP CON 07(018)1	17 16119841 4906499W 1	1950/06 1 3422 1	05 1					5701087 1(11 GREY CLAY 0140 1GREY MSND 0141 1
INNISFIL TOWNSHIP CON 07(019)1	17 16121131 4906538W 1	1987/04 1 4919 1	30 1B0 1	UK 0020 1 UK 0030 1	010 1/1 035 1 / 11:0 1	DO 1		5722100 (0497911 BRWN LOAM HARD 0001 BRWN CLAY SAND LYRD 0037 1
INNISFIL TOWNSHIP CON 07(019)1	17 16123791 4905339W 1	1990/10 1 1851 1	07 1	FR 0125 1	042 1/1 130 1 015 1/ 13:0 1	DO	0145 1 06 1	5727923 1(910001 1 BLCK LOAM 0002 BRWN SAND CLAY 0018 1 BRWN SAND SLTY 0060 1GREY CLAY 0125 1 GREY SAND WBRG 0141 1
INNISFIL TOWNSHIP CON 07(019)1	17 16127831 4906137L 1	2000/08 1 2514 1	06 1	FR 0115 1	008 1/1 105 1 004 1/ 13:0 1	DO	0110 1 05 1	5735500 1(2172801 1 BRWN SAND CLAY 0035 GREY SAND GRVL CLAY 0105 1GREY SAND GRVL 0115 1
INNISFIL TOWNSHIP CON 07(020) 1	17 16135641 4906423W 1	1984/12 1 3413 1	30 130 1	FR 0025 1	010 1/1 034 1 003 1/ 14:0 1	DO		5719499 1(11 LOAM 0002 1SAND 0012 1BRWN CLAY 0039 1
INNISFIL TOWNSHIP CON 07(02011	17 16133661 4906331L 1	1986/06 1 3030 1	36 1	FR 0010 1 FR 0004 1 FR 0017 1	004 1/1 / 1:0 1	DO		5720817 1(11 BRWN LOAM 0001 BRWN CLAY SNDY 0004 1 BRWN GRVL 0005 1GREY SILT 0017 1GREY SAND 0019 1GREY SILT 0023 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR [3]s	CASING DIA [4]s	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(02011	17 16129641 4906863W 1	1975/05 1 3203 1	05 1	FR 0042 1	020 1/ 030 1 003 1/ 1:0 1	DO	0048 1 04 1	5713442 (11 BRWN SAND CLAY 0042 BRWN SAND 0050 1 GREY SAND 0051 1
INNISFIL TOWNSHIP CON 07(020)1	17 16136141 4906143W 1	1973/09 1 3203 1	05 1	FR 0284 1	050 1/ 080 1 005 1/ 3:45 1	DO 1	0287 1 03 1	5710334 1(11 GREY CLAY SAND 0284 1GREY SAND 0290 1
INNISFIL TOWNSHIP CON 07(0201	17 16136641 4906123W 1	1973/04 1 4608 1	30 1	FR 0048 1	030 1/ 040 1 003 1/ :0 1	DO 1		5709993 1(11 BRWN CLAY 0005 1GREY CLAY GRVL 0048 1
INNISFIL TOWNSHIP CON 07(0201	17 16136041 4905723W 1	1969/08 1 3109 1	30 1	FR 0017 1	012 1/ / :0 1	DO		5707029 1(11 LOAM 0002 1CLAY MSND 0017 MSND 0020 1
INNISFIL TOWNSHIP CON 07(020)1	17 16137281 4905776W 1	1967/09 1 4608 1	30 1	FR 0010 1	004 1/ 002 1/ :0 1	DO		5701090 1(11 MSND 0002 1GRVL 0015 1
INNISFIL TOWNSHIP CON 07(0201	17 16136141 4906073W 1	1977/09 1 3203 1	05 1	FR 0318 1	075 1/ 153 1 005 1/ 5:0 1	DO		5715112 1(11 BLCK LOAM 0002 1BRWN SAND CLAY 0018 1 GREY CLAY 0063 1GREY CLAY SILT LYRD 0152 1GREY CLAY 0289 1GREY CLAY GRVL 0291 1GREY GRVL PCKD 0318 1GREY GRVL 0321 1GREY CLAY GRVL PCKD 0321 1
INNISFIL TOWNSHIP CON 07(0201	17 16133641 4906332L 1	2000/07 1 2514 1	06 1	SU 0480 1	128 1/1 475 1 001 1/ 4:0 1	DO 1		5735499 1(217242) 1 BRWN CLAY SAND LOAM 0002 1BRWN CLAY SAND GRVL 0035 1GREY CLAY SAND FSND 0120 1GREY CLAY GRVL SAND 0437 1GREY LMSN 0480 1
INNISFIL TOWNSHIP CON 07(0201	17 16133631 4906332L 1	2001/10 1 2513 1	06 1	FR 0116 1	030 1/ 080 1 020 1/ 1:0 1	DO 1	0112 1 04 1	5736436 1(224034) 1 LOAM 0001 1BRWN CLAY SAND 0003 1GREY CLAY 0049 1GREY SILT GRVL 0057 1GREY CLAY FSND 0092 1GREY CLAY 0112 1GREY SAND CLAY 0116 1
INNISFIL TOWNSHIP CON 07(0201	17 16133661 4906331L 1	1991/12 1 6386 1	06 1	FR 0034 1	018 1/ 030 1 007 1/ 2:1 1	DO 1	0034 1 04 1	5728876 1(872721 BRWN LOAM STNS LOOS 0007 1BRWN SAND SILT LOOS 0018 1BRWN SAND SILT DNSE 0034 1BRWN SAND WBRG LOAM 0038 1GREY SILT SAND LYRD 0048 1
INNISFIL TOWNSHIP CON 07(0201	17 16133661 4906331L 1	1991/07 1 2513 1	06 1	FR 0074 1	051 1/ 078 1 007 1/ 1:0 1	DO	0078 1 07 1	5728296 1(89187) 1 BRWN GRVL SAND FILL 0003 1BRWN CLAY 0013 1GREY CLAY SILT SAND 0074 1GREY MSND SILT 0085 1GREY CLAY 0085 1
INNISFIL TOWNSHIP CON 07(0201	17 16133901 4905783W 1	1988/05 1 4919 1	30 1	UK 0010 1 UK 0030 1	008 / 026 1 / 1:0 1	DO		5723315 1(25662) 1 BRWN LOAM HARD 10001 BRWN CLAY HARD 1 0020 1GREY CLAY HARD 10028 1
INNISFIL TOWNSHIP CON 07(0211	17 16139241 4905876W 1	1994/10 1 2513 1	06 1	FR 0104 1	031 1/ 106 1 010 1/ 1:30 1	DO	0108 1 07 1	5731242 1(14038911 BLCK LOAM 0001 1BRWN CLAY SAND 0016 1 GREY CLAY 0027 1GREY SAND SILT CLAY 0064 1GREY SAND SILT 0086 1GREY CLAY 0104 1GREY FSND CMTD 0116 1
INNISFIL TOWNSHIP CON 07(0211	17 16139611 4906527L 1	1989/03 1 3660 1	05 1	FR 0052 1	007 1/ 050 1 008 1/ 1:0 1	DO	0061 1 04 1	5724679 1(3815511 BRWN CLAY SAND 0010 1GREY CLAY SOFT 0033 1GREY CLAY HARD 10052 GREY FSND WBRG 0067 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(021)1	17 1613636 1 4907048W 1	2007/09 1 6809 1	02 1					7051649 1(Z63429) 1A059622 1 BRWN LOAM 0001 1GREY SILT SNDY 0020 1 GREY SAND GRVL WBRG 0025 1
INNISFIL TOWNSHIP CON 07(02211	17 1614214 1 4907313W 1	1970/06 1 4102 1	30 1	FR 0065 1	018 1/1 /1:0 1	DO		5707333 1(1 1 BRWN CLAY 0016 1BLUE CLAY STNS 0053 1 FSND 0061 1BLUE CLAY 0065 1
INNISFIL TOWNSHIP CON 07(0221	17 1614545 1 4906722L 1	1993/09 1 6386 1	05 106 1 05 1	FR 0029 1	008 1/1 004 1/ 12:1 1	DO	0035 1 04 1	5730217 1(116039) BRWN SAND SILT LOOS 0007 1GREY CLAY DNSE 0019 1GREY BLDR STNS DNSE 0023 1 GREY CLAY STNS DNSE 0029 1GREY SAND SILT LYRD 0039 1GREY CLAY FCRD LYRD 0043 1
INNISFIL TOWNSHIP CON 07(023)1	17 1615172 1 4907451W 1	1967/07 1 3903 1	30 1	FR 0015 1	010 1/1 003 1/1:0 1	DO 1		5701091 1(1 1 BRWN CLAY 0015 1BLUE CLAY MSND 0024 1 BLUE CLAY MSND GRVL 0030 1
INNISFIL TOWNSHIP CON 07(0231	17 1615122 1 4906915L 1	1989/08 1 2514 1	06 105 1 04 1	FR 0140 1	/1 008 1/13:0 1	DO 1	0040 1 07 1	5725659 1(59352) GREY CLAY 0010 1BLCK MUCK CLAY SNDY 0053 1GREY GRVL 0065 1GREY CLAY 0119 1 GREY FSND VERY 0140 1GREY SAND 0147 1
INNISFIL TOWNSHIP CON 07(023)1	17 1615114 1 4907523W 1	1971/10 1 3909 1	05 1	UK 0206 1	050 1/1 200 1 003 1/12:0 1	NUs		5708544 1(1 1 PRDG 0020 1BRWN CLAY STNS HPAN 0086 1 GREY CLAY SAND SILT 0142 1BLUE CLAY 0206 1BLCK FSND 0210 1
INNISFIL TOWNSHIP CON 07(02311	17 1615122 1 4906915L 1	1998/03 1 4645 1	06 1	FR 0070 1	004 1/1 060 1 020 1/12:0 1	DO 1	0066 1 04 1	5733368 1(187109) BLCK LOAM SOFT 0001 1BRWN CLAY SILT SOFT 0010 1GREY CLAY STNS LYRD 0018 1 GREY CLAY DNSE 0040 1GREY CLAY STNS HPAN 0055 1GREY SILT FSND LOOS 0070 1
INNISFIL TOWNSHIP CON 07(023)1	17 1615122 1 4906915L 1	1993/07 1 1413 1	06 1	FR 0070 1	/1 020 1 015 1/11:0 1	DO	0073 1 04 1	5730055 1(115495) 1 BRWN SAND CLAY SOFT 0012 1GREY CLAY STNS HARD 10035 1GREY FSND 0036 1GREY CLAY DNSE 0070 1BLCK FSND 0077 1
INNISFIL TOWNSHIP CON 07(0231	17 1614814 1 4907473W 1	1971/06 1 3413 1	30 1	FR 0025 1	025 1/1 025 1 010 1/ 12:0 1	DO		5708120 1(1 1 BRWN CLAY 0020 1GRVL 0025 1BLUE CLAY 0030 1
INNISFIL TOWNSHIP CON 07(02411	17 1615334 1 4907507W 1	1959/10 1 4102 1	30 1	FR 0020 1	010 1/1 002 1/1:0 1	DO		5701092 1(1 1 BLUE CLAY 0020 1MSND 0025 1
INNISFIL TOWNSHIP CON 07(02411	17 1615367 1 4907363W 1	1962/10 1 4102 1	30 1	FR 0020 1	010 1/1 002 1/1:0 1	DO		5701093 1(1 1 BLUE CLAY 0020 1MSND 0022 1
INNISFIL TOWNSHIP CON 07(02411	17 1615351 1 4907441W 1	1965/06 1 4102 1	30 1	FR 0014 1	005 1/1 004 1/1:0 1	DO		5701094 1(1 1 BRWN CLAY 0014 1CSND 0020 1
INNISFIL TOWNSHIP CON 07(02411	17 1615343 1 4907487W 1	1965/06 1 4102 1	30 1	FR 0013 1	006 1/1 004 1/1:0 1	DO		5701095 1(1 1 BRWN CLAY 0013 1CSND 0019 1
INNISFIL TOWNSHIP CON 07(02411	17 1615349 1 4907420W 1	1965/10 1 4102 1	30 1	FR 0012 1	012 1/1 007 1/1:0 1	ST		5701096 1(1 1 BLUE CLAY 0012 1CSND 0016 1BLUE CLAY 0030 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR [3]s	CASING DIA [4]s	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(024)1	17 1615865 1 4907258W 1	1967/03 1 4608 1	30 1	FR 0022 1	022 1/1 002 1/1:0 1	DO 1		5701097 1() 1 BRWN CLAY STNS 0018 1GREY CLAY STNS 0032 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615476 1 4907606W 1	1965/10 1 4102 1	30 1	FR 0008 1	005 1/1 004 1/1:0 1	DO		5701098 1() 1 BRWN CLAY STNS 0008 1GRVL 0011 1BLUE CLAY 0016 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615611 1 4907608W 1	1967/08 1 4608 1	30 1	UK 0013 1	003 1/1 002 1/1:0 1	DO		5701099 1() 1 BLCK MUCK 0002 1MSND 0015 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615661 1 4907651W 1	1967/11 1 4102 1	30 1	FR 0005 1	003 1/1 003 1/1:0 1	DO		5701100 1() 1 CSND 0005 1BLUE CLAY 0020 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615777 1 4907209W 1	1967/03 1 4608 1	30 1	FR 0037 1	025 1/1 002 1/1:0 1	DO 1		5701115 1() 1 BRWN CLAY STNS 0016 GREY CLAY STNS 0037 1MSND 0038 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615314 1 4907373W 1	1968/03 1 4102 1	30 1	FR 0016 1	014 1/1 004 1/1:0 1	DO		5705628 1() 1 BRWN CLAY 0004 1BLUE CLAY 0016 1CSND 0025 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615354 1 4907373W 1	1968/03 1 4102 1	30 1	FR 0018 1	014 1/1 004 1/1:0 1	DO		5705629 1() BRWN CLAY 0004 1BLUE CLAY 0018 1CSND 0025 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615464 1 4907423W 1	1969/08 1 4102 1	30 1	FR 0008 1	002 1/1 /1:0 1	DO		5705632 1() BRWN CLAY 0004 1BLUE CLAY 0008 1CSND 0018 1
INNISFIL TOWNSHIP CON 07(024)1	17 1614914 1 4907193W 1	1969/02 1 2514 1	06 105 1	FR 0381 1 FR 0360 1 FR 0340 1	064 1/1 300 1 008 1/12:30 1	DO		5706147 1() 1 LOAM 0001 1BLUE CLAY MSND 0253 1BLUE CLAY 0256 1MSND GRVL 0330 1GREY LMSN 0383 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615774 1 4907583W 1	1970/07 1 4102 1	30 1	FR 0007 1	007 1/1 /1:0 1	DO		5706537 1() BRWN CLAY STNS 0012 1BRWN CLAY 0020 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615764 1 4907463W 1	1969/07 1 3715 1	30 1	FR 0012 1	005 1/1 003 1/1:0 1	DO 1		5706568 1() 1 BRWN CLAY STNS 0008 1BLUE CLAY 0020 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615534 1 4907623W 1	1969/12 1 4608 1	30 1	FR 0008 1	008 1/1 015 1 004 1/11:0 1	DO 1		5706878 1() 1 BRWN CLAY STNS 0010 1GREY GRVL 0016 1 GREY CLAY 0017 1GREY MSND 0018 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615514 1 4907733W 1	1970/04 1 3203 1	05 1	FR 0051 1	010 1/1 044 1 005 1/11:0 1	DO	0052 1 03 1 0055 1 03 1	5707140 1() 1 BLCK LOAM 0002 1BRWN FILL 0004 1BRWN GRVL CLAY 0022 1BRWN CLAY GRVL 0026 1 BRWN CLAY STNS 0049 1BRWN SILT CLAY 0051 1BRWN FSND 0058 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615704 1 4907633W 1	1970/10 1 4608 1	30 1	FR 0018 1 FR 0008 1	007 1/1 016 1 005 1/11:0 1	DO 1		5707580 1() 1 BRWN CLAY 0012 1GREY MSND 0018 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615834 1 4907733W 1	1972/07 1 4102 1	30 1	FR 0012 1	012 1/1 /1:0 1	DO		5709337 1() 1 BLCK MUCK 0003 1BRWN CSND STNS 0012 1 BRWN MSND 0024 1BRWN CLAY 0027 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(024)1	17 1615814 1 4907473W 1	1972/07 1 3203 1	05 1	FR 0179 1	040 1/ 1 120 1 010 1/ 12:15 1	DO 1	0181 1 03 1	5709539 1() 1 YLLW CLAY SAND 0008 1GREY CLAY SAND 0014 1GREY SILT CLAY 0025 1GREY CLAY GRVL 0048 1GREY SILT SAND CLAY 0052 1 GREY CLAY 0085 1GREY SILT SAND CLAY 0110 1GREY CLAY 0160 1GREY SILT SAND CLAY 0168 1BLCK SAND CLAY 0179 1BLCK SAND 0185 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615884 1 4907503W 1	1972/07 1 3203 1	05 1	FR 0051 1 FR 0079 1	010 1/ 1 040 1 008 1/ 11:45 1	DO 1	0091 1 03 1	5709540 1() 1 BLCK LOAM 0001 1YLLW SAND CLAY 0010 1 GREY CLAY SAND 0025 1GREY CLAY GRVL 0051 1GREY SILT CLAY 0062 1GREY CLAY 0079 1GREY SILT 0085 1GREY FSND 0095 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615659 1 4907486W 1	1973/11 1 4102 1	30 1	FR 0015 1	009 1/ 1 / 1:0 1	DO 1		5710606 1() 1 LOAM 0001 1BRWN CLAY BLDR 0018 1BLUE CLAY 0025 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615700 1 4907353W 1	1973/08 1 4102 1	30 1 24 1	FR 0017 1	017 1/ 1 / 1:0 1	DO		5710612 1() 1 LOAM 0002 1BRWN CLAY STNS SAND 0017 1 BRWN SAND BLDR 0020 1BLUE CLAY STNS 0037 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615678 1 4907387W 1	1973/12 1 4102 1	06 1	FR 0066 1	022 1/ 1 066 1 002 1/ 1:0 1	DO 1	0067 1 03 1	5710615 1() 1 LOAM 0001 1BRWN FSND STNS 0025 1BRWN CLAY 0050 1BLUE CLAY 0066 1BRWN CSND 0070 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615694 1 4907320W 1	1974/01 1 3203 1	05 1	FR 0025 1	004 1/ 1 038 1 005 1/ 11:10 1	DO 1	0040 1 03 1	5710847 1() 1 BRWN SAND CLAY 0025 1GREY FSND 0038 1 GREY FSND CLAY 0043 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615673 1 4907439W 1	1973/12 1 4102 1	06 1	FR 0066 1	022 1/ 1 060 1 002 1/ 1:0 1	DO	0067 1 03 1	5710879 1() 1 LOAM 0001 1BRWN SAND STNS 0025 1BRWN CLAY 0050 1BLUE CLAY SAND 0066 1BRWN CSND 0070 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615314 1 4907573W 1	1973/07 1 3203 1	05 1	FR 0079 1	005 1/ 1 055 1 005 1/ 11:30 1	DO	0086 1 03 1	5710347 1() 1 BRWN LOAM GRVL 0003 1BRWN CLAY GRVL 0011 1BLUE CLAY 0030 1BRWN SAND CLAY 0045 1BLUE CLAY 0058 1BRWN SAND 0062 1 BLUE CLAY 0079 1GREY SAND 0089 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615822 1 4907481W 1	1973/08 1 4102 1	30 1	FR 0012 1	008 1/ 1 / 1:0 1	DO 1		5710611 1() 1 LOAM 0002 1BRWN CLAY STNS SAND 0015 1 BRWN CSND 0022 1BRWN FSND GRVL 0024 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615694 1 4907303W 1	1974/08 1 4102 1	05 1	FR 0087 1	011 1/ 1 030 1 007 1/ 11:0 1	DO 1	0093 1 05 1	5711949 1() 1 LOAM 0002 1BRWN CLAY BLDR 0017 1BRWN CLAY STNS PCKD 0066 1GREY SILT 0087 1 GREY FSND 0098 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615314 1 4907523W 1	1978/06 1 3742 1	30 1	FR 0025 1	006 1/ 1 020 1 004 1/ 14:0 1	DO 1		5715316 1() 1 CLAY SAND 0020 1CSND 0030 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615664 1 4907373W 1	1974/09 1 4102 1	05 1	FR 0060 1	011 1/ 1 030 1 006 1/ 11:0 1	DO 1	0067 1 04 1	5711948 1() 1 LOAM 0003 1BRWN CLAY BLDR 0018 1BRWN CLAY STNS PORS 0056 1GREY FSND LOOS 0070 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(024)1	17 1615714 1 4907573W 1	1975/09 1 1204 1	05 1	SU 0046 1	008 1/ 1 041 1 004 1/ 11:45 1	DO	0049 1 03 1	5712529 1() 1 PRDG 0015 1GREY CLAY SAND 0046 1GREY FSND 0053 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615694 1 4907573W 1	1975/10 1 1204 1	05 1	SU 0050 1	008 1/ 1 037 1 003 1/ 11:30 1	DO	0050 1 03 1	5712615 1() 1 FILL 0003 1BRWN CLAY FSND SOFT 0014 1 GREY CLAY SAND 0050 1GREY FSND SILT 0055 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615414 1 4907323W 1	1978/06 1 3742 1	30 1	FR 0035 1	012 1/ 1 030 1 004 1/ 14:0 1	DO		5715315 1() 1 BRWN CLAY 0014 1BLUE CLAY 0035 1SAND 0042 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615814 1 4907383W 1	1976/03 1 3742 1	30 1	FR 0015 1	016 1/ 1 020 1 / 1:0 1	DO		5713806 1() 1 FSND 0015 1BLUE CLAY 0032 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615664 1 4907673W 1	1976/06 1 3742 1	30 1	FR 0006 1	004 1/ 1 017 1 005 1/ 14:0 1	DO 1		5713808 1() 1 SAND 0006 1CLAY 0015 1BLUE SAND 0023 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615634 1 4907723W 1	1976/04 1 3203 1	05 1	FR 0042 1	005 1/ 1 034 1 005 1/ 12:0 1	DO 1	0047 1 05 1	5714176 1() 1 PRDG 0020 1GREY SAND STNS CLAY 0029 1 GREY CLAY 0042 1GREY SAND 0052 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615664 1 4907373W 1	1977/06 1 3203 1	05 1	FR 0020 1	018 1/ 1 023 1 006 1/ 11:0 1	DO 1		5715100 1() 1 PRDG 0020 1BRWN SAND 0038 1BRWN CLAY GRVL 0038 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615564 1 4907523W 1	1978/11 1 3669 1	30 1	FR 0006 1	001 1/ 1 002 1 / 1:0 1	DO 1		5716489 1() 1 BLCK LOAM 0002 1BRWN SAND 0006 1BRWN CLAY STNS 0021 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615764 1 4907373W 1	1982/10 1 3203 1	05 1	FR 0047 1	004 1/ 1 042 1 005 1/ 11:30 1	DO	0051 1 03 1	5718509 1() 1 BLCK LOAM 0001 1BRWN CLAY 0016 1GREY CLAY 0047 1GREY SILT 0049 1GREY SAND 0054 1GREY CLAY SAND 0056 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615564 1 4907573W 1	1983/06 1 3413 1	30 1	FR 0030 1	010 1/ 1 025 1 004 1/ 14:0 1	DO		5719027 1() 1 BLUE CLAY 0030 1BLUE FSND 0036 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615514 1 4907623W 1	1983/06 1 3413 1	30 1 30 1	FR 0065 1	012 1/ 1 054 1 004 1/ 14:0 1	DO		5719030 1() 1 BRWN CLAY 0001 1BLUE CLAY 0068 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615564 1 4907573W 1	1978/11 1 3669 1	30 1	FR 0006 1	001 1/ 1 002 1 / 1:0 1	DO 1		5716490 1() 1 BLCK LOAM 0002 1BRWN SAND 0006 1BRWN CLAY STNS 0019 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615614 1 4907423W 1	1981/10 1 3109 1	30 1 21 1	FR 0014 1	004 1/ 1 / 1:0 1	DO		5717781 1() 1 LOAM 0001 1BRWN CLAY STNY 0011 1CSND 0016 1BLUE CLAY STNY 0031 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615464 1 4907273W 1	1982/09 1 3109 1	30 1	FR 0024 1	010 1/ 1 / 16:0 1	DO		5718318 1() 1 LOAM 0001 1BRWN CLAY STNY 0018 1BLUE CLAY STNY 0024 1CSND 0025 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615514 1 4907373W 1	1982/11 1 2514 1	06 1	FR 0037 1	002 1/ 1 046 1 016 1/ 11:0 1	DO	0051 1 03 1	5718441 1() 1 YLLW SAND FILL 0001 1BRWN GRVL 0005 1 GREY CLAY 0024 1GREY SILT GRVL 0037 1 GREY FSND VERY 0054 1
INNISFIL TOWNSHIP CON 07(024)1	17 1615564 1 4907573W 1	1983/06 1 3413 1	30 1 21 1	FR 0095 1	050 1/ 1 050 1 004 1/ 14:0 1	DO 1		5719031 1() 1 BRWN CLAY 0001 1BLUE CLAY 0095 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(02411	17 1615614 1 4907673W 1	1983/05 1 3203 1	05 1	FR 0079 1	008 1/1 042 1 008 1/ 11:30 1	DO 1	0084 1 06 1	5719215 1(1 1 FILL 0005 1BLCK LOAM 0016 1GREY CLAY SOFT 0026 1GREY CLAY 0077 1GREY SILT 0079 1GREY FSND 0090 1GREY CLAY 0090 1
INNISFIL TOWNSHIP CON 07(0241 1	17 1615614 1 4907373W 1	1984/10 1 1467 1	05 1	FR 0050 1	009 1/1 048 1 003 1/ 12:0 1	DO	0053 1 04 1	5719588 1(1 1 BRWN FILL 0002 1GREY CLAY STNS SAND 0050 1GREY FSND SLTY 0058 1GREY CLAY SAND 0058 1
INNISFIL TOWNSHIP CON 07(0241 1	17 1615695 1 4907111L 1	1987/02 1 3903 1	06 105 1	FR 0230 1	004 1/1 057 1 250 1/ 124:0 1		0210 1 20 1	5721587 1(1 1 BRWN LOAM STNS LOOS 0001 1GREY CLAY GRVL LYRD 0030 1GREY CLAY DNSE 0100 1 GREY CLAY SILT LYRD 0120 1GREY CLAY DNSE 0130 1GREY CLAY SILT LYRD 0160 1 GREY CLAY STNS HARD 10191 1BRWN CSND STNS LOOS 0230 1GREY CLAY SAND LYRD 0233 1GREY CLAY STNS HARD 10237 1
INNISFIL TOWNSHIP CON 07(02411	17 1615695 1 4907111L 1	1990/02 1 3660 1	05 1	FR 0077 1	010 1/1 070 1 008 1/ 11:0 1	DO	0080 1 06 1	5726180 1(581731 BRWN CLAY 0021 1GREY CLAY GRVL HARD 1 0046 1GREY SILT 0068 1GREY FSND CLAY 0077 1GREY FSND 0086 1
INNISFIL TOWNSHIP CON 07(0241 1	17 1615695 1 4907111L 1	1990/12 1 4919 1	30 1	UK 0030 1	020 1/1 040 1 010 1/ 11:0 1	DO		5727639 1(772201 BRWN LOAM HARD 10001 1BRWN CLAY HARD 1 0030 1GREY SAND LOOS 0046 1
INNISFIL TOWNSHIP CON 07(0241 1	17 1615695 1 4907111L 1	1990/11 1 6386 1		FR 0198 1 FR 0032 1 FR 0095 1 FR 0182 1	030 1/1 080 1 030 1/ 17:0 1	COs	0199 1 03 1	5727672 1(872441 BRWN SAND SILT DNSE 0007 1BLUE SILT STNS PCKD 0017 1BLUE SAND SILT SOFT 0041 1BLUE SAND SILT LYRD 0095 1BLUE SAND WBRG SOFT 0101 1BLUE CLAY SILT LYRD 0182 1BLCK SAND SILT SOFT 0188 1 GREY CLAY SAND SOFT 0198 1GREY SAND GRVL LOOS 0201 1
INNISFIL TOWNSHIP CON 07(02411	17 1615695 1 4907111L 1	1991/10 1 3413 1	06 1	FR 0170 1 FR 0202 1	035 1/1 200 1 018 1/ 114:0 1	COs		5728766 1(32000) 1 BLCK LOAM 0001 1BRWN CLAY SAND 0060 1 BRWN CLAY HARD 10077 1BRWN CLAY SOFT 0098 1BLUE CLAY 0170 1BLUE SAND SLTY 0192 1BLUE CLAY 0202 1CGVL 0206 1BLUE CLAY 0213 1
INNISFIL TOWNSHIP CON 07(0241 1	17 1615692 1 4907111W 1	1991/12 1 6386 1	06 105 1	FR 0107 1	003 1/1 003 1/ 14:30 1	DO 1	0107 1 03 1	5728877 1(872451 BRWN SAND STNS DNSE 0018 1BLUE CLAY LYRD 0027 1BLUE CLAY STNS LYRD 0038 1 BRWN BLDR STNS PCKD 0053 1BLUE CLAY GRVL LYRD 0068 1GREY CLAY GRVL LOOS 0070 1GREY CLAY STNS DNSE 0107 1GREY SILT SAND PCKD 0110 1
INNISFIL TOWNSHIP CON 07(0241 1	17 1615692 1 4907111L 1	2001/01 1 2801 1				NUs		5735830 1(2257111
INNISFIL TOWNSHIP CON 07(0241 1	17 1615692 1 4907111L 1	2001/01 1 2801 1				NUs		5735832 1(225712) 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]s	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 07(0241 1	17 1615692 1 4907111L 1	2001/01 1 2801 1				NUs		5735831 1(225713) 1
INNISFIL TOWNSHIP CON 07(024) 1	17 1615695 1 4907111L 1	2001/01 1 2801 1				NUs		5735833 1(2257101
INNISFIL TOWNSHIP CON 07(02511	17 1615882 1 4907462W 1	1974/11 1 4102 1	30 1	FR 0012 1	012 1/1 /1:0 1	DO		5710577 1() 1 LOAM 0001 1BRWN CLAY STNS 0012 1BLUE CLAY 0027 1
INNISFIL TOWNSHIP CON 07(02511	17 1615388 1 4907354W 1	1991/12 1 6386 1		FR 0063 1	021 1/1 040 1 007 1/ 12:0 1	DO 1	0064 1 04 1	5728879 1(87270) 1 BRWN LOAM STNS LOOS 0001 1BRWN CLAY SILT DNSE 0023 1BRWN BLDR SILT DNSE 0026 BRWN GRVL SILT DNSE 0034 1BRWN BLDR SILT DNSE 0043 1GREY CLAY SILT DNSE 0058 1GREY SAND WBRG LOOS 0063 1 BRWN SAND WBRG LOOS 0068 1BRWN SAND SILT DNSE 0072 1
INNISFIL TOWNSHIP CON 08(0051 1	17 1615830 1 4908249W 1	1990/01 1 3660 1	05 1	FR 0036 1	002 1/1 030 1 005 1/ 11:0 1	DO	0035 1 05 1	5726181 1(5816811 BLCK LOAM 0002 1BRWN CLAY GRVL BLDR 0009 1GREY CLAY GRVL SOFT 0025 1GREY CLAY HARD 10036 1GREY FSND WBRG 0044 1
INNISFIL TOWNSHIP CON 08(010) 1	17 1615372 1 4907779W 1	1992/06 1 3413 1	06 1	FR 0067 1 FR 0025 1 FR 0051 1 FR 0224 1	061 1/1 084 1 015 1/ 12:0 1	COs	0227 1 03 1	5729442 1(1166081 BRWN CSND 0025 1GREY CLAY 0051 1BRWN GRVL CSND 0061 1GREY CLAY STNS FGRD 0067 1GREY FSND 0095 1GREY CLAY 0207 1 GREY CLAY SAND LYRD 0224 1BRWN GRVL CSND 0232 1
INNISFIL TOWNSHIP CON 08(01511	17 1615886 1 4906736W 1	1987/11 1 3030 1	36 1	FR 0003 1	003 1/1 /1:0 1	DO 1		5722798 1(1795311 BRWN LOAM 0001 1BRWN SAND 0004 1BRWN SAND GRVL 0006 1GREY FSND 0018 1
INNISFIL TOWNSHIP CON 08(01711	17 1611582 1 4906516W 1	2005/03 1 3413 1	06 1		001 1/1 105 1 005 1/ 112:0 1	DO 1	0134 1 04 1	5739620 1(Z2401911A023462 1 BRWN CLAY 0009 1BRWN SAND 0027 1BLUE SAND 0090 1BLUE CLAY 0130 1BRWN SAND 0138 1
INNISFIL TOWNSHIP CON 08(017) 1	17 1611664 1 4906492W 1	1967/04 1 3109 1	30 1	FR 0024 1	014 1/1 002 1/ 1:0 1	DO 1		5701143 1(1 1 LOAM 0002 1BRWN CLAY 0012 1BLUE CLAY STNS 0024 1MSND 0025 1BLUE CLAY STNS 0031 1
INNISFIL TOWNSHIP CON 08(017) 1	17 1611607 1 4906548W 1	1972/10 1 3203 1	05 1	FR 0045 1	015 1/1 045 1 003 1/ 11:10 1	DO	0050 1 03 1	5709535 1(1 1 BLCK LOAM 0001 1YLLW SAND 0018 1GREY SAND 0025 1GREY CLAY 0045 1GREY FSND 0050 1GREY SAND 0053 1
INNISFIL TOWNSHIP CON 08(017) 1	17 1611334 1 4907643W 1	1969/09 1 1350 1	06 1	FR 0193 1	014 1/1 019 1 025 1/ 14:15 1	DO		5706824 1(1 1 BRWN MSND 0014 1BRWN MSND SILT 0027 1 YLLW CLAY 0031 1GREY MSND SILT 0054 1 BLUE CLAY 0132 1GREY SILT 0140 1BLUE CLAY 0193 1GRVL 0194 1
INNISFIL TOWNSHIP CON 08(017) 1	17 1611362 1 4907128L 1	1999/01 1 3413 1	06 1	FR 0135 1	121 1/1 130 1 020 1/ 11:0 1	DO	0151 1 04 1	5734050 1(19592811 BRWN SAND 0010 1GREY CLAY 0025 1GREY SAND SILT 0085 1GREY CLAY STNS STNS 0135 1

TOWNSHIP CONCESSION (LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]s	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 08(018)1	17 611814 1 4907623W 1	1978/09 1 3109 1	30 124 1	FR 0014 1	010 1/1 020 1 / 112:0 1	DO		5715620 1() 1 LOAM 0002 1BRWN CLAY SNDY 0016 1BLUE CLAY STNY 0036 1
INNISFIL TOWNSHIP CON 08(018)1	17 1611914 1 4906623W 1	1977/10 1 3413 1	30 1	FR 0028 1	006 1/1 020 1 004 1/ 14:0 1	DO		5715053 1() BRWN CLAY 0006 1BLUE CLAY 0028 1CSND 0030 1
INNISFIL TOWNSHIP CON 08(018)1	17 1611639 1 4907890W 1	1961/12 1 2514 1	06 1	FR 0064 1	034 1/1 045 1 015 1/ 12:30 1	ST DO 1		5701144 1() 1 PRDG 0034 1BLUE CLAY MSND 0063 1GRVL 0064 1
INNISFIL TOWNSHIP CON 08(019)1	17 1612639 1 4906963W 1	1971/11 1 2514 1	06 1	FR 0079 1	021 1/1 067 1 010 1/ 12:0 1	DO 1 ST		5708641 1() 1 PRDG 0040 1GREY CLAY 0074 1GREY SAND SILT 0079 1YLLW GRVL 0080 1
INNISFIL TOWNSHIP CON 08(019)1	17 1612864 1 4906923W 1	1968/04 1 4608 1	30 1	FR 0020 1	008 1/1 / 1:0 1	DO 1		5705591 1() 1 LOAM 0002 1BRWN CLAY MSND STNS 0028 1
INNISFIL TOWNSHIP CON 08(019)1	17 612154 1 4908083W 1	1968/06 1 3109 1	30 1	FR 0025 1	009 1/1 / 1:0 1	DO		5705463 1() LOAM 0002 1BRWN CLAY 0014 1BLUE CLAY MSND 0032 1
INNISFIL TOWNSHIP CON 08(019)1	17 612693 1 4906850W 1	1965/08 1 3109 1	30 1	FR 0029 1	014 1/1 002 1/ 1:0 1	DO		5701146 1() LOAM 0002 1CLAY 0009 1CLAY STNS 0028 1 MSND 0029 1CLAY 0036 1
INNISFIL TOWNSHIP CON 08(019)1	17 1612648 1 4906970W 1	1964/12 1 3109 1	30 1	FR 0047 1	042 1/1 002 1/ 1:0 1	ST DO 1		5701145 1() LOAM 0001 1CLAY STNS 0046 1MSND 0048 1 CLAY 0057 1
INNISFIL TOWNSHIP CON 08(019)1	17 1612522 1 4907516L 1	1989/12 1 3656 1	06 1	FR 0053 1	008 1/1 044 1 009 1/ 17:0 1	DO 1	0055 1 03 1	5726142 1(39285) 1 BLCK MUCK SOFT 0012 1GREY CLAY SOFT 0049 GREY SILT SAND LYRD 0053 1SAND 0058 1
INNISFIL TOWNSHIP CON 08(019)1	17 1612764 1 4907053W 1	1968/04 1 4608 1	30 1	FR 0020 1	008 1/1 / 1:0 1	DO		5705592 1() LOAM 0001 1BRWN CLAY MSND STNS 0028 1
INNISFIL TOWNSHIP CON 08(019)1	17 1612522 1 4907516L 1	1992/08 1 1467 1	05 1	SU 0106 1	066 1/1 072 1 006 1/ 12:30 1	DO	0107 1 04 1	5729752 1(91248) 1 BRWN SAND CLAY GRVL 0019 1GREY SAND GRVL CLAY 0093 1GREY CLAY 0106 1BRWN SAND 0111 1GREY CLAY 0111 1
INNISFIL TOWNSHIP CON 08(019)1	17 612604 1 4907043W 1	1975/11 1 2514 1	06 1	FR 0090 1	022 1/1 095 1 014 1/ 12:0 1	DO	0092 1 08 1	5713143 1() 1 BRWN GRVL FILL 0001 1BRWN CLAY SAND GRVL 0029 1GREY CLAY SAND SILT 0080 1 GREY SILT SAND 0092 1GREY MSND CSND SILT 0101 1
INNISFIL TOWNSHIP CON 08(020)1	17 613318 1 4907054W 1	1963/09 1 4102 1	30 1	FR 0008 1	006 1/1 004 1/ 1:0 1	DO		5701147 1() 1 BRWN CLAY 0008 1CSND 0018 1
INNISFIL TOWNSHIP CON 08(020)1	17 1615860 1 4908387W 1	1987/08 1 3413 1	30 130 1	FR 0058 1	005 1/1 045 1 025 1/ 12:0 1	DO		5722351 1(17229) 1 BRWN CLAY 0018 1BLUE CLAY 0058 1GREY FSND 0060 1
INNISFIL TOWNSHIP CON 08(020)1	17 613428 1 4907110W 1	1965/09 1 4102 1	30 1	FR 0011 1	006 1/1 004 1/ 1:0 1	DO 1		5701148 1() BRWN CLAY 0011 1GRVL 0015 1BLUE CLAY 0025 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 08(02011	17 613108 1 4907713L 1	1999/01 1 3660 1	06 1			NU		5734071 1(165409) 1 GREY CLAY SAND 0090 1GREY CLAY 0130 1 GREY SAND CLAY 0160 1GREY SILT CLAY 0170 1GREY SILT SAND GRVL 0190 1GREY CLAY 0225 1
INNISFIL TOWNSHIP CON 08(02111	17 613695 1 4907911L 1	1990/05 1 3203 1	05 1	FR 0101 1	030 1/ 079 1 008 1/ 1:30 1	DO	0104 1 03 1	5727855 1(43646) 1 BRWN CLAY 0016 1GREY CLAY WBRG 0028 1 GREY CLAY DRY 0101 1GREY SAND 0107 1
INNISFIL TOWNSHIP CON 08(02111	17 1613507 1 4908078W 1	1960/12 1 5420 1	34 1	FR 0046 1	014 1/ 005 1/ :0 1	DO 1 ST		5701149 1() 1 LOAM 0001 1YLLW CLAY 0006 1BLUE CLAY 0046 1BLUE MSND 0048 1
INNISFIL TOWNSHIP CON 08(021) 1	17 613695 1 4907911L 1	1986/12 1 3413 1	30 130 1 24 1	FR 0006 1 FR 0030 1	006 1/ 025 1 025 1/ 2:0 1	DO		5722355 1(17227) BRWN SAND 0008 1BLUE CLAY 0030 1GREY SAND 0036 1
INNISFIL TOWNSHIP CON 08(02111	17 1613386 1 4908192W 1	1963/09 1 2514 1	06 1					5701150 1() 1 LOAM 0001 1BLUE CLAY MSND 0115 1MSND GRVL 0116 1BLUE CLAY 0336 1
INNISFIL TOWNSHIP CON 08(02111	17 613602 1 4907418W 1	1991/12 1 2514 1	06 105 1	FR 0063 1	020 1/ 075 1 018 1/ 1:30 1	DO	0076 1 06 1	5728706 1(108638) 1 BLCK LOAM 0001 1BRWN SAND CLAY 0063 1 BRWN SAND GRVL 0082 1
INNISFIL TOWNSHIP CON 08(02111	17 613925 1 4907389W 1	2004/07 1 2514 1				DO		5739140 1(Z15731) 1A015670 1 PRDG 0026 1
INNISFIL TOWNSHIP CON 08(022) 1	17 1614273 1 4907376W 1	1959/04 1 2514 1	06 1					5701151 1() PRDG 0024 1BLUE CLAY 0039 1
INNISFIL TOWNSHIP CON 08(022) 1	17 1614188 1 4907396W 1	1967/07 1 4608 1	30 1	FR 0015 1	015 1/ 002 1/ :0 1	DO		5701152 1() LOAM 0001 1BRWN CLAY 0010 1GREY CLAY 0030 1
INNISFIL TOWNSHIP CON 08(022) 1	17 1614114 1 4907373W 1	1971/11 1 3203 1	05 1	FR 0072 1	025 1/ 035 1 010 1/ 1:0 1	DO 1	0077 1 03 1	5708521 1() 1 LOAM 0001 1BRWN CLAY SAND 0025 1GREY CLAY SAND 0031 1GREY CLAY 0072 1GREY SAND 0080 1
INNISFIL TOWNSHIP CON 08(022) 1	17 1614094 1 4907373W 1	1972/06 1 1350 1	06 1	FR 0076 1	017 1/ 027 1 010 1/ 3:30 1	DO 1	0076 1 02 1	5708848 1() BRWN CLAY 0004 1BRWN CLAY BLDR 0015 1 BRWN SAND CLAY 0026 1GREY CLAY GRVL 0042 1GREY CLAY 0076 1BRWN SAND 0078 1
INNISFIL TOWNSHIP CON 08(02211	17 1614527 1 4907661W 1	1991/05 1 2514 1						5728010 1(904831 1 BRWN FILL 0002 1BRWN CLAY 0012 1GRVL 0015 1GREY CLAY GRVL STNS 0040 1SAND GRVL 0045 1GREY CLAY LYRD SAND 0130 1 GREY CLAY 0295 1GREY CLAY STNS 0315 1 BRWN LMSN 0330 1
INNISFIL TOWNSHIP CON 08(02211	17 614275 1 4908109L 1	1991/02 1 2514 1	08 1	FR 0049 1	010 1/ 028 1 100 1/ 26:0 1	MN S	0049 1 08 1	5727974 1(90476) BRWN CLAY 0006 1GREY CLAY STKY 0049 1 GREY SAND GRVL 0059 1GREY CLAY 0135 1 GREY CLAY FSND 0198 1GREY FSND 0203 1 GREY CLAY 0210 1GREY CLAY FSND 0235 1 GREY CLAY 0263 1HPAN 0270 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]S CNTR S	CASING DIA [4]	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 08(022)1	17 1614275 1 4908109L 1	1991/03 1 2514 1	08 1	FR 0045 1	006 1/ 1 041 1 100 1/ 126:0 1	MN 1	0046 1 12 1	5727978 1(90478) 1 BRWN CLAY 0008 BRWN CLAY 0045 GREY SAND CLAY 0058 GREY CLAY LYRD FSND 0165 1
INNISFIL TOWNSHIP CON 08(022)1	17 1614275 1 4908109L 1	1991/01 1 2514 1	06 1	FR 0150 1	007 1/ 1 150 1 011 1/ 115:0 1	MNS	0150 1 15 1	5727975 1(904751 1 BLCK LOAM 0001 BRWN CLAY 0008 BRWN SAND CLAY 0035 BRWN SAND 0045 GREY CLAY FSND 0150 GREY FSND VERY 0165 1
INNISFIL TOWNSHIP CON 08(022)1	17 1614275 1 4908109L 1	1991/01 1 2514 1	06 1					5727977 1(90474) 1 BLCK LOAM 0001 BRWN CLAY 0008 BRWN SAND CLAY 0035 BRWN SAND 0045 GREY CLAY FSND 0150 GREY FSND VERY 0165 1 GREY CLAY 0220 1
INNISFIL TOWNSHIP CON 08(02211	17 1614275 1 4908109L 1	1991/10 1 2514 1	08 1	FR 0061 1	016 1/ 1 044 1 096 1/ 124:0 1	PS	0049 1 12 1	5729235 1(1086351 1 BRWN CLAY TILL SAND 0018 GREY CLAY 0049 GREY SAND MGRD 0061 1
INNISFIL TOWNSHIP CON 08(022)1	17 1614272 1 4908109L 1	2000/11 1 2513 1	06 1	FR 0092 1	017 1/ 1 083 1 008 1/ 11:0 1	DO 1	0087 1 05 1	5735724 1(224005) 1 YLLW SNDS CLAY 0008 GREY CLAY SILT GRVL 0087 GREY FSND VERY 0092 1
INNISFIL TOWNSHIP CON 08(022)1	17 1614214 1 4907523W 1	1979/04 1 3203 1	05 1	FR 0072 1 FR 0087 1	005 1/ 1 070 1 008 1/ 12:0 1	DO	0091 1 05 1	5716066 1(11 BRWN SAND GRVL 0018 GREY CLAY 0039 1 GREY SILT SAND 0042 GREY CLAY SILT 0072 GREY FSND 0078 GREY CLAY 0087 1 GREY FSND 0096 1
INNISFIL TOWNSHIP CON 08(022)1	17 1614664 1 4907523W 1	1983/11 1 3203 1	05 1	FR 0072 1	010 1/ 1 068 1 006 1/ 11:0 1	DO	0082 1 03 1	5719220 1(11 PRDG 0037 GREY SILT 0041 GREY CLAY 0069 GREY CLAY SILT 0072 GREY SAND 0085 1
INNISFIL TOWNSHIP CON 08(022)1	17 1613964 1 4908673W 1	1985/07 1 4816 1	05 1		050 1/ 1 010 1/ 1:0 1	DO	0109 1 04 1	5720028 1(11 BRWN SAND 0015 GREY CLAY SLTY 0065 1 GREY CLAY DNSE 0103 FSND 0108 MSND 0113 1
INNISFIL TOWNSHIP CON 08(02211	17 1614064 1 4908673W 1	1984/10 1 3203 1	05 1	FR 0101 1	060 1/ 1 071 1 010 1/ 11:30 1	DO	0104 1 03 1	5720311 1(11 PRDG 0035 GREY CLAY 0101 GREY SAND 0107 GREY CLAY 0107 1
INNISFIL TOWNSHIP CON 08(022)1	17 1613964 1 4908673W 1	1984/10 1 3203 1	05 1	FR 0097 1	058 / 1 069 1 010 1/ 1:0 1	DO 1	0101 1 03 1	5720316 1(11 LOAM 0001 BRWN CLAY SAND 0016 GREY CLAY 0097 GREY SAND 0104 1
INNISFIL TOWNSHIP CON 08(022)1	17 1615852 1 4908416W 1	1986/12 1 3413 1	30 130 1	FR 0058 1	005 1/ 1 045 1 025 1/ 12:0 1	DO 1		5722354 1(172301 1 BRWN CLAY 0018 BLUE CLAY 0058 GREY FSND 0060 1
INNISFIL TOWNSHIP CON 08(02311	17 1614850 1 4908306L 1	1989/02 1 3203 1	05 1	FR 0036 1	010 1/ 1 035 1 006 1/ 11:0 1	DO 1	0044 1 06 1	5727787 1() 1 PRDG 0019 GREY SAND SILT 0036 GREY SAND 0053 GREY SAND SILT 0053 1
INNISFIL TOWNSHIP CON 08(02311	17 1614669 1 4907499W 1	1963/06 1 4102 1	30 1	FR 0023 1	008 1/ 1 003 1/ 1:0 1	DO 1		5701153 1(11 BLUE CLAY 0023 GRVL 0029 1
INNISFIL TOWNSHIP CON 08(02311	17 1614713 1 4907540W 1	1965/10 1 4102 1	30 1	FR 0022 1	006 1/ 1 010 1/ 1:0 1	DO		5701154 1(11 BRWN CLAY STNS 0022 FSND 0026 BLUE CLAY 0040 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]S CNTR S	CASING DIA [4]	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 08(023)1	17 1614964 1 4907623W 1	1974/09 1 3203 1	05 1	FR 0050 1	-003 1/ 1 003 1/ 120:10 1	DO 1	0050 1 03 1	5711639 1() 1 BRWN CLAY SAND 0010 GREY CLAY 0050 1 GREY SAND 0053 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614850 1 4908306L 1	1991/02 1 2514 1	06 1					5727976 1(90477) 1 LOAM 0001 BRWN SAND 0015 GREY CLAY 0038 GREY SAND 0040 GREY CLAY 0140 1 GREY SAND 0144 GREY CLAY 0220 GREY CLAY 0275 HPAN 0286 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614850 1 4908306L 1	1991/05 1 3903 1	06 1	FR 0116 1	013 1/ 1 080 1 030 1/ 124:0 1	COS	0096 1 20 1	5728313 1(104260) 1 BRWN CLAY SNDY STNS 0010 GREY CLAY SAND SOFT 0060 GREY CLAY DNSE HARD 1 0078 GREY FSND CLAY SOFT 0116 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614850 1 4908306L 1	1991/07 1 2514 1	08 106 1	UK 0024 1 UK 0255 1 FR 0271 1	039 1/ 1 225 1 168 1/ 124:0 1	MNS	0256 1 15 1	5728442 1(90493) 1 BRWN CLAY 0024 BRWN SAND CGVL 0026 1 GREY CLAY GRVL 0090 GREY CLAY LYRD SAND 0165 GREY CLAY 0255 GREY SAND GRVL CMTD 0271 GREY HPAN 0323 ROCK LMSN 0324 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614673 1 4907959W 1	1992/03 1 2514 1	08 1	FR 0248 1	060 1/ 1 222 1 155 1/ 132:0 1	MNS	0251 1 25 1	5729269 1(108644) 1 FILL 0004 BRWN CLAY 0030 BRWN SAND 0032 GREY CLAY 0135 GREY CLAY SNDY 0191 GREY SAND 0194 GREY CLAY SNDY 0248 GREY FSND MGRD 0260 GREY SAND GRVL 0276 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614616 1 4907973W 1	1990/11 1 2514 1	08 1	UK 0064 1	024 1/ 1 059 1 070 1/ 124:0 1	MNS	0064 1 10 1	5729737 1(108667) 1 BRWN CLAY SNDY 0015 GREY CLAY 0064 1 GREY SAND 0078 GREY CLAY 0316 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614621 1 4907929W 1	1992/10 1 2514 1				MNS		5729738 1(108665) 1 BRWN FILL 0004 BLCK LOAM 0005 BRWN CLAY SNDY 0012 BRWN CLAY 0032 BRWN SAND 0036 GREY CLAY 0330 ROCK 0330 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614658 1 4907998W 1	1992/04 1 2514 1	08 1			NUS		5729740 1(108639) 1 BRWN LOAM 0001 BRWN CLAY 0038 GREY SAND 0050 GREY CLAY 0250 GREY SAND CLAY LYRD 0272 GREY CLAY 0279 GREY SAND GRVL PCKD 0285 GREY CLAY STNS 0315 LMSN 0316 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614850 1 4908306L 1	1993/07 1 2576 1	06 1	UK 0036 1		NUS		5730080 1(119817) 1 BRWN CLAY 0008 GREY CLAY 0036 GREY GRVL SILT 0047 GREY SILT GRVL 0050 1 GREY SILT 0056 1
INNISFIL TOWNSHIP CON 08(023)1	17 1614850 1 4908306L 1	1993/07 1 2576 1		FR 0036 1 FR 0282 1		NUS		5730082 1(132669) 1 LOAM 0002 BRWN CLAY 0008 GREY CLAY 0037 BRWN SAND GRVL 0051 GREY SILT 0189 GREY SILT CLAY 0274 GREY SILT SAND WBRG 0294 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR s	CASING DIA [4]	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 08(02311	17 16148501 4908306L 1	1993/07 1 2576 1	06 1	FR 0224 1		NU s		5730083 1(132668) 1 LOAM 0002 1BRWN SAND SILT 0008 1GREY SILT SNDY STKY 0028 1GREY SILT WBRG 0126 1GREY CLAY STKY 0142 1GRVL SAND 0144 1GREY CLAY HARD 10206 1GREY FSND SILT 0218 1GREY CLAY 0224 1GREY GRVL SAND 0238 1GREY CLAY 0241 1
INNISFIL TOWNSHIP CON 08(0231 1	17 16148501 4908306L 1	1993/06 1 2576 1				NU s		5730084 1(132660) 1 LOAM 0001 1BRWN SILT SAND 0004 1GREY SILT CLAY STKY 0031 1GREY SAND GRVL WBRG 0054 1GREY SILT 0168 1GREY CLAY SILT 0253 1GREY SILT SAND WBRG 0263 1 GREY FSND SILT 0269 1GREY SAND GRVL 0276 1GREY SILT 0317 1GREY LMSN 0321 1
INNISFIL TOWNSHIP CON 08(023) 1	17 16148501 4908306L 1	1993/07 1 2576 1		FR 0034 1		NU s		5730081 1(119818) 1 BRWN CLAY 0006 1GREY CLAY SLTY 0033 1 GREY SILT GRVL 0046 1GREY GRVL 0047 1 GREY GRVL SILT 0052 1GREY SILT 0054 1
INNISFIL TOWNSHIP CON 08(0231 1	17 16148501 4908306L 1	1993/06 1 2576 1	06 1	FR 0223 1	/ 1 025 1/ 124:0 1	NU s	0230 1 10 1	5730079 1(132667 1 LOAM 0001 1BRWN SILT SAND 0004 1GREY GRVL SILT SAND 0034 1GREY SILT GRVL 0042 1GREY SILT 0189 1BRWN GRVL SILT WBRG 0201 1GREY SILT 0214 1GREY QSND WBRG 0223 1GRVL FSND WBRG 0234 1GREY SILT 0236 1
INNISFIL TOWNSHIP CON 08(0231 1	17 16147651 4907990W 1	1992/11 1 2514 1		UK 0220 1 UK 0205 1		MN 1		5729736 1(108669) 1 BRWN CLAY 0005 1BRWN SAND GRVL 0015 1 GREY CLAY 0060 1GREY CLAY GRVL 0070 1 GREY CLAY 0130 1GREY CLAY GRVL SOFT 0137 1GREY CLAY STKY HARD 0205 1GREY CLAY SAND GRVL 0220 1GREY CLAY STKY 0226 1GREY CLAY GRVL HARD 10245 1GREY SAND GRVL 0270 1GREY SAND GRVL 0290 1
INNISFIL TOWNSHIP CON 08(0231 1	17 16146851 4907809W 1	1993/08 1 2576 1	06 1	FR 0049 1		MN 1		5730571 1(126311 1 BRWN CLAY 0008 1GREY CLAY 0042 1GREY CLAY SAND LYRD 0049 1GREY MSND 0055 1 GREY CLAY 0056 1
INNISFIL TOWNSHIP CON 08(02311	17 16148501 4908306L 1	1993/12 1 2576 1	08 06 1			NU s		5730572 1(1327611 1 FILL 0002 1BRWN LOAM SILT HPAN 0010 1 GREY SILT 0034 1GREY SILT GRVL 0050 1 GREY QSND 0121 1BRWN SAND SILT 0128 1 GREY SILT CLAY 0145 1GREY CLAY 0206 1 GREY SILT GRVL 0210 1GREY SILT CLAY 0221 1GREY SILT GRVL 0223 1GREY GRVL SAND 0234 1

TOWNSHIP CONCESSION LOT)	UTM[1]	DATE [2]s CNTR [3]s	CASING DIA [4]s	WATER[5,6]s DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 08(0231 1	17 16148501 4908306L 1	1993/12 1 2576 1	06 1	FR 0223 1	065 1/ 1 050 1/ 11:0 1	MN s PS	0220 1 10 1	5730573 1(132760) 1 FILL 0002 1BRWN LOAM SILT HPAN 0010 1 GREY SILT 0034 1GREY SILT WBRG 0050 1 GREY QSND 0121 1BRWN SAND SILT 0128 1 GREY SILT CLAY 0145 1GREY CLAY 0206 1 GREY SILT GRVL WBRG 0210 1GREY SILT CLAY 0221 GREY SILT GRVL WBRG 0223 1 GREY GRVL SAND WBRG 0235 1GREY CLAY 0238 1
INNISFIL TOWNSHIP CON 08(02311	17 16151831 4907879W 1	1988/08 1 3135 1	05 1	FR 0051 1	008 1/ 1 050 1 005 1/ 11:20 1	DO 1		5724962 1(37762) 1 CLAY GRVL 0020 1CLAY 0040 1SAND CLAY 0051 1FSND 0057 1
INNISFIL TOWNSHIP CON 08(02311	17 16152801 4907894W 1	1988/07 1 3135 1	05 1	FR 0201 1	046 1/ 1 095 1 005 1/ 110:0 1	DO	0202 1 04 1	5724964 1(27478) 1 LOAM 0001 1CLAY SAND 0015 1CLAY HARD 1 0050 1CLAY SOFT 0165 1CLAY SILT 0201 1 SAND 0206 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16154201 4908503L 1	1990/07 1 4919 1	30 130 1	UK 0075 1	010 1/ 1 030 1 010 1/ 11:0 1	DO 1		5727546 1(7718211 BRWN LOAM HARD 10001 1BRWN CLAY HARD 1 0020 1GREY CLAY SAND LYRD 0082 1
INNISFIL TOWNSHIP CON 08(0241 1	17 6154201 4908503L 1	1989/11 1 3203 1	05 1	FR 0126 1	015 1/ 1 071 1 010 1/ 11:0 1	DO 1		5727795 1(4339811 GREY CLAY 0095 1GREY CLAY SAND 0107 1 GREY CLAY 0126 1GREY SAND WBRG 0156 1
INNISFIL TOWNSHIP CON 08(0241 1	17 6156521 4908102W 1	1961/12 1 4102 1	30 1	FR 0005 1	005 1/ 1 002 1/ 1:0 1	DO 1		5701155 1(11 MSND 0015 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16157841 4908223W 1	1968/06 1 4608 1	30 1	FR 0012 1	008 1/ 1 / 1:0 1	DO 1		5705816 1(11 BRWN CLAY STNS 0018 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16156641 4908153W 1	1968/09 1 4608 1	30 1	FR 0006 1	006 1/ 1 / 1:0 1	DO 1		5705819 1(11 GREY CLAY STNS 0010 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16154341 4907843W 1	1970/06 1 4102 1	30 1	FR 0027 1	019 1/ 1 004 1/ 1:0 1	DO		5707331 1(11 BRWN CLAY 0008 1BLUE CLAY 0027 1CSND 0030 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16157141 4908523W 1	1970/09 1 3203 1	05 1	FR 0042 1	006 1/ 1 034 1 002 1/ 11:0 1	DO 1		5707600 1(11 BRWN MSND FILL 0003 1BRWN SILT CLAY 0011 1GREY CLAY 0042 1GREY GRVL CLAY 0044 1GREY GRVL 0045 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16155241 4909223W 1	1970/11 1 3203 1	05 1	FR 0094 1	002 1/ 1 080 1 002 1/ 12:0 1	DO	0093 1 03 1	5707777 1(11 BRWN GRVL 0012 1GREY CLAY STNS 0080 1 GREY CLAY GRVL 0091 1GREY GRVL CLAY 0094 1GREY GRVL MSND 0096 1GREY GRVL CLAY 0098 1GREY CLAY 0108 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16158621 4907921W 1	1974/01 1 3203 1	05 1	FR 0041 1	001 1/ 1 038 1 003 1/ 11:10 1	DO 1	0040 1 03 1	5710849 1(11 BRWN SAND 0023 1GREY CLAY 0040 1GREY SAND CLAY 0042 1
INNISFIL TOWNSHIP CON 08(0241 1	17 16157451 4908377W 1	1973/04 1 3203 1	05 1	FR 0072 1	/ 1 030 1 008 1/ 11:10 1	DO 1	0080 1 03 1	5709936 1(11 BLCK LOAM 0001 1BRWN CLAY SAND 0015 1 GREY SAND 0029 1GREY CLAY 0072 1GREY SAND 0083 1

TOWNSHIP CONCESSION (LOT)	UTM[1]	DATE [2]S CNTR S	CASING DIA [4]S	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # (AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 08(02411	17 1615864 1 4907923W 1	1974/10 1 4102 1	30 1	FR 0006 1	005 1/1 /1:01	DO		5711994 1(11 LOAM 0002 1BRWN CLAY BLDR LOOS 0007 1 BRWN FSND SLTY 0010 1
INNISFIL TOWNSHIP CON 08(0241 1	17 1615714 1 4908173W 1	1974/12 1 3203 1	05 1	FR 0050 1	020 1/1 033 1 005 1/12:10 1	DO 1	0050 1 03 1	5712049 1(11 BRWN CLAY SAND 0022 1GREY CLAY 0028 1 GREY FSND DRY 0033 GREY CLAY 0050 1GREY SAND 0053 1
INNISFIL TOWNSHIP CON 08(02411	17 1615364 1 4907823W 1	1974/09 1 3203 1	04	FR 0055 1	010 1/1 050 1 007 1/11:10 1	DO 1	0070 1 04 1	5711597 1(11 BRWN GRVL SAND 0016 1GREY CLAY GRVL SILT 0051 1GREY SAND DRTY 0055 1GREY SAND 0074 1GREY CLAY 0075 1
INNISFIL TOWNSHIP CON 08(02411	17 1615414 1 4907873W 1	1974/08 1 3203 1	05 1	FR 0093 1	004 1/1 045 1 007 1/11:10 1	DO	0106 1 03 1	5711620 1(11 BRWN SAND STNS 0017 1GREY CLAY 0075 1 GREY SILT 0087 1GREY CLAY 0093 1GREY SAND 0109 1GREY SILT 0109 1
INNISFIL TOWNSHIP CON 08(02411	17 1615714 1 4908023W 1	1977/04 1 3742 1	24 130 1	FR 0034 1	009 1/1 025 1 003 1/14:0 1	DO		5714089 1(11 LOAM 0004 1SAND 0009 BLUE CLAY 0034 1 SAND 0037 1
INNISFIL TOWNSHIP CON 08(02411	17 1615754 1 4908423W 1	1975/02 1 3203 1	05 1	FR 0054 1	015 1/1 045 1 002 1/12:45 1	DO		5713414 () 1 BRWN CLAY 0003 1BLCK LOAM 0004 1GREY CLAY 0043 1GREY GRVL CLAY 0044 1GREY CLAY SAND PCKD 0054 1GRVL 0057 1
INNISFIL TOWNSHIP CON 08(02411	17 1615714 1 4908023W 1	1975/11 1 3203 1	05 1	FR 0034 1	008 1/1 025 1 005 1/12:0 1	DO	0034 1 05 1	5713418 1() 1 BRWN CLAY 0011 1GREY CLAY 0035 GREY SAND 0039 1
INNISFIL TOWNSHIP CON 08(0241 1	17 1615714 1 4908073W 1	1977/04 1 3742 1	30 1	FR 0030 1	009 1/1 025 1 003 1/14:0 1	DO		5714090 1(11 LOAM 0004 1SAND 0009 1BLUE CLAY 0030 1 SAND 0033 1
INNISFIL TOWNSHIP CON 08(0241 1	17 615420 1 4908503L 1	1990/08 1 2513 1	06 1	FR 0046 1	011 1/1 045 1 006 1/1110 1	DO	0049 1 04 1	5727451 (90209) 1 BRWN SAND STNS 0005 1GREY CLAY 0026 1 GREY SILT SAND 0046 1GREY FSND 0053 1
INNISFIL TOWNSHIP CON 08(02411	17 1615420 1 4908503L 1	1992/03 1 1350 1	06 1	FR 0039 1	006 1/1 054 1 009 1/12:0 1	DO 1	0059 1 05 1	5728949 1(109118) 1 BLCK LOAM 0001 1BRWN CLAY SNDY 0006 1 YLLW CLAY 0014 1GREY CLAY GRVL BLDR 0032 1GREY CLAY 0058 1GREY SAND 0064 1
INNISFIL TOWNSHIP CON 08(02411	17 1615420 1 4908503L 1	1993/03 1 2514 1	08 106 1	UK 0240 1 FR 0100 1	/1 250 1/14:0 1	PS	0242 1 20 1	5729889 1(121786) 1 BRWN CLAY 0004 1BRWN SAND GRVL 0045 1 GREY CLAY 0100 1GREY FSND 0130 GREY CLAY 0242 1GREY SAND GRVL PCKD 0262 1 GREY CLAY 0270 1
INNISFIL TOWNSHIP CON 08(0241 1	17 1615714 1 4908323W 1	1978/08 1 4816 1	06 1	FR 0094 1	011 1/1 089 1 007 1/12:0 1	DO	0091 1 03 1	5715588 1(11 SAND GRVL CLAY 0045 1FSND CLAY 0062 1 CLAY 0070 1GRVL CLAY SAND 0080 1CLAY SAND 0085 1CLAY 0094 1FSND 0097 1
INNISFIL TOWNSHIP CON 08(0241 1	17 1615564 1 4907873W 1	1978/07 1 3203 1	05 1	FR 0089 1	015 1/1 045 1 006 1/11:0 1	DO	0096 1 03 1	5716054 1(11 BRWN FILL 0003 1BLCK LOAM 0005 1BRWN CLAY 0014 1GREY CLAY 0089 1GREY SAND 0099 1
INNISFIL TOWNSHIP CON 08(0241 1	17 1615764 1 4908473W 1	1983/09 1 3413 1	30 1	FR 0056 1	014 1/1 055 1 005 1/14:0 1	DO		5719021 1(11 LOAM 0002 1BRWN CLAY 0014 1BLUE CLAY 0056 1CGVL 0060 1

TOWNSHIP : CONCESSION : (LOT) :	UTM[1] :	DATE :[2] CNTR :[3]	CASING : DIA :	WATER[5,6] DETAIL :	STAT :LVL/PUMP :LVL[7] : RATE[8]/TIME :HR :MIN :	WATER : USE[9] :	SCREEN : INFO[10] :	WELL :# :(AUDIT#) : WELL :TAG :# : DEPTHS :TO :WHICH :FORMATIONS :EXTEND[5,11] :
INNISFIL :TOWNSHIP : CON : 08(024)	17 615714 4908023W	983/07 3413	36 2	FR :0040	004 / 035 004 / 4:0	DO :		5719025 () BRWN :CLAY :0014 BLUE :CLAY :0045
INNISFIL :TOWNSHIP : CON : 08(024)	17 615514 4908073W	981/05 3109	24 30	FR :0009	009 / / 2:0	DO		5717617 () LOAM :0001 FSND :0010 BLUE :CLAY :STNY : 0034
INNISFIL :TOWNSHIP : CON : 08(024)	17 615314 4907923W	981/05 3109	30 24	FR :0014	008 / / 4:0	DO :		5717619 () LOAM :0001 CSND :0014 BLUE :CLAY :STNY : 0038
INNISFIL :TOWNSHIP : CON : 08(024)	17 615614 4908373W	981/08 3744	36 18		008 / 040 005 / 4:0	DO		5717671 () LOAM :0002 SAND :0006 CSND :0012 CLAY : 0050
INNISFIL :TOWNSHIP : CON : 08(024)	17 615764 4908423W	983/11 3109	30	FR :0047	018 / 004 / 2:0	DO :		5718891 () LOAM :0001 BRWN :CLAY :SNDY :0018 BLUE : CLAY :STNY :0047 FSND :0049
INNISFIL :TOWNSHIP : CON : 08(024)	7 615714 4908523W	983/09 3413	30	FR :0056	014 / 055 005 / 4:0	DO :		5719020 () LOAM :0002 BRWN :CLAY :0014 BLUE :CLAY : 0056 CGVL :0060
INNISFIL :TOWNSHIP : CON : 08(024)	17 615764 4907923W	983/09 3413	24 30	FR :0045	006 / 045 004 / 4:0	DO :		5719024 () BRWN :CLAY :0014 BLUE :CLAY :0045 CSND : 0052
INNISFIL :TOWNSHIP : CON : 08(024)	7 615714 4908073W	984/01 3413	30 24	FR :0036	005 / 025 004 / 4:0	DO :		5719584 () LOAM :0003 BRWN :SAND :0010 BLUE :CLAY : 0036 FSND :0038
INNISFIL :TOWNSHIP : CON : 08(024)	7 615814 4908173W	984/09 3660	05	FR :0095	003 / 080 005 / 2:0	DO :	0098 05	5719418 () BRWN :SAND :0005 GREY :CLAY :0020 BRWN : GRVL :0025 GREY :CLAY :0042 GREY :SILT : 0060 GREY :CLAY :0095 GREY :FSND :WBRG : 0103
INNISFIL :TOWNSHIP : CON : 08(024)	17 615721 4908046W	987/07 2514	06	FR :0114	009 / 090 015 / :0	DO	0114 06	5722085 ()
INNISFIL :TOWNSHIP : CON : 08(024)	7 615314 4908333W	988/09 5022	06	FR :0035	006 / 002 / 2:0	DO	0036 04	5723886 () LOAM :0001 BRWN :SAND :GRVL :STNS :0019 GREY :CLAY :GRVL :0031 CGVL :STNS :0038 GREY :CLAY :GRVL :STNS :0059 GREY :SILT : SAND :0066 GREY :CLAY :0078 FGVL :0082 GREY :SILT :FGVL :0127
INNISFIL :TOWNSHIP : CON : 08(025)	7 615707 4908083W	965/08 4608	30	FR :0034 FR :0045	034 / 002 / :0	DO		5701156 () BRWN :CLAY :0014 GREY :CLAY :0045 FSND : 0046
INNISFIL :TOWNSHIP : CON : 08(025)	7 615854 4908373W	973/02 4608	30	FR :0032	030 / 038 002 / :30	DO :		5710035 () BRWN :CLAY :STNS :0015 GREY :CLAY :SAND : 0040
INNISFIL :TOWNSHIP : CON : 08(025)	17 615854 4908343W	973/04 4608	30	FR :0022	022 / 030 002 / :0	DO :		5709994 () BRWN :CLAY :STNS :0010 BLUE :CLAY :SAND : 0033

TOWNSHIP : CONCESSION :(LOT):	UTM[1] :	DATE :[2] CNTR :[3]	CASING : DIA :[4]	WATER[5,6] : DETAIL :	STAT :LVL/PUMP :LVL[7] : RATE[8]/TIME :HR:MIN :	WATER : USE[9] :	SCREEN : INFO[10] :	WELL :# :(AUDIT#) : WELL :TAG :# : DEPTHS :TO :WHICH :FORMATIONS :EXTEND[5,11] :
INNISFIL :TOWNSHIP : CON : 08(025)	17 615802 4908535[W]	1974/09 3660	05	FR :0182	022 / 165 005 / 2:0	DO	0183 03	5711462 () BLCK :LOAM :0002 BRWN :CLAY :SAND :0013 GREY :CLAY :STNS :0052 BLUE :CLAY :0086 GREY :CLAY :SILT :0116 GREY :CLAY :0133 BLUE :CLAY :0152 BLUE :SILT :0165 BLUE : CLAY :SILT :0182 BLCK :MSND :0186
INNISFIL :TOWNSHIP : CON : 08(025)	17 615864 4908123[W]	1976/05 3660	05	SU :004	/ 040 003 / 2:0	DO	0045 06	5713260 () BLCK :LOAM :0001 GREY :CLAY :0025 BRWN : CLAY :SNDY :0035 GREY :CLAY :0041 GREY : FSND :CLAY :004 GREY :FSND :0051 CLAY : 0051
INNISFIL :TOWNSHIP : CON : 08(025)	17 615814 4908423[W]	1983/06 3413	30	FR :0026	-006 / 022 004 / 4:0	DO :		5719023 () LOAM :0002 BRWN :CLAY :0012 BLUE :CLAY : 0026 FSND :0031
INNISFIL :TOWNSHIP : CON : 08(025)	17 615814 4908523[W]	1980/01 3660	05	FR :0172	018 / 165 003 / 2:0	DO :	0172 03	5716610 () BLCK :LOAM :0002 GREY :CLAY :BLDR :0021 GREY :CLAY :0087 GREY :SAND :GRVL :CMTD : 0094 BLUE :CLAY :GRVL :0113 GREY :SILT : 0118 GREY :CLAY :0151 GREY :SILT :0165 GREY :FSND :0172 BRWN :MSND :0176
INNISFIL :TOWNSHIP : CON : 08(025)	17 615364 4909173[W]	1984/12 3203	05	FR :0231	015 / 060 008 / 24:0	DO :		5720317 () FILL :0003 BRWN :SAND :CLAY :0026 GREY : CLAY :0057 GREY :CLAY :GRVL :SLTY :0088 GREY :CLAY :GVLY :0219 GREY :GRVL :CLAY : PCKD :0231 GREY :GRVL :CLAY :0233 GREY : GRVL :CLAY :PCKD :0235
INNISFIL :TOWNSHIP : CON : 08(025)	17 615876 4908077[W]	1989/10 2514	06	FR :0088	014 / 080 007 / 1:30	DO :	0088 04	5725657 (59358) BRWN :CLAY :SAND :SNDY :0040 GREY :CLAY : 0088 GREY :FSND :0091
INNISFIL :TOWNSHIP : CON : 09(018)	17 611809 4909401[W]	1996/10 2513	06	FR :0037	010 / 043 030 / 1:0	DO :	0050 03	5732534 (173389) LOAM :0001 BRWN :SAND :SILT :BLDR :0037 YLLW :MSND :CSND :0053
INNISFIL :TOWNSHIP : CON : 09(018)	17 611803 4909386[W]	1996/12 2513				NU		5732649 (173391) PRDG :0032
INNISFIL :TOWNSHIP : CON : 09(018)	17 611688 4908675[L]	1998/03 2514	06	FR :0036	005 / 025 012 / 1:30	DO :	0040 03	5733358 (184114) BRWN :CLAY :SNDY :GRVL :0036 BRWN :SAND : GRVL :CGRD :0043
INNISFIL :TOWNSHIP : CON : 09(018)	17 611685 4908675[L]	2001/05 3413	30			NU		5736149 (222613)
INNISFIL :TOWNSHIP : CON : 09(018)	17 611625 4909193[W]	1960/01 2514	06	FR :0049	025 / 045 015 / 2:0	DO :		5701218 () PRDG :0017 BLUE :CLAY :0048 GRVL :0049
INNISFIL :TOWNSHIP : CON : 09(018)	17 611768 4908146[W]	1964/11 2514	06	FR :0065	040 / 062 012 / 1:30	ST : DO :	0068 03	5701219 () PRDG :0023 FSND :0025 BLUE :CLAY :MSND : 0053 BLUE :CLAY :0065 MSND :0071
INNISFIL :TOWNSHIP : CON : 09(018)	17 611310 4909156[W]	1965/09 2514	06	FR :0054	021 / 048 014 / 1:30	DO :	0056 03	5701220 () PRDG :0025 MSND :CLAY :0037 MSND :GRVL : 0040 FSND :0050 MSND :GRVL :0060

TOWNSHIP : CONCESSION :(LOT):	UTM[1]	DATE :[2] CNTR :[3]	CASING : DIA :	WATER[5,6] : DETAIL :	STAT :LVL/PUMP :LVL[7] : RATE[8]/TIME :HR:MIN :	WATER : USE[9] :	SCREEN : INFO[10] :	WELL :# :(AUDIT#) :WELL :TAG :# : DEPTHS :TO :WHICH :FORMATIONS :EXTEND[5,11] :
INNISFIL :TOWNSHIP : CON : 09(018)	17 611670 4909293[W]	1965/12 2514	06	FR :0041	028 / 038 010 / 1:30	DO		5701221 (PRDG :0028 YLLW :MSND :CLAY :0039 CSND : GRVL :0041
INNISFIL :TOWNSHIP : CON : 09(019)	17 612344 4909543[W]	1969/11 3203	05	FR :0054	026 / 035 006 / 1:0	DO :		5706885 (BRWN :MSND :0003 BRWN :CLAY :MSND :STNS : 0014 BRWN :MSND :CLAY :0036 BRWN :STNS : CLAY :0045 GREY :CLAY :0054 GREY :GRVL : MSND :0055
INNISFIL :TOWNSHIP : CON : 09(019)	17 612284 4909523[W]	1969/10 3203	05	FR :0054	025 / 031 010 / 1:0	DO		5706800 (FILL :0001 FILL :MSND :0003 CLAY :MSND : STNS :0044 GRVL :0049 CLAY :0054 MSND : GRVL :0055 CLAY :0057
INNISFIL :TOWNSHIP : CON : 09(019)	17 612364 4909473[W]	1969/07 4608	30	FR :0021 FR :0026	016 / 022 / 1:0	ST :		5706455 (BRWN :CLAY :STNS :0015 BRWN :MSND :STNS : 0021 GREY :MSND :0026
INNISFIL :TOWNSHIP : CON : 09(019)	17 612314 4909463[W]	1969/07 4608	30	FR :0015	007 / 013 / 1:0	DO		5706443 (BRWN :CLAY :STNS :0015 GREY :CSND :STNS : 0017
INNISFIL :TOWNSHIP : CON : 09(019)	17 612050 4909391[W]	1961/01 2514	06	FR :0050	028 / 045 018 / 2:30	ST : DO		5701222 (PRDG :0028 BLUE :CLAY :0049 GRVL :0050
INNISFIL :TOWNSHIP : CON : 09(019)	17 612034 4909382[W]	2002/07 2513				NU		5737065 (246402)
INNISFIL :TOWNSHIP : CON : 09(020)	17 612849 4908384[W]	1961/05 4102	30	FR :0025	010 / 003 / :0	DO :		5701224 (BRWN :CLAY :0020 MSND :0035
INNISFIL :TOWNSHIP : CON : 09(020)	17 612846 4909068[L]	1987/03 2576	06 06	FR :0215 FR :0230	-002 / 150 050 / 2:30	PS :	0215 15	5721928 (06996) FILL :0001 BLCK :MUCK :0004 YLLW :HPAN : 0006 GREY :CLAY :0045 GREY :CLAY :SAND : GRVL :0083 GREY :CLAY :FGVL :0093 GREY : CLAY :GRVL :STNS :0099 CLAY :GRVL :SAND : 0130 GRVL :CLAY :0140 CLAY :FGVL :0175 CLAY :SAND :0192 FGVL :STNS :0213 GRVL : SAND :0241 BRWN :LMSN :0245
INNISFIL :TOWNSHIP : CON : 09(020)	17 612846 4909068[L]	1987/03 2576	02 02	FR :0215 FR :0230	-001 / / :0	NU	0220 10	5721927 (06997) FILL :0001 BLCK :MUCK :0003 YLLW :HPAN : 0006 GREY :CLAY :GRVL :0043 GREY :CLAY : GRVL :SAND :0075 CLAY :HARD 0082 CLAY : GRVL :0098 STNS :CLAY :0128 GRVL :SAND : CLAY :0172 CLAY :SNDY :SILT :0189 GRVL : STNS :FSND :0230
INNISFIL :TOWNSHIP : CON : 09(020)	17 612861 4909587[W]	1952/08 5510	04	FR :0108	086 / 090 003 / 1:0	DO	0108 10	5701223 (CLAY :STNS :0037 MSND :0042 MSND :CLAY : 0105 MSND :0118
INNISFIL :TOWNSHIP : CON : 09(020)	17 612845 4909637[W]	1965/03 2514	06	FR :0108	058 / 107 005 / 4:0	ST : DO		5701225 (PRDG :0059 BRWN :CLAY :MSND :BLDR :0110 BRWN :CLAY :0112

TOWNSHIP /: CONCESSION :(LOT)/:	UTM[1] /:	DATE :[2] CNTR :[3]	CASING : DIA :	WATER[5,6] : DETAIL :	STAT :LVL/PUMP :LVL[7] : RATE[8]/TIME :HR :MIN :	WATER : USE[9] :	SCREEN : INFO[10] :	WELL :# :(AUDIT#) : WELL :TAG :# : DEPTHS :TO :WHICH :FORMATIONS :EXTEND[5,11] :
INNISFIL :TOWNSHIP : CON : 09(020)	17 612843 4909067[L]	2002/08 4645	06	FR :0065	013 / 060 008 / 1:0	DO	0061 04	5737131 (242021)- BRWN :CLAY :BLDR :HARD 0004 BRWN :CLAYO : STNS :HARD 0028 GREY :CLAY :HARD 0042 BRWN :SAND :LOOS :0043 GREY :CLAY :SILT : HARD 0060 BRWN :SAND :LOOS :0065
INNISFIL :TOWNSHIP : CON : 09(021)	17 613432 4909268[L]	1990/11 2513	06	FR :0128	085 / 123 010 / 1:30	DO	0128 04	5727564 (89200)- BLCK :LOAM :0001 BRWN :SILT :SAND :BLDRO : 0038 GREY :CLAY :SILT :0128 YLLW :MSND : SILT :CSND :0132
INNISFIL :TOWNSHIP : CON : 09(021)	17 613214 4909223[W]	1971/06 3203	05	FR :0131	060 / 115 005 / 1:0	DO :	0128 03	5708254 () BLCK :LOAM :0001 BRWN :MSND :CLAY :0006 GREY :CLAY :0052 GREY :CLAY :SILT :0089 GREY :CLAY :0130 BRWN :MSND :0131
INNISFIL :TOWNSHIP : CON : 09(021)	17 613241 4909629[W]	2002/06 2513	06	FR :0144 FR :0137	084 / 110 020 / 1:30	DO	0139 05	5737063 (246394) BLCK :LOAM :0001 BRWN :SILT :BLDR :0012 GREY :SAND :SILT :BLDR :0020 YLLW :SAND : SILT :0029 GREY :SILT :CLAY :0071 GREY : CLAY :0126 YLLW :SAND :CLAY :0137 YLLW : SAND :CSND :0144
INNISFIL :TOWNSHIP : CON : 09(021)	17 613754 4908813[W]	1975/11 3203		FR :0067	030 / 045 010 / 1:0	DO :	0070 03	5713398 () BRWN :CLAY :SAND :0012 GREY :CLAY :0067 GREY :SAND :0073
INNISFIL :TOWNSHIP : CON : 09(021)	17 613432 4909268[L]	1989/10 3203	05	FR :0064	035 / 045 008 / 1:0	DO	0079 03	5727777 (43410)- BRWN :SAND :CLAY :0026 GREY :SAND :CLAYO : 0068 BRWN :SAND :WBRG :0084 BRWN :SAND : CLAY :0084
INNISFIL :TOWNSHIP : CON : 09(021)	17 613273 4908658[W]	1963/09 4102	30	FR :0062	038 / 006 / :0)	DO)		5701227 () BLUE :CLAY :0062 CSND :0065 BLUE :CLAY : 0095
INNISFIL :TOWNSHIP : CON : 09(022)	17 614009 4909468[L]	1989/02 3203	05	FR :0080	010 / 069 009 / 1:0	DO	0081 04	5727774 ()- PRDG :0009 BRWN :SAND :CLAY :0016 GREYO : CLAY :SAND :0067 GREY :GRVL :CLAY :0073 GREY :GRVL :0076 GREY :CLAY :0078 GREY : GRVL :CLAY :0080 GREY :GRVL :0085
INNISFIL :TOWNSHIP : CON : 09(024)	17 615364 4909323[W]	1978/07 3203)	05	FR :0189	005 / 020 007 / 1:0	DO	0199 03	5716055 () PRDG :0025 GREY :CLAY :0072 GREY :SAND : CLAY :SILT :0075 GREY :CLAY :0172 GREY : SAND :SILT :CLAY :0189 GREY :SAND :0202
INNISFIL :TOWNSHIP : CON : 09(025)	17 615857 4909612[W]	1990/01 3203	05	FR :0097	008 / 095 007 / 2:0	DO		5727844 (43405) BRWN :SAND :0015 GREY :CLAY :SAND :0028 GREY :CLAY :GRVL :0078 GREY :CLAY :GRVL : SNDY :0097 GREY :SAND :WBRG :0107
INNISFIL :TOWNSHIP : CON : 10(018)	17 611309 4909256[W]	1964/10 2514	06	FR :0042	027 / 044 008 / 1:0	DO :	0045) 03)	5701337 () PRDG :0027 BLUE :CLAY :MSND :0042 MSND : 0048
INNISFIL :TOWNSHIP : CON : 10(018)	17 611611 4909498[W]	1997/05 3660	06	FR :0036	010 / 025 015 / 2:0	DO :	0043 03	5732919 (165380)- BRWN :CLAY :SAND :BLDR :0022 GREY :CLAYO : SOFT :0026 GREY :CLAY :GRVL :HARD 0033 BRWN :SAND :GRVL :DRTY :0036 BRWN :SAND : GRVL :WBRG :0043

TOWNSHIP CONCESSION (LOT)	UTM[1]	DATE [2] CNTR [3]	CASING DIA [4]	WATER[5,6] DETAIL	STAT LVL/PUMP LVL[7] RATE[8]/TIME HR:MIN	WATER USE[9]	SCREEN INFO[10]	WELL # (AUDIT#) WELL TAG # DEPTHS TO WHICH FORMATIONS EXTEND[5,11]
INNISFIL TOWNSHIP CON 10(019)	17 612114 909522 [W]	1962/08 102	30	FR 0022	020 / 002 / :0	ST) DO)		5701339 () BRWN CLAY 0022 MSND 0028 BLUE CLAY 0040
INNISFIL TOWNSHIP CON 10(019)	17 612380 909663 [W]	1989/08 2514	06	FR 0075	026 / 020 / 3:0	DO	0084) 06)	5725653 (59353) YLLW SAND 0001 BRWN CLAY GRVL STNS 0075 BRWN SAND 0090
INNISFIL TOWNSHIP CON 10(019)	17 612119 909537 [W]	1962/10 2514	05	FR 0035	025 / 038 005 / 1:0	ST DO	0038) 03)	5701340 () PRDG 0039 MSND 0042
INNISFIL TOWNSHIP CON 10(019)	17 611804 909473 [W]	1973/01 3203	05	FR 0042	017 / 038 007 / 1:10	DO	0049) 03)	5709732 () BRWN CLAY 0001 BRWN SAND STNS 0018 GREY CLAY STNS 0042 BRWN SAND 0052
INNISFIL TOWNSHIP CON 10(019)	17 612064 909623 [W]	1979/04 3203	06	FR 0058	020 / 042 015 / 1:0	DO	0062) 03)	5716065 () BRWN SAND CLAY STNY 0058 BRWN SAND 0065
INNISFIL TOWNSHIP CON 10(020)	17 612795 909717 [W]	1960/01 2514	06	FR 0092	056 / 085 007 / 2:30	DO	0089) 03)	5701343 () PRDG 0036 BRWN CLAY FSND 0088 MSND 0092
INNISFIL TOWNSHIP 06(017)	17 612491 905431 [W]	2006/06 2514	06	FR 0164	076 / 079 011 / 1:30	DO	0164 10	5741038 (Z34734) A032098 GREY CLAY GRVL 0052 GREY CLAY SAND 0161 GREY SAND CLAY 0170 GREY GRVL SAND 0174
INNISFIL TOWNSHIP 07(021)	17 613668 907025 [W]	2008/11 7147	35	FR 0005		NU		7116160 (Z88591)
INNISFIL TOWNSHIP 07(021)	17 613638 907048 [W]	7147	02	FR 0002	002 / / :0	NU		7115872 (M02875) A059622
INNISFIL TOWNSHIP 07(021)	17 613761 907146 [W]	2009/11 7147	35	FR				7134357 (Z097812)
INNISFIL TOWNSHIP 07(022)	17 614545 906722 [L]	1988/01 1467	05	SU 0073	010 / 030 005 / 1:30	DO	0078 07	5722973 (25883) LOAM 0001 BRWN SAND CLAY 0044 BRWN SAND 0049 GREY CLAY GRVL 0056 GREY CLAY 0073 GREY FSND 0086 GREY CLAY 0086
INNISFIL TOWNSHIP 07(022)	17 614545 906722 [L]	1987/10 2662	06	FR 0042 FR 0061	026 / 030 / 2:0	DO	0054 06	5722894 (10056) LOAM 0001 BRWN CLAY GRVL 0021 CLAY SLTY GRVL 0042 FGVL SAND STNS 0062 GREY CLAY GRVL SAND 0094 SAND GRVL CLAY 0160
INNISFIL TOWNSHIP 07(024)	17 615695 907111 [L]	1987/09 3203		FR 0072	010 / 072 005 / 1:0	DO	0083 04	5723053 () SAND 0016 GREY CLAY 0068 GREY CLAY SAND 0072 GREY SAND WBRG 0088 GREY CLAY 0088
INNISFIL TOWNSHIP 07(024)	17 615695 907111 [L]	1988/03 3203		FR 0074	008 / 054 007 / 1:0		0081 06	5723054 (27466) SAND FILL 0016 GREY CLAY 0068 GREY CLAY SAND 0074 GREY SAND 0088 GREY CLAY 0088
INNISFIL TOWNSHIP 07(024)	17 615695 907111[L]	1986/06 1467		FR 0029	005 / 029 005 / 2:0	DO	0031 04	5720727 () GREY FILL CLAY GRVL 0002 GREY GRVL STNS CLAY 0029 GREY MSND CMTD 0035

TOWNSHIP : CONCESSION :(LOT) :	UTM[1] :	DATE :[2] CNTR :[3]	CASING : DIA :[4]	WATER[5,6] : DETAIL :	STAT :LVL/PUMP :LVL[7] : RATE[8] :TIME :HR :MIN :	WATER : USE[9] :	SCREEN : INFO[10] :	WELL :# :(AUDIT#) :WELL :TAG :# : DEPTHS :TO :WHICH :FORMATIONS :EXTEND[5,11] :
INNISFIL :TOWNSHIP : 07(024)	17 615695 4907111[L]	1987/11 1467	05	FR :0238	080 / 155 005 / 3:0	DO :	0239 06	5722642 (18708) BLCK :LOAM :0001 BRWN :SAND :CLAY :0016 GREY :CLAY :SAND :GRVL :0054 GREY :SILT : 0061 GREY :CLAY :SAND :0079 GREY :CLAY : GRVL :0124 GREY :CLAY :HARD 0165 GREY : SAND :SLTY :0180 GREY :CLAY :HARD 0233 GREY :SILT :0238 GREY :SAND :CLAY :0250
INNISFIL :TOWNSHIP : 07(024)	17 615695 4907111[L]	1987/11 1467	05	SU :0117	027 / 064 005 / 3:30	DO	0117 04	5722643 (18707) BRWN :LOAM :0001 BRWN :SAND :CLAY :STNS : 0017 GREY :CLAY :GRVL :0053 GREY :SILT : 0059 GREY :CLAY :GRVL :STNS :0117 GREY : SAND :CLAY :LYRD :0122
INNISFIL :TOWNSHIP : 07(024)	17 615695 4907111[L]	1987/10 2513	06	FR :0078	012 / 066 011 / 1:0	DO	0078 04	5722590 () YLLW :SAND :0026 GREY :SAND :0047 GREY : CLAY :GRVL :HARD 0078 GREY :FSND :0082
INNISFIL :TOWNSHIP : 07(024)	17 615695 4907111[L]	1986/06 1467	05	FR :0026	004 / 029 005 / 4:0	DO	0029 04	5720728 () GREY :FILL :SAND :GRVL :0002 GREY :GRVL : STNS :0007 GREY :CLAY :GRVL :0026 GREY : SAND :0034 GREY :CLAY :0034
INNISFIL :TOWNSHIP : 07(024)	17 615695 4907111[L]	1986/12 2514	06	FR :0097	018 / 054 010 / 1:0	DO :	0098 03	5721421 (06602) BRWN :CLAY :SAND :STNS :0007 GREY :SILT : CLAY :SAND :0076 GREY :CLAY :0097 GREY : FSND :SILT :0101
INNISFIL :TOWNSHIP : 07(024)	17 615695 4907111[L]	1986/12 2514	06	FR :0100	018 / 071 010 / 1:0	DO	0100 03	5721422 (06595) BRWN :CLAY :SAND :BLDR :0007 GREY :CLAY : 0022 GREY :SILT :SAND :0040 GREY :CLAY : 0099 GREY :SAND :CLAY :LYRD :0103
INNISFIL :TOWNSHIP : 07(024)	17 615695 4907111[L]	1986/01 3203	05	FR :0042	010 / 028 003 / 1:0	DO :	0039 03	5721260 () SAND :FILL :0002 LOAM :0003 BRWN :SAND : CLAY :0014 GREY :SAND :0042 GREY :CLAY : 0042
INNISFIL :TOWNSHIP : 08(017)	17 611362 4907128[L]	1986/06 3030	36	FR :0012	012 / / :0	DO :		5720816 () BRWN :SAND :0004 BRWN :FSND :0012 BRWN : SAND :0020 BRWN :CSND :0025
INNISFIL :TOWNSHIP : 08(019)	17 612613 4907070[W]	2009/06 2514	06	FR :0095	023 / 074 010 / 1:0	DO :	0090 12	7125284 (Z91895) A080947 BRWN :SAND :GRVL :LOOS :0022 GREY :SAND : CLAY :GRVL :0085 GREY :SAND :GRVL :HARD 0102
INNISFIL :TOWNSHIP : 08(021)	17 613875 4907186[W]	2009/07 3406						7141014 (Z100550)
INNISFIL :TOWNSHIP : 08(022)	17 614275 4908109[L]	1987/09 4919	30	UK :0058	020 / 050 / 1:0	DO :		5722623 (17840) BRWN :LOAM :HARD 0001 BRWN :CLAY :0020 GREY :CLAY :HARD 0058 GREY :SAND :LOOS : 0060

TOWNSHIP : CONCESSION :(LOT) :	UTM[1] :	DATE :[2] CNTR :[3]	CASING : DIA :[4]	WATER[5,6] : DETAIL :	STAT :LVL/PUMP :LVL[7] : RATE[8]/TIME :HR :MIN :	WATER : USE[9] :	SCREEN : INFO[10] :	WELL :# :(AUDIT#) :WELL :TAG :# : DEPTHS :TO :WHICH :FORMATIONS :EXTEND[5,11] :
INNISFIL :TOWNSHIP : 08(022)	17 614275 4908109[L]	1988/04 1413	06	FR :0232	066 / 175 050 / 8:30	IN :	0202 30	5723307 (30243) BRWN :CLAY :STNS :SNDY :0014 GREY :CLAY : STNS :SLTY :0025 GREY :CLAY :SNDY :0041 GREY :CLAY :PCKD :0047 GREY :SAND :PCKD : 0063 GREY :CLAY :SNDY :0085 GREY :SAND :CLN : 0112 GREY :CLAY :PCKD :0197 GREY :SAND :CLN : 0232 GREY :CLAY :SAND :PCKD :0260
INNISFIL :TOWNSHIP : 08(022)	17 614515 4907629[W]	2007/11 2662						7119625 (Z90685) A079628
INNISFIL :TOWNSHIP : 08(023)	17 614409 4908111[W]	2007/10 2662						7119630 (Z90680) A079631
INNISFIL :TOWNSHIP : 08(023)	17 614541 4907758[W]	2007/11 2662						7119626 (Z90684) A079629
INNISFIL :TOWNSHIP : 08(023)	17 614669 4908019[W]	2007/10 2662						7119628 (Z90682) A079627
INNISFIL :TOWNSHIP : 08(023)	17 614964 4907998[W]	2008/09 2662						7119631 (Z90702) A079632
INNISFIL :TOWNSHIP : 08(023)	17 614671 4907907[W]	2007/10 2662						7119627 (Z90683) A079626
INNISFIL :TOWNSHIP : 08(024)	17 615420 4908503[L]	1989/06 3030	36 24 20	FR :0070 FR :0014 FR :0040 FR :0085	014 / / :0	DO :		5725317 (42782) BRWN :SAND :0014 BRWN :SAND :0015 BLUE : CLAY :SILT :LYRD :0095
INNISFIL :TOWNSHIP : 08(024)	17 615420 4908503[L]	1988/06 3660	05	FR :0065	005 / 070 003 / 1:0	DO	0067 06	5723605 (24531) BLCK :LOAM :0001 BRWN :CLAY :GRVL :0017 GREY :CLAY :SAND :HARD 0065 GREY :FSND : 0073
INNISFIL :TOWNSHIP : 08(024)	17 615420 4908503[L]	1987/07 2514	06	FR :0182	009 / 095 015 / 1:30	DO :	0182 03	5722084 () GREY :FILL :SNDY :0003 GREY :CLAY :SNDY : 0025 GREY :CLAY :0182 GREY :SAND :0185
INNISFIL :TOWNSHIP : 08(024)	17 615420 4908503[L]	1991/10 2513	06	MN 0040	/ 037 003 / 2:0	DO	0040 04	5728592 (108866) LOAM :0001 YLLW :SAND :0010 GREY :CLAY : BLDR :0036 GREY :FSND :SILT :VERY :0044
INNISFIL :TOWNSHIP : 09(023)	17 614582 4909667[L]	1986/07 3135	05	FR :0042	002 / 012 012 / 1:0	DO	0047 03	5722074 () LOAM :0001 CLAY :STNS :0034 CLAY :0042 SAND :WBRG :0050
INNISFIL :TOWNSHIP : ()	17 613650 4907070[W]	2007/07 7247	02				0019 05	7103763 (Z83962) A059622 BRWN :LOAM :LOOS :0006 BRWN :SILT :SNDY : HARD 0018 CLAY :TILL :GRVL : GREY :SILT : SNDY :HARD 0024 TILL :BLDR :
MATCHEDASH :TOWNSHIP : 08(023)	17 614959 4908019[W]	2007/10 2662						7119629 (Z90681) A079630

Notes:
. UTM in LZone, LEasting, LNorthing Land IDatum Lis LNAD83; LL: LUTM estimated Ifrom L Centroid Lof LLot; LW: LUTM not Ifrom LLot LCentroid
2. Date LWork LCompleted
3.L Well LContractor LLicence INumber
4. Casing Ldiameter Lin Linches
5. Unit Lof LDepth Lin LFeet
6. See LTable L4 for LMeaning Lof LCode
7. STAT LLVL: LStatic LWater LLevel Lin LFeet L; L PUMP LLVL: LWater Level LAfter LPumping Lin LFeet
.L Pump LTest LRate Lin LGPM, LPump LTest IDuration Lin LHour L: LMinutes
9. See LTable L3 Lfor LMeaning Lof LCode
10. Screen LDepth Land LLength Lin Lfeet
11. See LTable L and L2 for LMeaning Lof LCode L

1. Core Material and Descriptive terms									
Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD L	FRACTURED L	IRFM L	IRON L FORMATION	PORS L	POROUS L	SOFT L	SOFT L
BSLT	BASALT	FGRD	IFINE-GRAINED L	LIMY L	LIMY L	PRDG L	PREVIOUSLY DUG L	SPST L	SOAPSTONE L
CGRD	COARSE-GRAINED	FGVL L	FINE LGRAVEL	LMSN L	LIMESTONE L	PRDR L	PREV. DRILLED L	STKY	STICKY
CGVL	COARSE GRAVEL	FILL L	FILL L	LOAM	TOPSOIL	QRTZ L	QUARTZITE L	STNS	STONES
CHRT	CHERT	FLDS L	FELDSPAR L	LOOS	LOOSE	QSND L	QUICKSAND L	STNY	STONEY
CLAY	CLAY	FLNT L	FLINT	LTCL	LIGHT-COLOURED	QTZ L	QUARTZ L	THIK	THICK
CLN	CLEAN	FOSS	IFOSILIFEROUS	LYRD	AYERED	ROCK L	ROCK L	THIN	THIN
CLYY	CLAYEY	FSND L	FINE LSAND L	MARL	MARL	SAND L	SAND L	TILL	TILL
CMTD L	CEMENTED	GNIS L	GNEISS L	MGRD	MEDIUM-GRAINED	SHLE L	SHALE L	UNKN	UNKNOWN TYPE
CONG	LCONGLOMERATE	GRNT L	GRANITE	MGVL	MEDIUM GRAVEL	SHLY L	SHALY L	VERY	VERY
CRYS L	CRYSTALLINE	GRSN L	GREENSTONE	MRBL L	MARBLE	SHRP L	SHARP L	WBRG	WATER-BEARING
CSND L	COARSE LSAND	GRVL L	GRAVEL L	MSND	LMEDIUM LSAND	SHST L	SCHIST L	WDFR L	WOOD FRAGMENTS L
DKCL	DARK-COLOURED	GRWK L	GREYWACKE L	MUCK L	MUCK	SILT L	SILT L	WTHD L	WEATHERED L
DLMT	DOLOMITE	GVLY L	GRAVELLY L	OBDN L	OVERBURDEN	SLTE L	SLATE L		
DNSE	DENSE	GYPS L	GYPSUM L	PCKD L	PACKED L	SLTY L	SILTY L		
DRTY	DIRTY	HARD L	HARD L	PEAT L	PEAT	SNDS L	SANDSTONE L		
DRY L	DRY L	HPAN L	HARDPAN L	PGVL L	PEA LGRAVEL L	SNDY L	SANDY L		

2. Core Color	
Code	Description
WHIT	IWHITE
GREY	LGREY
BLUE	IBLUE
GREN	LGREEN
YLLW	LYELLOW
BRWN	IBROWN
RED L	RED
BLCK	IBLACK
BLGY	IBLUE-GREY L

3. Water Use			
Code	Description	Code	Description
DO	Domestic L	OT L	Other L
ST	Livestock L	TH L	Test LHole
IR	Irrigation L	DE L	Dewatering
IN	Industrial L	MO L	Monitoring L
CO	Commercial		
MN	Municipal		
PS	Public		
AC	Cooling LAnd A/C		
NU	Not LUsed L		

4. Water Detail			
Code	Description	Code	Description
FR L	Fresh L	GS L	Gas L
SA L	Salty L	IR L	Iron L
SU L	Sulphur L		
MN	Mineral L		
UK L	Unknown L		

COLE ENGINEERING

APPENDIX F

Water Well Survey

COLE O
ENGINEERING
Experience Enhancing Excellence

June 7th, 2010

Dear Resident: O

Cole Engineering Group Ltd. (CEG) is conducting a water well survey in your area as part of the O planning process requested by the Town of Innisfil. Our company representatives will be O conducting a door-to-door survey from Monday, June 7th, 2010 to Friday, June 11th, 2010 to O collect information on any water wells that may be on your property. We need this information O to determine if any future changes in land use in your area will impact groundwater resources. O

Well information collected from you will be used to assess the current groundwater usage and O flow patterns in your area. Information about your well will not be used for any other purpose O and will not be made available to the public. Your participation in this survey is voluntary; O however if you do use a private well, your participation is encouraged as it will help CEG to O assess and protect groundwater resources in your area. O

Please take a few minutes to review the attached well survey form. We ask that you please fill O out any information that you may have knowledge of and return the form using the prepaid self O addressed envelope. If you provide permission for CEG to collect a water sample from an O outdoor tap, CEG will contact you to arrange a time for sample collection at your convenience. O Please note that the water monitoring program will be conducted at no cost to you. O

If you have any questions, please do not hesitate to call 416-987-6161 or e-mail O tlee@coleengineering.ca. Your cooperation is very much appreciated. O

Sincerely, O

Tabitha Lee, M.A.Sc., P.Eng. O
Senior Hydrogeologist O
Environmental Management O
Cole Engineering Group Ltd. O

S:\2010 Projects\D-EE (E10)\Environmental Management\E10-223 Alcona HG Investigation\Water Well Survey\Letter to Resident.doc i

COLE
ENGINEERING

Well Survey

Well Owner Information

Name: S

Address: S

Phone No: S (   )

Other Details

Date: S   /   /

urveyor(s): S

Other: S

Well Details

Type: S ☐ Drilled S ☐ Dug S ☐ Other, specify: S

Total Depth: S ☐ meters i ☐ feet i | Depth to Water: S ☐ meters i ☐ feet | Screening S Interval: S ☐ meters i ☐ feet i

Diameter: S ☐ meters i ☐ feet | Stickup: S ☐ meters i ☐ feet i | MOE Well S Number: S

Casing S Material: S ☐ Metal S ☐ Plastic / PVC S ☐ Other, specify:

Security: S ☐ Proper Seal S ☐ Cap S ☐ Other, specify / Comments: S

Water Usage Details

Is the well in S use? S ☐ Yes S ☐ No S ☐ Other, specify: S

Type of Use: S ☐ Residential S ☐ Irrigation S ☐ Livestock S ☐ Commercial S ☐ Other, specify: S

Pump Type: S ☐ ubmersible S ☐ Jet S ☐ Other, specify: S

Number of S Users: S Adults: S Children: S

Influences on Groundwater Quality

Onsite Influences: S	Comments/Description: S	Neighbouring Influences: S	Comments/Description: S
☐ Storage Tanks S ☐ Fertilizer S ☐ Pesticides S ☐ Road Salt S ☐ Uncontained S Waste S ☐ Livestock S ☐ Uncontained S Chemicals S ☐ Automotive Fluids S ☐ Others, specify: S		☐ Storage Tanks S ☐ Fertilizer S ☐ Pesticides S ☐ Road Salt S ☐ Uncontained S Waste S ☐ Livestock S ☐ Uncontained S Chemicals S ☐ Automotive Fluids S ☐ Others, specify: S	

Notes

Site Plan o Figure

Well Sampling (for CEG use only)

Well sampled for: S

☐ Microbiological Parameters S

Total oliform
E. oli
kg
Heterotrophic Plate ount

☐ Inorganic Parameters S

Dissolved alcium
Dissolved opper
Dissolved Iron
Dissolved Magnesium
Dissolved Manganese
Dissolved Potassium
Dissolved Sodium
Dissolved Zinc
Ammonia as N
Dissolved Organic arbon
Alkalinity as aCO_3
onductivity
pH
hloride
Nitrate as N
Nitrite as N
Phosphate as P
Sulphate as P
Sulphate as SO_4

COLE ENGINEERING

Well Survey

Well Owner Information f

Name: S

Address: S 2108 20th Sideroad
Innisfil ON

Phone No: S ( )

Other Details f

Date: S 06/07/2010

Surveyor(s): S AR

Other: S

Well Details f

Type: S ☐ Drilled S ☒ Dug S ☐ Other, specify: S

Total Depth: S ☐ meters ☐ feet | Depth to Water: S ☐ meters ☐ feet | Screening S Interval: S ☐ meters ☐ feet

Diameter: S ☐ meters ☐ feet | tickup: ☐ meters ☐ feet | MOE Well S Number: S

Casing S Material: S ☐ Metal S ☐ Plastic / PVC S ☐ Other, specify:

ecurity: S ☐ Proper Seal S ☐ Cap S ☐ Other, spec fy / Comments: S

Water Usage Details f

Is the well in S use? S ☐ Yes S ☐ No S ☐ Other, specify:

Type of Use: S ☐ Residential S ☐ Irrigation S ☐ Livestock S ☐ Commercial S ☐ Other, specify: S

Pump Type: S ☐ Submersible S ☐ Jet S ☐ Other, specify: S

Number of S Users: S Adults: S Ch ldren:

Influences on Groundwater Quality f

Onsite Influences: S

☐ Storage Tanks S
☐ Fertilizer S
Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, spec fy: S

Comments/Descript on: S

Neighbouring Influences: S

☐ Storage Tanks S
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, specify: S

Comments/Description: S

Notes f

Left letter on property, noted dug well in front of house

Site Plan or Figure f

COLE ENGINEERING

Well Survey

Sample 2 taken from laundry room

Well Owner Information Q

Name: S Bob/Riley [illegible] Power
Address: S 2182 20th
Inn
Phone No: S (7?4) 30? 3517

Other Details

S Date: S 06'10'2010
urveyor(s): S AR
Other: S

Well Qetails Q

Type: S ☐ Drilled S ☑ Dug S ☐ Other, specify: S

Total Depth: S 7 38m ☑ meters ☐ feet | Depth to Water: 5.685 ☑ meters ☐ feet | Screening S Interval: S ☐ meters ☐ feet

Diameter: S .90 ☑ meters ☐ feet | Stickup: .42 ☑ meters ☐ feet | MOE Well S Number: S

Casing S Material: S ☒ Metal S ☐ Plastic / PVC S ☐ Other, specify:

Security: ☑ Proper Seal S ☐ Cap S ☐ Other, specify / Comments: S

Water Usage Details Q

Is the well in S use? S ☑ Yes S ☐ No S ☐ Other, specify: S

Type of Use: S ☒ Residential S ☐ Irrigation S ☐ Livestock S ☐ Commercial S ☐ Other, specify: S

Pump Type: S ☐ Submersible S ☐ Jet Q ☐ Other, specify: S

Number of S Users: S Adults: 4 Children: S 2

Influences on Groundwater Quality Q

Ons te Influences: S
- ☐ Storage Tanks S
- ☒ Fertilizer
- ☐ Pesticides S
- ☒ Road Salt S
- ☐ Uncontained S Waste S
- ☐ Livestock
- ☐ Uncontained S Chemicals S
- ☐ Automotive Fluids
- ☐ Others, specify: S

Comments/Description: S

Neighbouring Influences: S
- ☐ Storage Tanks S
- ☐ Fertilizer S
- ☐ Pesticides S
- ☐ Road Salt S
- ☐ Uncontained S Waste S
- ☐ Livestock
- ☐ Uncontained S Chemicals S
- ☐ Automotive Flu ds S
- ☐ Others, specify: S

Comments/Description: S

Notes Q

- Well depth greater than 38m
- sample #2 taken from tap in the laundry room.
- 2 wells on prop, second is abandoned.

Site Plan or Q igure Q

in house laundry room

COLE ENGINEERING

Well Survey

Sample 3 taken from basement

Well Owner Information Q

Name: S Ron Doucet
Address: S 2351 20th side road
~~[illegible]~~ innisfil
Phone No: S (705) ~~[illegible]~~ 431 - 2775

Other Qetails Q

Date: S 06'10'2010
Surveyor(s): S AR
Other: S

Well Qetails Q

Type: S ☑ Drilled ☐ Dug S ☐ Other, specify: S

Total Depth: S 13.5m 40 at least ☐ meters ☒ feet | Depth to Water: S 4.42 ☒ meters ☐ feet | Screening S Interval: — ☐ meters ☐ feet

Diameter: S ☐ meters ☐ feet 1 | Stickup: S .40 ☒ meters feet | MOE Well S Number: S N/A

Casing S Material: S ☐ Metal ☐ Plastic / PVC S ☑ Other, specify: S concrete

Security: S ☐ Proper Seal S ☑ Cap S ☐ Other, specify / Comments: S

Water Usage Details Q

Is the well in S use? S ☑ Yes ☐ No S ☐ Other, specify: S

Type of Use: S ☑ Residential S ☐ Irrigation S ☐ Livestock S ☐ Commercial S ☐ Other, specify: S

Pump Type: S ☐ Submersible S ☑ Jet S ☐ Other, specify: S

Number of S Users: S Adults: S 6 Children: 4

Influences on Groundwater Quality Q

Onsite Influences: S
- ☐ Storage Tanks S
- ☐ Fertilizer S
- ☐ Pesticides S
- ☐ Road Salt S
- ☐ Uncontained S Waste S
- ☐ Livestock S
- ☐ Uncontained S Chemicals S
- ☐ Automotive Fluids S
- ☐ Others, specify: S

Comments/Description: S

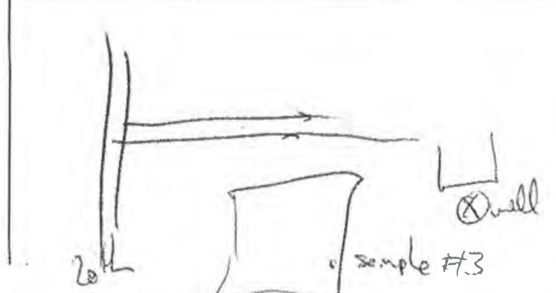
Neighbouring Influences: S
- ☐ Storage Tanks S
- ☐ Fertilizer S
- ☐ Pesticides S
- ☐ Road Salt S
- ☐ Uncontained S Waste S
- ☐ Livestock S
- ☐ Uncontained S Chemicals S
- ☐ Automotive Fluids S
- ☐ Others, specify: S

Comments/Description: S

Notes Q

- 1330 L per day ~~[illegible]~~ usage
- Ron Doucet requested copy of test results
- Sample #3 collected

Site Plan or Figure Q



COLE ENGINEERING

Well Survey

No Sample taken

Well Owner Information

Name: S Carol Browning.

Address: 2355 20th side road. innisfill. ON.

Phone No: S (705) 794 6616.

Other Details

Date: S 06/10/2010

Surveyor(s): S

Other: S

Well Details

Type: S ☑ Drilled S ☐ Dug S ☐ OthSr, specify: S

about 50 feet? Total DSpth: S 50 ? ☐ meters ☑ feet Depth to Water: about 15 ☐ meters ☑ feet ScreeSing S Interval: S ☐ meters ☐ feet

Diameter: S 1 m. ☑ meters ☐ feet StiSkup: S about ½ m ☑ meters ☐ feet MOE WSll S Number: S

CaSsing S Material: S ☐ Metal S ☐ Plastic / PVC S ☑ Other, specify: S Concrete

ecurity: S ☐ Proper Sal S ☐ Cap S ☐ Other, spScify / Comments: S

Water Usage Details

Is the well in use? S ☑ Yes ☐ No S ☐ Other, specify: S

Type of Use: S ☑ Rsidential S ☐ Irrigation S ☐ LiveStock S ☐ Commercial S ☐ Other, specify: S

Pump TypS: S ☐ Submersible S ☐ Jet S ☑ Other, specify: external pump in the house.

Number of Users: Adults: S ChildrSn: S about 2 - 4 people, varies, fish pond

Influences on Groundwater Quality

Onsite InfluSncSs: S

☐ Storage Tanks S
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, spScify: S

CommeSts/Description: S

Neighbouring InfluSnces: S

☐ Storage Tanks S
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, specify: S

Comments/Description: S

Notes

- very clear, good quality water (owner mention).
- owner mentioned that the adjacent farm land has sludge, septic waste dumped on the field.
- sludge diet.

Site Plan or Figure

COLE ENGINEERING

Well Survey

Well Owner Information

Name: S

Address: S 2366 20th sideroad Innisfil ON

Phone No: S ( )

Other Details

Date: S 06/10/2010

Surveyor(s): S AR

Other: S

Well Details

Type: S ☐ Drilled S ☑ Dug S ☐ Other, specify: S

Total Depth: S ☐ meters ☐ feet Depth to Water: S ☐ meters ☐ feet Screening S Interval: S ☐ meters ☐ feet

Diameter: S ☐ meters feet Stickup: S ☐ meters ☐ feet MOE Well S Number: S

Casing S Material: S ☐ Metal ☐ Plastic / PVC S ☐ Other, specify: S

Security: S ☐ Proper Seal S ☐ Cap S ☐ Other, specify / Comments: S

Water Usage Details

Is the well in S use? S ☐ Yes S ☐ No S ☐ Other, specify: S

Type of Use: S ☐ Residential S ☐ Irrigation S ☐ Livestock S ☐ Commercial S ☐ Other, specify: S

Pump Type: S ☐ Submersible S ☐ Jet S ☐ Other, specify: S

Number of S Users: S Adults: S Children: S

Influences on Groundwater Quality

Onsite Influences: S

☐ Storage Tanks S
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, specify: S

Comments/Description: S

Neighbouring Influences: S

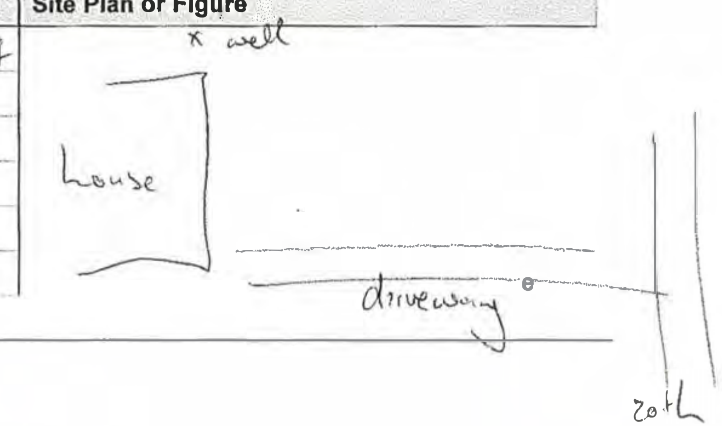
☐ Storage Tanks S
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, specify: S

Comments/Description: S

Notes

Noted well, property owner not home, left letter

Site Plan or Figure



COLE ENGINEERING

Well Survey

Well Owner Information

Name: Brendan Wauchope
Address: 1338 IBR
Innisfil ON
Phone No: ( )

Other Details

Date: 06/07/2010
Surveyor(s): AR
Other:

Well Details

Type: Drilled ☐ Dug ☒ Other, specify: ☐

Total Depth: ☐ meters ☐ feet | Depth to Water: ☐ meters ☐ feet | Screening Interval: ☐ meters ☐ feet

Diameter: ☐ meters ☐ feet | Stickup: ☐ meters ☐ feet | MOE Well Number:

Casing Material: ☐ Metal ☐ Plastic / PVC ☐ Other, specify:

Security: ☐ Proper Seal ☐ Cap ☐ Other, specify / Comments:

Water Usage Details

Is the well in use? ☒ Yes ☐ No ☐ Other, specify:

Type of Use: ☒ Residential ☐ Irrigation ☐ Livestock Commercial ☐ Other, specify:

Pump Type: ☐ Submersible ☐ Jet ☐ Other, specify:

Number of Users: Adults: Children:

Influences on Groundwater Quality

Onsite Influences:
☐ Storage Tanks
☐ Fertilizer
Pesticides
☐ Road Salt
☐ Uncontained Waste
☐ Livestock
☐ Uncontained Chemicals
Automotive Fluids
☐ Others, specify:

Comments/Description:

Neighbouring Influences:
☐ Storage Tanks
Fertilizer
Pesticides
☐ Road Salt
☐ Uncontained Waste
☐ Livestock
☐ Uncontained Chemicals
Automotive Fluids
☐ Others, specify:

Comments/Description:

Notes

Uses groundwater but well is covered by gardening decoration

Site Plan or Figure

COLE ENGINEERING

Well Survey

Well Owner Information

Name: Jose Figueiredo
Address: 1340 IBR
Innisfil ON L9S 4B7
Phone No: (~~704~~) 416-633-1663

Other Details

Date: 06/07/2010
Surveyor(s):
Other:

Well Details

Type: ☐ Drilled ☒ Dug ☐ Other, specify:

Total Depth: ± 30 ft ☐ meters ☒ feet | Depth to Water: 7.73 m ☐ meters ☐ feet | Screening Interval: ☐ meters ☐ feet

Diameter: 5 ft ☐ meters ☐ feet .39 | Stickup: .39 ☒ meters ☐ feet | MOE Well Number:

Casing Material: ☐ Metal ☐ Plastic / PVC ☒ Other, specify: Concrete Metal / Steel

Security: ☐ Proper Seal ☐ Cap ☐ Other, specify / Comments:

Water Usage Details

Is the well in use? ☒ Yes ☐ No ☐ Other, specify:

Type of Use: ☒ Residential ☐ Irrigation ☐ Livestock ☐ Commercial ☐ Other, specify:

Pump Type: ☐ Submersible ☐ Jet ☐ Other, specify: Turbo

Number of Users: Adults: 3 Children:

Influences on Groundwater Quality

Onsite Influences:
☐ Storage Tanks
☐ Fertilizer
☒ Pesticides
☒ Road Salt
☐ Uncontained Waste
☐ Livestock
☐ Uncontained Chemicals
☐ Automotive Fluids
☐ Others, specify:

Comments/Description:

Neighbouring Influences:
☐ Storage Tanks
☐ Fertilizer
☐ Pesticides
☐ Road Salt
☐ Uncontained Waste
☐ Livestock
☐ Uncontained Chemicals
☐ Automotive Fluids
Others, specify:

Comments/Description:

Notes

- Use Well
- Sample # 1 Collected here

Site Plan or Figure

COLE ENGINEERING

Well Survey

Well Owner Information

Name: Lee Vert

Address: 1537 JBR
Innisfil ON

Phone No: (436) 1601

Other Details

Date: 06/07/2010

urveyor(s): S AR

Other: S

Well Details

Type: S ☐ Drilled S ☒ Dug S ☐ Other, specify: S

Total Depth: S	46' (1984) ☐ meters ☒ feet	Depth to Water: S	.68 ☐ meters ☐ feet	Screening S Interval: S	☐ meters ☐ feet
Diameter: S	36' ☐ meters ☐ feet	Stickup: S	.12m ☐ meters ☐ feet	MOE Well S Number: S	

Casing S Material: S Metal ☐ Plastic / PVC S ☒ Other, specify: concrete

Security: S ☒ Proper Seal S ☐ Cap S ☐ Other, specify / Comments: S

Water Usage Details

Is the well in S use? S ☒ Yes ☒ No Other, specify: S

Type of Use: S ☐ Residential S ☐ Irrigation S Livestock S ☐ Commercial S ☐ Other, specify: S Pool

Pump Type: S ☐ Submersible S ☐ Jet S ☐ Other, specify: S

Number of S Users: S Adults: S Children:

Influences on Groundwater Quality

Onsite Influences: S
- Storage Tanks
- ☐ Fertilizer S
- Pesticides
- ☒ Road Salt S
- ☐ Uncontained Waste S
- ☐ Livestock S
- Uncontained S Chemicals S
- ☐ Automotive Fluids S
- ☐ Others, specify: S

Comments/Description: S

Neighbouring Influences: S
- ☐ Storage Tanks S
- ☐ Fertilizer S
- ☐ Pesticides S
- ☐ Road Salt S
- ☐ Uncontained S Waste S
- ☐ Livestock S
- ☐ Uncontained S Chemicals S
- Automotive Fluids S
- ☐ Others, specify: S

Comments/Description: S

Notes

decommissioned but still used for pool

Site Plan or Figure

COLE ENGINEERING

Well Survey

Well Owner Information Q

Name: S

Address: S 1538 Innisfil Beach Rd.
Innisfil ON

Phone No: S ( )

Other Details Q

Date: S 06/07/2010

Surveyor(s): S

Other: S

Well Details Q

Type: S ☐ Drilled S ☐ SDug S ☐ Other, specify: S

Total Depth: S	☐ meters ☐ feet	Depth to Water: S	☐ meters ☐ feet	Screening Interval: S	☐ meters ☐ feet
Diameter: S	☐ meters ☐ feet	Stickup: S	☐ meters ☐ feet	MOE Well S Number: S	

Casing S Material: S ☐ Metal S ☐ Plastic / PVC S ☐ Other, specify: S

Security: S ☐ Proper Seal S ☐ Cap S ☐ Other, specify / Comments: S

Water Usage Q etails Q

Is the well in S use? S ☐ Yes S ☐ No S ☐ Other, specify: S

Type of Use: S ☐ Residential S ☐ Irrigation S ☐ Livestock S ☐ Commercial S ☐ Other, specify: S

Pump Type: S ☐ Submersible S ☐ Jet S ☐ Other, specify: S

Number of S Users: S Adults: Children: S

Influences on Groundwater Quality f

Onsite Influences: S
- ☐ Storage Tanks S
- ☐ Fertilizer S
- ☐ Pesticides S
- ☐ Road Salt S
- ☐ Uncontained S Waste S
- ☐ Livestock S
- ☐ Uncontained S Chemicals S
- ☐ Automotive Fluids S
- ☐ Others, specify: S

Comments/Description: S

Neighbouring Influences: S
- ☐ Storage Tanks S
- ☐ Fertilizer S
- ☐ Pesticides S
- ☐ Road Salt S
- ☐ Uncontained S Waste S
- ☐ Livestock S
- ☐ Uncontained S Chemicals S
- ☐ Automotive Fluids S
- ☐ Others, specify: S

Comments/Description: S

Notes

Formerly had well, has been filled in

Site Plan or Q igure Q

COLE ENGINEERING

Well Survey

Well Owner Information Q

Name: S

Address: S 590 Innisfil Beach Road
Innisfil ON

PhonS No: S ( )

Other Details Q

Date: S 06 / 07 / 2010

SurvSyor(s): S AR

Other: S

Well Qetails Q

Type: S ☐ Dr llSd S ☒ Dug S ☐ Other, specify: S

Total Depth: S ☐ meters ☐ feet Depth to Water: S ☐ meters ☐ feet Screening S Interval: S ☐ meters ☐ feet

DiamSter: S ☐ meters ☐ feet Stickup: S ☐ meters ☐ feet MOE WSll S NumbSr: S

Casing S Material: S ☐ Metal S ☐ Plastic / PVC S ☐ Other, specify: S

Security: S ☐ Proper SSal S ☐ Cap S ☐ Other, specify / Comments: S

Water Usage Details Q

Is thS wSll in S use? S ☐ YSs S ☐ No S ☐ Other, specify: S

Type of UsS: S ☐ Residential S ☐ Irrigation S ☐ Livestock S ☐ CommSrcial S ☐ Other, specify: S

Pump TypS: S ☐ Submersible S ☐ JSt S ☐ Other, specify: S

Number of S UsSrs: S Adults: S ChildrSn:

Influences on Groundwater Quality Q

Onsite InfluSncSs: S
☐ Storage Tanks S
☐ Fertil zSr S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S WastS S
☐ Livestock S
☐ Uncontained Chemicals S
☐ Automotive Fluids S
☐ OthSrs, specify: S

Comments/Descr ption: S

Neighbouring Influences: S
☐ Storage Tanks S
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained Chemicals S
☐ Automotive Fluids S
☐ Others, specify: S

Comments/Description: S

Notes Q

Left letter on property, noted dug well

Site Plan or Figure Q

COLE ENGINEERING

Well Survey

Well Owner Information f

Name: S

Address: S Innisfil Community Church
Innisfil

Phone No: S ( )

Other Details f

Date: S 06 / 07 / 2010

Surveyor(s): S AR

Other: S

Well Details f

Type: S ☐ Drilled S ☐ Dug S ☐ Other, specify: S

Total Depth: S ☐ meters ☐ feet Depth to Water: S ☐ meters ☐ feet Screening S Interval: S ☐ meters ☐ feet

Diameter: S ☐ meters ☐ feet Stickup: S ☐ meters ☐ feet MOE Well S Number: S

Casing S Material: S ☐ Metal S ☐ Plastic / PVC S ☐ Other, specify: S

Security: S ☐ Proper Seal S ☐ Cap S ☐ Other, specify / Comments: S

Water Usage Details f

Is the well in S use? S ☐ Yes S ☐ No S ☐ Other, specify: S

Type of Use: S ☐ Residential S ☐ Irrigation S ☐ Livestock S ☐ Commercial S ☐ Other, specify: S

Pump Type: S ☐ Submersible S ☐ Jet S ☐ Other, specify: S

Number of S Users: S Adults: Children: S

nfluences on Groundwater Quality f

Onsite Influences: S
☐ Storage Tanks
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, specify: S

Comments/Description: S

Neighbouring Influences: S
☐ Storage Tanks S
☐ Fertilizer S
☐ Pesticides S
☐ Road Salt S
☐ Uncontained S Waste S
☐ Livestock S
☐ Uncontained S Chemicals S
☐ Automotive Fluids S
☐ Others, specify: S

Comments/Description: S

Notes

Left letter on ~~site~~ property

Site Plan or Figure f

COLE ENGINEERING

Well Survey

Well Owner Information

Name: New Developments E of Site

Address: Rankin / Webster
Innisfil ON

Phone No: (   )

Other Details

Date: 06/07/2010

Surveyor(s): AR

Other:

Well Details

Type: ☐ Drilled ☐ Dug ☐ Other, specify:

Total Depth: ☐ meters ☐ feet | Depth to Water: ☐ meters ☐ feet | Screening Interval: ☐ meters ☐ feet

Diameter: ☐ meters ☐ feet | Stickup: ☐ meters ☐ feet | MOE Well Number:

Casing Material: ☐ Metal ☐ Plastic / PVC ☐ Other, specify:

Security: ☐ Proper Seal ☐ Cap ☐ Other, specify / Comments:

Water Usage Details

Is the well in use? ☐ Yes ☐ No ☐ Other, specify:

Type of Use: ☐ Residential ☐ Irrigation ☐ Livestock ☐ Commercial ☐ Other, specify:

Pump Type: ☐ Submersible ☐ Jet ☐ Other, specify:

Number of Users: Adults: Children:

Influences on Groundwater Quality

Onsite Influences:	Comments/Description:	Neighbouring Influences:	Comments/Description:
☐ Storage Tanks ☐ Fertilizer ☐ Pesticides ☐ Road Salt ☐ Uncontained Waste ☐ Livestock ☐ Uncontained Chemicals ☐ Automotive Fluids ☐ Others, specify:		☐ Storage Tanks ☐ Fertilizer ☐ Pesticides ☐ Road Salt ☐ Uncontained Waste ☐ Livestock ☐ Uncontained Chemicals ☐ Automotive Fluids ☐ Others, specify:	

Notes

Conducted visual inspection, no appearance of wells on properties

Site Plan or Figure

COLE ENGINEERING

APPENDIX G

Water Balance Methodology

1 W BAS lgori hms and Equations

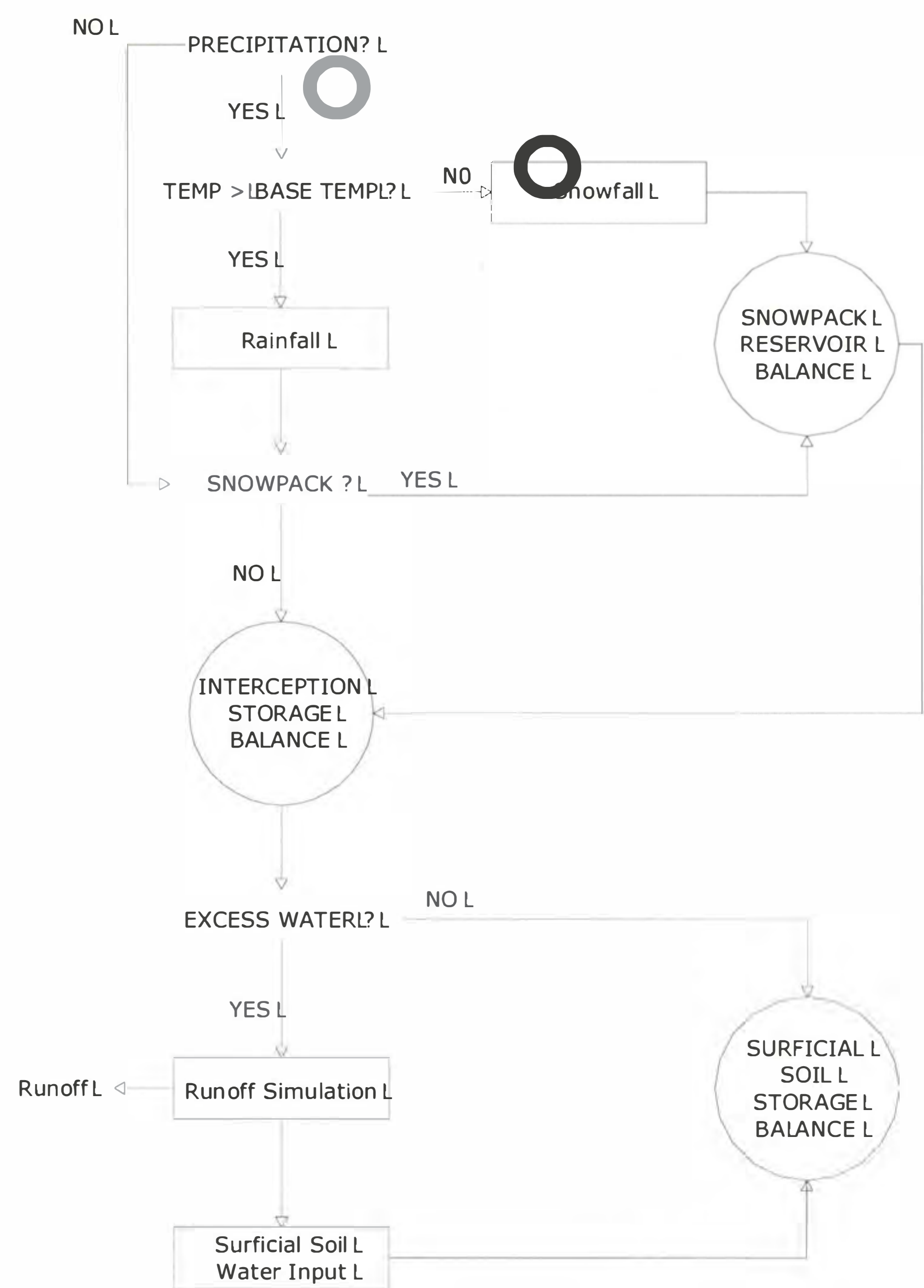


Figure 1: Snowpack, Interception, Surficial Soil Storage Schematics

1.1 Computation Methods

1.1.1 Snowpack Reservoir Balance

Two options are available in WABAS to simulate snow accumulation and melt: Environment Canada's average temperature index method and the GAWSER model maximum-minimum temperature method. The 'max-min' temperature method was used for the Beckett Farm watershed water balance.

The max-min reservoir balance routines in WABAS accumulate, consolidate, and release water from the snowpack in response to the passing of time, inputs of snowfall and rainfall, and due to temperature changes. During periods with snow on the ground, WABAS keeps track of the snowpack conditions by updating its density and liquid water holding capacity. As rainfall or snowmelt occurs, water is absorbed by the snowpack and the liquid water holding capacity decreases to a pre-determined limit after which excess water is released as runoff. Refreeze occurs during days when the temperature falls below the base value, typically 0 degrees Celsius. WABAS calculates both snowmelt and re-freeze during days when the maximum and minimum temperatures fluctuate across the base temperature.

Specifically, the model simulates one of three conditions during the day, as illustrated in **Figure 2**. As shown, melts occurs during period when the temperature exceeds the base value during part or the entire day. Conversely, refreeze occurs when the temperature falls below the base temperature. The area between the temperature line to the base temperature (hatched in figure) is a measure of the intensity of melt or freeze and is expressed as cumulative 'degree-hours'. The greater the degree-hours the more melt occurs. The lesser (negative) degree-hours the more refreeze occurs.

The model applies degree-day equations to calculate snowmelt and refreeze. Snowmelt is calculated as follows:

$$MELT = KM \cdot (T_{AIR} - T_{BAS})$$

Where: KM = melt factor, in mm/day/^{o}C.
T_{AIR} = air temperature, in degrees Celsius.
T_{BAS} = base temperature at which snow melts, in degrees Celsius

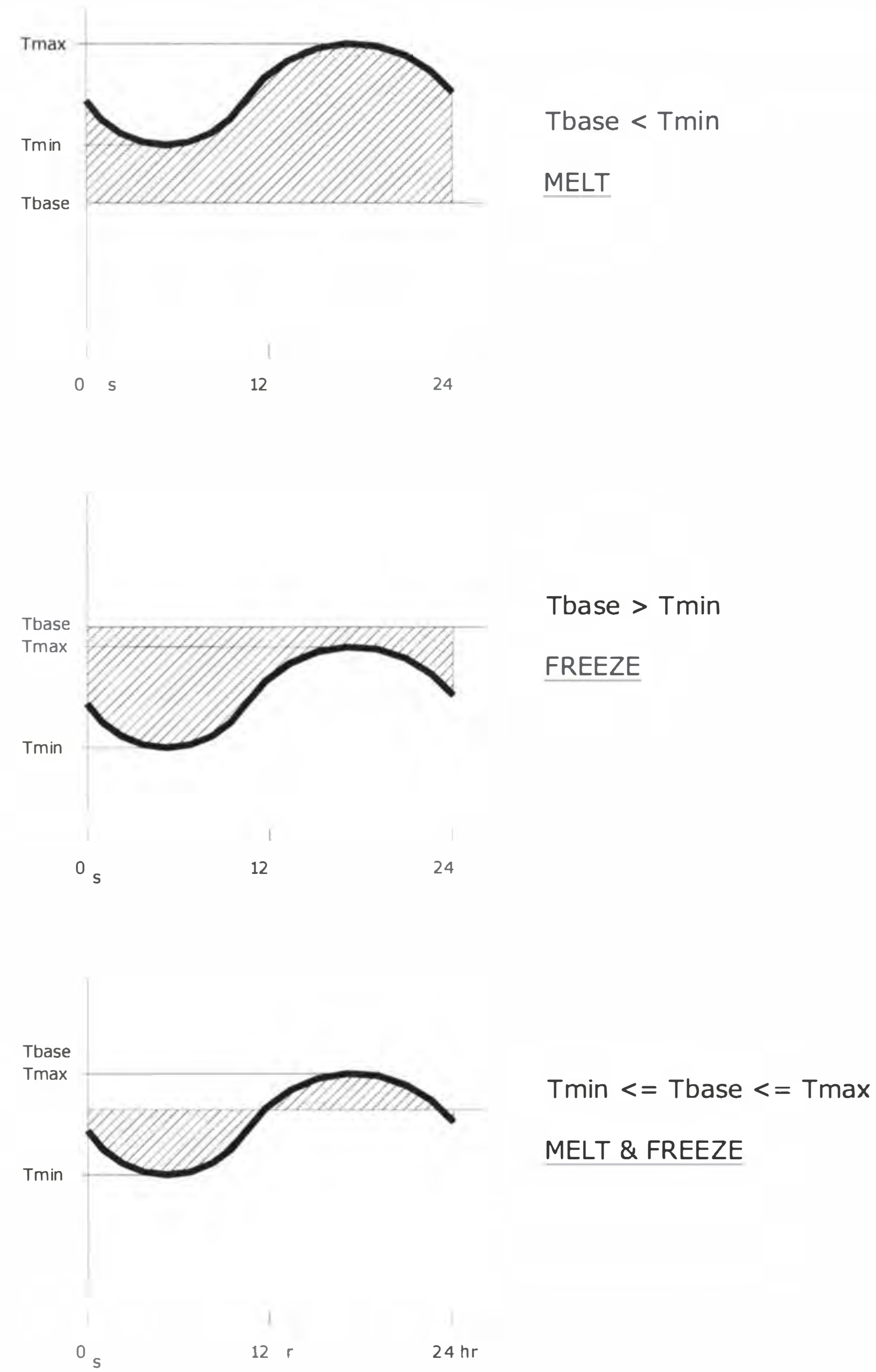


Figure 2: Snowmelt Cases in WABAS

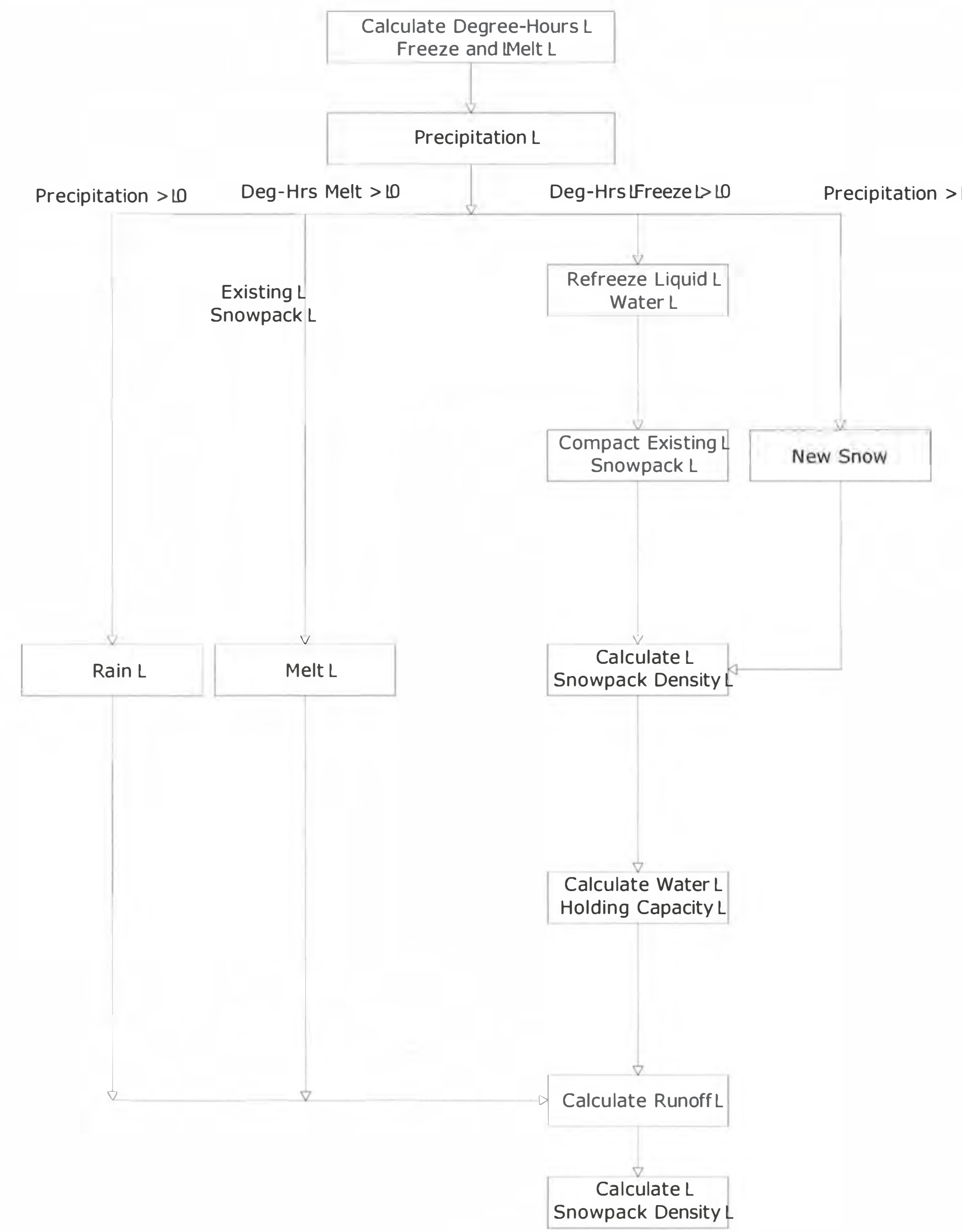


Figure 3: Snowpack Reservoir Balance Computation

The melt factor, KM, is time-varying and depends on location, type of cover, exposure to solar radiation, time of year, and meteorological conditions. There is no melt when the air temperature stays below the base temperature.

Refreeze is calculated as:

$$REFREEZE \quad KF \cdot (T_{BAS} - T_{AIR})$$

Where: KF = refreeze factor, in mm/day/°C.
T_{AIR} = air temperature, in degrees Celsius.
T_{BAS} = base temperature at which snow melts, in degrees Celsius

The refreeze factor, KF, has units of mm/day/°C and is also time-varying. It is set equal to KM.

The analysis implements a sinusoidal time-varying function to represent daily and seasonal parameter variations. For example, daily temperature variations are represented as follows:

$$T \quad \left(\frac{T_{MAX} - T_{MIN}}{2}\right) \cdot SIN\left[\left(\frac{t - t_{T\min}}{12} - \frac{1}{2}\right) \cdot \pi\right] + \left(\frac{T_{MAX} + T_{MIN}}{2}\right)$$

Where: T_{MAX} = refreeze factor, in mm/day/°C.
T_{MIN} = air temperature, in degrees Celsius.
t = current time, in hours.
t_{Tmin} = time when minimum temperature occurs, in hours.

Cumulative degree-melt or degree-freeze hours are calculated by integrating for the areas between the daily temperature curve and the base temperature. As indicated previously, this can be positive (melt), negative (freeze , or both (melt and freeze) during one day. Similarly, precipitation is distributed as rain and snow based on the relative magnitudes of degree-days.

The snowpack reservoir balance tracks the solid and liquid water content and the relative dry-density of the snowpack. Snowmelt runoff occurs when the liquid water content exceeds the liquid water holding capacity of the pack. The runoff volume, in mm, is calculated as follows:

$$RUNOFF \quad LWC - LWCAP$$

Where, RUNOFF = snowmelt runoff, in millimetres
LWC = liquid water content, in millimetres
LWCAP = liquid water holding capacity, in millimetres

The liquid water content of the snowpack at the end of the snowmelt event is equal to the liquid water holding capacity, LWCAP. The LWCAP is a function of the density of the snowpack, where density is expressed as:

$$RHO \quad \frac{SWC}{SDEP}$$

Where, RHO = relative dry density of the snowpack, vol/vol.
SWC = solid water content, in millimetres
SDEP = snowpack depth, in millimetres

The greater the density of the snowpack, the less water it can hold. New snow has the lowest density and highest water holding capacity. As per the GAWSER documentation, the relative dry density of new snow varies from 0.02 to 0.15, with a typical value of 0.1.

Snowpack density reductions occur due to melt and compaction. Compaction is calculated as follows:

$$HO_F \quad \frac{(\;HO_I \cdot RHO_{MAX})}{\left(RHO_I + (\;HO_{MAX} - RHO_I) \cdot \exp\left(-\frac{DT}{KC}\right)\right)}$$

Where, RHO_F = final relative dry density of the snowpack, vol/vol.
RHO_I = initial relative dry density, vol/vol.
RHO_{MAX} = maximum specified relative dry density, vol/vol.
DT = time period, in hours.
KC = compaction time constant, in hours.

The compaction time constant, KC, is a function of the air temperature, T. In WABAS, the average daily temperature is used to calculated KC as:

$$KC = B \cdot \exp(-A \cdot \overline{T})$$

Where, A, B = coefficients, in 1/C° and hours, respectively.
$\overline{T}$ = average daily temperature, in C°.
RHO_{MAX} = maximum specified relative dry density, vol/vol.
DT = time period, in hours.
KC = compaction time constant, in hours.

1.1.2 Interception (Abstraction) Storage Balance

Abstraction losses account for rainfall on vegetation on depressed areas where there is no possibility for lateral or downward movement. WABAS accounts for abstraction losses over pervious and impervious surfaces separately. In both cases, rain or snowmelt first fills the depressed storage prior to generating runoff and/or replenishing the surficial soil storage reservoir. After filling the depressions, abstraction storage is restored through evaporation. The amount of water stored, ABSTOR, in depressions is:

$$ABSTOR_F = ABSTOR_I + INPUT_{R+SM} - OUTPUT_{EVAP}$$

Where, $ABSTOR_F$ = final water in abstraction storage, in millimetres
$ABSTOR_I$ = final water in abstraction storage, in millimetres
$INPUT_{R+SM}$ = rainfall and snowmelt input to abstraction storage, in millimetres
$OUTPUT_{EVAP}$ = rainfall input to abstraction storage, in millimetres

ABSTOR is defined as part of the basin physical data for pervious and impervious areas.

1.1.3 Active Hydrologic Soil Zone Balance

The available storage in the active hydrologic soil zone, S, is very important in the water budget analysis process. The active soil zone connects the surface and groundwater systems. The amount of water entering the active hydrologic zone is controlled by the surface runoff equation, which in turn depends on how much storage is available in the active zone. The more storage available the more water absorbed into the surficial soil resulting in lower surface runoff. The amount entering the active hydrologic zone during wet-weather events is thus:

$$SI = TOTAL\_EXCESS\_WATER_{PER} - RUNOFF_{PER}$$

Where SI refers to water input. Water entering the active zone can be retained in the soil matrix by surface tension forces or moves downward into groundwater system (groundwater infiltration) or is lost through evapotranspiration. Other processes that may occur within the active hydrologic zone such as interflow movement are very difficult to simulate due to the variable soil conditions and are often dealt through model calibration.

WABAS calculates the water balance of this active soil storage accounting for inflows from the surface (water that does not runoff , and losses to evaporation and infiltration.

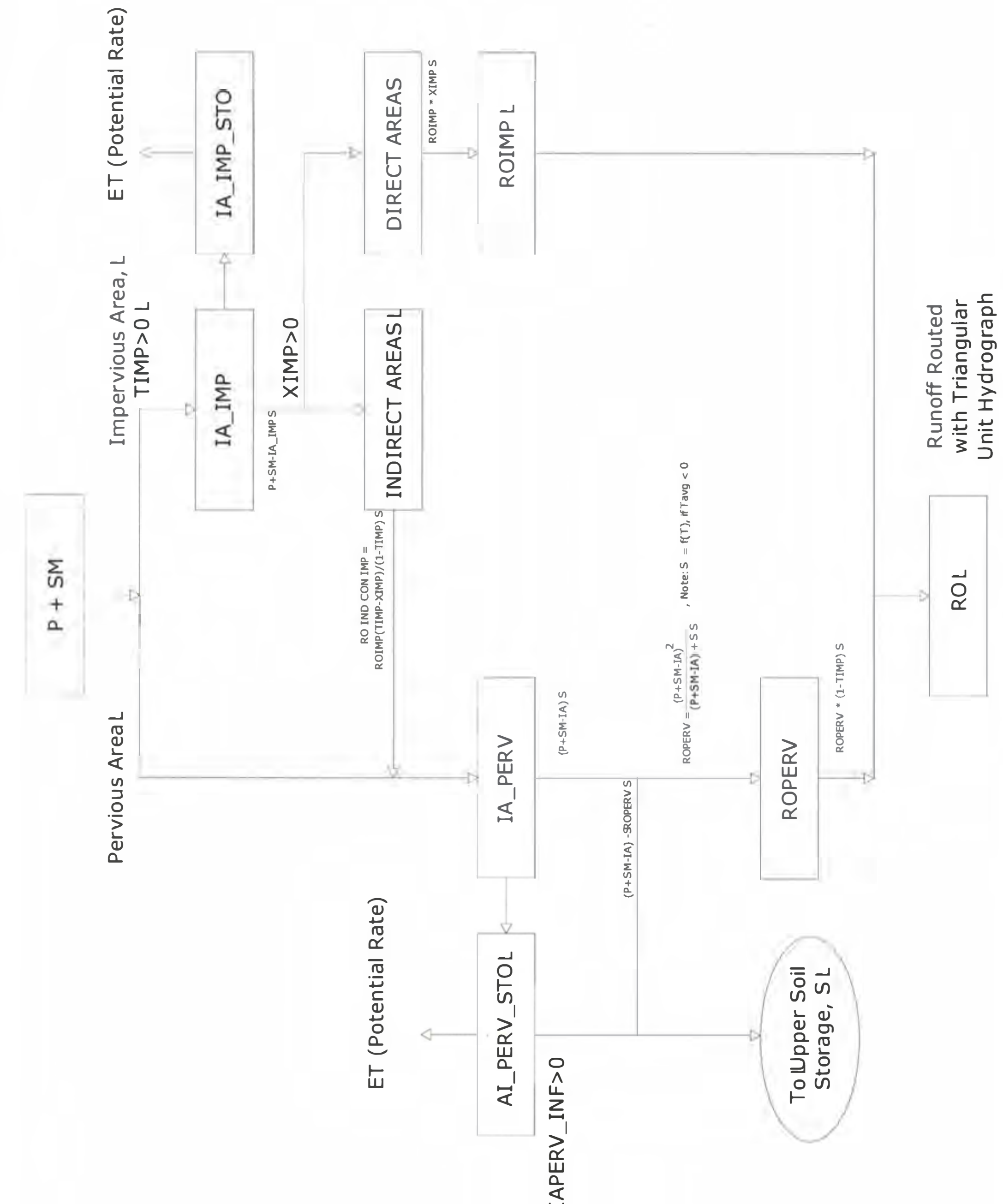


Figure 4: Active Hydrologic Soil Zone Balance

1.1.3.1 Runoff

Runoff is calculated independently from pervious and impervious surfaces. For impervious surfaces, runoff is simply the difference between the rainfall plus snowmelt and the abstraction losses.

$$UNOFF_{IMP} \quad AIN + SNOWMELT - ABSLOSS_{IMP}$$

Where, $RUNOFF_{IMP}$ = runoff from impervious land surfaces, in millimetres
RAIN = measured rainfall, in millimetres
SNOWMELT = melt water released from snowpack, in millimetres
$ABSLOSS_{IMP}$ = abstraction losses over impervious land surface, in millimetres

Rain plus snowmelt is determined from the snow reservoir routine, ensuring that precipitation as rain is not retained in the snowpack. Runoff from pervious surfaces is calculated using the modified form of the US Soil Conservation Service (SCS) Curve Number (CN) method. This method is consistent with other hydrologic analysis methods applied in several hydrologic models in southern Ontario. The form of the SCS runoff equation is:

$$UNOFF_{PER} = \frac{(RAIN + SNOWMELT + ICRO - ABSLOSS_{PER})^2}{(RAIN + SNOWMELT + IC \quad O - ABSLOSS_{PER}) + S}$$

Where, RUNOFFPER = runoff from pervious land surfaces, in millimetres
RAIN = measured rainfall, in millimetres
ICRO = effective runoff from indirectly connected impervious land surfaces, in millimetres
SNOWMELT = melt water released from snowpack, in millimetres
ABSLOSSPER = abstraction losses over pervious land surface, in millimetres
S = available storage in active hydrologic soil zone, in millimetres

As per impervious land surfaces, rain plus snowmelt is determined from the snow reservoir routine, ensuring that precipitation as rain is not retained in the snowpack. The term ICRO is the net contribution of water from impervious surfaces onto pervious surfaces referred to as 'indirectly connected impervious areas'. This 'net' factor accounts for several physical conditions reduce the impacts of indirectly connected impervious areas on pervious areas:

- Unlike precipitation and snowmelt, which are generally uniformly distributed over the pervious areas, runoff contributions from impervious areas are often concentrated in flow channels.

- Indirectly connected impervious areas are not always uniformly distributed over the entire basin and only affect a fraction of the pervious surfaces.

The net effect is that water from indirectly connected areas is somewhat reduced and not available over the entire pervious surfaces. WABAS implements this condition through a reduction factor for the indirectly connected areas. Evaluation of typical lot layouts and grading suggest that a 0.20 multiplication factor (80% reduction) of the indirectly connected areas is a reasonable value.

The water balance analysis also incorporates an effective soil storage adjustment during winter conditions in the presence of a snowpack. This factor simulates soil freeze conditions with an apparent reduction in available soil storage. Literature on this topic indicates that the infiltration characteristics of frozen versus unfrozen ground is not well understood and depends upon the moisture content at the time of freezing (EPA SWMM4, p. 437). The snow pack insulates the underlying soil and if the ground was frozen prior to snowfall it will remain frozen thereafter, even after the snow starts to melt. During snowmelt, WABAS assumes that the soil has very little storage available (approx. 90% reduction for the purpose of calculating net runoff. Again, this approach accounts for uneven areal-distribution of the snowpack or for different soil freeze condition during snowfall.

1.1.3.2 Evaporation

Evaporation is a measured parameter. Evapotranspiration (ET) is calculated using a modified version of the U.S. Agricultural Research Service (ARS) equation. ET from soil water accounts for the vegetation characteristics and amount of soil water available in the active hydrologic zone.

The form of the ET equation is as follows (Viessman, 1977 :

$$ET = GI \cdot k \cdot PE \cdot \left(\frac{S - SA}{AWC}\right)^n$$

Where, ET = actual evapotranspiration, in millimetres
GI = vegetation growth index as a proportion of maturity
k = ratio of ET to potential ET (PET) at full canopy with freely-available water
PE = lake evaporation taken as the potential, in millimetres
S= as identified in the following table, percentage.
SA= available porosity (unfilled by water .
AWC = porosity drainable only by evapotranspiration
n = an exponent that varies with soil type in the range of 0.1 to 0.25.

The growth index (GI) is modified seasonally by a sinusoidal distribution over the summer growing season. The model calculates actual ET from the vegetation growth index as a function of the of year, lake evaporation and the underlying soil conditions. The resulting ET is a measure of the water loss from surficial soil storage largely through diffusion of water vapour from plant leaves to the atmosphere (transpiration). The algorithm depletes surficial abstraction at the potential rate. The PET remaining and 'evapotranspiration opportunity' are used to quantify and extend the water loss from the upper soil storage to the root zone. Evapotranspiration opportunity is defined as the maximum amount of water available for evapotranspiration at a particular location during a prescribed time period.

1.1.3.3 Infiltration

Water moves from the active hydrologic soil zone downward according to Darcy's law. Darcy's law may be expressed

$$q = -K \frac{\partial h}{\partial z}$$

Where, q = Darcy flux in millimetres/day
K = saturated hydraulic conductivity, in millimetres per day
$\frac{\partial h}{\partial z}$ = is the hydraulic gradient in a downward direction

WABAS moves water downward within the hydrologically active zone based on the average relative permeability (calculated as function of water saturation) within the unsaturated zone. The movement from the active hydrologic zone downward is determined as a sharp wetting front.

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APPENDIX H

Statement of Limiting Conditions & Assumptions

Hydrogeological Investigation for Alcona Capital Properties
Project No. E10-223
December 2010

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other than the Intended Users has the right to use and rely on the Work without first obtaining the written authorization of Cole Engineering Group Ltd. (Cole Engineering) and its Owner.

2. Cole Engineering expressly excludes liability to any party except the Intended Users for any use of and/or reliance upon, the Work.

3. Cole Engineering notes that the following assumptions were made in completing the Work:

   a) the land use description(s) supplied to us are correct;
   b) the surveys and data supplied to Cole Engineering by the Owner are accurate;
   c) market timing, approval delivery and secondary source information is within the control of Parties other than Cole Engineering; and
   d) there are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances which would significantly affect the use or servicing.

   Investigations have not been carried out to verify these assumptions. Cole Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respects.

4. Cole Engineering accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub-soil conditions, environmental, engineering or other factual and technical matters disclosed by the Owner, the Client, or any public agency, which by their nature, may change the outcome of the Work. Such factors, beyond the scope of this Work, could affect the findings, conclusions and opinions rendered in the Work. We have made disclosure of related potential problems that have come to our attention. Responsibility for diligence with respect to all matters of fact reported herein rests with the Intended Users.

5. Cole Engineering practices engineering in the general areas of infrastructure and transportation. It is not qualified to and is not providing legal or planning advice in this Work.

6. The legal description of the property and the area of the site were based upon surveys and data supplied to us by the Owner. The plans, photographs, and sketches contained in this report are included solely to aide in visualizing the location of the property, the configuration and boundaries of the site, and the relative position of the improvements on the said lands.

7. We have made investigations from secondary sources as documented in the Work, but we have not checked for compliance with by-laws, codes, agency and governmental regulations, etc., unless specifically noted in the Work.

8. Because conditions, including capacity, allocation, economic, social, and political factors change rapidly and, on occasion, without notice or warning, the findings of the Work expressed herein, are as of the date of the Work and cannot necessarily be relied upon as of any other date without subsequent advice from Cole Engineering.

9. The value of proposed improvements should be applied only with regard to the purpose and function of the Work, as outlined in the body of this Work. Any cost estimates set out in the Work are based on construction averages and subject to change.

10. Neither possession of the Work, nor a copy of it, carries the right of publication. All copyright in the Work is reserved to Cole Engineering and is considered confidential by Cole Engineering. The Work shall not be disclosed, produced or reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of Cole Engineering and the Owner.

11. The Work is only valid if it bears the professional engineer's seal and original signature of the author, and if considered in its entirety. Responsibility for unauthorized alteration to the Work is denied.

ARG GROUP INC.

INFILTRATION TEST

Proposed Alcona Capital Residential Subdivision

EE15-0206.

COLE ENGINEERING

OCTOBER 2015

COLE ENGINEERING GROUP LTD.

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COLE ENGINEERING

October 30, 2015
Reference No. EE15-0206

Mr. Neil Palmer
ARG Group Inc.
111 Creditstone Road
Vaughan ON, L4K 1N3

Dear Mr. Palmer:

Re: Infiltration Testing
Proposed Alcona Capital Residential Subdivision
Part of Lot 8, Concession 21, Town of Innisfil, Ontario

Cole Engineering Group Ltd. is pleased to submit the enclosed Infiltration Testing Report. This report summarizes the infiltration tests completed at five locations across the future Alcona Capital Residential Subdivision, the purpose of the infiltration tests is to assess the hydraulic conductivity and infiltration rate of the native soil across the Site. These data can also be used to support the design of future infiltration Best Management Practices at the proposed development.

We thank you for the opportunity to undertake this work on your behalf. If you have any questions, please do not hesitate to call our office.

Yours truly,

COLE ENGINEERING GROUP LTD.

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Issues and Revisions Registry

Identification	Date	Description of issued and/or revision
Final Report	October 30, 2015	

Statement of Conditions

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APPENDICES

1 Introduction

Cole Engineering Group Ltd. was retained by ARG Group Inc. (Client) to conduct infiltration tests at five locations across the future Alcona Capital Residential Subdivision (will be referred to as the Site). The infiltration tests were required by Lake Simcoe Region Conservation Authority (LSRCA) to assess the potential infiltration rates at various locations and at varying depths across the Site. The results from the infiltration tests will provide a basis for the design of future infiltration Best Management Practices (BMPs) at the Site. The field infiltration tests were completed between August 12, 2015 and August 21, 2015.

1.1 Site Description and Project Background

The future Alcona Capital Residential Subdivision is located at the northeast quadrant of 20th Sideroad and Innisfil Beach Road, Town of Innisfil. The Site is approximately 15.3 hectares and the proposed development plan include town houses, detached houses, two Stormwater Management Ponds and a parkette.

Based on our meeting with the Town of Innisfil (Town) and LSRCA on June 23, 2015, the Town and LSRCA promote the proposed development to incorporate infiltration BMPs to maintain the existing infiltration and potentially reduce runoff. However, at this point, the location, type and depth of infiltration BMPs are not yet determined. Therefore, the infiltration tests were conducted at multiple locations and multiple depth across the Site to assess the soil conditions and general infiltration rate across the Site.

1.2 Goals and Objectives for the Infiltration Testing

Based on discussions with the Town and LSRCA, the feasibility for implementation of infiltration BMPs will need to be assessed through in-situ testing methods. The goal for conducting the field infiltration tests is to measure the saturated hydraulic conductivity and infiltration rate of the native soil at multiple locations and depths across the Site. These data can be used to support the design of infiltration BMPs proposed in future.

According to the *Stormwater Management Planning and Design Manual* (Ministry of the Environment and Climate Change, March 2003), infiltration BMPs such as infiltration trenches are typically sized to ensure a 24 hour to 48 hour drawdown of the stored water. Furthermore, the *Stormwater Management Planning and Design Manual* specified that infiltration trenches are not suitable if the native soil has a percolation rate less than 15 mm/hour. At this point, the exact location, type and depth of infiltration BMPs are not determined yet; however, the 15 mm/hour infiltration rate threshold specified by MOECC can be used as a general evaluation criteria to determine if the Site may be suitable for implementation of infiltration BMPs.

2 Infiltration Testing

The infiltration testing work plan was designed following the requirements from the *Low Impact Development Stormwater Management Planning and Design Guide, Appendix C – Site Evaluation and Soil Testing Protocol for Stormwater Infiltration* (TRCA and CVC, 2010). Furthermore, LSRCA was consulted to discuss the adequacy of the infiltration testing work plan and were satisfied with the proposed work plan.

2.1 Testing Locations

Five test pits were excavated Between August 12, 2015 and August 21, 2015 using a mechanical excavator to facilitate the infiltration testing. The test pits were excavated to a depth between 3 to 4 m below the existing ground and were tiered at approximately 1 m interval to allow easy access and infiltration testing

at various depths. The details of each test pit are summarized in Table 1. The location and ground elevation of the test pits were surveyed using a GPS and are shown on Figure 1. Photos of the test pits and infiltration test results are included in Appendix A.

Groundwater seepage was encountered at two test pits: Test Pit 3, at approximately 4 m below grade (267.9 masl) and Test Pit 5, at approximately 2.6 m below grade (263.5 masl). The groundwater levels observed in the test pits were consistent with the interpreted shallow groundwater contour included in the following hydrogeological investigation reports:

- Cole Engineering Group Ltd., December 2010, Hydrogeological Investigation for Alcona Capital Properties Inc. Part of Lot 8, Concession 21, Innisfil, ON.
- Cole Engineering Group Ltd., June 2011, Groundwater Level Monitoring Report for Alcona Capital Properties Inc. Part of Lot 8, Concession 21, Innisfil, ON.

Table 1 Test Pit Details

Test Pit Description	GPS Coordinate (m)	Existing Ground Elevation	Test Pit Depth and Floor Elevation	Soil Condition
Test Pit 1, located to the northwest portion of the Site	Easting: 613448 Northing: 4907696	269 masl	3.4 m, 265.6 masl	0.3 m top soil, underlain by 0.7 m silt, underlain by sandy silt till to 3.4 m
Test Pit 2, located to the northeast portion of the Site	Easting: 613641 Northing: 4907748	271 masl	3.5 m, 267.5 masl	0.3 m top soil, underlain by 0.7 m gravel and sand, underlain by 1 m sand, underlain by sandy silt and silt till to 3.5 m
Test Pit 3, located to the southwest portion of the Site	Easting: 613519 Northing: 4907490	271.9 masl	4 m, 267.9 masl	0.3 m top soil, underlain by sandy silt and sandy silt till to 4 m
Test Pit 4, located in the central portion of the Site	Easting: 613579 Northing: 4907592	272.7 masl	3.6 m, 269.1 masl	0.3 m top soil, underlain by sandy silt and silty sand till to 3.6 m
Test Pit 5, located to the southeast portion of the Site	Easting: 613717 Northing: 4907389	266.1 masl	3.1 m, 263 masl	0.3 m top soil, underlain by silty sand and sandy silt to 3.1 m

2.2 Test Procedure

For each infiltration test, a well hole was augered using a 6 cm diameter hand auger on the floor of the test pit to a depth range between 10 cm and 20 cm. Infiltration tests were performed in the well hole using a Guelph Permeameter.

The augered soil was collected in a zip-lock bag and one selected soil sample from each test pit was analyzed for grain size distribution. The details of each well hole used for the infiltration test are summarized in Table 2. Approximate depth and location of each well hole is also illustrated on photographs included in Appendix A.

Table 2 Well Hole Details

Test ID	Test Depth	Test Elevation	Well Hole Soil Description	Sample ID and Analysis
Test Pit 1, Test 1-1	1 m	~268 masl	light brown, dry to moist, silt, some gravel, clay and sand	Test Pit 1, ~1 m
Test Pit 1, Test 2-1	2.3 m	~266.7 masl	light brown, moist, sandy silt, trace gravel, signs of iron oxidation	Test Pit 1, ~2 m
Test Pit 1, Test 3-1	3.4 m	~265.6 masl	light brownish grey, moist to wet, sandy silt, some clay, trace gravel, signs of iron oxidation	Test Pit 1, ~3 m
Test Pit 1, Test 3-2	3.4 m	~265.6 masl	light brownish grey, moist to wet, sandy silt, some clay, trace gravel, signs of iron oxidation	Test Pit 1, ~3 m
Test Pit 2, Test 1-1	1 m	~270 masl	light yellowish brown, moist, sand	Test Pit 2, ~1 m
Test Pit 2, Test 2-1	2 m	~269 masl	dark brown, moist, sandy silt, some clay, trace of gravel	Test Pit 2, ~1.5 m
Test Pit 2, Test 2-2	2.5 m	~268.5 masl	light brownish grey, moist, silt, trace clay, sand and gravel	Test Pit 2, ~2 m
Test Pit 2, Test 3-1	3.5 m	~267.5 masl	light brownish grey, moist, silt, trace clay, sand and gravel	Test Pit 2, ~3 m
Test Pit 3, Test 1-1	0.5 m	~271.4 masl	light brown, dry, sandy silt	Test Pit 3, ~0.5 m
Test Pit 3, Test 1-2	1 m	~270.9 masl	light brown, moist, sandy silt	Test Pit 3, ~1 m
Test Pit 3, Test 2-1	2 m	~269.9 masl	light brown, moist, sandy silt, some clay, trace gravel	Test Pit 3, ~2 m
Test Pit 3, Test 3-1	3 m	~268.9 masl	light brown, moist, sandy silt	Test Pit 3, ~3 m
Test Pit 4, Test 1-1	1.1 m	~271.6 masl	light brown, dry, sandy silt	Test Pit 4, ~1 m
Test Pit 4, Test 1-2	1 m	~271.7 masl	light brown, dry, sandy silt	Test Pit 4, ~1 m, test 2
Test Pit 4, Test 2-1	2.3 m	~270.4 masl	light brown, moist, silty sand	Test Pit 4, ~2 m
Test Pit 4, Test 3-1	3.6 m	~269.1 masl	light brown, moist, silty sand, trace clay and gravel	Test Pit 4, ~3 m
Test Pit 5, Test 1-1	1 m	~265.1 masl	light greyish brown, moist, silty sand, trace gravel and cobble, iron oxidation	Test Pit 5, ~1 m
Test Pit 5, Test 1-2	1.5 m	~264.6 masl	light greyish brown, moist, silty sand, trace gravel and cobble, iron oxidation	Test Pit 5, ~1.5 m
Test Pit 5, Test 2-1	2 m	~264.1 masl	light greyish brown, moist to wet, sandy silt, trace gravel and cobble, iron oxidation	Test Pit 5, ~2 m

The infiltration tests were completed using the Guelph Permeameter and the device maintains a constant water depth in the well hole using the Marriott Principle. The water which infiltrates into the ground is replenished by the Guelph Permeameter reservoir and the rate of water level drop in the Guelph Permeameter reservoir is indicative of the infiltration rate at the well hole. Therefore, the infiltration rate is estimated by measuring the change in water level in the Guelph Permeameter reservoir until steady state is reached (minimum three consecutive of same or similar intervals of change in water level). The saturated hydraulic conductivity of the soil is estimated based on the steady-state infiltration rate.

3 Test Results

3.1 Soil Condition

Based on the field logging of soil samples and grain size distribution analysis completed for five soil samples, the overburden at the Site is primarily sandy silt and silty sand to a maximum investigation depth of 4 m below ground surface. A varying level of clay and gravel content was also observed in the sandy silt and silty sand material, which could potentially affect the infiltration rate.

A sand layer of approximately 1.7 m thick was encountered beneath the topsoil at Test Pit 2, located in the northeast portion of the Site. The grain size distribution analysis results are included in Appendix B.

3.2 Estimated Soil Hydraulic Conductivity and Infiltration Rate

The field saturated hydraulic conductivity (K_{fs}) was calculated using the "Guelph Permeameter Calculator" spreadsheet obtained from the Soilmoisture website (http://www.soilmoisture.com/home.php). The calculation requires input of water height in well hole (H), well hole radius (a), the Guelph Permeameter reservoir cross-section area, the steady state rate of water level drop in the Guelph Permeameter reservoir (R) and selection of a microscopic capillary length factor (α*) based on the soil text-structure category.

A shape factor (C) is required in order to calculate the field saturated hydraulic conductivity. The shape factor for each water head is based on the microscopic capillary length factor. For most of the infiltration tests, the overburden materials primarily consist of silt; therefore, a corresponding microscopic capillary length factor of 0.04 cm^{-1} was selected, which is representative of soils that are fine textured (clayey or silty), unstructured and may include some fine sand. Based on a microscopic capillary length factor of 0.04 cm^{-1}, the specific equation used to calculate the shape factor is as follows:

$$C_{(0.04)} = \left(\frac{H/a}{1.992 + 0.091(H/a)}\right)^{0.683}$$

For infiltration tests conducted in sandy materials (Test Pit 2, Test 1-1), a higher microscopic capillary length factor of 0.12 cm^{-1} was selected, which is representative of medium and fine sands. The corresponding shape factor is calculated using the following equation:

$$C_{(0.12)} = \left(\frac{H/a}{2.074 + 0.093(H/a)}\right)^{0.754}$$

The steady state infiltration rate (Q) is also required to calculate the field saturated hydraulic conductivity. It is estimated using the steady state rate of water level drop in the Guelph Permeameter reservoir and the corresponding cross-section area of the reservoir. For tests where only the inner reservoir (cross-section area of 2.16 cm^2) was used due to the low infiltration rate, the corresponding equation used to determine the steady state infiltration rate is as follows:

$$Q = R \times 2.16$$

For tests where the combined reservoirs were used (both inner and outer reservoir, with cross-section area of 35.22 cm^2), the following equation was used to determine the steady state infiltration rate:

$$Q = R \times 35.22$$

Once the shape factor and steady state infiltration rate are determined, the saturated hydraulic conductivity at each well hole is calculated using the following equation:

$$K_{fs} = \frac{C \times Q}{2\pi H^2 + \pi a^2 C + 2\pi \left(\frac{H}{\alpha *}\right)}$$

The soil at the Site are mostly sandy silt and silty sand with estimated saturated hydraulic conductivity range between 2.8 x 10^{-6} cm/s and 2.6 x 10^{-4} cm/s, with a geometric mean of 3.3 x 10^{-5} cm/s. The sand layer encountered at approximately 1 m below grade at Test Pit 2 (northeast portion of the Site) had a higher saturated hydraulic conductivity of 3.9 x 10^{-2} cm/s. The details of the saturated hydraulic conductivity calculation are summarized in Table 3 and the field notes are included in Appendix A.

The saturated hydraulic conductivity measured using the Guelph Permeameter will need to be converted to infiltration rates (T) for the purpose of designing the infiltration BMPs. The approximate relationship presented in the *Low Impact Development Stormwater Management Planning and Design Guide* (TRCA and CVC, 2010) was used for the conversion:

$$K_{fs} = 6 \times 10^{-11} \times T^{3.7363}$$

Based on the measured saturated hydraulic conductivity, the corresponding infiltration rate for the sandy silt material underlying the Site ranged between 18 mm/hour to 59 mm/hour, with corresponding geometric mean infiltration rate of 34 mm/hour. In general, the infiltration rates for the sandy silt material encountered at the test pits to the northern portion of the Site (Test Pit 1 and Test Pit 2) are slightly lower (approximately 18 mm/hour to 29 mm/hour) compared to the infiltration rates of the sandy silt material encountered at the central portion and southern portion of the Site (30 mm/hour to 59 mm/hour). Furthermore, the estimated infiltration rates tend to decrease with increase in testing depth, potentially due to increase in level of compaction to the overburden materials.

The sand layer encountered at Test Pit 2, beneath the topsoil had a high infiltration rate of approximately 228 mm/hour. The sand layer was not encountered at other test pits and is likely localized in areas around Test Pit 2 (northeast portion of the Site). The converted infiltration rate results are summarized in Table 4.

Table 3 Summary of the Estimated Saturated Hydraulic Conductivity at Each Well Hole

Test ID	Water Height in Well Hole (cm)	Guelph Permeameter Reservoir Used	Steady State Rate of Water Level Chance in Guelph Permeameter Reservoir (cm/min)	Kfs (cm/s)	Geometric Mean Kfs (cm/s)
Test Pit 1, Test 1-1	5	Inner	0.26	8.2E-06	1.0E-05
Test Pit 1, Test 2-1	7	Inner	0.48	1.3E-05	
Test Pit 1, Test 3-1	5	Inner	0.28	8.8E-06	
Test Pit 1, Test 3-2	5	Inner	0.42	1.3E-05	
Test Pit 2, Test 1-1	3	Combined	27	3.9E-02	3.9E-02
Test Pit 2, Test 2-1	7	Combined	0.04	1.7E-05	6.7E-06
Test Pit 2, Test 2-2	7	Inner	0.24	6.3E-06	
Test Pit 2, Test 3-1	5	Inner	0.09	2.8E-06	
Test Pit 3, Test 1-1	7	Combined	0.24	1.0E-04	7.7E-05
Test Pit 3, Test 1-2	7	Combined	0.08	3.4E-05	
Test Pit 3, Test 2-1	5	Combined	0.46	2.4E-04	
Test Pit 3, Test 3-1	7	Combined	0.1	4.2E-05	
Test Pit 4, Test 1-1	5	Combined	0.42	2.1E-04	1.4E-04
Test Pit 4, Test 1-2	5	Combined	0.3	1.5E-04	
Test Pit 4, Test 2-1	5	Combined	0.5	2.6E-04	
Test Pit 4, Test 3-1	5	Combined	0.1	5.1E-05	
Test Pit 5, Test 1-1	5	Combined	0.18	9.2E-05	5.4E-05
Test Pit 5, Test 1-2	5	Combined	0.16	8.2E-05	
Test Pit 5, Test 2-1	5	Inner	0.66	2.1E-05	

Table 4 Estimated Infiltration Rate at Each Well Hole

Test ID	Test Depth	Well Hole Soil Description	Kfs (cm/s)	Estimated Percolation Rate (mm/hour)	Geometric Mean Kfs (cm/s)	Geometric Mean Percolation Rate (mm/hour)
Test Pit 1, Test 1-1	1 m	light brown, dry to moist, silt, some gravel, clay and sand	8.2E-06	24	1.0E-05	25
Test Pit 1, Test 2-1	2.3 m	light brown, moist, sandy silt, trace gravel, signs of iron oxidation	1.3E-05	27		
Test Pit 1, Test 3-1	3.4 m	light brownish grey, moist to wet, sandy silt, some clay, trace gravel, signs of iron oxidation	8.8E-06	24		
Test Pit 1, Test 3-2	3.4 m	light brownish grey, moist to wet, sandy silt, some clay, trace gravel, signs of iron oxidation	1.3E-05	27		
Test Pit 2, Test 1-1	1 m	light yellowish brown, moist, sand	3.9E-02	228	3.9E-02	228
Test Pit 2, Test 2-1	2 m	dark brown, moist, sandy silt, some clay, trace of gravel	1.7E-05	29	6.7E-06	22
Test Pit 2, Test 2-2	2.5 m	light brownish grey, moist, silt, trace clay, sand and gravel	6.3E-06	22		
Test Pit 2, Test 3-1	3.5 m	light brownish grey, moist, silt, trace clay, sand and gravel	2.8E-06	18		
Test Pit 3, Test 1-1	0.5 m	light brown, dry, sandy silt	1.0E-04	47	7.7E-05	43
Test Pit 3, Test 1-2	1 m	light brown, moist, sandy silt	3.4E-05	35		
Test Pit 3, Test 2-1	2 m	light brown, moist, sandy silt, some clay, trace gravel	2.4E-04	58		
Test Pit 3, Test 3-1	3 m	light brown, moist, sandy silt	4.2E-05	37		
Test Pit 4, Test 1-1	1.1 m	light brown, dry, sandy silt	2.1E-04	57	1.4E-04	51
Test Pit 4, Test 1-2	1 m	light brown, dry, sandy silt	1.5E-04	52		
Test Pit 4, Test 2-1	2.3 m	light brown, moist, silty sand	2.6E-04	59		
Test Pit 4, Test 3-1	3.6 m	light brown, moist, silty sand, trace clay and gravel	5.1E-05	39		
Test Pit 5, Test 1-1	1 m	light greyish brown, moist, silty sand, trace gravel and cobble, iron oxidation	9.2E-05	45	5.4E-05	39
Test Pit 5, Test 1-2	1.5 m	light greyish brown, moist, silty sand, trace gravel and cobble, iron oxidation	8.2E-05	44		
Test Pit 5, Test 2-1	2 m	light greyish brown, moist to wet, sandy silt, trace gravel and cobble, iron oxidation	2.1E-05	30		

4 Summary

The field infiltration tests were completed between August 12, 2015 and August 21, 2015 at five test pits across the Alcona Capital Residential Subdivision site at various depths to maximum 4 m. The soils observed at all five test pits are primarily sandy silt material with varying amounts of clay and gravel. A surficial sand layer was noted at Test Pit 2 (to the northeast portion of the Site), beneath the topsoil to approximately 2 m below existing grade.

The infiltration tests were completed using the Guelph Permeameter, the estimated saturated hydraulic conductivity of the sandy silt material varied between 2.8×10^{-6} cm/s and 2.6×10^{-4} cm/s, with a geometric mean of 3.3×10^{-5} cm/s. The corresponding infiltration rate ranged between 18 mm/hour to 59 mm/hour, with corresponding geometric mean infiltration rate of 34 mm/hour.

The sand layer encountered at approximately 1 m below grade at Test Pit 2 (northeast portion of the Site) had a higher saturated hydraulic conductivity of 3.9×10^{-2} cm/s, which correspond to an infiltration rate of approximately 228 mm/hour. The sand layer was not encountered at other test pits and is likely localized in areas around Test Pit 2 (northeast portion of the Site).

Based on the infiltration tests, the estimated infiltration rates for the sandy silt material encountered across the Site were higher than the 15 mm/hour threshold specified in the *Stormwater Management Planning and Design Manual*, which indicate the Site may be suitable for implementation of infiltration BMPs. Appropriate safety factor specified in the *Low Impact Development Stormwater Management Planning and Design Guide* should also be applied to the estimated infiltration rate when designing infiltration BMPs to account for the natural variation in infiltration rate.

5 Reference

Credit Valley Conservation and Toronto and Region Conservation Authority, *Low Impact Development Stormwater Management Planning and Design Guide*, 2010.

Eijkelkamp Agrisearch Equipment, *Operating Instructions – 09.07 Guelph Permeameter*, November 2011.

Figure

Source:
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Aerial Photo: Esri, DigitalGlobe, Geoeye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo and the GIS User Community

LEGEND

- Site
- Infiltration Test Testpit Location

Infiltration Test Testpit Locations

Infiltration Testing

Proposed Subdivision at Part of the South Half of Lot 21, Concession 8, North of Innisfil Beach Road (Geographic Township of Innisfil)

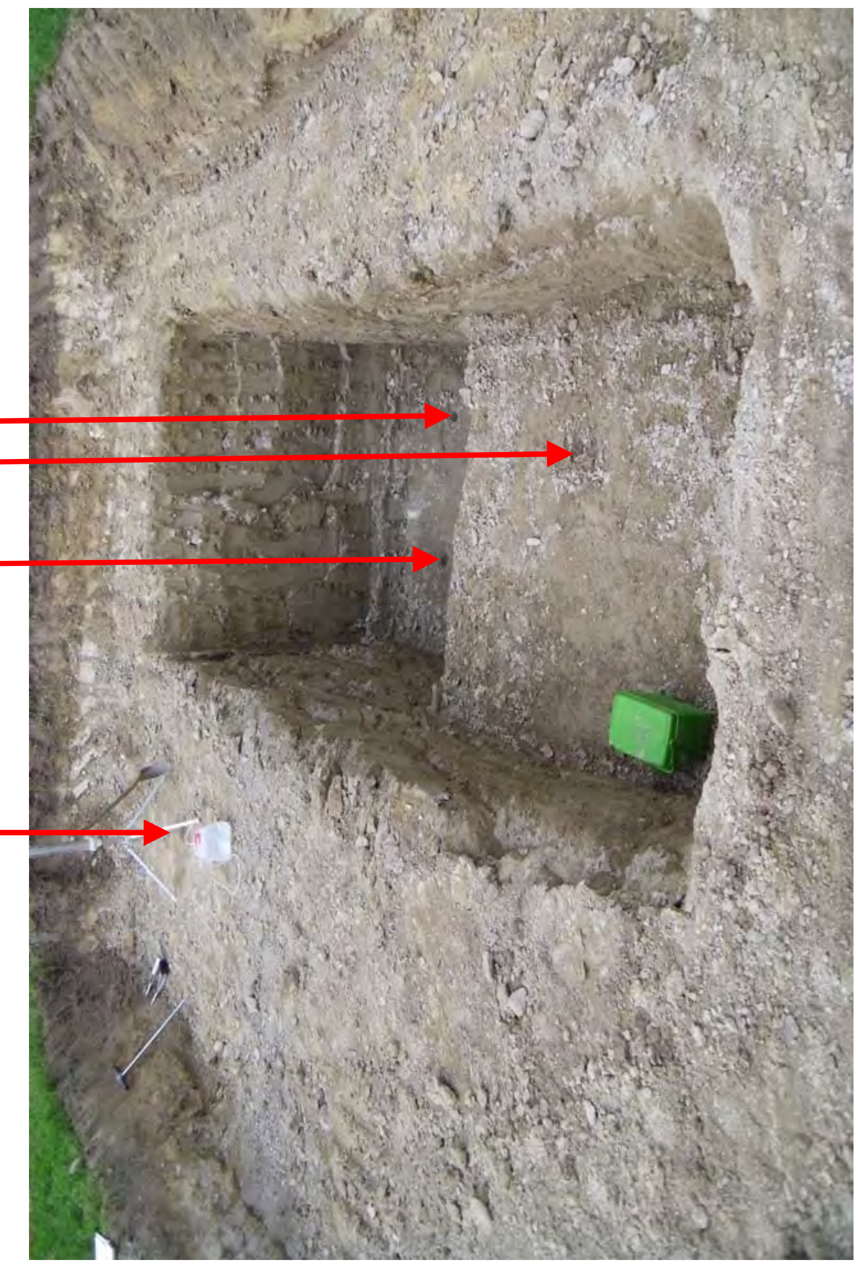
100 50 0 100 m

	Project No:EE15-0206
	Drawn By: X.X
Scale: 1:4,000	**Checked by: TL**
Figure No: 1	**Date: October 2015**

Appendix A

Infiltration Test Calculations and Photos

Test Pit 1 Overview



Soil Description

0 m - 0.3 m
Top Soil (sandy silt), dark brown, dry

0.3 m - 1 m
Test 1-1
silt, some clay, sand and gravel, light brown, dry to moist

1 m - 2.3 m
Test 2-1
sandy silt, trace gravel, light brown, moist, signs of iron oxidation

2.3 m - 3.4 m
Test 3-1, Test 3-2
sandy silt, some clay, trace gravel, light brownish grey, moist to wet, signs of iron oxidationclayey silt, dark

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	13-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Sunny, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	No
Test ID:	Test Pit 1, Test 1-1	**Soil Sample ID:**	Test Pit 1, ~1 m
Test Pit Easting (m):	613448	**Test Pit Northing (m):**	4907696
Test Depth (m below existing grade):	1 m	**Test Elevation (masl):**	~268, ground elevation ~269
Soil Description:	light brown, dry to moist, silt, some gravel, clay and sand		

Input　Result

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 2
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.2600

Res Type	2.16
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.260
Q	0.0094
pi	3.1415

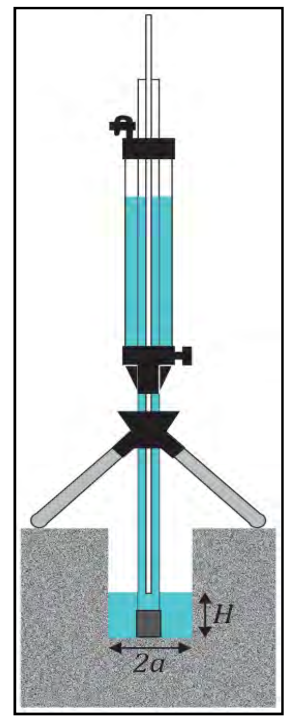
$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059

$Q =$ 0.00936 cm^3/sec

$K_{fs} =$ 8.16E-06 cm/sec; 4.89E-04 cm/min; 8.16E-08 m/sec; 1.93E-04 inch/min; 3.21E-06 inch/sec

$\Phi_m =$ 2.04E-04 cm^2/min



ARG Group Inc.
Infiltration Testing
Proposed Alcona Capital Residential Subdivision

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	13-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Sunny, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	No
Test ID:	Test Pit 1, Test 2-1	**Soil Sample ID:**	Test Pit 1, ~2 m
Test Pit Easting (m):	613448	**Test Pit Northing (m):**	4907696
Test Depth (m below existing grade):	2.3 m	**Test Elevation (masl):**	~266.7, ground elevation ~269
Soil Description:	light brown, moist, sandy silt, trace gravel, signs of iron oxidation		

Input　ult

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 2
Enter water Head Height ("H" in cm): 7
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.4800

Res Type	2.16
H	7
a	3
H/a	2.3333
a*	0.04
C0.01	0.9878
C0.04	1.0396
C0.12	1.0139
C0.36	1.0139
C	1.0396
R	0.480
Q	0.0173
pi	3.1415

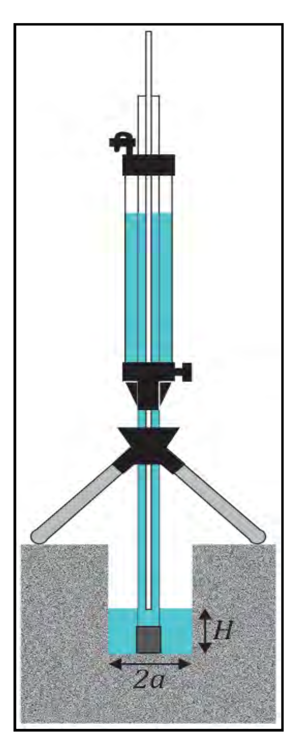
$\alpha^* =$ 0.04 1/cm

$C =$ 1.039608

$Q =$ 0.01728 cm^3/sec

$K_{fs} =$ 1.25E-05 cm/sec; 7.50E-04 cm/min; 1.25E-07 m/sec; 2.95E-04 inch/min; 4.92E-06 inch/sec

$\Phi_m =$ 3.13E-04 cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	13-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Sunny, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	No
Test ID:	Test Pit 1, Test 3-1	**Soil Sample ID:**	Test Pit 1, ~3 m
Test Pit Easting (m):	613448	**Test Pit Northing (m):**	4907696
Test Depth (m below existing grade):	3.4 m	**Test Elevation (masl):**	~265.6, ground elevation ~269
Soil Description:	light brownish grey, moist to wet, sandy silt, some clay, trace gravel, signs of iron oxidation		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 2
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.2800

Res Type	2.16
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.280
Q	0.0101
pi	3.1415

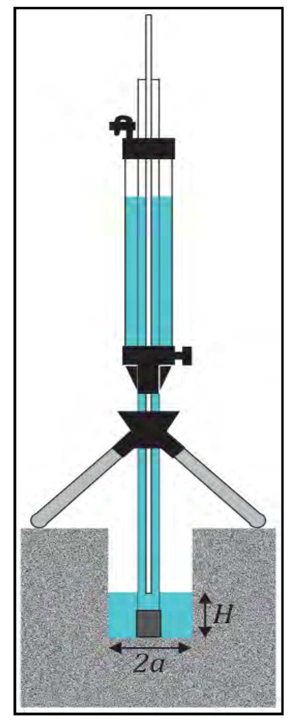
$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059
$Q =$ 0.01008 cm^3/sec

$K_{fs} =$ 8.78E-06 cm/sec
5.27E-04 cm/min
8.78E-08 m/sec
2.08E-04 inch/min
3.46E-06 inch/sec

$\Phi_m =$ 2.20E-04 cm^2/min

Input Result



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	13-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Sunny, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	No
Test ID:	Test Pit 1, Test 3-2	**Soil Sample ID:**	Test Pit 1, ~3 m
Test Pit Easting (m):	613448	**Test Pit Northing (m):**	4907696
Test Depth (m below existing grade):	3.4 m	**Test Elevation (masl):**	~265.6, ground elevation ~269
Soil Description:	light brownish grey, moist to wet, sandy silt, some clay, trace gravel, signs of iron oxidation		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 2
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.4200

Res Type	2.16
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.420
Q	0.0151
pi	3.1415

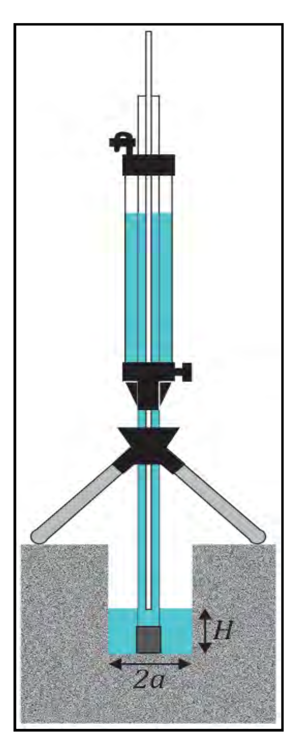
$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059
$Q =$ 0.01512 cm^3/sec

$K_{fs} =$ 1.32E-05 cm/sec
7.91E-04 cm/min
1.32E-07 m/sec
3.11E-04 inch/min
5.19E-06 inch/sec

$\Phi_m =$ 3.29E-04 cm^2/min

Input ılt



Test Pit 2 Overview

Test Pit 2, Test 1-1, ~1 m below existing grade
Test Pit 2, Test 2-1, ~2 m below existing grade
Test Pit 2, Test 2-2, ~2.5 m below existing grade
Test Pit 2, Test 3-1, ~3.5 m below existing grade

Soil Description

0 m - 0.3 m
Top Soil (sandy silt), dark brown, dry

0.3 m - 1 m
gravel and sand, light yellowish brown, dry

1 m - 2 m
Test 1-1
sand, light yellowish brown, moist

2 m - 2.3 m
Test 2-1
dark brown, moist, sandy silt, some clay, trace of gravel

2.3 m - 3.5 m
Test 2-2, Test 3-1
silt, trace clay, sand and gravel, light brownish grey, moist

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	19-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Cloudy, calm
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 2, Test 1-1	**Soil Sample ID:**	Test Pit 2, ~1 m
Test Pit Easting (m):	613641	**Test Pit Northing (m):**	4907748
Test Depth (m below existing grade):	1 m	**Test Elevation (masl):**	~270, ground elevation ~271
Soil Description:	light yellowish brown, moist, sand		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 3
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 27.0000

Res Type	35.22
H	3
a	3
H/a	1
a*	0.12
C0.01	0.5931
C0.04	0.6058
C0.12	0.5582
C0.36	0.5582
C	0.5582
R	27.000
Q	15.849
pi	3.1415

$\alpha^* =$ 0.12 1/cm

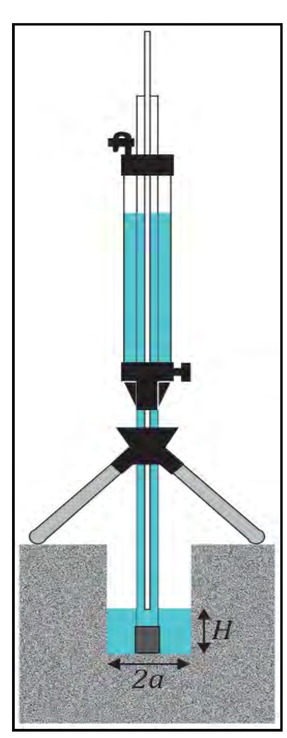
$C =$ 0.558165

$Q =$ 15.849 cm^3/sec

$K_{fs} =$ 3.86E-02 cm/sec
2.31E+00 cm/min
3.86E-04 m/sec
9.11E-01 inch/min
1.52E-02 inch/sec

$\Phi_m =$ 3.21E-01 cm^2/min

Input / ult



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	19-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Cloudy, calm
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 2, Test 2-1	**Soil Sample ID:**	Test Pit 2, ~1.5 m
Test Pit Easting (m):	613641	**Test Pit Northing (m):**	4907748
Test Depth (m below existing grade):	2 m	**Test Elevation (masl):**	~269, ground elevation ~271
Soil Description:	dark brown, moist, sandy silt, some clay, trace of gravel		

Input Result

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 7
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0400

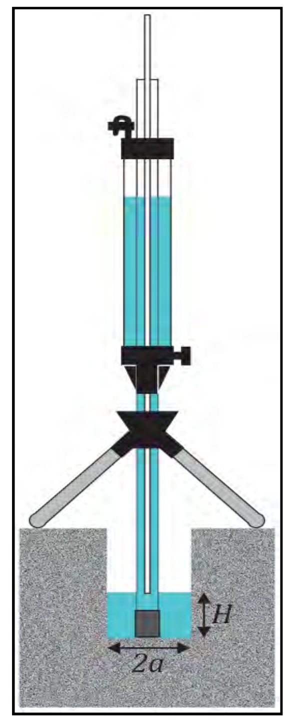
Res Type	35.22
H	7
a	3
H/a	2.3333
a*	0.04
C0.01	0.9878
C0.04	1.0396
C0.12	1.0139
C0.36	1.0139
C	1.0396
R	0.040
Q	0.0235
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 1.039608
$Q =$ 0.02348 cm^3/sec

$K_{fs} =$ 1.70E-05 cm/sec
1.02E-03 cm/min
1.70E-07 m/sec
4.01E-04 inch/min
6.69E-06 inch/sec

$\Phi_m =$ 4.25E-04 cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	19-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Cloudy, calm
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 2, Test 2-2	**Soil Sample ID:**	Test Pit 2, ~2 m
Test Pit Easting (m):	613641	**Test Pit Northing (m):**	4907748
Test Depth (m below existing grade):	2.5 m	**Test Elevation (masl):**	~268.5, ground elevation ~271
Soil Description:	light brownish grey, moist, silt, trace clay, sand and gravel		

Input ılt

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 2
Enter water Head Height ("H" in cm): 7
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.2400

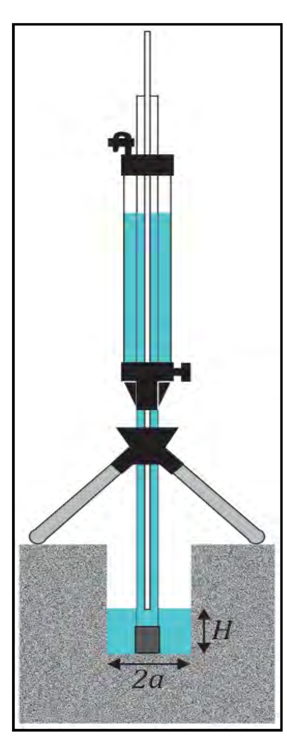
Res Type	2.16
H	7
a	3
H/a	2.3333
a*	0.04
C0.01	0.9878
C0.04	1.0396
C0.12	1.0139
C0.36	1.0139
C	1.0396
R	0.240
Q	0.0086
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 1.039608
$Q =$ 0.00864 cm^3/sec

$K_{fs} =$ 6.25E-06 cm/sec
3.75E-04 cm/min
6.25E-08 m/sec
1.48E-04 inch/min
2.46E-06 inch/sec

$\Phi_m =$ 1.56E-04 cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	19-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Cloudy, calm
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 2, Test 3-1	**Soil Sample ID:**	Test Pit 2, ~3 m
Test Pit Easting (m):	613641	**Test Pit Northing (m):**	4907748
Test Depth (m below existing grade):	3.5 m	**Test Elevation (masl):**	~267.5, ground elevation ~271
Soil Description:	light brownish grey, moist, silt, trace clay, sand and gravel		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 2
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0900

Res Type	2.16
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.090
Q	0.0032
pi	3.1415

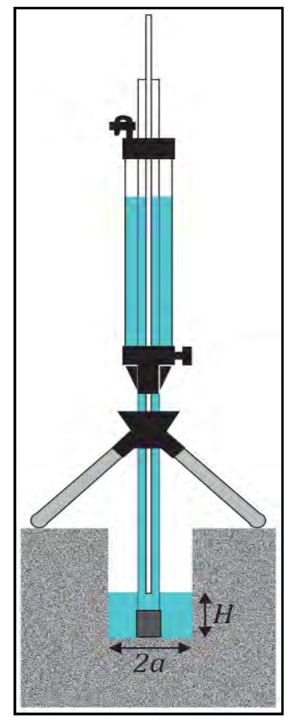
$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059
$Q =$ 0.00324 cm^3/sec

$K_{fs} =$
2.82E-06 cm/sec
1.69E-04 cm/min
2.82E-08 m/sec
6.67E-05 inch/min
1.11E-06 inch/sec

$\Phi_m =$ 7.06E-05 cm^2/min

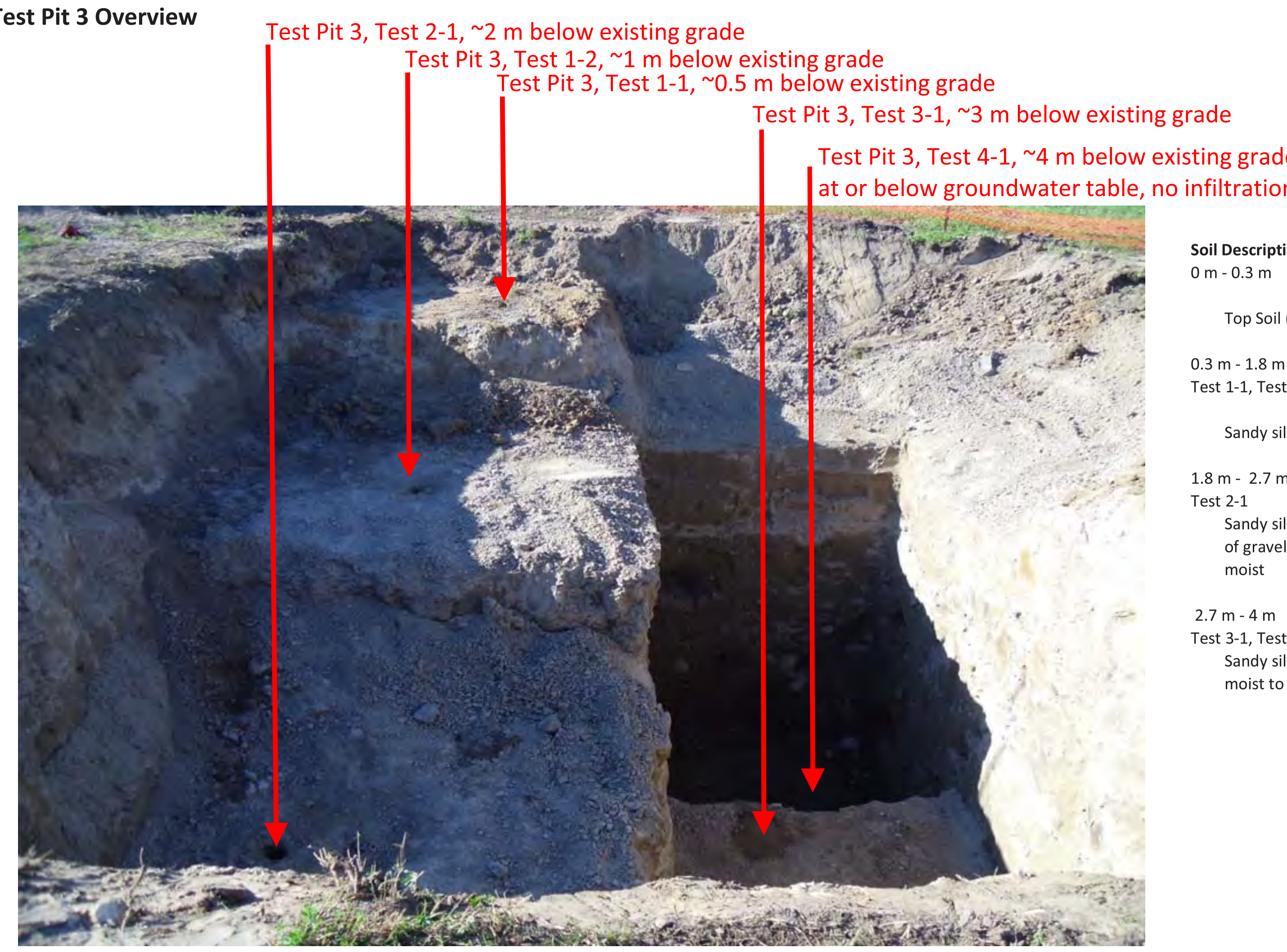
Input ult



ARG Group Inc.

Infiltration Testing
Proposed Alcona Capital Residential Subdivision

Test Pit 3 Overview



Soil Description

0 m - 0.3 m
Top Soil (silt), brown, dry

0.3 m - 1.8 m
Test 1-1, Test 1-2
Sandy silt, light brown, dry

1.8 m - 2.7 m
Test 2-1
Sandy silt, some clay, trace of gravel, light brown, moist

2.7 m - 4 m
Test 3-1, Test 4-1
Sandy silt, light brown, moist to wet

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	12-Aug-15
Site Name:	Alcona	**Weather:**	20°C, Cloudy, partly sunny, windy
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 3, Test 1-1	**Soil Sample ID:**	Test Pit 3, ~0.5 m
Test Pit Easting (m):	613519	**Test Pit Northing (m):**	4907490
Test Depth (m below existing grade):	0.5 m	**Test Elevation (masl):**	~271.4, ground elevation ~271.9
Soil Description:	light brown, dry, sandy silt		

Input Result

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 7
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.2400

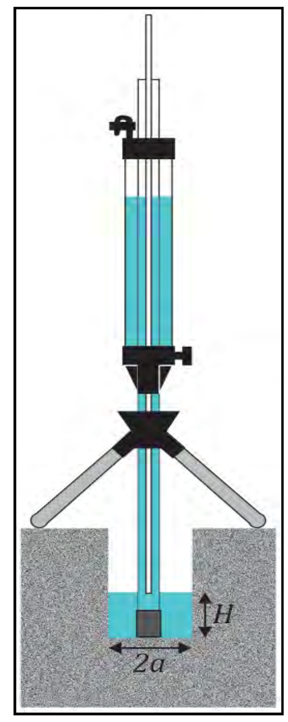
Res Type	35.22
H	7
a	3
H/a	2.3333
a*	0.04
C0.01	0.9878
C0.04	1.0396
C0.12	1.0139
C0.36	1.0139
C	1.0396
R	0.240
Q	0.1409
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 1.039608
$Q =$ 0.14088 cm^3/sec

$K_{fs} =$ 1.02E-04 cm/sec
6.12E-03 cm/min
1.02E-06 m/sec
2.41E-03 inch/min
4.01E-05 inch/sec

$\Phi_m =$ 2.55E-03 cm^2/min



ARG Group Inc.

Infiltration Testing
Proposed Alcona Capital Residential Subdivision

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	12-Aug-15
Site Name:	Alcona	**Weather:**	20°C, Cloudy, partly sunny, windy
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 3, Test 1-2	**Soil Sample ID:**	Test Pit 3, ~1 m
Test Pit Easting (m):	613519	**Test Pit Northing (m):**	4907490
Test Depth (m below existing grade):	1 m	**Test Elevation (masl):**	~270.9, ground elevation ~271.9
Soil Description:	light brown, moist, sandy silt		

Input ult

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 7
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0800

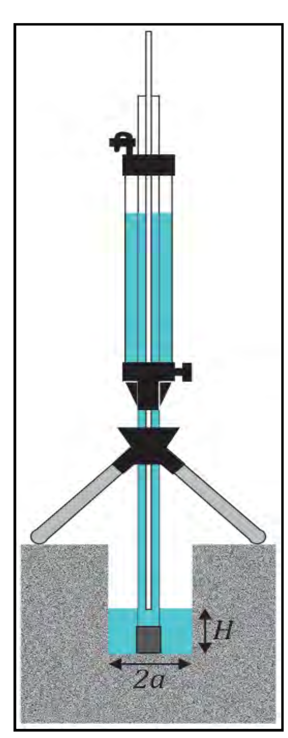
Res Type	35.22
H	7
a	3
H/a	2.3333
a*	0.04
C0.01	0.9878
C0.04	1.0396
C0.12	1.0139
C0.36	1.0139
C	1.0396
R	0.080
Q	0.047
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 1.039608
$Q =$ 0.04696 cm^3/sec

$K_{fs} =$ 3.40E-05 cm/sec
2.04E-03 cm/min
3.40E-07 m/sec
8.03E-04 inch/min
1.34E-05 inch/sec

$\Phi_m =$ 8.49E-04 cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	12-Aug-15
Site Name:	Alcona	**Weather:**	20°C, Cloudy, partly sunny, windy
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 3, Test 2-1	**Soil Sample ID:**	Test Pit 3, ~2 m
Test Pit Easting (m):	613519	**Test Pit Northing (m):**	4907490
Test Depth (m below existing grade):	2 m	**Test Elevation (masl):**	~269.9, ground elevation ~271.9
Soil Description:	light brown, moist, sandy silt, some clay, trace gravel		

Input Result

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.4600

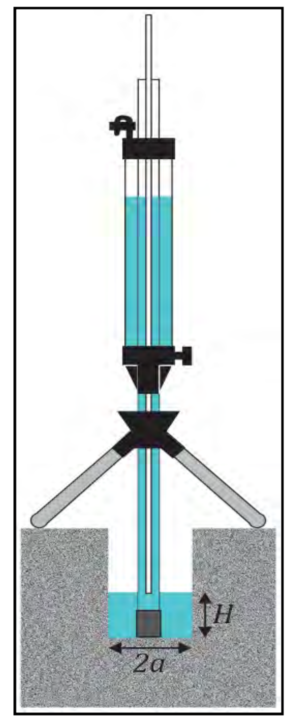
Res Type	35.22
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.460
Q	0.27
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059
$Q =$ 0.27002 cm^3/sec

$K_{fs} =$ 2.35E-04 cm/sec
1.41E-02 cm/min
2.35E-06 m/sec
5.56E-03 inch/min
9.26E-05 inch/sec

$\Phi_m =$ 5.88E-03 cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	12-Aug-15
Site Name:	Alcona	**Weather:**	20°C, Cloudy, partly sunny, windy
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 3, Test 3-1	**Soil Sample ID:**	Test Pit 3, ~3 m
Test Pit Easting (m):	613519	**Test Pit Northing (m):**	4907490
Test Depth (m below existing grade):	3 m	**Test Elevation (masl):**	~268.9, ground elevation ~271.9
Soil Description:	light brown, moist, sandy silt		

Input ult

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 7
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.1000

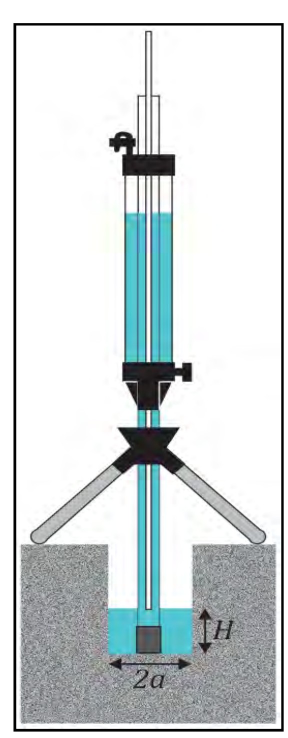
Res Type	35.22
H	7
a	3
H/a	2.3333
a*	0.04
C0.01	0.9878
C0.04	1.0396
C0.12	1.0139
C0.36	1.0139
C	1.0396
R	0.100
Q	0.0587
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 1.039608
$Q =$ 0.0587 cm^3/sec

$K_{fs} =$ 4.25E-05 cm/sec
2.55E-03 cm/min
4.25E-07 m/sec
1.00E-03 inch/min
1.67E-05 inch/sec

$\Phi_m =$ 1.06E-03 cm^2/min



Test Pit 4 Overview

Soil Description
0 m - 0.3 m
Top Soil (sandy silt), dark brown, dry

0.3 m - 1.8 m
Test 1-1, Test 1-2
Sandy silt, light brown, dry

1.8 m - 3.6 m
Test 2-1, Test 3-1
Silty sand, light brown, moist

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	13-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Sunny, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	No
Test ID:	Test Pit 4, Test 1-1	**Soil Sample ID:**	Test Pit 4, ~1 m
Test Pit Easting (m):	613579	**Test Pit Northing (m):**	4907592
Test Depth (m below existing grade):	1.1 m	**Test Elevation (masl):**	~271.6, ground elevation ~272.7
Soil Description:	light brown, dry, sandy silt		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.4200

Res Type	35.22
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.420
Q	0.2465
pi	3.1415

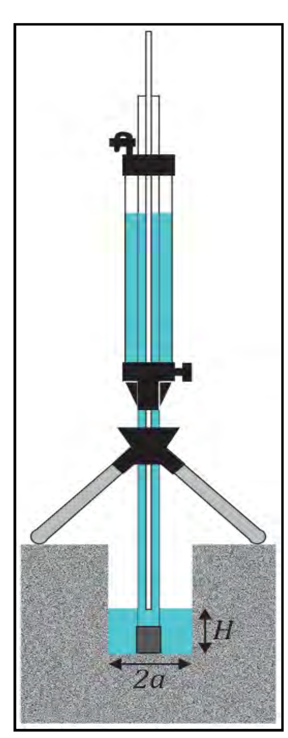
$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059
$Q =$ 0.24654 cm^3/sec

$K_{fs} =$ 2.15E-04 cm/sec
1.29E-02 cm/min
2.15E-06 m/sec
5.08E-03 inch/min
8.46E-05 inch/sec

$\Phi_m =$ 5.37E-03 cm^2/min

Input | ult



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	13-Aug-15
Site Name:	Alcona	**Weather:**	25°C, Sunny, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	No
Test ID:	Test Pit 4, Test 1-2	**Soil Sample ID:**	Test Pit 4, ~1 m, test 2
Test Pit Easting (m):	613579	**Test Pit Northing (m):**	4907592
Test Depth (m below existing grade):	1 m	**Test Elevation (masl):**	~271.7, ground elevation ~272.7
Soil Description:	light brown, dry, sandy silt		

Input | Result

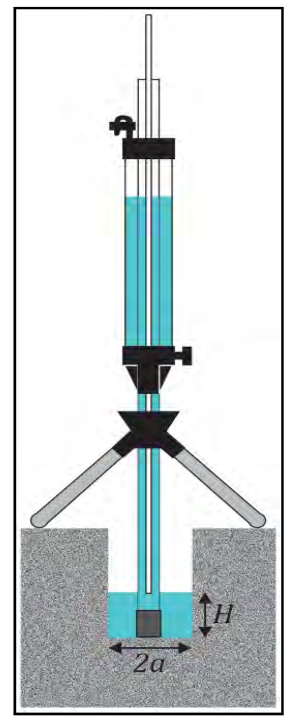
Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.3000

Res Type	35.22			
H	5			
a	3	$\alpha^* =$	0.04	1/cm
H/a	1.6667			
a*	0.04	$C =$	0.842059	
C0.01	0.8101	$Q =$	0.1761	cm^3/sec
C0.04	0.8421			
C0.12	0.8032	$K_{fs} =$	1.53E-04	cm/sec
C0.36	0.8032		9.21E-03	cm/min
C	0.8421		1.53E-06	m/sec
R	0.300		3.63E-03	inch/min
Q	0.1761		6.04E-05	inch/sec
pi	3.1415			
		$\Phi_m =$	3.84E-03	cm^2/min



ARG Group Inc.

Infiltration Testing
Proposed Alcona Capital Residential Subdivision

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	12-Aug-15
Site Name:	Alcona	**Weather:**	20°C, Cloudy, partly sunny, windy
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 4, Test 2-1	**Soil Sample ID:**	Test Pit 4, ~2 m
Test Pit Easting (m):	613579	**Test Pit Northing (m):**	4907592
Test Depth (m below existing grade):	2.3 m	**Test Elevation (masl):**	~270.4, ground elevation ~272.7
Soil Description:	light brown, moist, silty sand		

Input | ılt

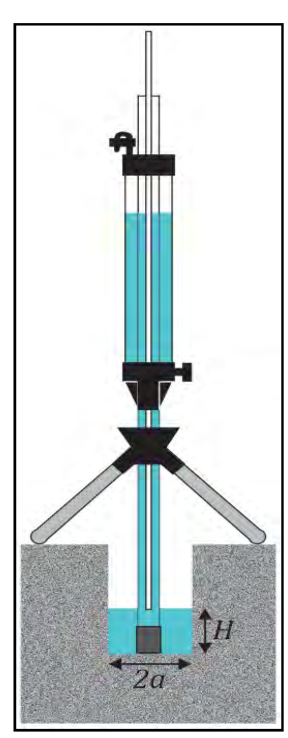
Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.5000

Res Type	35.22			
H	5			
a	3	$\alpha^* =$	0.04	1/cm
H/a	1.6667			
a*	0.04	$C =$	0.842059	
C0.01	0.8101	$Q =$	0.2935	cm^3/sec
C0.04	0.8421			
C0.12	0.8032	$K_{fs} =$	2.56E-04	cm/sec
C0.36	0.8032		1.53E-02	cm/min
C	0.8421		2.56E-06	m/sec
R	0.500		6.04E-03	inch/min
Q	0.2935		1.01E-04	inch/sec
pi	3.1415			
		$\Phi_m =$	6.39E-03	cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	12-Aug-15
Site Name:	Alcona	**Weather:**	20°C, Cloudy, partly sunny, windy
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 4, Test 3-1	**Soil Sample ID:**	Test Pit 4, ~3 m
Test Pit Easting (m):	613579	**Test Pit Northing (m):**	4907592
Test Depth (m below existing grade):	3.6 m	**Test Elevation (masl):**	~269.1, ground elevation ~272.7
Soil Description:	light brown, moist, silty sand, trace clay and gravel		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.1000

Res Type	35.22
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.100
Q	0.0587
pi	3.1415

$\alpha^* =$ 0.04 1/cm

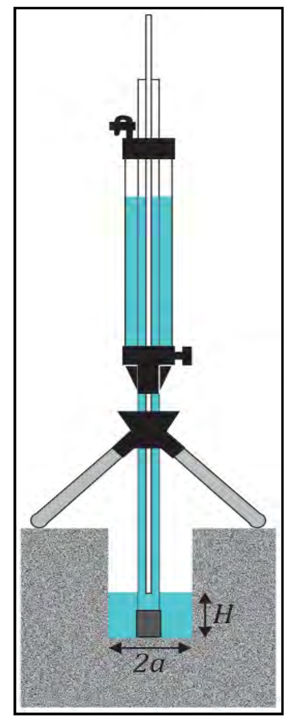
$C =$ 0.842059

$Q =$ 0.0587 cm^3/sec

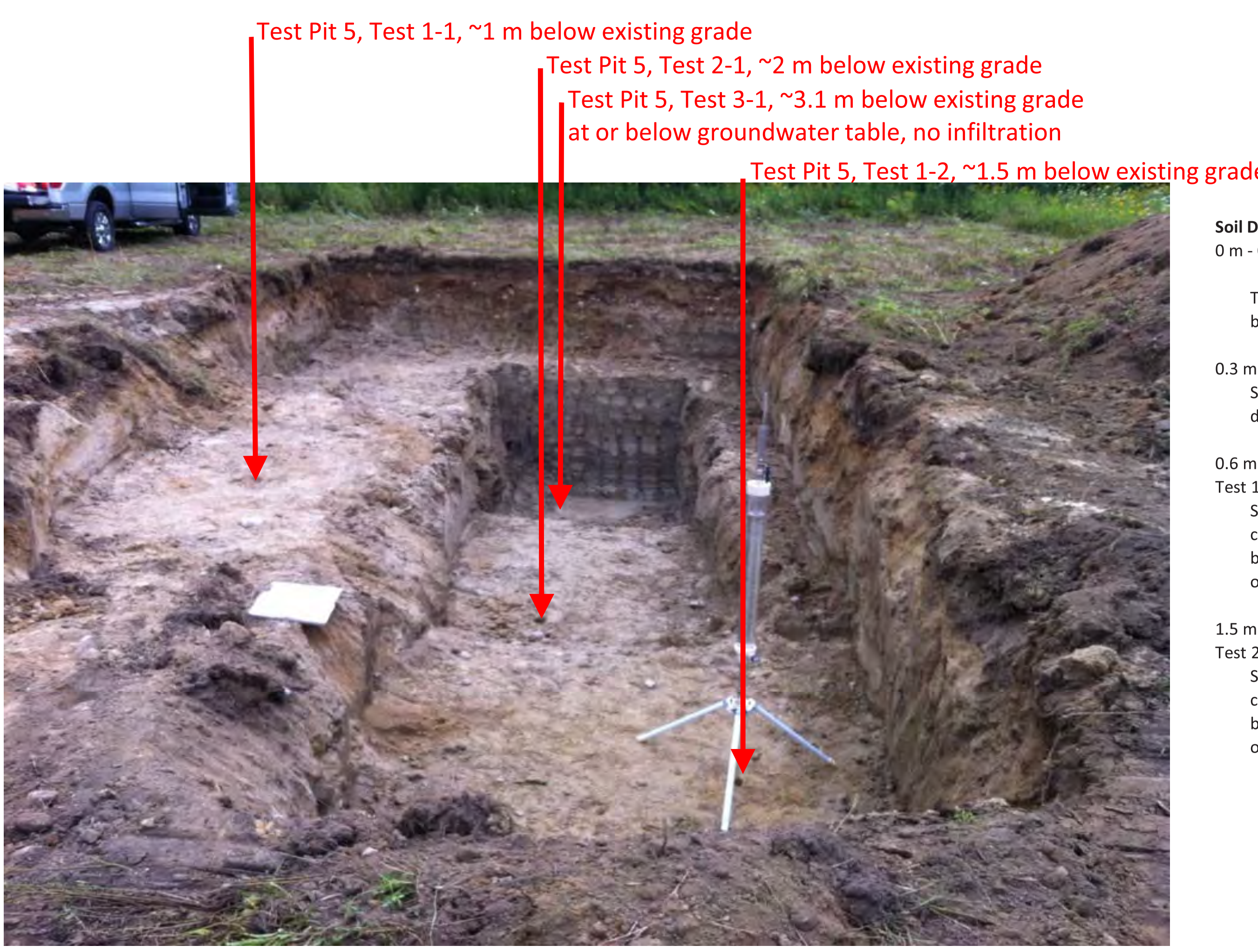
$K_{fs} =$	5.12E-05	cm/sec
	3.07E-03	cm/min
	5.12E-07	m/sec
	1.21E-03	inch/min
	2.01E-05	inch/sec

$\Phi_m =$ 1.28E-03 cm^2/min

Input ult



Test Pit 5 Overview



Soil Description

0 m - 0.3 m
Top Soil (sandy silt), dark brown, dry to moist

0.3 m - 0.6 m
Silty sand, brownish red, dry to moist

0.6 m - 1.5 m
Test 1-1, Test 1-2
Silty sand, trace gravel and cobble, light greyish brown, moist, iron oxidation

1.5 m - 3 m
Test 2-1, Test 3-1
Sandy silt, trace gravel and cobble, light greyish brown, moist to wet, iron oxidation

Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	21-Aug-15
Site Name:	Alcona	**Weather:**	18°C, Cloudy, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 5, Test 1-1	**Soil Sample ID:**	Test Pit 5, ~1 m
Test Pit Easting (m):	613717	**Test Pit Northing (m):**	4907389
Test Depth (m below existing grade):	1 m	**Test Elevation (masl):**	~265.1, ground elevation ~266.1
Soil Description:	light greyish brown, moist, silty sand, trace gravel and cobble, iron oxidation		

Input | Result

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.1800

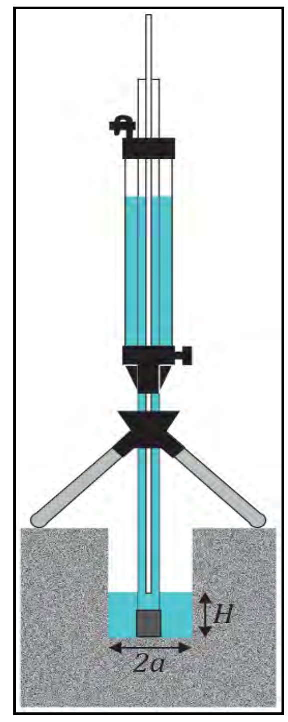
Res Type	35.22
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.180
Q	0.1057
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059
$Q =$ 0.10566 cm^3/sec

$K_{fs} =$ 9.21E-05 cm/sec
5.52E-03 cm/min
9.21E-07 m/sec
2.18E-03 inch/min
3.63E-05 inch/sec

$\Phi_m =$ 2.30E-03 cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	21-Aug-15
Site Name:	Alcona	**Weather:**	18°C, Cloudy, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 5, Test 1-2	**Soil Sample ID:**	Test Pit 5, ~1.5 m
Test Pit Easting (m):	613717	**Test Pit Northing (m):**	4907389
Test Depth (m below existing grade):	1.5 m	**Test Elevation (masl):**	~264.6, ground elevation ~266.1
Soil Description:	light greyish brown, moist, silty sand, trace gravel and cobble, iron oxidation		

Input | ult

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.1600

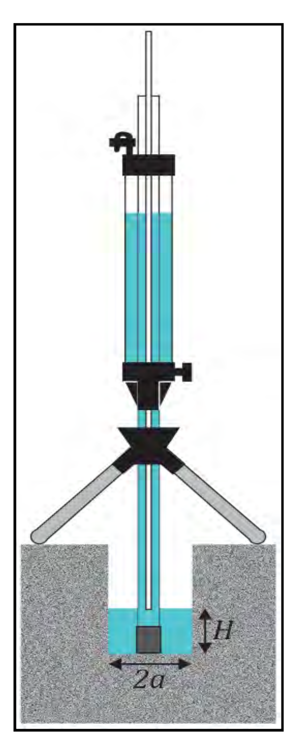
Res Type	35.22
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.160
Q	0.0939
pi	3.1415

$\alpha^* =$ 0.04 1/cm

$C =$ 0.842059
$Q =$ 0.09392 cm^3/sec

$K_{fs} =$ 8.18E-05 cm/sec
4.91E-03 cm/min
8.18E-07 m/sec
1.93E-03 inch/min
3.22E-05 inch/sec

$\Phi_m =$ 2.05E-03 cm^2/min



Saturated Hydraulic Conductivity Calculation

Project Number:	EE15-0210	**Date:**	21-Aug-15
Site Name:	Alcona	**Weather:**	18°C, Cloudy, light breeze
CEG Personnel:	Xin Xu	**Precipitation in Previous Two Days:**	Yes
Test ID:	Test Pit 5, Test 2-1	**Soil Sample ID:**	Test Pit 5, ~2 m
Test Pit Easting (m):	613717	**Test Pit Northing (m):**	4907389
Test Depth (m below existing grade):	2 m	**Test Elevation (masl):**	~264.1, ground elevation ~266.1
Soil Description:	light greyish brown, moist to wet, sandy silt, trace gravel and cobble, iron oxidation		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 2
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.6600

Res Type	2.16
H	5
a	3
H/a	1.6667
a*	0.04
C0.01	0.8101
C0.04	0.8421
C0.12	0.8032
C0.36	0.8032
C	0.8421
R	0.660
Q	0.0238
pi	3.1415

$\alpha^* =$ 0.04 1/cm

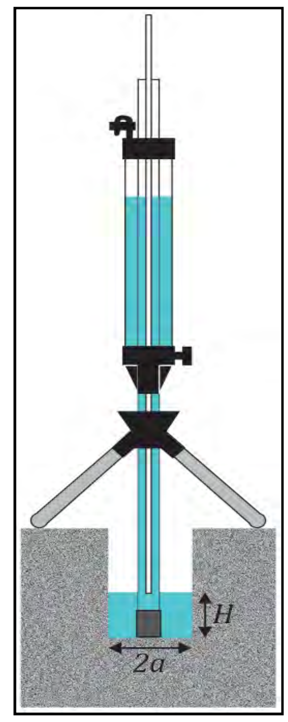
$C =$ 0.842059

$Q =$ 0.02376 cm^3/sec

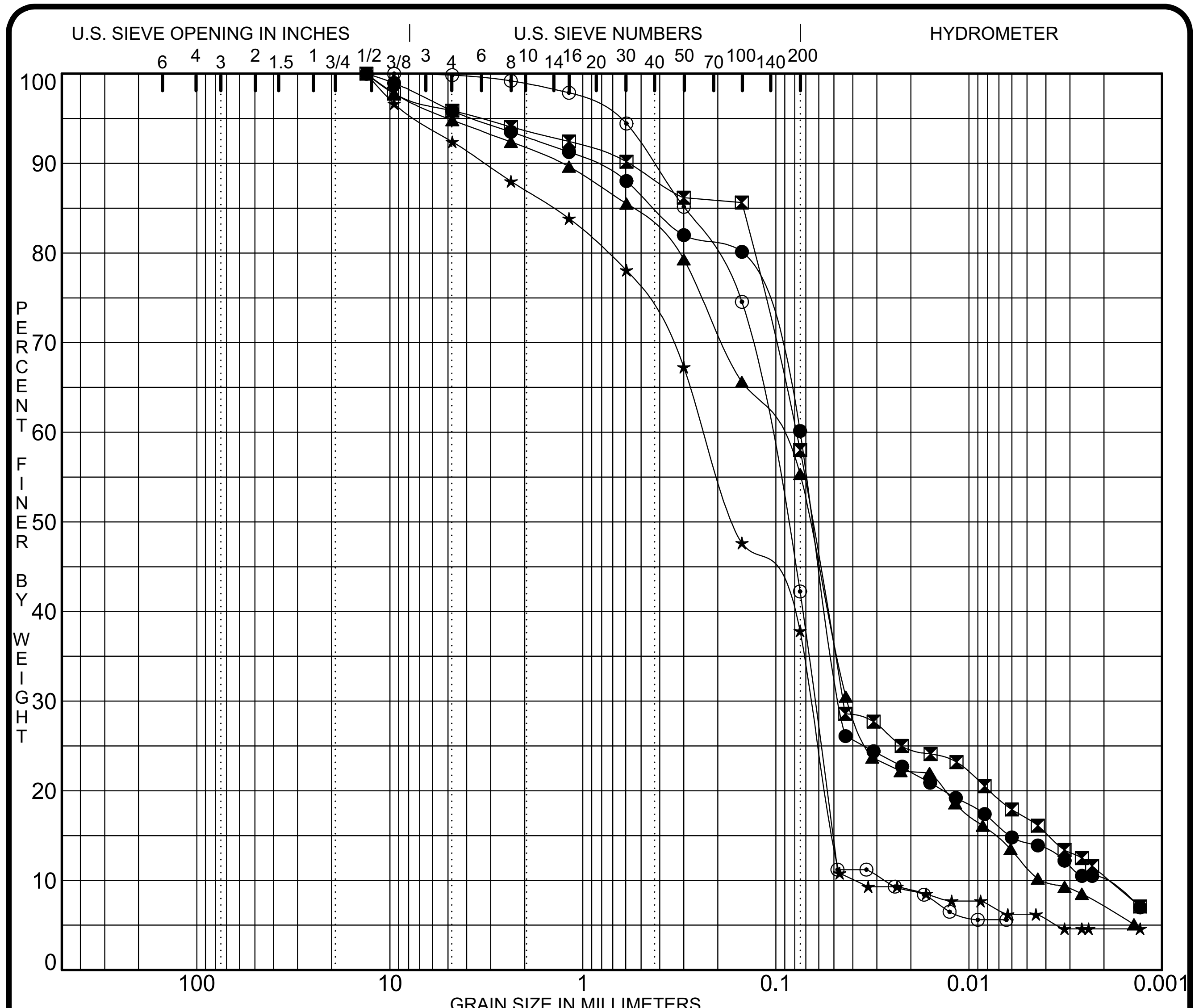
$K_{fs} =$ 2.07E-05 cm/sec; 1.24E-03 cm/min; 2.07E-07 m/sec; 4.89E-04 inch/min; 8.15E-06 inch/sec

$\Phi_m =$ 5.18E-04 cm^2/min

Input ult



Appendix B
Grain Size Distribution Analysis



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP-1**	**3.0**	Sandy Silt, some Clay, trace of Gravel					**13.57**	**35.3**
⧗	**TP-2**	**2.0**	Sandy Silt, some Clay, trace of Gravel					**13.64**	**42.0**
▲	**TP-3**	**2.0**	Sandy Silt, some Clay, trace of Gravel					**4.29**	**25.1**
★	**TP-4**	**3.0**	Silty Sand, trace of Clay & Gravel					**0.47**	**5.9**
⊙	**TP-5**	**1.5**	Silty Sand					**1.31**	**4.0**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-1**	**3.0**	**13.20**	**0.07**	**0.046**	**0.0021**	**4.1**	**35.7**	**45.9**	**14.3**
⧗	**TP-2**	**2.0**	**13.20**	**0.08**	**0.045**	**0.0019**	**4.1**	**37.9**	**41.2**	**16.8**
▲	**TP-3**	**2.0**	**13.20**	**0.10**	**0.042**	**0.0041**	**5.2**	**39.5**	**43.8**	**11.5**
★	**TP-4**	**3.0**	**13.20**	**0.23**	**0.065**	**0.0390**	**7.6**	**54.6**	**31.6**	**6.2**
⊙	**TP-5**	**1.5**	**9.50**	**0.11**	**0.063**	**0.0274**	**0.2**	**57.6**	**42.2**	

PROJECT **Gradation - 2245, 20th Sideroad, Innisfil, Ontario**

JOB NO. **2365-15-C-COL-F**
DATE **9/9/15**

GRADATION CURVES

Toronto Inspection Ltd.

Appendix B – Visual OTTHYMO Modelling

CALCULATIONS

Prepared by A. Soares
Checked by K. Chow

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Existing and Proposed Drainage Areas

	Existing Conditions			Proposed Conditions		
	Area ID	**Description**	**Area (ha)**	**Area ID**	**Description**	**Area (ha)**
WC3	110	Alcona-North	5.90	210	Alcona-North	4.66
	-	-	-	211	North Pond	0.63
	111	Alcona-North (WC)	2.16	212	Alcona-North (WC)	2.21
		Development to WC3 =	**8.06**		**Development to WC3 =**	**7.50**
	1000	*External Area*	*20.39*	*1000*	*External Area*	*20.39*
		TOTAL TO WC3 =	**28.45**		**TOTAL TO WC3 =**	**27.89**

	Existing Conditions			Proposed Conditions		
	Area ID	**Description**	**Area (ha)**	**Area ID**	**Description**	**Area (ha)**
WC4	100	Alcona-South	1.36	200	Alcona-South	7.79
	901a	Alcona-South	3.59	201	South Pond	0.79
	900	Alcona-South	1.18	900	Alcona-South (uncontrolled)	0.07
	4101	Alcona-South	0.42			
	4102	Alcona-South	0.73			
		Development to WC4 =	**7.28**		**Development to WC4 =**	**8.58**
	1	*Loblaw*	*0.31*	*1*	*Loblaw*	*0.31*
	2	*Loblaw*	*1.44*	*2*	*Loblaw*	*1.44*
	3	*Loblaw*	*0.14*	*3*	*Loblaw*	*0.14*
	4	*Loblaw*	*0.32*	*4*	*Loblaw*	*0.32*
	901b	*Future Development Lands*	*2.71*	*5*	*Future Development Lands*	*1.90*
	103	*Hydro Station*	*0.76*	*103*	*Hydro Station*	*0.76*
		External Area to WC4 =	***5.68***		***External Area to WC4 =***	***4.87***
		TOTAL TO WC4 =	**12.96**		**TOTAL TO WC4 =**	**13.45**
		Total Development =	**15.34**		**Total Development =**	**16.08**
		TOTAL to WC3 & WC4 =	**41.41**		**TOTAL to WC3 & WC4 =**	**41.34**

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Hydrologic Model (OTTHYMO) Parameters

Existing Conditions: WC3

NASHYD PARAMETERS						REFERENCES				
TYPE	**NHYD**	**AREA (ha)**	**TIME TO PEAK (hr)**	**CN**	**CN III**	**Odan Detech[1]**	**Stantec[2]**	**MSDS[3]**	**TSH[4]**	**Other**
NashHyd	1000	20.39	1.22	70	85					OBM mapping. Refer to 'Time to Peak Sheet'
NashHyd	110	5.90	0.35	70	85			CN (Catchment 302)		Refer to 'Time to Peak Design Sheet'
NashHyd	111	2.16	0.33	70	85					Same as NHYD 110 above

Existing Conditions: WC4

STANDHYD PARAMETERS							REFERENCES				
TYPE	**NHYD**	**AREA (ha)**	**XIMP (%)**	**TIMP (%)**	**CN**	**CN III**	**Odan Detech[1]**	**Stantec[2]**	**MSDS[3]**	**TSH[4]**	**Other**
StandHyd	1	0.31	0.99	0.99	80	91	Area 1, VO2 Catchment 27	-	-	-	-
StandHyd	2	1.44	0.72	0.72	80	91	Area 2, VO2 Catchment 26	-	-	-	-
StandHyd	3	0.14	0.70	0.70	80	91	Area 3, VO2 Catchment 47	-	-	-	-
StandHyd	103	0.76	0.50	0.60	73	87	-	-	CN (Catchment 410)	-	XIMP / TIMP measured from drawing layout

NASHYD PARAMETERS						REFERENCES				
TYPE	**NHYD**	**AREA (ha)**	**TIME TO PEAK (hr)**	**CN**	**CN III**	**Odan Detech[1]**	**Stantec[2]**	**MSDS[3]**	**TSH[4]**	**Other**
NashHyd	4	0.32	0.11	80	91	Area 4, VO2 Catchment 30	-	-	-	-
NashHyd	100	1.36	0.26	73	87	Area 2, VO2 Catchment 4	-	-	Catchment 4100	Refer to 'Time to Peak Design Sheet'
NashHyd	900	1.18	0.27	73	87	-	-	-	-	Assumed similar numbers as 4101 & 4102
NashHyd	901a	3.59	0.42	73	87	Area 5, VO2 Catchment 19	-	-	-	Refer to 'Time to Peak Design Sheet'
NashHyd	901b	2.71	0.36	73	87	Area 5, VO2 Catchment 19	-	-	-	-
NashHyd	4101	0.42	0.24	73	87	-	Catchment 4101	-	-	-
NashHyd	4102	0.73	0.34	73	87	-	Catchment 4102	-	-	-

Proposed Conditions: WC3

NASHYD PARAMETERS						REFERENCES				
TYPE	**NHYD**	**AREA (ha)**	**TIME TO PEAK (hr)**	**CN**	**CN III**	**Odan Detech[1]**	**Stantec[2]**	**MSDS[3]**	**TSH[4]**	**Other**
NashHyd	1000	20.39	1.22	70	85					Refer to 'Time to Peak Design Sheet'
NashHyd	212	2.21	0.33	70	85					Same as NHYD 111 above

STANDHYD PARAMETERS							REFERENCES				
TYPE	**NHYD**	**AREA (ha)**	**XIMP (%)**	**TIMP (%)**	**CN**	**CN III**	**Odan Detech[1]**	**Stantec[2]**	**MSDS[3]**	**TSH[4]**	**Other**
StandHyd	210	4.66	0.45	0.60	70	85	-	-	-	-	XIMP / TIMP measured from drawing layout
StandHyd	211	0.63	0.60	0.60	70	85	-	-	-	-	XIMP / TIMP measured from drawing layout

Proposed Conditions: WC4

STANDHYD PARAMETERS							REFERENCES				
TYPE	**NHYD**	**AREA (ha)**	**XIMP (%)**	**TIMP (%)**	**CN**	**CN III**	**Odan Detech[1]**	**Stantec[2]**	**MSDS[3]**	**TSH[4]**	**Other**
StandHyd	1	0.31	0.99	0.99	80	91	-	-	-	-	Same as NHYD 1 above
StandHyd	2	1.44	0.72	0.72	80	91	-	-	-	-	Same as NHYD 2 above
StandHyd	3	0.14	0.70	0.70	80	91	-	-	-	-	Same as NHYD 3 above
StandHyd	103	0.76	0.50	0.60	73	87	-	-	CN (Catchment 410)	-	XIMP / TIMP measured from drawing layout
StandHyd	200	7.79	0.45	0.60	73	87	-	-	-	-	XIMP / TIMP measured from drawing layout
StandHyd	201	0.79	0.60	0.60	73	87	-	-	-	-	XIMP / TIMP measured from drawing layout
StandHyd	900	0.07	0.45	0.60	73	87	-	-	-	-	Similar to NHYD 200

NASHYD PARAMETERS						REFERENCES				
TYPE	**NHYD**	**AREA (ha)**	**TIME TO PEAK (hr)**	**CN**	**CN III**	**Odan Detech[1]**	**Stantec[2]**	**MSDS[3]**	**TSH[4]**	**Other**
NashHyd	4	0.32	0.11	80	91	-	-	-	-	Same as NHYD 4 above
NashHyd	5	2.71	0.36	73	87	Area 5, VO2 Catchment 19	-	-	-	-

Notes:

1 Loblaw Design Brief Engineering Report - Town of Innisfil by Odan Detech (March 2009)
2 Channel Realignment Design Addendum by Stantec (April 2010)
3 Alcona Master Servicing and Drainage Study - Alcona Secondary Plan Area by Cumming Cockburn Limited (Septenber 1995)
4 Totten Sims Hubicki Associates (2006)
5 Initial abstraction (Ia) for pervious catchment areas modelled as 5 mm, typical for grassed surfaces.
6 Average slope of pervious area (SLPP) based on typical lot grading, 2%
7 Average slope of impervious area (SLPI) based on typical road grades, 1%
8 Overland flow length of impervious area (LGI), L = SQRT(1.5A)
9 Overland flow length of pervious area (LGP) based on typical lot depth, 40 m
10 CN based on Odan Detech model
11 CN (AMC III) values obtained from Table 3.6, Modern Sewer Design Canadian ed., American Iron and Steel Institute (1980)

CALCULATIONS

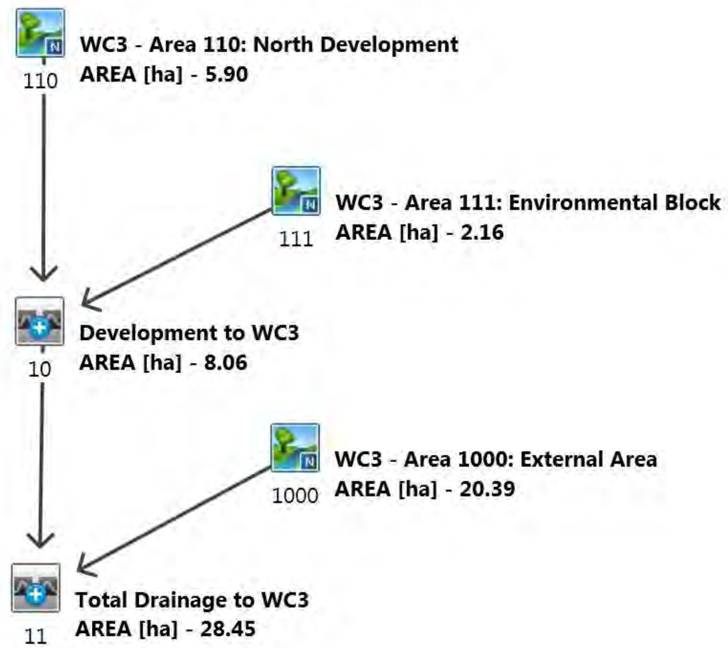
Prepared by A. Soares
Checked by K. Chow

Project Name Alcona Capital Properties Inc.
Project No. 09389
Subject Time to Peak Design Sheet

Area ID	Area (ha)	Length (m)	Slope (%)	Uplands Method													
				Forest & Meadow		Woodland		Pasture		Straight Row		Bare Soil		Grassed		Paved Areas	
				Tp (hr)	Tc (min)	Tp (hr)	Tc (min)	Tp (hr)	Tc (min)	Tp (hr)	Tc (min)	Tp (hr)	Tc (min)	Tp (hr)	Tc (min)	Tp (hr)	Tc (min)
100	1.36	361	2.91	0.52	46.65	**0.26**	23.64	0.19	16.85	0.15	13.45	0.13	12.07	0.09	7.91	0.07	5.87

Area ID	Area (ha)	Length (m)	Slope (%)	Bransby Williams		Airport Equation		Hymo Formula		Kirpisch Equation	
				Tp (hr)	Tc (min)	Tp (hr)	Tc (min)	Tp (hr)	Tc (min)	Tp (hr)	Tc (min)
1000	20.39	1594	1.00	0.74	66.20	**1.22**	108.98	0.39	35.00	1.06	94.90
110	5.90	253	2.57	0.11	9.84	**0.35**	31.79	0.16	13.98	0.16	14.34
111	2.16	211	2.37	0.10	9.23	**0.33**	29.83	0.11	9.81	0.15	12.99
212	2.21	211	2.37	0.10	9.21	**0.33**	29.83	0.11	9.89	0.15	12.99
900	1.18	175	3.40	0.08	7.57	**0.27**	24.11	0.07	6.56	0.10	9.39
901a	3.59	228	1.32	0.12	10.66	**0.42**	37.61	0.17	15.65	0.21	18.48
901b	2.71	230	2.20	0.11	9.98	**0.36**	31.91	0.12	11.09	0.16	14.41
4101	0.42	165	4.50	0.08	7.48	**0.24**	21.34	0.04	3.86	0.09	7.80
4102	0.73	283	3.55	0.14	12.73	**0.34**	30.23	0.06	5.33	0.15	13.31

B1 - Predevelopment

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=============================================================================================================

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        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM       O
       O   O    T      T    H   H    Y    M   M OO    O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


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DATE: 10/26/2015                          TIME: 05:43:02

USER:


COMMENTS: ____________________________________________________________


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  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND              HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                   min      ha   '  cms   hrs     mm           cms

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      --------------------
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ae23-96d
    remark: 2 yr 4 hr Chicago - Barrie WPCC
*
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    ADD [  0110+  0111]  0010  3  5.0    8.06    0.08  1.92   5.35  n/a   0.000
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.09  3.25   5.35 0.17   0.000
    [CN=70.0        ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.12  2.92   5.35  n/a   0.000
*
=============================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM       O
       O   O    T      T    H   H    Y    M   M OO    O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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```

```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\b0566b36-9128-43c2-a23b-6973c8719e90\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\b0566b36-9128-43c2-a23b-6973c8719e90\scenari


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COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 43.24 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\a076ef78-f0a2-4622-9aeb-7d7284b119dd\ed6415fa-5bf2-4597-
b226-1e4
    remark: 5 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.11  1.83   9.94 0.23   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.04  1.83   9.94 0.23   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.15  1.83   9.94  n/a   0.000
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.17  3.25   9.94 0.23   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.23  2.75   9.94  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O        T       H   Y Y   MM MM      O
       O   O   T      T    H   H    Y    M   M OO   O
        OOO T  T      TH   H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\a994f6ac-
d95b-4a39-a6cc-9fee9c2ceee8\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\a994f6ac-
d95b-4a39-a6cc-9fee9c2ceee8\scenari


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COMMENTS: ____________________________________________________________
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```
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 50.81 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\a076ef78-f0a2-4622-9aeb-7d7284b119dd\ba875e2e-86a3-4747-
b03a-164
    remark: 10 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.15  1.83  13.56 0.27   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.06  1.83  13.56 0.27   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.21  1.83  13.56  n/a   0.000
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.23  3.17  13.57 0.27   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.31  2.75  13.57  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T       T   H   H   Y Y   MM MM OO    O
       O   O    T       T   H   H    Y    M   M O   O
        OOO     T       T   H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\28486c58-
e4e5-4b5f-b71d-054a374c665e\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\28486c58-
e4e5-4b5f-b71d-054a374c665e\scenari


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  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 60.06 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\a076ef78-f0a2-4622-9aeb-7d7284b119dd\1a3791ef-cb04-4c8c-
b2dd-137
    remark: 25 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.21  1.83  18.49 0.31   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.35]
```

```
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.08  1.83  18.49 0.31   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.29  1.83  18.49  n/a   0.000
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.32  3.17  18.49 0.31   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.42  2.67  18.49  n/a   0.000
*
===============================================================================================================
```

```
       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM      O
       O   O    T      T    H   H    Y    M   M OO   O
        OOO T   T      T H  H   H    Y    M   M   OOO
```

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```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\07a0f0d7-
deba-4158-9e5c-35e82ac767fd\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\07a0f0d7-
deba-4158-9e5c-35e82ac767fd\scenari


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COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 67.14 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\a076ef78-f0a2-4622-9aeb-7d7284b119dd\3f4d28d9-7d81-45f6-
add9-6c4
    remark: 50 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.26  1.83  22.57 0.34   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.10  1.83  22.57 0.34   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.36  1.83  22.57  n/a   0.000
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.39  3.17  22.58 0.34   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.52  2.58  22.58  n/a   0.000
*
===============================================================================================================
```

```
       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
         V                 U                L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM      O
       O   O    T      T    H   H    Y    M   M OO   O
        OOO T   T      T H  H   H    Y    M   M   OOO
```

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```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:     C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\c2bdaed5-6455-4584-84ab-b2fb5148e6a7\scenari
  Summary        filename:       C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\c2bdaed5-6455-4584-84ab-b2fb5148e6a7\scenari


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  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 74.00 mm ]
    fname              :              C:\Users\asoares\AppData\Local\Temp\a076ef78-f0a2-4622-9aeb-7d7284b119dd
\6cec718f-0a40-4ea3-9abf-3c2
    remark: 100 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.31  1.83  26.76 0.36   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.12  1.83  26.76 0.36   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.43  1.83  26.76  n/a   0.000
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.47  3.17  26.77 0.36   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.62  2.17  26.77  n/a   0.000
*
===============================================================================================================
```

```
       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM      O
       O   O    T      T    H   H    Y    M   M OO   O
        OOO T   T      T H  H   H    Y    M   M   OOO
```

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```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:  C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\014d7382-
```

```
ca3b-4d3f-8e27-a4fccba134c3\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\014d7382-
ca3b-4d3f-8e27-a4fccba134c3\scenari


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USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\a076ef78-f0a2-4622-9aeb-7d7284b119dd\59adc387-87dc-4be3-a154-
bc5
    remark: 25mm 4 HOUR STORM FOR WATER QUALITY
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.04  2.08   3.10 0.12   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.01  2.08   3.10 0.12   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.05  2.08   3.10  n/a   0.000
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.06  3.33   3.10 0.12   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.08  2.50   3.10  n/a   0.000
*
 FINISH

=============================================================================================================
```

```
==============================================================================================================


      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL L
       VV V    I     SS        U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H    H  Y   Y  M   M   OOO    TM
      O   O          T          H   Y Y   MM MM       O
      O   O    T      T    H    H    Y    M   M OO    O
       OOO  T  T      T H  H    H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:  C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\47831a6d-
ada4-4508-88a3-21c80649bd66\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\47831a6d-
ada4-4508-88a3-21c80649bd66\scenari


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COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 42.00 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\f5ae1fe7-c98f-4622-bfb3-4afe4cf2cda7\3d2839af-a78a-4e3b-
bdb5-42b
    remark: 2 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.15  7.58   9.39 0.22   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.11  6.50   9.38 0.22   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.04  6.50   9.38 0.22   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.15  6.50   9.38  n/a   0.000
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.21  6.67   9.39  n/a   0.000
*
==============================================================================================================


      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL L
       VV V    I     SS        U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H    H  Y   Y  M   M   OOO    TM
      O   O          T          H   Y Y   MM MM       O
      O   O    T      T    H    H    Y    M   M OO    O
       OOO  T  T      T H  H    H    Y    M   M   OOO
```

```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\631f47f2-14ba-49a7-8583-aac9ab9d4d51\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\631f47f2-14ba-49a7-8583-aac9ab9d4d51\scenari


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COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 56.40 mm ]
    fname             :                C:\Users\asoares\AppData\Local\Temp\f5ae1fe7-c98f-4622-bfb3-4afe4cf2cda7
\f40b293c-588d-4485-90bb-10b
    remark: 5 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.27  7.50  16.49 0.29   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.19  6.50  16.48 0.29   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.07  6.42  16.48 0.29   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.26  6.50  16.48  n/a   0.000
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.38  6.67  16.48  n/a   0.000
*
=============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAA  L
        VV V    I      SS       U  A   A  L
         VV          SSSSS  UUUUU  A   A  LLLLL

        OOO  I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T        H   Y Y   MM MM       O
       O   O    T      T     H   H   Y    M   M  O  O  O
        OOO  T  T      T  H  H   H   Y    M   M   OOO
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```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4e6bd64d-215f-4036-9383-4a9717783299\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4e6bd64d-215f-4036-9383-4a9717783299\scenari


DATE: 10/26/2015                           TIME: 05:44:42

USER:


COMMENTS: ____________________________________________________________
```

```
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 66.00 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\f5ae1fe7-c98f-4622-bfb3-4afe4cf2cda7\75466258-7513-4a42-
a8a7-990
    remark: 10 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.36  7.50  21.91 0.33   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0110  1  5.0    5.90    0.26  6.50  21.90 0.33   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD         0111  1  5.0    2.16    0.10  6.42  21.90 0.33   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.35  6.50  21.90  n/a   0.000
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.52  6.67  21.91  n/a   0.000
*
=============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAA  L
        VV V    I      SS       U  A   A  L
         VV          SSSSS  UUUUU  A   A  LLLLL

        OOO  I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T     H   H   Y Y   MM MM  O     O
       O   O    T      T     H   H    Y    M   M  O  O   O
        OOO     T      T     H   H    Y    M   M   OOO
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```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\e4f65311-5ac3-41c2-a3ab-3c9ef50448f2\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\e4f65311-5ac3-41c2-a3ab-3c9ef50448f2\scenari


DATE: 10/26/2015                           TIME: 05:44:42

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 78.10 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\f5ae1fe7-c98f-4622-bfb3-4afe4cf2cda7\aa25e9eb-661e-4d82-9008-
c72
    remark: 25 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.48  7.50  29.37 0.38   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
```

```
*
 ** CALIB NASHYD        0110  1  5.0    5.90    0.35  6.50  29.36 0.38   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD        0111  1  5.0    2.16    0.13  6.42  29.36 0.38   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.48  6.50  29.36  n/a   0.000
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.70  6.67  29.36  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM       O
       O   O    T      T    H   H    Y    M   M OO   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output        filename:     C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\b0d2eb89-3047-4ab2-b9e5-ffa1e9520f92\scenari
  Summary       filename:     C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\b0d2eb89-3047-4ab2-b9e5-ffa1e9520f92\scenari


DATE: 10/26/2015                           TIME: 05:44:42

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 87.10 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\f5ae1fe7-c98f-4622-bfb3-4afe4cf2cda7\93d1e367-ca0b-4d11-
a7ba-121
    remark: 50 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD        1000  1  5.0   20.39    0.58  7.50  35.30 0.41   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD        0110  1  5.0    5.90    0.42  6.50  35.29 0.41   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD        0111  1  5.0    2.16    0.16  6.42  35.29 0.41   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.57  6.50  35.29  n/a   0.000
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    0.85  6.58  35.30  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
                                          L
         V             U
```

```
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O           T        H   Y Y   MM MM OO    O
      O   O    T      T    H   H    Y    M   M  O    O
       OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output        filename:     C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\0a0f0607-09db-49e2-bc23-f011b8ef756b\scenari
  Summary       filename:     C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\0a0f0607-09db-49e2-bc23-f011b8ef756b\scenari


DATE: 10/26/2015                           TIME: 05:44:42

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 96.00 mm ]
    fname             :            C:\Users\asoares\AppData\Local\Temp\f5ae1fe7-c98f-4622-bfb3-4afe4cf2cda7
\d0f608b0-7cb7-4961-9337-06a
    remark: 100 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD        1000  1  5.0   20.39    0.68  7.50  41.43 0.43   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD        0110  1  5.0    5.90    0.49  6.50  41.43 0.43   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD        0111  1  5.0    2.16    0.19  6.42  41.42 0.43   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111]  0010  3  5.0    8.06    0.68  6.50  41.43  n/a   0.000
*
    ADD [  0010+  1000]  0011  3  5.0   28.45    1.00  6.58  41.43  n/a   0.000
*
 FINISH

===========================================================================================================
```

```
=====================================================================================================

      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O          T         H   Y Y   MM MM       O
      O   O    T     T     H   H    Y    M   M  OO   O
       OOO  T  T     T H   H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output    filename:  C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\4ece81b4-
f662-4589-a6aa-f888846d701a\scenari
  Summary   filename:  C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\4ece81b4-
f662-4589-a6aa-f888846d701a\scenari

DATE: 10/26/2015                           TIME: 05:45:36

USER:

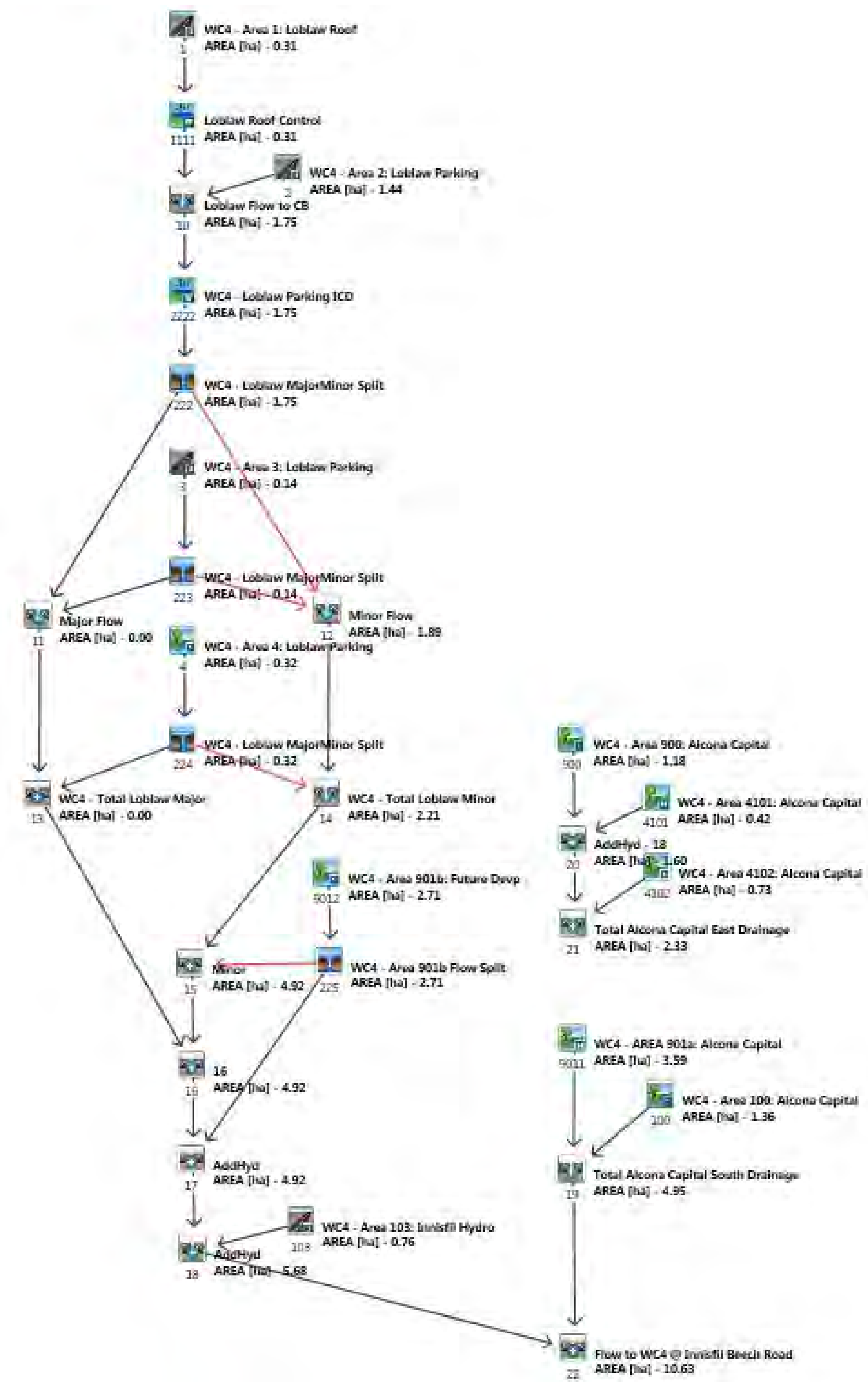
COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot=212.00 mm ]
    fname              :            C:\Users\asoares\AppData\Local\Temp\045fd79c-de72-42b3-bfd6-6899ebe59b42
\f06fd9b8-6bcb-481d-88ba-012
    remark: HURRICANE HAZEL
*
 ** CALIB NASHYD        1000  1  5.0   20.39    1.94 11.50 170.15 0.80   0.000
    [CN=85.0         ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD        0110  1  5.0    5.90    0.78 10.25 170.12 0.80   0.000
    [CN=85.0         ]
    [ N = 3.0:Tp 0.35]
*
 ** CALIB NASHYD        0111  1  5.0    2.16    0.29 10.25 170.11 0.80   0.000
    [CN=85.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0110+  0111] 0010  3  5.0    8.06    1.07 10.25 170.12  n/a   0.000
*
    ADD [  0010+  1000] 0011  3  5.0   28.45    2.72 11.25 170.14  n/a   0.000
*
 FINISH

=====================================================================================================
```



```
===========================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O        T        H   Y Y   MM MM        O
       O   O   T      T    H   H    Y    M   M OO   O
        OOO T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\b1badbc0-8915-4219-91e9-db8be966c9dd\scenari
  Summary       filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\b1badbc0-8915-4219-91e9-db8be966c9dd\scenari


DATE: 10/27/2015                            TIME: 11:56:04

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      -------------------
    READ STORM                 10.0
    [ Ptot= 31.96 mm ]
    fname          :               C:\Users\asoares\AppData\Local\Temp\cc4f5230-e976-4861-ac8a-28e8d4151b0f
\4e03e37b-7379-4893-8f6e-970
    remark: 2 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         9011  1  5.0    3.59    0.05  1.92   7.46 0.23   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD         0100  1  5.0    1.36    0.02  1.92   7.46 0.23   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.06  1.92   7.46  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.01  1.58   6.68 0.21   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0224  1  5.0    0.32    0.01  1.58   6.68  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    0.32    0.01  1.58   6.68  n/a   0.000
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.21  1.50  24.19 0.76   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.06  1.50  30.72 0.96   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.08  30.58  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.22  1.50  25.32  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.02  1.42  25.30  n/a   0.000
      {ST=  0.01 ha.m }
*
    DUHYD                0222  1  5.0    1.75    0.02  1.42  25.30  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
```

```
       MINOR SYSTEM:     0222  3  5.0    1.75    0.02  1.42  25.30  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.02  1.50  23.61 0.74   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.02  1.50  23.61  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.00    0.00  1.50  23.61  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.14    0.02  1.42  23.61  n/a   0.000
*
    ADD [  0222+  0223]  0011  3  5.0    0.00    0.00  1.50  23.61  n/a   0.000
*
    ADD [  0011+  0224]  0013  3  5.0    0.00    0.00  1.50  23.61  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.89    0.04  1.42  25.17  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.21    0.05  1.50  22.49  n/a   0.000
*
 ** CALIB NASHYD         9012  1  5.0    2.71    0.04  1.83   7.46 0.23   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.04  1.83   7.46  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.04  1.83   7.46  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.92    0.07  1.83  14.21  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.07  1.83  14.21  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.07  1.83  14.21  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.08  1.50  19.94 0.62   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.14  1.50  14.98  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.16  1.50  11.48  n/a   0.000
*
 *  CALIB NASHYD         0900  1  5.0    1.18    0.02  1.75   7.45 0.23   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
*
 *  CALIB NASHYD         4101  1  5.0    0.42    0.01  1.67   7.45 0.23   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.03  1.75   7.45  n/a   0.000
*
 *  CALIB NASHYD         4102  1  5.0    0.73    0.01  1.83   7.46 0.23   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.04  1.75   7.45  n/a   0.000
*
===========================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O        T        H   Y Y   MM MM        O
       O   O   T      T    H   H    Y    M   M OO   O
        OOO T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\c0c29b44-57dd-4cc9-bc96-6cf759b8265c\scenari
  Summary       filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\c0c29b44-57dd-4cc9-bc96-6cf759b8265c\scenari


DATE: 10/27/2015                            TIME: 11:56:04

USER:
```

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COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 43.24 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\cc4f5230-e976-4861-ac8a-28e8d4151b0f\a2d16486-3274-4893-b653-
f41
    remark: 5 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD          9011  1  5.0    3.59    0.08  1.92  12.84 0.30   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD          0100  1  5.0    1.36    0.03  1.92  12.84 0.30   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.11  1.92  12.84  n/a   0.000
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.01  1.50  12.64 0.29   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.01  1.50  12.64  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.32    0.01  1.50  12.64  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.30  1.50  34.02 0.79   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.09  1.50  41.95 0.97   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.25  41.80  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.30  1.50  35.40  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.04  2.00  35.37  n/a   0.000
      {ST=  0.02 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.04  2.00  35.37  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.75    0.04  2.00  35.37  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.03  1.50  33.37 0.77   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.03  1.50  33.37  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.01    0.01  1.50  33.37  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.13    0.02  1.42  33.37  n/a   0.000
*
    ADD [  0222+  0223]  0011  3  5.0    0.01    0.01  1.50  33.37  n/a   0.000
*
    ADD [  0011+  0224]  0013  3  5.0    0.01    0.01  1.50  33.37  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.88    0.05  2.00  35.23  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.20    0.06  1.50  31.94  n/a   0.000
*
 ** CALIB NASHYD          9012  1  5.0    2.71    0.07  1.83  12.84 0.30   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                 0225  1  5.0    2.71    0.07  1.83  12.84  n/a   0.000
       MAJOR SYSTEM:      0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0225  3  5.0    2.71    0.07  1.83  12.84  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.91    0.12  1.83  21.39  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.12  1.83  21.42  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.12  1.83  21.42  n/a   0.000
*
```

```
 *  CALIB STANDHYD        0103  1  5.0    0.76    0.11  1.50  28.65 0.66   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.20  1.50  22.39  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.25  1.83  17.94  n/a   0.000
*
 *  CALIB NASHYD          0900  1  5.0    1.18    0.04  1.75  12.83 0.30   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
*
 *  CALIB NASHYD          4101  1  5.0    0.42    0.01  1.67  12.83 0.30   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.05  1.75  12.83  n/a   0.000
*
 *  CALIB NASHYD          4102  1  5.0    0.73    0.02  1.83  12.84 0.30   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.07  1.75  12.83  n/a   0.000
*
==============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM O     O
       O   O    T      T    H   H    Y    M   M O O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:     C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\34566947-4f92-4b8e-974d-90d23661313f\scenari
  Summary        filename:       C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\34566947-4f92-4b8e-974d-90d23661313f\scenari


DATE: 10/27/2015                            TIME: 11:56:04

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 50.81 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\cc4f5230-e976-4861-ac8a-28e8d4151b0f\e5c80cd0-3b0a-4fdc-
b7d2-522
    remark: 10 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD          9011  1  5.0    3.59    0.11  1.92  16.97 0.33   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD          0100  1  5.0    1.36    0.04  1.92  16.97 0.33   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.15  1.92  16.97  n/a   0.000
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.02  1.50  17.24 0.34   0.000
```

```
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                   0224  1  5.0    0.32    0.02  1.50  17.24  n/a   0.000
       MAJOR SYSTEM:        0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:        0224  3  5.0    0.32    0.02  1.50  17.24  n/a   0.000
*
 *  CALIB STANDHYD          0002  1  5.0    1.44    0.35  1.50  40.77 0.80   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD          0001  1  5.0    0.31    0.10  1.50  49.48 0.97   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]      1111  1  5.0    0.31    0.01  2.42  49.33  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]     0010  3  5.0    1.75    0.36  1.50  42.29  n/a   0.000
*
    RESRVR [ 2:  0010]      2222  1  5.0    1.75    0.05  1.67  42.27  n/a   0.000
      {ST=  0.02 ha.m }
*
    DUHYD                   0222  1  5.0    1.75    0.05  1.67  42.27  n/a   0.000
       MAJOR SYSTEM:        0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:        0222  3  5.0    1.75    0.05  1.67  42.27  n/a   0.000
*
 *  CALIB STANDHYD          0003  1  5.0    0.14    0.03  1.50  40.09 0.79   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                   0223  1  5.0    0.14    0.03  1.50  40.09  n/a   0.000
       MAJOR SYSTEM:        0223  2  5.0    0.02    0.01  1.50  40.09  n/a   0.000
       MINOR SYSTEM:        0223  3  5.0    0.12    0.02  1.42  40.09  n/a   0.000
*
    ADD [  0222+  0223]     0011  3  5.0    0.02    0.01  1.50  40.09  n/a   0.000
*
    ADD [  0011+  0224]     0013  3  5.0    0.02    0.01  1.50  40.09  n/a   0.000
*
    ADD [  0222+  0223]     0012  3  5.0    1.87    0.06  1.67  42.12  n/a   0.000
*
    ADD [  0012+  0224]     0014  3  5.0    2.19    0.08  1.67  38.49  n/a   0.000
*
 ** CALIB NASHYD            9012  1  5.0    2.71    0.09  1.83  16.97 0.33   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                   0225  1  5.0    2.71    0.09  1.83  16.97  n/a   0.000
       MAJOR SYSTEM:        0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:        0225  3  5.0    2.71    0.09  1.83  16.97  n/a   0.000
*
    ADD [  0014+  0225]     0015  3  5.0    4.90    0.16  1.83  26.59  n/a   0.000
*
    ADD [  0013+  0015]     0016  3  5.0    4.92    0.16  1.83  26.64  n/a   0.000
*
    ADD [  0016+  0225]     0017  3  5.0    4.92    0.16  1.83  26.64  n/a   0.000
*
 *  CALIB STANDHYD          0103  1  5.0    0.76    0.13  1.50  34.76 0.68   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]     0018  3  5.0    5.68    0.24  1.50  27.73  n/a   0.000
*
    ADD [  0018+  0019]     0022  3  5.0   10.63    0.33  1.83  22.72  n/a   0.000
*
 *  CALIB NASHYD            0900  1  5.0    1.18    0.05  1.75  16.96 0.33   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
*
 *  CALIB NASHYD            4101  1  5.0    0.42    0.02  1.67  16.95 0.33   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  4101+  0900]     0020  3  5.0    1.60    0.06  1.75  16.96  n/a   0.000
*
 *  CALIB NASHYD            4102  1  5.0    0.73    0.03  1.83  16.97 0.33   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
*
    ADD [  0020+  4102]     0021  3  5.0    2.33    0.09  1.75  16.96  n/a   0.000
*
===============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

            I
```

```
        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM O     O
       O   O    T      T    H   H    Y    M   M O O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\a2fb0a96-3f16-48cd-ad96-8c03090df9bf\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\a2fb0a96-3f16-48cd-ad96-8c03090df9bf\scenari


DATE: 10/27/2015                            TIME: 11:56:04

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min      ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 60.06 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\cc4f5230-e976-4861-ac8a-28e8d4151b0f\cfe7351c-c575-4096-
b842-912
    remark: 25 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD           9011  1  5.0    3.59    0.14  1.92  22.48 0.37   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD           0100  1  5.0    1.36    0.05  1.92  22.48 0.37   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]    0019  3  5.0    4.95    0.20  1.92  22.48  n/a   0.000
*
 ** CALIB NASHYD           0004  1  5.0    0.32    0.03  1.50  23.36 0.39   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                  0224  1  5.0    0.32    0.03  1.50  23.36  n/a   0.000
       MAJOR SYSTEM:       0224  2  5.0    0.02    0.01  1.50  23.36  n/a   0.000
       MINOR SYSTEM:       0224  3  5.0    0.30    0.02  1.50  23.36  n/a   0.000
*
 *  CALIB STANDHYD         0002  1  5.0    1.44    0.42  1.50  49.18 0.82   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD         0001  1  5.0    0.31    0.12  1.50  58.70 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]     1111  1  5.0    0.31    0.01  2.50  58.57  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]    0010  3  5.0    1.75    0.42  1.50  50.85  n/a   0.000
*
    RESRVR [ 2:  0010]     2222  1  5.0    1.75    0.06  2.08  50.82  n/a   0.000
      {ST=  0.04 ha.m }
*
    DUHYD                  0222  1  5.0    1.75    0.06  2.08  50.82  n/a   0.000
       MAJOR SYSTEM:       0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:       0222  3  5.0    1.75    0.06  2.08  50.82  n/a   0.000
*
 *  CALIB STANDHYD         0003  1  5.0    0.14    0.04  1.50  48.46 0.81   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                  0223  1  5.0    0.14    0.04  1.50  48.46  n/a   0.000
       MAJOR SYSTEM:       0223  2  5.0    0.02    0.02  1.50  48.46  n/a   0.000
       MINOR SYSTEM:       0223  3  5.0    0.12    0.02  1.42  48.46  n/a   0.000
```

```
 *
    ADD [  0222+  0223]  0011  3  5.0    0.02    0.02  1.50  48.46  n/a   0.000
 *
    ADD [  0011+  0224]  0013  3  5.0    0.04    0.03  1.50  37.20  n/a   0.000
 *
    ADD [  0222+  0223]  0012  3  5.0    1.87    0.07  1.58  50.67  n/a   0.000
 *
    ADD [  0012+  0224]  0014  3  5.0    2.17    0.09  1.58  46.88  n/a   0.000
 *
  ** CALIB NASHYD        9012  1  5.0    2.71    0.12  1.83  22.48 0.37   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
 *
    DUHYD                0225  1  5.0    2.71    0.12  1.83  22.48  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.12  1.83  22.48  n/a   0.000
 *
    ADD [  0014+  0225]  0015  3  5.0    4.88    0.19  1.83  33.32  n/a   0.000
 *
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.19  1.83  33.36  n/a   0.000
 *
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.19  1.83  33.36  n/a   0.000
 *
  *  CALIB STANDHYD      0103  1  5.0    0.76    0.16  1.50  42.44 0.71   0.000
    [I%=50.0:S%= 2.00]
 *
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.31  1.50  34.57  n/a   0.000
 *
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.43  1.83  28.94  n/a   0.000
 *
  *  CALIB NASHYD        0900  1  5.0    1.18    0.06  1.75  22.47 0.37   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
 *
  *  CALIB NASHYD        4101  1  5.0    0.42    0.02  1.67  22.46 0.37   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
 *
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.09  1.75  22.47  n/a   0.000
 *
  *  CALIB NASHYD        4102  1  5.0    0.73    0.03  1.83  22.48 0.37   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
 *
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.12  1.75  22.47  n/a   0.000
 *
=============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO  I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O        T         H   Y Y   MM MM  O      O
       O   O    T      T   H   H    Y    M   M  O  O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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```

```

                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\5970bd54-
e538-4ecf-bf7b-cd0669477e65\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\5970bd54-
e538-4ecf-bf7b-cd0669477e65\scenari


DATE: 10/27/2015                            TIME: 11:56:05

USER:

COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************
```

```
  W/E COMMAND            HYD ID   DT     AREA  ' Qpeak Tpeak    R.V. R.C.    Qbase
                                  min     ha   '  cms   hrs      mm           cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 67.14 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\cc4f5230-e976-4861-ac8a-28e8d4151b0f\a5064fc1-11dd-4f31-
a4ee-997
    remark: 50 yr 4 hr Chicago - Barrie WPCC
 *
  ** CALIB NASHYD        9011  1  5.0    3.59    0.17  1.92  26.99 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
 *
  ** CALIB NASHYD        0100  1  5.0    1.36    0.07  1.92  26.99 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
 *
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.24  1.92  26.99  n/a   0.000
 *
  ** CALIB NASHYD        0004  1  5.0    0.32    0.04  1.50  28.35 0.42   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
 *
    DUHYD                0224  1  5.0    0.32    0.04  1.50  28.35  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.03    0.02  1.50  28.35  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    0.29    0.02  1.50  28.35  n/a   0.000
 *
  *  CALIB STANDHYD      0002  1  5.0    1.44    0.47  1.50  55.70 0.83   0.000
    [I%=72.0:S%= 2.00]
 *
  *  CALIB STANDHYD      0001  1  5.0    0.31    0.13  1.50  65.76 0.98   0.000
    [I%=99.0:S%= 2.00]
 *
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.58  65.63  n/a   0.000
      {ST=  0.01 ha.m }
 *
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.48  1.50  57.46  n/a   0.000
 *
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.06  2.00  57.44  n/a   0.000
      {ST=  0.04 ha.m }
 *
    DUHYD                0222  1  5.0    1.75    0.06  2.00  57.44  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.03    0.01  2.00  57.44  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    1.72    0.06  1.75  57.44  n/a   0.000
 *
  *  CALIB STANDHYD      0003  1  5.0    0.14    0.05  1.50  54.94 0.82   0.000
    [I%=70.0:S%= 2.00]
 *
    DUHYD                0223  1  5.0    0.14    0.05  1.50  54.94  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.03    0.03  1.50  54.94  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.11    0.02  1.42  54.94  n/a   0.000
 *
    ADD [  0222+  0223]  0011  3  5.0    0.06    0.03  1.50  56.30  n/a   0.000
 *
    ADD [  0011+  0224]  0013  3  5.0    0.09    0.04  1.50  45.85  n/a   0.000
 *
    ADD [  0222+  0223]  0012  3  5.0    1.83    0.07  1.67  57.28  n/a   0.000
 *
    ADD [  0012+  0224]  0014  3  5.0    2.12    0.09  1.67  53.38  n/a   0.000
 *
  ** CALIB NASHYD        9012  1  5.0    2.71    0.14  1.83  26.99 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
 *
    DUHYD                0225  1  5.0    2.71    0.14  1.83  26.99  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.14  1.83  26.99  n/a   0.000
 *
    ADD [  0014+  0225]  0015  3  5.0    4.83    0.22  1.83  38.57  n/a   0.000
 *
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.23  1.83  38.70  n/a   0.000
 *
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.23  1.83  38.70  n/a   0.000
 *
  *  CALIB STANDHYD      0103  1  5.0    0.76    0.19  1.50  48.47 0.72   0.000
    [I%=50.0:S%= 2.00]
 *
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.38  1.50  40.01  n/a   0.000
 *
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.50  1.83  33.95  n/a   0.000
 *
  *  CALIB NASHYD        0900  1  5.0    1.18    0.08  1.75  26.98 0.40   0.000
```

```
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
*
 *  CALIB NASHYD        4101  1  5.0    0.42    0.03  1.67  26.97 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.10  1.75  26.98  n/a   0.000
*
 *  CALIB NASHYD        4102  1  5.0    0.73    0.04  1.83  26.99 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.14  1.75  26.98  n/a   0.000
*
=============================================================================================================
```

```
       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAA  L
        VV V    I      SS       U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM      O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4a031025-77a3-4812-8a21-bff3e5c7c73e\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4a031025-77a3-4812-8a21-bff3e5c7c73e\scenari

DATE: 10/27/2015                            TIME: 11:56:05

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      -------------------
    READ STORM                 10.0
    [ Ptot= 74.00 mm ]
    fname               :              C:\Users\asoares\AppData\Local\Temp\cc4f5230-e976-4861-ac8a-28e8d4151b0f
\ff7c6c55-2345-4390-8c7e-8c6
    remark: 100 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD        9011  1  5.0    3.59    0.20  1.92  31.58 0.43   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD        0100  1  5.0    1.36    0.08  1.92  31.57 0.43   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.28  1.92  31.57  n/a   0.000
*
 ** CALIB NASHYD        0004  1  5.0    0.32    0.05  1.50  33.39 0.45   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD               0224  1  5.0    0.32    0.05  1.50  33.39  n/a   0.000
       MAJOR SYSTEM:    0224  2  5.0    0.05    0.02  1.50  33.39  n/a   0.000
       MINOR SYSTEM:    0224  3  5.0    0.27    0.02  1.50  33.39  n/a   0.000
*
 *  CALIB STANDHYD      0002  1  5.0    1.44    0.52  1.50  62.08 0.84   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD      0001  1  5.0    0.31    0.14  1.50  72.61 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.67  72.46  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.53  1.50  63.92  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.07  2.00  63.89  n/a   0.000
      {ST=  0.05 ha.m }
*
    DUHYD               0222  1  5.0    1.75    0.07  2.00  63.89  n/a   0.000
       MAJOR SYSTEM:    0222  2  5.0    0.10    0.02  2.00  63.89  n/a   0.000
       MINOR SYSTEM:    0222  3  5.0    1.65    0.06  1.58  63.89  n/a   0.000
*
 *  CALIB STANDHYD      0003  1  5.0    0.14    0.05  1.50  61.28 0.83   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD               0223  1  5.0    0.14    0.05  1.50  61.28  n/a   0.000
       MAJOR SYSTEM:    0223  2  5.0    0.03    0.03  1.50  61.28  n/a   0.000
       MINOR SYSTEM:    0223  3  5.0    0.11    0.02  1.42  61.28  n/a   0.000
*
    ADD [  0222+  0223]  0011  3  5.0    0.13    0.03  1.50  63.32  n/a   0.000
*
    ADD [  0011+  0224]  0013  3  5.0    0.17    0.05  1.50  55.34  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.76    0.07  1.50  63.73  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.04    0.10  1.50  59.65  n/a   0.000
*
 ** CALIB NASHYD        9012  1  5.0    2.71    0.17  1.83  31.57 0.43   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD               0225  1  5.0    2.71    0.17  1.83  31.57  n/a   0.000
       MAJOR SYSTEM:    0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:    0225  3  5.0    2.71    0.17  1.83  31.57  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.75    0.25  1.83  43.62  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.27  1.83  44.03  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.27  1.83  44.03  n/a   0.000
*
 *  CALIB STANDHYD      0103  1  5.0    0.76    0.22  1.50  54.40 0.74   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.43  1.50  45.42  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.59  1.83  38.97  n/a   0.000
*
 *  CALIB NASHYD        0900  1  5.0    1.18    0.09  1.75  31.56 0.43   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
*
 *  CALIB NASHYD        4101  1  5.0    0.42    0.03  1.67  31.55 0.43   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.12  1.75  31.56  n/a   0.000
*
 *  CALIB NASHYD        4102  1  5.0    0.73    0.05  1.83  31.57 0.43   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.17  1.75  31.56  n/a   0.000
*
=============================================================================================================
```



```
       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAA  L
        VV V    I      SS       U  A   A  L
         VV          SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM      O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\3181bd92-2a4d-4234-ba35-60347086d4cd\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\3181bd92-2a4d-4234-ba35-60347086d4cd\scenari

DATE: 10/27/2015                            TIME: 11:56:05

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname          :        C:\Users\asoares\AppData\Local\Temp\cc4f5230-e976-4861-ac8a-28e8d4151b0f\b1bdedf4-
b9b7-40af-89ef-51d
    remark: 25mm 4 HOUR STORM FOR WATER QUALITY
*
 ** CALIB NASHYD         9011  1  5.0    3.59    0.03  2.17   4.70 0.19   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD         0100  1  5.0    1.36    0.01  2.08   4.70 0.19   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.05  2.08   4.70  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.00  1.75   3.71 0.15   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0224  1  5.0    0.32    0.00  1.75   3.71  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    0.32    0.00  1.75   3.71  n/a   0.000
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.17  1.67  18.32 0.73   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.05  1.67  23.78 0.95   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.08  23.64  n/a   0.000
      {ST=  0.00 ha.m }
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.18  1.67  19.26  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.02  1.58  19.24  n/a   0.000
      {ST=  0.01 ha.m }
*
    DUHYD                0222  1  5.0    1.75    0.02  1.58  19.24  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    1.75    0.02  1.58  19.24  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.02  1.67  17.80 0.71   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.02  1.67  17.80  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.14    0.02  1.67  17.80  n/a   0.000
*
    ADD [  0222+  0223]  0011  3  0.0    0.00    0.00  0.00  17.80  n/a   0.000
*
    ADD [  0011+  0224]  0013  3  0.0    0.00    0.00  0.00  17.80  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.89    0.04  1.67  19.13  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.21    0.04  1.67  16.90  n/a   0.000
*
 ** CALIB NASHYD         9012  1  5.0    2.71    0.03  2.08   4.70 0.19   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.03  2.08   4.70  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.03  2.08   4.70  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.92    0.05  2.00  10.18  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.05  2.00  10.18  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.05  2.00  10.18  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.07  1.67  14.84 0.59   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.12  1.67  10.80  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.13  1.67   7.96  n/a   0.000
*
 *  CALIB NASHYD         0900  1  5.0    1.18    0.01  1.92   4.70 0.19   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.27]
*
 *  CALIB NASHYD         4101  1  5.0    0.42    0.01  1.92   4.69 0.19   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.02  1.92   4.70  n/a   0.000
*
 *  CALIB NASHYD         4102  1  5.0    0.73    0.01  2.00   4.70 0.19   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.34]
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.03  1.92   4.70  n/a   0.000
*
 FINISH

==========================================================================================
```

```
==========================================================================================================

      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL  L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O          T         H   Y Y   MM MM      O
      O   O   T      T     H   H    Y    M   M O O   O
       OOO  T  T      T H  H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\b39ac749-
a167-4b5d-88c4-ea79cbfe0ddc\scenari
  Summary    filename:    C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\b39ac749-
a167-4b5d-88c4-ea79cbfe0ddc\scenari


DATE: 10/27/2015                            TIME: 11:58:43

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 42.00 mm ]
    fname       :        C:\Users\asoares\AppData\Local\Temp\4f1fbb51-a752-46d0-b39e-a82feb95eff0\470585a3-
fd23-4e6c-9c40-4bd
    remark: 2 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         9011  1  5.0    3.59    0.07  6.58  12.20 0.29   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD         0100  1  5.0    1.36    0.03  6.50  12.20 0.29   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.10  6.58  12.20  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.02  6.25  11.92 0.28   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0222  1  5.0    0.32    0.02  6.25  11.92  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    0.32    0.02  6.25  11.92  n/a   0.000
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.05  6.25  40.70 0.97   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  6.75  40.55  n/a   0.000
      {ST=  0.01 ha.m }
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.17  6.25  32.91 0.78   0.000
    [I%=72.0:S%= 2.00]
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.17  6.25  34.27  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.02  5.92  34.24  n/a   0.000
      {ST=  0.01 ha.m }
*
    DUHYD                0224  1  5.0    1.75    0.02  5.92  34.24  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    1.75    0.02  5.92  34.24  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.02  6.25  32.29 0.77   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.02  6.25  32.29  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.14    0.02  6.25  32.29  n/a   0.000
*
    ADD [  0223+  0224]  0011  3  0.0    0.00    0.00  0.00  32.29  n/a   0.000
*
    ADD [  0011+  0222]  0013  3  0.0    0.00    0.00  0.00  32.29  n/a   0.000
*
    ADD [  0223+  0224]  0012  3  5.0    1.89    0.04  6.25  34.09  n/a   0.000
*
    ADD [  0012+  0222]  0014  3  5.0    2.21    0.05  6.25  30.88  n/a   0.000
*
 ** CALIB NASHYD         9012  1  5.0    2.71    0.06  6.50  12.20 0.29   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.06  6.50  12.20  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.06  6.50  12.20  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.92    0.10  6.25  20.59  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.10  6.25  20.59  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.10  6.25  20.59  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.07  6.25  27.67 0.66   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.17  6.25  21.54  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.23  6.25  17.19  n/a   0.000
*
 *  CALIB NASHYD         4102  1  5.0    0.73    0.02  6.50  12.20 0.29   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.34]
*
 *  CALIB NASHYD         4101  1  5.0    0.42    0.01  6.33  12.19 0.29   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.24]
*
 *  CALIB NASHYD         0900  1  5.0    1.18    0.03  6.42  12.19 0.29   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.05  6.42  12.19  n/a   0.000
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.06  6.42  12.19  n/a   0.000
*
==========================================================================================================

      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL  L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O          T         H   Y Y   MM MM      O
      O   O   T      T     H   H    Y    M   M O O   O
       OOO  T  T      T H  H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\d0834b84-5398-4111-a6cc-4178c8287b50\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\d0834b84-5398-4111-a6cc-4178c8287b50\scenari


DATE: 10/27/2015                            TIME: 11:58:43

USER:
```

```
COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      -------------------
    READ STORM               15.0
    [ Ptot= 56.40 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\4f1fbb51-a752-46d0-b39e-a82feb95eff0\f2519472-2e6a-4fd0-a77a-
ed2
    remark: 5 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         9011  1  5.0    3.59    0.13  6.58  20.25 0.36   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD         0100  1  5.0    1.36    0.05  6.50  20.25 0.36   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.17  6.58  20.25  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.03  6.25  20.88 0.37   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0222  1  5.0    0.32    0.03  6.25  20.88  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.01    0.01  6.25  20.88  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    0.31    0.02  6.25  20.88  n/a   0.000
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.06  6.25  55.05 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  6.75  54.90  n/a   0.000
      {ST=  0.01 ha.m }
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.23  6.25  45.84 0.81   0.000
    [I%=72.0:S%= 2.00]
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.24  6.25  47.45  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.05  6.42  47.42  n/a   0.000
      {ST=  0.03 ha.m }
*
    DUHYD                0224  1  5.0    1.75    0.05  6.42  47.42  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    1.75    0.05  6.42  47.42  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.02  6.25  45.10 0.80   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.02  6.25  45.10  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.00    0.00  6.25  45.10  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.14    0.02  6.08  45.10  n/a   0.000
*
    ADD [  0223+  0224]  0011  3  5.0    0.00    0.00  6.25  45.10  n/a   0.000
*
    ADD [  0011+  0222]  0013  3  5.0    0.01    0.01  6.25  27.17  n/a   0.000
*
    ADD [  0223+  0224]  0012  3  5.0    1.89    0.06  6.42  47.25  n/a   0.000
*
    ADD [  0012+  0222]  0014  3  5.0    2.20    0.08  6.33  43.52  n/a   0.000
*
 ** CALIB NASHYD         9012  1  5.0    2.71    0.11  6.50  20.25 0.36   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.11  6.50  20.25  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.11  6.50  20.25  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.91    0.18  6.42  30.67  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.18  6.42  30.66  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.18  6.42  30.66  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.10  6.25  39.38 0.70   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.25  6.25  31.83  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.37  6.50  26.43  n/a   0.000
*
 *  CALIB NASHYD         4102  1  5.0    0.73    0.03  6.42  20.24 0.36   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
*
 *  CALIB NASHYD         4101  1  5.0    0.42    0.02  6.33  20.23 0.36   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
*
 *  CALIB NASHYD         0900  1  5.0    1.18    0.06  6.42  20.24 0.36   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.08  6.33  20.23  n/a   0.000
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.11  6.42  20.24  n/a   0.000
*
===============================================================================================================
```

```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O           T        H   Y Y   MM MM O      O
      O   O    T      T    H   H    Y    M   M O O    O
       OOO  T  T      T H  H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\b180db1a-
f558-4168-89ec-45974e7ca276\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\b180db1a-
f558-4168-89ec-45974e7ca276\scenari

DATE: 10/27/2015                            TIME: 11:58:43

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      -------------------
    READ STORM               15.0
    [ Ptot= 66.00 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\4f1fbb51-a752-46d0-b39e-a82feb95eff0\aa5d45ab-4f75-489f-
a507-0aa
    remark: 10 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         9011  1  5.0    3.59    0.16  6.58  26.25 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD         0100  1  5.0    1.36    0.06  6.50  26.25 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.23  6.50  26.25  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.04  6.25  27.53 0.42   0.000
```

```
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0222  1  5.0    0.32    0.04  6.25  27.53  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.03    0.02  6.25  27.53  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    0.29    0.02  6.17  27.53  n/a   0.000
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.07  6.25  64.62 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  6.83  64.48  n/a   0.000
      {ST=  0.01 ha.m }
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.28  6.25  54.65 0.83   0.000
    [I%=72.0:S%= 2.00]
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.28  6.25  56.39  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.05  6.75  56.37  n/a   0.000
      {ST=  0.03 ha.m }
*
    DUHYD                0224  1  5.0    1.75    0.05  6.75  56.37  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    1.75    0.05  6.75  56.37  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.03  6.25  53.87 0.82   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.03  6.25  53.87  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.01    0.01  6.25  53.87  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.13    0.02  6.08  53.87  n/a   0.000
*
    ADD [  0223+  0224]  0011  3  5.0    0.01    0.01  6.25  53.87  n/a   0.000
*
    ADD [  0011+  0222]  0013  3  5.0    0.04    0.02  6.25  33.99  n/a   0.000
*
    ADD [  0223+  0224]  0012  3  5.0    1.88    0.07  6.25  56.19  n/a   0.000
*
    ADD [  0012+  0222]  0014  3  5.0    2.17    0.10  6.25  52.35  n/a   0.000
*
 ** CALIB NASHYD         9012  1  5.0    2.71    0.14  6.50  26.25 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.14  6.50  26.25  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.14  6.50  26.25  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.88    0.21  6.42  37.86  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.21  6.42  37.83  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.21  6.42  37.83  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.12  6.25  47.49 0.72   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.33  6.25  39.12  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.47  6.25  33.13  n/a   0.000
*
 *  CALIB NASHYD         4102  1  5.0    0.73    0.04  6.42  26.25 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.34]
*
 *  CALIB NASHYD         4101  1  5.0    0.42    0.03  6.33  26.23 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.24]
*
 *  CALIB NASHYD         0900  1  5.0    1.18    0.07  6.42  26.24 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.10  6.33  26.24  n/a   0.000
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.14  6.42  26.24  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

            I
```

```
        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM O    O
       O   O    T      T    H   H    Y    M   M O  O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
Developed and Distributed by Civica Infrastructure
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output            filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\2dbe9b81-0faf-44db-8d21-60056b031c27\scenari
  Summary        filename:         C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\2dbe9b81-0faf-44db-8d21-60056b031c27\scenari


DATE: 10/27/2015                             TIME: 11:58:44

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM               15.0
    [ Ptot= 78.10 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\4f1fbb51-a752-46d0-b39e-a82feb95eff0\767f9333-7ce9-4466-acb2-
c17
    remark: 25 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         9011  1  5.0    3.59    0.22  6.50  34.40 0.44   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD         0100  1  5.0    1.36    0.08  6.50  34.40 0.44   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.30  6.50  34.40  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.05  6.25  36.48 0.47   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0222  1  5.0    0.32    0.05  6.25  36.48  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.05    0.03  6.25  36.48  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    0.27    0.02  6.08  36.48  n/a   0.000
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.09  6.25  76.69 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  6.83  76.55  n/a   0.000
      {ST=  0.01 ha.m }
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.35  6.25  65.92 0.84   0.000
    [I%=72.0:S%= 2.00]
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.36  6.25  67.80  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.07  6.50  67.77  n/a   0.000
      {ST=  0.04 ha.m }
*
    DUHYD                0224  1  5.0    1.75    0.07  6.50  67.77  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.04    0.01  6.50  67.77  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    1.71    0.06  6.33  67.77  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.03  6.25  65.10 0.83   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.03  6.25  65.10  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.02    0.01  6.25  65.10  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.12    0.02  6.08  65.10  n/a   0.000
```

```
*
   ADD [  0223+  0224]  0011  3  5.0    0.05    0.01  6.25  66.91  n/a   0.000
*
   ADD [  0011+  0222]  0013  3  5.0    0.10    0.04  6.25  52.30  n/a   0.000
*
   ADD [  0223+  0224]  0012  3  5.0    1.84    0.07  6.25  67.60  n/a   0.000
*
   ADD [  0012+  0222]  0014  3  5.0    2.11    0.10  6.25  63.60  n/a   0.000
*
 ** CALIB NASHYD        9012  1  5.0    2.71    0.18  6.50  34.40 0.44   0.000
   [CN=73.0         ]
   [ N = 3.0:Tp 0.36]
*
   DUHYD                0225  1  5.0    2.71    0.18  6.50  34.40  n/a   0.000
      MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:     0225  3  5.0    2.71    0.18  6.50  34.40  n/a   0.000
*
   ADD [  0014+  0225]  0015  3  5.0    4.82    0.26  6.42  47.17  n/a   0.000
*
   ADD [  0013+  0015]  0016  3  5.0    4.92    0.27  6.42  47.28  n/a   0.000
*
   ADD [  0016+  0225]  0017  3  5.0    4.92    0.27  6.42  47.28  n/a   0.000
*
 *  CALIB STANDHYD      0103  1  5.0    0.76    0.16  6.25  57.99 0.74   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0103+  0017]  0018  3  5.0    5.68    0.42  6.25  48.71  n/a   0.000
*
   ADD [  0018+  0019]  0022  3  5.0   10.63    0.61  6.25  42.05  n/a   0.000
*
 *  CALIB NASHYD        4102  1  5.0    0.73    0.05  6.42  34.39 0.44   0.000
   [CN=73.0         ]
   [ N = 3.0:Tp 0.34]
*
 *  CALIB NASHYD        4101  1  5.0    0.42    0.04  6.33  34.37 0.44   0.000
   [CN=73.0         ]
   [ N = 3.0:Tp 0.24]
*
 *  CALIB NASHYD        0900  1  5.0    1.18    0.10  6.42  34.38 0.44   0.000
   [CN=73.0         ]
   [ N = 3.0:Tp 0.27]
*
   ADD [  4101+  0900]  0020  3  5.0    1.60    0.13  6.33  34.38  n/a   0.000
*
   ADD [  0020+  4102]  0021  3  5.0    2.33    0.18  6.42  34.38  n/a   0.000
*
=============================================================================================================

      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O           T        H   Y Y   MM MM  O     O
      O   O    T      T    H   H    Y    M   M O O    O
       OOO  T  T      T H  H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\c84137b8-
abd7-4a1c-8c4b-3be2246b9f25\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\c84137b8-
abd7-4a1c-8c4b-3be2246b9f25\scenari


DATE: 10/27/2015                            TIME: 11:58:44

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************
```

```
   W/E COMMAND             HYD ID   DT      AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                    min      ha   '  cms   hrs     mm           cms

       START @  0.00 hrs
       --------------------
     READ STORM                 15.0
     [ Ptot= 87.10 mm ]
     fname : C:\Users\asoares\AppData\Local\Temp\4f1fbb51-a752-46d0-b39e-a82feb95eff0\33fadf3d-9fcf-4477-a694-
fed
     remark: 50 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD        9011  1  5.0    3.59    0.26  6.50  40.81 0.47   0.000
     [CN=73.0         ]
     [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD        0100  1  5.0    1.36    0.10  6.50  40.81 0.47   0.000
     [CN=73.0         ]
     [ N = 3.0:Tp 0.41]
*
     ADD [  0100+  9011]  0019  3  5.0    4.95    0.36  6.50  40.81  n/a   0.000
*
 ** CALIB NASHYD        0004  1  5.0    0.32    0.06  6.25  43.46 0.50   0.000
     [CN=80.0         ]
     [ N = 3.0:Tp 0.11]
*
     DUHYD                0222  1  5.0    0.32    0.06  6.25  43.46  n/a   0.000
        MAJOR SYSTEM:     0222  2  5.0    0.06    0.04  6.25  43.46  n/a   0.000
        MINOR SYSTEM:     0222  3  5.0    0.26    0.02  6.08  43.46  n/a   0.000
*
 *  CALIB STANDHYD      0001  1  5.0    0.31    0.10  6.25  85.68 0.98   0.000
     [I%=99.0:S%= 2.00]
*
     RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  6.83  85.54  n/a   0.000
       {ST=  0.01 ha.m }
*
 *  CALIB STANDHYD      0002  1  5.0    1.44    0.40  6.25  74.39 0.85   0.000
     [I%=72.0:S%= 2.00]
*
     ADD [  1111+  0002]  0010  3  5.0    1.75    0.41  6.25  76.36  n/a   0.000
*
     RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.08  6.50  76.34  n/a   0.000
       {ST=  0.05 ha.m }
*
     DUHYD                0224  1  5.0    1.75    0.08  6.50  76.34  n/a   0.000
        MAJOR SYSTEM:     0224  2  5.0    0.09    0.02  6.50  76.34  n/a   0.000
        MINOR SYSTEM:     0224  3  5.0    1.66    0.06  6.25  76.34  n/a   0.000
*
 *  CALIB STANDHYD      0003  1  5.0    0.14    0.04  6.25  73.53 0.84   0.000
     [I%=70.0:S%= 2.00]
*
     DUHYD                0223  1  5.0    0.14    0.04  6.25  73.53  n/a   0.000
        MAJOR SYSTEM:     0223  2  5.0    0.02    0.02  6.25  73.53  n/a   0.000
        MINOR SYSTEM:     0223  3  5.0    0.12    0.02  6.08  73.53  n/a   0.000
*
     ADD [  0223+  0224]  0011  3  5.0    0.11    0.02  6.25  75.84  n/a   0.000
*
     ADD [  0011+  0222]  0013  3  5.0    0.18    0.06  6.25  64.37  n/a   0.000
*
     ADD [  0223+  0224]  0012  3  5.0    1.78    0.08  6.25  76.15  n/a   0.000
*
     ADD [  0012+  0222]  0014  3  5.0    2.03    0.10  6.25  72.01  n/a   0.000
*
 ** CALIB NASHYD        9012  1  5.0    2.71    0.22  6.50  40.80 0.47   0.000
     [CN=73.0         ]
     [ N = 3.0:Tp 0.36]
*
     DUHYD                0225  1  5.0    2.71    0.22  6.50  40.80  n/a   0.000
        MAJOR SYSTEM:     0225  2  5.0    0.07    0.03  6.50  40.80  n/a   0.000
        MINOR SYSTEM:     0225  3  5.0    2.64    0.19  6.33  40.80  n/a   0.000
*
     ADD [  0014+  0225]  0015  3  5.0    4.67    0.28  6.33  54.38  n/a   0.000
*
     ADD [  0013+  0015]  0016  3  5.0    4.85    0.31  6.33  54.75  n/a   0.000
*
     ADD [  0016+  0225]  0017  3  5.0    4.92    0.33  6.42  54.55  n/a   0.000
*
 *  CALIB STANDHYD      0103  1  5.0    0.76    0.18  6.25  65.95 0.76   0.000
     [I%=50.0:S%= 2.00]
*
     ADD [  0103+  0017]  0018  3  5.0    5.68    0.49  6.25  56.07  n/a   0.000
*
     ADD [  0018+  0019]  0022  3  5.0   10.63    0.72  6.50  48.96  n/a   0.000
*
 *  CALIB NASHYD        4102  1  5.0    0.73    0.06  6.42  40.80 0.47   0.000
```

```
    [CN=73.0          ]
    [ N = 3.0:Tp 0.34]
*
 *  CALIB NASHYD         4101  1  5.0    0.42    0.04  6.33  40.77 0.47   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.24]
*
 *  CALIB NASHYD         0900  1  5.0    1.18    0.11  6.42  40.79 0.47   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.16  6.33  40.78  n/a   0.000
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.22  6.42  40.79  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAA  L
        VV V    I      SS       U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM      O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\77c9478d-1c63-4f54-97cf-8b0918feae8e\scenari
  Summary        filename:       C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\77c9478d-1c63-4f54-97cf-8b0918feae8e\scenari


DATE: 10/27/2015                            TIME: 11:58:44

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\4f1fbb51-a752-46d0-b39e-a82feb95eff0\9d3f1662-f862-439e-8f80-
dea
    remark: 100 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         9011  1  5.0    3.59    0.30  6.50  47.38 0.49   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.42]
*
 ** CALIB NASHYD         0100  1  5.0    1.36    0.12  6.50  47.38 0.49   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.42  6.50  47.38  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.07  6.25  50.58 0.53   0.000
    [CN=80.0          ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0222  1  5.0    0.32    0.07  6.25  50.58  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.07    0.05  6.25  50.58  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    0.25    0.02  6.08  50.58  n/a   0.000
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.11  6.25  94.56 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]  1111  1  5.0    0.31    0.01  6.83  94.42  n/a   0.000
      {ST=  0.02 ha.m }
*
 *  CALIB STANDHYD      0002  1  5.0    1.44    0.44  6.25  82.82 0.86   0.000
    [I%=72.0:S%= 2.00]
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.45  6.25  84.88  n/a   0.000
*
    RESRVR [ 2:  0010]  2222  1  5.0    1.75    0.09  6.50  84.85  n/a   0.000
      {ST=  0.06 ha.m }
*
    DUHYD               0224  1  5.0    1.75    0.09  6.50  84.85  n/a   0.000
       MAJOR SYSTEM:    0224  2  5.0    0.15    0.04  6.50  84.85  n/a   0.000
       MINOR SYSTEM:    0224  3  5.0    1.60    0.06  6.25  84.85  n/a   0.000
*
 *  CALIB STANDHYD      0003  1  5.0    0.14    0.04  6.25  81.94 0.85   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD               0223  1  5.0    0.14    0.04  6.25  81.94  n/a   0.000
       MAJOR SYSTEM:    0223  2  5.0    0.02    0.02  6.25  81.94  n/a   0.000
       MINOR SYSTEM:    0223  3  5.0    0.12    0.02  6.08  81.94  n/a   0.000
*
    ADD [  0223+  0224]  0011  3  5.0    0.17    0.04  6.25  84.47  n/a   0.000
*
    ADD [  0011+  0222]  0013  3  5.0    0.25    0.09  6.25  74.44  n/a   0.000
*
    ADD [  0223+  0224]  0012  3  5.0    1.72    0.08  6.25  84.65  n/a   0.000
*
    ADD [  0012+  0222]  0014  3  5.0    1.96    0.10  6.25  80.37  n/a   0.000
*
 ** CALIB NASHYD        9012  1  5.0    2.71    0.25  6.50  47.38 0.49   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD               0225  1  5.0    2.71    0.25  6.50  47.38  n/a   0.000
       MAJOR SYSTEM:    0225  2  5.0    0.18    0.07  6.50  47.38  n/a   0.000
       MINOR SYSTEM:    0225  3  5.0    2.53    0.19  6.33  47.38  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.50    0.28  6.33  61.78  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.74    0.36  6.25  62.44  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.38  6.42  61.90  n/a   0.000
*
 *  CALIB STANDHYD      0103  1  5.0    0.76    0.20  6.25  73.93 0.77   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.56  6.25  63.51  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    0.83  6.42  56.00  n/a   0.000
*
 *  CALIB NASHYD        4102  1  5.0    0.73    0.07  6.42  47.38 0.49   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.34]
*
 *  CALIB NASHYD        4101  1  5.0    0.42    0.05  6.33  47.34 0.49   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.24]
*
 *  CALIB NASHYD        0900  1  5.0    1.18    0.13  6.42  47.36 0.49   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.18  6.33  47.36  n/a   0.000
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.25  6.42  47.36  n/a   0.000
*
 FINISH

===========================================================================================================
```

```
===========================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O         T          H   Y Y   MM MM O     O
       O   O    T      T    H   H    Y    M   M  O O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\97da97c0-3b5e-4694-aee2-8c9417140cdb\scenari
  Summary       filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\97da97c0-3b5e-4694-aee2-8c9417140cdb\scenari


DATE: 10/27/2015                            TIME: 11:58:10

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=212.00 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\6da3458d-da87-41a4-a122-f9b7055623f1\249df9f1-5d18-49c8-
b195-8c7
    remark: HURRICANE HAZEL
*
 ** CALIB NASHYD         4101  1  5.0    0.42    0.06 10.17 178.18 0.84   0.000
    [CN=87.0         ]
    [ N = 3.0:Tp 0.24]
*
 ** CALIB NASHYD         0900  1  5.0    1.18    0.16 10.17 178.24 0.84   0.000
    [CN=87.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  4101+  0900]  0020  3  5.0    1.60    0.22 10.17 178.22  n/a   0.000
*
 ** CALIB NASHYD         4102  1  5.0    0.73    0.10 10.25 178.30 0.84   0.000
    [CN=87.0         ]
    [ N = 3.0:Tp 0.34]
*
    ADD [  0020+  4102]  0021  3  5.0    2.33    0.32 10.17 178.25  n/a   0.000
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.05 10.17 178.78 0.84   0.000
    [CN=91.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0224  1  5.0    0.32    0.05 10.17 178.78  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.06    0.02 10.17 178.78  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    0.26    0.02  9.25 178.78  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.02 10.17 206.74 0.98   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.02 10.17 206.74  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.00    0.00 10.17 206.74  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.14    0.02  9.67 206.74  n/a   0.000
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.05 10.17 210.85 0.99   0.000
    [I%=99.0:S%= 2.00]
*
```
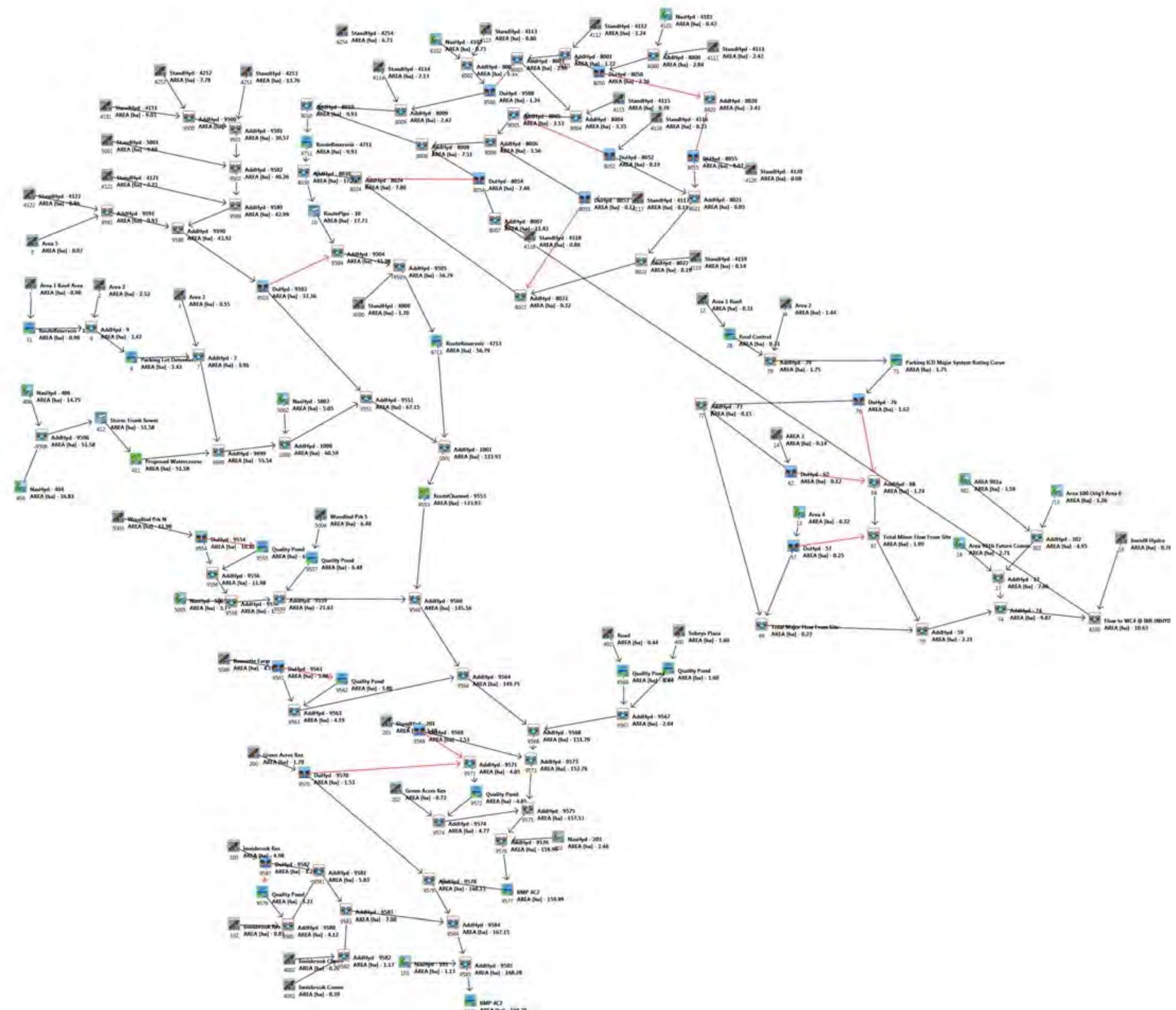

```
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.02 11.25 210.70  n/a   0.000
      {ST=  0.03 ha.m }
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.21 10.17 207.06 0.98   0.000
    [I%=72.0:S%= 2.00]
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.23 10.17 207.70  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.16 11.17 207.68  n/a   0.000
      {ST=  0.09 ha.m }
*
    DUHYD                0222  1  5.0    1.75    0.16 11.17 207.68  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.48    0.10 11.17 207.68  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    1.27    0.06  6.83 207.68  n/a   0.000
*
    ADD [  0222+  0223]  0011  3  5.0    0.48    0.10 11.17 207.68  n/a   0.000
*
    ADD [  0011+  0224]  0013  3  5.0    0.54    0.11 11.17 204.26  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.41    0.08  9.67 207.58  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    1.67    0.10  9.67 203.16  n/a   0.000
*
 ** CALIB NASHYD         9012  1  5.0    2.71    0.36 10.25 178.31 0.84   0.000
    [CN=87.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0098  1  5.0    2.71    0.36 10.25 178.31  n/a   0.000
       MAJOR SYSTEM:     0098  2  5.0    0.48    0.18 10.25 178.31  n/a   0.000
       MINOR SYSTEM:     0098  3  5.0    2.23    0.19  9.50 178.31  n/a   0.000
*
    ADD [  0014+  0098]  0015  3  5.0    3.90    0.28  9.67 188.93  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.44    0.39 10.17 190.81  n/a   0.000
*
    ADD [  0016+  0098]  0017  3  5.0    4.92    0.57 10.17 189.59  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.11 10.17 205.80 0.97   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.68 10.17 191.76  n/a   0.000
*
 *  CALIB NASHYD         0100  1  5.0    1.36    0.18 10.33 178.32 0.84   0.000
    [CN=87.0         ]
    [ N = 3.0:Tp 0.41]
*
 *  CALIB NASHYD         9011  1  5.0    3.59    0.46 10.33 178.33 0.84   0.000
    [CN=87.0         ]
    [ N = 3.0:Tp 0.42]
*
    ADD [  0100+  9011]  0019  3  5.0    4.95    0.64 10.33 178.33  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   10.63    1.31 10.17 185.51  n/a   0.000
*
 FINISH

===========================================================================================================
```

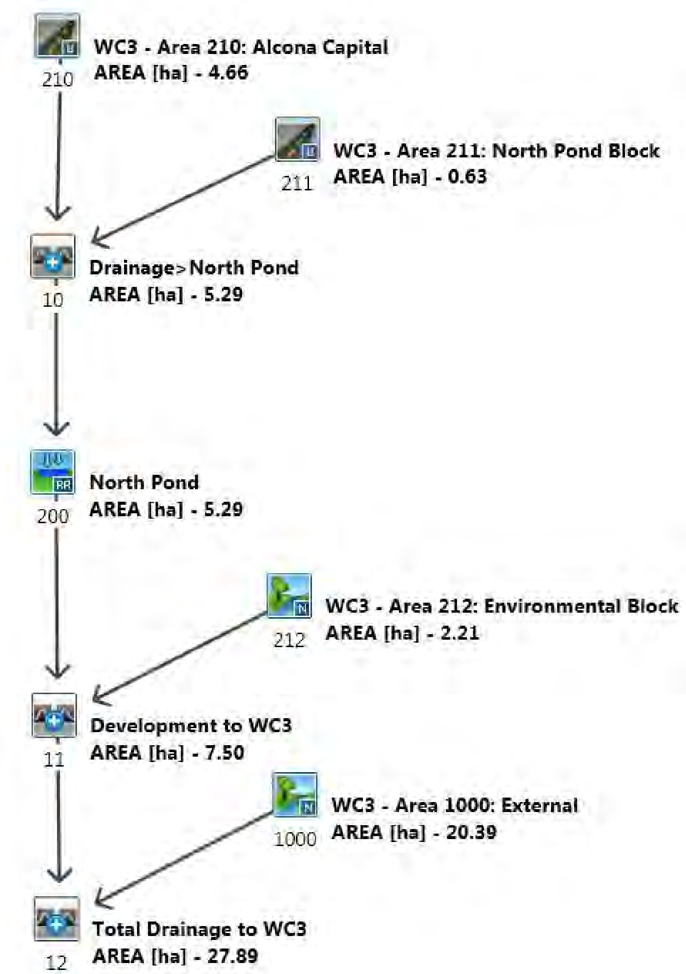


```
****************************
** SIMULATION NUMBER:   1 **
****************************

--------------------
| ADD HYD (   9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.007     1.73     2.11
      + ID2= 2 (   9584):  166.66   0.398     3.23     8.00
        ==================================================
        ID = 3 (  9585):   167.79   0.399     3.23     7.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   2 **
****************************

--------------------
| ADD HYD (   9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.024     8.32     7.12
      + ID2= 2 (   9584):  166.66   1.813     9.30    17.18
        ==================================================
        ID = 3 (  9585):   167.79   1.816     9.30    17.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   3 **
****************************

--------------------
| ADD HYD (   9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.034     8.32     9.85
      + ID2= 2 (   9584):  166.67   2.628     9.22    22.09
        ==================================================
        ID = 3 (  9585):   167.80   2.633     9.22    22.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   4 **
****************************

--------------------
| ADD HYD (   9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.059     8.32    17.50
      + ID2= 2 (   9584):  166.85   4.138     9.08    34.62
        ==================================================
        ID = 3 (  9585):   167.98   4.148     9.07    34.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   5 **
****************************

--------------------
| ADD HYD (   9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.077     8.32    22.67
      + ID2= 2 (   9584):  167.02   4.975     9.15    42.47
        ==================================================
        ID = 3 (  9585):   168.15   4.987     9.13    42.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   6 **
****************************

--------------------
```

```
| ADD HYD (    9585)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):      1.13   0.102     8.30    29.82
      + ID2= 2 (   9584):   167.15   8.988     8.78    52.81
        ====================================================
        ID = 3 (  9585):   168.28   9.017     8.78    52.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
```

```
****************************
** SIMULATION NUMBER:   1 **
****************************

--------------------
| ADD HYD (    9585)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):      1.13   0.064    10.00    66.53
      + ID2= 2 (   9584):   167.03  19.897    10.08   166.79
        ====================================================
        ID = 3 (  9585):   168.16  19.958    10.08   166.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
```

B2 - Post Development



```
=====================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O          T         H   Y Y   MM MM O     O
       O   O    T      T    H   H    Y    M   M  O O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\ee11a96d-
aab3-415c-8c2a-814378dcc92b\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\ee11a96d-
aab3-415c-8c2a-814378dcc92b\scenari

DATE: 10/26/2015                              TIME: 05:46:06

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 31.96 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\86503e44-97c4-4756-bb24-05552059ca8d\5fcd91ae-8efe-4e0b-bad3-
b52
    remark: 2 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.09  3.25   5.35 0.17   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.02  1.83   5.35 0.17   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.42  1.50  18.04 0.56   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.08  1.50  20.69 0.65   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.50  1.50  18.35  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.01  4.25  17.82  n/a   0.000
      {ST=  0.08 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.03  1.92  14.15  n/a   0.000
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.11  3.25   7.72  n/a   0.000
*
=====================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O          T         H   Y Y   MM MM O     O
             T          H
```

```
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\79ac1270-06ba-4af5-b99f-c9ee3b17cb83\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\79ac1270-06ba-4af5-b99f-c9ee3b17cb83\scenari

DATE: 10/26/2015                              TIME: 05:46:07

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 43.24 mm ]
    fname              :              C:\Users\asoares\AppData\Local\Temp\86503e44-97c4-4756-bb24-05552059ca8d
\1da4490c-38b3-4302-9e1b-066
    remark: 5 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.17  3.25   9.94 0.23   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.04  1.83   9.94 0.23   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.58  1.50  26.27 0.61   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.11  1.50  29.30 0.68   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.69  1.50  26.63  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.01  4.33  26.10  n/a   0.000
      {ST=  0.13 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.05  1.83  21.34  n/a   0.000
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.20  3.17  13.01  n/a   0.000
*
=====================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O          T         H   Y Y   MM MM O     O
       O   O    T      T    H   H    Y    M   M  O O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
```

```
\c4c4cb13-7667-41de-9b44-e8469daf32bc\scenari
  Summary       filename:       C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\c4c4cb13-7667-41de-9b44-e8469daf32bc\scenari


DATE: 10/26/2015                            TIME: 05:46:07

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM              10.0
    [ Ptot= 50.81 mm ]
    fname          :              C:\Users\asoares\AppData\Local\Temp\86503e44-97c4-4756-bb24-05552059ca8d
\2b394f11-6234-4fd0-962c-354
    remark: 10 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD        1000  1  5.0   20.39    0.23  3.17  13.57 0.27   0.000
    [CN=70.0        ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD        0212  1  5.0    2.21    0.06  1.83  13.56 0.27   0.000
    [CN=70.0        ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD      0210  1  5.0    4.66    0.71  1.50  32.10 0.63   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD      0211  1  5.0    0.63    0.12  1.50  35.30 0.69   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.83  1.50  32.48  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.04  4.17  31.95  n/a   0.000
      {ST=  0.15 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.07  1.83  26.53  n/a   0.000
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.28  3.25  17.05  n/a   0.000
*
=============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM  O    O
       O   O    T      T    H   H    Y    M   M O O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\43a0f669-
a7f2-491f-ad26-890b3883af42\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\43a0f669-
a7f2-491f-ad26-890b3883af42\scenari


DATE: 10/26/2015                            TIME: 05:46:07

USER:


COMMENTS: ____________________________________________________________
```

```
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM              10.0
    [ Ptot= 60.06 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\86503e44-97c4-4756-bb24-05552059ca8d\c1e95fb8-7476-406b-
a815-403
    remark: 25 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD        1000  1  5.0   20.39    0.32  3.17  18.49 0.31   0.000
    [CN=70.0        ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD        0212  1  5.0    2.21    0.08  1.83  18.49 0.31   0.000
    [CN=70.0        ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD      0210  1  5.0    4.66    0.85  1.50  39.49 0.66   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD      0211  1  5.0    0.63    0.15  1.50  42.82 0.71   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    1.00  1.50  39.88  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.06  3.75  39.36  n/a   0.000
      {ST=  0.16 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.10  1.83  33.21  n/a   0.000
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.40  3.17  22.45  n/a   0.000
*
=============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM  O    O
       O   O    T      T    H   H    Y    M   M O O   O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\31812c74-
ef04-458f-a3c3-00655ea0179d\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\31812c74-
ef04-458f-a3c3-00655ea0179d\scenari


DATE: 10/26/2015                            TIME: 05:46:07

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                  10.0
    [ Ptot= 67.14 mm ]
    fname              :              C:\Users\asoares\AppData\Local\Temp\86503e44-97c4-4756-bb24-05552059ca8d
\c0af3918-0ef2-4bc1-8317-432
    remark: 50 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.39  3.17  22.58 0.34   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.10  1.83  22.57 0.34   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.97  1.50  45.31 0.67   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.17  1.50  48.70 0.73   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    1.14  1.50  45.71  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.08  3.25  45.18  n/a   0.000
      {ST=  0.18 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.13  2.00  38.52  n/a   0.000
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.51  3.08  26.87  n/a   0.000
*
==============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAA  L
        VV V    I      SS       U  A   A  L
         VV          SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM       O
       O   O    T      T    H   H    Y    M   M  O    O
        OOO   T T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\088c2a86-5d7f-4519-955f-68b34688a545\scenari
  Summary        filename:       C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\088c2a86-5d7f-4519-955f-68b34688a545\scenari


DATE: 10/26/2015                           TIME: 05:46:07

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
    READ STORM                  10.0
    [ Ptot= 74.00 mm ]
    fname   :    C:\Users\asoares\AppData\Local\Temp\86503e44-97c4-4756-bb24-05552059ca8d\d8afe175-7662-4da9-
bf03-3ea
    remark: 100 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.47  3.17  26.77 0.36   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.12  1.83  26.76 0.36   0.000
```

```
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    1.08  1.50  51.06 0.69   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.20  1.50  54.50 0.74   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    1.28  1.50  51.47  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.11  2.92  50.94  n/a   0.000
      {ST=  0.19 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.18  2.00  43.81  n/a   0.000
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.61  3.08  31.35  n/a   0.000
*
==============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAA  L
        VV V    I      SS       U  A   A  L
         VV          SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM       O
       O   O    T      T    H   H    Y    M   M  O    O
        OOO   T T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\18064790-640b-4284-9790-ac2bee5a713c\scenari
  Summary        filename:       C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\18064790-640b-4284-9790-ac2bee5a713c\scenari


DATE: 10/26/2015                           TIME: 05:46:07

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname              :              C:\Users\asoares\AppData\Local\Temp\86503e44-97c4-4756-bb24-05552059ca8d
\d9f7e862-8da6-47cc-90c6-0a6
    remark: 25mm 4 HOUR STORM FOR WATER QUALITY
*
 ** CALIB NASHYD         1000  1  5.0   20.39    0.06  3.33   3.10 0.12   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.01  2.08   3.10 0.12   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.33  1.67  13.29 0.53   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.06  1.67  15.61 0.62   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.40  1.67  13.57  n/a   0.000
*
```

```
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.01  4.25  13.04  n/a   0.000
      {ST=  0.06 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.02  2.08  10.11  n/a   0.000
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.07  3.25   4.99  n/a   0.000
*
 FINISH

=================================================================================================
```

```
=================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM O     O
       O   O   T       T    H   H    Y    M   M O O   O
        OOO  T T       T H  H   H    Y    M   M   OOO
```

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```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\bf45e477-4373-41f2-b590-a748def6e60f\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\bf45e477-4373-41f2-b590-a748def6e60f\scenari

DATE: 10/26/2015                            TIME: 05:47:50

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 42.00 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\ac205e6b-09f1-4184-b4d7-fa7996b3c307\d29d2655-2917-4a5c-8b19-
ea7
    remark: 2 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD        0212  1  5.0    2.21    0.04  6.50   9.38 0.22   0.000
    [CN=70.0        ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD      0210  1  5.0    4.66    0.37  6.25  25.34 0.60   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD      0211  1  5.0    0.63    0.06  6.25  28.34 0.67   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.43  6.25  25.69  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.01 10.33  25.16  n/a   0.000
      {ST=  0.11 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.05  6.50  20.51  n/a   0.000
*
 *  CALIB NASHYD        1000  1  5.0   20.39    0.15  7.58   9.39 0.22   0.000
    [CN=70.0        ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.17  7.50  12.38  n/a   0.000
*
=================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM O     O
             T           H
```

```
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4dff3194-55f9-452e-b4f4-fd20ae9b8863\scenari
  Summary       filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4dff3194-55f9-452e-b4f4-fd20ae9b8863\scenari


DATE: 10/26/2015                           TIME: 05:47:50

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                  15.0
    [ Ptot= 56.40 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\ac205e6b-09f1-4184-b4d7-fa7996b3c307\dcfcd47c-bee7-4724-b8c7-
c27
    remark: 5 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.07  6.42  16.48 0.29   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.55  6.25  36.53 0.65   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.09  6.25  39.82 0.71   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.64  6.25  36.93  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.03  8.33  36.40  n/a   0.000
      {ST=  0.14 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.09  6.42  30.53  n/a   0.000
*
 *  CALIB NASHYD         1000  1  5.0   20.39    0.27  7.50  16.49 0.29   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.31  7.42  20.26  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O         T          H   Y Y   MM MM O    O
       O   O    T      T    H   H    Y    M   M O O   O
        OOO T   T      T H  H   H    Y    M   M   OOO
```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\9ec417ef-5f4f-40cb-8ba9-4bc0c136f780\scenari
  Summary       filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\9ec417ef-5f4f-40cb-8ba9-4bc0c136f780\scenari


DATE: 10/26/2015                           TIME: 05:47:50

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                  15.0
    [ Ptot= 66.00 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\ac205e6b-09f1-4184-b4d7-fa7996b3c307\8175907b-2123-40be-8d5d-
c16
    remark: 10 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.10  6.42  21.90 0.33   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.67  6.25  44.36 0.67   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.10  6.25  47.75 0.72   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.78  6.25  44.77  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.06  7.33  44.24  n/a   0.000
      {ST=  0.16 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.13  6.58  37.65  n/a   0.000
*
 *  CALIB NASHYD         1000  1  5.0   20.39    0.36  7.50  21.91 0.33   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.44  7.42  26.14  n/a   0.000
*
===========================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL  L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O         T          H   Y Y   MM MM O    O
       O   O    T      T    H   H    Y    M   M O O   O
        OOO T   T      T H  H   H    Y    M   M   OOO
```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\e6a37cda-
feeb-4360-8d71-426f82a4d6a5\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\e6a37cda-
feeb-4360-8d71-426f82a4d6a5\scenari


DATE: 10/26/2015                           TIME: 05:47:50

USER:


COMMENTS: ____________________________________________________________
```

```
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 78.10 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\ac205e6b-09f1-4184-b4d7-fa7996b3c307\662db4db-d799-45ab-b1c3-
b0b
    remark: 25 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.13  6.42  29.36 0.38   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.83  6.25  54.54 0.70   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.13  6.25  57.99 0.74   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    0.96  6.25  54.95  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.11  7.00  54.43  n/a   0.000
      {ST=  0.19 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.22  6.58  47.04  n/a   0.000
*
 *  CALIB NASHYD         1000  1  5.0   20.39    0.48  7.50  29.37 0.38   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.61  7.33  34.12  n/a   0.000
*
==============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O         T      H    Y Y   MM MM     O
       O   O   T     T   H  H   H   Y    M   M  OO   O
        OOO  T T     T H H  H   Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output      filename:     C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\9314ae68-8df6-40f1-ad80-e6537b0eb966\scenari
  Summary       filename:       C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\9314ae68-8df6-40f1-ad80-e6537b0eb966\scenari


DATE: 10/26/2015                             TIME: 05:47:50

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 87.10 mm ]
    fname        :        C:\Users\asoares\AppData\Local\Temp\ac205e6b-09f1-4184-b4d7-fa7996b3c307\be78c046-
b4aa-4c59-8d01-7a5
    remark: 50 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.16  6.42  35.29 0.41   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.96  6.25  62.30 0.72   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.14  6.25  65.77 0.76   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    1.10  6.25  62.72  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.16  6.83  62.19  n/a   0.000
      {ST=  0.21 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.29  6.58  54.26  n/a   0.000
*
 *  CALIB NASHYD         1000  1  5.0   20.39    0.58  7.50  35.30 0.41   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.76  7.25  40.40  n/a   0.000
*
==============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O         T      H    Y Y   MM MM     O
       O   O   T     T   H  H   H   Y    M   M  OO   O
        OOO  T T     T H H  H   Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\3841b971-
ad44-406d-934f-9fd352a07e13\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\3841b971-
ad44-406d-934f-9fd352a07e13\scenari


DATE: 10/26/2015                             TIME: 05:47:51

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 96.00 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\ac205e6b-09f1-4184-b4d7-fa7996b3c307\b31b00e8-b21c-495b-
a345-402
    remark: 100 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.19  6.42  41.42 0.43   0.000
    [CN=70.0         ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    1.08  6.25  70.10 0.73   0.000
```

```
   [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.16  6.25  73.56 0.77   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0210+  0211]  0010  3  5.0    5.29    1.24  6.25  70.51  n/a   0.000
*
    RESRVR [ 2:  0010]   0200  1  5.0    5.29    0.20  6.83  69.99  n/a   0.000
      {ST=  0.23 ha.m }
*
    ADD [  0200+  0212]  0011  3  5.0    7.50    0.37  6.50  61.57  n/a   0.000
*
 *  CALIB NASHYD         1000  1  5.0   20.39    0.68  7.50  41.43 0.43   0.000
    [CN=70.0          ]
    [ N = 3.0:Tp 1.22]
*
    ADD [  1000+  0011]  0012  3  5.0   27.89    0.90  7.25  46.85  n/a   0.000
*
 FINISH
================================================================================================
```

```
=====================================================================================
==========================


       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS       U  A   A  L
         VV     I    SSSSSU UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output                filename:        C:\Users\asoares\AppData\Local\CEG\VO3
\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\9ae98b86-897b-4b3f-be46-6c5262645f7a
\scenari
  Summary            filename:           C:\Users\asoares\AppData\Local\CEG\VO3
\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\9ae98b86-897b-4b3f-be46-6c5262645f7a
\scenari


DATE: 10/26/2015                          TIME: 05:47:23

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=212.00 mm ]
    fname       :       C:\Users\asoares\AppData\Local\Temp\8295a759-c65d-4aff-
b111-6e087e7a8ff4\5819a46e-1fe3-4f6d-af1a-bc4
    remark: HURRICANE HAZEL
*
 ** CALIB NASHYD         0212  1  5.0    2.21    0.29 10.25 170.11 0.80   0.000
    [CN=85.0          ]
    [ N = 3.0:Tp 0.33]
*
 *  CALIB STANDHYD       0210  1  5.0    4.66    0.67 10.17 194.04 0.92   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0211  1  5.0    0.63    0.09 10.17 194.65 0.92   0.000
    [I%=60.0:S%= 2.00]
*
```

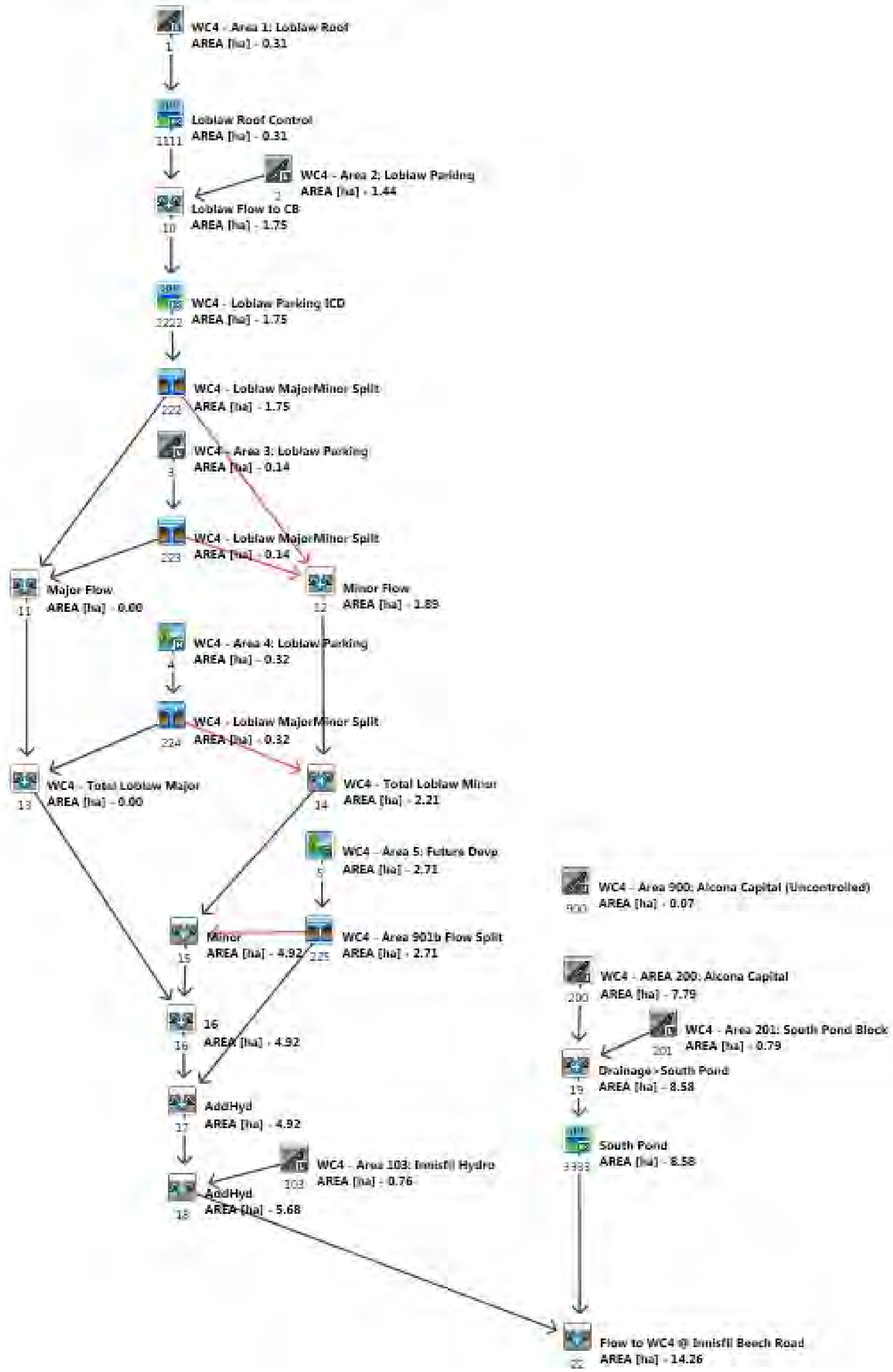


```
===============================================================================================

      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL  L
       VV V    I      SS       U  A    A  L
        VV          SSSSSU UUUUU  A    A  LLLLL

       OOO I TTTTT  TTTTT  H    H  Y   Y  M   M   OOO    TM
      O   O           T         H   Y Y   MM MM        O
      O   O    T      T     H   H    Y    M   M OO    O
       OOO  T  T      T H   H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\0b564786-
dbb9-4402-b486-80ab46dc4598\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\0b564786-
dbb9-4402-b486-80ab46dc4598\scenari


DATE: 10/27/2015                            TIME: 11:59:17

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND              HYD ID   DT     AREA  ' Qpeak Tpeak    R.V. R.C.    Qbase
                                    min     ha   '  cms   hrs      mm           cms

      START @  0.00 hrs
      --------------------
    READ STORM                  10.0
    [ Ptot= 31.96 mm ]
    fname               :              C:\Users\asoares\AppData\Local\Temp\de458b93-64d3-4b57-8ac5-5f86bf0f6c32
\4e03e37b-7379-4893-8f6e-970
    remark: 2 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD           0004  1  5.0    0.32    0.01  1.58   6.68 0.21   0.000
    [CN=80.0          ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                  0224  1  5.0    0.32    0.01  1.58   6.68  n/a   0.000
       MAJOR SYSTEM:       0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:       0224  3  5.0    0.32    0.01  1.58   6.68  n/a   0.000
*
 *  CALIB STANDHYD         0002  1  5.0    1.44    0.21  1.50  24.19 0.76   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD         0001  1  5.0    0.31    0.06  1.50  30.72 0.96   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]     1111  1  5.0    0.31    0.01  2.08  30.58  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]    0010  3  5.0    1.75    0.22  1.50  25.32  n/a   0.000
*
    RESRVR [ 2:  0010]     2222  1  5.0    1.75    0.02  1.42  25.30  n/a   0.000
      {ST=  0.01 ha.m }
*
    DUHYD                  0222  1  5.0    1.75    0.02  1.42  25.30  n/a   0.000
       MAJOR SYSTEM:       0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:       0222  3  5.0    1.75    0.02  1.42  25.30  n/a   0.000
*
 *  CALIB STANDHYD         0003  1  5.0    0.14    0.02  1.50  23.61 0.74   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                  0223  1  5.0    0.14    0.02  1.50  23.61  n/a   0.000
       MAJOR SYSTEM:       0223  2  5.0    0.00    0.00  1.50  23.61  n/a   0.000
       MINOR SYSTEM:       0223  3  5.0    0.14    0.02  1.42  23.61  n/a   0.000
*
    ADD [  0222+  0223]    0011  3  5.0    0.00    0.00  1.50  23.61  n/a   0.000
```

```
*
   ADD [  0011+  0224]  0013  3  5.0    0.00    0.00  1.50  23.61  n/a   0.000
*
   ADD [  0222+  0223]  0012  3  5.0    1.89    0.04  1.42  25.17  n/a   0.000
*
   ADD [  0012+  0224]  0014  3  5.0    2.21    0.05  1.50  22.49  n/a   0.000
*
** CALIB NASHYD         0005  1  5.0    2.71    0.04  1.83   7.46 0.23   0.000
   [CN=73.0        ]
   [ N = 3.0:Tp 0.36]
*
   DUHYD                0225  1  5.0    2.71    0.04  1.83   7.46  n/a   0.000
      MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:     0225  3  5.0    2.71    0.04  1.83   7.46  n/a   0.000
*
   ADD [  0014+  0225]  0015  3  5.0    4.92    0.07  1.83  14.21  n/a   0.000
*
   ADD [  0013+  0015]  0016  3  5.0    4.92    0.07  1.83  14.21  n/a   0.000
*
   ADD [  0016+  0225]  0017  3  5.0    4.92    0.07  1.83  14.21  n/a   0.000
*
 * CALIB STANDHYD       0103  1  5.0    0.76    0.08  1.50  19.94 0.62   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0103+  0017]  0018  3  5.0    5.68    0.14  1.50  14.98  n/a   0.000
*
 * CALIB STANDHYD       0200  1  5.0    7.79    0.70  1.50  19.21 0.60   0.000
   [I%=45.0:S%= 2.00]
*
 * CALIB STANDHYD       0201  1  5.0    0.79    0.10  1.50  21.54 0.67   0.000
   [I%=60.0:S%= 2.00]
*
   ADD [  0200+  0201]  0019  3  5.0    8.58    0.80  1.50  19.43  n/a   0.000
*
   RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.02  4.25  19.13  n/a   0.000
     {ST=  0.15 ha.m }
*
   ADD [  0018+  3333]  0022  3  5.0   14.26    0.15  1.50  17.48  n/a   0.000
*
 * CALIB STANDHYD       0900  1  5.0    0.07    0.01  1.50  18.36 0.57   0.000
   [I%=45.0:S%= 2.00]
*
=====================================================================================================
```

```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O         T         H   Y Y   MM MM  O    O
      O   O   T      T    H   H    Y    M   M OO   O
       OOO  T  T      T H  H   H    Y    M   M   OOO
```

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***** S U M M A R Y   O U T P U T *****

```
  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\4939b90e-
bbe0-4402-81d8-cca0becd8eb0\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\4939b90e-
bbe0-4402-81d8-cca0becd8eb0\scenari


DATE: 10/27/2015                           TIME: 11:59:18

USER:


COMMENTS: ____________________________________________________________


  ***************************
  ** SIMULATION NUMBER:   2 **
  ***************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms
```

```
     START @  0.00 hrs
     --------------------
   READ STORM                 10.0
     [ Ptot= 43.24 mm ]
     fname : C:\Users\asoares\AppData\Local\Temp\de458b93-64d3-4b57-8ac5-5f86bf0f6c32\a2d16486-3274-4893-b653-
f41
     remark: 5 yr 4 hr Chicago - Barrie WPCC
*
** CALIB NASHYD         0004  1  5.0    0.32    0.01  1.50  12.64 0.29   0.000
   [CN=80.0        ]
   [ N = 3.0:Tp 0.11]
*
   DUHYD                0224  1  5.0    0.32    0.01  1.50  12.64  n/a   0.000
      MAJOR SYSTEM:     0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:     0224  3  5.0    0.32    0.01  1.50  12.64  n/a   0.000
*
 * CALIB STANDHYD       0002  1  5.0    1.44    0.30  1.50  34.02 0.79   0.000
   [I%=72.0:S%= 2.00]
*
 * CALIB STANDHYD       0001  1  5.0    0.31    0.09  1.50  41.95 0.97   0.000
   [I%=99.0:S%= 2.00]
*
   RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.25  41.80  n/a   0.000
     {ST=  0.01 ha.m }
*
   ADD [  1111+  0002]  0010  3  5.0    1.75    0.30  1.50  35.40  n/a   0.000
*
   RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.04  2.00  35.37  n/a   0.000
     {ST=  0.02 ha.m }
*
   DUHYD                0222  1  5.0    1.75    0.04  2.00  35.37  n/a   0.000
      MAJOR SYSTEM:     0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:     0222  3  5.0    1.75    0.04  2.00  35.37  n/a   0.000
*
 * CALIB STANDHYD       0003  1  5.0    0.14    0.03  1.50  33.37 0.77   0.000
   [I%=70.0:S%= 2.00]
*
   DUHYD                0223  1  5.0    0.14    0.03  1.50  33.37  n/a   0.000
      MAJOR SYSTEM:     0223  2  5.0    0.01    0.01  1.50  33.37  n/a   0.000
      MINOR SYSTEM:     0223  3  5.0    0.13    0.02  1.42  33.37  n/a   0.000
*
   ADD [  0222+  0223]  0011  3  5.0    0.01    0.01  1.50  33.37  n/a   0.000
*
   ADD [  0011+  0224]  0013  3  5.0    0.01    0.01  1.50  33.37  n/a   0.000
*
   ADD [  0222+  0223]  0012  3  5.0    1.88    0.05  2.00  35.23  n/a   0.000
*
   ADD [  0012+  0224]  0014  3  5.0    2.20    0.06  1.50  31.94  n/a   0.000
*
** CALIB NASHYD         0005  1  5.0    2.71    0.07  1.83  12.84 0.30   0.000
   [CN=73.0        ]
   [ N = 3.0:Tp 0.36]
*
   DUHYD                0225  1  5.0    2.71    0.07  1.83  12.84  n/a   0.000
      MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:     0225  3  5.0    2.71    0.07  1.83  12.84  n/a   0.000
*
   ADD [  0014+  0225]  0015  3  5.0    4.91    0.12  1.83  21.39  n/a   0.000
*
   ADD [  0013+  0015]  0016  3  5.0    4.92    0.12  1.83  21.42  n/a   0.000
*
   ADD [  0016+  0225]  0017  3  5.0    4.92    0.12  1.83  21.42  n/a   0.000
*
 * CALIB STANDHYD       0103  1  5.0    0.76    0.11  1.50  28.65 0.66   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0103+  0017]  0018  3  5.0    5.68    0.20  1.50  22.39  n/a   0.000
*
 * CALIB STANDHYD       0200  1  5.0    7.79    1.00  1.50  27.85 0.64   0.000
   [I%=45.0:S%= 2.00]
*
 * CALIB STANDHYD       0201  1  5.0    0.79    0.13  1.50  30.47 0.70   0.000
   [I%=60.0:S%= 2.00]
*
   ADD [  0200+  0201]  0019  3  5.0    8.58    1.13  1.50  28.09  n/a   0.000
*
   RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.05  4.17  27.80  n/a   0.000
     {ST=  0.20 ha.m }
*
   ADD [  0018+  3333]  0022  3  5.0   14.26    0.21  1.50  25.64  n/a   0.000
*
 * CALIB STANDHYD       0900  1  5.0    0.07    0.01  1.50  26.91 0.62   0.000
   [I%=45.0:S%= 2.00]
*
=====================================================================================================
```

```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAA  L
       VV V    I      SS       U  A   A  L
        VV          SSSSS  UUUUU  A   A  LLLLL

       OOO  TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O          T        H   Y Y   MM MM      O
      O   O    T     T    H   H    Y    M   M  O   O
       OOO   T  T     T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output            filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4211ecb9-5aa0-448b-966e-a8b66515ec44\scenari
  Summary         filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\4211ecb9-5aa0-448b-966e-a8b66515ec44\scenari


DATE: 10/27/2015                              TIME: 11:59:18

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 50.81 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\de458b93-64d3-4b57-8ac5-5f86bf0f6c32\e5c80cd0-3b0a-4fdc-
b7d2-522
    remark: 10 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.02  1.50  17.24 0.34   0.000
    [CN=80.0          ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.02  1.50  17.24  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.32    0.02  1.50  17.24  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.35  1.50  40.77 0.80   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.10  1.50  49.48 0.97   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  2.42  49.33  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.36  1.50  42.29  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.05  1.67  42.27  n/a   0.000
      {ST=  0.02 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.05  1.67  42.27  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.75    0.05  1.67  42.27  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.03  1.50  40.09 0.79   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.03  1.50  40.09  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.02    0.01  1.50  40.09  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.12    0.02  1.42  40.09  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  5.0    0.02    0.01  1.50  40.09  n/a   0.000
*
```

```
    ADD [  0011+  0224]  0013  3  5.0    0.02    0.01  1.50  40.09  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.87    0.06  1.67  42.12  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.19    0.08  1.67  38.49  n/a   0.000
*
 ** CALIB NASHYD         0005  1  5.0    2.71    0.09  1.83  16.97 0.33   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.09  1.83  16.97  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.09  1.83  16.97  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.90    0.16  1.83  26.59  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.16  1.83  26.64  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.16  1.83  26.64  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.13  1.50  34.76 0.68   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.24  1.50  27.73  n/a   0.000
*
 *  CALIB STANDHYD       0200  1  5.0    7.79    1.19  1.50  33.93 0.67   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0201  1  5.0    0.79    0.16  1.50  36.66 0.72   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]  0019  3  5.0    8.58    1.35  1.50  34.18  n/a   0.000
*
    RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.07  4.17  33.88  n/a   0.000
      {ST=  0.23 ha.m }
*
    ADD [  0018+  3333]  0022  3  5.0   14.26    0.26  1.50  31.43  n/a   0.000
*
 *  CALIB STANDHYD       0900  1  5.0    0.07    0.01  1.50  32.93 0.65   0.000
    [I%=45.0:S%= 2.00]
*
===============================================================================================================


      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAA  L
       VV V    I      SS       U  A   A  L
        VV          SSSSS  UUUUU  A   A  LLLLL

       OOO  TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O          T        H   Y Y   MM MM      O
      O   O    T     T    H   H    Y    M   M  O   O
       OOO   T         H       H              M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\da67c849-
df5b-4121-8082-bc587d56c277\scenari
  Summary    filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\da67c849-
df5b-4121-8082-bc587d56c277\scenari


DATE: 10/27/2015                            TIME: 11:59:18

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
```

```
    --------------------
    READ STORM              10.0
    [ Ptot= 60.06 mm ]
    fname   :   C:\Users\asoares\AppData\Local\Temp\de458b93-64d3-4b57-8ac5-5f86bf0f6c32\cfe7351c-c575-4096-
b842-912
    remark: 25 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.03  1.50  23.36 0.39   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.03  1.50  23.36  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.02    0.01  1.50  23.36  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.30    0.02  1.50  23.36  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.42  1.50  49.18 0.82   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.12  1.50  58.70 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  2.50  58.57  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.42  1.50  50.85  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.06  2.08  50.82  n/a   0.000
      {ST=  0.04 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.06  2.08  50.82  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.75    0.06  2.08  50.82  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.04  1.50  48.46 0.81   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.04  1.50  48.46  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.02    0.02  1.50  48.46  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.12    0.02  1.42  48.46  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  5.0    0.02    0.02  1.50  48.46  n/a   0.000
*
    ADD [  0011+  0224]   0013  3  5.0    0.04    0.03  1.50  37.20  n/a   0.000
*
    ADD [  0222+  0223]   0012  3  5.0    1.87    0.07  1.58  50.67  n/a   0.000
*
    ADD [  0012+  0224]   0014  3  5.0    2.17    0.09  1.58  46.88  n/a   0.000
*
 ** CALIB NASHYD          0005  1  5.0    2.71    0.12  1.83  22.48 0.37   0.000
    [CN=73.0        ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                 0225  1  5.0    2.71    0.12  1.83  22.48  n/a   0.000
       MAJOR SYSTEM:      0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0225  3  5.0    2.71    0.12  1.83  22.48  n/a   0.000
*
    ADD [  0014+  0225]   0015  3  5.0    4.88    0.19  1.83  33.32  n/a   0.000
*
    ADD [  0013+  0015]   0016  3  5.0    4.92    0.19  1.83  33.36  n/a   0.000
*
    ADD [  0016+  0225]   0017  3  5.0    4.92    0.19  1.83  33.36  n/a   0.000
*
 *  CALIB STANDHYD        0103  1  5.0    0.76    0.16  1.50  42.44 0.71   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]   0018  3  5.0    5.68    0.31  1.50  34.57  n/a   0.000
*
 *  CALIB STANDHYD        0200  1  5.0    7.79    1.44  1.50  41.60 0.69   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD        0201  1  5.0    0.79    0.19  1.50  44.42 0.74   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]   0019  3  5.0    8.58    1.63  1.50  41.86  n/a   0.000
*
    RESRVR [ 2:  0019]    3333  1  5.0    8.58    0.10  4.00  41.56  n/a   0.000
      {ST=  0.27 ha.m }
*
    ADD [  0018+  3333]   0022  3  5.0   14.26    0.32  1.50  38.78  n/a   0.000
*
 *  CALIB STANDHYD        0900  1  5.0    0.07    0.01  1.50  40.52 0.67   0.000
    [I%=45.0:S%= 2.00]
*
==============================================================================================================
```

```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL  L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO  I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O          T      H   H   Y Y   MM MM  O   O
      O   O   T      T      H   H    Y    M   M O O   O
       OOO  T T      T H    H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\b9876c3b-
f578-40f2-a108-82d67d6671d1\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\b9876c3b-
f578-40f2-a108-82d67d6671d1\scenari


DATE: 10/27/2015                           TIME: 11:59:19

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM              10.0
    [ Ptot= 67.14 mm ]
    fname   :   C:\Users\asoares\AppData\Local\Temp\de458b93-64d3-4b57-8ac5-5f86bf0f6c32\a5064fc1-11dd-4f31-
a4ee-997
    remark: 50 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.04  1.50  28.35 0.42   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.04  1.50  28.35  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.03    0.02  1.50  28.35  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.29    0.02  1.50  28.35  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.47  1.50  55.70 0.83   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.13  1.50  65.76 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  2.58  65.63  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.48  1.50  57.46  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.06  2.00  57.44  n/a   0.000
      {ST=  0.04 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.06  2.00  57.44  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.03    0.01  2.00  57.44  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.72    0.06  1.75  57.44  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.05  1.50  54.94 0.82   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.05  1.50  54.94  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.03    0.03  1.50  54.94  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.11    0.02  1.42  54.94  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  5.0    0.06    0.03  1.50  56.30  n/a   0.000
*
    ADD [  0011+  0224]   0013  3  5.0    0.09    0.04  1.50  45.85  n/a   0.000
```

```
*
    ADD [  0222+  0223]  0012  3  5.0    1.83    0.07  1.67  57.28  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.12    0.09  1.67  53.38  n/a   0.000
*
 ** CALIB NASHYD         0005  1  5.0    2.71    0.14  1.83  26.99 0.40   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.14  1.83  26.99  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.14  1.83  26.99  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.83    0.22  1.83  38.57  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.23  1.83  38.70  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.23  1.83  38.70  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.19  1.50  48.47 0.72   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.38  1.50  40.01  n/a   0.000
*
 *  CALIB STANDHYD       0200  1  5.0    7.79    1.64  1.50  47.62 0.71   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0201  1  5.0    0.79    0.21  1.50  50.47 0.75   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]  0019  3  5.0    8.58    1.85  1.50  47.88  n/a   0.000
*
    RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.12  3.75  47.58  n/a   0.000
      {ST=  0.30 ha.m }
*
    ADD [  0018+  3333]  0022  3  5.0   14.26    0.40  1.50  44.57  n/a   0.000
*
 *  CALIB STANDHYD       0900  1  5.0    0.07    0.02  1.50  46.53 0.69   0.000
    [I%=45.0:S%= 2.00]
*
============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO  I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O         T       H   Y Y   MM MM      O
       O   O   T     T    H   H    Y    M   M  O O   O
        OOO  T  T     T H  H   H    Y    M   M   OOO
```


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output         filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\eb82345a-558d-4931-8eac-e2d463aa11c8\scenari
  Summary        filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\eb82345a-558d-4931-8eac-e2d463aa11c8\scenari


DATE: 10/27/2015                           TIME: 11:59:19

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min      ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                  10.0
    [ Ptot= 74.00 mm ]
    fname            :             C:\Users\asoares\AppData\Local\Temp\de458b93-64d3-4b57-8ac5-5f86bf0f6c32
\ff7c6c55-2345-4390-8c7e-8c6
    remark: 100 yr 4 hr Chicago - Barrie WPCC
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.05  1.50  33.39 0.45   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0224  1  5.0    0.32    0.05  1.50  33.39  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.05    0.02  1.50  33.39  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    0.27    0.02  1.50  33.39  n/a   0.000
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.52  1.50  62.08 0.84   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.14  1.50  72.61 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.67  72.46  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.53  1.50  63.92  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.07  2.00  63.89  n/a   0.000
      {ST=  0.05 ha.m }
*
    DUHYD                0222  1  5.0    1.75    0.07  2.00  63.89  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.10    0.02  2.00  63.89  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    1.65    0.06  1.58  63.89  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.05  1.50  61.28 0.83   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.05  1.50  61.28  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.03    0.03  1.50  61.28  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.11    0.02  1.42  61.28  n/a   0.000
*
    ADD [  0222+  0223]  0011  3  5.0    0.13    0.03  1.50  63.32  n/a   0.000
*
    ADD [  0011+  0224]  0013  3  5.0    0.17    0.05  1.50  55.34  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.76    0.07  1.50  63.73  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.04    0.10  1.50  59.65  n/a   0.000
*
 ** CALIB NASHYD         0005  1  5.0    2.71    0.17  1.83  31.57 0.43   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.17  1.83  31.57  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.17  1.83  31.57  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.75    0.25  1.83  43.62  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.27  1.83  44.03  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.27  1.83  44.03  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.22  1.50  54.40 0.74   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.43  1.50  45.42  n/a   0.000
*
 *  CALIB STANDHYD       0200  1  5.0    7.79    1.84  1.50  53.55 0.72   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0201  1  5.0    0.79    0.25  1.50  56.43 0.76   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]  0019  3  5.0    8.58    2.09  1.50  53.81  n/a   0.000
*
    RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.14  3.58  53.52  n/a   0.000
      {ST=  0.34 ha.m }
*
    ADD [  0018+  3333]  0022  3  5.0   14.26    0.45  1.50  50.29  n/a   0.000
*
 *  CALIB STANDHYD       0900  1  5.0    0.07    0.02  1.50  52.43 0.71   0.000
    [I%=45.0:S%= 2.00]
*
============================================================================================================
```

```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAAL L
       VV V    I      SS       U  A   A  L
        VV          SSSSSU UUUUU  A   A  LLLLL

       OOO  I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O           T         H   Y Y   MM MM O O     O
      O   O   T       T    H    H    Y    M   M O  O   O
       OOO  T T       T H  H    H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output            filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\127a233d-0282-44b0-911e-a6b192c7f0ea\scenari
  Summary         filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\127a233d-0282-44b0-911e-a6b192c7f0ea\scenari


DATE: 10/27/2015                            TIME: 11:59:19

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname        :         C:\Users\asoares\AppData\Local\Temp\de458b93-64d3-4b57-8ac5-5f86bf0f6c32\b1bdedf4-
b9b7-40af-89ef-51d
    remark: 25mm 4 HOUR STORM FOR WATER QUALITY
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.00  1.75   3.71 0.15   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                0224  1  5.0    0.32    0.00  1.75   3.71  n/a   0.000
       MAJOR SYSTEM:     0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0224  3  5.0    0.32    0.00  1.75   3.71  n/a   0.000
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.17  1.67  18.32 0.73   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.05  1.67  23.78 0.95   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  2.08  23.64  n/a   0.000
      {ST=  0.00 ha.m }
*
    ADD [  1111+  0002]  0010  3  5.0    1.75    0.18  1.67  19.26  n/a   0.000
*
    RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.02  1.58  19.24  n/a   0.000
      {ST=  0.01 ha.m }
*
    DUHYD                0222  1  5.0    1.75    0.02  1.58  19.24  n/a   0.000
       MAJOR SYSTEM:     0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0222  3  5.0    1.75    0.02  1.58  19.24  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.02  1.67  17.80 0.71   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                0223  1  5.0    0.14    0.02  1.67  17.80  n/a   0.000
       MAJOR SYSTEM:     0223  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0223  3  5.0    0.14    0.02  1.67  17.80  n/a   0.000
*
    ADD [  0222+  0223]  0011  3  0.0    0.00    0.00  0.00  17.80  n/a   0.000
*
    ADD [  0011+  0224]  0013  3  0.0    0.00    0.00  0.00  17.80  n/a   0.000
*
```

```
    ADD [  0222+  0223]  0012  3  5.0    1.89    0.04  1.67  19.13  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    2.21    0.04  1.67  16.90  n/a   0.000
*
 ** CALIB NASHYD         0005  1  5.0    2.71    0.03  2.08   4.70 0.19   0.000
    [CN=73.0         ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.03  2.08   4.70  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.71    0.03  2.08   4.70  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    4.92    0.05  2.00  10.18  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.92    0.05  2.00  10.18  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.05  2.00  10.18  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.07  1.67  14.84 0.59   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.12  1.67  10.80  n/a   0.000
*
 *  CALIB STANDHYD       0200  1  5.0    7.79    0.55  1.67  14.20 0.57   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0201  1  5.0    0.79    0.08  1.67  16.26 0.65   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]  0019  3  5.0    8.58    0.63  1.67  14.39  n/a   0.000
*
    RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.01  4.25  14.10  n/a   0.000
      {ST=  0.11 ha.m }
*
    ADD [  0018+  3333]  0022  3  5.0   14.26    0.12  1.67  12.78  n/a   0.000
*
 *  CALIB STANDHYD       0900  1  5.0    0.07    0.01  1.67  13.44 0.54   0.000
    [I%=45.0:S%= 2.00]
*
 FINISH

===========================================================================================================
```

```
=====================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM       O
       O   O    T      T    H   H    Y    M   M OO    O
        OOO  T  T      T H  H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\1269abdf-0525-4146-95db-fa87c6d78c1c\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\1269abdf-0525-4146-95db-fa87c6d78c1c\scenari

DATE: 10/27/2015                            TIME: 12:00:48

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 42.00 mm ]
    fname                :              C:\Users\asoares\AppData\Local\Temp\ddf3fe97-ac61-4525-8c3b-b176e9aff46a
\b4ebc222-2216-4a6a-86f1-239
    remark: 2 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.02  6.25  11.92 0.28   0.000
    [CN=80.0           ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.02  6.25  11.92  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.32    0.02  6.25  11.92  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.17  6.25  32.91 0.78   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.05  6.25  40.70 0.97   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  6.75  40.55  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.17  6.25  34.27  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.02  5.92  34.24  n/a   0.000
      {ST=  0.01 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.02  5.92  34.24  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.75    0.02  5.92  34.24  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.02  6.25  32.29 0.77   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.02  6.25  32.29  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.14    0.02  6.25  32.29  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  0.0    0.00    0.00  0.00  32.29  n/a   0.000
```

```
*
    ADD [  0011+  0224]   0013  3  0.0    0.00    0.00  0.00  32.29  n/a   0.000
*
    ADD [  0222+  0223]   0012  3  5.0    1.89    0.04  6.25  34.09  n/a   0.000
*
    ADD [  0012+  0224]   0014  3  5.0    2.21    0.05  6.25  30.88  n/a   0.000
*
 ** CALIB NASHYD          0005  1  5.0    2.71    0.06  6.50  12.20 0.29   0.000
    [CN=73.0           ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                 0225  1  5.0    2.71    0.06  6.50  12.20  n/a   0.000
       MAJOR SYSTEM:      0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0225  3  5.0    2.71    0.06  6.50  12.20  n/a   0.000
*
    ADD [  0014+  0225]   0015  3  5.0    4.92    0.10  6.25  20.59  n/a   0.000
*
    ADD [  0013+  0015]   0016  3  5.0    4.92    0.10  6.25  20.59  n/a   0.000
*
    ADD [  0016+  0225]   0017  3  5.0    4.92    0.10  6.25  20.59  n/a   0.000
*
 *  CALIB STANDHYD        0103  1  5.0    0.76    0.07  6.25  27.67 0.66   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]   0018  3  5.0    5.68    0.17  6.25  21.54  n/a   0.000
*
 *  CALIB STANDHYD        0200  1  5.0    7.79    0.62  6.25  26.88 0.64   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD        0201  1  5.0    0.79    0.08  6.25  29.47 0.70   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]   0019  3  5.0    8.58    0.70  6.25  27.11  n/a   0.000
*
    RESRVR [ 2:  0019]    3333  1  5.0    8.58    0.04  8.33  26.82  n/a   0.000
      {ST=  0.17 ha.m }
*
    ADD [  0018+  3333]   0022  3  5.0   14.26    0.18  6.25  24.71  n/a   0.000
*
 *  CALIB STANDHYD        0900  1  5.0    0.07    0.01  6.25  25.96 0.62   0.000
    [I%=45.0:S%= 2.00]
*
=====================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM       O
       O   O    T      T    H   H    Y    M   M OO    O
        OOO  T  T      T H  H   H    Y    M   M   OOO
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\84d01870-73e2-4df6-8c36-3c43c3886753\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\84d01870-73e2-4df6-8c36-3c43c3886753\scenari

DATE: 10/27/2015                            TIME: 12:00:48

USER:

COMMENTS: ____________________________________________________________

  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms
```

```
     START @  0.00 hrs
     --------------------
   READ STORM                15.0
   [ Ptot= 56.40 mm ]
   fname : C:\Users\asoares\AppData\Local\Temp\ddf3fe97-ac61-4525-8c3b-b176e9aff46a\dea21919-eb0f-49ce-9180-
cf9
   remark: 5 yr 12 hr SCS - Barrie WPCC
*
** CALIB NASHYD          0004  1  5.0    0.32    0.03  6.25  20.88 0.37   0.000
   [CN=80.0         ]
   [ N = 3.0:Tp 0.11]
*
   DUHYD                 0224  1  5.0    0.32    0.03  6.25  20.88  n/a   0.000
      MAJOR SYSTEM:      0224  2  5.0    0.01    0.01  6.25  20.88  n/a   0.000
      MINOR SYSTEM:      0224  3  5.0    0.31    0.02  6.25  20.88  n/a   0.000
*
 * CALIB STANDHYD        0002  1  5.0    1.44    0.23  6.25  45.84 0.81   0.000
   [I%=72.0:S%= 2.00]
*
 * CALIB STANDHYD        0001  1  5.0    0.31    0.06  6.25  55.05 0.98   0.000
   [I%=99.0:S%= 2.00]
*
   RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  6.75  54.90  n/a   0.000
     {ST=  0.01 ha.m }
*
   ADD [  1111+  0002]   0010  3  5.0    1.75    0.24  6.25  47.45  n/a   0.000
*
   RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.05  6.42  47.42  n/a   0.000
     {ST=  0.03 ha.m }
*
   DUHYD                 0222  1  5.0    1.75    0.05  6.42  47.42  n/a   0.000
      MAJOR SYSTEM:      0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:      0222  3  5.0    1.75    0.05  6.42  47.42  n/a   0.000
*
 * CALIB STANDHYD        0003  1  5.0    0.14    0.02  6.25  45.10 0.80   0.000
   [I%=70.0:S%= 2.00]
*
   DUHYD                 0223  1  5.0    0.14    0.02  6.25  45.10  n/a   0.000
      MAJOR SYSTEM:      0223  2  5.0    0.00    0.00  6.25  45.10  n/a   0.000
      MINOR SYSTEM:      0223  3  5.0    0.14    0.02  6.08  45.10  n/a   0.000
*
   ADD [  0222+  0223]   0011  3  5.0    0.00    0.00  6.25  45.10  n/a   0.000
*
   ADD [  0011+  0224]   0013  3  5.0    0.01    0.01  6.25  27.17  n/a   0.000
*
   ADD [  0222+  0223]   0012  3  5.0    1.89    0.06  6.42  47.25  n/a   0.000
*
   ADD [  0012+  0224]   0014  3  5.0    2.20    0.08  6.33  43.52  n/a   0.000
*
** CALIB NASHYD          0005  1  5.0    2.71    0.11  6.50  20.25 0.36   0.000
   [CN=73.0         ]
   [ N = 3.0:Tp 0.36]
*
   DUHYD                 0225  1  5.0    2.71    0.11  6.50  20.25  n/a   0.000
      MAJOR SYSTEM:      0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:      0225  3  5.0    2.71    0.11  6.50  20.25  n/a   0.000
*
   ADD [  0014+  0225]   0015  3  5.0    4.91    0.18  6.42  30.67  n/a   0.000
*
   ADD [  0013+  0015]   0016  3  5.0    4.92    0.18  6.42  30.66  n/a   0.000
*
   ADD [  0016+  0225]   0017  3  5.0    4.92    0.18  6.42  30.66  n/a   0.000
*
 * CALIB STANDHYD        0103  1  5.0    0.76    0.10  6.25  39.38 0.70   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0103+  0017]   0018  3  5.0    5.68    0.25  6.25  31.83  n/a   0.000
*
 * CALIB STANDHYD        0200  1  5.0    7.79    0.95  6.25  38.54 0.68   0.000
   [I%=45.0:S%= 2.00]
*
 * CALIB STANDHYD        0201  1  5.0    0.79    0.11  6.25  41.33 0.73   0.000
   [I%=60.0:S%= 2.00]
*
   ADD [  0200+  0201]   0019  3  5.0    8.58    1.06  6.25  38.79  n/a   0.000
*
   RESRVR [ 2:  0019]    3333  1  5.0    8.58    0.07  7.58  38.50  n/a   0.000
     {ST=  0.23 ha.m }
*
   ADD [  0018+  3333]   0022  3  5.0   14.26    0.28  6.25  35.84  n/a   0.000
*
 * CALIB STANDHYD        0900  1  5.0    0.07    0.01  6.25  37.48 0.66   0.000
   [I%=45.0:S%= 2.00]
*
=============================================================================================================
```

```
       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I     SS        U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O          T         H   Y Y   MM MM O     O
       O   O    T     T    H    H    Y    M   M O O   O
        OOO  T  T     T H  H    H    Y    M   M   OOO
```

Developed and Distributed by Civica Infrastructure


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output          filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\71968309-5433-47e0-bd44-3fcf26e325bc\scenari
  Summary       filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\71968309-5433-47e0-bd44-3fcf26e325bc\scenari


DATE: 10/27/2015                            TIME: 12:00:48

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND              HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min      ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 66.00 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\ddf3fe97-ac61-4525-8c3b-b176e9aff46a\ff8aa0d7-39fe-4ee0-8aa5-
a46
    remark: 10 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.04  6.25  27.53 0.42   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.04  6.25  27.53  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.03    0.02  6.25  27.53  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.29    0.02  6.17  27.53  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.28  6.25  54.65 0.83   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.07  6.25  64.62 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  6.83  64.48  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.28  6.25  56.39  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.05  6.75  56.37  n/a   0.000
      {ST=  0.03 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.05  6.75  56.37  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.75    0.05  6.75  56.37  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.03  6.25  53.87 0.82   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.03  6.25  53.87  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.01    0.01  6.25  53.87  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.13    0.02  6.08  53.87  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  5.0    0.01    0.01  6.25  53.87  n/a   0.000
*
```

```
   ADD [  0011+  0224]  0013  3  5.0    0.04    0.02  6.25  33.99  n/a   0.000
*
   ADD [  0222+  0223]  0012  3  5.0    1.88    0.07  6.25  56.19  n/a   0.000
*
   ADD [  0012+  0224]  0014  3  5.0    2.17    0.10  6.25  52.35  n/a   0.000
*
 ** CALIB NASHYD         0005  1  5.0    2.71    0.14  6.50  26.25 0.40   0.000
   [CN=73.0        ]
   [ N = 3.0:Tp 0.36]
*
   DUHYD                0225  1  5.0    2.71    0.14  6.50  26.25  n/a   0.000
      MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:     0225  3  5.0    2.71    0.14  6.50  26.25  n/a   0.000
*
   ADD [  0014+  0225]  0015  3  5.0    4.88    0.21  6.42  37.86  n/a   0.000
*
   ADD [  0013+  0015]  0016  3  5.0    4.92    0.21  6.42  37.83  n/a   0.000
*
   ADD [  0016+  0225]  0017  3  5.0    4.92    0.21  6.42  37.83  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.12  6.25  47.49 0.72   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0103+  0017]  0018  3  5.0    5.68    0.33  6.25  39.12  n/a   0.000
*
 *  CALIB STANDHYD       0200  1  5.0    7.79    1.16  6.25  46.64 0.71   0.000
   [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0201  1  5.0    0.79    0.13  6.25  49.49 0.75   0.000
   [I%=60.0:S%= 2.00]
*
   ADD [  0200+  0201]  0019  3  5.0    8.58    1.29  6.25  46.90  n/a   0.000
*
   RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.10  7.33  46.61  n/a   0.000
     {ST=  0.27 ha.m }
*
   ADD [  0018+  3333]  0022  3  5.0   14.26    0.37  6.25  43.63  n/a   0.000
*
 *  CALIB STANDHYD       0900  1  5.0    0.07    0.01  6.25  45.53 0.69   0.000
   [I%=45.0:S%= 2.00]
*
==============================================================================================================
```

```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAA  L
       VV V    I      SS       U  A   A  L
        VV          SSSSS  UUUUU  A   A  LLLLL

       OOO  TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O          T       H   Y Y   MM MM  O   O
      O   O   T      T    H   H    Y    M   M  O   O
       OOO                H   H         M   M   OOO
```

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***** S U M M A R Y   O U T P U T *****

```
  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output     filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\4976a282-
f49d-4223-94a4-83fec4318b54\scenari
  Summary   filename:   C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783\4976a282-
f49d-4223-94a4-83fec4318b54\scenari


DATE: 10/27/2015                            TIME: 12:00:48

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
```

```
     --------------------
   READ STORM                 15.0
   [ Ptot= 78.10 mm ]
   fname            :             C:\Users\asoares\AppData\Local\Temp\ddf3fe97-ac61-4525-8c3b-b176e9aff46a
\d5b94659-4e85-4fad-8d83-558
   remark: 25 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD         0004  1  5.0    0.32    0.05  6.25  36.48 0.47   0.000
   [CN=80.0        ]
   [ N = 3.0:Tp 0.11]
*
   DUHYD                0224  1  5.0    0.32    0.05  6.25  36.48  n/a   0.000
      MAJOR SYSTEM:     0224  2  5.0    0.05    0.03  6.25  36.48  n/a   0.000
      MINOR SYSTEM:     0224  3  5.0    0.27    0.02  6.08  36.48  n/a   0.000
*
 *  CALIB STANDHYD       0002  1  5.0    1.44    0.35  6.25  65.92 0.84   0.000
   [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD       0001  1  5.0    0.31    0.09  6.25  76.69 0.98   0.000
   [I%=99.0:S%= 2.00]
*
   RESRVR [ 2:  0001]   1111  1  5.0    0.31    0.01  6.83  76.55  n/a   0.000
     {ST=  0.01 ha.m }
*
   ADD [  1111+  0002]  0010  3  5.0    1.75    0.36  6.25  67.80  n/a   0.000
*
   RESRVR [ 2:  0010]   2222  1  5.0    1.75    0.07  6.50  67.77  n/a   0.000
     {ST=  0.04 ha.m }
*
   DUHYD                0222  1  5.0    1.75    0.07  6.50  67.77  n/a   0.000
      MAJOR SYSTEM:     0222  2  5.0    0.04    0.01  6.50  67.77  n/a   0.000
      MINOR SYSTEM:     0222  3  5.0    1.71    0.06  6.33  67.77  n/a   0.000
*
 *  CALIB STANDHYD       0003  1  5.0    0.14    0.03  6.25  65.10 0.83   0.000
   [I%=70.0:S%= 2.00]
*
   DUHYD                0223  1  5.0    0.14    0.03  6.25  65.10  n/a   0.000
      MAJOR SYSTEM:     0223  2  5.0    0.02    0.01  6.25  65.10  n/a   0.000
      MINOR SYSTEM:     0223  3  5.0    0.12    0.02  6.08  65.10  n/a   0.000
*
   ADD [  0222+  0223]  0011  3  5.0    0.05    0.01  6.25  66.91  n/a   0.000
*
   ADD [  0011+  0224]  0013  3  5.0    0.10    0.04  6.25  52.30  n/a   0.000
*
   ADD [  0222+  0223]  0012  3  5.0    1.84    0.07  6.25  67.60  n/a   0.000
*
   ADD [  0012+  0224]  0014  3  5.0    2.11    0.10  6.25  63.60  n/a   0.000
*
 ** CALIB NASHYD         0005  1  5.0    2.71    0.18  6.50  34.40 0.44   0.000
   [CN=73.0        ]
   [ N = 3.0:Tp 0.36]
*
   DUHYD                0225  1  5.0    2.71    0.18  6.50  34.40  n/a   0.000
      MAJOR SYSTEM:     0225  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
      MINOR SYSTEM:     0225  3  5.0    2.71    0.18  6.50  34.40  n/a   0.000
*
   ADD [  0014+  0225]  0015  3  5.0    4.82    0.26  6.42  47.17  n/a   0.000
*
   ADD [  0013+  0015]  0016  3  5.0    4.92    0.27  6.42  47.28  n/a   0.000
*
   ADD [  0016+  0225]  0017  3  5.0    4.92    0.27  6.42  47.28  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.16  6.25  57.99 0.74   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0103+  0017]  0018  3  5.0    5.68    0.42  6.25  48.71  n/a   0.000
*
 *  CALIB STANDHYD       0200  1  5.0    7.79    1.43  6.25  57.14 0.73   0.000
   [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0201  1  5.0    0.79    0.16  6.25  60.01 0.77   0.000
   [I%=60.0:S%= 2.00]
*
   ADD [  0200+  0201]  0019  3  5.0    8.58    1.60  6.25  57.40  n/a   0.000
*
   RESRVR [ 2:  0019]   3333  1  5.0    8.58    0.14  7.25  57.11  n/a   0.000
     {ST=  0.33 ha.m }
*
   ADD [  0018+  3333]  0022  3  5.0   14.26    0.48  6.25  53.76  n/a   0.000
*
 *  CALIB STANDHYD       0900  1  5.0    0.07    0.01  6.25  56.00 0.72   0.000
   [I%=45.0:S%= 2.00]
*
==============================================================================================================
```

```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAA  L
       VV V    I      SS       U  A   A  L
        VV          SSSSS  UUUUU  A   A  LLLLL

       OOO  TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
      O   O          T       H   H   Y Y   MM MM   O   O
      O   O    T     T    H   H    Y    M   M   O   O
       OOO     T     T    H   H    Y    M   M    OOO
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```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\0b850df5-7ae0-457d-ab79-bdd08ad95951\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\0b850df5-7ae0-457d-ab79-bdd08ad95951\scenari


DATE: 10/27/2015                             TIME: 12:00:49

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 87.10 mm ]
    fname          :             C:\Users\asoares\AppData\Local\Temp\ddf3fe97-ac61-4525-8c3b-b176e9aff46a
\c1c894c3-088d-4de1-839e-8bb
    remark: 50 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.06  6.25  43.46 0.50   0.000
    [CN=80.0          ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.06  6.25  43.46  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.06    0.04  6.25  43.46  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.26    0.02  6.08  43.46  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.40  6.25  74.39 0.85   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.10  6.25  85.68 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  6.83  85.54  n/a   0.000
      {ST=  0.01 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.41  6.25  76.36  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.08  6.50  76.34  n/a   0.000
      {ST=  0.05 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.08  6.50  76.34  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.09    0.02  6.50  76.34  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.66    0.06  6.25  76.34  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.04  6.25  73.53 0.84   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.04  6.25  73.53  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.02    0.02  6.25  73.53  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.12    0.02  6.08  73.53  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  5.0    0.11    0.02  6.25  75.84  n/a   0.000
*
    ADD [  0011+  0224]   0013  3  5.0    0.18    0.06  6.25  64.37  n/a   0.000
```

```
*
    ADD [  0222+  0223]   0012  3  5.0    1.78    0.08  6.25  76.15  n/a   0.000
*
    ADD [  0012+  0224]   0014  3  5.0    2.03    0.10  6.25  72.01  n/a   0.000
*
 ** CALIB NASHYD          0005  1  5.0    2.71    0.22  6.50  40.80 0.47   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                 0225  1  5.0    2.71    0.22  6.50  40.80  n/a   0.000
       MAJOR SYSTEM:      0225  2  5.0    0.07    0.03  6.50  40.80  n/a   0.000
       MINOR SYSTEM:      0225  3  5.0    2.64    0.19  6.33  40.80  n/a   0.000
*
    ADD [  0014+  0225]   0015  3  5.0    4.67    0.28  6.33  54.38  n/a   0.000
*
    ADD [  0013+  0015]   0016  3  5.0    4.85    0.31  6.33  54.75  n/a   0.000
*
    ADD [  0016+  0225]   0017  3  5.0    4.92    0.33  6.42  54.55  n/a   0.000
*
 *  CALIB STANDHYD        0103  1  5.0    0.76    0.18  6.25  65.95 0.76   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]   0018  3  5.0    5.68    0.49  6.25  56.07  n/a   0.000
*
 *  CALIB STANDHYD        0200  1  5.0    7.79    1.64  6.25  65.11 0.75   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD        0201  1  5.0    0.79    0.19  6.25  67.98 0.78   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]   0019  3  5.0    8.58    1.83  6.25  65.37  n/a   0.000
*
    RESRVR [ 2:  0019]    3333  1  5.0    8.58    0.17  7.17  65.08  n/a   0.000
      {ST=  0.37 ha.m }
*
    ADD [  0018+  3333]   0022  3  5.0   14.26    0.57  6.25  61.49  n/a   0.000
*
 *  CALIB STANDHYD        0900  1  5.0    0.07    0.02  6.25  63.93 0.73   0.000
    [I%=45.0:S%= 2.00]
*
============================================================================================================
```



```
      V    V   I    SSSSS  U   U    A    L
      V        I    SS         U   A A
       V  V    I     SS    U   U  AAAAA  L
       VV V    I      SS       U  A   A  L
        VV          SSSSS  UUUUU  A   A  LLLLL

       OOO  TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
      O   O          T       H   H   Y Y   MM MM   O   O
      O   O    T     T    H   H    Y    M   M   O   O
       OOO     T     T    H   H    Y    M   M    OOO
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```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\809ba3f9-0211-41f6-98ff-c52bcbd011b7\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\809ba3f9-0211-41f6-98ff-c52bcbd011b7\scenari


DATE: 10/27/2015                             TIME: 12:00:49

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                 15.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\asoares\AppData\Local\Temp\ddf3fe97-ac61-4525-8c3b-b176e9aff46a\881358e7-5786-4b69-9ce1-
a4d
    remark: 100 yr 12 hr SCS - Barrie WPCC
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.07  6.25  50.58 0.53   0.000
    [CN=80.0          ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.07  6.25  50.58  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.07    0.05  6.25  50.58  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.25    0.02  6.08  50.58  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.44  6.25  82.82 0.86   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.11  6.25  94.56 0.98   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.01  6.83  94.42  n/a   0.000
      {ST=  0.02 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.45  6.25  84.88  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.09  6.50  84.85  n/a   0.000
      {ST=  0.06 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.09  6.50  84.85  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.15    0.04  6.50  84.85  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.60    0.06  6.25  84.85  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.04  6.25  81.94 0.85   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.04  6.25  81.94  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.02    0.02  6.25  81.94  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.12    0.02  6.08  81.94  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  5.0    0.17    0.04  6.25  84.47  n/a   0.000
*
    ADD [  0011+  0224]   0013  3  5.0    0.25    0.09  6.25  74.44  n/a   0.000
*
    ADD [  0222+  0223]   0012  3  5.0    1.72    0.08  6.25  84.65  n/a   0.000
*
    ADD [  0012+  0224]   0014  3  5.0    1.96    0.10  6.25  80.37  n/a   0.000
*
 ** CALIB NASHYD          0005  1  5.0    2.71    0.25  6.50  47.38 0.49   0.000
    [CN=73.0          ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                 0225  1  5.0    2.71    0.25  6.50  47.38  n/a   0.000
       MAJOR SYSTEM:      0225  2  5.0    0.18    0.07  6.50  47.38  n/a   0.000
       MINOR SYSTEM:      0225  3  5.0    2.53    0.19  6.33  47.38  n/a   0.000
*
    ADD [  0014+  0225]   0015  3  5.0    4.50    0.28  6.33  61.78  n/a   0.000
*
    ADD [  0013+  0015]   0016  3  5.0    4.74    0.36  6.25  62.44  n/a   0.000
*
    ADD [  0016+  0225]   0017  3  5.0    4.92    0.38  6.42  61.90  n/a   0.000
*
 *  CALIB STANDHYD        0103  1  5.0    0.76    0.20  6.25  73.93 0.77   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]   0018  3  5.0    5.68    0.56  6.25  63.51  n/a   0.000
*
 *  CALIB STANDHYD        0200  1  5.0    7.79    1.86  6.25  73.10 0.76   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD        0201  1  5.0    0.79    0.22  6.25  75.95 0.79   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]   0019  3  5.0    8.58    2.07  6.25  73.36  n/a   0.000
*
    RESRVR [ 2:  0019]    3333  1  5.0    8.58    0.20  7.08  73.07  n/a   0.000
      {ST=  0.41 ha.m }
*
    ADD [  0018+  3333]   0022  3  5.0   14.26    0.67  6.25  69.26  n/a   0.000
*
 *  CALIB STANDHYD        0900  1  5.0    0.07    0.02  6.25  71.89 0.75   0.000
    [I%=45.0:S%= 2.00]
*
 FINISH

=========================================================================================================
```

```
===============================================================================================================


       V    V   I    SSSSS  U   U    A    L
       V        I    SS         U   A A
        V  V    I     SS    U   U  AAAAAL L
        VV V    I      SS       U  A   A  L
         VV          SSSSSU UUUUU  A   A  LLLLL

        OOO I TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O           T        H   Y Y   MM MM        O
       O   O    T      T    H   H    Y    M   M OO     O
        OOO  T  T      T H  H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
  Output           filename:      C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\1dd0f9a5-7252-4fa8-8b20-f06f29a9c51b\scenari
  Summary        filename:        C:\Users\asoares\AppData\Local\CEG\VO3\2526db57-9b7c-4f31-9ccb-e5ef0dd23783
\1dd0f9a5-7252-4fa8-8b20-f06f29a9c51b\scenari


DATE: 10/27/2015                             TIME: 11:59:59

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                    min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=212.00 mm ]
    fname    :    C:\Users\asoares\AppData\Local\Temp\728a48a0-b714-497b-ae0f-40b6d59cce86\c370ac8c-bd02-4350-
bece-473
    remark: HURRICANE HAZEL
*
 ** CALIB NASHYD          0004  1  5.0    0.32    0.05 10.17 178.78 0.84   0.000
    [CN=91.0          ]
    [ N = 3.0:Tp 0.11]
*
    DUHYD                 0224  1  5.0    0.32    0.05 10.17 178.78  n/a   0.000
       MAJOR SYSTEM:      0224  2  5.0    0.06    0.02 10.17 178.78  n/a   0.000
       MINOR SYSTEM:      0224  3  5.0    0.26    0.02  9.25 178.78  n/a   0.000
*
 *  CALIB STANDHYD        0002  1  5.0    1.44    0.21 10.17 202.91 0.96   0.000
    [I%=72.0:S%= 2.00]
*
 *  CALIB STANDHYD        0001  1  5.0    0.31    0.05 10.17 210.70 0.99   0.000
    [I%=99.0:S%= 2.00]
*
    RESRVR [ 2:  0001]    1111  1  5.0    0.31    0.02 11.25 210.56  n/a   0.000
      {ST=  0.03 ha.m }
*
    ADD [  1111+  0002]   0010  3  5.0    1.75    0.22 10.17 204.26  n/a   0.000
*
    RESRVR [ 2:  0010]    2222  1  5.0    1.75    0.16 11.17 204.24  n/a   0.000
      {ST=  0.09 ha.m }
*
    DUHYD                 0222  1  5.0    1.75    0.16 11.17 204.24  n/a   0.000
       MAJOR SYSTEM:      0222  2  5.0    0.47    0.10 11.17 204.24  n/a   0.000
       MINOR SYSTEM:      0222  3  5.0    1.28    0.06  7.00 204.24  n/a   0.000
*
 *  CALIB STANDHYD        0003  1  5.0    0.14    0.02 10.17 202.30 0.95   0.000
    [I%=70.0:S%= 2.00]
*
    DUHYD                 0223  1  5.0    0.14    0.02 10.17 202.30  n/a   0.000
       MAJOR SYSTEM:      0223  2  5.0    0.00    0.00 10.17 202.30  n/a   0.000
       MINOR SYSTEM:      0223  3  5.0    0.14    0.02  9.75 202.30  n/a   0.000
*
    ADD [  0222+  0223]   0011  3  5.0    0.47    0.10 11.17 204.24  n/a   0.000
```
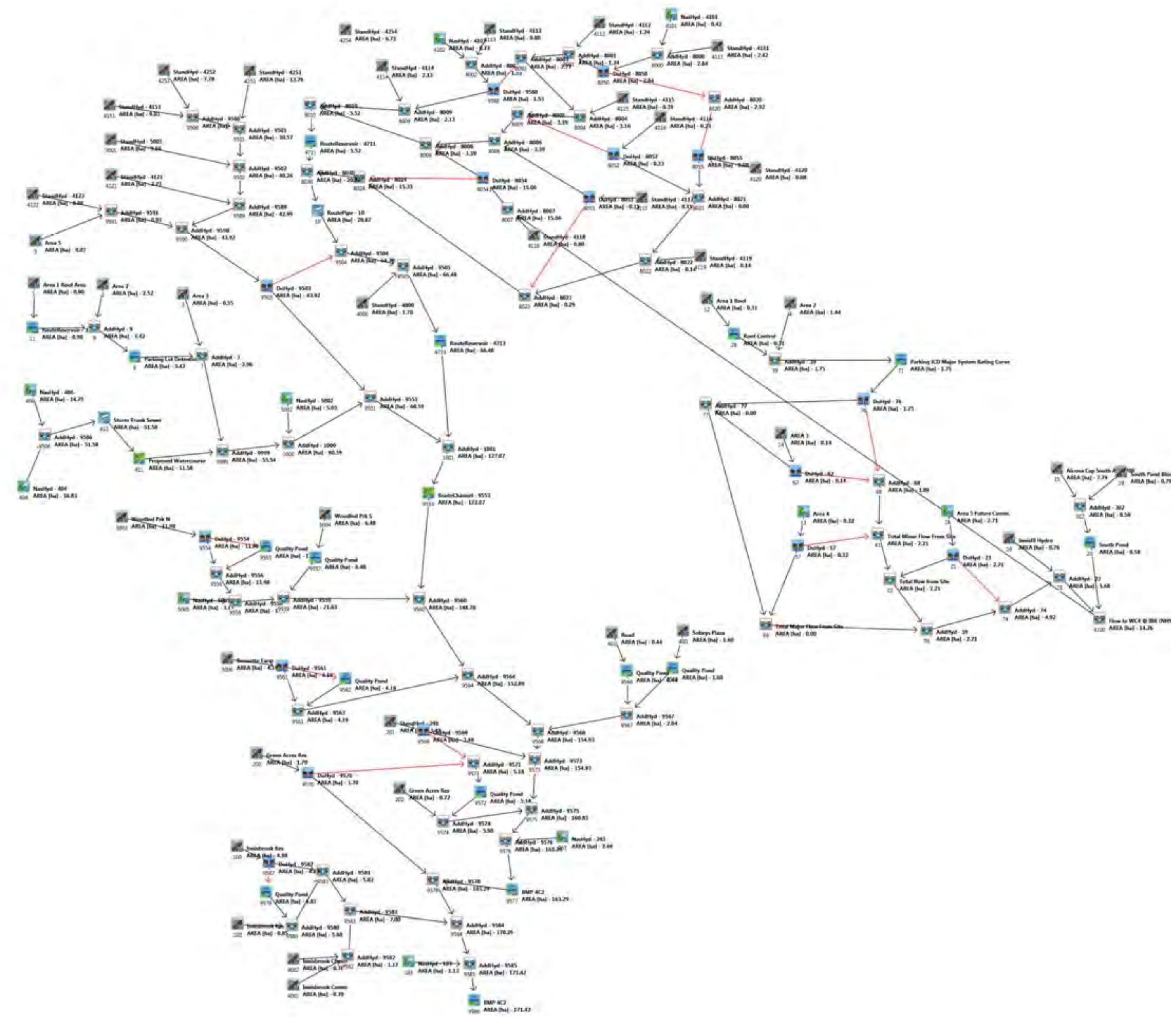

```
*
    ADD [  0011+  0224]  0013  3  5.0    0.53    0.11 11.17 201.17  n/a   0.000
*
    ADD [  0222+  0223]  0012  3  5.0    1.42    0.08  9.75 204.05  n/a   0.000
*
    ADD [  0012+  0224]  0014  3  5.0    1.68    0.10  9.75 200.19  n/a   0.000
*
 ** CALIB NASHYD         0005  1  5.0    2.71    0.36 10.25 178.31 0.84   0.000
    [CN=87.0          ]
    [ N = 3.0:Tp 0.36]
*
    DUHYD                0225  1  5.0    2.71    0.36 10.25 178.31  n/a   0.000
       MAJOR SYSTEM:     0225  2  5.0    0.48    0.18 10.25 178.31  n/a   0.000
       MINOR SYSTEM:     0225  3  5.0    2.23    0.19  9.50 178.31  n/a   0.000
*
    ADD [  0014+  0225]  0015  3  5.0    3.91    0.28  9.75 187.69  n/a   0.000
*
    ADD [  0013+  0015]  0016  3  5.0    4.44    0.39 10.17 189.31  n/a   0.000
*
    ADD [  0016+  0225]  0017  3  5.0    4.92    0.57 10.17 188.25  n/a   0.000
*
 *  CALIB STANDHYD       0103  1  5.0    0.76    0.11 10.17 197.62 0.93   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0103+  0017]  0018  3  5.0    5.68    0.68 10.17 189.50  n/a   0.000
*
 *  CALIB STANDHYD       0200  1  5.0    7.79    1.12 10.17 197.52 0.93   0.000
    [I%=45.0:S%= 2.00]
*
 *  CALIB STANDHYD       0201  1  5.0    0.79    0.11 10.17 197.93 0.93   0.000
    [I%=60.0:S%= 2.00]
*
    ADD [  0200+  0201]  0019  3  5.0    8.58    1.24 10.17 197.56  n/a   0.000
*
    ADD [  0018+  0019]  0022  3  5.0   14.26    1.91 10.17 194.35  n/a   0.000
*
 *  CALIB STANDHYD       0900  1  5.0    0.07    0.01 10.17 196.06 0.92   0.000
    [I%=45.0:S%= 2.00]
*
 FINISH

==========================================================================================================
```



```
****************************
** SIMULATION NUMBER:   1 **
****************************

--------------------
| ADD HYD (    9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.006     1.67     2.06
      + ID2= 2 (   9584):   170.29   0.393     3.17     8.92
        ====================================================
        ID = 3 (  9585):   171.42   0.394     3.17     8.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   2 **
****************************

--------------------
| ADD HYD (    9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.022     8.33     6.94
      + ID2= 2 (   9584):   170.29   1.763     9.33    19.64
        ====================================================
        ID = 3 (  9585):   171.42   1.766     9.33    19.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   3 **
****************************

--------------------
| ADD HYD (    9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.030     8.17     9.59
      + ID2= 2 (   9584):   170.30   2.587     9.17    24.63
        ====================================================
        ID = 3 (  9585):   171.43   2.592     9.17    24.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   4 **
****************************

--------------------
| ADD HYD (    9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.053     8.17    17.05
      + ID2= 2 (   9584):   170.50   4.084     9.17    37.32
        ====================================================
        ID = 3 (  9585):   171.63   4.092     9.17    37.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   5 **
****************************

--------------------
| ADD HYD (    9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.069     8.17    22.08
      + ID2= 2 (   9584):   170.68   4.914     9.17    45.22
        ====================================================
        ID = 3 (  9585):   171.81   4.924     9.17    45.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   6 **
****************************

--------------------
| ADD HYD (    9585)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.092     8.17    29.05
      + ID2= 2 (   9584):   170.82   8.952     8.83    55.63
        ====================================================
        ID = 3 (  9585):   171.95   8.975     8.83    55.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
```

```
****************************
** SIMULATION NUMBER:   1 **
****************************

--------------------
| ADD HYD (   9585)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     1.13   0.064    10.00    66.53
      + ID2= 2 (   9584):   170.53  19.945    10.08   169.78
        ====================================================
        ID = 3 (  9585):   171.66  20.006    10.08   169.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
```

Appendix C – Pond Design

C1 - North Pond

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Extended Detention Calculations

Criteria: 25mm- 4 hour Storm Event

Drainage Area: 5.29 ha

Runoff Volume = 13.57 mm (From VH Model Results)

= 135.7 m^3/ha

Ext. Det. Volume = Runoff Volume x Area

= 718 m^3

Compared to 40 m^3 * Area[1]= 212 m^3

Therefore use volume from 25mm- 4 hour Storm Event

Qpeak = Ext. Det Volume / Duration

Qpeak(24h) = 0.008 m^3/s

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Permanent Pool Volume Calculation

Criteria: 80% T.S.S Removal
Drainage Area: 5.29 ha
Imperviousness: 60%

Permanent Pool Volume[1] = (198m^3/ha - 40 m^3/ha) x Area
= 838 m^3

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

CALCULATIONS

Project Name	Alcona Capital Residential - North Pond
Project No.	09389
Subject	North Pond - Forebay Settlement and Dispersion Length

Sediment Forebay Length

Inlet flowrate (Q)=	0.660	m^3/sec	Flow Diverted to Pond (5 yr Rational Method)
Quality Release Rate (Q_p)=	0.008	m^3/sec	25mm Extended Detention Release Rate
Settlement particle size =	0.1500	mm	
Settling Velocity (V_s)=	0.00033	m/s	
Forebay Velocity (V_f)=	0.5000	m/s	
Forebay length/Width (r)=	2.0		
Permanent Pool Depth (d)=	2.0	m	

Settlement Length = $(r\ Q_p\ )/\ V_s)^{0.5}$

Settlement Length = **7.1** **m** Equation 4.5[1]

Dispersion Length = $8Q\ /\ (d\ V_f)$

Dispersion Length = **5.3** **m** Equation 4.6[1]

Therefore the Sediment Forebay Length must be > 7.1 m

Min. Forebay Deep Zone Bottom Width = Dispersion Length / 8

Width = **0.7** **m** Equation 4.7[1]

[1] Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

5-Year Design Inlet FlowRate

Q = (CiA)/360

where	**Q = design flow inlet, m^3/s**	**0.66**
	C = Runoff Coefficient	0.62
	i = Rainfall intensity, mm/hr	72.39
	A = Area, ha	5.29

$i = a\ (t)^b$

where	a =	27.7	
	b =	-0.693	
	t =	15	min
therefore	i =	72.39	

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - SWM Facility Stage-Volume Information

Depth Increment (m)	0.10
Perm. Pool Vol. Req'd (m^3)	838
Permanent Pool Elevation (m)	266.80
Permanent Pool Vol. (m^3)	2014
Bottom of Pond (m)	264.80
Max. Pond Elevation (m)	268.00
Max Active Storage (m^3)	2570

Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)	
264.80	0	88	101.4	Bottom of Pond
265.30	0.5	595	68.2	
265.80	1.0	936	92.3	
266.40	1.6	1490	170.5	
266.80	2.0	2172	154.0	Permanent Pool
267.20	2.4	2788	147.2	
268.00	3.2	3966	147.2	Top of Pond

Elevation (m)	Depth (m)	Area (m^2)	Incr. Volume (m^3)	Cum. Volume (m^3)	Active Storage Volume (m^3)	Ext. Det. Volume (m^3)
264.80		88				
264.90	0.10	189	14	14		
265.00	0.20	291	24	38		
265.10	0.30	392	34	72		
265.20	0.40	494	44	116		
265.30	0.50	595	54	171		
265.40	0.60	663	63	234		
265.50	0.70	731	70	303		
265.60	0.80	800	77	380		
265.70	0.90	868	83	463		
265.80	1.00	936	90	553		
265.90	1.10	1028	98	652		
266.00	1.20	1121	107	759		
266.10	1.30	1213	117	876		
266.20	1.40	1305	126	1002		
266.30	1.50	1398	135	1137		
266.40	1.60	1490	144	1281		
266.50	1.70	1661	158	1439		
266.60	1.80	1831	175	1613		
266.70	1.90	2002	192	1805		
266.80	2.00	2172	209	2014		
266.90	2.10	2326	225	2239	225	225
267.00	2.20	2480	240	2479	465	465
267.10	2.30	2634	256	2735	721	721
267.20	2.40	2788	271	3006	992	992
267.30	2.50	2935	286	3292	1278	
267.40	2.60	3083	301	3593	1579	
267.50	2.70	3230	316	3908	1895	
267.60	2.80	3377	330	4239	2225	
267.70	2.90	3524	345	4584	2570	
267.80	3.00	3672	360	4944	2930	
267.90	3.10	3819	375	5318	3304	
268.00	3.20	3966	389	5707	3694	

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Outlet Design

Incremental Depth(m) =	0.10

Orifice: $Q=CA(2gH)^{0.5}$

	Orifice 1	Orifice 2
Contraction coeff, C=	0.62	
Orifice Diameter (mm) =	100	
Area of Orifice(m^2), A=	0.0079	
Horizontal Orifice (y/n)	n	
Invert 1 (m) =	266.80	
N.W.L./Inlet Elevation (m) =	266.80	

Weir: Q=2/3*Cd*(2*g)^0.5*L*H^3/2

	Weir 1	Weir 2
Length (m)=	0.60	
Coef.C_d =	0.62	
Rect'lr (y/n) =	y	
Crest Hght (m)=		
Crest EL (m)=	267.30	

Extended Detention

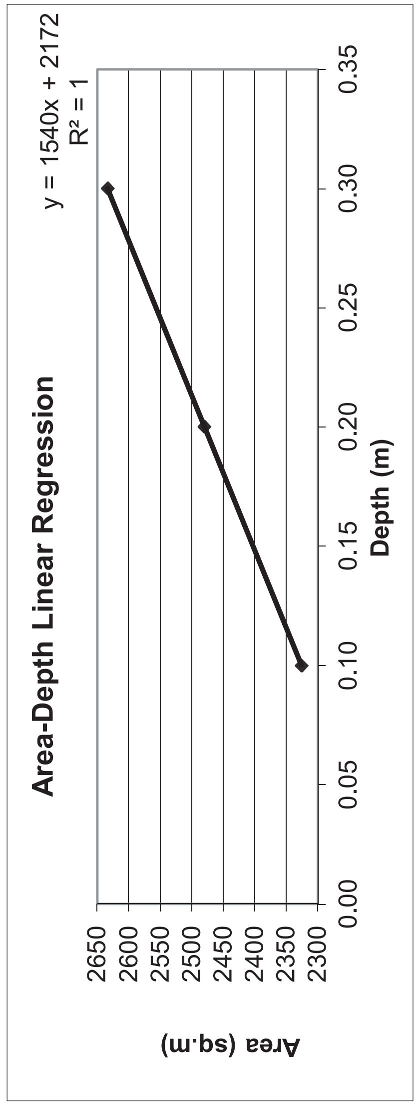
Volume Required (m^3) =	718
Detention Time (hr)=	30
Depth (m)=	0.3
EL (m)=	267.10
Max. Q_{rel} (m^3/s)=	0.013
Volume Available (m^3)=	992

Water E.L.	Depth (m)	Head 1 (m)	Orifice 1 Q (mid-orifice)	Head 2 (m)	Orifice 2 Q (mid-orifice)	Weir 1 Q (m^3/sec)	Emergency Spillway (m^3/sec)	Total Q (m^3/sec)	Total Storage (m^3)
266.90	0.10	0.01	0.002					0.002	225
267.00	0.20	0.15	0.008					0.008	465
267.10	0.30	0.25	0.011					0.011	721
267.20	0.40	0.35	0.013					0.013	992
267.30	0.50	0.45	0.014					0.014	1278
267.40	0.60	0.55	0.016			0.034		0.050	1579
267.50	0.70	0.65	0.017			0.092		0.109	1895
267.60	0.80	0.75	0.019			0.168		0.187	2225
267.70	0.90	0.85	0.020			0.258		0.278	2570
267.80	1.00	0.95	0.021			0.360	0.311	0.692	2930
267.90	1.10	1.05	0.022			0.472	0.943	1.437	3304
268.00	1.20	1.15	0.023			0.593	1.847	2.463	3694

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Detention Time

Elevation (m)	Depth (m)	Area (m^2)
266.90	0.10	2326
267.00	0.20	2480
267.10	0.30	2634



Equation 4.11 SWM Planning & Design Manual (MOE, 2003)

Drawdown Time = $t = (0.66C_2h^{1.5} + 2C_3h^{0.5}) / (2.75A_0)$

where,

C_2 = slope coefficient from area-depth linear regression =	1540	
h = Maximum water elevation above orifice =	0.25	m
C_3 = intercept from the area depth linear regression =	2172	
A_o = cross sectional area of orifice =	0.0079	m^2

t = 106445 s

t = 30 hr

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Emergency Spillway Calculations

FLOW OVER WEIR (QUANTITY CONTROL): C_w= 1.83

$Q_w=C_w*(H_w)^{1.5}*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))$

INVERT OF WEIR 1	267.70	m
WEIR 1 HEIGHT	0.3	m
WEIR 1 WIDTH of base	5.0	m

ELEVATION (m)	TAILWATER (m)	WEIR 1 FLOW (cms)	WIDTH (L) (m)	H (m)	TOTAL FLOW (cms)
267.70		0.00	5.0	0.0	0.00
267.80		0.31	5.0	0.1	0.31
267.90		0.94	5.0	0.2	0.94
268.00		1.85	5.0	0.3	1.85

Q(100) = 1.27 cms > Q(Reg) = 0.75 cms
Q(weir) = 1.85 cms @ 0.3 m depth

Therefore the weir will convey the 100-year uncontrolled flow.

Velocity V = Q/A where Q = 1.27 cms, A = 3.0 sq.m.
V = 1.27 / 3 = 0.42 m/s

CALCULATIONS

Project Name	Alcona Capital Residential Developments
Project No.	09389
Subject	North Pond - Sediment Removal Frequency

Drainage Area	5.29	ha
Imperviousness	60%	
SWMP Type	WP	(Infiltration (I), Wetlands (WL), Hybrid (H), Wet Pond (WP))
Protection Level	1	
Total Suspended Solids Removal	80%	
Reduction in Efficiency to Initiate	5%	
Starting Storage Volume	158	m^3/ha
Req. Permanent Pool Volume	838	m^3

Table 6.3: Annual Sediment Loading
(MOE SWM Planning and Design Manual, March 2003)

Imperviousness	Loading (kg/ha)	Wet Density (kg/m^3)	Loading (m^3/ha)
35%	770	1230	0.63
55%	2300	1230	1.87
70%	3495	1230	2.84
85%	4680	1230	3.80

Annual Loading/ha	2.2	m^3/ha/yr
Annual Loading	11.7	m^3/yr

Year	Starting Storage Volume m^3/ha	Sediment Removal Efficiency %	Amount of Sediment Removed m^3	Starting Permanent Pool Volume m^3	End of Year Permanent Pool Volume m^3	End of Year Storage Volume m^3/ha	Cumulative Sediment Removed m^3
1	158	80.0%	9.336	838.3	829.0	156.7	9.3
2	156.7	79.8%	9.311	829.0	819.6	154.9	18.6
3	154.9	79.6%	9.285	819.6	810.4	153.2	27.9
4	153.2	79.3%	9.260	810.4	801.1	151.4	37.2
5	151.4	79.1%	9.235	801.1	791.9	149.7	46.4
6	149.7	78.9%	9.210	791.9	782.7	148.0	55.6
7	148.0	78.7%	9.184	782.7	773.5	146.2	64.8
8	146.2	78.5%	9.159	773.5	764.3	144.5	74.0
9	144.5	78.3%	9.134	764.3	755.2	142.8	83.1
10	142.8	78.1%	9.110	755.2	746.1	141.0	92.2
11	141.0	77.8%	9.085	746.1	737.0	139.3	101.3
12	139.3	77.6%	9.060	737.0	727.9	137.6	110.4
13	137.6	77.4%	9.035	727.9	718.9	135.9	119.4
14	135.9	77.2%	9.011	718.9	709.9	134.2	128.4
15	134.2	77.0%	8.986	709.9	700.9	132.5	137.4
16	132.5	76.8%	8.962	700.9	691.9	130.8	146.4
17	130.8	76.6%	8.937	691.9	683.0	129.1	155.3
18	129.1	76.4%	8.913	683.0	674.1	127.4	164.2
19	127.4	76.2%	8.889	674.1	665.2	125.7	173.1
20	125.7	76.0%	8.864	665.2	656.3	124.1	182.0
21	124.1	75.8%	8.840	656.3	647.5	122.4	190.8
22	122.4	75.5%	8.816	647.5	638.7	120.7	199.6
23	120.7	75.3%	8.792	638.7	629.9	119.1	208.4
24	119.1	75.1%	8.768	629.9	621.1	117.4	217.2
25	117.4	74.9%	8.744	621.1	612.4	115.8	225.9
26	115.8	74.7%	8.721	612.4	603.6	114.1	234.6
27	114.1	74.5%	8.697	603.6	595.0	112.5	243.3
28	112.5	74.3%	8.673	595.0	586.3	110.8	252.0
29	110.8	74.1%	8.649	586.3	577.6	109.2	260.7

Cleanout when Sediment Removal Efficiency drops to:	75%	
Sediment Removal Frequency	**25**	**Years**
Total Sediment Accumulated	226	m^3
Recommended cleanout	10	Years
	92	m^3

CALCULATIONS

Project	Alcona Capital Residential Developments
Project No.	09389
Description:	North Pond - Forebay Stage-Volume Information

Conveyance Pipe Diameter 0.25 m
10yr Sediment Volume 92 cu.m

Depth Increment (m) 0.05

Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)
264.80	0	31	12.8
265.80	1.0	287	19.5
266.30	1.5	482	45.5
266.50	1.7	664	45.5

Elevation (m)	Depth (m)	Area (m^2)	Incr. Volume (m^3)	Cum. Volume (m^3)	
264.80		31			
264.85	0.05	44	2	2	
264.90	0.10	57	3	4	
264.95	0.15	69	3	8	
265.00	0.20	82	4	11	
265.05	0.25	95	4	16	
265.10	0.30	108	5	21	
265.15	0.35	121	6	27	
265.20	0.40	133	6	33	
265.25	0.45	146	7	40	
265.30	0.50	159	8	47	
265.35	0.55	172	8	56	
265.40	0.60	185	9	65	
265.45	0.65	197	10	74	
265.50	0.70	210	10	84	
265.55	0.75	223	11	95	10-year Sediment Level
265.60	0.80	236	11	107	
265.65	0.85	249	12	119	
265.70	0.90	261	13	132	
265.75	0.95	274	13	145	
265.80	1.00	287	14	159	
265.85	1.05	307	15	174	
265.90	1.10	326	16	190	
265.95	1.15	346	17	206	
266.00	1.20	365	18	224	
266.05	1.25	385	19	243	
266.10	1.30	404	20	263	
266.15	1.35	424	21	283	
266.20	1.40	443	22	305	
266.25	1.45	463	23	328	
266.30	1.50	482	24	351	

Project Nam	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Reverse-Slope Outlet Pipe Flow

$$Q = A_p[(2gH) / (1 + k_m + k_pL)]^{0.5}$$

where:
Q = discharge (cfs)
A_p = pipe cross sectional area (ft^2)
g = acceleration of gravity (ft/s^2)
H = elevation head differential (ft)
k_m = coefficient of minor losses (use 1.0)
k_p = pipe friction coefficient = $5087n^2/D^{4/3}$ (Manning's n and pipe diameter, D)
L = pipe length (ft)

Metric input			Imperial input		
D =	675	mm	D =	27	in
n =	0.011	(PVC)	Ap =	3.87	ft^2
H =	0.05	m	H =	0.16	ft
L =	30	m	L =	98.7	ft
k_m =	1.0		k_p =	0.01	

Metric result			Imperial result		
Q =	**0.21**	m^3/s	Q =	**7.58**	ft^3/s

Q > $Q_{Pond,100yr}$ (0.20 m^3/s) , therfore OK

Natural Resources Conservation Service (NRCS) Engineering Field Manual For Conservation Practices, U.S. Soil Conservation Service (Engineering Division), July 1984

Pond Outlet Pipe

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.011	
Channel Slope	2.30	%
Normal Depth	0.45	m
Diameter	450	mm
Discharge	0.51	m³/s

Results

Discharge	0.51	m³/s
Normal Depth	0.45	m
Flow Area	0.16	m²
Wetted Perimeter	1.41	m
Hydraulic Radius	0.11	m
Top Width	0.00	m
Critical Depth	0.44	m
Percent Full	100.0	%
Critical Slope	0.02032	m/m
Velocity	3.21	m/s
Velocity Head	0.53	m
Specific Energy	0.98	m
Froude Number	0.00	
Maximum Discharge	0.55	m³/s
Discharge Full	0.51	m³/s
Slope Full	0.02300	m/m
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Average End Depth Over Rise	0.00	%

Pond Outlet Pipe

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.45	m
Critical Depth	0.44	m
Channel Slope	2.30	%
Critical Slope	0.02032	m/m

C2 - South Pond

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Extended Detention Calculations

Criteria: 25mm- 4 hour Storm Event
Drainage Area: 8.58 ha

Runoff Volume = 14.39 mm (From OTTHYMO Model Results)
= 143.9 m^3/ha

Ext. Det. Volume = Runoff Volume x Area
= 1,235 m^3

Compared to 40 m^3 * Area[1]= 343 m^3
Therefore use volume from 25mm- 4 hour Storm Event

Qpeak = Ext. Det Volume / Duration
Qpeak(24h) = 0.014 m^3/s

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Permanent Pool Volume Calculation

Criteria: 80% T.S.S Removal
Drainage Area: 8.58 ha
Imperviousness: 60%

Permanent Pool Volume[1] = (198m^3/ha - 40 m^3/ha) x Area
= 1,360 m^3

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

Project Name	Alcona Capital Residential Developments
Project No.	09389
Subject	South Pond - Forebay Settlement and Dispersion Length

Sediment Forebay Length

Inlet flowrate (Q)=	1.070	m^3/sec	Flow Diverted to Pond (5 yr Rational Method)
Quality Release Rate (Q_p)=	0.014	m^3/sec	25mm Extended Detention Release Rate
Settlement particle size =	0.1500	mm	
Settling Velocity (V_s)=	0.00033	m/s	
Forebay Velocity (V_f)=	0.5000	m/s	
Forebay length/Width (r)=	2.0		
Permanent Pool Depth (d)=	2.0	m	

Settlement Length = $(r\ Q_p)/V_s)^{0.5}$

Settlement Length = **9.3** **m** Equation 4.5[1]

Dispersion Length = $8Q / (d\ V_f)$

Dispersion Length = **8.6** **m** Equation 4.6[1]

Therefore the Sediment Forebay Length must be > 9.3 m

Min. Forebay Deep Zone Bottom Width = Dispersion Length / 8

Width = **1.1** **m** Equation 4.7[1]

[1] Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

5-Year Design Inlet FlowRate

Q = (CiA)/360

where	Q = design flow inlet, m^3/s	1.07
	C = Runoff Coefficient	0.62
	i = Rainfall intensity, mm/hr	72.39
	A = Area, ha	8.58

i = a $(t)^b$

where	a =	27.7	
	b =	-0.693	
	t =	15	min
therefore	i =	72.39	

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Stage-Volume Information

		Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)	
Depth Increment (m)	0.10	257.50	0	95	49.0	Bottom of Pond
Perm. Pool Vol. Req'd (m^3)	1360	258.00	0.5	340	85.2	
Settlement Pool Elevation (m)	259.50	258.50	1.0	766	74.8	
Permanent Pool Vol. (m^3)	1621	259.00	1.5	1140	151.4	
Bottom of Pond (m)	257.50	259.50	2.0	1897	140.6	Permanent Pool
Max. Pond Elevation (m)	261.50	260.00	2.5	2600	118.5	
Max Active Storage (m^3)	5257	261.50	4.0	4377	118.5	Top of Pond

Elevation (m)	Depth (m)	Area (m^2)	Incr. Volume (m^3)	Cum. Volume (m^3)	Active Storage Volume (m^3)	Ext. Det. Volume (m^3)
257.50		95				
257.60	0.10	144	12	12		
257.70	0.20	193	17	29		
257.80	0.30	242	22	51		
257.90	0.40	291	27	77		
258.00	0.50	340	32	109		
258.10	0.60	425	38	147		
258.20	0.70	510	47	194		
258.30	0.80	596	55	249		
258.40	0.90	681	64	313		
258.50	1.00	766	72	385		
258.60	1.10	841	80	466		
258.70	1.20	916	88	553		
258.80	1.30	990	95	649		
258.90	1.40	1065	103	751		
259.00	1.50	1140	110	862		
259.10	1.60	1291	122	983		
259.20	1.70	1443	137	1120		
259.30	1.80	1594	152	1272		
259.40	1.90	1746	167	1439		
259.50	2.00	1897	182	1621		
259.60	2.10	2038	197	1818	197	197
259.70	2.20	2178	211	2029	408	408
259.80	2.30	2319	225	2253	632	632
259.90	2.40	2459	239	2492	871	871
260.00	2.50	2600	253	2745	1124	1124
260.10	2.60	2741	267	3012	1391	1391
260.20	2.70	2881	281	3293	1672	
260.30	2.80	3022	295	3589	1968	
260.40	2.90	3162	309	3898	2277	
260.50	3.00	3303	323	4221	2600	
260.60	3.10	3444	337	4558	2937	
260.70	3.20	3584	351	4910	3289	
260.80	3.30	3725	365	5275	3654	
260.90	3.40	3865	380	5655	4034	
261.00	3.50	4006	394	6048	4427	
261.10	3.60	4147	408	6456	4835	
261.20	3.70	4287	422	6878	5257	
261.30	3.80	4428	436	7313	5692	
261.40	3.90	4568	450	7763	6142	
261.50	4.00	4709	464	8227	6606	

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Outlet Design

Incremental Depth(m) =	0.10	
Orifice: Q=CA(2gH)^0.5		
	Orifice 1	Orifice 2
Contraction coeff, C=	0.62	
Orifice Diameter (mm) =	100	
Area of Orifice(m^2), A=	0.0079	
Horizontal Orifice (y/n)	n	
Invert 1 (m) =	259.50	
N.W.L./Inlet Elevation (m) =	259.50	

Weir: Q=2/3*Cd*(2*g)^0.5*L*H^3/2		
	Weir 1	Weir 2
Length (m)=	0.11	
Coef.C_d =	0.62	
Rect'lr (y/n) =	y	
Crest Hght (m)=		
Crest EL (m)=	260.00	

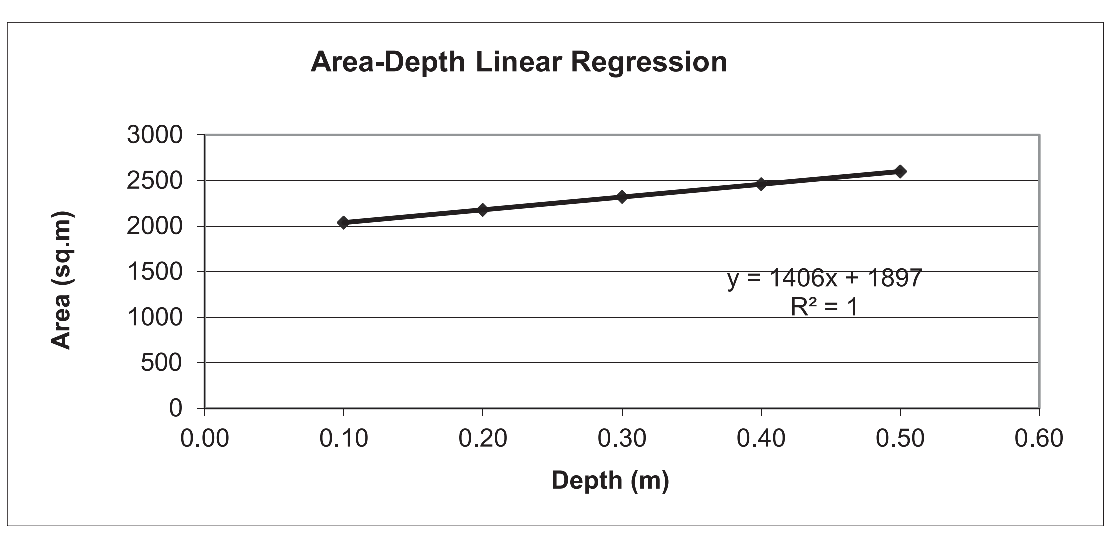
Extended Detention	
Volume Required (m^3) =	1235
Detention Time (hr)=	36
Depth (m)=	0.60
EL (m)=	260.10
Max. Q_{rel} (m^3/s)=	0.022
Volume Available (m^3)=	1391

Water E.L.	Depth (m)	Head 1 (m)	Orifice 1 Q (mid-orifice)	Head 2 (m)	Orifice 2 Q (mid-orifice)	Weir 1 Q (m^3/sec)	Emergency Spillway (m^3/sec)	Total Q (m^3/sec)	Total Storage (m^3)
259.60	0.10	0.01	0.00					0.002	197
259.70	0.20	0.15	0.01					0.008	408
259.80	0.30	0.25	0.01					0.011	632
259.90	0.40	0.35	0.01					0.013	871
260.00	0.50	0.45	0.01					0.014	1124
260.10	0.60	0.55	0.02			0.006		0.022	1391
260.20	0.70	0.65	0.02			0.018		0.035	1672
260.30	0.80	0.75	0.02			0.033		0.052	1968
260.40	0.90	0.85	0.02			0.050		0.070	2277
260.50	1.00	0.95	0.02			0.070		0.091	2600
260.60	1.10	1.05	0.02			0.092		0.114	2937
260.70	1.20	1.15	0.02			0.116		0.139	3289
260.80	1.30	1.25	0.02			0.141		0.165	3654
260.90	1.40	1.35	0.03			0.168		0.193	4034
261.00	1.50	1.45	0.03			0.196		0.222	4427
261.10	1.60	1.55	0.03			0.226		0.253	4835
261.20	1.70	1.65	0.03			0.257		0.285	5257
261.30	1.80	1.75	0.03			0.289	0.369	0.687	5692
261.40	1.90	1.85	0.03			0.322	1.107	1.458	6142
261.50	2.00	1.95	0.03			0.356	2.148	2.534	6606

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Detention Time

Elevation (m)	Depth (m)	Area (m^2)
259.60	0.10	2038
259.70	0.20	2178
259.80	0.30	2319
259.90	0.40	2459
260.00	0.50	2600



Equation 4.11 SWM Planning & Design Manual (MOE, 2003)

Drawdown Time = $t = (0.66C_2h^{1.5} + 2C_3h^{0.5}) / (2.75A_0)$

where,
- C_2 = slope coefficient from area-depth linear regression = 1406
- h = Maximum water elevation above orifice = 0.45 m
- C_3 = intercept from the area depth linear regression = 1897
- A_o = cross sectional area of orifice = 0.0079 m^2

t = 130806 s

t = 36 hr

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Emergency Spillway Calculations

FLOW OVER WEIR (QUANTITY CONTROL): C_w= 1.83
$Q_w=C_w*(H_w)\^{}1.5*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))$

INVERT OF WEIR 1	261.20 m
WEIR 1 HEIGHT	0.3 m
WEIR 1 WIDTH of base	6.0 m

ELEVATION (m)	TAILWATER (m)	WEIR 1 FLOW (cms)	WIDTH (L) (m)	H (m)	TOTAL FLOW (cms)
261.20		0.00	6.0	0.00	0.00
261.30		0.37	6.0	0.10	0.37
261.40		1.11	6.0	0.20	1.11
261.50		2.15	6.0	0.30	2.15

Q(100) = 2.06 cms > Q(Reg) = 1.22 cms
Q(weir) = 2.15 cms @ 0.3 m depth

Q(weir) is larger than Q(100), and will therefore convey 100-year uncontrolled inflow

Velocity V = Q/A where Q = 2.06 cms, A = 3.6 sq.m.
V = 2.06 / 3.6 = 0.58 m/s

CALCULATIONS

Project	Alcona Capital Residential
Project No.	09389
Description:	South Pond - Forebay Stage-Volume Information

Conveyance Pipe Diameter 0.25 m
10yr Sediment Volume 150 cu.m

Depth Increment (m) 0.10

Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)
257.50	0	22	20.6
258.50	1.0	228	33.6
259.00	1.5	396	63.0
259.50	2.0	711	63.0

Elevation (m)	**Depth (m)**	**Area (m^2)**	**Incr. Volume (m^3)**	**Cum. Volume (m^3)**	
257.50		22			
257.60	0.10	43	3	3	
257.70	0.20	63	5	9	
257.80	0.30	84	7	16	
257.90	0.40	104	9	25	
258.00	0.50	125	11	37	
258.10	0.60	146	14	50	
258.20	0.70	166	16	66	
258.30	0.80	187	18	84	
258.40	0.90	207	20	103	
258.50	1.00	228	22	125	
258.60	1.10	262	24	149	10-year Sediment Level
258.70	1.20	295	28	177	
258.80	1.30	329	31	209	
258.90	1.40	362	35	243	
259.00	1.50	396	38	281	
259.10	1.60	459	43	324	
259.20	1.70	522	49	373	
259.30	1.80	585	55	428	
259.40	1.90	648	62	490	
259.50	2.00	711	68	558	

Project Nam	Alcona Capital Residential Developments
Project No.:	09389
Description:	South Pond - Reverse-Slope Outlet Pipe Flow

$$Q = A_p[(2gH) / (1 + k_m + k_pL)]^{0.5}$$

where:
Q = discharge (cfs)
A_p = pipe cross sectional area (ft^2)
g = acceleration of gravity (ft/s^2)
H = elevation head differential (ft)
k_m = coefficient of minor losses (use 1.0)
k_p = pipe friction coefficient = $5087n^2/D^{4/3}$ (Manning's n and pipe diameter, D)
L = pipe length (ft)

Metric input			*Imperial input*		
D =	750	mm	D =	30	in
n =	0.011	(PVC)	Ap =	4.78	ft^2
H =	0.05	m	H =	0.16	ft
L =	40	m	L =	131.6	ft
k_m =	1.0		k_p =	0.01	

Metric result			*Imperial result*		
Q =	**0.26**	m^3/s	Q =	**9.16**	ft^3/s

Q > $Q_{Pond,100yr}$ (0.20 m^3/s) , therfore OK

Natural Resources Conservation Service (NRCS) Engineering Field Manual For Conservation Practices, U.S. Soil Conservation Service (Engineering Division), July 1984

Pond Outlet Pipe

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.011	
Channel Slope	1.00	%
Normal Depth	0.45	m
Diameter	450	mm
Discharge	0.34	m³/s

Results

Discharge	0.34	m³/s
Normal Depth	0.45	m
Flow Area	0.16	m²
Wetted Perimeter	1.41	m
Hydraulic Radius	0.11	m
Top Width	0.00	m
Critical Depth	0.40	m
Percent Full	100.0	%
Critical Slope	0.00893	m/m
Velocity	2.12	m/s
Velocity Head	0.23	m
Specific Energy	0.68	m
Froude Number	0.00	
Maximum Discharge	0.36	m³/s
Discharge Full	0.34	m³/s
Slope Full	0.01000	m/m
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Average End Depth Over Rise	0.00	%

Pond Outlet Pipe

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.45	m
Critical Depth	0.40	m
Channel Slope	1.00	%
Critical Slope	0.00893	m/m

Appendix D – Water Balance

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Water Balance - Rain Garden Annual Infiltration Volume

Lot Size[1] = 325 m^2

Rain Garden
Footprint = 10 m^2
Depth = 1 m
Storage volume[3] = 4 m^3
Drainage area[4] = 195 m^2
Imperviousness of drainage area = 75%

Rainfall captured in rain garden (depth) = $\frac{\text{Storage volume } (m^3)}{\text{Drainage area } (m^2)}$
= 21 mm
from impervious area = 15 mm
from pervious area = 5 mm
= 0 mm (minus 5 mm initial abstraction)

Total rainfall captured in rain garden (depth) = 16 mm

Total average annual occurance, @ 16 mm[5] = 86%
Total annual precipitation[2] = 826 mm /year
Total annual precipitation accounted for in the rain garden = 711 mm /year

Total annual volume accounted for in the rain garden = Precipitation (mm/year) x Drainage area (m^2)
= 139 m^3 /year

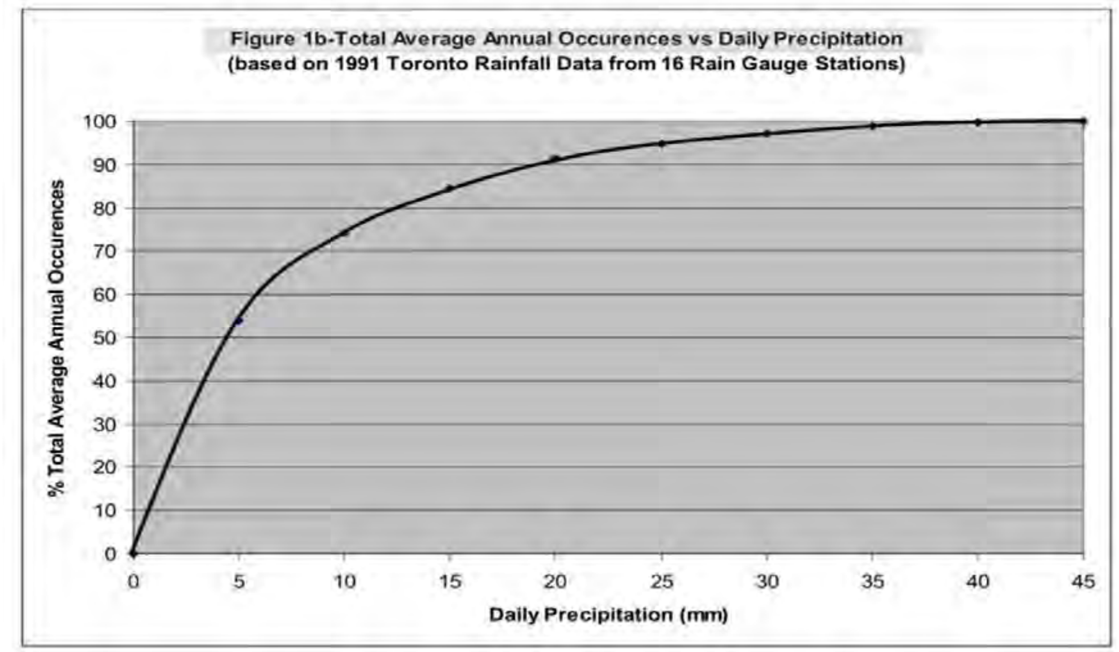
Annual infiltraton deficit[2] = 11,295 m^3 /year

# of rain gardens required to meet deficit = $\frac{\text{Annual infiltraton deficit } (m^3/\text{year})}{\text{Annual volume in the rain garden } (m^3/\text{year})}$

= 82

Notes:
1 Typical Single Family Residential lot, measured from Lot 75 - Draft Plan of Subdivision (March 2015)
2 Water Budget Assessment in Hydrogeological Investigation (Alcona Capital) by COLE ENG. (November 2013)
3 Assumes 40% void space ratio
4 Comprised of front lot drainage and roof area
5 Figure 1b, TRCA Wet Weather Flow Guidelines (November 2009)

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Water Balance - Rain Garden Annual Infiltration Volume



Source: Wet Weather Flow Guidelines, Toronto and Region Conservation Authority (November 2009)

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Rain Garden Sizing

Parameter	Value	Units	Note #
Infiltration (Percolation) rate =	22	mm/hr	1, 2, 3
Safety correction factor =	2.5		4
Infiltration rate (design) =	**9**	mm/hr	
Void space ratio =	0.4		5
Time to drain =	48	hr	6
Maximum Trench depth =	**1.1**	m	7
Trench depth (design) =	1.0	m	
Void space ratio =	0.4		
Trench footprint (design) =	10	m^2	
Storage volume =	**4**	m^3	

Notes:
1. Geometric mean at Test Pit 2, Table 4 - Infiltration Testing by Cole Eng. (Oct. 2015)
2. at the bottom elevation of the BMP.
3. from Figure C1 (CVC LID Guide, 2010).
4. from Table C2 (CVC LID Guide, 2010).
5. recommended value for filter bed and gravel storage layer (CVC LID Guide, 2010).
6. recommended value (CVC LID Guide, 2010).
7. as per equation on page 4-57 (CVC LID Guide, 2010).

Appendix E – Phosphorous Budget

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Ontario
MINISTRY OF THE ENVIRONMENT

Project DEVELOPMENT Summary

DEVELOPMENT: **Alcona Capital Properties, Innisfil**
Subwatershed: **Innisfil Creeks**

Total Pre-Development Area (ha):	**13.438**	Total Pre-Development Phosphorus Load (kg/yr):	**1.63**

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Cropland	6.74	0.19	1.28
Forest	5.9447	0.05	0.30
Hay-Pasture	0.7534	0.07	0.05

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
Low Intensity Development	13.07	0.13	Wet Detention Ponds	63%	0.63
			Standard wet pond - 80% TSS removal		
Open Water	0.37	0.26	Wet Detention Ponds	63%	0.04
			Permanent pool		

Post-Development Area Altered: **13.44**
Total Pre-Development Area: **13.44**
Unaffected Area: **0**

	P Load (kg/yr)
Pre-Development:	**1.63**
Post-Development:	**1.80**
Change (Pre - Post):	**-0.16**
	10% Net Increase in Load
Post-Development (with BMPs):	**0.66**
Change (Pre - Post):	**0.97**
	59% Net Reduction in Load

DEVELOPMENT: **Alcona Capital Properties, Innisfil**
Subwatershed: **Innisfil Creeks**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	P Load (kg/yr)
Pre-Development:	**1.63**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**0.66**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**0.97**
Conclusion:	**59% Reduction in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	S. Fischer			K. Chow		
2	A Soares			K. Chow		

www.ghd.com

BENCHMARK NOTE
Township: ALCONA
ELEV. = 261.700m
TOWN OF INNISFIL BENCHMARK # 2001 - 005. ELEVATION = 261.700m BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.

No.	By	Date	Revision	Checked
1.	D.J.S.	NOV. 16/2015	1st SUBMISSION	R.S.

INFRASTRUCTURE AND ENGINEERING SERVICES

TOWN PEER REVIEW ENGINEER

DATE :

ACCEPTED FOR CONSTRUCTION

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HORIZONTAL

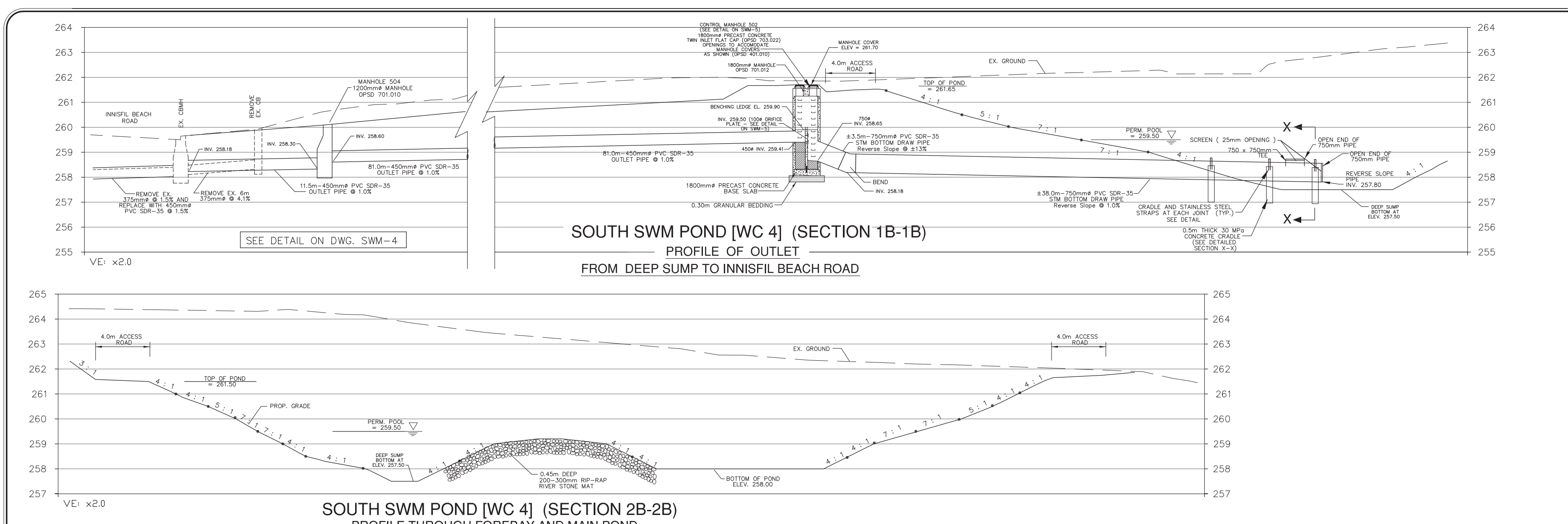
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

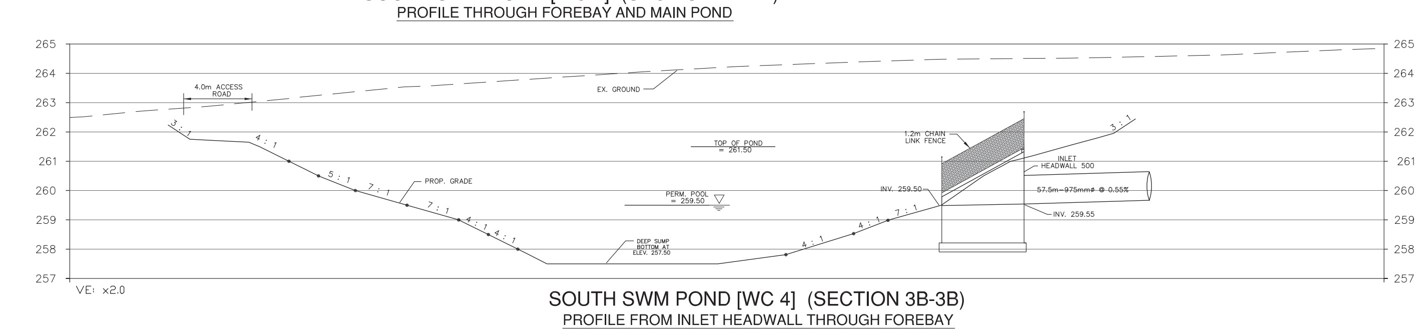
TOWN OF INNISFIL

STORMWATER MANAGEMENT PONDS
(NORTH AND SOUTH)
BLOCKS 151 AND 152

Designed By	D.J.S.	Date	October, 2015	Checked By	R.S.
Drawn By	V.T.			Approved By	
Scale:	1 : 500	Project No.	09002	Drawing No.	SWM-1

D12-2013-001





BENCHMARK NOTE
Township: ALCONA
ELEV. = 261.700m
TOWN OF INNISFIL BENCHMARK # 2001 - 005. ELEVATION = 261.700m BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.

No.	By	Date	Revision	Checked
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INFRASTRUCTURE AND ENGINEERING SERVICES

TOWN PEER REVIEW ENGINEER

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HORIZONTAL

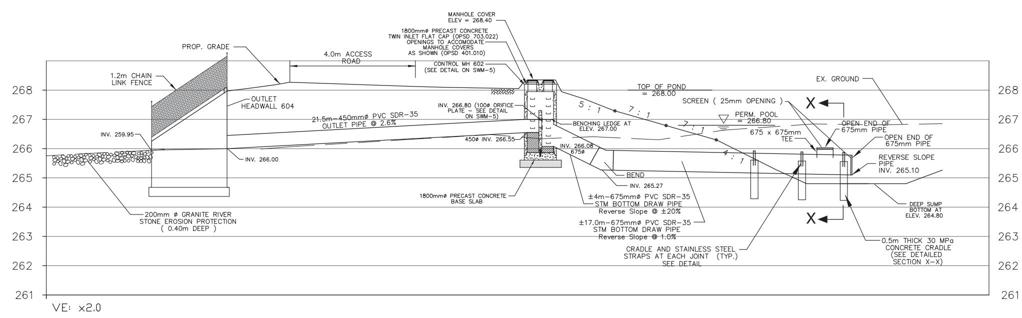
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

TOWN OF INNISFIL

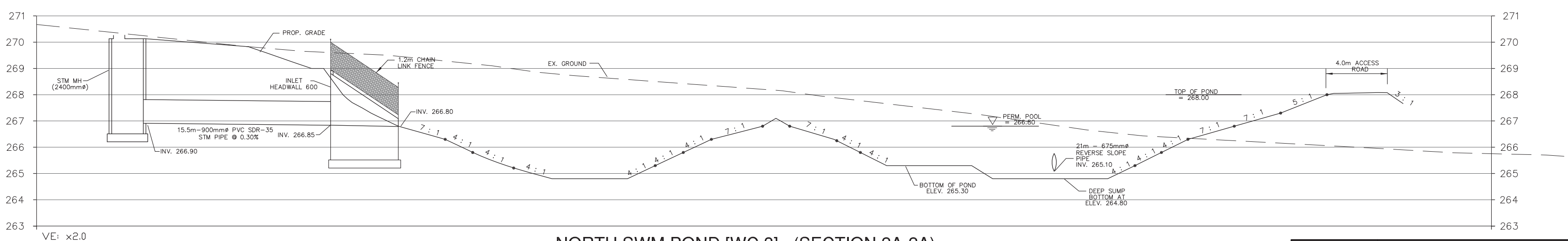
SWM POND [WC 4]
CROSS-SECTIONS AND DETAILS
(SOUTH POND)

Designed By	D.J.S.	Date	October, 2015	Checked By	R.S.
Drawn By	V.T.			Approved By	
Scale:	1 : 150 horiz 1 : 75 vert	Project No.	09002	Drawing No.	SWM-2

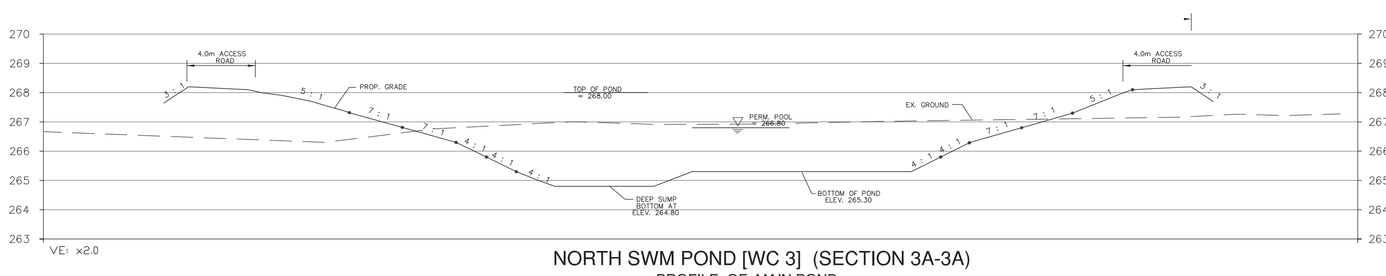
D12-2013-001



NORTH SWM POND [WC 3] (SECTION 1A-1A)
PROFILE OF OUTLET
FROM DEEP SUMP TO HEADWALL



NORTH SWM POND [WC 3] (SECTION 2A-2A)
PROFILE FROM INLET HEADWALL THROUGH MAIN POND



NORTH SWM POND [WC 3] (SECTION 3A-3A)
PROFILE OF MAIN POND

BENCHMARK NOTE	TOWN OF INNISFIL BENCHMARK # 2001 – 005. ELEVATION = 261.700m BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.
Township: ALCONA	
ELEV. = 261.700m	

No.	By	Date	Revision	Checked
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ROSARIO SACCO
NOV 16, 2015

HORIZONTAL

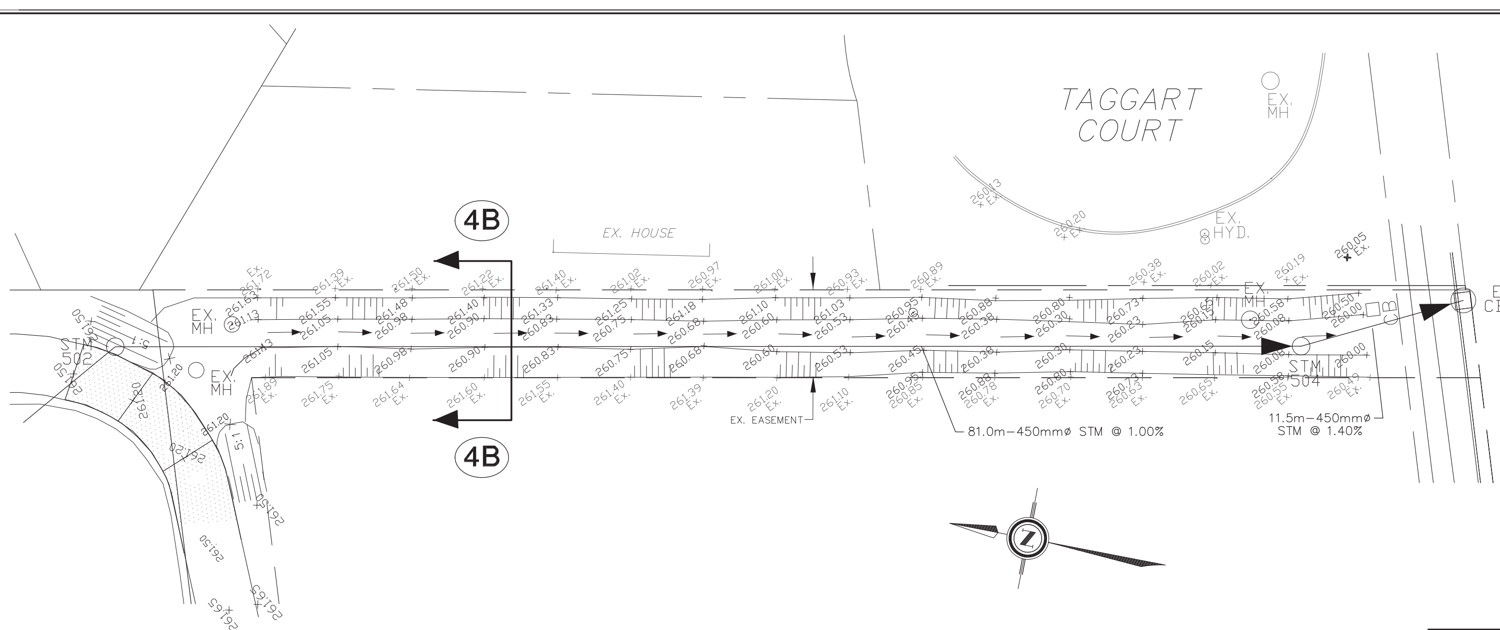
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

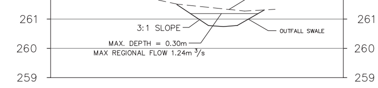
TOWN OF INNISFIL

SWM POND [WC 3]
CROSS-SECTIONS AND DETAILS
(NORTH POND)

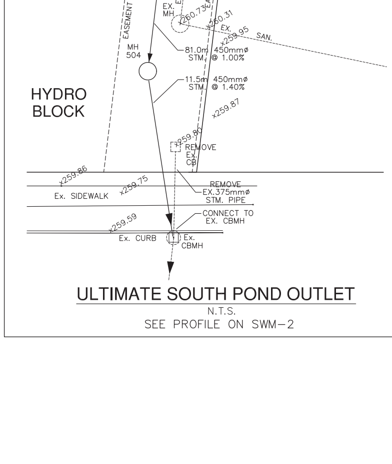
Designed By D.J.S.	Date October, 2015	Checked By R.S.
Drawn By V.T.		Approved By
Scale: 1 : 150 horiz 1 : 75 vert	Project No. 09002	Drawing No. SWM-3

D12-2013-001





SOUTH POND (SECTION 4B-4B)
OUTFALL SWALE THROUGH EASEMENT



ULTIMATE SOUTH POND OUTLET
N.T.S.
SEE PROFILE ON SWM–2

BENCHMARK NOTE	TOWN OF INNISFIL BENCHMARK # 2001 – 005. ELEVATION = 261.700m BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.
Township: ALCONA	
ELEV. = 261.700m	

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NOV 16, 2015

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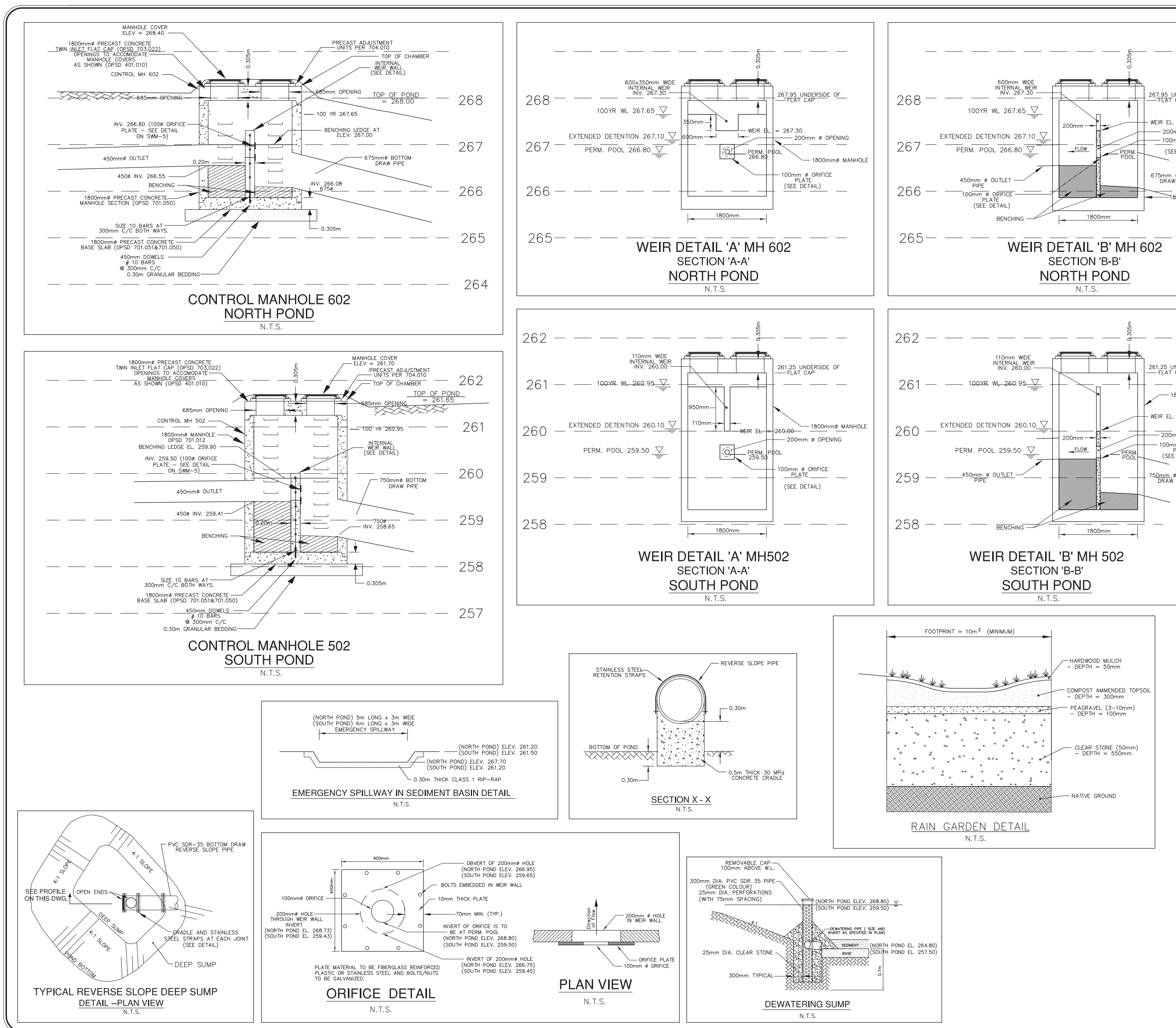
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

TOWN OF INNISFIL

SOUTH SWM POND
ULTIMATE OUTFALL DETAILS

Designed By D.J.S.	Date October, 2015	Checked By R.S.
Drawn By V.T.		Approved By
Scale: 1 : 150 horiz 1 : 75 vert	Project No. 09002	Drawing No. SWM-4

D12-2013-001



BENCHMARK NOTE — Township: ALCONA — ELEV. = 261.700m
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No.	By	Date	Revision	Checked
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INFRASTRUCTURE AND ENGINEERING SERVICES — TOWN PEER REVIEW ENGINEER

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ROSARIO SACCO — PROVINCE OF ONTARIO

HORIZONTAL

ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

TOWN OF INNISFIL

STORMWATER MANAGEMENT FACILITIES DETAILS

Designed By: D.J.S.	Date: October, 2015	Checked By: R.S.
Drawn By: V.T.		Approved By:
Scale: 1 : 150 horiz	Project No. 09002	Drawing No. SWM-5

D12-2013-001

BENCHMARK NOTE — Township: ALCONA — ELEV. = 261.700m
TOWN OF INNISFIL BENCHMARK # 2001 – 005. ELEVATION = 261.700m BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.

No.	By	Date	Revision	Checked
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INFRASTRUCTURE AND ENGINEERING SERVICES — TOWN PEER REVIEW ENGINEER

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ROSARIO SACCO — NOV 16, 2015 — PROVINCE OF ONTARIO

HORIZONTAL

PROJECT
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

MUNICIPALITY
TOWN OF INNISFIL

TITLE
EROSION AND SEDIMENTATION CONTROL PLAN (NORTH)
(STAGE 1-TREE REMOVAL/TOPSOIL STRIPPING)

Designed By: D.J.S.	Date: October, 2015	Checked By: R.S.
Drawn By: V.T.		Approved By:
Scale: 1 : 750	Project No. 09002	Drawing No. ESC-1a

D12-2013-001

STAGE 1 SITE ALTERATION SEQUENCING PLAN:

1. TEMPORARY CONSTRUCTION ENTRANCE TO BE ESTABLISHED PRIOR TO ANY DEVELOPMENT OF THE SITE. 600MM DIAM. CSP CULVERTS TO BE PROVIDED AS REQUIRED BY EXISTING DITCH GRADES.

2. SINGLE AND DOUBLE ROW EROSION/SILTATION FENCING IS TO BE PLACED WHERE SPECIFIED PRIOR TO STRIPPING.

3. CONSTRUCT DRAINAGE SWALES WHERE SPECIFIED. ROCK CHECK DAMS ARE TO BE PLACED IN THE PROPOSED SWALES. THE DAMS ARE TO BE SPACED SUCH THAT THE BOTTOM ELEVATION OF THE UPSTREAM DAM IS EQUAL TO THE TOP ELEVATION OF THE DOWNSTREAM DAM.

4. THE SOUTH POND BLOCK AND PHASE 1 AREA TO BE STRIPPED FIRST. PHASE 2 AREA TO BE STRIPPED ONLY UP TO THE LSRCA FILL REGULATION LIMIT. BALANCE OF PHASE 2 AREA AND NORTH POND BLOCK TO BE STRIPPED UPON ISSUANCE OF LSRCA PERMIT APPROVAL.

5. THE STRIPPED TOPSOIL IS TO BE PLACED IN A STOCKPILE LOCATED NEAR THE TEMPORARY CONSTRUCTION ENTRANCE.

6. THE PROPOSED TEMPORARY SOUTH SEDIMENT POND IS TO BE EXCAVATED ACCORDING TO POND SPECIFICATIONS. THE FILL FROM THE POND EXCAVATION IS TO BE PLACED IN PHASE 1 AS PER PROPOSED GRADING.

7. THE OUTLET CONTROL STRUCTURE IS TO BE INSTALLED ACCORDING TO POND SPECIFICATIONS.

8. RIP RAP IS TO BE PLACED WHERE SPECIFIED TO DISSIPATE SWALE FLOWS. 100–150MM DIAM. RIP RAP IS TO BE USED FOR A MINIMUM THICKNESS OF 300MM. THE RIP RAP IS TO BE LINED WITH TERRAFIX 270R FILTER CLOTH (OR APPROVED EQUIVALENT).

9. SEDIMENT TRAPS ARE TO BE CONSTRUCTED WHERE SPECIFIED TO ALLOW PROPER DRAINAGE AND SILTATION CONTROL. 100–150MM DIAM. RIP RAP IS TO BE USED FOR A MINIMUM THICKNESS OF 300MM. THE RIP RAP IS TO BE LINED WITH TERRAFIX 270R FILTER CLOTH (OR APPROVED EQUIVALENT).

10. REFER TO DRAWING ESC–1a and ESC–1b FOR NOTES & DETAILS.

TREE PROTECTION MEASURES:

1. TREE PROTECTION MEASURES WILL HAVE TO BE IMPLEMENTED PRIOR TO EARTH WORKS TO ENSURE THE TREES IDENTIFIED FOR PRESERVATION ARE NOT IMPACTED BY THE DEVELOPMENT.

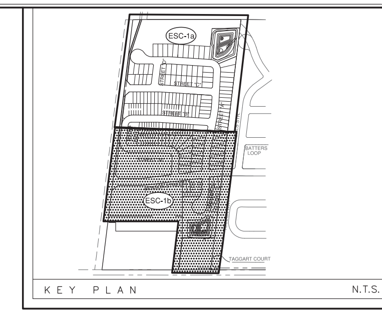
2. THERE WILL BE NO GRADING, FILLING OR STORAGE OF CONSTRUCTION MATERIALS, OR DEBRIS, OR DISTURBANCE OF ANY TYPE WITHIN THE AREAS IDENTIFIED AS A TREE PRESERVATION ZONE (TPZ) ON ESC DRAWINGS AND TREE PRESERVATION REPORT FIGURES # 1, 2 & 3.

3. HAZARD TREES WITHIN THE TREE PROTECTION ZONE WILL BE IDENTIFIED AND REMOVED WITHOUT DAMAGE TO THE PROTECTED TREES. HAZARD TREES WILL HAVE TO BE REMOVED PRIOR TO THE ERECTION OF TREE PRESERVATION FENCING. HAZARD TREES ARE TO FELLED BY HAND (CHAINSAW) WITHOUT THE USE OF MACHINERY WITHIN THE AREAS IDENTIFIED AS A TREE PRESERVATION ZONE. ALL HAZARD TREES ARE TO BE FELLED TOWARDS THE WORKING AREA AND AWAY FROM THE TPZ.

4. A QUALIFIED ARBORIST OR OTHER TREE PROFESSIONAL AS APPROVED BY THE TOWN OF INNISFIL, MUST PRUNE ROOTS OR BRANCHES EXTENDING BEYOND PRESCRIBED TREE PROTECTION ZONE WHICH REQUIRE PRUNING. ALL PRUNING OF TREE ROOTS AND BRANCHES MUST BE IN ACCORDANCE WITH GOOD ARBORICULTURAL STANDARDS.

5. SITE VISITS, PRE, DURING AND POST CONSTRUCTION IS RECOMMENDED BY EITHER A CERTIFIED CONSULTING ARBORIST (I.S.A.) OR REGISTERED PROFESSIONAL FORESTER (R.P.F.) TO ENSURE PROPER UTILIZATION OF TREE PROTECTION BARRIERS. TREES SHOULD ALSO BE INSPECTED FOR DAMAGE INCURRED DURING CONSTRUCTION TO ENSURE APPROPRIATE PRUNING OR OTHER MEASURES ARE IMPLEMENTED.

6. TREE PRESERVATION FENCING SHOULD CONSIST OF PAIGE WIRE FENCING SUPPORTED BY METAL T–BARS AT 3M CENTERS. WHERE TREE PRESERVATION FENCING COINCIDE WITH SEDIMENT FENCING, THE SILTATION FABRIC IS TO BE SUPPORTED ON THE PAIGE WIRE FENCE.



KEY PLAN N.T.S.

LEGEND

EXISTING CULVERT
EXISTING FENCE
CUT-OFF SWALE
DIRECTION OF SURFACE RUNOFF
SILT FENCE
ROCK CHECK DAM
PERIMETER FENCE (PER NOTE ON ESC-3)
CONSTRUCTION ENTRANCE MAT
CB SILTATION INSERT

BENCHMARK NOTE: TOWN OF INNISFIL BENCHMARK # 2001 – 005. ELEVATION = 261.700m. BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.
Township: ALCONA
ELEV. = 261.700m

1. D.J.S. NOV. 16/2015 1st SUBMISSION R.S.

INFRASTRUCTURE AND ENGINEERING SERVICES | TOWN PEER REVIEW ENGINEER

DATE : | DATE :

ACCEPTED FOR CONSTRUCTION

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ROSARIO SACCO

HORIZONTAL

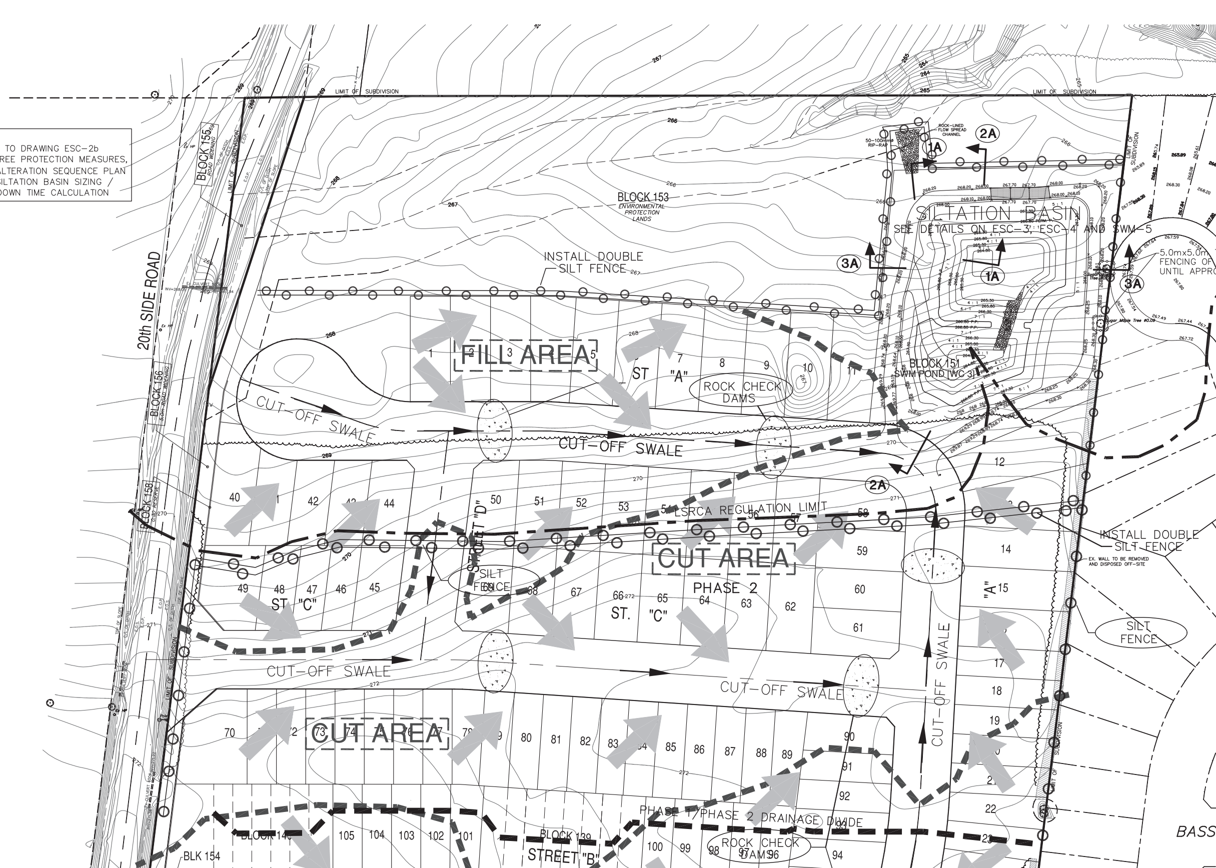
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

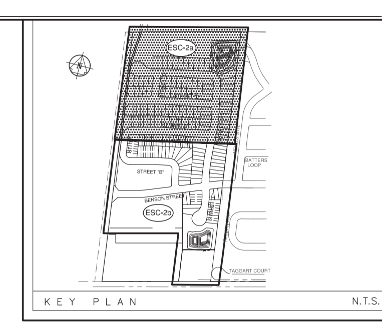
TOWN OF INNISFIL

EROSION AND SEDIMENTATION CONTROL PLAN (SOUTH)
(STAGE 1-TREE REMOVAL/TOPSOIL STRIPPING)

Designed By: D.J.S. | Date: October, 2015 | Checked By: R.S.
Drawn By: V.T. | Approved By:
Scale: 1 : 750 | Project No.: 09002 | Drawing No.: ESC-1b

D12-2013-001





KEY PLAN N.T.S.

LEGEND

EXISTING CULVERT
EXISTING FENCE
CUT-OFF SWALE
DIRECTION OF SURFACE RUNOFF
SILT FENCE
ROCK CHECK DAM
PERIMETER FENCE (PER NOTE ON ESC-3)
CONSTRUCTION ENTRANCE MAT
CB SILTATION INSERT

BENCHMARK NOTE: TOWN OF INNISFIL BENCHMARK # 2001 – 005. ELEVATION = 261.700m. BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.
Township: ALCONA
ELEV. = 261.700m

1. D.J.S. NOV. 16/2015 1st SUBMISSION R.S.

INFRASTRUCTURE AND ENGINEERING SERVICES | TOWN PEER REVIEW ENGINEER

DATE : | DATE :

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CONSULTANT

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ROSARIO SACCO

HORIZONTAL

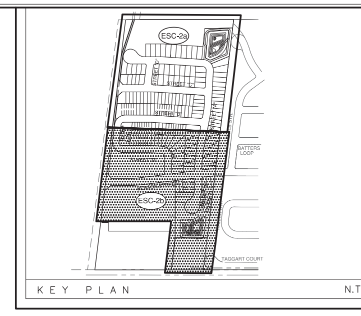
PROJECT
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

MUNICIPALITY
TOWN OF INNISFIL

TITLE
EROSION AND SEDIMENTATION CONTROL PLAN (NORTH)
(STAGE 2 - GRADING)

Designed By: D.J.S. | Date: October, 2015 | Checked By: R.S.
Drawn By: V.T. | Approved By:
Scale: 1 : 750 | Project No.: 09002 | Drawing No.: ESC-2a

D12-2013-001



LEGEND

- EXISTING CULVERT
- EXISTING FENCE
- CUT-OFF SWALE
- DIRECTION OF SURFACE RUNOFF
- SILT FENCE
- ROCK CHECK DAM
- PERIMETER FENCE (PER NOTE ON ESC-3)
- CONSTRUCTION ENTRANCE MAT
- CB SILTATION INSERT

STAGE 2 SITE ALTERATION SEQUENCING PLAN:

1. PHASE 1 AND 2 IS TO BE GRADED TO PRE-GRADE LEVELS RESULTING IN THE RAISED ELEVATION OF THE ENTIRE PHASE AREA BY APPROXIMATELY 1.0 TO 1.5M. GRADING OF PHASE 2 AREA WITHIN THE LSRCA FILL REGULATION LIMIT IS TO BE DEFERRED UNTIL ISSUANCE OF LSRCA PERMIT APPROVAL.

2. STAGE 2 ADDITIONAL SWALES ARE TO BE PLACED WHERE SPECIFIED TO DIRECT FLOW TO THE TEMPORARY SEDIMENT POND. ROCK CHECK DAMS ARE TO BE PLACED IN THE PROPOSED SWALE. THE DAMS ARE TO BE SPACED SUCH THAT THE BOTTOM ELEVATION OF THE UPSTREAM DAM IS EQUAL TO THE TOP ELEVATION OF THE DOWNSTREAM DAM.

3. RIP RAP IS TO BE PLACED WHERE SPECIFIED TO DISSIPATE SWALE FLOWS. 100-150. DIAM. RIP RAP IS TO BE USED FOR A MINIMUM THICKNESS OF 300MM DIAM. THE RIP RAP IS TO BE LINED WITH TERRAFIX 270R FILTER CLOTH (OR APPROVED EQUIVALENT).

4. REFER TO DRAWING ESC-5 & ESC-6 FOR NOTES & DETAILS.

5. SERVICING FOR THE PROPOSED STORM SEWER SYSTEM AND OUTFALL TO STORM WATER MANAGEMENT POND IS TO BE INSTALLED UPON RECEIPT OF MOE APPROVAL.

6. TEMPORARY DITCH INLET CATCHBASINS ARE TO BE INSTALLED WHERE SPECIFIED TO DIRECT SWALE AND OVERLAND FLOW FROM FUTURE PHASES AND AREAS OF PROPOSED DWELLING CONSTRUCTION TO THE STORM SYSTEM.

7. FOR STORM SEWER DETAILS AND INFORMATION REFER TO PLAN AND PROFILE DRAWINGS AND STORM DRAINAGE PLANS.

8. SWALES ARE TO BE PLACED, AND NOT LIMITED TO, WHERE SPECIFIED TO DIRECT FLOW TO PROPOSED INLET POINTS. SHOULD PONDING WATER BE FOUND IN AREAS OF PROPOSED DWELLING CONSTRUCTION, SWALES ARE BE CONSTRUCTED AS DIRECTED IN THE SAME MANNER AS THOSE SHOWN. ROCK CHECK DAMS ARE BE PLACED IN THE SWALES AND ARE TO BE SPACED SUCH THAT THE BOTTOM ELEVATION OF THE UPSTREAM DAM IS EQUAL TO THE TOP ELEVATION OF THE DOWNSTREAM DAM.

TREE PROTECTION MEASURES:

1. TREE PROTECTION MEASURES WILL HAVE TO BE IMPLEMENTED PRIOR TO EARTH WORKS TO ENSURE THE TREES IDENTIFIED FOR PRESERVATION ARE NOT IMPACTED BY THE DEVELOPMENT.

2. THERE WILL BE NO GRADING, FILLING OR STORAGE OF CONSTRUCTION MATERIALS, OR DEBRIS, OR DISTURBANCE OF ANY TYPE WITHIN THE AREAS IDENTIFIED AS A TREE PRESERVATION ZONE (TPZ) ON ESC DRAWINGS AND TREE PRESERVATION REPORT FIGURES # 1, 2 & 3.

3. HAZARD TREES WITHIN THE TREE PROTECTION ZONE WILL BE IDENTIFIED AND REMOVED WITHOUT DAMAGE TO THE PROTECTED TREES. HAZARD TREES WILL HAVE TO BE REMOVED PRIOR TO THE ERECTION OF TREE PRESERVATION FENCING. HAZARD TREES ARE TO FELLED BY HAND (CHAINSAW) WITHOUT THE USE OF MACHINERY WITHIN THE AREAS IDENTIFIED AS A TREE PRESERVATION ZONE. ALL HAZARD TREES ARE TO BE FELLED TOWARDS THE WORKING AREA AND AWAY FROM THE TPZ.

4. A QUALIFIED ARBORIST OR OTHER TREE PROFESSIONAL AS APPROVED BY THE TOWN OF INNISFIL, MUST PRUNE ROOTS OR BRANCHES EXTENDING BEYOND PRESCRIBED TREE PROTECTION ZONE WHICH REQUIRE PRUNING. ALL PRUNING OF TREE ROOTS AND BRANCHES MUST BE IN ACCORDANCE WITH GOOD ARBORICULTURAL STANDARDS.

5. SITE VISITS, PRE, DURING AND POST CONSTRUCTION IS RECOMMENDED BY EITHER A CERTIFIED CONSULTING ARBORIST (I.S.A.) OR REGISTERED PROFESSIONAL FORESTER (R.P.F.) TO ENSURE PROPER UTILIZATION OF TREE PROTECTION BARRIERS. TREES SHOULD ALSO BE INSPECTED FOR DAMAGE INCURRED DURING CONSTRUCTION TO ENSURE APPROPRIATE PRUNING OR OTHER MEASURES ARE IMPLEMENTED.

6. TREE PRESERVATION FENCING SHOULD CONSIST OF PAIGE WIRE FENCING SUPPORTED BY METAL T-BARS AT 3M CENTERS. WHERE TREE PRESERVATION FENCING COINCIDE WITH SEDIMENT FENCING, THE SILTATION FABRIC IS TO BE SUPPORTED ON THE PAIGE WIRE FENCE.

BENCHMARK NOTE: TOWN OF INNISFIL BENCHMARK # 2001 - 005. ELEVATION = 261.700m. BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.
Township: ALCONA
ELEV. = 261.700m

No.	By	Date	Revision	Checked
1.	D.J.S.	NOV 16/2015	1st SUBMISSION	R.S.

INFRASTRUCTURE AND ENGINEERING SERVICES — DATE :
TOWN PEER REVIEW ENGINEER — DATE :

ACCEPTED FOR CONSTRUCTION

URBAN ECOSYSTEMS LIMITED
7050 WESTON ROAD, SUITE 705
WOODBRIDGE, ONTARIO L4L 8G7
t. (905)856-0629
f. (905)856-0698

ROSARIO SACCO — NOV 16, 2015 — PROVINCE OF ONTARIO

HORIZONTAL

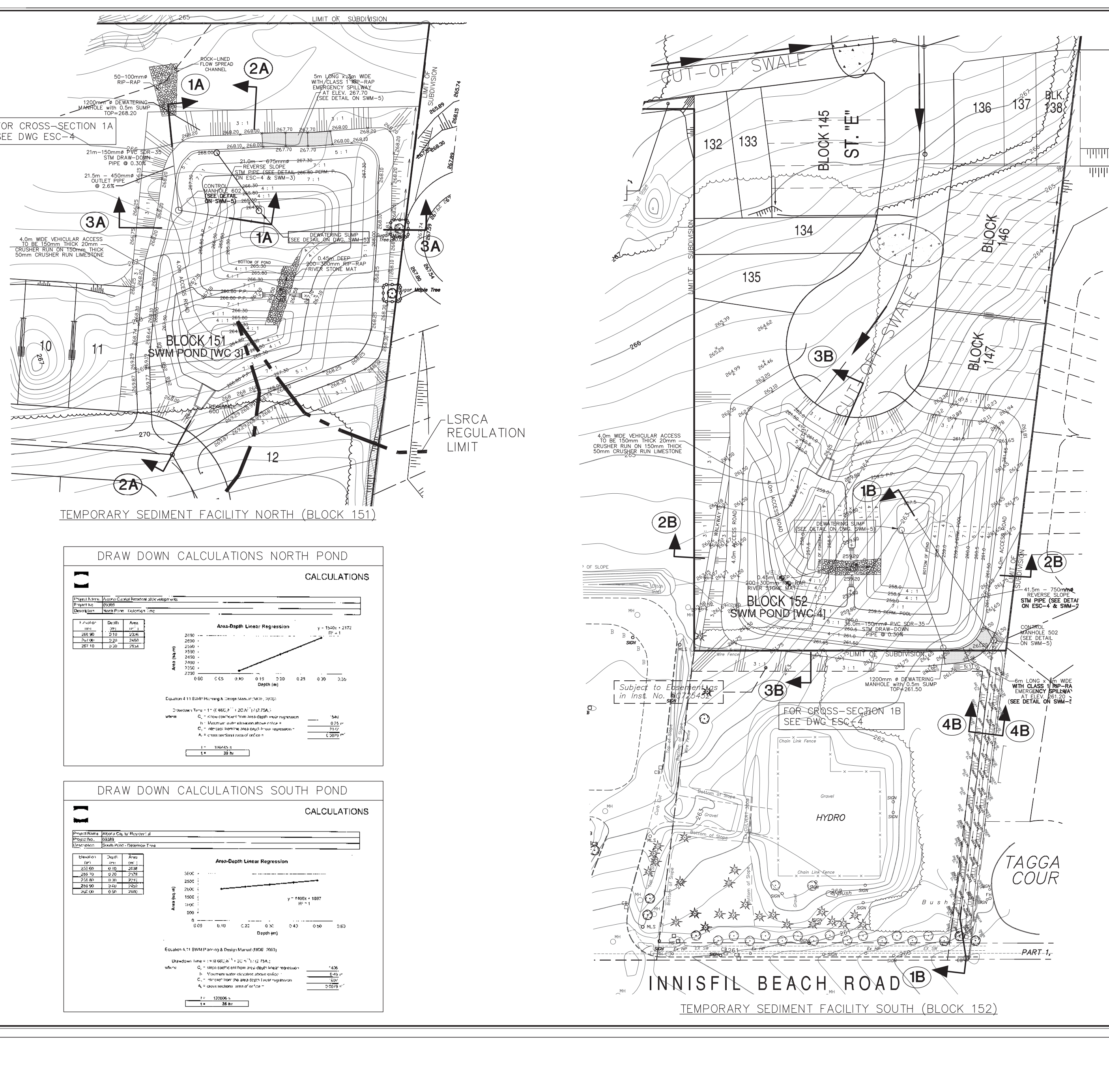
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

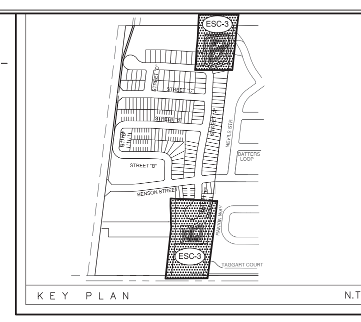
TOWN OF INNISFIL

EROSION AND SEDIMENTATION CONTROL PLAN (SOUTH)
(STAGE 2 - GRADING)

Designed By: D.J.S.	Date: October, 2015	Checked By: R.S.
Drawn By: V.T.		Approved By:
Scale: 1 : 750	Project No. 09002	Drawing No. ESC-2b

D12-2013-001





BENCHMARK NOTE: TOWN OF INNISFIL BENCHMARK # 2001 - 005. ELEVATION = 261.700m. BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.
Township: ALCONA
ELEV. = 261.700m

No.	By	Date	Revision	Checked
1.	D.J.S.	NOV 16/2015	1st SUBMISSION	R.S.

INFRASTRUCTURE AND ENGINEERING SERVICES — DATE :
TOWN PEER REVIEW ENGINEER — DATE :

ACCEPTED FOR CONSTRUCTION

URBAN ECOSYSTEMS LIMITED
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ROSARIO SACCO — NOV 16, 2015 — PROVINCE OF ONTARIO

HORIZONTAL

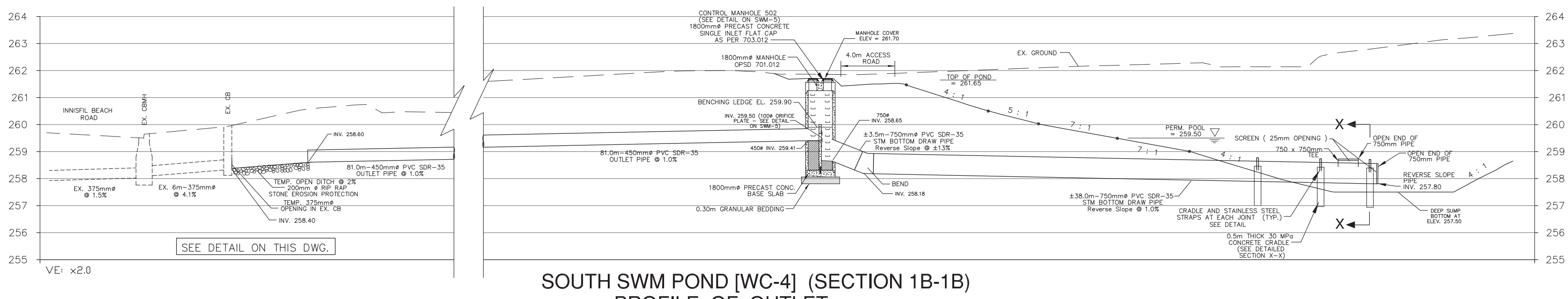
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

TOWN OF INNISFIL

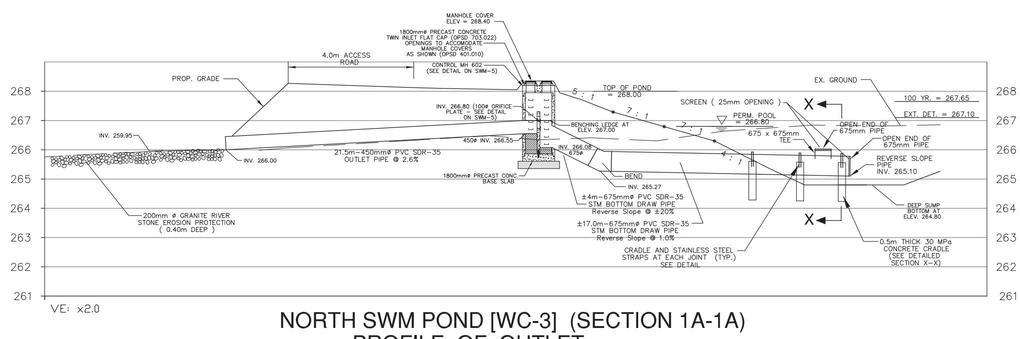
EROSION AND SEDIMENTATION CONTROL
TEMPORARY SILTATION BASINS

Designed By: D.J.S.	Date: October, 2015	Checked By: R.S.
Drawn By: V.T.		Approved By:
Scale: 1 : 500	Project No. 09002	Drawing No. ESC-3

D12-2013-001



SOUTH SWM POND [WC-4] (SECTION 1B-1B)
PROFILE OF OUTLET
FROM DEEP SUMP TO INNISFIL BEACH ROAD



NORTH SWM POND [WC-3] (SECTION 1A-1A)
PROFILE OF OUTLET
FROM DEEP SUMP TO HEADWALL

BENCHMARK NOTE
Township: ALCONA
ELEV. = 261.700m
TOWN OF INNISFIL BENCHMARK # 2001 – 005. ELEVATION = 261.700m BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.

No.	By	Date	Revision	Checked
1.	D.J.S.	NOV 16/2015	1st SUBMISSION	R.S.

INFRASTRUCTURE AND ENGINEERING SERVICES

TOWN PEER REVIEW ENGINEER

DATE :

ACCEPTED FOR CONSTRUCTION

URBAN ECOSYSTEMS LIMITED
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ROSARIO SACCO
NOV 16, 2015

HORIZONTAL

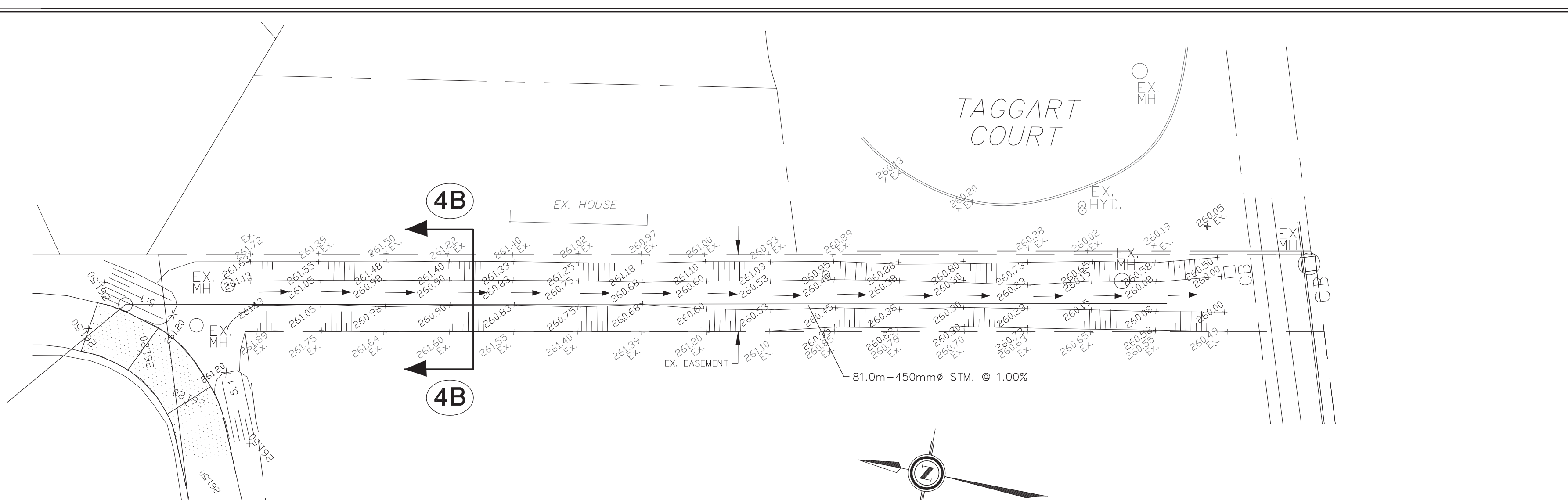
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

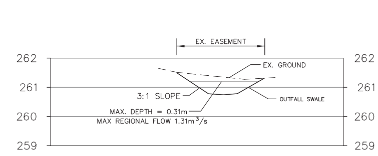
TOWN OF INNISFIL

EROSION AND SEDIMENTATION CONTROL
TEMPORARY SILTATION BASINS
CROSS-SECTIONS AND DETAILS

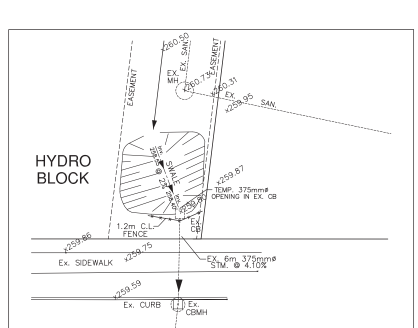
Designed By	D.J.S.	Date	October, 2015	Checked By	R.S.
Drawn By	V.T.			Approved By	
Scale:	1 : 150 horiz 1 : 75 vert	Project No.	09002	Drawing No.	ESC-4

D12-2013-001





SOUTH POND (SECTION 4B-4B)
OUTFALL SWALE THROUGH EASEMENT



TEMPORARY SOUTH POND OUTLET
N.T.S.

BENCHMARK NOTE
Township: ALCONA
ELEV. = 261.700m
TOWN OF INNISFIL BENCHMARK # 2001 – 005. ELEVATION = 261.700m BRASS CAP IN SOUTHWEST CORNER OF HYDRO SUBSTATION ON NORTH SIDE OF INNISFIL BEACH ROAD.

No.	By	Date	Revision	Checked
1.	D.J.S.	NOV 16/2015	1st SUBMISSION	R.S.

INFRASTRUCTURE AND ENGINEERING SERVICES

TOWN PEER REVIEW ENGINEER

DATE :

ACCEPTED FOR CONSTRUCTION

URBAN ECOSYSTEMS LIMITED
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ROSARIO SACCO
NOV 16, 2015

HORIZONTAL

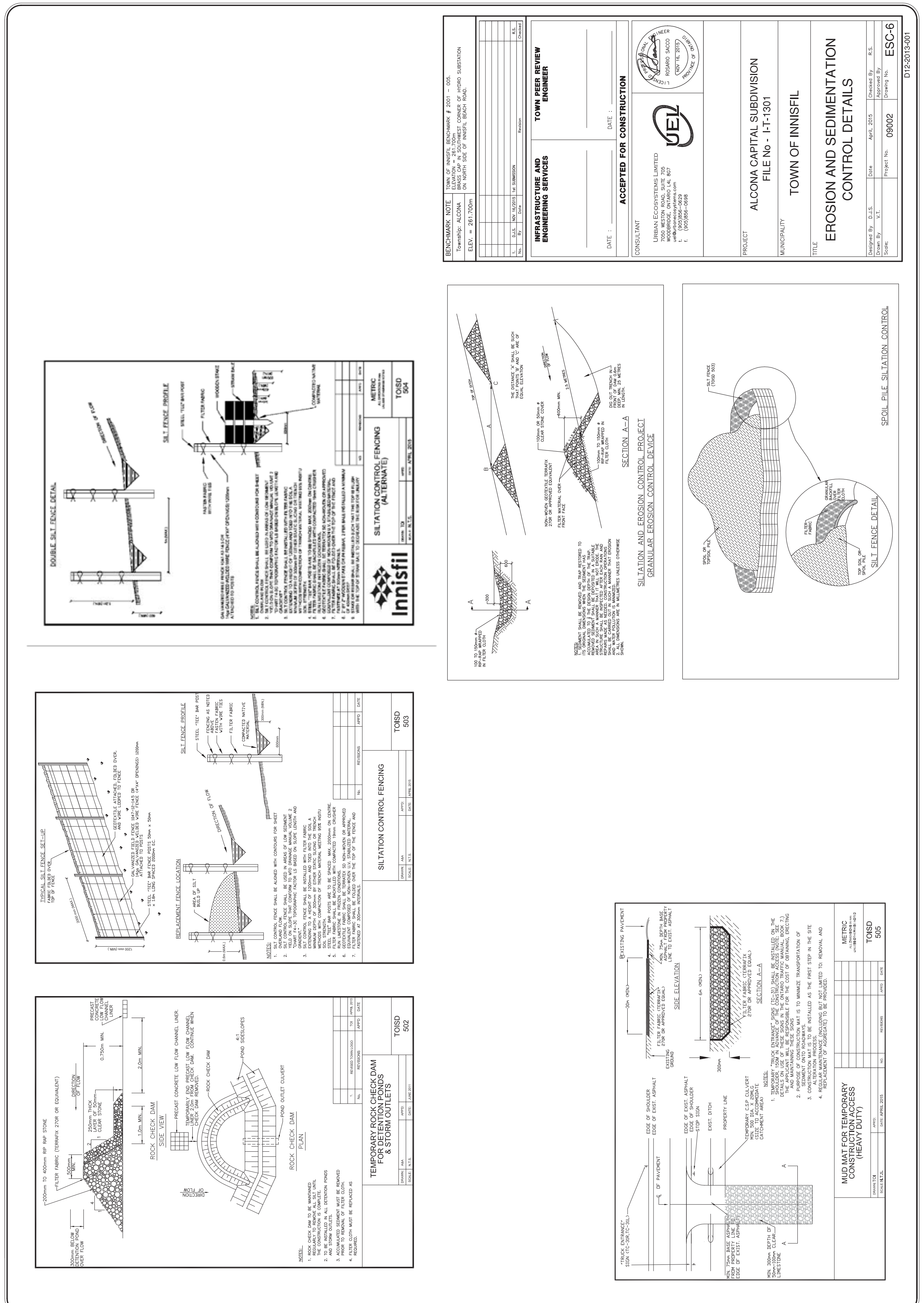
ALCONA CAPITAL SUBDIVISION
FILE No - I-T-1301

TOWN OF INNISFIL

SOUTH SWM POND
OUTFALL DETAILS
(TEMPORARY SCENARIO)

Designed By	D.J.S.	Date	April, 2015	Checked By	R.S.
Drawn By	V.T.			Approved By	
Scale:	1 : 150 horiz 1 : 75 vert	Project No.	09002	Drawing No.	ESC-5

D12-2013-001



May 3, 2016

Ms. Lisa-Beth Bulford, M.Sc.
Development Planner
Lake Simcoe Region Conservation Authority
120 Bayview Avenue
Newmarket ON L3Y 4X1

Our ref: /2820551/09389

Dear Ms Bulford,

RE: Alcona Capital Properties
Stormwater Management Report Addendum

Please find enclosed an Addendum to the Stormwater Management Report (the Report) issued by our office for the above site in November 2015. The addendum contains complementary information to the Report, it should therefore be read in conjunction with the Report. The addendum also provides support to our response to your comments dated March 17, 2016; we have included our response to your comments as an attachment for your convenience.

The content of the addendum was pre-consulted with the Conservation Engineer in charge of the file through email and telephone communications. In general terms, the addendum provides supplementary information about the proposed stormwater management treatment train approach for the Site, illustrates design details of the proposed LID, updates the phosphorous budget calculations and documents minor changes to the design of the proposed SWM ponds.

Since minor changes were made to the geometry of the ponds to address your comments, Appendix C, Figures 4 and 5, and page 12 of the report were updated accordingly. For your convenience, we have included the updated report content as an attachment to the addendum.

We trust that the information provided in this addendum addresses all your outstanding concerns. If you have any questions, please do not hesitate to contact the undersigned at your convenience.

Sincerely
GHD Limited

Abraham J. Barrios, P.Eng.
Senior Water Resources Engineer
905-814-4377

Scott Passmore, P.Eng.
Service Group Manager, Community Development
905-814-4383

Alcona Development Addendum to the SWM Report, May, 2016

The contents of this *Addendum to the SWM Report* provide supporting information to our response to the LSRCA comments dated March 17, 2016. As such, this addendum should be read in conjunction with the Report and our *Response to Comments* dated May 2, 2016, which can be found in **Attachment A**. Please note that Attachment A also contains a copy of our joint response (with Cole Engineering) to the *Hydrogeological Investigation Comments* provided by the LSRCA on September 27, 2013.

1. **SWM Treatment Train Approach**

The SWM strategy for the Site includes a comprehensive treatment train approach that features SWM best management practices (BMP) at the lot, conveyance and end of pipe levels.

Lot level BMP include rain gardens/infiltration trenches at the front yards of all single-detached lots. The infiltration trenches will be the default features during construction, the choice of turning an infiltration trench into a rain garden will be left to the homeowner. For the purposes of water balance and phosphorous removal calculations, no distinction will be made between infiltration trenches and rain gardens. As a conservative measure, the impact of the proposed infiltration trenches/rain gardens on quantity control objectives has not been considered in the design of the proposed SWM facilities.

Conveyance level BMP include property grassed swales. Although their impact on stormwater quantity control (infiltration) and quality enhancement (TSS removal) is not credited in any design calculation in the Report, grassed swales will be permanent fixtures and should be therefore considered part of the treatment train from a qualitative perspective.

End of pipe BMP include two wet ponds that provide stormwater quantity and quality controls to the proposed development. The ponds are described in detail in the Report. A qualitative summary of the proposed treatment train approach is presented in **Table 1** below:

Table 1: Alcona Development Proposed SWM Treatment Train

SWM Criteria	Lot Level Measure	Conveyance Measure	End of pipe Measure
Water quantity	Infiltration Trench / Rain garden storage	Swale and sewer storage	Wet pond, active storage
Water quality	Infiltration Trench / Rain garden capture and filtration treatment	Grassed swale treatment by property line swales	Wet pond, sediment forebay treatment
Water balance	Infiltration Trench / Rain garden retention and infiltration Backyard infiltration	Property line swale infiltration	
Phosphorous removal	Infiltration Trench / Rain garden capture and infiltration	Property line swale infiltration	Wet pond, permanent pool treatment

2. **Infiltration Trenches / Rain Gardens**

For the purposes of this addendum, infiltration trenches and rain gardens are equivalent LID features. The 137 single detached lots will be constructed with an infiltration trench in the lowest point of the front yards. The default surface of the infiltration trench will be grass; the homeowner would have the option to convert the infiltration trench into a rain garden as a landscaping add-on.

The preliminary design in the Report indicates that 82 rain gardens with an average volume of 10 m^3 would capture and infiltrate the first 16 mm of runoff from roofs, front yards and driveways. However, town grading guidelines do not allow driveways to drain to the front yards.

The revised infiltration trench design excludes driveways. The trenches will receive clean flows from the roof leads via underground pipes and the runoff from most of the front yards. They will be sized to retain and/or induce infiltration volumes corresponding to approximately 18 mm over their estimated drainage areas. Front yard grading around the infiltration trenches will allow for the overflow of excess runoff to exit the site via property swales.

The typical infiltration trench will measure 3.5 m x 2.0 m x 1 m for an average size of 7 m^3, which for highly permeable material with a 40% void ratio translates into 2.8 m^3 of storage. The revised design provides a total storage of 959 m^3, which exceeds the 820 m^3 originally proposed in the Report to meet the water balance objectives. Updated Appendix D of the Report containing the location of the proposed infiltration trenches, design calculations and grading details of a typical lot with a rain garden can be found in **Attachment B1**.

3. **SWM Pond Length to Width Ratio**

The length to width ratios of both ponds were enhanced by redesigning the berms between the sediment forebays and main cells as shown in updated Figures 4 and 5 in **Attachment B**. The berms were raised to approximately the extended detention levels to allow for longer flow pathways during most precipitation events. The updated Appendix C of the Report (SWM pond design calculations) can be found in **Attachment B2** of this addendum. A partial summary of key design features and updated storage and level values is presented in **Table 2**:

Table 2: Updated SWM Facility Values

Parameter	North Pond	South Pond
Drainage Area (ha)	5.29	8.58
Design Imperviousness (%)	60	60
Permanent Pool Volume Required (m^3)	838	1,360
Permanent Pool Volume Provided (m^3)	1,373	1,363
Permanent Pool Elevation (m)	266.80	259.50
Sediment Forebay length-to- width ratio	2	2
Extended Detention (25 mm storm) Volume (m^3)	622	1,091
Extended Detention Release Time (h)	26	35
Extended Detention Water Level (m)	267.08	260.01
100 year storm elevation (m)	267.63	261.00
100 year storm storage (m^3)	2,272	4,174
Top of facility (m)	268.10	261.50
SWM Facility length-to-width ratio	5.3	4.9

It was assumed that the impact of the minor changes to the geometry of the ponds would have no significant impact on the rating curves of the ponds.

4. **Phosphorous Budget**

The phosphorous budget referenced in Section 3.6 of the Report has been updated to reflect the use of a high intensity residential coefficient (where applicable) and the proposed infiltration trenches on overall site phosphorous removal during post-development conditions.

Changes with respect to the Report include the following:

a) A high intensity residential development coefficient was used for the portion of the site that does not drain first to the proposed infiltration trenches.

b) Given the limited input options provided by the MOECC Tool, a low intensity residential development coefficient was chosen for the roofs draining to the proposed infiltration trenches under the assumption that roofs do not contribute significant amounts of phosphorous to storm runoff. Furthermore, the phosphorous removal efficiency of the infiltration trenches with respect to roof runoff was set to 87 % on the basis that the design storage of the trenches (18 mm of rain), is greater than 87 % of all precipitation occurrences in the City of Toronto according to the City of Toronto Wet Weather Flow Management Guidelines.

c) A low intensity residential coefficient was chosen for the portions of the front yards draining to the proposed infiltration trenches on the basis that according to the MOECC tool guidelines this coefficient can be applied to low imperviousness, "manicured" lawns.

d) An "open water" coefficient and high removal rates were used for the SWM blocks on the basis that the permanent pools can be considered open water, no significant phosphorous contribution is expected from the SWM blocks, well-established vegetation will act as filter strips and the particular grading will prevent local runoff from leaving the blocks.

The MOECC tool results indicate that the site will not meet the phosphorus removal objectives; however, consideration must be given to the fact that the theoretical 63% removal efficiency provided by the wet pond is a significant factor. Since sizing of the ponds does not take into consideration the impact on peak flows to be provided by the proposed infiltration trenches and storm conduits, it is conceivable that the ponds may have a better phosphorous removal performance than theoretically assumed. Additional factors that may result in an enhanced phosphorous removal performance by the ponds include permanent pool depths of 2.0 m, larger extended storage volumes and length to width ratios greater than 4. The updated Appendix E of the Report (phosphorous budget calculations) can be found in **Attachment B3**.

Attachments:

Attachment A: Response to Comments

Attachment B: Updated SWM Report Content

Attachment B1: Updated Appendix D Water Balance/LID Design Calculations

Attachment B2: Updated Appendix C SWM Pond Calculations

Attachment B3: Updated Appendix E Phosphorous Budget

May 3, 2016

Ms. Lisa-Beth Bulford, M.Sc.
Development Planner
Lake Simcoe Region Conservation Authority
120 Bayview Avenue
Newmarket ON L3Y 4X1

Our ref: /2820551/09389

Dear Sir,

RE: Alcona Capital Properties
Stormwater Management Report

Further to your letter via email of March 17, 2016, we offer the following response to your comments (in blue):

1. Comment has been addressed.
2. Comment has been addressed.
3. Comment has been addressed.
4. Comment has been addressed.
5. Comment has been addressed.
6. Comment has been addressed.
7. **We confirm that the proposed imperviousness levels will be below 60%, please refer to imperviousness calculations in Attachment 1.**
8. Comment has been addressed.
9. Comment has been addressed.
10. **According to *as-constructed* drawings for the Pratt Alcona North Subdivision (existing subdivision to the east of the Site), the existing 2.33 ha portion of the Site that drains east has been accounted for as an external drainage area. Please refer to Attachment 2 for details.**
11. Comment has been addressed.
12. Comment has been addressed.
13. **The 100 year elevation is shown in drawings SWM-1 to SWM-5. The supporting information for flood line calculations is contained in the updated Appendix C of the report, which is included in the Addendum to the SWM Report.**
14. Comment has been addressed.
15. Comment has been addressed.
16. Comment has been addressed.
17. **f) The post-development Stantec Model was rerun. We confirm that the diversion was accounted for in the post-development flows. Please refer to Attachment 3.**
18. Comment has been addressed.
19. Comment has been addressed
20. Comment has been addressed
21. Comment has been addressed
22. Comment has been addressed
23. **Additional information concerning the proposed LID includes calculations, drawings and design criteria and is provided in the Addendum to the SWM Report. A detailed description of the proposed treatment train approach is also provided in the Addendum.**
    a) **The purpose of the proposed LID is to meet the water balance objectives and contribute to the phosphorous removal targets. The proposed LID are designed to receive clean water from the roofs and front yards only. A summary of the proposed treatment train approach is provided in Section 1 of the Addendum to the SWM Report**
    b) **Due to Town grading standard limitations it is not possible to direct the runoff from driveways to the proposed rain gardens. As a result the rain garden design has been revised to receive flows from roofs and front yards only. Design details of the revised rain garden are provided in the Addendum to the SWM Report.**
    c) **Preliminary design details of the typical rain garden are provided in the Addendum to the SWM Report.**
    d) **The proposed LID will be located within the front yards of the lots, where access for maintenance purposes can take place. A figure showing the approximate location of the proposed LID is provided in the Addendum to the SWM Report.**
24. **The proposed treatment train approach is documented in Section 1 of the Addendum to the SWM Report**
25. Comment has been addressed
26. Comment has been addressed
27. Comment has been addressed
28. Comments will be provided at the detailed design stage on erosion and sediment control.
29. **The version of Visual Otthymo used in the last submission is 3.0. A CD containing the latest VH files (Visual Otthymo 3.0) is included with the Addendum to the SWM Report.**

30. Full versions of the VH output files are provided in pdf format in the CD included with the Addendum to the SWM Report.

31. The referenced typo has been corrected. A new Page 12 of the SWM Report has been included in Attachment B of the Addendum to the SWM Report.

32. The length-to-width ratios of the proposed ponds have been enhanced and the pond design revised accordingly, please refer to Section 3 of the Addendum to the SWM Report for details.

33. Specifications for the proposed SWM pond liners can be found in Attachment 4.

34. The Phosphorous budget has been revised with a “high intensity residential” coefficient as requested. It was also modified to assess the impact of the proposed LID on phosphorous removal. The updated phosphorous budget is discussed in Section 4 of the Addendum to the SWM Report.

I trust that your outstanding concerns have been addressed. If you have any questions regarding the above, please do not hesitate to contact the undersigned at your convenience.

Sincerely
GHD Limited

Abraham J. Barrios, P.Eng.
Senior Water Resources Engineer
905-814-4377

Attachments:

1. Imperviousness calculations
2. Pratt Alcona Subdivision As-Constructed Drainage Plan
3. Stantec Model Diagram
4. SWM Pond Liner Specifications

COLE ENGINEERING
Experience Enhancing Excellence

May 2, 2016
Our Ref: E10-223

Lake Simcoe Region Conservation Authority
120 Bayview Parkway, Box 282
Newmarket, Ontario L3Y 4X1

Attention: **Ms.** Charles F. Burgess, MCIP, RPP
Senior Planning Coordinator

Dear Mr. Burgess:

Re: Hydrogeological Investigation Comment Response
Draft Plan of Subdivision
Your File: 1-T-1301 (Alcona Capital Properties Inc.)
Primary Settlement Area of Alcona, Town of Innisfil, County of Simcoe

Cole Engineering Group Ltd. (CEG) is pleased to provide responses to the Lake Simcoe Region Conservation Authority (LSRCA) comments provided on September 27, 2013, on the Hydrogeological Investigation (December 2010) and Groundwater Level Monitoring Report (June 2011) related to the proposed residential development in the Primary Settlement Area of Alcona.

Comment 1: The reports should be amended to confirm the total area (hectares) of the subject property.

Response 1: The site area is 15.3 hectares. Reports will be modified accordingly.

Comment 2: The water balance assessment was based on the modelling system Water Balance Analysis System (WABAS) developed by Cole Engineering Group Ltd., and not the Thornthwaite and Mather approach. Cole Engineering should provide additional details regarding Table 14; in particular the tabulated results for the outputs (per unit area) for the two catchments as outlined in Table 2 (page 32) of the Hydrogeological Assessment Submissions Guidelines (June 2013).

Response 2: The initial water balance analysis conducted by CEG was completed using WABAS software. The WABAS software computes the water balance based on the similar algorithms used by Guelph All-Weather Sequential-Events Runoff (GAWSER) model. The infiltration in the WABAS model was estimated using Darcy’s Law. Both the WABAS model and the Thornthwaite and Mather method are based on the same theory and should produce similar water balance results.

Table 14 provides the pre-development and post-development values in mm/year per unit area for the north and south catchments. The volumes would be as shown below:

Catchment	Precipitation	Pre-Development	Post-Development

COLE ENGINEERING GROUP LTD.
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Markham, ON CANADA
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T. 905.940.6161 | 416.987.6161
F. 905.940.2064
www.ColeEngineering.ca

		Runoff (m³/yr)	GWI (m³/yr)	ET (m³/yr)	Runoff (m³/yr)	GWI (m³/yr)	ET (m³/yr)
North	61,812	9,656	16,388	35,292	32,232	9,044	19,176
South	77,265	13,515	20,060	43,095	41,480	10,710	23,120

The water balance was recalculated using the Thornthwaite and Mather method as described in the Hydrogeological Assessment Submissions (June 2013) guidance document.

The results are attached to this response letter in Attachment 1.

Comment 3: It appears the sites imperviousness was "inferred based on typical urban design practices" (page 14, December 2010). The impervious surface area (i.e. buildings, roads/driveways) needs to be confirmed for the post-development water balance based on the proposed plan of subdivision. Real numbers within the water balance calculations should be provided.

Response 3: A combination of the site plan and aerial imagery for the subdivision to the east of the site was used to calculate impervious areas. A sample developed lot layout is provided in Attachment 1.

Comment 4: The purpose of Policy 4.8-DP is to ensure there is no loss in infiltration from pre-development to post-development conditions. Page 23 of the Hydrogeological Report (December 2010) report indicates that "the implementation of best management practices will be able to help increase the amount of infiltration to the aquifer system, and minimize the environmental impacts of the development". The report should include a post-development water balance assessment with mitigation measures. Details on the post-development mitigation measures to address the additional runoff and reduced infiltration produced from development impacts should also be provided. Details should include location of enhanced infiltration, the volume/rate and condition of soils to support water being infiltrated. All calculations should be provided in a table format which clearly demonstrates that input (precipitation, additional runoff etc.) are equal to outputs (infiltration, runoff etc.)

Response 4: The water balance section of the SWM Report has been updated to discuss the proposed post development mitigation measures, which include rain gardens and infiltration trenches at the lot level. Please refer to the latest SWM Report and Addendum to the SWM Report dated May, 2016 for details.

Comment 5: Page 20 of the Hydrogeological Report (December 2010) noted that "the estimated reduction of infiltration to the regional aquifer system as a result of the proposed development is small and is not expected to have an influence on the overall function of the groundwater system in the Lake Simcoe Watershed." It is unacceptable to compare pre and post development infiltration losses within the north and south catchments to the overall area of the subwatershed. It is recommended that especially in areas delineated as Significant Groundwater Recharge Areas, pre-development infiltration should be matched in the post development scenarios utilizing low impact development solutions.

Response 5: The proposed subdivision design incorporates LID measures that enhance post-development infiltration conditions. Please refer to the latest SWM Report and Addendum to the SWM Report dated May, 2016.

Comment 6: It is unclear how the existing grade will change with the proposed development and what impacts there will be to surface drainage. In addition, it is unclear where existing infiltration is occurring on-site and how the proposed use will affect these infiltration areas in a post development situation. Please identify how the existing grade will change with the proposed development and what are the anticipated impacts to surface drainage/infiltration on the site (i.e. where will runoff be directed to, where will infiltration be occurring, etc.)

Response 6: The proposed grading and LID location plans provide details about the direction of surface drainage and location of infiltration-enhanced areas. Please refer to the latest SWM Report and Addendum to the SWM Report dated May, 2016 for additional details.

Comment 7: The December 2010 report recommended that a pumping test be carried out during detailed design, to better characterize the aquifer formation, establish the zone of influence and anticipated dewatering rates as a result of construction-related dewatering. We concur with the report's recommendation to complete a pumping test. Cole Engineering should also provide documentation of the pumping test including rate and duration, water level data in the form of hydrographs from observation wells used to measure impacts (i.e. shallow and deep aquifer units, mini piezometers in surface water features, nearby private wells), along with documentation of the test and data interpretations including calculated zone of influence, distance-drawdown, etc.

The report should also include an assessment of the potential for short term impacts during and post construction activities on a site-specific scale and long term impacts (time delay responses) associated with regional and local groundwater systems and their effects on existing well users and the natural environment.

Response 7: Cole Engineering has resumed the monitoring of groundwater level at onsite monitoring wells, nearby private wells and surface water monitoring at Lenoard's Creek near the northern portion of the Site since early 2015. Based on the information collected during the 2010 hydrogeological investigation and the ongoing monitoring, we believe we have sufficient amount of information to complete the dewatering calculations and to estimate dewatering zone of influence, therefore, a pumping test will not be required to collect additional information. Prior to construction dewatering, a Permit to Take Water or a registry on the Environmental Activity and Sector Registry (EASR) will be applied to facilitate the construction dewatering. The application will include estimation of dewatering rates, zone of influence, assessment of potential impacts and proposed monitoring and mitigation activities to be implemented during construction dewatering.

Comment 8: We concur with the report's recommendation that prior to construction, a dewatering discharge plan be prepared to assess the quantity and quality of dewatering discharge as well as assess the assimilative capacity of the receiving water bodies.

Response 8: Acknowledged. The dewatering discharge plan will be prepared and included as part of the Permit to Take Water or Environmental Activity and Sector Registry application.

Comment 9: Based on the June 11 water level report, the water level data suggests both the shallow and deep groundwater flow systems show similar trends suggesting the presence of permeable windows which have the potential for a hydraulic connection between the two systems. Also a reversal in the vertical hydraulic gradient was observed between monitor MW-01S and D and a very close gradient in MW-04S and D was noted between September November 2010. This suggests the site may be contributing to limited seasonal groundwater discharge conditions.

Response 9: Based on 2015 monitoring results, water levels from two on-site nested wells (MW-01S/MW-01D, MW-04S/MW-04D) generally showed a downward vertical hydraulic gradient with a magnitude ranging between 0.01 m/m and 0.31 m/m. Monitoring well nest MW-01S/MW-01D located near the southern portion of the Site showed slight upward vertical hydraulic gradient (0.03 m/m to 0.04 m/m) on two occasions. Both events were in October and are likely due to the seasonally low shallow groundwater table, which likely have a larger magnitude of seasonal fluctuations compared to the deeper groundwater level.

Comment 10: For future water balance assessments prepared to implement Policy 4.8-DP, Cole Engineering should refer to the MOEE Hydrogeologic Technical Information Requirements for Land Development Applications (1995) for basic guidelines and the Hydrogeological Assessments Conservation Authority Guidelines to Support Development Applications (June 2013) for more explanation and an example on completing water balances.

Response 10: Acknowledged. The water balance analysis will be completed by GHD.

Yours truly,

COLE ENGINEERING GROUP LTD.

Tabitha Lee, M.A.Sc., P.Eng.
Project Manager

/xx/ac

Alcona Capital Residential Developments - Addendum (May 2016)
Impervious Area Calculation
Residential Areas

DESIGN VALUES FOR HYDROLOGICAL MODELLING

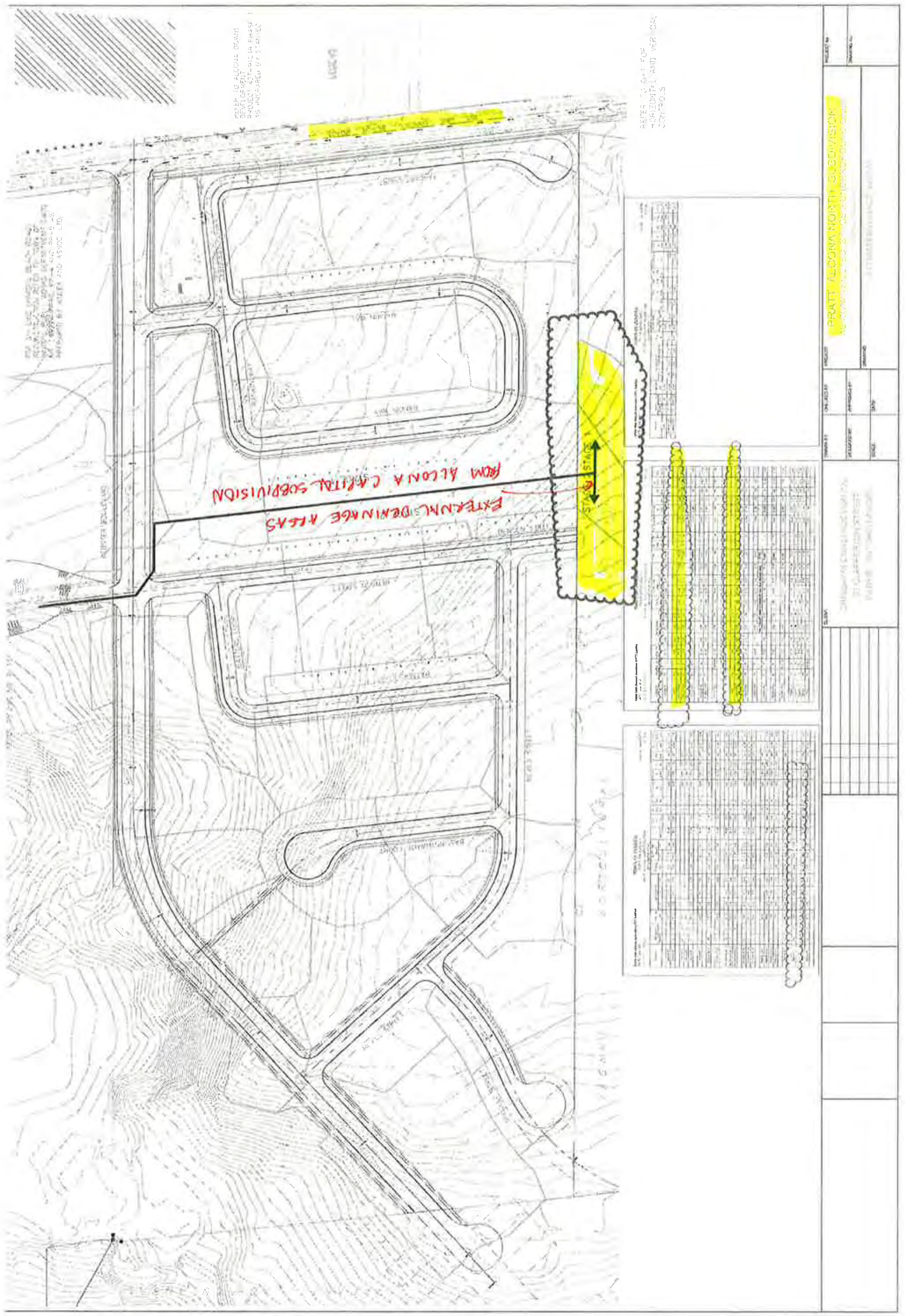
Lot Type	TOTAL IMPERVIOUSNESS (%)
Detached	69%
Semi-detached	45%
Townhouse	58%
ROW	68%

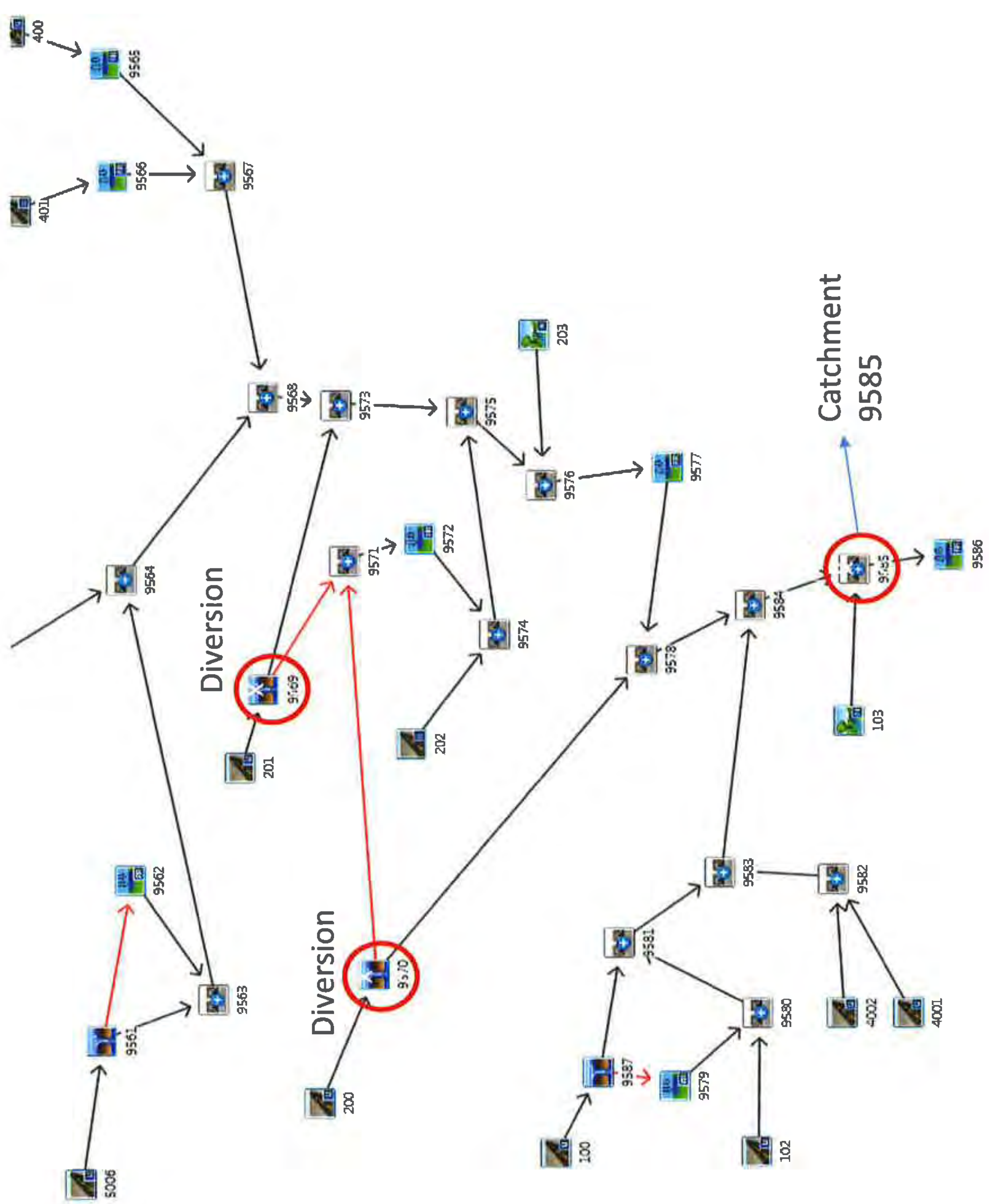
North Pond (W3)

Land Use	Area (ha)	Imp. (%)	Imp. Area (ha)
Detached	1.71	69	1.18
Semi-detached	1.36	45	0.61
Townhouse	0.00	58	0.00
ROW	1.41	68	0.96
Backyards	0.18	0	0.00
Block pond (North Pond)	0.63	50	0.32
TOTALS	**5.29**	**58**	**3.07**
Residential lots only	**3.25**	**55**	**1.79**

South Pond (W4)

Land Use	Area (ha)	Imp. (%)	Imp. Area (ha)
Detached	0.00	69	0.00
Semi-detached	2.32	45	1.04
Townhouse	1.45	58	0.84
Roads	2.31	68	1.57
Block 150 (Parkette)	0.13	85	0.11
Fut. Townhouse	1.20	64	0.77
Temp. Working Easement	0.39	20	0.08
Block pond (North Pond)	0.79	50	0.40
TOTALS	**8.58**	**56**	**4.81**
Residential lots only	**4.97**	**53**	**2.65**


EXTERNAL DRAINAGE AREAS
FROM ALCONA CAPITAL SUBDIVISION
PRATT ALCONA NORTH SUBDIVISION


Catchment
9585
Diversion
Diversion
400
9565
401
9566
9567
9568
9573
9575
203
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9577
9564
9571
9572
9574
9569
201
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9578
9584
9586
103
9562
9563
9561
5006
9570
200
9583
9582
9581
9580
4002
4001
9587
9579
100
102

A□□□□□ □□□A4□

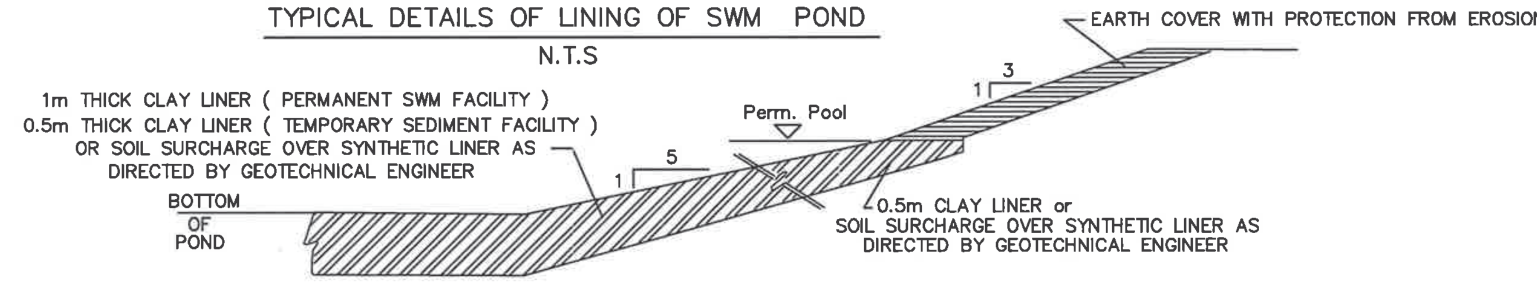
□□ M□□□□d□□□□□r□□□□□□□□□□□□□□□□

POND LINER NOTES

1. SWM POND LINER TO BE AT LEAST 1m IN THICKNESS CONSISTING OF MORE THAN 40% CLAY AND SILT (LINER CAN TAPER TO 0.5m AT TOP OF POND).
2. SAMPLES OF THE MATERIAL USED FOR LINER MUST BE PROVIDED TO GEOTECHNICAL ENGINEER FOR APPROVAL.
3. THE MATERIAL USED AS CLAY LINER MUST BE UNIFORMLY COMPACTED TC 98% SPD IN LIFTS OF 200mm UNDER FULL TIME SUPERVISION BY GEOTECHNICAL ENGINEER
4. CLAY LINER CAN BE SUBSTITUTED FOR SYNTEHTIC LINER AS DIRECTED BY GEOTECHNICAL ENGINEER.

TYPICAL DETAILS OF LINING OF SWM POND

N.T.S

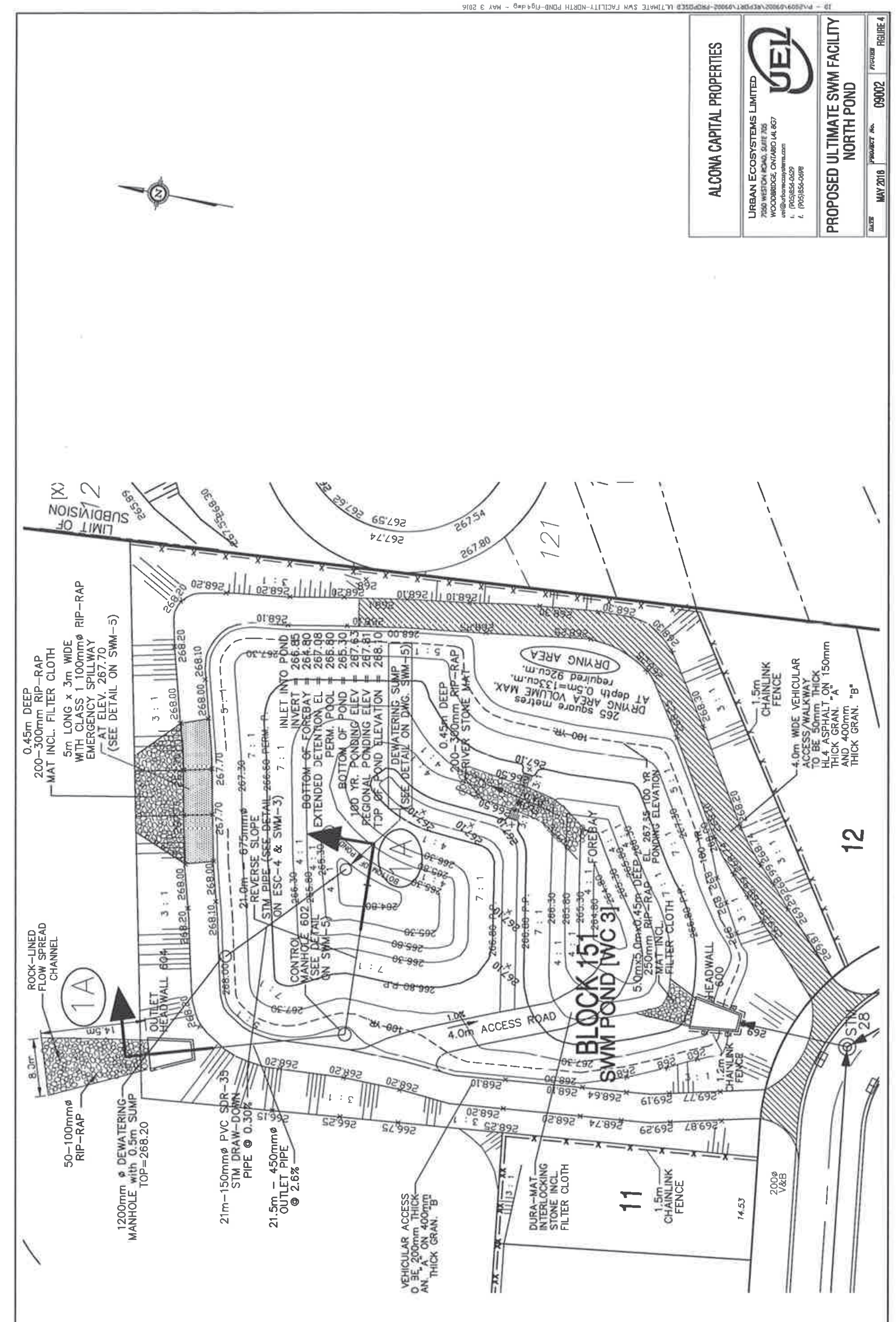


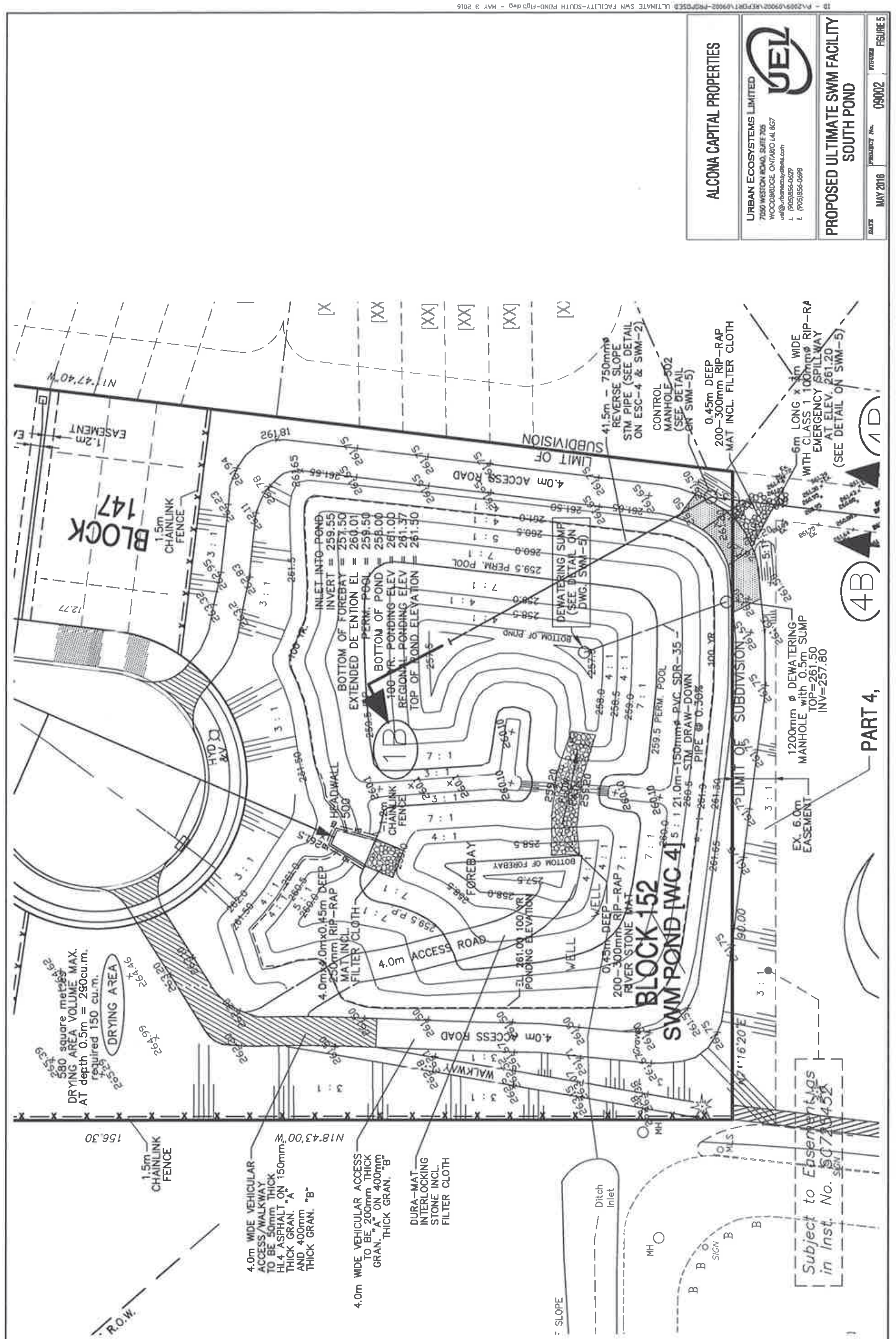
ALCONA CAPITAL PROPERTIES

URBAN ECOSYSTEMS LIMITED
7050 WESTON ROAD, SUITE 705
WOODBRIDGE, ONTARIO L4L 8G7
uel@urbanecosystems.com
t. (905)856-0629
f. (905)856-0698

POND LINER DETAIL

DATE	PROJECT No.	FIGURE
APRIL 2016	09002	


ALCONA CAPITAL PROPERTIES
URBAN ECOSYSTEMS LIMITED
PROPOSED ULTIMATE SWM FACILITY NORTH POND
MAY 2016
09002
FIGURE 4
BLOCK 151
SWM POND [WC 3]
ACCESS ROAD
DRYING AREA
LIMIT OF SUBDIVISION [X]



- Water Balance – Make every feasible effort to maintain pre-development infiltration and evapotranspiration rates to the receiving watercourses.
- Phosphorus Removal – A target of "zero" increase in phosphorus loading from pre-development to post-development conditions.

[illegible]

As per the design criteria identified for the development in Section 2.2, Enhanced (Level 1) quality control is proposed to be provided using two SWM facilities (North and South ponds). Table 3.2 of the MOEE Stormwater Management Planning and Design Manual, March 2003 (SWMP Manual) and the Town of Innisfil Design Standards were used in the design of these SWM facilities.

The permanent pool volume calculations are based on the contributing drainage from the proposed developments associated with each pond. This contributing drainage area with an assumed 60% imperviousness results in a quality storage requirement of 198 m^3/ha, which includes the allowance of 40 m^3/ha for extended detention.

[illegible]

The contributing drainage catchment for this pond is 5.29 ha, which includes the pond block area. Using an imperviousness of 60% for the development described above, a permanent pool storage volume of 838 m^3 would be required. The permanent pool has water surface elevation of 266.80 m with a maximum depth of 2.0 m (EL 264.80 m). The sediment forebay has a depth of 2.0 m deep with a bottom elevation of 264.80 m. Thus the permanent pool will be set at 266.80 m with 1,373 m^3 of available storage volume, which satisfies the permanent pool storage requirement set out in the MOE SWMP manual.

[illegible]

The contributing drainage catchment for this pond is 8.58 ha, which includes the pond block area and 0.81 ha from the potential townhouse lots from the Loblaw's site. Using the same imperviousness for the development (60%), the required permanent pool storage volume is 1,360 m^3. The permanent pool has a water surface elevation of 259.50 m with a maximum depth of 2.0 m (EL 257.50 m) in the sediment forebay. The main pond cell has a pond bottom at EL 257.50 m at a depth of 2.0 m, and an outlet plunge pool at a depth of 2.0 m (bottom EL 257.50 m). Thus the permanent pool will be set at 259.50 m with 1,363 m^3 of available storage volume, which satisfies the permanent pool storage requirement set out in the MOE SWMP manual.

[illegible]

[illegible]

The OTTHYMO hydrologic model was used to establish the post-development runoff from the proposed development. Post-development drainage area boundaries considered for the model are shown on **Figure 3**. Drainage area numbers and the respective areas are tabulated in **Table 4**, including the external areas west of 20th Side Road. Supporting calculations for modelling parameters are included in **Appendix B**.

[illegible]

Area ID	Description	Area (ha)
	WC 3 – Alcona Capital Development North	
1000	External Drainage	20.39
210	North Development Residential	4.66
211	North Pond Block	0.63
212	Environmental (Watercourse) Block	2.21
	WC 4 – Loblaw's and Hydro Station	
1	Loblaw's Building	0.31
2	Loblaw's Parking	1.44
3	Loblaw's Landscaping to Innisfil Hydro	0.14
4	Loblaw's Landscaping to 8th Line	0.32
5	Loblaw's Future Expansion Area	1.90
103	Innisfil Hydro Substation	0.76
	WC 4 – Alcona Capital Development South	
200	South Development Residential	7.79
201	South Pond Block	0.79
	WC 4 – To Adjoining Development	
900	South Development Residential Uncontrolled Rear Yards	0.07

The active storage requirement for extended detention storage is the greater of 40 m³/ha or the calculated storage required to provide the required erosion control. Modelling of the 4 hour, 25 mm Chicago design storm event calculated the following required extended detention volumes:

- 622 m³ for the north pond with a maximum release rate of 0.01 m³/s (1,237 m³ provided)
- 1,091 m³ for south pond with a maximum release rate of 0.01 m³/s (1,322 m³ provided)

For the north pond this results in required extended detention storage of 136 m³/ha, based on the 5.29 ha catchment area. For the south pond the required extended detention storage will be 144 m³/ha based on the contributing catchment of 8.58 ha. Since these volumes are both greater than 40 m³/ha criteria, the 25 mm storm was the governing criteria in generating the extended detention volumes for both ponds. The erosion control volume can therefore be provided between 266.80 m and 267.08 m in the north pond and between 259.50 m and 260.01 m in the south pond. **Table 5** presents a summary of the requirements and the provided storage.

[illegible]

Pond	Area	Required Erosion / Water Quality Treatment	
		Active Storage*	Permanent Pool
North Pond	5.29 ha (60% Imp.)	Max. release rate of 0.01 m³/s (718 m³)	158 m³/ha (838 m³)
South Pond	8.58 ha (60% Imp.)	Max. release rate of 0.01 m³/s (1,235 m³)	148 m³/ha (1,360 m³)

Note: * Active storage release rate for quality control based on the 25 mm 4 hr Chicago design storm event and OTTHYMO.

Attachment B1:
Updated Appendix D of the SWM Report
Water Balance/Infiltration Trench Calc.

CALCULATIONS
Prepared by A. Soares

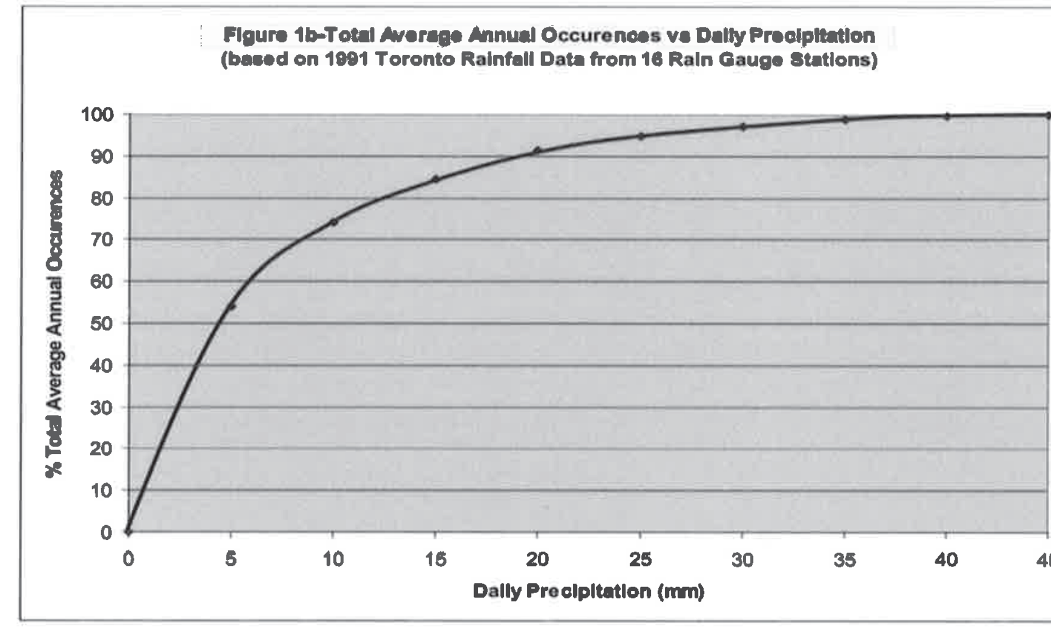
Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Water Balance - Rain Garden Annual Infiltration Volume

Lot Size[1]	=	325 m^2
Infiltration Trench/Rain Garden		
Footprint	=	7 m^2
Depth	=	1 m
Storage volume[3]	=	2.8 m^3
Drainage area[4]	=	154 m^2
Imperviousness of drainage area	=	90%
Rainfall captured in rain garden (depth)	=	$\frac{\text{Storage volume } (m^3)}{\text{Drainage area } (m^2)}$
	=	18 mm
from impervious area	=	16 mm
from pervious area	=	2 mm
Total rainfall captured in rain garden (depth)	=	18 mm
Total average annual occurance, @ 18 mm[5]	=	87%
Total annual precipitation[2]	=	826 mm /year
Total annual precipitation accounted for in the rain garden	=	719 mm /year
Total annual volume accounted for in the rain garden	=	Precipitation (mm/year) x Drainage area (m^2)
	=	111 m^3 /year
Annual infiltraton deficit[2]	=	11,295 m^3 /year
# of inf tr/ rain gar required to meet deficit	=	$\frac{\text{Annual infiltraton deficit } (m^3/\text{year})}{\text{Annual volume in the rain garden } (m^3/\text{year})}$
	=	102
# of infiltration trenches provided:	=	137

Notes:
1 Typical Single Family Residential lot, measured from Lot 75 - Draft Plan of Subdivision (March 2015)
2 Water Budget Assessment in Hydrogeological Investigation (Alcona Capital) by COLE ENG. (November 2013)
3 Assumes 40% void space ratio
4 Comprised of front lot drainage and roof area
5 Figure 1b, TRCA Wet Weather Flow Guidelines (November 2009)

CALCULATIONS
Prepared by A. Soares

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Water Balance - Rain Garden Annual Infiltration Volume



Source: Wet Weather Flow Guidelines, Toronto and Region Conservation Authority (November 2009)

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Rain Garden Sizing

Parameter	Value	Units	Note #
Infiltration (Percolation) rate =	22	mm/hr	1, 2, 3
Safety correction factor =	2.5		4
Infiltration rate (design) =	**9**	mm/hr	
Void space ratio =	0.4		5
Time to drain =	48	hr	6
Maximum Trench depth =	**1.1**	m	7
Trench depth (design) =	1.0	m	
Void space ratio =	0.4		
Trench footprint (design) =	7	m^2	
Storage volume =	**2.8**	m^3	

Notes:
1. Geometric mean at Test Pit 2, Table 4 - Infiltration Testing by Cole Eng. (Oct. 2015)
2. at the bottom elevation of the BMP.
3. from Figure C1 (CVC LID Guide, 2010).
4. from Table C2 (CVC LID Guide, 2010).
5. recommended value for filter bed and gravel storage layer (CVC LID Guide, 2010).
6. recommended value (CVC LID Guide, 2010).
7. as per equation on page 4-57 (CVC LID Guide, 2010).

Project Name	Alcona Capital Properties Inc.
Project No.	09389
Subject	Rain Garden Sizing

Figure C1: Approximate relationship between infiltration rate and hydraulic conductivity

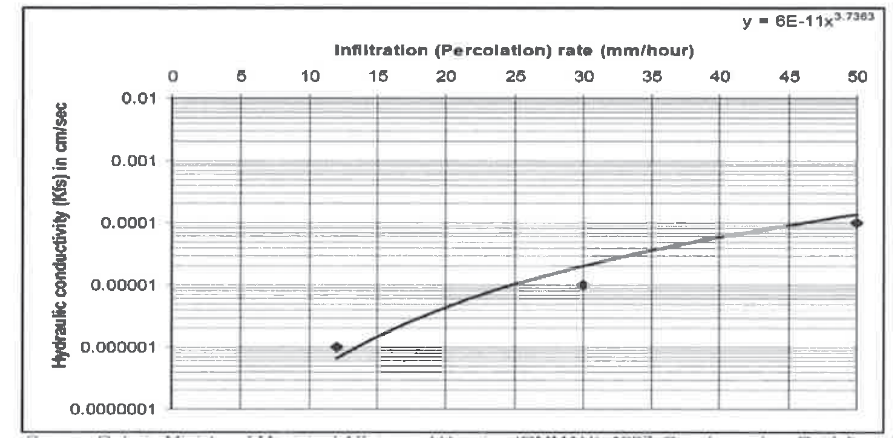


Table C2: Safety correction factors for calculating design infiltration rates

Ratio of Mean Measured Infiltration Rates[1]	Safety Correction Factor[2]
≤ 1	2.5
1.1 to 4.0	3.5
4.1 to 8.0	4.5
8.1 to 16.0	6.5
16.1 or greater	8.5

Source: Wisconsin Department of Natural Resources. 2004. Conservation Practice Standards. Site Evaluation for Stormwater Infiltration (1002). Madison, WI.

Table 11.2. Ranges of saturated hydraulic conductivity (K_{sat}) and porosity for the USDA soil textural classes (Clapp and Hornberger, 1978; Rawls et al., 1998; Saxton and Rawls, 2005)

	(Saxton and Rawls 2005)[1]		(Rawls *et al.* 1998)		(Clapp and Hornberger 1978)	
USDA Soil Textural Class	K_{sat} (ft/h)	Porosity (m^3/m^3)	K_{sat} (ft/h)	Porosity (m^3/m^3)	K_{sat} (ft/h)	Porosity (m^3/m^3)
Sand	0.5091–0.3058	0.48–0.46	0.5965–0.3000	0.44–0.39	0.9732	0.40
Loamy Sand	0.4464–0.1638	0.47–0.44	0.4039–0.1358	0.46–0.37	0.4783	0.44
Sandy Loam	0.3653–0.0744	0.47–0.42	0.1831–0.0425	0.47–0.37	0.1453	0.44
Loam	0.0271–0.1538	0.48–0.46	0.0130–0.0201	0.47–0.39	0.0331	0.45
Silt Loam	0.0402–0.2126	0.48–0.46	0.0472–0.0106	0.49-0.39	0.0083	0.49
Silt	0.0425–0.1068	0.49–0.47	-	-	-	-
Sandy Clay Loam	0.0128–0.0653	0.46–0.42	0.0248–0.0094	0.44–0.37	0.0296	0.42
Clay Loam	0.0122–0.0256	0.50–0.45	0.0142–0.0024	0.48–0.40	0.0083	0.48
Silty Clay Loam	0.0183–0.0252	0.53–0.49	0.0118–0.0165	0.50-0.43	0.0024	0.48
Sandy Clay	0.0003–0.0088	0.46–0.43	0.0035	0.39	0.0036	0.43
Silty Clay	0.0115-0.0118	0.55–0.50	0.0059	0.53	0.0012	0.49
Clay	0.0103–0.0056	0.56–0.46	0.0071–0.0060	0.48-0.40	0.0071	0.48

[1] *Assuming 2.5% organic matter content and normal compaction*

Alcona Development May, 2016

Contributions to infiltration trenches/rain gardens

Frontage	Roof (m^2)	Front yard (m^2)	Total (m^2)	# of Lots	Total roof (m^2)	Total Front (m^2)	Total (m^2)
10 m	125	15	140	92	11500	1380	12880
12.8 m	160	20	180	11	1760	220	1980
13.7 m	180	20	200	13	2340	260	2600
14.7m	260	24	284	21	5460	504	5964
				137	21060	2364	23424

Average values for WB Calculations	
Average front (m2)	17
Average roof (m2)	154
Imperviousness:	90

Attachment B2:
Updated Appendix C of the SWM Report
SWM Pond Calculations

A□□□□d□□□□ – Pond Design

C1 - North Pond

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Extended Detention Calculations

Criteria: 25mm- 4 hour Storm Event
Drainage Area: 5.29 ha

Runoff Volume = 13.57 mm (From VH Model Results)
= 135.7 m^3/ha

Ext. Det. Volume = Runoff Volume x Area
= 718 m^3

Max. Ext. Det. Volume =	718	m^3
Max. Storage used during 25mm Storm Simulation =	622	m^3
Design Ext. Det. Volume =	622	m^3

Compared to 40 m^3 * Area[1]= 212 m^3
Therefore use volume from 25mm- 4 hour Storm Event

Qpeak = Ext. Det Volume / Duration
Qpeak(24h) = 0.008 m^3/s

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Permanent Pool Volume Calculation

Criteria: 80% T.S.S Removal
Drainage Area: 5.29 ha
Imperviousness: 60%

Permanent Pool Volume[1] = (198m^3/ha - 40 m^3/ha) x Area
= 838 m^3

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

CALCULATIONS

Project Name	Alcona Capital Residential - North Pond
Project No.	09389
Subject	North Pond - Forebay Settlement and Dispersion Length

Sediment Forebay Length

Inlet flowrate (Q)=	0.660	m^3/sec	Flow Diverted to Pond (5 yr Rational Method)
Quality Release Rate (Q_p)=	0.008	m^3/sec	25mm Extended Detention Release Rate
Settlement particle size =	0.1500	mm	
Settling Velocity (V_s)=	0.00033	m/s	
Forebay Velocity (V_f)=	0.5000	m/s	
Forebay length/Width (r)=	2.0		
Permanent Pool Depth (d)=	2.0	m	

Settlement Length = $(r\ Q_p\ )/\ V_s)^{0.5}$

Settlement Length = **7.1** m Equation 4.5[1]

Dispersion Length = 8Q / (d V_f)

Dispersion Length = **5.3** m Equation 4.6[1]

Therefore the Sediment Forebay Length must be > 7.1 m

Min. Forebay Deep Zone Bottom Width = Dispersion Length / 8

Width = **0.7** m Equation 4.7[1]

[1] Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

5-Year Design Inlet FlowRate

Q = (CIA)/360

where	**Q = design flow inlet, m^3/s**	**0.66**
	C = Runoff Coefficient	0.62
	i = Rainfall intensity, mm/hr	72.39
	A = Area, ha	5.29

$i = a\,(t)^b$

where	a =	27.7	
	b =	-0.693	
	t =	15	min
therefore	i =	72.39	

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - SWM Facility Stage-Volume Information

Depth Increment (m)	0.10
Perm. Pool Vol. Req'd (m^3)	838
Permanent Pool Elevation (m)	266.80
Permanent Pool Vol. (m^3)	1373
Bottom of Pond (m)	264.80
Max. Pond Elevation (m)	268.10
Max Active Storage (m^3)	2510

Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)	
264.80	0	0	52.0	Bottom of Pond
265.30	0.5	260	54.1	
265.80	1.0	530	87.7	
266.30	1.5	969	201.1	
266.80	2.0	1975	202.6	Permanent Pool
267.20	2.4	2785	132.6	
268.10	3.3	3979	132.6	Top of Pond

Elevation (m)	Depth (m)	Area (m^2)	Incr. Volume (m^3)	Cum. Volume (m^3)	Active Storage Volume (m^3)	Ext. Det. Volume (m^3)
264.80		0				
264.90	0.10	52	3	3		
265.00	0.20	104	8	10		
265.10	0.30	156	13	23		
265.20	0.40	208	18	42		
265.30	0.50	260	23	65		
265.40	0.60	314	29	94		
265.50	0.70	368	34	128		
265.60	0.80	422	40	167		
265.70	0.90	476	45	212		
265.80	1.00	530	50	262		
265.90	1.10	618	57	320		
266.00	1.20	706	66	386		
266.10	1.30	794	75	461		
266.20	1.40	881	84	545		
266.30	1.50	969	93	637		
266.40	1.60	1170	107	744		
266.50	1.70	1371	127	871		
266.60	1.80	1572	147	1019		
266.70	1.90	1774	167	1186		
266.80	2.00	1975	187	1373		
266.90	2.10	2177	208	1581	208	208
267.00	2.20	2380	228	1809	435	435
267.10	2.30	2583	248	2057	684	684
267.20	2.40	2785	268	2325	952	952
267.30	2.50	2918	285	2610	1237	1237
267.40	2.60	3050	298	2909	1536	
267.50	2.70	3183	312	3220	1847	
267.60	2.80	3316	325	3545	2172	
267.70	2.90	3448	338	3883	2510	
267.80	3.00	3581	351	4235	2862	
267.90	3.10	3713	365	4600	3226	
268.00	3.20	3846	378	4978	3604	
268.10	3.30	3978	391	5369	3996	

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Outlet Design

Incremental Depth(m) =	0.10

Orifice: $Q=CA(2gH)^{0.5}$	Orifice 1	Orifice 2
Contraction coeff, C=	0.62	
Orifice Diameter (mm) =	100	
Area of Orifice(m^2), A=	0.0079	
Horizontal Orifice (y/n)	n	
Invert 1 (m) =	266.80	
N.W.L./Inlet Elevation (m) =	266.80	

Weir: Q=2/3*Cd*(2*g)^0.5*L*H^3/2	Weir 1	Weir 2
Length (m)=	0.60	
Coef.C_d =	0.62	
Rect'lr (y/n) =	y	
Crest Hght (m)=		
Crest EL (m)=	267.30	

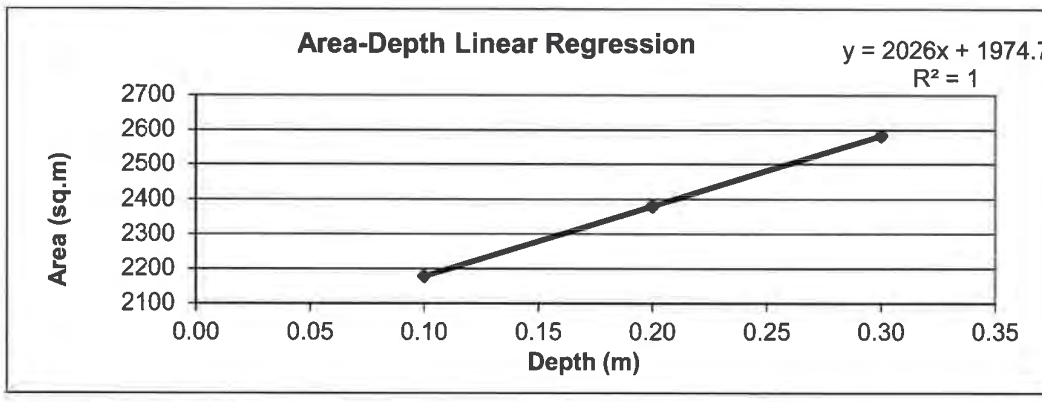
Extended Detention	
Volume Required (m^3) =	622
Detention Time (hr)=	26
Depth (m)=	0.3
EL (m)=	267.10
Max. Q_{rel} (m^3/s)=	0.013
Volume Available (m^3)=	1237

Water E.L.	Depth (m)	Head 1 (m)	Orifice 1 Q (mid-orifice)	Head 2 (m)	Orifice 2 Q (mid-orifice)	Weir 1 Q (m^3/sec)	Emergency Spillway (m^3/sec)	Total Q (m^3/sec)	Total Storage (m^3)
266.90	0.10	0.01	0.002					0.002	208
267.00	0.20	0.15	0.008					0.008	435
267.10	0.30	0.25	0.011					0.011	684
267.20	0.40	0.35	0.013					0.013	952
267.30	0.50	0.45	0.014					0.014	1237
267.40	0.60	0.55	0.016			0.034		0.050	1536
267.50	0.70	0.65	0.017			0.092		0.109	1847
267.60	0.80	0.75	0.019			0.168		0.187	2172
267.70	0.90	0.85	0.020			0.258		0.278	2510
267.80	1.00	0.95	0.021			0.360	0.311	0.692	2862
267.90	1.10	1.05	0.022			0.472	0.943	1.437	3226
268.00	1.20	1.15	0.023			0.593	1.847	2.463	3604
268.10	1.30	1.25	0.024			0.723	3.020	3.767	3996

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Detention Time

Elevation (m)	Depth (m)	Area (m^2)
266.90	0.10	2177
267.00	0.20	2380
267.10	0.30	2583



Equation 4.11 SWM Planning & Design Manual (MOE, 2003)

Drawdown Time = $t = (0.66C_2h^{1.5} + 2C_3h^{0.5}) / (2.75A_0)$

where,

C_2 =	slope coefficient from area-depth linear regression =	2026
h =	Maximum water elevation above orifice =	0.23 m
C_3 =	intercept from the area depth linear regression =	1974.7
A_o =	cross sectional area of orifice =	0.0079 m^2

t = 94523 s

t = 26 hr

CALCULATIONS

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Emergency Spillway Calculations

FLOW OVER WEIR (QUANTITY CONTROL): C_w= 1.83

$Q_w=C_w*(H_w)^\wedge1.5*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))$

INVERT OF WEIR 1	267.70 m
WEIR 1 HEIGHT	0.4 m
WEIR 1 WIDTH of base	5.0 m

ELEVATION (m)	TAILWATER (m)	WEIR 1 FLOW (cms)	WIDTH (L) (m)	H (m)	TOTAL FLOW (cms)
267.70		0.00	5.0	0.0	0.00
267.80		0.31	5.0	0.1	0.31
267.90		0.94	5.0	0.2	0.94
268.00		1.85	5.0	0.3	1.85
268.10		3.02	5.0	0.4	3.02

Q(100) = 1.28 cms > Q(Reg) = 0.76 cms
Q(weir) = 3.02 cms @ 0.4 m depth

Therefore the weir will convey the 100-year uncontrolled flow.

Velocity V = Q/A where Q = 1.28 cms, A = 3.0 sq.m.
V = 1.28 / 3 = 0.43 m/s

CALCULATIONS

Project Name Alcona Capital Residential Developments
Project No. 09389
Subject North Pond - Sediment Removal Frequency

Drainage Area	5.29	ha
Imperviousness	60%	
SWMP Type	WP	(Infiltration (I), Wetlands (WL), Hybrid (H), Wet Pond (WP))
Protection Level	1	
Total Suspended Solids Removal	80%	
Reduction in Efficiency to Initiate	5%	
Starting Storage Volume	158	m^3/ha
Req. Permanent Pool Volume	838	m^3

Table 6.3: Annual Sediment Loading (MOE SWM Planning and Design Manual, March 2003)			
Imperviousness	Loading (kg/ha)	Wet Density (kg/m^3)	Loading (m^3/ha)
35%	770	1230	0.63
55%	2300	1230	1.87
70%	3495	1230	2.84
85%	4680	1230	3.80

Annual Loading/ha	2.2	$m^3/ha/yr$
Annual Loading	11.7	m^3/yr

Year	Starting Storage Volume m^3/ha	Sediment Removal Efficiency %	Amount of Sediment Removed m^3	Starting Permanent Pool Volume m^3	End of Year Permanent Pool Volume m^3	End of Year Storage Volume m^3/ha	Cumulative Sediment Removed m^3
1	158	80.0%	9.336	838.3	829.0	156.7	9.3
2	156.7	79.8%	9.311	829.0	819.6	154.9	18.6
3	154.9	79.6%	9.285	819.6	810.4	153.2	27.9
4	153.2	79.3%	9.260	810.4	801.1	151.4	37.2
5	151.4	79.1%	9.235	801.1	791.9	149.7	46.4
6	149.7	78.9%	9.210	791.9	782.7	148.0	55.6
7	148.0	78.7%	9.184	782.7	773.5	146.2	64.8
8	146.2	78.5%	9.159	773.5	764.3	144.5	74.0
9	144.5	78.3%	9.134	764.3	755.2	142.8	83.1
10	142.8	78.1%	9.110	755.2	746.1	141.0	92.2
11	141.0	77.8%	9.085	746.1	737.0	139.3	101.3
12	139.3	77.6%	9.060	737.0	727.9	137.6	110.4
13	137.6	77.4%	9.035	727.9	718.9	135.9	119.4
14	135.9	77.2%	9.011	718.9	709.9	134.2	128.4
15	134.2	77.0%	8.986	709.9	700.9	132.5	137.4
16	132.5	76.8%	8.962	700.9	691.9	130.8	146.4
17	130.8	76.6%	8.937	691.9	683.0	129.1	155.3
18	129.1	76.4%	8.913	683.0	674.1	127.4	164.2
19	127.4	76.2%	8.889	674.1	665.2	125.7	173.1
20	125.7	76.0%	8.864	665.2	656.3	124.1	182.0
21	124.1	75.8%	8.840	656.3	647.5	122.4	190.8
22	122.4	75.5%	8.816	647.5	638.7	120.7	199.6
23	120.7	75.3%	8.792	638.7	629.9	119.1	208.4
24	119.1	75.1%	8.768	629.9	621.1	117.4	217.2
25	117.4	74.9%	8.744	621.1	612.4	115.8	225.9
26	115.8	74.7%	8.721	612.4	603.6	114.1	234.6
27	114.1	74.5%	8.697	603.6	595.0	112.5	243.3
28	112.5	74.3%	8.673	595.0	586.3	110.8	252.0
29	110.8	74.1%	8.649	586.3	577.6	109.2	260.7

Cleanout when Sediment Removal Efficiency drops to:	75%	
Sediment Removal Frequency	**25**	**Years**
Total Sediment Accumulated	226	m^3
Recommended cleanout	10	Years
	92	m^3

CALCULATIONS

Project	Alcona Capital Residential Developments
Project No.	09389
Description:	North Pond - Forebay Stage-Volume Information

Conveyance Pipe Diameter 0.25 m
10yr Sediment Volume 92 cu.m

Depth Increment (m) 0.05

Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)
264.80	0	31	12.8
265.80	1.0	287	19.5
266.30	1.5	482	45.5
266.50	1.7	664	45.5

Elevation (m)	Depth (m)	Area (m^2)	Incr. Volume (m^3)	Cum. Volume (m^3)	
264.80		31			
264.85	0.05	44	2	2	
264.90	0.10	57	3	4	
264.95	0.15	69	3	8	
265.00	0.20	82	4	11	
265.05	0.25	95	4	16	
265.10	0.30	108	5	21	
265.15	0.35	121	6	27	
265.20	0.40	133	6	33	
265.25	0.45	146	7	40	
265.30	0.50	159	8	47	
265.35	0.55	172	8	56	
265.40	0.60	185	9	65	
265.45	0.65	197	10	74	
265.50	0.70	210	10	84	
265.55	0.75	223	11	95	10-year Sediment Level
265.60	0.80	236	11	107	
265.65	0.85	249	12	119	
265.70	0.90	261	13	132	
265.75	0.95	274	13	145	
265.80	1.00	287	14	159	
265.85	1.05	307	15	174	
265.90	1.10	326	16	190	
265.95	1.15	346	17	206	
266.00	1.20	365	18	224	
266.05	1.25	385	19	243	
266.10	1.30	404	20	263	
266.15	1.35	424	21	283	
266.20	1.40	443	22	305	
266.25	1.45	463	23	328	
266.30	1.50	482	24	351	

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	North Pond - Reverse-Slope Outlet Pipe Flow

$$Q = A_p[(2gH) / (1 + k_m + k_pL)]^{0.5}$$

where:
Q = discharge (cfs)
A_p = pipe cross sectional area (ft^2)
g = acceleration of gravity (ft/s^2)
H = elevation head differential (ft)
k_m = coefficient of minor losses (use 1.0)
k_p = pipe friction coefficient = $5087n^2/D^{4/3}$ (Manning's n and pipe diameter, D)
L = pipe length (ft)

Metric input			*Imperial input*		
D =	675	mm	**D =**	27	in
n =	0.011	(PVC)	**Ap =**	3.87	ft^2
H =	0.05	m	**H =**	0.16	ft
L =	30	m	**L =**	98.7	ft
k_m =	1.0		**k_p =**	0.01	

Metric result			*Imperial result*		
Q =	**0.21**	**m^3/s**	**Q =**	**7.58**	**ft^3/s**

$Q > Q_{Pond,100yr}$ (0.20 m^3/s) , therefore OK

Natural Resources Conservation Service (NRCS) Engineering Field Manual For Conservation Practices, U.S. Soil Conservation Service (Engineering Division), July 1984

[illegible]

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.011	
Channel Slope	2.30	%
Normal Depth	0.45	m
Diameter	450	mm
Discharge	0.51	m^3/s

Results

Discharge	0.51	m^3/s
Normal Depth	0.45	m
Flow Area	0.16	m^2
Wetted Perimeter	1.41	m
Hydraulic Radius	0.11	m
Top Width	0.00	m
Critical Depth	0.44	m
Percent Full	100.0	%
Critical Slope	0.02032	m/m
Velocity	3.21	m/s
Velocity Head	0.53	m
Specific Energy	0.98	m
Froude Number	0.00	
Maximum Discharge	0.55	m^3/s
Discharge Full	0.51	m^3/s
Slope Full	0.02300	m/m
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Average End Depth Over Rise	0.00	%

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.45	m
Critical Depth	0.44	m
Channel Slope	2.30	%
Critical Slope	0.02032	m/m

C2 - South Pond

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Extended Detention Calculations

Criteria: 25mm- 4 hour Storm Event
Drainage Area: 8.58 ha

Runoff Volume = 14.39 mm (From OTTHYMO Model Results)
= 143.9 m^3/ha

Ext. Det. Volume = Runoff Volume x Area
= 1,235 m^3

Max. Ext. Det. Volume =	1,235	m^3
Max. Storage used during 25mm Storm Simulation =	1,091	m^3
Design Ext. Det. Volume =	1,091	m^3

Compared to 40 m^3 * Area[1]= 343 m^3
Therefore use volume from 25mm- 4 hour Storm Event

Qpeak = Ext. Det Volume / Duration
Qpeak(24h) = 0.014 m^3/s

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Permanent Pool Volume Calculation

Criteria: 80% T.S.S Removal
Drainage Area: 8.58 ha
Imperviousness: 60%

Permanent Pool Volume[1] = (198m^3/ha - 40 m^3/ha) x Area
= 1,360 m^3

[1] As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

Project Name	Alcona Capital Residential Developments
Project No.	09389
Subject	South Pond - Forebay Settlement and Dispersion Length

Sediment Forebay Length

Inlet flowrate (Q)=	1.070	m^3/sec	Flow Diverted to Pond (5 yr Rational Method)
Quality Release Rate (Q_p)=	0.014	m^3/sec	25mm Extended Detention Release Rate
Settlement particle size =	0.1500	mm	
Settling Velocity (V_s)=	0.00033	m/s	
Forebay Velocity (V_f)=	0.5000	m/s	
Forebay length/Width (r)=	2.0		
Permanent Pool Depth (d)=	2.0	m	

Settlement Length = $(r\ Q_p\ )/\ V_s)^{0.5}$

Settlement Length = **9.3** m Equation 4.5[1]

Dispersion Length = $8Q\ /\ (d\ V_f)$

Dispersion Length = **8.6** m Equation 4.6[1]

Therefore the Sediment Forebay Length must be > 9.3 m

Min. Forebay Deep Zone Bottom Width = Dispersion Length / 8

Width = **1.1** m Equation 4.7[1]

[1] Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003

5-Year Design Inlet FlowRate

$Q = (CiA)/360$

where Q = design flow inlet, m^3/s	1.07
C = Runoff Coefficient	0.62
i = Rainfall intensity, mm/hr	72.39
A = Area, ha	8.58

$i = a\ (t)^b$

where	a = 27.7	
	b = -0.693	
	t = 15	min
therefore	i = 72.39	

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Stage-Volume Information

Depth Increment (m)	0.10
Perm. Pool Vol. Req'd (m^3)	1360
Permanent Pool Elevation (m)	259.50
Permanent Pool Vol. (m^3)	1363
Bottom of Pond (m)	257.50
Max. Pond Elevation (m)	261.50
Max Active Storage (m^3)	4962

Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)	
257.50	0	0	40.5	Bottom of Pond
258.00	0.5	202	85.5	
258.50	1.0	630	81.7	
259.10	1.6	1120	164.6	
259.50	2.0	1779	141.6	Permanent Pool
260.30	2.8	2912	114.9	
261.50	4.0	4291	114.9	Top of Pond

Elevation (m)	Depth (m)	Area (m^2)	Incr. Volume (m^3)	Cum. Volume (m^3)	Active Storage Volume (m^3)	Ext. Det. Volume (m^3)
257.50		0				
257.60	0.10	40	2	2		
257.70	0.20	81	6	8		
257.80	0.30	121	10	18		
257.90	0.40	162	14	32		
258.00	0.50	202	18	51		
258.10	0.60	288	25	75		
258.20	0.70	373	33	108		
258.30	0.80	459	42	150		
258.40	0.90	544	50	200		
258.50	1.00	630	59	259		
258.60	1.10	712	67	326		
258.70	1.20	793	75	401		
258.80	1.30	875	83	484		
258.90	1.40	957	92	576		
259.00	1.50	1038	100	676		
259.10	1.60	1120	108	784		
259.20	1.70	1285	120	904		
259.30	1.80	1449	137	1041		
259.40	1.90	1614	153	1194		
259.50	2.00	1779	170	1363		
259.60	2.10	1920	185	1548	185	185
259.70	2.20	2062	199	1747	384	384
259.80	2.30	2203	213	1961	597	597
259.90	2.40	2345	227	2188	825	825
260.00	2.50	2487	242	2430	1066	1066
260.10	2.60	2628	256	2685	1322	1322
260.20	2.70	2770	270	2955	1592	
260.30	2.80	2912	284	3239	1876	
200.40	2.90	3027	297	3536	2173	
260.50	3.00	3142	308	3845	2481	
260.60	3.10	3257	320	4165	2801	
260.70	3.20	3371	331	4496	3133	
260.80	3.30	3486	343	4839	3476	
260.90	3.40	3601	354	5193	3830	
261.00	3.50	3716	366	5559	4196	
261.10	3.60	3831	377	5937	4573	
261.20	3.70	3946	389	6326	4962	
261.30	3.80	4061	400	6726	5362	
261.40	3.90	4176	412	7138	5774	
261.50	4.00	4291	423	7561	6198	

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Outlet Design

Incremental Depth(m) =	0.10

Orifice: $Q=CA(2gH)^{0.5}$	Orifice 1	Orifice 2
Contraction coeff, C=	0.62	
Orifice Diameter (mm) =	100	
Area of Orifice(m^2), A=	0.0079	
Horizontal Orifice (y/n)	n	
Invert 1 (m) =	259.50	
N.W.L./Inlet Elevation (m) =	259.50	

Weir: Q=2/3*Cd*(2*g)^0.5*L*H^3/2	Weir 1	Weir 2
Length (m)=	0.11	
Coef.C_d =	0.62	
Rect'lr (y/n) =	y	
Crest Hght (m)=		
Crest EL (m)=	260.10	

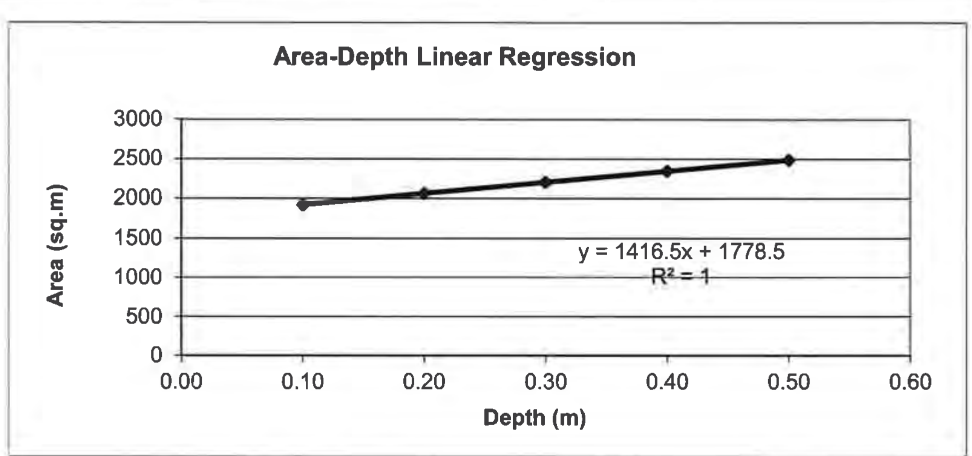
Extended Detention	
Volume Required (m^3) =	1091
Detention Time (hr)=	35
Depth (m)=	0.60
EL (m)=	260.10
Max. Q_{rel} (m^3/s)=	0.016
Volume Available (m^3)=	1322

Water E.L.	Depth (m)	Head 1 (m)	Orifice 1 Q (mid-orifice)	Head 2 (m)	Orifice 2 Q (mid-orifice)	Weir 1 Q (m^3/sec)	Emergency Spillway (m^3/sec)	Total Q (m^3/sec)	Total Storage (m^3)
259.60	0.10	0.01	0.00					0.002	185
259.70	0.20	0.15	0.01					0.008	384
259.80	0.30	0.25	0.01					0.011	597
259.90	0.40	0.35	0.01					0.013	825
260.00	0.50	0.45	0.01					0.014	1066
260.10	0.60	0.55	0.02					0.016	1322
260.20	0.70	0.65	0.02			0.006		0.024	1592
260.30	0.80	0.75	0.02			0.018		0.037	1876
260.40	0.90	0.85	0.02			0.033		0.053	2173
260.50	1.00	0.95	0.02			0.050		0.071	2481
260.60	1.10	1.05	0.02			0.070		0.092	2801
260.70	1.20	1.15	0.02			0.092		0.115	3133
260.80	1.30	1.25	0.02			0.116		0.140	3476
260.90	1.40	1.35	0.03			0.141		0.166	3830
261.00	1.50	1.45	0.03			0.168		0.194	4196
261.10	1.60	1.55	0.03			0.196		0.223	4573
261.20	1.70	1.65	0.03			0.226		0.254	4962
261.30	1.80	1.75	0.03			0.257	0.369	0.655	5362
261.40	1.90	1.85	0.03			0.289	1.107	1.425	5774
261.50	2.00	1.95	0.03			0.322	2.148	2.500	6198

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Detention Time

Elevation (m)	Depth (m)	Area (m^2)
259.60	0.10	1920
259.70	0.20	2062
259.80	0.30	2203
259.90	0.40	2345
260.00	0.50	2487



Equation 4.11 SWM Planning & Design Manual (MOE, 2003)

Drawdown Time = $t = (0.66C_2h^{1.5} + 2C_3h^{0.5}) / (2.75A_0)$

where,
C_2 = slope coefficient from area-depth linear regression = 1416.5
h = Maximum water elevation above orifice = 0.46 m
C_3 = intercept from the area depth linear regression = 1778.5
A_o = cross sectional area of orifice = 0.0079 m^2

t = 125201 s

t = 35 hr

CALCULATIONS

Project Name:	Alcona Capital Residential
Project No.:	09389
Description:	South Pond - Emergency Spillway Calculations

FLOW OVER WEIR (QUANTITY CONTROL): C_w = 1.83
$Q_w = C_w*(H_w)$^1.5*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))

INVERT OF WEIR 1	261.20 m
WEIR 1 HEIGHT	0.3 m
WEIR 1 WIDTH of base	6.0 m

ELEVATION (m)	TAILWATER (m)	WEIR 1 FLOW (cms)	WIDTH (L) (m)	H (m)	TOTAL FLOW (cms)
261.20		0.00	6.0	0.00	0.00
261.30		0.37	6.0	0.10	0.37
261.40		1.11	6.0	0.20	1.11
261.50		2.15	6.0	0.30	2.15

Q(100) = 2.09 cms > Q(Reg) = 1.24 cms
Q(weir) = 2.15 cms @ 0.3 m depth

Q(weir) is larger than Q(100), and will therefore convey 100-year uncontrolled inflow

Velocity V = Q/A where Q = 2.06 cms, A = 3.6 sq.m.
V = 2.06 / 3.6 = 0.58 m/s

CALCULATIONS

Project Name	Alcona Capital Residential - South Pond
Project No.	09389
Subject	Sediment Removal Frequency

Drainage Area	8.58	ha
Imperviousness	60%	
SWMP Type	WP	(Infiltration (I), Wetlands (WL), Hybrid (H), Wet Pond (WP))
Protection Level	1	
Total Suspended Solids Removal	80%	
Reduction in Efficiency to Initiate	5%	
Starting Storage Volume	158	m^3/ha
Permanent Pool Volume	1360	m^3

Table 6.3: Annual Sediment Loading
(MOE SWM Planning and Design Manual, March 2003)

Imperviousness	Loading (kg/ha)	Wet Density (kg/m^3)	Loading (m^3/ha)
35%	770	1230	0.63
55%	2300	1230	1.87
70%	3495	1230	2.84
85%	4680	1230	3.80

Annual Loading/ha	2.2	m^3/ha/yr
Annual Loading	18.9	m^3/yr

Year	Starting Storage Volume m^3/ha	Sediment Removal Efficiency %	Amount of Sediment Removed m^3	Starting Permanent Pool Volume m^3	End of Year Permanent Pool Volume m^3	End of Year Storage Volume m^3/ha	Cumulative Sediment Removed m^3
1	158	80.0%	15.142	1359.7	1344.5	156.7	15.1
2	156.7	79.8%	15.101	1344.5	1329.4	154.9	30.2
3	154.9	79.6%	15.060	1329.4	1314.4	153.2	45.3
4	153.2	79.3%	15.019	1314.4	1299.3	151.4	60.3
5	151.4	79.1%	14.978	1299.3	1284.4	149.7	75.3
6	149.7	78.9%	14.937	1284.4	1269.4	148.0	90.2
7	148.0	78.7%	14.897	1269.4	1254.5	146.2	105.1
8	146.2	78.5%	14.856	1254.5	1239.7	144.5	120.0
9	144.5	78.3%	14.815	1239.7	1224.8	142.8	134.8
10	142.8	78.1%	14.775	1224.8	1210.1	141.0	149.6
11	141.0	77.8%	14.735	1210.1	1195.3	139.3	164.3
12	139.3	77.6%	14.695	1195.3	1180.6	137.6	179.0
13	137.6	77.4%	14.655	1180.6	1166.0	135.9	193.7
14	135.9	77.2%	14.615	1166.0	1151.4	134.2	208.3
15	134.2	77.0%	14.575	1151.4	1136.8	132.5	222.9
16	132.5	76.8%	14.535	1136.8	1122.3	130.8	237.4
17	130.8	76.6%	14.496	1122.3	1107.8	129.1	251.9
18	129.1	76.4%	14.456	1107.8	1093.3	127.4	266.3
19	127.4	76.2%	14.417	1093.3	1078.9	125.7	280.8
20	125.7	76.0%	14.377	1078.9	1064.5	124.1	295.1
21	124.1	75.8%	14.338	1064.5	1050.2	122.4	309.5
22	122.4	75.5%	14.299	1050.2	1035.9	120.7	323.8
23	120.7	75.3%	14.260	1035.9	1021.6	119.1	338.0
24	119.1	75.1%	14.221	1021.6	1007.4	117.4	352.3
25	117.4	74.9%	14.183	1007.4	993.2	115.8	366.4
26	115.8	74.7%	14.144	993.2	979.1	114.1	380.6
27	114.1	74.5%	14.106	979.1	965.0	112.5	394.7
28	112.5	74.3%	14.067	965.0	950.9	110.8	408.8
29	110.8	74.1%	14.029	950.9	936.9	109.2	422.8
30	109.2	73.9%	13.991	936.9	922.9	107.6	436.8

Cleanout when Sediment Removal Efficiency drops to:	75%	
Sediment Removal Frequency	**25**	**Years**
Total Sediment Accumulated	366	m^3
Recommended cleanout	10	Years
	150	m^3

CALCULATIONS

Project	Alcona Capital Residential
Project No.	09389
Description:	South Pond - Forebay Stage-Volume Information

Conveyance Pipe Diameter 0.25 m
10yr Sediment Volume 150 cu.m

Depth Increment (m) 0.10

Elevation (m)	Depth (m)	Surface Area (m^2)	Incr. Area (m^2)
257.50	0	22	20.6
258.50	1.0	228	33.6
259.00	1.5	396	63.0
259.50	2.0	711	63.0

Elevation (m)	Depth (m)	Area (m^2)	Incr. Volume (m^3)	Cum. Volume (m^3)	
257.50		22			
257.60	0.10	43	3	3	
257.70	0.20	63	5	9	
257.80	0.30	84	7	16	
257.90	0.40	104	9	25	
258.00	0.50	125	11	37	
258.10	0.60	146	14	50	
258.20	0.70	166	16	66	
258.30	0.80	187	18	84	
258.40	0.90	207	20	103	
258.50	1.00	228	22	125	
258.60	1.10	262	24	149	10-year Sediment Level
258.70	1.20	295	28	177	
258.80	1.30	329	31	209	
258.90	1.40	362	35	243	
259.00	1.50	396	38	281	
259.10	1.60	459	43	324	
259.20	1.70	522	49	373	
259.30	1.80	585	55	428	
259.40	1.90	648	62	490	
259.50	2.00	711	68	558	

Project Name:	Alcona Capital Residential Developments
Project No.:	09389
Description:	South Pond - Reverse-Slope Outlet Pipe Flow

$$Q = A_p[(2gH) / (1 + k_m + k_pL)]^{0.5}$$

where:
Q = discharge (cfs)
A_p = pipe cross sectional area (ft^2)
g = acceleration of gravity (ft/s^2)
H = elevation head differential (ft)
k_m = coefficient of minor losses (use 1.0)
k_p = pipe friction coefficient = $5087n^2/D^{4/3}$ (Manning's n and pipe diameter, D)
L = pipe length (ft)

Metric input			*Imperial input*		
D =	750	mm	D =	30	in
n =	0.011	(PVC)	Ap =	4.78	ft^2
H =	0.05	m	H =	0.16	ft
L =	40	m	L =	131.6	ft
k_m =	1.0		k_p =	0.01	

Metric result			*Imperial result*		
Q =	**0.26**	m^3/s	Q =	9.16	ft^3/s

$Q > Q_{Pond,100yr}$ (0.20 m^3/s) , therefore OK

Natural Resources Conservation Service (NRCS) Engineering Field Manual For Conservation Practices, U.S. Soil Conservation Service (Engineering Division), July 1984

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.011	
Channel Slope	1.00	%
Normal Depth	0.45	m
Diameter	450	mm
Discharge	0.34	m³/s

Results

Discharge	0.34	m³/s
Normal Depth	0.45	m
Flow Area	0.16	m²
Wetted Perimeter	1.41	m
Hydraulic Radius	0.11	m
Top Width	0.00	m
Critical Depth	0.40	m
Percent Full	100.0	%
Critical Slope	0.00893	m/m
Velocity	2.12	m/s
Velocity Head	0.23	m
Specific Energy	0.68	m
Froude Number	0.00	
Maximum Discharge	0.36	m³/s
Discharge Full	0.34	m³/s
Slope Full	0.01000	m/m
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Average End Depth Over Rise	0.00	%

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.45	m
Critical Depth	0.40	m
Channel Slope	1.00	%
Critical Slope	0.00893	m/m

Attachment B3:
Updated Appendix E of the SWM Report
Phosphorous Budget

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Ontario
MINISTRY OF THE ENVIRONMENT

Project DEVELOPMENT Summary

EVELOPMENT: Alcona Capital Properties, Innisfil
ıbwatershed: Innisfil Creeks

ɔtal Pre-Development Area (ha):	13.443	Total Pre-Development Phosphorus Load (kg/yr):	1.89

·e-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
·ropland	8.58	0.19	1.63
ɔrest	4.11	0.05	0.21
ay-Pasture	0.7534	0.07	0.05

ɔST-DEVELOPMENT LOAD

ɔst-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
gh Intensity - Residential	9.88	1.32	Wet Detention Ponds	63%	4.83
			Standard wet pond - 80% TSS removal		
w Intensity Development	1.87	0.13	Perforated Pipe Infiltration/Exfiltration Systems	90%	0.02
			Clean water from roofs directed to infiltration trenches do not contribute Phosphorou:		
NOTE: BMP efficiency has been adjusted from the reference provided value by 3% (from 87% to 90%)					
w Intensity Development	0.24	0.13	Soakaways - Infiltration trenches	60%	0.01
			Front Yards draining to infiltration trenches		
ɔen Water	1.45	0.26	Vegetated Filter Strips/Stream Buffers	65%	0.13
			SWM Pond Blocks are not expected to contribute Phosphorous budge		

ɔst-Development Area Altered: 13.44
Total Pre-Development Area: 13.44
Unaffected Area: 0

	P Load (kg/yr)
Pre-Development:	1.89
Post-Development:	13.69
Change (Pre - Post):	-11.80
	625% Net Increase in Load
Post-Development (with BMPs):	4.99
Change (Pre - Post):	-3.11
	164.46% Net Increase in Load

ɔNSTRUCTION PHASE LOAD

UMMARY WITH IMPLEMENTATION OF BMPs	P Load (kg/yr)
re-Development:	1.89
onstruction Phase Amortized Over 8 Years :	to be determined
ost-Development:	4.99
ost-Development + Amortized Construction:	to be determined
re-Development Load - Post-Development Load:	**-3.11**
Conclusion:	**164% Increase in Load**
re-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

ɜased on a comparison of Pre-Development and Post-Development loads, and in consideration of ɔonstruction Phase loads, the Ministry would encourage the Municipality to:

Not approve development as site specific appropriate

Appendix L

Culvert Assessment Memorandum

9040 Leslie Street, Unit 218
Richmond Hill, ON L4B 3M4
905-709-4554

TECHNICAL MEMORANDUM

TO:	File	**DATE:**	June 28, 2021
FROM:	Daniela Hurtado Caicedo, M.A.Sc	**PROJECT #:**	20-021
PROJECT:	Town of Innisfil Webster Boulevard North Extension Environmental Assessment		
SUBJECT:	Culvert Assessment and Sizing for Preliminary Conceptual Design		

1 INTRODUCTION

This technical memorandum presents the hydrologic and hydraulic analyses conducted for the proposed culvert across the Webster Boulevard extension. The objective of this assessment was to provide a preliminary conceptual design and sizing for the future structure to be crossed by the new collector roadway. Details on peak flow calculations, recommendations on culvert size, and inlet and outlet scour protection are included in this document.

2 STUDY AREA

The study area is illustrated in **Figure 1**.

Figure 1: Proposed Collector Road and Culvert Location (from County of Simcoe GIS Site)

3 DRAINAGE AREAS AND WATERCOURSES

The Study Area is located within the Leonard's Creek subwatershed (**Appendix A**). The watercourse crossing the proposed collector road is a small tributary of Leonard's Creek and was identified as watercourse WC3 by GHD Limited (2015). The drainage area for WC3 was generated with the Ontario Flow Assessment Tool III (OFAT) by the Ministry of Natural Resources and Forestry (MNRF) and it is shown in **Figure 2**. The area of the WC3 tributary subwatershed according to OFAT is 31.4 ha.

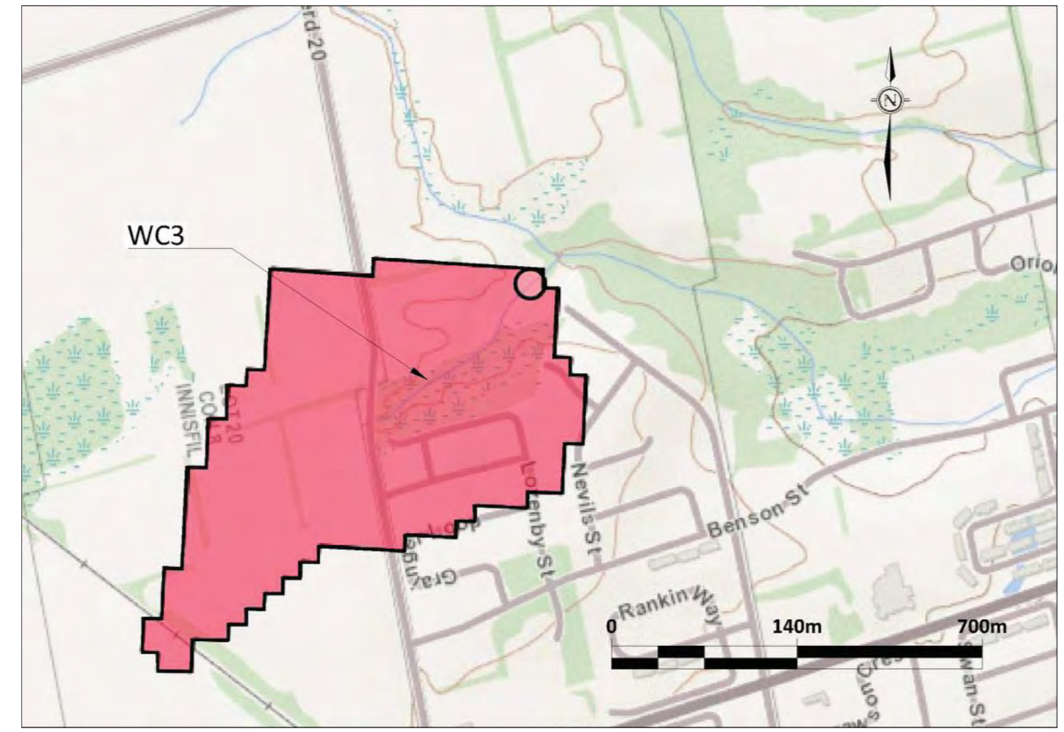


Figure 2: Drainage Area for the Proposed Culvert (from OFAT)

4 BACKGROUND INFORMATION

Background information for future hydraulic and hydrological parameters and watershed physiology was obtained from:

- *Engineering Design Standards and Specifications Manual*, June 2011 (Revision #5: May 2020) by the Town of Innisfil.
- *Alcona Capital Properties Residential Subdivision Town of Innisfil, Stormwater Management Report*, November 2015 by GHD Limited.
- *Draft Master Drainage Plan Study Report*, August 2011 by C.C. Tatham & Associates Ltd.
- *Alcona North Secondary Plan* by the Town of Innisfil.
- *Soil Survey of Simcoe County*, 1962 by D. W. Hoffman, R. E. Wicklund, and N. R. Richards (Research Branch, Canada Department of Agriculture and the Ontario Agricultural College).
- GIS Imagery, Simcoe County Website (figures generated with AutoCAD).

5 DESIGN CRITERIA

The design criteria for the proposed culvert, shown in **Table 1**, follow the Drainage Management Manual (MTO, 1997) and the design standards of the Town of Innisfil (2019).

Table 1: Design Criteria for the Culvert

Parameter	Restriction	Comment
Culvert design period	25-year	For a collector road, with a total span of less than 6 m[1]
Check flow	115% * 100-year	For a collector road, with a total span of less than 6 m[1]
Time of concentration method	Eq. 2	Bransby-Williams formula for runoff coefficients of more than 0.4[4]
IDF curves	Eq. 3	A, B, and C based on Barrie WPCC Station #6110557[2]
Minimum culvert size	500 mm	Minimum size for road crossing culverts[1]
Maximum flow depth, HW/D	≤ 1.5	Culverts with diameter or rise of less than 3.0 m
Manning's n	0.013 0.024	For concrete box culverts[3] For corrugated pipe[2]
Maximum permissive flow velocities for scour/erosion protection	0.75 m/s	Sandy loam and water carrying fine silts[3]
Riprap size		Based on cross-sectional mean flow velocity[4]
Right-of-way (ROW) width	26 m	For a collector road[2]

[1] Highway Drainage Design Standards (MTO, 2008)
[2] Engineering Design Standards and Specifications Manual (Town of Innisfil, 2011)
[3] Drainage Management Manual (MTO, 1997)
[4] Guide to bridge hydraulics (TAC, 2001)

6 METHODOLOGY

6.1 Design Flows

Design flows were determined for the structure using available information on soil type and land use data. According to the Highway Drainage Design Standards (MTO, 2008), for a collector road, the design flow return period for culverts with a total span of less than 6 m is 25 years. These standards can be considered valid for collector roads within the Town of Innisfil's jurisdiction. Peak flow data for watercourse WC3 were not readily available; therefore, peak flows for culvert C-1 were derived using the Rational Method, given as:

$$Q = 0.0028 * C * I * A \qquad \text{Eq. 1}$$

Where:
Q = Peak runoff rate (m^3/s)
C = Composite runoff coefficient
I = Rainfall intensity (mm/h)
A = Drainage area (ha)

As stated by the Engineering Design Standards and Specifications Manual prepared by the Town (2011), the runoff coefficient (C) should be adjusted for return periods greater than 10 years to account for the increase in runoff due to soil saturation. For the 25- and 100-year storm events, this adjustment value corresponds to 10% and 25%, respectively.

From the superposition of the proposed road and the drainage area delineated with OFAT, it was found that a small section of the road would be part of the WC3 subwatershed as illustrated in **Figure 3**. However, for calculation purposes, it was assumed that the entire extension would be located inside the subwatershed to account for a potential increase in imperviousness. In addition, it was also assumed that the unimproved area immediately south of the extension could be potentially developed.

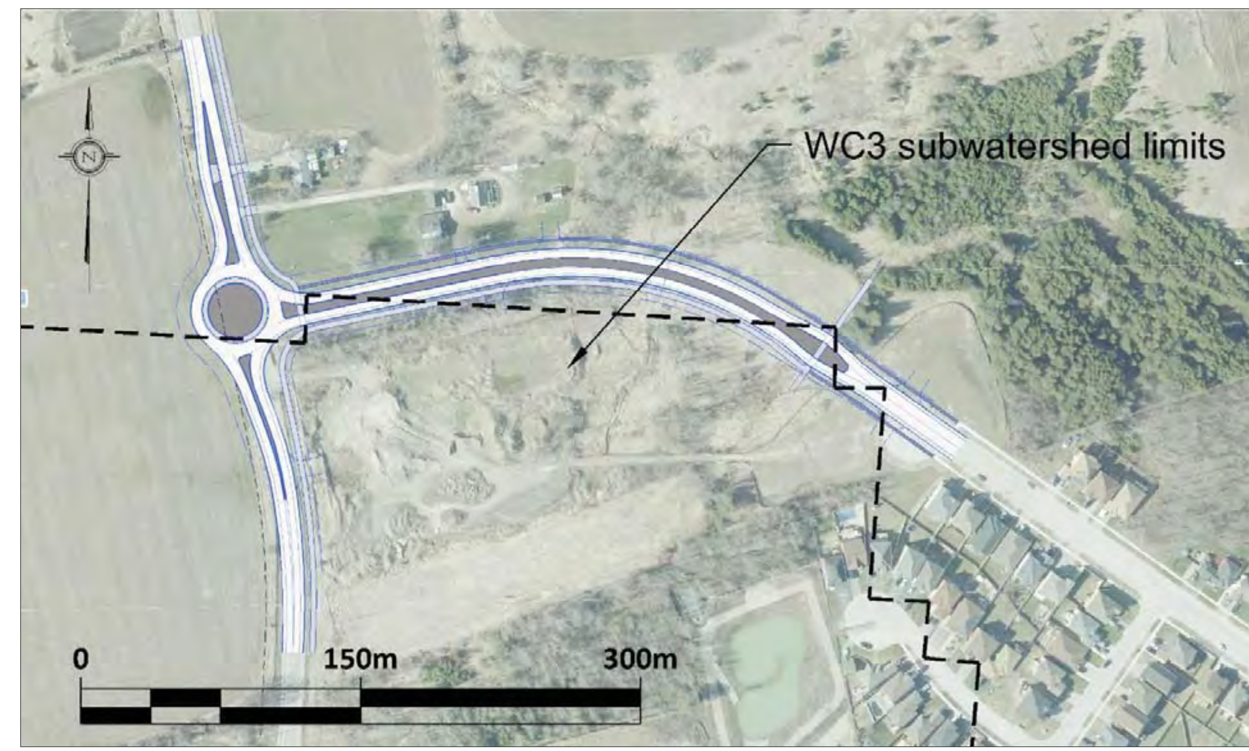


Figure 3: Proposed Extension and WC3 Subwatershed Limits

The time of concentration was determined using the Bransby-Williams expression since the calculated runoff coefficient was greater than 0.4 (see **Table 1**):

$$Tc = \frac{0.057 * L}{{S_w}^{0.2} * A^{0.1}} \qquad \text{Eq. 2}$$

Where:
L = Length of overland sheet flow (m)
S_w = Average slope of watershed (%)
A = Catchment area (ha)

The rainfall intensity was determined with the following expression:

$$i = \frac{A}{(Tc + B)^C} \qquad \text{Eq. 3}$$

i = Rainfall intensity for a given return period (mm/h)
Tc = Time of concentration (min)
A, B, and C are a function of the local intensity-duration data for a given return period

IDF information developed by Environment Canada was used to determine rainfall intensity. These curves correspond to the Barrie WPCC Station #6110557 and are based on rain gauge data collected from 1979 to 2003 (Town of Innisfil, 2011). To account for climate change, rainfall intensity data were increased by 15% prior to calculation of parameters A, B, and C. These parameters are summarized in **Table 2** for the 25- and 100-year return periods.

Table 2: IDF Curve Parameters

Parameter	25-year	100-year
A	1146.275	1426.408
B	4.922	5.273
C	0.757	0.759

6.2 Culvert Analysis

Culvert sizing and hydraulic analysis were performed using the computer program HY-8 7.6 by the United States Federal Highway Administration (FHWA). Manning coefficients were specified as per the Town's design criteria. Following the roadway classification guidelines by the Town (2011), a ROW width of 26 m was used to define the length of the culvert.

Information on the stream channel geometry for WC3 was not available. To determine input data for Culvert C-1, a trapezoidal channel cross section with 3H:1V side slopes and a width of 3 m were assumed. The channel slope and the outlet invert elevation were determined using survey data from the proposed road extension limits (A.R. (Sandy) Wakeling). The ratio of the headwater depth to the diameter or rise of the culvert (HW/D) was also verified; according to the Highway Drainage Design Standards (MTO, 2008), this value for collector roads should be less than 1.5 for a diameter or rise of less than 3 m. This standard applies to closed-footing culverts and open-footing culverts with a non-erodable bottom.

6.3 Local Scour Protection

Since local scour is caused by high flow velocities at the culvert ends, the flow for scouring was determined as 115% of the 100-year design flow. To determine whether scour protection was required, outlet and inlet velocities were determined based on outputs from the culvert hydraulic analysis (**Appendix C**). The calculated velocities were subsequently compared to the maximum permissible velocities for the channel material (MTO, 1997). Finally, outlet and inlet velocities against stone were calculated as 2/3 of the mean velocities in order to specify a rock size for riprap protection based on the Guide to Bridge Hydraulics (for a stone with a relative density of 2.65 and for side slopes of 2H:1V; TAC, 2001).

7 RESULTS AND COMMENTS

7.1 Design Flows

Input data and design flow calculations are presented in **Appendix B**. Peak flows for the culvert are summarized in **Table 3**.

Table 3: Culvert C-1 Peak Flow Results

Description	Culvert C-1 Design Flow (m^3/s)
Q25	4.09
Check flow (115%*Q100)	6.57

7.2 Culvert Sizing

Table 4 shows the suggested size for the culvert to convey the minimum 25-year design flow. HY-8 simulation outputs are presented in **Appendix C**. Two alternatives are presented for this structure, a circular CSP pipe and a precast concrete box culvert.

Table 4: Proposed Culvert Configuration

Culvert	Type	Size	Slope
C-1, Alt 1	Circular CSP	1.8 m by 22.0 m	0.03 m/m
C-1, Alt 2	Box	1.5 m by 2.4 m by 22.0 m	0.03 m/m

Notes:

- Culvert barrels to be embedded 300 mm below stream invert to facilitate fish passage (MTO, 2008).
- HW/D for culverts C-1 Alt 1 and C-1 Alt 2 is 0.97, and 0.93 respectively, which complies with requirements in **Table 1** (embedment is considered).

The sizes in **Table 4** are based on preliminary project data. This study does not consider the actual height of the arterial road crest which will be later defined during detailed design. For the ultimate design of the culverts, it is important to consider that a freeboard of no less than 1.0 m should be guaranteed between the top of the arterial road and the headwater level according to the Drainage Management Manual (MTO, 1997). When the crest elevation of the arterial road is specified, it must be defined whether the water level generated by the Check Flow should exceed the edge of the traveled lane; however, according to the Town standards, overtopping of the road is allowed to up to 0.15 m above the crown of the road for the 100-year storm event.

7.3 Local Scour Protection

Scour protection for each culvert was calculated based on inlet and outlet velocities. These values are presented in **Appendix D** and summarized in **Table 5**. The type of soil in the area was found to be sandy loam based on the soil map and report for Simcoe County (Hoffman et al., 1962; **Appendix E**); for this type of soil, the permissible velocity was found to be 0.75 m/s (**Table D-3**).

Table 5: Velocities and Proposed D_{50} Size for Stones

Culvert	Inlet Velocity Against Stone (m/s)	D_{50} (mm)	Outlet Velocity Against Stone (m/s)	D_{50} (mm)
C-1, Alt 1	1.93	150	2.34	200
C-1, Alt 2	1.22	150	2.47	200

Notes:

- Protection was specified for velocities above 0.75 m/s (see **Appendix D, Tables D-1, and D-2**).

For inlet velocities against stone that were below or close to 2 m/s, the smallest practical size of riprap was proposed (D_{50}= 150 mm). According to the Guide to Bridge Hydraulics (TAC, 2001), the thickness of the riprap is recommended to be 1.5*D_{50}. For final design considerations, outlet and inlet velocities should be checked, the correct method to determine gradation limits should be applied, and specifications of riprap aprons or basins should also be included in the design details.

7.4 Imperviousness and Recommended Stormwater Management Plan

Although the increase in impervious area for the WC-3 subwatershed caused by the proposed road would be negligible (3%), it is important to consider the localized impact of increased runoff on the adjacent property at 2351 20th Sideroad. As one of the Stormwater Best Management Practices, it is recommended that runoff from the proposed extension be drained via grassed swales on the north side of the road. These swales will eventually drain into the WC-3 tributary downstream of the culvert. According to the LID Guidelines Manual (NCHRP), it is recommended that the grassed swales be designed with a trapezoidal cross section with a maximum slope of 3H:1V. Longitudinal slopes along the road should be less than 0.5% for effectiveness. Slopes between 0.5% and 6% are permitted; however, check dams should be incorporated for slopes greater than 3%. If additional infiltration, water retention, and nutrient and pollutant removal are required, bioswales can be used instead; this can be achieved by adding bioretention media to the existing swale. **Figure 4** shows a schematic of a typical cross section.

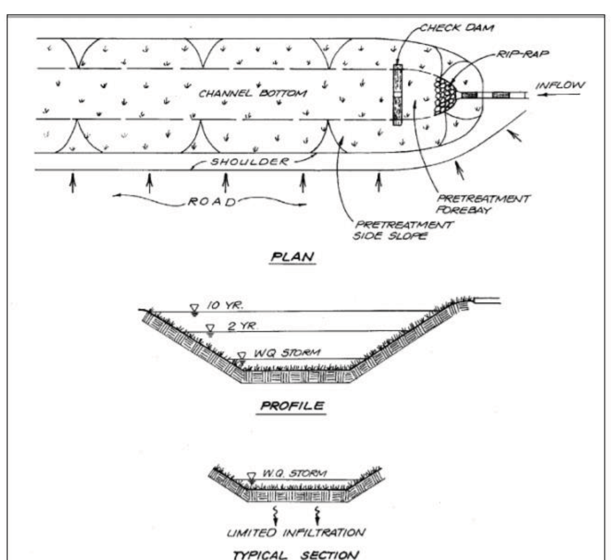


Figure 4: Plan, Profile, and Section Views of a Grass Swale (from LID Stormwater Management Planning and Design Guide, 2001, pages 4-142)

Memorandum prepared by:

Daniela Hurtado Caicedo, M.A.Sc
Water Resources Specialist
BT Engineering Inc.

Attachments: Appendix A – Leonard's Creek Watershed
Appendix B – Peak Flow Calculations
Appendix C – HY-8 Culvert Analysis Report
Appendix D – Scour/Erosion Protection
Appendix E – Soil Survey

Appendix A

Leonard's Creek Watershed

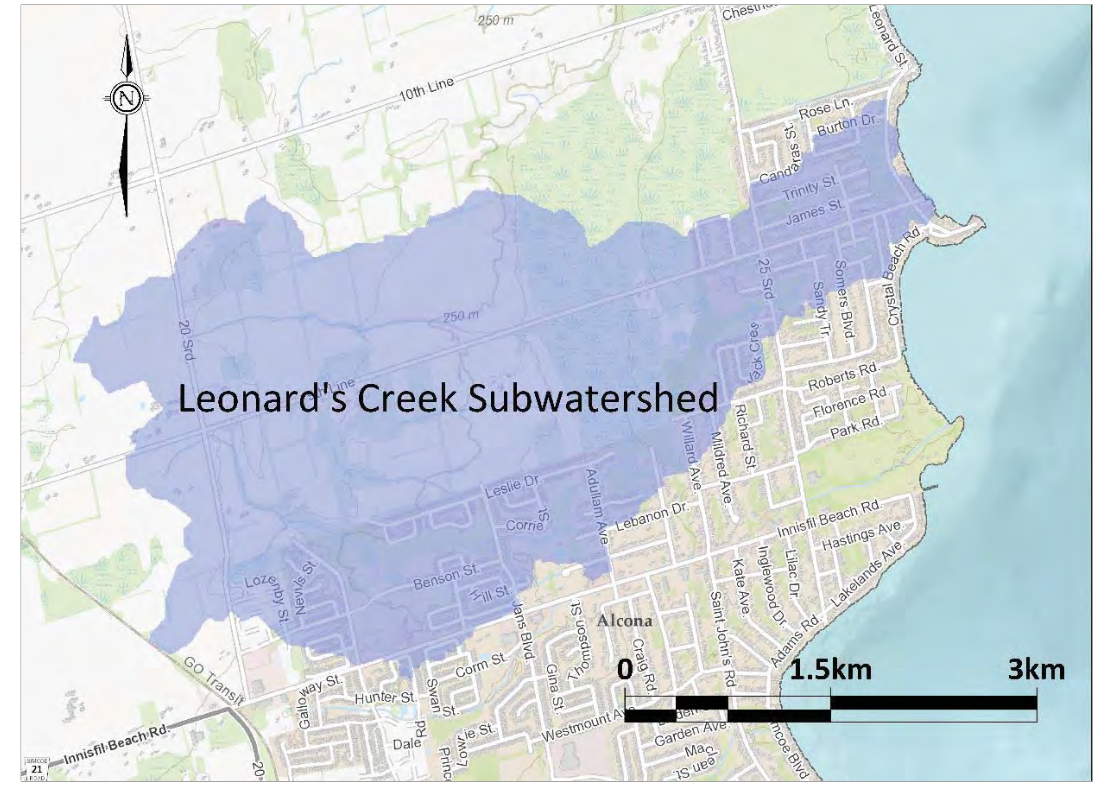


Figure A-1: Leonard's Creek Subwatershed
(Adapted from Comprehensive Stormwater Management Master Plan by Tatham & Associates Ltd., 2016)

Appendix B

Design Flow Calculations

Design Flow Calculations for Culvert C-1

Table B-1: Input Data and Design Flow Calculations Results for Culvert C-1

Input Data	
Drainage area	31.40 ha[a]
Composite Runoff coefficient, C	0.52[a]
Watershed length, L	1046 m [a]
Watershed slope, Sw	2% [a]
Calculations	
Time of concentration, Tc	36.77 min
i100	83.53 m^3/s
i25	68.06 m^3/s
Q100	**5.71 m^3/s**
Q25	**4.09 m^3/s**
Check flow (115%*Q100)	**6.57 m^3/s**

[a]OFAT (MTO)

[b]Engineering Design Standards and Specifications Manual (Town of Innisfil, 2011))

Appendix C

HY-8 Culvert Analysis Report

BT ENGINEERING

BTE

Culvert C-1 - Alternative 1

<u>Crossing properties</u>

Crossing Discharge Data
Discharge Selection Method: Specify Minimum, Design, and Maximum Flow
Minimum Flow: 0 cfs
Design Flow: 144.437 cfs
Maximum Flow: 232.017 cfs

Tailwater Channel Data - Leonad's Creek WC-3
Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 3.00 m
Side Slope (H:V): 3.00 (_:1)
Channel Slope: 0.0300
Channel Manning's n: 0.0350
Channel Invert Elevation: 0.00 m

<u>Culvert properties</u>

Site Data - Culvert C-1 Alt 1
Site Data Option: Culvert Invert Data
Inlet Station: 0.00 m
Inlet Elevation: 0.66 m
Outlet Station: 22.00 m
Outlet Elevation: 0.00 m
Number of Barrels: 1

Culvert Data Summary - Culvert C-1 Alt 1
Barrel Shape: Circular
Barrel Diameter: 1800.00 mm
Barrel Material: Corrugated Steel
Embedment: 300.00 mm
Barrel Manning's n: 0.0240 (top and sides)
Manning's n: 0.0350 (bottom)
Culvert Type: Straight
Inlet Configuration: Mitered to Conform to Slope
Inlet Depression: None

Table C-1 - Culvert Summary Table: Culvert C-1 Alt 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	0.96	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
0.66	0.66	1.39	0.428	0.0*	1-S2n	0.256	0.276	0.256	0.150	1.700	1.274
1.31	1.31	1.64	0.681	0.0*	1-S2n	0.393	0.425	0.393	0.223	2.120	1.609
1.97	1.97	1.84	0.880	0.027	1-S2n	0.507	0.546	0.507	0.280	2.395	1.833
2.63	2.63	2.01	1.054	0.241	1-S2n	0.611	0.651	0.611	0.329	2.606	2.006
3.29	3.29	2.18	1.224	0.470	1-S2n	0.702	0.746	0.702	0.372	2.805	2.147

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
4.09	4.09	2.41	1.447	0.773	1-S2n	0.808	0.850	0.808	0.419	3.008	2.294
4.60	4.60	2.57	1.606	0.985	5-S2n	0.875	0.912	0.875	0.446	3.119	2.376
5.26	5.26	2.80	1.837	1.266	5-S2n	0.962	0.985	0.962	0.479	3.244	2.470
5.91	5.91	3.06	2.099	1.573	5-S2n	1.052	1.055	1.052	0.510	3.351	2.557
6.57	6.57	3.35	2.394~	2.295	7-M2c	1.151	1.116	1.116	0.540	3.530	2.636

* Full Flow Headwater elevation is below inlet invert.
~ Inlet control is shown, but flow profile is substantially FF.

Straight Culvert
Inlet Elevation (invert): 0.96 m
Outlet Elevation (invert): 0.30 m
Culvert Length: 22.01 m
Culvert Slope: 0.0300

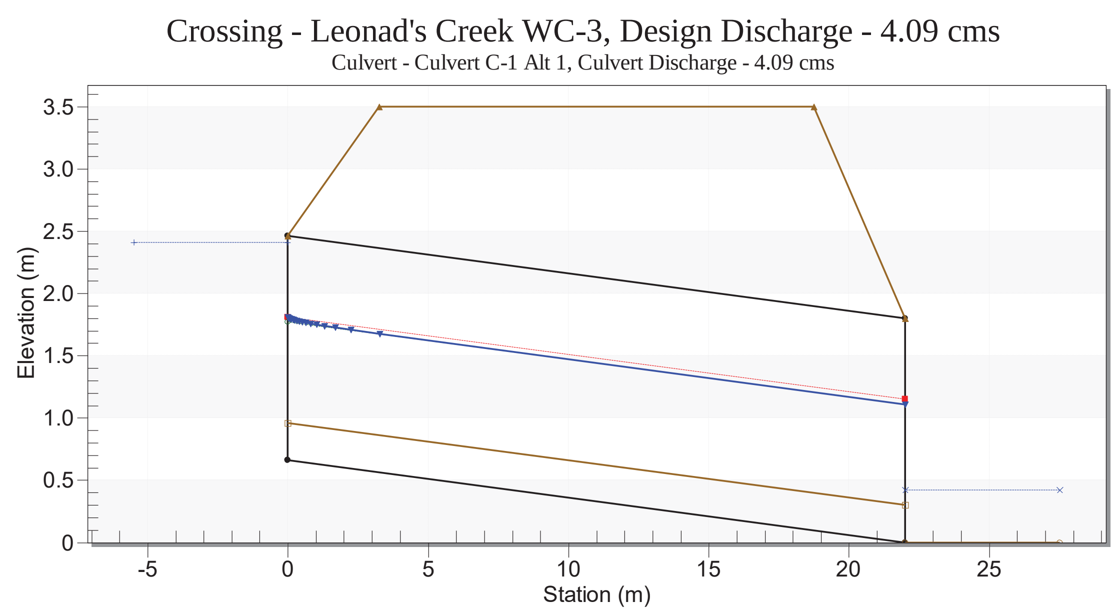


Figure C-1: Water Surface Profile Plot for Culvert C-1, Alternative 1

Culvert C-1 - Alternative 2

Crossing properties

Crossing Discharge Data
Discharge Selection Method: Specify Minimum, Design, and Maximum Flow
Minimum Flow: 0 cfs
Design Flow: 144.437 cfs
Maximum Flow: 232.017 cfs

Tailwater Channel Data - Leonad's Creek WC-3
Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 3.00 m
Side Slope (H:V): 3.00 (_:1)
Channel Slope: 0.0300
Channel Manning's n: 0.0350
Channel Invert Elevation: 0.00 m

Culvert properties

Site Data - Culvert C-1 Alt 1
Site Data Option: Culvert Invert Data
Inlet Station: 0.00 m
Inlet Elevation: 0.66 m
Outlet Station: 22.00 m
Outlet Elevation: 0.00 m
Number of Barrels: 1

Culvert Data Summary - Culvert C-1 Alt 1
Barrel Shape: Circular
Barrel Diameter: 1800.00 mm
Barrel Material: Corrugated Steel
Embedment: 300.00 mm
Barrel Manning's n: 0.0240 (top and sides)
Manning's n: 0.0350 (bottom)
Culvert Type: Straight
Inlet Configuration: Mitered to Conform to Slope
Inlet Depression: None

Table C-2: Culvert Summary Table: Culvert C-1 Alt 1

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	0.96	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
0.66	0.66	1.39	0.428	0.0*	1-S2n	0.256	0.276	0.256	0.150	1.700	1.274
1.31	1.31	1.64	0.681	0.0*	1-S2n	0.393	0.425	0.393	0.223	2.120	1.609
1.97	1.97	1.84	0.880	0.027	1-S2n	0.507	0.546	0.507	0.280	2.395	1.833
2.63	2.63	2.01	1.054	0.241	1-S2n	0.611	0.651	0.611	0.329	2.606	2.006
3.29	3.29	2.18	1.224	0.470	1-S2n	0.702	0.746	0.702	0.372	2.805	2.147

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
4.09	4.09	2.41	1.447	0.773	1-S2n	0.808	0.850	0.808	0.419	3.008	2.294
4.60	4.60	2.57	1.606	0.985	5-S2n	0.875	0.912	0.875	0.446	3.119	2.376
5.26	5.26	2.80	1.837	1.266	5-S2n	0.962	0.985	0.962	0.479	3.244	2.470
5.91	5.91	3.06	2.099	1.573	5-S2n	1.052	1.055	1.052	0.510	3.351	2.557
6.57	6.57	3.35	2.394	2.295	7-M2c	1.151	1.116	1.116	0.540	3.530	2.636

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert
Inlet Elevation (invert): 0.96 m
Outlet Elevation (invert): 0.30 m
Culvert Length: 22.01 m
Culvert Slope: 0.0300

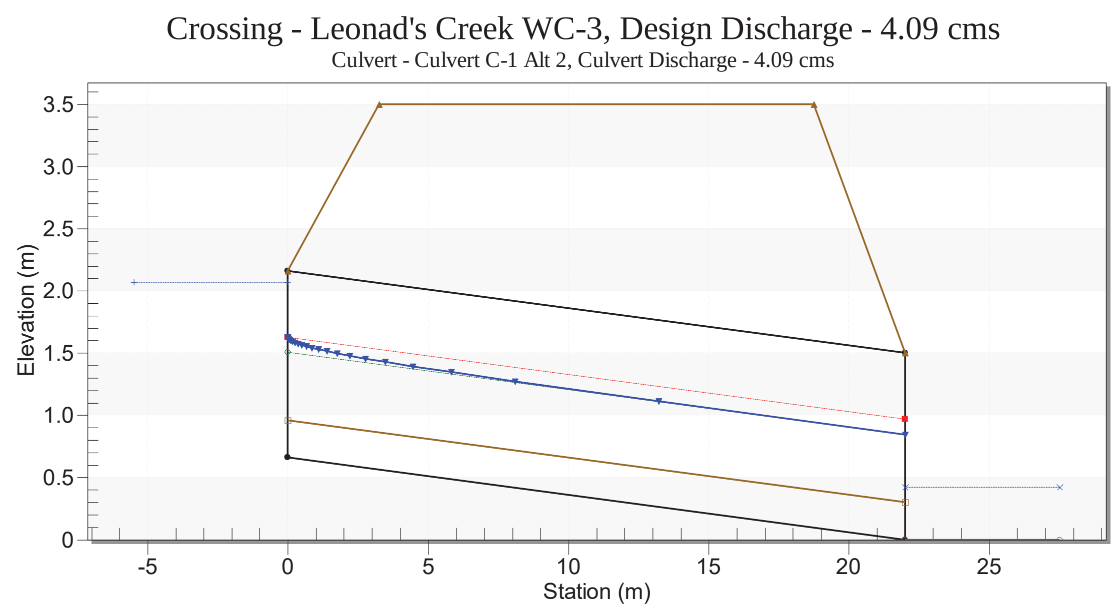


Figure C-2: Water Surface Profile Plot for Culvert C-1, Alternative 2

Appendix D

Scour/Erosion Protection

BT ENGINEERING
BTE

Outlet and Inlet Velocities Calculation

Table D-1: Velocities Culvert C-1, Alternative 1

Inlet Velocity		
Design discharge, 115%*Q100	6.57	m^3/s
Culvert diameter, D	1.80	m
Inlet depth	1.80	m
Wetted area, A	2.27	m^2
Inlet velocity, Vi	**2.90**	**m/s**
Velocity against stone, 2/3*Vi	**1.93**	**m/s**
Outlet Velocity		
Design discharge, 115%*Q100	6.57	m^3/s
Culvert diameter, D	1.80	m
Outlet depth	1.12	m
Wetted area, A	1.87	m^2
Outlet velocity, Vo	**3.52**	**m/s**
Velocity against stone, 2/3*Vo	**2.34**	**m/s**

Table D-2: Velocities Culvert C-1, Alternative 2

Inlet Velocity		
Design discharge, 115%*Q100	6.57	m^3/s
Culvert span, B	2.40	m
Inlet depth	1.50	m
Wetted area, A	3.60	m^2
Inlet velocity, Vi	**1.83**	**m/s**
Velocity against stone, 2/3*Vi	**1.22**	**m/s**
Outlet Velocity		
Design discharge, 115%*Q100	6.57	m^3/s
Culvert span, B	2.40	m
Outlet depth	0.74	m
Wetted area, A	1.78	m^2
Outlet velocity, Vo	**3.70**	**m/s**
Velocity against stone, 2/3*Vo	**2.47**	**m/s**

Standards

Table D-3: Maximum Permissive Flow Velocities - Native Material/Linings (Adapted from Drainage Management Manual, 2008, part 4, page 54)

Material	Velocities: Clear Water (m/s)	Velocities: Water Carrying Fine Silts (m/s)	Velocities: Water Carrying Sand and Gravel (m/s)
Fine sand (noncolloidal)	0.45	0.75	0.5
Sandy loam (noncolloidal)	0.5	**0.75**	0.6
Silt loam (noncolloidal)	0.6	0.9	0.6
Ordinary firm loam	0.75	1.1	0.7
Volcanic ash	0.75	1.1	0.6
Fine gravel	0.75	1.5	1.15
Stiff clay (very colloidal)	1.15	1.5	0.9
Graded, loam to cobbles (noncolloidal)	1.15	1.5	0.5
Graded, silt to cobbles (colloidal)	1.2	1.7	1.5
Alluvial silts (noncolloidal)	0.6	1.1	1.6
Alluvial silts (colloidal)	1.15	1.5	0.9
Coarse gravel (noncolloidal)	1.2	1.85	2
Cobbles and Shingles	1.5	1.7	2
Shales and hard plans	1.85	1.85	1.5

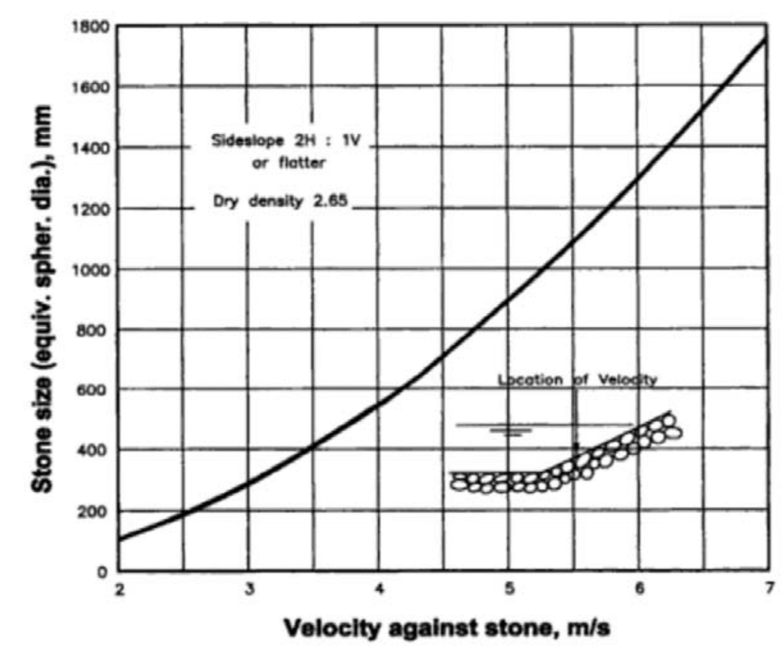
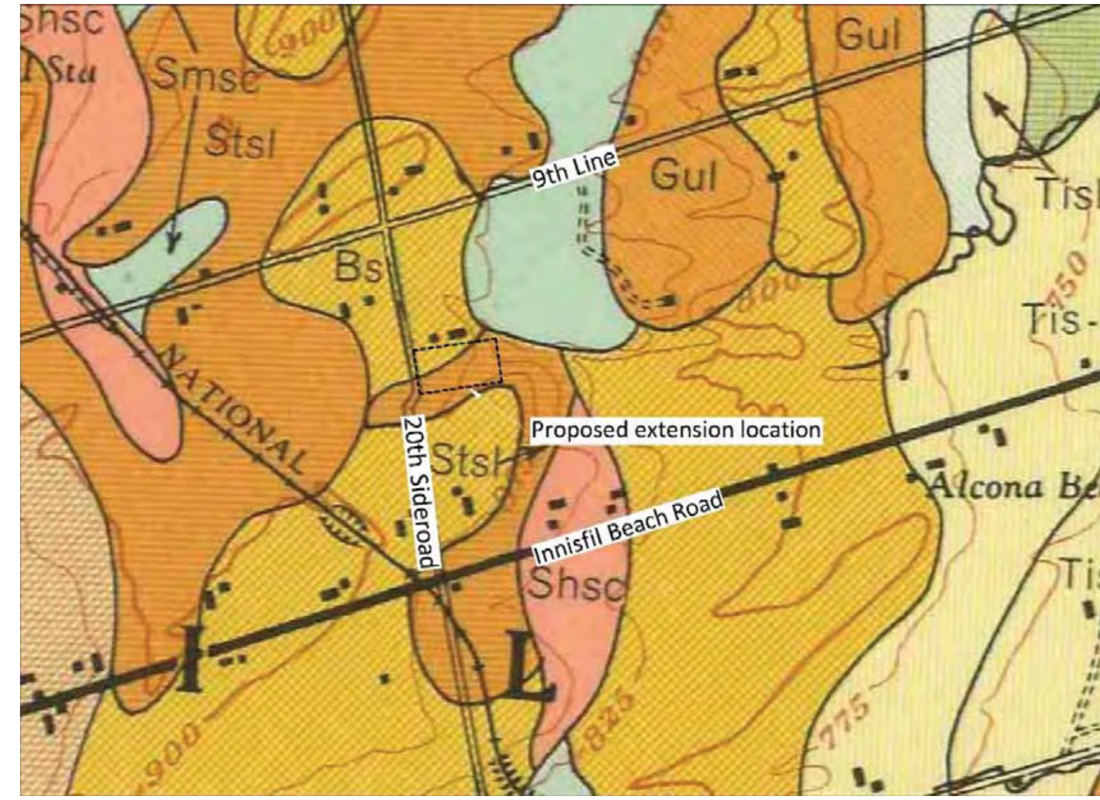


Figure D-1: "Compromise" Riprap Sizing Curve from 1973 Guide to Bridge Hydraulics (From Guide to Bridge Hydraulics, 2001, pg. 131)

Appendix E

Soil Survey

BT ENGINEERING
BTE



Legend

Bs Stsl

Figure E-1 Soil Map of the Study Area (Adapted from Soil Survey of Simcoe County, Report No. 29). Legend corresponds to types of soil in the Study Area.

Legend	Description
	BONDHEAD Sandy loam • Light grey, calcareous, loam and sandy loam till • Good drainage. • Smooth moderately to steeply sloping topography • Slightly to very stony surface. • Neutral surface reaction. • Great soil group: Grey-Brown Pofzolic
	SARGENT Gravelly Sandy Loam • Pale brown, calcareous outwash gravel. • Good drainage. • Smooth, gently sloping topography • Stonefree surface • Neutral to alkaline surface reaction. • Brown forest

Appendix M

Electrical Brief

Innisfil Webster Boulevard Extension
LIGHTING DESIGN BRIEF

July 12, 2021

Prepared for:

The Town of Innisfil

Prepared by:

Chiarelli Korbel Engineering ltd.
Nicholas Korbel, P.Eng.
NickCKELtd@gmail.com, 613-277-0119
1857 Dunrobin Rd., Kanata, ON K2K 1X7

1. SCOPE OF ELECTRICAL WORK

The scope of the electrical portion of this project is to provide illumination on the new extension of the Webster Boulevard to 20th Sideroad, including a roundabout intersection connecting the two roads.

The preferred illumination requested by the Town of Innisfil for the extension of the Webster Boulevard was to continue with the same design used on the present terminus of Webster Boulevard. This consists of LED luminaires installed on 12.2 m high round smooth concrete poles equipped with 3 m aluminum tapered arms. The poles are approximately 50 m apart and installed in a zigzag pattern on both sides of the boulevard.

In addition to the lights on Webster Boulevard, the illumination of the roundabout will be achieved by installing lights on three (3) existing Hydro One poles located on the east side of 20th Sideroad at the roundabout.

2. ILLUMINATION OPTIONS

Luminaires:

The luminaires at the present end of Webster Boulevard appear to be Cree Lighting XSPSM LED Street/Area Luminaires – small type lights. See picture. The exact model of the existing luminaires could not be verified from the available documents.

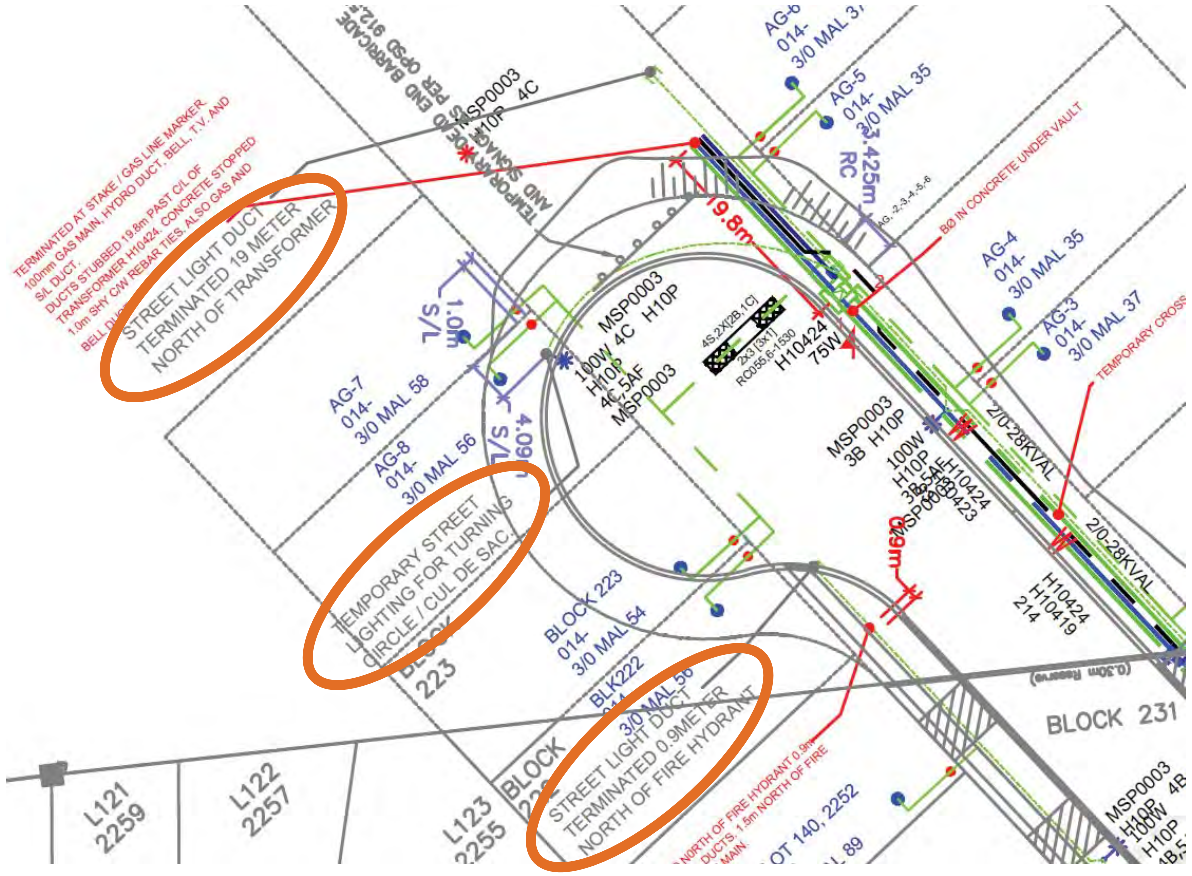
The illumination level calculations were done assuming a XSPSM-D-HT-3ME-8L-40K7-UL-SV-N model of this luminaire installed on 12.2 m high poles, with 3 m arms.

Source of Power:

It is assumed that the power supply located near the present end of the Webster Boulevard on north side will have sufficient spare capacity to supply power for the lights on the extension. The available power shall be confirmed by Innpower.

Underground Street Lighting Ducts:

The Hydro One drawing of buried service at the end of the Webster Boulevard is showing capped termination locations of the street lighting ducts. The ducts for the new lights will be extended on both sides of the street. See the following drawing.



This drawing also shows a temporary light at the present cul-de-sac that will become redundant and will have to be removed during the construction of the extension.

Preferred Layout:

The extension will require 7 more lighting poles to be installed on Webster Boulevard and 3 lights installed on Hydro One poles near the roundabout. The added wattage of these lights will be 9 x 70W = 630 Watts (as one existing light would be removed).

See the Appendix for details.

3. CONCLUSIONS

The preferred layout should be implemented as it was requested and approved during the design process by the design team.

As discussed above, the capacity of the existing power supply will shall to be verified for spare capacity by Innpower.

The timeframe of this project is: detailed design in 2022 with construction in 2023.

4. APPENDICES:

1. Preferred Layout
2. Luminaire Specification

XSP Series

XSPSM LED Street/Area Luminaire - Small

Rev. Date: V5 12/04/2019

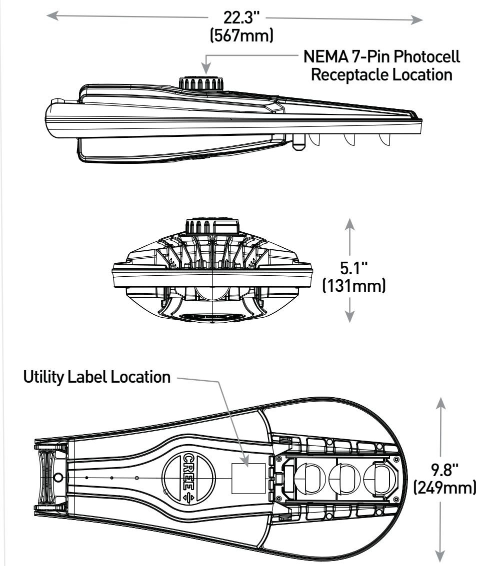
Product Description

In addition to a low initial cost, the XSPSM LED Street/Area luminaire maintains the familiar look of the traditional cobrahead design and delivers substantial energy savings while reducing maintenance time and costs. The hassle-free design of the XSP small luminaire includes tool-less entry and +/- 5° fixture leveling for easy installation. Our NanoOptic® Precision Delivery Grid™ optic achieves better optical control than traditional street and area lighting fixtures and efficiently delivers white uniform light for safer-feeling communities.
Applications: Residential roads, collector roads, parking lots, and general area spaces

Performance Summary

- NanoOptic® Precision Delivery Grid™ optic
- Assembled in the U.S.A. of U.S. and imported parts
- **Initial Delivered Lumens:** Up to 7,825
- **Efficacy:** Up to 113 LPW
- **CRI:** Minimum 70 CRI
- **CCT:** 2700K, 3000K, 4000K, 5000K, 5700K
- **Limited Warranty†:** 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

† See http://creelighting.com/warranty for warranty terms



Accessories

Field-Installed

Backlight Control Shield	Bird Spikes	Shorting Cap
XA-SPR3BLS - Provides 1 mounting height cutoff - Polycarbonate construction - Refer to initial delivered lumen tables for lumen output	XSP-BRDGRDS	XA-XSLSHRT

Lumen Packages	Weight
5L	9.0 lbs. (4.1kg)
5L w/DAL	9.6 lbs. (4.4kg)
8L	9.2 lbs. (4.2kg)

Ordering Information

Example: XSPSM-D-HT-2LG-5L-27K7-UL-SV-N

XSPSM	D	HT	3ME	8L	40K7	UL		N	
Product	**Version**	**Mounting**	**Optic**	**Lumen Package****	**CCT/CRI**	**Voltage**	**Color Options**	**Utility Label/ Receptacle**	**Options**
XSPSM	**D**	**HT** Horizontal Tenon	**Asymmetric** **2LG*** Type II Long **2ME*** Type II Medium **3ME*** Type III Medium **4ME*** Type IV Medium **Symmetric** **5SH** Type V Short	**5L** 5,000 Lumens **8L** 8,000 Lumens	**27K7** 2700K, 70 CRI **30K7** 3000K, 70 CRI **40K7** 4000K, 70 CRI **50K7** 5000K, 70 CRI **57K7** 5700K, 70 CRI	**UL** Universal 120-277V **UH** Universal 347-480V	**BK** Black **BZ** Bronze **SV** Silver	**N** **Utility Label and NEMA® 7-Pin Photocell Receptacle** - External wattage label per ANSI C136.15 - 7-pin receptacle per ANSI C136.41 - Receptacle leads are factory connected to the driver - Requires photocell or shorting cap (by others)	**DLI DALI Compatible** - Available with UL voltage only - Not available with Q or X options **Q9/Q8/Q7/Q6/Q5/Q4/Q3/Q2/Q1** **Field Adjustable Output** - Must select Q9, Q8, Q7, Q6, Q5, Q4, Q3, Q2, or Q1 - Offers full range lumen adjustability - Includes wattage label for setting selected - Refer to pages 8 & 9 for power and lumen values - Luminaire may also be dimmed through 7-Pin receptacle with use of dimming control by others **X8/X7/X6/X5/X4/X3/X2/X1** **Locked Lumen Output** - Must select X8, X7, X6, X5, X4, X3, X2, or X1 - Lumen output is permanently locked to the setting selected - Includes wattage label for setting selected - Refer to pages 8 & 9 for power and lumen values - Dimming is only available through 7-Pin receptacle with use of dimming control by others

* Available with Backlight Shield when ordered with field-installed accessory (see table above)
** Lumen Package codes identify approximate light output only. Actual lumen output levels may vary depending on CCT and optic selection. Refer to Initial Delivered Lumen tables for specific lumen values

CREE LIGHTING

US: creelighting.com (800) 236-6800
Canada: creelighting-canada.com (800) 473-1234

Product Specifications

CONSTRUCTION & MATERIALS

- Die cast aluminum housing w/UV stabilized polymeric door for long weathering and reliability
- Tool-less entry
- Mounts on 1.25" (32mm) IP, 1.66" (42mm) O.D. or 2" (51mm) IP, 2.375" (60mm) O.D. horizontal tenon (minimum 8" (203mm) in length) and is adjustable +/- 5° to allow for fixture leveling (includes two axis T-level to aid in leveling)
- Luminaire secures with two 410 stainless steel mounting bolts
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable black, bronze or silver powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion
- **Weight:** 5L: 9.0 lbs. (4.1kg); 8L: 9.2 lbs. (4.2kg); 5L w/DAL: 9.6 lbs. (4.4kg)

ELECTRICAL SYSTEM

- **Input Voltage:** 120-277V or 347-480V, 50/60Hz
- **Power Factor:** > 0.9 at full load
- **Total Harmonic Distortion:** < 20% at full load
- Integral 10kV surge suppression protection standard
- When code dictates fusing, a slow blow fuse or type C/D breaker should be used to address inrush
- Designed with 0-10V dimming capabilities. Controls by others
- **10V Source Current:** 0.15mA
- Luminaires with DLI option are DALI compatible per IEC 62386
- **Operating Temperature Range:** -40°C - +40°C (-40°F - +104°F)

REGULATORY & VOLUNTARY QUALIFICATIONS

- cULus Listed
- Suitable for wet locations
- Certified to ANSI C136.31-2001, 3G bridge and overpass vibration standards
- Meets CALTrans 611 Vibration testing
- ANSI C136.2 10kV surge protection, tested in accordance with IEEE/ANSI C62.41.2
- Meets FCC Part 15, Subpart B, Class A limits for conducted and radiated emissions
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- Meets Buy American requirements within ARRA
- RoHS compliant. Consult factory for additional details
- Dark Sky Friendly, IDA Approved when ordered with 27K7 or 30K7 CCTs. Please refer to https://www.darksky.org/our-work/lighting/lighting-for-industry/fsa/fsa-products/ for most current information
- DLC and DLC Premium qualified versions available when ordered with asymmetric optics. Please refer to https://www.designlights.org/search/ for most current information.
- **CA RESIDENTS WARNING:** Cancer and Reproductive Harm – www.p65warnings.ca.gov

Electrical Data*

Lumen Package	Optics	CCT/CRI	System Watts 120-480V	Utility Label Wattage	Total Current (A) 120V	208V	240V	277V	347V	480V
5L	Asymmetric	All	47	50	0.40	0.23	0.20	0.17	0.14	0.10
	Symmetric	All	43	40	0.36	0.20	0.18	0.16	0.12	0.09
8L	Asymmetric	All	69	70	0.58	0.34	0.29	0.26	0.20	0.15
	Symmetric	All	59	60	0.50	0.28	0.25	0.22	0.17	0.12

* Electrical data at 25°C (77°F). Actual wattage may differ by +/- 10% when operating between 120-277V or 347-480V +/- 10%.

XSP Series (XSPSM) Ambient Adjusted Lumen Maintenance[1]

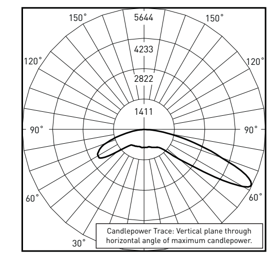
Ambient	Optics	Initial LMF	25K hr Reported[2] LMF	50K hr Reported[2] LMF	75K hr Estimated[3] LMF	100K hr Estimated[3] LMF
5°C (41°F)	Asymmetric	1.03	1.03	1.03	1.03	1.03
	Symmetric	1.04	1.03	1.03	1.03	1.03
10°C (50°F)	Asymmetric	1.03	1.03	1.03	1.03	1.03
	Symmetric	1.03	1.02	1.02	1.02	1.02
15°C (59°F)	Asymmetric	1.02	1.02	1.02	1.02	1.02
	Symmetric	1.02	1.01	1.01	1.01	1.01
20°C (68°F)	Asymmetric	1.01	1.01	1.01	1.01	1.01
	Symmetric	1.01	1.01	1.00	1.00	1.00
25°C (77°F)	Asymmetric	1.00	1.00	1.00	1.00	1.00
	Symmetric	1.00	0.99	0.99	0.99	0.99

[1] Lumen maintenance values at 25°C (77°F) are calculated per IES TM-21 based on IES LM-80 report data for the LED package and in-situ luminaire testing. Luminaire ambient temperature factors (LATF) have been applied to all lumen maintenance factors. Please refer to the Temperature Zone Reference Document for outdoor average nighttime ambient conditions.
[2] In accordance with IES TM-21, Reported values represent interpolated values based on time durations that are up to 6x the tested duration in the IES LM-80 report for the LED.
[3] Estimated values are calculated and represent time durations that exceed the 6x test duration of the LED.

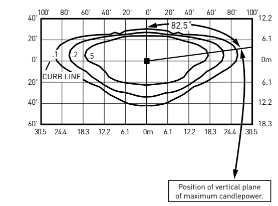
Photometry

All published luminaire photometric testing performed to IES LM-79-08 standards. To obtain an IES file specific to your project consult: http://creelighting.com/products/outdoor/street-and-roadway/xsp-series

2LG



RESTL Test Report #: PL12486-001B
XSPSM-D-**-2LG-5L-40K7-UL-**-N
Initial Delivered Lumens: 5,168

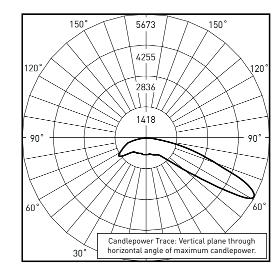


XSPSM-D-**-2LG-5L-40K7-UL-**-N
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 5,200
Initial FC at grade

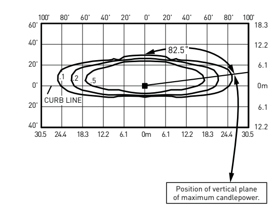
Type II Long Distribution

Lumen Package	2700K Initial Delivered Lumens*	2700K BUG Ratings** Per TM-15-11	3000K Initial Delivered Lumens*	3000K BUG Ratings** Per TM-15-11	4000K Initial Delivered Lumens*	4000K BUG Ratings** Per TM-15-11	5000K Initial Delivered Lumens*	5000K BUG Ratings** Per TM-15-11	5700K Initial Delivered Lumens*	5700K BUG Ratings** Per TM-15-11
5L	4,930	B2 U0 G2	5,075	B2 U0 G2	5,200	B2 U0 G2	5,225	B2 U0 G2	5,225	B2 U0 G2
8L	7,375	B2 U0 G2	7,575	B2 U0 G2	7,775	B2 U0 G2	7,825	B2 U0 G2	7,825	B2 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf



RESTL Test Report #: PL12762-001B
XSPSM-D-**-2LG-5L-40K7-UL-**-N
w/XA-SPR3BLS
Initial Delivered Lumens: 3,651



XSPSM-D-**-2LG-5L-40K7-UL-**-N
w/XA-SPR3BLS
Mounting Height: 2 5' (7.6m) A.F.G.
Initial Delivered Lumens: 3,690
Initial FC at grade

Type II Long w/BLS Distribution

Lumen Package	2700K Initial Delivered Lumens*	2700K BUG Ratings** Per TM-15-11	3000K Initial Delivered Lumens*	3000K BUG Ratings** Per TM-15-11	4000K Initial Delivered Lumens*	4000K BUG Ratings** Per TM-15-11	5000K Initial Delivered Lumens*	5000K BUG Ratings** Per TM-15-11	5700K Initial Delivered Lumens*	5700K BUG Ratings** Per TM-15-11
5L	3,500	B1 U0 G1	3,600	B1 U0 G1	3,690	B1 U0 G1	3,710	B1 U0 G1	3,710	B1 U0 G1
8L	5,225	B1 U0 G1	5,375	B1 U0 G1	5,525	B1 U0 G1	5,550	B1 U0 G1	5,550	B1 U0 G1

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf

Photometry

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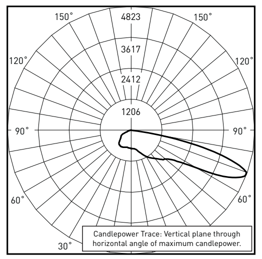
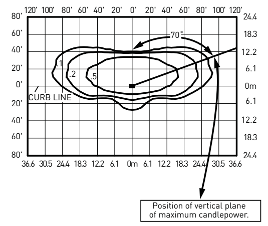
http://creelighting.com/products/outdoor/street-and-roadway/xsp-series

2ME



RESTL Test Report #: PL12483-001B
XSPSM-D-**-2ME-5L-40K7-UL-**-N
Initial Delivered Lumens: 5,221



XSPSM-D-**-2ME-5L-40K7-UL-**-N
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 5,200
Initial FC at grade

Type II Medium Distribution

Lumen Package	2700K		3000K		4000K		5000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
5L	4,930	B1 U0 G1	5,075	B1 U0 G1	5,200	B1 U0 G1	5,225	B1 U0 G1	5,225	B1 U0 G1
8L	7,375	B1 U0 G2	7,575	B1 U0 G2	7,775	B2 U0 G2	7,825	B2 U0 G2	7,825	B2 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
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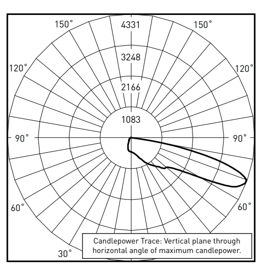
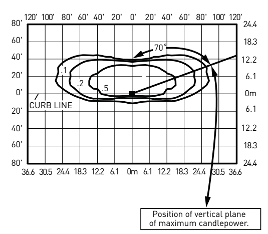


RESTL Test Report #: PL12759-001B
XSPSM-D-**-2ME-5L-40K7-UL-**-N
w/XA-SPR3BLS
Initial Delivered Lumens: 4,193



XSPSM-D-**-2ME-5L-40K7-UL-**-N
w/XA-SPR3BLS
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 4,160
Initial FC at grade

Type II Medium w/BLS Distribution

Lumen Package	2700K		3000K		4000K		5000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
5L	3,940	B0 U0 G1	4,060	B0 U0 G1	4,160	B0 U0 G1	4,180	B0 U0 G1	4,180	B0 U0 G1
8L	5,900	B1 U0 G2	6,050	B1 U0 G2	6,225	B1 U0 G2	6,250	B1 U0 G2	6,250	B1 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf

Photometry

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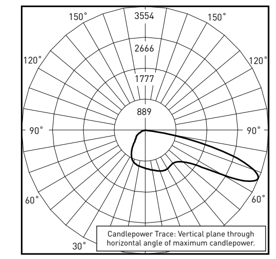
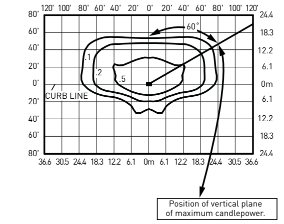
3ME



RESTL Test Report #: PL12484-001B
XSPSM-D-**-3ME-5L-40K7-UL-**-N
Initial Delivered Lumens: 5,145



XSPSM-D-**-3ME-5L-40K7-UL-**-N
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 5,200
Initial FC at grade

Type III Medium Distribution

Lumen Package	2700K		3000K		4000K		5000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
5L	4,930	B1 U0 G1	5,075	B1 U0 G1	5,200	B1 U0 G1	5,225	B1 U0 G1	5,225	B1 U0 G1
8L	7,375	B2 U0 G2	7,575	B2 U0 G2	7,775	B2 U0 G2	7,825	B2 U0 G2	7,825	B2 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
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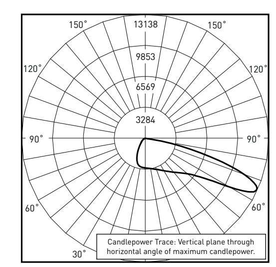
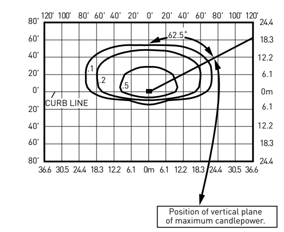


RESTL Test Report #: PL12765-002B
XSPLG-D-**-3ME-24L-40K7-UL-**-N
w/XA-SP2BLS
Initial Delivered Lumens: 16,503



XSPSM-D-**-3ME-5L-40K7-UL-**-N
w/XA-SPR3BLS
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 3,690
Initial FC at grade

Type III Medium w/BLS Distribution

Lumen Package	2700K		3000K		4000K		5000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
5L	3,500	B1 U0 G1	3,600	B1 U0 G1	3,690	B1 U0 G1	3,710	B1 U0 G1	3,710	B1 U0 G1
8L	5,225	B1 U0 G2	5,375	B1 U0 G2	5,525	B1 U0 G2	5,550	B1 U0 G2	5,550	B1 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf

Photometry

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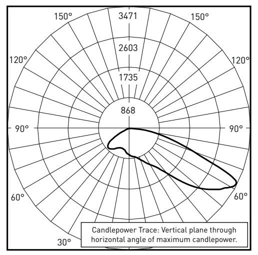
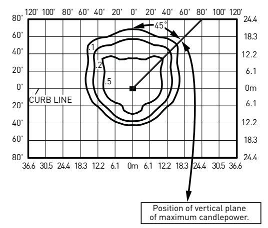
4ME



RESTL Test Report #: PL12485-001B
XSPSM-D-**-4ME-5L-40K7-UL-**-N
Initial Delivered Lumens: 5,256



XSPSM-D-**-4ME-5L-40K7-UL-**-N
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 5,200
Initial FC at grade

Type IV Medium Distribution										
	2700K		3000K		4000K		5000K		5700K	
Lumen Package	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
5L	4,930	B2 U0 G1	5,075	B2 U0 G1	5,200	B2 U0 G1	5,225	B2 U0 G1	5,225	B2 U0 G1
8L	7,375	B2 U0 G2	7,575	B2 U0 G2	7,775	B2 U0 G2	7,825	B2 U0 G2	7,825	B2 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
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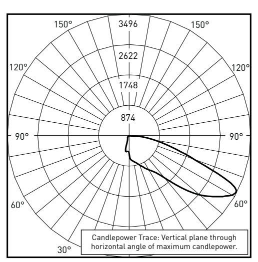
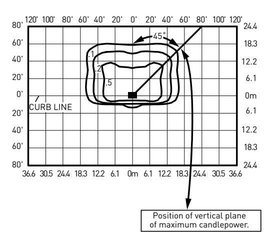


RESTL Test Report #: PL12761-001B
XSPSM-D-**-4ME-5L-40K7-UL-**-N
w/XA-SPR3BLS
Initial Delivered Lumens: 3,899



XSPSM-D-**-4ME-5L-40K7-UL-**-N
w/XA-SPR3BLS
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 3,850
Initial FC at grade

Type IV Medium w/BLS Distribution										
	2700K		3000K		4000K		5000K		5700K	
Lumen Package	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
5L	3,650	B1 U0 G1	3,760	B1 U0 G1	3,850	B1 U0 G1	3,870	B1 U0 G1	3,870	B1 U0 G1
8L	5,450	B1 U0 G2	5,600	B1 U0 G2	5,750	B1 U0 G2	5,800	B1 U0 G2	5,800	B1 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf

Photometry

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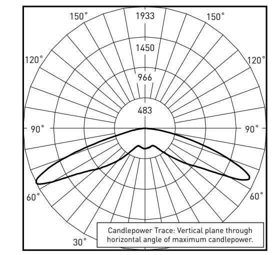
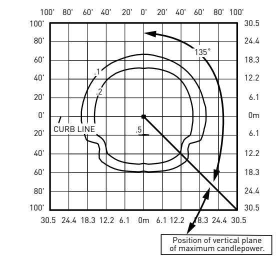
5SH



RESTL Test Report #: PL12983-001A
XSPSM-D-**-5SH-5L-30K7-UL-**-N
Initial Delivered Lumens: 4,561



XSPSM-D-**-5SH-5L-30K7-UL-**-N
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 4,590
Initial FC at grade

Type V Short Distribution										
	2700K		3000K		4000K		5000K		5700K	
Lumen Package	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
5L	3,670	B2 U0 G1	4,590	B3 U0 G1	4,930	B3 U0 G1	4,930	B3 U0 G1	4,930	B3 U0 G1
8L	5,375	B3 U0 G2	6,800	B3 U0 G2	7,325	B3 U0 G2	7,325	B3 U0 G2	7,325	B3 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
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Luminaire EPA

Horizontal Tenon Mount – Weight: 5L: 9.0 lbs. (4.1kg); 8L: 9.2 lbs. (4.2kg); 5L w/DAL: 9.6 lbs. (4.4kg)				
Single	2 @ 90°	2 @ 180°	3 @ 90°	4 @ 90°
Tenon Configuration If used with Cree Lighting tenons, please add tenon EPA with luminaire EPA				
PD-1H4; PT-1H	PD-2H4(90); PT-2H(90)	PD-2H4(180); PT-2H(180)	PD-3H4(90); PT-3H(90)	PD-4H4(90); PT-4H(90)
0.57	0.85	1.14	1.42	1.56

Tenon EPA

Part Number	EPA
PD Series Tenons	0.09
PT Series Tenons	0.10
WM-2L	0.13
XA-TMDA8	0.19

Tenons and Brackets‡ (must specify color)

Square Internal Mount Horizontal Tenons (Aluminum)
- Mounts to 4" (102mm) square aluminum or steel poles
PD-1H4 – Single
PD-2H4(90) – 90° Twin
PD-2H4(180) – 180° Twin
PD-3H4(90) – 90° Triple
PD-4H4(90) – 90° Quad

Wall Mount Brackets
- Mounts to wall or roof
WM-2L – Extended Horizontal

Round External Mount Horizontal Tenons (Aluminum)
- Mounts to 2.375"-3" (60-76mm) O.D. round aluminum or steel poles or tenons
- Mounts to 3" (76mm), 4" (102mm), 5" (127mm), or 6" (152mm) square pole with PB-1A* tenon
PT-1H – Single
PT-2H(90) – 90° Twin
PT-2H(180) – 180° Twin
PT-3H(90) – 90° Triple
PT-4H(90) – 90° Quad

Direct Arm Pole Adaptor Bracket
- Mounts to 3-6" (76-152mm) round or square aluminum or steel poles
XA-TMDA8

‡ Refer to the Bracket and Tenons spec sheet for more details
* Specify pole size: 3 (3"), 4 (4"), 5 (5"), or 6 (6") for single, double or triple luminaire orientation or 4 (4"), 5 (5") or 6 (6") for quad luminaire orientation

Field Adjustable Output (Q9/Q8/Q7/Q6/Q5/Q4/Q3/Q2/Q1) Option Description:

The Field Adjustable Output option enables the street and area luminaire within the XSP Series on this page to be tuned to the exact needs of a particular application through multiple levels of adjustment. When ordered with the Q option, the luminaire will be shipped from the factory at the selected lumen output, will be fully adjustable between the outputs, and will include a wattage label that indicates the wattage of the luminaire at the selected lumen output (Rounded to nearest 10 watts per ANSI C136.15-2015.). Additional dimming functionality is available when a dimming control (by others) is used in the 7-Pin receptacle.

Locked Lumen Output (X8/X7/X6/X5/X4/X3/X2/X1) Option Description:

The Locked Lumen Output option on this page permanently locks the lumen output on the XSP Series street and area luminaire to the setting selected. When ordered with the X option, the luminaire will be shipped from the factory at the lumen output setting selected, and will include a wattage label that indicates the wattage of the setting selected. When this option is selected, the luminaire output is not able to be adjusted in the field except if a dimming control (by others) is used in the 7-Pin receptacle.

Q & X Option Power & Lumen Data – 5L

Q Option Setting	X Option Setting	CCT/ CRI	System Watts†		Label Wattage		Lumen Values†						Optics Qualified on DLC QPL	
			Asymmetric	Symmetric	Asymmetric	Symmetric	2LG/2ME/3ME/4ME	5SH	2LG w/BLS	2ME w/BLS	3ME w/BLS	4ME w/ BLS	Standard	Premium
		27K7					4,930	3,670	3,500	3,940	3,500	3,650		2LG, 2ME, 3ME, 4ME
		30K7					5,075	4,590	3,600	4,060	3,600	3,760	2LG, 2ME, 3ME, 4ME	
Q9	N/A (Full Power)	40K7	47	43	50	40	5,200	4,930	3,690	4,160	3,690	3,850		2LG, 2ME, 3ME, 4ME
		50K7					5,225	4,930	3,710	4,180	3,710	3,870		2LG, 2ME, 3ME, 4ME
		57K7					5,225	4,930	3,710	4,180	3,710	3,870		2LG, 2ME, 3ME, 4ME
		27K7					4,780	3,560	3,390	3,820	3,390	3,540		2LG, 2ME, 3ME, 4ME
		30K7					4,910	4,450	3,490	3,930	3,490	3,630		2LG, 2ME, 3ME, 4ME
Q8	X8	40K7	44	39	40	40	5,050	4,790	3,590	4,040	3,590	3,740		2LG, 2ME, 3ME, 4ME
		50K7					5,075	4,770	3,600	4,060	3,600	3,760		2LG, 2ME, 3ME, 4ME
		57K7					5,075	4,700	3,600	4,060	3,600	3,760		2LG, 2ME, 3ME, 4ME
		27K7					4,580	3,410	3,250	3,660	3,250	3,390		2LG, 2ME, 3ME, 4ME
		30K7					4,710	4,260	3,340	3,770	3,340	3,490		2LG, 2ME, 3ME, 4ME
Q7	X7	40K7	42	37	40	40	4,830	4,590	3,430	3,860	3,430	3,570		2LG, 2ME, 3ME, 4ME
		50K7					4,860	4,570	3,450	3,890	3,450	3,600		2LG, 2ME, 3ME, 4ME
		57K7					4,860	4,570	3,450	3,890	3,450	3,600		2LG, 2ME, 3ME, 4ME
		27K7					4,450	3,310	3,160	3,560	3,160	3,290		2LG, 2ME, 3ME, 4ME
		30K7					4,570	4,140	3,240	3,660	3,240	3,380		2LG, 2ME, 3ME, 4ME
Q6	X6	40K7	40	35	40	40	4,690	4,450	3,330	3,750	3,330	3,470		2LG, 2ME, 3ME, 4ME
		50K7					4,720	4,430	3,350	3,780	3,350	3,490		2LG, 2ME, 3ME, 4ME
		57K7					4,720	4,430	3,350	3,780	3,350	3,490		2LG, 2ME, 3ME, 4ME
		27K7					4,125	3,040	2,930	3,300	2,930	3,050		2LG, 2ME, 3ME, 4ME
		30K7					4,250	3,810	3,020	3,400	3,020	3,150		2LG, 2ME, 3ME, 4ME
Q5	X5	40K7	37	33	40	30	4,350	4,100	3,090	3,480	3,090	3,220		2LG, 2ME, 3ME, 4ME
		50K7					4,375	4,080	3,110	3,500	3,110	3,240		2LG, 2ME, 3ME, 4ME
		57K7					4,375	4,080	3,110	3,500	3,110	3,240		2LG, 2ME, 3ME, 4ME
		27K7					3,800	2,860	2,700	3,040	2,700	2,810		2LG, 2ME, 3ME, 4ME
		30K7					3,925	3,580	2,790	3,140	2,790	2,900		2LG, 2ME, 3ME, 4ME
Q4	X4	40K7	33	29	30	30	4,025	3,850	2,860	3,220	2,860	2,980		2LG, 2ME, 3ME, 4ME
		50K7					4,050	3,830	2,880	3,240	2,880	3,000		2LG, 2ME, 3ME, 4ME
		57K7					4,050	3,830	2,880	3,240	2,880	3,000		2LG, 2ME, 3ME, 4ME
		27K7					3,480	2,590	2,470	2,780	2,470	2,580		2LG, 2ME, 3ME, 4ME
		30K7					3,580	3,240	2,540	2,860	2,540	2,650		2LG, 2ME, 3ME, 4ME
Q3	X3	40K7	30	27	30	30	3,670	3,490	2,610	2,940	2,610	2,720		2LG, 2ME, 3ME, 4ME
		50K7					3,700	3,470	2,630	2,960	2,630	2,740		2LG, 2ME, 3ME, 4ME
		57K7					3,700	3,470	2,630	2,960	2,630	2,740		2LG, 2ME, 3ME, 4ME
		27K7					3,160	2,350	2,240	2,530	2,240	2,340		2LG, 2ME, 3ME, 4ME
		30K7					3,250	2,940	2,310	2,600	2,310	2,410		2LG, 2ME, 3ME, 4ME
Q2	X2	40K7	27	24	30	20	3,340	3,170	2,370	2,670	2,370	2,470		2LG, 2ME, 3ME, 4ME
		50K7					3,360	3,160	2,390	2,690	2,390	2,490		2LG, 2ME, 3ME, 4ME
		57K7					3,360	3,160	2,390	2,690	2,390	2,490		2LG, 2ME, 3ME, 4ME
		27K7					2,890	2,150	2,050	2,310	2,050	2,140		2LG, 2ME, 3ME, 4ME
		30K7					2,970	2,690	2,110	2,380	2,110	2,200		2LG, 2ME, 3ME, 4ME
Q1	X1	40K7	24	21	20	20	3,040	2,890	2,160	2,430	2,160	2,250		2LG, 2ME, 3ME, 4ME
		50K7					3,060	2,880	2,170	2,450	2,170	2,260		2LG, 2ME, 3ME, 4ME
		57K7					3,060	2,880	2,170	2,450	2,170	2,260		2LG, 2ME, 3ME, 4ME

† Electrical and lumen data at 25˚C (77˚F). Actual wattage and lumen output may differ by +/-10% when operating between 120-277V or 347-480V +/-10%

Field Adjustable Output (Q9/Q8/Q7/Q6/Q5/Q4/Q3/Q2/Q1) Option Description:

The Field Adjustable Output option enables the street and area luminaire within the XSP Series on this page to be tuned to the exact needs of a particular application through multiple levels of adjustment. When ordered with the Q option, the luminaire will be shipped from the factory at the selected lumen output, will be fully adjustable between the outputs, and will include a wattage label that indicates the wattage of the luminaire at the selected lumen output (Rounded to nearest 10 watts per ANSI C136.15-2015.). Additional dimming functionality is available when a dimming control (by others) is used in the 7-Pin receptacle.

Locked Lumen Output (X8/X7/X6/X5/X4/X3/X2/X1) Option Description:

The Locked Lumen Output option on this page permanently locks the lumen output on the XSP Series street and area luminaire to the setting selected. When ordered with the X option, the luminaire will be shipped from the factory at the lumen output setting selected, and will include a wattage label that indicates the wattage of the setting selected. When this option is selected, the luminaire output is not able to be adjusted in the field except if a dimming control by others is used in the 7-Pin receptacle.

Q & X Option Power & Lumen Data – 8L

Q Option Setting	X Option Setting	CCT/ CRI	System Watts†		Label Wattage		Lumen Values†						Optics Qualified on DLC QPL	
			Asymmetric	Symmetric	Asymmetric	Symmetric	2LG/2ME/3ME/4ME	5SH	2LG w/BLS	2ME w/BLS	3ME w/BLS	4ME w/ BLS	Standard	Premium
		27K7					7,375	5,375	5,225	5,900	5,225	5,450	2LG, 2ME, 3ME, 4ME	
		30K7					7,575	6,800	5,375	6,050	5,375	5,600		2LG, 2ME, 3ME, 4ME
Q9	N/A (Full Power)	40K7	69	59	70	60	7,775	7,325	5,525	6,225	5,525	5,750	2LG, 2ME, 3ME, 4ME	
		50K7					7,825	7,325	5,550	6,250	5,550	5,800	2LG, 2ME, 3ME, 4ME	
		57K7					7,825	7,325	5,550	6,250	5,550	5,800	2LG, 2ME, 3ME, 4ME	
		27K7					7,150	5,225	5,075	5,725	5,075	5,300		2LG, 2ME, 3ME, 4ME
		30K7					7,325	6,600	5,200	5,850	5,200	5,425		2LG, 2ME, 3ME, 4ME
Q8	X8	40K7	65	55	70	60	7,525	7,175	5,350	6,025	5,350	5,575	2LG, 2ME, 3ME, 4ME	
		50K7					7,575	7,075	5,375	6,050	5,375	5,600	2LG, 2ME, 3ME, 4ME	
		57K7					7,575	7,075	5,375	6,050	5,375	5,600	2LG, 2ME, 3ME, 4ME	
		27K7					6,850	5,000	4,875	5,475	4,875	5,075		2LG, 2ME, 3ME, 4ME
		30K7					7,025	6,325	5,000	5,625	5,000	5,200		2LG, 2ME, 3ME, 4ME
Q7	X7	40K7	62	52	60	50	7,225	6,875	5,125	5,775	5,125	5,350	2LG, 2ME, 3ME, 4ME	
		50K7					7,275	6,775	5,175	5,825	5,175	5,375		2LG, 2ME, 3ME, 4ME
		57K7					7,275	6,775	5,175	5,825	5,175	5,375		2LG, 2ME, 3ME, 4ME
		27K7					6,650	4,850	4,720	5,325	4,720	4,920		2LG, 2ME, 3ME, 4ME
		30K7					6,825	6,125	4,850	5,450	4,850	5,050		2LG, 2ME, 3ME, 4ME
Q6	X6	40K7	59	50	60	50	7,000	6,650	4,970	5,600	4,970	5,175		2LG, 2ME, 3ME, 4ME
		50K7					7,050	6,575	5,000	5,650	5,000	5,225		2LG, 2ME, 3ME, 4ME
		57K7					7,050	6,575	5,000	5,650	5,000	5,225		2LG, 2ME, 3ME, 4ME
		27K7					6,125	4,470	4,350	4,900	4,350	4,530		2LG, 2ME, 3ME, 4ME
		30K7					6,275	5,650	4,460	5,025	4,460	4,640		2LG, 2ME, 3ME, 4ME
Q5	X5	40K7	54	46	50	50	6,450	6,125	4,580	5,150	4,580	4,770		2LG, 2ME, 3ME, 4ME
		50K7					6,500	6,050	4,620	5,200	4,620	4,810		2LG, 2ME, 3ME, 4ME
		57K7					6,500	6,050	4,620	5,200	4,620	4,810		2LG, 2ME, 3ME, 4ME
		27K7					5,750	4,200	4,080	4,600	4,080	4,260		2LG, 2ME, 3ME, 4ME
		30K7					5,900	5,300	4,190	4,720	4,190	4,370		2LG, 2ME, 3ME, 4ME
Q4	X4	40K7	49	42	50	40	6,050	5,750	4,300	4,840	4,300	4,480		2LG, 2ME, 3ME, 4ME
		50K7					6,100	5,675	4,330	4,880	4,330	4,510		2LG, 2ME, 3ME, 4ME
		57K7					6,100	5,675	4,330	4,880	4,330	4,510		2LG, 2ME, 3ME, 4ME
		27K7					5,200	3,800	3,690	4,160	3,690	3,850		2LG, 2ME, 3ME, 4ME
		30K7					5,350	4,800	3,800	4,280	3,800	3,960		2LG, 2ME, 3ME, 4ME
Q3	X3	40K7	44	38	40	40	5,475	5,225	3,890	4,380	3,890	4,050		2LG, 2ME, 3ME, 4ME
		50K7					5,525	5,150	3,920	4,420	3,920	4,090		2LG, 2ME, 3ME, 4ME
		57K7					5,525	5,150	3,920	4,420	3,920	4,090		2LG, 2ME, 3ME, 4ME
		27K7					4,750	3,450	3,370	3,800	3,370	3,520		2LG, 2ME, 3ME, 4ME
		30K7					4,875	4,370	3,460	3,900	3,460	3,610		2LG, 2ME, 3ME, 4ME
Q2	X2	40K7	40	34	40	30	4,975	4,740	3,530	3,980	3,530	3,680		2LG, 2ME, 3ME, 4ME
		50K7					5,025	4,680	3,570	4,020	3,570	3,720		2LG, 2ME, 3ME, 4ME
		57K7					5,025	4,680	3,570	4,020	3,570	3,720		2LG, 2ME, 3ME, 4ME
		27K7					4,325	3,150	3,070	3,460	3,070	3,200		2LG, 2ME, 3ME, 4ME
		30K7					4,425	3,980	3,140	3,540	3,140	3,270		2LG, 2ME, 3ME, 4ME
Q1	X1	40K7	35	30	40	30	4,550	4,330	3,230	3,640	3,230	3,370		2LG, 2ME, 3ME, 4ME
		50K7					4,575	4,270	3,250	3,660	3,250	3,390		2LG, 2ME, 3ME, 4ME
		57K7					4,575	4,270	3,250	3,660	3,250	3,390		2LG, 2ME, 3ME, 4ME

† Electrical and lumen data at 25˚C (77˚F). Actual wattage and lumen output may differ by +/-10% when operating between 120-277V or 347-480V +/-10%

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