Rationale for Urban Growth in Northwest Welland

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Prepared by: SGL Planning & Design Inc. *in collaboration with: AgPlan Limited, ASI Archaeological and Cultural Heritage Services, Aquafor Beech Limited and Associated Engineering*

Executive Summary

This report has evaluated the appropriateness of the Northwest Welland study area for urban development. Background studies, policy evaluation and capacity analysis have been conducted to assess the feasibility of designating the subject lands as greenfield area and urban land use. Including the lands within the urban boundary and redesignating of the lands to urban land use presents an opportunity for the City of Welland to accommodate its forecasted growth to 2041.

The Northwest Welland study area is comprised of approximately 190.3 hectares of primarily rural/agriculturally designated lands. The Natural Heritage System, as currently designated, accounts for 31 hectares of the overall study area and approximately 55 hectares of the study area are already developed and / or located within the Built-up Area on Schedule A of the City's Official Plan and in the Province's Built Boundary mapping. As well, a further 8.4 hectares is comprised of existing roads. Therefore, there is approximately 96 hectares of land for potential development. The Agricultural Assessment in Section 3 of this report confirms that the lands within the study area have poorer agricultural quality and currently have limited agricultural activity.

As identified in **Figure 3**, the subject lands are adjacent to urban land uses. Regional policy direction requires that expansion in greenfield areas promote sequential, orderly and contiguous development. As identified in Section 2 of this report, the predominate land use in the surrounding area is residential with some institutional, commercial and rural residential land uses, most of which are also found within the subject lands. Therefore, residential and mixed-use development is considered to be a more compatible land use for the study area. Development of the Northwest Welland lands will act to fill the hole in the donut by connecting and integrating the existing Built-up Areas, which will in turn help to promote the development of complete communities.

The Northwest Welland lands also benefit from existing institutional services within the study area. Future residential development can be serviced by the three existing schools (Public, Catholic and French) that are located both within and adjacent to the study area as well as the Niagara College Welland Campus, which is located south-east of the study area.

Development of the Northwest Welland study area will make efficient use of existing and planned City of Welland and Niagara Region transportation and servicing infrastructure. As per the servicing report in Section 3 and Appendix A, the study area has existing water and sanitary services that can easily be extended. The study area will also directly be affected by a number of planned upgrades and developments that are scheduled over the next ten years including two pump upgrade projects identified in the Niagara Region's 25-Year MSP Upgrade that will be operational by 2021. These upgrades will positively affect the water servicing to the study area. As per the servicing report in Section 3, development of the subject lands will require stormwater management facilities, however this will contribute to addressing existing stormwater and flooding issues within the study area and the adjacent Built-up Areas.

The Northwest Welland study area is well serviced with both regional and local road network of both collector and arterial roads. Development of the Northwest Welland study area can support the planned future widening of Regional Road 54 (Rice Road) and Quaker Road, First Avenue and Niagara Street. The Transportation Assessment in Section 3 has identified that full build-out of the East Fonthill Secondary Plan, the Port Robinson West Secondary Plan and the Regional Road 37 (Merritt Road) extension will alter traffic patterns and should be considered when developing a preferred plan for the study area. The development of internal road network within the Northwest Welland study area can help connect the adjacent Built-up Areas by extending new roads and increasing the road network and capacity for the surrounding urban areas.

The existing active transportation facilities within the Northwest Welland study area are limited. This condition creates an opportunity for the study area to provide dedicated active transportation facilities for pedestrians and cyclists. There is also an opportunity to provide active transportation links between the study area and the East Fonthill and West Port Robinson Secondary Plan areas. First Avenue/Cataract Road is a candidate for enhanced cyclist facilities as per the Niagara Region's Strategic Cycling Network Development Technical Paper. Development of the subject lands, in conjunction with the adjacent Secondary Plan areas, creates an opportunity to enhance transit services and provide an improved transit network and more rapid services including an opportunity for improved transit services to and from Niagara College.

The City of Welland is forecast to grow by between 13,630 to 18,630 people by 2041. Based on these forecasts, the City would need to accommodate between

2,340 to 3,635 dwelling units in its Designated Greenfield Area (DGA) based on an intensification target of 50%. Current registered plans, draft plans, applications and vacant lands without applications within the City are estimated to contain between 1,739 and 2,163 units. The City therefore has a shortfall of approximately 177 to 1,896 units.

West of the Welland Canal, two potential areas could accommodate the City's future greenfield growth: the Northwest Welland lands and the lands located north of Forks Road and east of Highway 58 ("East of 58 lands") which are currently Deferred in the City's Official Plan.

The East of 58 lands are not considered appropriate lands for future development, they are not well integrated with the City of Welland and are physically disconnected by the railway tracks to the north and the canal to the east. Development of the East of Highway 58 lands would require major municipal servicing works.

In comparison, development of the Northwest Welland study area will allow the City of Welland to accommodate its forecasted growth through orderly, sequential and contiguous development. Development of the subject lands will contribute to better integration and connectivity of the surrounding built-up areas in order to achieve the development of complete communities.

Section 5 of the report evaluates the appropriateness of developing the Northwest Welland lands from a Provincial, Regional and Local policy perspective. Development of the Northwest Welland study area is found to conform to policies that require designated greenfield areas to be supported by existing or planned infrastructure and public service facilities. It also aligns with policy directives that require proposed settlement boundary expansions to be contiguous to the existing settlement area boundary.

As identified in Section 3 and Section 5 of this report, the Northwest Welland study area has existing and planned water, sanitation and transportation services. The subject lands are surrounded by the municipal Built-up Areas in Welland, Pelham and Thorold. Development of the Northwest Welland lands will fill the existing void, as seen in **Figure 3**, and will ensure that greenfield development is sequential, orderly and contiguous. Development of the Northwest Welland lands will also help to create better connectivity between the municipalities and in turn work towards creating a complete community.

In summary, Northwest Welland lands are appropriate lands for future urban development due to their existing and planned infrastructure, proximity to existing built-up areas and ability to contribute to orderly, sequential and contiguous development.

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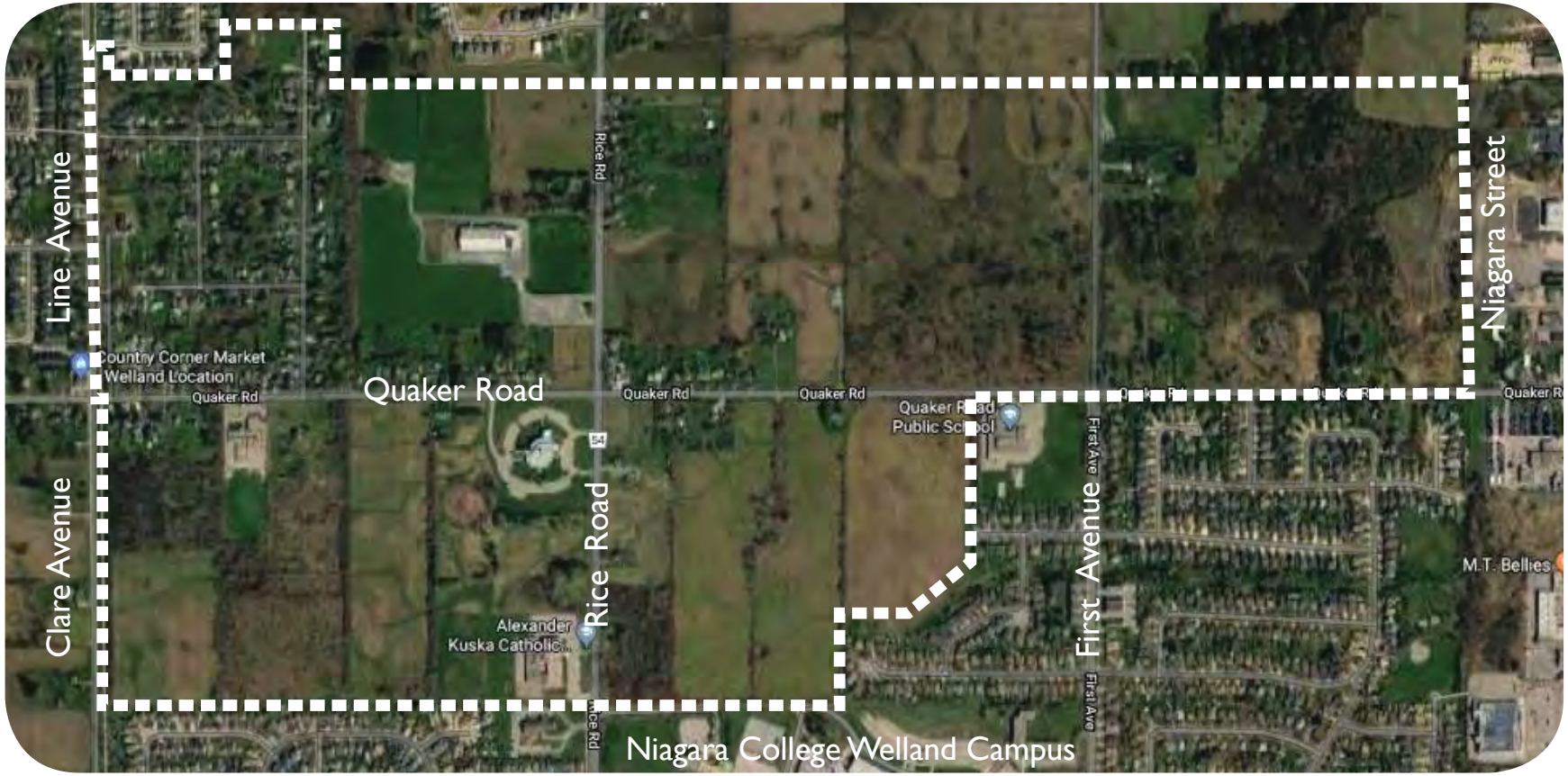
1 Introduction

1.1 Background

The City of Welland is located in the heart of the Niagara Peninsula and is bound by the City of Thorold and the Town of Pelham to the north, the City of Port Colborne to the south, the Township of Wainfleet to the west and the City of Niagara Falls to the east. The City has accommodated nearly all of its recent growth within its Built-up and Designated Greenfield Areas within an increasing proportion of growth accommodated within the Built-up Area. However, not all of the City's future growth can be accommodated solely in its Built-up Area, yet the City has limited lands available for future Designated Greenfield development over the next twenty years.

The City has identified the Northwest Welland lands as an appropriate location for future Designated Greenfield development. The Northwest Welland study area, as seen in **Figure 1**, runs along Quaker Road and is bound by the City of Pelham and City of Thorold to the north, Niagara Street to the east, Niagara College Welland Campus to the south and Line Avenue and Clare Avenue on the west. The Northwest Welland lands comprise approximately 189 hectares of primarily rural/agriculturally designated lands. Approximately 55 hectares of the subject lands are presently developed and serviced and are identified as 'Built-up Area', on Schedule A of the City's Official Plan and in the Province's Built Boundary mapping despite not being located within a settlement area boundary. The implications of this are if the lands are included in the City's settlement area boundary, the 55 hectares will not be included in the Designated Greenfield Area for density calculations.

Figure 1: Northwest Welland Study Area Boundary



The subject lands have existing Regional and local infrastructure and services. In addition, the abutting development of the Port Robinson Secondary Plan in the City of Thorold and the Fonthill Secondary Plan in the Town of Pelham have increased the economic feasibility of further servicing the subject lands. Therefore, the City believes that the Northwest Welland study area is a prime candidate for a boundary expansion.

In 2008, the City prepared a Planning and Servicing Study/Municipal Class Environmental Assessment for the Northwest Welland study area. The 2008 study was conducted concurrently with the City's Official Plan review and update. However, the decision to modify the City's urban boundary was deferred by the Region of Niagara.

The Region is currently conducting a Municipal Comprehensive Review (MCR), and update to its Official Plan, which will determine the anticipated residential and employment growth to 2041 as well as the need for and locations for settlement expansion. The City is continuing to consult and work with the Region on determining the appropriate population forecast and location for future development to 2041 as the Region finalizes its MCR.

The City of Welland has commenced this study to evaluate the feasibility of the Northwest Welland study area as a potential location to accommodate future Designated Greenfield Area growth to 2041.

1.2 Study Purpose and Process

The purpose of the study is to assess the feasibility for development within the Northwest Welland study area and justify whether the subject lands are an appropriate location to accommodate the City's forecasted Designated Greenfield Area growth to 2041.

The City of Welland has retained consultants in the fields of Agriculture, Archeology, Environment, Servicing, Transportation, Planning and Urban Design to conduct studies that build on previous justification for development of the Northwest Welland study area. The feasibility and justification of including the Northwest Welland lands within the City's urban boundary is informed by the following background studies that are being conducted by the consultant team:

- Agricultural Impact Assessment;
- Archeological Resource Assessment;
- Cultural Heritage Resource Assessment;
- Municipal Servicing Study;
- Transportation Study;
- Natural Heritage Study/Environmental Impact Study;
- Floodplain and Natural Hazards Study; and
- Land Needs Study.

The study also assesses Provincial, Regional and City policies as part of the justification for including the Northwest Welland lands within the City's urban boundary.

The consultant team introduced the study and presented their initial background findings to the public at a Public Information Centre on June 18th, 2018. Following the presentation, the public was invited to engage with the consultants and ask any questions pertaining to their subject matter. A summary of the PIC can be found in **Appendix G** of this report.

The background studies and policy analysis have been used to prepare this report and have been the basis for demonstrating that the Northwest Welland study area is an appropriate location for an expansion to the City's urban boundary.

1.3 Contents of the Report

The report is broken down into the following sections.

Chapter Two provides land use context for the Northwest Welland study area and analyzes the existing neighbourhood character in the area.

Chapter Three provides an overview of the background studies conducted by the consultant team. It analyzes the feasibility of development within the Northwest Welland study area from an Agricultural, Archeological, Cultural Heritage, Municipal and Transportation perspectives.

Chapter Four describes the population and employment forecasts for the City of Welland and the range of forecasts to accommodate by the year 2041. It then discusses the City's existing land supply and determines the amount of additional lands needed to meet the City's growth targets. The chapter then analyzes the City's available land, and feasibility of development within the Northwest Welland study area. It also discusses the implications of modifying the City's Urban Boundary to remove the East of Highway 58 Lands.

Chapter Five provides an overview of the policy pertaining to growth and development for a settlement expansion and development on Designated Greenfield Area lands and provides rationale for how including the Northwest Welland lands within the urban boundary conform to Provincial, Regional and City policy.

Chapter Six contains a conclusion of the report.

2 Site Context

2.1 Land Use

The Northwest Welland study area generally consists of a mix of single-detached residential dwellings, institutional uses (Niagara District Catholic School Board, Alexander Kuska Catholic School and Nouvel Horizon Elementary School), recreational, and open space uses, active and fallow agricultural land and natural heritage features. The most predominant use is fallow agricultural lands and natural heritage features. There are a number of single-detached dwellings located along Quaker Road, however the majority are within the well-established Summerlea Community in the north-west corner of the study area.

The City's Zoning By-Law in **Figure 2** illustrates the existing and permitted land uses within the study area. The study area is predominately zoned A1 for agricultural uses.

The study area is situated adjacent to existing built-up and planned urban areas. The subject lands abut Quaker Road Public School and the Niagara College, Welland Campus is immediately to the south of the study area with residential subdivisions on the south and southeastern boundary of the study area. Immediately to the north of the study area are urban lands within the Town of Pelham, including the East Fonthill Secondary Plan Area, and lands within the City of Thorold, including the Port Robinson West Secondary Plan Area. The land use maps for the City of Welland, the Town of Pelham and the City of Thorold have been overlaid in **Figure 3**. This overlay map illustrates the existing built-up area and the significant existing infrastructure that both surrounds and is located within the study area. It also illustrates that the Northwest Welland study area is predominately surrounded by existing and planned urban land uses.

Figure 2: City of Welland Zoning By-Law for Northwest Welland

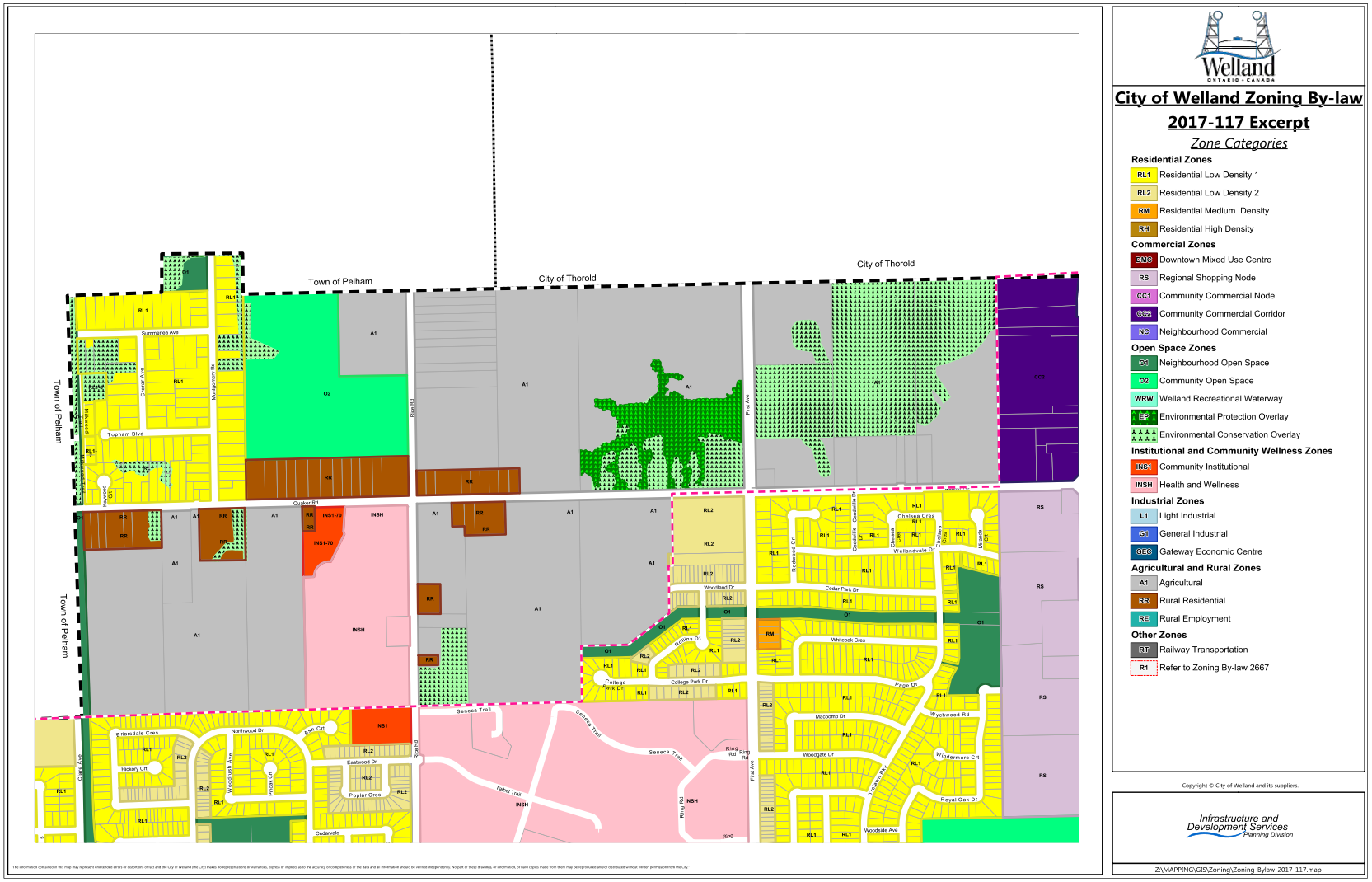
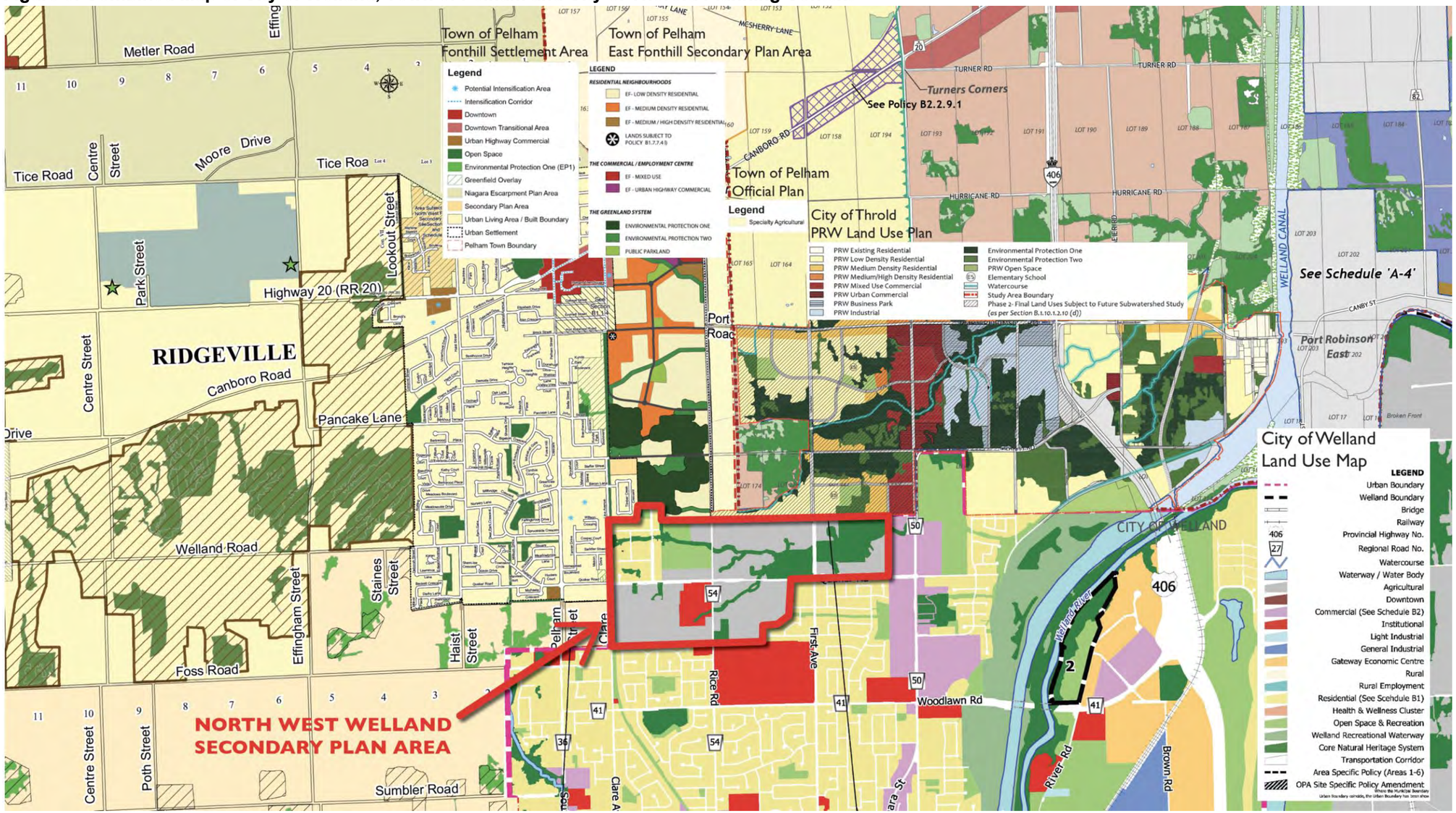


Figure 3: Combined Map of City of Welland, Town of Pelham and City of Thorold Planning Context



2.2 Neighbourhood Character Analysis

The Northwest Welland study area is comprised of a range of land uses from residential and institutional uses to open space, natural heritage features and agricultural lands. The following section speaks to the existing land uses in the study area and the distinctive characteristics that should be considered in the design of future urban development within the study area.

Quaker Road

As seen in **Figure 1**, the study area is bisected by Quaker Road, a local arterial road, which was surveyed prior to 1862, as identified in the archaeological assessment in Section 3 of this report. The Cultural Heritage Resource assessment describes Quaker Road as an important arterial roadway, which has had rows of residential structures built along it. Nearly all of these buildings have been oriented towards the road and connected to Quaker Road through driveways. Some post-war detached homes have been built along Quaker Road, most significantly the Summerlea LA subdivision in the northwest quadrant of the study area.

Quaker Road has largely preserved its rural character. As seen in **Figure 4**, the road is composed of two vehicular lanes and bordered by gravel shoulders and ditches. The roadway is lined with hydro poles, vegetation, and residences. Quaker Road, as compared to the other streets within the study area, consists of a more residential built form. The road is also lined with agricultural lands, most of which are fallow and some natural heritage features. The existing built form is predominately single detached residential units, either one or two storeys in height. These buildings are generally set back from the road, with garages either flush with the building or setback. Quaker Road is also intersected with garage driveways of varying widths and materials.

Figure 4: Existing character of Quaker Road

As seen in **Figure 5**, the western segment of Quaker Road has more residential built form. The northern segment of the road has a more formalized drainage ditch as compared to the ditches on the south side. A small, informal and fragmented pedestrian path is also present to the north of Quaker Road from the Nouvel Horizon Elementary Street to Rice Road. The northeastern segment of Quaker Road consists of primarily fallow agricultural land and woodlots, while the southern segment, which is outside of the study area, is back-lotted by an existing subdivision, as seen in **Figure 6** and **Figure 7**.

Figure 5: North west segment of Quaker Rd.

Figure 6: Fallow agricultural land on Quaker Rd

Figure 7: Existing back-lotting on the south-eastern segment of Quaker Road

Quaker Road will likely be a main east-west spine for any future development within the study area. As per Schedule F, of the City's Official Plan, a future widening is planned for Quaker Road, this widening should aim to preserve existing mature vegetation where possible, while also improving active transit facilities such as formalized pedestrian and cycling paths. In addition, any future built form along Quaker Road should take design cues from the existing built form with regards to building setbacks, position of garages, heights and landscaping treatments. However, any potential development should not replicate the back-lotting treatment seen on the south-eastern segment of Quaker Road. This type of development should be prohibited for any future development within the study area as it creates unsafe, unattractive and an impermeable streetscape.

Summerlea Subdivision

The Summerlea subdivision was constructed in the post WWII period and consists predominantly of residential single detached dwellings that are on wide lots with generous front, rear and side yard setbacks. The subdivision consists of a number of local streets, which have no curbs or sidewalks, as seen in **Figure 8 and 9** below. The Summerlea subdivision also contains a significant amount of vegetation and is bound by the Milkweed Trail on the south-west corner. As seen in **Figure 10 and 11**, the residential buildings are predominately from the post-war era with some modifications and additions.

Figure 8: Existing streetscape

Figure 9: Milkweed Trail

Figure 10: Existing built form

Figure 11: Existing built form with garage setback

Any future development adjacent to the Summerlea subdivision should be respectful of the existing character of the subdivision and provide an appropriate transition of lot size and density.

3 Background Studies

3.1 Agricultural Impact Assessment Study

An Agricultural Impact Assessment was conducted by AgPlan Ltd. for the Northwest Welland study area. The purpose of the study was to determine, from an agricultural perspective, the feasibility of the Northwest Welland lands for urban land use purposes. This feasibility was determined by reviewing the presence of livestock facilities and the veracity of the agricultural systems within the study area. The complete agricultural impact assessment can be found in **Appendix A**.

The assessment was conducted through research on published literature, quantitative statistics from Statistics Canada and the Ontario Ministry of Agriculture, Food and Rural Affairs, fieldwork, and aerial photo interpretation. Census data for Welland and Thorold have also been used, as well as looking at trends from 1981 – 2016 due to a high amount of agricultural data suppression.

The study area is designated as Good General Agricultural Area and Rural Area in the *Niagara Regional Official Plan.* In the City of Welland's Official Plan, the study area is designated Agricultural, Institutional, Residential, Open Space and Recreation and Core Natural Heritage System uses. The study area is almost entirely surrounded by non-agricultural uses and designations.

The Niagara Region is known to have a generally high agricultural performance rating relative to other Regions/Counties in southern Ontario. Niagara holds a very important role in the context of southern Ontario and that agricultural lands proposed for non-agricultural development need to be studied and chosen carefully. However, trends in census farm numbers from 1981 – 2016 indicate a decline in farm numbers and farm area in the City of Welland. More money is being spent on imported fruits and vegetables that are being earned via exporting Ontario's fruits and vegetables. The Agricultural and Agri-Food Canada Land Use for the study area is shown in **Figure 12** and illustrates that less than half of the study area is in agricultural use and that no fruit or vegetable farms are present.

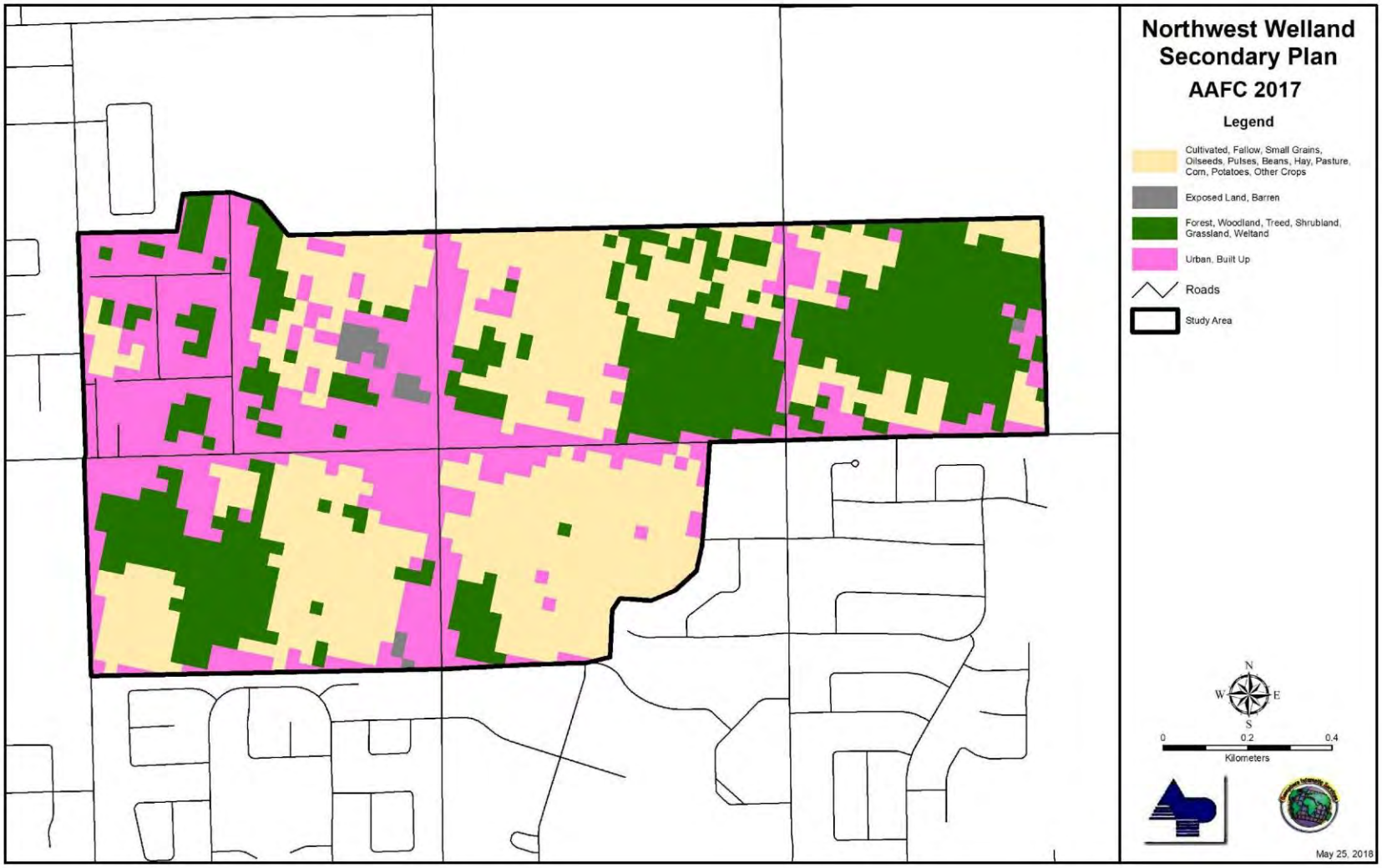
The predominant soils within the study area include the soil series Beverly, Toledo, Tuscola, Berrien, Colwood and alluvium, which are imperfectly and poorly drained. These soils permit some potential for the production of fruit and vegetable crops, however, the lands within the study area are currently not being used for fruit or vegetable production. The study area is not within or adjacent to a Specialty Crop Area, as defined in the Provincial Policy Statement. A review of aerial photography shows farms within the study area are predominantly used for common field crop production, as seen in Map 2 in **Appendix A**. Woodlands, including wetlands, are the second most predominant use. There is no significant agricultural related infrastructure and no livestock barns or facilities that aid in agricultural production and processing and as such an MDS analysis was determined to be unnecessary.

Mitigation measures to prevent conflicts between agriculture and urban uses were deemed unnecessary for the study area. The Northwest Welland study area is of lower importance for agriculture in the context of the City of Welland and Niagara Region. This condition, in addition to the lack of existing agricultural infrastructure, the lack of high-value fruit and vegetable crops and greenhouses, and the size of the study area further deem the need for mitigation measures unnecessary.

In conclusion, the study area does not meet the requirements for Specialty Crop Areas as defined in the Provincial Policy Statement. The study area does not have a high average potential for the production of specialty crops such as fruits and vegetables. As such, the Northwest Welland study area is relatively poorer agriculturally and is isolated from other agricultural uses as it is predominately adjacent to urban land uses. Therefore, development within the study area is a logical extension of existing or planned urban development within the City of Welland, the Town of Pelham and the City of Thorold.

USE FOR THE STUDY AREA

Figure 12: AAFC Land Uses for Northwest Welland Study Area



3.2 Archaeological Resource Assessment

A Stage 1 Archaeological Assessment of the Northwest Welland study area was conducted by ASI. The stage 1 review considered the proximity of previously registered archaeological sites and the original environmental setting of the property, nineteenth and twentieth-century settlement trends as well as engagement with the Indigenous communities.

Welland was incorporated as a town on January 1, 1878, and later as a City on July 1, 1917. In Section 1.2.3 of the report in **Appendix B**, a review of nineteenth and early twentieth century mapping was conducted to determine Euro-Canadian settlement features that may represent potential archaeological resources on the property. Through this review, historical mapping confirmed that the study area had a rural, agricultural landscape in the mid-nineteenth century. The review also found that the present-day roadways of Quaker Road, Line Avenue/Clare Avenue, Rice Road and First Ave were surveyed prior to 1862. A review of 1934 and 1954 aerial photography is provided in Section 1.2.4 of **Appendix B**. Aerial photography of the study area from 1934 shows a rural landscape with numerous agricultural fields and some residences and/or farm complexes fronting Quaker Road. The tributary of the Welland River is faintly visible in the 1934 mapping. On the 1954 image, the study area remains largely rural with the exception of a subdivision located near the northwest corner. The tributary of the Welland River is less discernible in the 1954 mapping. A review of 1996 topographic mapping shows that the study area has remained largely rural in character with some urban development to the south and northwest, and commercial development to the east of the study area.

The stage 1 report reviews potential for the presence of archaeological sites within the study area. Three sources of information were consulted for this review: the site record forms for registered sites housed at the MTCS, published and unpublished documentary sources, and ASI files. Based on the Ontario Archaeological Sites Database (OASD), which is maintained by the MTCS, there are no archaeological sites registered within the study area. However, there are 34 sites registered within a 1km radius of the study area. There is also one known unregistered site within the study area, which was identified by a resident and brought to ASI's attention at a Northwest Welland Secondary Plan public information session.

No archaeological assessments are known to have been conducted within the limits of the study area, however there are five known archaeological assessments within 50 metres of the study area, a list of these can be found in **Appendix B**.

The stage 1 report identifies the different types of characteristics that can indicate archaeological potential, the review identifies that Indigenous archaeological potential zones encompass approximately 99% or 187.2 hectares of the study area. As for Euro-Canadian architectural potential, there are no designated or listed properties known to be located within the limits of the study area. However, Euro-Canadian archaeological potential zones encompass approximately 48% or 90 hectares of the study area.

Although nothing indicates that these lands would not be suitable for urban uses from an archaeological perspective, the stage 1 report recommends that a stage 2 Archaeological Assessment be required for any future development within the study area. All active or formerly worked agricultural lands must be accessed through a pedestrian survey. Wood lots and other non-arable lands must be assessed by means of test pit survey. Areas deemed to be disturbed or of no potential due to factors of slope or drainage during the stage 2 assessment process must be appropriately documented. The archaeological assessment of any proposed development should be carried out on all lands within that particular subject property, not simply those lands identified as exhibiting potential in this study.

Indigenous Engagement

As part of the Indigenous Engagement, a meeting took place on September 13, 2018 at the Department of Consultation and Accommodation office in Hagersville, Ontario. The meeting began with a presentation of the history of the Mississaugas of the Credit First Nation by the Nation's Traditional Knowledge and Land Use Coordinator. Following this, the project team described the rationale for undertaking this secondary planning study, the scope of the project and timeline, and preliminary results. A copy of the presentation be found in **Appendix G6**.

Consultation staff from the Mississaugas of the Credit First Nation responded that the Nation has an interest in the project and expressed their expectation for future involvement in any fieldwork related to the project as well as the request to review and comment on any environmental planning and design options for the

project. In particular, the Nation communicated to the City of Welland that they would like to have Field Liaison Representatives for any remaining environmental monitoring fieldwork or archaeological fieldwork as it relates to the North West Welland Secondary Plan project.

3.3 Cultural Resource Assessment

ASI conducted a Cultural Heritage Resource Assessment for the Northwest Welland Study area, which included a built heritage and cultural heritage landscape assessment.

The Cultural Heritage Resource Assessment was based on a review of the 1876 Illustrated Historical Atlas of the Counties of Lincoln and Welland, Ont., 1934 aerial photo of the study area. This review determined that a majority of properties within the study area contained farmhouses and orchards. However, when compared to current day conditions, a majority of the original 1800s structures have been removed, with some exceptions. The study has identified a total of 13 potential cultural heritage resources within the study area, these are listed in more detail in **Appendix C**.

The study has also identified a number of cultural heritage landscapes within the study area, which include:

- Quaker Road;
- Milkweed Trail: a laneway that provided access to four residential buildings. It was originally a driveway for a farm that is no longer existing;
- Steve Bauer Trail: the trail was originally the location of the Niagara, St. Catharines and Toronto Railway;
- 436 Quaker Road farmhouse and outbuildings; and
- Summerlea Veterans Land Act (VLA) Subdivision: a post-WWII residential neighbourhood located north of Quaker Road, east of Line Avenue.

Although the cultural resource assessment found nothing to indicate that these lands would not be suitable for urban uses, the study did identify mitigation measures and/or alternative development approaches that should be incorporated to reduce any adverse impacts to potential cultural heritage resources in the area. The assessment provides the following recommendations for the development of the Northwest Welland study area:

- Any future Secondary Plan should incorporate policies that promote the conservation of any properties that have been determined to merit heritage recognition from the assessment's identified built heritage resources and cultural heritage resources;

- The Summerlea VLA Subdivision should be maintained and new adjacent development should be designed to ensure these qualities and characteristics are not negatively impacted;
- Any proposed development on or adjacent to an identified potential cultural heritage resource should require a cultural heritage impact assessment to further assess the cultural heritage value of the identified potential cultural heritage resources, and to ensure that the cultural heritage resources in the study area are conserved;
- Upon the completion of any Secondary Plan, the Cultural Resource Assessment should be updated to consider the potential impacts of these plans on the identified potential cultural heritage resources and additional mitigation measures; and
- Should future work require an expansion of the study area, then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed plan area on potential heritage resources.

3.4 Municipal Servicing

A Municipal Servicing Report was prepared by Associated Engineering, it entails a capacity analysis of existing water, sanitary and storm sewer servicing and provides general recommendations to accommodate future development in the Northwest Welland study area. The full report can be found in **Appendix D**.

Currently the study area is pipe fed with water from the Welland Water Treatment Plant to Shoalt's Drive Reservoir and Pumping station. Existing infrastructure within the study area include the following, as seen in **Figure 13**:

- 300 mm diameter cast iron (CI) City watermain that flows east along Quaker Road;
- 750 mm diameter concrete pressure pipe (CPP) watermain that flows south along Line Avenue / Clare Avenue;
- 150 mm diameter asbestos cement (AC) watermain approximately 525 m long that flows north on Rice Road from Quaker Road, which serviced the former soccer club (469 Rice Road);
- 200 mm diameter AC watermain that flows south on Rice Road from Quaker Road;
- 300 mm diameter CI watermain that flows south on First Avenue from Quaker Road; and

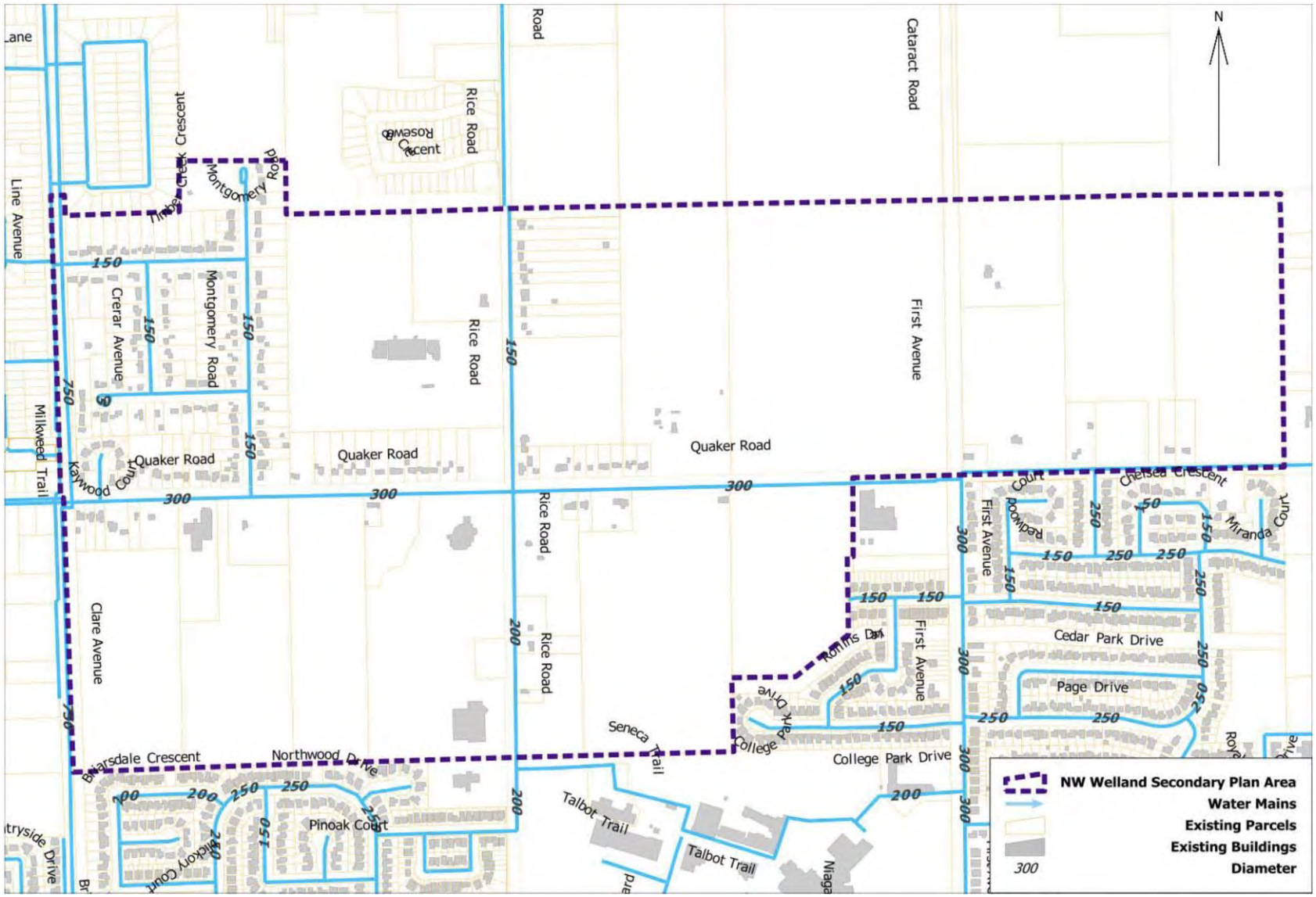
- 200 mm diameter CI watermain that flows north on Niagara Street from Quaker Road.

The capacity assessment has determined that existing water services in the area can accommodate some additional development and that pressure in the study area will accommodate the proposed development east of Rice Road. The study has identified that many nodes west of Rice Road to Montgomery Road have pressures between 40 and 45 psi, which is below the preferred pressure range.

All nodes east of Rice Road, depending on future watermain sizing and configuration, will be able to provide adequate pressure during average day demand (ADD) and maximum day demand (MDD) conditions. Depending on watermain sizing and configuration, Quaker Road should also be able to provide enough flow and pressure to service open space, single and multi-residential homes, and institutional areas. Adequate flow and pressure may be provided to apartment buildings with correct retrofits; however, the existing system will not provide enough flow or pressure to commercial spaces.

The Niagara Region's 25-Year Master Servicing Plan (MSP) has identified that there are several planned upgrades and developments that are scheduled over the next ten years that will affect water servicing to the study area. This includes two pump upgrade projects identified in the study. These upgrades will directly affect the Northwest Welland study area and be operational by 2021. Existing watermains along Rice Road, Quaker Road, Line / Clare Avenue and First Avenue are to be reviewed during preliminary design to ensure the watermains are large enough to provide adequate flow and pressure.

Figure 13: Existing Configuration of Watermains in Northwest Welland Study Area



The Welland Wastewater Treatment Plant (WWTP) services the City of Welland, Town of Pelham, and the Port Robinson area of the City of Thorold. Existing sanitary services in the Northwest Welland study area include a regional sanitary sewer along Rice Road, local sanitary sewer in the Montgomery subdivision, and local and regional sanitary sewer along Quaker Road. Primary sanitary sewage flows south along Rice Road, and then east along Quaker Road to Towpath Road. Sanitary sewage then flows northeast along Towpath Road to Towpath Sewage Pumping Station (SPS). Both the Welland WWTP and the Towpath Sewage Pumping Station have existing capacity to accommodate the Northwest Welland study area flows, however the NWSP area was not considered as part of the study. The contribution of the NWSP area will likely necessitate an upgrade to the sanitary system earlier than indicated in the MSP. The Niagara Region's 25-Year Master Servicing Plan (MSP) addresses some projected deficits and capacity issues with regards to the Towpath Sanitary Pumping Station as well as a need for additional trunk capacity on Quaker Road to support existing and growth flows from the Pelham system. These capacity deficiencies have been addressed in the MSP with two proposed capital projects. Development of the Northwest Welland study area can help support these already planned infrastructure costs. It is recommended that the planned upgrade to sanitary mains and Towpath SPS considers the development of the NWSP area in order to provide adequate servicing to the area.

With regards to stormwater management, the Northwest Welland study area has two major drainage channels that flow through the site. The existing channel appears to be backed up at Rice Road, which causes backwater effects and localized overland flooding. The existing natural drainage channels through the site do not have adequate slope and capacity to accommodate stormflow for development in the study area and further erosion of the natural channels is a concern. A large portion of the study area has also been identified as "significant groundwater recharge areas" by the NPCA. Stormwater management is therefore a key consideration for the development of the study area. The servicing report suggests that the design will likely include a storm pipe network draining to a storm pond facility. Two or three stormwater management facilities will be required to adequately address the drainage for the study area. The study states that it is important that the design of the study area ensure that post development flows match existing conditions and that low-impact development measures are implemented. Furthermore, placement of drainage features and stormwater management facilities will need careful and early consideration to ensure adequate property is reserved to accommodate full build-out.

3.5 Transportation Study

Associated Engineering conducted an assessment of the existing transportation conditions within the Northwest Welland study area. The study provides an understanding of the existing and proposed state of transportation infrastructure for development of lands within the study area.

The major roadways within the study area include Quaker Road (traverses east-west through the middle of the Study Area), Rice Road, and First Avenue. Line Avenue/Clare Avenue, a north-south rural collector roadway, is situated to the western edge of the site, outside the study area. Other Major Regional Arterial roadways located outside but in close proximity to the study area include Pelham Street and Niagara Street. Each north-south roadway within the study area intersects with Quaker Road at a four-legged intersection with average annual daily traffic (AADT) volumes ranging from 3,400 – 9,100 vehicles per day (vpd). Outside the study area, Pelham Street averages an AADT volume of 12,000 – 13,000 vpd, Niagara Street averages an AADT volume of 15,000 – 18,000 vpd, and Line Avenue/Clare Avenue averages an AADT volume of 2,400 vpd.

Quaker Road, Regional Road 54 (Rice Road), and First Avenue have been identified as roadways that will be impacted as a result of additional traffic generated by development of the Northwest Welland study area. A summary of each roadway's characteristics can be found in **Appendix E**.

Under base year (2018) background traffic conditions, the level of service (LOS) of all but one intersection operates below capacity (level C or better). The intersection of First Avenue and Quaker Road operates at a LOS of D, on the east side approach. Forecasted population growth in the area is anticipated to increase traffic flow along Rice Road and Niagara Street impacting the study area. In addition, the proposed Merritt Road (Regional Road 37) extension is expected to significantly impact traffic operations to the surrounding area, as the section would be a candidate to become a Regional Roadway, and act to relive Regional Road 20 of additional capacity heading towards Highway 406. Traffic patterns are also expected to change once East Fonthill Secondary Plan and Port Robinson West Secondary Plan areas are fully built-out. Therefore, a further review of traffic operations will be required when developing a preferred plan for the Northwest Welland study area.

Limited active transportation facilities are present within the study area. There is a separated segment of granular pathway on the north side of Quaker Road between Regional Road 54 (Rice Road) and 622 Quaker Road with a ladder cross-walk providing access to École Élémentaire Nouvel Horizon. No dedicated cycling facilities have been provided along Quaker Road. With regards to the north-south roadways within or adjacent to the development lands:

- Regional Road 54 (Rice Road) has no active transportation facilities present;
- First Avenue (north of Quaker Road) has no active transportation facilities present;
- First Avenue (south of Quaker Road) has semi-mountable curbs, concrete sidewalks, and bicycle lanes on both sides of the roadway; and
- Line Avenue has semi-mountable curbs with a concrete sidewalk on the west side of the roadway while the Steve Bauer Trail (a multi-use trail maintained by the Town of Pelham) is situated alongside the east side of the roadway.

None of the remaining minor roadways within the study area have sidewalks or cycling facilities. According to the Niagara Region's Strategic Cycling Network Development Technical Paper[1], First Avenue/Cataract Road was confirmed as a candidate for enhanced cyclist facilities. Therefore, opportunities exist to provide or improve active transportation facilities within the study area in order to accommodate existing and future pedestrians and cyclists more effectively.

Access to existing public transit is also limited within the study area. Quaker Road between First Avenue and Niagara Street is serviced by Welland Transit and three additional routes operate in close proximity to the study area. It is recommended that public transit facilities be expanded into the study area, when appropriate.

The transportation analysis has assessed traffic operations during the horizon year (2031) for total traffic volumes (background plus development) and compared to the horizon year (2031) background traffic conditions to identify changes to level of service experience as a result of development related growth within the study area. The analysis has concluded that traffic operations are generally providing adequate level of service and that there is no need for any modifications to any of the intersections from a capacity and operations perspective. In addition, residential development within the study area can help

[1] Regional Municipality of Niagara, Strategic Cycling Network Development Technical Paper, 2017

support the planned extension of Merritt Road and the planned widening of Rice Road, which will improve operational capacity and connectivity within the study area. Therefore, the transportation analysis supports urban development within the Northwest Welland study area.

3.6 Natural Heritage and Natural Hazards Existing Conditions

A Natural Heritage and Natural Hazards Existing Conditions report was prepared by Aquafor Beech Limited. Characterizing the existing conditions of the Northwest Area of the City, the report details the results of detailed field investigations completed by Aquafor Beech Limited, as well as background research and agency consultation. The full report can be found in **Appendix F**.

The report characterizes the Natural Heritage Features (NHS) in the Secondary Plan area and identifies significant and sensitive features and/or other constraints. The features which meet the criteria for the Environmental Protection Area designation include Provincially Significant Wetlands and Significant Habitat of Endangered or Threatened Species identified. The features which meet the criteria for the Environmental Conservation Area designation include Significant Woodlands, Significant Wildlife Habitat and Significant Habitat of Species of Concern. Fish Habitat and potential headwater drainage features are also identified in the report.

Following the Characterization of NHS features, the report outlines the regulatory requirements related to these features within the Environmental Protection Areas and Environmental Conservation Areas.

Following the regulatory requirements, the report identifies opportunities for enhancement, improvement, or restoration of the existing NHS and provides recommendations for the delineation, protection, and management of natural heritage features and functions. The report also includes recommendations on potential corridor locations for linking natural heritage features. The Aquafor Beech Limited report provides a description of the potential corridor locations and the species and key natural heritage features they link and protect in Section 7.4.

Further, the report suggests: naturalizing Species At Risk (SAR) habitat and Significant Wildlife Habitat in targeted locations; incorporating “green”

technologies and wildlife friendly features into developments; managing non-native and invasive species; incorporating butterfly gardens into parklands; and using vegetated buffers around drainage features to improving water quality and fish habitat.

The report recommends future studies or work to be completed as part of site-specific EISs. This further work includes future EIS studies for sites where access was denied resulting in only secondary source information being available in those areas. The report suggests a variety of Species at Risk, Species of Conservation Concern and significant wildlife habitat studies to be undertaken dependant of proposed developments and the habitat types/areas they affect. As noted previously, further studies are recommended to identify specific locations for buffers. Additionally, further identification and assessment of headwater drainage features including existing mapped watercourses provided by NPCA should be completed according to the protocol described in the "Evaluation, Classification, and Management of Headwater Drainage Features: Interim Guidelines" (CVC & TRCA, 2014). The study also recommends further assessment of other hydrologic features such as small wetland features.

4 Land Needs Study

4.1 Population and Housing Forecasts to 2041

The City of Welland's population, as per the most recent Statistics Canada 2016 Census is 52,293 (people). When accounting for net under-coverage, the 2016 population is actually 53,670 people. This population comprises 22,490 households in the City of Welland[2].

Population and employment growth targets for the Niagara Region have been prepared through a Regional Municipal Comprehensive Review (MCR) process, which developed three different options for allocating Regional growth across Niagara. The first option is referred to as 'Current Policy', the second is 'Market Driven' and the third is 'Strategic Growth'. Phase 3 of the MCR recommended the Strategic Growth Option as the preferred growth strategy for the Region. Under this forecast option, the City of Welland is to accommodate 66,180 people and 28,760 jobs by the year 2041[3], which represents a growth of 13,630 people and 5,170 jobs between 2016 and 2041. In order to accommodate the Strategic Growth Option targets, the City of Welland would need to accommodate an additional 212 housing units per year until 2041.

However, the Strategic Growth Option forecast does not align with the population forecast prepared by the City of Welland during their 2014 Development Charge Study. The City forecasted that by 2031 the population of Welland would grow to 62,931 people as compared to 59,600 as forecasted in the MCR, which represents a difference of 3,331 people. As stated in the Watson & Associates Economists Ltd. (Watson & Associates) 2041 Niagara Region MCR review, for the City of Welland, it is the opinion of the City of Welland staff and the Council, that the population growth allocations for the City of Welland in the Region's MCR do not reflect the long-term potential of the City[4].

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[2] City of Welland 2016 Census profile from Statistics Canada goo.gl/WCK1Bk

[3] Niagara 2041 – How We Grow, Public Information Centre 3 Boards, 2016

[4] Watson & Associates Economists Ltd, Review of Niagara Region Municipal Comprehensive Review Population Growth Allocations for the City of Welland, 2017, page 1-1

In response to the City of Welland's concern with the MCR's Strategic Growth population allocations, the Niagara Region retained Watson & Associates to review the population growth allocations for the City. The evaluation considered recent residential development trends, local housing market demand and longer-term population growth drivers associated with the 55+ age group. The evaluation determined that the City of Welland's share of Regional population will not decline as significantly as forecasted, but rather it will remain relatively stable at the current ratio of 11.7%, or decline modestly to approximately 11.5%[5]. The evaluation recommended an increase of approximately 4,000 to 5,000 people over the Strategic Growth option. Using the Strategic Growth's net change of 13,630, the recommended increase in population equates to 17,630 to 18,630 people by the year 2041.

The Region has recently initiated Phase 4 of the MCR. As part of this work, Hemson Consulting has reviewed the results of the 2016 Census, policy changes and other information that has become available since the Phase 3, Strategic Growth population and employment forecasts were completed in 2016. The results of the 2016 Census indicate that the Region has experienced relatively strong growth in population, housing and employment.

The 2016 Census results indicate that between 2011-2016 the City of Welland has seen an increase of 1,000 occupied households and a population growth of 1,690 people[6]. This increase represents 190 households and a population growth of 1,120 people more than forecasted in the Region's Phase 3 Strategic Growth forecasts. Despite this robust growth, Hemson proposes that the share of growth allocations for the City of Welland remain at 8%. As well, due to new PPU (person per unit) data from the 2016 Census, the forecasted population growth for the City has been reduced by 530 people[7]. The updated growth forecasts for the City of Welland does not reflect any of the analysis or recommendations resulting from the 2017 Watson and Associates report.

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[5] Watson & Associates Economists Ltd, Review of Niagara Region Municipal Comprehensive Review Population Growth Allocations for the City of Welland, 2017, page 4-2

[6] Niagara Region Municipal Comprehensive Review – Draft Updated Forecast and Local Growth Allocations, Hemson Consulting Ltd, 2018, page 4

[7] Niagara Region Municipal Comprehensive Review – Draft Updated Forecast and Local Growth Allocations, Hemson Consulting Ltd, 2018, page 9

Table 4.1 provides a breakdown of the potential range of population growth for the City of Welland as forecasted by the MCR's Strategic Growth Option, the 2018 Strategic Growth Option Update and Watson & Associates evaluation.

TABLE 4.1: POPULATION GROWTH BY PLANNING PERIOD

Population Forecast	2016	2041	Net Change
MCR Strategic Growth Option 2016	52,550	66,180	13,630
MCR Strategic Growth Option Update 2018	53,670	65,650	11,980
Watson & Associates	53,910	72,540	18,630

* Population including Net Undercoverage (3%)
** Source: Statistics Canada, Niagara Region and Watson & Associates

The unit growth resulting from the above population forecasts are presented in Table 4.2 and ranges from 4,676 to 7,272 units to be built in the City of Welland by the year 2041.

Table 4.2: 2016-2041 Total Housing Unit Growth

	Unit Growth	
MCR Strategic Growth Option 2016	5,320	-
MCR Strategic Growth Option Update 2018	4,676	
Watson/City	6,881	7,272

The Phase 3 MCR report requires that half of the total units be accommodated in the Built-up Area and half in the Designated Greenfield Area (DGA). Therefore, the City of Welland is required to accommodate a range of 2,340 to 3,635 units in their DGA. This 50% target matches with the requirement in the 2019 Growth Plan.

When considering this intensification target, it is informative to consider the rates of intensification that they City has achieved over the past 5 years. These rates per year are set out in Table 4.3.

Table 4.3: 2014-2018 City of Welland Intensification (New Dwelling Units)							
Year	Built-Up Units	Built-Up %	DGA Units	DGA %	Outside Urban Units	Outside Urban %	Total Units
2014	114	62.30	65	35.52	4	2.19	183
2015	104	60.12	65	37.57	4	2.31	173
2016	46	34.85	82	62.12	4	3.03	132
2017	140	71.07	51	25.89	6	3.05	197
2018	279	69.92	111	27.82	9	2.26	399

4.2 Land Supply in the Existing DGA

The City of Welland's Designated Greenfield Area (DGA) totals 1,039.46 hectares as illustrated in **Figure 13**. **Figure 13** reflects the City of Welland's Schedule A 'City Structure', in which it delineates the City's Built-up Area and DGA. The DGA represents all lands between the Delineated Built-up Area and the Settlement Area boundary. For the purposes of assigning a density to the DGA, the Growth Plan (2019) permits a municipality to exclude natural features and the Natural Heritage System, Employment Areas, cemeteries and right-of-ways of major infrastructure. These excluded components, referred to as "take-outs", total 849.14 hectares as noted in Table 4.3. The remaining developable area within the existing DGA totals 190.32 hectares.

Figure 14 further categories the DGA into existing applications, draft and registered plans and lands that are currently vacant. Table 4.4 also identifies the land use and development status of the remaining developable area according to the above noted categories.

Residential Land Supply

The supply of residential units within the DGA is categorized as follows:

- Built (applying to all existing units within the DGA that have been built since 2006, when the first Growth Plan introduced the built boundary and the DGA). This is estimated to be 72.52 hectares of the DGA;
- Registered Plans (applying to the portion of the DGA that is subject to a registered plan of subdivision but is not yet built). The City has no registered plans that have not been built:
- Draft Approved (applying to the portion of the DGA that is subject to draft approved subdivision applications). The City has active development on 84.26 hectares of these DGA lands;

- Applications (applying to the portion of the DGA that is subject to active applications that have not yet been approved), totalling 0.56 hectares; and
- Vacant (applying to the portion of the DGA that is not subject to any development applications, and where an assumption for number of units is made on the lands). Welland has 32 hectares of residential designated land remaining vacant without application and 0.98 hectares of vacant commercial lands within a draft plan of subdivision.

TABLE 4.4: DGA AREA BREAKDOWN

	Area (ha)
DGA TOTAL AREA	**1,039.46**
DGA Take-out Areas	**849.14**
Employment	275.82
Cemetery	0.01
Right-of-ways of Major Infrastructure	228.67
Natural Heritage System	344.64
DGA Developable Areas	**190.32**
Built	72.52
Registered	0.00
Draft Approved	84.26
Application	0.56
Vacant Residential	32.00
Vacant Commercial	0.98

Figure 14: Designated Greenfield Area Development Status

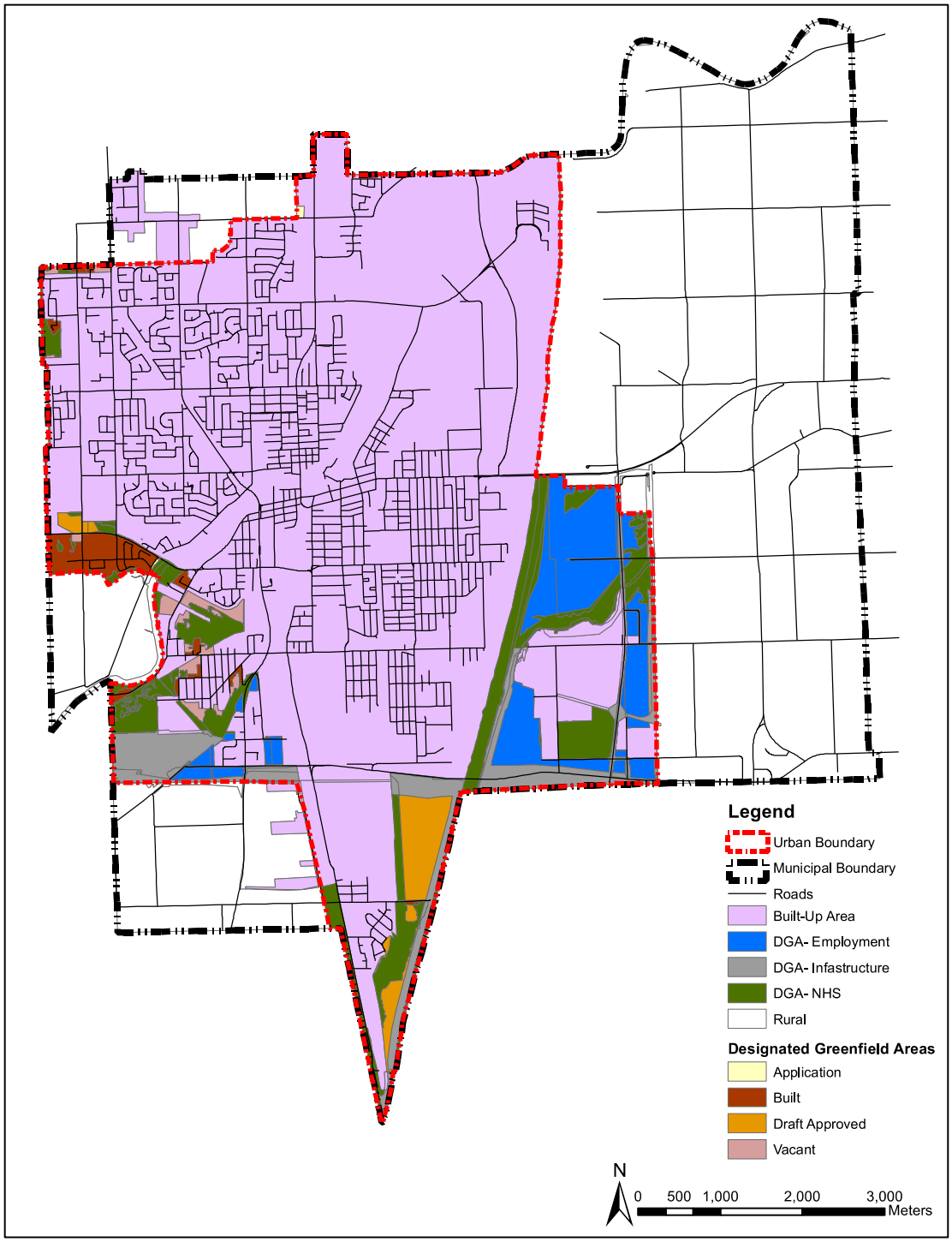


Table 4.5 illustrates the supply of draft approved, application and vacant units by type within the DGA. The remaining vacant lands without application are designated Low Density Residential as per Schedule B1 of the Official Plan. At an assumed density of 24 units per net hectare, and assuming a gross to net factor of 60%, these vacant lands could accommodate 460 units. The total unit potential, including vacant lands, is therefore anticipated at 1,739 – 2,163 units. The majority of the units (62-68%) are of a single or semi-detached built form, with 15-17% townhouse units and 16-20% apartment units.

TABLE 4.5: UNITS IN EXISTING DGA - REGISTERED, DRAFT APPROVED, APPLICATION AND VACANT

Status	Singles/Semis (units)	Towns (units)	Apartments (units)	TOTAL UNITS	Area (Hectares)
Draft Approved	717-887	247-344	289-446	1,253-1,677	84.26
Application	0	26	0	26	0.56
Vacant	460	0	0	460	32.00
TOTAL	**1,177-1,347**	**273-370**	**289-446**	**1,739-2,163**	**116.82**

As per Section 4.1, the City's unit target for the DGA ranges from 2,340 to 3,635 units at a 50% intensification target. Therefore, the City has a shortfall of 177 to 1,896 units in order to accommodate its forecasted growth by 2041.

The DGA supply does not include the lands south and east of Highway 58 which are currently Deferred in the City's Official Plan. However, the lands have been included in the land supply in the Niagara Region's MCR.

4.3 Population Density in the Existing DGA

The population and employment density that could be achieved within the existing residential DGA has been determined by applying persons per unit (PPU) values and employment numbers. The PPU was taken from the City's 2014 Development Charges Background Study[8]. Consistent with the trend experienced across Ontario, there is a forecast decline in the household size, therefore the forecasted persons per unit by 2041 is as follows:

- 2.54 PPU – Singles and Semis
- 2.03 PPU – Townhouses
- 1.73 PPU – Apartments

A preliminary analysis of potential jobs was also evaluated. The following assumptions were made with respect to the rate of jobs for people who work at home.

TABLE 4.6 WORK AT HOME JOBS		
2041 Jobs:	28,760	
Share of 2041 Jobs (Work-at-Home):	5%	
# of 2041 Work-at-Home Jobs:	1,438	
2041 Population:	73,116	
Rate of Work-at-Home Jobs/Person*:	**0.0197**	***(1.97%)***

Table 4.7 illustrates the persons and jobs and density by application status. The density analysis assumes the mid range of units from Table 4.5. The overall density is almost 38 persons and jobs per hectare. However, the Table 4.7 analysis does not represent the entire DGA lands as it does not include the population on built lands in the DGA.

[8] 2014 Development Charges Background Study – City of Welland, BMA Management Consulting Inc.

TABLE 4.7: DENSITY IN EXISTING DGA							
Application Status	**Singles/ Semis (persons)**	**Towns (persons)**	**Apartments (persons)**	**Total Persons**	**Jobs**	**Area (Ha)**	**Density (people+jobs/ha)**
Draft Approved	1,948	611	635	3,194	63	84.26	37.9
Application		53	0	53	1	0.56	94.3
Vacant	1,168	0	0	1,168	23	32	36.5
TOTAL	**3,117**	**664**	**635**	**4,415**	**87**	**116.82**	**37.80**

4.4 Additional Land Needs to accommodate forecasted population growth to 2041

As identified above, the City of Welland must accommodate an additional 2,340 to 3,635 units in the DGA to achieve the population forecasts identified in Table 4.2. In order to achieve this target, the City must identify appropriate lands for future growth and development.

West of the Welland Canal, two potential areas could accommodate the City's future greenfield growth: the Northwest Welland lands and the lands located north of Forks Road and the lands east of Highway 58 which are currently Deferred in the City's Official Plan.

4.4.1 The Northwest Welland Lands

The Northwest Welland study area is comprised of approximately 190 hectares. Approximately 55 hectares are currently developed and identified as part of the Built-up Area on Schedule A of the Official Plan. The Natural Heritage and Natural Hazards Existing Conditions report has found that the Natural Heritage System may comprise approximately 31 hectares. Therefore, there is approximately 96 hectares for potential development within the study area.

4.4.2 East of 58 Lands

The Deferred lands east of Hwy 58 ("East of 58 lands") are situated within the City of Welland's Municipal Boundary and are considered an Urban Area in the Niagara Region Official Plan. However, the lands are currently shown as Deferred in the City's Official Plan. The East of 58 lands comprise of approximately 92 hectares, excluding natural heritage features, and are currently primarily used for agricultural purposes and rural residential dwellings along Colborne Street.

4.5 Implications of Removing Lands East of Hwy 58 from the Urban Boundary

In 2010, the City of Welland Council approved to redesignate the East of 58 Lands from an Urban to Rural land use designation. The City, in collaboration with the Region, initiated an amendment (ROPA 7), in 2014, to permit a change to the Niagara Region's Urban Area Boundary for the City of Welland. However the amendment is still under review[9].

On February 7, 2017, the Ministry of Municipal Affairs and Housing indicated that the East of 58 lands are Canada Land Inventory Class 3 lands that appear to meet the definition of prime agricultural lands and should therefore be considered Prime Agricultural Area in the PPS.

Unlike the Northwest Welland study area, the East of 58 lands are not well integrated with the City's existing built-up area being bound by two railways and the former canal and with employment designated lands to the north and east and agricultural lands to the west and south, as illustrated in **Figure 15** below.

[9] Policy Initiation Report, Regional Official Plan Amendment (ROPA 7), Urban Area Boundary Modification for the City of Welland, 2014

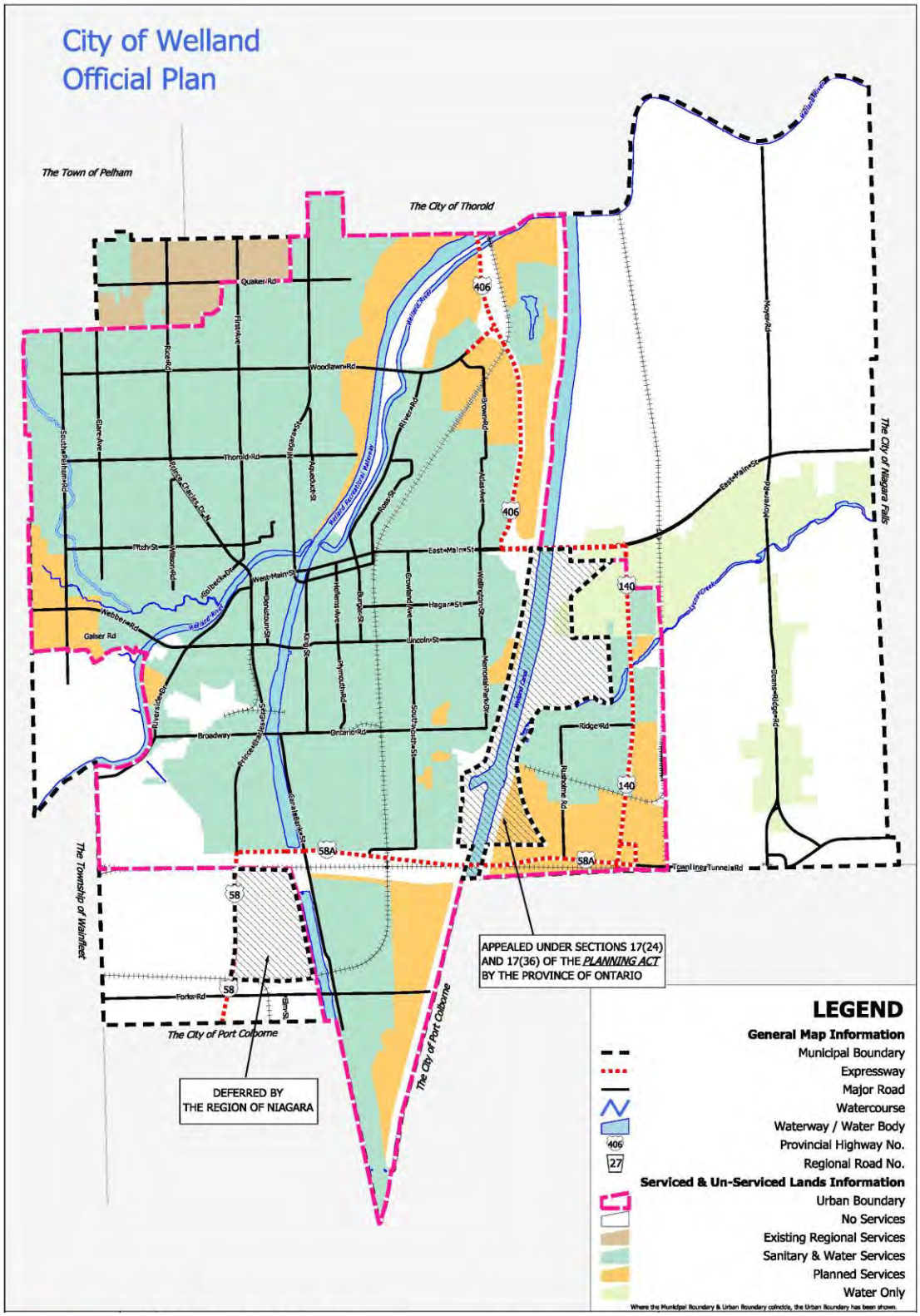
Figure 15: East of 58 Lands, City of Welland

As per the City's Schedule D (see **Figure 16**), the East of 58 lands have no Regional or Local services. Therefore, if developed, the area would require extensive municipal servicing. The City's Comprehensive Zoning By-law Recommendation Report stated that development of the East of 58 lands involves the uneconomical expansion of municipally services, therefore these lands are not needed nor desired for urban development in a 20 year timeline and beyond[10]. The East of 58 lands were added to the City's Urban Area through Official Plan Amendment 67, in 1988, the Recommendation Report also states that in hindsight, this decision is considered bad planning. City staff have therefore recommended that these lands be zoned A1, in order to protect this prime agricultural area for urban development and to preserve the rural character of the area.

The removal of these lands from the City's urban boundary could be offset by the addition of the Northwest Welland study area in the City's urban boundary.

[10] Recommendation Report, City of Welland Comprehensive Zoning By-law, Report P&B-2017-53, 2017

Figure 16: City of Welland Official Plan Schedule D, Serviced and Unserviced Lands



5 Policy Rationale

As demonstrated in Section 4 of this report, the City of Welland requires additional urban lands to accommodate its forecasted growth. The following section assesses the appropriateness of these lands from a Provincial, Regional and Local policy perspective based on the recommendations of the background studies and the capacity analysis in Section 4.

5.1 Provincial Policy Statement, 2014

The PPS requires that healthy, livable and safe communities are sustained by:

a) promoting efficient development and land use patterns which sustain the financial well-being of the Province and municipalities over the long term;
b) accommodating an appropriate range and mix of residential and other uses to meet long-term needs;
c) avoiding development and land use patterns which may cause environmental or public health and safety concerns;
d) promoting cost-effective development standards to minimize land consumption and servicing costs; and,
e) ensuring the necessary infrastructure and public service facilities are or will be available to meet current and projected needs [Policy 1.1.1, in part].

As established in Section 3 of this report, the Northwest Welland study area has existing infrastructure and public service facilities that can be easily extended for future development. In addition to its existing regional and local municipal services and transportation network, the study area will also be directly affected by planned infrastructure investments from both the regional and local level. Therefore, development of the Northwest Welland study area has the potential to minimize servicing costs. In addition, the Northwest Welland study area is surrounded by existing urban built-up areas, therefore development of the study area will promote efficient development and land use patterns.

Land Needs and Land Use Patterns

The PPS further directs that sufficient land shall be made available through “intensification” and “redevelopment” and, if necessary, “designated growth areas”, to accommodate an appropriate range and mix of housing and other land uses to meet projected needs for a time horizon of up to 20 years unless an

alternative time period has been established by the Province. For the Greater Golden Horseshoe area including the City of Welland, that time period is 2041 [Policy 1.1.2].

As per Section 4, the additional greenfield land is required to accommodate growth over the next 20 years after accounting for intensification opportunities.

The PPS provides that settlement areas are to be the focus of growth, and their vitality and regeneration promoted. Land use patterns within settlement areas shall be based on densities and a mix of land uses that:

a) efficiently use land and resources;
b) are appropriate for and efficiently use infrastructure and public service facilities which are planned or available, and avoid the need for their unjustified and/or uneconomical expansion;
c) minimize negative impacts to air quality and climate change, and promote energy efficiency;
d) support active transportation and are transit supportive; and
e) are freight-supportive (Policies 1.1.3.1 & 1.1.3.2 a)).

These policies are overarching principles that need to be considered when establishing land use and densities in a subsequent secondary plan, but the subject lands are able to provide for a mix of residential and supporting land use that can efficiently use resources and infrastructure in a manner that supports transit and manages climate change impacts.

Intensification

Policy 1.1.3.3 requires planning authorities to identify appropriate locations and promote opportunities for intensification taking into account the existing building stock, brownfield sites and availability of suitable existing or planned infrastructure.

Policy 1.1.3.4 further directs that appropriate development standards should be promoted to facilitate intensification, redevelopment and compact form, while maintaining appropriate levels of public health and safety. The City of Welland has recently revised its Zoning By-law to relax regulations and permitted uses that apply to Residential Zones throughout the urban area in order to promote development, create opportunities for infill development, promote development in the built-up area and to reflect market demands. These by-law revisions have assisted the City in continuing to achieve 60% of its growth through intensification

and residential growth in the City's built-up area as per the Growth Plan for the Greater Golden Horseshoe[11]. However, the City cannot achieve its growth targets for 2041 through intensification alone and requires additional development of its designated greenfield areas to accommodate growth.

Housing

The PPS also contains policies aimed at providing for an appropriate range of housing types and densities. Included are policies requiring that planning authorities provide for an appropriate range of housing types and densities to meet projected requirements by permitting and facilitating, among other matters:

- minimum targets for housing that is affordable to low and moderate income households;
- all forms of residential intensification and redevelopment including second suites;
- directing the development of new housing towards locations where appropriate levels of infrastructure and public service facilities are available;
- promoting densities for new housing which efficiently use land, resources, infrastructure and public service facilities; and
- establishing development standards for residential intensification, redevelopment and new residential development, which minimize the cost of housing and facilitate compact form [Policy 1.4.3].

Northwest Welland can provide a range of housing types in a Greenfield Area where infrastructure is readily available and close to existing public service facilities.

Settlement Boundary Expansions

Policy 1.1.3.8 requires that planning authorities only allow an expansion of a settlement area boundary where it has been demonstrated that sufficient opportunities for growth are not available through intensification, redevelopment and designated growth areas to accommodate the protected needs to 2041. The City of Welland is committed to intensification and redevelopment within its urban areas, however, to accommodate forecasted growth, additional greenfield lands are required the City has identified the Northwest Welland study area as an appropriate location for future growth, as discussed in Section 4 of this report.

[11] Infrastructure and Development Services Planning Division, Recommendation Report, Comprehensive Zoning By-law, P&B-2017-53

Energy Conservation, Air Quality and Climate Change
Section 1.8 of the PPS requires that planning authorities support energy efficiency and improved air quality through land use and development patterns that are compact, promote the use of public transit and alternate forms of transportation, and improve the mix of employment and housing to shorten commute times. These policy directions are overarching principles that will be considered in the justification of appropriate lands to accommodate future growth and development.

The Northwest Welland study area can support orderly development that will integrate and connect existing built-up areas that surround the study area. Additional residential developments within this area will help improve and promote transit services and active transit services within the area and between the existing adjacent urban areas.

5.2 Growth Plan for the Greater Golden Horseshoe, 2019

The Growth Plan for the Greater Golden Horseshoe (Growth Plan) further reinforces the importance of the PPS policies and encourages better use of land, and efficient use of infrastructure. The Growth Plan provides a framework for implementing Ontario's vision for building stronger, prosperous communities by better managing growth in the Region.

Managing Growth
The Growth Plan has established population and growth forecasts for the Greater Golden Horseshoe area. Policy 2.2.1.2 speaks to forecasted growth to the horizon of this Plan and states that growth will be allocated based on the following:

a) the vast majority of forecasted growth will be directed to settlement areas that:
    i. have a delineated built boundary;
    ii. have existing or planned municipal water and wastewater systems; and
    iii. can support the achievement of complete communities.
b) within settlement areas, growth will be focused in:
    iv. delineated built-up areas;
    v. strategic growth areas;
    vi. locations with existing or planned transit, with a priority on higher order transit where it exists or is planned; and
    vii. areas with existing or planned public service facilities;

Welland has a delineated built boundary with full municipal services; it is a complete community, and it has existing and planned transit.

Designated Greenfield Areas

Policy 2.2.7.1 of the Growth Plan states that new development taking place in designated greenfield areas will be planned, designated, zoned and designed in a manner that:

a) supports the achievement of complete communities;
b) supports active transportation; and
c) encourages the integration and sustained viability of transit services.

As a designated greenfield area, the Northwest Welland study area will support the achievement of complete communities by ensuring sequential and orderly development that is contiguous with the existing built-up areas surrounding the study area. Development of the Northwest Welland study area will also support the improvement and enhancement of active transportation in the area, as well as increase the viability of transit services.

Settlement Area Boundary Expansions

Policy 2.2.8.2 states that a settlement area boundary expansion may only occur through a municipal comprehensive review where it is demonstrated that sufficient opportunities to accommodate forecasted growth are not available through intensification and in the designated greenfield area based on the minimum intensification and density targets and based on a land needs assessment.

The Niagara Region is currently conducting a municipal comprehensive review to manage and allocate growth in the Region. Although the Region has not finalized the Land Needs Assessment component of the MCR in accordance with the land needs methodology, the preliminary review of land supply for the City of Welland contained in Section 4 of this report, identifies the likely need for additional greenfield lands to accommodate Welland's anticipated growth based on an intensification target of 50 percent.

Policy 2.2.8.3 states that were the need for a settlement boundary expansion has been justified through Policy 2.2.8.2, the most appropriate location for a proposed expansion will be identified based on the following:

a) there is sufficient capacity in existing or planned infrastructure and public service facilities;

b) the infrastructure and public service facilities needed would be financially viable over the full life cycle of these assets;
c) the proposed expansion would be informed by applicable water and wastewater master plans or equivalent and stormwater master plans or equivalent;
d) the proposed expansion, including the associated water, wastewater and stormwater servicing, would be planned and demonstrated to avoid, or if avoidance is not possible, minimize and mitigate any potential negative impacts on watershed conditions and the water resource system, including the quality and quantity of water;
e) key hydraulic areas and the Natural Heritage System should be avoided where possible;
h) prime agricultural areas should be avoided where possible. To support the Agricultural System, alternative locations across the upper-or single-tier municipality will be evaluated, prioritized and determined based on avoiding, minimizing and mitigating the impact on the Agricultural system and in accordance with the following:
    I. expansion into specialty crop areas is prohibited;
    II. reasonable alternatives that avoid prime agricultural areas are evaluated; and
    III. where prime agricultural areas cannot be avoided, lower priority agricultural lands are used;
i) the settlement area to be expanded is in compliance with the minimum distance separation formulae;
j) any adverse impacts on the agri-food network, including agricultural operations, from expanding settlement areas would be avoided, or if avoidance is not possible, minimized and mitigated as determined through an agricultural impact assessment.

The study area is currently serviced with existing water and sanitary services that can be easily extended. As per Section 3 of this report, the Niagara Region's Master Servicing Plan has identified planned upgrades to some of the existing infrastructure.

In terms of public service facilities, as identified in Section 2 of this report, there are two existing public schools within the study area. As well, Quaker Road Public School abuts the study while the Niagara College, Welland Campus is located immediately south of the study area. These institutional uses will support future development of the subject lands.

The Northwest Welland study area is surrounded by three municipal built-up areas and is therefore already well integrated into the existing road network. The streets within the subject lands are also included in future widening projects at both the Regional and City level.

As per Section 3, the development of the Northwest Welland study area will also contribute to mitigating and reducing the existing stormwater management issues within the surrounding area but a detailed stormwater master plan will be completed as part of any future secondary plan.

A natural heritage assessment has identified the Natural Heritage System and key hydraulic areas that are to be protected and studied further in the next stages of the planning process.

The agricultural impact assessment in Section 3 of this report has confirmed that the study area is relatively poorer agriculturally with limited existing agricultural infrastructure and no livestock infrastructure and is therefore in compliance with the minimum distance separation formulae. The agricultural assessment concludes that there will be no adverse impacts on agricultural operations in the study area and that the most logical long-term use of the land is for an extension of urban development.

Policy 2.2.1.3 speaks to undertaking an integrated planning approach to manage forecasted growth. The integrated approach includes establishing a hierarchy of settlement areas and strategic growth areas. The policy states that growth should be supported by existing or planned infrastructure and public service facilities. This approach aims to provide direction for an urban form that will optimize infrastructure and support the achievement of complete communities through a more compact built form.

Growth in the study area would certainly support existing infrastructure ad public service facilities. It would also optimize transportation corridors that cross through the study area linking adjacent urban areas. By filling in the gap between three urban areas, growth in the study area would also contribute to a more compact built form.

Policy 2.2.1.6 permits municipalities to determine if they have excess lands through a land needs assessment. Municipalities with excess lands will identify the excess lands and prohibit development on the excess lands until 2041.

Policy 2.2.8.4 also allows municipalities to adjust settlement area boundaries provided there is no increase in land within settlement areas and provided:

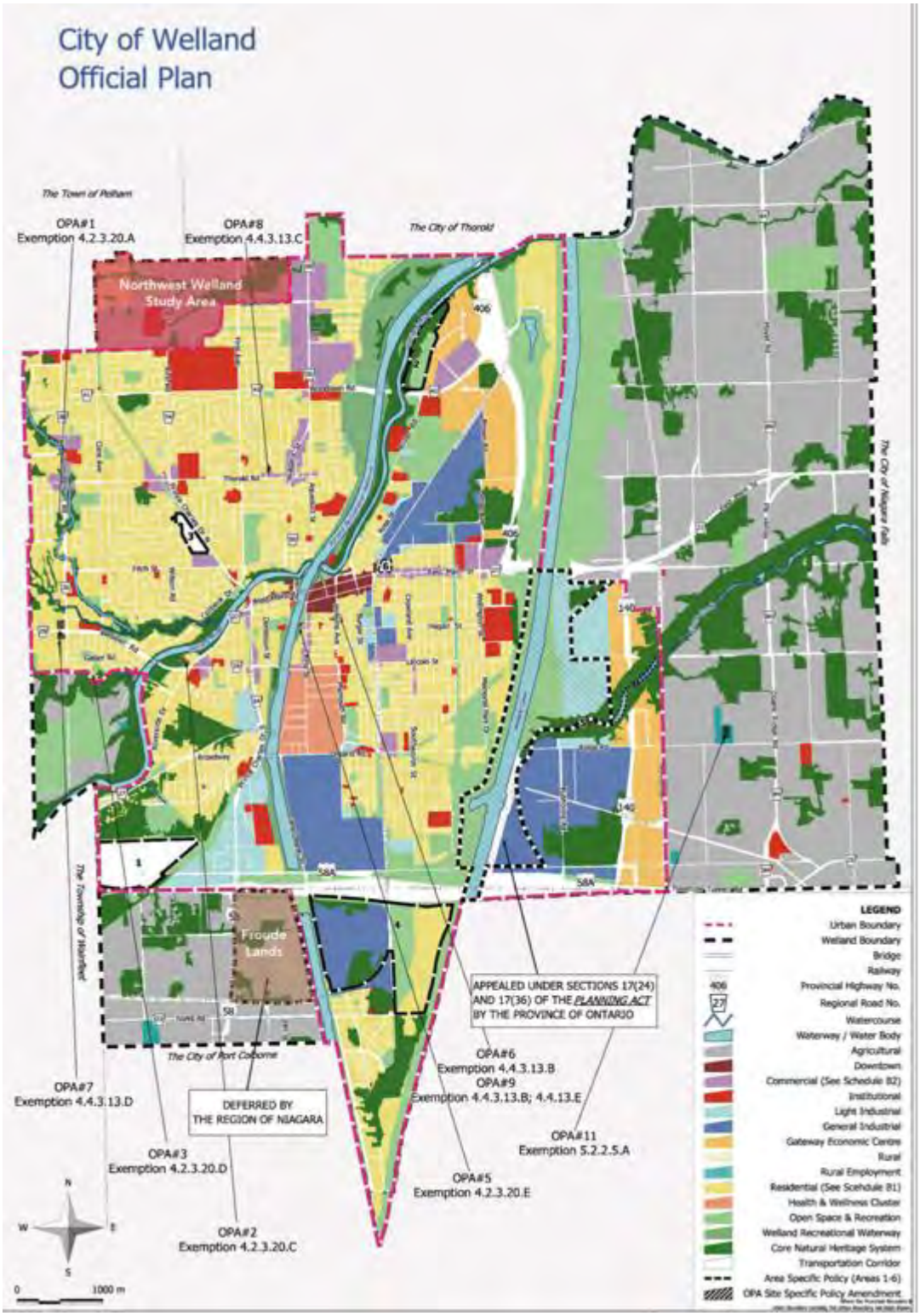
- The adjustment would support the ability to meet the intensification and density targets;
- The location of the lands to be added would satisfy the requirements of policy 2.2.8.3;
- The lands are serviced by municipal water and wastewater systems,

As discussed in Section 4 of this report, the City of Welland has recently conducted a comprehensive review of the City's Zoning By-law. Through this process, the City reestablished that the East of 58 lands should be redesignated from Urban to Rural lands as they are currently predominately being used for agricultural purposes; they are not currently serviced and will require an uneconomical expansion of municipal services. In addition, as seen in **Figure 17**, the East of 58 lands are not well integrated with the City of Welland's existing built-up area and are physically separated by the train tracks to the north and the Welland Canal to the east.

In comparison, the Northwest Welland study area has existing municipal servicing infrastructure that can be easily extended and are included in planned infrastructure upgrades. As illustrated in **Figure 3**, the subject lands are surrounded by the City of Welland, Town of Pelham and City of Thorold's urban areas and is therefore very well integrated. Development of these lands will fill the existing void and will help to create better connectivity between the municipalities, which will work towards creating a complete community and improving active transportation services for both the subject lands and the surrounding area. The existing Summerlea subdivision within the north-west segment of the study area will also benefit from improved services and connectivity.

The Region's MCR process provides an opportunity to identify the East of 58 lands as excess lands under Section 2.2.1.6 of the Growth Plan and designate additional lands in Northwest Welland as part of the City's urban boundary or alternatively to adjust the urban boundary by swapping the East of 58 lands for the study area lands as permitted by 2.2.8.4 of the Growth Plan.

Figure 17: Schedule B Land Use Map



5.3 Niagara Regional Official Plan, 2014

The Niagara Regional Official Plan provides policy direction to guide the physical, economic and social development of the Regional Municipality of Niagara in order to manage growth, protect natural environment, resources, and agricultural land and provide required infrastructure. The policies in chapter 4 pertain to managing growth in the Niagara Region with the following key growth management objectives:

Objective 4.A.1.1 Direct the majority of growth and development to Niagara's existing Urban Areas.

Objective 4.A.1.2 Direct a significant portion of Niagara's future growth to the Built-up Area through intensification.

Objective 4.A.1.6 Build compact, mixed use, transit supportive, active transportation friendly communities in the Built-up Area and in Designated Greenfield Areas.

Objective 4.A.1.7 Reduce dependence on the automobile through the development of compact, mixed use, transit supportive, active transportation friendly urban environments.

Objective 4.A.1.8 Provide a foundation for developing access to intra and inter-city transit.

Objective 4.A.1.9 Ensure the availability of sufficient employment and residential land to accommodate long term growth in Niagara to the year 2031.

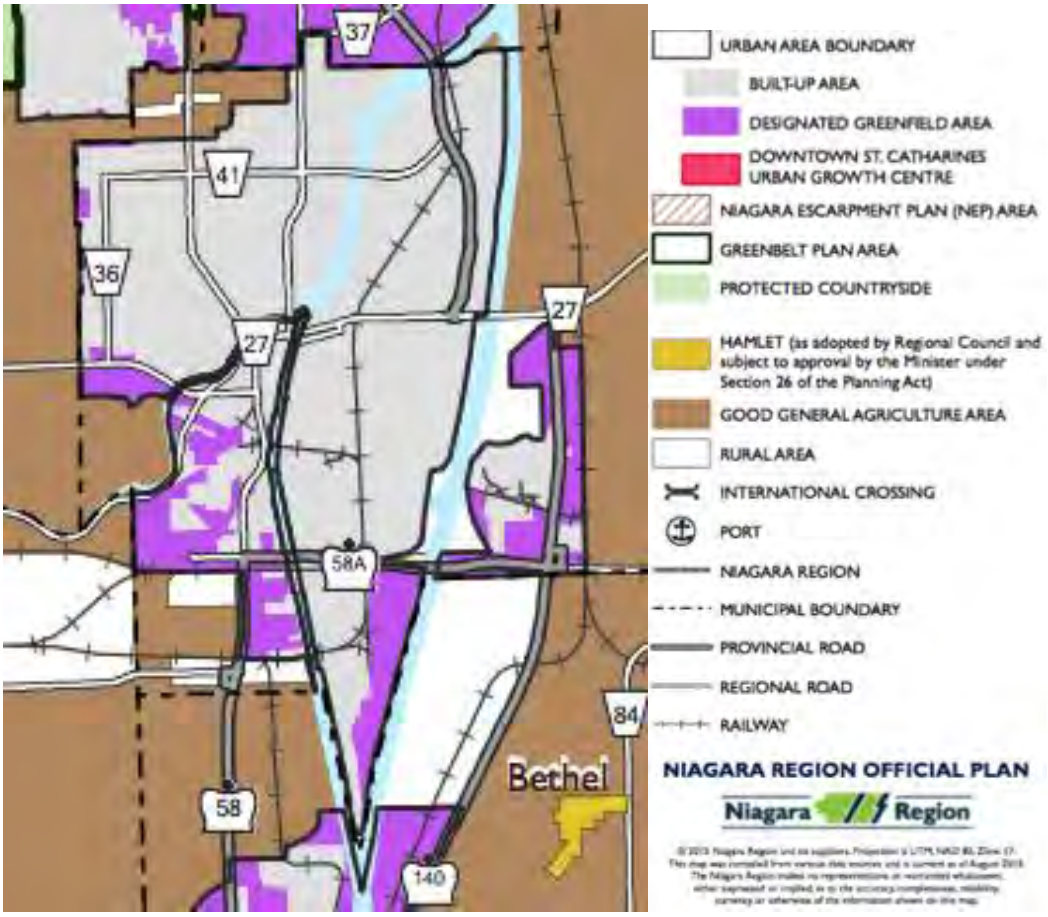
Objective 4.A.1.10 Provide a framework for developing complete communities all across Niagara, including a diverse mix of land uses, a range of local employment opportunities and housing types, high quality public open spaces, and easy access to local stores and services via automobile, transit and active transportation.

Objective 4.A.1.12 Direct growth in a manner that promotes the efficient use of existing municipal sewage and water services.

The City of Welland is continuing to achieve 60% of its growth through intensification in the City's built-up area. However, as discussed in Section 4 of this report, the City has limited available Designated Greenfield Area land to accommodate its future growth targets. By including the Northwest Welland lands within the urban boundary, the City can accommodate its long-term growth targets. Directing growth to the Northwest Welland study area promotes efficient use of existing municipal sewage and water services. The study area's proximity to existing built-up areas will also contribute to the Plan's objectives of building a compact, mixed use, transit supportive and active transportation friendly community. Development in the Northwest Welland study area will also support the improvement and enhancement of intra and inter-city transit.

The Niagara Region's Regional Structure identifies the study area as a 'Good General Agriculture Area' with a small area designated 'Rural Area', as seen in **Figure 18**. The Region's designation does not reflect the existing Summerlea neighbourhood at the northwest corner of the study area. Chapter 5 of the Plan states that areas of good general agricultural lands are suitable for the production of field crops and for livestock operations. As per the agricultural assessment in Section 3 of this report, the Northwest Welland study area is relatively poorer agriculturally and lacks agricultural infrastructure and livestock operations. The assessment also states that non-agricultural uses are actually predominant within the Northwest Welland study area.

Figure 18: Niagara Region Official Plan – Schedule A – Regional Structure Intensification and Greenfield Growth



As per section 4.C of the Niagara Region's Official Plan, intensification includes all forms of development that occur within the built-up area as identified on Schedule A of the Niagara Region's Official Plan. Each municipality will develop and implement through its local Official Plan and other supporting documents, a strategy and policies for promoting intensification and achieving intensification targets set out in sub-section 4.C.4 of the Region's Official Plan. The City of Welland's Official Plan encourages appropriately planned infill and intensification within its Downtown, Welland Recreational Waterway, brownfield and greyfield areas and areas with access to planned or existing transit services. As previously mentioned, the City is continuing to meet its intensification targets, as set out in the Growth Plan for the Greater Golden Horseshoe. However, additional lands are required for the City to meet its growth targets by the year 2041.

Policy 4.C.5, aligns with the PPS and requires that Designated Greenfield Areas are planned as compact, complete communities. The policy also speaks to ensuring that Greenfield development is sequential, orderly and contiguous with existing built-up areas. From a Regional perspective, the Northwest Welland study area is adjacent to built-up areas in the Town of Pelham, the City of Thorold and the City of Welland. The development of these lands will provide an opportunity to create sequential, orderly and contiguous development that supports existing Regional transportation networks as well as makes efficient use of existing and planned City of Welland transportation and servicing infrastructure.

Policy 4.D provides direction with regards to an Urban Area boundary expansion. The Region expects that local municipalities develop comprehensive work programs in collaboration with the Region to ensure that requests for Urban Area boundary expansions are done within the context of and in conformity with Provincial legislation and policies, and the policies of the Region's Official Plan. The City of Welland has developed, in collaboration with the Region, a comprehensive work program to prepare a planning justification rationale for development of Northwest Welland and the development of a Secondary Plan for the study area. As part of the planning justification report, sub-consultants have been retained to ensure that both regional and local existing and planned infrastructure required to accommodate the proposed Northwest Welland expansion can be provided in a financially and environmentally sustainable manner. A summary of these studies can be found in Section 3 of this report, and the full studies are within **Appendix A to F**.

In Section 4.G, the Regional Official Plan addresses urban growth and provides the following common objectives, which should guide decisions related to land use planning, infrastructure development, natural and cultural resource management and fiscal planning. The policies in this section align with those of the PPS and Growth Plan with the objective to build compact, vibrant, sustainable, integrated and complete communities. The policies in Section 4.G also speak to maximizing the use of existing and planned infrastructure to support growth in a compact and efficient manner.

The development of lands in Northwest Welland will contribute to building a compact, vibrant, sustainable, and complete community, while also integrating with existing, adjacent communities in the City of Welland, City of Thorold and Town of Pelham. Residential development of the Northwest Welland study area

will also maximize the use of existing and planned infrastructure and will help support the future widening of Regional Road 54 (Rice Road) and Quaker Road, First Avenue and Niagara Street. As mentioned in Section 3 of this report, the Northwest Welland and surrounding area has limited active transportation facilities, therefore development of the Northwest Welland study area will also contribute to enhancing the active transportation network in the area and will support a public transit network expansion.

5.4 City of Welland Official Plan

The City of Welland's Official Plan aims to implement a range of local, regional and provincial policies, plans and strategies in order to help achieve the community's long-term vision.

Section 3 of the Official Plan speaks to City's growth management strategy. Growth and development within the Urban Area boundary should be planned to be serviced with municipal water and sanitary wastewater services. The City encourages appropriately planned infilling and intensification within several strategic locations, such as the Downtown and also supports compact and transit supportive development on its Designated Greenfield Areas (DGA). As previously mentioned, the Northwest Welland study area is well serviced with municipal water and sanitary wastewater services. Due to the study area's proximity to existing built-up areas, development of these lands can support compact built form and will enable improvements to transit and active transportation services.

The Official Plan recognizes that a small amount of growth and development will occur within the Agricultural and Rural Areas. Rural growth should be concentrated on existing lots of record and lands with existing access to water services, allowing the City to protect its valuable agricultural lands and linked natural heritage system in order to prevent land fragmentation and degradation of natural systems. The Northwest Welland study area is currently within the City's Agricultural and Rural Area. The predominant activity in this area, as per policy 3.4.3.1 is farming and other limited non-farm activities, however as per the agricultural assessment in Section 3, there is very little agricultural activity in the Northwest Welland study area. These lands also have access to existing water services and local and regional road network. Development within the study area will not fragment lands but rather provide orderly, staged development, which integrates and logically connects existing urban, built-up areas within the City of Welland, the City of Thorold and the Town of Pelham. Development of the

Northwest Welland study area will contribute to creating a complete community by ensuring orderly development that is contiguous with the existing built-up areas surrounding the study area. Studies have been conducted to ensure that development of the study area does not negatively impact agricultural lands and the natural heritage system.

The City of Welland's Urban Boundary defines the area in which urban growth and development is directed. As per Policy 3.4.2.2, lands within the City's Urban Boundary are to be serviced, or intended to be serviced, with major roads, transit and piped sanitary and water services. As previously discussed, the Northwest Welland study area is well serviced with both regional and local roads as well as water and sanitary services. The Northwest Welland study area therefore meets Policy 3.4.2.2 requirements for serviced lands within an urban boundary.

The Official Plan's objectives are to provide a framework for transforming Welland into a complete community, that builds compact, mixed-use, transit supportive, pedestrian friendly communities. Section 4.2.1.1. speaks to there being an appropriate distribution of residential areas throughout the City and that future growth occurs in an orderly manner. As previously shown in **Figure 3**, the Northwest Welland study area is surrounded by existing urban development within the City of Welland, the Town of Pelham and the City of Thorold. Therefore directing development to this area will ensure there is orderly development and growth that integrates with and connects three existing urban areas.

6 Conclusion

This report has analyzed whether the Northwest Welland study area is an appropriate location for future developed to accommodate the City of Welland's anticipated population growth.

The report has included a summary of background studies that evaluated the Northwest Welland study area from an agricultural, archeological, transportation and servicing perspective. A Natural Heritage System and Floodplain and Natural Hazard Lands studies are still being finalized and therefore not included in this report. As identified in Section 3, the subject lands have poor agricultural quality and have limited agricultural activity. Apart from the fallow agricultural land, approximately 55 hectares of the Northwest Welland study area are currently developed and identified as Built-up Area. As identified in the transportation and servicing studies, the subject lands have existing and planned Regional and local infrastructure and services. The developed lands within the study area include residential dwellings and institutional uses, which include two schools and the Niagara Catholic School District School Board office.

The Northwest Welland lands are surrounded by built-up areas and are bound by the City of Thorold's Port Robinson Secondary Plan, the Town of Pelham's East Fonthill Secondary Plan as well as the City of Welland's built-up area. Development of the Northwest Welland lands will act to fill the donut, which will improve the integration and connectivity of these existing urban areas.

The report has analyzed the City of Welland's development trends within its greenfield areas. This analysis has provided further justification that the City of Welland does not have enough land to accommodate within its Designated Greenfield Area to accommodate its forecasted growth by 2041. A modification to the City's urban boundary is therefore required. The report evaluates the opportunity to re-designate the East of 58 Lands, in order to offset the increase in urban land supply when including the Northwest Welland lands.

The report finds that the Northwest Welland lands are appropriate lands for future urban development due to their existing and planned infrastructure, proximity to existing built-up areas and ability to contribute to orderly, sequential and contiguous development.

APPENDIX A – Agricultural Assessment Review

by AgPlan Limited

AGRICULTURAL ASSESSMENT REVIEW
FOR THE NORTH WEST SECONDARY PLAN STUDY AREA LOCATED
IN THE CITY OF WELLAND, NIAGARA REGION

Prepared for:
The City of Welland

By:
AgPlan Limited

April 30, 2019.

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1.0 STUDY OBJECTIVES

1.1 Introduction

This report has been prepared as an Agricultural Impact Assessment related to a secondary plan study in northwest Welland as shown on Maps 1 and 2. The study's general objective is outlined in the Request for Proposal (RFP) as follows:

> *The focus of the secondary plan and associated studies is to create a vision for the subject lands and related policies/directions that will ensure its successful implementation. The process will identify opportunities and constraints for development of the subject lands and the location, extent and sensitivity of the existing natural, social, cultural and economic environment in the study area. Mitigation measures for any impacts to the environment will also be determined.*

With respect to agriculture, the RFP specifies two requirements for a:

- *Minimum Distance Separation I Study to determine whether the Northwest expansion lands are impacted by active or potential livestock facilities. If the study finds that the Northwest lands are within 300 metres of an active or potential livestock facility then mitigation measures will need to be provided; and an,*
- *Agricultural Impact Assessment to assess the impact of future development on prime agricultural areas and how to minimize and mitigate any impacts on the agricultural system; and, where necessary, how an urban area expansion is in compliance with the Minimum Distance Separation formulae.*

Therefore, following the RFP, the content of this report is framed by policy as well as guidelines and addresses several agricultural characteristics of the study area, Welland, and Niagara Region, given the agricultural context of southern Ontario. As a result, this agricultural assessment is based on current conditions as well as on an estimate of future conditions and was completed to answer three questions as follows:

- What are the characteristics of the agricultural environment within and adjacent to the Northwest Welland Secondary Plan Study Area?
- How have the agricultural characteristics within Welland, Thorold and Niagara Region changed over the past 35 years?
- Are agriculture-related mitigation measures required with respect to the proposed non-agricultural development in the Northwest Welland Secondary Plan Study Area and what mitigation measures are available for the reduction of impacts to agriculture *to the extent feasible*?

The use of past conditions to project/estimate future conditions is subject to the extrapolation of existing measurements and therefore to the general limitations associated with extrapolation (as outlined in many statistics texts and described within Wikipedia). The phrase "The Northwest Welland Secondary Plan Study Area" is used synonymously with the words "study area" and "site" within this report.

The terms of reference for the work was for a Secondary Plan study. A Secondary Plan study of a greenfield site can reasonably only occur if the lands, which are the subject of

the Secondary Plan, are already chosen as, or are one of several options already chosen as, a settlement expansion area. Therefore, the principal analysis and importance ranking of agriculture occurs (if at all) at the time of the settlement expansion area decision. The terms of reference for the Northwest Welland Secondary Plan Study did not include the use of agricultural information to derive different settlement area options or to evaluate those settlement area options from an AIA perspective. If agriculture is important in the multidisciplinary evaluation of settlement area options (and, in practice, agriculture sometimes isn't of importance), the preferred option or options would be that/those that have the least agricultural impact. Subsequently, an AIA for a secondary plan study is appropriately restricted or scoped to:

- phasing of development;
- implementation of recommendations, if any, provided in the settlement expansion area AIA (if the settlement expansion area study gave sufficient weight to the importance of agriculture that an AIA was prepared); and,
- recommendations, if any, related to the boundary condition(s) between urban uses and adjacent agricultural uses (often referred to as "edge planning").

The scoped AIA components listed above, are reflected in the *Draft Agricultural Impact Assessment (AIA) Guidance Document* (OMAFRA, 2018) as described in the findings section later in this report.

The Northwest Secondary Plan planning process includes reports from several different disciplines. Therefore, this agricultural assessment information should be supplemented with information provided within other reports prepared for the The Northwest Secondary Plan Study Area. As well, the contents of this agricultural report may be changed by the author as a result of information and questions provided within external reviews.

The report uses four phrases which are defined as follows:

- **Soil Capability Class** - This term is the one most often used in rating agricultural soils and is defined as part of the *Canada Land Inventory Soil Capability Classification for Agriculture* - Soil Capability for Common Field Crops. It is an interpretive classification of the soils maps produced within Canada where soils are identified by texture, drainage class, layers (diagnostic horizons) etc. following the Canadian System of Soil Classification (1978, third edition 1989 http://sis.agr.gc.ca/cansis/references/1998sc_a.html). The soil capability rating is a seven-class system consisting of a class number (1 (best) – 7 (poorest)) and a subclass limitation such as stoniness, slope, or erosion (represented by an alphabetic code P, T, E, etc.). The best soils with no limitations for production of common field crops are ranked as class I and soils unsuitable for agriculture are rated as class 7. This information concerning capability classes and subclass limitations is provided as part of the relational database included with the soil mapping digitized by OMAFRA and provided by LIO/MNR (Land Information Ontario/Ministry of Natural Resources).
- **Soil Productivity Index** - The original soil capability classification classes one through seven have been converted from an ordinal to a ratio scale based on crop yields. For common field crops, such as grain corn, oats and barley, a

relationship was measured to demonstrate that if class I land was assigned the soil productivity index value 1.00, then class 2 would be 0.80 and class 3 would be 0.64 etc. The use of the ratio scale allows for a mathematically acceptable measurement of mean value. Therefore, a given study area can have a single average value of a soil productivity index. When comparing different site alternatives, the use of the soil productivity index allows comparison of the alternatives using a single value. The use of the soil productivity index also provides a way to deal with soil complexes - where a soil complex is represented by a single polygon (in the past this was called a map unit) where there are two or more soil series/types present and mapped and where there is some likelihood to be a combination of soil capability classes such as 60% class I and 40% class 2T, for example.

- **Soil Potential Index** - Like the aforementioned Soil Productivity Index, the Soil Potential Index provides an "average" (single value) soil potential for agricultural production for a given area when that area contains more than one soil potential rank or rating. The Soil Potential Index is based on ranks which are part of an ordinal scale and provide a potential rating for the production of fruit and vegetable crops.
- **Agricultural Performance** - Agricultural performance is a single relative comparative measure that combines many agricultural characteristics of a given area in comparison to another given area (for example, one Region or County relative to another Region or County). The scoring, ranking or relative difference is quantitative. Agricultural performance includes economic, socio-cultural and physical variables and is described in more detail in in the method section following.

1.2 Methods

Several different sources and methods have been used to characterize agriculture presently, as well as trends over time, to distinguish whether the study area is relatively better or poorer. Poorer sites have lower impacts and require less mitigation. Direct observation in the field have been supplemented with indirect observations provided by aerial photo interpretation, as well as third-party quantitative data that have been analysed statistically. The viewpoint has been taken that information from several different sources provides a more powerful tool when assessing agriculture.

Therefore, the findings described in the following section are based on published literature, which is listed in the references section, quantitative statistics, fieldwork, and aerial photo interpretation. Much of the information relates to the use of data from Statistics Canada and the Ontario Ministry of Agriculture, Food and Rural Affairs and is subject to the limitations of the surveys completed by these government groups. The use of published information, fieldwork, and aerial photo interpretation is intended to provide quantitative as well as qualitative evidence in support of the opinions on agricultural impacts outlined within this report. This agricultural assessment presents data graphs as well as mapped information together at the end of the report to allow the reader to review the information used to provide the descriptions and opinions within this report.

Single factor analysis as well as the use of multi-attribute data analysis was used to compare the agricultural performance of Niagara and Welland relative to other sub-tier municipalities in Niagara Region. The multi-attribute data analyses were completed using two methods; linear weighted combination, and concordance which are described in more detail in Appendix 4.

Agricultural census data for Welland (and the other sub-tier municipalities in Niagara Region) are sometimes subject to suppression for reasons of confidentiality. However, the data can be imputed. Several different methods are available to impute missing information. In this report, the imputed value, for example, an area or total number of animals reported in Niagara Region not accounted for in the data supplied for the sub-tier municipalities, was assigned to the sub-tier municipalities having suppressed information, based on the number of farms reporting the agricultural information and lacking the area or animal number data. The formula used to calculate the imputed value was:

$$((A - B)/(F))*S$$

Where:

A= the total value reported for the Census District).

B= the values reported for the sub-tier municipalities (Census Consolidated Subdivision) where data was <u>not</u> suppressed.

F= the total number of farms associated with all the sub-tier municipalities having suppressed data.

S= the number of farms associated with the sub-tier municipality having the suppressed data and for which the value is being imputed.

The amount of suppression of agricultural data is relatively high for Welland because it does not contain a large amount of agricultural land. For example, for the Census years from 1981 to 2016, no agricultural data are presented for Welland in the years 1986, 1991, 2011 and 2016. Agricultural data for Welland have been combined with that of Thorold for the Census years 2011 and 2016. Therefore, for several analyses looking at trends from 1981 to 2016, data have been combined for Welland and Thorold

Additional information related to methods is included as part of subsections addressing findings on the following pages.

2.0 FINDINGS

2.1 Planning Context

The information gathered and analysed is informed generally by several planning documents:

1. Government of Ontario. 2014. *Provincial Policy Statement*. Queen's Printer for Ontario; which indicates the need for minimizing land use conflict and the application of Minimum Distance Separation (MDS).
2. Ministry of Municipal Affairs. 2017. *Growth Plan for the Greater Golden Horseshoe (2017)*. Queen's Printer for Ontario; which introduces and defines the *Agricultural System* and the *Agri-Food Network*.

3. Ontario Ministry of Agriculture, Food and Rural Affairs. 2018. *Draft Agricultural Impact Assessment (AIA) Guidance Document;* which refers to agricultural assessments at the secondary plan stage.
4. Ontario Ministry of Agriculture, Food and Rural Affairs. 2018. *Implementation Procedures for the Agricultural System in Ontario's Greater Golden Horseshoe*; which provides additional detail with respect to the *Agricultural System* and the *Agri-Food Network*.
5. Ontario Ministry of Agriculture, Food and Rural Affairs. 2017. *The Minimum Distance Separation (MDS) Document, Formulae and Guidelines for Livestock Facility and Anaerobic Digester Odour Setbacks*. Publication 853, implemented March 1, 2017; which documents the process and calculation method for MDS.

Much of what is referred to in these five documents has little relevance to the Northwest Welland Secondary Plan Study Area because this area has already been affected by non-agricultural development within and adjacent to the study area (as will be described later within this report). The study area and current official plan designations for Niagara Region are shown on Map 1. Current and proposed official plan designations for Welland, Thorold and Pelham have also been reviewed and are presented on Map 2 which is a single map combining land-use designations for all three sub- tier municipalities.

The impacts to agriculture are informed specifically by reference to these Official Plans. The Welland Northwest Secondary Plan Study Area is designated as Good General Agriculture and Rural in the Niagara Region Official Plan (Map 1). The study area includes designations for Agriculture, Institutional, Residential Open Space and Recreation as well as Core Natural Heritage System in the Welland Official Plan (Map 2). Maps 1 and 2 also indicate that the study area is almost entirely surrounded by non-agricultural uses or designations and that the proposed non-agricultural development of the Welland Northwest Secondary Plan Study Area is a logical extension of existing or planned urban development within Pelham, Thorold and Welland. The Northwest Welland Secondary Plan Study Area is a small residual area of agriculture, a "hole in the donut" where the doughnut is the non-agricultural development in Pelham, Thorold and Welland.

Agricultural Impact Assessment (AIA) guidance at the Secondary Plan stage has been described by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA, 2018) in draft guidelines. The draft AIA guidelines refer to secondary plans and state that edge planning tools:

- can be implemented to alleviate land use conflicts between agricultural and non-agricultural uses,
- include directing traffic away from farming areas, using buffers and providing separation distance.

The need for mitigation measures, as described within the PPS (2014), is a result of possible conflict between urban and rural inhabitants. This potential conflict has been summarized by Pasato (2001) from both the farmers and urbanites. OMAFRA, in its

publication *Guidelines on Permitted Uses in Ontario's Prime Agricultural Areas* (2016), summarizes possible impacts to agriculture as follows:

> *Impacts can be short- or long-term and may affect agricultural production, infrastructure, operations or farmers' flexibility in carrying out their farming business. Examples of potential impacts include:*

- *loss of agricultural land,*
- *increased traffic and safety risks for slow-moving farm equipment operators and people in passing vehicles,*
- *nuisance complaints by new residents related to normal farm practices (may depend on wind direction, landforms, vegetation, etc.),*
- *farmer concern over lighting, noise, dust and other changes in settlement areas that are incompatible with agriculture (also dependent on physical site attributes),*
- *new or increased minimum distance separation requirements that may restrict future development or expansion of livestock facilities,*
- *trespassing, vandalism, pets at large and litter/garbage disposal on farm properties,*
- *change in water quality or quantity,*
- *increased growth pressure on remaining agricultural lands.*

As can be seen on Maps 1 and 2 mitigation the presence of urban development and,

- the existing influence due to the urbanization of Mississauga and Oakville.

Regardless, mitigation will be discussed more fully in section 2.7 of this report.

Agricultural Impact Assessments (AIA) at the secondary plan stage can reasonably be scoped based on history, practice and guidelines. The use of agricultural information in Secondary Plan studies tended not to occur until relatively recently. AgPlan's first agricultural assessment for a secondary plan was completed in 2011. Communications with OMAFRA staff at that time provided the guidance that the principal concerns related to the Secondary Plan were the phasing of development, Minimum Distance Separation and the general design of the boundary condition (edge planning for the reduction of land use conflict), between the settlement area secondary plan boundary and the adjacent agricultural land.

The Niagara Region has no agricultural impact assessment guidelines. The *Draft Agricultural Impact Assessment (AIA) Guidance Document* (OMAFRA, 2018) refers to Secondary Plans but qualifies statements with the use of the word "may" as follows:

> *Secondary plans may include policies and maps that provide direction on topics including land use, infrastructure, transportation, design and the natural environment. Additionally, they may be utilized as a means to implement the recommendations that have been provided in an AIA.*

The *Draft Agricultural Impact Assessment (AIA) Guidance Document* (OMAFRA, 2018) has been written to address a broad cross-section of development proposals which are described generally into 3 categories by OMAFRA as a *settlement area expansion*, *mineral aggregate operation*, and *infrastructure*. The effects of urban settlement area development tend to be different from those associated with mining, pipelines, electrical transmission lines, and a transportation system such as road and rail. Therefore, the

guidance provided by the *Draft Agricultural Impact Assessment (AIA) Guidance Document* (OMAFRA, 2018) must be scoped relative to the proposed use.

The *Draft Agricultural Impact Assessment (AIA) Guidance Document* (OMAFRA, 2018) discusses Secondary Planning together with Subdivision Design and, with reference to secondary plans, states that they *may include policies and maps that provide direction on topics including land use, infrastructure, transportation, design and the natural environment*. The *Draft Agricultural Impact Assessment (AIA) Guidance Document* (OMAFRA, 2018) is more specific regarding subdivision planning, which follows the secondary plan stage, and states that:

> *Design elements that could be incorporated into subdivision in the fringe areas include:*
> - *Road design to direct traffic away from farming areas*
> - *Increased lot depths/sizes along the urban-agriculture boundary to allow for greater separation between uses*
> - *Planting vegetation buffers and/or installing fences to protect residential areas from possible spray drift, dust and noise*
> - *Recognition that a road right of way may be an adequate buffer and planting vegetation to improve the existing roadway buffer and*
> - *Increased building setback provisions in the zoning by-law to increase the separation between uses.*

Therefore, mitigation measures such as road design, buffers and setbacks are appropriately evaluated and implemented, as is reasonable, at the subdivision design stage rather than at the secondary plan stage. Hence, this report does not contain recommendations related to these mitigation measures.
While previous references are made to the *Draft Agricultural Impact Assessment (AIA) Guidance Document* (OMAFRA, 2018), the "Guidance Document" is still a draft and the release date of the final document is unknown (personal communication, 2019, OMAFRA Land Use Planning staff). Given that the OMAFRA AIA document is draft, and is a guideline, it lacks the "status" of a final document and is of lesser importance than matters described specifically in policy.

An AIA is completed to assess positive as well as negative changes in agriculture resulting from a proposed non-agricultural use. In assessing those changes or impacts, the changes due to the proposed new or different use need to be distinguished from those changes which are occurring, and which relate to factors other than the proposed non-agricultural use. For example, changes in:

- consumer preferences which may result in the purchase of different food products;
- regulatory environments such as tariffs, import quotas which may affect production costs, product sale price and product substitutes;
- weather patterns affecting crop yields and product availability.

These changes can and do occur at different scales. Therefore, the AIA prepared by AgPlan for the Northwest Welland Secondary Plan Study includes an extensive reference and graphic display of a cross-section of agricultural characteristics given agricultural data available in the latest census and, for many factors, over a timeframe of 35 years (in keeping with planning time frames of 20 to 40 years). The agricultural data were gathered and analysed to put Welland, Niagara and the study area in an

agricultural context over time. The inclusion of this time/trend agricultural information is greater than is normally provided for a secondary plan study.

The mapping of soil capability and agricultural land use, as provided in the AgPlan AIA for the secondary plan study area and adjacent agricultural lands, also is more information than is currently gathered for the purposes of evaluating different secondary plan options. This information was reviewed and presented for purposes of recommendations for the phasing of urban development and to the treatment of the urban/rural interface or boundary to be examined at the time of subdivision planning.

Based on the OMAFRA AIA scope outlined and the historical practice related to an AIA, site-specific studies of agriculture within the Northwest Welland Secondary Plan Study Area were not completed because agriculture in that area is intended to end. Therefore, there is no need for site-specific soil surveys, soil capability and soil potential interpretations. Regardless, existing published information related to soil capability and soil potential has been evaluated within this report to inform any recommendations made with respect to work to be completed at the time of subdivision planning.

2.2 Agricultural Context, Trends and Evaluation

A comprehensive examination of agricultural single factors as well as multi-attribute analysis has been completed and the results summarized graphically in Appendix 1. The single factor evaluations are based directly on information gathered as part of the Agricultural Census for Canada over a 35-year timeframe from 1981 to 2016. In some cases, the analyses required a calculation. For example, graphing trends/changes in nutrient unit production (formerly animal units) from 1981 to 2016 required converting livestock numbers for several different species to nutrient units following tables in *The MDS Document* (2017). Observations on the combination of nutrient units with odour factor also required reference to *The MDS Document* (2017).

Multi-attribute analysis can be completed using different methods, databases and importance ranking (weighting) as described previously. Several different databases were used which have been identified using a single descriptor such as “fruits and vegetables”, “yield”, “economic” and “food production”. All the multi-attribute analyses presented graphically in Appendix 1 have each database variable given the same weight (unit weight). Additionally, none of the database variables were inverted values of the original census information. The results of several different multi-attribute analyses have been included to demonstrate that the highest scored 5 Counties/Regions and the lowest scored 5 Counties/Regions tend to be similar irrespective of the database. This does not mean that there are not some exceptions.

<u>Agricultural Performance</u>

Niagara Region generally has a very high-performance rating relative to other Regions/Counties in southern Ontario. Niagara has the highest score when crop and livestock data are compared using the 2016 census information (Figure 1). When the dataset is restricted to economics, Niagara ranks sixth out of 35 Regions/Counties (Figure 2). When the economics information is restricted to gross and net income

Niagara ranks second (Figure 3). Niagara does relatively poorly with the rank of 30th out of 35 when 12 field crop yields (grain corn, barley, canola, coloured beans, fodder corn, hay, mixed grain, oats, soybeans, spring wheat, dry white beans, and winter wheat) are compared (Figure 4) but improves to a rank of 19th when the predominantly grown five field crops yields of grain corn, fodder corn, hay, soybeans and winter wheat are used in the multi-attribute analysis.

The agricultural performance of Niagara indicates that Niagara is very important in the context of southern Ontario and that agricultural lands proposed for non-agricultural development need to be studied and chosen carefully. Findings described in the following pages will indicate that the choice of the Northwest Welland Secondary Plan Study Area is a good one which minimizes agricultural impacts.

Census Farm Number and Area

Figures 5 through 8 indicate that from 1981 to 2016:

- Census farm number and census farm area have been decreasing in Welland.
- Welland's proportion of Niagara Region's total census farm area has decreased.
- Welland's proportion of Niagara's total census farm area has varied but is approximately 1%.

Area in Greenhouses

Figures 9 and 10 indicate that:

- In 2016 Niagara ranked 2nd in total square metres of area under glass, plastic or other protection relative to other Counties/Regions in southern Ontario.
- Area under glass, plastic or other protection data are skewed with a very high percentage being found in Essex County.
- Niagara's total area under glass, plastic or protection is mostly found in Lincoln and Niagara-on-the-Lake and there is a very small amount of area under glass, plastic or other protection in Thorold + Welland.

Economics and Financial

Figures 11 to 20 provide context for several economic and financial indicators as follows:

- On-farm net operating average income in Ontario does not surpass off-farm income until the revenue category $100,000-$249,999 is reached.
- Over 80% of farm operators have more off-farm income than on-farm operating income in Ontario.
- Ontario average farm value (dollars gross per hectare) is greater for a cross-section of fruits and vegetables (apples, grapes, sweet corn, pumpkins and squash; grapes are the fruit crop predominantly grown in Niagara Region) than for common field crops such as soybeans, winter wheat and hay.
- Average farm value for crops has increased from 1981 to 2016,
- gross income per hectare for greenhouse products is much higher (up to $1.5 million per hectare).
- The proportion of farms in each total farm capital class varies from Niagara Region relative to Welland + Thorold. Welland + Thorold has a higher proportion of farms with total farm capital of less than $1 million relative to Niagara.

- The proportion of farms in each total gross receipts class varies from Niagara Region relative to Welland + Thorold. Welland + Thorold has a higher proportion of farms, has more farms with lower total gross receipts than does Niagara Region.
- Analysing trends in gross farm receipts minus total business expenses to calculate net on-farm income is limited because the farm expense categories have changed over time. However, farm expense categories have been the same for 2001, 2006 and 2011 as summarized in Table 1. Separate farm expense categories are not provided in the 2016 agricultural census.

TABLE 1

STATISTICS CANADA CENSUS FARM EXPENSE CATEGORIES (2001, 2006, 2011)
Fertilizer and lime purchases
Purchases of herbicides, insecticides, fungicides, etc.
Seed and plant purchases (excluding materials purchased for resale)
Total feed, supplements and hay purchases
Total feed, supplements and hay purchases
Livestock and poultry purchases
Veterinary services, drugs, semen, breeding fees, etc.
Custom work, contract work and hired trucking
Total wages and salaries $
Wages and salaries paid to family members $
Wages and salaries paid to all other persons $
All fuel expenses (diesel, gasoline, oil, wood, natural gas, propane, etc.)
Repairs and maintenance to farm machinery, equipment and vehicles
Repairs and maintenance to farm buildings and fences
Rental and leasing of land and buildings
Rental and leasing of farm machinery, equipment and vehicles
Electricity, telephone and all other telecommunication services
Farm interest expenses
All other expenses (excluding depreciation and capital cost allowance)

- When 2016 total farm capital, total value of land and buildings, the value of all farm machinery and equipment, total gross farm receipts, total farm operating expenses, and net on farm income (gross receipts minus operating expenses) are calculated proportionate to area and also to number of farms (per unit area in hectares and per farm, respectively) and subject to multi-attribute analysis, Welland + Thorold is poorer than the value for Niagara Region and ranks ninth on a per farm basis and 10th out of 12 on a per hectare basis.

<u>Agricultural Land Use</u>

Agricultural as well as non-agricultural land use within the study area is graphed in Figures 21 through 28.

- Agriculture and Agri-Food Canada (AAFC) prepares agricultural land use maps yearly which are based on the interpretation of aerial photography. The 2017

map (Maps 4 and 5) has been generalized into broad categories such as "cultivated, fallow, small grains, oilseeds, pulses, beans, hay, pasture, corn, potatoes, other crops"; fruits and vegetables"; "urban, built up" etc. and demonstrates that less than half of the Northwest Welland Secondary Plan Study Area is in agricultural use and that no fruits and vegetables are present.

- The Statistics Canada information of 2016 supports that of AAFC and indicates that where agricultural land is present in Thorold + Welland, 87% of that is in common field crops, hay, forage or pasture with less than 1% reported production of fruits and vegetables. In Niagara Region, 73% is in common field crops, hay, forage or pasture and fruit berries and nuts are at 11% with vegetables at 1%.
- Trends in fruit production over time show a reduction in the number of farms reporting as well as the number of hectares of fruit reported in Thorold + Welland from 1981 to 2016.
- Trends and vegetable production show a reduction in the number of hectares of vegetables reported in Thorold + Welland with fluctuating levels of farms reporting. However, farms reporting vegetable production in Thorold + Welland are low ranging from 1 to 8 farms.
- Thorold + Welland and Niagara Region show declining areas of fruit and vegetable production proportionate to total farm area between 1981 to 2016.
- Balance of trade data demonstrate that more money is being spent on imported fruits and vegetables that is being earned via exporting Ontario's fruit and vegetables.

<u>Livestock and Manure Production</u>

Figures 29 and 30 compare the relative number of nutrient units as well as those nutrient units per unit area in Niagara Region, Thorold + Welland and Welland as follows:

- Where data are available, the total number of nutrient units has declined from 1981 to 2006 in Welland.
- In Niagara Region and Thorold + Welland, the total nutrient units per Census Farm hectare has declined from 1981 to 2016.
- In 2016, Niagara Region and Thorold + Welland had less than one animal nutrient unit per hectare.

2.3 Agricultural Soil Capability and Soil Potential

The predominant soils within the Northwest Welland Secondary Plan Study Area include the soil series Beverly, Toledo, Tuscola, Berrien, Colwood and alluvium which are imperfectly and poorly drained. These soils are predominantly prime lands in soil capability classes 1 through 3 as shown on Map 6. Additional description for soil classification and soil capability are outlined in Appendix 3.

Soils and soil capability information could be used at the secondary plan stage to:

- identify soils that provide a better base for parks and playing fields and/or
- provide a rationale for the timing at the such that the better agricultural lands are developed last.

However, the application/utility of the soils and soil capability information will depend on the rate at which urban development needs or does occur and the relative aerial extent of different kinds of urban use. Neither the rate nor extent of proposed urban use are currently known.

Soils within the study area have some soil potential for the production of fruit and vegetable crops. The soil capability classification is for common field crops and does not include fruit and vegetable crops. Thus, various classifications on the potential of various soils to produce fruits and vegetables have been published more recently for some Regions/Counties in southern Ontario. Specialty crop classification systems are described more fully and summarized in tabular form in Appendix 2. Niagara Region does have soil potential ratings for fruits and vegetables and these have been adapted within this report. There are 20 crop groupings in this specialty crop rating system as shown in Table 2 (9 groups for fruits and 11 groups for vegetables). The crop groups A, B, C and E are rated as unsuitable (rank 7) due to climate and/or are not grown commercially in Welland.

Table 2 summarizes soil potential ratings for the predominant soils within the study area. The soil potential rating assumes that tile drainage and irrigation are applied as required. Only two soil series, Berrien and Tuscola with a slope ranging between 0.5 and 5%, have an average soil potential rating of 3. The remaining soils, which are predominant, have an average rating of 4 and 5. Notwithstanding the average rating, the smaller areas of Berrien and Tuscola soils have relatively good potential for the production of labrusca grapes, apples, pears, plums, raspberries, strawberries, currants, gooseberries, as well as a broad cross-section of vegetables including cole crops (broccoli, Brussels sprouts, cauliflower), eggplant, peppers, cucumbers, tomatoes, sweet corn, pumpkins and squash.

Soil potential for the production of fruits and vegetables does not mean that the lands are being used for that kind of production. Neither does soil potential for fruit and vegetables indicate that the lands are a *Specialty Crop Area* as defined in the PPS. The Northwest Welland Secondary Plan Study Area is not, nor is it adjacent to a *Specialty Crop Area.* As already described, the study area is not being used for fruit and vegetable production and, at the broader scale of Thorold + Welland and Niagara, area of fruit and vegetable production is declining.

The fruit and vegetable crops that can be grown in Welland and the study area are not unique in the context of the Province or of the Greater Toronto Area. The amounts of different specialty crops and trends and their relative area of production have been described previously and will be addressed again in the following section.

TABLE 2 SOIL POTENTIAL RATINGS

				FRUITS									VEGETABLES										Total Score	Average Soil Potential Rating
SOIL_NAME1	SLOPE1	CLASS1	DRAINAGE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T		
Alluvium	1.0	B/C	Poor	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	140	7
Berrien	1.0	B	Imperfect	7	7	7	2	7	2	2	1	3	2	2	1	2	2	2	2	2	2	2	1	58	3
Beverly loamy	1.0	B	Imperfect	7	7	7	3	7	3	2	4	3	1	4	5	3	2	3	5	1	2	2	3	74	4
Beverly	1.0	B	Imperfect	7	7	7	3	7	3	2	4	3	2	5	5	3	3	4	5	2	3	3	3	81	4
Beverly	3.5	C,c	Imperfect	7	7	7	3	7	3	2	4	3	2	5	5	3	3	4	5	2	3	3	3	81	4
Colwood	1.0	B	Poor	7	7	7	4	7	3	3	3	3	2	3	2	3	2	4	3	2	3	3	3	74	4
Toledo loamy	1.0	B	Imperfect	7	7	7	4	7	4	4	5	5	2	4	5	3	3	4	5	2	2	2	4	86	4
Toledo	1.0	B	Imperfect	7	7	7	4	7	4	4	5	5	3	5	5	3	4	5	5	3	3	3	4	93	5
Toledo	3.5	C,c	Imperfect	7	7	7	4	7	4	4	5	5	3	5	5	3	4	5	5	3	3	3	4	93	5
Tuscola	3.5	B	Imperfect	7	7	7	1	7	2	2	1	1	1	2	1	2	1	2	2	1	1	2	2	52	3

Crops Used:

Tree Fruits, Grapes and Small Fruits:

A	Peaches, Apricots, Nectarines
B	Sweet Cherries
C	Sour Cherries
D	Labrusca Grapes
E	Vinifera Grapes
F	Apples
G	Pears, Plums
H	Strawberries, Raspberries
I	Currants, Gooseberries

Vegetable Crops:

J	Broccoli, Brussel Sprouts, Cauliflower
K	Bulb Onions, Garlic
L	Green (Bunching) Onions
M	Eggplant, Peppers
N	Cucumbers
O	Muskmelon
P	Potatoes
Q	Tomatoes
R	Sweet Corn
S	Celery, Lettuce
T	Pumpkins, Squash

2.3 Agricultural Land Use

Agricultural land use within the study area was ascertained based on field work (roadside reconnaissance), area photo interpretation as well as by reference to the published literature. The Northwest Welland Secondary Plan Study Area lands are predominantly used for common field crop production as can be seen by interpreting the

aerial photo base on Map 2. Woodland (including wetlands) areas are the 2nd most predominant land use (based on areal measurement). The study area includes a significant amount of non-agricultural development including strip development adjacent to roads. These observations are supported by AAFC and Statistics Canada census information which was described previously.

2.5 Climate

There are no readily available regional maps that integrate the various components of climate such as crop heat units, precipitation during the growing season, depth to water table, availability of water for irrigation, sunshine days and other climate risk factors into a single potential rating similar to soil capability. However, several broad scale, recent as well as historical climate information maps, are available from Agriculture and Agri-Food Canada at the national and provincial levels. These maps are at broad scale and appropriate for application at the Provincial and regional scales such as for southern Ontario. These maps are not sufficiently precise for application in the Northwest Welland Secondary Plan Study Area. Regardless, the climate information provides the evidence that Niagara is relatively unique within the context of Ontario. Hence, the mapping of a significant proportion of Niagara as *Specialty Crop Area*. As already discussed the Northwest Welland Secondary Plan Study Area is not within the *Specialty Crop Area*.

Niagara Region is unique in that it has more specific mapping for grape site selection (Fisher and Slingerland, 2002). This mapping provides information indicating that the Northwest Secondary Plan Study Area is in areas classified as “F” and “G” which are the poorer areas for grape production. Niagara Region also has done studies related to irrigation water (Niagara Region Irrigation Working Group, 2019; JAYEFF Partners, 2018; Stantec, 2005, 2007). Given the current agricultural land use and lack of fruits and vegetables within the Northwest Welland Secondary Plan Study Area, irrigation requirements are minimal.

2.6 Livestock and Manure Production

Several data sources have been used at various scales to characterize livestock use. For example, impediments to the construction of new livestock buildings are to be found in government regulation such as the Nutrient Management Act (NMA, 2002) and the Act’s associated Regulation (2005), in addition to the costs associated with the livestock business.

These costs include:

- The requirements of compliance with the NMA. Costs are significant and vary with agricultural industry and are outlined in the paper by Brethour et al. (2004). The poultry business is in a relatively good position to expense those costs.
- Costs for entering supply controlled agricultural industry such as dairy or poultry (which are the livestock industries with a good expectation of high net returns) is high. Combe (2000) estimated that the capital investment (excluding land costs) related to 30,000 units of chicken broiler quota was $1.609 million. Therefore, the capital investment (excluding land) for the 30,000 units of chicken broiler quota would be in excess of $1.6 million at current prices.

Given the level of liability, costs of compliance, hard work and uncertainty associated with livestock production, that production may become a less desirable farming option. For example, livestock farming may not be the favoured choice for an agricultural operation because of externally imposed requirements related to nutrient management, animal welfare, diseases such as BSE and avian influenza in addition to the cost of quota associated with supply-controlled industries (chicken, eggs and dairy). This perspective is supported by information that indicates that less livestock and manure is being produced within Niagara Region over time (as discussed previously).

The trends provided by the published literature support field observations and aerial photo interpretation that indicate no barns within and adjacent to the Northwest Welland Secondary Plan Study Area. Therefore, there is no need to calculate Minimum Distance Separation (MDS). If there were barns within a 1.5 km radius of the study area, the need for MDS calculations would be diminished because of the application of Guideline 12 in the MDS Document (2017) which states that MDS does not need to be applied when four or more existing non-agricultural uses are in close proximity to a barn. The specific circumstances related to the application of guideline 12 are outlined in the MDS Document.

2.7 Agricultural Infrastructure

Agricultural Systems in the *Agri-Food Network* are related to infrastructure that supports and/or is integral to agricultural production and processing. Fieldwork and aerial photo interpretation did not reveal the presence of agricultural infrastructure serving the needs of farmers in the area. The lack of livestock barns correlates with the lack of other agricultural infrastructure within the Northwest Welland Secondary Plan Study Area.

2.8 Mitigation

There is much qualitative literature describing possible conflict between agriculture and urban uses where that conflict is related to dust, pesticides, noise, light, transportation, odour, trespass, vandalism, farm management, animal care and other matters related to life in, and expectations associated with, agricultural versus urban areas. Is not the intent of this report to review that literature extensively. OMAFRA does not have documents that describe mitigation measures and their efficacy but have provided information prepared by some municipalities within southern Ontario (London, Mississippi Mills) and to government papers available for British Columbia (OMAFRA, 2016). The literature from British Columbia is more extensive. Published literature generally provides information with respect to subdivision design and other recommendations intended to reduce urban/rural conflict.

- Roads at the boundary between agricultural and urban areas should be designed to accommodate large, wide, slow-moving farm machinery (by use of wider road surfaces including paved shoulders; by placement of road markers, signage, mail boxes, away from the road edge, for example).
- Visual barriers provided by tree plantings within the agricultural and urban areas would potentially reduce some impacts related to light and noise.
- Choose areas of lower agricultural importance/priority for non-agricultural development where that proposed non-agricultural development has a boundary adjacent to relatively lower priority agricultural lands.

The literature shows that mitigation can take the form of:

- physical separation (buffer strips),
- berms,
- fencing,
- screening through use of vegetation,
- insertion of low-density uses between high-density urban uses and farm land,
- specialized zoning of buffer strips to prevent structures, storage, and removal of vegetation,
- clauses attached to land title which warn that adjacent uses include farm land where normal farm practices are protected and where those practices include the production of dust, vibration, odours, light, noise etc. and the use of fertilizers and pesticides,
- any combination of the aforementioned.

The need for, as well as the form or characteristics of, that mitigation can depend on several factors such as:

- the relative importance of the farmland as defined by planning policy;
- the kind and scale/size of agricultural operations (livestock versus fruit production, for example) probably affected by new urban development;
- the probability of impacts to agriculture and the severity of those impacts if they should occur;
- the probability that mitigation in any, or of specific form, can significantly reduce probable impacts;
- the relative positive impacts of residential development adjacent to farm land compared to negative impacts associated with the juxtaposition of residential and agricultural development.

The literature tends to emphasize the negative interactions at the urban/agricultural interface. However, there are some positive impacts, and these are outlined by Sokolow (Chapter 12, no date).

> *The common generalization from several studies is that urban proximity can provide profit-making opportunities as well as problems for farmers, considering the potential for direct marketing, other forms of access to urban consumers, and off-farm income for operators. (Edelman, et al., 1999). But only certain kinds of intensely-cultivated farms, including vegetable producers, seem to benefit from such locations (Larson, et al., 2001). A USDA review of the available information on farms in metropolitan areas characterizes them as smaller, producing more per acre, more diverse, and more focused on high-value production than farms in non-metropolitan areas (U.S. Department of Agriculture, 2001).*

Given that the Northwest Welland Secondary Plan Study Area is of relatively lower importance in the context of Welland and Niagara, the lack of agricultural infrastructure, no need for Minimum Distance Separation, the lack of high-value fruit and vegetable crops and greenhouses, the size and juxtaposition of the study area relative to non-agricultural uses, the mitigation discussed in the literature is not necessary related to the study area.

3.0 SUMMARY/CONCLUSIONS/RECOMMENDATIONS

The findings of the AgPlan analyses and mitigation review are summarized as follows;

- The study area does not meet the requirements for a *Specialty Crop Area* as defined within the PPS.
- The area does not have a high average potential for the production of specialty crops (fruits and vegetables) unlike lands in the *Specialty Crops Area* delineated in the northern parts of Niagara Region.
- Lands in the study area are predominantly in soil capability classes 1 through 3 (prime lands) as is much of Niagara Region.
- Soils have different drainage classes and textures.
- Common field crops are predominantly grown in areas of current agricultural use. Non-agricultural uses are predominant within the Northwest Welland Secondary Plan Study Area.
- Census farm number and area is diminishing over time and will likely continue as non-agricultural development occurs in Niagara and Welland.
- The majority of farms have more off-farm income than non-farm income.
- There are significant differences in gross and net incomes associated with common field crops versus fruits and vegetables versus greenhouse crops. High gross and net income crops are not present in the Northwest Welland Secondary Plan Study Area.
- Niagara has a relatively high total farm capital in the context of Ontario whereas Thorold + Welland does not. Farm capital in Thorold + Welland is relatively lower in the context of Niagara.
- Niagara's gross income and net income are relatively high in the context of other Counties/Regions in southern Ontario. Gross and net income in Thorold + Welland is relatively lower in the context of Niagara.
- At a Regional/County scale, multi-attribute analyses rate Niagara's performance as high except in the instance of field crop yields.
- Common field crop production predominates in Niagara Region as a whole and in Welland.
- Farms producing fruits and vegetables and the area in fruits and vegetables have diminished between 1981 and 2016. No fruit and vegetable production were observed in the Northwest Welland Secondary Plan Study Area.
- Nutrient (formerly animal) units are diminishing within Welland and Niagara.
- Nutrient units times odour factor is also diminishing within Welland and Niagara.
- No MDS measurements are required related to the Northwest Welland Secondary Plan Study Area because livestock barns were not observed in the 1.5 km MDS study area around the site.
- No observable farm infrastructure such as seed drying, and sales facilities were observed within or adjacent to the Northwest Welland Secondary Plan Study Area.
- The Northwest Welland Secondary Plan Study Area is a small area which is almost entirely surrounded by planned or existing non-agricultural uses. The study area also contains a relatively high amount of strip development and non-agricultural uses

In conclusion, the Northwest Welland Secondary Plan Study Area is relatively poorer agriculturally and is isolated from other agricultural uses. The study area's lack of agricultural infrastructure and compliance with MDS minimize impacts to the remaining agricultural lands which are currently in common field crop production. The Northwest Welland Secondary Plan Study Area is a logical extension of Welland.

Given the characteristics of the Northwest Welland Secondary Plan Study Area, no recommendations, including mitigation, related to the secondary plan are made. However, it is recommended that Minimum Distance Separation and edge planning tools be re-evaluated at the time of the preparation of plan(s) of subdivision for the Northwest Welland Secondary Plan Study Area.

AgPlan Limited

Michael K. Hoffman
Agricultural Analyst

4.0 ADDITIONAL REFERENCES

Acton, C. J. 1989. *The Soils of Brant County*. Report no. 55 of the Ontario Institute of Pedology.

Agricultural Land Commission. 1993. Landscape Buffer Specifications.

British Columbia Ministry of Agriculture. 2015. Guide for Bylaw Development in Farming Areas.

British Columbia Ministry of Agriculture, Strengthening Farming Program. No date. Guide to Edge Planning. Promoting Compatibility along Agricultural - Urban Edges.

British Columbia Ministry of Agriculture, Fisheries and Food. Provincial Agricultural Land Commission. 1996. Subdivision near Agriculture. A Guide for Approving Officers.

British Columbia Ministry of Agriculture, Fisheries and Food. Provincial Agricultural Land Commission. 1997. Planning Subdivisions near Agriculture.

Brethour, Cher, Kate Stiefelmeyer and Al Mussell. 2004. *Financial Impact of the Nutrient Management Regulations (267/03) and Assessment of Affordability*. Prepared by the George Morris Centre for the Ontario Ministry of Agriculture and Food.

Brown, D. M and R. E. Place. 1989. Rating climate in southern Ontario for horticultural crops. *Can. J. Plant Sci*. 69: 325-336.

Canada Soil Survey Committee (CSSC), Sub-committee on Soils Classification. 1978. *The Canadian System of Soil Classification*. Canadian Department of Agriculture Publication 1646. Supply and Services Canada, Ottawa.

Curran, Deborah. 2005. *Protecting the Working Landscape of Agriculture: A Smart Growth Direction for Municipalities in British Columbia*. West Coast and Environmental Law.

Ecologistics Limited and Smith, Hoffman Associates Limited. 1984. *Soil Rating System for Specialty Crops*. Prepared for Ontario Hydro.

Englund, Krista. 2003. Vegetative Buffers in BC. An investigation of existing buffers and their effectiveness in mitigating conflict. British Columbia Ministry of Agriculture and Lands, Resource Management Branch.

Environment Canada. 1972. The Canada Land Inventory Report No. 2, *Soil Capability Classification for Agriculture*.

Fisher, Helen and Ken Slingerland. 2002. *Site Selection for Grapes in the Niagara Peninsula*.

Gillespie J. E., R. E. Wicklund and M. H. Miller. 1971. *The Soils of Niagara County.* Report No. 43 of the Ontario Soil Survey.

Government of Ontario. 2014. *Provincial Policy Statement.* Queen's Printer for Ontario.

Hagerty T. J. and M. S. Kingston. 1992. *The Soils of the Middlesex County*. Volume 1 and 2. Report no. 56 of the Ontario Centre for Soil Resource Evaluation.

Hoffman, D. W., 1971. *The Assessment of Soil Productivity for Agriculture*. ARDA Report No. 4.

Hoffman, Douglas Weir. 1973. *Crop Yields of Soil Capability Classes and Their Uses in Planning for Agriculture*. PhD Thesis, University of Waterloo.

Hoffman, D. W., B. C. Matthews and R. E. Wicklund. 1964. *Soils Associations of Southern Ontario*. Report No. 30 of the Ontario Soil Survey.

Hoffman, D. W., and H. F. Noble. 1975. *Acreages of Soil Capability Classes for Agriculture in Ontario*. ARDA Report Number 8.

Irwin, Ross W. 1999. *Twenty Year Record of Drainage Benefit*. Prepared as a factsheet for the Land Improvement Contractors of Ontario.

JAYEFF Partners. 2018. *Niagara Irrigation Strategic Action Plan.* Bill Schenck, Chair, Strategy Steering Committee.

Kingston, M. S., and E. W. Presant. 1989. *The Soils of the Regional Municipality of Niagara*. Volumes 1 and 2. Report no. 60 of the Ontario Institute of Pedology.

Land Information Ontario (LIO). 2017. Map shapefiles and associated databases for soils and soil capability.

McBride, Raymond A. 1983. *Agronomic and Engineering Soil Interpretations from Water Retention Data*. PhD Thesis. University of Guelph.

Ministry of Municipal Affairs and Housing. 2006. Growth Plan for the Greater Golden Horseshoe, 2006. Office Consolidation to 2013. Queen's Printer for Ontario.

Ministry of Municipal Affairs and Housing. 2016. Proposed Growth Plan for the Greater Golden Horseshoe, 2016. Queen's Printer for Ontario.

Mussell, Al, Jim Willwerth and Helen Fisher. December, 2011. *Grape Varieties in Ontario Wine Regions*. *Understanding the Potential and the Risks*. Grape Growers of Ontario.

Mussell, Al, Kate Stiefelmeyer, Anatoliy Oginskyy, Claudia Schmidt and Bob Seguin. December, 2010. *Aligning the Ontario Grape Supply and Demand: A Varietal Plan for the Grape and Wine Industry*. Executive summary. George Morris Centre.

Niagara Region Irrigation Working Group Update. 2019. Memorandum Irrigation Working Group Update and Historical Background. APAC - C 03 - 2019.

Ontario Ministry of Agriculture, Food and Rural Affairs. 2016. *Guide to Fruit Production*. Publication 360.

Ontario Ministry of Agriculture, Food and Rural Affairs. 2016. *Guidelines on Permitted Uses in Ontario's Prime Agricultural Areas*. Publication 851.

Ontario Ministry of Agriculture, Food and Rural Affairs. 2017. *The Minimum Distance Separation (MDS) Document, Formulae and Guidelines for Livestock Facility and Anaerobic Digester Odour Setbacks*. Publication 853, implemented March 1, 2017.

Ontario Ministry of Agriculture, Food and Rural Affairs. 2015. Urban Agriculture Business Information Bundle. http://www.omafra.gov.on.ca/english/livestock/urbanagbib/raisinglivestockandpoultry.htm

Ontario Ministry of Agriculture, Food and Rural Affairs. 2014. Urban Agriculture Business Information Bundle Welcome to the Urban Agriculture Business Information Bundle (BIB) Producing Food in Cities. http://www.omafra.gov.on.ca/english/livestock/urbanagbib/welcome.htm

Ontario Professional Planners Institute. 2011. Planning School Edition. Ontario Planning Journal, vol. 26 (4).

Pasato, Nancy. 2001. Guidelines on Development within the Rural/Urban Interface. City of London Planning Division. Draft. Not adopted by City of London Council.

Presant, E. W. and R. E. Wicklund. 1971. *The Soils of Waterloo County*. Report number 44 of the Ontario Soil Survey.

Presant, E. W. and C. J. Acton. 1984. *The Soils of the Regional Municipality of Haldimand-Norfolk*. Volumes 1 and 2. Report number 57 of the Ontario Soil Survey.

Santa Barbara County Planning & Development Department Long Range Planning Division. 2012. Research on Agricultural Buffers. A White Paper. Attachment G.

Smith, Barry E. 1998. Planning for Agriculture. Policy Planner, Agricultural Land Commission, British Columbia.

Sokolow, Alvin D., Sonja Verea Hammond, Maxwell Norton, and Evan E. Schmidt. 2010. California communities deal with conflict and adjustment at the urban-agricultural edge. http://californiaagriculture.ucanr.org .

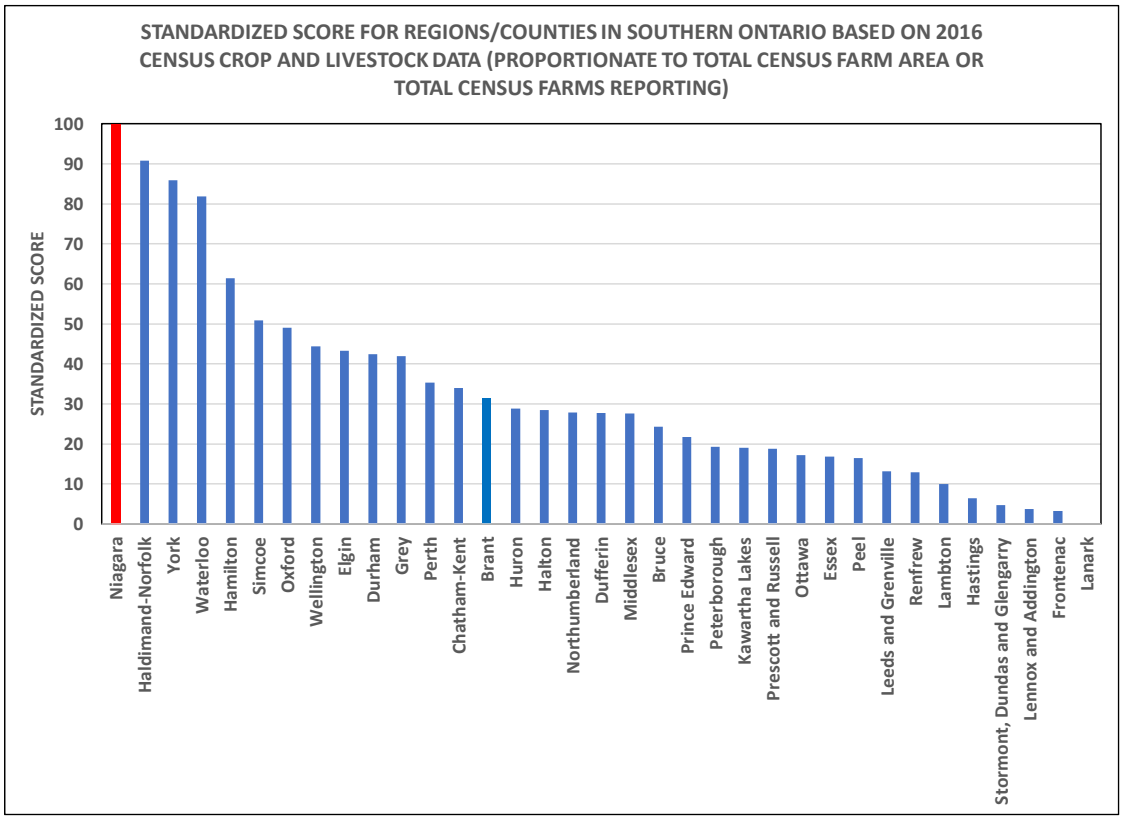
Sokolow, Alvin D. No date. California's Edge Problem: Urban Impacts on Agriculture. Chapter 12.

Statistics Canada. 1981 - 2016. Census of Agriculture data.

Weibe, J. and E. T. Anderson. 1976. *Grape Climatic Zones in Niagara*. Ontario Ministry of Agriculture and Food.

APPENDIX 1
FINDINGS - DATA GRAPHS AND MAPS

FIGURE 1



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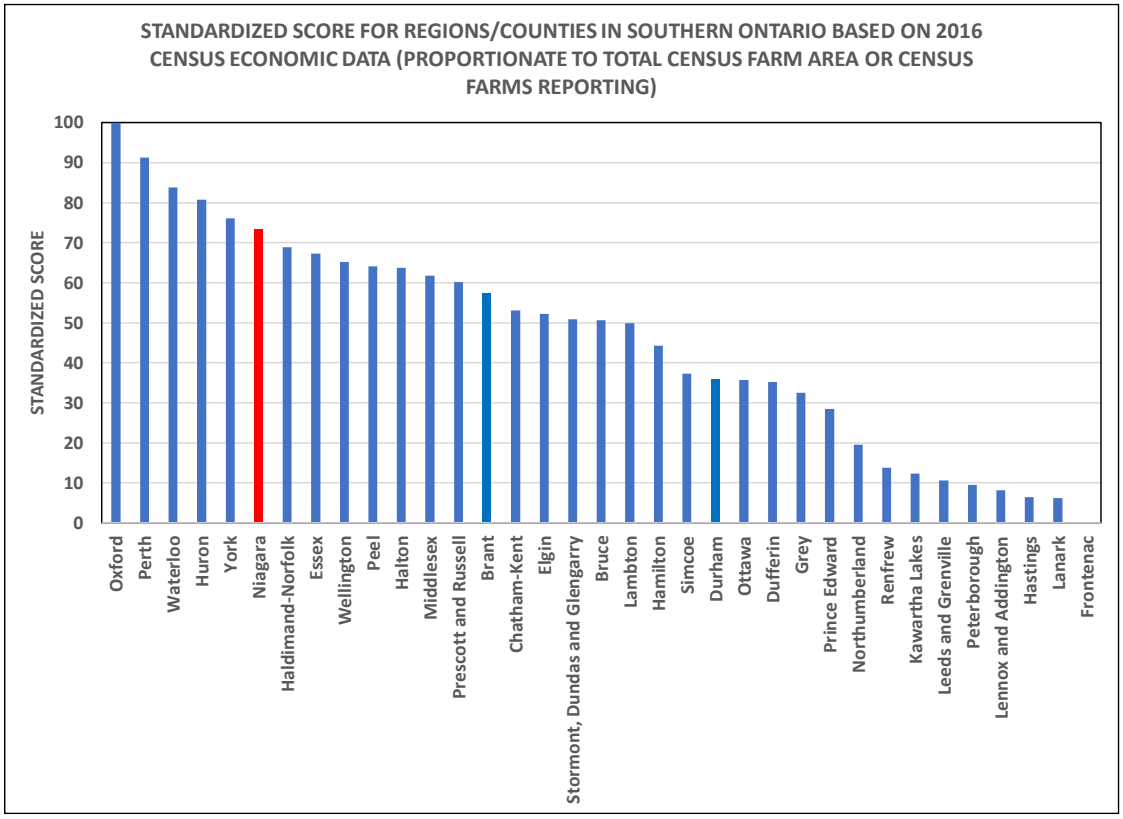

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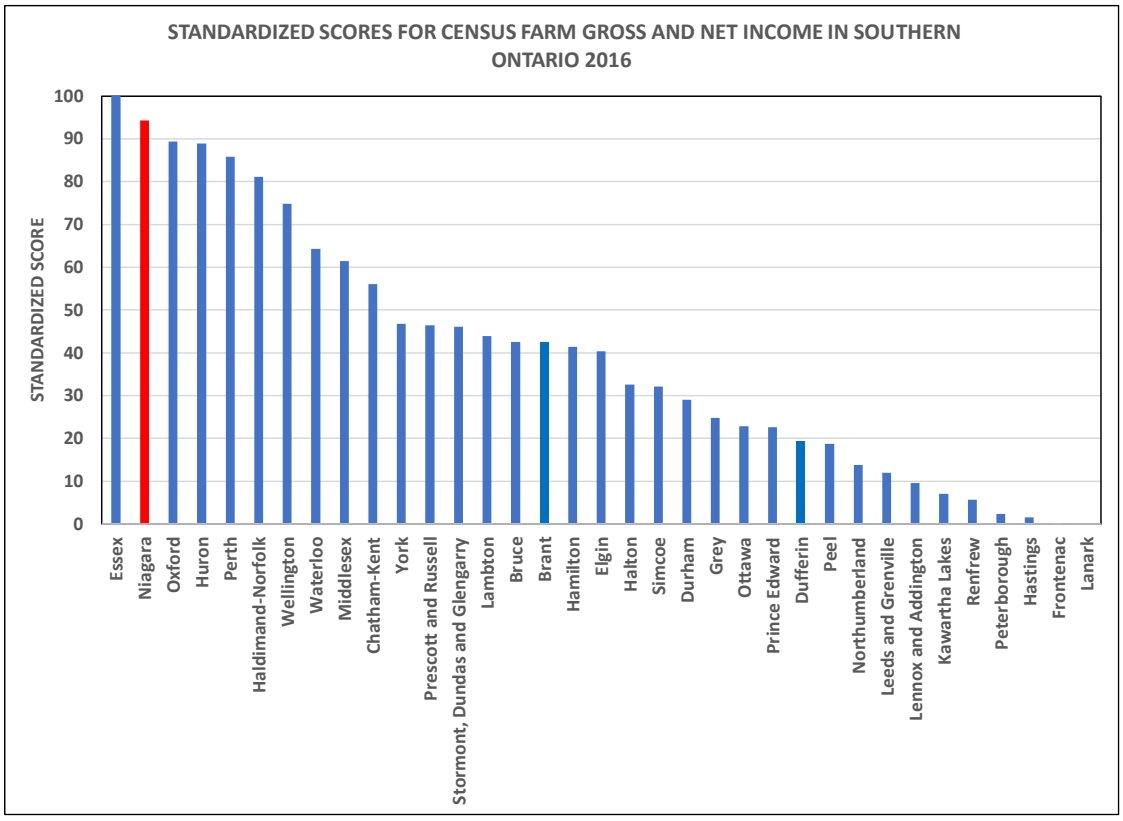

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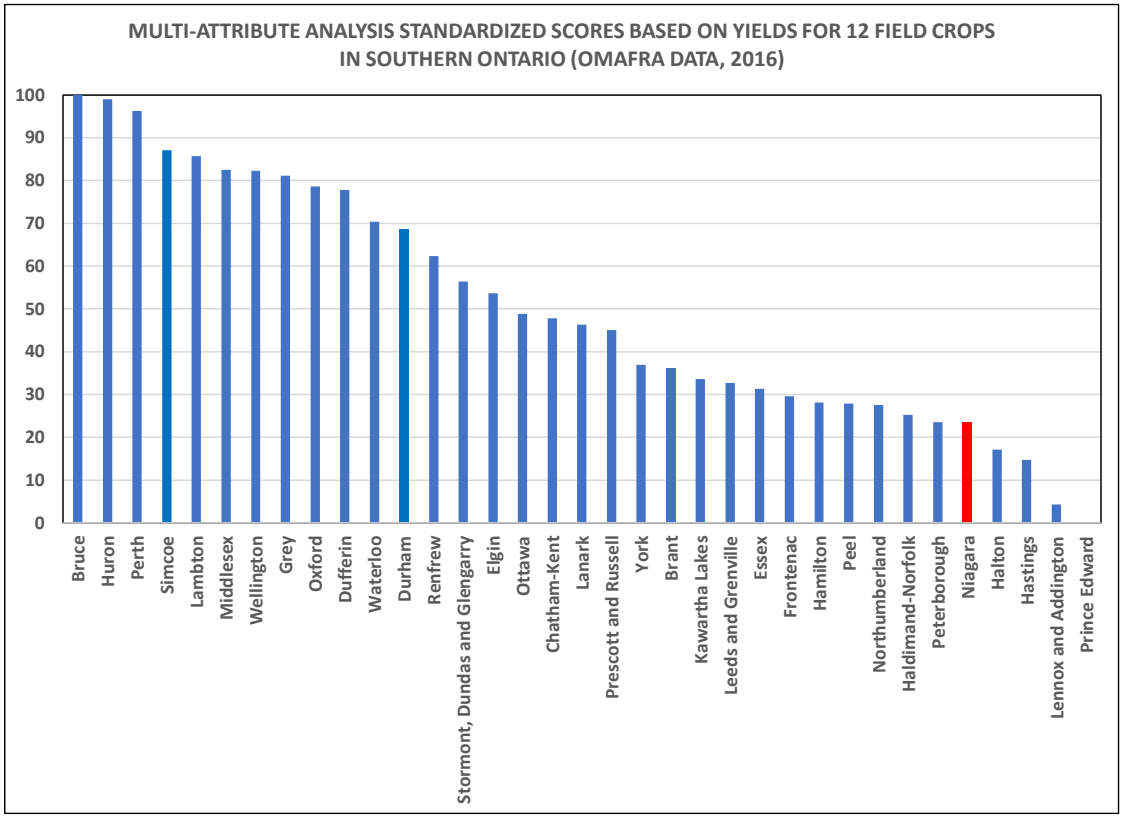

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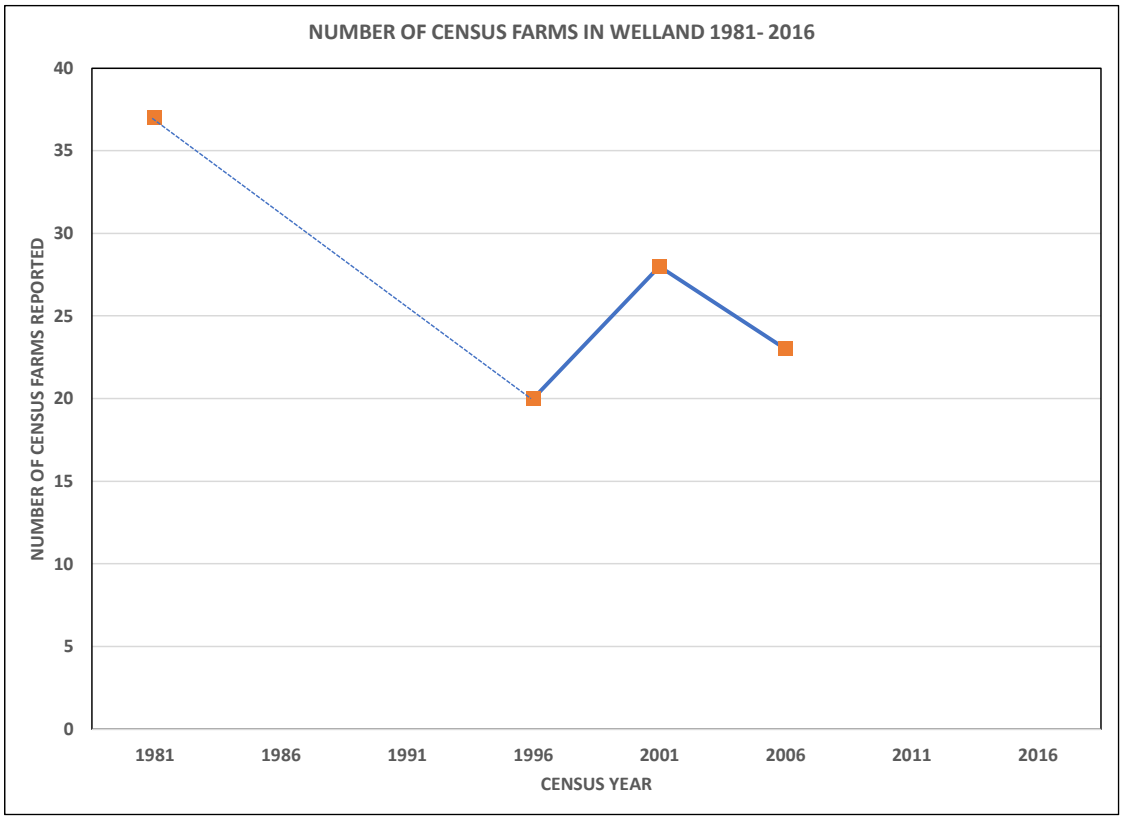

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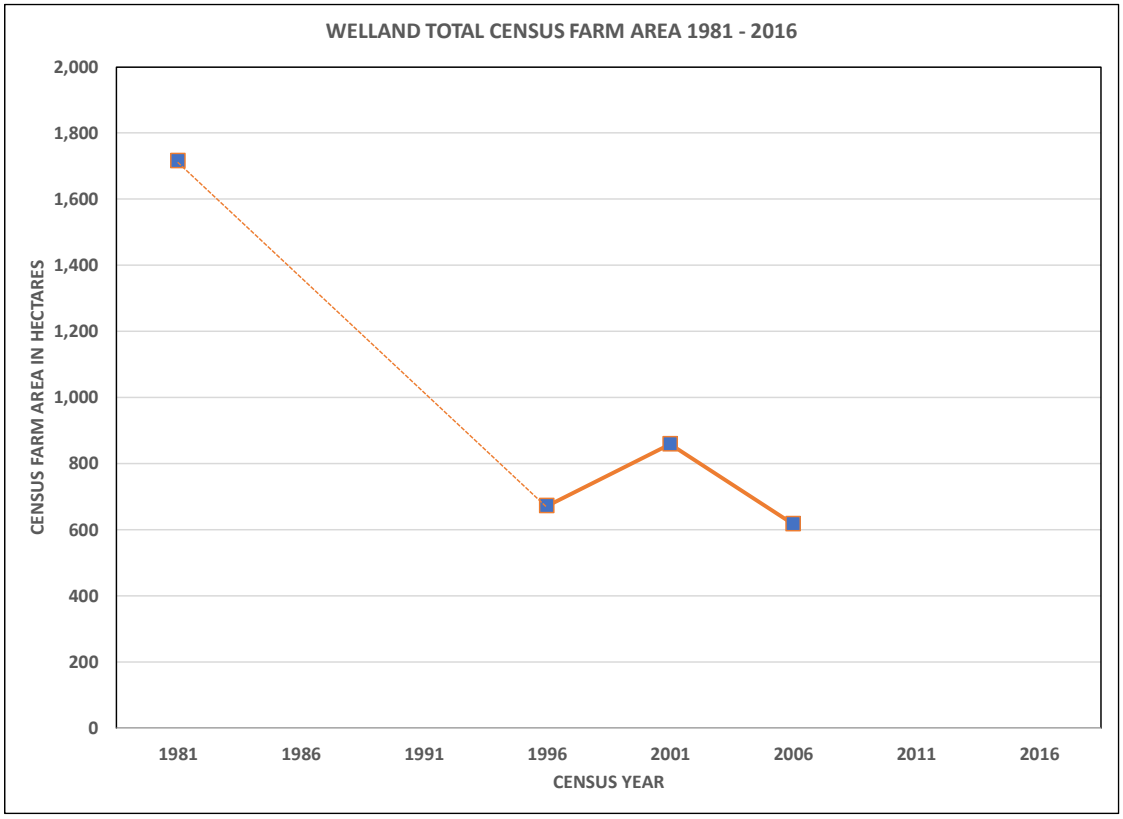

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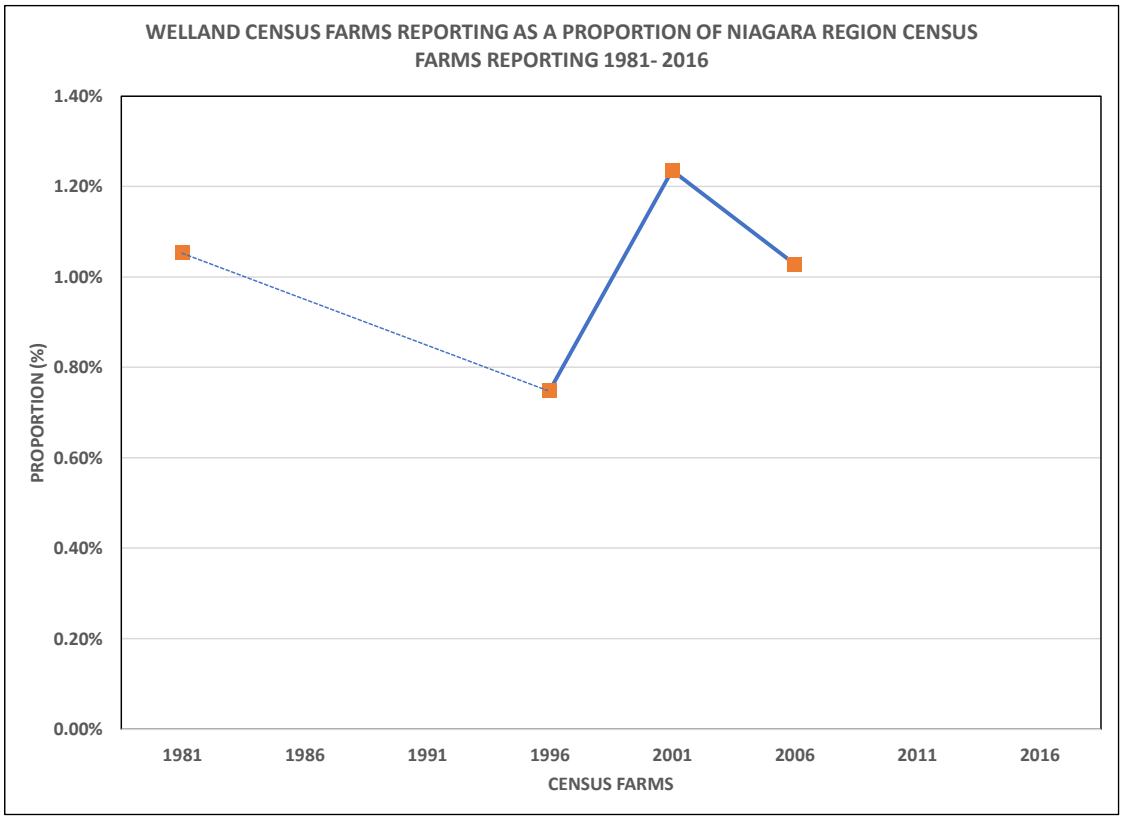

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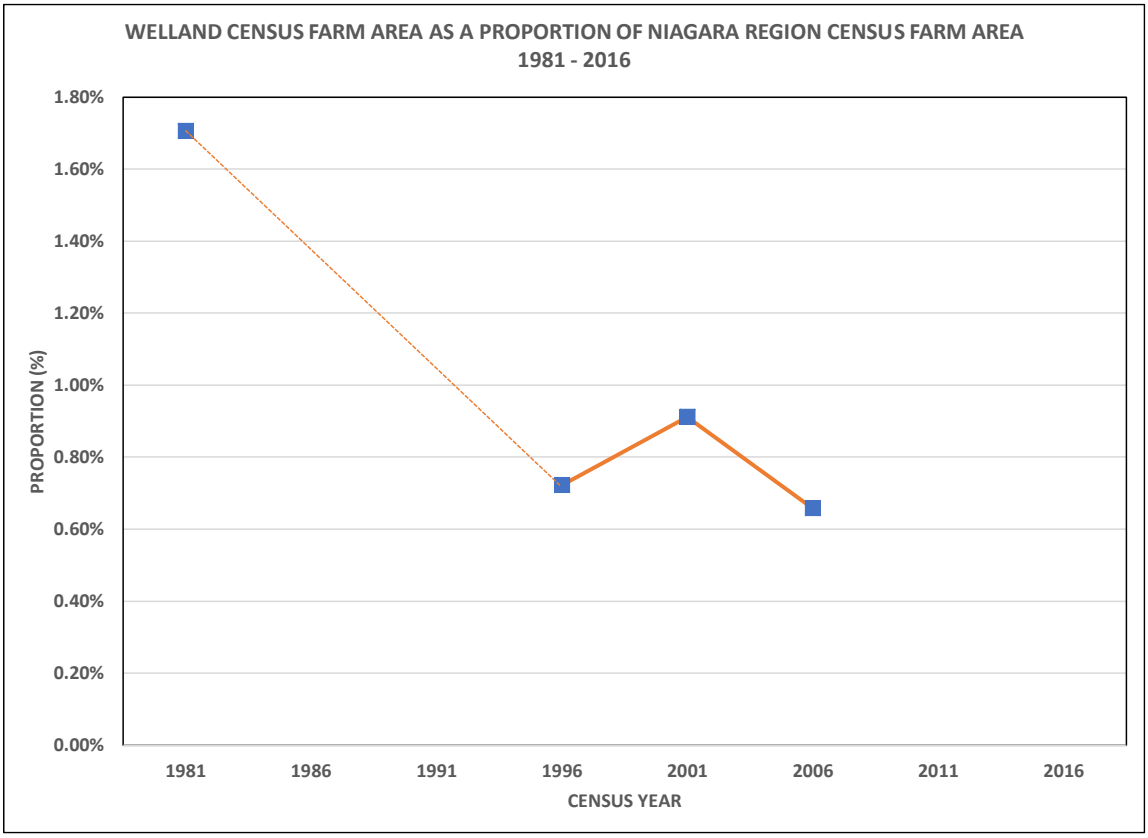

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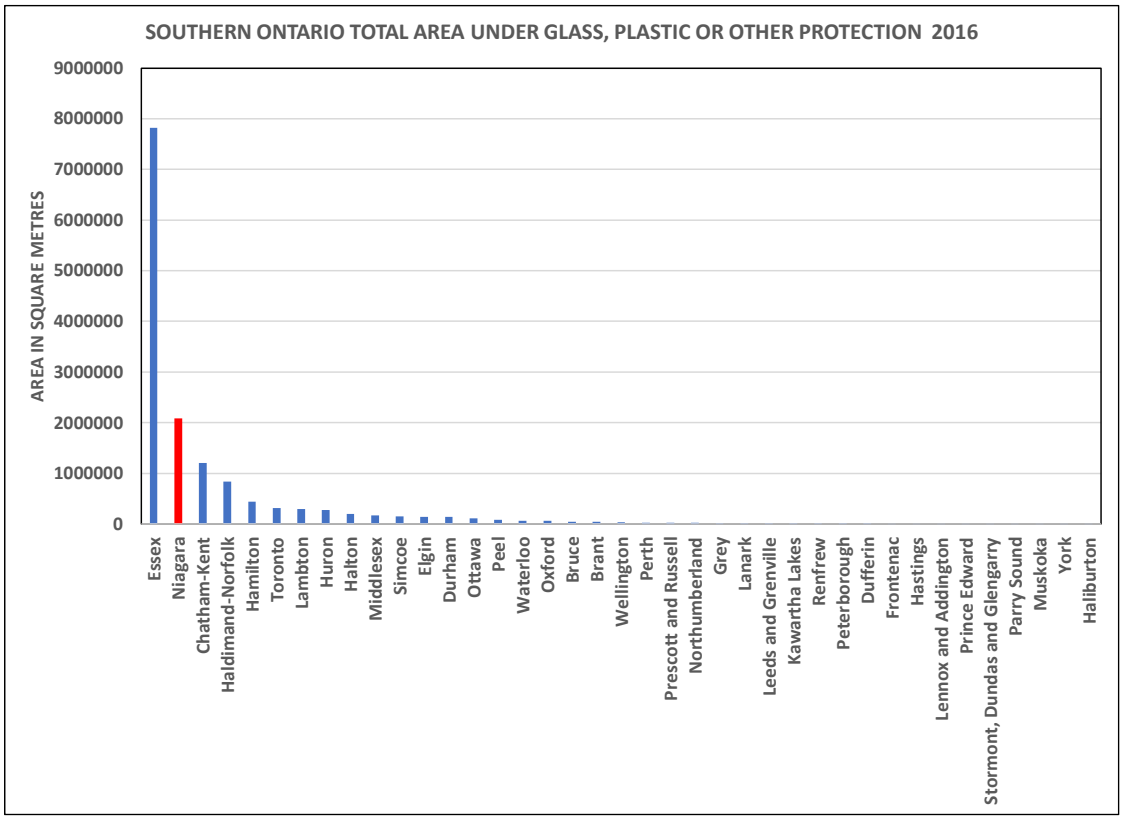

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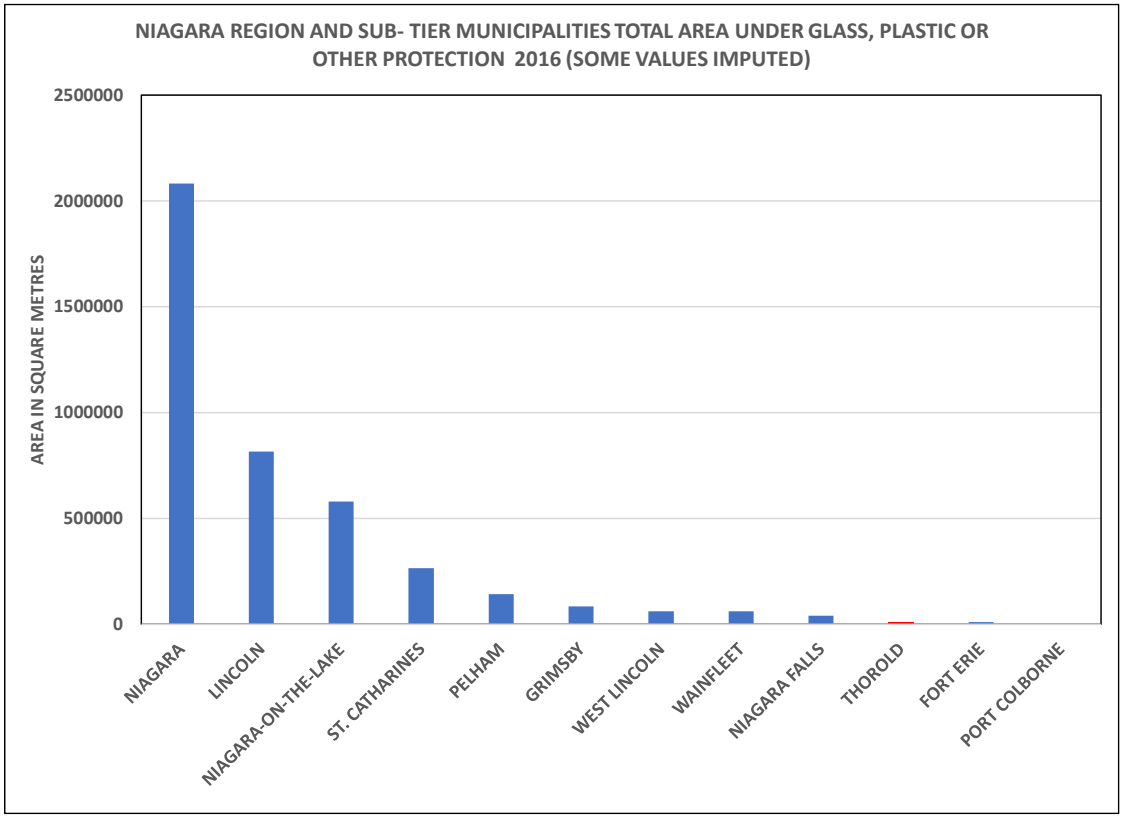

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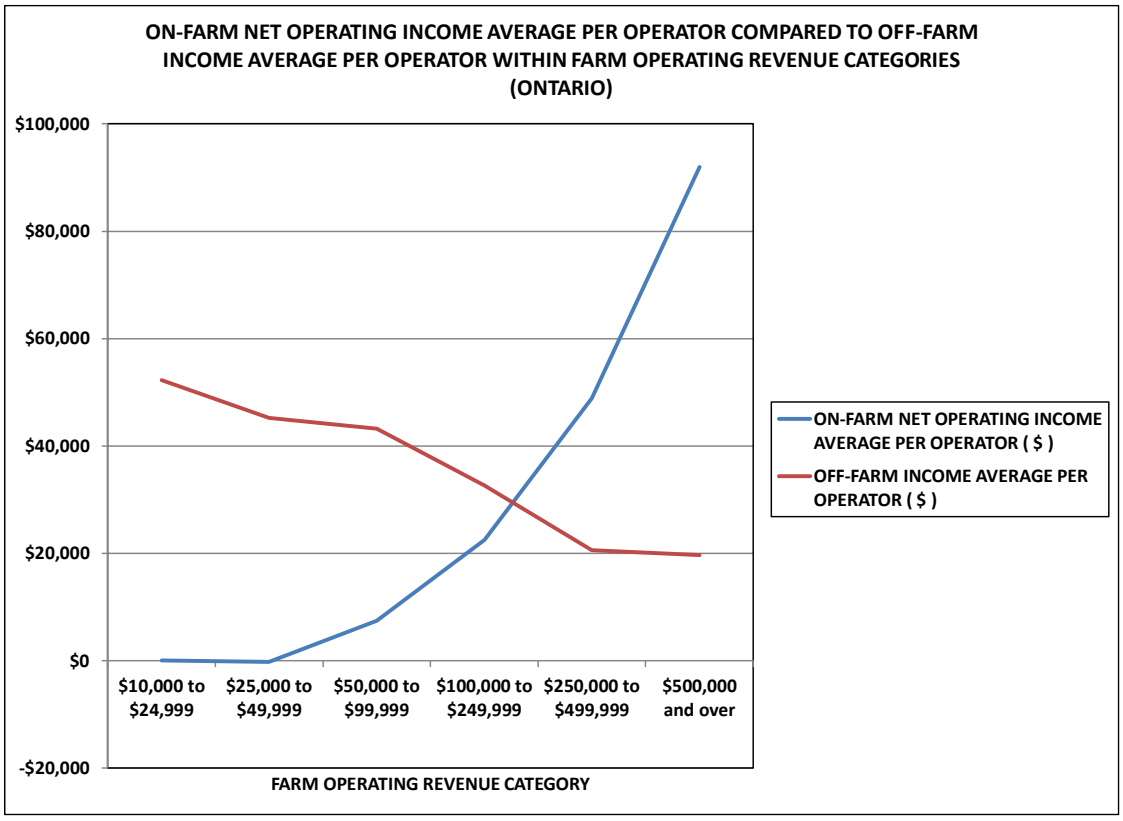

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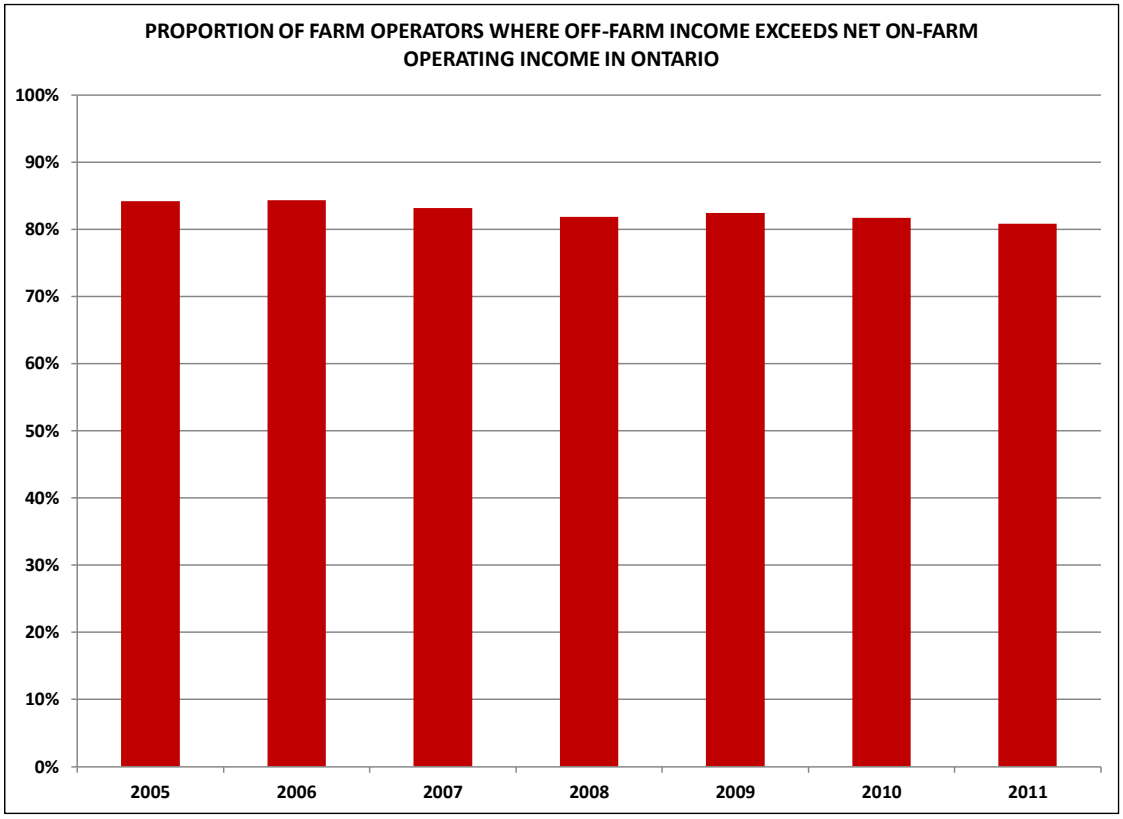

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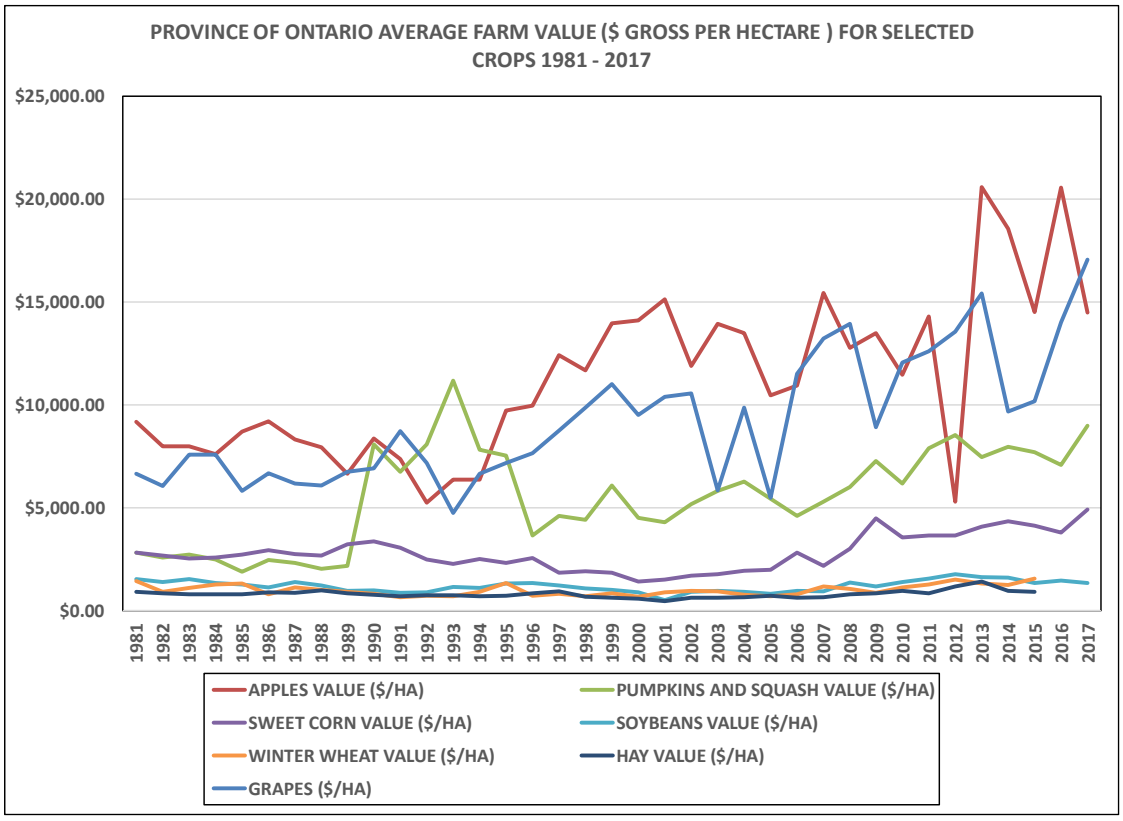

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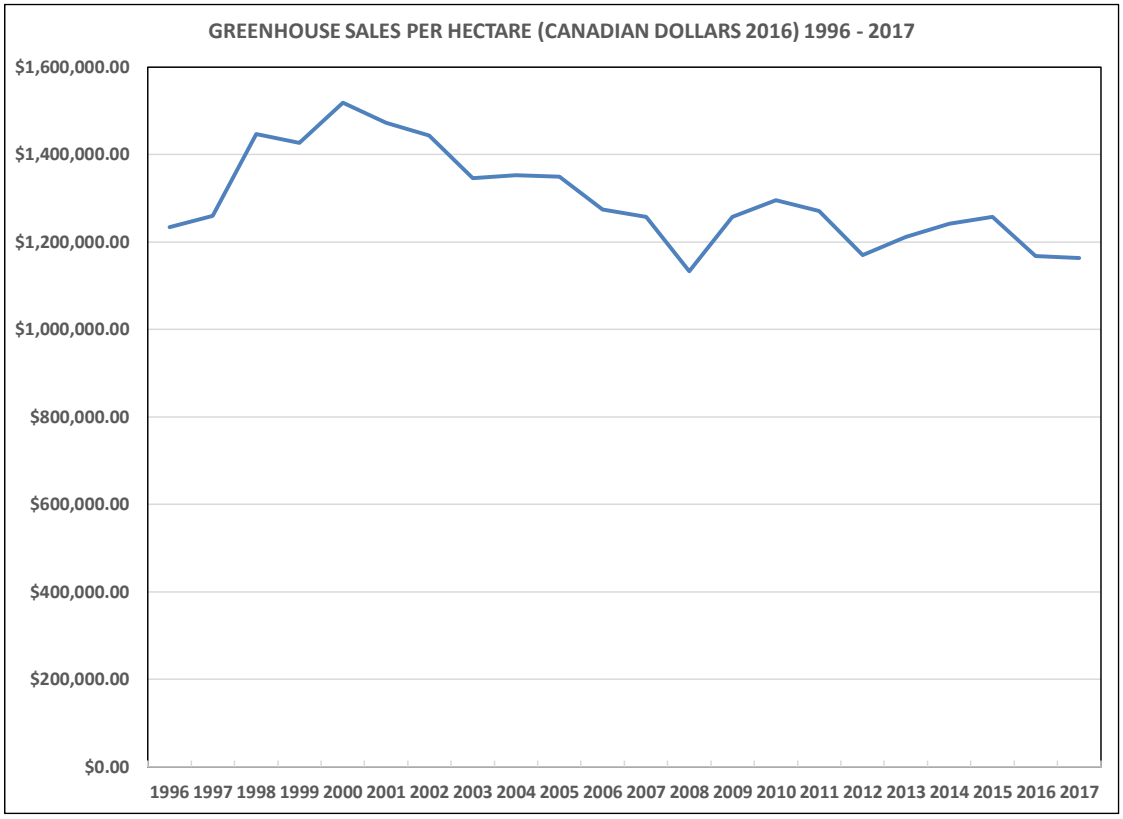

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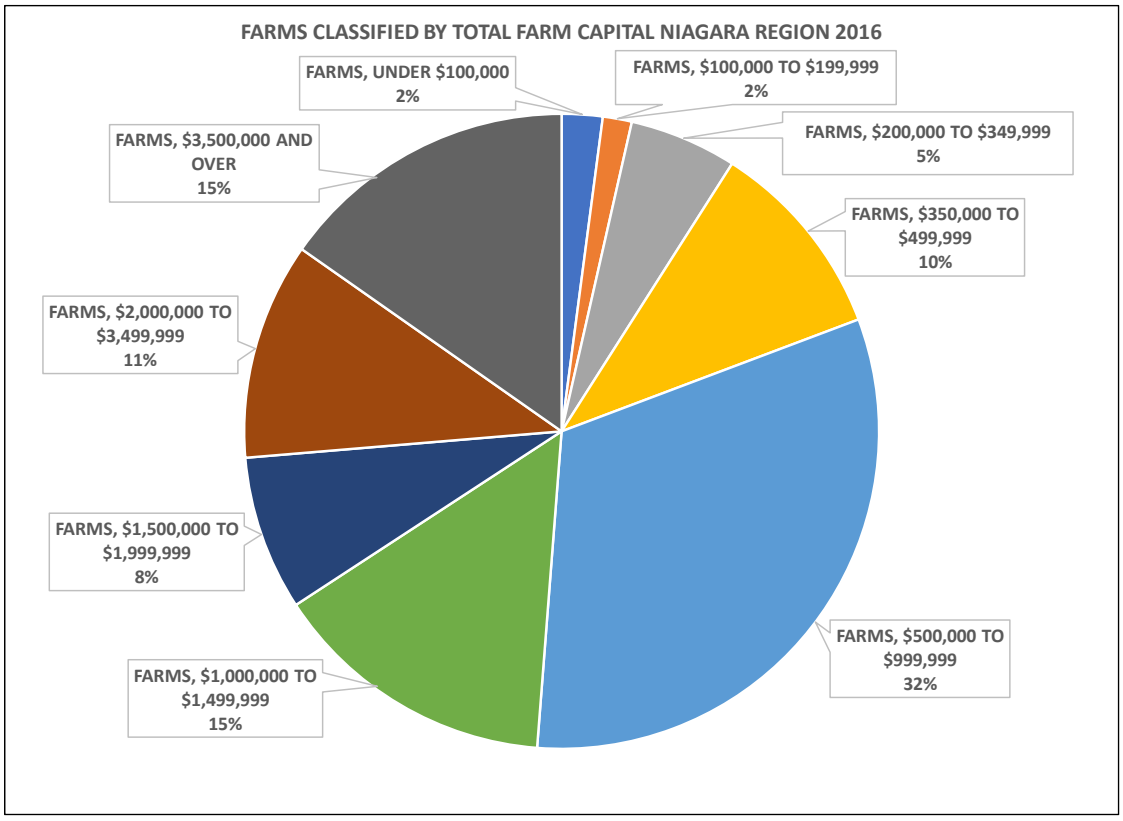

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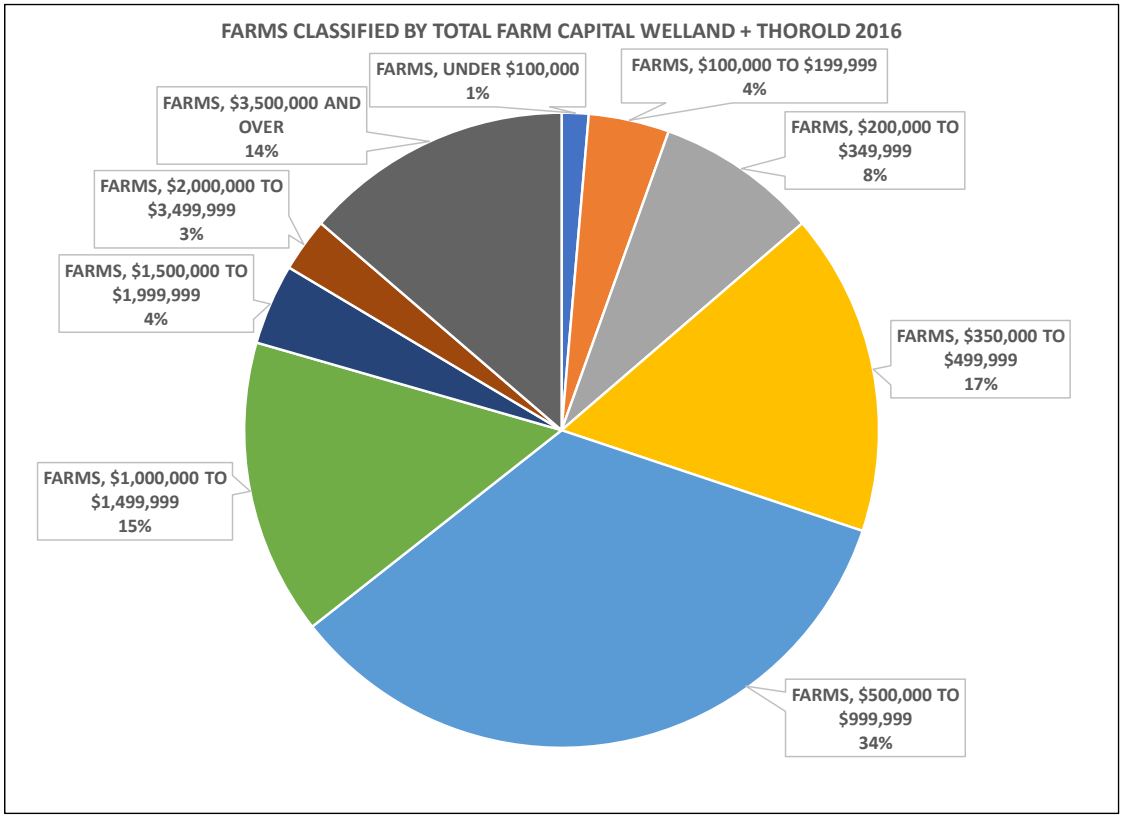

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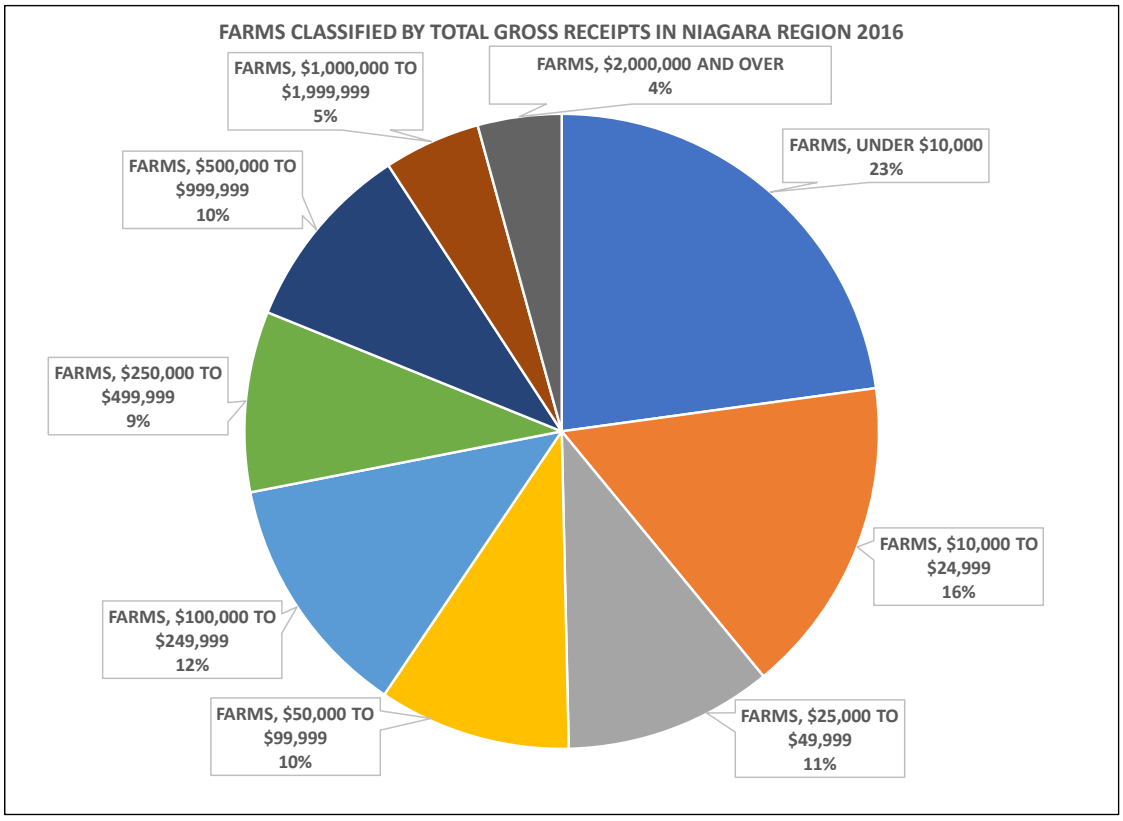

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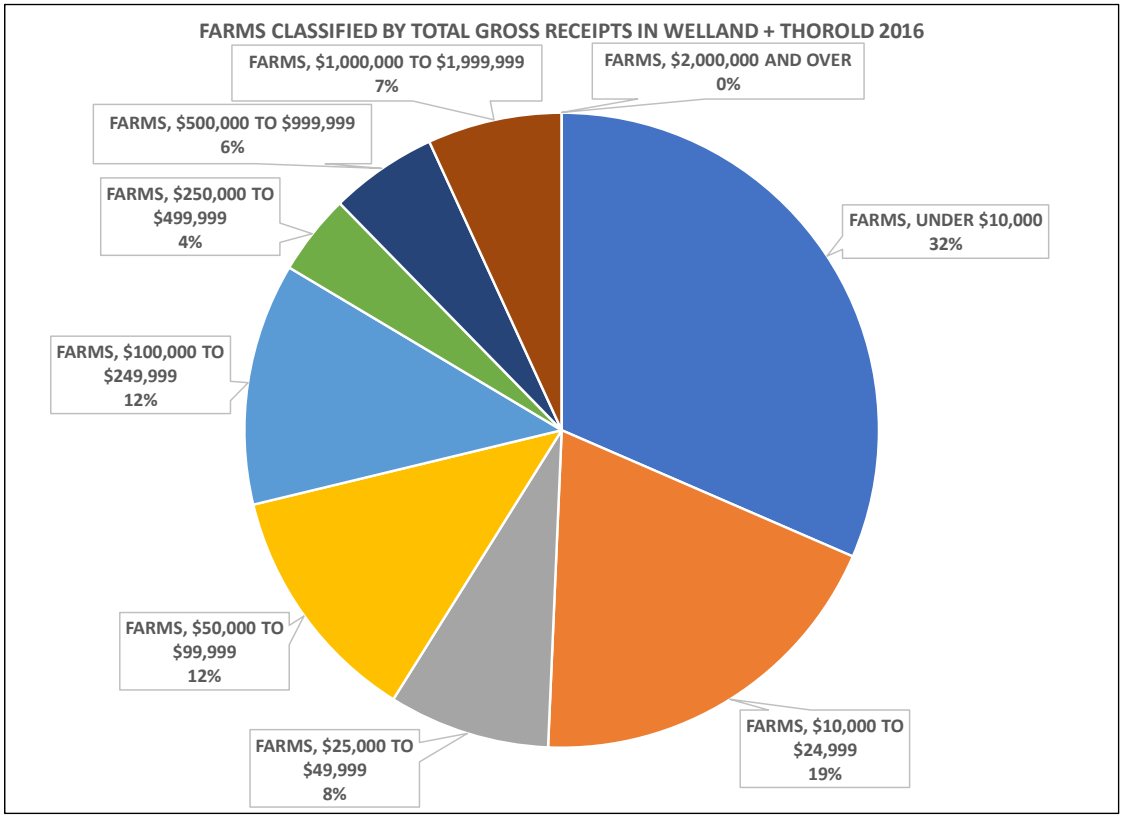

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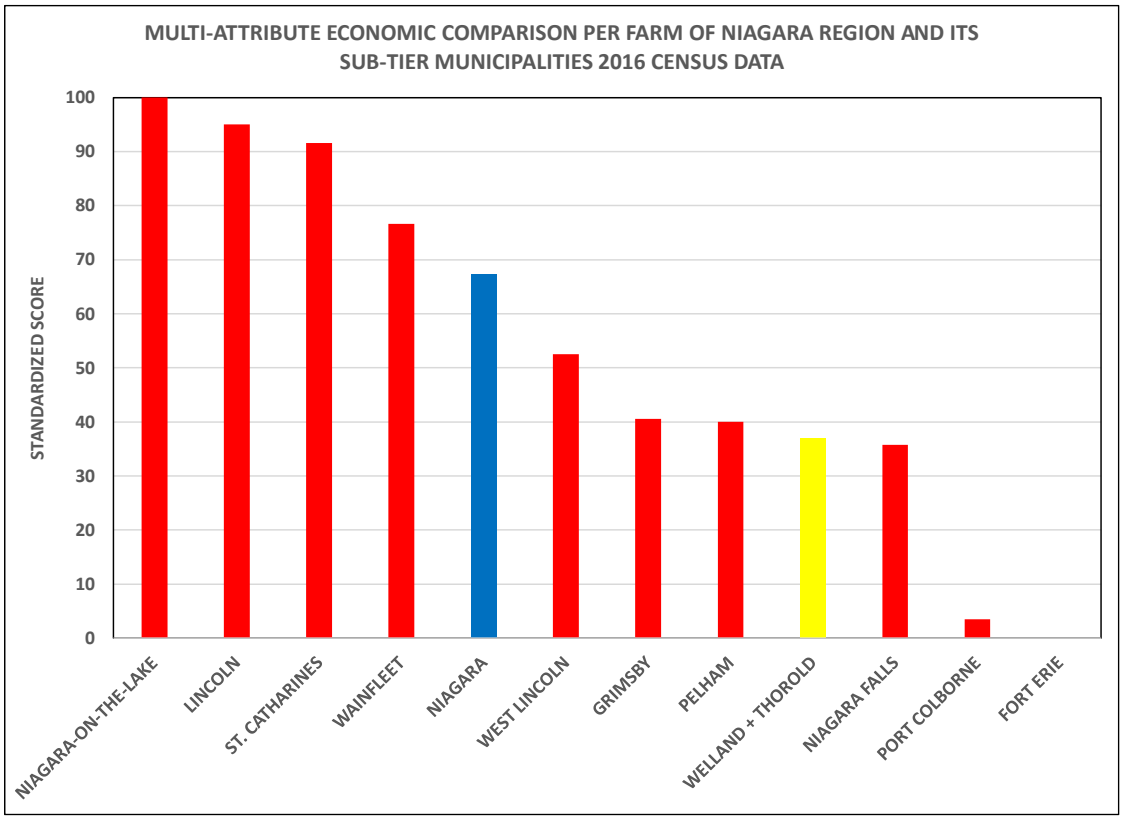

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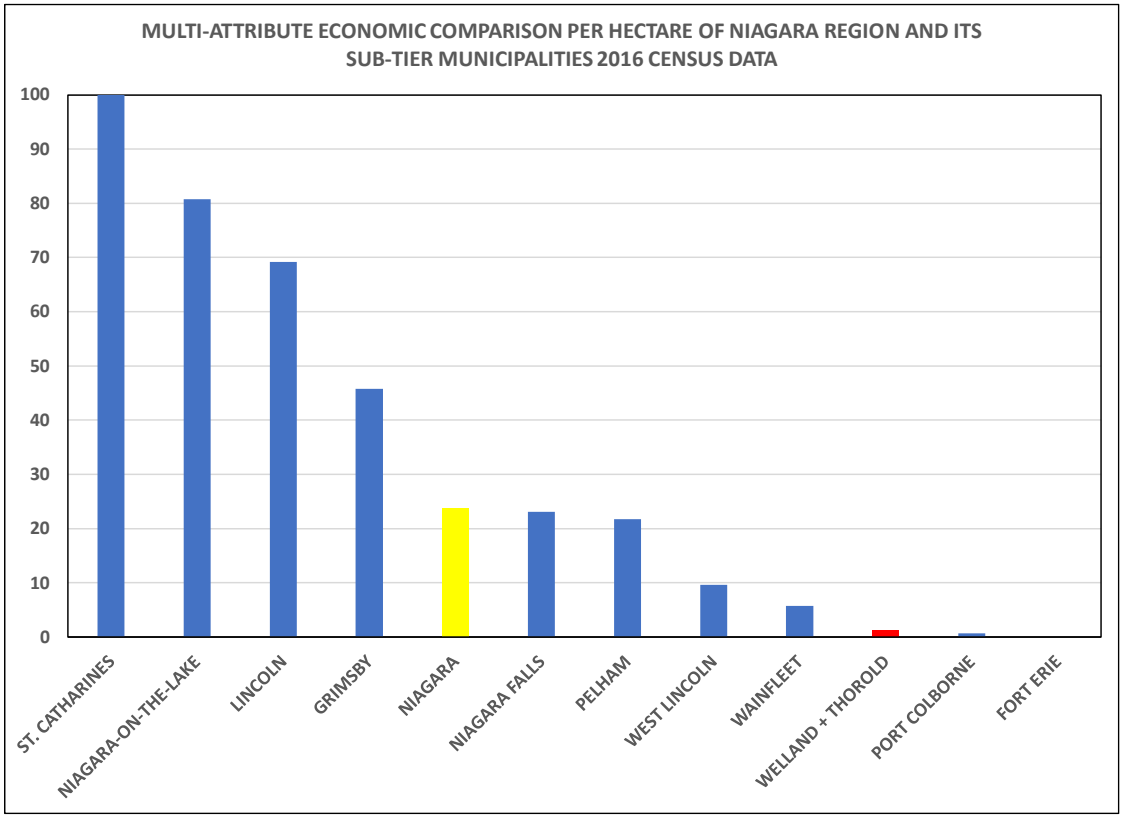

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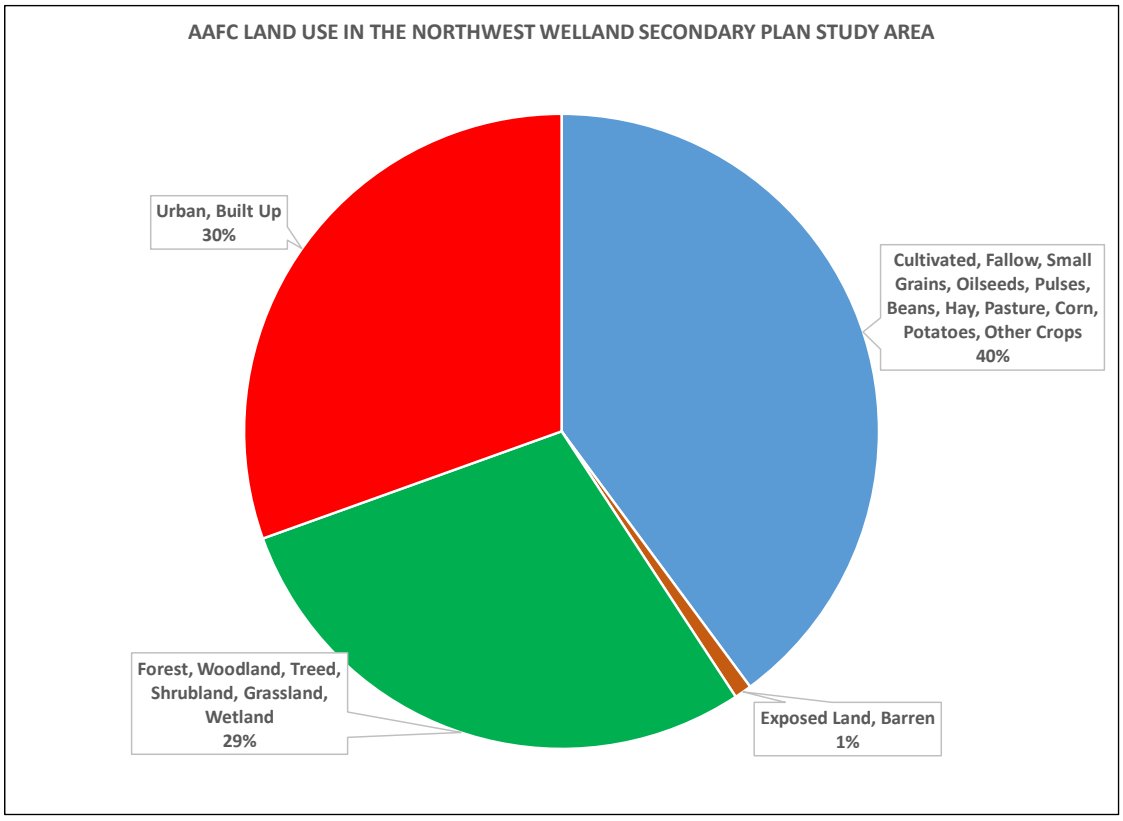

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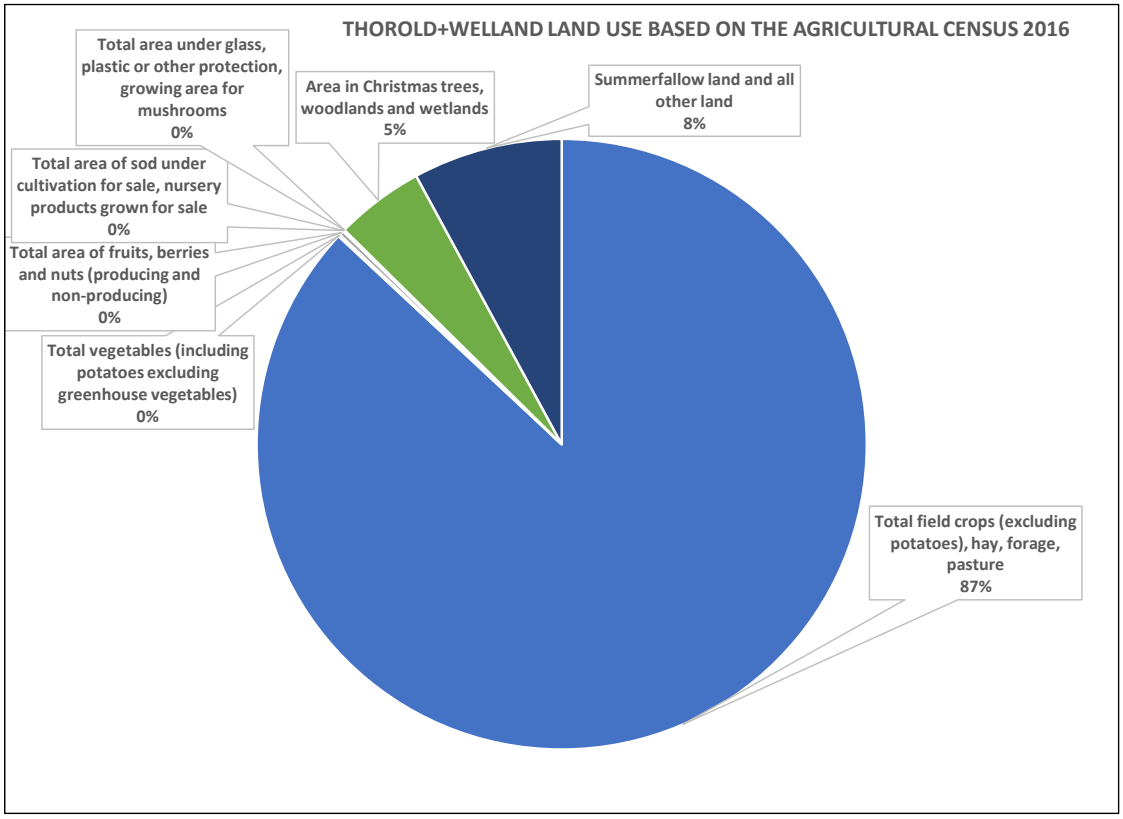

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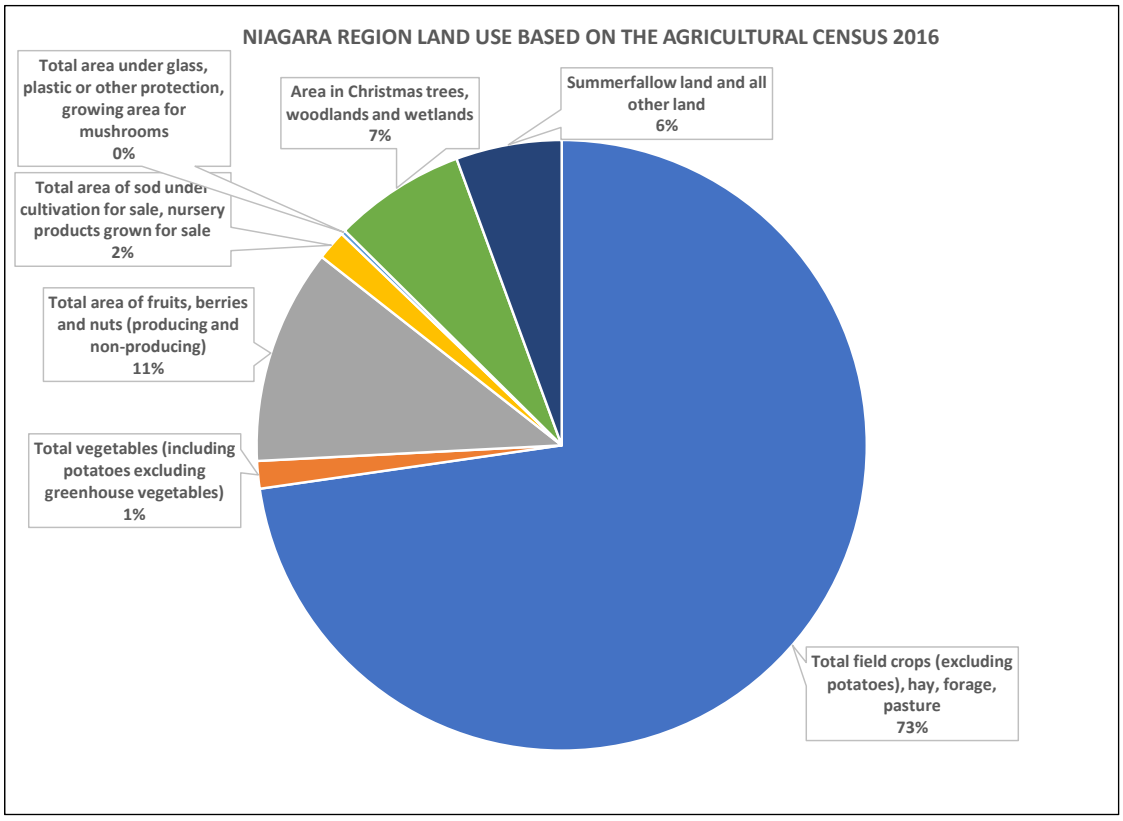

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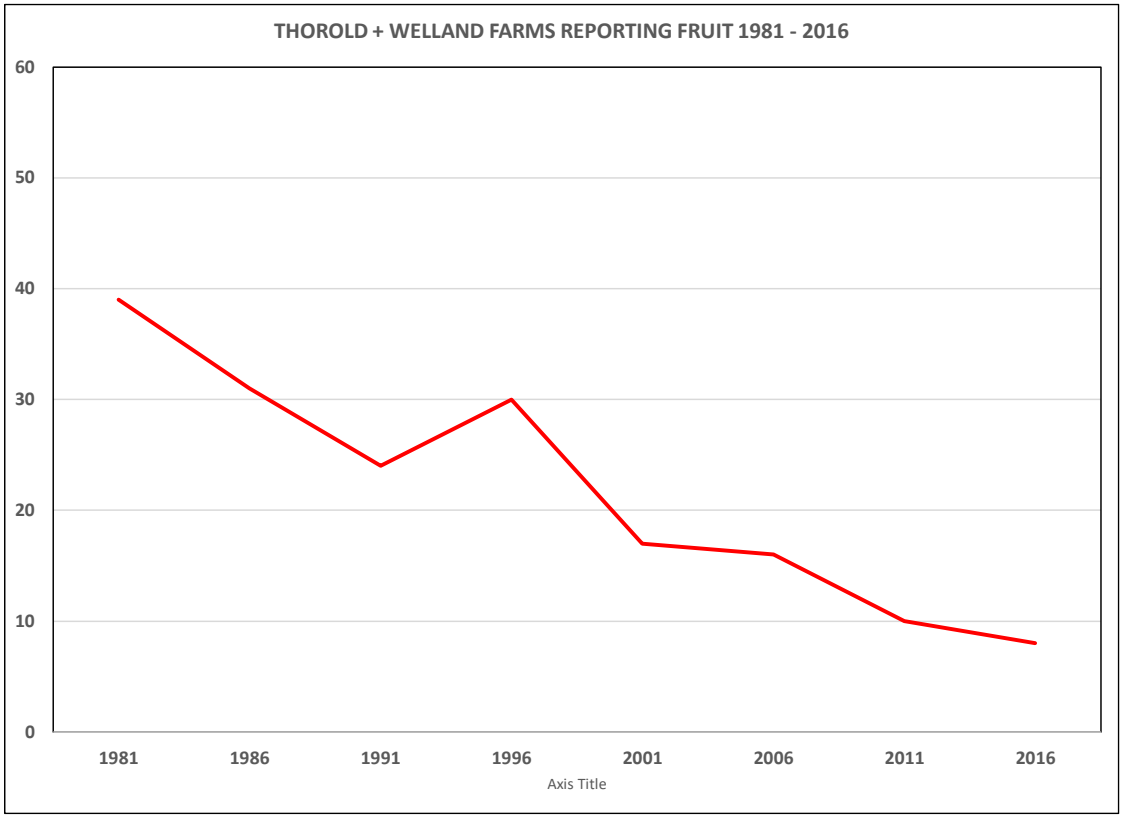

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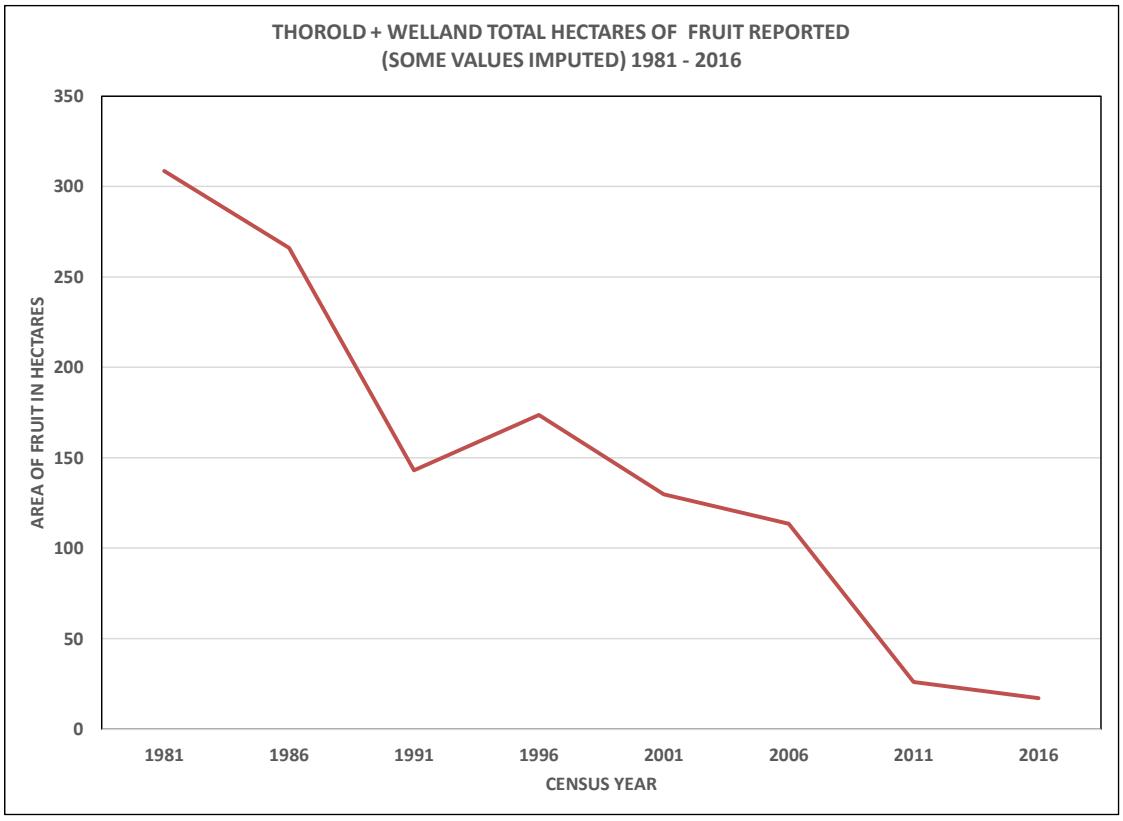

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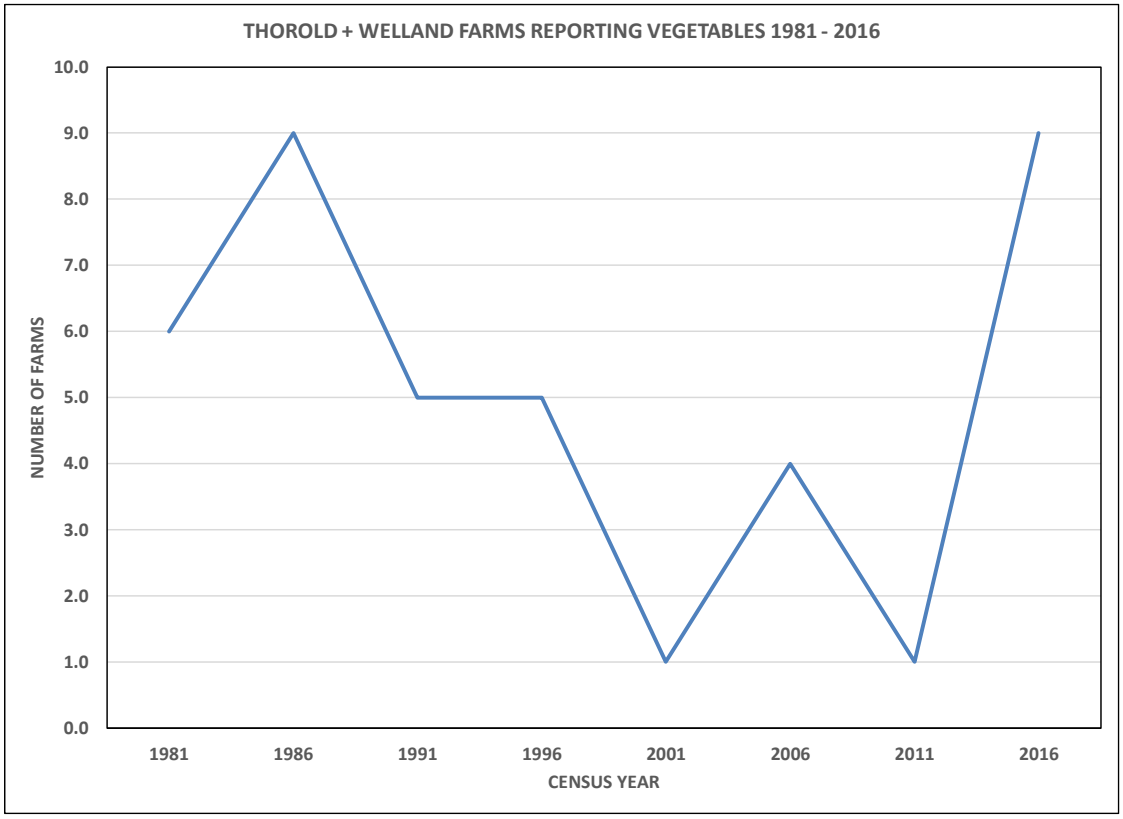

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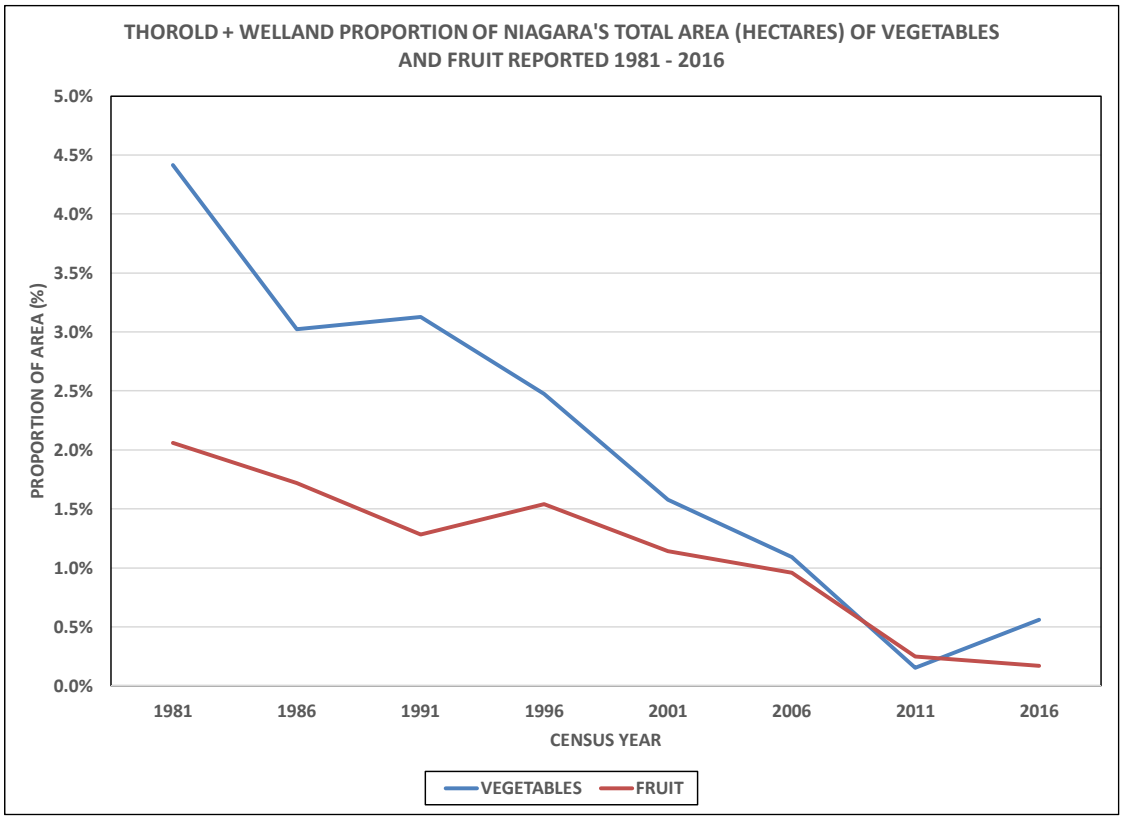

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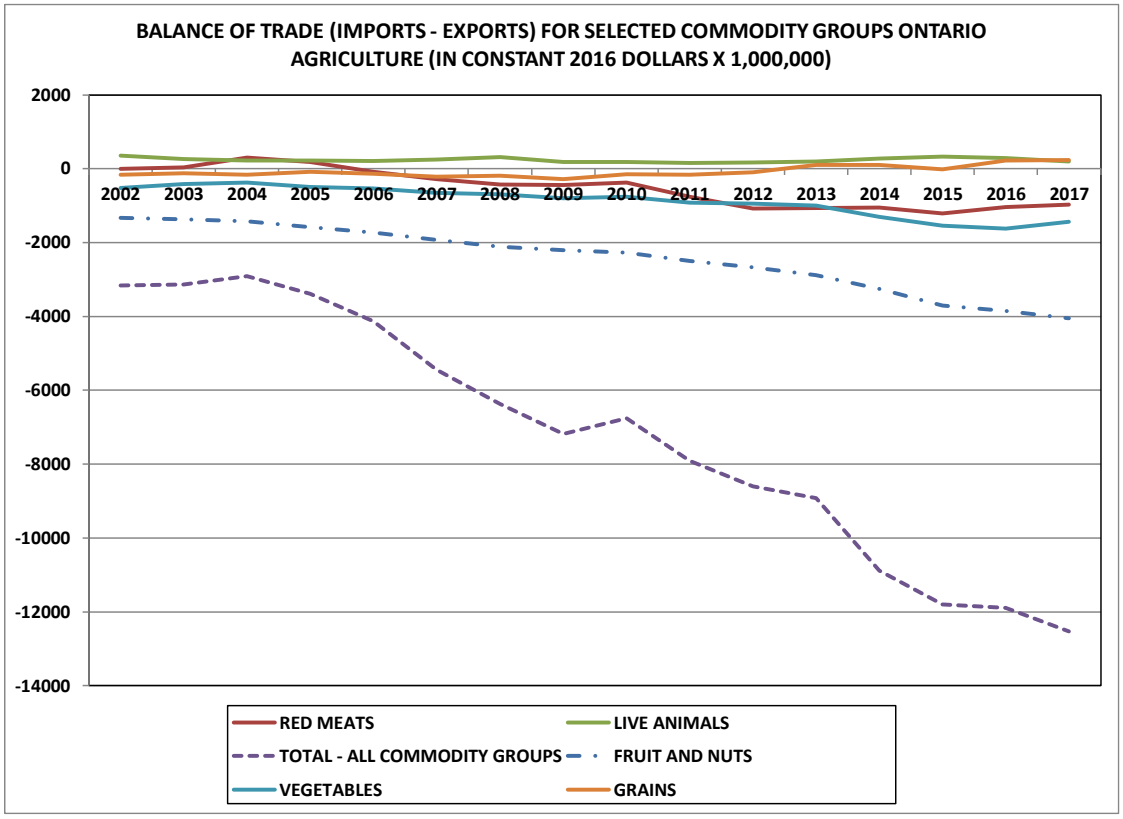

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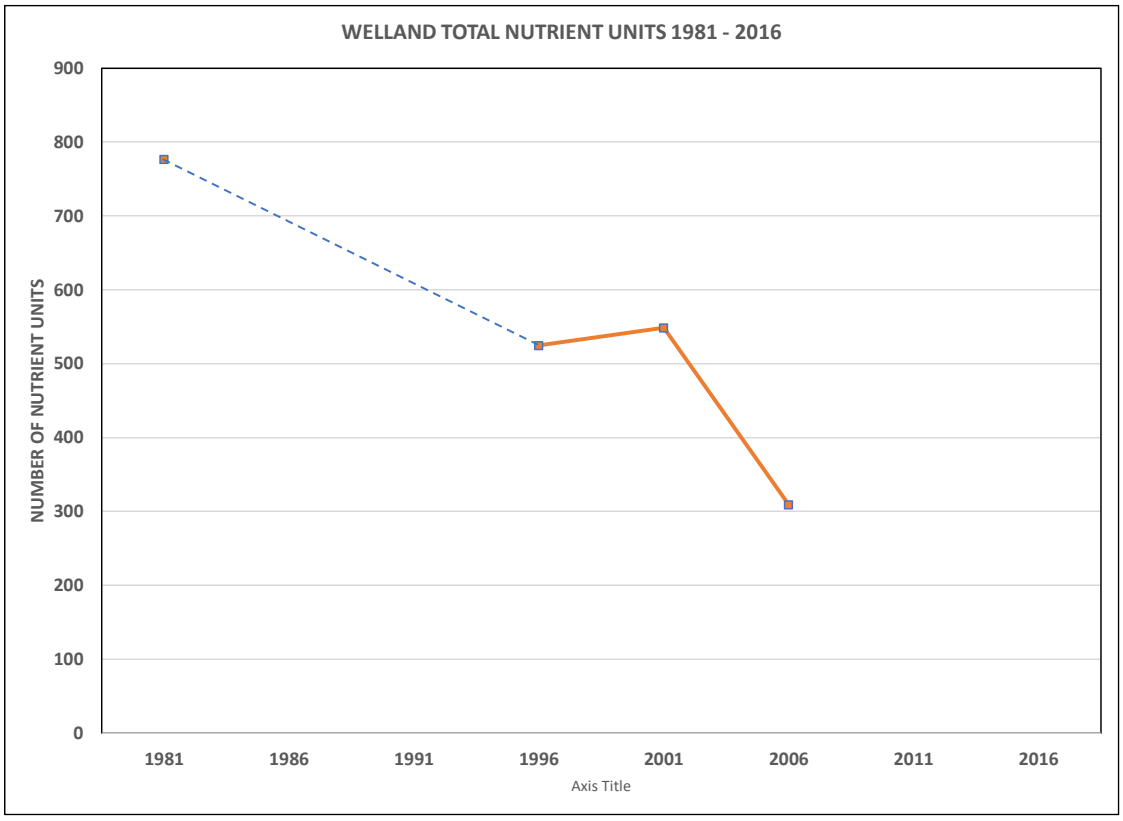

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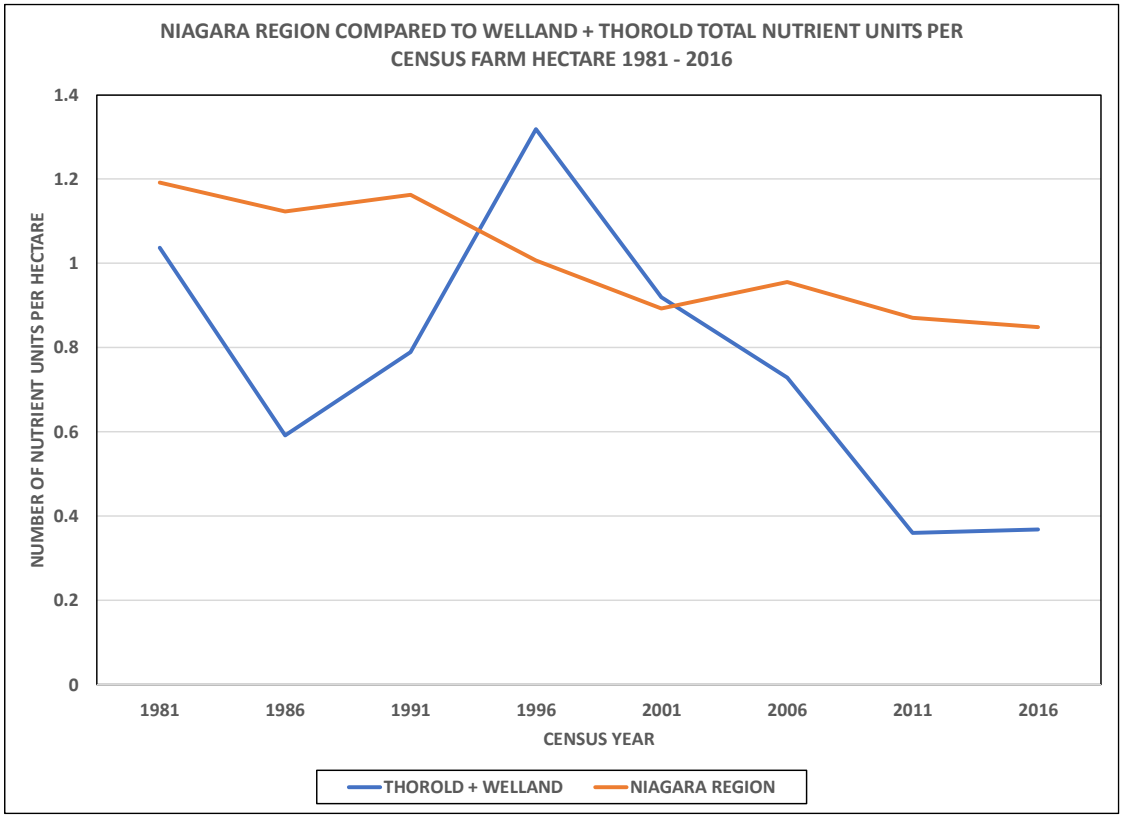
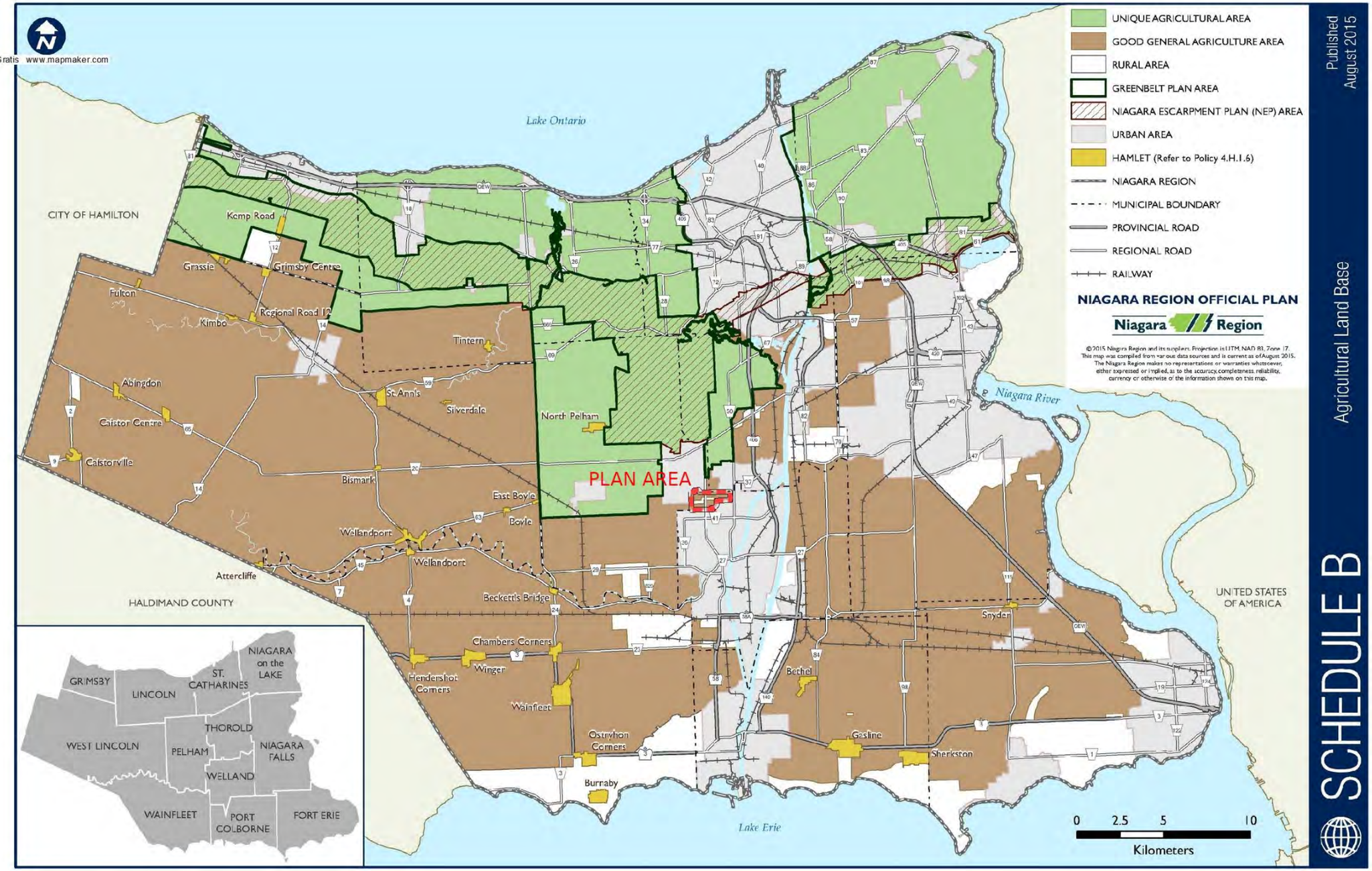
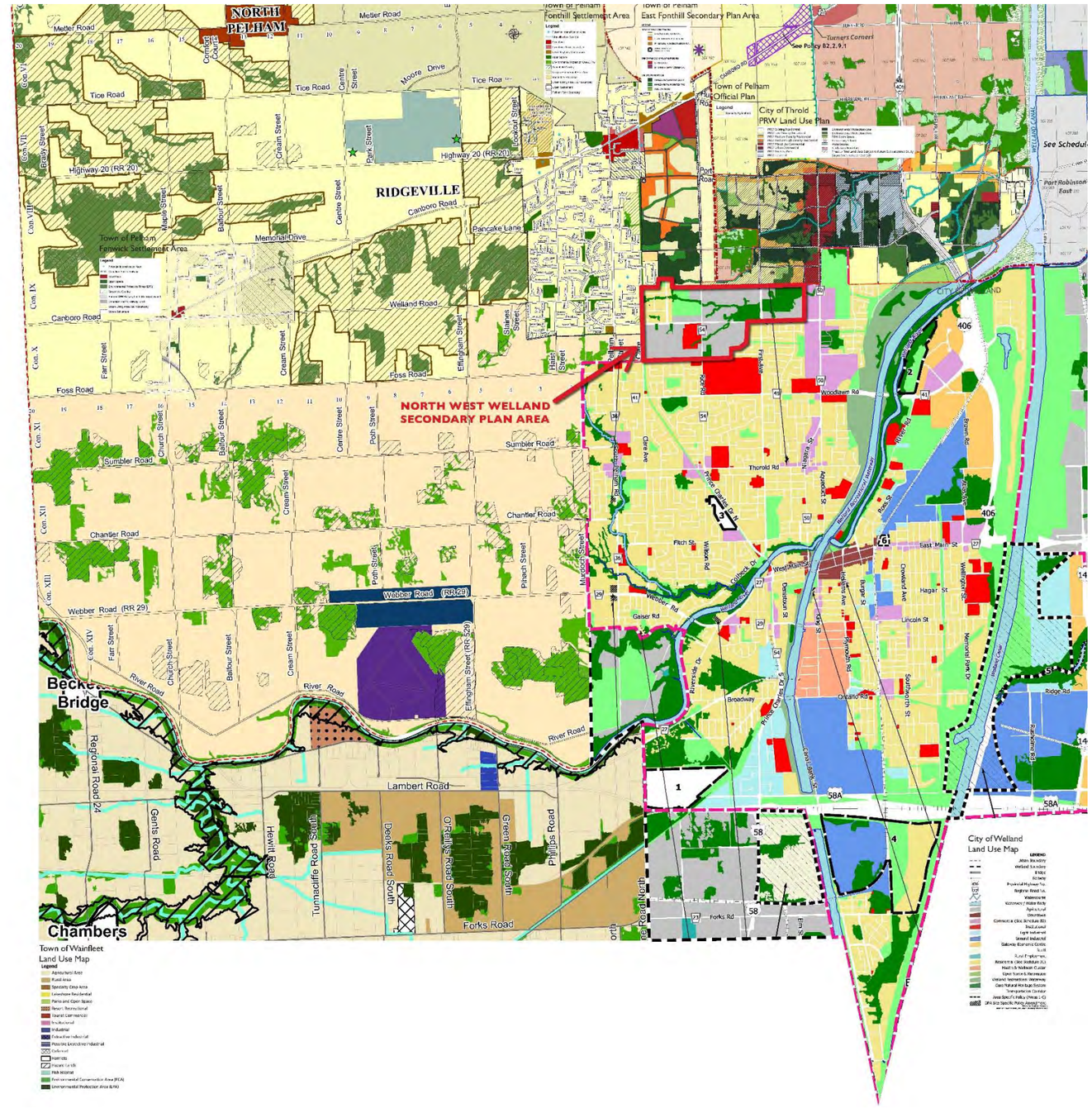


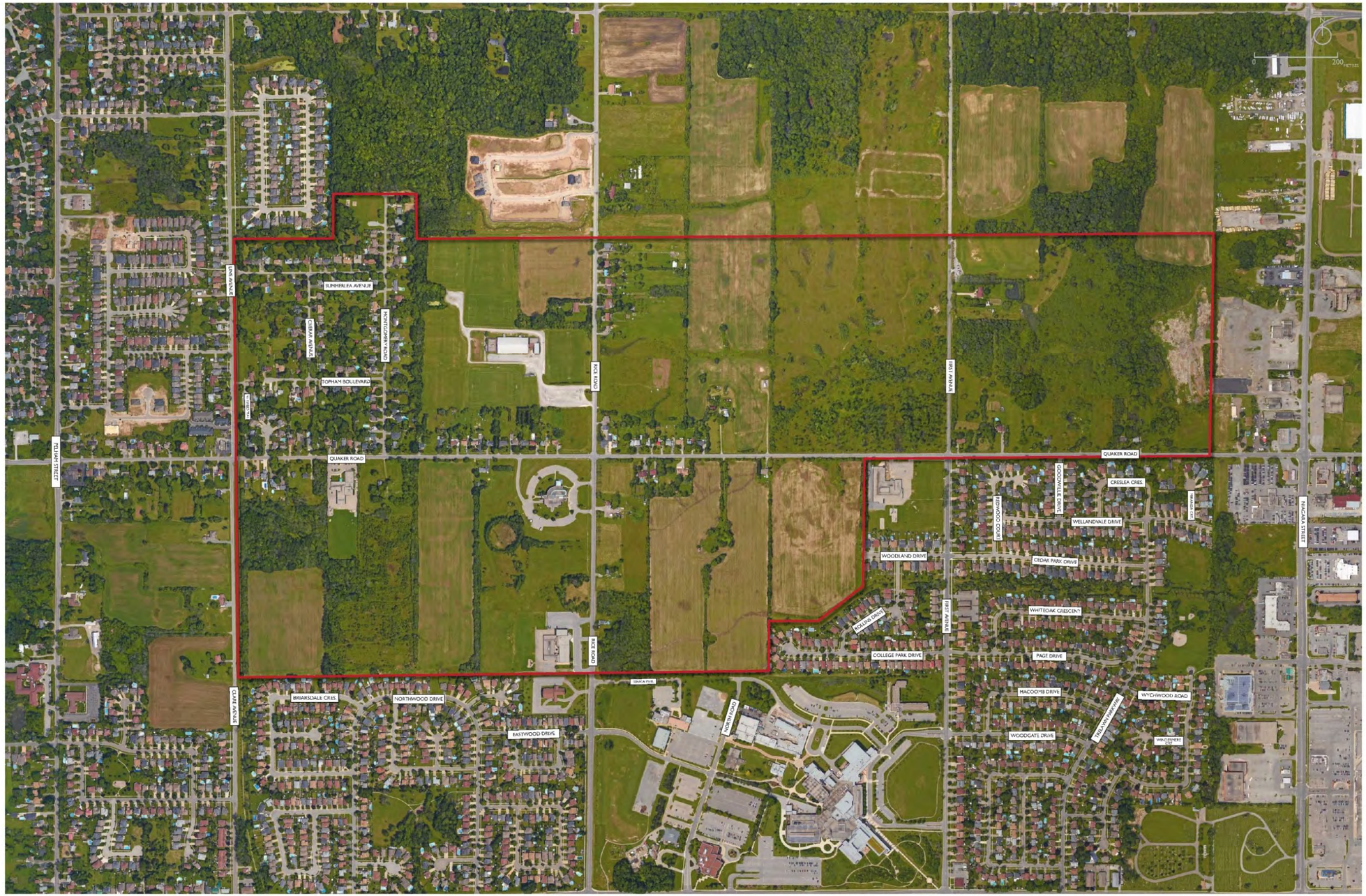
MAP 1 STUDY AREA LOCATION



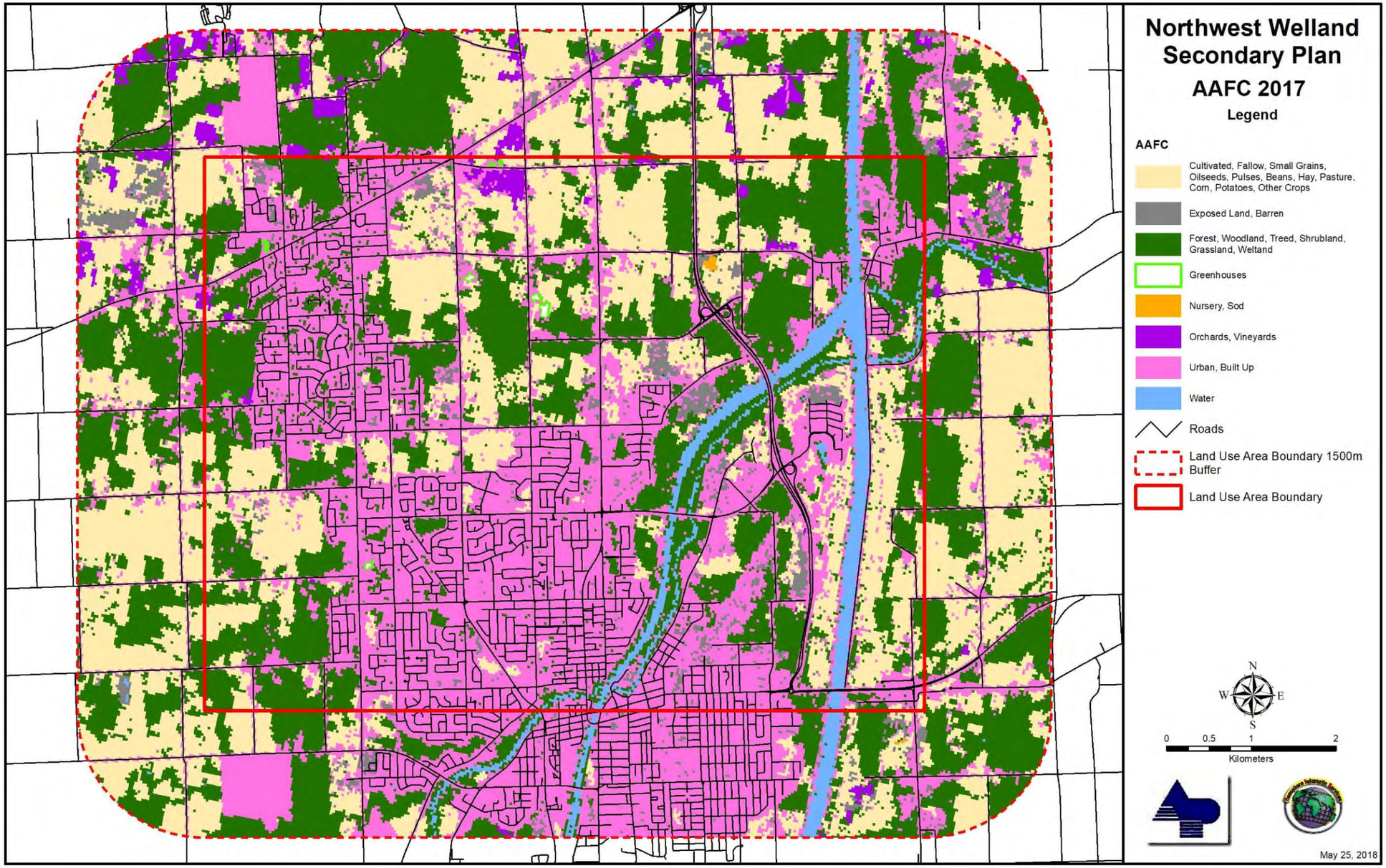
MAP 2 STUDY AREA AND SURROUNDING LANDS DESIGNATIONS



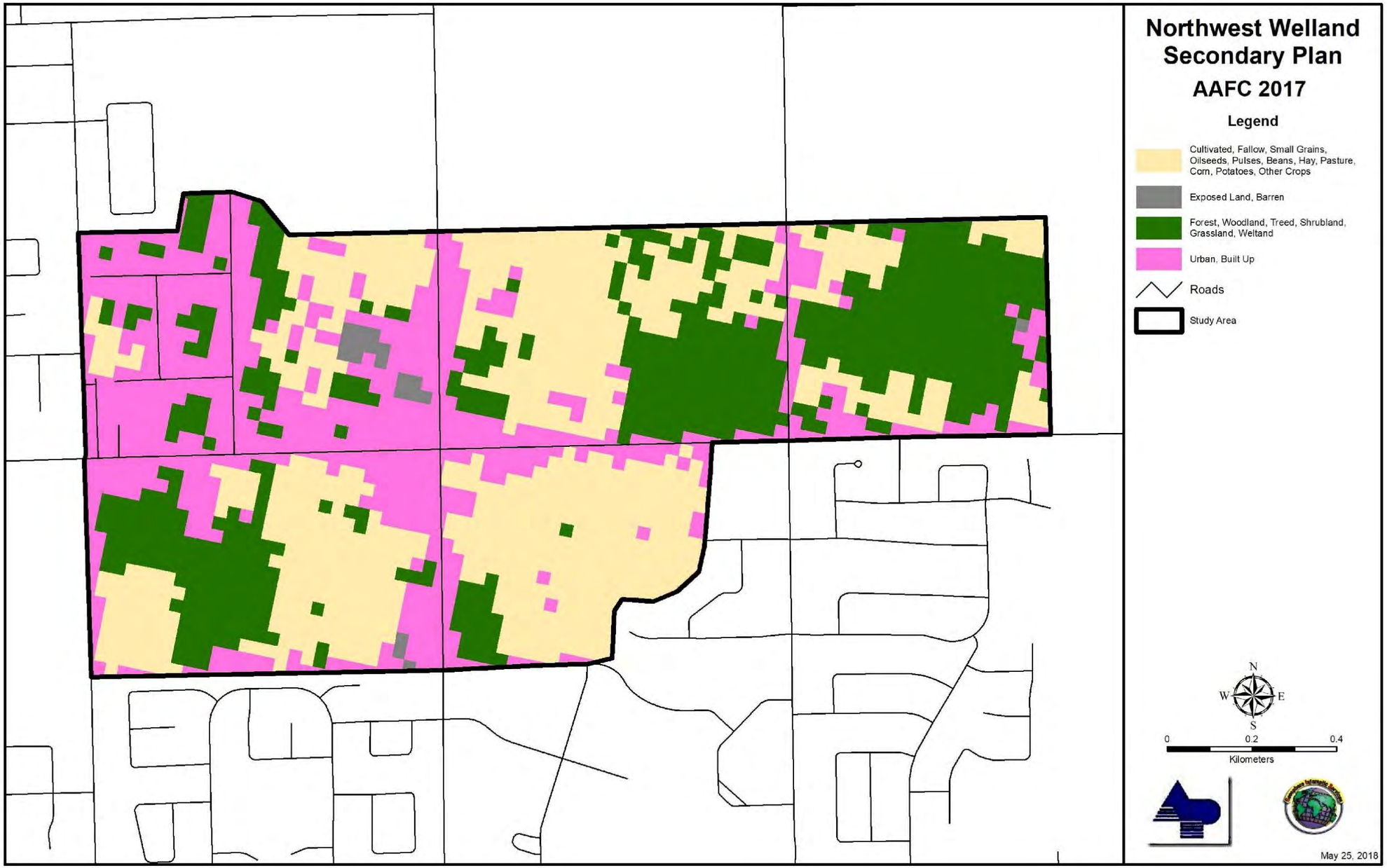
MAP 3 AERIAL PHOTOGRAPH OF THE NORTHWEST SECONDARY PLAN STUDY AREA



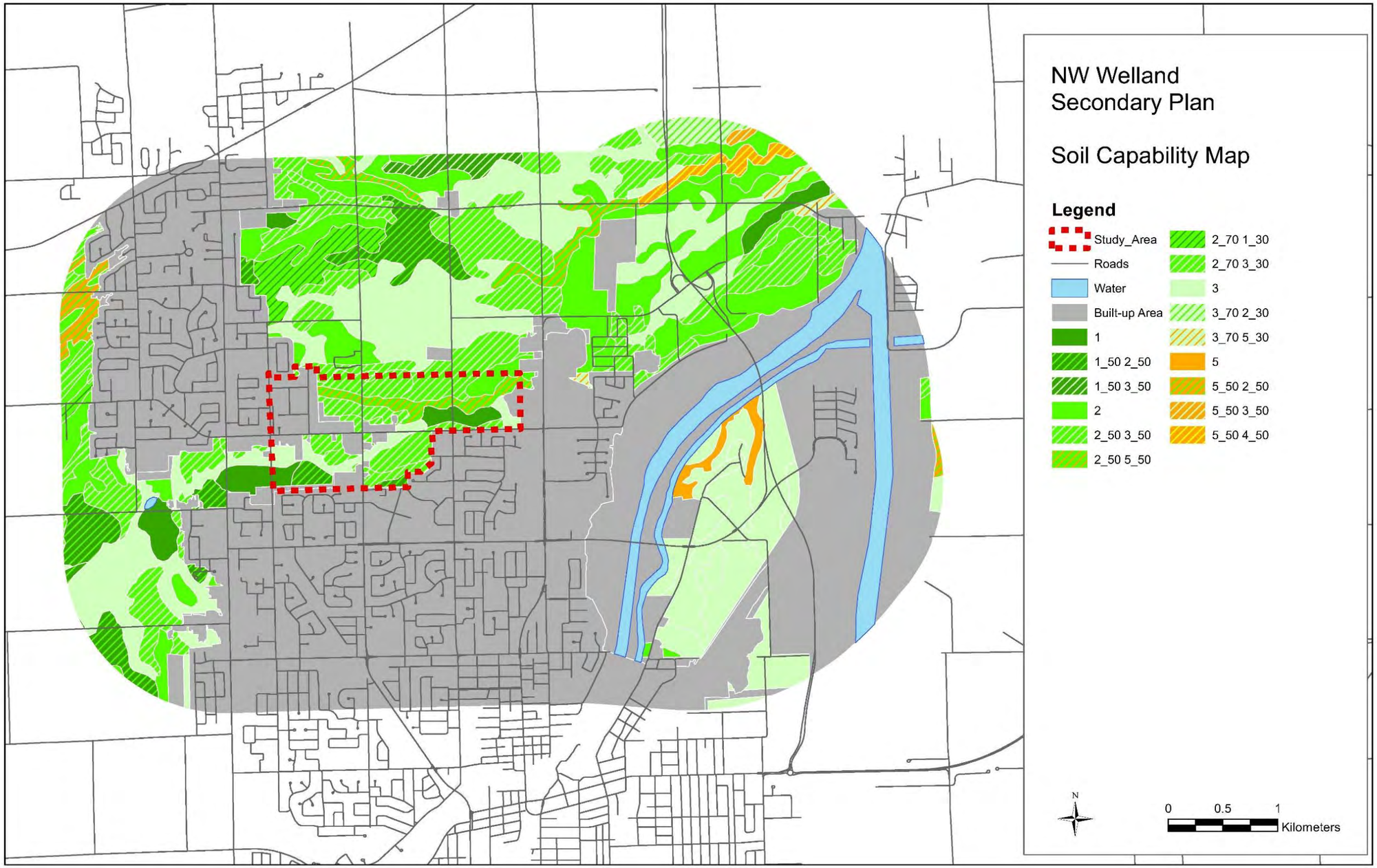
MAP 4
AAFC LAND USE BROADSCALE VIEW



MAP 5
AAFC LAND USE FOR THE STUDY AREA



MAP 6
SOIL
CAPABILITY



APPENDIX 2
SOIL PRODUCTIVITY INDEX and SOIL POTENTIAL INDEX CALCULATION

Soil potential ratings for fruits and vegetables have data limitations associated with soil rating systems and climate as described in the following paragraphs. All the databases evaluated have limitations associated with scale, data availability or alternatively, data suppression. For example, a soil rating system for specialty crops was developed by Hoffman and Cressman in 1984 for Ontario Hydro (Ecologistics and Smith, Hoffman, 1984). This is a three-class system – good, fair or poor which uses crop groupings but has not been applied on a broad scale to the Province. The Ontario Institute of Pedology and subsequently the Ontario Center for Soil Resource Evaluation has compiled specialty crop capability systems for some areas within Ontario. However, the Province has not a single specialty crop soil potential rating for all of Ontario. Given this lack of comprehensive soil potential information for specialty crops, it is not possible to reasonably differentiate which soils are most unique for specialty crop production within the Province.

However, some soil potential ratings for fruit and vegetables have been produced for Haldimand-Norfolk, Niagara, Elgin, Middlesex and Brant. Unfortunately, the fruit and vegetable crop groupings used in different soil surveys are dissimilar in number as well as in the kinds of fruits or vegetables included in each group. For example, Niagara has 20 crop groupings (9 for fruits and 11 for vegetables) whereas Haldimand-Norfolk has 15 groups that do not always separate fruit and vegetables into separate categories. More details about the soil potential ratings for specialty crops are outlined in a summary in the table following in this Appendix. In addition, both five as well as seven class soil potential rating systems have been used in published soil survey reports in Ontario.

As a second example of information limitations, climate data is limited due to scale and a lack of integration. Several single factor maps produced on a broad scale are available for crop heat units, plant hardiness zones, temperature minima and maxima as well as precipitation. More specific maps such as the map for *Site Selection for Grapes in the Niagara Peninsula* (Fisher and Slingerland, 2002) are not available for the province of Ontario. Additionally, specific studies on irrigation such as that done for Niagara Region (Stantec, 2007) are not available for southern Ontario.

ONTARIO SPECIALTY CROP SOIL CLASSIFICATIONS SUMMARY

Crop Grouping Description 1	Niagara Crop Grouping	Crop Grouping Description 2	Haldimand-Norfolk Crop Grouping	Crop Grouping Description 3	Middlesex and Elgin Crop Grouping	Crop Grouping Description 4	Brant Crop Grouping
	Seven Class System		Seven Class System		Five Class System		Seven Class System
Tree Fruits, Grapes and Small Fruits:	**Tree Fruits, Grapes and Small Fruits:**	**Tree Fruits, Grapes and Small Fruits:**	**Tree Fruits, Grapes and Small Fruits:**	**Tree Fruits, Grapes and Small Fruits:**	**Tree Fruits, Grapes and Small Fruits:**	**Tree Fruits, Grapes and Small Fruits:**	**Tree Fruits, Grapes and Small Fruits:**
Peaches, Apricots, Nectarines	A	Apricots, Sour Cherries, Sweet Cherries,	D1				

Crop Grouping Description 1	Niagara Crop Grouping	Crop Grouping Description 2	Haldimand-Norfolk Crop Grouping	Crop Grouping Description 3	Middlesex and Elgin Crop Grouping	Crop Grouping Description 4	Brant Crop Grouping
		Peaches					
Sweet Cherries	B						
Sour Cherries	C						
Labrusca Grapes	D	Hybrid and Vinifera Grapes, Labrusca Grapes	D3				
Vinifera Grapes	E						
Apples	F	Apples	D4	Apples	2	Apples	D1
Pears, Plums	G	Pears, Plums	D2	Pears, Plums	3		
Strawberries, Raspberries	H	Peppers, Raspberries, Rhubarb, Strawberries	B3	Raspberries, Strawberries	1	Strawberries	B3
Currants, Gooseberries	I						
				Rutabagas	3		
		Peanuts	A2	Peanuts	2		
				Heart Nuts, Filbert Nuts	3		
				Walnuts	2		
Vegetable Crops:	**Vegetable Crops:**	**Vegetable Crops:**	**Vegetable Crops:**	**Vegetable Crops:**	**Vegetable Crops:**	**Vegetable Crops:**	**Vegetable Crops:**
Crop Grouping Description 1	Niagara Crop Grouping	Crop Grouping Description 2	Haldimand-Norfolk Crop Grouping	Crop Grouping Description 3	Middlesex and Elgin Crop Grouping	Crop Grouping Description 4	Brant Crop Grouping
Broccoli, Brussels Sprouts, Cauliflower	J	Cabbage, Cauliflower, Canola, Sweet Corn, Tomatoes, Turnips	C3	Brussels Sprouts, Cauliflower, Cabbage	8	Cabbage, Cauliflower	C2
Bulb Onions, Garlic	K	Onions, Beets, Carrots	B1				
Green (Bunching) Onions	L						
Eggplant, Peppers	M	Peppers, Raspberries, Rhubarb, Strawberries	B3	Peppers	6	Peppers	B2
Cucumbers	N			Cucumbers	4		
Muskmelon	O	Ginseng, Muskmelon, Watermelon	B2			Ginseng	B1
Potatoes	P	Potatoes	A3	Irish Potatoes	3	Potatoes	A1
Tomatoes	Q					Tomatoes	C2
Sweet Corn	R			Sweet corn	7	Sweet Corn	C2
Celery, Lettuce	S	Cucumber, Lettuce, Radish	C4				
Pumpkins, Squash	T	Green Beans, Peas, Pumpkins, Squash	C2				
		Asparagus	A1	Asparagus	1		
		Fava Beans, Soybeans, White Beans	C1	Soybeans	4	Beans	C1
				Sweet Potatoes	2		
				White beans	5		

SOIL PRODUCTIVITY INDEX CALCULATION

The soil productivity index is an arithmetic mean that expresses the relative occurrence of soil capability classes 1 to 7 on selected properties or within specified boundaries. The index is most often based on soil productivity ratings (Hoffman, 1973). Areas with the highest soil capability index will have mainly class 1 land. Areas with a low index will consist of lower soil capabilities. The productivity index method has been used because it provides a single number derived from a listing, by proportion, of the soil capability classes 1 through 7 which allows for direct comparison among different areas or sites. Impacts on soil capability will generally be greatest on an area with a high soil capability index; that is, impacts will be highest when good (higher capability land) is lost to development.

Method

Soil Productivity Index = *(proportion of area of class 1 soils x 1.0) + (proportion of area of class 2 soils x 0.8) + (proportion of area of class 3 soils x 0.64) + (proportion of area of class 4 soils x 0.49) + (proportion of area of class 5 soils x 0.33) + (proportion of area of class 6 soils x 0.17) + (proportion of area of class 7 soils x 0.02)*

The area of each soil map unit was measured, and areas of similar soil capability were summed for CLI classes 1 to 7 lands. The area was calculated for each CLI class and subsequently multiplied by a productivity index corresponding to each soil class. The productivity index is specific to each capability class. The proportion of each area occupied by each soil capability class was multiplied by the corresponding soil productivity value (following Hoffman, 1973) and products were subsequently summed to obtain a soil productivity index for lands affected by or potentially affected by development.

SOIL POTENTIAL RATING FOR FRUITS AND VEGETABLES

Soil potential ratings are based on crop groupings and classes described for Brant County by Acton (1989) and for Niagara Region by Kingston and Presant (1989). Crop suitability class descriptors in the original Kingston and Presant's report have been placed in an ordinal scale for soil potential as outlined in the following:

- Good (G) – 1
- Fair to Good (F-G) – 2
- Fair (F) – 3
- Poor to Fair (P-F) – 4
- Poor (P) – 5
- Very Poor (VP) – 6
- Unsuitable (U) - 7

A matrix is created having rows which are the different soils found within a given area in the columns are for the crop groupings. The highest or best rating is class 1 and those soils that are unsuitable rated lowest as class 7. Climate has been assumed to limit the production of peaches, nectarines, apricots, cherries and vinifera grapes within some Counties/Regions and the soil potential rating has been modified to class 7 (unsuitable)

based on that climate limitation. An average specialty crop soil potential rating was calculated by adding the classes for the separate crops or crop groupings and dividing it by the total number of those crop groups (8 crop groupings following Acton and 20 crop groupings following Kingston and Presant).

The application of this average soil potential rating is limited to comparisons at a provincial and regional/county scale at its broadest extent but depending on variations in climate may only be suitable as a relative rating at the municipal or township level.
It should also be noted that the soil potential rating is an average and that there may be individual crops that will grow very well on a particular soil. In other words, a soil with an average specialty crop potential class 4 rating may contain one or two crop groupings with soil potential ratings at a higher level - that is, soil potential subclass 2, for example.

Soil Potential Index

The average soil potential index is an arithmetic mean that expresses the relative occurrence of soil potential ratings 1 to 7 on selected properties or within specified boundaries. Areas with the highest soil potential index will have mainly rating 1 land. Areas with a low index will consist of lower soil potential (5-7) for specialty crops. The potential index method has been used because it provides a single number derived from a listing, by proportion, of the soil potential ratings 1 through 7 in a given area which allows for direct comparison among different areas or sites.

Method

Soil Potential Index = *(proportion of area of rating 1 soils x 1) + (proportion of area of rating 2 soils x 2) + (proportion of area of rating 3 soils x 3) + (proportion of area of rating 4 soils x 4) + (proportion of area of reading 5 soils x 5) + (proportion of area of rating 6 soils x 6) + (proportion of area of class 7 soils x 7)*

The area of each soil map unit was measured using GIS and areas of similar soil potential were summed for potential ratings 1 to 7 lands. The soil productivity index and the soil potential index both tend to correlate with soil capability class.

APPENDIX 3
SOIL CLASSIFICATION AND SOIL SURVEY

Ontario's published soil surveys follow a hierarchical system of soil classification to represent a three-dimensional area called a pedon (see http://www.pedosphere.ca/resources/CSSC3rd/chapter02.cfm). This three-dimensional area is intended to be represented as a two-dimensional map polygon usually shown as the soil series on soil maps in Ontario. Soil characteristics such as texture and particle size are a part of a continuum and the soil map also must present a landscape continuum as part of a discrete map polygon. In short, soils are represented as discrete units on a map even though the soils themselves are not discrete. As a result, there can be, and there have been, different ways of representing changes in soils that have been mapped within Ontario and within parts of the rest of the world. Not surprisingly, the opportunity to represent soils in different ways has resulted in significant changes in the approach to mapping soils over the time within which soil surveys have been published in Ontario. The older soil surveys tend to lump large areas into soil map polygons, whereas newer soil surveys have smaller more detailed polygons. Newer soil surveys also tend to have complexes (which are soil map polygons containing 2 or more soil series and/or two a more soil capability classes and subclass limitations). Examples of more recent soil surveys include Niagara, Haldimand-Norfolk, Brant, Kent, Middlesex, Ottawa urban fringe, Ottawa-Carlton and the soils component within the report titled *State of the Resources for the Duffin-Rouge Agricultural Preserve*. A review of older as well as newer Ontario soil reports indicates the following:

- soil series with the same name may not have the same characteristics between Counties and/or Regions,
- some soil series identified in detailed field studies are not always represented in the County/Regional published soil survey within which the detailed work is being completed; and,
- not all the soil capabilities assigned to a specific soil series are consistent from one soil report to another soil report.

The significance of the difference between old mapping styles and newer ones can be illustrated by using an old soil report and comparing the old soil map to a newer map. Both maps were produced by government staff. Within Durham Region, as well as a part of York Region, an area identified as an Agricultural Preserve was remapped (Schut *et al*) at a scale of 1: 20,000 in 1994 relative to two maps produced in 1956 (Olding et al.) and 1955 (Hoffman and Richards) both at a scale of 1: 63,360. A review of these older and newer maps shows that:

- there are differences in the number and size of soil polygons and the differences in the soil polygons represent differences in soil series and soil phases, and
- soil capability values assigned to each of the soil polygons are different from older map to newer map.

When the soil capability information is calculated as a productivity index, the old map assigned a productivity index of 0.91 (equivalent to capability class 1 soils) to that part of the Agricultural Preserve located within Durham Region whereas the new map has a productivity index of 0.66 that is relatively equivalent to capability class 3 (0.64). This information demonstrates that the soil productivity within the Preserve is significantly lower than the original mapping by Olding *et al.* (1956) would indicate. Given that some of the soils mapped in the Preserve by Schut et al. (1994, OMAF) require tile drainage,

this tile drainage would need to be in place to reach the average productivity index value of 0.66.

RATING FOR COMMON FIELD CROPS

The original soil capability classification is part of the Canada Land Inventory (CLI) and used an ordinal scale having the numbers 1 through 7. (A discussion of the definition of different scales is available in many mathematics texts. Siegel (1956) outlines a good summary matrix of the definitions for different scales that can be related to statistical tests). Alternatively, Velleman and Wilkinson (1993) describe mathematical scales as part of a continuum and argue that the use of specific statistical tests for specific scales is inappropriate. Irrespective of scale, the CLI capability interpretation was derived based on "*research data, recorded observations, and experience*" and was not intended for use as an indicator of the "*most profitable use of land*".

The class, the broadest category in the capability classification, is a grouping of subclasses that have the same relative degree of limitation or hazard. The limitation or hazard becomes progressively greater from class 1 to class 7. The class indicates the general suitability of the soils for agricultural use.

Class 1 - Soils in this class have no significant limitations in use for crops.

Class 2 - Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.

Class 3 - Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices or both.

Class 4 - Soils in this class have severe limitations that restrict the range of crops or require special conservation practices or both.

Class 5 - Soils in this class have very severe limitations that restrict their capability of producing perennial forage crops, and improvement practices are feasible.

Class 6 - Soils in this class are capable only of producing perennial forage crops and improvement practices are not feasible.

Class 7 - Soils in this class have no capability for arable agriculture or permanent pasture.

Agricultural soils information is currently available in old-style printed format as well as in digital format. The original information with all presented as soil survey reports with accompanying soil maps. Some more recent soil survey publications include a separate interpretive map for soil capability following the rules outlined in the Canada Land Inventory Soil Capability Classification for Agriculture. However, most reports contain a section that has a matrix summarizing soil capability classes for different soil series and phases relative to slope class. The very early soil reports prior to the 1960s tend to have a descriptive summary of the relative merits of different soil series for common field crop production - a precursor to the CLI soil capability classification. When the CLI soil capability classification work was started, a list of all the soil series was compiled and a soil capability class assigned to each soil series having a given set of limitation such as slope class and stoniness class. This information served as a base and blueprint maps, produced by projecting soil polygon/map unit boundaries on to topographic maps at a scale of 1 to 50,000, summarized capability on a County basis. When the County work was being done, additional detailed soil surveys were completed in several smaller

sample areas to assist in assigning soil capability classes to the soils/soil polygons found within the County. The blueprint maps served (without edit) as the base to produce generalized 1: 250,000 scale soil capability maps by the Federal Government in Ottawa. The same blueprint maps were also used as a data source when the soil surveys for Ontario were digitized by OMAFRA. The digitizing included matching soil polygon series and soil capability information at the boundaries between Counties/Regions. Additionally, several more detailed soil surveys have been completed and the soil capabilities outlined in these published reports do not always match the soil capability values assigned on the blueprint maps. Thus, soil capability values can come from several different sources as follows:

- the unpublished summary of capability classes assigned to all the soil series present as a result of mapping up to the 1960s;
- the blueprint map soil capability classes;
- the separate County summary data prepared as the base for the blueprint maps;
- the soil capability classes assigned within published soil reports after the 1960s some of which result because of published scientific information about the effects of soil characteristics such as density on soil capability.

Other soil capabilities have been derived because of the identification of new soil series, new soil phases and differing opinions about the capability of different soils

Subsequently, research by Hoffman (1973) indicated that soil capability class was an indicator of common field crop yields and productivity (yield) indices could be derived based on those yields. The indices, described more specifically in Appendix 1, are used as an “average” for three crops: oats, barley, and corn.

The soil capability class ordinal scale could then be converted into an interval scale using Hoffman’s (1973) data. The data used to create the interval scale are based on older soil surveys and the soil capability class summaries associated with the older surveys are summarized by Hoffman and Noble (1975). New surveys have been completed for Regions such as Middlesex, Elgin and Niagara. In these new surveys, because of work by McBride (1983), the soil capability classes for some soils have been changed to a lower class, particularly for soils with a high clay content. While McBride’s work has been related to average yield data, on a County or Regional basis, no site-specific yield data has been used to confirm that the newer changes to soil capability class is supported by specific yields as was completed in Hoffman’s (1973) research. Therefore, the capability classes used in the newer soil surveys, such as the one for Niagara, might better be described as part of an ordinal scale.

Regardless of the difference of opinion concerning arithmetic scale, yield data, and productivity indices, both data sources and methods have been investigated as part of the work described in this report.

The original soil capability rating report (Environment Canada, 1972) has assumptions which have been applied to the interpretation of soil capability. Two of these assumptions (Environment Canada, 1972) are germane to a discussion on the capability of the subject lands and are as follows:

- *Good soil management practices that are feasible and practical under a largely mechanized system of agriculture are assumed.*
- *Soils considered feasible for improvement by draining, by irrigating, by removing stones, by altering soil structure, or by protecting from overflow, are classified*

according to their continuing limitations or hazards in use after the improvements have been made. The term "feasible" implies that it is within present day economic possibility for the farmer to make such improvements and it does not require a major reclamation project to do so. Where such major projects have been installed, the soils are grouped according to the soil and climatic limitations that continue to exist. A general guide as to what is considered a major reclamation project is that such projects require co-operative action among farmers or between farmers and governments. (Minor dams, small dykes, or field conservation measures are not included).

Therefore, these assumptions have been considered in the evaluation of soils in this specialty crop study. Soil capability mapping has been based on the original soil map which is now available in digital format from LIO based on information originally supplied by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

As discussed previously, the Canada Land Inventory (CLI) originally assumed that soil management that could be applied by a farmer would occur. Therefore, improvements such as irrigation and adequate drainage (both surface and subsurface) were already assumed to be applied in the rating of soils into capability classes.

Tile Drainage

As noted previously, soil capability and therefore productivity makes assumptions about tile drainage (that is, that tile drainage is applied where it is needed and that capability class ratings reflect the fact that the drainage is already assumed to be in place). There are some differences of opinion about which soil drainage classes would benefit from tile drainage. However, it is likely that imperfectly and poorly drained soils would show improved yields when tiles had been installed. There is no doubt that poorly drained soils have better yields when tile drained. As well, it is likely that the imperfectly drained soils would benefit from tile drainage. Unfortunately, the newer soil surveys do not indicate how soil capability class levels would change if imperfectly drained soils are not tiled.

Some information is available to assist in estimating how productivity is diminished in areas requiring tile drainage. For example, yield data collected over 20 years and that were summarized and evaluated by Irwin (1999) indicate that, because of tile drainage, average yields have improved within a range where the least improvement was a 10 percent increase for coloured beans in contrast to a high increase of 38 percent for wheat. The summary by Irwin (1999) did not differentiate by soil series, soil drainage class, or by location in the Province. Based on a general interpretation of the data from Irwin (1999), it can be estimated that imperfectly drained soils in an undrained state could be poorer by a single capability class. However, the installation of tile drainage on the imperfectly drained soils is less likely than installation on poorly and very poorly drained soils.

APPENDIX 4
MULTI-ATTRIBUTE ANALYSIS AND AGRICULTURAL PERFORMANCE

MULTI-ATTRIBUTE ANALYSIS

There are several different methods available to rank agricultural areas given provincial agricultural policy. In all cases, more than one agricultural attribute is used to differentiate the better from the poorer agricultural lands to designate the better lands as prime. Hence, all agricultural land evaluation related to the PPS must be multi-attribute analysis. Any multi-attribute analysis may have different results based on:

- the number and kind of variables considered,
- the scale and therefore precision at which the agricultural information is available,
- the accuracy of the information,
- the analysis method,
- the weights applied to the variables,
- the number of evaluation and area units evaluated and therefore the geographic extent of the evaluation,
- whether the data was standardized, and
- whether all the data was presented consistently to mean that a high number is intended to indicate a high importance value.

A review of the literature did not present information suggesting that a particular single multi-attribute analysis method is the best method. Even the wording employed for the quantitative methods used to combine information varies. The University of Redlands and the Spatial Decision Support Consortium (2012) have prepared a summary of the language and definitions associated with Multi-Criteria Decision Analysis (MCDA). Some of the work described by the University of Redlands is based on work by Malczewski (2006). Multi-attribute Combination Methods is a subset of MCDA having subcategories of Analytical Hierarchy Process, Concordance Methods, Fuzzy Aggregation Operation, Ideal/Reference Point Method, Value/Utility Function Method and Weighted Linear Combination. Therefore, there is a need to consider more than one agricultural metric and more than one analysis method when evaluating agricultural land.

The Ontario Ministry of Agriculture, Food and Rural Affairs suggests using a Land Evaluation and Area Review (LEAR) method to evaluate agricultural lands. The rationale for this recommendation is not available. A Lear analysis fits in to the subcategory of Weighted Linear Combination which is described on the Redlands website as "the most often used technique for tackling spatial multi-attribute decision making".

There are several other methods that could be used to show similarity/dissimilarity amongst the combined variables defining agricultural value of the lands within Ontario. The Lear analysis is linear and other methods available to differentiate the better from the poorer agricultural lands can be used to emphasize differences by squaring those differences - thus, looking at differences based on an exponential relationship. A cluster analysis is based on a sum of squares technique and has been used to measure similarity/dissimilarity. Alternatively, Massam (1993) has used Concordance to complete spatial analyses rating different land areas. Concordance is an additive method which emphasizes the weights assigned to variables more so than the actual range of numerical difference when comparing those variables.

Regardless, there are several decisions that must be made when evaluating agricultural land given the guidance provided by the PPS and these decisions include, but are not limited to, the:

- multi-attribute analysis method(s),
- agricultural indicators/variables used in the analysis,
- evaluation unit size,
- weighting/importance rating,
- minimum area designated, and,
- point at which differences are sufficient to place lands in specialty crop, agricultural or rural designations.

The agricultural multi-attribute analyses results presented within this report are the "weighted linear combination" method such as the LEAR described by OMAFRA.

Any multi-attribute analysis, including a LEAR analysis, may have different results based on:

- the number and kind of variables considered,
- the analysis method,
- the weights applied to the variables,
- whether the data was standardized, and
- whether all the data was presented consistently to mean that a high number is intended to indicate a high importance value.

A review of the literature did not present information suggesting that a single multi-attribute analysis method is the best method. Even the wording employed for the quantitative methods used to combine information varies. The University of Redlands and the Spatial Decision Support Consortium (2012) have prepared a summary of the language and definitions associated with Multi-Criteria Decision Analysis (MCDA). Some of the work described by the University of Redlands is based on work by Malczewski (2006). Multi-attribute Combination Methods is a subset of MCDA having subcategories of Analytical Hierarchy Process, Concordance Methods, Fuzzy Aggregation Operation, Ideal/Reference Point Method, Value/Utility Function Method and Weighted Linear Combination. A LEAR analysis fits in to the subcategory of Weighted Linear Combination which is described on the Redlands website as "the most often used technique for tackling spatial multi-attribute decision making".

AgPlan Limited and Michael Hoffman have carried out various multi-criteria decision analyses at different scales throughout the Province of Ontario. The following paragraphs briefly describe the methods used to evaluate agricultural performance within different Regions or Counties in central to southwestern Ontario. Most of the variables used in the regional scale analyses are outlined in the Agricultural Census for Ontario. Additional variables for soil productivity and crop yields are available through OMAF(RA) for the years used in the analyses. The early census years had relatively few variables (in the order of 30) while later census years used many variables (in the range of hundreds). Some environmental variables used in the later analyses first appeared in 1996. There is the potential for an infinite number of ways to modify the data using the three ways described. Therefore, individual databases were designed to include some relatively different measures of agricultural performance/achievement.

Regional Comparison

At the regional scale for example, environmental, economic, and production viewpoints were separated for some databases. In other instances, a modified characterization within a single category such as production was completed. For example, production was characterized as using total production values (volumetric or gravimetric) for some data sets and as production per unit area (yield) in other data sets. Multiple characterisations were used to represent different perspectives as well as different values associated with the agricultural indicators/metrics. Therefore, for example, total production values were included because they give a relative indication of a County's contribution to the total food production that occurred within a given year within southern to central Ontario. However, this production indicator tends to be correlated with the area of the County. Therefore, yield data was included and/or emphasized to minimize any effect associated with a Region/County's size on that Region/County's performance rating. As well, each of the data sets was modified using different weighting schemes to represent disparate views about which indicators are better predictors of agricultural performance.

Different agricultural variables were grouped into databases to emphasize different parts of each year's agricultural indicators. In general terms, one database was prepared for fruits and vegetables and the second database produced so that the area and farm number data from the first a database was proportional to the total census farm area or total number of census farms.

Methods and Standardization

The combination of different variables to produce a single value has traditionally presented problems and colloquially is known as the "combining apples and oranges" problem. The problem of combination has been reduced by choosing methods that compare indicators using a standardized quantitative scale. As described previously, each data set could be analysed using two different methods as follows:

(1) Simple additive weighting (SAW);
(2) Concordance (CCD); and

For the simple additive weighting and concordance methods, the data were standardized based on the maximum and minimum indicator values for each variable. Standardization used the following formula:

$$\text{Standardized Score} = 100 \times \frac{(\text{Raw Data Value}) - (\text{Minimum Raw Data Value})}{(\text{Maximum Raw Data Value}) - (\text{Minimum Raw Data Value})}$$

Therefore, all scores range between the values 0 and 100.

In addition to different data sets, and different agglomeration analysis methods, different weights were considered. However, in this instance all variables were given equal/unit weight. The agricultural analysis methods were also set up to allow for the calculation of the inverse of any variable.

APPENDIX B – Stage 1 Report – Archaeological Assessment by ASI

Stage 1 Archaeological Assessment of the Northwest Welland Secondary Plan
Part of Lots 174, 175, 176, 226, 227, 228, 233, 234, 235 and 236, Geographic Township of Thorold, Welland County City of Welland, Regional Municipality of Niagara

ORIGINAL REPORT

Prepared for:

SGL Planning & Design Inc.
1547 Bloor Street West
Toronto, ON M6P 1A5
T 416-923-6630

Archaeological Licence P449 (Bhardwaj)
Ministry of Tourism, Culture and Sport PIF P449-0207-2018
ASI File: 17PL-329

10 July 2018

ASI Providing Archaeological & Cultural Heritage Services
528 Bathurst Street Toronto, ONTARIO M5S 2P9
416-966-1069 F 416-966-9723 asiheritage.ca

STAGE 1 ARCHAEOLOGICAL ASSESSMENT OF
THE NORTHWEST WELLAND SECONDARY PLAN
PART OF LOTS 174, 175, 176, 226, 227, 228, 233, 234, 235 AND 236,
GEOGRAPHIC TOWNSHIP OF THOROLD, WELLAND COUNTY
CITY OF WELLAND, REGIONAL MUNICIPALITY OF NIAGARA

EXECUTIVE SUMMARY

ASI was contracted by SGL Planning & Design Inc. to undertake a Stage 1 Archaeological Assessment of the Northwest Welland Secondary Plan, part of Lots 174, 175, 176, 226, 227, 228, 233, 234, 235 and 236, in the Geographic Township of Thorold, Welland County, now in the City of Welland, Regional Municipality of Niagara. The study area is approximately 189 hectares in size. Permission to carry out all activities necessary for the completion of the assessment was granted by the proponent on February 5, 2018.

The Stage 1 background review entailed consideration of the proximity of previously registered archaeological sites and the original environmental setting of the property, along with nineteenth and twentieth-century settlement trends. The extent of previous archaeological assessments carried out in the vicinity of the study area was also reviewed. This research has led to the conclusion that there is potential for the presence of significant Indigenous and Euro-Canadian archaeological resources throughout the vast majority of the study area.

Based on the application of the modeling criteria, approximately 99% or 187.4 ha of the Northwest Welland Secondary Plan study area exhibits potential for the presence of Indigenous and/or Euro-Canadian archaeological resources.

In light of these results the following recommendations are made:

1. Any future developments within the study area must be preceded by Stage 2 Archaeological Assessment. Such assessment(s) must be conducted in accordance with the Ministry of Tourism, Culture and Sport's 2011 *Standards and Guidelines for Consultant Archaeologists*. All active or formerly worked agricultural lands must be assessed through pedestrian survey. Wood lots and other non-arable lands must be assessed by means of test pit survey. Areas deemed to be disturbed or of no potential due to factors of slope or drainage during the Stage 2 assessment process must be appropriately documented.

   This work is required prior to any land disturbing activities in order to identify any archaeological resources that may be present.

   It should be noted that the archaeological assessment of any proposed development (e.g., a draft plan of subdivision) must be carried out on **all** lands within that particular subject property, not simply those lands identified as exhibiting potential in this study.

PROJECT PERSONNEL

Project Managers:	Beverly Garner, Hons. BA Senior Archaeologist | Manager, Planning Assessment Division
	Jennifer Ley, Hons. BA (R376) Associate Archaeologist | Assistant Manager, Planning Assessment Division
Project Director:	Robb Bhardwaj, MA (P449) Associate Archaeologist | Field Director, Planning Assessment Division
Report Preparation:	Jennifer Ley
	Douglas Todd (R055) Associate Archaeologist | Analyst, Laboratory and Fieldwork Services, Operations Division
Graphics:	Jonas Fernandez, MSc. (R281) Lead Archaeologist | Assistant Manager, Fleet & Geomatics Specialist, Operations Division
	Blake Williams, MLitt (P383) Associate Archaeologist | Geomatics Specialist, Operations Division
Report Reviewers:	Beverly Garner
	David Robertson, MA Partner | Director, Planning Assessment Division

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Figure 13: Northwest Welland Secondary Plan Composite Archaeological Potential 28

1.0 PROJECT CONTEXT

ASI was contracted by SGL Planning & Design Inc. to undertake a Stage 1 Archaeological Assessment of the Northwest Welland Secondary Plan, part of Lots 174, 175, 176, 226, 227, 228, 233, 234, 235 and 236, in the Geographic Township of Thorold, Welland County, now in the City of Welland, Regional Municipality of Niagara (Figure 1). The study area is approximately 189 hectares (ha) in size.

1.1 Development Context

This assessment was conducted under the project management of Ms. Beverly Garner and Ms. Jennifer Ley (R376), and under the project direction of Mr. Robb Bhardwaj (MTCS PIF P449-0207-2018). All activities carried out during this assessment conform to the requirements of the *Provincial Policy Statement* under the *Ontario Planning Act* and the *Places to Grow: Growth Plan for the Greater Golden Horseshoe* (Ministry of Municipal Affairs and Housing 1990, 2014, 2017). The Northwest Welland Secondary Plan study will help the City of Welland create a vision for related policies and/or directions that will ensure its successful implementation. This process will identify opportunities and constraints for development and the location, extent and sensitivity of the existing natural, social, cultural and economic environment in the study area.

All work was completed in accordance with the *Ontario Heritage Act* (Ministry of Culture 1990) and the *Standards and Guidelines for Consultant Archaeologists* (S & G) (Ministry of Tourism and Culture 2011; now administered by the Ministry of Tourism, Culture and Sport [MTCS]).

Permission to access the study area and to carry out all activities necessary for the completion of the assessment was granted by the proponent on February 5, 2018.

1.2 Historical Context

The purpose of this section, according to the S & G, Section 7.5.7, Standard 1, is to describe the past and present land use and the settlement history and any other relevant historical information pertaining to the study area. A summary is first presented of the current understanding of the Indigenous land use of the study area. This is then followed by a review of the historical Euro-Canadian settlement history.

The study area is located within part of Lots 174, 175, 176, 226, 227, 228, 233, 234, 235 and 236, in the Geographic Township of Thorold, Welland County. The study area currently comprises a mix of residential, educational and recreational lands within a predominately rural landscape within the northwest portion of the City of Welland. The Town of Pelham boarders the north and west limits of the study area.

1.2.1 Indigenous Overview

The City of Welland has a cultural history that begins approximately 11,000 years ago and continues to the present. Table 1 provides a general summary of the Indigenous settlement of the study area.

Table 1: Outline of Southern Ontario Prehistory

Period	Archaeological/ Material Culture	Date Range	Lifeways/ Attributes
PALEO-INDIAN			
Early	Gainey, Barnes, Crowfield	9000-8500 BC	Big game hunters
Late	Holcombe, Hi-Lo, Lanceolate	8500-7500 BC	Small nomadic groups
ARCHAIC			
Early	Nettling, Bifurcate-base	7800-6000 BC	Nomadic hunters and gatherers
Middle	Kirk, Stanly, Brewerton, Laurentian	6000-2000 BC	Transition to territorial settlements
Late	Lamoka, Genesee, Crawford Knoll, Innes	2500-500 BC	Polished/ground stone tools (small stemmed)
WOODLAND			
Early	Meadowood	800-400 BC	Introduction of pottery
Middle	Point Peninsula, Saugeen	400 BC-AD 800	Incipient horticulture
Late	Algonkian, Iroquoian	AD 800-1300	Transition to village life and agriculture
	Algonkian, Iroquoian	AD 1300-1400	Establishment of large palisaded villages
	Algonkian, Iroquoian	AD 1400-1600	Tribal differentiation and warfare
HISTORIC			
Early	Huron, Neutral, Petun, Odawa, Ojibwa	AD 1600-1650	Tribal displacements
Late	Six Nations Iroquois, Ojibwa	AD 1650-1800's	
	Euro-Canadian	AD 1800-present	European settlement

1.2.2 Historical Overview

Township of Thorold

The land that comprises the Township of Thorold was alienated by the British from the native Mississaugas by an "indenture" dated May 22, 1784. Through this purchase, the British obtained much of the land which now includes the Niagara Region, lying to the west of the reserved strip along the Niagara River which the Crown had possessed since 1763. The sale was officially ratified by Treaty number 3, dated at Navy Hall on December 7, 1792 (*Indian Treaties* vol. 1:5-7).

The first legal settlers in Thorold Township were United Empire Loyalists, who arrived during and after the American Revolutionary War. Many of these early settlers were part of Butler's Rangers, Loyalists who fought under Lt. Col. John Butler, arriving between 1784 and 1787. The first township survey was not undertaken until 1788. At that time, Thorold had not yet been named and it was simply known as "Township No. 9." A statement of expenses submitted to the Surveyor General's department for the work in Thorold showed the survey was done at least in part by Augustus Jones. Jones continued to be employed in "making out the Plans of the Townships of this Settlement" in the late autumn of 1791, which included a "List of reduced Provincial Troops" settled in the area, as well as reports on features "towards the public utility" such as waterfalls, minerals and/or quarries, and the quality of the timber (Fraser 1906:346, 388-389, 426-427; Mika and Mika 1983:506).

By the early 1800s roads had been constructed connecting many communities within the township and grist and saw mills were built to support the growing farming and lumbering activities. By 1817, the population was 830, and much of the land had been cleared. By 1846, approximately 49 percent of the privately-owned land in Thorold Township was under cultivation. The township was referred to as one of the "best settled townships in the Niagara District, containing a great number of excellent, well cleared farms." The land was described as "rolling," and well adapted to growing wheat, oats, barley, rye and other crops. At that time, the township contained eight grist mills and five saw mills. The population stood at 2,284 and the total assessment for property was £49,699. In 1879, the Niagara, St. Catharines and Toronto Railway was extended through the township (Mika and Mika 1983:505-506; Smith 1846:191).

Early Development of the City of Welland

Settlement throughout Welland was a result of the first Welland Canal being constructed in 1829. At this time, a wooden aqueduct was constructed to carry the Welland Canal over the Welland River. This development formed the settlement called Aqueduct or The Aqueduct. In 1844, after the wooden aqueduct was replaced by one of stone, the settlement name was changed to Merrittsville, in honour of William Hamilton Merritt, of the Welland Canal Company. Many who settled in the area were Irish immigrants and escaped slaves from the United States, employed in the construction of the canal. This settlement was incorporated as the Village of Welland on July 24, 1858 (Mika and Mika 1983:614, 616; The Corporation of the City of Welland 2018a).

The Village of Welland was located on the west side of Crowland Towship adjacent to the Welland River. A portion of the village was also located on the west side of the Welland River, situated in Thorold Township; a swing bridge across the river/canal connected the village. In 1876, the population was approximately 1,900. The village was the County Town for the County of Welland providing a number of amenities and services including several churches, fine brick stores, large mills, a court house, a jail, a registry office and a registrar surrogate office. Similar to other villages located along the Welland ship canal, in addition to the Canada Southern Railway, the village of Welland owed a great deal of its growth to that work, providing many facilities for travellers and shippers (Page 1876).

Welland was incorporated as a town on January 1, 1878, and later as a city on July 1, 1917 (The Corporation of the City of Welland 2018a).

The Niagara, St. Catharines and Toronto Electric Railway

The Niagara, St. Catharines and Toronto (NS&T) Electric Railway is located along the west boundary of the study area, now corresponding to the location of the present-day Steve Bauer Trail. From 1899 to 1959, this railway provided transport for people and goods across the Niagara Region; Port Dalhousie to Port Colborne, Welland to Niagara Falls, and from St. Catharines to Niagara-on-the-Lake. In 1929, the railway was at its peak, providing hourly passenger transport (The Corporation of the City of Welland 2018b).

Quaker Road

Quaker Road was originally situated on land owned by Hon. Robert Hamilton, a wealthy Queenston merchant who purchased 7900 acres in Welland County in 1799. The road's name stems from the number of Quakers who chose to settle in the southern part of Thorold Township and in nearby Pelham Corners, situated at the intersection of Quaker Road and Pelham Street. In 1926, the road became the first improved road in Thorold Township (Betti 1967).

1.2.3 Review of Historical Mapping

A review of nineteenth and early twentieth century mapping was completed in order to determine if these sources depict any nineteenth-century Euro-Canadian settlement features that may represent potential archaeological resources on the property (Figures 2-4) [1]. It should be noted that not all settlement features were depicted systematically in the compilation of these historical map sources, given that they were financed by subscription, and subscribers were given preference with regard to the level of detail provided. Moreover, not every feature of interest from the perspective of archaeological resource management would have been within the scope of these sources.

Historical mapping has confirmed that the study area was a rural, agricultural landscape in the mid-nineteenth century. In addition, historical map analysis indicates that the present-day roadways of Quaker Road, Line Avenue/Clare Avenue, Rice Road and First Avenue were surveyed prior to 1862. The mapping further records the names of landowners and/or occupants, as well as the location and arrangement of homesteads and associated orchards.

The 1862 *Tremaine Map of the Counties of Lincoln and Welland* indicates 13 land owners and/or occupants within the study area (Figure 2). Three of the individuals, J. H. E Page (Lot 236), Thomas Spencer (Lot 236) and Orin Bemmiss (Lot 228) have associated homesteads shown fronting present-day Quaker Road which bisects the study area east-west. However, prior to the landowners and/or occupants noted on this map, Robert Spencer purchased 400 acres on Lots 234, 235 and 236 around 1820. According to *The Globe*, Mr. Spencer's home became a frequent resting spot for American slaves on the Underground Railway (*The Globe* 1899). Table 2 below provides the names of all land owners and/or occupants within the study area in 1862.

The 1876 *Illustrated Historical Atlas of the Counties of Lincoln and Welland* indicates that several of the lots have been sold or passed down to family members; many of the lots have also been divided into smaller parcels (Figure 3). A total of 16 land owners and/or occupants are now indicated within the study area and a total of 14 homesteads are illustrated. The three homesteads identified on Lots 236 and 288 (referenced above) appear to have persisted into the late-nineteenth century. Table 2 provides the names of all land owners and/or occupants and associated homesteads within the study area in 1876.

[1] Use of historic map sources to reconstruct/predict the location of former features within the modern landscape generally proceeds by using common reference points between the various sources. These sources are then georeferenced in order to provide the most accurate determination of the location of any property on historic mapping sources. The results of such exercises are often imprecise or even contradictory, as there are numerous potential sources of error inherent in such a process. These include the vagaries of map production (both past and present), the need to resolve differences of scale and resolution, and distortions introduced by reproduction of the sources. To a large degree, the significance of such margins of error is dependent on the size of the feature one is attempting to plot, the constancy of reference points, the distances between them, and the consistency with which both they and the target feature are depicted on the period mapping.

Table 2: Nineteenth-Century Property Owners and Historical Features within the Study Area

	1862		1876	
Lot	**Owner(s)/Tenant(s)**	**Feature(s)**	**Owner(s)/Tenant(s)**	**Feature(s)**
176	Aaron Page (west half)		A. Page (west half)	Homestead, orchards
176	Ander Hill (east half)		A. Hill (east half)	Homestead, orchard
175	J. H. Smith		S. Dougherty	Homestead, orchards
174	Lewis Page (west half)		A. N. Page (west half)	Homestead, orchard
174	R. S. Garner (east half)		R. R. Garner (east half)	Homestead, orchard
228	Orin Bemiss	Homestead	Orin Bemis	Homestead, orchard
227	Joseph Goodwillie		Orin Bemis (west half)	Homestead, orchard
227	n/a		E. Early (west half)	Homestead, orchard
226	Jacob Gainer Jr. (west half)		J. Gainer Jr.	Homestead, orchards
226	Jacob Gainer		n/a	
236	J. H. E. Page (west half)	Homestead	J. H. E. Page (west half)	Homestead, orchard
236	Thomas Spencer (east half)	Homestead	G. A. Swayze (east half)	Homestead, orchard
235	A. Killman		G. A. Swayze (west quarter)	
235	n/a		E. Sisler (east three-quarters)	Homestead, orchard
234	William Spencer		D. Moore (west quarter)	
234	n/a		William Glinz (east three-quarters)	Homestead, orchard
233	A. Page & E. Lawson		O. B. (northwest corner)	Homestead, orchard
233	n/a		J. Seanton (west quarter)	
233	n/a		George Page (east three-quarters)	Orchard

It is also important to make note of settlement features adjacent to the subject property, given the degree of error on historical map sources. There are no features adjacent to the study area on the 1862 mapping, however, there are a number of features surrounding the study area limits on the 1876 mapping. These features and associated property owners are described in Table 3 below. Included within these features, is a schoolhouse identified within Lot 233 at the intersection of present-day Quaker Road and First Avenue. Currently, the schoolyard of the existing Quaker Road Public School is situated in this location. However, the first Quaker Road log schoolhouse was built ca. 1816 on the north side of Quaker Road within Lot 174 on R. S. Garner's farm. In 1861, a brick schoolhouse was built on Lot 233, and in 1893 a third schoolhouse was built of red brick (Betti 1967; Goodwillie 2005; Quaker Road Public School 2018). It is assumed that the schoolhouse adjacent to the study area on the 1876 mapping represents the second structure built in 1862.

Table 3: Nineteenth-Century Historical Features adjacent to Study Area

Lot	Owner(s)/Tenant(s)	Feature(s)
177	J. Wilson Estate	Orchard
226	J. Gainer Jr.	Orchard
237	William Vanderburg	Homestead, Orchard
234	D. Moore	Homestead, Orchards
233	George Page	Schoolhouse, Homestead, Orchards
232	Alex Page	Homesteads**, Orchard
231	H. Goodwillie	Homestead, Orchard
231	Owner unclear	Homestead, Orchard

** Two structures are shown and may represent an original dwelling and a replacement dwelling, or perhaps a dwelling and a barn.

A factor in evaluating the potential for the presence of historical features pre-dating the homesteads illustrated on the 1862 and 1876 mapping above is the likely construction of one-storey log or frame homes during the first half of the nineteenth century. Log houses were associated with earlier settlers as it reflected the use of a material which was the by-product of the forest clearing process. The original log house was then often replaced with an improved frame, brick or stone structure, which was frequently built close to the location of the original log house (MacDonald 1997). Therefore, there is the added potential of recovering discrete early nineteenth century log cabins within the study area.

Figure 4 illustrates the study are on the 1907 *Niagara Topographic Sheet* (Department of Militia and Defense). Land features such as waterways, woodlots and elevation are clearly illustrated, in addition to the early twentieth century road network and structure locations. The study area is predominately indicated as cleared for agriculture, with the exception of small wooded locales, which in many instances appear to correspond to the location of various orchards on the previous 1862 and 1876 mapping. A total of 10 structures is illustrated, all or most of which appear to correspond with previous homestead locations. Table 4 below provides a list of all structures and the corresponding land owners and/or occupants based on earlier mapping. Topographic information indicates that the west side of the study area is at a higher elevation, and that the property in general features a subtle negative slope to the east-southeast in the direction of the Welland River; multiple tributaries of the Welland River are found in the immediate vicinity, one of which flows through the east half of the study area. The Niagara St. Catharines and Toronto (NS&T) Electric Railway is also depicted on this map, forming the west limit of the study area (now the Steve Bauer Trail). Just beyond the west limit is the community of Pelham Corners at the intersection of Quaker Road and Pelham Road South.

Table 4: Features Identified within the Study Area on the 1907 *Niagara Topographic Sheet*

Lot	Features(s)	Owner(s)/Tenant(s) in 1862	Owner(s)/Tenant(s) in 1876
175	Homestead	n/a	S. Dougherty
174	Homestead	n/a	A. N. Page (west half)
174	Homestead	n/a	R. R. Garner (east half)
228	Homestead	Orin Bemiss	Orin Bemis
226	Homestead	n/a	J. Gainer Jr.
236	Homestead	J. H. E. Page (west half)	J. H. E. Page (west half)
236	Homestead	Thomas Spencer (east half)	G. A. Swayze (east half)
235	Homestead	n/a	E. Sisler (east three-quarters)
234	Homestead	n/a	D. Moore (west quarter)**
234	Homestead	n/a	William Glinz (east three-quarters)

** This structure may correspond to the homestead of D. Moore adjacent to the study area on the 1876 mapping, or it may be a more recent structure.

1.2.4 Review of Aerial Photography

In order to further assess the previous land use of the subject property, available aerial imagery from 1934 and 1954 was reviewed (Google Earth 2018; University of Toronto 2018). On the 1934 image, the study area comprises a rural landscape with numerous agricultural fields (Figure 5). A number of residences and/or farm complexes are also present, many fronting the east-west Quaker Road. The tributary of the Welland River, identified on the previous 1907 mapping, is faintly visible on the 1934 aerial image. On the 1954 image, the study area remains largely rural with the exception of a subdivision located near the northwest corner; this area corresponds to Montgomery Road, Crerar Avenue, Topham Boulevard and Summerlea Avenue (Figure 6). The tributary of the Welland River is even less discernible in this image.

1.2.5 Review of Modern Topographic Mapping

In order to understand more recent development within the study area, the modern 1996 *Niagara Topographic Sheet* was also reviewed (Department of Natural Resources). This map indicates that the study area has remained rural throughout the twentieth century; urban development is found to the south and northwest and commercial development is located to the east (Figure 7). The study area is dotted with various structures along all of the roadways, including Milkweed Trail, a more recently constructed roadway located parallel to Line Avenue. The tributary of the Welland River is illustrated flowing east-west through the study area, and two small, man-made, rectangular ponds are located near the watercourse.

1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the study area, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and current land use and field conditions. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the MTCS through "Ontario's Past Portal"; published and unpublished documentary sources; and the files of ASI.

1.3.1 Registered Archaeological Sites

In order that an inventory of archaeological resources could be compiled for the study area, three sources of information were consulted: the site record forms for registered sites housed at the MTCS, published and unpublished documentary sources, and the files of ASI.

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (OASD) which is maintained by the MTCS. This database contains archaeological sites registered within the Borden system. The Borden system was first proposed by Dr. Charles E. Borden and is based on a block of latitude and longitude. Each Borden block measures approximately 13 km east-west by 18.5 km north-south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The study area under review is located within the AgGt Borden block.

Based on a search of the OASD, no archaeological sites have been registered within the study area, however, 34 sites have been registered within a one km radius (MTCS 2018). The nearest sites to the study area are AgGt-45, located approximately 695 metres to the west and AgGt-217, located approximately 875 metres to the north. All of the registered sites have been in summarized in Table 5 below. Refer to Table 1 for the cultural/temporal categories.

Table 5: Registered Archaeological Sites within 1 km of the Study Area

Borden No.	Name	Temporal/ Cultural Affiliation	Site Type	Researcher
AgGt-33	Bell	Late Archaic	Campsite	ASI 1984
AgGt-34	Goar	Late Archaic	Campsite	ASI 1984
AgGt-36	Quaker Park	Early Archaic	Campsite	MPPA 1984
AgGt-44	Milburn	Late Archaic	Campsite	ASI 1984
AgGt-45		Early Woodland, Meadowood	Findspot	ASI 1984
AgGt-51	Kunda Park Extension 2	Undermined Pre-contact	Unknown	MAS 1987
AgGt-147	River Realty 2	Late, Middle Archaic	Unknown	MHCI 2007
AgGt-148		Undetermined Pre-contact	Unknown	n/a 2007
AgGt-149		Late, Middle Archaic; Late Woodland	Campsite	MHCI 2007
AgGt-150		Euro-Canadian	Homestead	MHCI 2007
AgGt-151	Harkes	Undetermined Pre-contact	Unknown	MHCI 2007
AgGt-153	Fonthill 1	Euro-Canadian	Homestead	MHCI 2007
AgGt-155	Fonthill 3	Undetermined Pre-contact	Findspot	MHCI 2007
AgGt-156	Fonthill 4	Undetermined Pre-contact	Findspot	MHCI 2007
AgGt-162		Pre-contact; Euro Canadian	Unknown; Homestead	Archaeologix 2008
AgGt-163		Euro-Canadian	Homestead	Archaeologix 2008
AgGt-164		Undetermined Pre-contact	Unknown	Archaeologix 2008
AgGt-165		Undetermined Pre-contact	Unknown	Archaeologix 2008
AgGt-166		Undetermined Pre-contact	Unknown	Archaeologix 2008
AgGt-167		Woodland	Campsite	Archaeologix 2008
AgGt-168		Euro-Canadian	Homestead	Archaeologix 2008

Borden No.	Name	Temporal/ Cultural Affiliation	Site Type	Researcher
AgGt-169		Undetermined Pre-contact	Unknown	Archaeologix 2008
AgGt-170		Late Archaic	Findspot	Archaeologix 2008
AgGt-171		Undetermined Pre-contact	Unknown	Archaeologix 2008
AgGt-198	East Fonthill Lands Location 1	Late Archaic	Findspot	Golder Associates 2014
AgGt-199	East Fonthill Lands Location 2	Undetermined Pre-contact; Euro-Canadian	Unknown; Unknown	Golder Associates 2014
AgGt-200		Undetermined Pre-contact	Unknown	DCL 2014
AgGt-201		Undetermined Pre-contact	Campsite	DCL 2014
AgGt-203	P8	Paleo-Indian, Hi-Lo	Findspot	DCL 2014, 2015
AgGt-214		Euro-Canadian	Homestead	DCL 2015
AgGt-215		Undetermined Pre-contact	Campsite	DCL 2015
AgGt-216		Late Archaic	Campsite	DCL 2015, 2016
AgGt-217		Middle Archaic	Campsite	DCL 2015, 2016
AgGt-219	P1	Undetermined Pre-contact	Unknown	DCL 2014

MPPA = Mayer, Pihl, Poulton & Associates Inc., MAS = Michael Arch Services, MHCI = Mayer Heritage Consultants Inc., DCL = Detritus Consulting Ltd.

It is also important to acknowledge any known unregistered sites within the study area, and in this case, one such site is known. This find was brought to the attention of ASI during a public information session held as part of the Northwest Welland Secondary Plan study.

Mr. Douglas Todd of ASI met with the local resident who encountered the artifact within the northwest portion of the study area. The find was documented approximately 10 metres north of a rectangular manmade pond near a seasonal creek east of Montgomery Road. The find comprises a single biface fragment, possibly representing an Early Archaic or Early Woodland Meadowood blade; the Early Archaic period dates from 7800-6000 BC, while the Early Woodland period dates from 800-400 BC. The artifact is made from Onondaga chert and is 73.86 mm in length, 25.2 mm in width and 5.31 mm in thickness. Based on the information provided, this find has been entered into the OASD as a "site lead" and has been assigned the tracking number Lead-0053.

1.3.2 Previous Archaeological Assessments

No archaeological assessments are known to have been conducted within the limits of the Northwest Welland Secondary Plan study area. However, five archaeological assessments are known within 50 metres of the study area limits. These assessments are described below.

In 2000, Mayer Heritage Consultants Inc. (MHCI) conducted a Stage 1 and 2 Archaeological Assessment for the proposed Timber Creek Estates subdivision in the Town of Pelham under MTCS PIF 2000-001-091. The study area is estimated to be approximately 7.7 ha located on Lots 176 and 177, situated immediately north of the current Northwest Welland Secondary Plan study area. The assessment methodology and findings are unknown as a copy of this report was not available for review, although no sites appear to be registered in relation to this assessment (MTCS 2018).

In 2007, MHCI conducted a Stage 1 Archaeological Assessment for the Town of Pelham / East Fonthill Secondary Plan Study under MTCS P040-208-2007. The 187 ha study area was located on all of Lots 171 and 172 and on part of Lots 166, 167, 175 and 176, situated immediately north of the current Northwest Welland Secondary Plan study area. The findings of the assessment determined that the study area exhibited the potential of encountering both Indigenous and Euro-Canadian archaeological resources. As such, it was recommended that a Stage 2 Archaeological Assessment was warranted for any properties within the study area to be developed or in any way disturbed, except those properties which had already been assessed (MHCI 2007).

In 2010, MHCI conducted a Stage 1 Archaeological Assessment for the Clare Avenue road extension under MTCS PIF P040-350-2010. The precise location of the study area is unknown, as the report was unavailable for review, but the study area may have been located along the western boundary of the current Northwest Welland Secondary Plan study area (MTCS 2018). It does not appear that any related Stage 2 Archaeological Assessment was completed for this project.

In 2014, Detritus Consulting Ltd. (DCL) conducted a Stage 1 and 2 Archaeological Assessment of the proposed Rosewood Estates subdivision in the Town of Pelham under MTCS PIF P230-0013-2014. The 12.804 ha study area was located within Lot 175, situated immediately north of the current Northwest Welland Secondary Plan study area. The assessment was completed by means of a pedestrian survey and test pit survey at five metre intervals; a large area of the study area was not subject to any assessment as it was exempt from development under By-Law 3494. During the course of the assessment, six isolated Euro-Canadian locations and one isolated Indigenous location were documented. None of these locations were recommended for further archeological assessment (DCL 2014).

In 2017, DCL conducted a Stage 1 and 2 Archaeological Assessment of 1011 Clare Road and 703 Quaker Road in the Town of Pelham under MTCS PIF P017-0543-2016. The 0.567 ha study area was located within Lot 237, situated immediately west of the current Northwest Welland Secondary Plan study area. The assessment was completed by means of a test pit survey at five metre intervals. No archaeological materials were documented during the course of this work (DCL 2017).

1.3.3 Geography

The subject property is situated within the Haldimand Clay Plain physiographic region (Chapman and Putnam 1984:156-159), which is among the largest of the 53 defined physiographic regions in southern Ontario, comprising approximately 3,500 square km. Extending from the Niagara Escarpment to Lake Erie, the clay plain was submerged by glacial Lake Warren around 12,500 B.P. Generally, this region is flat and poorly drained, although it includes several distinctive landforms including dunes, cobble, clay, and sand beaches, limestone pavements, and back-shore wetland basins (MacDonald 1980).

Soil drainage for the study area is presented in Figure 8. Soils within the study area are primarily imperfectly drained and poorly drained; a very small pocket of well drained soil is located within the northwest corner of the study area (Kingston and Presant 1989).

Surficial geology information for the study area is presented in Figure 9. With the exception of sand within northwest corner and a small area within the southwest corner, the majority of the study area comprises clay (OGS 2010).

The study area is situated within the central Welland River watershed, and more specifically within the Tow Path Drain subwatershed. Tow Path Drain is a tributary of the Welland River and flows through the northern and central portions of study area (Figures 1, 10); this watercourse was illustrated but unnamed on previously reviewed mapping (e.g. Figure 4). The Tow Path Drain covers an area of 17 square km, draining into the Welland Recreational Canal, which is the former alignment of the Welland Canal located immediately west of the Welland River (NPCA 2010). Further, based on additional water data obtained as part of this study, a second tributary of the Welland River is located within the southeast portion of the study area (Figure 10). The Welland River flows approximately 1.4 km east of the study area.

In terms of pre-contact subsistence and economy, perhaps the most significant environmental factor influencing resource extraction schedules and thus pre-contact settlement locations in this general region

is the bedrock geology and the relative accessibility of chert-bearing deposits (Parkins 1974; 1977). Indeed, the nearby outcroppings of Onondaga formation cherts provided one of the most widely used materials for stone tool manufacture throughout the pre-contact history of southern Ontario. The material is a finely crystalline, medium to massive bedded, medium to dark grey coloured, cherty limestone. Its most distinctive feature is the abundance of light to medium grey mottled chert, constituting 40-70% of the whole mass. The chert occurs in bedded, nodular, and lenticular masses and outcrops extensively on most of the north shore of Lake Erie from Fort Erie to Nanticoke. In these locations, Onondaga chert would have been available in abundance to Indigenous peoples. Quarrying was unnecessary, as rectanguloid chert cobbles still litter the local beaches. Wave action would have fractured and reduced the chert nodules then deposited them on the beach to be collected. According to Parkins (1977:86), Onondaga chert today accounts for 35-65% of the cobbles found on north shore beaches. The amount of Onondaga chert on a particular beach may have varied annually, but this material was always abundant locally. The deposition of chert by wave action ensured that it was a continually replenished, renewable resource.

1.3.4 Existing Conditions

The study area is irregular in shape and is approximately 189 ha in size. The study area is located within the northwest portion of the City of Welland and is generally bounded by Steve Bauer Trail along the west, various commercial and industrial lots fronting Niagara Street to the east, recent residential developments, agricultural and wooded lands to the north, and residential development and the campus of Niagara College to the south (Figure 10). The Town of Pelham boarders the north and west limits of the study area.

The study area is largely rural in terms of current land use and is dominated by existing and former agricultural fields. The area also includes residential and educational lands, in addition to a sports complex with a series of soccer fields. The study area features a subtle slope from west to east and varies between 191 and 180 metres above sea level; the highest lands are along the west boundary, particularly within the northwest corner.

2.0 ANALYSIS AND CONCLUSION

The optional field review was not required as part of this assessment, as per the S & G, Section 1.2. The historical and archaeological contexts have been analyzed to help determine the archaeological potential of the study area and these data are presented below. Archaeological potential mapping is presented in Figures 11-13.

2.1 Indigenous Archaeological Resource Potential

The S & G, Section 1.3.1 stipulates that undisturbed lands within 300 metres of primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (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 the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential. As mentioned above, tributaries of the Welland River flow through the study area.

Other geographic characteristics that can indicate archaeological potential include: elevated topography (eskers, drumlins, large knolls, plateaux), 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 (migratory routes, spawning areas, prairie) and scarce raw materials (quartz, copper, ochre, or outcrops of chert) are also considered characteristics that indicate archaeological potential. Based on a review of the geography, pockets of sandy soil are found within the northwest and southwest corners of the study area; the remainder of the study area is heavy clay soils.

Indigenous archaeological potential zones within the study area, encompassing approximately 99% or 187.2 ha of the land mass (Figure 11), have been defined based on the factors/features indicative of Indigenous archaeological site potential identified in the S & G (MTC 2011). All known water sources have been buffered by 300 metres, as have areas known to comprise sandy soils.

2.2 Euro-Canadian Archaeological Resource Potential

The S & G (MTC 2011:18) stipulates that areas of early Euro-Canadian settlement, including places of early military pioneer settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches and early cemeteries, are considered to have archaeological potential. There may be commemorative markers of their history, such as local, provincial, or federal monuments or heritage parks. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the *Ontario Heritage Act* or a federal, provincial, or municipal historic landmark or site, and properties that local histories or informants have identified with possible archaeological sites, historical events, activities, or occupations are also considered to have archaeological potential. As mentioned above, a number of settlement features have been identified on the reviewed historical mapping. No designated or listed properties are known to be located within the limits of the Northwest Welland Secondary Plan study area.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those which are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be captured by the basic proximity to the water model, since these occupations were subject to similar environmental constraints. An added factor, however, is the development of the network of concession roads and railroads through the course of the nineteenth century. These transportation routes frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites. As mentioned above, a number of early settlement roads are within or adjacent to the study area.

Euro-Canadian archaeological potential zones within the study area, encompassing approximately 48% or 90 ha of the land mass (Figure 12), have been defined based on the factors/features indicative of Euro-Canadian archaeological site potential identified in the S & G (MTC 2011). All early roads identified on historical mapping have been buffered by 100 metres, as have the locations of all mapped 1862 and 1878 historical structures.

2.3 Composite Archaeological Potential

Combining the Indigenous and Euro-Canadian potential layers results in approximately 99% or 187.4 ha of the study area land mass being identified as exhibiting archaeological potential (Figure 13).

Aside from areas of localized disturbance surrounding existing buildings, there are no apparent factors related to integrity that negate potential within these generally defined zones.

2.4 Summary

ASI was contracted by SGL Planning & Design Inc. to undertake a Stage 1 Archaeological Assessment of the Northwest Welland Secondary Plan, part of Lots 174, 175, 176, 226, 227, 228, 233, 234, 235 and 236, in the Geographic Township of Thorold, Welland County, now in the City of Welland, Regional Municipality of Niagara. The study area is approximately 189 ha in size.

The Stage 1 background review entailed consideration of the proximity of previously registered archaeological sites and the original environmental setting of the property, along with nineteenth and twentieth-century settlement trends. The extent of previous archaeological assessments carried out in the vicinity of the study area was also reviewed. This research has led to the conclusion that there is potential for the presence of significant Indigenous and Euro-Canadian archaeological resources throughout the vast majority of the study area.

Based on the application of the modeling criteria, approximately 99% or 187.4 ha of the Northwest Welland Secondary Plan study area exhibits potential for the presence of Indigenous and/or Euro-Canadian archaeological resources.

3.0 RECOMMENDATIONS

Given the findings of the Stage 1 Archaeological Assessment research, the following recommendations are made:

1. Any future developments within the study area must be preceded by Stage 2 Archaeological Assessment. Such assessment(s) must be conducted in accordance with the Ministry of Tourism, Culture and Sport's 2011 *Standards and Guidelines for Consultant Archaeologists*. All active or formerly worked agricultural lands must be assessed through pedestrian survey. Wood lots and other non-arable lands must be assessed by means of test pit survey. Areas deemed to be disturbed or of no potential due to factors of slope or drainage during the Stage 2 assessment process must be appropriately documented.

   This work is required prior to any land disturbing activities in order to identify any archaeological resources that may be present.

   It should be noted that the archaeological assessment of any proposed development (e.g., a draft plan of subdivision) must be carried out on **all** lands within that particular subject property, not simply those lands identified as exhibiting potential in this study.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Cultural Programs Unit of the Ministry of Tourism Culture should be immediately notified.

The documentation and materials related to this project will be curated by ASI until such a time that

arrangements for their ultimate transfer to Her Majesty the Queen in right of Ontario, or other public institution, can be made to the satisfaction of the project owner(s), the Ontario Ministry of Tourism, Culture and Sport, and any other legitimate interest groups.

4.0 ADVICE ON COMPLIANCE WITH LEGISLATION

- This report is submitted to the Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, RSO 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 field work and report recommendations ensure the conservation, preservation and protection 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 Ministry of Tourism, Culture and Sport, 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 field work 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 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 sec. 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 or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the Registrar of Cemeteries at the Ministry of Consumer Services is also immediately notified.

- Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence.

5.0 BIBLIOGRAPHY

Betti, Michael
1967 *Township of Thorold: 1793 to 1967*. Armath Associates in conjunction with Township of Thorold, Toronto.

Chapman, L.J. and D.F. Putman
1984 *The Physiography of Southern Ontario*. Second Edition. University of Toronto Press, Toronto.

The Corporation of the City of Welland
2018a Welland History. < https://www.welland.ca/AboutWelland.asp >

2018b Heritage Events. < https://www.welland.ca/Heritage/HeritageEvents.asp >

Department of Militia and Defence
1907 *Niagara Topographic Sheet.*

Department of Natural Resources
1996 *Niagara Topographic Sheet*. 30 M/3 & 30 M/6, Edition 7.

Detritus Consulting Ltd. (DCL)
2014 Archaeological Assessment (Stage 1, 2), Proposed Rosewood Estates, Part of Lot 175, Geographic and Historical Township of Thorold, Town of Pelham, Historical County of Welland, Regional Municipality of Niagara. Revised Report.

2017 Archaeological Assessment (Stage 1, 2), 1011 Clare Road and 703 Quaker Road, Pelham, Part of Lot 237, Geographical Township of Thorold, Historical County of Welland, Regional Municipality of Niagara.

Fraser, Alexander
1906 "Minutes and Correspondence of the Land Board, District of Nassau," *Third Bureau of the Archives Reports for the Province of Ontario* (1905.) L.K. Cameron (King's Printer), Toronto.

The Globe
1899 "One Who Remembers… Brock" 16 September 1899. p4.

Goodwillie, Diane.
2005 *Quaker Road: History, Stories and Goodwillie Genealogy*. Trafford, Victoria BC.

Google Earth Pro
2018 Quaker Road, Welland, Ontario. Version 7.1.7.2606.

Kingston, M. S. and Presant, E. W.
1989 The Soils of The Regional Municipality of Niagara, Volume 1. Report No. 60 of the Ontario Institute of Pedology. Ontario Ministry of Agriculture and Food and Agriculture Canada.

MacDonald, Eva M.
1997 The Root of the Scatter: Nineteenth Century Artifact and Settlement Patterns in Rural Ontario. *Ontario Archaeology* 64:56-80.

MacDonald, I. D.
1980 *Life Science Features of the Haldimand Clay Plan Physiographic Region*. Ontario Ministry of Natural Resources, Richmond Hill, Ontario.

Mayer Heritage Consultants Inc. (MHCI)
2007 Archaeological Assessment (Stage 1) Town of Pelham / East Fonthill Secondary Plan Study, R.M. of Niagara, Ontario.

Mika, N. and H. Mika
1977 *Places in Ontario: Their Name Origins and History, A-E*. Mika Publishing Company, Belleville, Ontario.

1981 *Places in Ontario: Their Name Origins and History, F-M*. Mika Publishing Company, Belleville, Ontario.

1983 *Places in Ontario: Their Name Origins and History*, *N-Z*. Mika Publishing Company, Belleville, Ontario.

Ministry of Culture (now the Ministry of Tourism, Culture and Sport)
1990 *Ontario Heritage Act.*

Ministry of Municipal Affairs and Housing
1990 *The Planning Act,* R.S.O. 1990, c. P.13.

2014 *Provincial Policy Statement.*

2017 *Places to Grow: Growth Plan for the Greater Golden Horseshoe.*

Ministry of Tourism and Culture, now the Ministry of Tourism, Culture and Sport (MTCS)
2011 *Standards and Guidelines for Consultant Archaeologists*. Cultural Programs Branch, Archaeology and Planning Unit. Toronto.

2018 Ontario's Past Portal. <https://www.pastport.mtc.gov.on.ca/APSWeb/public/login.xhtml?lang=en>

Niagara Peninsula Conservation Authority (NPCA)
2010 Central Welland River Watershed Plan. < https://npca.ca/sites/default/files/Central_Welland_River_Watershed_Plan.pdf >

Ontario Geological Survey (OGS)
2010 Surficial Geology of Southern Ontario. Ontario Geological Survey, Miscellaneous Release—Data 128—Revised.

Page, H.R.
1876 *Illustrated Historical Atlas of the Counties of Lincoln and Welland, Ont*. H. R. Page & Co. Toronto, Ontario.

Parkins, W.G.
1974 Source of Chert from Welland River Archaeological Sites. Unpublished BSc Thesis, Brock University, St. Catharines, Ontario.

1977 Onondaga Chert: Geological and Palynological Studies as Applied to Archaeology. Unpublished MSc Theses, Bock University, St. Catharines, Ontario.

Quaker Road Public School
2018 Quaker Road School – Early History. <http://quakerroad.dsbn.org/about.html>

Smith, William H.
1846 *Smith's Canadian Gazetteer*. H. & W. Rowsell, Toronto.

Tremaine, G.C.
1862 *Tremaine's Map of the Counties of Lincoln and Welland.* George C. Tremaine, Toronto.

University of Toronto
2018 Digital Aerial Photographs. Southern Ontario 1954. University of Toronto Map & Data Library. < https://mdl.library.utoronto.ca/collections/air-photos/1954-air-photos-southern-ontario/index >

6.0 MAPS

See the following pages for detailed assessment maps and figures.

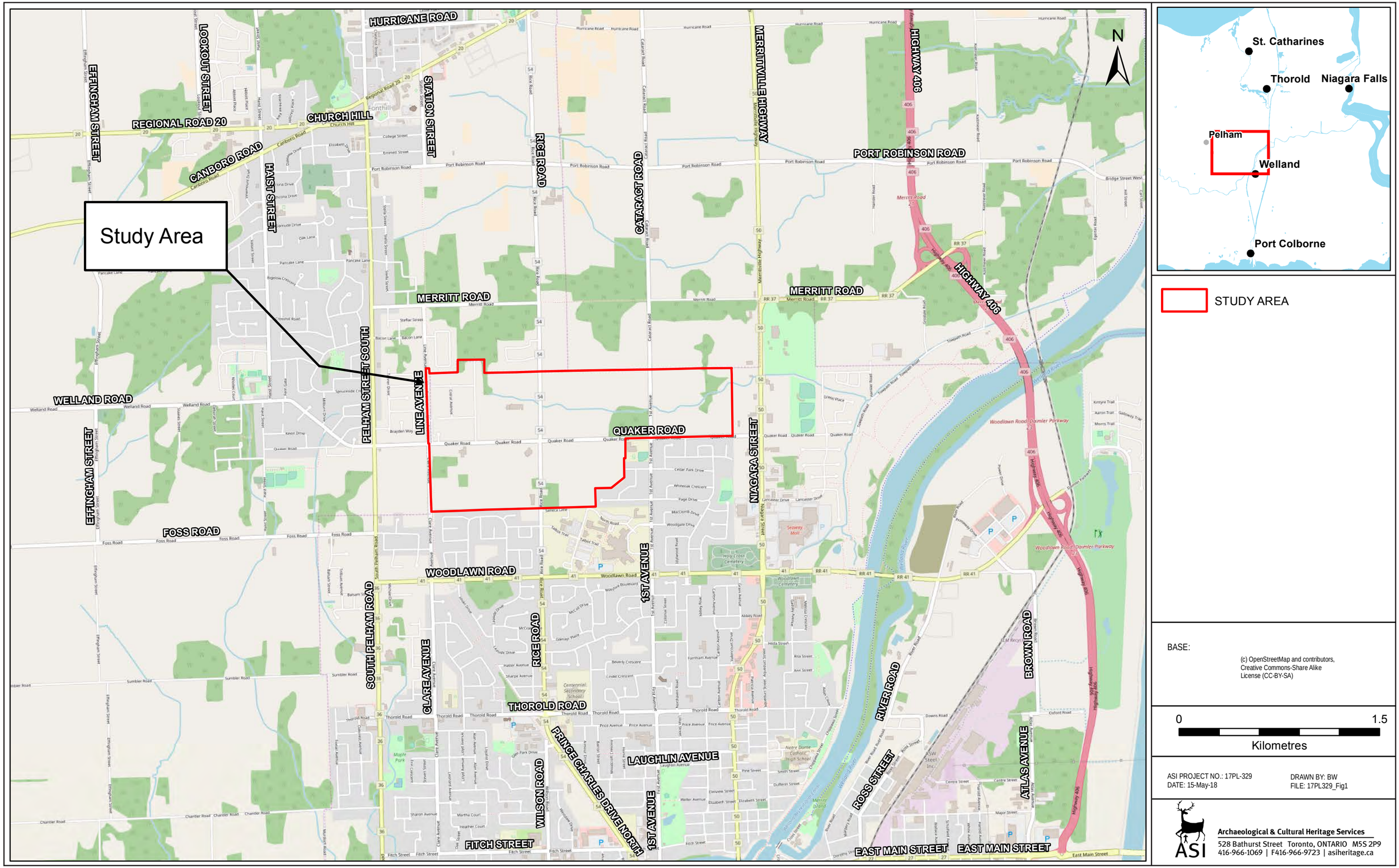

Figure 1: Location of the Study Area.

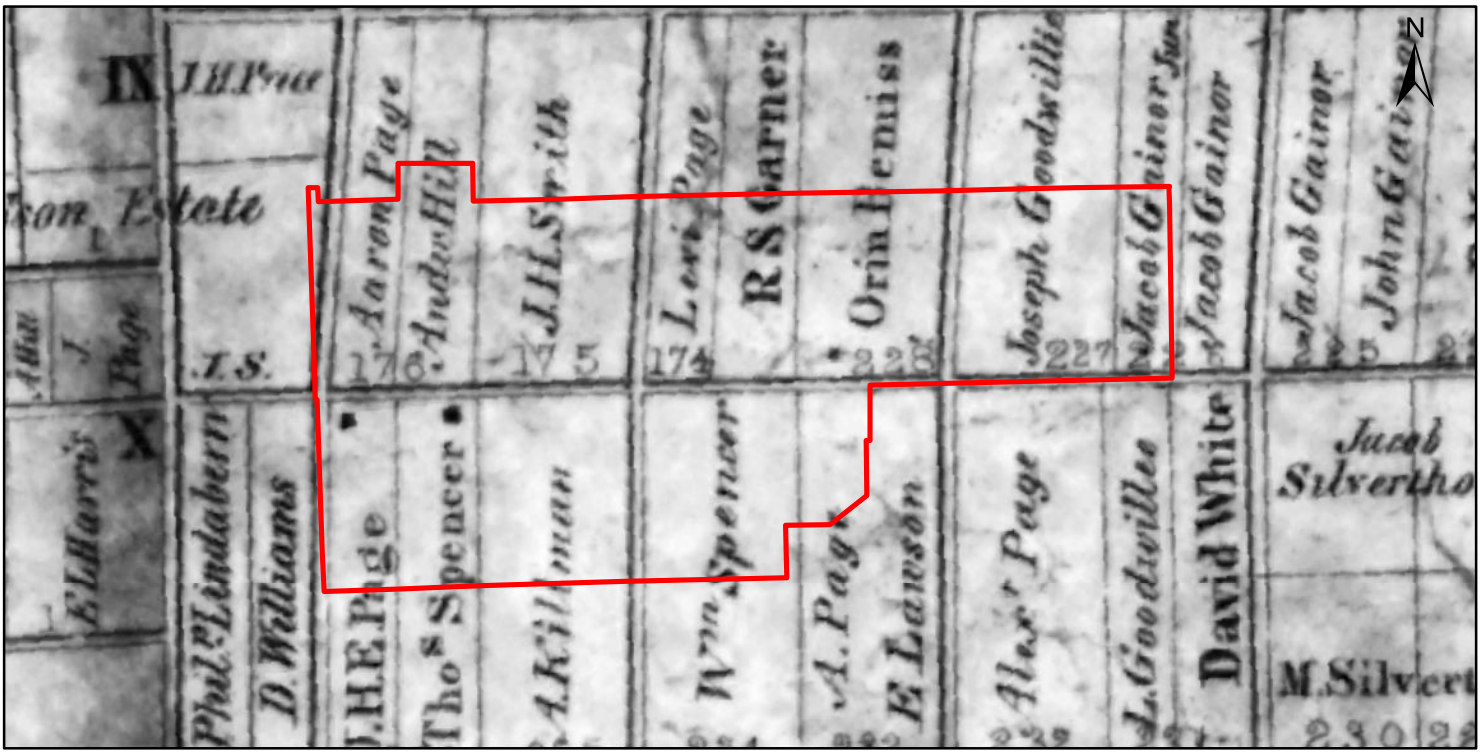

Figure 2: Study Area located on the 1862 Tremaine Map of the Counties of Lincoln and Welland.

Figure 3: Study Area located on the 1876 Illustrated Historical Atlas of the Counties of Lincoln and Welland.

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STUDY AREA

0 500
Metres

ASI PROJECT NO.: 17PL-329
DATE: 15-May-18
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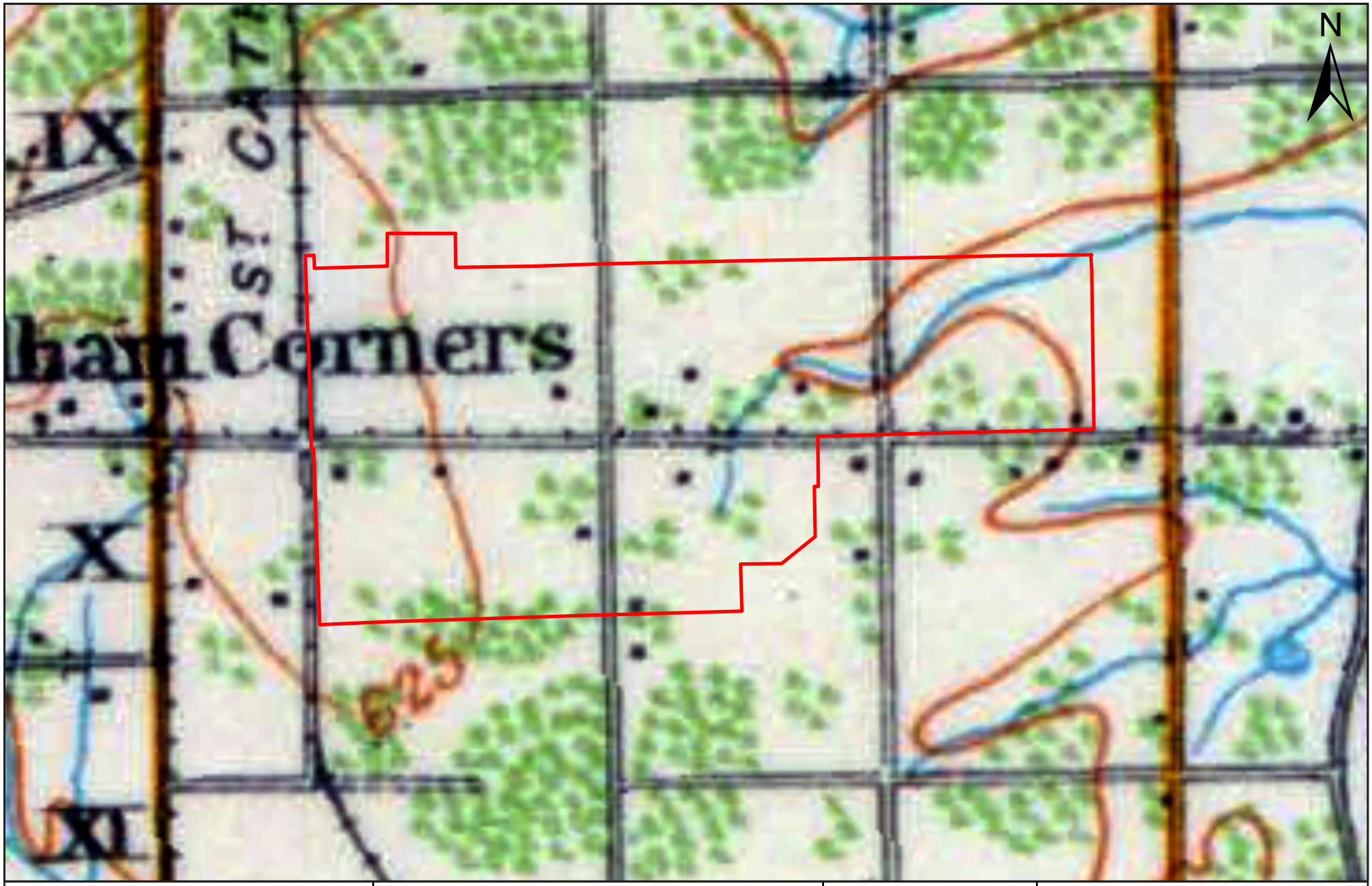

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Figure 4: Study Area located on the 1907 topographic map, Niagara Sheet

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STUDY AREA

0 500
Metres

ASI PROJECT NO.: 17PL-329
DATE: 15-May-18
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Figure 5: Study Area located on 1934 aerial imagery

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STUDY AREA

0 500
Metres

ASI PROJECT NO.: 17PL-329
DATE: 15-May-18
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Figure 6: Study Area located on 1954 aerial imagery

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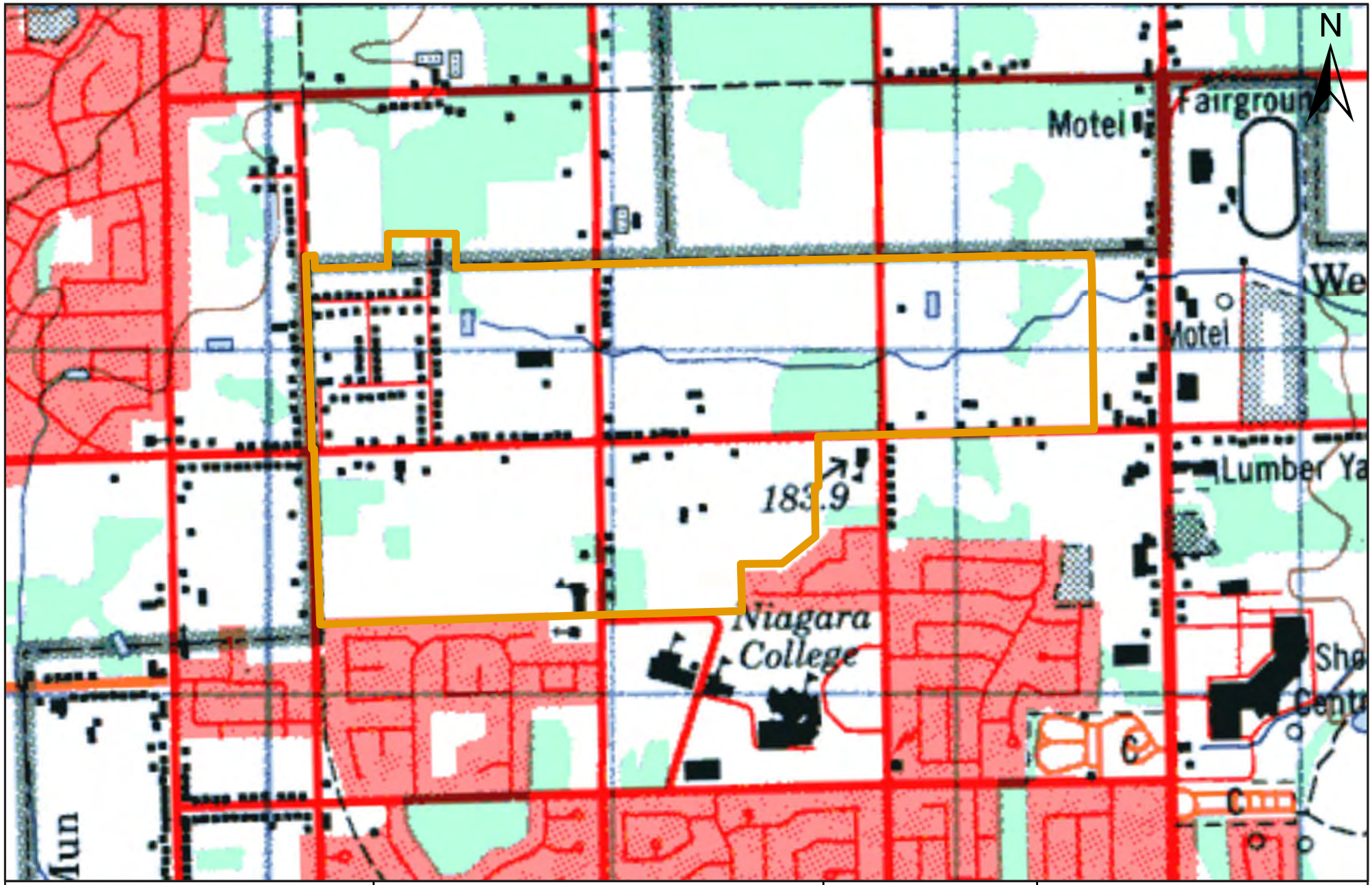

STUDY AREA

0 750
Metres

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Figure 7: Study Area located on 1996 topographic map, Niagara Sheet.

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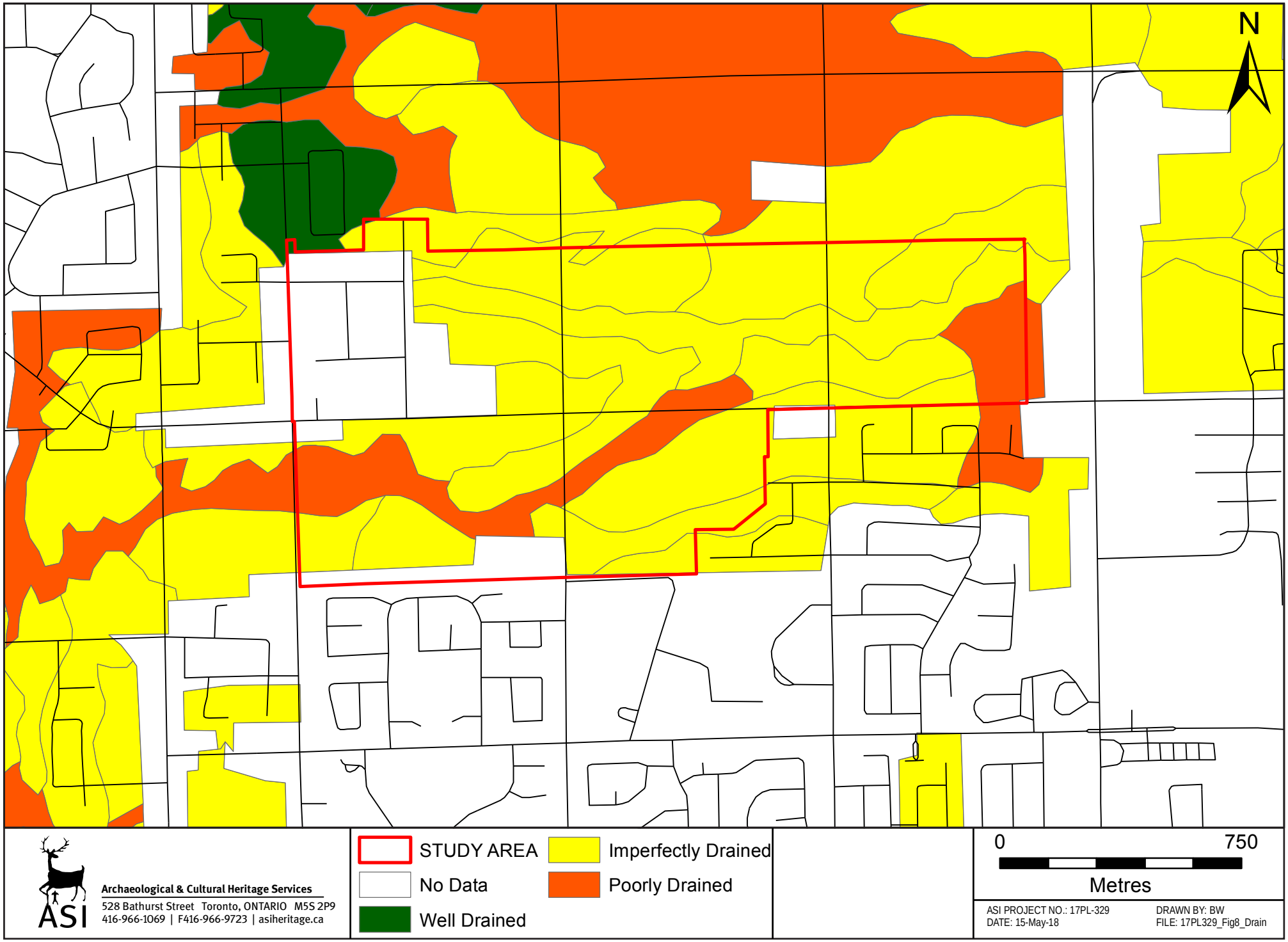

Figure 8: Soil drainage within the Study Area

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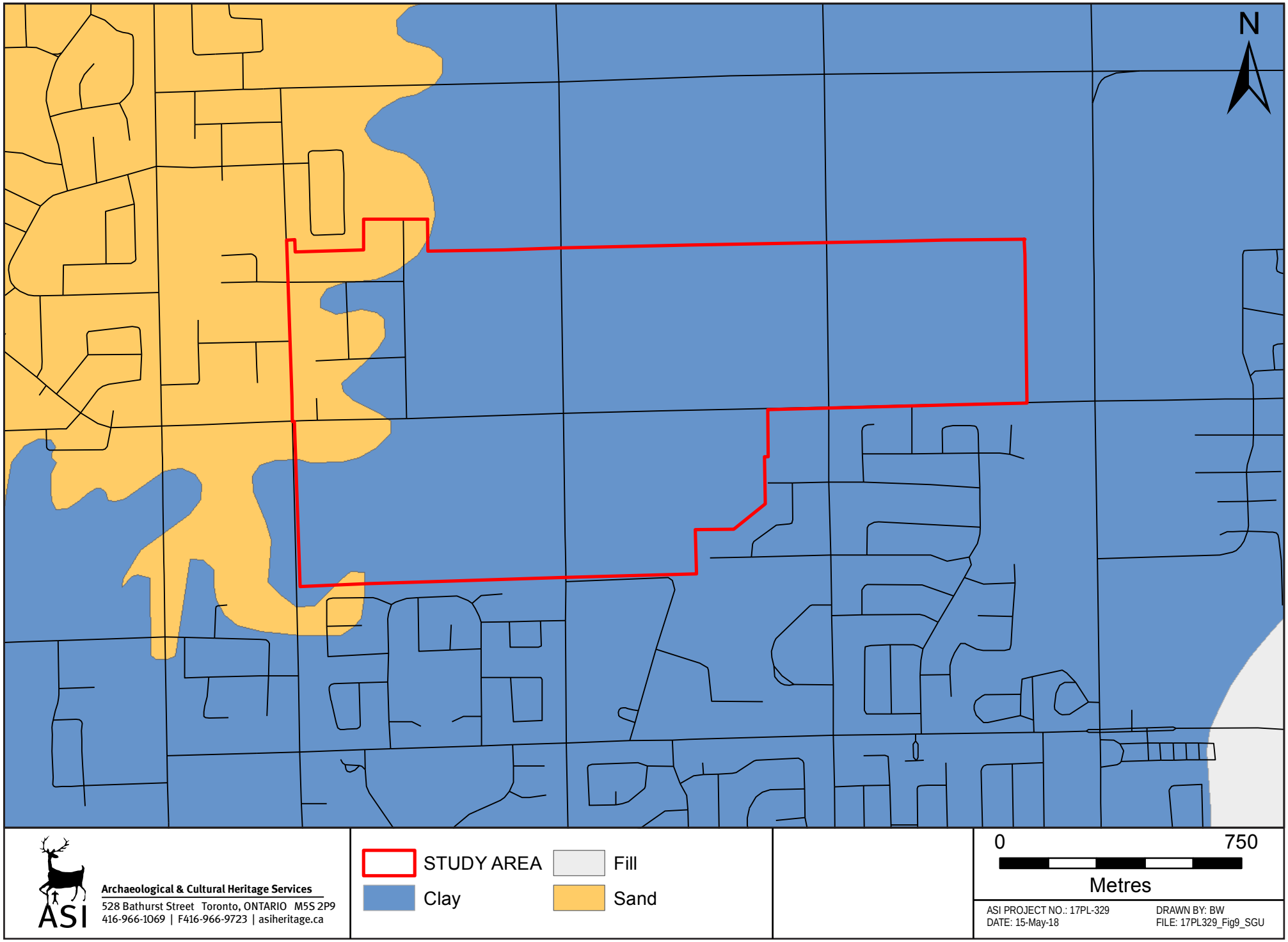

Figure 9: Surficial Geology within the Study Area

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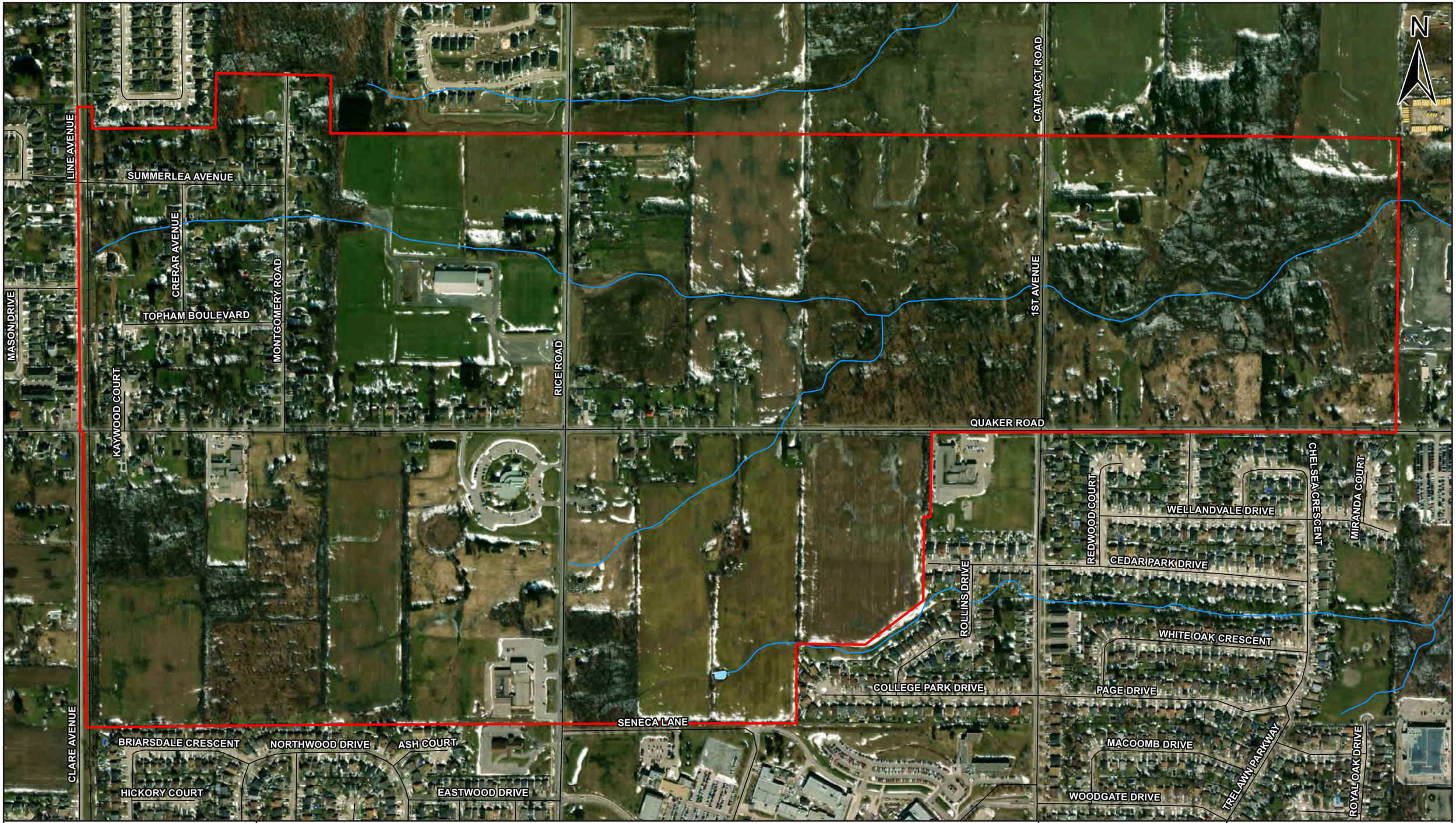

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STUDY AREA — ROAD — WATER
RAIL

BASE:
Ortho
Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 300
Metres

ASI PROJECT NO.: 17PL-329
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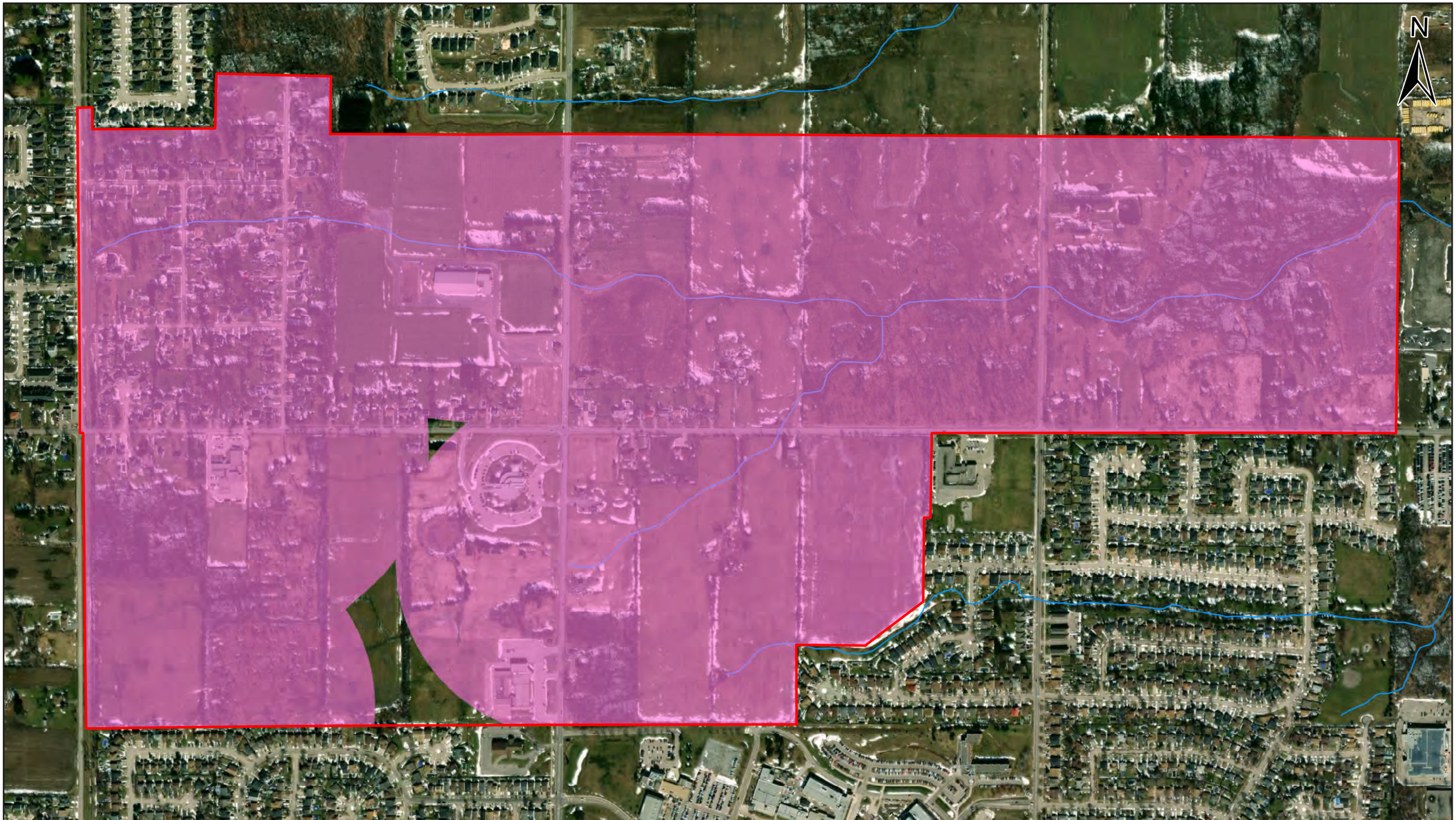
Figure 10: Existing conditions of the Study Area



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STUDY AREA

INDIGENOUS ARCHAEOLOGICAL POTENTIAL

WATER

BASE:

Ortho
Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 300
Metres

ASI PROJECT NO.: 17PL-329
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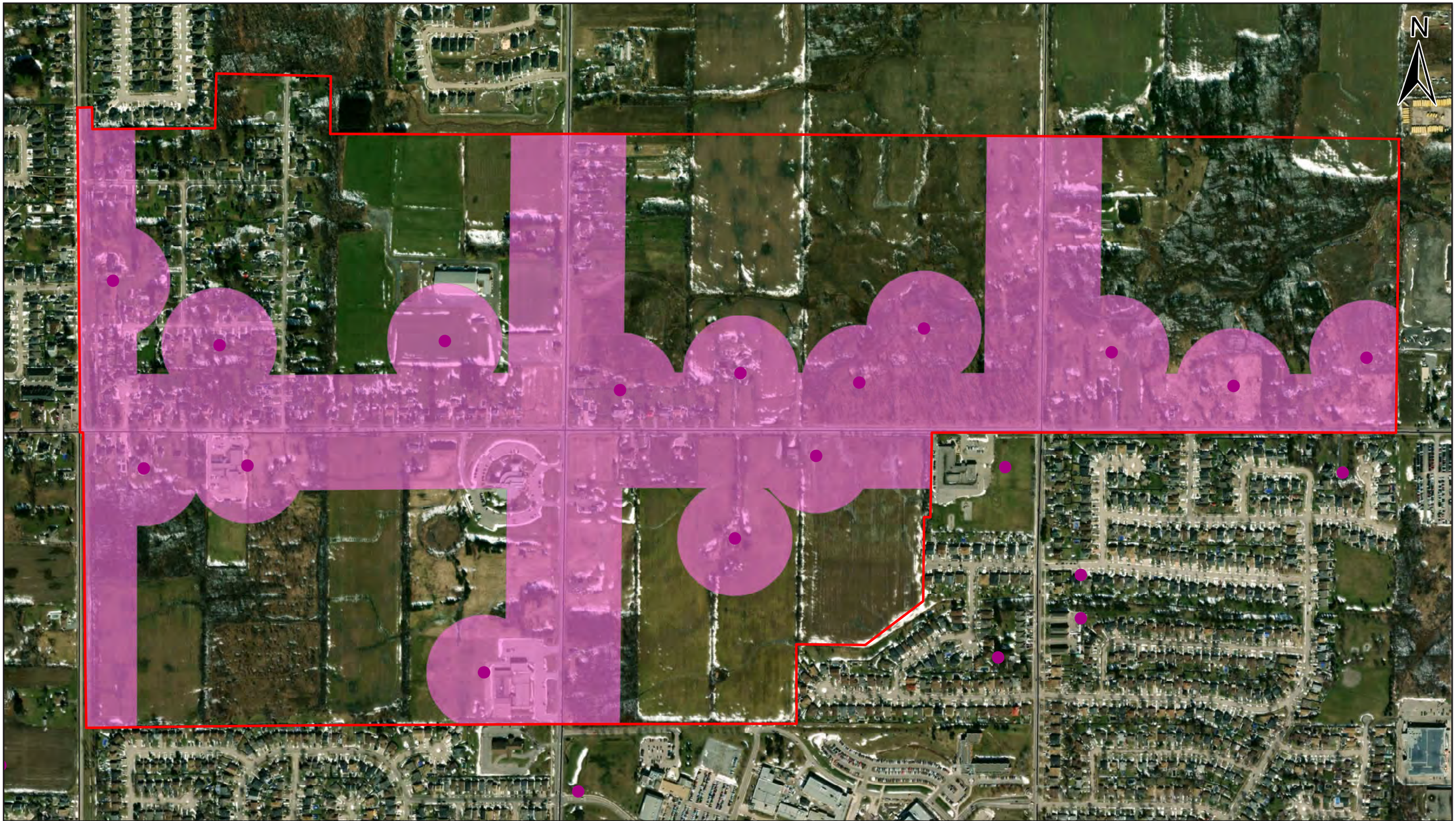
Figure 11: Northwest Welland Secondary Plan Indigenous Archaeological Potential



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STUDY AREA
HISTORICAL ARCHAEOLOGICAL POTENTIAL
HISTORICAL ROAD
HISTORICAL BUILDING

BASE:
Ortho
Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 300
Metres

ASI PROJECT NO.: 17PL-329
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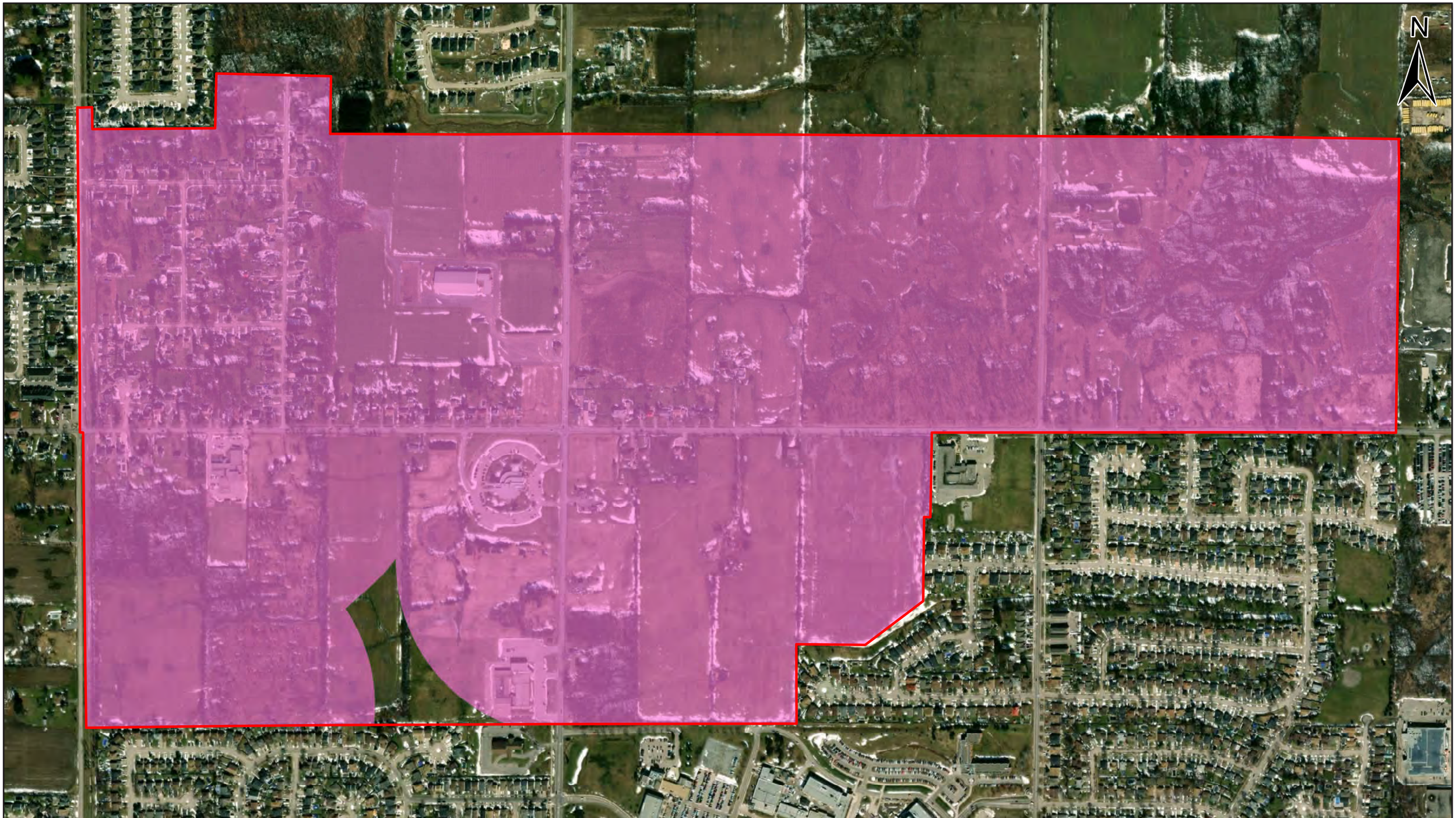
Figure 12: Northwest Welland Secondary Plan Historical Archaeological Potential



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STUDY AREA

COMPOSITE ARCHAEOLOGICAL POTENTIAL

BASE:

Ortho
Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 300
Metres

ASI PROJECT NO.: 17PL-329
DATE: 7/4/2018

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Figure 13: Northwest Welland Secondary Plan Composite Archaeological Potential

APPENDIX C – Cultural Heritage Resource Assessment by ASI

NORTHWEST WELLAND SECONDARY PLAN
CULTURAL HERITAGE RESOURCE ASSESSMENT STUDY
EXISTING CONDITIONS REPORT

CITY OF WELLAND, ONTARIO

Prepared for:

City of Welland
60 East Main Street
Welland Ontario
L3B3X4

ASI File 17CH-159

July 2018

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528 Bathurst Street Toronto, ONTARIO M5S 2P9
416-966-1069 F 416-966-9723 asiheritage.ca

NORTHWEST WELLAND SECONDARY PLAN
CULTURAL HERITAGE RESOURCE ASSESSMENT STUDY
EXISTING CONDITIONS REPORT

CITY OF WELLAND, ONTARIO

EXECUTIVE SUMMARY

ASI was retained by the City of Welland, as a part of a consulting team led by SGL Planning and Design Inc., to conduct a Cultural Heritage Resource Assessment for the Northwest Welland Secondary Plan. The project involves a built heritage and cultural heritage landscape assessment of the subject lands to assist the City of Welland in the preparation of the Secondary Plan.

The purpose of this report is to describe the existing conditions of the study area, present an inventory of potential cultural heritage resources, and propose appropriate mitigation measures and recommendations for minimizing and avoiding possible negative impacts on identified potential cultural heritage resources. The assessment was conducted under the project management of James Neilson, Cultural Heritage Specialist in the Cultural Heritage Division at ASI.

The background research, data collection, and field review conducted for the study area determined that there are 13 potential cultural heritage resources located within the Northwest Welland Secondary Plan study area. These include eight potential built heritage resources and five potential cultural heritage landscapes. Based on the research and analysis presented in this report, the identified potential cultural heritage resources may be candidates for conservation and integration into future land uses in the secondary plan area and should be subject to cultural heritage impact assessments during subsequent development planning applications.

Based on the results of the assessment, the following recommendations have been developed:

1. A total of 13 potential cultural heritage resources were identified within the Northwest Welland Secondary Plan study area. These include eight potential built heritage resources and five potential cultural heritage landscapes. The Northwest Welland Secondary Plan should incorporate policies that promote the conservation of any properties that have been determined to merit heritage recognition.

2. As the only existing stable neighbourhood in the study area, the qualities and characteristics of the Summerlea VLA Subdivision should be maintained and new adjacent development should be designed to ensure that these qualities and characteristics are not negatively impacted. These qualities and characteristics include the existing building typologies, setbacks (front, side and rear) and streetscape. Urban design guidelines that reflect the existing condition should be incorporated into the Secondary Plan for this area.

3. Identified potential cultural heritage resources may be historically, architecturally, and/or contextually significant properties, which have emerged from their contextual setting, and contribute to land use patterns within the Northwest Welland Secondary Plan study area. Accordingly, any proposed development on or adjacent to an identified potential cultural heritage resource should require a cultural heritage impact assessment to further assess the cultural heritage value of the identified potential cultural heritage resources, and to ensure that the cultural heritage resources in the study area are conserved. Any evaluation should include consideration of its historical and natural context within the City of Welland, and should include a comprehensive assessment of the design, historical, and contextual values of the property.

4. Upon the completion of the proposed Secondary Plan the following report should be updated to consider the potential impacts of these plans on the identified potential cultural heritage resources. Additional mitigation measures may be identified.

5. Should future work require an expansion of the study area, then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.

ARCHAEOLOGICAL SERVICES INC.

PROJECT PERSONNEL

Senior Project Manager:	Rebecca Sciarra, MA, CAHP Partner and Director, Business Services
Project Manager:	James Neilson, MES (Planning) Cultural Heritage Specialist, Cultural Heritage Division
Project Administrator:	Carol Bella, Hons BA Research Archaeologist and Administrative Assistant
Report Preparation:	James Neilson
Graphics:	Adam Burwell, MSc Geomatics Specialist
Report Reviewer:	Kristina Martens, BA, Dip. Heritage Conservation Cultural Heritage Specialist, Cultural Heritage Division
	Katherine Hull, PhD Director, Cultural Heritage Division

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1.0 INTRODUCTION

ASI was retained by the City of Welland, as a part of a consulting team led by SGL Planning and Design Inc., to conduct a Cultural Heritage Resource Assessment for the Northwest Area of the City of Welland Secondary Plan study area in the City of Welland, Ontario (Figure 1). The project involves a built heritage resource and cultural heritage landscape assessment of the subject lands to assist the City of Welland in the preparation of the Northwest Welland Secondary Plan.

The subject study area consists of 190 hectares in the City of Welland and has an irregular boundary consisting of land approximately 500m on either side of Quaker Road, roughly bounded by Clare Avenue and Line Avenue to the west and an eastern boundary approximately 200m west of Niagara Street (Figure 2). As a part of the Secondary Plan, new zoning and land-use designations will be proposed for the area.

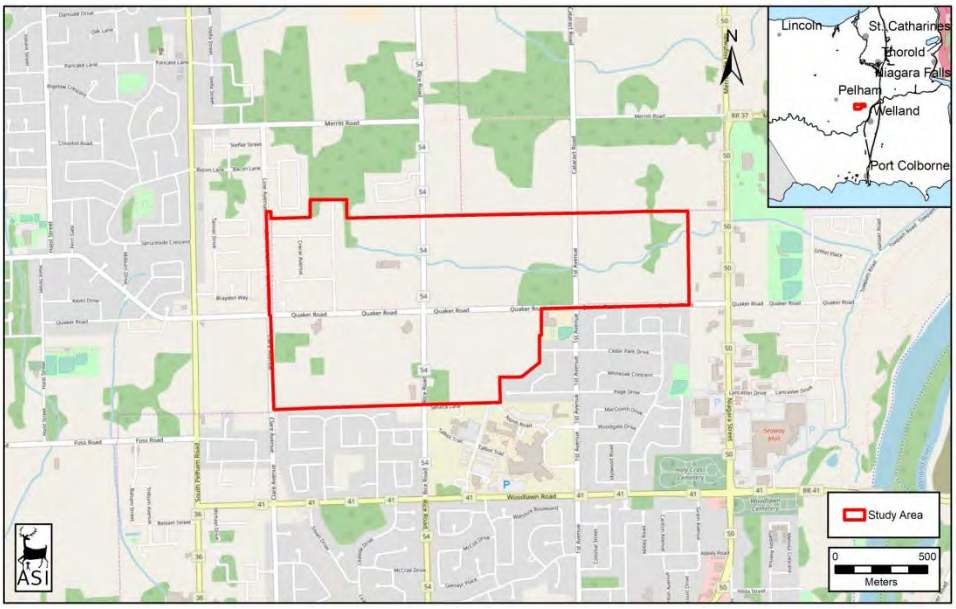


Figure 1: Northwest Welland Secondary Plan study area (Open Street Maps)

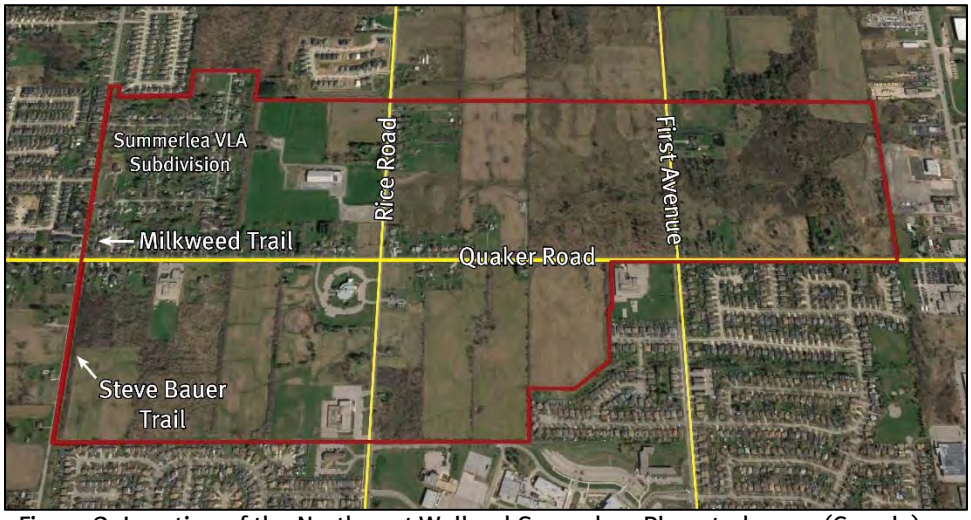


Figure 2: Location of the Northwest Welland Secondary Plan study area (Google)

The purpose of this report is to describe the existing conditions of the study area, present a built heritage and cultural landscape inventory of potential cultural heritage resources, and propose appropriate mitigation measures and recommendations for minimizing and avoiding negative impacts on identified cultural heritage resources. It also presents the outcome of the review of archival, historical, and known resources. The assessment was conducted under the project management of James Neilson, Cultural Heritage Specialist in the Cultural Heritage Division at ASI.

2.0 BUILT HERITAGE RESOURCE AND CULTURAL HERITAGE LANDSCAPE ASSESSMENT CONTEXT

2.1. Legislation and Policy Context

The authority to request this heritage assessment arises from Section 2 (d) of the *Planning Act*. The *Planning Act* (1990) and related *Provincial Policy Statement* (*PPS*), which was updated in 2014, make several provisions relating to heritage conservation. One of the general purposes of the *Planning Act* is to integrate matters of provincial interest in provincial and municipal planning decisions. To inform all those involved in planning activities of the scope of these matters of provincial interest, Section 2 of the *Planning Act* provides an extensive listing of potential concerns and interest. These matters of provincial interest shall be regarded when certain authorities, including the council of a municipality, carry out their responsibilities under the *Act*. One of these provincial interests is directly concerned with:

> 2.(d) the conservation of features of significant architectural, cultural, historical, archaeological or scientific interest

Part 4.7 of the *PPS* states that:

> The official plan is the most important vehicle for implementation of this Provincial Policy Statement. Comprehensive, integrated and long-term planning is best achieved through official plans.
>
> Official plans shall identify provincial interests and set out appropriate land use designations and policies. To determine the significance of some natural heritage features and other resources, evaluation may be required.
>
> Official plans should also coordinate cross-boundary matters to complement the actions of other planning authorities and promote mutually beneficial solutions. Official plans shall provide clear, reasonable and attainable policies to protect provincial interests and direct development to suitable areas.
>
> In order to protect provincial interests, planning authorities shall keep their official plans up-to-date with this Provincial Policy Statement. The policies of this Provincial Policy Statement continue to apply after adoption and approval of an official plan.

Those policies of relevance for the conservation of cultural heritage features are contained in Section 2 - Wise Use and Management of Resources, wherein Subsection 2.6 - Cultural Heritage and Archaeological Resources, makes the following provisions:

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

Those policies of relevance for the conservation of natural heritage features are contained in Section 2-Wise Use and Management of Resources, wherein Subsection 2.1 – Natural Heritage, makes the following provisions:

2.1.1 Natural features and areas shall be protected for the long term.

Several definitions that have specific meanings for use in a policy context accompany the policy statement. These definitions include built heritage resources and cultural heritage landscapes.

A *built heritage resource* is defined as: "a building, structure, monument, installation or any manufactured remnant that contributes to a property's cultural heritage value or interest as identified by a community, including an Aboriginal community" (*PPS* 2014).

A *cultural heritage landscape* is defined as "a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Aboriginal community. The area may involve features such as structures, spaces, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association" (*PPS* 2014). Examples may include, but are not limited to farmscapes, historic settlements, parks, gardens, battlefields, mainstreets and neighbourhoods, cemeteries, trailways, and industrial complexes of cultural heritage value.

Adjacent lands are defined as those lands contiguous to a protected heritage property or as otherwise defined in the municipal official plan. (*PPS* 2014).

In addition, significance is also more generally defined. It is assigned a specific meaning according to the subject matter or policy context, such as wetlands or ecologically important areas. Regarding cultural heritage and archaeology resources, resources of significance are those that are valued for the important contribution they make to our understanding of the history of a place, an event, or a people (*PPS* 2014).

Criteria for determining significance for the resources are recommended by the Province, but municipal approaches that achieve or exceed the same objective may also be used. While some significant resources may already be identified and inventoried by official sources, the significance of others can only be determined after evaluation (*PPS* 2014).

Accordingly, the foregoing guidelines and relevant policy statement were used to guide the scope and methodology of the cultural heritage assessment.

2.2. City of Welland Official Plan

The City of Welland has developed an Official Plan (20 June 2017), which sets out several policies with regard to cultural heritage resources.

6.6 ARTS, CULTURE AND HERITAGE
6.6.1 Planning Objectives

6.6.1.1 Maintain and Enhance our Cultural and Heritage Resources and Landscapes
The City will encourage the conservation, protection, and enhancement of the City's cultural heritage resources, including landscapes, archaeological sites, important views and vistas, buildings and structures of historic, cultural, and architectural value.

6.6.1.2 Encourage Quality Design

The City will encourage growth and development which promotes the protection and sympathetic treatment and use of heritage resources.

6.6.1.3 Recognize Districts with Cultural Heritage Attributes

The City will encourage the protection and awareness of the rich heritage of the City's Downtown area as well as the various ethnic cultures and neighbourhoods.

6.6.2 Policies

6.6.2.1 General Conservation

Conservation of landscapes, important views and vistas, sites, buildings or structures of cultural heritage, historical, architectural, or archaeological merit shall be encouraged throughout the City, wherever possible.

6.6.2.2 Advisory Committee

Heritage Welland shall be consulted on matters relating to heritage resources.

6.6.2.3 Heritage Inventory

The City shall maintain an inventory of buildings of architectural and/or historic interest for the purposes of designating, by By-law, selected properties for preservation and protection from alteration pursuant to the *Ontario Heritage Act*.

6.6.2.4 Use of Heritage Designations

Heritage features shall be appropriately designated using relevant provincial legislation including the *Ontario Heritage Act*, the *Planning Act*, the *Municipal Act* and other applicable statutory legislation in order to preserve and enhance the City's heritage resources.

6.6.2.5 Heritage Designations for Specific Properties

Individual properties and areas of unique cultural, architectural and historical significance may be recognized through designation pursuant to the *Ontario Heritage Act*.

6.6.2.6 Heritage Designations for Districts

Special studies may be undertaken for districts having heritage potential. Should an area represent a group of significant sites, buildings or structures, or period of the City's history, a Heritage Conservation District may be established pursuant to the *Ontario Heritage Act*. All new development within a Heritage Conservation District will be required to maintain the character of the area.

6.6.2.7 Conservation Easements

The use of a conservation easement registered on title of a property is encouraged if designation under the *Ontario Heritage Act* is not appropriate.

6.6.2.8 Alteration of Heritage Properties

Alterations may be made to properties designated by By-law as having historical significance provided that the alterations do not affect the reasons for the designation, are in keeping with the Policies of this Plan, and meet the requirements of the Zoning By-law, other City By-laws and applicable municipal and provincial policies and codes.

6.6.2.9 Partnership Funding for Heritage
Council shall endeavour to obtain funds for the conservation and restoration of buildings through all available sources with the assistance of applicable agencies such as the Ontario Heritage Foundation.

6.6.2.10 Regard for Heritage Resources during Development
All new development shall have regard for heritage resources by conserving, accommodating and incorporating heritage resources in development and redevelopment proposals. Existing landmark or heritage trees, tree lines, hedge lines, or fence lines shall be considered, evaluated, and where possible, integrated in the design of any development or redevelopment.

6.6.2.11 Retention of Designated Heritage Properties
Designated properties shall be retained as part of any new development or redevelopment to ensure that the heritage value of the building and/or lands is not compromised.

6.6.2.12 Public Works Compatibility with Heritage Resources
Consideration shall be given to the effects of public works and development on buildings, infrastructure, sites and areas of historical, architectural, scenic or archaeological importance prior to the approval of public works and proposals for development. At the discretion of the Manager of Planning and Development Services, emergency repairs to infrastructure within buildings, sites and areas of historical, architectural, scenic or archaeological importance may not require a permit.

6.6.2.13 Roadway Changes and Heritage Resources
In the extending of streets and other necessary road improvements, including realignment and widening, consideration shall be given to the impact of such extensions or improvements on heritage resources, especially the character of streetscapes.

6.6.2.19 Mobility and Accessibility Improvements to Heritage Buildings
The redevelopment of heritage buildings shall address the need to improve the accessibility and mobility for all individuals.

Definitions

Built heritage resources
One or more significant 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 the City, province or federal government.

Conserved
The identification, protection, use and/or management of cultural heritage and archaeological resources in such a way that their heritage values, attributes and integrity are retained. This may be addressed through a conservation plan or heritage impact assessment.

Cultural heritage landscape
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, mainstreets and neighbourhoods, cemeteries, trailways and industrial complexes of cultural heritage value.

Heritage attributes
The principal features, characteristics, context and appearance that contribute to the cultural heritage significance of a protected heritage property.

Protected heritage property
Real property designated under Parts IV, V or VI of the *Ontario Heritage Act*; heritage conservation easement property under Parts II or IV of the *Ontario Heritage Act*; and property that is the subject of a covenant or agreement between the owner of a property and a conservation body or level of government, registered on title and executed with the primary purpose of preserving, conserving and maintaining a cultural heritage feature or resource, or preventing its destruction, demolition or loss.

Significant
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.

2.3 Niagara Region Official Plan

The Niagara Region Official Plan (2014) contains several policies that provide guidance for the preservation of heritage properties in the Region. These include:

4.G Urban Growth

4.G.1.7 Promote the preservation and enhancement of cultural heritage resources.

10.C Creative Places

10.C.1.1 To support the identification and conservation of significant built heritage resources, significant cultural heritage landscapes and archaeological resources and areas of archaeological potential.

10.C.1.5 To conserve significant built heritage resources and cultural heritage landscapes within the unique community context of every site.

10.C.2.1.1 Significant built heritage resources and cultural heritage landscapes shall be conserved using the provisions of the *Ontario Heritage Act*, the *Planning Act*, the *Environmental Assessment Act*, the *Funeral, Burial and Cremations Act* and the *Municipal Act.*

10.C.2.1.2 The Region shares an interest in the protection and conservation of significant built heritage resources and encourages local municipalities to develop policies to protect and conserve locally significant built heritage resources and to utilize its authority under the *Ontario Heritage Act* to designate individual properties, cultural heritage landscapes and heritage conservation districts that are of cultural heritage value or interest.

10.C.2.1.3 Municipalities are encouraged to establish a Municipal Heritage Committee (MHC) to advise and assist Council on matters related to Parts IV and V of the *Ontario Heritage Act.* Local Councils may expand the role of this committee to advise and assist Local Councils on other matters of cultural heritage conservation.

10.C.2.1.4 Public works projects and plans undertaken or reviewed by the Region, where in the vicinity of significant built and/ or cultural heritage landscapes will be designed in a sensitive manner and will provide appropriate mitigation measures in both design and location to conserve, enhance and complement the existing significant built and/ or cultural heritage resources.

10.C.2.1.5 Where development, site alteration and/ or a public works project is proposed on or adjacent to a significant built heritage resource(s) or cultural heritage landscapes, a heritage impact assessment will be required. The findings of the assessment shall include recommendations for design alternatives and satisfactory measures to mitigate any negative impacts on identified significant heritage resources.

10.C.2.1.6 The Region encourages local municipalities to establish Cultural Heritage Landscapes policies in their official plans and identify Significant Cultural Heritage Landscapes for designation. The purpose of this designation is to conserve groupings of features (buildings, structures, spaces, archaeological sites and natural elements) with heritage attributes that, together form a significant type of heritage form, distinctive from that of its constituent elements or parts.

10.C.2.1.7 The local municipalities shall adopt official plan policies to conserve significant cultural heritage resources and ensure that development and site alteration on adjacent lands to protected properties will conserve the heritage attributes of the protected heritage property.

10.C.2.1.8 The Region will assist local municipalities with the preparation of Cultural Heritage Landscape Conservation Plans for Significant Cultural Heritage Landscapes that cross municipal boundaries or are of Regional interest.

10.C.2.1.9 The Region, in collaboration with local municipalities, will prepare and maintain a Regional Implementation Guideline for Significant Cultural Heritage Landscape Conservation.

Definitions:
Adaptive Re-use - means a change in use of surplus farm facilities on existing farms for approved non-farm uses that are compatible with the surrounding farming activities and are of a scale appropriate to the farm operation. Adaptive re-use is oriented to the preservation of heritage buildings and landscapes that would otherwise disappear as a result of their no longer being required for farm purposes.

Adjacent - means for the purposes of Cultural Heritage, those properties immediately abutting built heritage resources or a locally identified Cultural Heritage Landscape.

Built Heritage Resources - means one or more significant 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.

Conserved - means the identification, protection, use and/or management of cultural heritage and archaeological resources in such a way that their heritage values, attributes and integrity are retained. This may be determined through a Conservation Plan or heritage impact assessment as approved by the local municipality.

Cultural Heritage Landscapes - 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, mainstreets and neighbourhoods, cemeteries, trailways and industrial complexes of cultural heritage value.

Heritage Attributes - means the principal features, characteristics, context and appearance that contribute to the cultural heritage significance of a property protected under the *Ontario Heritage Act*.

Protected Heritage Property - means real property designated under Parts IV,V or VI of the *Ontario Heritage Act*; heritage conservation easement property under Parts II or IV of the *Ontario Heritage Act*, and property that is the subject of a covenant or agreement between the owner of a property and a conservation body or level of government, registered on title and executed with the primary purpose of preserving, conserving and maintaining a cultural heritage feature or resource, or preventing its destruction, demolition or loss.

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 person/ people.

2.4 Northwest Welland Secondary Plan Context

The Northwest Welland Secondary Plan Study will help the City of Welland accommodate growth by permitting urban land uses within this area. The Secondary Plan will establish an appropriate range and mix of land use designations to help achieve the City's vision to plan a complete and healthy community and support future urban growth.

2.5 Data Collection

During the Cultural Heritage Resource Assessment, all potentially-affected cultural heritage resources within the study area are subject to inventory. Short form names are usually applied to each resource type (e.g. barn, residence). Generally, when conducting a preliminary identification of cultural heritage resources, three stages of research and data collection are undertaken to appropriately establish the potential for, and existence of, cultural heritage resources in a geographic area.

Background historical research, which includes consultation of primary and secondary research sources and historical mapping, is undertaken to identify early settlement patterns and broad agents or themes of change in a study area. This stage in the data collection process enables the researcher to determine the

presence of sensitive heritage areas that correspond to nineteenth and twentieth century settlement and development patterns. To augment data collected during this stage of the research process, federal, provincial, and municipal databases and/or agencies are consulted to obtain information about specific properties that have been previously identified and/or designated as retaining cultural heritage value. Typically, resources identified during these stages of the research process are reflective of particular architectural styles, associated with an important person, place, or event, and contribute to the contextual facets of a particular place, neighbourhood, or intersection.

A field review is then undertaken to confirm the location and condition of previously identified cultural heritage resources. The field review is also utilized to identify cultural heritage resources that have not been previously identified on federal, provincial, or municipal databases.

Several investigative criteria are utilized during the field review to appropriately identify new cultural heritage resources. These investigative criteria are derived from provincial guidelines, definitions, and past experience. A built structure or landscape is identified as a cultural heritage resource that should be considered during the assessment if the resource meets one or more of the following criteria:

- It is 40 years or older[1];
- It is a rare, unique, representative or early example of a style, type, expression, material or construction method;
- It displays a high degree of craftsmanship or artistic merit;
- It demonstrates a high degree of technical or scientific achievement;
- The site and/or structure retains original stylistic features and has not been irreversibly altered to destroy its integrity;
- It has a direct association with a theme, event, belief, person, activity, organization, or institution that is significant to the City of Welland, the Province of Ontario, Canada, or the world heritage list;
- It yields, or had the potential to yield, information that contributes to an understanding of the City of Welland, the Province of Ontario, Canada, or the world heritage list;
- It demonstrates or reflects the work or ideas of an architect, artist, builder, designer, or theorist who is significant to the City of Welland, the Province of Ontario, Canada, or a world heritage site;
- It is important in defining, maintaining, or supporting the character of an area;
- It is physically, functionally, visually, or historically linked to its surroundings;
- It is a landmark;
- It illustrates a significant phase in the development of the community or a major change or turning point in the community's history;
- The landscape contains a structure other than a building (fencing, culvert, public art, statue, etc.) that is associated with the history or daily life of that area or region; or
- There is evidence of previous historical and/or existing agricultural practices (e.g. terracing, deforestation, complex water canalization, apple orchards, vineyards, etc.).

[1] This criterion is according to the MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes http://www.forms.ssb.gov.on.ca/mbs/ssb/forms/ssbforms.nsf/GetFileAttach/021-0500E~1/$File/0500E.pdf. Apart from the Summerlea VLA Subdivision, this criterion has not been used for the Northwest Welland Secondary Plan due to the presence of a great number of buildings that were constructed between 1934 and 1978. To provide greater focus on potentially significant cultural heritage resources, 1934 has been used as a threshold due to the presence of aerial photography of the study area from that year.

If a resource satisfies an appropriate combination of these criteria, it will be identified as a potential cultural heritage resource and is subject to further research where appropriate and when feasible. Typically, further historical research and consultation is required to determine the specific significance of the identified cultural heritage resource. When identifying cultural heritage landscapes, the following categories are typically utilized for the purposes of the classification during the field review:

Farmscapes:	comprise two or more buildings, one of which must be a farmhouse or barn, and may include a tree-lined drive, tree windbreaks, fences, domestic gardens and small orchards.
Roadscapes:	generally two lanes in width with absence of shoulders or narrow shoulders only, ditches, tree lines, bridges, culverts and other associated features.
Waterscapes:	waterway features that contribute to the overall character of the cultural heritage landscape, usually in relation to their influence on historic development and settlement patterns.
Railscapes:	active or inactive railway lines or railway rights of way and associated features.
Historical Settlements:	groupings of two or more structures with a commonly applied name.
Streetscapes:	generally consists of a paved road found in a more urban setting, and may include a series of houses or commercial buildings that would have been built in the same time period.
Historical Agricultural Landscapes:	generally comprises a historically rooted settlement and farming pattern that reflects a recognizable arrangement of fields within a lot and may have associated agricultural outbuildings and structures.
Cemeteries:	land used for the burial of human remains.

3 HISTORICAL CONTEXT

3.4 Introduction

This section provides a summary of historical research and a description of identified above ground cultural heritage resources that may be affected by the proposed undertaking. A review of available primary and secondary source material was undertaken to produce a contextual overview of the study area, including a general description of Euro-Canadian settlement and land use. Historically, the study area is located within the Township of Thorold in Part of Lots 174-176, 226-228, and 233-236.

3.5 Physiographic Setting

The study area is located within the Haldimand Clay Plain physiographic region (Chapman and Putnam 1984:156-159), which is among the largest of the 53 defined physiographic regions in southern Ontario, comprising approximately 3,500 square km (MacDonald 1980:3). Generally, this region is flat and poorly drained, although it includes several distinctive landforms including dunes, cobble, clay, and sand

beaches, limestone pavements, and back-shore wetland basins. Within this part of the Niagara peninsula, several environmental sub-regions have been described, including the Niagara Slough Clay Plain, the Fort Erie Clay Plain, the Calcareous Rock Plain (Onondaga Escarpment), the Buried Moraines, the Lake Erie Coast, and the Niagara River Valley (MacDonald 1980). The distribution and nature of these sub-regions, and the specific environmental features they contain, have influenced land use in the region throughout history and pre-history.

3.6 Township Survey and Settlement

3.6.1 Township of Thorold

The land that comprises the geographic Township of Thorold was alienated by the British from the native Mississaugas by an "indenture" dated May 22, 1784. Through this purchase, the British obtained much of the land which now includes the Niagara Region, lying to the west of the reserved strip along the Niagara River which the Crown had possessed since 1763. The sale was officially ratified by Treaty number 3, dated at Navy Hall on December 7, 1792 (*Indian Treaties* vol. 1:5-7).

Between 1784 and 1791, this part of southern Ontario formed part of the Nassau District in the judicial District of Montreal in the Province of Quebec. In 1791, the old Province of Quebec was divided into Upper and Lower Canada, and in 1792 the old District of Nassau was renamed as the Home District of Upper Canada (Armstrong 1985:137ff).

Thorold Township was originally included within Lincoln County in the original Home District. York was selected as the unofficial capital of Upper Canada in the winter of 1796, but it was not until February 1798 that it was selected by the Duke of Portland to be the "seat of Government on mature deliberation" (Firth 1962:24, 47).

The first settlers are believed to have taken up their land in Thorold around 1787-88. At that time, the purchase price for "wild land" was estimated at seven pence per acre. The first township survey was not undertaken until a few years later in 1788. At that time, Thorold had not yet been named and it was simply known as "Township No. 9." A statement of expenses submitted to the Surveyor General's department for the work in Thorold showed the survey was done at least in part by Augustus Jones. This initial work was carried out between August 24 and October 19 of that year. The names of the assistants (chain bearers and axe men) are given: Joseph Jones, Benjamin Stanton, Benjamin Johnson, Isaac Hany, Hugh Wilson, David Damude, Dirk VanEvery, and George Hanceler. These men were recruited from the vicinity where the survey was being carried out, and several of them were Loyalist settlers and the disbanded men from Butler's Rangers. The miscellaneous expense of "ferriage" was included, for a total cost of £42.12.0 NYC. Jones continued to be employed in "making out the Plans of the Townships of this Settlement" in the late autumn of 1791, which included a "List of reduced Provincial Troops" settled in the area, as well as reports on features "towards the public utility" such as water falls, minerals and/or quarries, and the quality of the timber etcetera (Fraser 1906:346, 388-389, 426-427).

The "Land Board" for the District of Nassau was established ("constituted") under orders from Lord Dorchester in October 1788. The six Board members were to meet at Navy Hall "immediately after the January Quarter Sessions" of 1789. The main duties of this Board were to "examine the loyalty but more particularly into the character" of all prospective settlers, to administer the oath of allegiance to each settler/claimant, and to issue a location ticket for land to which each family was entitled. The Board continued to receive instructions and correspondence with respect to their duties, and as a result their first regular meeting was not held until late October 1789. The Land Board meeting which allotted specific

farm lots to settlers in Thorold was held on February 10, 1791. Much of the business of the local Land Boards had been completed and they were subsequently disbanded under instructions from John Graves Simcoe in November 1794. Thereafter, the business formerly carried out by the Boards was transferred to the Land Committee of the Executive Council.

Thorold acquired its present name in 1792, and it was probably named in honor of Sir John Thorold (1734-1815), who was a representative for Lincolnshire in the House of Commons. This family had been in Grantham in Lincolnshire since "before the Conquest," and at their (then) family seat since the mid-fourteenth century (Gardiner 1899:276-277; Armstrong 1985:147; Rayburn 1997:342-343).

In 1799, a provincial *Gazetteer* noted that Lincoln County was "a fine and populous settlement, consisting of twenty townships, containing about 6,000 souls, and furnishing five battalions of militia." Thorold was simply referred to as a township "south of Grantham, and is watered by the Welland River." A near contemporary who compiled a similar work a few years later plagiarized the earlier publication but added his own observations. He noted that Thorold was "well watered, and promises speedy settlement" (Smith 1799:29, 144, 65; Boulton 1805:49, 89).

Settlement in Thorold advanced at a pace that was roughly equal to that seen in the other nearby townships in the county. Most of the early settlement and land allotment was made to Loyalists and disbanded soldiers from Butler's Rangers. Several of the farms within the township suffered damage to fences and crops, and from plunder, during the Battle of Beaver Dams in June 1813. The subject property would have been located a short distance to the south-west of the main battlefield site and the spot where the American forces capitulated under the command of Colonel Boerstler.

The remainder of the population during the nineteenth century was comprised of "Canadians" (i.e., the descendants of the original United Empire Loyalists) and other "American" émigrés, as well as those of Irish, Scotch, English and Welsh background.

By 1846, approximately 49 percent of the privately-owned land in Thorold Township was under cultivation. The township was referred to as one of the "best settled townships in the Niagara District, containing a great number of excellent, well cleared farms." The land was described as "rolling," and well adapted to growing wheat, oats, barley, rye and other crops. At that time, the township contained eight grist mills and five saw mills. The population stood at 2,284 and the total assessment for property was £49,699 (Smith 1846:191).

3.6.2 City of Welland

The city's existence is owed to the construction of the first Welland Canal, completed in 1829 (Mika and Mika 1983). An aqueduct was constructed where the canal and the Welland River crossed. A settlement grew around this structure and the city retained the name of "Aqueduct" until 1842 when it was renamed "Merritsville" in honour of William Hamilton Merritt of the Welland Canal Company. By 1858, the settlement would be renamed once again to "Welland."

Many of Welland's first inhabitants were Irish immigrants and escaped slaves from the United States and were employed to construct the canal. Additional labourers came when the wooden aqueduct was upgraded to a stone aqueduct in 1850. The permanent population was around 150 people at this time. Industries were largely dependent on the canal, and in 1851 included two sawmills, two grist mills and a cloth factory (Mika and Mika 1983). The community was made the judicial seat of Welland County in 1855, was incorporated as a village in 1858 and a town in 1878. By this time, the population was

approximately 1900 people. Along with the canal, the town had railway stations for both the Welland Railway and Canada Southern.

The third and fourth Welland Canals were constructed in 1887 and 1932 respectively (with a Welland by-pass constructed in 1967). The fourth canal allowed for vessels up to 730 feet long to traverse between Lake Erie and Lake Ontario. Welland became a city in 1917. The canal and railways attracted numerous industries producing steel and rubber products.

The City of Welland, as it exists today, was created in 1970 with the annexing of the Townships of Crowland, Humberstone and Thorold.

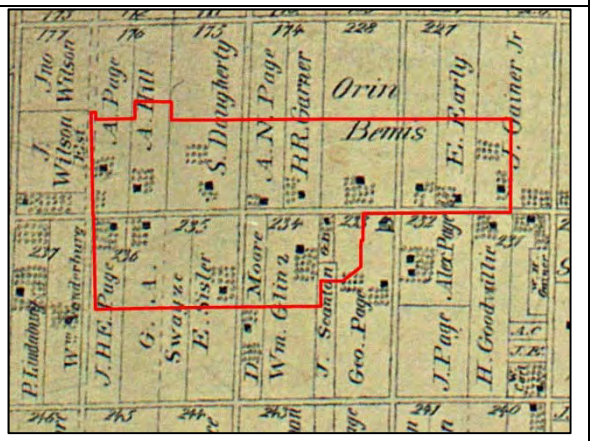
3.4 Land Use History

Several property owners and historical features are illustrated within the study area on the earliest maps featured in this study: the 1862 *Tremaine's Map of the Counties of Lincoln and Welland*, *Canada West* and the 1876 *Illustrated Historical Atlas of the Counties of Lincoln and Welland, Ont.* The maps reviewed record the names of owners/occupants of properties within the study area, as well as the location and arrangement of residences, farmhouses, churches, schools and other key resources. It should be noted, however, that not all features of interest were mapped systematically in the Ontario series of historical atlases, given that they were financed by subscription, and subscribers were given preference regarding the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases.

The 1862 *Tremaine* map provides limited information about the study area. The owner of each property is noted along with the layouts of Clare Avenue/Line Avenue, Rice Road, First Avenue and Quaker Road. While all ten lots are attributed to owners, only three buildings are noted in the study area on properties owned by J.H.E. Page (Lot 236), Thomas Spencer (Lot 236), and Orin Bemis (Lot 228).

The 1876 *Illustrated Atlas* map provides additional information about the study area, depicting land ownership, the location of houses and orchards. When compared to the 1862 *Tremaine* Map it is notable that several properties have changed hands over the years and the rural character of the area becomes apparent. Farmsteads exist on many of the properties within the study area. Details of historical property owners and features in the study area are listed in Table 1 and a more detailed historical overview of the evolution of each lot from 1876 to 2018 is provided in Sections 3.4.2 to 3.4.11.

Table 1: 1862 *Tremaine Map* and 1876 *Illustrated Atlas* details

	1862 *Tremaine Map*		1876 *Illustrated Atlas*	
				
Lot	Owner	Historical Features	Owner	Historical Features
174	Levi Page	N/A	A.N. Page	House on Quaker Road with orchard
	R.S. Garner	N/A	R.R. Garner	House on Quaker Road with orchard
175	J.H. Smith	N/A	S. Daugherty	House on Quaker Road with two orchards
176	Aaron Page	N/A	A. Page	House on Clare Avenue with two orchards
	Andrew Hill	N/A	A. Hill	House on Quaker Road with orchard
22 6	Jacob Gainor Jr.	N/A	J. Gainer Jr.	House on Quaker Road with three orchards
	Jacob Gainor	N/A		
227	Joseph Goodwills	N/A	E. Early	House on Quaker Road with orchard
			Orin Bemis	House on Quaker Road with orchard
22 8	Orin Bemis	House on Quaker Road	Orin Bemis	House on Quaker Road with orchard
233	A. Page	N/A	George Page	House noted at corner of Quaker Road and First Avenue. Additional home located along First Avenue. Two orchards.
	E. Lawson	N/A	J. Scanlon	N/A
			G. B.	House on Quaker Road with orchard
234	William Spencer	N/A	William Glinz	House on Quaker Road with orchard
			D. Moore	House on Quaker Road with two orchards
235	A. Killman	N/A	E. Sisler	House on Rice Road with orchard
			G.A. Swayze	N/A
236	J.H.E. Page	House on Quaker Road	G.A. Swayze	House on Quaker Road with orchard

	Thomas Spencer	House on Quaker Road	J.H.E. Page	House on Quaker Road with orchard

In addition to nineteenth-century mapping, historical topographic mapping and aerial photographs from the twentieth century were examined. This report presents maps and aerial photographs from 1907, 1934, and 1973. These do not represent the full range of maps consulted for this study but were judged to cover the full range of land uses that occurred in the area during each period.

In the early 1900s, a standardized system of topographic mapping was developed, officially known as the National Topographic System. These maps provide a snapshot of buildings, environmental features, roads, railways and other infrastructure. Several maps were created that depict the study area and the following are a select few that are intended to display the evolution of the study area.

The 1907 NTS map displays the rural character of the study area (Figure 3). Only ten buildings are noted withinstudy area. The area has been largely cleared of trees, particularly when compared to areas to the north and south, providing further evidence of farmland development. A small creek is visible in the eastern portion of the study area.

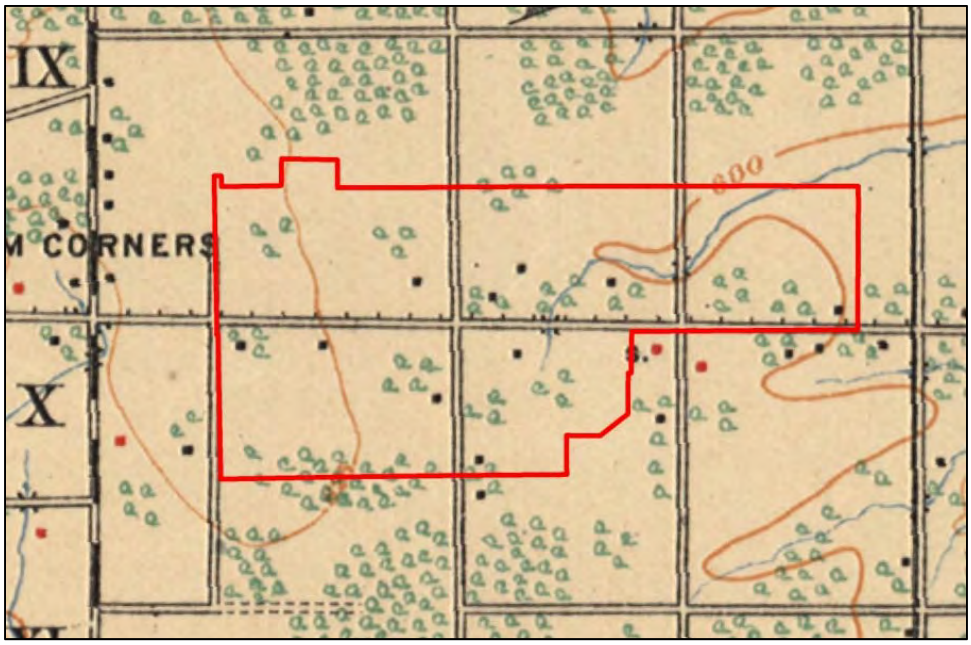


Figure 3: 1907 NTS Map (Department of Militia and Defence 1907)

The earliest aerial photo of the study area dates to 1934. The image provides a snapshot of the farms and orchards that were depicted in the 1876 *Illustrated Atlas* map. Many farmhouses and orchards depicted in the earlier map remain on the aerial photo (for a more detailed lot-by-lot analysis see Sections 3.4.2 to 3.4.11). Compared to the 1907 map, the study area appears to contain additional buildings. The photo also depicts the importance of Quaker Road as an arterial roadway, with nearly all properties oriented towards the road and connected to Quaker Road with driveways. The Niagara, St. Catharines and Toronto Railway is visible parallel to Clare and Line Avenues. Furthermore, the area remains largely devoid of dense vegetation unlike the woodlots that are particularly visible to the north of the study area. Additionally, a creek in the western portion of the study area is visible in the aerial photo.

Figure 4: 1934 Aerial photo (Brock University)

The 1973 NTS Map (Figure 5) shows several significant changes to the study area, most noticeably in the west where a residential subdivision (known as the Summerlea VLA Subdivision) has been constructed to the northeast of the intersection at Line Avenue and Quaker Road. Rows of residential buildings have been built along Quaker Road. The Niagara, St. Catharines and Toronto Railway is noted parallel to Clare and Line Avenues. A large greenhouse is depcited on the easternmost portion of the study area. Two creeks are present, one north of Quaker Road and visible on previous maps and aerial photos, and a second in the south portion of the study area.

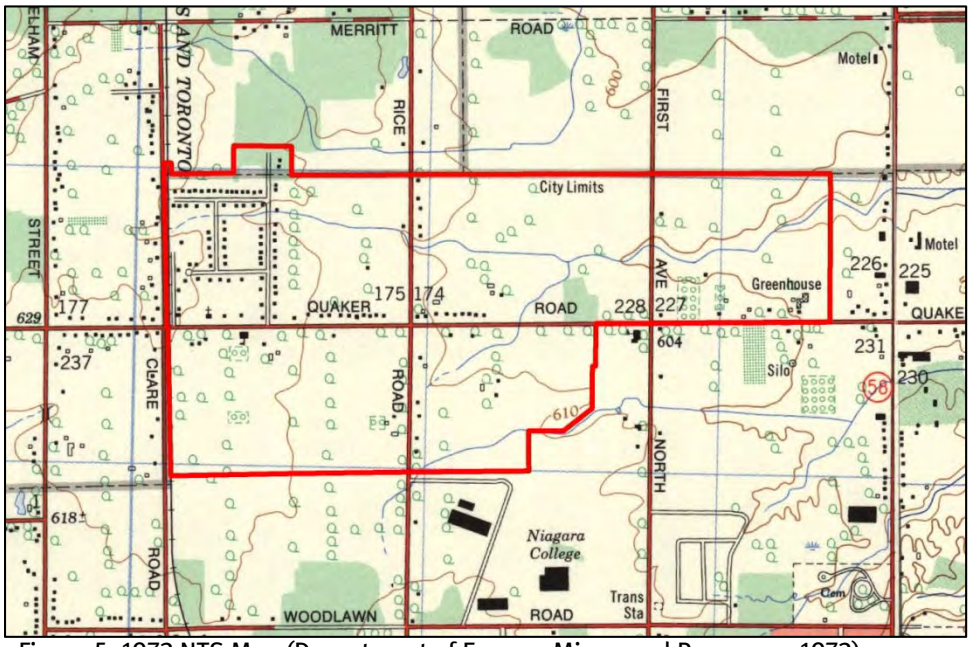


Figure 5: 1973 NTS Map (Department of Energy, Mines and Resources 1973)

3.4.1 Quaker Road

Quaker Road (Figure 6) was originally situated on land owned by Hon. Robert Hamilton, a wealthy Queenston merchant who purchased 7,900 acres in Welland County in 1799 (Betti 1967). The road's name stems from the number of Quakers who chose to settle in the southern part of Thorold Township and in nearby Pelham Corners. A school has been located on this road since 1816, the first being a log school building on Lot 174. Later, a brick schoolhouse was built on Lot 233 in 1861, where Quaker Road Elementary School is located today. In 1926, the road became the first improved road in Thorold Township and the west end was paved in 1950. Except for the addition of post-WWII detached homes, the road has largely preserved its rural character to this day.

Figure 6: Looking west on Quaker Road c.1920. (Goodwillie 2005)

3.4.2 Lot 176

1876 1934 2018

Lot 176 was split into two parcels by 1876, owned by A. Page and A. Hill. Each had a house with a surrounding orchard. Additionally, Mr. Page had a second orchard near the modern-day intersection of Quakers Road and Line Avenue. Mr. Page and his family were Quakers who owned five properties along Quaker Road by 1876. First Avenue was originally known as Page Road and nearby Page Drive is named after the family (Goodwillie 2005).

In 1934, the Page farmhouse is visible on the west side of the lot along Line Avenue with an orchard in the rear. The narrow strip of land between Line Avenue and the farm's driveway was the location of the Niagara, St. Catharines and Toronto Railway, which was an electric railway that operated from 1899 to 1959. Two building complexes are visible to the south along the main driveway. Plowed fields and another orchard are adjacent to these buildings. Along Quaker Road are two additional houses, suggesting that parcels of land had been subdivided and sold. On the east side of the lot, a complex of buildings is present on the 1876 location of Mr. Hill's farmhouse and accessed by a long straight driveway from Quaker Road. A second house is situated on Quaker Road. This half of the lot features plowed fields, the potential remnants of an orchard and a woodlot to the north, which extends to modern-day Merritt Road.

Today, Lot 176 consists of residential houses within a subdivision built between 1942 and 1954. This subdivision is known as the Summerlea VLA Subdivision (Figure 7 to Figure 9)**Error! Reference source not found.** and was constructed as housing for veterans of World War II under the *Veterans' Land Act*. According to the original plans for the neighbourhood (Figure 10), the first twelve properties were constructed by four architecture firms: Humphrys, Rule-Wynn-Rule, Van Norman, and Moody & Moore. All these firms except for Humphrys were notable Canadian architecture firms. The properties were divided into half-acre lots, with some corner lots expanded to 0.7 acres. The roads were constructed with crushed stone and the area's water supply came from a central well.

Figure 7: 54 Montgomery Road in the Summerlea VLA Subdivision in 1948 (Summerlea Association)

Figure 8: 54 Montgomery Road in 2018 with garage and rear addition. (Google)

Figure 9: The Summerlea VLA Subdivision in 1950 (Summerlea Association)

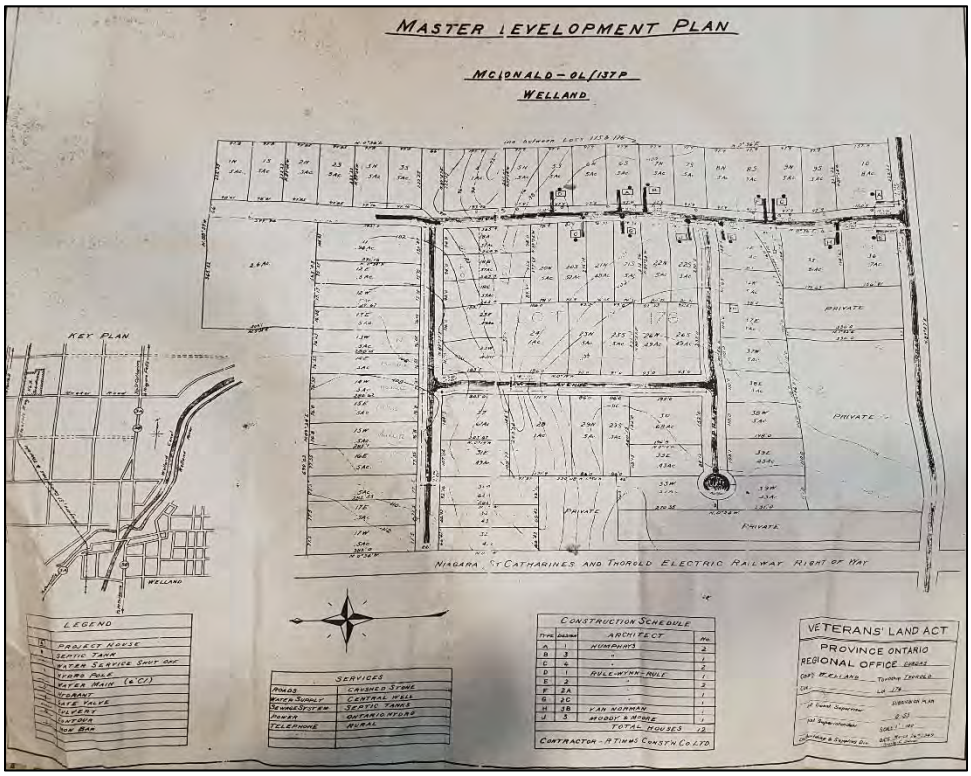


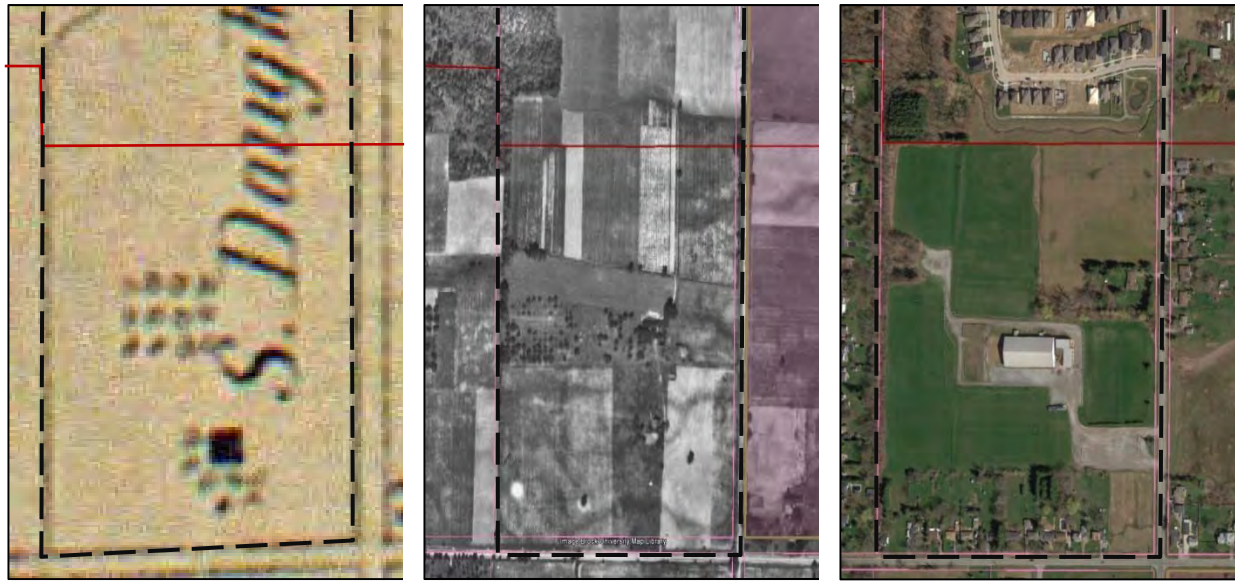
Figure 10: 1949 Plan of Subdivision for the Summerlea VLA Subdivision (Summerlea Association)

On the west side of the lot, the 2018 aerial photo shows a house on the site of the original Page farmhouse. However, this house is a new construction, as the original farmhouse was demolished in 2016. The original driveway is present today in the form of a small sideroad, now known as Milkweed Trail, while the original railway line has been converted into a recreational trail. The houses associated with the two building complexes visible along the driveway in 1934 are present in 2018 and known today as 72 Milkweed Trail and 672 Quaker Road. Furthermore, of the two buildings located on Quaker Road in 1934, only 638 Quaker Road remains today. None of the three extant buildings appear on the early NTS Maps but appear in the 1934 aerial photo. On the east portion of the lot, the complex of buildings associated with the Hill farm has been reduced to a single residential building at 19 Topham Boulevard,

which has been integrated into the subdivision. Additionally, the house at 624 Quaker Road, which is visible in 1934, appears to remain today.

The historical NTS mapping notes the presence of a church on the 1942 NTS map. The church is present on both the 1964 and 1973 NTS maps and historical aerial photos from Google suggest that it was removed prior to 2007. Other homes along Quaker Road were constructed in the post-war period.

3.4.3 Lot 175



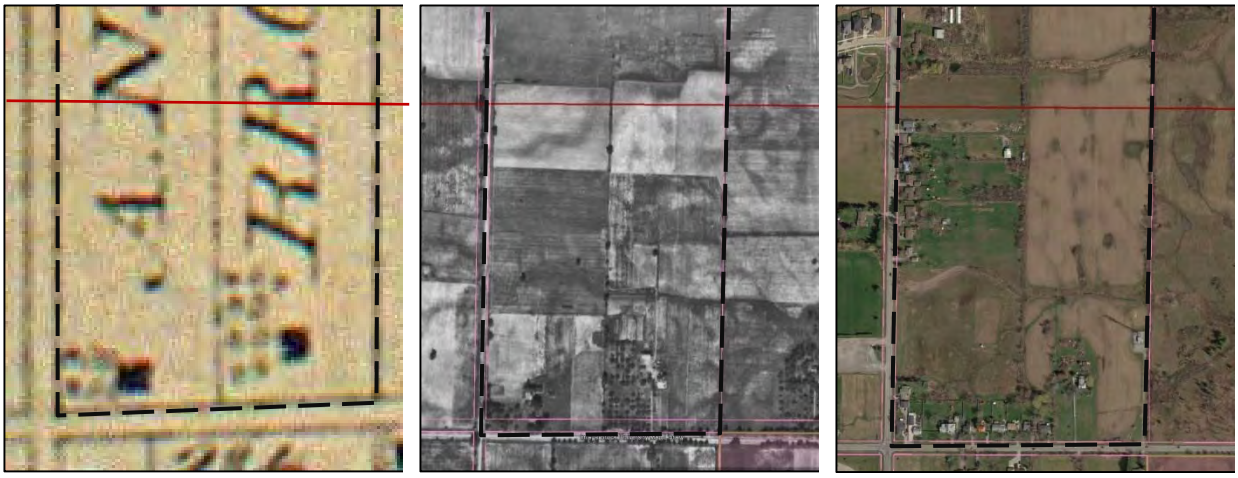
1876 1934 2018

Lot 175 was owned by S. Daugherty in 1876. The property consisted of a single farm house surrounded by an orchard, with an additional orchard to the north.

By 1934, both the farmhouse and an orchard are present on the property, along with agricultural fields. The property is accessed via a driveway that connects with Quaker Road, just west of Rice Road.

None of the previous associations with the Daughtery property are seen today, as the lot was home to the Welland Soccer Club for much of its recent history. Further, a row of residential buildings, built after World War II, front Quaker Road. An additional house has been built along Rice Road.

3.4.4 Lot 174



1876 1934 2018

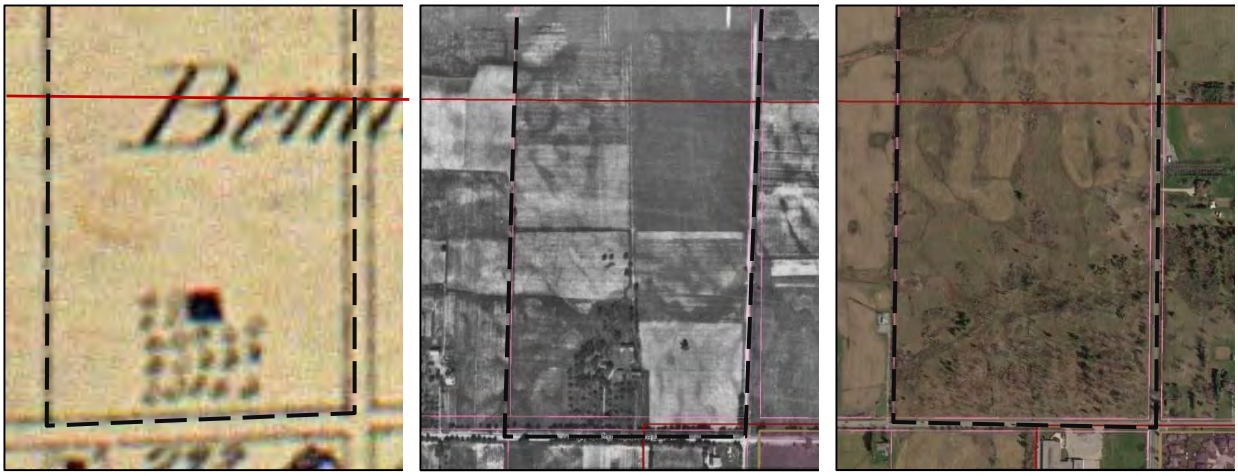
Lot 174 was divided into two properties owned by A.N. Page and R.R. Garner in 1876. The western half of the property contained the Page farmhouse and a small orchard at the corner of modern-day Quaker Road and Rice Road. The eastern half of the lot consisted of the Garner farmhouse and an orchard. The Garner Farm was home to Quaker Road's first school constructed in 1816. The school moved to Lot 233 in 1861 (Goodwillie 2005). In 1914, The Garner farm listed for sale in the Globe. The article described the property as follows:

> This farm is clay loam; very rich and suitable for growing all kinds of fruit including peachers, grapes and vegetables; there is a good orchard and plenty of wood to last 25 years, with good wells, etc.; there is a good house, barn, drive house, all lighted with electric lights; this farm lies parallel with the Niagara, St. Catharines and Toronto Trolley line (Globe 1914).

In 1934, the lot appears to be unchanged from its 1876 depiction. Both orchards are present, while agricultural fields are visible throughout the remainder of both properties. Both properties are accessed via driveways connected to Quaker Road. A small creek or ditch is visible to the north of the farmhouses. A line of vegetation separates the two halves of the lot.

By 2018, the Page farmhouse and its orchard have been removed and a row of residential buildings have been constructed along Quaker Road. An additional row of residential buildings has been constructed along Rice Road to the north. These residential buildings start to appear on the 1964 NTS map. The Garner farm at 436 Quaker Road is entirely intact with a farmhouse and outbuildings surrounded by an agricultural field. The buildings are accessed by a straight driveway that connects to Quaker Road. A radio tower has been constructed on the easternmost edge of the property. A small creek is visible to the north of the farm complex. The original line of vegetation separating the two halves of the lot remains visible.

3.4.5 Lot 228



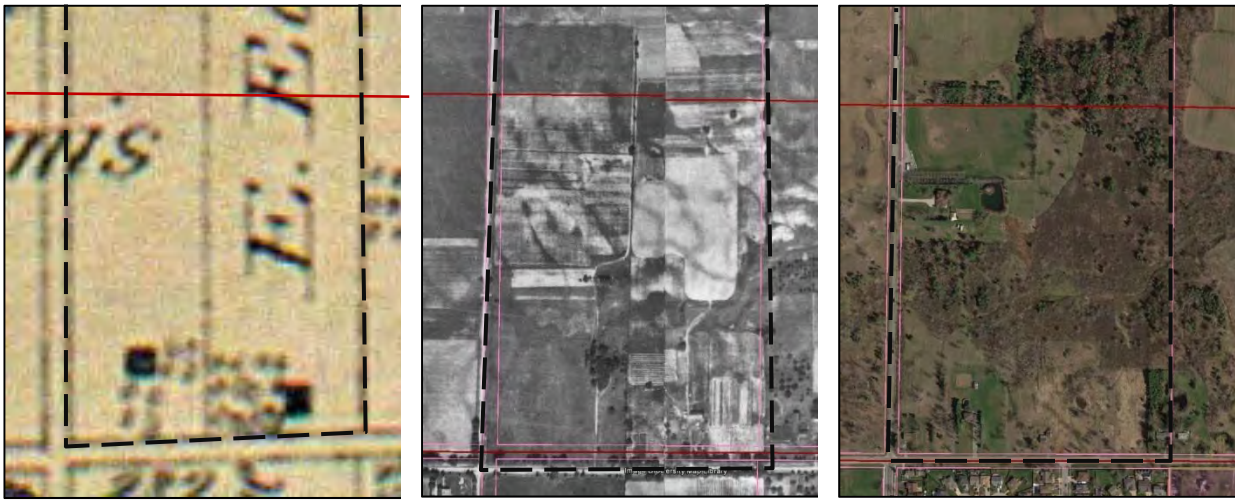
1876 1934 2018

In 1876, Lot 228 was owned by Orin Bemis, who also owned half of the adjacent Lot 227. His lot contained a farmhouse and an orchard along Quaker Road. Bemis died in 1886, and his son Harlan took over the farm, planting a vineyard and growing grains and fruit (Cruikshank 1887).

By 1934, the property appears largely unchanged from how it is depicted in 1876. The farm house is visible in the centre of the lot along Quaker Road, surrounded by an orchard and additional outbuildings. The driveway from Quaker Road led straight to the complex of buildings and beyond in a straight line to the north. The surrounding area consists of agricultural fields.

However, by 2018, all buildings associated with the Bemis farm have been removed from the property though foundation remnants are visible from the aerial photograph. No other interventions have been made to the lot.

3.4.6 Lot 227



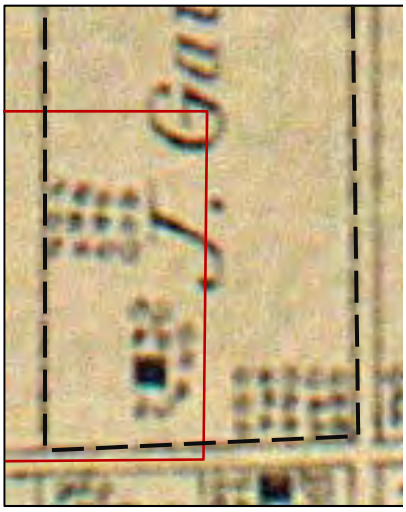
1876 1934 2018

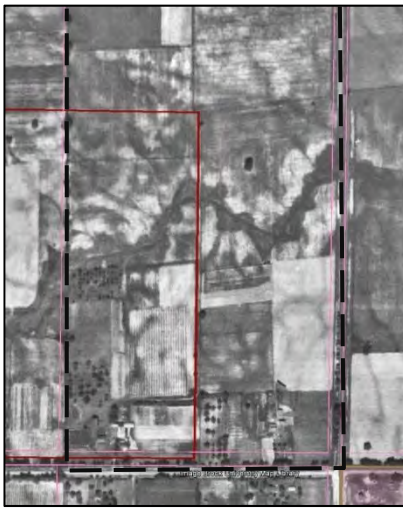
Lot 227 consisted of an extension of the Orin Bemis farm from Lot 228 and a farm owned by E. Early. Both farms featured farmhouses surrounded by orchards. Bemis purchased his portion of the lot from the Goodwillie family in 1852. The Goodwillie's original home burned down in 1837 and was rebuilt the following year with log beams and 3-inch thick planks (Goodwillie 2005). It is likely that this is the home that is visible on the 1876 *County Atlas*. After Bemis purchased the house, the Goodwillies moved to Lot 232 to a house that remains at 209 Quaker Road, located adjacent to the study area.

In 1934, the Bemis property comrpises a straight driveway from Quaker Road leading passed a group of trees towards a house. The driveway veers to the east and extends northward. The property consists of agricultural fields. On the Early Farm, the farmhouse from the 1876 map is visible in the south end of the property. A driveway from Quaker Road extends from the road to a large plowed field. A row of plantings is visible to the northwest of the house.

By 2018, there are no traces of either the Bemis property or the Early farm. The original driveway is visible, but no longer in use. According to Google Streetview, the original barn on the Early farm was demolished between 2012 and 215. The lot contains four houses along Quaker Road and a fifth residence on First Avenue. A small pond has been created behind this fifth residence. Much of the lot has not been maintained.

3.4.7 Lot 226


1876


1934

2018

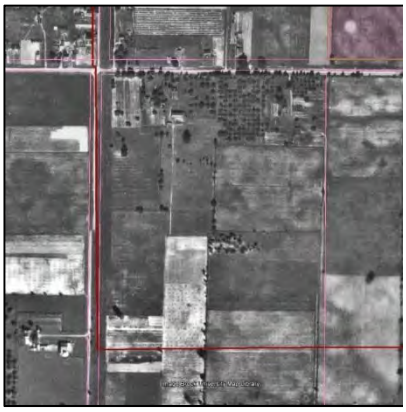
Lot 226 was owned by J. Gainer Jr. in 1876 and the portion of the lot within the Study Area contained a farmhouse surrounded by an orchard and a second orchard to the north. The Gainer family owned this property and the adjacent Lot 225 (the site of the modern-day Niagara Regional Exhibition fairgrounds and Welland Sports Complex).

In 1934, the Gainer Jr. Farm appears to be largely intact. A complex of farm buildings is visible on the same location as the farmhouse in 1876. Both orchards are present and there is visible evidence of farming throughout the property. A small creek is visible to the north of the farmed land and it appears that no farming has been conducted beyond the creek.

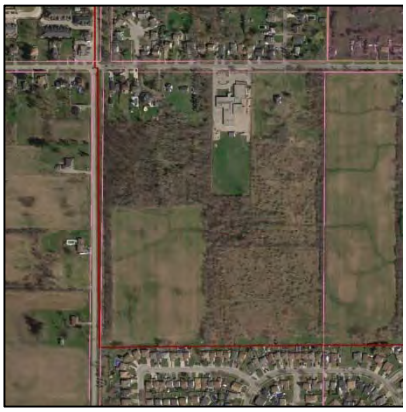
By 2018, there are no visible remnants of the Gainer Jr. farm. The lot does not appear to be maintained, apart from the northern edge of the Study Area, and a single residential building on the southwest corner of the lot along Quaker Road. The small creek remains visible.

3.4.8 Lot 236

1876



1934



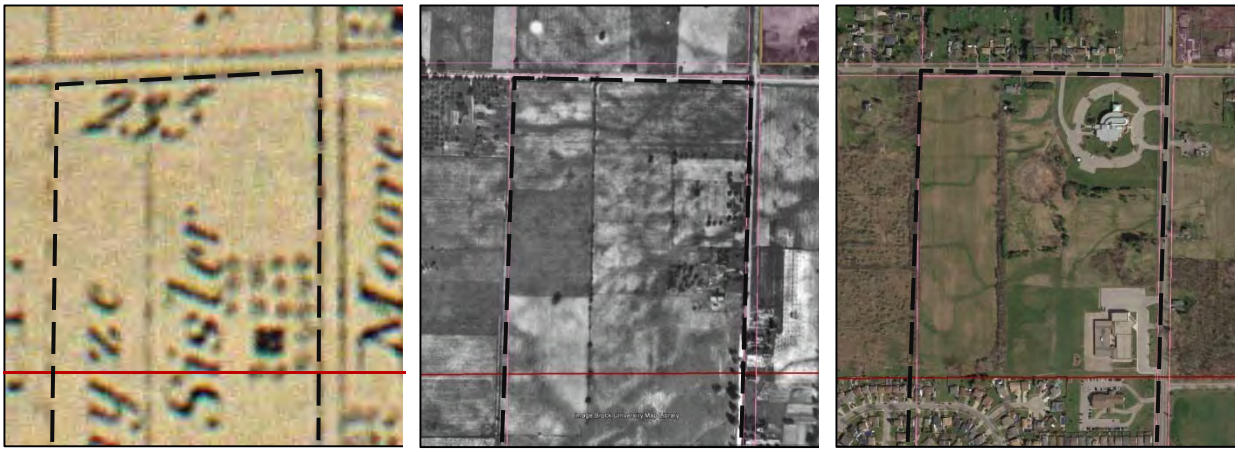
2018

In 1876, Lot 236 was divided in half with J.H.E. Page owning the western half and G.A. Swayze owning the eastern half. Both properties contained a farmhouse and orchard along Quaker Road. Historically, the property had been once owned by Robert Spencer who had purchased 400 acres on Lots 234, 235 and 236 around 1820. According to the Globe, Mr. Spencer's home became a frequent resting spot for American slaves on the Underground Railway (Globe 1899). It is unknown if there are any extant signs of this history today.

The lot in 1934 reflects the appearance depicted in 1876. Both the Page and Swayze farmhouses, outbuildings, and orchards are visible. The Page farm appears to have a second house. The Niagara, St. Catharines and Toronto Railway (an electric railway that operated from 1899 to 1959) is visible along the western edge of the lot.

In 2018, both the Page and Swayze farmhouses (at 661 Quaker Road and 607 Quaker Road, respectively) and the second Swayze farm house (653 Quaker Road) are still present. However, apart from an area to the south, the lot no longer appears to function as a working farm. Four residential buildings and an elementary school have been built along Quaker Road.

3.4.9 Lot 235



1876 1934 2018

In 1876, Lot 235 consists of the eastern extension of the Swayze Farm (as discussed in Lot 236) and the E. Sisler Farm. While no buildings are depicted on the Swayze property, the Sisler Farm contains a farmhouse and orchard along Rice Road. Historically, the property had been owned by Robert Spencer who had purchased 400 acres on Lots 234, 235 and 236 around 1820. According to the Globe, Mr. Spencer's home became a frequent resting spot for American slaves on the Underground Railway (Globe 1899). It is unknown if there are any extant signs of this history today.

The 1934 aerial photo shows the property much as it would have looked in 1876. The farmhouse and orchard are present along Rice Road, surrounded by agricultural fields. A line of vegetation demarcates the property boundaries within the lot.

By 2018, the Sisler farm is no longer intact. According to Google Streetview, the farmhouse was demolished between 2012 and 2014. The lot now contains an elementary school near the site of the former farmhouse and the Niagara Catholic District School Board's main office located at the corner of Quaker Road and Rice Road. A ring of trees associated with the Niagara Catholic District School is visible behind the Niagara Catholic District School Board's main office. One house has been constructed along Quaker Road. The original line of vegetation separating the two parts of the lot remains visible.

3.4.10 Lot 234

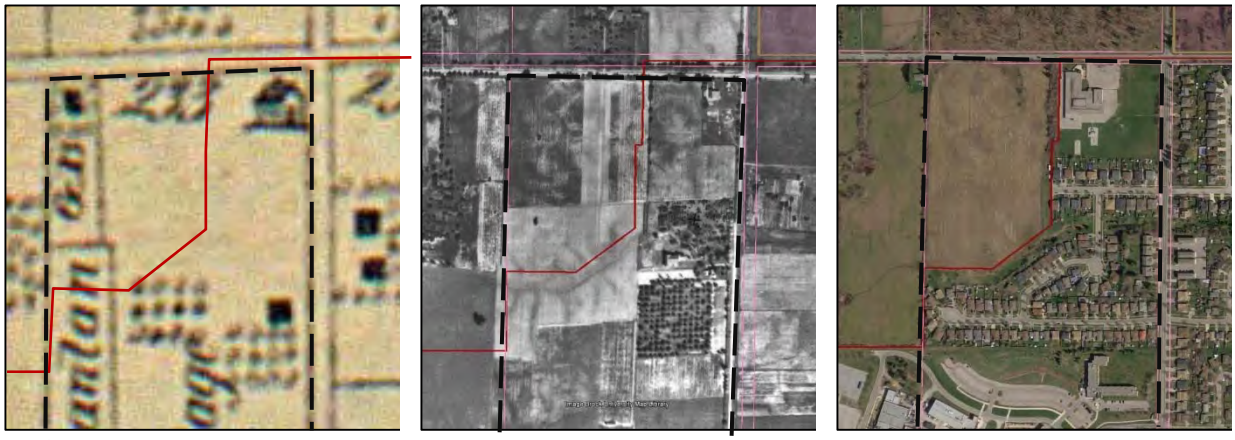
1876 1934 2018

In 1876, Lot 234 was divided into two properties, with a quarter of the lot owned by D. Moore and three quarters of the lot owned by William Glinz. The Moore farmhouse was located along Rice Road, and appears to be outside of the Study Area, though due to inaccuracies when drawing the map, it is possible that is was located within the Study Area boundaries. The Glinz farmhouse was set back considerably from Quaker Road in comparison to surrounding properties. The house was surrounded by an orchard. Historically, the property was owned by Robert Spencer who had purchased 400 acres on Lots 234, 235 and 236 around 1820. According to the Globe, Mr. Spencer's home became a frequent resting spot for American slaves on the Underground Railway (Globe 1899). It is unknown if there are any extant signs of this history today.

By 1934, the lot appears to be divided in the same way it had been in 1876, though a complex of buildings is now located along Rice Road in the southernmost portion of the Study Area, and the surrounding field has been plowed. A hedgerow divides the property from a property to the north, and an additional row of vegetation divides the original Moore property from the Glinz property. The Glinz farmhouse and its orchard are visible on the property with a tree-lined driveway extending from Quaker Road to the farmhouse and southward into the agricultural field.

In 2018, the lot has seen several changes since 1934. The complex of buildings along Rice Road have been removed and notable woodlot along Rice Road. Two additional houses have been built along Rice Road and four houses have been built along Quaker Road. The Glinz farmhouse has been removed though its foundations are visible in the aerial photograph. The driveway is intact and the vegetation that originally lined the driveway and surrounded the farmhouse in 1934 is present today.

3.4.11 Lot 233



1876 1934 2018

Lot 233 was divided into three properties. The westernmost portion of the lot was split by an owner labeled as "G.B." and J. Scanlan. The G.B. property contained a house. George Page owned the remainder of the lot, though his house and orchards were situated outside the Study Area on the current site of Niagara College. Page was the owner of several racehorses and his property contained a private track, which included a centre judged stand (Betti 1967).

By 1934, the lot within the Study Area does not contain any buildings or features and consists of an agricultural field.

The property appears largely unchanged in 2018. The original line of vegetation separating the lot from the adjacent Quaker Road Elementary School remains visible.

4 DATA COLLECTION RESULTS

To make a preliminary identification of existing built heritage features and cultural heritage landscapes within the study area and to collect any relevant information, the City of Welland's Municipal Register of Cultural Heritage Properties was consulted.

Other resources consulted for the preliminary identification of cultural heritage resources within the study area include:

- The Ontario Heritage Trust's Ontario Heritage Plaque Guide, an online, searchable database of Ontario Heritage Plaques[2]
- the Federal Heritage Buildings Review Office (FHBRO) [these properties are recognized under the Treasury Board Policy on the Management of Real Property (TBPMRP)][3]

[2] http://www.heritagetrust.on.ca/Resources-and-Learning/Online-Plaque-Guide.aspx [Accessed 17 April 2018]
[3] http://www.pc.gc.ca/progs/beefp-fhbro/roles/beefp-fhbro.aspx [Accessed 17 April 2018]

- Parks Canada's *Canada's Historic Places* website: available online[4], the searchable register provides information on historic places recognized for their heritage value at the local, provincial, territorial and national levels.
- Parks Canada website (national historic sites)[5]

In addition, Planning Staff in the City of Welland Planning Department were contacted to gather any relevant information regarding cultural heritage resources and concerns within the study area (by email communication, April 2018).

A field review was undertaken by ASI on 30 May 2018 and 18 June 2018 to document the existing conditions of the study area. The field review was preceded by a review of available, current, and historical aerial photographs and maps (including online sources such as Bing and Google maps). The existing conditions of the study area are described below. Identified cultural heritage resources are discussed in Table 2 and Table 3 of this report.

4.4 Northwest Welland Secondary Plan Study Area - Existing Conditions

The subject study area consists of 190 hectares in the City of Welland and has an irregular boundary consisting of land approximately 500m on either side of Quaker Road, roughly bounded by Clare Avenue and Line Avenue to the west and an eastern boundary approximately 200m west of Niagara Street. As a part of the Northwest Welland Secondary Plan, new zoning and land-use designations will be proposed for the area.

The area is historically predominantly rural agricultural, and this rural character is still reflected in the existing conditions. Quaker Road is a rural roadscape composed of two lanes of divided vehicular traffic bordered by gravel shoulders and ditches. The roadway is lined with hydro poles, vegetation, and residences set back significantly from the road with adjacent active and remnant farmscapes. The study area consists of three cross streets (Clare Avenue/Line Avenue, Rice Road and First Avenue) and each exhibit similar conditions, though there are fewer residences along these streets than along Quaker Road. A post-WWII subdivision known as the Summerlea VLA Subdivision is present to the north of Quaker Road, east of Line Avenue. This neighbourhood consists of residential houses on wide lots, with generous front, rear and sideyard setbacks, no curbs or sidewalks and significant vegetation throughout the neighbourhood. The study area also includes two elementary schools and the Steve Bauer Trail.

[4] http://www.historicplaces.ca/en/home-accueil.aspx [Accessed 17 April 2018].
[5] http://www.pc.gc.ca/eng/progs/lhn-nhs/index.aspx [Accessed 17 April 2018]

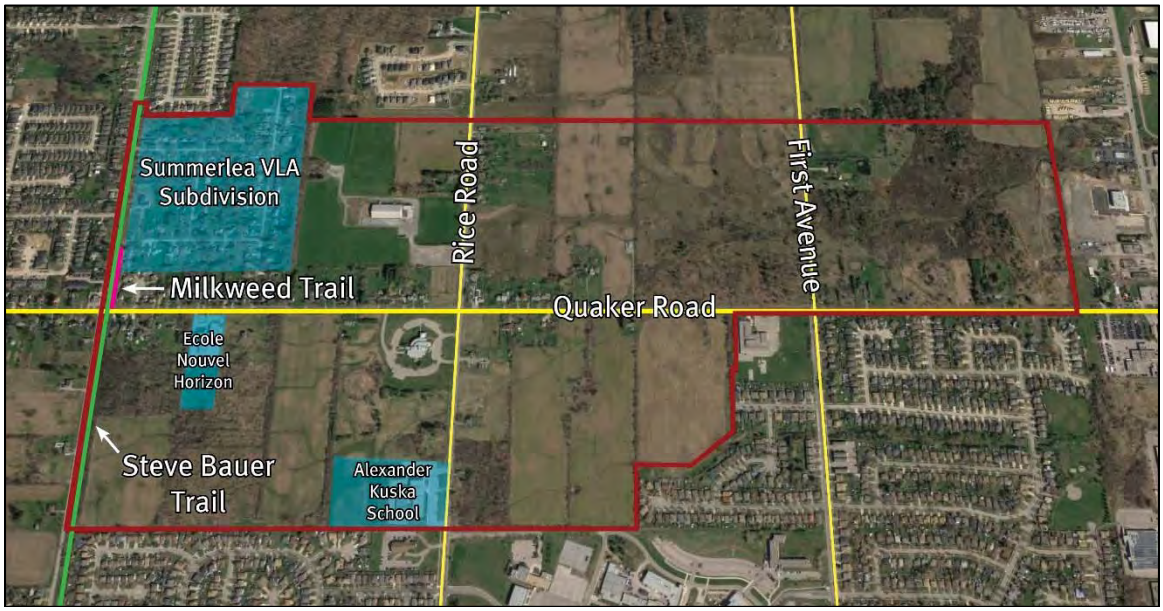


Figure 11: Northwest Welland Secondary Plan Study Area

4.2 Northwest Welland Secondary Plan – Identified Potential Cultural Heritage Resources

Based on the results of the background research and field review, there are 13 potential cultural heritage resources within the study area. See Table 2 for a summary of built heritage resources and cultural heritage landscapes, and Table 3 in Appendix A for a detailed description of these identified resources.

Table 2: Summary of Potential Cultural Heritage Resources in the Study Area

Feature	Location	Recognition	Description/Comments
BHR1	72 Milkweed Trail	Identified during field review	2-storey Edwardian residential building clad in vinyl siding with an enclosed porch.
BHR2	672 Quaker Road	Identified during field review	2-storey Edwardian residential building clad in vinyl with rear addition.
BHR3	638 Quaker Road	Identified during field review	1-storey residential building clad in vinyl siding.
BHR4	624 Quaker Road	Identified during field review	1.5-storey residential building clad in Angelstone.
BHR5	19 Topham Boulevard	Identified during field review	2-storey Edwardian residential building clad in vinyl with an enclosed porch. The building faces the west rather than addressing the street to the north.
BHR6	661 Quaker Road	Identified during field review	1.5-storey house with rear addition.
BHR7	653 Quaker Road	Identified during field review	2-storey residential building with stucco.
BHR8	607 Quaker Road	Identified during field review	2-storey farmhouse with front and side porches.

Table 2: Summary of Potential Cultural Heritage Resources in the Study Area

Feature	Location	Recognition	Description/Comments
CHL1	Quaker Road	Identified during field review	An east-west two-lane paved roadway, lined with vegetation, detached residences, schools and open fields.
CHL2	Milkweed Trail	Identified during field review	A north-south gravel one-to-two lane laneway providing access to four residential buildings. The laneway was originally a driveway for a farm that is no longer extant.
CHL3	Steve Bauer Trail	Identified during field review	A gravel trail which runs parallel to Line Avenue and Clare Avenue. The trail was originally the location of the Niagara, St. Catharines and Toronto Railway.
CHL4	436 Quaker Road	Identified during field review	1.5-storey residential building set back significantly from the road. A barn is situated to the northwest of the residential building
CHL5	Summerlea VLA Subdivision	Identified during field review	A post-WWII residential neighbourhood

5 CONCLUSIONS

The results of background historical research and a review of secondary source material, including historical mapping, revealed that the study area has a rural land use history dating back to the early nineteenth century. The field review confirmed that this area retains several nineteenth- and twentieth-century cultural heritage resources. The following provides a summary of the assessment results:

Key Findings

- No properties in the study area are currently recognized as heritage properties by the City of Welland.

- A total of 13 potential cultural heritage resources have been identified within the Northwest Welland Secondary Plan study area. These include eight potential built heritage resources and five potential cultural heritage landscapes;

- Identified potential cultural heritage resources may be historically, architecturally, and/or contextually significant rural and agricultural properties, which have emerged from their physiographic and natural heritage contextual setting, and contribute to land use patterns within the Northwest Welland Secondary Plan study area. These properties will require evaluations under Ontario Regulation 9/06 to determine if they contain cultural heritage value and merit designation under the Ontario Heritage Act.

6 RECOMMENDATIONS

The background research, data collection, and field review conducted for the study area determined that there are 13 potential cultural heritage resources located within the Northwest Welland Secondary Plan study area. These include eight potential built heritage resources and five potential cultural heritage landscapes. As a result of the research and analysis found in this report, the identified cultural heritage resources are potential candidates for conservation and integration into future land uses in the secondary

plan area, and their cultural heritage value should be determined via cultural heritage impact assessments during subsequent development planning applications.

As part of the development of policies for the Northwest Welland Secondary Plan, the following mitigation measures and/or alternative development approaches should be incorporated to reduce the potential for adverse impacts to potential cultural heritage resources in the area. Common mitigation protocols may include, but are not limited to, the following and are suitable for consideration and application for minimizing impacts on potential cultural heritage resources:

- Encouraging interim tenant occupancy for properties currently vacant to help ensure security and protection of heritage resources;
- Avoidance and mitigation to allow development to proceed while retaining potential cultural heritage resources in situ and intact;
- Adaptive re-use of a built heritage structure or cultural heritage resources;
- Alternative development approaches to conserve and enhance a significant heritage resource;
- Avoidance protocols to isolating development and land alterations to minimize impacts on significant built and natural features and vistas;
- Historical commemoration of the cultural heritage of a property/structure/area, historical commemoration by way of interpretive plaques;
- Documentation and salvage including the relocation of a structure or (as a last resort) the salvaging of its architectural components may be considered;
- Architectural design guidelines for buildings on adjacent and nearby lots to help integrate and harmonize mass, setback, setting, and materials;
- Limiting height and density of buildings on adjacent and nearby lots;
- Ensuring compatible lot patterns, situating parks and storm water ponds near a heritage resource;
- Vegetation buffer zones, tree planting, site plan control and other planning mechanisms;
- Allowing only compatible infill and additions;
- Preparation of cultural heritage impact assessments for all developments affecting a cultural heritage resource;
- Preparation of conservation, restoration and adaptive reuse plans as necessary;
- Heritage Designation, Heritage Conservation Easement; and
- Preparation of security plan and/or letter of credit to help ensure security and protection of heritage resources.

Based on the results of the assessment, the following recommendations have been developed:

1. A total of 13 potential cultural heritage resources were identified within the Northwest Welland Secondary Plan study area. These include eight potential built heritage resources and five potential cultural heritage landscapes. The Northwest Welland Secondary Plan should incorporate policies that promote the conservation of any properties that have been determined to merit heritage recognition.

2. As the only existing stable neighbourhood in the study area, the qualities and characteristics of the Summerlea VLA Subdivision should be maintained and new adjacent development should be designed to ensure that these qualities and characteristics are not negatively impacted. These qualities and characteristics include the existing building typologies, setbacks (front, side and rear) and streetscape. Urban design guidelines that reflect the existing condition should be incorporated into the Secondary Plan for this area.

3. Identified potential cultural heritage resources may be historically, architecturally, and/or contextually significant properties, which have emerged from their contextual setting, and contribute to land use patterns within the Northwest Welland Secondary Plan study area. Accordingly, any proposed development on or adjacent to an identified potential cultural heritage resource should require a cultural heritage impact assessment to further assess the cultural heritage value of the identified potential cultural heritage resources, and to ensure that the cultural heritage resources in the study area are conserved. Any evaluation should include consideration of its historical and natural context within the City of Welland, and should include a comprehensive assessment of the design, historical, and contextual values of the property.

4. Upon the completion of the proposed Secondary Plan the following report should be updated to consider the potential impacts of these plans on the identified potential cultural heritage resources. Additional mitigation measures may be identified.

5. Should future work require an expansion of the study area, then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.

7.0 REFERENCES

Armstrong, Frederick H.
1985 *Handbook of Upper Canadian Chronology*. Toronto: Dundurn Press.

Betti, Michael
1967 *Township of Thorold: 1793 to 1967*. Toronto: Armath Associates in conjunction with Township of Thorold.

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

Cruikshank, Ernest Alexander
1887 *The History of the County of Welland Ontario*. Welland: Welland Tribune Printing House

Fraser, Alexander
1906 "Minutes and Correspondence of the Land Board, District of Nassau," *Third Bureau of the Archives Reports for the Province of Ontario* (1905.) Toronto: L.K. Cameron (King's Printer).

Gardiner, Herbert F.
1899 *Nothing But Name: An Inquiry into the Origin of the Names of the Counties and Townships of Ontario*. Toronto: George N. Morang & Co. Ltd.

The Globe
1899 "One Who Remembers… Brock" 16 September 1899. p4.
1914 "Classified Ad" 17 January 1914. p25.

Goodwillie, Diane.
2005 *Quaker Road: History, Stories and Goodwillie Genealogy*. Victoria BC: Trafford.

Macdonald, I.D.
1980 *Life Science Features of the Haldimand Clay Plain Physiographic Region*, Ontario Ministry of Natural Resources, Parks and Recreation Section, Central Region, Richmond Hill, Ontario.

Rayburn, Alan
1997 *Place Names of Ontario*. Toronto: University of Toronto Press.

Smith, David William
1799 *A Short Topographical Description of His Majesty's Province of Upper Canada in North America, to which is added a Provincial Gazetteer*. London: W. Faden.

Smith, William H.
1846 *Smith's Canadian Gazetteer*. Toronto: H. & W. Rowsell.

APPENDIX A: Northwest Welland Mapping of Potential Cultural Heritage Resources

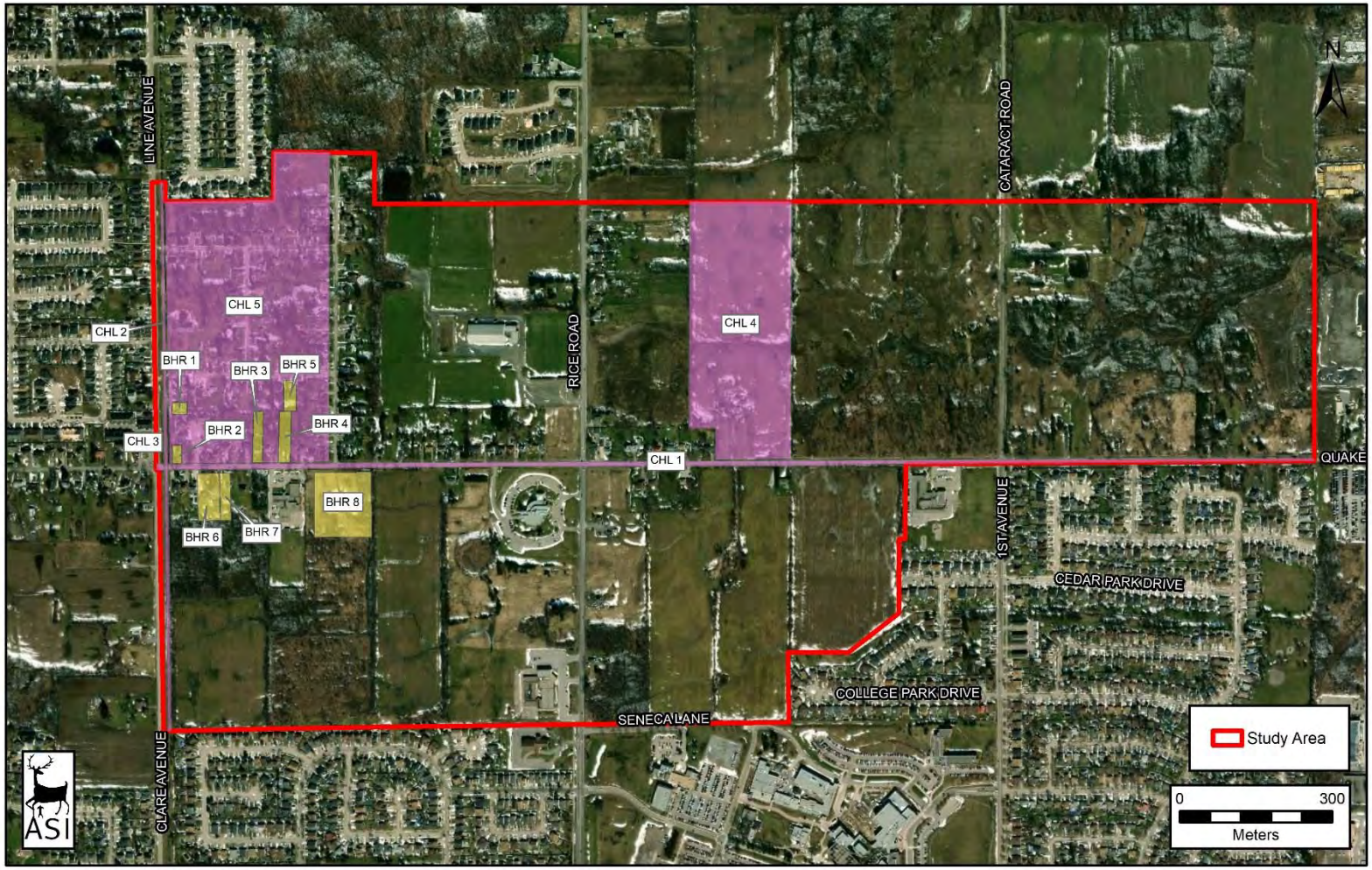


Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR1	72 Milkweed Trail	Identified during field review	Residential	Design: 2-storey Edwardian residential building with a hipped roof, two dormers, and an elevated front porch. The house was recently reclad in a stone veneer and siding likely coinciding with the construction of a new addition to the south side, which has changed the massing of the house. The windows are a mix of casement, double-hung and sliding. A two-door garage is located to the south with identical vinyl siding. History: Located in Lot 176, the property was owned by Aaron Page on the 1862 *Tremaine* map and 1876 *County Atlas*. The building was not the original farmhouse building on the property, which was located to the north. The building first appears on the 1934 aerial photo of the area. Context: The building is located within a post-WWII subdivision along a road that was the original farm driveway. Milkweed Trail runs parallel to a trail that was originally the Niagara, St. Catharines and Toronto Railway.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR2	672 Quaker Road	Identified during field review	Residential	Design: A 2-storey Edwardian residential building with a hipped roof, a veranda with a hipped roof, brick chimney and numerous irregular additions to the rear and to the second floor. The building is clad in vinyl and contains a mix of slider and double-hung windows. The property is accessed via a driveway connected to Quaker Road and has a large front lawn with the property boundary marked by a white picket fence. History: Located in Lot 176, the property was owned by Aaron Page on the 1862 *Tremaine* map and 1876 *County Atlas*. The building was not the original farmhouse building on the property, which was located to the north. The building first appears on the 1934 aerial photo of the area. Context: The building is located on the corner of Quaker Road and Milkweed Trail within a post-war subdivision along a road that was the original farm driveway. Milkweed Trail runs parallel to a trail that was originally the Niagara, St. Catharines and Toronto Railway.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR3	638 Quaker Road	Identified during field review	Residential	Design: A 1-storey residence with a gable roof and a front porch with columns and a gable roof. The house is clad in siding and has asphalt shingles. The property contains significant vegetation, preventing the house from being visible from the street. The property is accessed via a gravel driveway that connects with Quaker Road. History: Located in Lot 176, the property was owned by Aaron Page on the 1862 *Tremaine* map and 1876 *County Atlas*. The building was not the original farmhouse building on the property, which was located to the north. The building first appears on the 1934 aerial photo of the area. Context: Located on Quaker Road where a row of modern residences has been constructed.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR4	624 Quaker Road	Identified during field review	Residential	Design: A 1.5-storey residence with a hipped roof, wraparound porch and three dormers. The house is clad in siding and had an asphalt roof. History: Located in Lot 176, the property was owned by Andrew Hill on the 1862 *Tremaine* map and the 1876 *County Atlas*. The property's original farmhouse is to the north. This building first appears on the 1934 aerial photo of the area. Context: Located on Quaker Road where a row of modern residences has been constructed.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR5	19 Topham Boulevard	Identified during field review	Residential	Design: A 2-storey Edwardian residence with vinyl siding, a hipped roof, a single dormer, chimney and enclosed porch with a hipped roof. The building has a 1-storey rear addition. The building is oriented towards the neighbouring house and not Topham Boulevard. History: Located in Lot 176, the property was owned by Andrew Hill on the 1862 *Tremaine* map and the 1876 *County Atlas*. The building is located on the location of the early farmhouse, but its architectural style suggests that it may be a later building. Context: The property is located on Topham Boulevard, which is part of a post-war subdivision. The building is oriented towards the west, while its neighbouring houses are oriented towards the north, suggesting that the house was oriented as part of its earlier farm context.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR6	661 Quaker Road	Identified during field review	Residential	Design: A 1.5-storey residence with a 2-storey rear addition. The building incorporates cross gables and appears to have had a number of alterations and additions made to it. The front of the building is dominated by a veranda with a hipped roof. At least one dormer is visible from the street along with a brick chimney. A U-shaped driveway provides access to the residence. History: Located in Lot 236, the property was owned by J.H.E Page on the 1862 *Tremaine* map and on the 1876 *County Atlas*. The building is in the location of the original farmhouse building on the property. Context: The property is located on Quaker Road, which is largely comprised of residential properties set back from the road within a rural setting.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR7	653 Quaker Road	Identified during field review	Residential	Design: A 2-storey stucco residence with a 2-storey rear addition, gable roof, and front porch with enclosed second storey. The building appears to have both slider and double-hung windows. A gravel driveway connects the house to Quaker Road. History: Located in Lot 236, the property was owned by J.H.E Page on the 1862 *Tremaine* map and on the 1876 *County Atlas*. The building is in the location of a building present on the 1934 aerial photograph of the property. Context: The building is set back significantly from Quaker Road, which is a consistent condition amongst the post-war residential buildings on the street.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
BHR8	607 Quaker Road	Identified during field review	Residential	Design: A 2-storey Edwardian residence with a hipped roof, front and side porches with hipped roofs, dormer offset from centre, brick chimney and alterations to window and the creation of a second floor balcony. A gravel driveway leads to the house from Quaker Road. History: Located in Lot 236, the property was owned by Thomas Spencer on the 1862 *Tremaine* map and G.A. Swayze on the 1876 *County Atlas*. The building is in the location of a building present on the 1934 aerial photograph of the property, though it appears that there is a second residence on this aerial photo, which may have been the original farmhouse residence based on the architectural style of the existing house. Context: The building is setback considerably from the road in comparison to other residential buildings on Quaker Road. The property is adjacent to the Nouvel Horizon Elementary School and unlike the north side of Quaker Road and the south side condition to the west; the building is isolated and has no closely neighbouring residential buildings.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
CHL1	Quaker Road	Identified during field review	Streetscape	Design: A straight two-lane asphalt road oriented east-west with gravel shoulders with ditches on both sides of the road. The road is flat with residential buildings, vegetation and trees lining it. The road is sparsely populated except for the south side of the road between Niagara Street and First Avenue and the north side of the road between Line Avenue and Rice Road where subdivisions are located. History: The road's name stems from the number of Quakers who chose to settle in the southern part of Thorold Township and in nearby Pelham Corners. A school has been located on this road since 1816, the first being a log school building situated on Lot 174 and later a brick schoolhouse was built on Lot 233 in 1861, where Quaker Road Elementary School is located today. In 1926, the road became the first improved road in Thorold Township and the west end was paved in 1950. Context: Vehicle traffic along this section of road is low and there is no pedestrian traffic. It is located along a corridor between two urban boundaries (Pelham to the northwest and Welland to the south), with an expanse of agricultural lands to the north.	 (Images from Google Streetview)

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
CHL2	Milkweed Trail	Identified during field review	Streetscape	Design: An L-shaped one-to-two-lane gravel road starting at Quaker Road and running parallel with the Steve Bauer Trail and Line Avenue before connecting with Line Avenue. The entrance at Line Avenue contains two metal gates which are open and can be closed to traffic. The road is narrow as it is entered from Quaker Road, with fence and trees lining it. Beyond this point, the road widens to allow for two vehicles and narrows again before it bends towards Line Avenue. History: Milkweed Trail was originally a driveway for farmhouse located to the north. The original driveway extended beyond its current endpoint. At least two existing houses used the laneway for access as early as 1934. Context: Milkweed Trail primarily services four houses, and as such sees minimal vehicular or pedestrian traffic. The road runs parallel to the Steve Bauer Trail.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
CHL3	Steve Bauer Trail	Identified during field review	Railscape	Design: A straight gravel pathway running parallel to Line Avenue and Clare Avenue. History: Originally the location of the Niagara, St. Catharines and Toronto Railway, which operated between St. Catharines to Port Colborne from 1899 to 1959. Context: The trail is adjacent to Line Avenue and Clare Avenue and is part of a larger trail network in the area.	

Table 3: **Detailed Description of Cultural Heritage Resources in the Study Area**

Feature ID	Address	Heritage Status	Resource Type	Description/Comments	Photograph(s)
CHL4	436 Quaker Road	Identified during field review	Residential, farmscape	Design: A 1.5-storey residence with a gable roof, gable dormer and brick chimney. A wood barn is located on the property to the west of the residence. A straight driveway leads from the house to Quaker Road. History: Located in Lot 174, the property was owned by R.S. Garner on the 1862 *Tremaine* map and R.R. Garner on the 1876 *County Atlas*. The building is in the location of the original farmhouse building on the property. Context: The property is located on Quaker Road, and is one of the few remaining intact farm properties on Quaker Road. The building has a significant setback from the road that reflects its early rural character.	 (Image from Google Streetview)

CHL5	Summerlea VLA Subdivision	Identified during field review	Residential	Design: A neighbourhood consisting of residential buildings on wide lots, with significant setbacks from the street. The neighbourhood has narrow roads, no sidewalks or curbs and significant vegetation. History: The Summerlea VLA Subdivision was constructed after World War II. It was constructed for veterans of the war. Context: The neighbourhood is a stable neighbourhood with a variety of post-war residential styles, generous setbacks from the street and between houses, no curbs or sidewalks and significant vegetation.	

APPENDIX D – Municipal Servicing Report

by Associated Engineering

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

City of Welland

Northwest Welland Secondary Plan
Municipal Servicing
Existing Conditions Report

April 2019

CANADA'S BEST MANAGED COMPANIES Platinum member

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Appendix A – Fenwick Existing Sanitary Sewer Capacity Assessment

Appendix B – Stormwater Analysis: Modified Rational Method

Appendix C – Response to Comments on Northwest Welland Secondary Plan – Site Servicing

1 Introduction

The City of Welland identified the development of the Northwest Secondary Plan as a priority to provide for detailed land use planning policies for a mix of uses including policies that address infrastructure requirements, and natural and cultural heritage considerations. The Northwest Welland Secondary Plan (NWSP) will guide future growth and development for the study area in Welland. This report reviews background information for the area and provides capacity analysis for existing water, sanitary, and storm sewer servicing in the study area. This analysis is used to provide general recommendations for municipal water, sanitary, and storm servicing requirements.

1.1 STUDY AREA

The Study Area includes the land within the urban area boundary of Welland that is bounded by Clare Avenue to the West, Niagara Street to the west, land on the south side of Quaker Road to a depth of approximately 500 m to the south and 500 m to the north and comprises approximately 190 ha (Figure 1-1). Quaker Road bisects through the Study Area and is identified as an arterial road and all other streets are considered local roads.

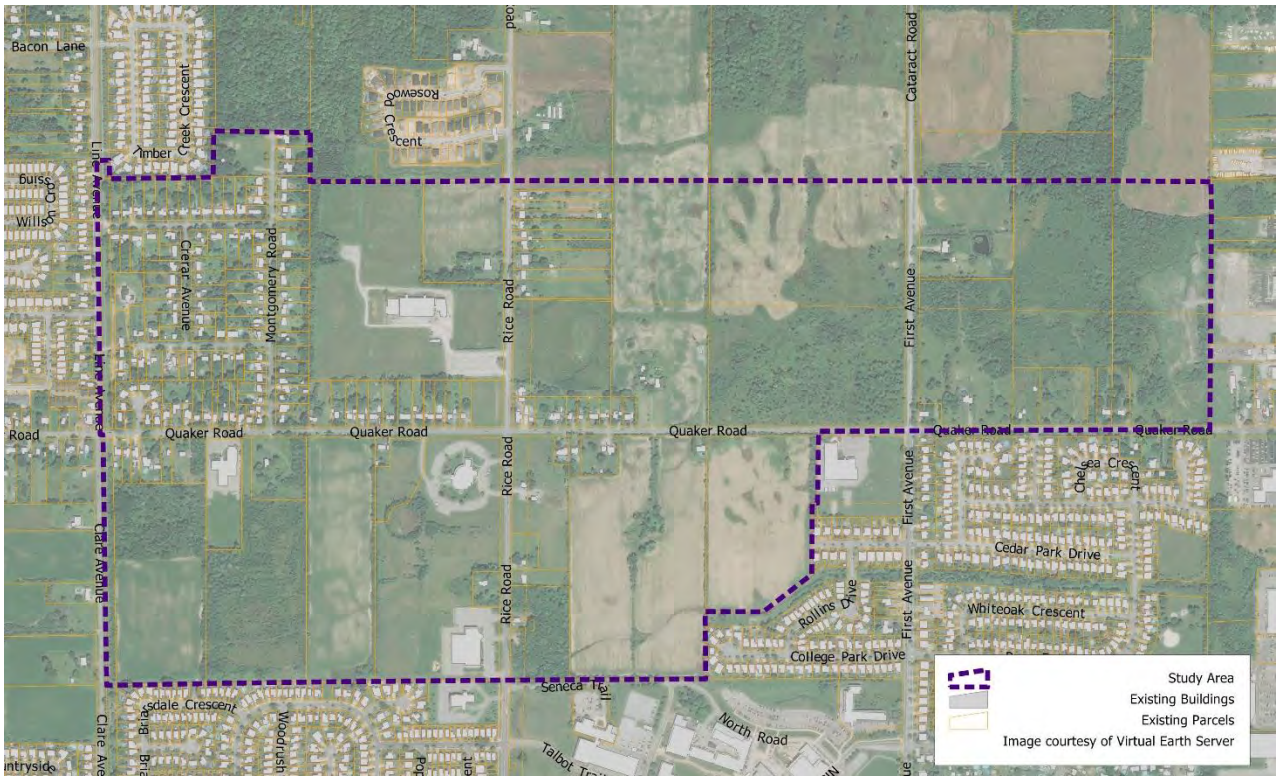


Figure 1-1: Northwest Welland Secondary Plan Study Area

Existing zonings are primarily residential, institutional, agricultural, and open space. Currently, municipal services for water, sanitary and storm exist in parts of the NWSP area. It is anticipated that existing services will be leveraged to accommodate the NWSP area.

It is important to note that the NWSP area was not included as one of the growth areas in the Niagara Region's Master Serving Plan (2017) (Figure 1-2). This means that MSP's capacity assessment for sanitary and water did not consider the impacts of growth in the NWSP area and therefore development in this area will contribute additional demands and generate additional flows to the ones identified in the MSP.

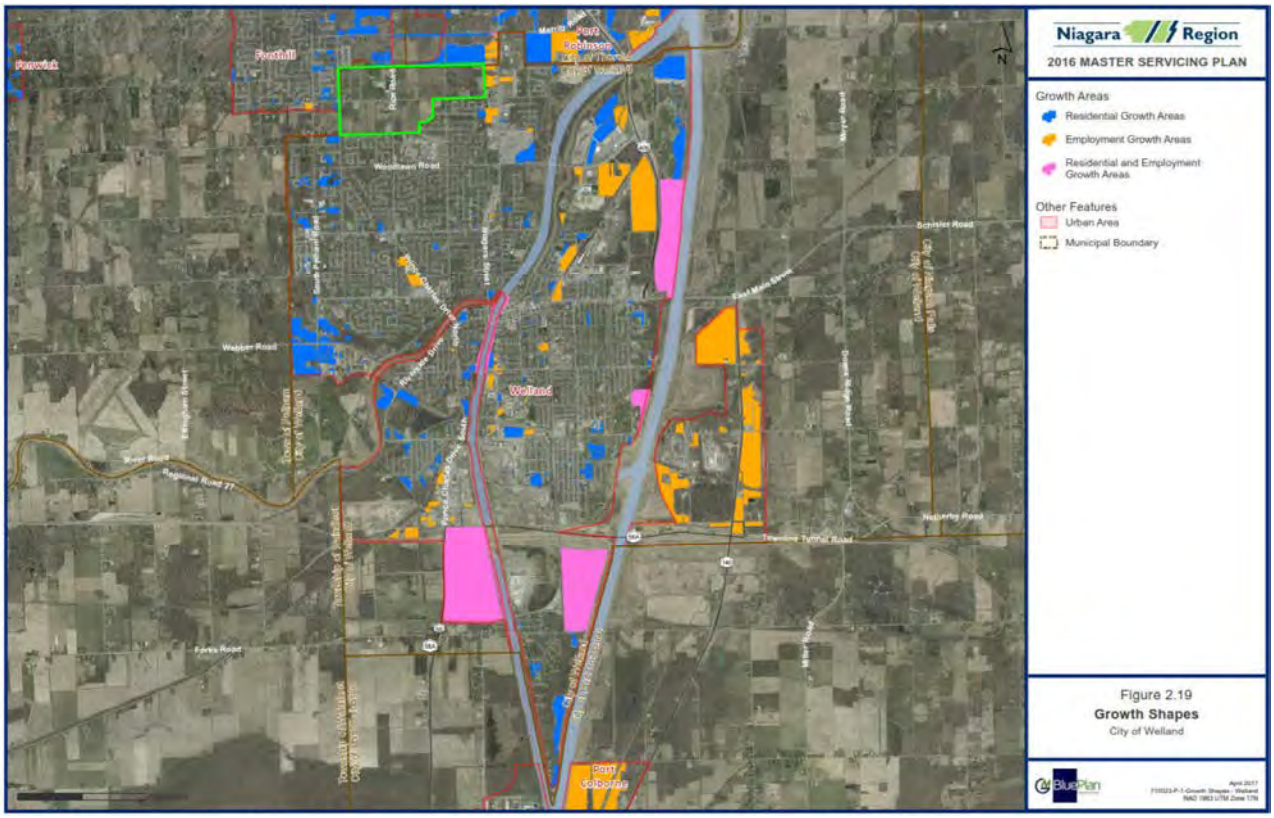


Figure 1-2: Growth areas as identified in the Niagara Region's Master Servicing Plan; Welland NWSP area is highlighted in green

2 Background Information

2.1 SOURCES

Table 2-1 provides a list of sources used to aid the analysis of existing water, wastewater, and stormwater servicing.

2.2 DATA GAPS

Data gaps are presented in Table 2-2, which summarizes missing, relevant information that would provide a clearer picture of the existing and future needs of the systems in future steps of this process (i.e.: confirmation of criteria to be used in future pre-design of systems). The Table contains a description of the key considerations, along with the potential impacts on the servicing strategies and future planning. These are things that would be good to have going forward, to help prepare meaningful alternatives in the next phase.

Assessments of each system would be benefited from the collection of detailed population / housing density, to provide better servicing estimates. The water distribution system was well represented in the existing model and no further information is required to define the system at this time, unless new information becomes available. The current sanitary model is skeletonized; there are no local sewer conduits in the model. Therefore, assessment of the sanitary system would be benefited from the collection of local sanitary sewer information for all sanitary sewer pipes and connections. The hydraulic model was considered to be a more current and accurate representation of the existing sanitary conditions however, as-built drawings would be useful to resolve these discrepancies and confirm the properties of the existing sanitary system.

The Niagara Peninsula Conservation Authority (NPCA) has information regarding the Towpath Drain, as the drain has been modelled for hydrology and hydraulics. Any information on the groundwater in the study area will also be obtained from the NPCA.

Table 2-1: Water, Sanitary, and Storm Data and Sources

System	Description	File Type(s)	Author(s)
All	City of Welland Northwest Area Planning and Servicing Study Municipal Class EA	PDF	EarthTech
	Elevation Contours	DWG	NPCA
	Niagara Region GIS Data	GIS	Niagara Region
	City of Welland Official Plan	PDF	Dillon Consulting
Water	2016 Water and Wastewater Master Servicing Plan Update Hydraulic Model for City of Welland, May 2017	PDF	GM Blue Plan
	Welland Water Model (part of the Niagara Region Water Model for the 2017 Niagara Region Master Servicing Plan), 2017	InfoWater	Niagara Region
Wastewater	Niagara Region Hydraulic Wastewater Model	InfoSWMM	Niagara Region
	Welland Wastewater All Pipes Model	InfoSWMM	City of Welland
Stormwater	Municipal Engineering Design Criteria and Standard Drawings, 2016	PDF	City of Welland
	Drainage Management Manual, 1997	PDF	MTO Drainage & Hydrology Section
	Stormwater Management Planning and Design Manual, March 2003	PDF	MOE
	City of Welland Municipal Standards, February 2012	PDF	City of Welland
	Volume Control Targets for Ontario – Final Report, October 2016	PDF	Aquafor Beech for MOECC
	Advancing Low Impact Development as a Smart Solution for Stormwater Management – Version 3.0 – Monitoring Data 2011 to 2015	PDF	Credit Valley Conservation Authority

Table 2-2: Data Gaps

System	Data Gaps	Justification
All	Population / housing density	To provide better servicing estimates (demands / use)
	Housing and properties layout / new development plan	To provide better servicing estimates (spatial context)
	Field investigations	To provide context and identify additional on-site conditions
Water	None	
Sanitary	As-built drawings	To confirm properties of the local sanitary system (conduit length, diameters, slopes, etc.)
Storm	As-builts drawings	To confirm existing culvert properties (length, diameters, slopes, material, etc.)
	Detailed topographic survey	To confirm elevations, including watershed and structures (i.e. culverts)
	NPCA Defined Environmental Protection Zones	To confirm NPCA requirements for treatment

3 Water

A schematic of the extent of existing water services in the study area is present in Figure 3-1. For the purposes of this analysis, the Region's 2016 Hydraulic Model created in InfoWater for the Water and Wastewater Master Servicing (MSP) Update was used. It was assumed that this model was calibrated and the information it contains is accurate. No quality control checks were conducted and no changes were made to the existing model.

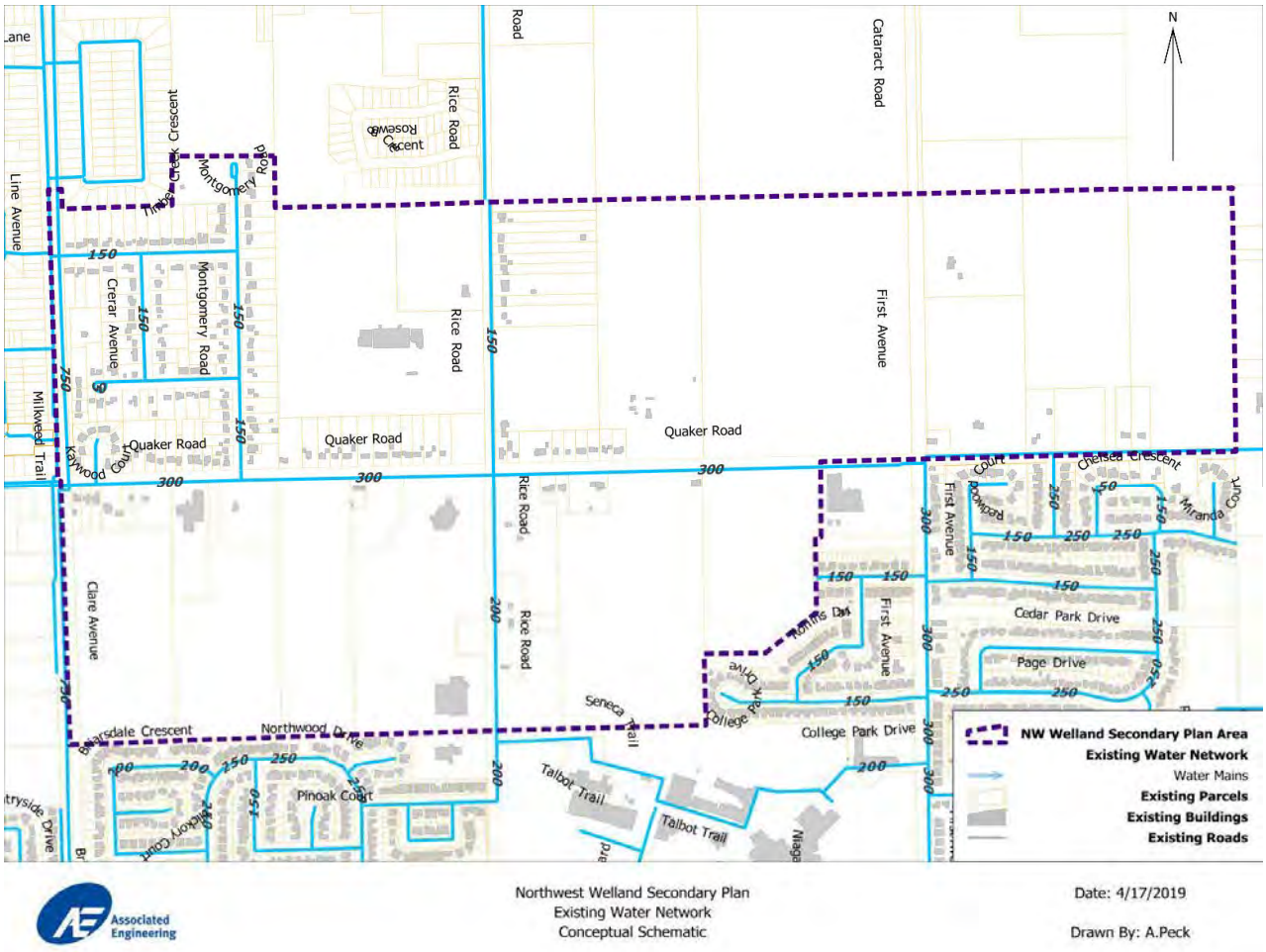


Figure 3-1: Schematic of water distribution servicing in NW Welland study area (existing water main diameters are *italicized*)

3.1 DESIGN CRITERIA

The design criteria used for the analysis of the existing system and its capacities include:

- Allowable Residual System Pressure: 40 psi to 100 psi
- Fireflow Requirements at MDD with 20 psi residual for zones within the study area:
  - Open Space: 67.7 L/s
  - Residential (single family): 67.7 L/s
  - Residential (multi-family): 133.3 L/s
  - Apartments: 266.7 L/s
  - Institutional: 133.3 L/s
  - Commercial: 350.0 L/s
- Demand patterns for average day demand (ADD) and maximum day demand (MDD) based on 2014 SCADA data
- Pipe C-Factors for pipes within and surrounding the study area:
  - Polyvinyl Chloride (PVC): 140
  - Asbestos Cement (AC): 110
  - Cast Iron (CI): 75

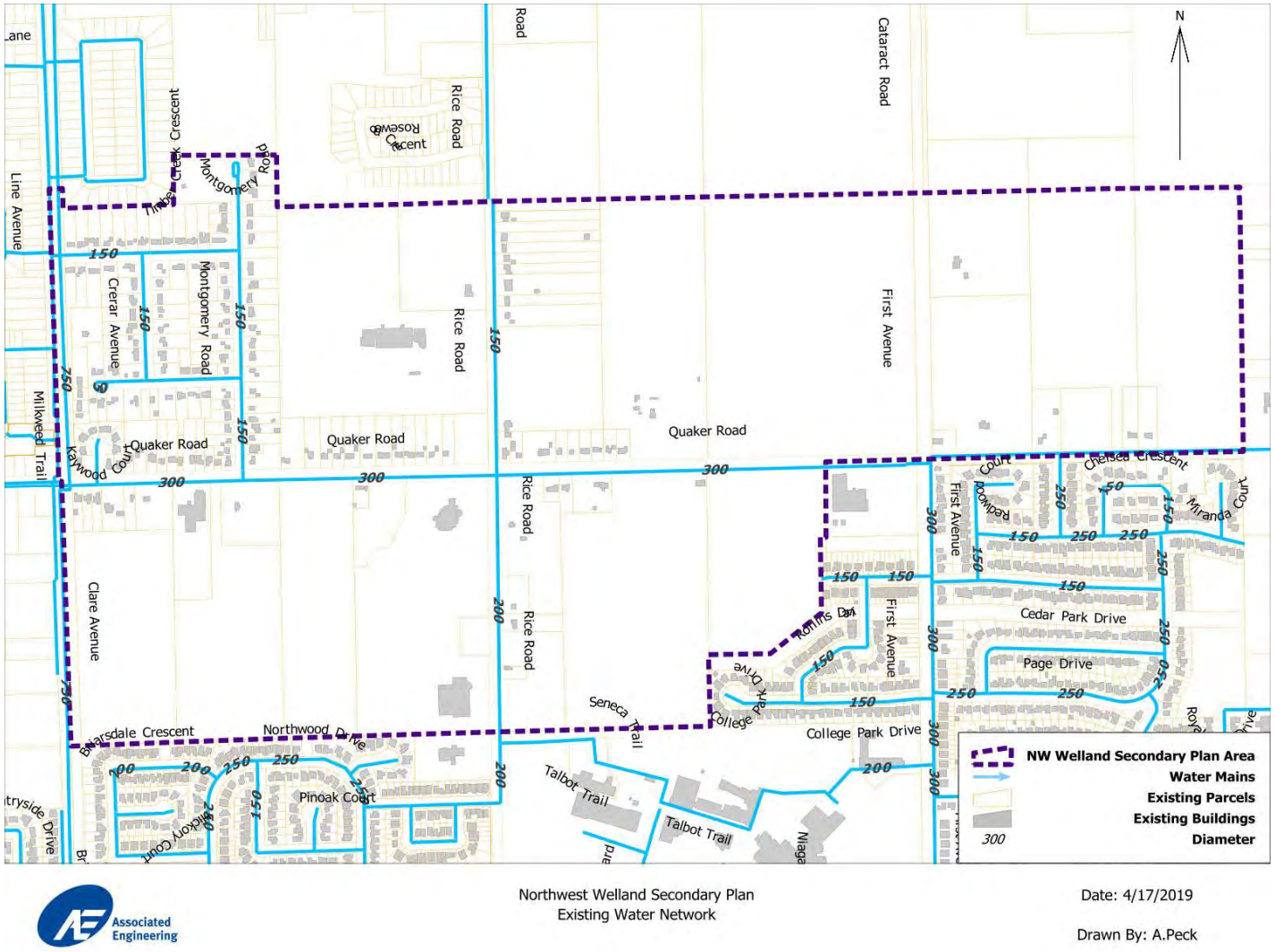
This design criteria is from the City of Welland's Municipal Standards, Section 8: Design Standards – Watermain, February 2013. The fireflow requirements are taken from Associated Engineering's Technical Memorandum titled "City of Welland Fireflow Requirements – By Building Zone" written by Rick Gabel, P.Eng. to Marvin Ingebrigtsen, P.Eng. dated March 18, 2014.

3.2 EXISTING CONDITIONS

Currently, the area surrounding the proposed development is pipe fed from the Welland Water Treatment Plant to the Shoalt's Drive Reservoir and Pumping Station to the surrounding area. A 300 mm diameter cast iron (CI) City watermain flows east along Quaker Road. A 750 mm diameter concrete pressure pipe (CPP) watermain flows south along Line Avenue / Clare Avenue. A 150 mm diameter asbestos cement (AC) watermain approximately 525 m long flows north on Rice Road from Quaker Road, which serviced the former soccer club. A 200 mm diameter AC watermain flows south on Rice Road from Quaker Road. A 300 mm diameter CI watermain flows south on First Avenue from Quaker Road. A 200 mm diameter CI watermain flows north on Niagara Street from Quaker Road.

Within the proposed development area, there is a small existing development east of Line Avenue and north of Rice Road. This area, which was built in 2002, consists of 150 mm PVC watermain connecting to both the 750 mm CPP on Line Avenue and the 300 mm CI on Quaker Road. There are existing properties along Quaker Road, which are assumed to be serviced off of the 300 mm main.

The existing system configuration with pipe diameters can be found below in Figure 3-2.



Associated Engineering

Northwest Welland Secondary Plan
Existing Water Network

Date: 4/17/2019

Drawn By: A.Peck

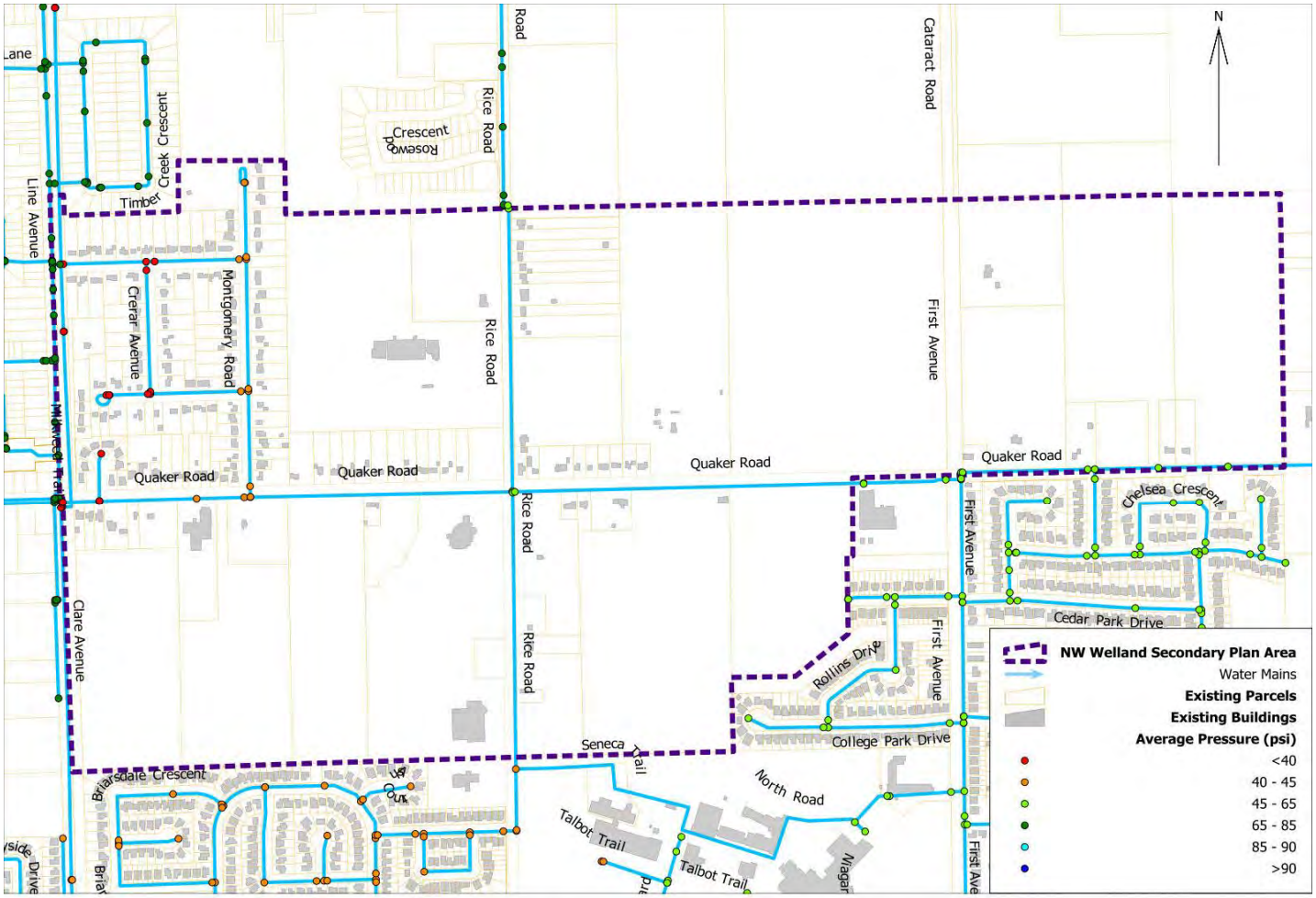
Figure 3-2: Existing Configuration of Watermains in Study Area

The existing model provided for this analysis had current (2016) ADD and MDD scenarios set up based on the 2014 SCADA data. Both of these scenarios were run to determine the existing system pressures. The pressures within the study area are adequate during both ADD and MDD, as shown below in Figure 3-3 and Figure 3-4, respectively. As stated in the design criteria, the allowable residual system pressure is between 40 psi and 100 psi.

During both ADD and MDD scenarios, average system pressures to the east of Rice Road are all between 45psi and 90psi, which are within the allowable pressure limits. Average system pressures along Montgomery Road are between 40psi and 45psi, and although these are within the acceptable limits, they are lower than desired pressures. Average system pressures between Montgomery Road, Quaker Road, and Line Avenue are below acceptable limits.

A fireflow scenario was run using the MDD demand set. In the given model, the required fireflow controls at each node in a residential area was set to 75 L/s, which is slightly higher than the City of Welland's 67.7 L/s fireflow requirement for single family and multi-density housing zones. The required fireflow controls along Quaker Road east of Rice Road, and along Rice Road south of Quaker Road were set to 175 L/s, which is slightly higher than institutional demands but lower than residential apartments and commercial space demands. Land surrounding the intersection of Niagara Street and Quaker Road is currently zoned "C4", or 'highway commercial" and has a fireflow requirement of 350 L/s. The remaining land along Quaker Road is zoned residential, agricultural, and open space and has a fireflow requirement of 67.7L/s.

During a MDD+FF scenario, the system pressures must be at or above 20 psi during fireflow. Figure 3-5 shows which nodes will remain at or above 20 psi in the event of a fire, and the available flow at each of the nodes. As shown in the figures, the majority of the nodes provide adequate pressure and flow. There are a minimum number of nodes unable to provide adequate fireflow and these nodes are located at deadends of 150 mm diameter mains.



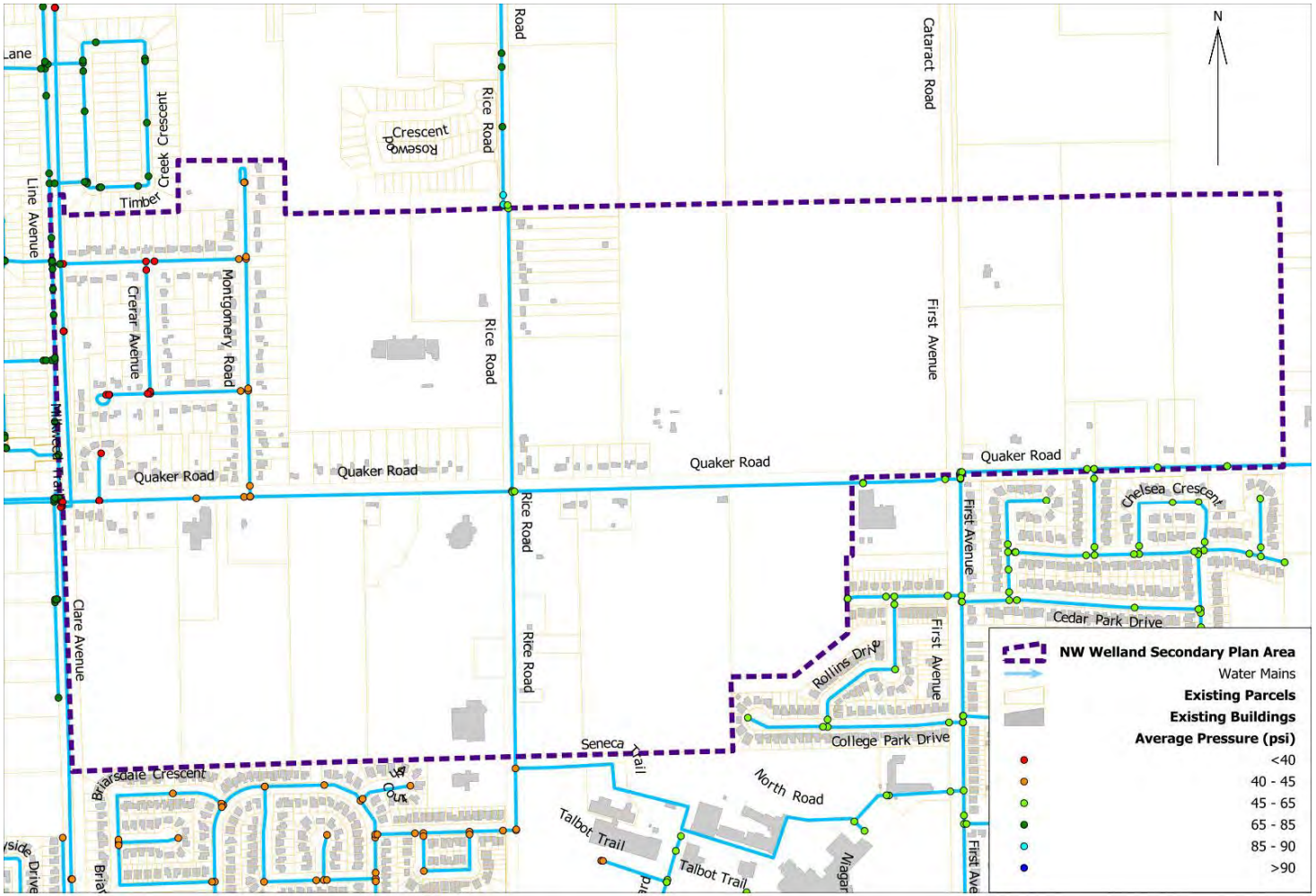
Associated Engineering

Northwest Welland Secondary Plan
Existing Water Network
ADD

Date: 4/17/2019

Drawn By: A.Peck

Figure 3-3: 2016 ADD Junction Pressures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Cataract Road
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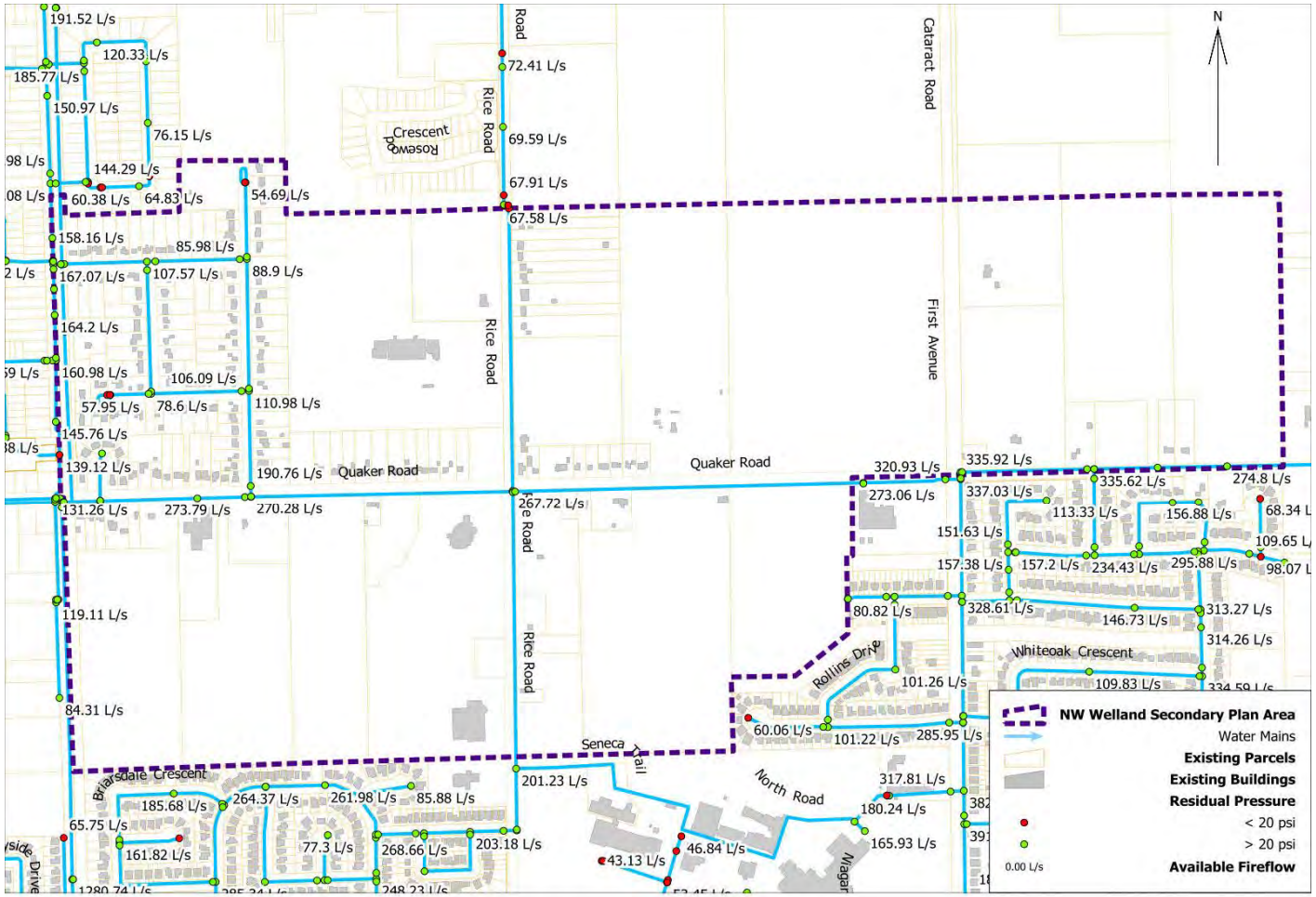


Associated Engineering

Northwest Welland Secondary Plan
Existing Water Network
MDD+FF

Date: 4/17/2019

Drawn By: A.Peck

Figure 3-5: Fireflow Availability

3.3 CAPACITY ASSESSMENT

To determine if there is capacity available with the proposed development, the conceptual layout, population and demands from the City of Welland Northwest Area Planning and Servicing Study Municipal Class Environmental Assessment created by EarthTech in June 2008 was used.

Child scenarios of the existing ADD and MDD scenarios were created and the conceptual development was added using the existing ground elevations for the nodes. These child scenarios were run to determine the available pressures within the new development area. The pressure in the proposed development area follows the same trend as the existing conditions. The majority of nodes west of Rice Road to Montgomery Road have pressures between 40 and 45 psi. Everything east of Montgomery Road has pressure below the allowable pressure of 40 psi. All nodes east of Rice Road, depending on the watermain sizing and configuration will be able to provide adequate pressure during ADD and MDD conditions.

The existing flow through the 300 mm CI main on Quaker Road during fireflow is between 260 and 270 L/s, meaning depending on watermain sizing and configuration, it should be able to provide enough flow and pressure to open space, single and multi-residential homes, and institutional areas. It may or may not be able to provide adequate flow and pressure to apartment building and it will not be able to provide enough flow or pressure to commercial spaces.

3.3.1 Future Works

The capacity assessment conducted as part of this assignment was based on the existing conditions. However, there are a number of planned upgrades and developments that are scheduled over the next ten (10) years that will affect the water servicing to the study area. When completing the preliminary design of this development, these will need to be considered, as they will affect the expected capacity.

As of the date of this report, there are two (2) additional developments that have been approved, which are directly to the north and east of the Welland Northwest Secondary Plan and will increase the surrounding population. These developments will alter the existing system pressures and dynamics by increasing the water demands in the area surrounding the study area.

As part of the Niagara Region's 25-Year MSP Upgrade, developed by GMBluePlan in 2016, there are five (5) proposed projects relating to the Welland Water Treatment Plant. Of these five (5) projects, two (2) will directly affect the Northeast Secondary Plan. These include: upgrades to the Shoalt's Drive Low Lift Pumping Station (replacing both 3 MLD low lift pumps with 6.5 MLD pumps) and upgrades to the Shoalt's Drive High Lift Pumping Station (replace all four 5.4 MLD high lift pumps with 10MLD pumps). The plan suggests these pumps will be operational by 2021. The detail design of these pumps should include all future developments, including this development and should be able to provide adequate pressure throughout the area.

The existing water model used for this analysis has these upgrades and developments incorporated into future scenarios. During the preliminary design, these future scenarios will be used when completing the preliminary design of the Northeast Secondary Plan. Existing watermains along Rice Road, Quaker Road, Line / Clare Avenue and First Avenue will be reviewed during preliminary design to ensure the watermains are large enough to provide adequate flow and pressure.

4 Sanitary

The Welland Wastewater Treatment Plant (WWTP) services the City of Welland, Town of Pelham, and the Port Robinson area of the City of Thorold. Sanitary sewage from the Northwest Welland Secondary Plan (NWSP) area will ultimately be treated at the Welland WWTP.

The existing sanitary services in the NWSP area includes a regional main down Rice Road, local main in the Mongomery subdivision, and local and regional sanitary sewer along Quaker Road. Primary sanitary sewage flows south down Rice Road, and then east down Quaker Road to Towpath Road. Sanitary sewage then flows northeast along Towpath Road to Towpath Sewage Pumping Station (SPS). Towpath SPS receives gravity flow from the regional trunk sanitary sewer along Quaker Road and flows from Hurricane Road SPS. Sewage from Towpath SPS is pumped through a forcemain across the Welland River to a gravity system, which ultimately flows to the Welland WWTP. A schematic of the existing sanitary servicing within the NWSP study area is provided in Figure 4-1.

This section provides a background on the existing physical systems within (and servicing) the secondary area, a list of design criteria for the engineering of sanitary infrastructure, and finally a capacity analysis of the existing systems. The analysis includes a high-level sanitary sewage design sheet for existing flows along primary sewer mains within the NWSP area.

4.1 EXISTING CONDITIONS

The existing sanitary system appears to service some of the study area, including the existing subdivision just northeast of the intersection of Quaker Road and Line Avenue.

The remainder of this sub-section provides a physical description of the following existing sanitary infrastructure systems:

- Welland WWTP
- Sanitary Trunk Sewers
- Towpath SPS
- Towpath Forcemain

Associated Engineering

Northwest Welland Secondary Plan
Existing Sanitary Network
Conceptual Schematic

Date: 4/17/2019

Drawn By: A.Peck

Figure 4-1: Schematic of existing sanitary services in northwest Welland Secondary Plan Area (existing sanitary sewer diameters are *italicized*)

4.1.1 Wastewater Treatment Plant Capacity

Sanitary flows from the existing NWSP area are treated at the Welland WWTP. Based on a review of existing information, Table 4-1 provides an overview of the existing Welland WWTP physical system, as provided by the Niagara Region's MSP.

Table 4-1: Welland WWTP existing physical system

Welland WWTP 505 River Road R.R. #1 Welland, ON		
Description	**Value**	**Notes**
Existing Physical System		
Total Catchment Area	3,550.9 ha	Including all subcatchment areas / contributions from SPSs
Sanitary Sewage Pumping Stations Serviced	8	
Treatments	Conventional activated sludge, grit removal, effluent disinfection, tertiary filtration	
Receiving Body	Welland River	
Existing Flows		
Existing Rated Capacity	54.5 MLD	
Existing Peak Flow Capacity	136.2 MLD	

4.1.2 Trunk Sewers

Based on a review of existing information, Table 4-2 provides an overview of the existing Quaker/Towpath Road sanitary trunk sewer system, as provided by information contained in the Niagara Region's MSP and Welland GIS data.

Table 4-2: Welland sanitary trunk sewers within (and/or servicing) the Secondary Area

Sanitary Sewer		
Description	**Value**	**Notes**
Existing Physical System Quaker Road between Milkweed Trail and Montgomery Road		
Material	PVC	
Diameter	250 mm	Municipal sewer
Length	324 m	Estimated from quantities
Existing Physical System Quaker Road between Montgomery Road and Rice Road		
Material	PVC	
Diameter	300 mm	Municipal sewer
Length	481 m	One of these mains contains a drop structure; estimated from quantities and GIS intrinsics
Existing Physical System Quaker Road between Rice Road and Niagara Street		
Material	CP	
Diameter	750 mm	Region sewer
Length	1,659 m	Estimated from quantities
Average velocity	0.52 m/s	Estimated from downstream and upstream pipe velocities in model
Existing Physical System Quaker Road between Niagara Street and Towpath Road		
Material	CP	
Diameter	750 mm	Region sewer

Sanitary Sewer		
Description	**Value**	**Notes**
Length	717 m	Estimated from intrinsic GIS properties
Average velocity	0.59 m/s	Estimated from downstream and upstream pipe velocities in model
Existing Physical System Towpath Road between Quaker Road and Towpath SPS		
Material	CP	
Diameter	750 / 900 / 1050 mm	Region sewer
Length	290 / 1,003 / 18 m	Respectively; estimated from intrinsic GIS properties
Upstream / downstream DWF	17.3 / 18.6 L/s	
Average velocity	0.55 m/s	

4.1.3 Pumping Station and Forcemain

Based on a review of existing information, Table 4-3 provides an overview of the existing Towpath SPS physical system, including the forcemain as identified in the Niagara Region's MSP.

Table 4-3: Towpath SPS existing physical system

Towpath SPS 1149 Kottmeier Rd. Welland, ON		
Description	**Value**	**Notes**
Existing Physical System		
Total Catchment Area	289.3 ha	Including contribution from Hurricane SPS
Total Equivalent Service Population	5,133	Including contribution from Hurricane SPS

Towpath SPS 1149 Kottmeier Rd. Welland, ON		
Description	**Value**	**Notes**
Pumps	2	
Existing ECA Firm Capacity	150.0 L/s	
Existing Operational Firm Capacity	141.7 L/s	@ TDH of 25.0 m; from MSP
Existing Forcemain Physical System		
Diameter	400 mm	
Length	647 m	
Capacity at 2.5 m/s	1,021 L/s	
Existing Flows		
Existing DWF	8.4 L/s	
Existing Design Peak WWF	66.1 L/s	

4.2 DESIGN CRITERIA

Sanitary loadings used in the capacity assessment were assumed to be the same as those used in the City of Welland all-pipes model. Table 4-4 outlines the additional design criteria that were considered in the capacity analysis for the existing system.

Table 4-4: Design criteria used in the capacity assessment of the existing system

Description	Value	Notes
Design Criteria		
Extraneous flows	0.286 L/s/ha	From MSP / MOECC Design Guidelines
Roughness coefficient	0.013	Per City of Welland Municipal Standards

Description	Value	Notes
Residential per capita flow rate	275 L/cap/day	Based on the values used to estimate residential per-capita flow rate in the MSP
Peaking factors	2.0 – 4.0	Peaking factor based on Harmon formula with values between 2.0 and 4.0 with consideration to the catchment area performance

It is important to recall that the NWSP area was not included as one of the growth areas in the MSP sanitary servicing plan (Figure 1-2). It will therefore be especially important to consider how the new development may impact sanitary flows in the entire system. A comprehensive flow assessment for the future proposed development area should consider potential contribution to flows at Quaker Road trunk sewer, Towpath SPS, and Welland WWTP, respectively.

4.3 CAPACITY ASSESSMENT

The following section provides a high-level capacity assessment for the existing sanitary sewer infrastructure systems outlined in section 4.1.

4.3.1 Welland WWTP

The MSP identified that the existing Welland WWTP has surplus capacity available to treat existing and future flows at the plant. With an existing capacity surplus of 25.8 MLD, it is anticipated that the WWTP will have capacity to treat the additional flows from the Welland NWSP area. However, since the NWSP area was not considered as a growth area in the MSP, the contributing flows from this area may trigger 80% capacity earlier than anticipated in the MSP.

4.3.2 Pumping Station & Forcemain

The MSP identified Towpath SPS has existing additional available pumping capacity of approximately 30 L/s based on existing design peak wet weather flows. Although existing pumping capacity appears sufficient for existing flows, the MSP identified that Towpath SPS will exceed current pumping capacities by 2041.

The MSP identified that the existing Towpath SPS would experience growth and wet weather-related sanitary capacity servicing deficit (of 115.4 L/s) by 2041. As such, the MSP identified a capital project to upgrade the Towpath station anticipated during the timeframe of 2022 – 2031 from 150 L/s to 300 L/s (WW-SPS-037). The Welland NWSP area would contribute additional flows to Towpath SPS that were not accounted for in MSP's flow estimations. Therefore, with the development of Welland NWSP area, Towpath SPS may

experience an even greater servicing deficit than anticipated by 2041 and if the proposed NWSP development were to proceed prior to 2022, it would likely trigger the need for an upgrade sooner.

In addition, the MSP indicates that the existing Towpath SPS forcemain has current and projected surplus capacity. The MSP identified approximately 764 L/s of projected future surplus capacity in the Towpath SPS forcemain. It is anticipated that the Towpath SPS forcemain has sufficient existing and future capacity to accommodate flows from the Welland NWSP area.

4.3.3 Trunk Sewers

A spreadsheet capacity assessment was completed for the existing NWSP area sanitary collection system (Appendix A). Those pipes with sufficient capacity to transmit existing peak sanitary flows are indicated by a rating of “OK” and those pipes with insufficient capacity to transmit flows are indicated by “OOPS”. As indicated in the capacity analysis, most of the existing sanitary system has sufficient capacity to transmit existing sanitary flows. This is consistent with the findings of the MSP which identified existing available capacity in the sanitary trunks along Rice Road, Quaker Avenue, and Towpath Road. However, the Niagara Region’s MSP identified (at a high level) that future peak flows due to growth in the service area (including the area serviced by Hurricane SPS) will exceed existing capacity along Towpath sanitary trunk sewer (from the downstream (east end) of Quaker Road along Towpath Road to the Towpath SPS). It is believed however, that this projected deficit is due to the projected pumping deficit at Towpath SPS, resulting in backup in the sanitary system. Therefore, the planned future upgrade of Towpath SPS should resolve the capacity issues along Towpath Road. However, note that if the proposed development were to proceed prior to 2022, it may trigger the need for an earlier upgrade.

The MSP identified a need for additional trunk capacity on Quaker Road to support existing and growth flows from the Pelham system. To accommodate additional future flows, MSP recommended a new 600 mm trunk sewer between Pelham Street and Rice Road (WW-SS-002). This proposed new trunk sewer could potentially be used to service the southwest area of the NWSP area south of Quaker Road, to the west of Rice Road. Otherwise, there may be an opportunity to split sanitary flows in this area. Flows from the north side of the southwest NWSP area may be directed towards the existing sanitary along Quaker Road, while sanitary flows on the south side may be directed to the existing sanitary system along Northwood Avenue. A capacity assessment for the Northwood Drive system would need to be completed if flows are split in this way. The proposed development plan for the NWSP area will help guide decision making of this nature.

4.4 SUMMARY

The following infrastructure has existing capacity to accommodate the NWSP area flows:

- Welland WWTP; and
- Towpath SPS forcemain.

The following infrastructure has limited existing capacity to accommodate the NWSP area flows:

- Quaker Road / Towpath sanitary trunk main; and
- Towpath SPS.

The following capital projects from the MSP may be an opportunity to address the capacity limitations, above and accommodate NWSP area flows:

- WW-SPS-037; increase station capacity at Towpath SPS
- WW-SS-002; new sewer on Quaker Road between Pelham Street and Rice Road

5 Storm

5.1 EXISTING CONDITIONS

The Northwest Welland Secondary Plan area topography is quite flat and drains in a west to east direction. The land use is mainly pasture/agricultural land interspersed with country residential homes (Figure 5-2). The plan area is significantly developed all around the boundary as well as within the plan area itself. The west side of the study area is already developed with country residential homes. There are two (2) major drainage channels that flow through the site. These two (2) channels are identified by the Niagara Peninsula Conservation Authority (NPCA) as requiring approval for any development draining to the channels. Erosion and sediment control will likely be a concern. The City of Welland has identified flood hazards zones adjacent to the streams draining through the study area as well. The area has a history of localized flooding issues during high rainfall events (Figure 5-1), which appears to overwhelm the roadside ditches generating localized flooding conditions on properties and at intersections along Quaker Road. In addition, due to the relatively flat drainage area at the site of the former soccer fields west of Rice Road, there is poor drainage and multiple topographical depressions causing water ponding. The existing channel appears to back up at Rice Road causing backwater effects and localized overland flooding.

The NPCA has hydrologic and hydraulic models for the Towpath Drain, a tributary of which drains through the study area. The model will be obtained and modified as required to develop the stormwater design criteris for the study area during preliminary design.

A large portion of the study area has also been identified as “significant groundwater recharge areas” by the NPCA. This would mean that at the planning and development level, promoting groundwater recharge through source control practices would be beneficial from an environmental approvals standpoint. Any reporting on groundwater conditions on the study area will be obtained by the NPC and considered in preliminary design.

Based on the design criteria that the post development peak runoff rate will be controlled to the design pre-development runoff rate, the more conservative value between the existing culvert capacities and the 5-year predevelopment peak flow rate will be used for the pre-development condition.

Figure 5-1: Localized flooding issues in the Welland NWSP area in May, 2017 (photos as provided by City resident)

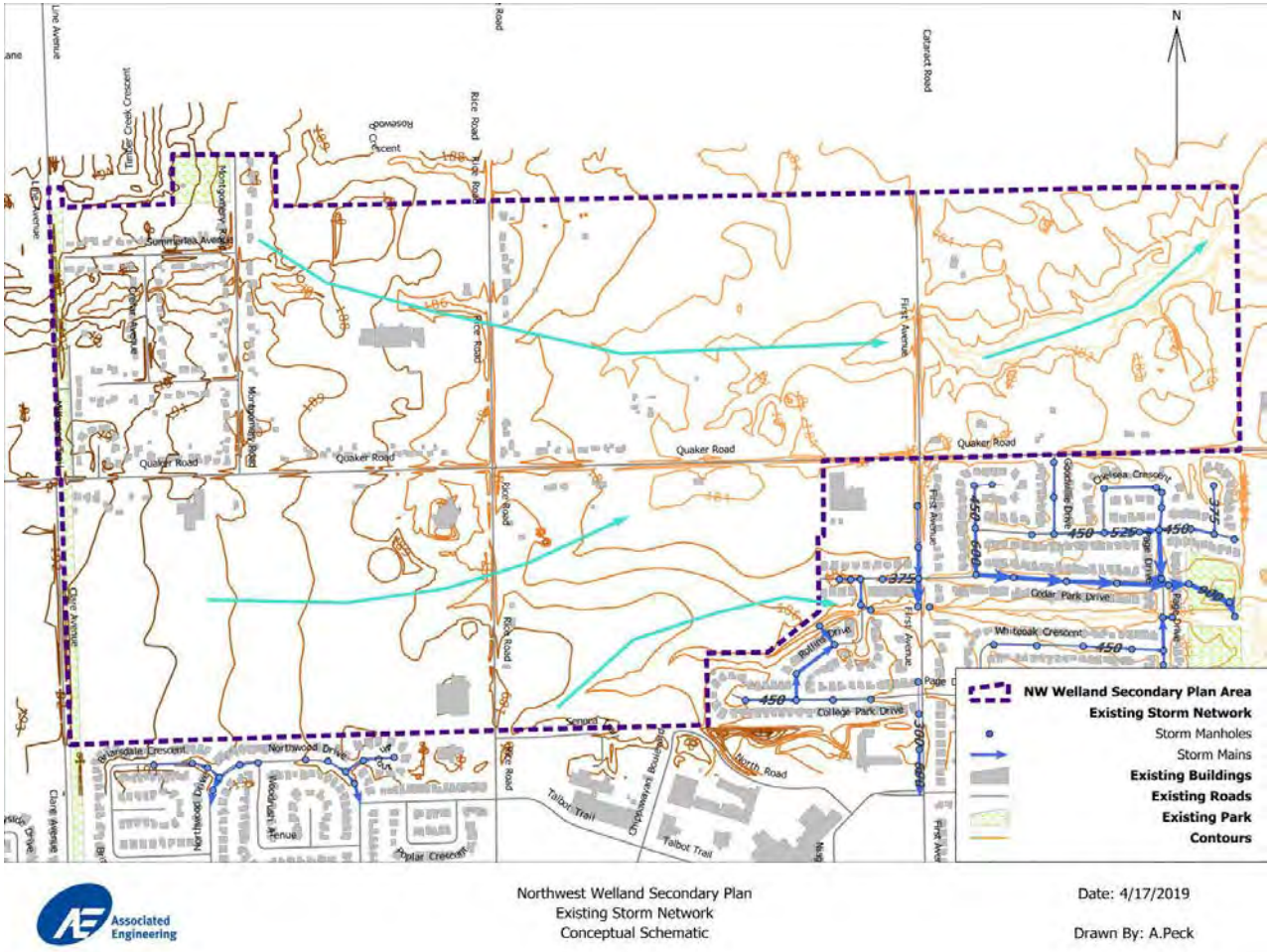


Figure 5-2: Schematic of stormwater drainage paths in the Northwest Welland Secondary Plan Area (existing storm sewer diameters are *italicized*; and drainage paths are in light blue)

5.2 DESIGN CRITERIA

The design criteria that will be used for the stormwater analysis are the following, based on City of Welland Engineering Design Criteria, City of Welland Municipal Standards, MOECC Guidelines, and MTO Drainage Management Manual:

- Where applicable, the Rational Method may be used for stormwater system design;
- The design storm hyetographs used for the storm system design are the 5 and 100-year rainfall events based on the City of Welland rainfall data;
- For water quality management, the 25 mm rainfall event based on the City of Welland rainfall data will be used for stormwater pond sizing, based on MOECC guidelines.
- The use of Low Impact Development techniques will be encouraged and explored in the design.
- The receiving water course (Welland Canal) is classified as a warm water fishery and an important fish habitat by the Ministry of Natural Resources (MNR). Therefore, erosion protection controls are considered mandatory.

The following table of IDF curves were used in the analysis:

Table 5-1
IDF Curves for the City of Welland

Return Period (Yrs.)	a	b	c
5	830	0.777	7.3
100	1020	0.731	4.7

5.3 PRELIMINARY STORMWATER ASSESSMENT

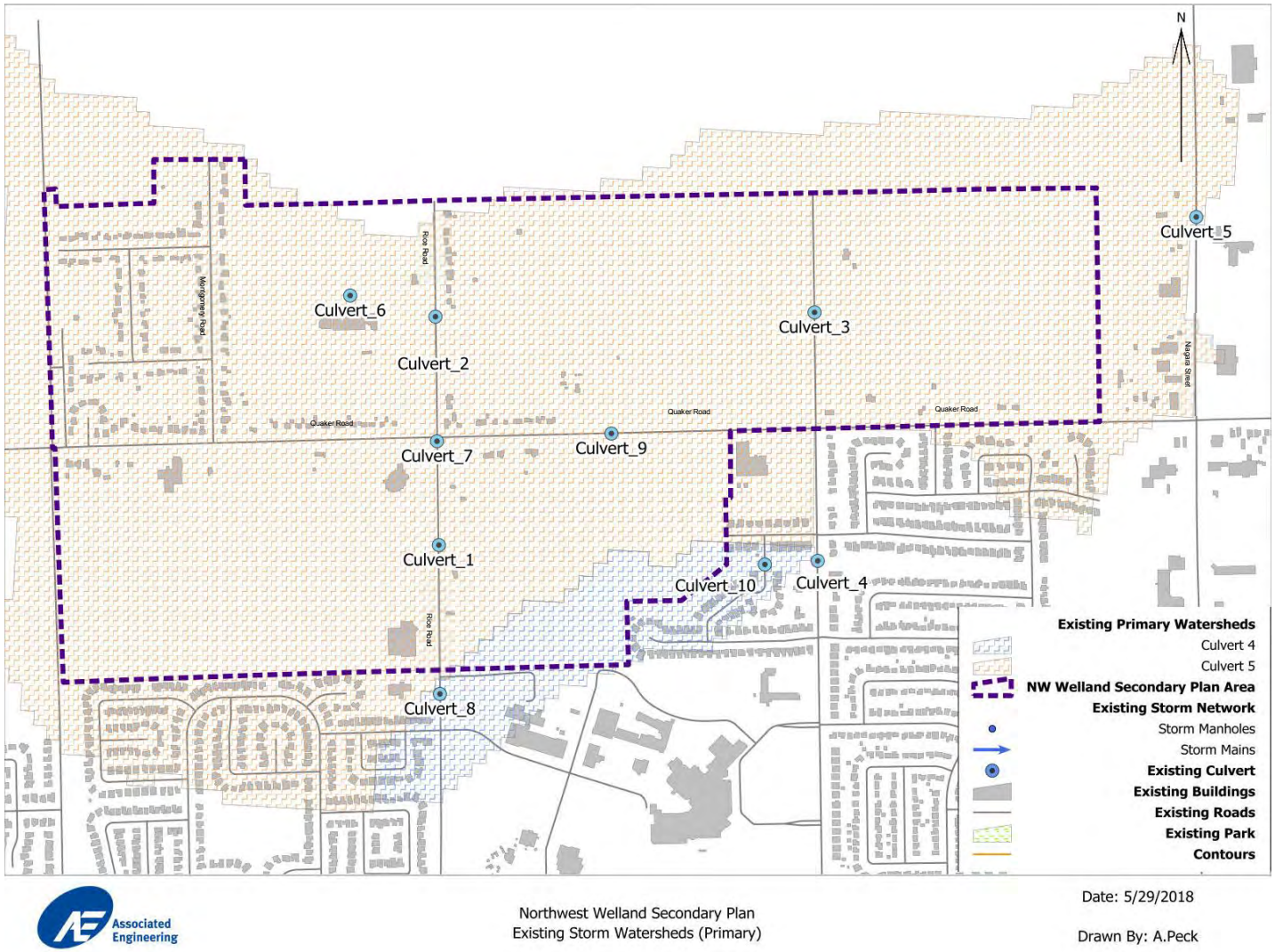
5.3.1 Predevelopment Condition

There are two main existing drainage paths that convey runoff in a west to east direction through the study area. Several existing culverts cross roads within the study area, Rice Road and First Avenue to aid the conveyance of runoff downstream; see Figure 5-3 for the existing site plan. The subcatchments draining to the culverts were analyzed for the pre-development condition using the Rational Method. See the Appendix B for detailed calculations. The design parameters and flow results are provided in Table 5-2. The existing culvert analysis is therefore summarized in Table 5-3.

The design pre-development flow rate for each subcatchment will be the culvert's capacity when the culvert capacity is smaller than the 5-year peak flow rate. Alternatively, where the culvert exceeds the 5-year pre-

development flow rate, then the subcatchment flow rate will be used as the design pre-development flow. If the overall study area will be piped under the roads to a larger facility at the downstream end of the site. This analysis may not be the stormwater management approach taken at the preliminary design stage.

The design pre-development flow rate for each subcatchment will be the culvert's capacity when the culvert capacity is smaller than the 5-year peak flow rate. Alternatively, where the culvert exceeds the 5-year pre-development flow rate, then the subcatchment flow rate will be used as the design pre-development flow. Each subcatchment's design pre-development flow rates are therefore as presented in Table 5-4:



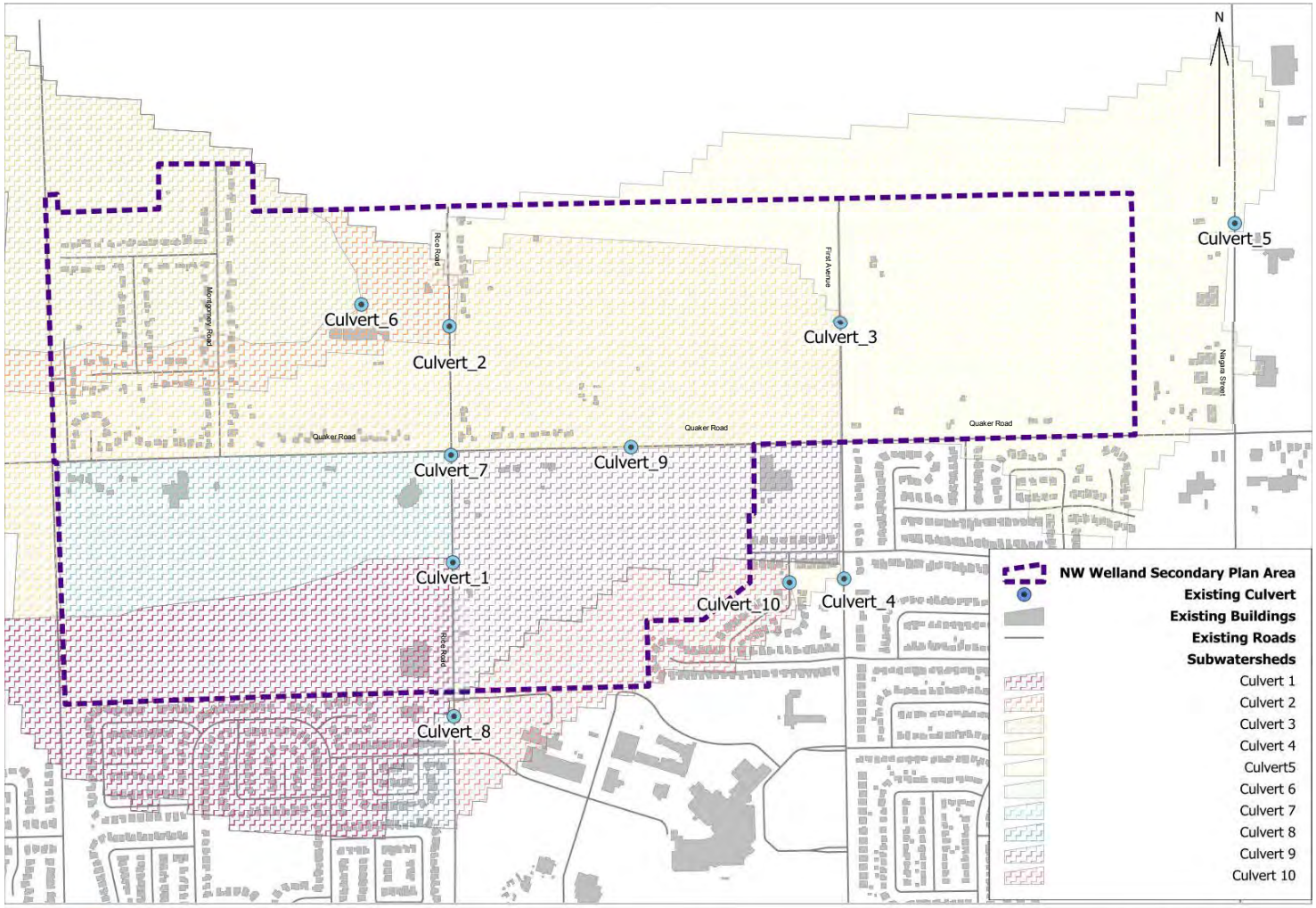
Associated Engineering

Northwest Welland Secondary Plan
Existing Storm Watersheds (Primary)

Date: 5/29/2018

Drawn By: A.Peck

Figure 5-3: Existing Culvert Watersheds (Primary)



Associated Engineering

Northwest Welland Secondary Plan
Existing Storm Subwatersheds

Date: 5/29/2018

Drawn By: A.Peck

Table 5-2: Subcatchment Design Parameters

Subcatchment	Area (ha)	Slope (%)	Runoff Coefficient	5-yr Flow (m^3/s)	100-yr Flow (m^3/s)
1	25	0.53	0.32	0.7	1.2
2	80	1.86	0.38	2.8	4.4
3	217	1.45	0.35	6.0	9.2
4	19	0.51	0.47	0.8	1.3
5	299	1.16	0.32	3.9	6.1
6	68	1.83	0.38	2.9	4.4
7	23	0.78	0.28	0.7	1.1
8	20	0.77	0.51	1.1	1.8
9	63	0.7	0.32	1.9	2.8
10	18	0.51	0.35	0.7	1.2

1. Time of concentration was calculated using the Federal Aviation Administration (FAA) method.

Table 5-3: Culvert Design Parameters

Culvert	Material	Size (mm)[1]	Catchment Area (ha)	Slope (%)[2]	Capacity (m^3/s)	Meets 5-yr Flow?
1	CSP	450	25	0.53	0.2	No
2	CSP	2 x 600	80	1.86	0.7	No
3	CSP	1440	217	1.45	4.8	No
4	CONC	1220W x 750H	19	0.51	2.0	Yes
5	CONC	3200W x 900H	299	1.16	8.7	Yes
6	CSP	875	80	1.83	1.3	No

Culvert	Material	Size (mm)[1]	Catchment Area (ha)	Slope (%)[2]	Capacity (m^3/s)	Meets 5-yr Flow?
7	CSP	800	68	0.78	0.8	Yes
8	CSP	375	23	0.77	0.1	No
9	CSP	800	20	0.7	0.9	No
10	CONC	1250	63	0.51	3.4	Yes
d/s 1	CONC	2 x 2500 x 1100	331	1.083	16.9	N/A
d/s 2	CSP	1050, 1125, 1200	644	0.984	7.2	N/A

1. Culvert slope was assumed to be the same as the catchment slope.

2. Inlet control was assumed for all culverts, as downstream slope was adequate and no immediate ponds or storage were directly downstream from the culverts.

Table 5-4: Design Pre-Development Flow Rates

Subcatchment	Pre-Development Flow Rate (m^3/s)
1	0.2
2	0.7
3	4.8
4	0.8
5	3.9
6	1.3
7	0.7
8	0.1
9	0.9
10	0.7

5.3.2 Stormwater Management Facilities (SWMF)

The stormwater management of the development area will likely include a storm pipe network draining to a storm pond type facility. The natural drainage channel through the site are already on very flat slope, and likely full during spring runoff events. They are not sized to accommodate the proposed Welland Secondary Plan development.

The NPCA has stipulated that runoff from new development will have to be controlled for quantity and quality before being released to the Towpath Drain. This will mean that storm pipe network can be conveyed to a larger stormwater management facility on the east side of the study area.

The location of the stormwater management facility will likely be at the easterly limit due to the topography of the study area. Due to the size of the study area there will likely be more than one SWMF.

The SWMFs would be sized to detain the 100 year design storm, and release at the predevelopment flow rate. The control for the SWMF will likely be orifices installed on the outlet pipe within a manhole, for ease of maintenance.

5.3.3 Source Control Practices: Opportunities

The construction of roads, buildings, paved walkways and parking lots results in increased runoff from developed areas. Additional runoff and higher peak flows can increase erosion in streams that are connected to developed catchments. Thus, increasing the runoff rate and volume can negatively impact the natural drainage paths. Erosion can be accelerated by development if proper control measures aren't in place. Regardless of peak flow rate, an increase in annual runoff volume is likely for new developments that use conventional end-of-pipe stormwater management practices. Runoff volumes and peaks can be reduced by promoting infiltration as far upstream in the catchment as possible.

Source control practices are measures to reduce the amount of runoff from a development at the lot level. Reducing runoff to an acceptable level has many benefits such as aquafer recharge, maintaining watershed biodiversity, reduced sizing of stormwater management facilities. Low Impact Development (LID) is a broad term describing the various techniques that can be used to promote infiltration higher up in the watershed.

The transition from conventional end-of-pipe to source control stormwater management approaches is one that is supported by the Ministry of Environment and Climate Change (MOECC). In October 2016, the Runoff Volume Control Targets for Ontario was published. This report gives guidance to the target percentage of annual rainfall that should be kept and infiltrated into the catchment. Based on this report, the runoff volume control target for Ontario is the 90th percentile of the total annual rainfall seen at the site. Or rather, only 10% of the total annual rainfall should be release downstream from the development. In addition to this report, a guiding document for LIDs is also being developed by MOECC and is currently in draft.

6 Conclusions

The following conclusions from the water, sanitary, and storm servicing capacity assessments are as follows:

All:

- The Welland northwest secondary plan (NWSP) area is outside of the Welland Urban boundaries;
- Projected growth area in this area was not considered as part of the Niagara Region's Master Servicing Plan (MSP) and therefore any findings of the MSP does not consider the additional contributions or demands from the NWSP area; and
- Therefore, the future proposed servicing in the NWSP should consider potential implications to the recommendations provided in the MSP, in addition to the potential system-wide impacts that the NWSP servicing may have in addition to those outlined in the MSP.

Water:

- Most of the NWSP area has adequate pressure available, except for east of Montgomery Road;
- Depending on the watermain sizing and configuration, it is anticipated that most areas east of Rice Road will be able to provide adequate pressure during ADD and MDD conditions;
- Depending on watermain sizing and configuration, the main on Quaker Road should be able to provide enough flow and pressure to open space, single and multi-residential homes, and institutional areas, possibly apartments, but will not be able to provide enough flow or pressure to commercial spaces;
- Additional nearby planned developments will create increased water demands and alter the existing system pressures and dynamics in the area surrounding the NWSP area;
- When designing water main sizes, minimize the size as much as possible, while still allowing for adequate pressure and fireflow, to reduce the age of the water in the pipes, which in turn will increase the water quality; and
- When designing the system, minimize the dead-end mains and use loops where possible, which will increase water quality and fireflow availability.

Sanitary:

- There is capacity available at the existing Welland WWTP to treat additional flows;
- There is existing capacity available in the Rice Road, Quaker Road, and Towpath Road trunk sewers; however, it is anticipated that Towpath trunk sewer will experience a capacity deficit in the future, which would require an upgrade to Towpath SPS to increase pumping capacity and accommodate additional future flows; and
- There is available pumping capacity of approximately 30 L/s at the existing Towpath SPS. However, as identified in the MSP, Towpath SPS would likely require an upgrade to meet future projected flows. Since the NWSP area was not considered as a growth area in the MSP, development of this area would likely necessitate an upgrade to Towpath SPS earlier than forecasted in the MSP. Future pump selection and station design should consider contributing inflows from the proposed development of the NWSP area.

Storm:

The following recommendations have been provided to aid the design of the Northwest Welland Secondary Plan Area:

- There existing a stormwater management facility downstream of the site that has experience ponding and flooding issues in the past. Care in design and ensuring post development flows match existing conditions will be important;
- Storm pipe network will be required to service the new development;
- The existing drainage channels do not have adequate slope and capacity to accommodate stormflow from new development and further erosion of the natural channels are a concern; and
- Two (or three) stormwater management facilities (ponds) will be required to adequately address the drainage for the Study Area.

Appendix A – Fenwick Existing Sanitary Sewer Capacity Assessment

SANITARY SEWER DESIGN SHEET

Date: 13-Jul-18
Design By: AP
Checked By:

Project:
Location:

Roughness Coefficient (n) = 0.013
Residential Per Capita Flow Rate = 0.00318287 L/cap/s (275 L/cap/day)
Commercial Flows = 0 L/s/ha (10000 L/ha/day)
Industrial Sewage Flows = 0 L/s/ha (20000 L/ha/day)
Institutional Flows = 0 L/s/ha (20000 L/ha/day)
Infiltration Rate= 0.286 L/s/ha

Associated Engineering

Location						RESIDENTIAL AREA AND POPULATION							INFILTRATION			TOTALS		SEWER DESIGN									
Description	MANHOLE		Invert Elevns		Length	AREA	POP.	CUMULATIVE		AVG. DAILY FLOW	PEAKING FACTOR (PF = 1+14/(4+P^1/2))	PEAK FLOW (NO INFIL.)	TOTAL AREA	ACCU. AREA	INFILT. FLOW	AVG. FLOW	PEAK FLOW	PIPE SIZE	SLOPE	Act. Dia.	PIPE AREA	HYD. RAD.	FULL FLOW VELOCITY	FULL FLOW CAPACITY	PERCENT FULL	CAPACITY CHECK	Available Capacity
			U/S	D/S				AREA	POP. Served																		
STREET	FROM	TO			m	(ha)	(ppl)	(ha)	(ppl)	(l/s)	(dimnl)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(l/s)	(mm)	(%)	(mm)	(m^2)	(m)	(m/s)	(L/s)	(%)		(L/s)
Kaywood Crt: KA to Q(Kay)	406417MH02	406427MH01	188.89	188.47	65	0.5	15	0.5	15	0.05	4.00	0.19	0.50	0.50	0.14	0.2	0.3	200	0.65	203.2	0.032	0.051	0.85	**27.5**	**1.2**	**OK**	27.17
Tomham Blvd: TA to MB	406428MH01	406541MH01	188.66	186.12	420	9.5	133	9.5	133	0.42	4.00	1.69	9.50	9.50	2.72	3.1	4.4	250	0.60	254.0	0.051	0.064	0.95	**48.2**	**9.1**	**OK**	43.83
Montgomery Rd: MA to MB	406543MH01	406541MH01	186.53	186.10	179	2.6	25	12.1	158	0.50	4.00	2.01	2.60	12.10	3.46	4.0	5.5	250	0.24	254.0	0.051	0.064	0.60	**30.4**	**18.0**	**OK**	24.96
Montgomery Rd: MB to Q(Mon)	406541MH01	406447MH03	186.08	185.03	423	4.8	78	16.9	368	1.17	4.00	4.68	4.80	16.90	4.83	6.0	9.5	250	0.25	254.0	0.051	0.064	0.61	**30.9**	**30.8**	**OK**	21.41
Quaker Rd: Q(Mil) to Q(Kay)	406417MH03	406427MH01	188.89	188.42	53	0.7	10	17.6	378	1.20	4.00	4.81	0.65	17.55	5.02	6.2	9.8	200	0.88	203.2	0.032	0.051	0.99	**32.1**	**30.6**	**OK**	22.26
Quaker Rd: Q(Kay) to Q(Mon)	406427MH01	406447MH03	188.41	184.55	270	4.7	35	22.8	428	1.36	4.00	5.44	4.70	22.75	6.51	7.9	11.9	250	1.43	254.0	0.051	0.064	1.46	**74.1**	**16.1**	**OK**	62.18
Quaker Rd: Q(Mon) to Q(Ric)	406447MH03	406497MH01	184.52	181.64	481	5.5	35	45.2	830	2.64	3.85	10.17	5.50	45.15	12.91	15.6	23.1	300	0.60	304.8	0.073	0.076	1.07	**78.1**	**29.6**	**OK**	54.97
Flows from Hurricane SPS		P1	N/A	N/A	N/A	N/A	N/A			6.10						6.1	45.6										
Flows from Pelham (Fonthill)	P1	406592MH01	N/A	N/A				0.0		6.10	4.00	24.38	0.00	0.00	0.00	6.1	150.0	450 / 600									
Rice Rd: RA to Q(Ric)	406592MH01	406497MH01	180.37	179.30	513			0.0		6.10	4.00	24.38	0.00	0.00	0.00	6.1	24.4	600	0.21	609.6	0.292	0.152	1.00	**292.6**	**8.3**	**OK**	268.18
Quaker Rd: Q(Ric) to TA	406497MH01	416487MH01	179.28	172.98	2375			45.2	830	8.74	3.85	25.3898	0.00	45.15	12.91	21.6	38.3	750	0.27	762.0	0.456	0.191	1.31	**598.1**	**6.4**	**OK**	559.82
Towpath Rd: TA to TB	436437MH03	436540MH01	172.85	171.25	290	172.7	0	217.9	5133	16.34	3.23	38.30	172.70	217.85	62.31	78.6	100.6	750	0.55	762.0	0.456	0.191	1.89	**862.7**	**11.7**	**OK**	762.07
Towpath Rd: TB to Towpath SPS	436540MH01	446525MH01	171.23	169.14	985	172.7	5133	172.7	5133	16.34	3.23	100.61	172.70	172.70	49.39	65.7	150.0	900	0.21	914.4	0.657	0.229	1.32	**869.9**	**17.2**	**OK**	719.94

Notes:
1. Residential design flows as per UCC
2. Diameters as per City of Welland GIS
2. Slopes as per City of Welland GIS (based on invert elevations)
3. Infiltration rate is 0.286 as per Region Master Plan 2017
4. Peak Factors as per Harmon's Formula
5. Population estimated using a combination of MSP numbers and GIS
6. No downstream backflows analysis was completed at this stage

Appendix B – Stormwater Analysis: Modified Rational Method

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM :	5 yr
Storm Duration (min)	53.25
A=	830
b=	0.7777
c=	7.3

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area	
A1 - Impervious	25000 (m^2)	Assumed 10% imperviousness
A2 - Grassed	225000 (m^2)	
Total Area	**250000** (m^2)	

Weighted 'C' Value = **0.32**

Rainfall Intensity

I = a/(t+c)^b
I = **34.13** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.51) * (32.29 mm/hr) * (250000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **0.747 m^3/s**
746.62 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM :	100 yr
Storm Duration (min)	53.25
A=	1020
b=	0.731
c=	4.7

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area
A1 - Impervious	25000 (m^2)
A2 - Grassed	225000 (m^2)
Total Area	**250000** (m^2)

Weighted 'C' Value = **0.32**

Rainfall Intensity

I = a/(t+c)^b
I = **52.46** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.51) * (53.81 mm/hr) * (250000 m^2) * (1 m / 1000 mm) * (1 hr / 36
Q = **1.148 m^3/s**
1147.57 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (hrs): 53.76
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

		'C'
Impervious Area =		0.9
Grassed Area =		0.25

Cover Type	Cover Area		
A1 - Asphalt	160000	(m^2)	Assumed 20% imperviousness
A2 - Grassed	640000	(m^2)	
Total Area	**800000**	(m^2)	

Weighted 'C' Value = **0.38**

Rainfall Intensity

I = a/(t+c)^b
I = **33.91** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.38) * (32.07 mm/hr) * (800000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **2.863 m^3/s**
2863.35 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (hrs): 53.76
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

		'C'
Impervious Area =		0.9
Grassed Area =		0.25

Cover Type	Cover Area		
A1 - Asphalt	160000	(m^2)	
A2 - Grassed	640000	(m^2)	
Total Area	**800000**	(m^2)	

Weighted 'C' Value = **0.38**

Rainfall Intensity

I = a/(t+c)^b
I = **52.12** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.38) * (53.45 mm/hr) * (800000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **4.402 m^3/s**
4401.55 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (min) 68.73
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area	
A1 - Asphalt	325350 (m^2)	Assumed 15% imperviousness
A2 - Grassed	1843650 (m^2)	
Total Area	**2169000** (m^2)	

Weighted 'C' Value = **0.35**

Rainfall Intensity

I = a/(t+c)^b
I = **28.59** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.35) * (27.01 mm/hr) * (2169000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **5.986 m^3/s**
5986.04 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (min) 68.73
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area
A1 - Asphalt	325350 (m^2)
A2 - Grassed	1843650 (m^2)
Total Area	**2169000** (m^2)

Weighted 'C' Value = **0.35**

Rainfall Intensity

I = a/(t+c)^b
I = **44.12** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.35) * (45.02 mm/hr) * (2169000 m^2) * (1 m / 1000 mm) * (1 hr / 3
Q = **9.237 m^3/s**
9237.41 lps

Design by: S.Bourke, P.Eng April 26, 2018

Existing Site Peak Runoff
Rational Method Calculations

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (min) 57.88
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

		'C'
Impervious Area =		0.9
Grassed Area =		0.25

Cover Type	Cover Area	
A1 - Asphalt	63536 (m^2)	Assumed 33% imperviousness
A2 - Grassed	127,264 (m^2)	
Total Area	**190800** (m^2)	

Weighted 'C' Value = **0.47**

Rainfall Intensity

I = a/(t+c)^b
I = **32.23** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.47) * (30.46 mm/hr) * (190800 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **0.797 m^3/s**
796.75 lps

Design by: S.Bourke, P.Eng April 26, 2018

Existing Site Peak Runoff
Rational Method Calculations

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (min) 57.88
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

		'C'
Impervious Area =		0.9
Grassed Area =		0.25

Cover Type	Cover Area	
A1 - Asphalt	63536 (m^2)	
A2 - Grassed	127,264 (m^2)	
Total Area	**190800** (m^2)	

Weighted 'C' Value = **0.47**

Rainfall Intensity

I = a/(t+c)^b
I = **49.59** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.47) * (50.76 mm/hr) * (190800 m^2) * (1 m / 1000 mm) * (1 hr / 36
Q = **1.226 m^3/s**
1225.99 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM :	5 yr
Storm Duration (min)	170.72
A=	830
b=	0.7777
c=	7.3

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area	
A1 - Asphalt	299250 (m^2)	Assumed 10% imperviousness
A2 - Grassed	2693250 (m^2)	
Total Area	**2992500** (m^2)	

Weighted 'C' Value = **0.32**

Rainfall Intensity

I = a/(t+c)^b
I = **14.75** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.32) * (14.3 mm/hr) * (2992500 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **3.863 m^3/s**
3863.03 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM :	100 yr
Storm Duration (min)	170.72
A=	1020
b=	0.731
c=	4.7

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area
A1 - Asphalt	299250 (m^2)
A2 - Grassed	2693250 (m^2)
Total Area	**2992500** (m^2)

Weighted 'C' Value = **0.32**

Rainfall Intensity

I = a/(t+c)^b
I = **23.34** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.32) * (23.83 mm/hr) * (2992500 m^2) * (1 m / 1000 mm) * (1 hr / 3
Q = **6.112 m^3/s**
6112.49 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (min) 42.86
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area	
A1 - Asphalt	140000 (m^2)	Assumed 20% imperviousness
A2 - Grassed	540000 (m^2)	
Total Area	**680000** (m^2)	

Weighted 'C' Value = **0.38**

Rainfall Intensity

I = a/(t+c)^b
I = **39.51** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.38) * (41.59 mm/hr) * (680000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **2.865 m^3/s**
2864.56 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (min) 42.86
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area
A1 - Asphalt	140000 (m^2)
A2 - Grassed	540000 (m^2)
Total Area	**680000** (m^2)

Weighted 'C' Value = **0.38**

Rainfall Intensity

I = a/(t+c)^b
I = **60.61** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.38) * (69.32 mm/hr) * (680000 m^2) * (1 m / 1000 mm) * (1 hr / 36
Q = **4.394 m^3/s**
4394.25 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (min) 43.70
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area	
A1 - Asphalt	11500 (m^2)	Assumed 5% impervious
A2 - Grassed	220000 (m^2)	
Total Area	**231500** (m^2)	

Weighted 'C' Value = **0.28**

Rainfall Intensity

I = a/(t+c)^b
I = **39.00** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.28) * (37.07mm/hr) * (230000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **0.708 m^3/s**
707.99 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (min) 43.70
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area
A1 - Asphalt	11500 (m^2)
A2 - Grassed	220000 (m^2)
Total Area	**231500** (m^2)

Weighted 'C' Value = **0.28**

Rainfall Intensity

I = a/(t+c)^b
I = **59.84** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.28) * (61.78mm/hr) * (230000 m^2) * (1 m / 1000 mm) * (1 hr / 36
Q = **1.086 m^3/s**
1086.18 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (min) 41.12
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area	
A1 - Asphalt	80000 (m^2)	Assumed 40% imperviousness
A2 - Grassed	120000 (m^2)	
Total Area	**200000** (m^2)	

Weighted 'C' Value = **0.51**

Rainfall Intensity

I = a/(t+c)^b
I = **40.61** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.51) * (38.68 mm/hr) * (200000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **1.151 m^3/s**
1150.68 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (min) 41.12
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area
A1 - Asphalt	80000 (m^2)
A2 - Grassed	120000 (m^2)
Total Area	**200000** (m^2)

Weighted 'C' Value = **0.51**

Rainfall Intensity

I = a/(t+c)^b
I = **62.29** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.51) * (64.47 mm/hr) * (200000 m^2) * (1 m / 1000 mm) * (1 hr / 36
Q = **1.765 m^3/s**
1764.78 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (min) 53.63
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area	
A1 - Asphalt	63000 (m^2)	Assumed 10% imperviousness
A2 - Grassed	567000 (m^2)	
Total Area	**630000** (m^2)	

Weighted 'C' Value = **0.32**

Rainfall Intensity

I = a/(t+c)^b
I = **33.97** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.32) * (32.13 mm/hr) * (630000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **1.872 m^3/s**
1872.37 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (min) 53.63
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

	'C'
Impervious Area =	0.9
Grassed Area =	0.25

Cover Type	Cover Area
A1 - Asphalt	63000 (m^2)
A2 - Grassed	567000 (m^2)
Total Area	**630000** (m^2)

Weighted 'C' Value = **0.32**

Rainfall Intensity

I = a/(t+c)^b
I = **52.21** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.32) * (53.54 mm/hr) * (630000 m^2) * (1 m / 1000 mm) * (1 hr / 36
Q = **2.878 m^3/s**
2878.12 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 5 yr
Storm Duration (min) 56.71
A= 830
b= 0.7777
c= 7.3

Runoff Coefficient, C

		'C'
Impervious Area =		0.9
Grassed Area =		0.25

Cover Type	Cover Area	
A1 - Asphalt	60000 (m^2)	Assumed 33 % imperviousness
A2 - Grassed	120000 (m^2)	
Total Area	**180000** (m^2)	

Weighted 'C' Value = **0.47**

Rainfall Intensity

I = a/(t+c)^b
I = **32.68** mm/hr

5 year Runoff Peak Flow Rate

Q = CIA
Q = (0.47) * (30.89 mm/hr) * (180000 m^2) * (1 m / 1000 mm) * (1 hr / 3600 s)
Q = **0.763 m^3/s**
762.64 lps

Design by: S.Bourke, P.Eng April 26, 2018

Associated Engineering Ltd.
300-509 Glendale Avenue East
NOTL, ON, L0S 1J0

Existing Site Peak Runoff
Rational Method Calculations

PROJECT: Northwest Welland Secondary Plan
PROJECT NUMBER: 2018-5190
CLIENT: SGL
MUNICIPALITY: City of Welland

DESIGN STORM : 100 yr
Storm Duration (min) 56.71
A= 1020
b= 0.731
c= 4.7

Runoff Coefficient, C

		'C'
Impervious Area =		0.9
Grassed Area =		0.25

Cover Type	Cover Area
A1 - Asphalt	60000 (m^2)
A2 - Grassed	120000 (m^2)
Total Area	**180000** (m^2)

Weighted 'C' Value = **0.47**

Rainfall Intensity

I = a/(t+c)^b
I = **50.28** mm/hr

100 year Runoff Peak Flow Rate

Q = CIA
Q = (0.47) * (51.49 mm/hr) * (180000 m^2) * (1 m / 1000 mm) * (1 hr / 36
Q = **1.173 m^3/s**
1173.16 lps

Design by: S.Bourke, P.Eng April 26, 2018

Appendix C – Response to Comments on Northwest Welland Secondary Plan – Site Servicing

Response to Comments on Northwest Welland Secondary Plan – Site Servicing
Existing Conditions Report
Associated Engineering (Ont.) Ltd.
January 31st, 2019

Regional Comments

Comment	**Responses**
1) General Comment - The Niagara Region understands that this draft report has been written to document the existing servicing conditions of the study area. With respect to stormwater management, it is important to understand the location and nature of the aquatic and terrestrial features within the study area as these features are often intertwined with the area's hydrologic regime. The Niagara Region further understands that the environmental existing conditions report will be forwarded to this office in the near future. As such, these stormwater management comments are offered on a preliminary basis and are subject to revision based on our review of the environmental report.	Noted – another member of the project team (Aquafor Beech) will submit the environmental report.
2) Section 2.2 – Data Gaps: a. The Niagara Region notes that Niagara Peninsula Conservation Authority possesses Advisory 100 year Floodplain Mapping for the Towpath Drain within the Study Area. The Niagara Region recommends that this study engage the Niagara Peninsula Conservation Authority in order to obtain additional information, reports, and hydrologic and hydraulic modelling information regarding this system.	AE has received modelling for the Towpath Drain and will consider and include this information through the preliminary and detailed design phase of this assignment, as required.
b. The Niagara Region notes that the Niagara Peninsula Conservation Authority possesses a significant amount of groundwater information and data. As such, the Niagara Region recommends that this study engage the Niagara Peninsula Conservation Authority in order to obtain this information that is applicable to the Study Area.	AE has received groundwater information from the NPCA and will take the information into consideration through detailed design

3) Section 5.1 – Existing Conditions: a. The Niagara Region notes that the watercourse known as the Towpath Drain (also known as the Welland Canal Tributaries #7 & #8) flows through the study area. The Niagara Region further notes that despite its name, the Towpath Drain has not been designated a Municipal Drain pursuant to the provincial *Drainage Act*. As such, this section shall be revised to include a more fulsome discussion of the Towpath Drain with respect to drainage area, origin, extent, point of discharge, capacity, and habitat type.	As part of the proposed assessments, we will include appropriate background information on the Towpath study area.
b. The small existing development is east of Line Ave and north of Quaker Rd.	This sentence has been revised.
c. The Niagara Region notes that Figure 5.1 shows photos of local flooding issues within the Study Area. If local flooding is a concern within the Study Area, this document should further discuss this issue with regards to drainage area, flood location, flood frequency, flood impacts, local storm infrastructure capacity, and perceived causes.	The analysis in Section 5.3.1 will be expanded upon in preliminary design - proposed development results will greatly impact the requirements for analysis in this section
d. The Niagara Region notes that this section indicates that a large portion of the study area has been identified as a Significant Groundwater Recharge Area. The Niagara Region will require that additional discussion be provided regarding the extent, nature, and depth of the groundwater regime, recharge area, and soils within the Study Area.	Noted – the team (Aquafor Beech) will submit the results of the groundwater recharge analysis
4) Section 5.2 – Design Criteria: As of January 2018, the protocol regarding the Memorandum of Understanding between the Niagara Region and the Niagara Peninsula Conservation Authority (NPCA) has changed. The Niagara Region is now responsible for stormwater management review and approval for Planning Act applications. As such, the Niagara Region will require the following criteria to be met for all new development in the Study Area:	All comments in the section are noted, and will be included in the final reporting.

a. That all post development stormwater runoff peak flows be attenuated to pre-development levels for up to and including the 100 year return period design storm event prior to discharge into the Towpath Drain. b. That all stormwater runoff be treated to a Normal standard prior to discharge into the Towpath Drain. c. That stormwater runoff from the 25mm design storm event be captured and detained for a period of at least 24 hours in order to mitigate the impacts of erosion on the Towpath Drain. d. While the Niagara Region supports the concept of communal stormwater management facilities in principle, the Niagara Region requires that stormwater runoff be managed *prior* to its introduction into the Towpath Drain.	See above.
5) Section 5.3.1 – Predevelopment Conditions: a. The Niagara Region has no objection to the preliminary assessment of the capacity of the existing culverts within the Study Area. b. The Niagara Region would request that commentary be provided on the Level of Service required of the roads in the Study Area and if the existing culverts are adequate to convey the required flows.	Noted – road classification will be ensured with the final deliverable.
6) Section 5.3.2 – Stormwater Management Facilities and Section 5.3.3 – Source Control Practice Opportunities: a. The Niagara Region understands that this report is meant to outline the existing servicing and hydrologic conditions within the Study Area. The Niagara Region has no objection to this. However, in the absence of background environmental information, further information regarding groundwater and soils conditions, and a preliminary land use pattern, all discussion regarding proposed stormwater management concepts are premature. As such, the Niagara	Noted. This will either be removed, or better justification provided.

Region recommends removing these sections from this document.	
7) Appendix B – Rational Method for Stormwater Management Facility Sizing a. The Niagara Region notes that this Appendix contains the calculations to generate pre-development flows draining to the various culverts within the Study Area. As such, it is recommended that this Appendix be renamed. b. Please indicate the catchment in question for the various calculations in this Appendix.	Understood, this will be clarified in the final submission, and the appendix will be updated appropriately.

City Comments (Marvin Ingebritsen)

Comment	**Responses**
Data Gaps - "All Pipes" sanitary model	The calibrated model was not available at the time of our analysis for the baseline study. The proposed study will utilize the updated model for the proposed option capacity analysis
Table 2-1 - Water category	Noted - we will use the City's Water Model for the proposed design
Pg 6, Sect. 3	See response number 2 - the updated City model will be used for proposed, and compared to existing results
General comment - street names	Yes, street names will be added to all figures for the final reporting
Pg. 20, Table 4-4 - Extraneous Flows, 0.286 l/s/ha in existing	We will identify locations and make recommendations for the City to insert flow monitoring equipment in the area in early 2019
Pg 21, Assessment of Welland WWTP	We have identified that the MSP did not consider this area as part of future growth. We will assess during our proposed conditions analysis, once generated flows have been calculated, whether the downstream SPS (Towpath) and subsequent Regional facilities are appropriately sized.
Pg 21, Higher I/I - Flow monitoring is recommended	Noted - we will include recommendations as part of the 2019 flow monitoring program
Pg 22 Trunk Sewers - use model	Noted - will use updated model, and confirm existing conditions
Pg 24 – IDF curves	Noted – will request updated IDF information from the City and if available for the proposed assessments, we will incorporate.

Change erosion protection wording - mandatory	noted
Pg 31 – culverts	Many culverts will be replaced as a drainage conduit by storm sewers. The existing culverts that will remain will be clarified for capacity in the final design.

APPENDIX E – Transportation Assessment

by Associated Engineering

SGL

ASI

Aquafor Beech Limited

Associated Engineering

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

City of Welland

Northwest Welland Secondary Plan
Transportation Assessment
Existing Conditions Report

April 2019

CANADA'S BEST MANAGED COMPANIES Platinum member

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1 Introduction

The intended function of this report is to document the assessment of existing transportation infrastructure within the proposed development area referred to as the Northwest Welland Secondary Plan situated within the City of Welland's rural boundary. As a result of the development of the area, it is understood that the City's urban boundary will be expanded to include these development lands.

1.1 DEVELOPMENT CONTEXT

The Northwest Welland Secondary Plan is a proposed mixed-density residential development that will provide housing for full-time residents within the City of Welland. The development area will be a community marked by sustainable transportation infrastructure through the implementation of sidewalks, cycling facilities, and/or multi-use pathways creating a unified and integrated network for all modes of transportation. The development area is comprised of approximately 189 hectares of primarily rural/agricultural designated lands. Within the project limits, there are approximately 55 hectares (or 29% of the area) of land presently developed and municipally serviced.

Situated within the northwest quadrant of the City of Welland in a currently zoned rural area, **Figure 1-1** illustrates the location plan of the Northwest Welland Secondary Plan. Situated to the east of the development lands, Highway 406 is accessed via Regional Road 37 (Merritt Road), Regional Road 50 (Niagara Street/Merrittville Highway), and Quaker Road. Traversing east-west to the south of the development lands is Regional Road 51 (Woodlawn Road) while Regional Road 36 (Pelham Road) traverses north-south and is located to the west of the development lands.

While single-detached residential is the predominant existing populated land use within the development lands, there are other land uses including, but not necessarily limited to: agricultural and fallow land, institutional land (Niagara Catholic District School Board, École Élémentaire Nouvel Horizon, etc.), open space and recreational land (former Welland Soccer Club), wetlands, and wooded areas. Of these non-residential land uses, agricultural lands and wooded areas are the most dominant.

Adjacent to the Northwest Welland Secondary Plan development lands, the surrounding area is comprised of single-detached residential, agricultural and fallow lands, institutional (Niagara College), open space and recreational land, and commercial. Lands to the immediate north are located within the urban boundary of the Town of Pelham (including the recent East Fonthill Secondary Plan) and City of Thorold (including the proposed Port Robinson West Secondary Plan). The East Fonthill Secondary Plan and Port Robinson West Secondary Plan are discussed further in the following section of this report.

1.2 DEVELOPMENT LANDS AND STUDY AREA

The proposed development lands are in the northwest quadrant of the City of Welland, bounded to the north by the City of Welland's municipal limits, to the west by Line Avenue/Clare Avenue, and to the east by the rear property line of those properties fronting onto Regional Road 50 (Niagara Street). The boundary of the development lands to the south is more complex which is bounded immediately north of Briarsdale

Crescent, Northwood Drive, Ash Court, and the Seneca Trail before jogging to the north avoiding Rollins Drive up to Quaker Road where it continues east. **Figure 1-2** illustrates the approximate location of the boundary of the development lands alongside the arterial and collector roadways within the limits.

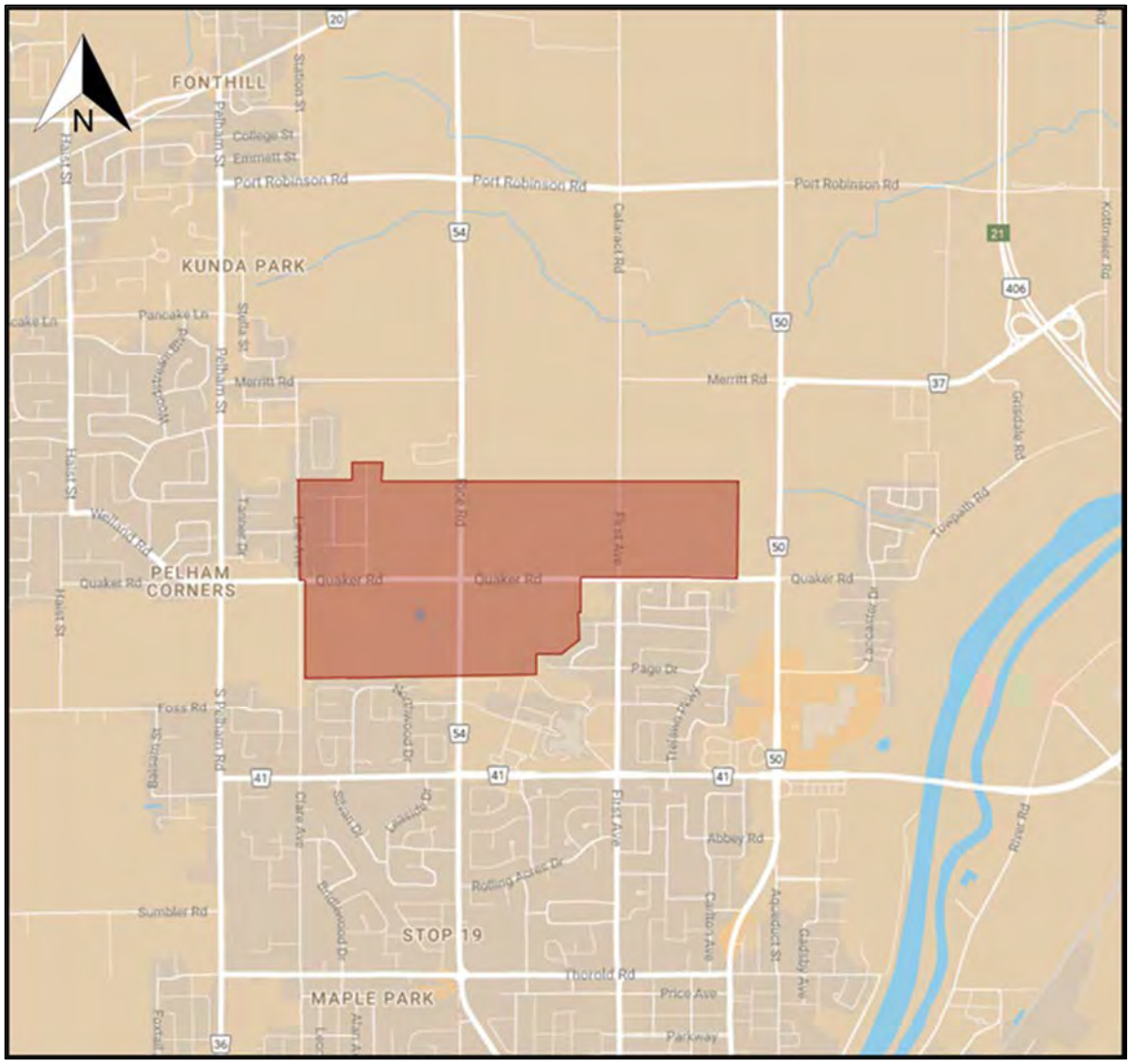


Figure 1-1
Northwest Welland Secondary Plan Location Plan

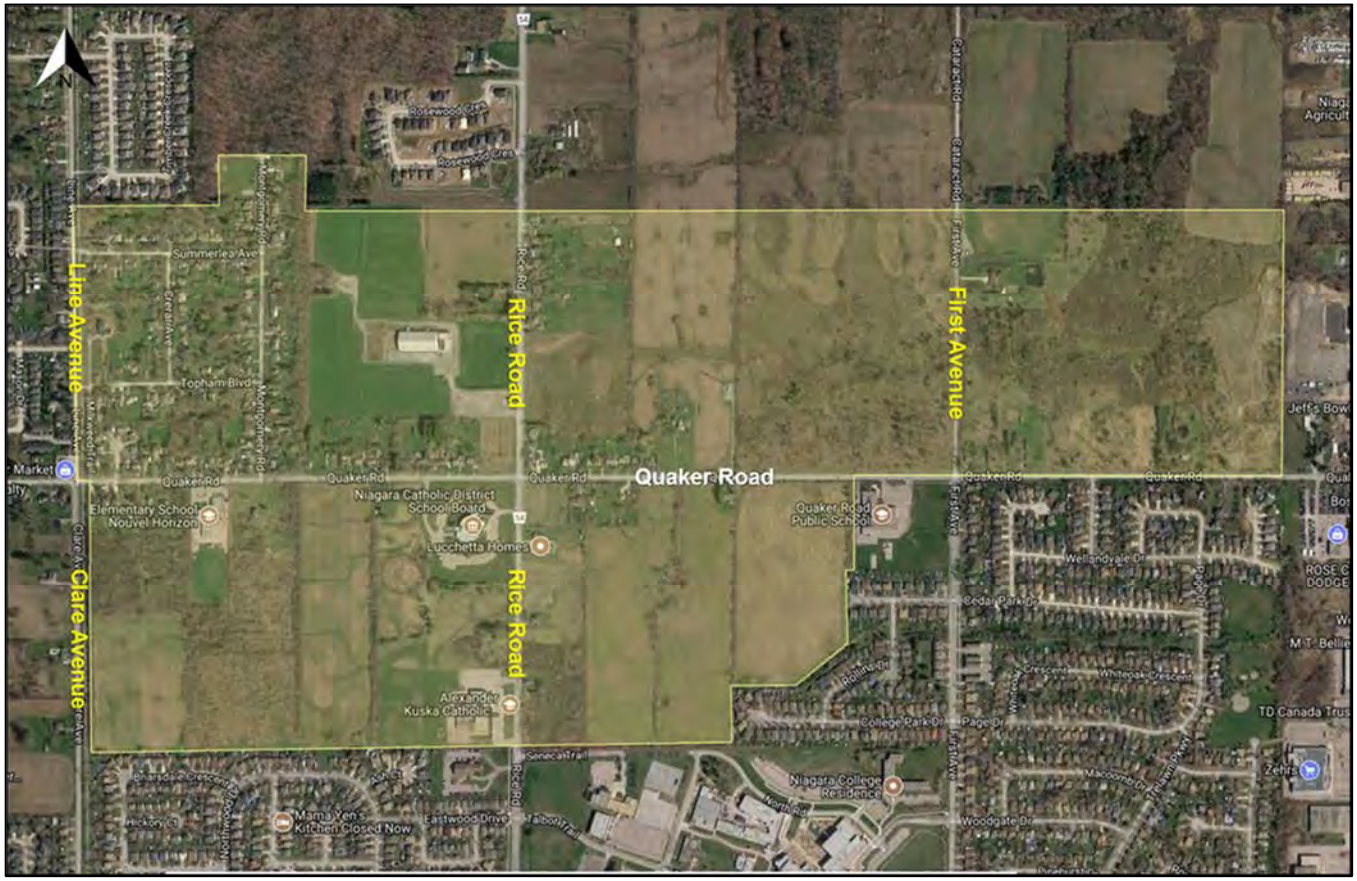


Figure 1-2
Northwest Welland Secondary Plan Development Limits

1.3 OBJECTIVES OF TRANSPORTATION ASSESSMENT

To effectively understand the existing and proposed state of the transportation infrastructure within the Northwest Welland Secondary Plan development lands, the following objectives are set forth for the transportation assessment partially documented within this report:

Base Year (2018), Background Traffic Conditions

- Collect and analyse eight (8) hour turning movement counts (TMCs) and twenty-four (24) hour automated traffic recorder (ATR) data including traffic volume, vehicle classification, and observed speed for the intersections and midblock roadway sections within the study area during the weekday morning (AM) and afternoon (PM) peak hours;
- Assess traffic operations during the base year (2018) for background traffic volumes to set a benchmark for comparison to the anticipated level of service for future years before and after the full-build out of the development lands; and
- Undertake a detailed field investigation to document and review existing conditions in terms of roadway geometry, roadway cross-section, intersection control, and presence of active transportation facilities, and transit service.

Horizon Year (2031), Background Traffic Conditions

- Project base year (2018) background traffic volumes to horizon year (2031) background traffic volumes through the application of a suitable compound annual growth rate; and
- Assess traffic operations during the horizon year (2031) for background traffic volumes and compare to the base year (2018) background traffic conditions to identify changes to level of service experienced as a result of non-development related growth within the area.

Horizon Year (2031), Development Traffic Conditions

- Determine the trip generation and trip attraction with regards to the proposed land use(s) during the morning (AM) and afternoon (PM) peak hours using the Institute of Transportation Engineers *Trip General Manual*; and
- Determine the trip distribution of the development traffic volumes using a combination of *Transportation Tomorrow Survey Data* and existing travel patterns derived from the eight (8) hour TMCs for the study area intersections.

Horizon Year (2031), Total Traffic Conditions

- Assess traffic operations during the horizon year (2031) for total traffic volumes (background plus development) and compare to the horizon year (2031) background traffic conditions to identify changes to level of service experienced as a result of development related growth within the area; and

- Assess the capabilities of the existing transportation infrastructure to accommodate all types of road users ranging from the increased vehicular volume at intersections as well as how the traffic accesses the existing road network to the presence of pedestrians and cyclists as a result of the sustainability focused design of the development lands.

Identification and Recommendation of Capacity and or Active Transportation Improvements

While the previous objectives encompass the entire transportation assessment, this report specifically documents the review of the existing transportation infrastructure.

2 Existing Transportation Infrastructure

The following section documents the state of the existing multi-modal transportation infrastructure within the study area and assesses the performance of the subject intersections through utilization of the existing traffic data and traffic modelling software. Furthermore, the following subsections describe and discuss the existing transportation network.

2.1 ROADWAY CLASSIFICATION

Within the development lands, the major existing roadways are Quaker Road, Regional Road 54 (Rice Road), and First Avenue. Immediately outside of the western boundary of the study area is Line Avenue/Clare Avenue. Of these three north-south roadways, each intersect Quaker Road at a four-legged intersection; it is noted that Line Avenue/Clare Avenue is marginally offset between the north and south approaches.

The twenty-four (24) hour ATR data provided by the Regional Municipality of Niagara and the City of Welland was used to determine the roadway classifications in accordance with Transportation Association of Canada's *Geometric Design Guide for Canadian Roadways*, 2017. **Table 2-1** summarizes the traffic volume and resulting roadway classification based on the average annual daily traffic (AADT) volumes.

Table 2-1
Existing Roadway Classification

Roadway	From/To Roadways	Year	AADT	Classification
Quaker Road	Line Avenue/Clare Avenue to Regional Road 54 (Rice Road)	2017	6,000	Rural Arterial
Quaker Road	First Avenue to Regional Road 50 (Niagara Street)	2017	9,100	Rural Arterial
Regional Road 54 (Rice Road)	Port Robinson Road to Quaker Road	2016	7,500	Rural Arterial
Regional Road 54 (Rice Road)	Quaker Road to Regional Road 41 (Woodlawn Road)	2016	7,700	Rural Arterial
First Avenue	Regional Road 37 (Merritt Road) to Quaker Road	2017	3,400	Rural Collector
First Avenue	Quaker Road to Regional Road 41 (Woodlawn Road)	2017	6,000	Urban Collector

Two (2) major regional roadways are location to the west and east of the study area: Regional Road 36 (Pelham Street) and Regional Road 50 (Niagara Street). Regional Road 36 (Pelham Street) is an arterial roadway that has an approximate AADT volume of 12,000 to 13,000 vehicles per day while Regional Road 50 (Niagara Street) is an arterial roadway that has an approximate AADT volume of 15,000 to 18,000 vehicles per day. Line Avenue/Clare Avenue carries approximately 2,400 vehicles per day and would be considered a rural collector. Given their proximity to the development lands, traffic data was assessed since they are roadways likely to be impacted by the development traffic.

2.2 ROADWAY CROSS-SECTION AND INTERSECTION CONTROL

Within the study development lands, there are three (3) primary roadways that will be impacted as a result of the additional traffic generated by the Northwest Welland Secondary Plan: Quaker Road, Regional Road 54 (Rice Road), and First Avenue.

Quaker Road is currently a two-lane roadway comprised of a rural cross-section bisecting east-west through the middle of the study area. **Figure 2-1** illustrates the typical roadway cross-section throughout the corridor. As per the traffic data, Quaker Road operates as a rural arterial roadway with traffic volumes in the range of 6,000 to 9,000 vehicles per day. From west to east, Quaker Road intersects with Regional Road 36 (Pelham Street) under traffic signal control, Line Avenue/Clare Avenue under all-way stop control, Regional Road 54 (Rice Road) under all-way stop control, First Avenue under all-way stop control, and Regional Road 50 (Niagara Street) under traffic signal control. All minor intersections along this corridor operation under stop control for the minor roadway approaches only. Under existing conditions, Quaker Road operates with a posted regulatory speed limit of 50 kilometres per hour with the exception of the school zones where School Zone Maximum Speed When Flashing signs are present reducing the speed to 40 kilometres per hour. In general, Quaker Road has a relatively straight and flat alignment within the study area.

Figure 2-1
Quaker Road Cross-Section (View to West at Montgomery Avenue)

Regional Road 54 (Rice Road) is currently a two-lane roadway comprised of a rural cross-section traversing north-south through the study area. **Figure 2-2** illustrates the typical roadway cross-section throughout the corridor. As per the traffic data, Regional Road 54 (Rice Road) operates as a rural arterial roadway with traffic volumes in the range of 7,500 to 7,700 vehicles per day. Under existing conditions, Regional Road 54 (Rice Road) operates with a posted regulatory speed limit of 50 kilometres per hour and 40 kilometres per hour to the north and south of Quaker Road, respectively. In general, Regional Road 54 (Rice Road) has a relatively straight and flat alignment within the study area.

Figure 2-2
Regional Road 54 (Rice Road) Cross-Section (View to South at Quaker Road)

First Avenue is currently a two-lane roadway comprised of a rural cross-section (north of Quaker Road) and an urban cross-section (south of Quaker Road) traversing north-south through the study area. It is noted that only the section of First Avenue north of Quaker Road is situated within the study area. **Figure 2-3** illustrates the typical roadway cross-section throughout the corridor. As per the traffic data, First Avenue (north of Quaker Road) operates as a rural collector roadway with traffic volumes of approximately 3,400 vehicles per day. First Avenue (south of Quaker Road) operates as an urban collector roadway with traffic volumes of approximately 6,000 vehicles per day. Under existing conditions, First Avenue operates with a posted regulatory speed limit of 50 kilometres per hour. In general, First Avenue has a relatively straight and flat alignment within the study area.

Figure 2-3
First Avenue Cross-Section (View to North Near Quaker Road)

As previously indicated, the intersections of Quaker Road with Regional Road 54 (Rice Road) and First Avenue currently operate under all-way stop control. All other minor roadways within the development lands operate under stop control along the minor roadway. The signalized intersections of Quaker Road with Regional Road 36 (Pelham Street) and Regional Road 50 (Niagara Street) were included in the scope of this assessment due to their proximity to the development lands and likelihood that they will provide a link to the arterial road network. The intersection of Regional Road 50 (Niagara Street/Merrittville Highway) and Regional Road 37 (Merritt Road) is also signalized and included as a result of its strategic importance as a gateway intersection from Highway 406 into the northwest quadrant of Welland. Figure 2-4 illustrates the intersection control at the subject intersections within and around the development lands. Eight (8) hour TMCs and traffic signal phasing and timing plans (as applicable) were requested for each of these intersections.

Refer to **Appendix A** for the traffic data collected as part of this study.

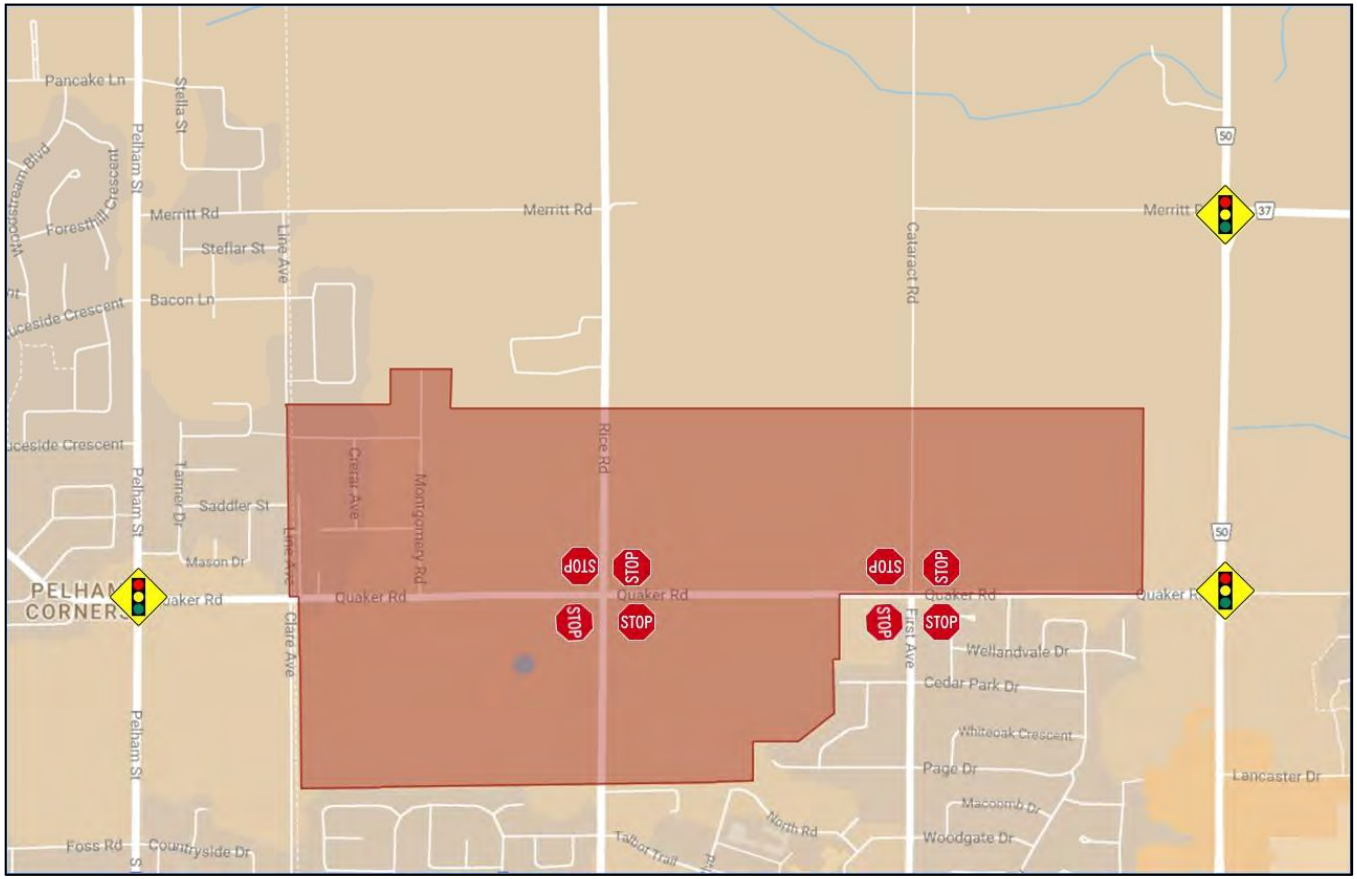


Figure 2-4
Existing Intersection Control

2.3 ACTIVE TRANSPORTATION FACILITIES

Alongside Quaker Road, limited active transportation facilities are present. There is a separated segment of granular pathway on the north side of Quaker Road between Regional Road 54 (Rice Road) and 622 Quaker Road with a ladder cross-walk providing access to École Élémentaire Nouvel Horizon. No dedicated cyclist facilities have been provided along Quaker Road.

With regards to the north-south roadways within or adjacent to the development lands:

- Regional Road 54 (Rice Road) has no active transportation facilities present;
- First Avenue (north of Quaker Road) has no active transportation facilities present;
- First Avenue (south of Quaker Road) has semi-mountable curbs, concrete sidewalks, and bicycle lanes on both sides of the roadway; and
- Line Avenue has semi-mountable curbs with a concrete sidewalk on the west side of the roadway while the Steve Bauer Trail (a multi-use trail maintained by the Town of Pelham) is situated alongside the east side of the roadway.

None of the remaining minor roadways within the development lands have sidewalks or cyclist facilities. According to the Regional Municipality of Niagara's *Strategic Cycling Network Development Technical Paper*[1], First Avenue/Cataract Road was confirmed as a candidate for enhanced cyclist facilities.

Opportunities exist to provide or improve active transportation facilities within the development lands to accommodate pedestrians and cyclists more effectively.

2.4 TRANSIT ROUTES AND FACILITIES

The existing transit service within and around the development lands is depicted in **Figure 2-5**. Within the Northwest Welland Secondary Plan, the only sections of roadway serviced via Welland Transit (Route 8 and Route 10) is along Quaker Road between First Avenue and Regional Road 50 (Niagara Street). Route 8 offers regular service with buses arriving every 30 to 60 minutes between Monday and Sunday. Route 10 offers regular service with buses arriving every 30 to 60 minutes between Monday and Saturday with an extended bus service during off-peak periods. Immediately to the south, Route 2 provides service. Welland Transit operates under stop-request service allowing for riders to alight the bus at a location specified other than standard transit stops.

Opportunities exist to provide or improve transit routes and facilities within the development lands to accommodate transit users more effectively.

[1] Regional Municipality of Niagara, *Strategic Cycling Network Development Technical Paper*, 2017.

Figure 2-5
Existing Transit Routes and Facilities

2.5 TURNING MOVEMENT COUNTS AND TRAFFIC SIGNAL PHASING AND TIMING PLANS

The Regional Municipality of Niagara and the City of Welland provided eight (8) hour turning movement counts for each of the five (5) intersections identified within or adjacent to the development lands which may be impacted as a result of the Northwest Welland Secondary Plan development. **Table 2-2** highlights the weekday one-hour morning (AM) and afternoon (PM) peak traffic periods.

In addition, the Regional Municipality of Niagara provided traffic signal phasing and timing plans for the signalized intersections previously noted.

Table 2-2
Existing Weekday Morning (AM) and Afternoon (PM) Peak Traffic Periods

Intersection	Weekday Morning (AM) Peak	Weekday Afternoon (PM) Peak
Quaker Road and Regional Road 50 (Rice Road)	7:45 a.m. – 8:45 a.m.	3:45 p.m. – 4:45 p.m.
Quaker Road and First Avenue	8:00 a.m. – 9:00 a.m.	4:15 p.m. – 5:15 p.m.
Regional Road 36 (Pelham Street) and Quaker Road	8:00 a.m. – 9:00 a.m.	5:00 p.m. – 6:00 p.m.
Regional Road 50 (Niagara Street) and Quaker Road	8:00 a.m. – 9:00 a.m.	4:15 p.m. – 5:15 p.m.
Regional Road 37 (Merritt Road) and Regional Road 50 (Niagara Street/Merrittville Highway)	7:45 a.m. – 8:45 a.m.	4:30 p.m. – 5:30 p.m.

2.6 TRAFFIC ANALYSIS METHODOLOGY

Within the roadway network, intersections are typically the critical capacity control points. The five (5) intersections previously discussed have been analysed to determine the existing level of service, average vehicular delay, and any capacity constraints as measured by volume-to-capacity ratios through the use of Synchro 9 and SimTraffic 9. All of the traffic operations modelling is in accordance with the Regional Municipality of Niagara's *Guidelines for Traffic Impact Studies*[2].

2.7 BASE YEAR (2018) BACKGROUND TRAFFIC CONDITIONS

Figure 2-6 illustrates the turning movement counts during the weekday morning (AM) and afternoon (PM) peak hours used within the traffic operations assessment. From **Figure 2-6**, it is apparent that the heaviest traffic flows are along Regional Road 37 (Merritt Road) and Regional Road 50 (Niagara Street) stressing the importance of these corridors are connectors to the Provincial Highway Network and as a gateway into the northwest quadrant of Welland. Traffic flows are approximately balanced between the north-south and east-west movements at the subject intersections.

Level of Service (a performance measure based on delay) was calculated for each approach and movement. Level of Service is a qualitative measures of traffic flow at an intersection and is dependent upon vehicular delay and vehicle queue lengths on the various intersection approaches. The values range from a Level of Service of A (little or no delay) to Level of Service of F (congested conditions with significant

[2] Regional Municipality of Niagara, *Guidelines for Traffic Impact Studies*, 2012.

delay). **Appendix B** provides further information on the Level of Service definitions (A through F). The Level of Service for each intersection is presented by approach and movement in **Figure 2-7**.

The analysis indicates that overall, the intersections are all operating below capacity with an adequate Level of Service; all movements noted as being a Level of Service of C or better. The one exception is the intersection of First Avenue and Quaker Road, which is experiencing a Level of Service of D on the east approach (all movements); indicating that long delays may be occurring during peak hour conditions in both the AM and PM peak hours. During the AM peak hour, the control delay on the eastbound approach is 25.3 seconds (per vehicle on average). During the PM peak hour, the control delay on the eastbound approach is 29.5 seconds (per vehicle on average). **Appendix B** provides the traffic operations assessment reports for the base year (2018) background traffic.

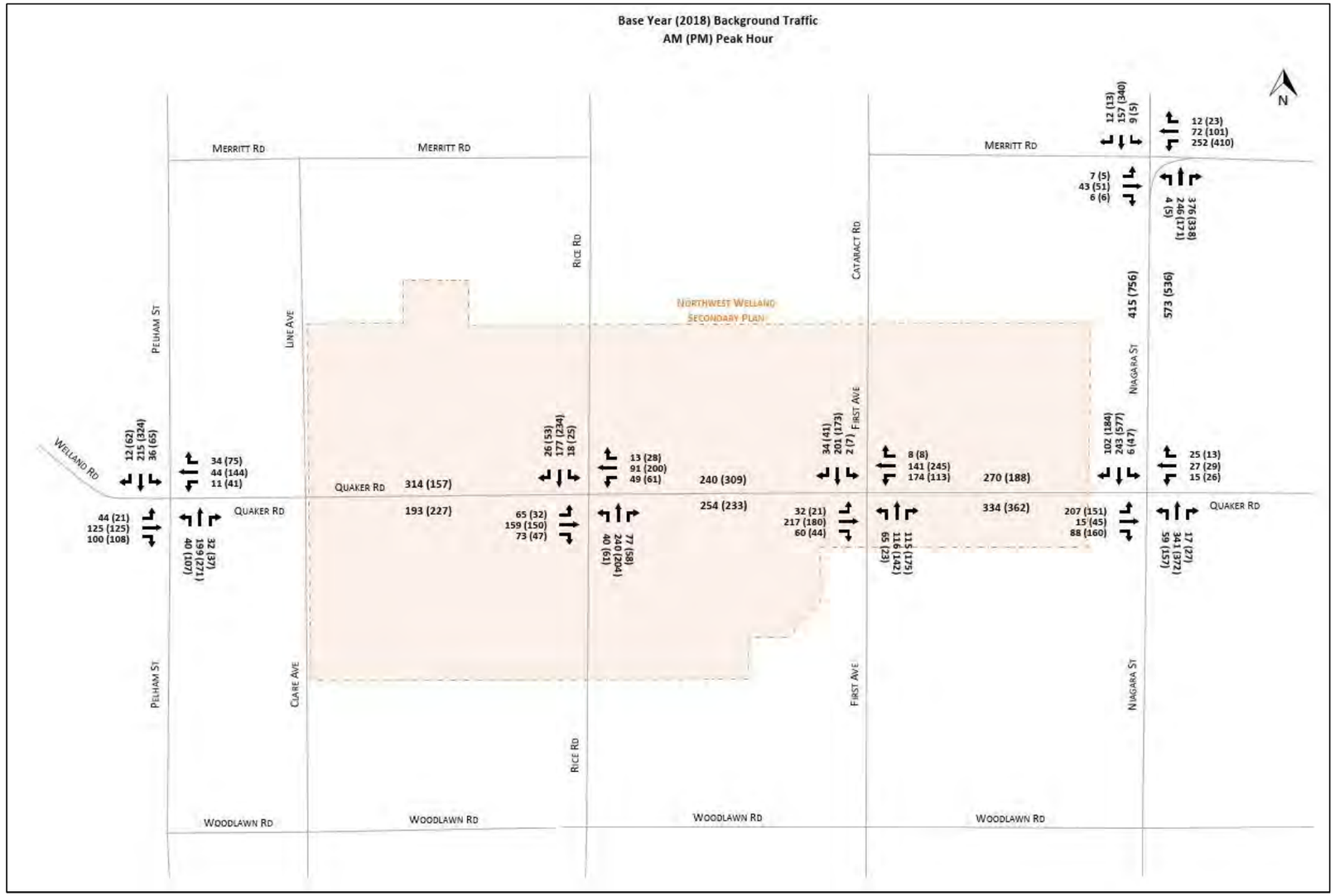


Figure 2-6
Base Year (2018) Background Traffic Peak Hour Turning Movement Volumes

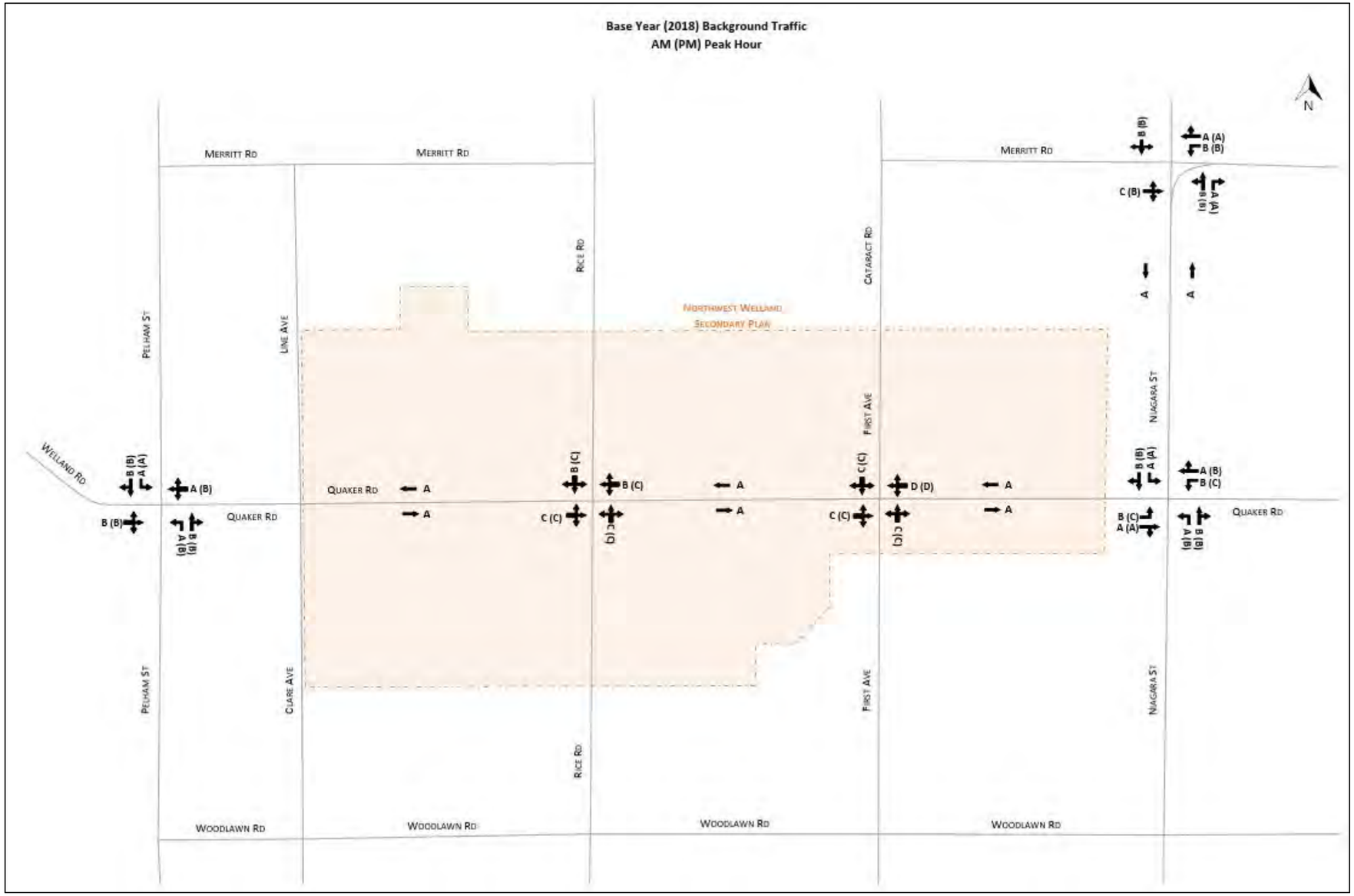


Figure 2-7
Base Year (2018) Background Traffic Peak Hour Levels of Service

2.8 TRAFFIC CONTROL SIGNAL JUSTIFICATIONS

The intersections of Quaker Road with Regional Road 54 (Rice Road) and First Avenue are currently operating under all-way stop control. The justification for installing traffic signals was evaluated in accordance with the Ontario Ministry of Transportation's *Ontario Traffic Manual, Book 12: Traffic Signals*[3]. The results, provided in **Appendix C**, indicated that in the base year (2018) background traffic conditions, traffic control signals are not justified for either of the two (2) intersections.

2.9 SURROUNDING DEVELOPMENT AND ANTICIPATED IMPACTS TO TRAFFIC

As part of the transportation assessment, the surrounding area was reviewed in terms of proposed developments and the impact of the associated traffic would have on the Northwest Welland Secondary Plan.

2.9.1 East Fonthill Secondary Plan

The East Fonthill Secondary Plan was included in the Town of Pelham Official Plan, and adopted in 2012.

Existing lands within the East Fonthill Secondary Plan are categorized as either "greenfield" or "intensification" zones. The Land Use Plan describes scheduled land uses within the secondary plan area, and includes a mix of low, medium, and high density residential areas, environmental protection zones, mixed-use commercial centres, and public parkland. The most dominant of these are low-density residential areas and environmental protection zones. With the implementation of the Secondary Plan, the entire area within the Secondary Plan is expected to achieve a minimum gross density of 50 persons and jobs combined per hectare.

The residential growth within the East Fonthill Secondary Plan is limited to a maximum of 3,000 residents and jobs combined by 2021, 4,500 residents and jobs combined by 2026, and 5,350 residents and jobs combined by 2031. The growth within the Commercial/Employment Centre is limited to a maximum of 785 residents and jobs combined by 2021, and a maximum of 1,190 residents and jobs combined by 2031.

It is anticipated that traffic generated by the East Fonthill Secondary Plan will result in an future increase in traffic flow along Regional Road 54 (Rice Road through the study area. Further information on the impacts of the East Fonthill Secondary Plan will be requested from the Regional Municipality of Niagara.

2.9.2 West Port Robinson Secondary Plan

The West Port Robinson Secondary Plan was included in the City of Thorold Official Plan, and adopted in 2016.

[3] Ontario Ministry of Transportation, *Ontario Traffic Manual, Book 12: Traffic Signals*, 2012.

Existing lands within the Port Robinson West Secondary Plan are considered “greenfield”. The lands generally include a mix of low, medium, and high density residential properties, institutional, mixed-use commercial, industrial, and environmental protection zones. The most dominant of these are low-density residential and environmental protection zones. With the implementation of the Secondary Plan, the residential areas are expected to achieve a gross density of 50 persons and jobs combined per hectare.

The Secondary Plan area is expected to generate approximately 12,500 people and jobs, divided into 8,500 people for residential areas, 2,400 jobs for employment areas, and 1,850 jobs for commercial areas. The employment area is expected to develop as a Business Park, and include both light industrial uses and office uses.

It is anticipated that traffic generated by the West Port Robinson Secondary Plan will result in an future increase in traffic flow along Regional Road 50 (Niagara Street) through the study area. Further information on the impacts of the West Port Robinson Secondary Plan will be requested from the Regional Municipality of Niagara.

2.9.3 Niagara College, Welland Campus

The Niagara College, Welland Campus is located between Regional Road 54 (Rice Road) and First Avenue on Regional Road 41 (Woodlawn Road). According to the City of Welland, they have not been made aware of any significant expansion plans at Niagara College, Welland Campus that would result in significant impacts to traffic operations within the study area.

2.9.4 Regional Road 37 (Merritt Road) Extension

In the Regional Municipality of Niagara’s *Transportation Master Plan*[4], it was recommended that the Capital Budget 2017 include a project to construct a new connector roadway, extending Regional Road 37 (Merritt Road) between Regional Road 54 (Rice Road) and Cataract Road. The Region indicated that within the next five (5) years, this extension will be designed and constructed. This is expected to significantly impact traffic operations in the surrounding area, as the section would be a candidate to become a Regional Roadway, and act to relive Regional Road 20 of additional capacity heading towards Highway 406. Further information on the impacts of the Regional Road 37 (Merritt Road) extension will be requested from the Regional Municipality of Niagara.

3 Conclusions and Recommendations

The previous sections within this report document the review of existing conditions from a transportation engineering perspective. The following is noted.

A review of existing conditions indicates that both Quaker Road and Regional Road 54 (Rice Road) through the study area are characterized as rural arterial roadways. First Avenue acts as a collector roadway,

[4] Regional Municipality of Niagara, *Transportation Master Plan, Subarea Analysis Summary*, 2017.

having an urban cross-section south of Quaker Road and a rural-cross section north of Quaker Road. Immediately west and east of the study area, Regional Road 36 (Pelham Street) and Regional Road 50 (Niagara Street) function as arterial roadways.

The two (2) major intersections within the study area are Quaker Road and Regional Road 54 (Rice Road) and Quaker Road and First Street; both of which operate under all-way stop control. Regional Road 36 (Pelham Street) and Quaker Road, Regional Road 50 (Niagara Street) and Quaker Road, and Regional Road 37 (Merritt) and Regional Road 50 (Niagara Street/Merrittville Highway) all operate under traffic signal control. These intersections were chosen due to the proximity to the study area and the potential for traffic generated by the development to impact traffic at these intersections.

The roadways within the study area have very limited active transportation facilities. There is a separated segment of granular pathway on the north side of Quaker Road between Regional Road 54 (Rice Road) and 622 Quaker Road with a ladder cross-walk providing access to École Élémentaire Nouvel Horizon. No dedicated cyclist facilities have been provided along Quaker Road.

With development of the Northwest Welland Secondary Plan, there is an opportunity to provide dedicated active transportation facilities for pedestrians and cyclists. According to the Regional Municipality of Niagara's *Strategic Cycling Network Development Technical Paper*[5], First Avenue/Cataract Road was confirmed as a candidate for enhanced cyclist facilities. Limited transit service is provided within the study area with only a short segment of Quaker Road between First Street and Regional Road 50 (Niagara Street) being serviced by Welland Transit. Expanded transit service should be considered in conjunction with development of the subject lands.

The traffic operations analysis indicates that overall, the intersections are all operating below capacity with an adequate Level of Service; all movements noted as being a Level of Service of C or better. The one exception is the intersection of First Avenue and Quaker Road, which is experiencing a Level of Service of D on the east approach (all movements); indicating that long delays may be occurring during peak hour conditions in both the AM and PM peak hours. Under base year (2018) background traffic conditions, there is no need for any modifications to any of the intersections reviewed from a capacity and operations perspective.

The review of traffic operations with the preferred plan will need to account for changes in traffic patterns anticipated to occur as a result of the full build-out of the East Fonthill Secondary Plan, the West Port Robinson Secondary Plan, and the Regional Road 37 (Merritt Road) extension. No other developments were identified that would impact traffic within the study area. In follow up, additional information will be requested from the Regional Municipality of Niagara to capture the anticipated impacts of these developments.

The Region provided comments on this draft. The comments and our response are attached as **Appendix D.**

[5] Regional Municipality of Niagara, *Strategic Cycling Network Development Technical Paper*, 2017.

Appendix A – Traffic Data

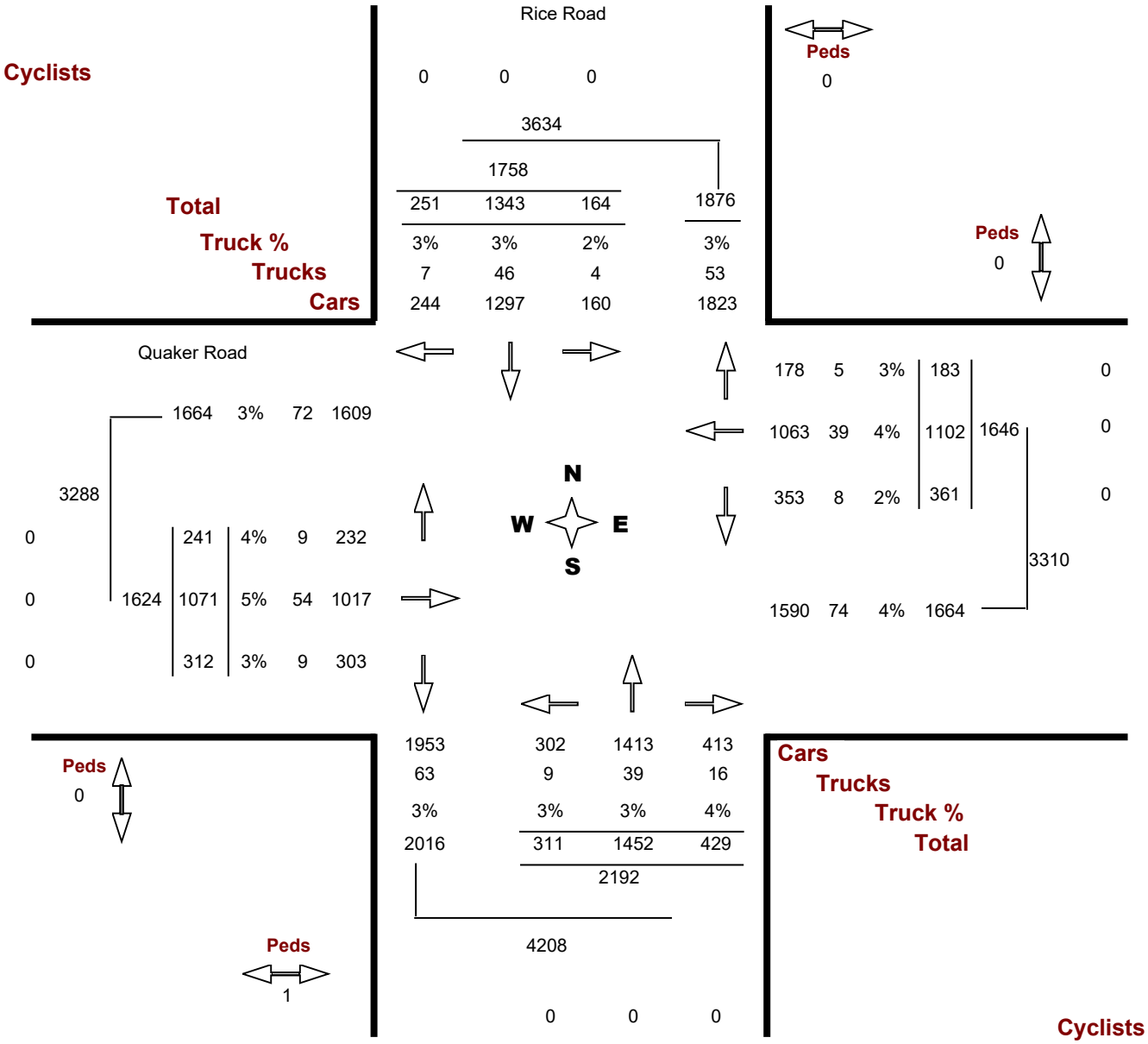
Turning Movement Count Report
Full Study

Location..... Quaker Road @ Rice Road

Municipality..... WELLAND

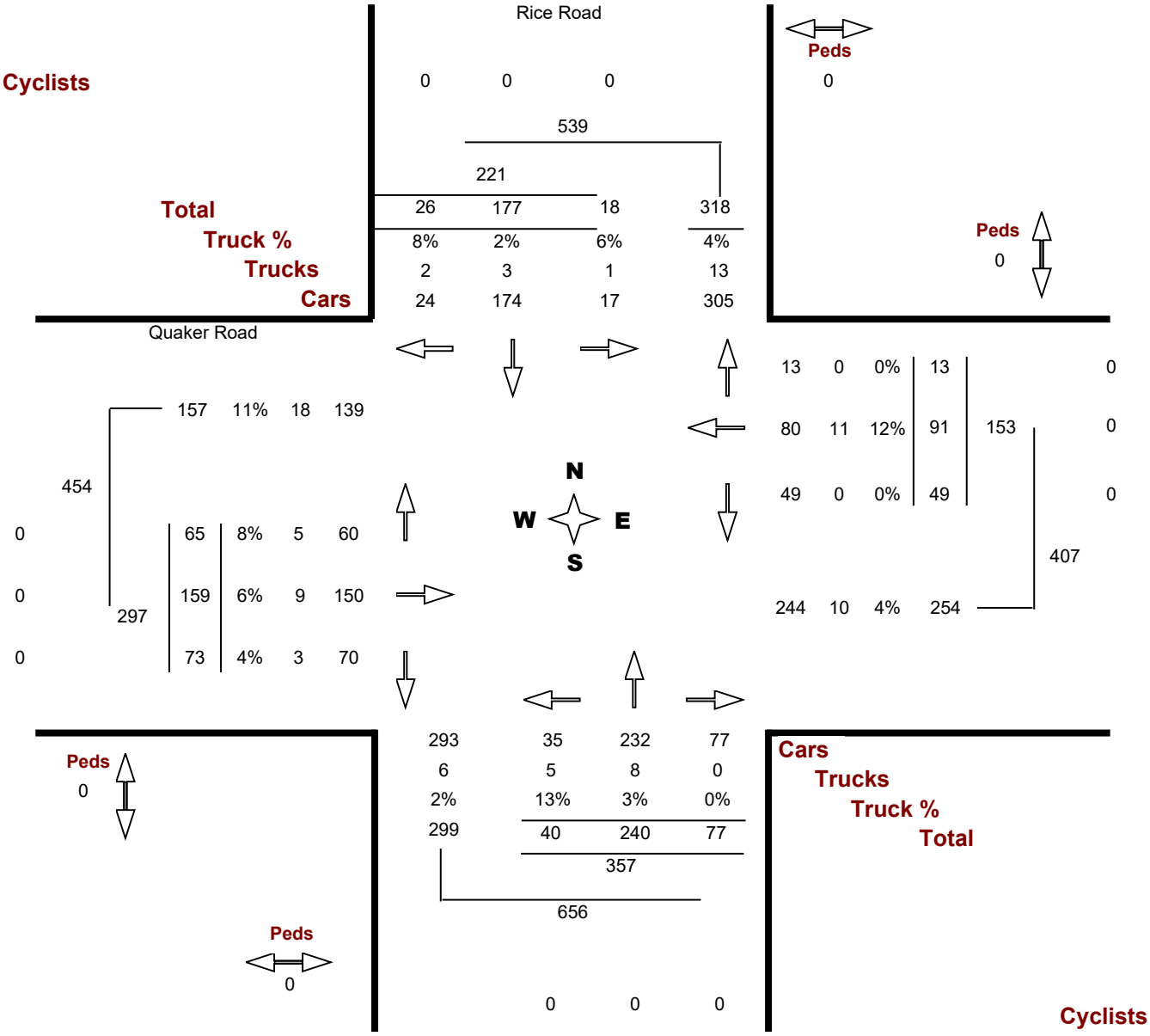
GeoID..... 07178

Count Date..... Monday, 13 June, 2016



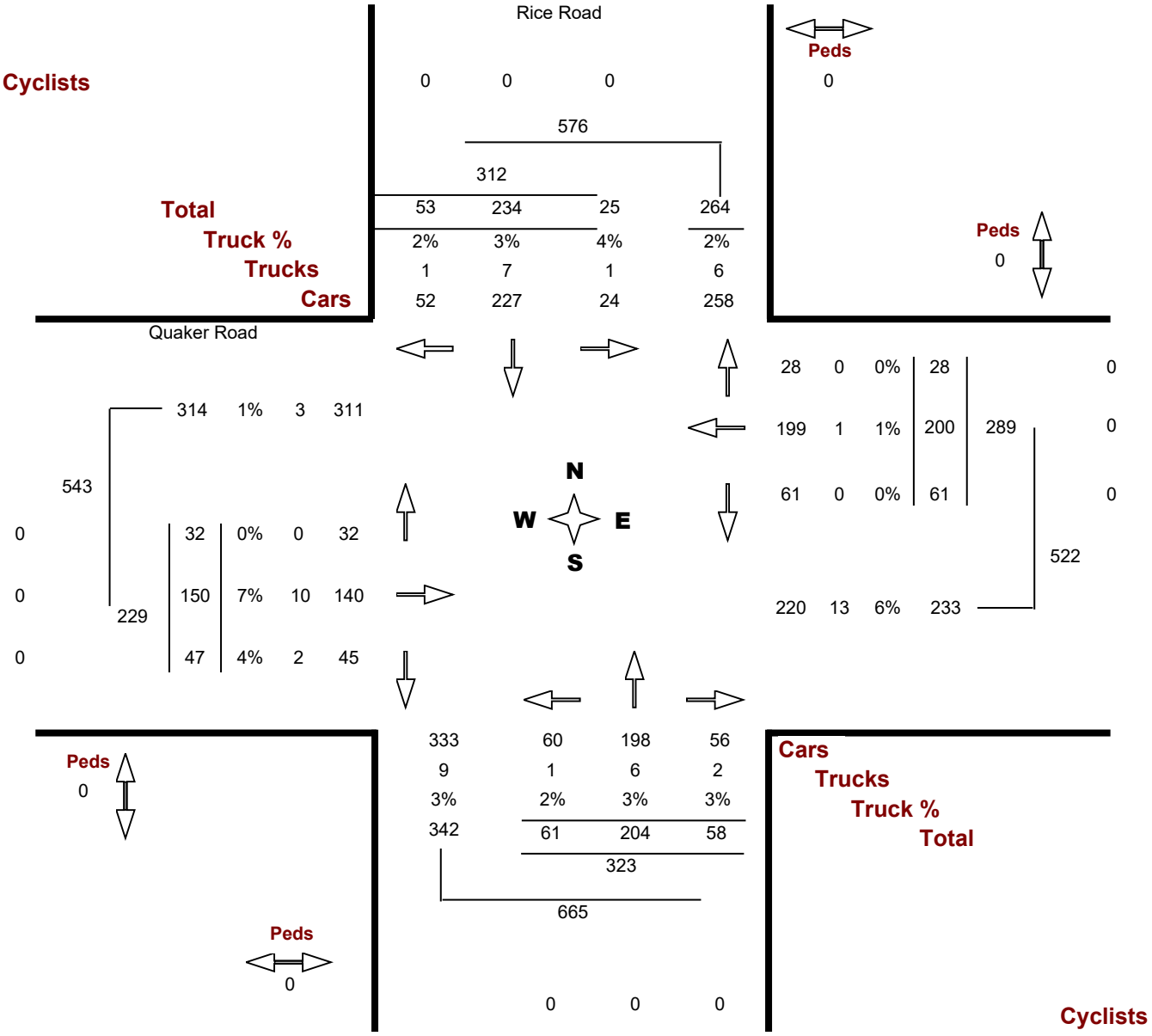
Turning Movements Report - AM Period

Location.....	Quaker Road @ Rice Road	**GeoID.....**	07178
Municipality.	WELLAND	**Count Date.**	Monday, 13 June, 2016
Traffic Cont.	Stop sign	**Count Time.**	07:00 AM — 09:00 AM
Major Dir.....	None	**Peak Hour..**	07:45 AM — 08:45 AM



Turning Movements Report - PM Period

Location.....	Quaker Road @ Rice Road	**GeoID.....**	07178
Municipality.	WELLAND	**Count Date.**	Monday, 13 June, 2016
Traffic Cont.	Stop sign	**Count Time.**	03:00 PM — 06:00 PM
Major Dir.....	None	**Peak Hour..**	03:45 PM — 04:45 PM



First Ave @ Quaker Rd

Total Count Diagram

Municipality: Welland
Site #: 0000000002
Intersection: Quaker Rd & First Ave
TFR File #: 2
Count date: 22-Mar-2016

Weather conditions:
Clear/Dry

Person(s) who counted:
Diane

**** Non-Signalized Intersection ****

Major Road: Quaker Rd runs W/E

North Leg Total:	2421
North Entering:	1327
North Peds:	0
Peds Cross:	⋈

Heavys	1	0	0	1
Trucks	3	14	0	17
Cars	216	1038	55	1309
Totals	220	1052	55	

Heavys	1
Trucks	13
Cars	1080
Totals	1094

East Leg Total:	4434
East Entering:	2157
East Peds:	1
Peds Cross:	⧗

First Ave

Heavys	Trucks	Cars	Totals
3	56	1724	1783

Cars	Trucks	Heavys	Totals
58	0	0	58
1259	44	2	1305
733	60	1	794
2050	104	3	

Quaker Rd

N
W E
S

Heavys	Trucks	Cars	Totals
1	1	150	152
4	38	1304	1346
1	15	267	283
6	54	1721	

Quaker Rd

Cars	Trucks	Heavys	Totals
2189	83	5	2277

First Ave

Peds Cross:	⧗
West Peds:	0
West Entering:	1781
West Leg Total:	3564

Cars	2038
Trucks	89
Heavys	2
Totals	2129

Cars	249	872	830	1951
Trucks	9	12	45	66
Heavys	0	0	1	1
Totals	258	884	876	

Peds Cross:	⋈
South Peds:	1
South Entering:	2018
South Leg Total:	4147

Comments

First Ave @ Quaker Rd

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Welland
Site #: 0000000002
Intersection: Quaker Rd & First Ave
TFR File #: 2
Count date: 22-Mar-2016

Weather conditions:
Clear/Dry

Person(s) who counted:
Diane

**** Non-Signalized Intersection ****

Major Road: Quaker Rd runs W/E

North Leg Total:	393
North Entering:	237
North Peds:	0
Peds Cross:	⋈

Heavys	0	0	0	0
Trucks	1	4	0	5
Cars	33	197	2	232
Totals	34	201	2	

Heavys	0
Trucks	1
Cars	155
Totals	156

East Leg Total:	657
East Entering:	323
East Peds:	0
Peds Cross:	⧗

First Ave

Heavys	Trucks	Cars	Totals
0	8	232	240

Cars	Trucks	Heavys	Totals
8	0	0	8
137	4	0	141
159	15	0	174
304	19	0	

Quaker Rd

N
W E
S

Heavys	Trucks	Cars	Totals
0	0	32	32
0	13	204	217
0	4	56	60
0	17	292	

Quaker Rd

Cars	Trucks	Heavys	Totals
308	26	0	334

First Ave

Peds Cross:	⧗
West Peds:	0
West Entering:	309
West Leg Total:	549

Cars	412
Trucks	23
Heavys	0
Totals	435

Cars	62	115	102	279
Trucks	3	1	13	17
Heavys	0	0	0	0
Totals	65	116	115	

Peds Cross:	⋈
South Peds:	0
South Entering:	296
South Leg Total:	731

Comments

First Ave @ Quaker Rd

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:15:00
To: 17:15:00

Municipality: Welland
Site #: 0000000002
Intersection: Quaker Rd & First Ave
TFR File #: 2
Count date: 22-Mar-2016

Weather conditions:
Clear/Dry

Person(s) who counted:
Diane

**** Non-Signalized Intersection ****

Major Road: Quaker Rd runs W/E

North Leg Total: 392
North Entering: 221
North Peds: 0
Peds Cross: ⋈

Heavys	0	0	0	0
Trucks	0	0	0	0
Cars	41	173	7	221
Totals	41	173	7	

Heavys	0
Trucks	2
Cars	169
Totals	171

East Leg Total: 728
East Entering: 366
East Peds: 0
Peds Cross: ⧗

First Ave

Heavys	Trucks	Cars	Totals
0	4	305	309

Quaker Rd

Cars	Trucks	Heavys	Totals
8	0	0	8
241	4	0	245
104	9	0	113
353	13	0	

N
W E
S

Heavys	Trucks	Cars	Totals
0	0	21	21
0	7	173	180
0	0	44	44
0	7	238	

Quaker Rd

Cars	Trucks	Heavys	Totals
349	13	0	362

First Ave

Peds Cross: ⧗
West Peds: 0
West Entering: 245
West Leg Total: 554

Cars	321
Trucks	9
Heavys	0
Totals	330

Cars	23	140	169	332
Trucks	0	2	6	8
Heavys	0	0	0	0
Totals	23	142	175	

Peds Cross: ⋈
South Peds: 0
South Entering: 340
South Leg Total: 670

Comments

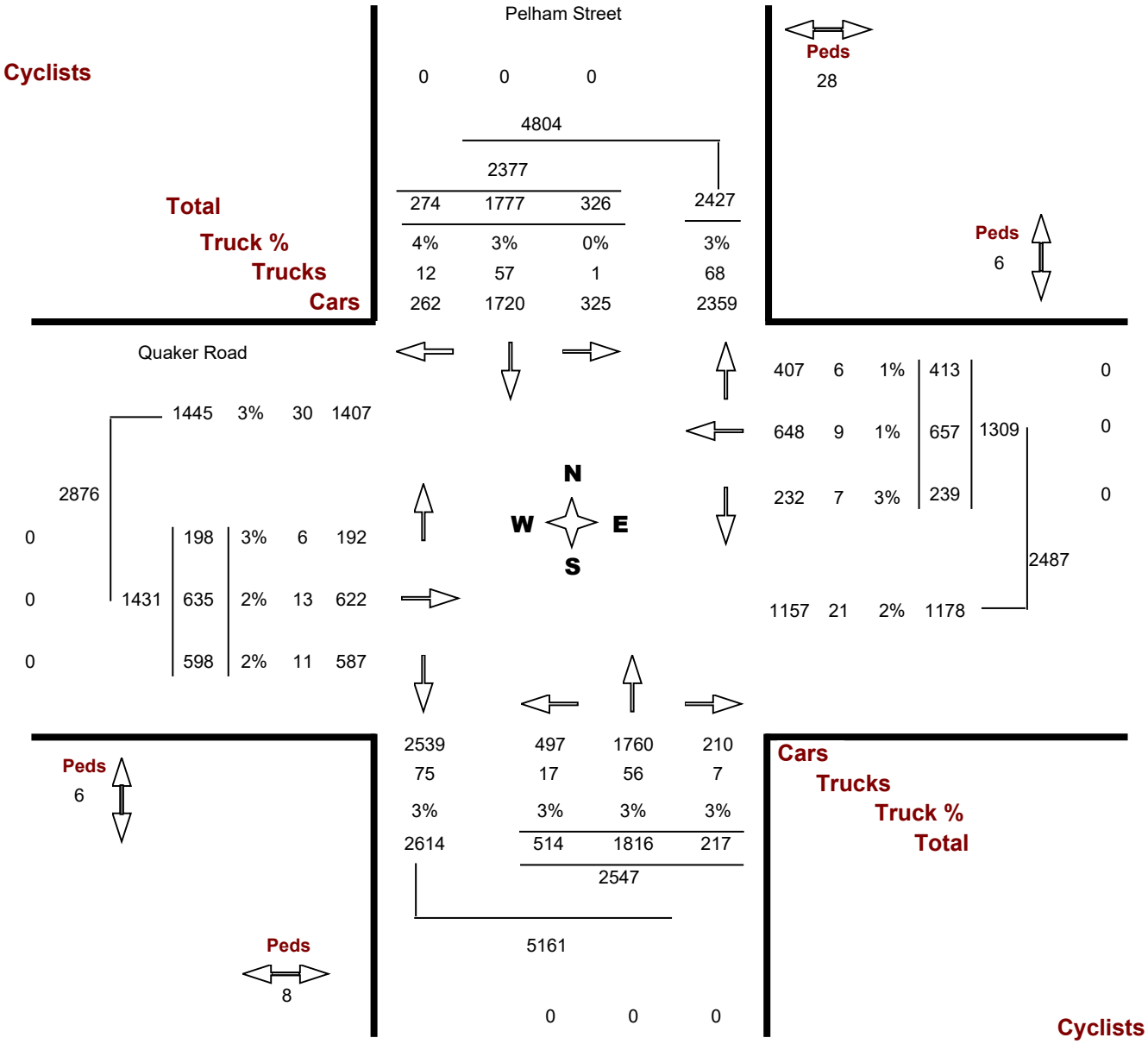
Turning Movement Count Report
Full Study

Location..... Pelham Street @ Quaker Road

Municipality..... PELHAM

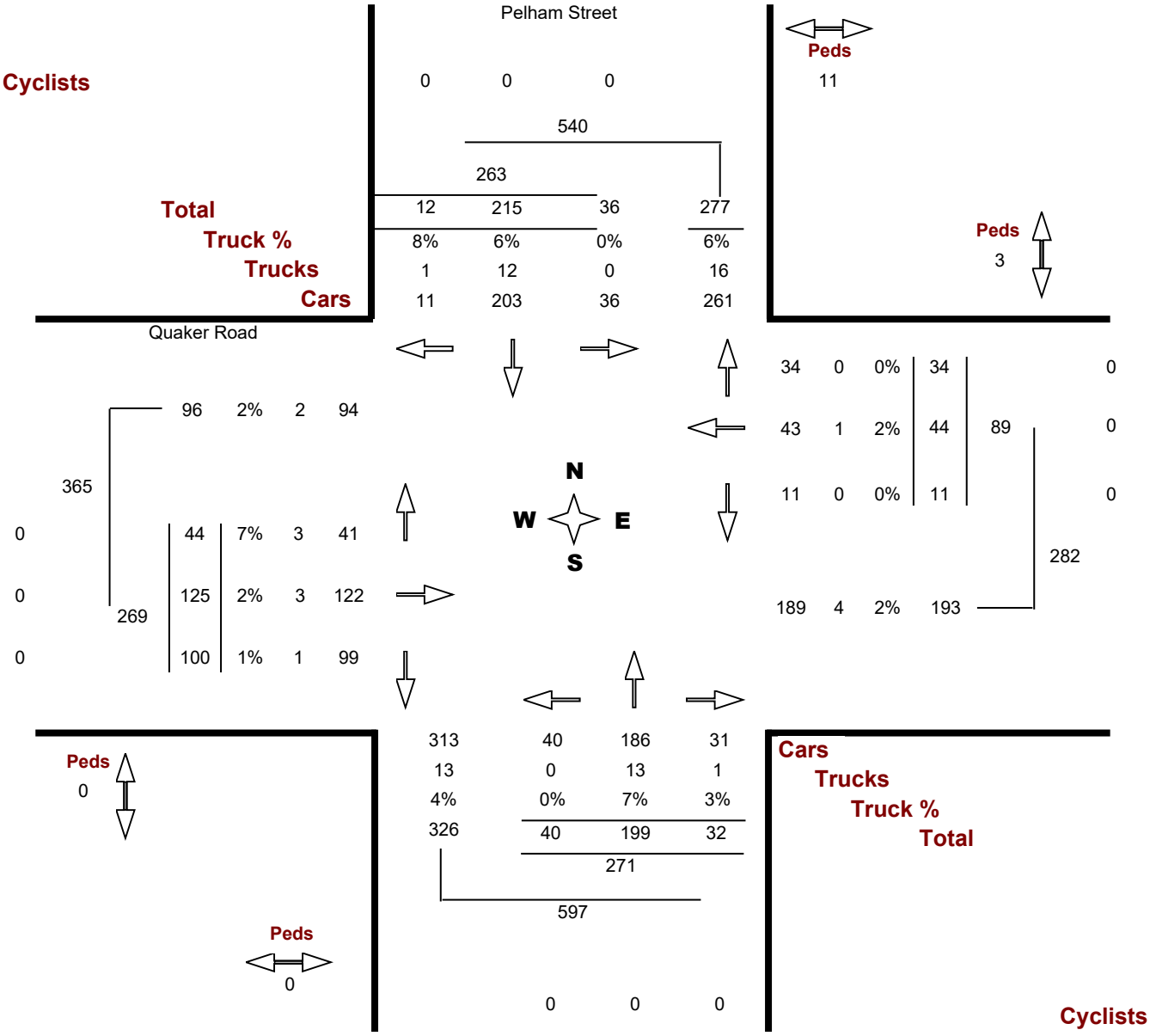
GeoID..... 00488

Count Date..... Monday, 23 July, 2012



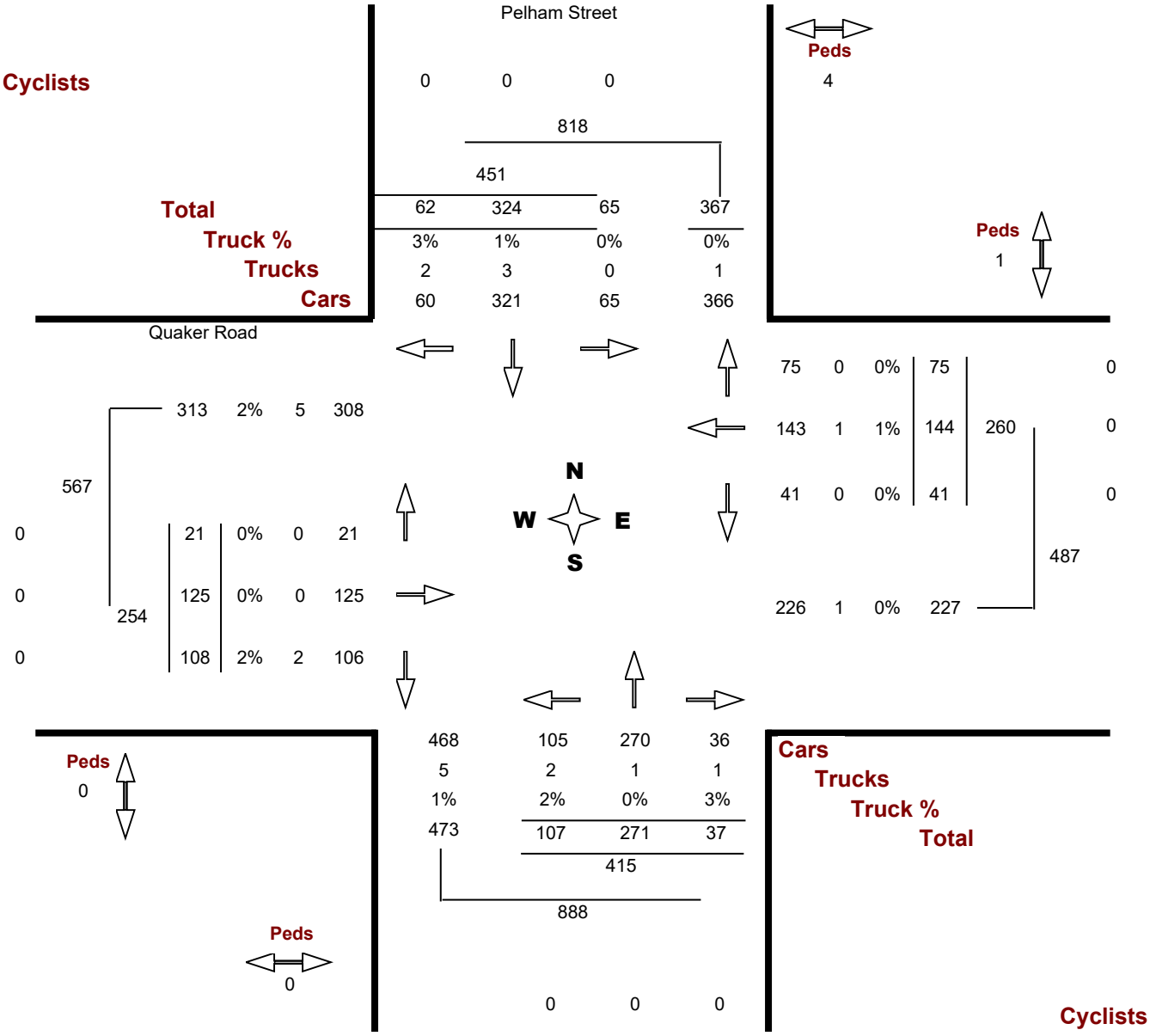
Turning Movements Report - AM Period

Location.....	Pelham Street @ Quaker Road	**GeoID.....**	00488
Municipality.	PELHAM	**Count Date.**	Monday, 23 July, 2012
Traffic Cont.	Traffic signal	**Count Time.**	07:00 AM — 09:00 AM
Major Dir.....	None	**Peak Hour..**	08:00 AM — 09:00 AM



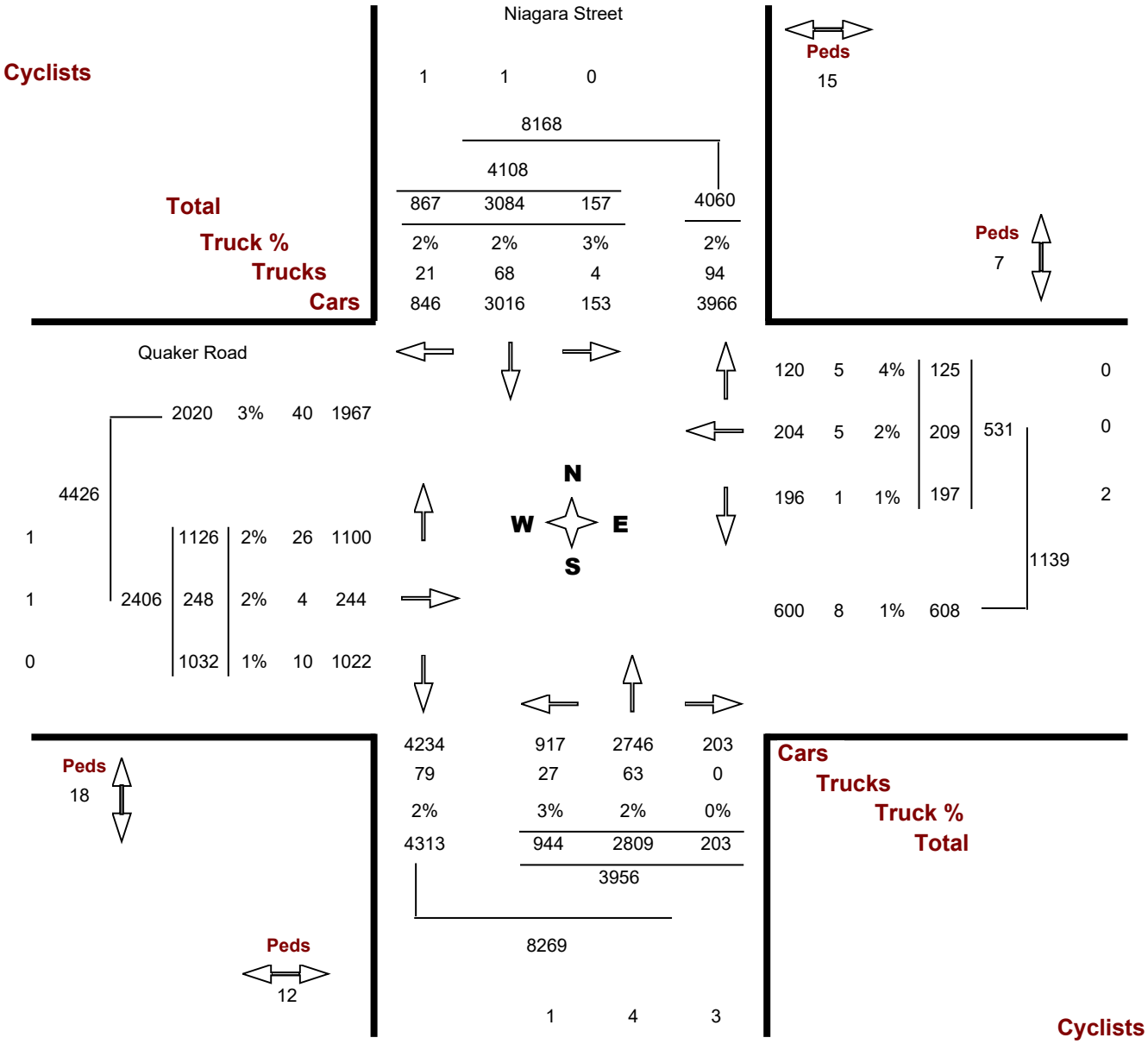
Turning Movements Report - PM Period

Location.....	Pelham Street @ Quaker Road	**GeoID.....**	00488
Municipality.	PELHAM	**Count Date.**	Monday, 23 July, 2012
Traffic Cont.	Traffic signal	**Count Time.**	03:00 PM — 06:00 PM
Major Dir.....	None	**Peak Hour..**	05:00 PM — 06:00 PM



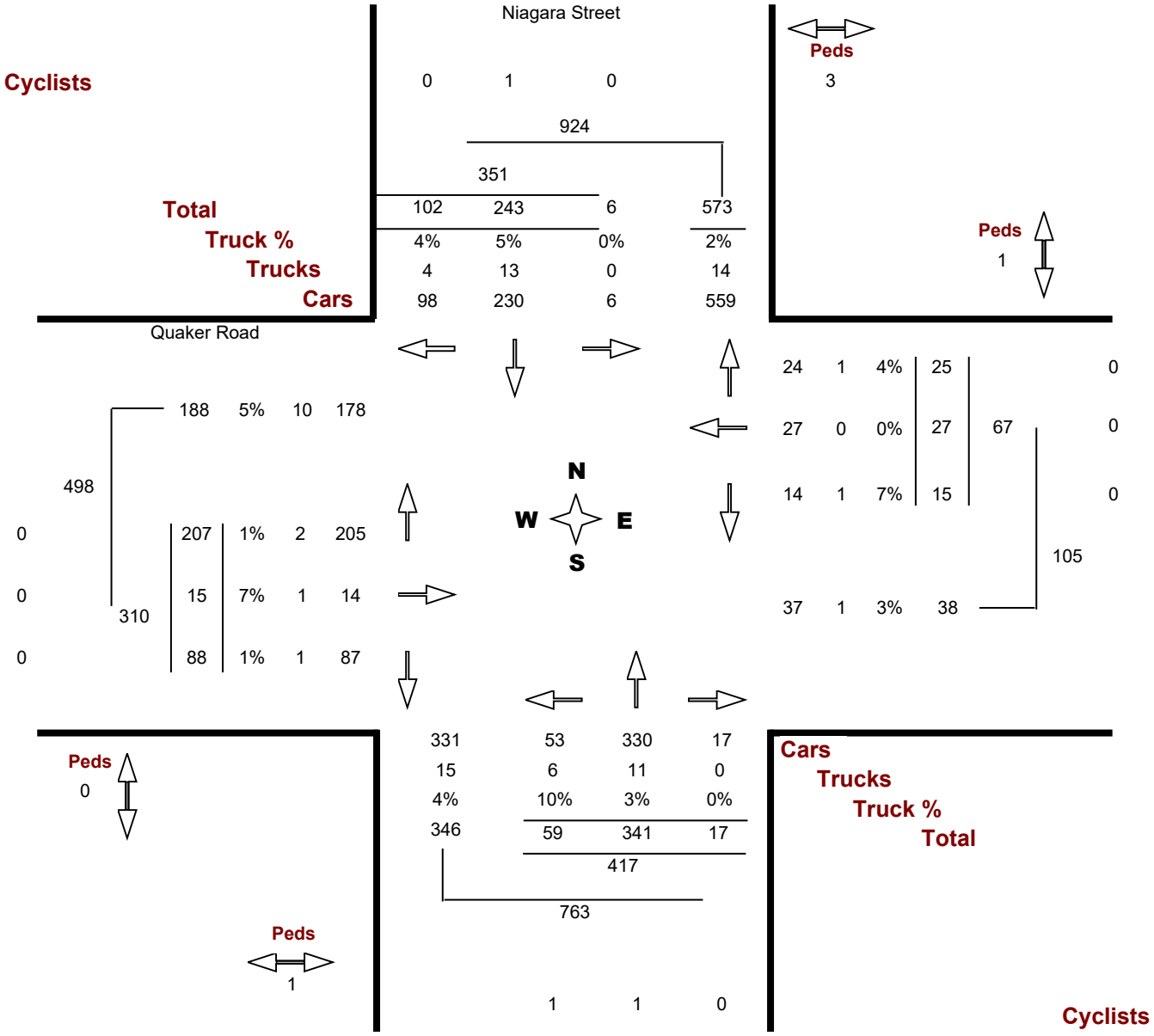
Turning Movement Count Report
Full Study

Location..... Niagara Street @ Quaker Road
Municipality..... WELLAND
GeoID..... 00838
Count Date..... Friday, 14 July, 2017



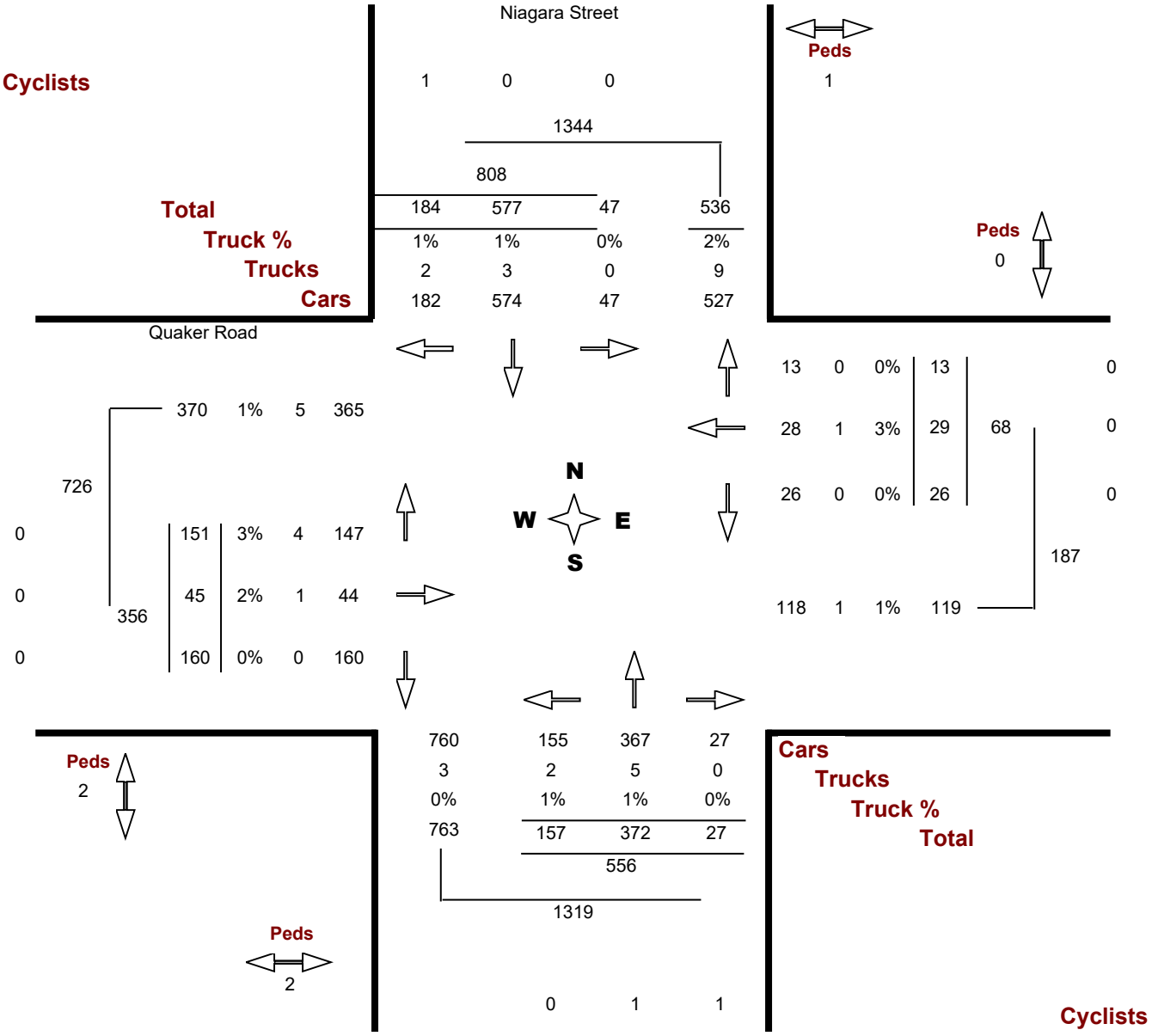
Turning Movements Report - AM Period

Location.....	Niagara Street @ Quaker Road	**GeoID.....**	00838
Municipality.	WELLAND	**Count Date.**	Friday, 14 July, 2017
Traffic Cont.	Traffic signal	**Count Time.**	07:00 AM — 09:00 AM
Major Dir.....	None	**Peak Hour..**	08:00 AM — 09:00 AM



Turning Movements Report - PM Period

Location.....	Niagara Street @ Quaker Road	**GeoID.....**	00838
Municipality.	WELLAND	**Count Date.**	Friday, 14 July, 2017
Traffic Cont.	Traffic signal	**Count Time.**	03:00 PM — 06:00 PM
Major Dir.....	None	**Peak Hour..**	04:15 PM — 05:15 PM



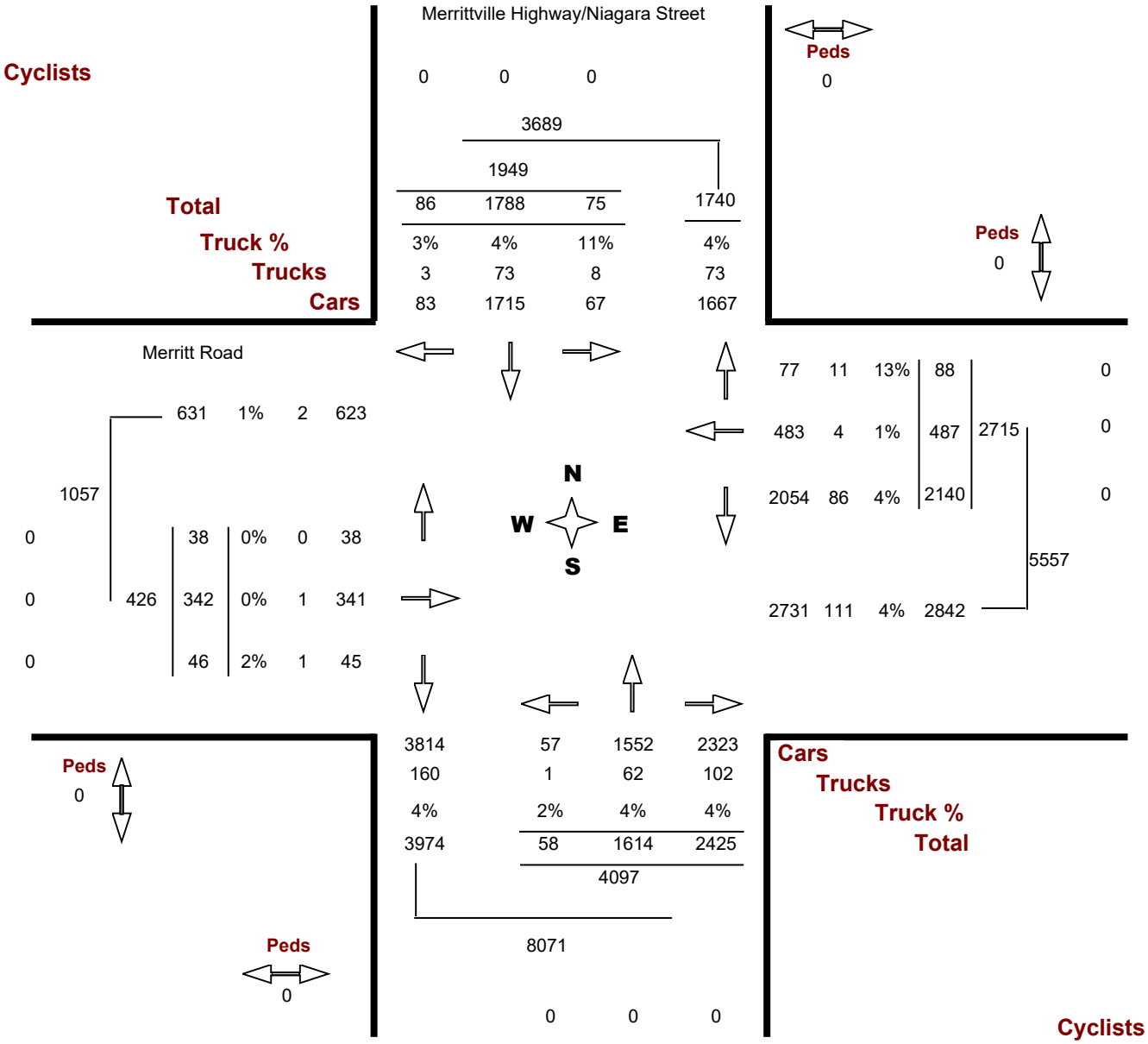
Turning Movement Count Report
Full Study

Location..... Merritt Road @ Merrittville Highway/Niagara Street

Municipality..... WELLAND

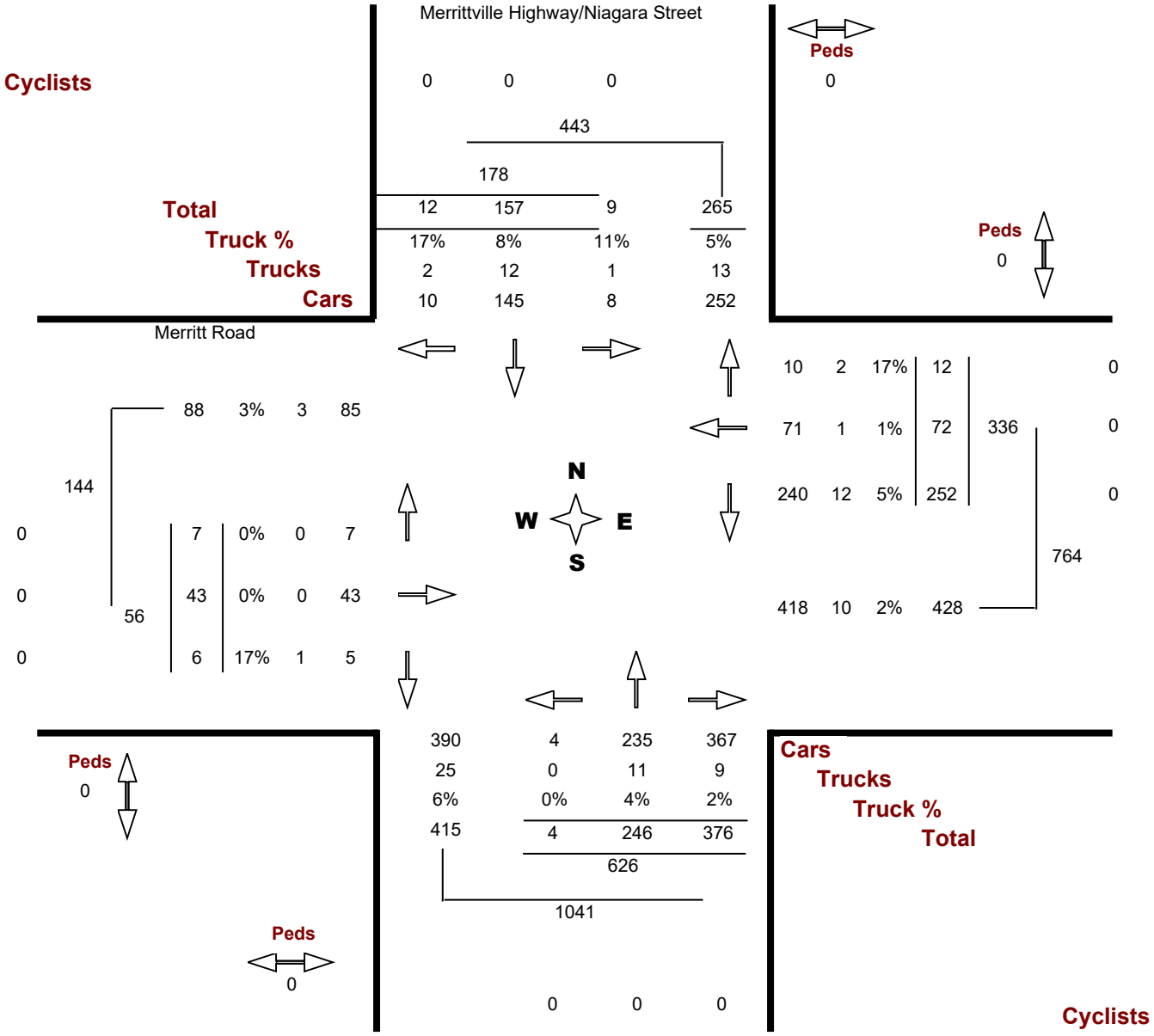
GeoID..... 00424

Count Date..... Tuesday, 21 June, 2016



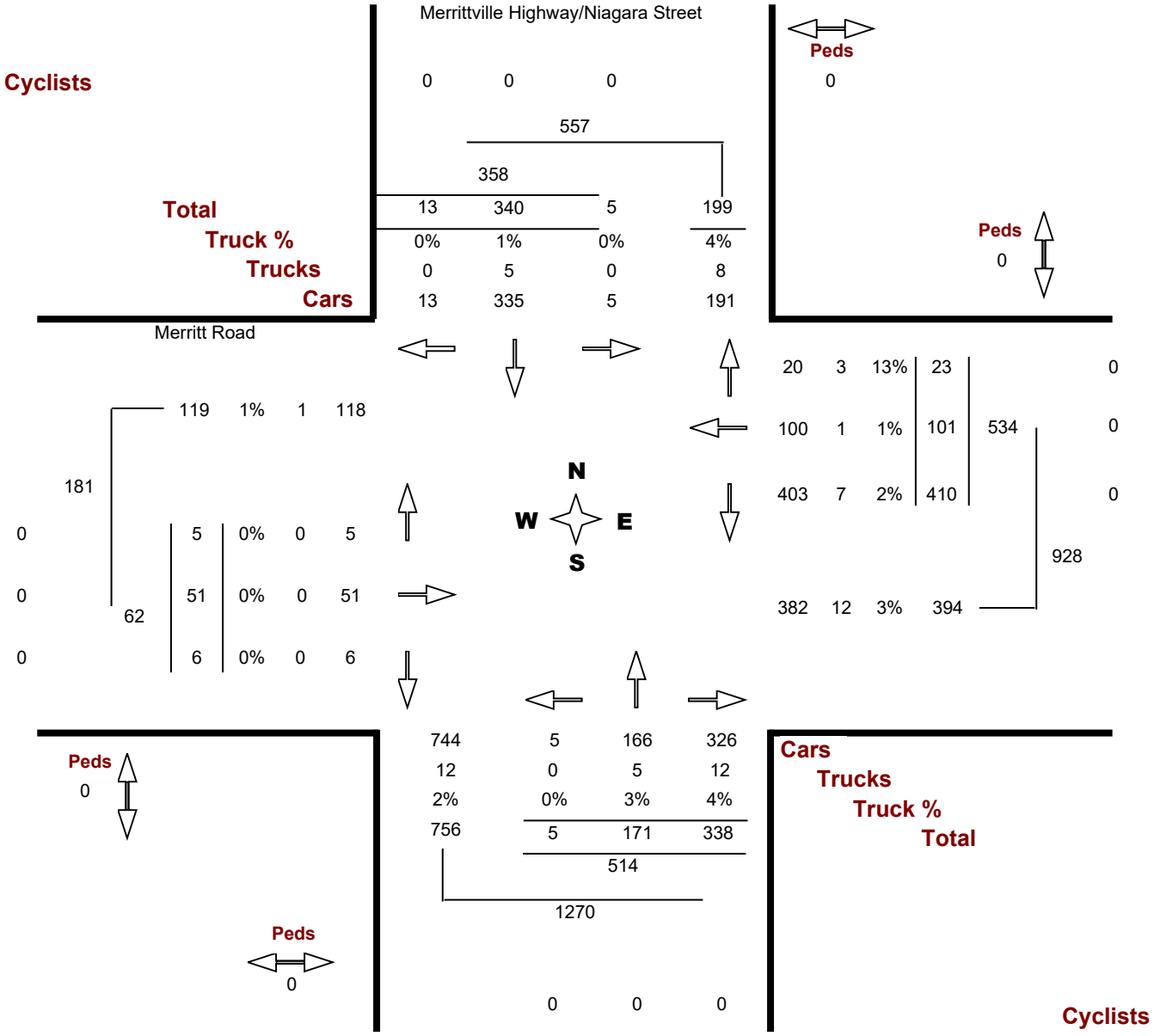
Turning Movements Report - AM Period

Location.....	Merritt Road @ Merrittville Highway/Niagara Street	**GeoID.....**	00424
Municipality.	WELLAND	**Count Date.**	Tuesday, 21 June, 2016
Traffic Cont.	Traffic signal	**Count Time.**	07:00 AM — 09:00 AM
Major Dir.....	None	**Peak Hour..**	07:45 AM — 08:45 AM



Turning Movements Report - PM Period

Location.....	Merritt Road @ Merrittville Highway/Niagara Street	**GeoID.....**	00424
Municipality.	WELLAND	**Count Date.**	Tuesday, 21 June, 2016
Traffic Cont.	Traffic signal	**Count Time.**	03:00 PM — 06:00 PM
Major Dir.....	None	**Peak Hour..**	04:30 PM — 05:30 PM



Signal Code: PLHQUK						
Intersection: PELHAM ST.& QUAKER RD.						
Municipality: pelham						
Owner: city						
Last Modified: 5/14/2015 1:23:40 PM						
Timing Parameters	**NBD & SBD THRU PELHAM RD.**	**EBD & WBD THRU QUAKER RD.**	**n/a**	**n/a**	**n/a**	**n/a**
Min Green	10	8	0	0	0	0
Walk	10	10	0	0	0	0
Ped Clearance	17	16	0	0	0	0
Vehicle Ext.	2.5	2.5	0	0	0	0
Max Green	30	24	0	0	0	0
Yellow	4.1	4.1	0	0	0	0
All Red	2.2	2.4	0	0	0	0

		Offset
Minimum Cycle	30.8	0
Pedestrian Cycle	65.8	
Maximum Cycle	66.8	0
Operation	FA	

Installed On:

3/21/2005

Count Date:

7/23/2012

FA = Fully Actuated SA = Semi Actuated FT = Fixed Time

Close Window Print Entry* Refresh Entry

*Note: you need to change the paper orientation from Portriat to Landscape

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Signal Code: 050QUK
Intersection: RR50 (NIAGARA ST.) & QUAKER RD.
Municipality: welland
Owner: Region
Last Modified: 1/24/2018 8:52:53 AM

Timing Parameters	NBD & SBD ADVANCE NIAGARA ST.	NBD & SBD THRU NIAGARA ST.	EBD & WBD THRU QUAKER RD.	n/a	n/a	n/a
Min Green	6	10	8	0	0	0
Walk	0	9	11	0	0	0
Ped Clearance	0	14	18	0	0	0
Vehicle Ext.	2.5	2.5	2.5	0	0	0
Max Green	15	35	25	0	0	0
Yellow	3	4.1	4.1	0	0	0
All Red	0	2.5	2.8	0	0	0

		Offset
Minimum Cycle	31.5	0
Pedestrian Cycle	65.5	
Maximum Cycle	91.5	0
Operation	FA	

Installed On:

9/11/1995

Count Date:

7/14/2017

FA = Fully Actuated SA = Semi Actuated FT = Fixed Time

Close Window Print Entry* Refresh Entry

*Note: you need to change the paper orientation from Portriat to Landscape

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Signal Code: 037050
Intersection: RR37 (MERRITT RD.) & RR50 (NIAGARA ST.)
Municipality: welland
Owner: Region
Last Modified: 4/9/2018 9:38:41 AM

Timing Parameters	NBD & SBD NIAGARA ST.	WBD ADV. MERRITT RD.	EBD & WBD MERRITT RD.	n/a	n/a	n/a
Min Green	10	10	8	0	0	0
Walk	0	0	0	0	0	0
Ped Clearance	0	0	0	0	0	0
Vehicle Ext.	5	3	3	0	0	0
Max Green	40	15	20	0	0	0
Yellow	4.1	3	4.1	0	0	0
All Red	2.3	0	2	0	0	0

		Offset
Minimum Cycle	30.5	0
Pedestrian Cycle	0	
Maximum Cycle	90.5	0
Operation	FA	

Installed On:

1/29/2002

Count Date:

6/21/2016

FA = Fully Actuated **SA = Semi Actuated** **FT = Fixed Time**

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Appendix B – Traffic Operations Assessment Reports (Base Year, Background Traffic)

LEVEL OF SERVICE ANALYSIS AT SIGNALIZED INTERSECTIONS

To assist in clarifying the arithmetic analysis associated with traffic engineering, it is often useful to refer to "Level of Service". The term Level of Service implies a qualitative measure of traffic flow at an intersection. It is dependent upon vehicle delay and vehicle queue lengths at the approaches. Specifically, Level of Service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The following table describes the characteristics of each level:

Level of Service	Features	Stopped Delay per Vehicle (sec)
A	At this level of service, almost no signal phase is fully utilized by traffic. Very seldom does a vehicle wait longer than one red indication. The approach appears open, turning movements are easily made and drivers have freedom of operation.	≤ 5.0
B	At this level, an occasional signal phase is fully utilized and many phases approach full use. Many drivers begin to feel somewhat restricted within platoons of vehicles approaching the intersection.	> 5.0 and ≤ 15.0
C	At this level, the operation is stable though with more frequent fully utilized signal phases. Drivers feel more restricted and occasionally may have to wait more than one red signal indication, and queues may develop behind turning vehicles. This level is normally employed in urban intersection design.	> 15.0 and ≤ 25.0
D	At this level, the motorist experiences increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period, but there are enough cycles with lower demand to permit occasional clearance of developing queues and prevent excessive backups.	> 25.0 and ≤ 40.0
E	At this level, capacity is reached. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several signal cycles.	> 40.0 and ≤ 60.0
F	At this level, saturation occurs, with vehicle demand exceeding the available capacity.	> 60.0

LEVEL OF SERVICE ANALYSIS AT UNSIGNALIZED INTERSECTIONS[1]

The term "level of service" implies a qualitative measure of traffic flow at an intersection. It is dependent upon the vehicle delay and vehicle queue lengths at approaches. The level of service at unsignalized intersections is often related to the delay accumulated by flows on the minor streets, caused by all other conflicting movements. The following table describes the characteristics of each level.

Level of Service	Features
A	Little or no traffic delay occurs. Approaches appear open, turning movements are easily made, and drivers have freedom of operation.
B	Short traffic delays occur. Many drivers begin to feel somewhat restricted in terms of freedom of operation.
C	Average traffic delays occur. Operations are generally stable, but drivers emerging from the minor street may experience difficulty in completing their movement. This may occasionally impact on the stability of flow on the major street.
D	Long traffic delays occur. Motorists emerging from the minor street experience significant restriction and frustration. Drivers on the major street will experience congestion and delay as drivers emerging from the minor street interfere with the major through movements.
E	Very long traffic delays occur. Operations approach the capacity of the intersection.
F	Saturation occurs, with vehicle demand exceeding the available capacity. Very long traffic delays occur.

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(1) Highway Capacity Manual - Special Report No. 209, Transportation Research Board, 1985.

Intersection	
Intersection Delay, s/veh	17.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	65	159	73	49	91	13	40	240	77	18	177	26
Future Vol, veh/h	65	159	73	49	91	13	40	240	77	18	177	26
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	8	6	4	0	12	0	13	3	0	6	2	8
Mvmt Flow	71	173	79	53	99	14	43	261	84	20	192	28
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	17.3	12.7	20.6	14.2
HCM LOS	C	B	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	11%	22%	32%	8%
Vol Thru, %	67%	54%	59%	80%
Vol Right, %	22%	25%	8%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	357	297	153	221
LT Vol	40	65	49	18
Through Vol	240	159	91	177
RT Vol	77	73	13	26
Lane Flow Rate	388	323	166	240
Geometry Grp	1	1	1	1
Degree of Util (X)	0.663	0.566	0.309	0.427
Departure Headway (Hd)	6.152	6.31	6.684	6.402
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	586	571	536	562
Service Time	4.201	4.362	4.748	4.459
HCM Lane V/C Ratio	0.662	0.566	0.31	0.427
HCM Control Delay	20.6	17.3	12.7	14.2
HCM Lane LOS	C	C	B	B
HCM 95th-tile Q	4.9	3.5	1.3	2.1

Intersection	
Intersection Delay, s/veh	21.8
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	32	217	60	174	141	8	65	116	115	2	201	34
Future Vol, veh/h	32	217	60	174	141	8	65	116	115	2	201	34
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	6	7	9	3	0	5	1	11	0	2	3
Mvmt Flow	35	236	65	189	153	9	71	126	125	2	218	37
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	21.7	25.3	21.2	17.8
HCM LOS	C	D	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	22%	10%	54%	1%
Vol Thru, %	39%	70%	44%	85%
Vol Right, %	39%	19%	2%	14%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	296	309	323	237
LT Vol	65	32	174	2
Through Vol	116	217	141	201
RT Vol	115	60	8	34
Lane Flow Rate	322	336	351	258
Geometry Grp	1	1	1	1
Degree of Util (X)	0.626	0.643	0.698	0.516
Departure Headway (Hd)	7.001	6.895	7.159	7.216
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	515	521	502	497
Service Time	5.065	4.962	5.223	5.288
HCM Lane V/C Ratio	0.625	0.645	0.699	0.519
HCM Control Delay	21.2	21.7	25.3	17.8
HCM Lane LOS	C	C	D	C
HCM 95th-tile Q	4.3	4.5	5.4	2.9

Lanes, Volumes, Timings
100: Rice Road & Quaker Rd

04/19/2018

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	159	73	49	91	13	40	240	77	18	177	26
Future Volume (vph)	65	159	73	49	91	13	40	240	77	18	177	26
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.967			0.989			0.971			0.984	
Flt Protected		0.989			0.984			0.994			0.996	
Satd. Flow (prot)	0	1562	0	0	1572	0	0	1614	0	0	1646	0
Flt Permitted		0.989			0.984			0.994			0.996	
Satd. Flow (perm)	0	1562	0	0	1572	0	0	1614	0	0	1646	0
Link Speed (k/h)		50			50			40			50	
Link Distance (m)		836.8			819.8			627.0			519.3	
Travel Time (s)		60.2			59.0			56.4			37.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	8%	6%	4%	0%	12%	0%	13%	3%	0%	6%	2%	8%
Adj. Flow (vph)	71	173	79	53	99	14	43	261	84	20	192	28
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	323	0	0	166	0	0	388	0	0	240	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 58.3%	ICU Level of Service B
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	217	60	174	141	8	65	116	115	2	201	34
Future Volume (vph)	32	217	60	174	141	8	65	116	115	2	201	34
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.974			0.997			0.948			0.981	
Flt Protected		0.995			0.974			0.989				
Satd. Flow (prot)	0	1589	0	0	1583	0	0	1534	0	0	1662	0
Flt Permitted		0.995			0.974			0.989				
Satd. Flow (perm)	0	1589	0	0	1583	0	0	1534	0	0	1662	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		819.8			825.5			222.1			515.9	
Travel Time (s)		59.0			59.4			16.0			37.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	6%	7%	9%	3%	0%	5%	1%	11%	0%	2%	3%
Adj. Flow (vph)	35	236	65	189	153	9	71	126	125	2	218	37
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	336	0	0	351	0	0	322	0	0	257	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

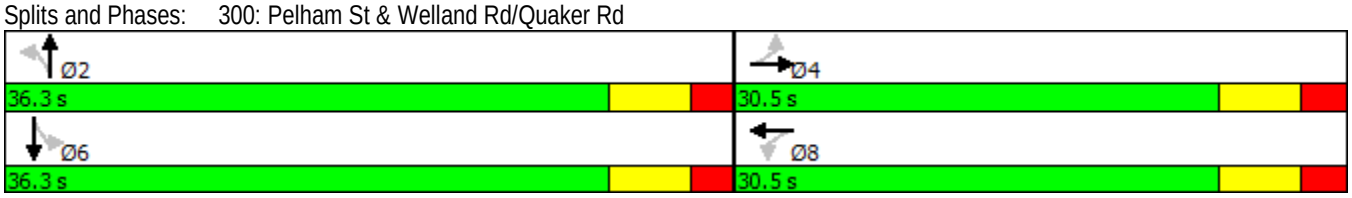
Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 82.7%	ICU Level of Service E
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	44	125	100	11	44	34	40	199	32	36	215	12
Future Volume (vph)	44	125	100	11	44	34	40	199	32	36	215	12
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	0.0		0.0	0.0		0.0	55.0		0.0	55.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99			1.00		1.00		
Frt		0.950			0.949			0.979			0.992	
Flt Protected		0.992			0.994		0.950			0.950		
Satd. Flow (prot)	0	1592	0	0	1596	0	1644	1586	0	1644	1618	0
Flt Permitted		0.935			0.938		0.606			0.603		
Satd. Flow (perm)	0	1497	0	0	1506	0	1049	1586	0	1041	1618	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		53			37			17			6	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		251.9			404.7			1006.2			780.9	
Travel Time (s)		18.1			29.1			60.4			46.9	
Confl. Peds. (#/hr)	11					11			3	3		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	7%	2%	1%	0%	2%	0%	0%	7%	3%	0%	6%	8%
Adj. Flow (vph)	48	136	109	12	48	37	43	216	35	39	234	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	293	0	0	97	0	43	251	0	39	247	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	14.5	14.5		14.5	14.5		16.3	16.3		16.3	16.3	
Total Split (s)	30.5	30.5		30.5	30.5		36.3	36.3		36.3	36.3	
Total Split (%)	45.7%	45.7%		45.7%	45.7%		54.3%	54.3%		54.3%	54.3%	
Maximum Green (s)	24.0	24.0		24.0	24.0		30.0	30.0		30.0	30.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.4	2.4		2.4	2.4		2.2	2.2		2.2	2.2	
Lost Time Adjust (s)		-2.5			-2.5		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		13.7			13.7		14.2	14.2		14.2	14.2	
Actuated g/C Ratio		0.38			0.38		0.39	0.39		0.39	0.39	
v/c Ratio		0.49			0.16		0.10	0.40		0.10	0.39	
Control Delay		10.3			6.2		8.7	10.3		8.6	10.5	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		10.3			6.2		8.7	10.3		8.6	10.5	
LOS		B			A		A	B		A	B	
Approach Delay		10.3			6.2			10.0			10.2	
Approach LOS		B			A			B			B	
90th %ile Green (s)	17.5	17.5		17.5	17.5		17.1	17.1		17.1	17.1	
90th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Gap		Hold	Hold	
70th %ile Green (s)	12.8	12.8		12.8	12.8		12.4	12.4		12.4	12.4	
70th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Gap		Gap	Gap	
50th %ile Green (s)	10.3	10.3		10.3	10.3		10.1	10.1		10.1	10.1	
50th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Gap		Gap	Gap	
30th %ile Green (s)	8.4	8.4		8.4	8.4		10.0	10.0		10.0	10.0	
30th %ile Term Code	Gap	Gap		Hold	Hold		Min	Min		Min	Min	
10th %ile Green (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
10th %ile Term Code	Min	Min		Hold	Hold		Min	Min		Min	Min	
Queue Length 50th (m)		8.7			1.9		1.4	8.6		1.3	8.9	
Queue Length 95th (m)		27.9			9.1		6.5	26.1		6.1	26.3	
Internal Link Dist (m)		227.9			380.7			982.2			756.9	
Turn Bay Length (m)							55.0			55.0		
Base Capacity (vph)		1140			1142		945	1430		937	1458	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.26			0.08		0.05	0.18		0.04	0.17	

Intersection Summary	
Area Type: Other	
Cycle Length: 66.8	
Actuated Cycle Length: 36.1	
Natural Cycle: 40	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.49	
Intersection Signal Delay: 9.8	Intersection LOS: A
Intersection Capacity Utilization 55.8%	ICU Level of Service B
Analysis Period (min) 15	
90th %ile Actuated Cycle: 47.4	
70th %ile Actuated Cycle: 38	
50th %ile Actuated Cycle: 33.2	
30th %ile Actuated Cycle: 31.2	
10th %ile Actuated Cycle: 30.8	

Splits and Phases: 300: Pelham St & Welland Rd/Quaker Rd



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	207	15	88	15	27	25	59	341	17	6	243	102
Future Volume (vph)	207	15	88	15	27	25	59	341	17	6	243	102
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	65.0		0.0	20.0		0.0	75.0		0.0	30.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	2.5			2.5			55.0			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	1.00	0.99		1.00	0.99			1.00		1.00		
Frt		0.871			0.928			0.993			0.956	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1628	1463	0	1536	1564	0	1495	3171	0	1644	3002	0
Flt Permitted	0.720			0.685			0.421			0.522		
Satd. Flow (perm)	1230	1463	0	1107	1564	0	662	3171	0	902	3002	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		96			27			6			80	
Link Speed (k/h)		50			50			50			60	
Link Distance (m)		825.5			214.4			467.2			1021.4	
Travel Time (s)		59.4			15.4			33.6			61.3	
Confl. Peds. (#/hr)	3		1	1		3			1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	7%	1%	7%	0%	4%	10%	3%	0%	0%	5%	4%
Adj. Flow (vph)	225	16	96	16	29	27	64	371	18	7	264	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	225	112	0	16	56	0	64	389	0	7	375	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane								Yes				
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	8.0	8.0		8.0	8.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	14.9	14.9		14.9	14.9		11.1	16.6		11.1	16.6	
Total Split (s)	35.9	35.9		35.9	35.9		18.0	41.6		18.0	41.6	
Total Split (%)	37.6%	37.6%		37.6%	37.6%		18.8%	43.6%		18.8%	43.6%	
Maximum Green (s)	29.0	29.0		29.0	29.0		15.0	35.0		15.0	35.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		3.0	4.1		3.0	4.1	
All-Red Time (s)	2.8	2.8		2.8	2.8		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-2.9	-2.9		-2.9	-2.9		1.0	-2.6		1.0	-2.6	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)	11.0	11.0		11.0	11.0			9.0			9.0	
Flash Dont Walk (s)	18.0	18.0		18.0	18.0			14.0			14.0	
Pedestrian Calls (#/hr)	0	0		0	0			0			0	
Act Effct Green (s)	17.1	17.1		17.1	17.1		20.1	19.0		17.3	14.8	
Actuated g/C Ratio	0.37	0.37		0.37	0.37		0.44	0.41		0.38	0.32	
v/c Ratio	0.49	0.19		0.04	0.09		0.16	0.30		0.02	0.37	
Control Delay	16.8	4.9		11.4	7.8		9.2	11.0		8.7	12.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	16.8	4.9		11.4	7.8		9.2	11.0		8.7	12.8	
LOS	B	A		B	A		A	B		A	B	
Approach Delay		12.8			8.6			10.8			12.8	
Approach LOS		B			A			B			B	
90th %ile Green (s)	23.0	23.0		23.0	23.0		8.8	18.0		6.0	15.2	
90th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Hold		Min	Gap	
70th %ile Green (s)	16.4	16.4		16.4	16.4		8.0	23.1		0.0	12.1	
70th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Hold		Skip	Gap	
50th %ile Green (s)	13.4	13.4		13.4	13.4		6.9	20.0		0.0	10.1	
50th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Hold		Skip	Gap	
30th %ile Green (s)	10.9	10.9		10.9	10.9		0.0	10.0		0.0	10.0	
30th %ile Term Code	Gap	Gap		Hold	Hold		Skip	Min		Skip	Min	
10th %ile Green (s)	8.0	8.0		8.0	8.0		0.0	10.5		0.0	10.5	
10th %ile Term Code	Min	Min		Hold	Hold		Skip	Dwell		Skip	Dwell	
Queue Length 50th (m)	14.3	0.8		0.9	1.6		2.6	8.8		0.3	10.2	
Queue Length 95th (m)	35.3	9.0		4.2	7.7		9.6	28.2		2.2	25.0	
Internal Link Dist (m)		801.5			190.4			443.2			997.4	
Turn Bay Length (m)	65.0			20.0			75.0			30.0		
Base Capacity (vph)	912	1109		821	1167		572	2603		652	2478	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.25	0.10		0.02	0.05		0.11	0.15		0.01	0.15	

Intersection Summary	
Area Type: Other	
Cycle Length: 95.5	
Actuated Cycle Length: 46	
Natural Cycle: 45	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.49	
Intersection Signal Delay: 11.8	Intersection LOS: B
Intersection Capacity Utilization 45.4%	ICU Level of Service A
Analysis Period (min) 15	
90th %ile Actuated Cycle: 63.5	
70th %ile Actuated Cycle: 53	
50th %ile Actuated Cycle: 46.9	
30th %ile Actuated Cycle: 34.4	
10th %ile Actuated Cycle: 32	

Splits and Phases: 400: Niagara St & Quaker Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	43	6	252	72	12	4	246	376	9	157	12
Future Volume (vph)	7	43	6	252	72	12	4	246	376	9	157	12
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	0.0		0.0	55.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	0		1	0		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.985			0.979				0.850		0.990	
Flt Protected		0.994		0.950				0.999			0.997	
Satd. Flow (prot)	0	1662	0	1566	1640	0	0	1663	1442	0	2984	0
Flt Permitted		0.938		0.619				0.996			0.936	
Satd. Flow (perm)	0	1569	0	1020	1640	0	0	1658	1442	0	2801	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			12				409		11	
Link Speed (k/h)		50			80			60			60	
Link Distance (m)		831.3			202.8			1021.4			164.8	
Travel Time (s)		59.9			9.1			61.3			9.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	17%	5%	1%	17%	0%	4%	2%	11%	8%	17%
Adj. Flow (vph)	8	47	7	274	78	13	4	267	409	10	171	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	62	0	274	91	0	0	271	409	0	194	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4		3	8			2			6	

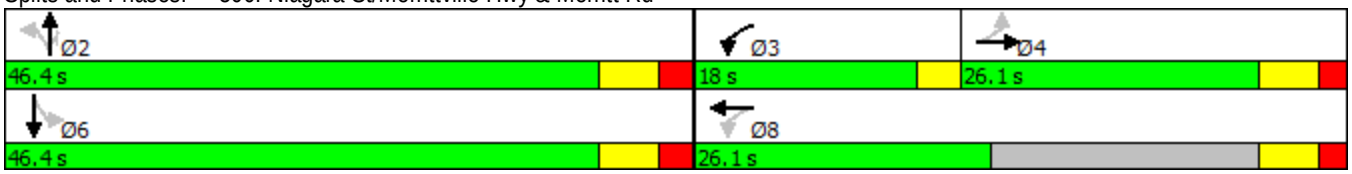
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		3	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	8.0	8.0		10.0	8.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	14.1	14.1		13.0	14.1		16.4	16.4	16.4	16.4	16.4	
Total Split (s)	26.1	26.1		18.0	26.1		46.4	46.4	46.4	46.4	46.4	
Total Split (%)	28.8%	28.8%		19.9%	28.8%		51.3%	51.3%	51.3%	51.3%	51.3%	
Maximum Green (s)	20.0	20.0		15.0	20.0		40.0	40.0	40.0	40.0	40.0	
Yellow Time (s)	4.1	4.1		3.0	4.1		4.1	4.1	4.1	4.1	4.1	
All-Red Time (s)	2.0	2.0		0.0	2.0		2.3	2.3	2.3	2.3	2.3	
Lost Time Adjust (s)		-2.1		1.0	-2.1			-2.4	-2.4		-2.4	
Total Lost Time (s)		4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Vehicle Extension (s)	3.0	3.0		3.0	3.0		5.0	5.0	5.0	5.0	5.0	
Recall Mode	None	None		None	None		Min	Min	Min	Min	Min	
Act Effct Green (s)		11.5		19.7	19.7			22.2	22.2		22.2	
Actuated g/C Ratio		0.23		0.39	0.39			0.44	0.44		0.44	
v/c Ratio		0.17		0.52	0.14			0.37	0.47		0.16	
Control Delay		21.3		15.6	9.8			13.1	3.6		10.1	
Queue Delay		0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay		21.3		15.6	9.8			13.1	3.6		10.1	
LOS		C		B	A			B	A		B	
Approach Delay		21.3			14.2			7.4			10.1	
Approach LOS		C			B			A			B	
90th %ile Green (s)	10.7	10.7		15.0	28.7		29.7	29.7	29.7	29.7	29.7	
90th %ile Term Code	Gap	Gap		Max	Hold		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	8.5	8.5		14.3	25.8		22.8	22.8	22.8	22.8	22.8	
70th %ile Term Code	Gap	Gap		Gap	Hold		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	8.0	8.0		11.5	22.5		17.9	17.9	17.9	17.9	17.9	
50th %ile Term Code	Min	Min		Gap	Hold		Gap	Gap	Gap	Hold	Hold	
30th %ile Green (s)	0.0	0.0		11.1	8.0		14.8	14.8	14.8	14.8	14.8	
30th %ile Term Code	Skip	Skip		Hold	Hold		Gap	Gap	Gap	Hold	Hold	
10th %ile Green (s)	0.0	0.0		11.1	8.0		12.9	12.9	12.9	12.9	12.9	
10th %ile Term Code	Skip	Skip		Hold	Hold		Dwell	Dwell	Dwell	Dwell	Dwell	
Queue Length 50th (m)		4.4		15.7	3.9			18.2	0.0		5.7	
Queue Length 95th (m)		15.8		41.6	13.8			38.7	13.5		12.7	
Internal Link Dist (m)		807.3			178.8			997.4			140.8	
Turn Bay Length (m)				55.0								
Base Capacity (vph)		749		607	1308			1357	1254		2295	
Starvation Cap Reductn		0		0	0			0	0		0	
Spillback Cap Reductn		0		0	0			0	0		0	
Storage Cap Reductn		0		0	0			0	0		0	
Reduced v/c Ratio		0.08		0.45	0.07			0.20	0.33		0.08	

Intersection Summary

Area Type: Other
Cycle Length: 90.5
Actuated Cycle Length: 50.7

Natural Cycle: 45	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.52	
Intersection Signal Delay: 10.4	Intersection LOS: B
Intersection Capacity Utilization 50.3%	ICU Level of Service A
Analysis Period (min) 15	
90th %ile Actuated Cycle: 70.9	
70th %ile Actuated Cycle: 61.1	
50th %ile Actuated Cycle: 52.9	
30th %ile Actuated Cycle: 35.3	
10th %ile Actuated Cycle: 33.4	

Splits and Phases: 500: Niagara St/Merrittville Hwy & Merritt Rd



Intersection	
Intersection Delay, s/veh	20.5
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	32	150	47	61	200	28	61	204	58	25	234	53
Future Vol, veh/h	32	150	47	61	200	28	61	204	58	25	234	53
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	7	4	0	1	0	2	3	3	4	3	2
Mvmt Flow	35	163	51	66	217	30	66	222	63	27	254	58
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	16.9	20.4	22.2	21.5
HCM LOS	C	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	19%	14%	21%	8%
Vol Thru, %	63%	66%	69%	75%
Vol Right, %	18%	21%	10%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	323	229	289	312
LT Vol	61	32	61	25
Through Vol	204	150	200	234
RT Vol	58	47	28	53
Lane Flow Rate	351	249	314	339
Geometry Grp	1	1	1	1
Degree of Util (X)	0.662	0.491	0.609	0.644
Departure Headway (Hd)	6.785	7.105	6.979	6.832
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	530	505	515	529
Service Time	4.842	5.17	5.038	4.89
HCM Lane V/C Ratio	0.662	0.493	0.61	0.641
HCM Control Delay	22.2	16.9	20.4	21.5
HCM Lane LOS	C	C	C	C
HCM 95th-tile Q	4.8	2.7	4	4.5

Intersection	
Intersection Delay, s/veh	22.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	180	44	113	245	8	23	142	175	7	173	41
Future Vol, veh/h	21	180	44	113	245	8	23	142	175	7	173	41
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	4	0	8	2	0	0	1	3	0	0	0
Mvmt Flow	23	196	48	123	266	9	25	154	190	8	188	45
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	17.6	29.5	22.9	16.8
HCM LOS	C	D	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	7%	9%	31%	3%
Vol Thru, %	42%	73%	67%	78%
Vol Right, %	51%	18%	2%	19%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	340	245	366	221
LT Vol	23	21	113	7
Through Vol	142	180	245	173
RT Vol	175	44	8	41
Lane Flow Rate	370	266	398	240
Geometry Grp	1	1	1	1
Degree of Util (X)	0.682	0.522	0.768	0.48
Departure Headway (Hd)	6.642	7.058	6.946	7.187
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	543	509	521	500
Service Time	4.702	5.128	5.004	5.257
HCM Lane V/C Ratio	0.681	0.523	0.764	0.48
HCM Control Delay	22.9	17.6	29.5	16.8
HCM Lane LOS	C	C	D	C
HCM 95th-tile Q	5.2	3	6.8	2.6

Lanes, Volumes, Timings
100: Rice Road & Quaker Rd

04/19/2018

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	150	47	61	200	28	61	204	58	25	234	53
Future Volume (vph)	32	150	47	61	200	28	61	204	58	25	234	53
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.972			0.987			0.976			0.977	
Flt Protected		0.993			0.990			0.991			0.996	
Satd. Flow (prot)	0	1585	0	0	1679	0	0	1628	0	0	1636	0
Flt Permitted		0.993			0.990			0.991			0.996	
Satd. Flow (perm)	0	1585	0	0	1679	0	0	1628	0	0	1636	0
Link Speed (k/h)		50			50			40			50	
Link Distance (m)		836.8			819.8			627.0			519.3	
Travel Time (s)		60.2			59.0			56.4			37.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	7%	4%	0%	1%	0%	2%	3%	3%	4%	3%	2%
Adj. Flow (vph)	35	163	51	66	217	30	66	222	63	27	254	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	249	0	0	313	0	0	351	0	0	339	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 67.9%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	180	44	113	245	8	23	142	175	7	173	41
Future Volume (vph)	21	180	44	113	245	8	23	142	175	7	173	41
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.976			0.997			0.930			0.975	
Flt Protected		0.996			0.985			0.997			0.998	
Satd. Flow (prot)	0	1634	0	0	1637	0	0	1574	0	0	1684	0
Flt Permitted		0.996			0.985			0.997			0.998	
Satd. Flow (perm)	0	1634	0	0	1637	0	0	1574	0	0	1684	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		819.8			825.5			222.1			515.9	
Travel Time (s)		59.0			59.4			16.0			37.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	4%	0%	8%	2%	0%	0%	1%	3%	0%	0%	0%
Adj. Flow (vph)	23	196	48	123	266	9	25	154	190	8	188	45
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	267	0	0	398	0	0	369	0	0	241	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

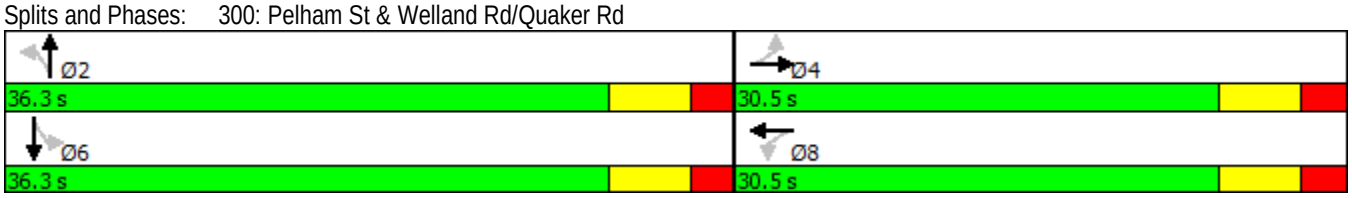
Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 77.2%	ICU Level of Service D
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	125	108	41	144	75	107	271	37	65	324	62
Future Volume (vph)	21	125	108	41	144	75	107	271	37	65	324	62
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	0.0		0.0	0.0		0.0	55.0		0.0	55.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99			1.00		1.00		
Frt		0.943			0.961			0.982			0.976	
Flt Protected		0.996			0.992		0.950			0.950		
Satd. Flow (prot)	0	1612	0	0	1629	0	1612	1689	0	1644	1667	0
Flt Permitted		0.954			0.911		0.431			0.519		
Satd. Flow (perm)	0	1543	0	0	1496	0	731	1689	0	898	1667	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		66			36			14			20	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		251.9			404.7			1006.2			780.9	
Travel Time (s)		18.1			29.1			60.4			46.9	
Confl. Peds. (#/hr)	4					4			1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	2%	0%	1%	0%	2%	0%	3%	0%	1%	3%
Adj. Flow (vph)	23	136	117	45	157	82	116	295	40	71	352	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	276	0	0	284	0	116	335	0	71	419	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	14.5	14.5		14.5	14.5		16.3	16.3		16.3	16.3	
Total Split (s)	30.5	30.5		30.5	30.5		36.3	36.3		36.3	36.3	
Total Split (%)	45.7%	45.7%		45.7%	45.7%		54.3%	54.3%		54.3%	54.3%	
Maximum Green (s)	24.0	24.0		24.0	24.0		30.0	30.0		30.0	30.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		4.1	4.1		4.1	4.1	
All-Red Time (s)	2.4	2.4		2.4	2.4		2.2	2.2		2.2	2.2	
Lost Time Adjust (s)		-2.5			-2.5		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		15.4			15.4		18.4	18.4		18.4	18.4	
Actuated g/C Ratio		0.36			0.36		0.43	0.43		0.43	0.43	
v/c Ratio		0.46			0.50		0.37	0.45		0.18	0.57	
Control Delay		11.4			13.6		12.8	10.8		9.5	12.6	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		11.4			13.6		12.8	10.8		9.5	12.6	
LOS		B			B		B	B		A	B	
Approach Delay		11.4			13.6			11.3			12.1	
Approach LOS		B			B			B			B	
90th %ile Green (s)	21.6	21.6		21.6	21.6		27.1	27.1		27.1	27.1	
90th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
70th %ile Green (s)	15.1	15.1		15.1	15.1		19.2	19.2		19.2	19.2	
70th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
50th %ile Green (s)	11.6	11.6		11.6	11.6		14.4	14.4		14.4	14.4	
50th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
30th %ile Green (s)	9.2	9.2		9.2	9.2		11.4	11.4		11.4	11.4	
30th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
10th %ile Green (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
10th %ile Term Code	Min	Min		Min	Min		Min	Min		Min	Min	
Queue Length 50th (m)		9.6			11.8		4.7	13.5		2.6	17.8	
Queue Length 95th (m)		33.2			38.2		18.1	38.8		10.7	50.8	
Internal Link Dist (m)		227.9			380.7			982.2			756.9	
Turn Bay Length (m)							55.0			55.0		
Base Capacity (vph)		1049			1008		586	1357		720	1341	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.26			0.28		0.20	0.25		0.10	0.31	

Intersection Summary	
Area Type: Other	
Cycle Length: 66.8	
Actuated Cycle Length: 42.3	
Natural Cycle: 40	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.57	
Intersection Signal Delay: 12.0	Intersection LOS: B
Intersection Capacity Utilization 66.8%	ICU Level of Service C
Analysis Period (min) 15	
90th %ile Actuated Cycle: 61.5	
70th %ile Actuated Cycle: 47.1	
50th %ile Actuated Cycle: 38.8	
30th %ile Actuated Cycle: 33.4	
10th %ile Actuated Cycle: 30.8	

Splits and Phases: 300: Pelham St & Welland Rd/Quaker Rd



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	151	45	160	26	29	13	157	372	27	47	577	184
Future Volume (vph)	151	45	160	26	29	13	157	372	27	47	577	184
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	65.0		0.0	20.0		0.0	75.0		0.0	30.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	2.5			2.5			55.0			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	1.00	0.99		1.00	1.00		1.00				0.99	
Frt		0.883			0.954			0.990			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1596	1505	0	1644	1611	0	1628	3225	0	1644	3120	0
Flt Permitted	0.727			0.517			0.183			0.500		
Satd. Flow (perm)	1220	1505	0	894	1611	0	313	3225	0	865	3120	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		174			14			9			53	
Link Speed (k/h)		50			50			50			60	
Link Distance (m)		825.5			214.4			467.2			1021.4	
Travel Time (s)		59.4			15.4			33.6			61.3	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	0%	0%	3%	0%	1%	1%	0%	0%	1%	1%
Adj. Flow (vph)	164	49	174	28	32	14	171	404	29	51	627	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	164	223	0	28	46	0	171	433	0	51	827	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane								Yes				
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	8.0	8.0		8.0	8.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	14.9	14.9		14.9	14.9		11.1	16.6		11.1	16.6	
Total Split (s)	35.9	35.9		35.9	35.9		18.0	41.6		18.0	41.6	
Total Split (%)	37.6%	37.6%		37.6%	37.6%		18.8%	43.6%		18.8%	43.6%	
Maximum Green (s)	29.0	29.0		29.0	29.0		15.0	35.0		15.0	35.0	
Yellow Time (s)	4.1	4.1		4.1	4.1		3.0	4.1		3.0	4.1	
All-Red Time (s)	2.8	2.8		2.8	2.8		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-2.9	-2.9		-2.9	-2.9		1.0	-2.6		1.0	-2.6	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)	11.0	11.0		11.0	11.0			9.0			9.0	
Flash Dont Walk (s)	18.0	18.0		18.0	18.0			14.0			14.0	
Pedestrian Calls (#/hr)	0	0		0	0			0			0	
Act Effct Green (s)	17.5	17.5		17.5	17.5		39.1	34.0		30.7	25.1	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.60	0.52		0.47	0.39	
v/c Ratio	0.50	0.42		0.12	0.10		0.44	0.26		0.11	0.67	
Control Delay	28.4	9.4		22.3	16.5		10.2	10.4		7.4	19.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	28.4	9.4		22.3	16.5		10.2	10.4		7.4	19.2	
LOS	C	A		C	B		B	B		A	B	
Approach Delay		17.4			18.7			10.4			18.5	
Approach LOS		B			B			B			B	
90th %ile Green (s)	24.5	24.5		24.5	24.5		15.0	42.5		7.5	35.0	
90th %ile Term Code	Gap	Gap		Hold	Hold		Max	Hold		Gap	Max	
70th %ile Green (s)	17.4	17.4		17.4	17.4		13.0	32.8		6.4	26.2	
70th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Hold		Gap	Gap	
50th %ile Green (s)	13.8	13.8		13.8	13.8		10.5	26.4		6.0	21.9	
50th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Hold		Min	Gap	
30th %ile Green (s)	10.7	10.7		10.7	10.7		9.2	29.6		0.0	17.4	
30th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Hold		Skip	Gap	
10th %ile Green (s)	8.0	8.0		8.0	8.0		6.7	23.1		0.0	13.4	
10th %ile Term Code	Min	Min		Hold	Hold		Gap	Hold		Skip	Gap	
Queue Length 50th (m)	16.0	4.3		2.4	2.8		7.5	15.0		2.1	37.2	
Queue Length 95th (m)	41.6	23.3		10.0	11.6		20.5	31.0		7.6	74.3	
Internal Link Dist (m)		801.5			190.4			443.2			997.4	
Turn Bay Length (m)	65.0			20.0			75.0			30.0		
Base Capacity (vph)	635	867		465	845		488	2036		685	1935	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.26	0.26		0.06	0.05		0.35	0.21		0.07	0.43	

Intersection Summary	
Area Type: Other	
Cycle Length: 95.5	
Actuated Cycle Length: 65	
Natural Cycle: 50	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 15.8	Intersection LOS: B
Intersection Capacity Utilization 66.7%	ICU Level of Service C
Analysis Period (min) 15	
90th %ile Actuated Cycle: 91	
70th %ile Actuated Cycle: 73.1	
50th %ile Actuated Cycle: 62.7	
30th %ile Actuated Cycle: 53.8	
10th %ile Actuated Cycle: 44.6	

Splits and Phases: 400: Niagara St & Quaker Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	51	6	410	101	23	5	171	338	5	340	13
Future Volume (vph)	5	51	6	410	101	23	5	171	338	5	340	13
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (m)	0.0		0.0	55.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	0		1	0		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.986			0.972				0.850		0.995	
Flt Protected		0.996		0.950				0.999			0.999	
Satd. Flow (prot)	0	1700	0	1612	1630	0	0	1680	1414	0	3238	0
Flt Permitted		0.958		0.606				0.986			0.951	
Satd. Flow (perm)	0	1635	0	1028	1630	0	0	1658	1414	0	3082	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			16				367		5	
Link Speed (k/h)		50			80			60			60	
Link Distance (m)		831.3			202.8			1021.4			164.8	
Travel Time (s)		59.9			9.1			61.3			9.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	2%	1%	13%	0%	3%	4%	0%	1%	0%
Adj. Flow (vph)	5	55	7	446	110	25	5	186	367	5	370	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	67	0	446	135	0	0	191	367	0	389	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		2.5			2.5			2.5			2.5	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4		3	8			2			6	

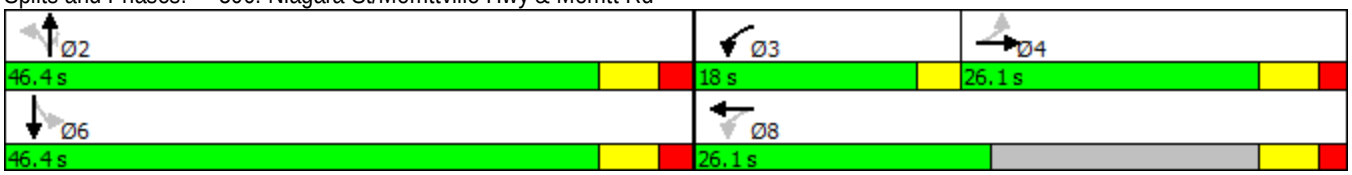
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		3	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	8.0	8.0		10.0	8.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	14.1	14.1		13.0	14.1		16.4	16.4	16.4	16.4	16.4	
Total Split (s)	26.1	26.1		18.0	26.1		46.4	46.4	46.4	46.4	46.4	
Total Split (%)	28.8%	28.8%		19.9%	28.8%		51.3%	51.3%	51.3%	51.3%	51.3%	
Maximum Green (s)	20.0	20.0		15.0	20.0		40.0	40.0	40.0	40.0	40.0	
Yellow Time (s)	4.1	4.1		3.0	4.1		4.1	4.1	4.1	4.1	4.1	
All-Red Time (s)	2.0	2.0		0.0	2.0		2.3	2.3	2.3	2.3	2.3	
Lost Time Adjust (s)		-2.1		1.0	-2.1			-2.4	-2.4		-2.4	
Total Lost Time (s)		4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Vehicle Extension (s)	3.0	3.0		3.0	3.0		5.0	5.0	5.0	5.0	5.0	
Recall Mode	None	None		None	None		Min	Min	Min	Min	Min	
Act Effct Green (s)		11.3		20.9	20.9			18.0	18.0		18.0	
Actuated g/C Ratio		0.24		0.44	0.44			0.38	0.38		0.38	
v/c Ratio		0.17		0.72	0.19			0.30	0.48		0.33	
Control Delay		19.4		18.5	8.0			14.1	4.2		12.9	
Queue Delay		0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay		19.4		18.5	8.0			14.1	4.2		12.9	
LOS		B		B	A			B	A		B	
Approach Delay		19.4			16.1			7.6			12.9	
Approach LOS		B			B			A			B	
90th %ile Green (s)	10.2	10.2		15.0	28.2		22.3	22.3	22.3	22.3	22.3	
90th %ile Term Code	Gap	Gap		Max	Hold		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	8.4	8.4		15.0	26.4		17.5	17.5	17.5	17.5	17.5	
70th %ile Term Code	Gap	Gap		Max	Hold		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	8.0	8.0		15.0	26.0		14.8	14.8	14.8	14.8	14.8	
50th %ile Term Code	Min	Min		Max	Hold		Gap	Gap	Gap	Hold	Hold	
30th %ile Green (s)	0.0	0.0		13.4	10.3		12.2	12.2	12.2	12.2	12.2	
30th %ile Term Code	Skip	Skip		Gap	Hold		Gap	Gap	Gap	Hold	Hold	
10th %ile Green (s)	0.0	0.0		11.1	8.0		10.0	10.0	10.0	10.0	10.0	
10th %ile Term Code	Skip	Skip		Hold	Hold		Min	Min	Min	Min	Min	
Queue Length 50th (m)		5.0		25.0	5.2			13.7	0.0		14.6	
Queue Length 95th (m)		15.1		#62.0	15.5			27.8	13.9		24.9	
Internal Link Dist (m)		807.3			178.8			997.4			140.8	
Turn Bay Length (m)				55.0								
Base Capacity (vph)		824		673	1339			1399	1250		2602	
Starvation Cap Reductn		0		0	0			0	0		0	
Spillback Cap Reductn		0		0	0			0	0		0	
Storage Cap Reductn		0		0	0			0	0		0	
Reduced v/c Ratio		0.08		0.66	0.10			0.14	0.29		0.15	

Intersection Summary

Area Type: Other
Cycle Length: 90.5
Actuated Cycle Length: 47.6

Natural Cycle: 45	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 12.5	Intersection LOS: B
Intersection Capacity Utilization 52.5%	ICU Level of Service A
Analysis Period (min) 15	
90th %ile Actuated Cycle: 63	
70th %ile Actuated Cycle: 56.4	
50th %ile Actuated Cycle: 53.3	
30th %ile Actuated Cycle: 35	
10th %ile Actuated Cycle: 30.5	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 500: Niagara St/Merrittville Hwy & Merritt Rd



Appendix C – Traffic Control Signal Justifications (Base Year, Background Traffic)

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

GO TO Justification:

Intersection: Quaker Road / Rice Road

Count Date: 2016-06-13

Summary Results

Justification			Compliance	Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	100 %	☐	☑
	B	Crossing Volume	100 %		
2. Delay to Cross Traffic	A	Main Road	57 %	☐	☑
	B	Crossing Road	100 %		
3. Combination	A	Justificaton 1	100 %	☐	☑
	B	Justification 2	57 %		
4. 4-Hr Volume			100 %	☐	☑
5. Collision Experience			0 %	☐	☑
6. Pedestrians	A	Volume	Justification not met	☐	☑
	B	Delay	Justification not met		

First Ave @ Quaker Rd

Count Date: 22-Mar-2016
Intersection: Quaker Rd & First Ave
Municipality: Welland
Major Road: Quaker Rd
Major Road Runs: E/W one lane each way
Operating Speed of Major Road: 50 km/hr
Operating under restricted flow conditions

Warrant #1: Minimum Vehicular Volumes.

A. All Approaches. **80% Satisfied**

No. of Lanes	Minimum Requirements					Hours Ending								Percentage Warrant	
	1 Lane Each Way		2 Lanes Each Way		3 Lanes										
Flow Condition	1 Lane F. Flow (Code 1)	1 Lane R. Flow (Code 2)	2 Lane F. Flow (Code 3)	2 Lane R. Flow (Code 4)	or More R. Flow (Code 5)	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00		
100%	480	720	600	900	1125	608	1165	783	769	752	996	1130	1080		100%
80%	385	575	480	720	900									Yes:	
														No:	X
All Approa-ches	100% Fulfilled						100	100	100	100	100	100	100		700
	80% Fulfilled					80									80
	Actual % if Below 80%														0
														Total:	780
														Actual Average (Total/8):	98%

B. Minor Street Both Approaches.

100%	120	170	120	170	170	295	533	336	364	358	437	569	453		100%
80%	95	135	95	135	135									Yes:	X
														No:	
Minor Street Both Approa-ches	100% Fulfilled					100	100	100	100	100	100	100	100		800
	80% Fulfilled														0
	Actual % if Below 80%														0
														Total:	800
														Actual Average (Total/8):	100%

First Ave @ Quaker Rd

Count Date: 22-Mar-2016
Intersection: Quaker Rd & First Ave
Major Road: Quaker Rd
Operating Speed of Major Road: 50 km/hr

Municipality: Welland
Major Road Runs: E/W one lane each way
Operating under restricted flow conditions

Warrant #2: Delay to Cross Traffic.

A. Major Street Both Approaches. **Not Satisfied**

No. of Lanes	Minimum Requirements					Hours Ending								Percentage Warrant
	1 Lane Each Way		2 Lanes Each Way		3 Lanes									
Flow Condition	1 Lane F. Flow (Code 1)	1 Lane R. Flow (Code 2)	2 Lane F. Flow (Code 3)	2 Lane R. Flow (Code 4)	or More R. Flow (Code 5)	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00	
100%	480	720	600	900	1125	313	632	447	405	394	559	561	627	100% Yes:
80%	385	575	480	720	900									No: X
All Approa-ches	100% Fulfilled													0
	80% Fulfilled						80						80	160
	Actual % if Below 80%					43		62	56	55	78	78		372
													Total:	532
													Actual Average (Total/8):	67%

B. Traffic Crossing Major Street.

100%	50	75	50	75	75	126	268	154	142	131	196	208	199	100% Yes: X
80%	40	60	40	60	60									No:
All Approa-ches	100% Fulfilled					100	100	100	100	100	100	100	100	800
	80% Fulfilled													0
	Actual % if Below 80%													0
													Total:	800
													Actual Average (Total/8):	100%

First Ave @ Quaker Rd

Count Date: 22-Mar-2016
Intersection: Quaker Rd & First Ave
Municipality: Welland
Major Road: Quaker Rd
Major Road Runs: E/W one lane each way
Operating Speed of Major Road: 50 km/hr
Operating under restricted flow conditions

Warrant #3: Accident Experience.

Not Satisfied

A. Reportable accidents within a twelve month period averaged over 36 consequtive months susceptible to correction by a traffic signal.

Minimum Requirements	Actual Number of Accidents	Average Number of Accidents	Fulfilled
5	0 in 0 years	Invalid	0%

B. Adequate trial of less restrictive remedies has failed to reduce accident frequency.	No
C. Either Warrant 1 (Minimum Vehicular Volume) or Warrant 2 (Delay to Cross Traffic) satisfied 80% or more.	Yes

Warrant #4: Combination Warrant.
(Used if no warrant satisfied 100%)

Not Satisfied

Minimum Requirements	Warrant Satisfied 80% or More	Fulfilled
Two Warrants Satisfied 80%	Warrant 1 (Minimum Vehicular Volume) Warrant 2 (Delay to Cross Traffic) Warrant 3 (Accident Experience)	Yes No No

Conclusion: Traffic signal not warranted.

Appendix D - Comments and AE Response

Response to Comments on Northwest Welland Secondary Plan – Traffic
Existing Conditions Report
Associated Engineering (Ont.) Ltd.
January 31st, 2019

Comment	**Responses**
Section 2.1 Roadway Classification – Regional Road 54 (Quaker Road) should read (Rice Road)	Corrected
Figure 2-6 and Figure 2-7 – Display link volumes on figures or prepare separate figures for link volumes	Provided.
Section 2.9.1 East Fonthill Secondary Plan – Change 2036 to 2026	Corrected.
First Street should be First Avenue	Corrected.
2.9.3 – please ensure you connect with Niagara College. An update to their Campus Master Plan may soon be underway.	Niagara College has indicated that they are not aware of any plans to expand the campus.

APPENDIX F – Natural Heritage and Natural Hazards

Existing Conditions Report
by Aquafor Beech

Submitted to:

City of Welland

Welland Northwest Area Secondary Plan
Phase 1: Background Studies

Natural Heritage and Natural Hazards
Existing Conditions

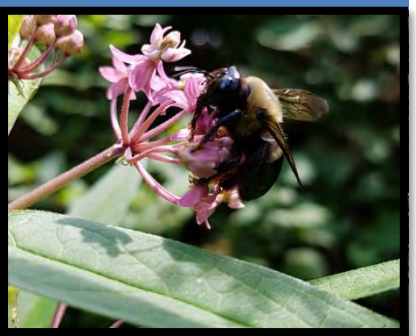
Prepared by:

Aquafor Beech Limited

2600 Skymark Avenue

Bldg 6, Suite 202

Mississauga, Ontario



Reference: 66295

April 11, 2019

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1 Introduction

The City of Welland has initiated a Secondary Plan for the Northwest Area in order to create a strategy for the future development of these lands in a way that is sustainable and integrated with the existing urban infrastructure. The Northwest Area of the City is not currently within the urban development boundary but, per the RFP for this assignment, "over the course of recent years, City of Welland Councils have supported the inclusion of the lands in the Northwest Area of the City within its urban area boundary so that urban development of these lands could proceed. The Northwest Area has significant potential to accommodate growth by permitting urban land uses within this Area. The Northwest Area of the City is a prime candidate area for boundary expansion."

Aquafor Beech Limited was retained as part of an overall project team headed by SGL Planning to complete the Natural Heritage background studies that will form the foundation of the eventual Secondary Plan. This Natural Heritage Study Report is intended to characterize the existing conditions of the Northwest Area of the City, and identify constraints and opportunities that will affect future land use decisions and policies. The findings of this study will be used to develop a comprehensive Secondary Plan, including stormwater management and natural heritage strategies, which will protect, rehabilitate, and enhance the environment within the Welland Northwest Secondary Plan study area.

The overall Secondary Plan is being undertaken in three phases. This report has been prepared as part of Phase 1 of the process, which consists of background/characterization studies that will act as a baseline for Phases 2 and 3. Natural Heritage study components included in this document include all background data review and field investigations tasks necessary to characterize and map the existing Natural Heritage System within the study area. Natural Hazard study components included in this document broadly include those related to the site's existing conditions with regards to stormwater management, floodplain mapping, and groundwater. However, as Natural Hazard information was primarily obtained from previous studies and other secondary sources, the main focus of this document will on the Natural Heritage aspects which were investigated in depth through this study.

This report details the results of detailed field investigations completed by Aquafor Beech Limited, as well as background research and agency consultation. **Section 6** presents the analysis of these data through a systems approach to natural heritage planning in which constraints and opportunities for development are identified. This report is intended to be followed at a later date by Environmental Impact Studies (EIS) and additional hydrologic assessment relevant to specific proposed developments within the Secondary Plan area. Recommendations for further study during the EIS phase are outlined in **Section 7**.

1.1 Northwest Secondary Plan Area

The study area, illustrated in **Figure 1-1**, is generally centered around the intersection of Quaker Road and Rice Road in the northwest part of the City of Welland. The area includes approximately 189 ha of land, the majority of which is currently zoned for agriculture. The area also includes existing single-detached residential properties (primarily in the northwest portion of the area), institutional properties (e.g., schools), and recreational/open space (e.g., the former Welland Soccer Club). Lands to the immediate north are located within the urban area boundary of the Town of Pelham (including the East Fonthill Secondary Plan study area) and City of Thorold (including the Port Robinson West Secondary Plan study area).

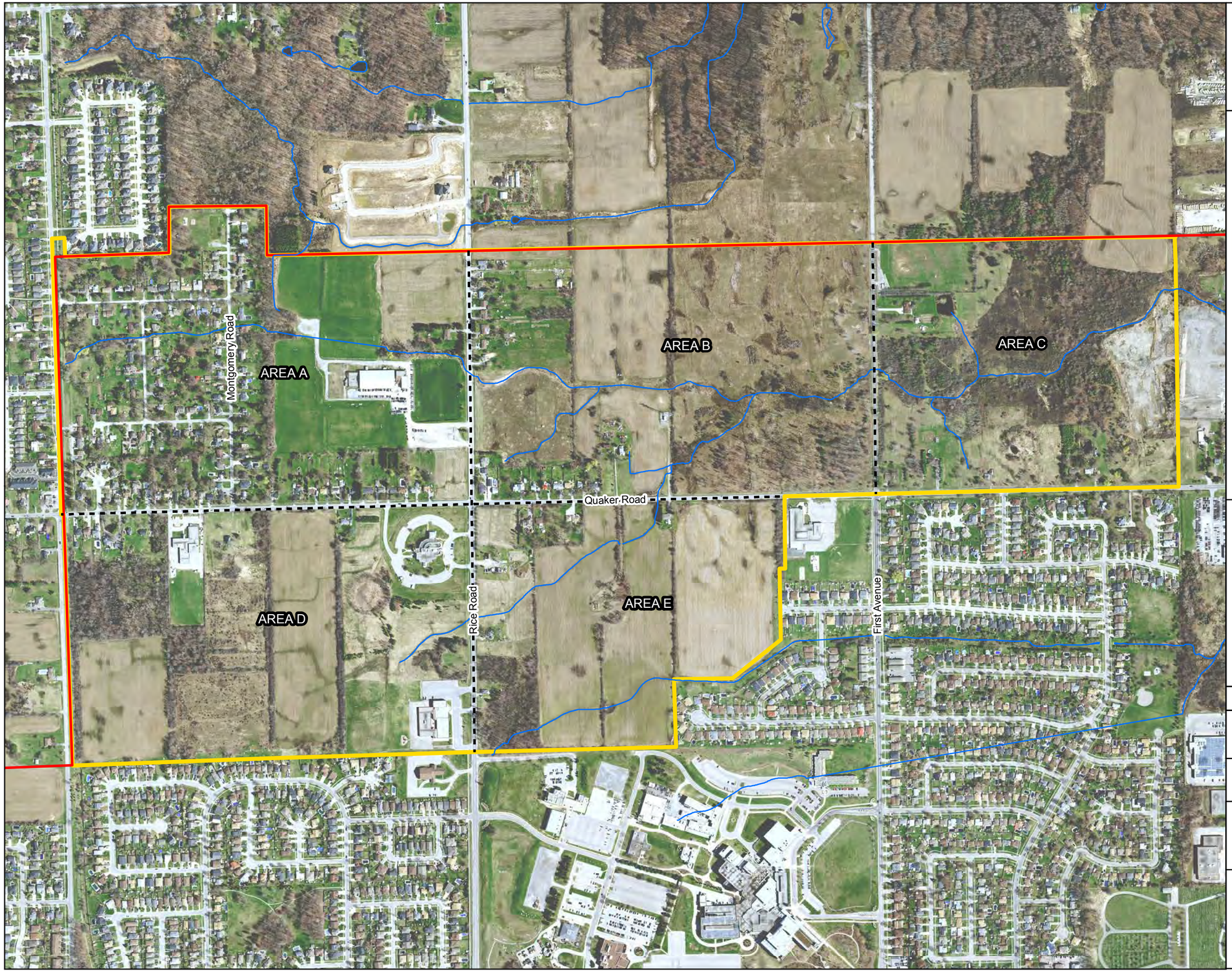
The study area was subdivided into five areas (designated Area A through Area E) based on existing road divisions, for simplicity and clarity during field investigations. The five areas, which are shown on **Figure 1-1**,

have been carried forward in this report mainly in the labeling of vegetation communities and discussion of habitat/feature locations.

1.2 Study Objectives

The main objectives of the Natural Heritage Study are to:

- Characterize all of the natural heritage features in the Secondary Plan area;
- Identify significant/sensitive features and/or other constraints which may apply to future development;
- Identify opportunities for enhancement, improvement, or restoration of the existing Natural Heritage System (NHS);
- Identify regulatory requirements related to the above;
- Provide recommendations for the delineation, protection, and management of natural heritage features and functions; and
- Identify appropriate future studies or work to be completed as part of site-specific EIS.



Legend

- Vegetation Survey Area Divisions
- Watercourse (NPCA)
- Municipal Boundary
- Secondary Plan Boundary

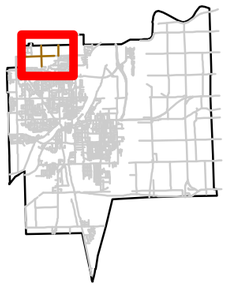


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Figure 1.1

Welland Northwest Area Location

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

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Kilometers

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2 Background Resources

Aquafor Beech Limited inventoried and characterized the natural heritage features within the Northwest Area of the City of Welland using a combination of primary and secondary information sources. The results of this baseline assessment were used to identify areas and features which are eligible for inclusion in the NHS, as described in **Section 7.1**.

Aquafor Beech Limited requested background information on the Northwest Welland study area from the Niagara Peninsula Conservation Authority (NPCA) and the Guelph District Ministry of Natural Resources and Forestry (MNRF). Background documents and other information sources reviewed by Aquafor Beech Limited in the preparation of this document include the following:

- The Northwest Area Planning and Servicing Review Class Environmental Assessment – Environmental Impact Study (Earth Tech Canada, 2003);
- The Northwest Area Planning and Servicing Study Class Environmental Assessment (Earth Tech Canada, 2008);
- The Draft Lot 228, Cities of Welland and Thorold Environmental Review (Ecologistics Limited, 1996);
- Niagara Region 2014 Consolidated Regional Official Plan;
- Corporation of the City of Welland Official Plan (2017);
- Correspondence with David Denyes, Management Biologist with the Vineland Field Office (Guelph District) of the MNRF;
- The NPCA Watershed Explorer online mapping resource;
- The Niagara Region Natural Areas Inventory (NPCA, 2010) and its associated species lists (Oldham, 2010)
- The Central Welland River Watershed Plan (NPCA, 2010);
- The Niagara Street – Cataract Road Wetland Complex Wetland Evaluation Report (MNRF, 2010);
- Natural Heritage Information Centre (NHIC) database records and mapping of significant species and natural areas; and
- Citizen science observation databases such as eBird, iNaturalist, and the Ontario Reptile and Amphibian Atlas.

Relevant information from the above-noted sources (and others as listed in detail in **Section 9**) has been incorporated into this document in the appropriate sections to create a comprehensive, single-source reference describing the existing conditions of the Welland Northwest study area.

3 Existing Planning Framework

3.1 Provincial Policy Statement

The 2014 Provincial Policy Statement (PPS), issued under Section 3 of the *Planning Act*, directs municipal land-use planning activities related to matters of provincial interest. Section 2.1.2 of the Provincial Policy Statement (PPS) states that "the diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features" (Ontario Ministry of Municipal Affairs and Housing, 2014)

The PPS supports not only the protection of individual natural heritage features (e.g., woodlands, wetlands,

valleylands, wildlife habitat, etc.) but also the linkages that connect them into a broader NHS. The NHS approach is effective because it acknowledges that natural heritage features have strong functional ties to one another, and this functionality may be compromised when such features become isolated within a predominately agricultural or urban matrix.

The Province of Ontario provides technical guidance to implement the natural heritage policies of the PPS through the Natural Heritage Reference Manual (NHRM) (Ontario Ministry of Natural Resources, 2010). The first iteration of the NHRM, issued by the Ministry of Natural Resources and Forestry (MNRF) in 1999, recognizes the development of a natural heritage system as a comprehensive approach to defining and protecting natural heritage features and areas. The most recent edition of the NHRM, issued in 2010, places greater emphasis on planning for natural heritage systems and providing connectivity among natural heritage features and areas. The NHRM itself is an advisory document outlining what planning authorities (e.g., municipalities, conservation authorities) should consider when reviewing development proposals for impacts on natural heritage features.

The PPS defines an NHS as "a system made up of natural heritage features and areas, and linkages intended to provide connectivity (at the regional and site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems. These systems can include natural heritage features and areas, federal and provincial parks and conservation reserves, other natural heritage features, lands that have been restored and areas with the potential to be restored to a natural state, areas that support hydrologic functions, and working landscapes that enable ecological functions to continue" (Ontario Ministry of Municipal Affairs and Housing, 2014).

The NHS approach is a useful method for the protection of natural heritage features and areas because it reinforces an understanding that the elements of the system have strong ecological ties to each other, as well as to other physical features and areas in the overall landscape. The NHS approach also addresses a number of important land use planning concerns, including biodiversity decline, landscape fragmentation, and the maintenance of ecosystem health. The NHRM describes these planning concerns in greater detail and outlines the potential benefits of a NHS (Ontario Ministry of Natural Resources, 2010).

The study area is outside of lands subject to the Niagara Escarpment Plan and the Greenbelt Plan.

3.2 Municipal Official Plans

The Official Plans (OPs) of the City of Welland (2017) and Niagara Region (2014) were developed to provide objectives and policies to guide future development and land use, and to refine the larger-scale policies of the PPS (2014) and ensure their application on the local scale.

The function of the City of Welland's Core Natural Heritage System is "to provide for the protection, maintenance, restoration and, where possible, enhancement of Welland's natural systems, ecological health, integrity and biodiversity. The Core Natural Heritage System is also intended to provide a framework for establishing the linkages among natural heritage features, within the system and major surface water resources" (Dillon Consulting Limited, 2017). Components of the Core Natural Heritage System defined in the OP are as follows:

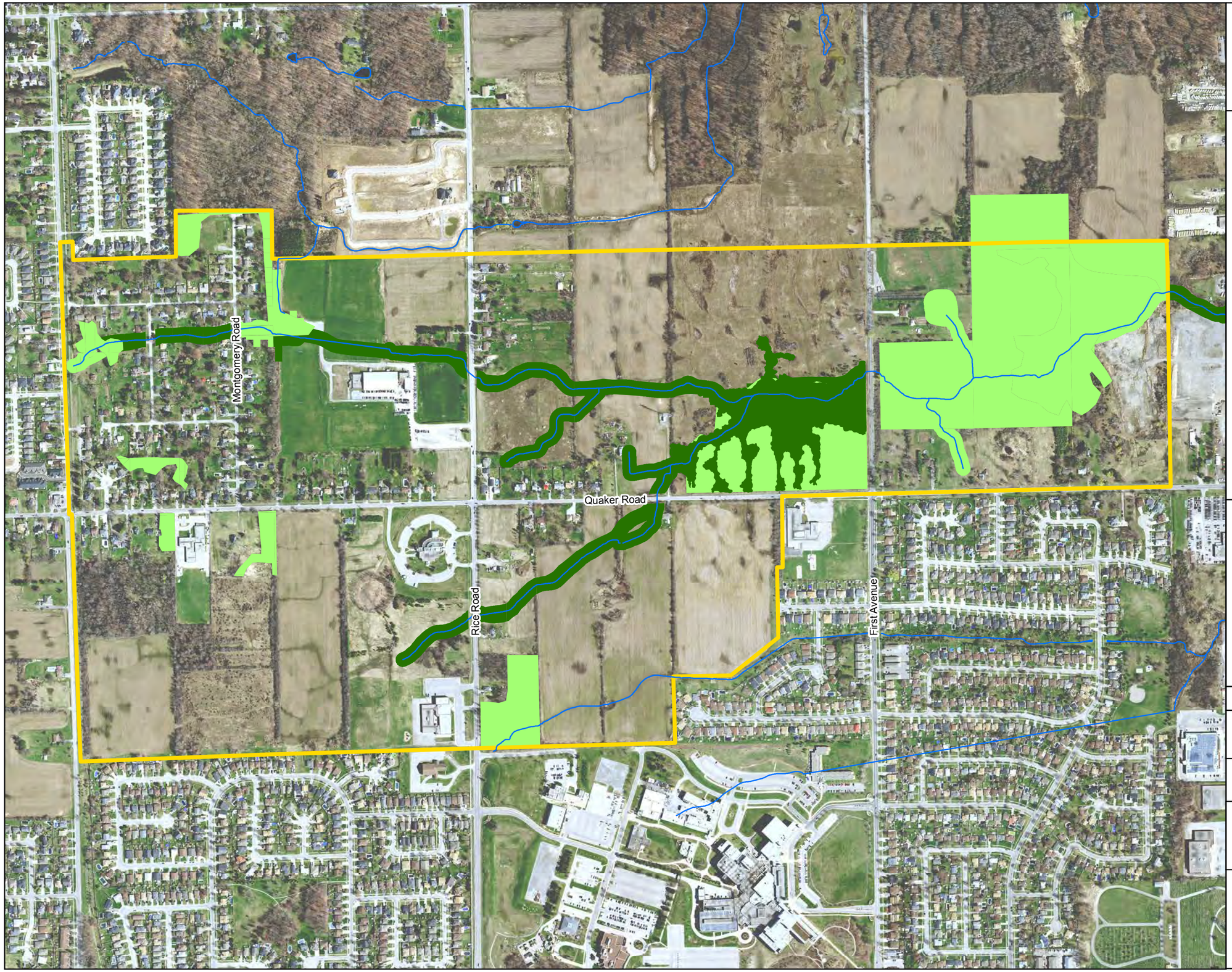
- Environmental Protection Area
    - Provincially Significant Wetlands (PSWs) (N.B.: portions of the Niagara Street - Cataract Road Wetland Complex PSW are found within the study area, as discussed in **Section 5.2.3**.)
    - Provincially significant Life Science Areas of Natural and Scientific Interest (ANSIs)

    - Significant habitat of threatened and endangered species
- Environmental Conservation Area
    - Significant woodlands (i.e., woodlands which: contain threatened or endangered species or species of concern; are at least 2 ha in size if located within or overlapping the Urban Area Boundary; are at least 10 ha in size if located within the Agricultural and Rural Area; contain interior woodland habitat at least 100 m in from the woodland boundaries; contain older growth forest and are 2 ha or greater in area; overlap or contain one or more of the other listed significant natural heritage features; or abut or are crossed by a watercourse or water body and are 2 ha or more in area)
    - Significant wildlife habitat
    - Significant habitat of species of concern
    - Regionally significant Life Science ANSIs
    - Other evaluated wetlands
    - Significant valleylands
    - Savannahs and tallgrass prairies
    - Alvars
    - Publicly-owned conservation lands
- Natural Heritage Corridors
    - Natural and open space linkages connecting the Core Natural Areas components noted above
- Fish Habitat
    - All areas on which fish depend directly or indirectly to carry out their life processes

The study area is currently shown on Schedule C of the OP as containing Environmental Protection Areas and Environmental Conservation Areas (see **Figure 3-1**). This study will seek to confirm and refine the current land use designations and determine if additional features or areas are present which should be included in the Core NHS.

Development and site alteration within or adjacent to the Core NHS is subject to the policies of the OP. According to Section 6.1.2.3 of the OP:

> *Development and site alteration shall not be permitted within Environmental Protection Areas except for the following:*
>
> *a) forest, fish and wildlife management;*
> *b) conservation and flood or erosion control projects where it has been demonstrated that they are necessary in the public interest and other alternatives are not available; and*
> *c) small scale, passive recreational uses and accessory uses such as trails, boardwalks, footbridges, fences, docks and picnic facilities that will have no significant negative impact on natural features or ecological functions of the Core Natural Heritage System.*
>
> *Where such uses are proposed, the proponent shall be required to prepare an Environmental Impact Study (EIS) to the satisfaction of the City in accordance with the Policies of [the OP].*
>
> *Development and site alteration may be permitted without an amendment to [the OP] in Environmental Conservation Areas, Natural Heritage Corridors, and on all adjacent lands… if it has been demonstrated that there will be no negative impact on the natural features or their ecological functions. The proponent shall be required to prepare an Environmental Impact Study (EIS) in accordance with the Policies of [the OP].*



Welland
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Legend

Watercourse

Secondary Plan Boundary

Core Natural Heritage System Status

Environmental Protection Areas

Environmental Conservation Areas

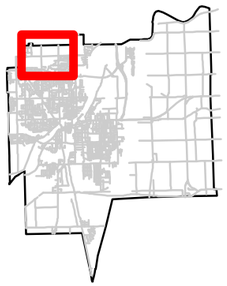

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Figure 3.1

Excerpt from Welland
Official Plan - Schedule C

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

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Kilometers

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Where development or site alteration is proposed in, or near, a Natural Heritage Corridor… the Corridor shall be considered in the development review process. Development should be located, designed and constructed to maintain and, where possible, enhance the ecological functions of the Corridor in linking Core Natural Areas or an alternative corridor should be developed.

Within Fish Habitat and/or adjacent lands… development and site alteration may be permitted if it will result in no net loss of the productive capacity of fish habitat as determined by the Department of Fisheries and Oceans or its designate. The proponent shall be required to prepare an Environmental Impact Study (EIS) to the satisfaction of the Department of Fisheries and Oceans.

Key hydrologic features have not been previously mapped as such within the study area by the OP, but it is indicated in Section 6.1.2.1.I that these features are to be identified through the planning and development review process and through future studies. This study has taken the approach that hydrologic features falling under one of the Natural Heritage categories listed above (for which policies regarding development and site alteration have previously been developed) will be identified first and foremost under those categories. Other hydrologic features which are not captured by those categories (e.g., small/isolated wetlands) will be indicated as Key Hydrologic Features to ensure that they are give consideration by future studies.

3.3 Conservation Authority Policies and Regulations

Under the *Conservation Authorities Act* (1990), Ontario Regulation (O.Reg.) 155/06 grants the NPCA the authority to regulate development, interference with wetlands, and alteration of shorelines and watercourses within the watershed under their jurisdiction. Current mapping indicates that there are regulated watercourses, flood areas, and wetlands in the study area (**Figure 3-2).**

The NPCA further maintains land use planning policies (NPCA, 2011) which are generally in keeping with the policies laid out under other legislation as noted previously in this document.

3.4 Central Welland River Watershed Plan

The study area is found in the Central Welland River watershed as defined by NPCA, an area which includes numerous smaller subwatersheds that all discharge to the central portion of the Welland River. Management objectives on the watershed scale as noted in the Watershed Plan (NPCA, 2010) include the following:

<u>Water Resources</u>

- improve, enhance, maintain or protect water quality and/or natural stream processes to support human uses, agricultural needs and ecological functions in accordance with Provincial Water Quality Objectives;
- protect, improve or restore hydrologically sensitive areas (surface and groundwater features);
- ensure that storm water management practices minimize storm water volumes and contaminant loads;
- Manage and mitigate flooding risks to human life and property within acceptable limits;
- recognize the role of natural features and pervious features in minimizing the impacts of flooding; and
- find an ecologically compatible balance between drain maintenance and function.

<u>Fish and Aquatic Habitat</u>

- protect, enhance and restore populations of native species and their habitats in the watershed; and

- eliminate barriers to fish migration.

Natural Heritage and Resources

- protect, enhance and restore the health, diversity and integrity of the natural heritage systems in the watershed;
- create, maintain, protect, and enhance corridors and linkages to natural heritage systems in adjoining watersheds;
- maintain, restore and improve the linkages among surface water features, groundwater features, hydrologic functions and natural heritage features and areas, and their ecological functions;
- restore and protect habitat for all species; and
- reach goals set by Environment Canada's recommended habitat targets (riparian, wetland and upland features)

Communication, Education and Recreation

- foster educational programs and awareness pertaining to urban and rural best management practices (e.g. water conservation practices, alternate farming practices, septic maintenance, buffers, value of local resources);
- inform public of current incentive programs; and
- enhance and develop partnerships between and amongst agencies, interest groups and landowners

Development

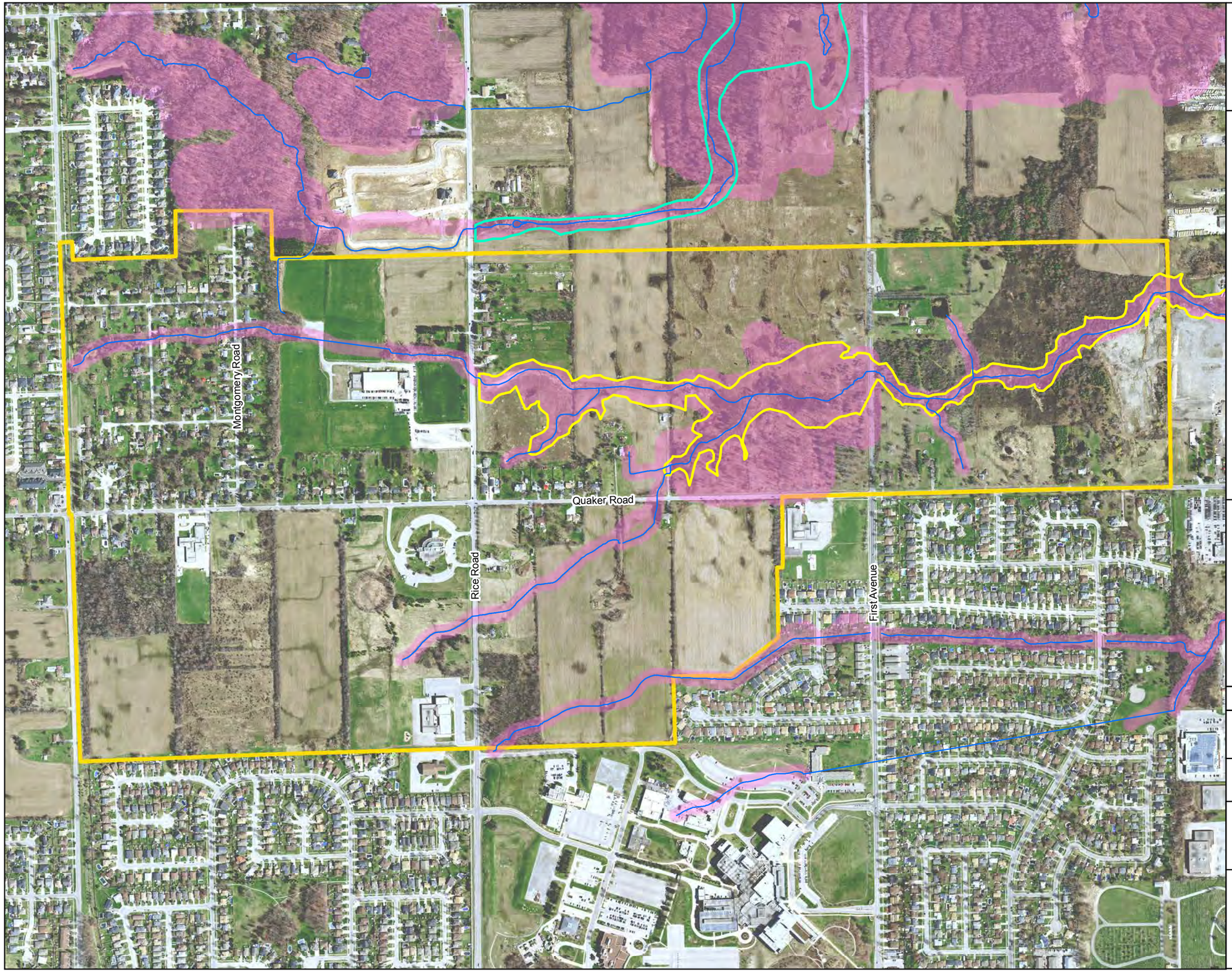
- Incorporate best management practices into land use and zoning decisions (e.g. buffers);
- Investigate and utilize incentive programs/packages for brownfield development;
- promote environmentally-sound land use decisions for current and future urban development and rural/agricultural land use;
- encourage stormwater management within municipalities to address existing development and future growth capacity projections; and
- encourage intensification of urban areas

More specifically, the Northwest Area is associated with the 17 km^2 Tow Path Drain subwatershed within the Central Welland River watershed. Applicable targets and objectives specifically pertaining to this subwatershed include:

- Enhancement or re-establishment of riparian habitat: large amounts of the subwatershed currently flow through agricultural lands with little to no riparian buffer. Enhancing the riparian area will help to reduce sediment and contaminant loads from surrounding land uses and cool the water to enhance water quality and fish habitat.

- Enhancement of upland linkages: a "very high suitability for enhancement surrounding existing upland and wetland habitat" was identified in the portion of the subwatershed north of Quaker Road, which is part of the Northwest Area. Suggested actions include filling in gaps of natural areas to reduce the forest edge to interior ratio and create a larger continuous natural area which would have improved ability to support a larger diversity of flora and fauna.

- Wetland protection: protect existing wetlands by creating a Critical Function Zone (CFZ) surrounding wetland areas. A CFZ is a functional extension of the wetland into upland habitat providing for a variety of critical functions for wetland-associated fauna that extend beyond the wetland boundary (e.g., nesting habitat).



Welland
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Legend

- Watercourse
- NPCA Regulatory Floodplain
- NPCA Advisory Floodplain
- NPCA Regulation Lands
- Secondary Plan Boundary

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Figure 3.2

NPCA Regulated Areas

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

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Kilometers

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3.5 Endangered Species Act

The Ontario *Endangered Species Act* (ESA) (2007) lists species that have been designated as Species at Risk (SAR) in the province, and provides for their protection. Specifically, the ESA prohibits the killing, harming, harassing, capture, buying or selling of Extirpated, Endangered, and Threatened species, and also protects the general or specific habitat pertaining to those species (depending on whether specific habitat has been defined via the development of a recovery strategy). Species listed as Special Concern do not receive this regulatory protection under the ESA.

Actions which affect Endangered or Threatened species may be allowed to proceed with the acquisition of a permit from the MNRF, or if the conditions of specific exemptions are met. Requirements for approval are decided on a project-by-project basis.

SAR are also federally legislated under the *Species at Risk Act* (SARA) (2002). However, outside of federal lands this Act is generally only applied to fish (via the federal *Fisheries Act* [1985]) and to birds that are also protected under the federal *Migratory Birds Convention Act* (1994). In most cases, therefore, only the Ontario SAR regulations will apply.

4 Field Work Methodology and Dates

In addition to the use of the background resources listed above, existing conditions in the study area were characterized through field investigations. Table 4-1 details the surveys completed to identify Natural Heritage features and functions within the study area, and the associated methodologies and dates for field investigations completed by Aquafor Beech Limited as part of the current study.

Aquafor Beech was not given permission to access all properties contained within the study area. Features on lands not accessed during this study were evaluated from adjacent lands, if possible, and through air photo interpretation and background review.

Table 4-1: Summary of Ecological Field Surveys

Survey Type (Report Section)	**Methodology**	**Date(s)**
Breeding Bird Surveys (**Section 5.3.1**)	Breeding birds were surveyed in accordance with the guidelines in the Atlas of the Breeding Birds of Ontario (Bird Studies Canada et al., 2001)**.**	May 30 and June 18, 2018
Amphibian Calling Surveys (**Section 5.3.3**Error! Reference source not	Amphibian calling surveys were conducted in accordance with the methodology of the Marsh Monitoring Program (Bird Studies Canada, 2009).	April 24, May 22, and June 26, 2018
Vegetation Community Classification (**Section 5.2.1**)	Vegetation community surveys were completed in accordance with the Ecological Land Classification (ELC) system for Southern Ontario (Lee, et al., 1998) on lands to which permission to enter was granted. Additional information was gathered through background information review, aerial image interpretation, and roadside assessments as needed to fill data gaps.	June 22, Aug. 1, Aug. 2, and Oct. 11, 2018
Botanical Inventories (**Section 5.2.2**)	Botanical inventory was conducted using an area search methodology. N.B.: Was only completed where property access was granted or where surveys could be completed from adjacent lands.	As for Vegetation Community Classification, above
Incidental Wildlife	Incidental observations of wildlife (including direct observation, tracks, scat, and other signs) were recorded during all other field surveys.	All

Survey Type (Report Section)	**Methodology**	**Date(s)**
Aquatic Habitat Assessment (**Section 5.1.1**)	Aquatic habitat was characterized using Ontario Stream Assessment Protocol (OSAP) Version 10 (Stanfield, 2017) and supplemented with background information	June 20, 2018
Benthic Macroinvertebrate Assessment (**Section 5.1.2**)	Benthic macroinvertebrate assessments were conducted in accordance with the Ontario Benthos Biomonitoring Network (OBBN) traveling kick and sweep protocol	May 18, 2018
Fish Community Assessment (**Section 5.1.3**)	Fish communities were characterized using OSAP protocols, and supplemented with background information	May 18, 2018

5 Existing Natural Heritage Conditions

The following sections provide an overview of the environmental features and functions currently existing in the Welland Northwest Area, as defined through the background review and field investigations described in previous sections. The natural ecosystem that existed prior to human settlement has been extensively altered by agricultural cultivation, construction of roads and buildings, and development of residential neighbourhoods. Defining the current state of the environment, as well as the relationships between features, is necessary in order to characterize key environmental functions, define opportunities and constraints associated with future development, and to ultimately establish alternative strategies to protect, enhance, or restore the environmental features over time.

5.1 Aquatic Ecology

Per the Central Welland River Watershed Plan (NPCA, 2010), the watercourse within the study area is the Tow Path Drain, and the majority of the study area falls within the catchment area for this channel.

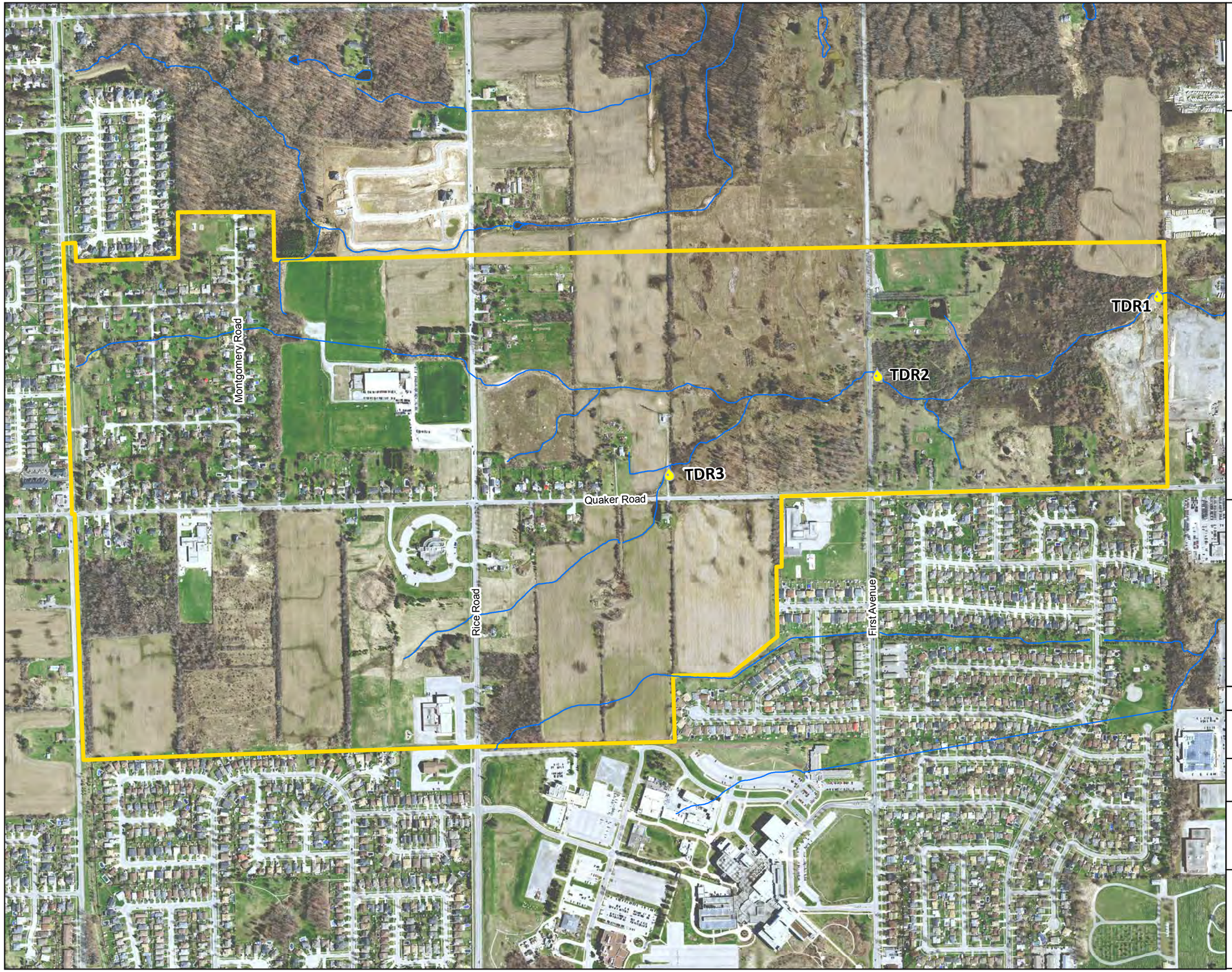
The Tow Path Drain subwatershed displays conditions of a spatially-intermittent watercourse, with the majority of the watercourse remaining dry throughout the year, as was observed during aquatic field exercises. Standard aquatic field protocols require that the watercourse or aquatic habitat in question be inundated during the time of assessment, proving it difficult, if not impossible, to accurately characterize the Tow Path Drain subwatershed using these protocols. The Tow Path Drain subwatershed was characterized in the Central Welland River Watershed Plan (NPCA, 2010). Information from this report will be used throughout the following sections to supplement where standard field procedures would not allow for accurate characterization.

Aquatic habitat, benthic macroinvertebrate and fish community assessments were completed in accordance with standard protocols at three locations throughout the Tow Path Drain subwatershed, where conditions allowed. These locations are shown on **Figure 5-1**. The methods and results for aquatic components of the subwatershed are described in the following subsections. Due to dry site conditions, only TDR1 and TDR2 were assessed. TDR3, which was a proposed assessment location, was found to be dry during both site visits, thus no data was collected at this station.

5.1.1 Aquatic Habitat

Where conditions were appropriate, aquatic habitat was assessed using Section 4: Module 2 of the Ontario Stream Assessment Protocol (OSAP), Point-Transect Sampling for Channel Structure, Substrate and Bank Conditions. Information collected included parameters such as channel morphology measurements, bank undercuts and instream cover, point source impacts, flow regime characteristics, substrate, critical habitats, and riparian cover and shading. Sampleable areas were limited to only the downstream 20 m of TDR1. For areas that were unsampleable due to dry conditions, observations from benthic community assessments as well as from background studies were used where applicable.

Results from the assessment are displayed in **Table 5-1** and field observations are displayed in **Appendix A**. Photographs of the site(s) are displayed in **Figure 5-2** through **Figure 5-5.**



Welland
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Legend

- Aquatic Survey Stations
- Watercourse (NPCA)
- Secondary Plan Boundary

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Figure 5.1

Aquatic Survey Locations

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.2 0.4
Kilometers

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Aquafor Beech Limited

Figure 5-2: TDR1 Downstream

Figure 5-3: TDR1 Upstream

Figure 5-4: TDR2 Upstream

Figure 5-5: TDR3 Upstream

Table 5-1: Aquatic Habitat Assessment Observations

Habitat Characteristics	Site		
	TDR1	**TDR2**	**TDR3**
General Flow Regime	Intermittent	Intermittent	Intermittent
Site Characteristics	TDR1 was the furthest downstream site, located approximately 200 m upstream of Niagara Street.	TDR2 is the most upstream site that held water during field exercises, although was dry at the time of OSAP exercises. It is located immediately downstream of First Avenue.	TDR3 is the furthest upstream site. It is located immediately upstream of Quaker Road. This site was found to be dry during each of the field visits, and was therefore foregone.
Habitat Description	This site was a long run with little to no flow. The site ran dry beyond the 9th transect, or 19 m upstream of the starting transect. The average wetted width was 1.08 m. The average wetted depth and max depth were 49 mm and 110 mm, respectively. There was no instream cover and no cover provided by overhead canopy.	At the time of benthic sampling this site was evenly distributed between shallow runs and riffles with deeper pools dispersed throughout. Instream cover was moderate with the majority provided by woody material and rooted riparian vegetation. The site ran through a buckthorn thicket with larger willows present throughout which provided much of the site with canopy cover.	
Substrate Composition	This site was composed entirely of unconsolidated clay and silt. The substrate was poorly sorted.	This site mainly consisted of unconsolidated clay and silt. The substrate was poorly sorted.	
Bank Stability	Both banks were observed to be stable, with no undercuts observed. Both were well vegetated with herbaceous cover and consisted of clay and silt substrate.	Both banks were observed to be stable, with undercuts only present where large willow root wads protruded into the channel. Banks were very low in elevation indicating that they likely overtop during freshet events. Both were very well vegetated with forest and scrub dominant vegetation.	

Habitat Characteristics	Site		
	TDR1	TDR2	TDR3
Instream and Riparian Vegetation	Very little instream vegetation was present throughout this site, consisting only of macrophytes. Riparian vegetation was also poorly distributed, with no transects having forested zones within 1 m.	Instream vegetation was present, with emergent macrophytes and algae. Riparian vegetation was abundant, consisting of forest, scrubland and herbaceous vegetation.	
Fish Barriers and Other Disturbances	Adjacent land use consists of agricultural land located due north within 40 m of the site. There are also industrial buildings located immediately downstream of the site which could be sources of contaminants. While no barriers were observed, the site was seen as intermittent with the upstream extent being completely dry, limiting fish movement throughout the watercourse.	The site fell immediately downstream of the First Avenue Right-of-way, which could be a source of contaminants. Agricultural and residential land adjacent to the site could also be sources of nutrients and contaminants. No fish barriers were observed during the field investigations; however, the site was observed with dry conditions for extended periods of time, limiting fish movement and habitat throughout the watercourse.	

While the information collected during field visits conducted in 2018 is limited due to dry site conditions, it supports background documentation of the watercourse as provided by the Central Welland River Watershed Plan (NPCA, 2010). This document notes that 30% of the watercourse has some riparian habitat, which reflects the agricultural and residential land observed in the field. It also states that the groundwater vulnerability is predominately low, with the headwaters and the majority of the flow originating in the Fonthill Kame-Delta Complex area, approximately 2 km west of the study area boundary. These headwaters are separated from the study area by residential developments, through which the nature of their hydrologic connectivity is unknown, realizing that much of this watercourse is dry for much of the year, save during spring freshet and large rain events.

5.1.2 Benthic Macroinvertebrate Community

Benthic macroinvertebrate sampling was conducted by the travelling kick and sweep method for stream sampling, following the Ontario Benthos Biomonitoring Network (OBBN) Protocol (Jones, Somers, Craig, & Reynoldson, 2007). Sampling was conducted at TDR1 and TDR2, as illustrated on **Figure 5-1**. OBBN Protocol requires three replicate samples from each station, which were conducted within site boundaries at both sites. Site conditions are shown above in **Figure 5-2** through **Figure 5-5**.

All samples were identified to family level, and indices were calculated to describe the habitat of benthic invertebrates and water quality. Indices include:

- species richness (i.e., number of taxa)
- % Oligochaeta, % Chironomidae, and % Isopoda, % Diptera (i.e., taxa groups with various associated habitat indications, as discussed below)
- % Ephemeroptera Plecoptera and Trichoptera (EPT) (i.e., taxa that typically exhibit strong associations to high quality habitats)
- % feeding groups (i.e., % Scraper, Shredder, Clinger, Collector-filterer and Collector-gatherer)
- Shannon-Weiner Diversity Index
- Hilsenhoff Family Biotic Index (FBI)
- Percent Model Affinity Index (PMA)

For Taxa Richness; % EPT; % Scraper, % Shredder, % Clinger, % Omnivore (i.e., feeding groups typically associated with predators and taxa that maintain stronger associations with high quality habitats); and the Shannon-Weiner Index, a larger value implies a healthier biological community and low values imply reduced health (Jones, 2007; Barbour et al, 2009). For % Oligochaeta, % Chironomidae, % Isopoda, and FBI, a lower value implies a healthier community (Jones, 2007; Barbour et al, 2009). In the case of % Collector-Filterer, % Collector-Gatherer, % Predator and % Diptera, critical values lie at both extremes (Jones, 2007; Barbour et al, 2009). Therefore, these metrics were not used as an indication of better water quality between sites. However, they are useful to note habitat differences and changes in habitat quality over time, which suggests a change in water quality. Since the PMA method has a specific threshold, it is the one measurement that can provide a definitive definition of an unimpaired stream. A waterbody is considered impaired if a PMA value less than 39.1 is observed. Results from the assessment are discussed below and displayed in **Table 5-2**.

Table 5-2: Benthic Macroinvertebrate Community Results

	TDR1			TDR2				
	Rep1&2	**Rep3**	**SUM**	**Rep1**	**Rep2**	**Rep3**	**SUM**	**TOTAL**
Total Number of Organisms	111	107	**218**	104	119	116	**339**	**557**
Taxa Richness	15	7	**17**	9	6	6	**9**	**18**
% Oligochaeta	11.71	1.87	**6.88**	28.85	10.92	0.86	**12.98**	**10.59**
% Diptera	13.51	0.93	**7.34**	14.42	9.24	9.48	**10.91**	**9.52**
% Chironomidae	6.31	0.00	**3.21**	6.73	7.56	3.45	**5.90**	**4.85**
% Isopoda	30.63	13.08	**22.02**	29.81	48.74	66.38	**48.97**	**38.42**
% EPT	5.41	0.93	**3.21**	0.00	0.00	0.00	**0.00**	**1.26**
% F-C	3.60	0.00	**1.83**	0.96	0.00	0.00	**0.29**	**0.90**
% G-C	61.26	21.50	**41.74**	88.46	94.12	90.52	**91.15**	**71.81**
% Pred	13.51	0.93	**7.34**	14.42	9.24	9.48	**10.91**	**9.52**
% Scr	23.42	76.64	**49.54**	2.88	3.36	3.45	**3.24**	**21.36**
% Shr	0.90	0.93	**0.92**	0.00	0.00	0.00	**0.00**	**0.36**
% Omni	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**0.00**
% Clinger	32.43	77.57	**54.59**	4.81	3.36	3.45	**3.83**	**23.70**
Shannon-Weiner Diversity	0.93	0.37	**0.77**	0.71	0.59	0.45	**0.62**	**0.77**
FBI	4.79	1.50	**3.17**	7.21	7.19	6.98	**7.13**	**5.58**
PMA	31.12	13.91	**24.97**	23.90	24.73	15.42	**23.07**	**23.81**

Indicates best water quality
Indicates second best water quality
Indicates worst water quality
Exceeds PMA threshold (39.1)

Overall, 557 total organisms of 18 different families were sampled within the subwatershed. The downstream site (TDR1) had the highest total taxa richness but had a lower total number of organisms than the upstream site (TDR2). TDR1 results indicate higher water quality than TDR2 in all indices. TDR1 had a higher percentage of organisms that demonstrate low tolerance for disturbances from pollution and fluctuating water levels while TDR2 had a higher percentage of organisms that demonstrate high tolerance. This is not surprising as TDR1 was observed to be inundated later into the year while TDR2 was dry. Using the PMA value as the defining index, TDR1 was the least impaired, although the value is well below the 39.1 threshold for both sites. While these indices are used to demonstrate poor water quality, results from the Tow Path Drain benthic community assessments could reflect that of a spatially intermittent stream with limited habitat for healthy benthic communities.

5.1.3 Fish Community

Due to dry site conditions, fish community surveys were only conducted at the most downstream site: TDR1. While TDR2 had pockets of standing water that allowed for collection of benthic invertebrates, there was insufficient water volume to allow for electrofishing. Samples at TDR1 were collected in accordance with OSAP Section 3: Module 1: Fish Community Sampling using Screening, Standard, and Multiple Pass Electrofishing Techniques (Stanfield, 2017). A screening survey was conducted on May 18, 2018. No fish were observed or captured during the survey.

The Central Welland River Watershed Plan (NPCA, 2010) notes that the much of the Tow Path Drain subwatershed has not been evaluated for fish habitat. It does however note that the Welland Recreational Canal is important fish habitat and that the Tow Path Drain's connectivity to the Canal is undisturbed with no evident fish barriers. The Tow Path Drain has the potential to provide important habitat to the fish species found within the Welland Recreational Canal in the form of spawning, rearing or feeding grounds. Information provided by the MNRF indicate that the fish species found are predominately warmwater with no evidence of provincially significant species in terms of NHIC rarity rankings (Earth Tech Canada, 2003).

5.2 Vegetation

The vegetation communities and vascular plants within the study area are described below in the following subsections.

5.2.1 Vegetation Communities

Field work conducted within the study area in 2018 identified 33 ELC polygons comprised of 22 different vegetation community types. Four of the ELC polygons represent complex communities (i.e., patterns of two or more ecosites or vegetation types forming a mosaic that cannot be mapped at the level of resolution being employed).

Much of the site was underlain by soils with high clay content and evidence of poor drainage, with seasonal flooding occurring in some areas. As was stated in the Draft Lot 228 report (Ecologistics Limited, 1996), due to these conditions, "this area will be sensitive to changes in surface drainage or changes in the water table".

The study area contains a wide variety of vegetation community types ranging from highly disturbed early-succession fields to natural forests and wetlands. Two of the vegetation community types

documented in the study area are considered to be provincially rare:

- Polygon A3: FOD9-5, Fresh-Moist Bitternut Hickory Deciduous Forest (S3S4); and
- Polygon D1: SWD1-2, Bur Oak Mineral Deciduous Swamp Complex (S3) – complexed with Green Ash Mineral Deciduous Swamp (SWD2-2); and

Both of these community types are further discussed as Significant Wildlife Habitat (SWH) in **Section 5.5**. Two additional rare community types were listed for polygons within the study area where these types were the 'best fit' based on the ELC guide. However, these areas are highly disturbed and exhibited signs of cultural origin. They include: FOD7-4 (S2S3) assigned to Polygon C13, and SWT2-9 (S3S4) assigned to Polygon E3. Polygon C13 is likely of cultural origin and is currently under cultural management (i.e., frequent mowing of the ground cover). This polygon does not exhibit the qualities or associate species typically found in the natural Black Walnut (*Juglans nigra*) lowland forest community type that is ranked as S2S3. Similarly, Polygon E3 refers to a narrow channelized riparian corridor that has recently either been planted or grown in with patches of Grey Dogwood (*Cornus racemosa*). This community is very young and was complexed with a meadow marsh community type to better characterize the patchy cover provided by shrubs, which is atypical of the natural thicket community type. Given the context of Polygons C13 and E3, neither are considered to be rare for the purposes of this report.

The Vegetation Communities Table provided in **Appendix B** lists all 33 vegetation polygons, providing information on ELC type, dominant vegetation composition, relevant soils information, and representative photos. Maps delineating each polygon and the original ELC field data forms are also included in **Appendix B**.

In addition to the ELC assessment detailed above, Aquafor Beech Limited also completed an assessment of hedgerows within the study area. These are narrow, linear features which are not well classified by the ELC system, but they can provide important linkages on the landscape and act as buffers to adjacent areas. As such, hedgerows were reviewed in the context of linkage potential, habitat potential, and quality of vegetative cover. Hedgerow descriptions have included as part of the Vegetation Communities Table in **Appendix B**.

5.2.2 Flora

A botanical inventory was conducted in concert with vegetation community surveys to create an inventory of vascular plant species within the study area and to assess whether significant flora was present. The area search method (i.e., a qualitative survey within the bounds of each ELC polygon) was used to identify vascular plants in the study area. Those species that could not be identified to species due to lack of identifyable features at the time of survey were identified to genus. In total, 239 species were identified to species level with an additional 17 identified to genus.

The majority of species recorded are considered to be common and secure (S4-S5, no other designations), and approximately 28% of the total species observed are also non-native/introduced. An annotated list of the vascular plants recorded within the study area is contained in **Appendix B**.

Three plant SAR were found during the botanical inventory and are discussed further in **Section 5.4**:

- Butternut (*Juglans cinerea*) – END;
- Eastern Flowering Dogwood (*Cornus florida*) – END; and

- White Wood Aster (*Eurybia divaricata*) – THR.

In addition, 24 species recorded in the study area are listed as regionally uncommon or rare in Niagara Region, per the Checklist of the Vascular Plants of Niagara Regional Municipality, Ontario (Oldham, 2010). These species are presented in **Table 5.3**.

Table 5-3 Regionally Rare and Uncommon Plant Species.

Scientific Name	Common Names	ESA	SARA	S-rank	Regional Ranking	Locations
Allium canadense var. canadense	Wild Garlic			S5	U	C13
Aster divaricatus	White Wood Aster	THR	THR	S1	U	A1
Carex arctata	Drooping Wood Sedge			S5	R	A3
Cornus florida	Eastern Flowering Dogwood	END	END	S4	U	A1
Cornus stolonifera	Red-osier Dogwood			S5	U	A4, B9, C8
Cyperus esculentus	Field Nut Sedge			S5	U	A1
Eleocharis smallii	Small's Spike-rush			S5	R	C7
Fraxinus nigra	Black Ash			S5	U	A1, A3
Hydrocotyle americana	Marsh Pennywort			S5	R	A1, C1, C7
Hypericum mutilum ssp. mutilum	Dwarf St. John's-wort			S4	U	B1, B8
Juglans cinerea	Butternut	END	END	S2?	U	A1
Juncus torreyi	Torrey's Rush			S5	U	C7
Larix laricina	Tamarack			S5	R	E4
Malus coronaria	Wild Crabapple			S4	U	C1
Menispermum canadense	Moonseed			S4	U	A1, A2
Oenothera perennis	Small Sundrops			S4S5	U	B1, B3, B4, B8
Panicum acuminatum var. acuminatum	Hairy Panic Grass			S5	U	B4
Penstemon digitalis	Foxglove Beard-tongue			S4S5	U	B2, B4, B5, B6, B7, C1
Quercus macrocarpa	Bur Oak			S5	U	C9, D1, D3
Salix petiolaris	Slender Willow			S5	U	B2
Solidago patula	Rough-leaved Goldenrod			S5	R	B1, B3
Veronica scutellata	Marsh Speedwell			S5	U	B8
Viburnum rafinesquianum	Downy Arrow-wood			S5	U	A4, B9
Zizania palustris	Northern Wild Rice			S4	R	C1

A number of the introduced species recorded are also considered to be invasive. Particularly prevalent throughout the study area are Glossy Buckthorn (*Rhamnus frangula*) and Common Buckthorn (*R. cathartica*), two aggressively growing shrubs that have spread into the understory of woodlands and form dense thickets. Other invasive species present include Garlic Mustard (*Alliaria petiolata*) and Common Reed (*Phragmites australis*).

5.2.3 Wetlands

A portion of the Niagara Street - Cataract Road Wetland Complex PSW is located within the Northwest Area; additional portions are located a short distance north of the study area boundary. Aquafor Beech Limited did not complete a formal re-evaluation of the wetland as part of this study, nor a re-mapping of PSW boundaries in consultation with MNRF, as these tasks were not within the scope of this assignment. The assessment of vegetation communities within the study area, however, provides a current snapshot of wetland habitat that is present on the site; wetland community boundaries were defined in accordance with both ELC and the Ontario Wetland Evaluation System (OWES), by MNRF certified biologists. **Figure 5-6** illustrates how these current wetland conditions compare to the existing extent of the PSW, as previously mapped using the MNRF wetland evaluation protocol (per the 2012 mapping update to the Niagara Street - Cataract Road Wetland Complex Wetland Evaluation Report).

The previously-mapped wetland boundary shown on **Figure 5-6** excludes several large areas which were previously under agricultural cultivation (per interpretation of historic aerial photos) but which have now naturalized and currently exhibit the vegetative characteristics of wetlands. It is anticipated that a re-evaluation of the PSW (such as may be appropriate during site-specific assessment studies; see **Section 8**) would result in the incorporation of additional wetland areas, including those mapped as part of the current study.

5.3 Terrestrial Wildlife

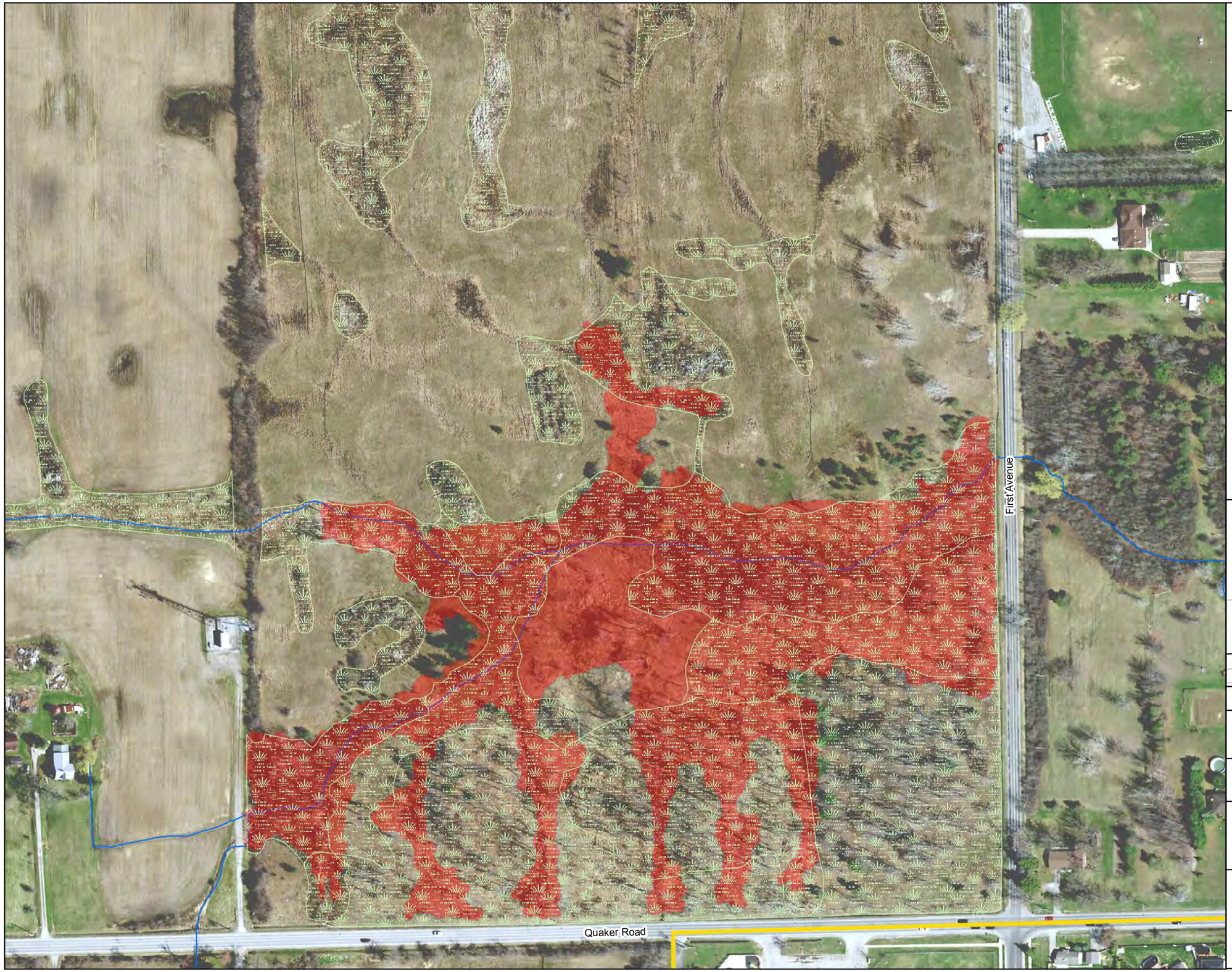
The following sections summarize the results of terrestrial wildlife surveys and related incidental observations, as well as relevant background information obtained. Terrestrial wildlife survey locations referenced in the following sections are illustrated on **Figure 5-7**.

5.3.1 Birds

The nests and eggs of most birds in Ontario are protected under the federal *Migratory Birds Convention Act* (2010). Bird SAR and SOCC occurring or suspected to occur in the study area are discussed further in **Section 5.4**, below.

5.3.1.1 Breeding Bird Surveys

Breeding bird surveys were completed in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (Bird Studies Canada et al., 2001). Ten-minute point counts were completed at nine stations on two occasions more than 15 days apart during the core breeding season, within five hours of dawn and in favourable weather. All bird species and individuals seen and heard were recorded, as was all breeding evidence observed for all species.



Welland
ONTARIO · CANADA

Legend

- Watercourse
- ABL Wetland (Surveyed 2018)
- Provincially Significant Wetland (MNRF)
- Secondary Plan Boundary

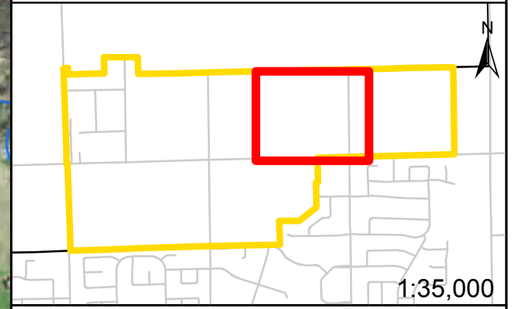


Figure 5.6

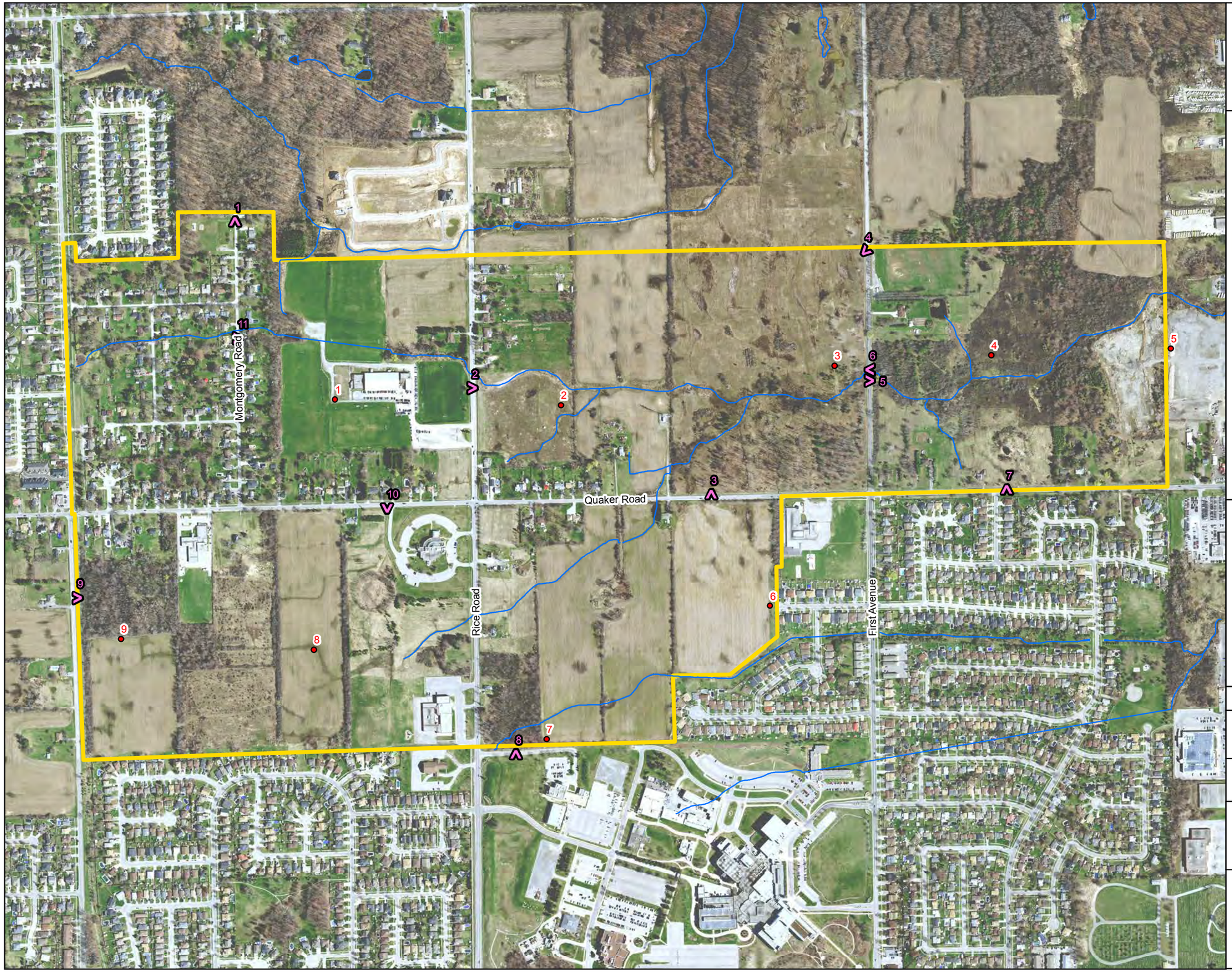
Wetland Boundary Comparison

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 50 100
Metres

N

Aquafor Beech Limited



Welland
ONTARIO · CANADA

Legend

- Breeding Bird Point Count Stations
- Amphibian Survey Stations
- Watercourse
- Secondary Plan Boundary

N

1:290,000

Figure 5.7

Terrestrial Survey Locations

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.2 0.4
Kilometers

N

Aquafor Beech Limited

A total of 43 bird species were recorded during the breeding bird surveys, as listed in **Table 5-4,** below. Of the 43 species, breeding was confirmed for five, probable for 15 and possible for 19. The remaining four species were observed with no evidence of breeding. One of the observed species, Barn Swallow (*Hirundo rustica*) is a SAR and will be discussed further in **Section 5.4**.

Survey locations referenced in **Table 5-4** are illustrated on **Figure 5-7**.

Table 5-4 - Breeding Bird Survey Results

Species Name		**Species Status**			**Highest Observed Breeding Status**
Scientific	**Common**	**ESA**	**SARA / COSEWIC**	**S-Rank**	
Agelaius phoeniceus	Red-winged Blackbird			S4	Probable
Anas platyrynchos	Mallard			S5	Possible
Bombycilla cedrorum	Cedar Waxwing			S5B	Possible
Branta canadensis	Canada Goose			S5	Observed
Buteo jamaicensis	Red-tailed Hawk	NAR	NAR	S5	Probable
Cardinalis cardinalis	Northern Cardinal			S5	Probable
Charadrius vociferous	Killdeer			S5B S5N	Confirmed
Colaptes auratus	Northern Flicker			S4B	Possible
Corvus brachyrhynchos	American Crow			S5B	Possible
Cyanocitta cristata	Blue Jay			S5	Possible
Dumetella carolinensis	Gray Catbird			S4B	Probable
Empidonax traillii	Willow Flycatcher			S5B	Probable
Eremophila alepstris	Horned Lark			S5B	Possible
Geothlypis trichas	Common Yellowthroat			S5B	Probable
Haemorhous mexicanus	House Finch			SNA	Possible
Hirundo rustica	Barn Swallow	THR	THR	S4B	Confirmed
Icterus galbula	Baltimore Oriole			S4B	Possible
Larus delawarensis	Ring-billed Gull			S5B S4N	Observed
Leuconotopicus villosus	Hairy Woodpecker			S5	Possible
Melanerpes carolinus	Red-bellied Woodpecker			S4	Possible
Meleagris gallapavo	Wild Turkey			S5	Possible
Melospiza melodia	Song Sparrow			S5B	Probable
Molothrus ater	Brown-headed Cowbird			S4B	Probable
Myiarchus crinitus	Great Crested Flycatcher			S4B	Possible
Passer domesticus	House Sparrow			SNA	Confirmed
Passerculus sandwichensis	Savannah Sparrow			S4B	Probable
Phalacrocorax auritus	Double-crested Cormorant	NAR	NAR	S5B	Observed
Pheucticus ludovicianus	Rose-breasted Grosbeak			S4B	Possible

Species Name		Species Status			Highest Observed Breeding Status
Scientific	**Common**	**ESA**	**SARA / COSEWIC**	**S-Rank**	
Picoides pubescens	Downy Woodpecker			S5	Possible
Poecile atricapillus	Black-capped Chickadee			S5	Possible
Quiscalus quiscula	Common Grackle			S5B	Confirmed
Sayornis phoebe	Eastern Phoebe			S5B	Possible
Setophaga petechia	Yellow Warbler			S5B	Probable
Spinus tristis	American Goldfinch			S5B	Probable
Spizella passerina	Chipping Sparrow			S5B	Probable
Stelgidopteryx serripennis	Northern Rough-winged Swallow			S4B	Observed
Sturnus vulgaris	European Starling			SNA	Possible
Tachycineta bicolor	Tree Swallow			S4B	Possible
Troglodytes aedon	House Wren			S5B	Probable
Turdus migratorius	American Robin			S5B	Confirmed
Tyrannus tyrannus	Eastern Kingbird			S4B	Possible
Vireo gilvus	Warbling Vireo			S5B	Probable
Zenaida macroura	Mourning Dove			S5	Probable

5.3.1.2 Other Bird Obervations

Aquafor Beech Limited's field staff recorded all incidental bird observations that were made during field investigations, including several species which were not recorded during breeding bird surveys. Additional bird observation records were also obtained from NatureCounts, an online resource run by Bird Studies Canada that compiles and distributes data from eBird, Project Feederwatch, and other citizen science initiatives. One of the results from this source is Rusty Blackbird (*Euphagus carolinus*), a Special Concern species which will be discussed further in **Section 5.4.6**.

An annotated list of the bird species obtained from incidental observations and other sources which are additional to those observed during breeding bird surveys is contained in **Table 5-5**. Breeding evidence and exact location for each species is not available; this list is not a representation of breeding birds in the study area but includes species that would only be present as migrants or winter residents.

Table 5-5: Additional Bird Observations

Species Name		Species Status		
Scientific	**Common**	**SARA/COSEWIC**	**ESA**	**S-Rank**
Acanthis flammea	Common Redpoll			S4B
Acanthis hornemanni	Hoary Redpoll			SNA
Accipiter cooperii	Cooper's Hawk	NAR		S4
Accipiter striatus	Sharp-shinned Hawk	NAR		S5
Baeolophus bicolor	Tufted Titmouse			S4
Bubo virginianus	Great Horned Owl			S4
Buteo platypterus	Broad-winged Hawk			S5B
Butorides virescens	Green Heron			S4
Cathartes aura	Turkey Vulture			S5B
Corvus corax	Common Raven			S5
Euphagus carolinus	Rusty Blackbird	SC	SC	S4B
Gallinago delicata	Wilson's Snipe			S5B
Haemorhous purpureus	Purple Finch			S4B
Junco hyemalis	Dark-eyed Junco			S5B
Larus argentatus	Herring Gull			S5B S5N
Mimus polyglottos	Northern Mockingbird			S4
Perisoreus canadensis	Gray Jay			S5
Scolopax minor	American Woodcock			S4B
Sialia sialis	Eastern Bluebird			S5B
Sitta canadensis	Red-breasted Nuthatch			S5
Sitta carolinensis	White-breasted Nuthatch			S5
Spinus pinus	Pine Siskin			S4B
Spizella arborea	American Tree Sparrow			S4B
Thryothorus ludovicianus	Carolina Wren			S4
Vireo olivaceus	Red-eyed Vireo			S5B
Zonotrichia albicollis	White-throated Sparrow			S5B
Zonotrichia leucophrys	White-crowned Sparrow			S4B

5.3.2 Mammals

Surveys targeting mammals were not undertaken as part of this study. However, several common mammal species were observed incidentally during field surveys in 2018, either directly or by other sign (e.g., tracks, scat, etc.). These included: Eastern Grey Squirrel (*Sciurus carolinensis*), Northern Raccoon (*Procyon lotor*), Red Fox (*Vulpes vulpes*), Coyote (*Canis latrans*), and White-tailed Deer (*Odocoileus virginianus*). Correspondence from local residents (Murphy, April 2018) further indicated that other wildlife including flying squirrels (*Glaucomys* sp.), Virginia Opossum (*Didelphis virginiana*), and Striped Skunk (*Mephitis mephitis*) had been observed using natural habitat and vegetated corridors in the northwest portion of the study area.

Given the habitat types present within the study area, other mammals common to rural and agricultural lands in southern Ontario are also likely present, such as Groundhog (*Marmota monax*), Meadow Vole (*Microtus pennsylvanicus*), Eastern Cottontail (*Sylvilagus floridanus*), Eastern Chipmunk (*Tamias striatus*), and the domestic housecat (*Felis catus*).

5.3.3 Amphibians

Amphibian call surveys were conducted near wetlands and ponds within the study area to determine the presence and significance of frog and toad breeding habitat. Surveys followed the standard protocol set out by the Marsh Monitoring Program (Bird Studies Canada, 2009), occuring on still nights typically during or immediately after rain. Parameters recorded during each survey are summarized in**Table 5-6,** including date, time, air temperature, wind speed, degree of cloud cover and level of precipitation**.** Amphibian call survey field data forms are located in **Appendix C**.

Table 5-6: Weather Conditions during Amphibian Call Surveys

Survey #	Date/Time	Air Temp (°C)	Beaufort Wind Scale	Cloud Cover (10ths)	Precipitation
1	April 24, 2018 20:30 – 21:28	10-11 °C	1	1	None/Dry
2	May 22, 2018 21:00 – 21:47	15°C	2	1	None/Dry
3	June 26, 2018 21:30 – 22:15	20°C	1-2	1-2	None/Dry

As illustrated on **Figure 5-7**, a total of 11 stations were surveyed. At each call survey station, the intensity and number of calling amphibians were measured using call level and abundance codes, as outlined in the MMP. Codes are as follows:

Level 1: Calls are not simultaneous and calling individuals can be counted;
Level 2: Some calls are simultaneous but number of individuals can be estimated;
Level 3: Calls are continuous and overlapping, numbers cannot be estimated.

Aquafor Beech Limited staff completed three surveys at each of the 11 survey stations. In total, three species were detected during surveys: American Toad (*Anaxyrus americanus*), Spring Peeper (*Pseudacris crucifer*), and Green Frog (*Lithobates clamitans*). All three species recorded are considered secure in Ontario. The highest call level recorded was 2; no full chorus was recorded. Detailed results of the surveys are contained in **Table 5-7**.

Table 5-7: Amphibian Call Survey Results

Survey #	Station #	Species Detected	Call Level Code	# of Individuals
1	1	No calls		
	2	No calls		
	3	Spring Peeper*	2	4
	4	No calls		
	5	Spring Peeper	2	3
	6	Spring Peeper	2	5
	7	Spring Peeper*	2	4
	8	No calls		
	9	No calls		
	10	No calls		
	11	No calls		
2	All	No calls recorded at any station		
3	1	No calls		
	2	American Toad	1	1
	3	Green Frog	1	3
	4	No calls		
	5	Green Frog	1	4
	6	Green Frog	1	3
	7	Green Frog*	1	2
	8	American Toad	1	2
	9	No calls		
	10	No calls		
	11	No calls		

**Species was recorded within wetlands outside of the 100 m survey station.*

Outside of the breeding surveys, Aquafor Beech Limited biologists incidentally encountered two additional amphibian species at several locations. One Pickerel Frog (*Lithobates palustris*) was observed in vegetation community C1; this species is considered Regionally Signficiant in the Niagara Region based on specialized habitat requirements (i.e., cold, clear groundwater discharge areas) and localized distrubution (NPCA, 2010). Northern Leopard Frogs (*Lithobates pipiens*) were also encountered in communities A1 (pond), C8, and C13.

5.4 Species at Risk and other Species of Conservation Concern

Species at Risk (SAR) are those designated as Endangered (END), Threatened (THR), or Special Concern (SC) under the Ontario ESA and/or the federal SARA. Other Species of Conservation Concern (SOCC) include those with Global Ranks of G1-G3 and/or Sub-national/Provincial ranks of S1-S3. No SOCC that are not also listed as SAR were documented in the study area.

Species listed provincially as Endangered and Threatened receive regulatory protection for themselves and their general or specific habitat under the ESA:

- General Habitat: an area on which a species depends directly or indirectly to carry out its life processes (under clause 2(1)(b) of the ESA) or,

- Regulated Habitat: the area prescribed for a species in a habitat regulation (under clause 2(1)(a) of the ESA). A habitat regulation may prescribe an area as the habitat of a species by describing the boundaries of the area, the features of the area, or by describing the area in any other manner. Regulated habitat may be smaller or larger than general habitat. As well, unlike the general habitat of a species, regulated habitat may include areas currently unoccupied by the species, such as areas where the species formerly occurred or areas where there is the potential for the species to become re-established. These areas are commonly referred to as "recovery habitat".

The habitat of Special Concern species does not receive regulatory protection under the ESA but is considered significant wildlife habitat (SWH) and is thus protected under municipal policy and the PPS. Confirmed and potential SWH is discussed in **Section 5.5**. Habitat of regionally rare species receives no regulatory protection, and these species are therefore not discussed further in this report in terms of defining the ecological constraints of the study area. Further examination of these species and their locations may, however, be appropriate during a site-specific EIS to be completed at a later date (see **Section 8**).

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is often the first to reassess species status based on recent evidence and trends. The COSEWIC status has therefore also been considered in this document where it differs from the regulatory designation.

The SAR list provided in **Appendix D** was developed using all available information sources for the study area. Using this list, Aquafor Beech Limited assessed the likelihood of each species to currently occur by cross-referencing the habitat needs of each species with the habitat conditions present within the study area and adjacent lands. As indicated in **Appendix D** and discussed in the following sections, six SAR have been confirmed to be present within the study area. Eleven additional SAR that were not confirmed on site, but have potential to occur based on habitat suitability are discussed under **Section 5.4.7**.

5.4.1 Barn Swallow

Barn Swallow is a Threatened bird species of open-country habitats. It is commonly found in close proximity to humans as it forages over agricultural fields and builds its cup-shaped mud nests inside barns, on the underside of bridges, and in drainage culverts. Although it is the most widespread and abundant swallow in the world, it has been listed as a SAR due to population declines over the northern

part of its North American breeding range (Heagy, et al., 2014).

At least five Barn Swallows were seen foraging over the sports fields northwest of the intersection of Rice Rd. and Quaker Rd., and over the vacant field northeast of that intersection. Two active nests were observed on a storage building in the middle of the sports field complex. A barn northeast of the intersection may represent another possible nesting site, but it could not be assessed as access was not granted to that property.

Protected general habitat for Barn Swallow in Ontario includes nest sites and the associated foraging habitat up to 200 m from a nest (MNRF, 2013). This includes nest sites which are found on artificial structures, such as the storage building in the study area; however, due to its anthropogenic origin, this structure is not proposed for inclusion in the NHS despite supporting SAR habitat. Removal of buildings or structures supporting nest sites may occur subject to conditions laid out in O.Reg. 242/08 under the ESA, but the impacts to the species associated with such an action (including the loss of associated foraging habitat, if this is removed for development) would need to be addressed in site-specific impact assessment studies (**Section 8**).

5.4.2 Eastern Flowering Dogwood

Eastern Flowering Dogwood is a showy understory species in the dogwood family (Cornaceae). Its distribution in Ontario is restricted to the southwest (i.e., the Carolinian Zone). It exists in a variety of mid-aged to mature forests, including open dry-mesic hickory woodlands, mesic maple-beech deciduous forest and mixed forest (Bickerton & Thompson-Black, 2010), and can also occur within hedgerows. It prefers coarser soils, in particular acidic sandy-loams.

This species is currently listed as Endangered primarily due to infection by an exotic fungus known as *Discula destructiva* (“dogwood anthracnose”). It tends to be most severe in shaded, moist areas, and it spreads primarily in cool, wet seasons. After infection, tan spots surrounded by a purple ring develop in the lower leaves. The infection then spreads further into the crown and may produce cankers along the stem.

Per O.Reg. 242/08, protected Eastern Flowering Dogwood habitat in several regions of southern Ontario, including the Regional Municipality of Niagara includes:

1. A terrestrial area (i.e., an area where the water table is rarely or briefly above the soil surface and in which hydric soils have not developed) within 20 m of the stem of an Eastern Flowering Dogwood.

2. An area populated by a naturally-occurring ELC vegetation community type containing Eastern Flowering Dogwood.

The recommended protected habitat for this species under the provincial Recovery Strategy (Bickerton & Thompson-Black, 2010) also includes the contiguous ELC ecosite polygon within which the existing trees are found. However, where trees exist near the edge of a unit, it recommends a 25 m protected radius around the stem of each tree. To ensure the adequate protection of this Endangered species, Aquafor Beech recommends the more conservative definition of habitat be applied.

One Eastern Flowering Dogwood was observed directly by Aquafor Beech in vegetation community A1.

The specimen showed signs of twig dieback and bark loss on the trunk, however the canopy cover was observed at over 85% and overall, the specimen seemed healthy.

5.4.3 Butternut

Butternut is a short-lived (<75 years), mast-bearing tree in the walnut family (Juglandaceae). It is frequently found along floodplains, streambanks, and ravine slopes, but can occur in a wide variety of other conditions; it is more common in areas with underlying limestone and is generally absent from regions with acidic soil such as the granite-dominated areas of the Canadian Shield. Butternut is intolerant of shade and tends to be found either as a mature canopy tree or in openings and edges (COSEWIC, 2017).

Butternut is currently designated as Endangered and receives general habitat protection under the ESA. The primary threat to Butternut is an introduced exotic fungal pathogen, *Sirococcus clavigignenti-juglandacearum* ("butternut canker"). Infection generally occurs through wounds, broken branches or leaf scars, causing twig dieback and eventual tree mortality. The most obvious sign of infection is a black, oozing or sooty canker on the trunk or branches. Potential habitat for butternut occurs throughout the subwatershed study area.

The provincial Butternut Recovery Strategy (Poisson & Ursic, 2013) recommends that a minimum radius of 25 m from the base of the trunk of all Butternuts be considered protected habitat. However, it also recommends that this protection only be applied to healthy trees (i.e., trees which are not affected by the canker to the degree that they are classed as "non-retainable" by a Butternut Health Assessment). The MNRF's interim guidance on general habitat for Butternut under the ESA (2015) confirms that a 25 m radius from each tree should be considered Category 1 habitat which protects the critical root zone and other functions that support the life of that individual, but further adds that suitable areas from 25-50 m of a tree should be considered Category 2 habitat necessary for nut dispersal and seedling establishment. Aquafor Beech therefore recommends a 50 m radius around each retainable Butternut be protected as habitat.

Four Butternuts were observed directly by Aquafor Beech in vegetation community A1. Health assessments of these trees were not completed as part of this study as they are more appropriate to conduct during site-level impact assessments (**Section 8**), but it was generally noted that sooty cankers were observed on the trunks. Canopy coverage for all four specimens was above 80% at the time of observation.

5.4.4 White Wood Aster

This Threatened plant species was observed directly by Aquafor Beech in vegetation community A1. Two patches consisting of approximately 40 and 15 stems each were confirmed within suitable forest habitat.

White Wood Aster is a late summer-to-fall-blooming plant that typically grows 30-90 cm tall in open, deciduous forests. It prefers drier soils but is fairly tolerant of wet conditions, and seems to have a strong preference for sites with a thick accumulation of leaf litter. According to notations in the regional species checklist, recent fieldwork (i.e., including the Natural Areas Inventory field work conducted from 2006 to 2009) has documented more than a dozen new populations of this species in Niagara Region. Mainly restricted to dry sandy uplands with suitable moisture on the Niagara Escarpment, the Fonthill

Kame, St. David's Buried Valley, Onandaga Escarpment, forested Lake Erie dunes, abadonded shorelines of glacial lakes, and occassionally along steep valley slopes associated wih large watercourses (Oldham, 2010). The main threats to this species include residential/urban and agricultural development which results in habitat loss and degradation.

This species currently receives general habitat protection in Ontario under the ESA, meaning that the area on which this species depends, directly or indirectly, to carry out its life processes is a protected area. Specific habitat is not currently defined by the MNRF.

However, a federal Recovery Strategy for this species was recently published. This document defines critical habitat for White Wood Aster as the extent of biophysical attributes (i.e., suitable habitat) up to an 80 m radius around the occurrence. Additionally, since this species may be found near the transition zone between suitable and unsuitable habitat, a critical function zone distance of 50 m is also identified as critical habitat around the occurrence when the biophysical attributes of habitat extend for less than 50 m (Environment and Climate Change Canada, 2018). Although this definition of critical habitat has not been adopted provincially, it does reflect the latest science on what may be considered an area on which the species depends for its life processes (i.e., what would be defined as "general habitat" under the ESA). Aquafor Beech Limited therefore recommends that the federal critical habitat definition be used until or unless other literature determines otherwise.

5.4.5 Monarch

The well-known Monarch butterfly (*Danaus plexippus*) is currently listed as Special Concern both provincially and federally and therefore receives no regulatory protection. However, COSEWIC reassessed the Monarch as Endangered in 2016, citing declines of greater than 50% in the last decade. The primary threats facing the Eastern North American Monarch population include the degradation and loss of overwintering habitat in Mexico, the widespread use of pesticides and herbicides throughout their breeding grounds, climate change, severe weather events, succession and/or conversion of breeding and nectaring habitat, and the impacts of bark beetles on overwintering habitat (Environment and Climate Change Canada, 2016).

Adult monarchs were observed in multiple locations throughout the study area, feeding on wildflowers. Meadow and meadow marsh patches containing wildflowers, particularly milkweeds (*Asclepias* spp.), could support this species by providing foraging and breeding habitat.

The federal Management Plan for the Monarch (Environment and Climate Change Canada, 2016) recommends the conservation and enhancement of Monarch breeding and nectaring habitat in Ontario - i.e., open grasslands, meadows, wetlands, etc. which contain wildflowers, particularly milkweeds which are the required larval host plants. The Management Plan also encourages landscaping with native species and the creation of butterfly gardens in residential developments, which is a measure that could be carried forward to future development proposals (**Section 7**).

5.4.6 Rusty Blackbird

This Special Concern species was reported to eBird in November 2012 from a location just northwest of the intersection of Quaker Road and First Avenue (i.e., within the boundary of the Niagara Street - Cataract Road Wetland Complex PSW). Rusty Blackbird breeds in northern Ontario but is often observed passing through southern Ontario during migration, which is undoubtedly the source of the reported

observation.

The conversion of wetlands, both in the winter range and the migratory range south of the boreal region, is considered one of the most significant contributing factors to Rusty Blackbird population declines (Environment Canada, 2015). Conservation of wetland habitat in the study area would help support this species by maintaining its migratory stopover habitat.

5.4.7 Potential Occurrences

An additional twelve SAR and SOCC, listed below, are considered to have the potential to occur within the study area based on habitat suitability and/or past occurrence records in the vicinity (see **Appendix D** for details). None of the species listed below were observed in the study area during field investigations for the current study, but could potentially find suitable habitat in the study area in future.

- **Bobolink (*Dolichonyx oryzivorus*; THR) and Eastern Meadowlark (*Sturnella magna*; THR)** – Both of these Threatened birds nest in open habitats/grasslands including old field meadows and sometimes agricultural fields. There are currently few large, contiguous open habitat patches in the study area, and neither Bobolink nor Eastern Meadowlark was observed during breeding bird surveys. If agricultural fields are allowed to go fallow in future, however, these areas could attract nesting pairs at that time.

- **Eastern Wood-pewee (*Contopus virens*; SC)** – Eastern Wood-pewee is often found in woodlands and woodland edges in and adjacent to urban and suburban areas. The majority of potential habitat for this species is therefore located in woodlands, i.e., within natural areas that will be included in the NHS and subject to the City's policies.

- **Wood Thrush (*Hylocichla mustelina*; SC)** – Wood Thrush nests in deciduous and mixed forests, preferring large forest patches but also sometimes occurring in small remnants. Similar to Eastern Wood-pewee, the majority of potential habitat for this species is found in features that will be protected as part of the NHS.

- **Golden-winged Warbler (*Vermivora chrysoptera*; SC) and Yellow-breasted Chat (*Icteria virens*; END)** – These two species nest in early-successional habitats such as thickets and scrubby forest edges. Neither was identified during breeding bird surveys completed in 2018, but successional thickets and edge habitats are present in the study area and may expand in future if agricultural lands are allowed to go fallow.

- **Short-eared Owl (*Asio flammeus*; SC)** – This species uses meadows and other open habitats. Typically it requires large areas of contiguous habitat to establish a territory, but it is considered feasible that over-wintering birds could still make use of the site.

- **SAR bats (END)** – Summer (i.e., maternity/roosting) habitat for the four SAR bat species found in Ontario could potentially be present in woodlots in the study area. Forest habitat on the site may potentially provide the necessary habitat features (i.e., tree snags with cracks, crevices, cavities, loose bark, etc.) for bats. However, the majority of potential habitat for this species is found in features that will be protected as part of the NHS (i.e., woodlands).

- **Eastern Ribbonsnake (*Thamnophis sauritus*; SC)** - Potentially suitable habitat for this species in the study area includes wet meadows and open riparian areas adjacent to wetlands.

5.5 Significant Wildlife Habitat

The province has provided guidance for the identification and assessment of Significant Wildlife Habitat (SWH). In the Niagara Region, the primary document to use to assess SWH is the MNRF Criteria Schedule for Ecoregion 7E (MNRF, 2015). The detailed SWH screening assessment completed for the study area is located in **Appendix E**. A summary of SWH within the study area is illustrated on **Figure 5-8** and discussed in the following sections.

5.5.1 Confirmed SWH

Rare Vegetation Communities

As previously described in **Section 5.2.1**, two provincially rare vegetation community types were documented in the study area:

- FOD9-5, Fresh-Moist Bitternut Hickory Deciduous Forest (S3S4) - Polygon A3; and
- SWD1-2, Bur Oak Mineral Deciduous Swamp (S3) - Polygon D1 – complexed with Green Ash Mineral Deciduous Swamp (SWD2-2)

5.5.2 Candidate SWH

Specialized Habitat for Wildlife: Special Concern and Rare Wildlife Species

Habitat on which species of conservation concern depend to carry out their life processes is considered SWH. Two Special Concern species were documented in the study area, although the extent of their critical habitat in the study area is to be confirmed through future studies (**Section 8**):

- Monarch (SC) – nectaring and breeding habitat in any open meadow or similar habitat containing milkweeds and other wildflowers.

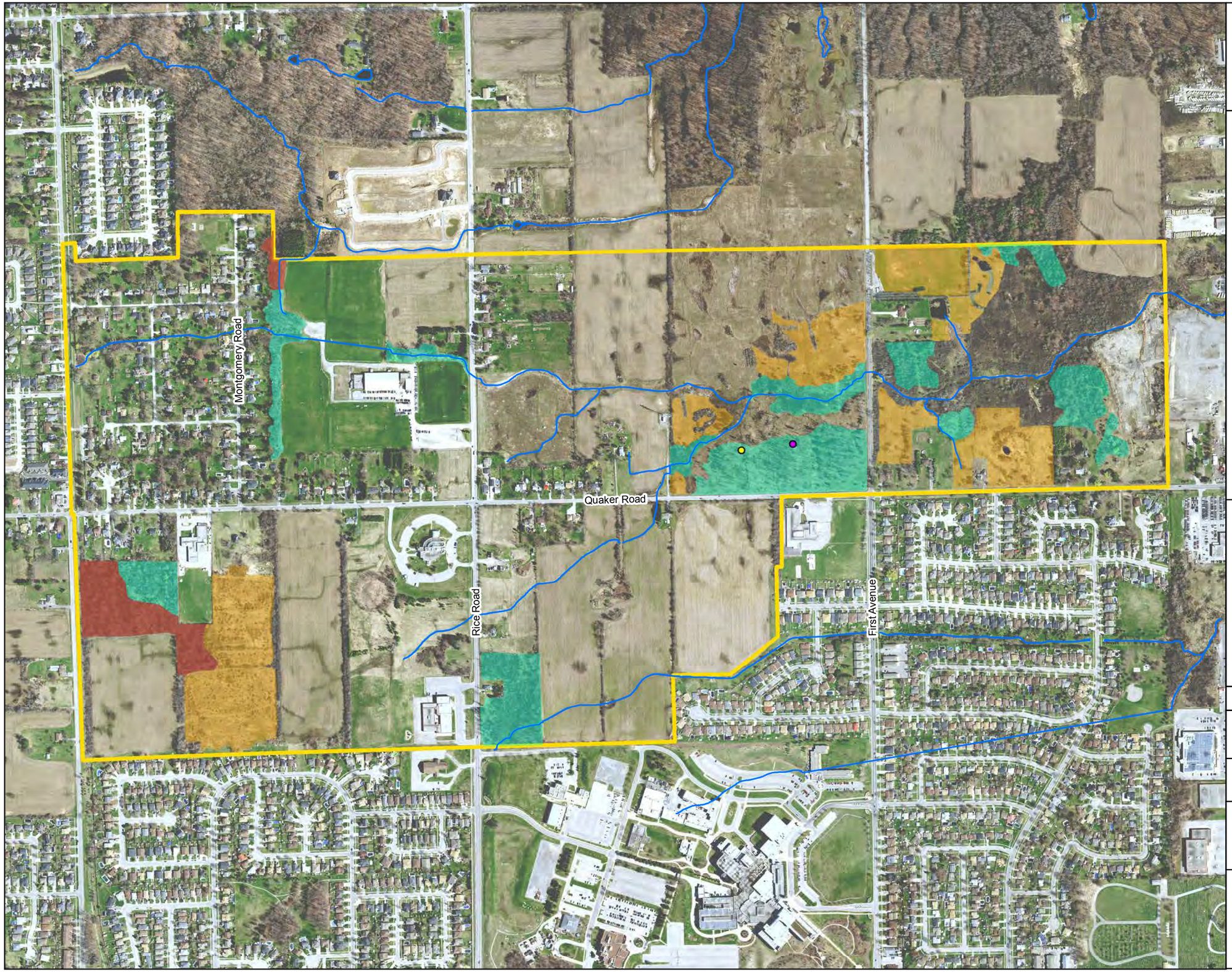
- Rusty Blackbird (SC) – migratory/non-breeding habitat associated with the Niagara Street - Cataract Road Wetland Complex PSW.

Bat Maternity Colonies

There is potential for bat species to be using forest and swamp vegetation communities within the study area as maternity roosting habitat. No targeted bat surveys were undertaken as a part of this study. Since use of study area woodlands by bats is not known, further studies would be required to confirm which, if any, of these habitats is used for bat maternity roosting (**Section 8**).

Reptile Hibernacula

There is potential for reptile hibernacula to occur in features such as burrows, rock piles, old stone fences, abandoned crumbling foundations, and cavities around tree roots. One location in the study area was noted as having potential hibernaculum features during field investigations, and this is illustrated on **Figure 5-8**: the site of a former homestead in Area B was noted to have stone foundations still in place from a house and barn. Other sites or features may also be present in the study area; additional surveys would be required to confirm the absence of candidate habitat (**Section 8**).



Welland
ONTARIO · CANADA

Legend

Watercourse

Secondary Plan Boundary

Confirmed Significant Wildlife Habitat

Rare Vegetation Community

Candidate Significant Wildlife Habitat

Reptile Hibernaculum

Habitat of Special Concern Species (Rusty Blackbird)

Habitat of Special Concern Species (Monarch)

Bat Maternity Colonies

N

1:290,000

Figure 5.8

Significant Wildlife Habitat

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.2 0.4
Kilometers

N

Aquafor Beech Limited

6 Surface Water Resources

The Northwest Welland Secondary Plan area is bisected by the Towpath Drain and associated watercourse; these are tributaries of the Welland River. In 2012, Aquafor Beech Limited undertook the Central Welland River Floodplain Mapping Study for the Niagara Peninsula Conservation Authority (NPCA). An overview of the hydrology and hydraulics associated with the 2012 Central Welland River Floodplain Mapping Study is provided in the following subsections.

6.1 Hydrology

Hydrology is the science that deals with the interaction of water and land, and the processes by which precipitation is transformed into runoff to the receiving watercourse or infiltrated into the groundwater system. These processes are generally called the hydrologic cycle. One of the most dramatic changes brought about by urbanization is the change in hydrological cycle and stream hydrology. These changes can result in increases in flooding, channel erosion, sediment transport and pollutant loadings. Computer simulations known as hydrologic models are used to estimate runoff volumes and flow rates associated with specific rainfall events or long-term climate patterns given catchment characteristics such as slope, impervious cover, soil type and area.

The hydrologic modelling for the Welland River tributaries was completed using the Hydrologic Modelling System (HEC-HMS) model. Subwatersheds were delineated in a manner that would provide flow estimates at similar locations to the flow nodes from a previous 1989 Watershed Hydrology Study. Hydrologic modelling parameters assigned to the 267-ha catchment area upstream of Niagara Street on the Towpath Drain are summarized in **Table 6-1**.

Table 6-1: Towpath Drain Hydrologic Parameters (Central Welland River Floodplain Mapping Study, 2012)

Catchment ID		TP-2
Area (ha)		267
% Impervious		20.88
Curve Number		82.9
Initial Abstractions (mm)	**Perv.**	2.0
	Imperv.	1.0
Overland Flow Length (m)		4968
Basin Slope (%)		2.15
Time of Concentration (hrs.)		3.21
Lag Time (hrs.)	**Base**	1.84
	Adj. (x2.09)	3.84

6.2 Hydraulics

Watercourse hydraulics is the science that deals with how water flows through an open channel and along the associated floodplain. It is typically completed using a computer simulation that represents channel and floodplain dimensions along with hydraulic structures such as bridges, culvers and dykes. Flow rates from the associated hydrologic model are used as inputs to the hydraulic model. Hydraulic model outputs typically include extent and depth of inundation along the floodplain and velocity of flow in the channel. Hydraulic models are used to define the extend of flooding in order to implement natural hazards regulations and associated planning policies.

Figure 6-3 illustrates hydrologic features within the study area (both confirmed and potential), including: watercourses previously defined by NPCA; floodplain limits developed by Aquafor Beech Limited for NPCA; wetland polygons identified by Aquafor Beech Limited via Ecological Land Classification assessment of the study area (previously discussed in **Section 5.2.1**); and potential Headwater Drainage Features (HDFs) identified through aerial photo interpretation.

Mapping extents for the study included both the main channel and several tributary reaches with drainage areas greater than 125 hectares. Within the Secondary Plan Area, the watercourses upstream of Rice Road to the west and upstream of Quaker Road to the south have drainage areas smaller than the 125-ha threshold established for mapping.

A 12-hr Chicago distribution storm hyetograph was applied to the HEC-HMS model for the Towpath Drain. The resulting peak flows were applied to a HEC-RAS hydraulic model to determine floodplain limits corresponding to the specified return periods. Rainfall depths for specific return period precipitation events along with corresponding flows are presented in **Table 2**. The NPCA Digital Elevation Model was used to define ground elevation along the Towpath Drain. A total of four hydraulic structures on the Towpath Drain were inventoried and surveyed in the field before being input into the HEC-RAS model. One of these structures, a corrugated steel pipe at First Avenue north of Quaker Road, is within the Northwest Welland Secondary Plan Area. The Hydraulic Structure Inventory Sheet for this crossing and floodplain mapping within the Northwest Secondary Plan are below.

Table 6-2: Rainfall Depths and Flows for Specified Return Period Events

Return Period	Rainfall Depth (mm)	Flow (m^3/s) Upstream of Niagara Street
1:2-year	42	2.9
1:5-year	56	4.3
1:10-year	64	5.1
1:25-year	75	6.3
1:100-year	92	8.3

NIAGARA PENINSULA CONSERVATION AUTHORITY

HYDRAULIC STRUCTURE INVENTORY SHEET

Welland Canal

STRUCTURE No. 4

First Avenue, North of Quaker Road

Aquafor Beech Limited

Watershed and location Information	Structure Configuration and Dimensions	Current Flow Information
Date (dd/mm/yyyy): 13/05/2009	Structure Type (Culvert/Bridge): Culvert	Flow Present (Yes/No): Yes
Field Crew: A.S./B.S.	Number of Cells: 1	Approx. Depth (m) (U/S): 0.04
Watershed Name: Welland Canal	Material (Concrete/Steel): Steel	Velocity* (m/s): 0.01
Reach No.: TP1	Open Footing (Yes/No): No	Upstream Erosion (Yes/No): No
Floodplain Map Sheet No. TPD-5	Height (m) x Width (m): 1.15 X 1.87	Downstream Erosion (Yes/No): No
Tributary Name: Tow Path Drain	Diameter (m) (If Applicable):	Additional Flow Information:
Cross Section Range: 3748 - 3773	Length (m): 13.43	
Municipality: Welland		*The Velocity reported is superficial and measured upstream close to inlet.
Additional Field Note:		
	Height from Obvert to Top of Road (m): 1.165	
	Upstream Invert (m): 180.730	
	Downstream Invert (m): 180.653	
	Top of the Road Elevation (m): 182.998	
	Slope (%): 0.57	

Site Photograph and Aditional Field Notes

Key Map:

Upstream Photograph (Looking Downstream)

Downstream Photograph (Looking Upstream)

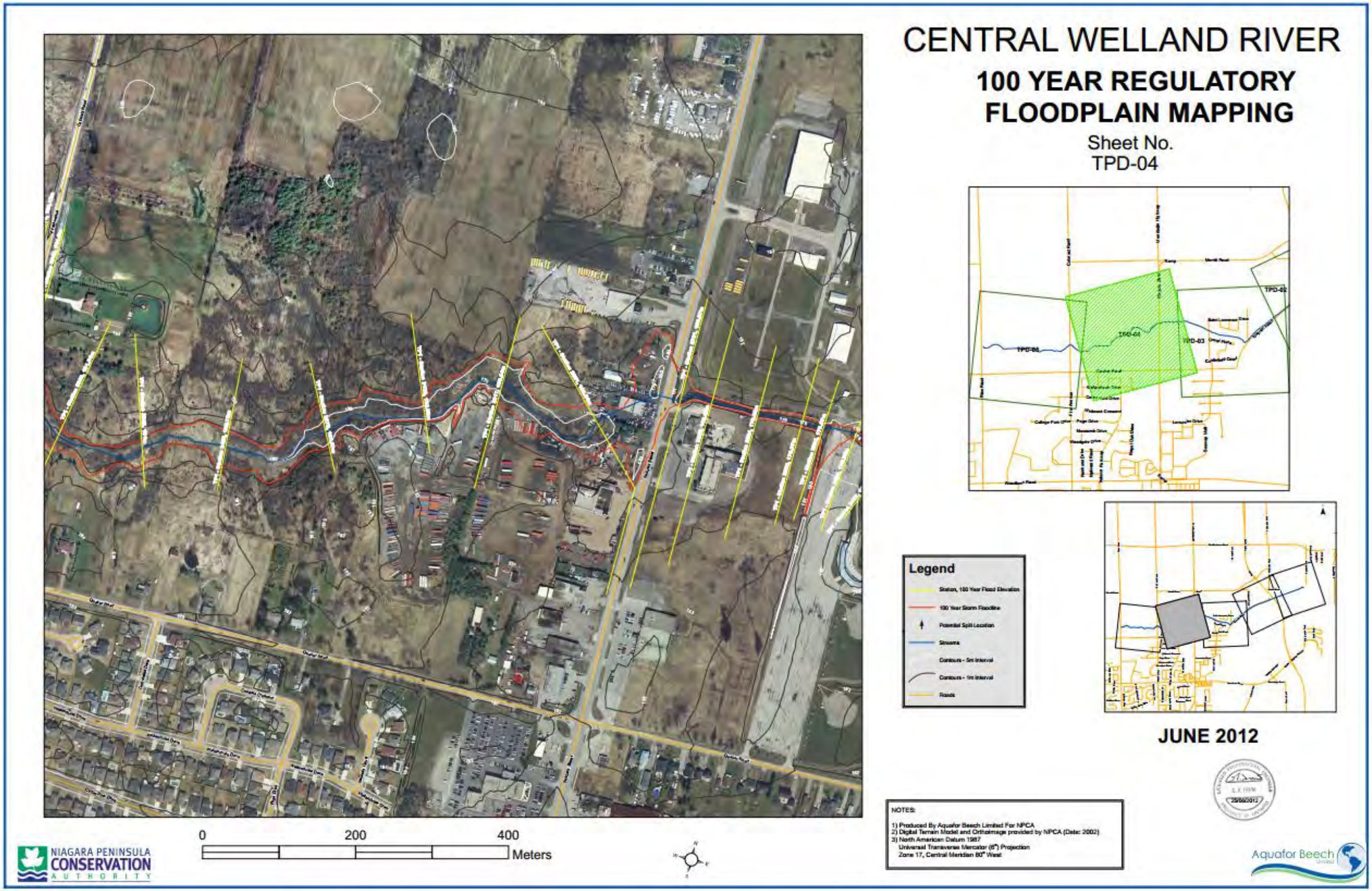


Figure 6-1: Central Welland River 100-year Regulatory Floodplain Mapping (Sheet TPD-04)

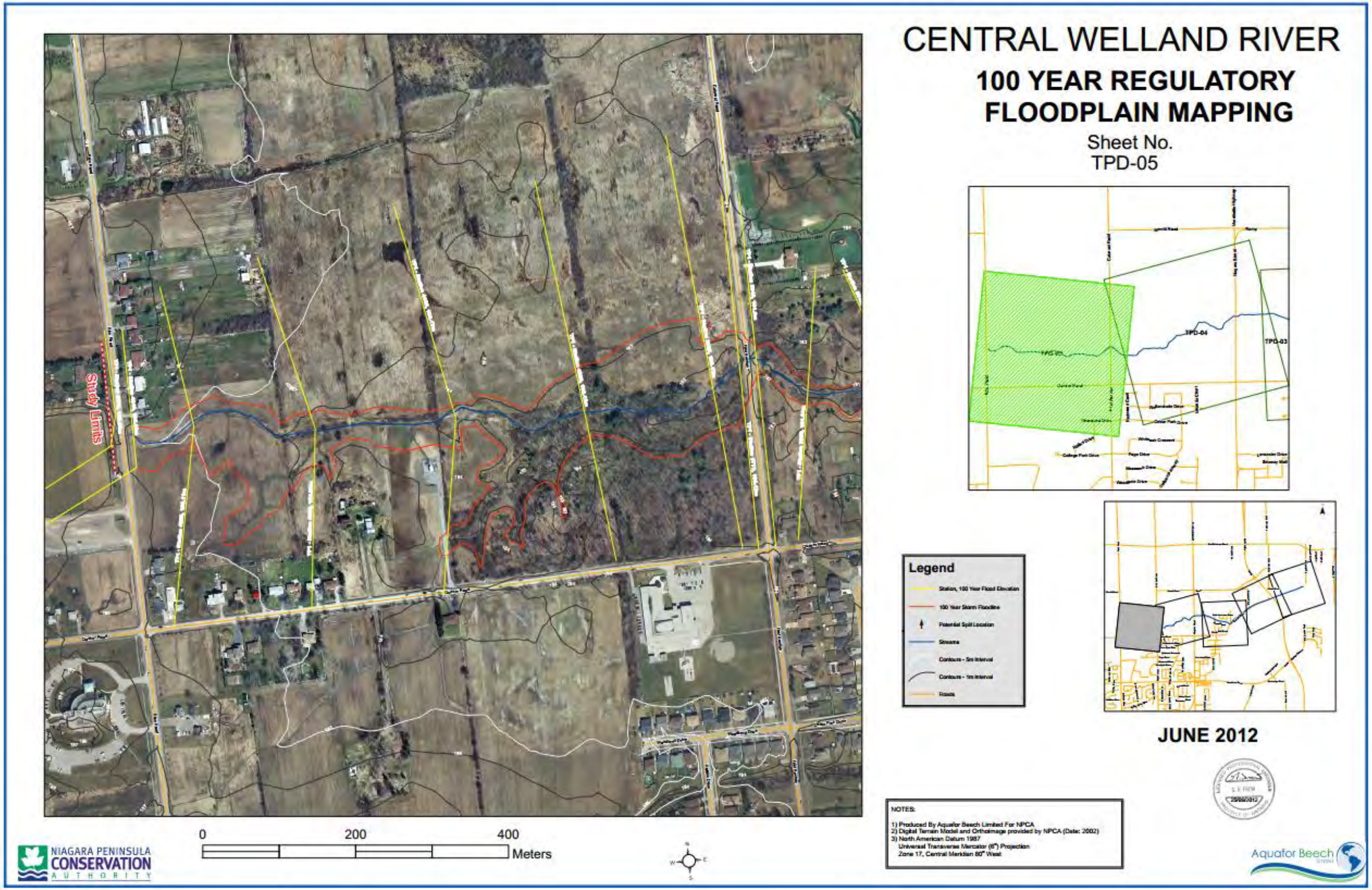


Figure 6-2: Central Welland River 100-year Regulatory Floodplain Mapping (Sheet TPD-05)

6.3 Headwater Drainage Features

Assessment of HDFs was originally included as a provisional item in the work plan for this study, but this item was not carried forward. HDF assessment has therefore not been completed and will be required at a later stage of the project using the protocol described in the "Evaluation, Classification, and Management of Headwater Drainage Features: Interim Guidelines" (CVC & TRCA, 2014). Aerial photo interpretation strongly suggests the presence of HDFs in some agricultural fields within the study area; a preliminary delineation of HDFs based on aerial photo interpretation has therefore been provided for reference on **Figure 6-3**, although it is recognized that the future study may refine or improve this initial estimate using hydrologic modelling.

It is further recognized that the watercourses labeled using NPCA mapping include features which may more appropriately be considered HDFs and may therefore also be subject to further assessment using the HDF assessment protocol. As previously noted in **Section 5.1.1**, some mapped watercourse reaches were noted to be dry during field assessment.

The protection of headwater areas is critical to maintaining the baseflow of watercourses and the hydrology of wetlands; specific to the study area, hydrologic features may support the Niagara Street - Cataract Road Wetland Complex PSW and the important downstream fish habitat in the Welland River.

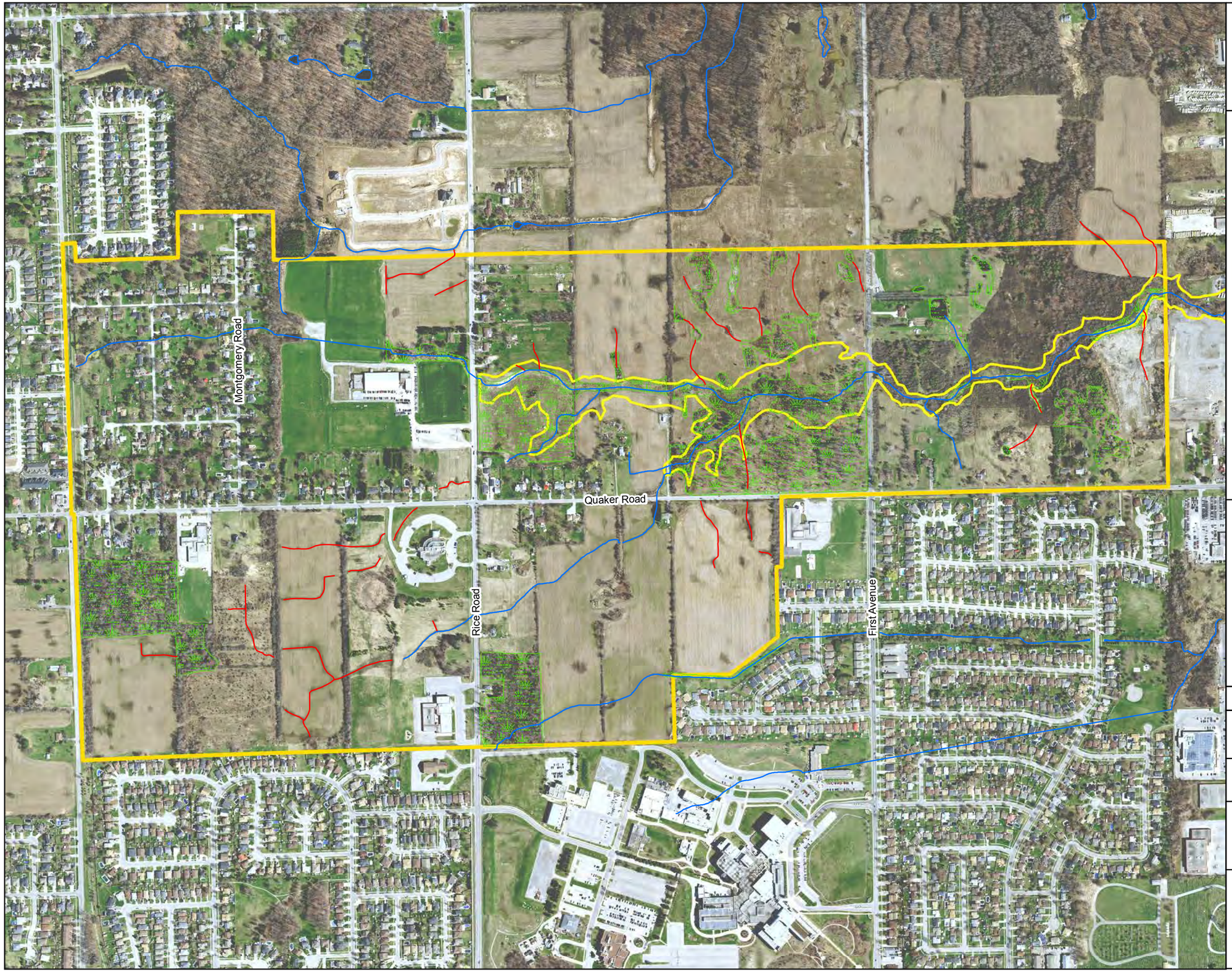
Depending on the results of HDF assessment, hydrologic features within the study area may be recommended for a range of management options:

- Protection – for features that provide <u>important functions</u> such as swamp habitat for breeding amphibians, perennial drainage, permanent fish habitat, or seeps/springs. For this category, the existing feature and its riparian zone would be recommended for protection and/or enhancement.

- Conservation – for features that provide <u>valued functions</u> such as seasonal fish habitat with woody riparian cover or marsh habitat for breeding amphibians. Features included in this category may be recommended to be maintained, relocated, or enhanced.

- Mitigation – for features that provide <u>contributing or recharge functions</u> such as contributing fish habitat with meadow vegetation or limited cover. The function of features included in this category may be replicated or enhanced through enhanced lot-level conveyance measures.

- No Management Required – for features with <u>limited function</u>, e.g., low or minimal flow, no riparian vegetation, no downstream connections, or no fish or amphibian habitat considerations.



Welland
ONTARIO · CANADA

Legend

- Watercourse (NPCA)
- Headwater Drainage Features*
- Wetlands
- NPCA Advisory Floodplain
- Secondary Plan Boundary

(*) NOTE: Pending Further Assessment

N

1:290,000

Figure 6.1

Hydrologic Features
(Pending Further Study)

Date: March 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.2 0.4
Kilometers

N

Aquafor Beech
Limited

7 Identification of Constraints and Opportunities

7.1 City of Welland Natural Heritage System

The components of the City of Welland's NHS are identified and assessed in **Table 7-1**. Features which meet the criteria to be considered for the Environmental Protection Area or Environmental Conservation Area designation are illustrated on **Figure 7-1** and **Figure 7-2**.

Policies applicable to the various natural heritage designations were detailed previously in **Section 3**. In brief:

- Development and site alteration are not permitted in Environmental Protection Areas except for selected conservation or passive recreational uses, proposals for which must be accompanied by an EIS.

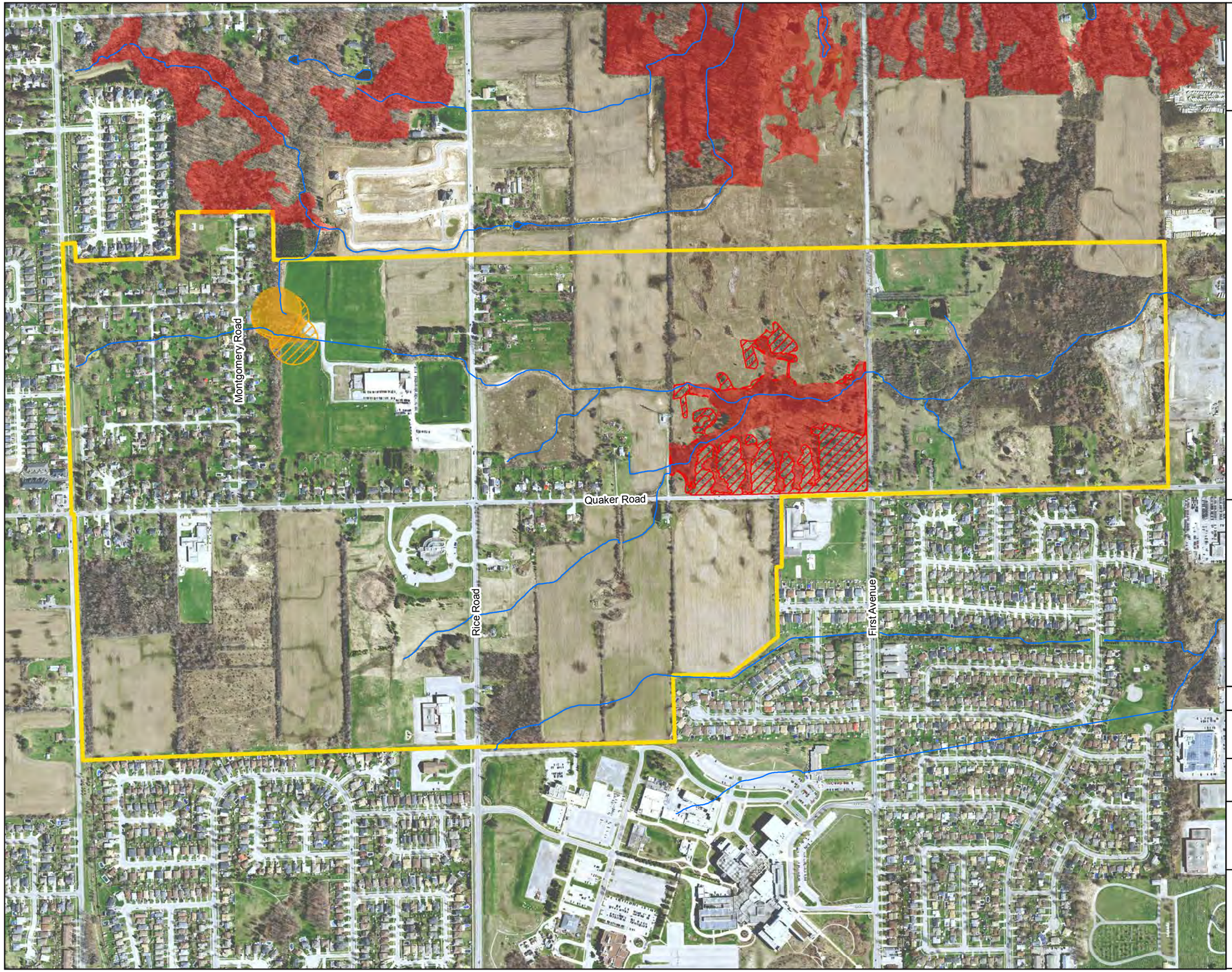
- Development and site alteration may be permitted in Environmental Conservation Areas, Natural Heritage Corridors, and on lands adjacent to these features if it is demonstrated through an EIS that there will be no negative impact on the natural features or their ecological functions.

- Within Fish Habitat and lands adjacent to Fish Habitat, development and site alteration may be permitted if it will result in no net loss of the productive capacity of fish habitat as determined through an EIS prepared to meet DFO policies and requirements.

Table 7-1: Assessment of City of Welland NHS Features

Natural Heritage Designation	Feature	Discussion
Environmental Protection Area	Provincially Significant Wetland	Portions of the Niagara Street - Cataract Road Wetland Complex PSW are found within the study area. For the purpose of this report, only the previously-confirmed PSW boundary provided by MNRF has been used to identify the Environmental Protection Area since a formal re-evaluation and mapping of wetland boundaries was not within the scope of this assignment. Connected wetland features have been indicated on **Figure 7-1** as Potential Environmental Protection Area (Pending Further Assessment) and will at a minimum be designated under Environmental Conservation Area as "Other Evaluated Wetland" (see below). The Environmental Protection Area designation may need to be altered in the future based on a re-evaluation of the Niagara Street - Cataract Road Wetland Complex PSW in cooperation with the MNRF.
	Significant Habitat of Endangered or Threatened Species	See **Section 5.4** for full details. Protected habitat includes: <u>White Wood Aster</u> – Contiguous habitat within 80 m of the occurrences of this species, in combination with a 50 m critical function zone around the occurrences even if this 50 m includes areas that do not currently contain habitat (e.g., the sports fields). <u>Butternut</u> – up to 50 m from the stems of healthy/retainable trees. As a Butternut Health Assessment has not yet been completed for the trees on site, these locations have been indicated on **Figure 7-1** as Potential Environmental Protection Area (Pending Further Assessment). <u>Eastern Flowering Dogwood</u> – The contiguous ELC unit in which the trees occur, plus a 25 m radius from each stem where they occur near the edges of ELC units, even if this 25 m includes areas that do not currently contain habitat.
	Provincially Significant Life Science ANSIs	N/A - not present in the study area.
Environmental Conservation Area	Significant Woodlands • contain threatened or endangered species or species of concern; • are at least 2 ha in size if located within or overlapping the Urban Area Boundary (*N.B.: this size criterion has been used for the study area since the lands are intended to be used as part of the urban area*); • are at least 10 ha in size if located within the Agricultural and Rural Area; • contain interior woodland habitat at least 100 m in from the woodland boundaries; • contain older growth forest and are 2 ha or greater in area; • overlap or contain one or more of the other listed significant natural heritage features; or • abut or are crossed by a watercourse or water body and are 2 ha or more in area. The OP definition of woodland is: "treed areas, woodlots or forested areas… do not include cultivated fruit or nut orchards or plantations for… Christmas trees".	<u>Area A</u>: The woodland in the northwest corner of the study area (including ELC polygons A1, A2, and A3) contains SAR and is part of a larger woodlot 16+ ha in size (mostly to the north of the study area). Therefore, this contiguous woodland area qualifies as a Significant Woodland. (It must be noted that a portion of polygon A2 falls on lands that are part of the residential lots fronting on Montgomery Road, which are zoned Residential and cannot be reclassified at this time as part of the NHS. Protection of natural features on residential properties is solely at the discretion of the landowners. NHS designation would apply solely to portions of the polygon which fall within the proposed future development area, but assessment of the polygon and application of NHS criteria was based on the feature as a whole.) <u>Area B</u>: Wooded areas (primarily swamps) which overlap the Niagara Street - Cataract Road Wetland Complex PSW qualify as Significant Woodlands. However, these areas also qualify for an NHS designation as "Other Evaluated Wetlands" and it is felt they are more appropriately discussed under that category (see below). <u>Area C</u>: The majority of Area C is a large thicket that does not meet the definition of a woodland per the OP. Several smaller polygons within Area C do, however, meet at least one of the listed requirements: • the northernmost polygon identified as ELC community C12 is a mixed forest connected to additional wooded areas to the north, and the total size of this woodland (4+ ha) qualifies it as a Significant Woodland. • the contiguous woodland area formed by community types C8 and C12 near the eastern project limits is less than 2 ha in total size but includes a swamp community which would be considered as "Other Evaluated Wetland". This contiguous wooded area is therefore considered a Significant Woodland as it overlaps one of the other listed significant natural heritage features. <u>Area D</u>: The woodland comprised of ELC polygons D1 and D2 is approx. 3.6 ha in size and contains SWH (a rare vegetation community) in addition to wetland habitat. This feature therefore qualifies as a Significant Woodland.

Natural Heritage Designation	Feature	Discussion
		Area E: The single isolated woodlot in Area E (polygon E1) is approx. 2 ha in size, and consists of a wetland community type (swamp). It therefore qualifies as a Significant Woodland.
	Significant Wildlife Habitat	See **Section 5.5** and **Figure 5.8** for full details. Confirmed SWH in the study area includes rare vegetation communities which have also been accounted for in Significant Woodland designations. Potential, unconfirmed SWH in the study area (i.e., habitat of Monarch and Rusty Blackbird, reptile hibernacula, and bat maternity colonies) has not been included in the NHS at this time as it requires further evaluation during site-level assessments to confirm the extent and usage of specific habitat features that may be affected by development or land-use changes (**Section 8**).
	Significant Habitat of Species of Concern	See **Section 5.5** for full details. Habitat of Species of Concern is considered a type of Significant Wildlife Habitat and was discussed previously in this table.
	Regionally Significant Life Science ANSIs	N/A - not present in the study area.
	Other Evaluated Wetlands	All wetlands other than PSW that are greater than 0.5 ha in size have been included in this category as they are eligible for evaluation under the Ontario Wetland Evaluation System (OWES); the minimum size for evaluation under OWES is 0.5 ha unless specialized or rare features are present to justify evaluation of a smaller wetland. All wetlands, regardless of size, may nevertheless be considered Key Hydrologic Features (see **Section 7.2**).
	Significant Valleylands	Watercourses and channels throughout the study area generally did not have defined valley slopes and therefore Significant Valleylands were not identified in the study area.
	Savannahs and Tallgrass Prairies	N/A - not present in the study area.
	Alvars	N/A - not present in the study area.
	Publicly-owned Conservation Lands	N/A - not present in the study area.
Natural Heritage Corridors	Natural and open space linkages between features noted above	See **Section 7.4** for discussion.
Fish Habitat	All areas on which fish depend directly or indirectly to carry out their life processes	See **Section 5.1** for full details. Tow Path Drain is considered to provide supporting habitat to the important fish habitat present downstream in the Welland Canal. Further assessment of drainage features throughout the study area may be required to determine the extent and significance of fish habitat provided by HDFs and other supporting hydrologic features.



Welland
ONTARIO · CANADA

Legend

- Watercourse
- Secondary Plan Boundary Provincially
- Provincially Significant Wetland (MNRF)
- *Potential Provincially Significant Wetland
- Species at Risk Habitat
- *Potential Species at Risk Habitat

(*) NOTE: Pending Further Assessment

N

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Figure 7.1

Features Meeting Criteria as Environmental Protection Areas

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority, City of Welland

0 0.2 0.4
Kilometers

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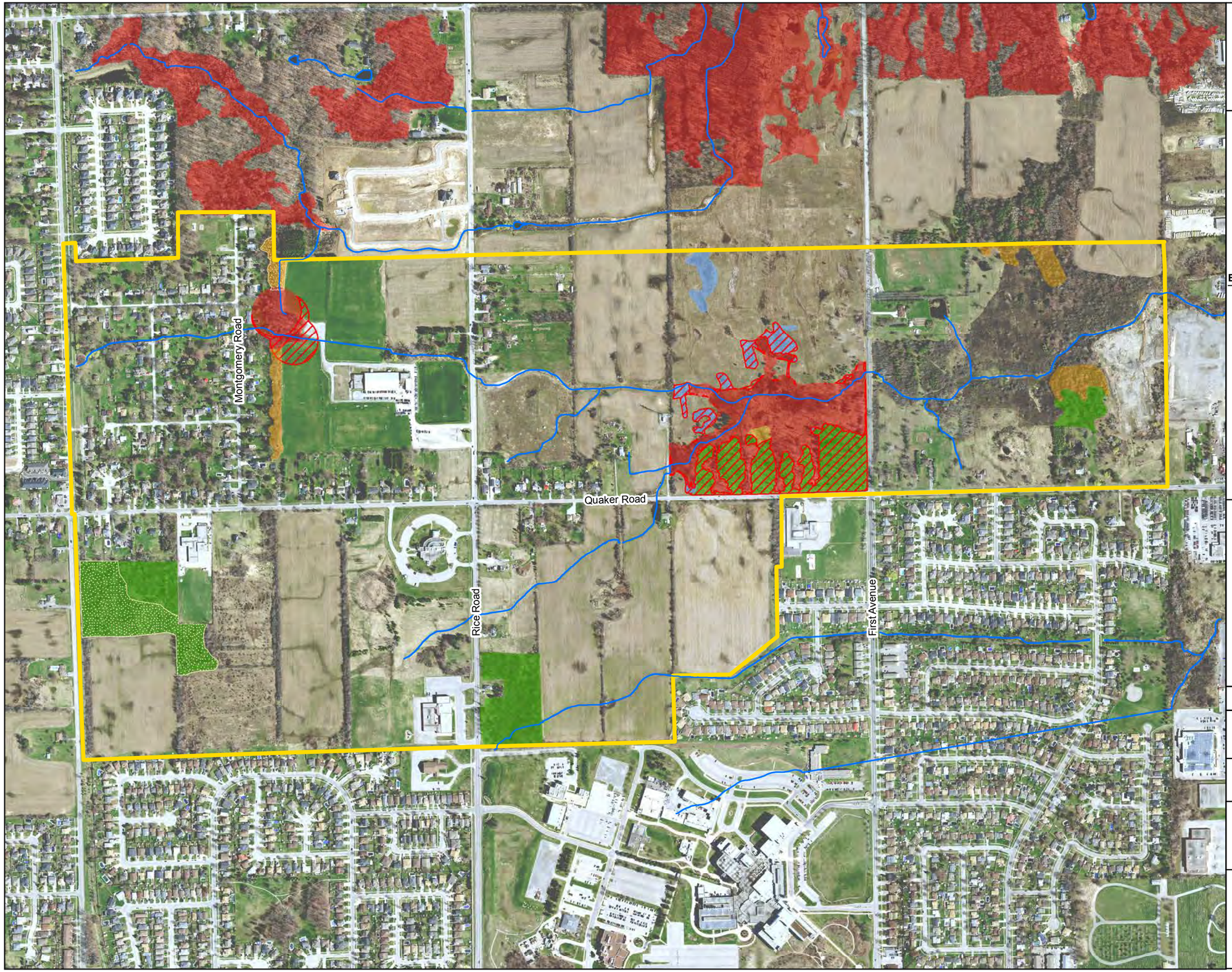
Aquafor Beech Limited



Welland
ONTARIO · CANADA

Legend

- Watercourse (NPCA)
- Environmental Protection Area
- Potential Environmental Protection Area*
- Secondary Plan Boundary

Environmental Conservation Area

- Significant Woodland
- Confirmed Significant Wildlife Habitat
- Other Evaluated Wetland
- Significant Woodland and Other Evaluated Wetland

(*) NOTE: Pending Further Assessment

N

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Figure 7.2

Features Meeting Criteria as Environmental Conservation Areas

Date: March 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority, City of Welland

0 0.2 0.4
Kilometers

N

Aquafor Beech Limited

7.2 Hydrologic Features

Key Hydrologic Features include permanent and intermittent streams, lakes and their littoral zones, seepage areas, springs, and wetlands (Niagara Region, 2014). The City's OP indicates that although Key Hydrologic Features (other than fish habitat) have not been identified and mapped in the current OP schedules, "these features will be identified through the planning and development review process and through future studies". All mapped watercourses, waterbodies, and ELC polygons that were confirmed as a wetland through field investigations (regardless of size), are potentially Key Hydrologic Features. HDFs (not assessed by this study) may also provide important hydrologic function within the study area, particularly where they support the function of other features such as PSWs.

Hydrologic features in the study area were previously illustrated on **Figure 6-3**. Hydrologic features that meet the criteria for the NHS designations discussed in the previous section (i.e., Provincially Significant Wetlands, Other Evaluated Wetlands) have been included in this document under those designations and will be subject to the polices and protections applicable to those designations under the OP. Other hydrologic features (e.g., small wetland pockets and HDFs) identified in the study area will require additional assessment to confirm the significance of their hydrologic function and the appropriate level of management, and previously-mapped watercourses may also be reviewed to confirm their status (as discussed in **Section 6.3**). The hydrologic features included in the NHS versus those requiring further assessment are illustrated on **Figure 7-3**.

The need for an EIS to address Key Hydrologic Features is not explicitly stated in the OP. However, it is appropriate to assess how a proposed development or site alteration will affect the hydrologic function provided by these features prior to proceeding with the proposed actions. Management options such as those presented in **Section 6.3** may be applied based on the significance/sensitivity of the various hydrologic features.

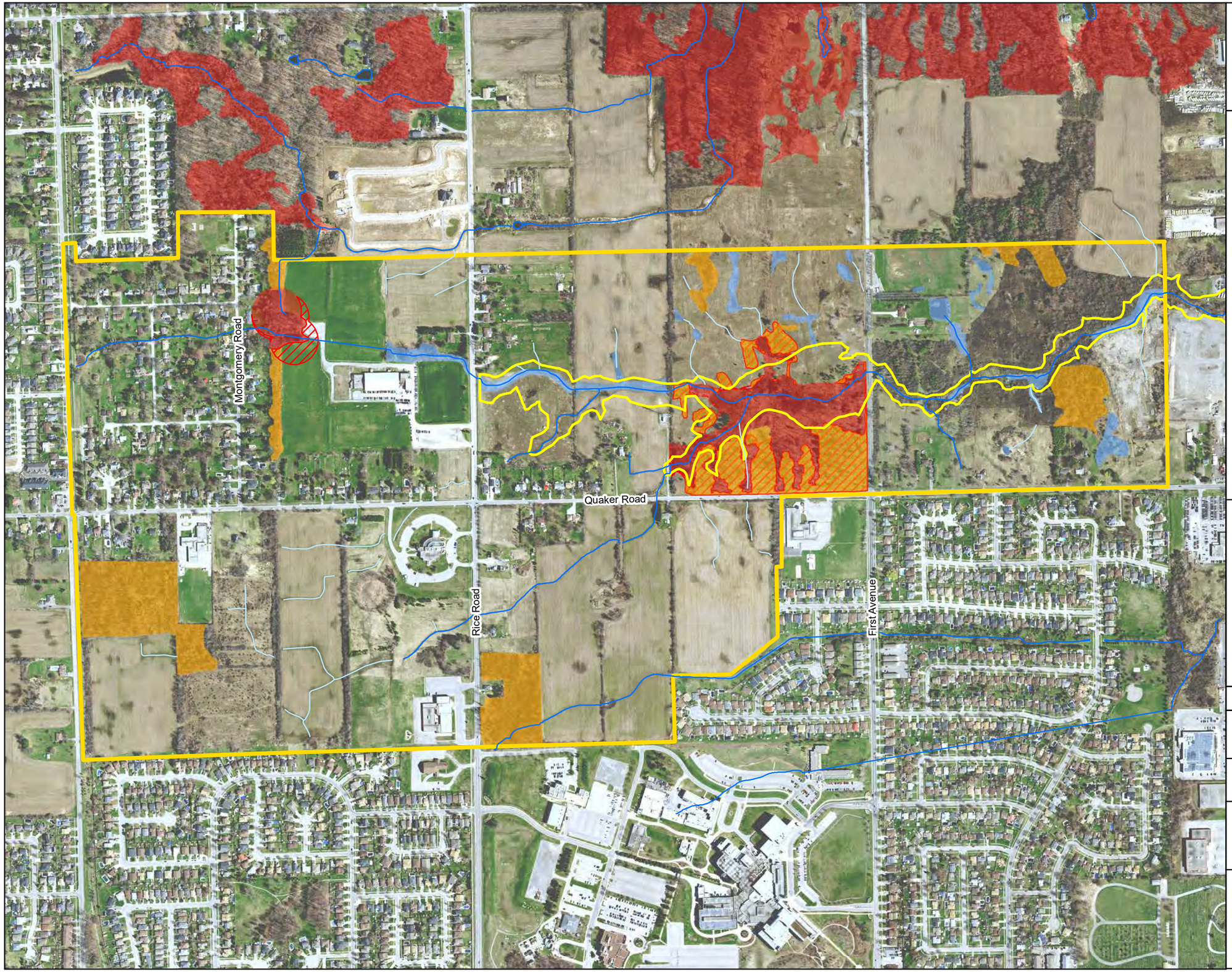
Features that provide important supporting function to significant wetlands, watercourses, or fish habitat may warrant designation as Key Hydrologic Features.

7.3 Buffers

Buffers (also sometimes called protection zones or vegetation protection zones) are typically applied around natural heritage features to minimize edge effect (i.e., changes in microclimate, moisture, vegetation composition, noise, etc., associated with the edges of natural areas) and protect the integrity and function of these features from adjacent development.

The City of Welland's OP requires a 30 m buffer from the stable top of bank adjacent to Critical Fish Habitat, and a 15 m buffer for Important or Marginal Fish Habitat. It also states a target of target of a "30 m wide naturally vegetated buffer along 70% of the length of the first to third order streams in Welland." Application of these buffer requirements is dependent on the completion of additional assessment of hydrologic features in the study area.

The OP further indicates that where development or site alteration is proposed in or adjacent to the NHS, appropriate buffer zones around components of the NHS are to be determined through site-specific studies prepared in accordance with City policies (e.g., in EIS assessments associated with development proposals).



Welland
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Legend

- Secondary Plan Boundary
- Environmental Protection Area
- Potential Environmental Protection Area*
- Environmental Conservation Area

Hydrologic Features

- Watercourse (NPCA)*
- NPCA Advisory Floodplain
- Headwater Drainage Features*
- Wetlands <0.5 ha*

(*) NOTE: Pending Further Assessment

N

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Figure 7.3

Hydrologic Features (Pending Further Study) and the NHS

Date: March 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority, City of Welland

0 0.2 0.4
Kilometers

N

Aquafor Beech Limited

7.4 Corridors and Connections

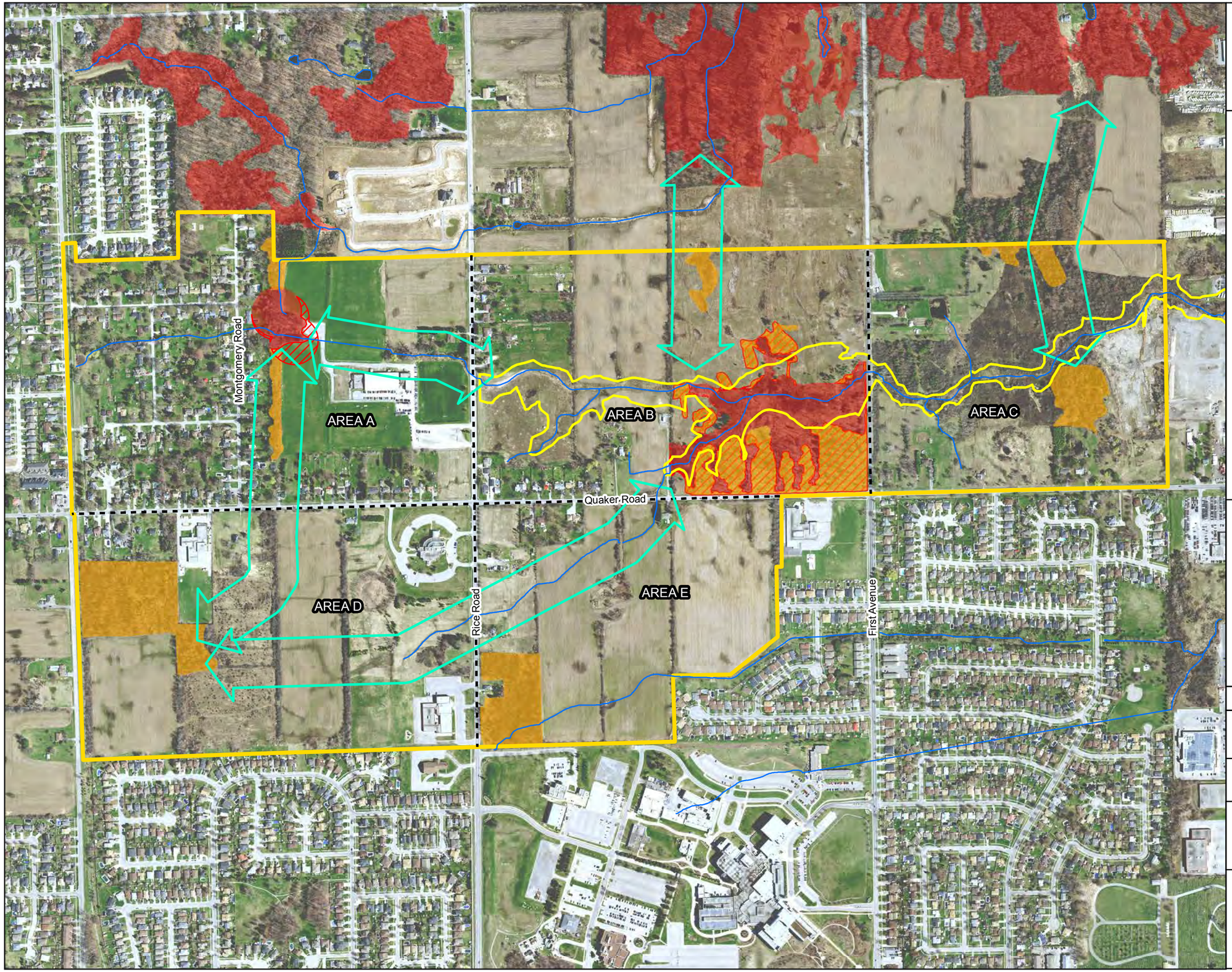
Connections between natural features on the landscape are important for the movement of wildlife and the maintenance of genetic diversity in both plant and wildlife populations (as dispersal of seeds, pollen, and animals becomes restricted when habitat patches are isolated by development or other barriers). The City of Welland OP indicates an intention to employ an ecosystem approach in planning decisions, addressing "the health and integrity of the broader landscape, including impacts on the natural environment in neighbouring jurisdictions" and "the long term and cumulative impacts on the ecosystem". The maintenance or restoration of linkages and corridors, both within the study area and between the study area and adjacent lands, would support this stated goal of the OP.

Natural Heritage Corridors, a component of the City's NHS, are defined by the OP as "natural and open space linkages between the Core Natural Areas" (Core Natural Areas being those designated Environmental Protection Area and Environmental Conservation Area), and include "naturally vegetated stream corridors, valleylands, shorelines, woodlands, wetlands, natural vegetation communities, and other features which provide linkages".

Areas that meet the criteria for Environmental Protection Areas and Environmental Conservation Areas in the study area are, as illustrated on **Figure 7-4**, largely disjunct from each other and often only connected via agricultural fields (which do not pose a significant barrier to wildlife movement but also do not provide abundant cover or food sources). **Figure 7-4** therefore also illustrates potential landscape connections that could be maintained and/or enhanced to promote connectivity and ecological function in the study area. These potential corridors are situated such that they connect Core Natural Areas, overlap or incorporate other existing features (e.g., small wetlands, hedgerows, drainage features) as much as possible, and allow for shortest-distance connections between features that might otherwise become isolated on the landscape should development or land-use alteration occur. They also allow for connectivity between the study area and significant features outside of the study area (e.g., significant wetlands to the north), although it is recognized that maintenance of connective features outside of the City of Welland cannot be ensured.

A corridor width of 40-50 m is thought to allow for amphibian dispersal and movement from breeding sites (Coster, Veysey Powell, & Babbitt, 2014), and a width of 15-60 m has also been also noted to provide adequate habitat for species using corridors as a travel lane or for food, nesting, or escape cover (Indiana Division of Fish & Wildlife, 2004). Environment Canada stated that "corridors designed to facilitate species movement should be a minimum of 50 to 100 metres in width" in their 2013 document "How Much Habitat is Enough?". Aquafor Beech Limited therefore suggests that a minimum corridor width of 50 m should be considered where Natural Heritage Corridors are to be established in the study area, with the understanding that a wider corridor would not only maintain connectivity but allow the corridor to provide habitat in and of itself.

For the purposes of the Welland Northwest Area Secondary Plan, establishment of a corridor may not necessarily be incompatible with development. Land uses such as parks or stormwater management blocks may include naturalized features and vegetated areas that promote landscape connectivity. Even low-density residential use over a short distance may not necessarily constitute a barrier to wildlife movement, seed dispersal, and other valued functions, especially if those residential lots are encouraged to include landscaping with native species. It would be the responsibility of site-level environmental assessments to review proposed land uses/developments and determine their potential impacts on landscape connectivity.



Legend

- Watercourse (NPCA)
- Vegetation Survey Area Divisions
- Environmental Protection Area
- *Potential Environmental Protection Area
- Environmental Conservation Area
- Potential Corridor
- NPCA Advisory Floodplain
- Secondary Plan Boundary

(*) NOTE: Pending Further Assessment

N

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Figure 7.4

Potential Landscape Connections

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.2 0.4
Kilometers

N

The following sections provide additional discussion of study area connectivity, broken down for ease of reference into the five survey areas (A through E) used previously in this report.

7.4.1 Area A

The forest communities located in the northwest corner of the study area (ELC Polygons A1 and A3) are directly connected to natural areas just north of the Welland municipal boundary, in the Town of Pelham. The Town of Pelham's Official Plan indicates that this area is associated with the Kunda Park Forest Life Science ANSI (candidate/regionally significant) and additional portions of the Niagara Street-Cataract Road Wetland Complex PSW. The area is also known to provide deer wintering areas (a SWH type) (Town of Pelham, 2014). There is currently excellent connectivity between the study area woodlands and these habitats to the north. The current land use planning in the Town of Pelham indicates that the associated natural heritage areas within their boundary will be preserved.

Connectivity between this area and additional vegetation communities to the south (e.g., polygons D1-D2) is currently provided by Polygon A2, the narrow, linear feature that follows the rear boundary of residential lots fronting on Montgomery Road. The establishment of a vegetated buffer along the east side of this feature, including naturalization plantings, would greatly increase the utility of this connection. While the corridor provided by A2 is somewhat discontinuous from the natural areas in Area D to the south (it is interrupted by Quaker Road and the associated residential properties), it still provides a valuable connection by vastly decreasing the open space that would otherwise exist between core natural areas to the north (A1 and beyond) and south (D1 and D2).

Connections from the woodlands in the northwest corner of the study area to other natural areas to the east via the watercourse corridors are currently minimal since there is little riparian vegetation present. There is the potential to reinstate the section of the drainage corridor that is currently buried beneath the sports fields, thus restoring the natural east-west connection. Provision of buffers around watercourses may further improve this connectivity in the future.

7.4.2 Area B

The portion of the Niagara Street-Cataract Road Wetland Complex PSW which is found within the study area is currently separated from additional portions of this PSW approximately 300 m to the north (in the Town of Pelham) by a mosaic of agricultural fields, small wetland pockets, and potential headwater drainage features. This current land use is unlikely to prove a significant barrier to animal movement between the two natural areas.

The establishment of a vegetated corridor between these two disjunct areas of wetland would provide additional cover and food sources for migrating wildlife, and allow for the dispersal of species to ensure that wildlife populations in the two areas do not become isolated. A corridor at this location would ideally incorporate the small wetlands found scattered throughout the agricultural fields in this area, and also the contiguous north-south hedgerow (BH2) as this feature was noted to contain wetland features, vernal pools, and high-quality woodland remnants.

The current land use plan of the City of Thorold provides for the protection of the PSW north of the study area. There is currently a narrow strip of agricultural land between that wetland and the north boundary of the City of Welland which may be subject to future development (as it is slated for low-density residential use per the Port Robinson West Neighbourhood Structure Plan, included in the City

of Thorold OP); however, that is not within the scope nor control of this study, and the degree to which potential future development in the City of Thorold may act as a barrier is unknown.

7.4.3 Area C

The identified vegetation communities in Area C currently have good connectivity with additional natural areas to the north in the City of Thorold. The current land use plan of the City of Thorold indicates that the associated natural heritage areas within their boundary will be preserved.

The majority of vegetated area identified in Area C consists of a buckthorn thicket. Buckthorn is a non-native, invasive, and densely-growing shrub species that can suppress the growth of native vegetation and is not known to provide high quality wildlife habitat. The existing thicket is therefore not considered to provide a natural heritage corridor function.

7.4.4 Area D

In association with polygon A2 (as discussed above), the northern portions of polygon D3 and hedgerow DH3 should be maintained and improved to provide a linkage between the habitat in polygons D1 and D2 (which includes a provincially rare Bur Oak deciduous swamp community) and other natural areas to the north in Area A. The connection would be interrupted by Quaker Road.

Connectivity to the east may be maintained by providing a corridor between polygon D3 and the drainage feature that passes beneath Rice Road. Aerial photo interpretation suggests that the land included in this potential corridor may include HDFs.

There is limited connectivity between natural habitat in Area D and lands to the south or west due to existing residential and institutional developments.

7.4.5 Area E

Natural heritage features in Area E are limited. Although the woodland in this area (ELC polygon E1) is largely isolated at present, some wildlife likely moves across the agricultural fields that compose most of the rest of Area E; if/when these fields are developed, the associated wildlife movement area will be lost. Maintaining a connection between the existing woodlot and the drainage feature to the north would help sustain wildlife movement between this area and the PSW to the northeast, north of Quaker Road (assuming that the drainage feature is retained following future assessment of hydrologic features in the study area).

7.5 Opportunities for Improvement

The City of Welland's OP includes a target of "30% of the land area in Welland in forest cover or wetland, with at least 10% of each subwatershed in wetland". Per the Central Welland River Subwatershed Plan (NPCA, 2010), the Tow Path Drain subwatershed falls short of this goal, with only 6% wetland habitat and 20 % "upland" habitat (which includes woodland, prairie, and meadow). Although this Plan was published in 2010, due to development pressures in the area it is considered unlikely that the total natural cover in the subwatershed would have improved significantly since then. Identifying opportunities for preservation of wetlands, enhancement of linkages and buffers, and creation of habitat (especially in areas where new habitat would provide valuable buffering or connectivity functions) were therefore considered a priority of this study in order to meet the stated targets.

Opportunities for the improvement of connections and corridors in the study area were previously discussed in **Section 7.4**. Naturalized corridors would contribute to the overall natural cover in the study area and the subwatershed as a whole.

The woodlands located in the northwest corner of the study area provide another good opportunity for enhancement. This area is associated with SAR habitat and Significant Wildlife Habitat (due to the presence of a rare vegetation community), but is bordered by a sports field and contains numerous non-native species, including Common Buckthorn, European Euonymus (*Euonymus europaea*), and Tartarian Honeysuckle (*Lonicera tatarica*), which can form dense shrub cover and potentially shade out native species. Actions to improve this area could include:

- Naturalization of SAR habitat areas that are currently associated with the sports field using native vegetation (using the adjacent existing habitat as a template for appropriate species). This would both create new natural cover (potentially providing additional SAR habitat in future) and reduce edge pressure on the existing habitat that supports SAR.

- Management of non-native species and enhancement of buffers via native species planting. Improving the condition of the existing woodland may also increase the habitat and dispersal potential of native species, including the SAR plants.

Management of invasive buckthorn would help improve any natural areas to be retained/enhanced in Area C, particularly, as this part of the study area is currently associated with a large, dense buckthorn thicket. Buckthorn management would lessen the pressure of buckthorn growth on the native plant communities in the area, including several pockets of forest and swamp habitat.

Measures to improve water quality and fish habitat (direct or indirect) could be considered in all areas where watercourses occur. Establishing vegetated buffers around drainage features by planting with native species and allowing those buffers to naturalize would improve riparian habitat greatly in areas where the current channel is bordered closely by cultivated agricultural fields.

8 Recommendations for Future Studies

8.1 Environmental Impact Studies

As originally noted in **Section 3.2**, the City of Welland OP requires an EIS to accompany development applications on lands adjacent to components of the NHS:

- Provincially Significant Wetland - All lands within 120 metres.
- Habitat of Threatened and Endangered Species - All lands within 50 metres.
- Environmental Conservation Area - All lands within 50 metres.
- Fish Habitat - All lands within 30 metres of the top of bank.

Please refer back to **Section 3.2** and to the City of Welland OP for further details on EIS requirements and related policies. Following is a summary of the site-specific considerations which may need to be addressed by a future EIS.

Site Access

Properties for which access was not permitted during this study were characterized from secondary sources and observations made from property boundaries. These areas should be subject to a detailed study to confirm existing conditions and constraints prior to any development.

SAR, SOCC, and SWH

Information on and status of SAR are constantly being updated. At a minimum, an EIS for future development proposals will need to update the SAR assessment and screening to account for new data and relisting of species.

This report also listed potential rare and at-risk species and potential significant habitat types that were not able to be confirmed by this study and/or that could conceivably occur in the study area in future. Depending on the proposed development and the habitat types/areas affected, it may be appropriate to complete additional targeted field surveys to confirm the presence or absence of species of concern and/or significant habitats.

Any site-specific EIS prepared for the study area or a portion thereof should include detailed floral inventories to confirm the presence/absence of Butternut and other rare/at-risk plants in proposed vegetation removal areas. In addition, a Butternut Health Assessment for any Butternut that may be harmed or removed due to the proposed work should be completed in keeping with MNRF requirements. Proposed tree removals should also be reviewed to identify potential SAR bat habitat (e.g., bats).

For any buildings that are to be demolished to accommodate new development, the site-specific EIS must address the potential for these structures to provide habitat for SAR (e.g., Barn Swallow, Chimney Swift, bats), and provide all appropriate mitigation/protection/compensation measures in keeping with the current SAR legislation. Potential SWH (e.g., snake hibernacula) associated with buildings and other anthropogenic structures such as old foundations and stone fences should also be assessed.

It is recommended that the MNRF be consulted throughout subsequent planning stages to avoid any unforeseen concerns regarding SAR. At the detailed design stage, an Information Gathering Form (IGF) should be completed and submitted to the MNRF for review for any Endangered and Threatened

species confirmed or potentially present within the study area.

Buffers

Buffers should be established adjacent to natural areas/features as appropriate to ensure that adjacent land use changes or developments do not negatively impact the features and functions of those natural areas/features. Buffers should be based on the most recent literature on appropriate protection distances for natural heritage features and functions.

Tree Savings Plan

Per the City of Welland OP, where a woodland greater than 0.5 hectares in size is located on, or adjacent to, lands that are the subject of an application for a plan of subdivision, a consent, site plan approval, or a development permit, a Tree Saving Plan must be prepared and approved by the City. If an EIS has been approved for the development, the Tree Saving Plan shall be in accordance with the recommendations of the EIS.

Long-term Use Considerations

For developments proposed adjacent to the NHS and associated buffers, the site-specific EIS should address not only the direct impacts of the development (i.e., changes within the area of land developed) but the long-term predicted impacts associated with the future land use (e.g., spread of non-native garden plants, presence of roaming pets, increased presence of urban "pests" such as Raccoons, dumping of yard waste over property lines, use of salt on roads and sidewalks, creation of unofficial trails in natural areas, etc.).

Developments should preferably incorporate "green" technologies, wildlife-friendly features, and parklands to allow for greater integration with the natural environment. For example, native wildflowers, (especially milkweed species which would support Monarch) could be included in seeding plans, and landscaped areas or neighbourhood parks could include 'Butterfly Gardens' to provide both aesthetic interest and wildlife habitat.

8.2 Hydrologic Investigations

As previously noted, identification and assessment of HDFs should be completed according to the protocol described in the "Evaluation, Classification, and Management of Headwater Drainage Features: Interim Guidelines" (CVC & TRCA, 2014). The assessment should identify hydrologic features that provide a key function within the study area (e.g., indirect fish habitat, support for significant wetlands) and provide suitable management recommendations for all identified features. The assessment should also confirm the status of existing mapped watercourses as provided by NPCA (i.e., determine whether the indicated features are watercourses or would more appropriately be assessed under the HDF protocol).

9 References

Bickerton, H., & Thompson-Black, M. (2010). *Recovery Strategy for the Eastern Flowering Dogwood (Cornus florida) in Ontario. Ontario Recovery Strategy Series.*

Bird Studies Canada. (2009). *Marsh Monitoring Program Participant's Handbook for Surveying Amphibians, 2009 Edition.* Bird Studies Canada in cooperation with Environment Canada and the US Environmental Protection Agency.

Bird Studies Canada et al. (2001). *Ontario Breeding Bird Atlas Guide For Participants.*

City of London. (2004). *Environmental Management Guidelines, Chapter 5: Guidelines for Determining Setbacks and Ecological Buffers.*

COSEWIC. (2017). *COSEWIC Assessment and Status Report on the Butternut Juglans cinerea in Canada.*

Coster, S., Veysey Powell, J., & Babbitt, K. (2014). Characterizing the width of amphibian movements during postbreeding migration. *Conservation Biology, 28*(3), 756-762.

CVC & TRCA. (2014). Evaluation, Classification, and Management of Headwater Drainage Features Guideline. Toronto, Ontario, Canada.

Dillon Consulting Limited. (2017). *The Corporation of the City of Welland Official Plan.*

Earth Tech Canada. (2003). *Northwest Area Planning and Servicing Review Class Environmental Assessment - Environmental Impact Study.*

Earth Tech Canada. (2008). *City of Welland Northwest Area Planning and Servicing Study Municipal Class Environmental Assessment.*

Ecologistics Limited. (1996). *Draft Lot 228, Cities of Welland and Thorold Environmental Review.*

Environment and Climate Change Canada. (2016). *Management Plan for the Monarch (Danaus plexippus) in Canada.*

Environment and Climate Change Canada. (2018). *Recovery Strategy for the White Wood Aster (Eurybia divaricata) in Canada.*

Environment Canada. (2010). *Recovery Strategy for the Butternut (Juglas cinerea) in Canada.*

Environment Canada. (2013). *How Much Habitat is Enough? Third Edition.* Toronto, Ontario: Environment Canada.

Environment Canada. (2015). *Management Plan for the Rusty Blackbird (Euphagus carolinus) in Canada.*

Heagy, A., Badzinski, D., Bradley, M., Falconer, M., McCracken, J., Reid, R., & Richardson, K. (2014). *Recovery Strategy for the Barn Swallow (Hirundo rustica) in Ontario. Ontario Recovery Strategy Series.*

Indiana Division of Fish & Wildlife. (2004). *Habitat Managmenet Fact Sheet - Wildlife Corridors.*

Jones, C., Somers, K. M., Craig, B., & Reynoldson, T. B. (2007). *Ontario Benthos Biomonitoring Network: Protocol Manual.* Toronto: Queen's Printer for Ontario.

Lee, H., Bakowsky, W., Riley, J., Bowles, J., Puddister, M., Uhlig, P., & McMurray, S. (1998). *Ecological Land Classification for Southern Ontario, First Approximation and its Application.* North Bay, Ontario: Ontario Ministry of Natural Resources.

MNRF. (2010). *Niagara Street – Cataract Road Wetland Complex Wetland Evaluation Report.*

MNRF. (2013). *General Habitat Description for the Barn Swallow (Hirundo rustica).*

MNRF. (2015). *Significant Wildlife Habitat Criteria Schedule for Ecoregion 7E.*

Niagara Region. (2014). *Regional Official Plan.*

NPCA. (2010). *Central Welland River Watershed Plan.*

NPCA. (2010). *Natural Areas Inventory, 2006-2009.* Welland: NPCA.

NPCA. (2011). *Policies, Procedures, and Guidelines for the Administration of Ontario Regulation 155/06 and Land Use Planning Policy Document.*

Oldham, M. J. (2010). Checklist of the Vascular Plants of Niagara Regional Municipality, Ontario. In NPCA, *Natural Areas Inventory, 2006-2009.* Welland: NPCA.

Ontario Ministry of Municipal Affairs and Housing. (2014). *Provincial Policy Statement.*

Ontario Ministry of Municipal Affairs and Housing. (2017). *Growth Plan for the Greater Golden Horseshoe.*

Ontario Ministry of Natural Resources. (2010). *Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, Second Edition.* Toronto: Queen's Printer for Ontario.

Poisson, G., & Ursic, M. (2013). *Recovery Strategy for the Butternut (Juglans cinerea) in Ontario. Ontario Recovery Strategy Series.*

Stanfield, L. (2017). *OSAP Version 10.*

Town of Pelham. (2014). *Town of Pelham Official Plan.*

Appendix A – Aquatic Habitat Assessment Data

Site Identification

Stream Code	Site Code	Sample	Date (yyyy-mm-dd)
TDR	TDR1	01	2018-05-18

Stream Name: TOWPATHDRAIN

Alternate Site Code: —

Site Length (m): 40.0

*** Record using NAD83 datum	Zone	Easting	Northing
Uncorr. UTM	17	642373.0	4765162.0
Corr. UTM	1	.	.

OR → Lat. / Long. — DD MM SS.sss

Source of Uncorrected UTM Coordinates: GPS/DGPS [X] GIS [ ] OBM [ ] Other

Source of Corrected UTM Coordinates: FWIS [ ] Ortho-photos [ ] GIS [ ] Other

Name of Layer Used for Correction

Access Route

PARK AT BERTIE + CLINTON MUTUAL INSURANCE, 1003 NIAGARA ST, WELLAND.
WALK TO WATERCOURSE, N. OF PARKING LOT

Site Description

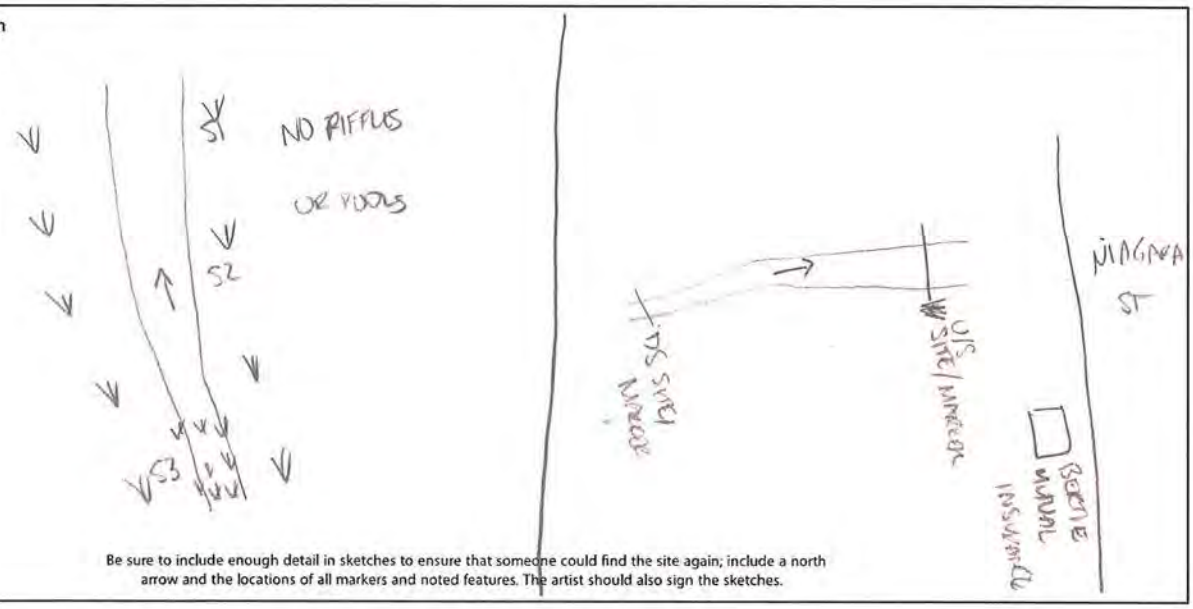
DS END IS ~15 m US OF CULVERT

23
17

[ ] Site Was Unsampleable - add reason(s) on reverse

Sketches

Site/Access Route Sketch



Be sure to include enough detail in sketches to ensure that someone could find the site again; include a north arrow and the locations of all markers and noted features. The artist should also sign the sketches.

Comments

TRANSECTS = 20
TRANSECT SPACING = 2.1 m
MIN WIDTH = <1.0 m
ONLY 9 TRANSECTS CONTAINED FLOW FOR FISH + CHANNEL MORPH

Crew Leader (init. & last name)	Crew	Recorder	Entered	Verified	Corrected
L KARLEWICZ	G. EBY	LK			

Site Marker Details

UPSTREAM SITE MARKER
(measure from stake to site)

Bearing (D): 0

Distance (m): 1.0

Description:

DOWNSTREAM SITE MARKER
(measure from stake to site)

Bearing (D): 0

Distance (m): 1.0

Description:

ADDITIONAL SITE MARKER
(measure from stake to site)

Bearing (D):

Distance (m):

Description:

Photos

	Photo No.	Photo Name	Photo Description
Upstream			
Upstream	1		
Downstream	2		
Downstream			
Upstream	3		
Downstream	4		
Other Features			

Site is Unsampleable Reason(s)

- ☐ Stream dry
- ☐ Insufficient water to sample effectively
- ☐ Stream is no longer present at location (tiled or relocated, etc)
- ☐ Naturally unwadeable (i.e. > 1.5 m deep)
- ☐ Unwadeable due to ponding from a permanent barrier
- ☐ Unwadeable due to ponding from temporary barrier (eg. beaver dam)
- ☐ Landowner could not be contacted
- ☐ Landowner refused access
- ☐ Inaccessible for safety reasons (add details in comments below)
- ☐ Stream is wadeable but not appropriate for the intended sampling

What is the permanent barrier?

What is the temporary barrier?

Modules to have been used (e.g. S2.M1, S3.M1):

Comments

Site Features

Mandatory Fields In Grey
Must be filled out for processing

Stream Code: TDR

Site Code: TD81

Sample: 01

Date (mm-dd): 2018 05-18

Stream Name: TOWPATH DRAIN

For each landuse, check box that applies. Be sure to include comments explaining the particulars, including names and numbers of contacts

Site Features	Ongoing & Active	Historical Evidence	No Evidence but Reported	No Evidence	Unknown	Comments
Potential Point or Non-point Source Contaminant Sources	☒	☐	☐	☐	☐	INDUSTRIAL PROP. ADJACENT
Major Nutrient Sources Upstream	☒	☐	☐	☐	☐	AG.
Channel Hardening or Straightening	☒	☐	☐	☐	☐	DRAIN
Adjacent Landuses that Destabilize Banks	☐	☐	☐	☒	☐	
Sediment Loading or Deprivation	☐	☐	☐	☒	☐	
Instream Habitat Modifications	☐	☐	☐	☒	☐	
Barriers and/or Dams in the Vicinity of the Site	☐	☐	☐	☒	☐	
High Fishing Pressure	☐	☐	☐	☒	☐	
Log Jam Deflectors	☐	☐	☐	☒	☐	
Springs or Seeps at the Site	☐	☐	☐	☒	☐	
Impervious Substrate Limiting Burrowing Depth of Fish	☐	☐	☐	☒	☐	
Fish Stocked Near Sample Site	☐	☐	☐	☒	☐	
Other Activities that Could Influence Biota or Habitat	☐	☐	☐	☒	☐	
Intensive Logging Activities within the Riparian Zone	☐	☐	☐	☒	☐	

Sources of Information
Visual Immediate ☒ Visual Extended ☒ Interview ☐ Maps & Photos ☐

Temperatures
Time (24hr): ___:___ Air Temp (°C): ____
Water Temp (°C): ____ Max Air Temp (°C): ____
Max. Water Temp (°C): ____ Source of Max. Air Temp: ____

Riparian Vegetation Community
Only check one box for each bank and zone.

Dominant Vegetation Type

Riparian Zone	Left Bank None	Left Bank Lawn	Left Bank Crop-land	Left Bank Mea-dow	Left Bank Scrub-land	Left Bank Forest	Left Bank Wet-lands	Right Bank None	Right Bank Lawn	Right Bank Crop-land	Right Bank Mea-dow	Right Bank Scrub-land	Right Bank Forest	Right Bank Wet-lands
1.5-10m	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
10-30m	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐
30-100m	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐	☐

Comments

Crew Leader (initial & last name): L KARLEWICZ

Crew Initials: G.EBY

Recorder: L.K

Ent/Scanned: ____ Verified: ____ Corrected: ____

Benthic Survey Sheet

Mandatory Fields in Grey
Must be filled out for processing

Stream Code: TDR1
Site Code: TDR1
Sample: 01
Date (mm-dd): 2018 05 18
Time (24hr): 08:00

Stream Name: TOWPATH DRAIN

NOTE:
For all measurements, right and left banks defined facing upstream.

Water Quality

Water Temp (°C): 12.8
Conductivity (uS/cm): 777
pH: 7.5
DO (mg/L): 6.4.5
Alkalinity (mg/L as CaCO3): ___

Substrate

Enter dominant substrate class and second dominant class for each sub-sample.

	Collect. Area 1	Collect. Area 2	Collect. Area 3
Dominant	1	1	1
2nd Dominant	2	2	2

Class	Description
1	Clay (hard pan)
2	Silt (floury, <0.06 mm particle diameter)
3	Sand (grainy, 0.06 - 2mm)
4	Gravel (2 - 65 mm)
5	Cobble (65 - 250 mm)
6	Boulder (>250 mm)
7	Bed Rock

Bankfull Width (m): ___.___

ON CHANNEL MORPH

Gear Type
- [ ] Poled Seine
- [ ] Ponar
- [x] D-Net
- [ ] Ekman
- [ ] Surber
- [ ] Other

Mesh Size (microns)
- [ ] 250
- [ ] 600
- [x] 500
- [ ] 1000

(Select the box that most closely represents the mesh size used.)

% Canopy Cover
- [x] 0 - 24
- [ ] 50 - 74
- [ ] 25 - 49
- [ ] 75 - 100

If instrument used, record type:

River Characterization
- [ ] Perennial
- [ ] Intermittent
- [x] Unknown

Candidate Reference Site? (ie. minimally impacted)
- [ ] Yes
- [x] No

Comments

Crew Leader (initial & last name): L KAKLANIEC

Aquatic Macrophytes & Algae

Enter appropriate abundance class for each type and sub-sample.

Macrophytes	Collect. Area 1	Collect. Area 2	Collect. Area 3
Emergent	1	1	2
Rooted Floating	0	0	0
Submergent	1	1	0
Free Floating	0	0	0

Algae	Collect. Area 1	Collect. Area 2	Collect. Area 3
Floating Algae	0	0	0
Filamentous	0	0	0
Attached Algae	1	1	1

Class	Description
0	Absent
1	Present
2	Abundant

Riparian Vegetation Community

Only check one box for each bank and zone.

Dominant Vegetation Type

Riparian Zone	Left Bank: None	Lawn	Crop-land	Mea-dow	Scrub-land	Forest	Wet-lands	Right Bank: None	Lawn	Crop-land	Mea-dow	Scrub-land	Forest	Wet-lands
1.5-10m	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
10-30m	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐
30-100m	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐	☐

ND R368

	Pool or Riffle (P/R)	Sampling Dist (m)	Sampling Time (min : sec)	Max. Depth (mm)	Hydraulic Head (mm)	Wetted Width (m)	Grab/ Area
Collection Area 1:	/	2.0	3:00	90	0	1.6	
Collection Area 2:	/	2.0	3:00	200	0	3.8	
Collection Area 3:	/	2.0	3:00	210	0	4.1	

Enter a P or an R to indicate whether the collection was a riffle or pool.

1, 2, or 3 grabs can be collected within each collection area.

Pebble sizes (mm) use sizes from table 1

Crew Names: G.BSY

Recorder Init.	Entered	Verified	Corrected
LK			

L 1
R

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Stream Name: TOWPATH DRAIN

Date (mm-dd): 2018-06-20

Stream Code: TDR

Site Code: TDR1

Sample: 01

Transect No.: 01 of 20

Bearing (D): 251

Min. Width (m): <1.0

Site Length (m): 40.0

Active Channel Width (m): 0.15

No. of Transects: 20

Transect Spacing (m): 2.10

Point Spacing (m): .075

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No.Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm) (Measure depth & hydraulic head to nearest 5 mm)	Hydraulic Head (mm)	Particle Sizes (mm) Point	Particle Sizes (mm) Max. in Ring	Cover: Unmeasurable	Cover: Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	1.04	50	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	1.11	60	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
3	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

	> 2 m	0 mm	250 mm	750 mm	1500 mm	Amount of Undercut (mm)	No. of Veg. Squares on Bank
Left Bank Height	☐	15	90	70	0		
Left Bank Substrate Diameters		0.01	0.01	0.01	0.01		
Right Bank Height	☐	220	200	150	0		
Right Bank Substrate Diameters		0.01	0.01	0.01	0.05		

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Cropland	Meadow	Scrubland	Forest	Wetland
Left Bank	☒	☐	☐	☐	☐	☐	☐
Right Bank	☐	☐	☐	☒	☐	☐	☐

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments

Crew Leader (initial & last name): L KARLEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
G.OBY	GE			

L 0.13
R 0.4

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Date (mm-dd): 2018-06-20

Stream Name: TOWPATH DRAIN

Stream Code: TDR

Site Code: TDR1

Sample: 01 | Transect No.: 02 of 20 | Bearing (D): 260

Min. Width (m): <1.0 | Site Length (m): 40.0 | Active Channel Width (m): 0.3

No. of Transects: 20 | Transect Spacing (m): 2.10 | Point Spacing (m): 0.15

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No.Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm)	Hydraulic Head (mm)	Particle Sizes (mm) Point	Particle Sizes (mm) Max. in Ring	Cover: Unmeasurable	Cover: Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.21	65	0	0.01	0.05	☐	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	0.36	35	0	0.01	0.05	☐	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
3	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

		> 2 m	0 mm	250 mm	750 mm	1500 mm	Amount of Undercut (mm)	No. of Veg. Squares on Bank
Left Bank	Height	☐	170	150	140	0		5
	Substrate Diameters		0.01	0.01	0.01	0.01		
Right Bank	Height	☐	180	200	160	0		10
	Substrate Diameters		0.01	0.01	0.01	0.01		

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Cropland	Meadow	Scrubland	Forest	Wetland
Left Bank	☐	☐	☐	☒	☐	☐	☐
Right Bank	☐	☐	☐	☒	☐	☐	☐

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments

Crew Leader (initial & last name): LKARLEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
G.EBY	GE			

L 0.6
R 1.6

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Date (mm-dd): 2018-06-20

Stream Name: TOWDATH DRAIN

Stream Code: TDR

Site Code: TDR1

Sample: 01 | Transect No.: 03 of 20 | Bearing (D): 255

Min. Width (m): <1.0 | Site Length (m): 40.0 | Active Channel Width (m): 1.0

No. of Transects: 20 | Transect Spacing (m): 2.10 | Point Spacing (m): 0.5

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No. Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm)	Hydraulic Head (mm)	Particle Sizes (mm) Point	Particle Sizes (mm) Max. in Ring	Cover: Unmeasurable	Cover: Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.85	70	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
2	1.35	30	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
3	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

	> 2 m	0 mm	250 mm	750 mm	1500 mm	Amount of Undercut (mm)	No. of Veg. Squares on Bank
Left Bank Height	☐	170	100	90	0		8
Left Bank Substrate Diameters		0.01	0.01	0.01	0.01		
Right Bank Height	☐	340	340	280	0		10
Right Bank Substrate Diameters		0.01	0.01	0.05	0.05		

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Cropland	Meadow	Scrubland	Forest	Wetland
Left Bank	☐	☐	☐	☑	☐	☐	☐
Right Bank	☐	☐	☐	☑	☐	☐	☐

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments:

Crew Leader (initial & last name): L KARLEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
G.034	GE			

L O
R 2.2

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Stream Name: TOWDATH DRAIN

Date (mm-dd): 2018-06-20

Stream Code: TDR

Site Code: TDR1

Sample: 01 | Transect No.: 01 of 20 | Bearing (D): 257

Min. Width (m): <1.0 | Site Length (m): 40.0 | Active Channel Width (m): 2.2

No. of Transects: 20 | Transect Spacing (m): 2.10 | Point Spacing (m): 1.1

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No.Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm)	Hydraulic Head (mm)	Point	Max. in Ring	Unmeasurable	Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.55	110	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	1.65	70	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
3	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Measure depth & hydraulic head to nearest 5 mm — Particle Sizes (mm) — Cover — Aquatic Vegetation Types Present

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

	> 2 m	0 mm	250 mm	750 mm	1500 mm	Amount of Undercut (mm)	No. of Veg. Squares on Bank
Left Bank Height	☑	600	570	480	0		6
Left Bank Substrate Diameters		0.01	0.01	0.01	0.05		
Right Bank Height	☑	620	580	300	0		18
Right Bank Substrate Diameters		0.01	0.01	0.05	0.05		

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Crop-land	Mea-dow	Scrub-land	Forest	Wet-land
Left Bank	☐	☐	☐	☐	☒	☐	☐
Right Bank	☐	☐	☐	☒	☐	☐	☐

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments

Crew Leader (initial & last name): L KARLEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
G.EBY	GE			

L 0.1
R 2.2

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Date (mm-dd): 2018-06-20

Stream Name: TOWDATH DRAIN

Stream Code: TDR

Site Code: TDR1

Sample: 01 Transect No.: 05 of 20 Bearing (D): 260

Min. Width (m): <1.0 Site Length (m): 40.0 Active Channel Width (m): 2.1

No. of Transects: 20 Transect Spacing (m): 2.10 Point Spacing (m): 1.05

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No.Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm)	Hydraulic Head (mm)	Particle Sizes (mm) Point	Particle Sizes (mm) Max. in Ring	Unmeasurable	Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.63	55	6	0.01	0.05	✓	0										✓			
2	1.68	45	0	0.01	0.05	✓	0										✓			
3	.																			
4	.																			
5	.																			
6	.																			

Measure depth & hydraulic head to nearest 5 mm

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

	> 2 m	0 mm	250 mm	750 mm	1500 mm
Left Bank Height	✓	460	500	350	0
Left Bank Substrate Diameters		0.01	0.01	0.05	0.05
Right Bank Height	✓	350	430	230	0
Right Bank Substrate Diameters		0.01	0.05	0.05	0.05

Amount of Undercut (mm):

No. of Veg. Squares on Bank: 16 / 8

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Crop-land	Mea-dow	Scrub-land	Forest	Wet-land
Left Bank				✓			
Right Bank				✓			

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments

Crew Leader (initial & last name): L KARLEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
G.OBY	GE			

L 0.2
R 1.8

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Stream Name: TOWDATH DRAIN

Date (mm-dd): 2018-06-20

Stream Code: TDR

Site Code: TDR1

Sample: 01 Transect No.: 06 of 20 Bearing (D): 255

Min. Width (m): <1.0 Site Length (m): 40.0 Active Channel Width (m): 1.6

No. of Transects: 20 Transect Spacing (m): 2.10 Point Spacing (m): 0.8

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No.Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm)	Hydraulic Head (mm)	Point	Max. in Ring	Unmeasurable	Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.6	50	0	0.01	0.05	☐	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	1.4	70	0	0.01	0.05	☐	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
3	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Measure depth & hydraulic head to nearest 5 mm — Particle Sizes (mm) — Cover — Aquatic Vegetation Types Present

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

	> 2 m	0 mm	250 mm	750 mm	1500 mm	Amount of Undercut (mm)	No. of Veg. Squares on Bank
Left Bank Height	☐	590	520	400	0		12
Left Bank Substrate Diameters		0.01	0.05	0.05	0.05		
Right Bank Height	☐	600	520	390	0		12
Right Bank Substrate Diameters		0.01	0.01	0.05	0.05		

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Cropland	Meadow	Scrubland	Forest	Wetland
Left Bank	☐	☐	☐	☒	☐	☐	☐
Right Bank	☐	☐	☐	☒	☐	☐	☐

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments

Crew Leader (initial & last name): L KARLEWICK

Crew	Recorder	Ent/Scanned	Verified	Corrected
G. EBY	GE			

L 0.5

R 0.8

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Date (mm-dd): 2018-06-20

Stream Name: TOWDATH DRAIN

Stream Code: TDR

Site Code: TDR1

Sample: 01 Transect No.: 07 of 20 Bearing (D): 257

Min. Width (m): <1.0 Site Length (m): 40.0 Active Channel Width (m): 0.3

No. of Transects: 20 Transect Spacing (m): 2.10 Point Spacing (m): 0.15

Points per Transect: 2

Transect & Point Layout		
Use this table to determine the number of transects & points required, given the minimum stream width.		
Minimum Width (m)	No.Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm) (Measure depth & hydraulic head to nearest 5 mm)	Hydraulic Head (mm)	Particle Sizes (mm) Point	Particle Sizes (mm) Max. in Ring	Unmeasurable	Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.58	30	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	0.73	30	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
3	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	.					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

	> 2 m	0 mm	250 mm	750 mm	1500 mm	Amount of Undercut (mm)	No. of Veg. Squares on Bank
Left Bank Height	☑	390	300	200	0		10
Left Bank Substrate Diameters		0.01	0.01	0.05	0.05		
Right Bank Height	☑	220	300	200	0		8
Right Bank Substrate Diameters		0.01	0.01	0.05	0.05		

Dominant Vegetation Type (Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Crop-land	Mea-dow	Scrub-land	Forest	Wet-land
Left Bank	☐	☐	☐	☒	☐	☐	☐
Right Bank	☐	☐	☐	☒	☐	☐	☐

Table Codes

Particle Sizes: *Measure all particles between 2.00mm and 1000mm*

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments

Crew Leader (initial & last name): L KARLEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
G.Eby	GE			

L 0
R 1.5

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Stream Name: TOWDATH DRAIN

Date (mm-dd): 2018-06-20

Stream Code: TDR

Site Code: TDR1

Sample: 01

Transect No.: 08 of 20

Bearing (D): 261

Min. Width (m): 41.0

Site Length (m): 40.0

Active Channel Width (m): 1.5

No. of Transects: 20

Transect Spacing (m): 2.10

Point Spacing (m): 0.75

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No.Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm)	Hydraulic Head (mm)	Particle Sizes (mm) Point	Particle Sizes (mm) Max. in Ring	Cover: Unmeasurable	Cover: Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.38	35	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	1.13	35	0	0.01	0.05	☑	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
3	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	.					☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

	> 2 m	0 mm	250 mm	750 mm	1500 mm
Left Bank Height	☑	240	230	130	0
Left Bank Substrate Diameters		0.01	0.01	0.01	0.01
Right Bank Height	☑	290	240	200	0
Right Bank Substrate Diameters		0.01	0.01	0.05	0.05

Amount of Undercut (mm): —

No. of Veg. Squares on Bank: 12

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Crop-land	Meadow	Scrub-land	Forest	Wet-land
Left Bank	☐	☐	☐	☒	☐	☐	☐
Right Bank	☐	☐	☐	☒	☐	☐	☐

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments

Crew Leader (initial & last name): LKARLEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
GBM	GE			

L 0.4
R 0.95

Channel Morphology

Mandatory Fields In Grey
Must be filled out for processing

Stream Name: TOWPATH DRAIN

Date (mm-dd): 2018-06-20

Stream Code: TDR

Site Code: TDR1

Sample: 01 | Transect No.: 09 of 20 | Bearing (D): 260

Min. Width (m): 11.0 | Site Length (m): 40.0 | Active Channel Width (m): 0.55

No. of Transects: 20 | Transect Spacing (m): 2.10 | Point Spacing (m): 0.28

Points per Transect: 2

Transect & Point Layout

Use this table to determine the number of transects & points required, given the minimum stream width.

Minimum Width (m)	No. Transects at Site	Points per Transect
> 3.0	10	6
1.5 - 3.0	12	5
1.0 - 1.49	15	3
< 1.0	20	2

Calculations:

Transect Spacing = Site Length / (No. of Transects - 1)

Point Spacing = Active Channel Width / Points per Transect

1st Point = Point Spacing / 2 (from left bank)

Point No.	Location (m)	Depth (mm) (Measure depth & hydraulic head to nearest 5 mm)	Hydraulic Head (mm)	Particle Sizes (mm) Point	Particle Sizes (mm) Max. in Ring	Cover: Unmeasurable	Cover: Quality	Wood	Round Rock	Flat Rock	Macrophyte	Bank	Other	FL	AL	SS	MC	WC	GR	TR
1	0.54	20	0	0.01	0.05	✓	0										X			
2	0.82	30	0	0.01	0.05	✓	0										X			
3	.																			
4	.																			
5	.																			
6	.																			

Bank Angle & Particle Median Diameters
(Bank to tape height; if a height is >2m use check box, else enter values in proper observation points)

		> 2 m	0 mm	250 mm	750 mm	1500 mm	Amount of Undercut (mm)	No. of Veg. Squares on Bank
Left Bank	Height	✓	260	220	170	0		4
	Substrate Diameters		0.01	0.01	0.01	0.05		
Right Bank	Height	✓	230	210	160	0		10
	Substrate Diameters		0.01	0.01	0.05	0.05		

Dominant Vegetation Type
(Check box of the dominant type within the 1 x 2 m area)

	None	Lawn	Crop-land	Meadow	Scrub-land	Forest	Wet-land
Left Bank				X			
Right Bank				X			

Table Codes

Particle Sizes:
Measure all particles between 2.00mm and 1000mm

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Cover Quality:
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Aquatic Vegetation Types:
FL = Filamentous Algae
AL = Non-Filamentous
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Comments:

Crew Leader (initial & last name): L KARCEWICZ

Crew	Recorder	Ent/Scanned	Verified	Corrected
GLBM	GE			

Fish Sampling

Mandatory Fields In Grey
Must be filled out for processing

Stream Name: TOWPATH DRAIN

Date (yyyy-mm-dd): 2018-05-18

Stream Code: TDR

Site Code: TDR1

Sample: 01 Run No.: 01 of 01

Science Collect. No.: 1089829

Start Time (24hr): 08:00

Stop Time (24hr): 08:05

Elapsed Min.: 5

Shocker Sec.: 335

Model No.: HT2000

Anod. Voltage: 1150

Frequency: 80

Pulse: DC

Channel Morphology Available? [X] Yes [ ] No

If no, measure the stream length surveyed and 10 wetted widths.

Length (m): 40.0

Widths (m)

1		•		6		•	
2		•		7		•	
3		•		8		•	
4		•		9		•	
5		•		10		•	

Deviations *(Check all that apply)*

- [ ] Inexperienced Sampler
- [ ] Upstream Blocknet Used
- [ ] All Habitats not Sampled
- [ ] Imprecise Weigh Scale

Individual Fish

- [ ] Total Length
- [ ] Fork Length

B = Bulk P = Preserved O = Otolith S = Scale

ID	Species	Length (mm)	Weight (g)	B O	P S	Sp Name/Remarks
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Bulk Fish

Grp #
0 = unsorted or mixed sizes/ages
1 = YOY salmonines with total length < 100mm
2 = salmonines with total length > 100mm

Batch	Species	Grp #	Fish Total	Bulk Weight (g)	Presvd	Bag #	Sp Name/Remarks
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Crew Leader (init. & last name): L KARLEWICZ

Crew: GE3Y

Recorder: GE

Field ID (init. & last name): L KARLEWICZ

Cert. Level:

Lab ID (init. & last name):

Cert. Level:

Entered/Scanned: GE

Verified:

Corrected:

No Catch = 1

Comments: NO FISH

Site Identification

Stream Code	Site Code	Sample	Date (yyyy-mm-dd)
TDR	TDDR2	01	2018-05-18

Stream Name: TOWPATH DRAIN

Alternate Site Code: —

Site Length (m): 44.4

*** Record using NAD83 datum	Zone	Easting	Northing
Uncorr. UTM	17	641790.0	4764995.0
Corr. UTM	1	.	.

OR → Lat. / Long. (DD MM SS.sss): —

Source of Uncorrected UTM Coordinates: GPS/DGPS ☒ GIS ☐ OBM ☐ Other

Source of Corrected UTM Coordinates: FWIS ☐ Ortho-photos ☐ GIS ☐ Other

Name of Layer Used for Correction: —

Access Route

PARK NEAR FIRST AVE / QUAKER RD IN WELLAND.

Site Description

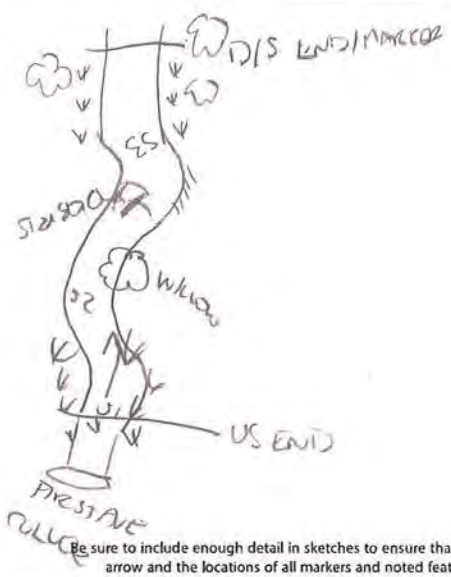
SITE IS JUST U/S OF STREAM CROSSING N. OF INTERSECTION

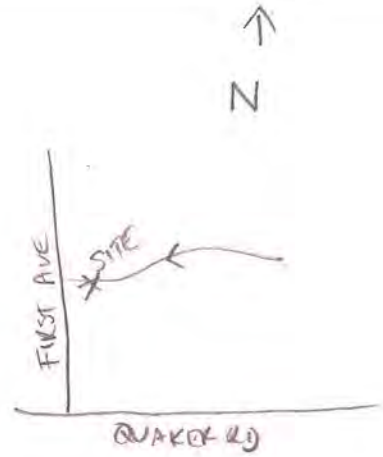
3.3
8.8
4.9
9.6
5.1
12.7

☒ Site Was Unsampleable - add reason(s) on reverse

Sketches

Site/Access Route Sketch





Be sure to include enough detail in sketches to ensure that someone could find the site again; include a north arrow and the locations of all markers and noted features. The artist should also sign the sketches.

Comments

TRANSECTS = DRY DURING FISH + CHANNEL MORPH
TRANSECT SPACING =
MIN WIDTH =

Crew Leader (init. & last name)	Crew	Recorder	Entered	Verified	Corrected
L KARLEWICZ	G. EBY	LK			

Site Marker Details

UPSTREAM SITE MARKER
(measure from stake to site)

Bearing (D) | Distance (m)

Description

DOWNSTREAM SITE MARKER
(measure from stake to site)

Bearing (D) | Distance (m)

Description

ADDITIONAL SITE MARKER
(measure from stake to site)

Bearing (D) | Distance (m)

Description

Photos

	Photo No.	Photo Name	Photo Description
Upstream			
Upstream	1		
Downstream	2		
Downstream			
Upstream	3		
Downstream	4		
Other Features			

Site is Unsampleable Reason(s)

- ☐ Stream dry
- ☐ Insufficient water to sample effectively
- ☐ Stream is no longer present at location (tiled or relocated, etc)
- ☐ Naturally unwadeable (i.e. > 1.5 m deep)
- ☐ Unwadeable due to ponding from a permanent barrier
- ☐ Unwadeable due to ponding from temporary barrier (eg. beaver dam)
- ☐ Landowner could not be contacted
- ☐ Landowner refused access
- ☐ Inaccessible for safety reasons (add details in comments below)
- ☐ Stream is wadeable but not appropriate for the intended sampling

What is the permanent barrier?

What is the temporary barrier?

Modules to have been used (e.g. S2.M1, S3.M1):

Comments

Site Features

Mandatory Fields In Grey
Must be filled out for processing

Stream Code: TLR

Site Code: TDR2

Sample: 01

Date (mm-dd): 2018 05-18

Stream Name: TOWPATH DRAIN

For each landuse, check box that applies. Be sure to include comments explaining the particulars, including names and numbers of contacts

Site Features	Ongoing & Active	Historical Evidence	No Evidence but Reported	No Evidence	Unknown	Comments
Potential Point or Non-point Source Contaminant Sources	☒	☐	☐	☐	☐	ROAD
Major Nutrient Sources Upstream	☒	☐	☐	☐	☐	AG
Channel Hardening or Straightening	☐	☐	☐	☒	☐	
Adjacent Landuses that Destabilize Banks	☐	☐	☐	☒	☐	
Sediment Loading or Deprivation	☐	☐	☐	☒	☐	
Instream Habitat Modifications	☐	☐	☐	☒	☐	
Barriers and/or Dams in the Vicinity of the Site	☐	☐	☐	☒	☐	
High Fishing Pressure	☐	☐	☐	☒	☐	
Log Jam Deflectors	☒	☐	☐	☐	☐	MAJOR
Springs or Seeps at the Site	☐	☐	☐	☒	☐	
Impervious Substrate Limiting Burrowing Depth of Fish	☐	☐	☐	☒	☐	
Fish Stocked Near Sample Site	☐	☐	☐	☒	☐	
Other Activities that Could Influence Biota or Habitat	☐	☐	☐	☒	☐	
Intensive Logging Activities within the Riparian Zone	☐	☐	☐	☒	☐	

Sources of Information
Visual Immediate ☐ Visual Extended ☐ Interview ☐ Maps & Photos ☐

Temperatures
Time (24hr) __:__ Air Temp (°C)
Water Temp (°C) Max Air Temp (°C)
Max. Water Temp (°C) Source of Max. Air Temp

Riparian Vegetation Community
Only check one box for each bank and zone.

Dominant Vegetation Type

Riparian Zone	Left Bank None	Left Bank Lawn	Left Bank Crop-land	Left Bank Mea-dow	Left Bank Scrub-land	Left Bank Forest	Left Bank Wet-lands	Right Bank None	Right Bank Lawn	Right Bank Crop-land	Right Bank Mea-dow	Right Bank Scrub-land	Right Bank Forest	Right Bank Wet-lands
1.5-10m	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐
10-30m	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐
30-100m	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐

Comments

Crew Leader (initial & last name): LKARLEWICZ

Crew Initials: G.EBY

Recorder: LK

Ent/Scanned | Verified | Corrected

Benthic Survey Sheet

Mandatory Fields in Grey
Must be filled out for processing

Stream Code: TDR
Site Code: TDR2
Sample:
Date (mm-dd): 2018 05 18
Time (24hr):

Stream Name: TOWPATH DRAIN

NOTE:
For all measurements, right and left banks defined facing upstream.

Water Quality

Water Temp (°C): 13.4
Conductivity (uS/cm): 858
pH: 7.6
DO (mg/L): 52.3
Alkalinity (mg/L as CaCO3):

Substrate

Enter dominant substrate class and second dominant class for each sub-sample.

	Collect. Area 1	Collect. Area 2	Collect. Area 3
Dominant	1	1	1
2nd Dominant	2	2	2

Class	Description
1	Clay (hard pan)
2	Silt (floury, <0.06 mm particle diameter)
3	Sand (gritty, 0.06 - 2mm)
4	Gravel (2 - 65 mm)
5	Cobble (65 - 250 mm)
6	Boulder (>250 mm)
7	Bed Rock

Aquatic Macrophytes & Algae

Enter appropriate abundance class for each type and sub-sample.

Macrophytes	Collect. Area 1	Collect. Area 2	Collect. Area 3
Emergent	1	1	1
Rooted Floating	0	0	0
Submergent	0	0	0
Free Floating	0	0	0

Algae	Collect. Area 1	Collect. Area 2	Collect. Area 3
Floating Algae	0	0	0
Filamentous	0	0	0
Attached Algae	1	1	1

Class	Description
0	Absent
1	Present
2	Abundant

Riparian Vegetation Community

Only check one box for each bank and zone.

Dominant Vegetation Type

Riparian Zone	Left Bank: None	Lawn	Crop-land	Mea-dow	Scrub-land	Forest	Wet-lands	Right Bank: None	Lawn	Crop-land	Mea-dow	Scrub-land	Forest	Wet-lands
1.5-10m	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐
10-30m	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐
30-100m	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐

Bankfull Width (m):

ON CHANNEL
MORDH
STREETS

Gear Type
☐ Poled Seine ☐ Ponar
☒ D-Net ☐ Ekman
☐ Surber ☐ Other:

Mesh Size (microns)
☐ 250 ☒ 500 ☐ 500 ☐ 1000
(Select the box that most closely represents the mesh size used.)

	Pool or Riffle (P/R)	Sampling Dist. (m)	Sampling Time (min : sec)	Max. Depth (mm)	Hydraulic Head (mm)	Wetted Width (m)	Grabs/ Area
Collection Area 1:	R	2.0	3:00	200	0	3.0	
Collection Area 2:	P	2.0	3:00	250	0	2.5	
Collection Area 3:	R	2.0	3:00	220	0	2.6	

Enter a P or an R to indicate whether the collection was a riffle or pool.

1, 2, or 3 grabs can be collected within each collection area.

% Canopy Cover
☐ 0 - 24 ☒ 50 - 74
☐ 25 - 49 ☐ 75 - 100

If instrument used, record type:

River Characterization
☐ Perennial
☐ Intermittent
☒ Unknown

Candidate Reference Site?
(ie. minimally impacted)
☐ Yes
☐ No

Pebble sizes (mm) use sizes from table 1

Comments

Crew Leader (initial & last name): L KARLEWICZ

Crew Names: G.EKM

Recorder Init.	Entered	Verified	Corrected
LK			

Appendix B – Vegetation Community Assessment Data

Welland
ONTARIO · CANADA

Legend

- Watercourse
- Vegetation Community Boundary
- Secondary Plan Boundary

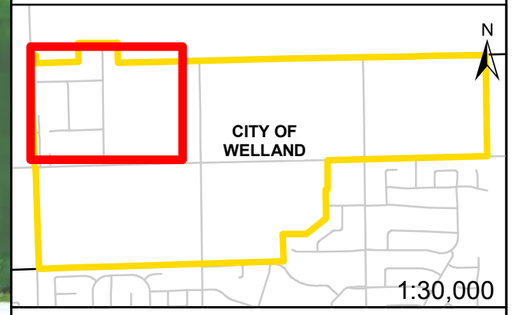


Figure B.1

Ecological Land Classification

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.05 0.1
Kilometers

N

Aquafor Beech Limited

Welland
ONTARIO · CANADA

Legend

- Watercourse
- Vegetation Community Boundary
- Secondary Plan Boundary

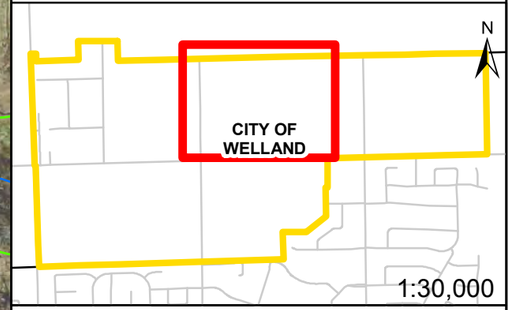


Figure B.2

Ecological Land Classification

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.05 0.1
Kilometers

N

Aquafor Beech Limited

Welland
ONTARIO · CANADA

Legend

- Watercourse
- Vegetation Community Boundary
- Secondary Plan Boundary

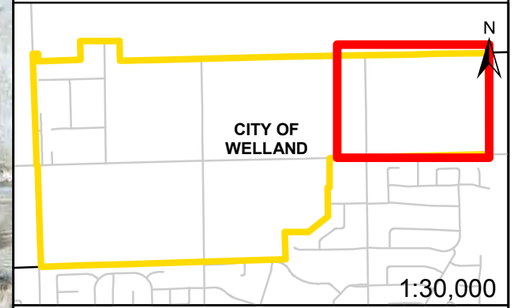


Figure B.3

Ecological Land Classification

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.05 0.1
Kilometers

N

Aquafor Beech Limited

Welland
ONTARIO · CANADA

Legend

- Watercourse
- Vegetation Community Boundary
- Secondary Plan Boundary

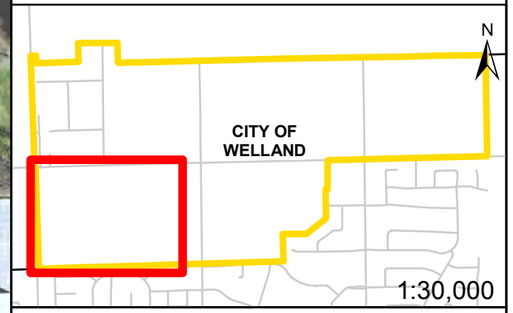


Figure B.4

Ecological Land Classification

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.05 0.1
Kilometers

N

Aquafor Beech Limited

Welland
ONTARIO · CANADA

Legend

- Watercourse
- Vegetation Community Boundary
- Secondary Plan Boundary

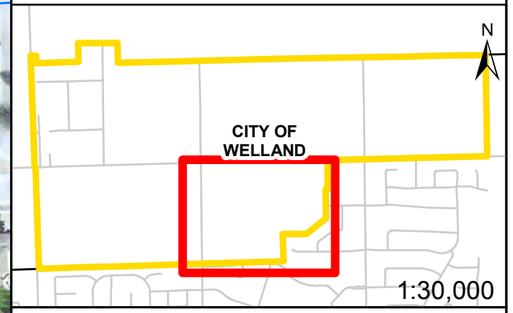


Figure B.5

Ecological Land Classification

Date: January 2019
Projection: NAD83_UTM_Zone_17N
Data Source: Niagara Peninsula Conservation Authority,
City of Welland

0 0.05 0.1
Kilometers

N

Aquafor Beech Limited

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
A1	FOD6-5	Fresh-Moist Sugar Maple-Hardwood Deciduous Forest	GNR	S5	Small woodlot located near the northwest study area limits. Sugar Maple is dominant with a variety of other hardwood species also present: e.g., Basswood (*Tilia americana*), Black Cherry (*Prunus serotina*), Bitternut Hickory (*Carya cordiformis*), Trembling Aspen (*Populus tremuloides*), and Freeman's Maple (*Acer* x *freemanii*). Understory and ground layer species include Alternate-leaved Dogwood (*Cornus alternifolia)*, Poison-ivy (*Rhus radicans*), Garlic Mustard (*Alliaria petiolata*), and Black Walnut (*Juglans nigra*). The soil consists of a 10-15 cm A horizon of silty loam underlain by silt or silty clay; mottles were observed at 20-50 cm with no gley or water table found to a depth of 120 cm. There were multiple significant species observations in this unit: **Butternut** (*Juglans cinerea*), **Eastern Flowering Dogwood** (*Cornus florida*), and **White Wood Aster** (*Eurybia divaricata*). The unit also includes a small, shallow pond, at which multiple incidental wildlife observations were made (e.g., frogs, Racoon and Red Fox tracks). Plant species associated with this feature include Swamp Milkweed (*Asclepias incarnata*), Common Water-plantain (*Alisma plantago-aquatica*), Purple Loosestrife (*Lythrum salicaria*), and Lesser Duckweed (*Lemna minor*).	
A2	FOD7	Fresh-Moist Lowland Deciduous Forest	-	-	A narrow, linear forest community extending south from community A1, bordered by a residential development to the west and a sports field to the east. Anthropogenic disturbance is evident in the vegetation community composition (i.e., non-native species were abundant). Black Walnut, Common Apple (*Malus pumila*), Norway Maple (*Acer platanoides*), Manitoba Maple (*Acer negundo*), and Red Ash (*Fraxinus pennsylvanica*) present in canopy; subcanopy species include hawthorn (*Crataegus* sp.), Common Buckthorn (*Rhamnus cathartica*), Common Privet (*Ligustrum vulgare*), and Multiflora Rose (*Rosa multiflora*). Ground cover includes Garlic Mustard, Bull Thistle (*Cirsium vulgare*), Canada Goldenrod (*Solidago canadensis*), Kentucky Blue Grass (*Poa pratensis*), and Tawny Day-lily (*Hemerocallis fulva*).	
A3	FOD9-5	**Fresh-Moist Bitternut Hickory Deciduous Forest**	GNR	**S3S4**	A small community found immediately north of A1, running along a ditch and therefore containing some wetland ground layer species but not representing a wetland community overall. Bitternut Hickory is dominant in the canopy with Basswood and Eastern Cottonwood (*Populus deltoides*) also abundant. Anthropogenic influence is apparent in the presence of non-native species, e.g.: Common Buckthorn, European Euonymus (*Euonymus europaea*), Tartarian Honeysuckle (*Lonicera tatarica*), Ground Ivy (*Glechoma hederacea*), and Northern Catalpa (*Catalpa speciosa*). As a provincially rare community type, Polygon A3 is further addressed in the Significant Wildlife Habitat portion of this study.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
A4	SWD4-1	Willow Mineral Deciduous Swamp	GNR	S4	A small, isolated deciduous swamp community surrounded by sports fields, agricultural fields, and buildings. The canopy is dominated by hybrid White Willow (*Salix* x *rubens*) with abundant Freeman's Maple and occasional Eastern Cottonwood, Manitoba Maple, White Elm (*Ulmus americana*), and Red Ash. Glossy Buckthorn (*Rhamnus frangula*) is abundant in the understory. The ground layer is dominated by Fowl Manna grass (*Glyceria striata*) with abundant Spotted Touch-me-not (*Impatiens capensis*), Purple Loosestrife, and Swamp Milkweed. The soil consists of a deep silty clay A horizon with mottles observed at 15 cm.	
B1	MAM2	Mineral Meadow Marsh	-	-	Found in patches and linear strips throughout the agricultural fields in Area B. Dominated by Narrow-leaved Cattail (*Typha angustifolia*), with other species including: Pussy Willow (*Salix discolor*), Purple Loosestrife, Grey Dogwood (*Cornus foemina* ssp. *racemosa*), Peach-leaved Willow (*Salix amygdaloides*), Black Bulrush (*Scirpus atrovirens*), Common Water-plantain, Blue Vervain (*Verbena hastata*), Sensitive Fern (*Onoclea sensibilis*), Kentucky Blue Grass, Soft Rush (*Juncus effusus* ssp. *solutus*), and New England Aster (*Aster novae-angliae*). The effective soil texture in this unit is clay, with mottles encountered at 5 cm and no gley or water table observed to 120 cm.	
B2	SWT2-2	Willow Mineral Thicket Swamp	G5	S5	Thicket swamp community found in several patches in Area B, dominated by Pussy Willow but also with Slender Willow (*Salix petiolaris*), Meadowsweet (*Spiraea alba*), Grey Dogwood, Glossy Buckthorn, Purple Loosestrife, Canada Goldenrod, Moneywort (*Lysimachia nummularia*), Fowl Manna Grass, and Black Bulrush. Soil sampling discovered silty clay to clay texture with mottles at 10 cm and gley at 70 cm.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
B3	SWD2-2	Green Ash Mineral Deciduous Swamp	G?	S5	Located in two discrete patches in Area B. Green Ash, White Elm, hybrid White Willow, and Red Maple (*Acer rubrum*) in the canopy. Other species present include abundant to occasional Pussy Willow, Grey Dogwood, Nannyberry (*Viburnum lentago*), Graceful Sedge (*Carex gracillima*), New England Aster, Spotted Joe-pye-weed (*Eupatorium maculatum* ssp. *maculatum*), and Panicled Aster (*Aster lanceolatus* ssp. *lanceolatus*). Soil mottling was encountered at 18 cm.	
B4	SWD3-3	Swamp Maple Mineral Deciduous Swamp	GNR	S5	Treed swamp with sloughs present. Freeman's Maple is dominant in both canopy and subcanopy layers, with Red Ash and Red Maple also abundant. The understory is dominated by Glossy Buckthorn, with lesser amounts of Grey Dogwood and Meadowsweet. The most abundant species in the ground layer are: Canada Goldenrod, Graceful Sedge, Purple Loosestrife, Cow Vetch (*Vicia cracca*), Soft Rush, Panicled Aster, and Fowl Manna Grass. Soils consisted of a 15 cm deep sandy clay A horizon underlain with clay, with mottles observed at 15 cm and no gley encountered.	
B5	CUW1	Mineral Cultural Woodland	-	-	This unit is associated with a former homestead and still exhibits signs of disturbance resulting from this (e.g., stone foundations present). The open canopy includes Black Walnut, Red Ash, Sugar Maple, Trembling Aspen, and Manitoba Maple. Glossy Buckthorn dominates the understory. Ground cover species include: Canada Goldenrod, Timothy (*Phleum pratense*), Tawny Day-lily, Kentucky Blue Grass, Ox-eye Daisy (*Chrysanthemum leucanthemum*), Cow Vetch, and Wild Strawberry (*Fragaria virginiana* ssp. *virginiana*). Soils in this unit had a relatively deep (65 cm) A horizon of medium sand underlain by sandy clay in the B horizon, suggesting that sandy fill may have been placed during the construction of the former homestead. Mottles were encountered at 65 cm.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
B6	SWD2-2	Green Ash Mineral Deciduous Swamp	G?	S5	This unit was noted to have a large number of dead and dying ash trees, with standing snags present. Red Ash is dominant in the canopy and subcanopy with occasional Red Maple and Trembling Aspen and rare occurrences of Swamp White Oak (*Quercus bicolor*). The understory is heavily dominated by Glossy Buckthorn; ground layer is dominated by Canada Goldenrod, Soft Rush, and Purple Loosestrife.	
B7	CUM1-1	Dry-Moist Old Field Cultural Meadow	-	-	Open areas dominated by typical disturbed old field herbaceous species, e.g.: Canada Goldenrod, Kentucky Blue Grass, Bird's-foot Trefoil (*Lotus corniculatus*), Cow Vetch, Rough Cinquefoil (*Potentilla norvegica* ssp. *monspeliensis*), Common Milkweed (*Asclepias syriaca*), White Clover (*Trifolium repens*), Red Clover (*T. pratense*), Foxglove Beard-tongue (*Penstemon digitalis*), Common Yarrow (*Achillea millefolium* ssp. *millefolium*), Spotted St. John's-wort (*Hypericum punctatum*), and Indian Hemp (*Apocynum cannabinum*). Scattered woody species include Scots Pine (*Pinus sylvestris*), Trembling Aspen, Eastern Cottonwood, Grey Dogwood, and Glossy Buckthorn.	
B8	MAM2-5	Narrow-leaved Sedge Mineral Meadow Marsh	G4	S5	*Juncus*-dominated meadow marsh found in sloughs. Soft Rush with lesser amounts of Purple Loosestrife, Small Sundrops (*Oenothera perennis*), Panicled Aster, Fox Sedge (*Carex vulpinoidea*), Northern Water-horehound (*Lycopus uniflorus*), and Wool Grass (*Scirpus cyperinus*).	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
B9	CUT1-4 / MAM2	Grey Dogwood Mineral Cultural Thicket / Mineral Meadow Marsh Complex	-	-	The cultural thicket portion of this community is dominated by Grey Dogwood with occasional Meadowsweet and Common Buckthorn, and rarely Red-osier Dogwood (*Cornus stolonifera*) and Downy Arrow-wood (*Viburnum rafinesquianum*). Ground cover includes mainly common old field species such as Wild Carrot (*Daucus carota*), Common Teasel (*Dipsacus fullonum* ssp. *sylvestris*), Cow Vetch, Kentucky Blue Grass, and Common Milkweed. The meadow marsh portion of the complex includes Path Rush (*Juncus tenuis*), Grass-leaved Goldenrod (*Euthamia graminifolia*), Panicled Aster, Devil's Beggar-ticks (*Bidens frondosa*), Purple Loosestrife, Wool Grass, and unidentified sedge (*Carex*) and spike-rush (*Eleocharis*) species. Special Concern butterfly species **Monarch** (*Danaus plexippus*) was observed incidentally in this unit.	
C1	CUM1-1	Dry-Moist Old Field Cultural Meadow Inclusion of: MAM2 Mineral Meadow Marsh	- Incl: -	- Incl: -	This pioneer community is associated with a former driving range. The overall unit is dominated by grasses (mainly Kentucky Blue Grass, with Timothy also abundant) and includes common early-succession species such as Wild Carrot, Chicory (*Cichorium intybus*), Bull Thistle, Red Clover, Spotted St. John's-wort, and Horseweed (*Conyza canadensis*). Woody species occur rarely but include Freeman's Maple, Red Ash, and Scots Pine. The meadow marsh inclusion is dominated by Marsh Pennywort (*Hydrocotyle americana*), with other species including: unidentified spike-rush, Northern Wild Rice (*Zizania palustris*), Common Hop Sedge (*Carex lupulina*), Pink Knotweed (*Polygonum pensylvanicum*), Reed Canary Grass (*Phalaris arundinacea*), and Fowl Blue Grass (*Poa palustris*).	
C2	MAS2	Mineral Shallow Marsh	-	-	A small marsh unit dominated by invasive Common Reed (*Phragmites australis*).	
C3	MAS2 / OAO	Mineral Shallow Marsh / Open Aquatic Complex	-	-	A residential pond just northwest of community C2, with Common Reed around the edges.	(photo not available)

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
C4	CUT1	Mineral Cultural Thicket	-	-	Dense Glossy Buckthorn thicket. Other observed species present in lower numbers include: Grey Dogwood, Red Ash, Swamp White Oak, Scots Pine, Kentucky Blue Grass, and Choke Cherry (*Prunus virginiana* ssp. *virginiana*). Wet swales throughout the unit are dominated by Reed Canary Grass.	
C5	CUM1-1	Dry-Moist Old Field Cultural Meadow	-	-	This unit represents a recently disturbed, industrial area with soils dominated by gravel fill and asphalt remnants. Runners of Common Reed have entered this unit from surrounding areas and established dominance. Other species that are present are generally also very early-succession plants of disturbed areas, such as: White Sweet-clover (*Melilotus alba*), Selfheal (*Prunella vulgaris* ssp. *vulgaris*), Common Ragweed (*Ambrosia artemisiifolia*), Common Mugwort (*Artemisia vulgaris*), White Clover, and Wild Carrot. Woody vegetation is mainly limited to willows (*Salix alba*, *S. bebbiana*, *S.* x *rubens*).	(photo not available)
C6	SWD3-3	Swamp Maple Mineral Deciduous Swamp	GNR	S5	This community occurs in a small, linear unit near the northeast project limits, and was observed to be highly disturbed. Hybrid White Willow is dominant with abundant Freeman's Maple, Grey Dogwood, Common Mugwort, Narrow-leaved Cattail, and Broad-leaved Cattail (*Typha latifolia*).	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
C7	MAM2	Mineral Meadow Marsh	-	-	A very narrow, linear unit occurring along a drainage swale. Some Grey Dogwood is present but the majority of vegetation is herbaceous. Common Water-plantain, Rice Cut Grass (*Leersia oryzoides*), Devil's Beggar-ticks, Marsh Bedstraw (*Galium palustre*), Broad-leaved Cattail, Narrow-leaved Cattail, Wild Mint (*Mentha arvensis* ssp. *borealis*), and Purple Loosestrife are among the species observed.	
C8	SWD4-1	Willow Mineral Deciduous Swamp	GNR	S4	Located near the southeast limits of the study area. Hybrid White Willow is dominant with abundant Freeman's Maple and Trembling Aspen. The understory mainly consisted of Bebb's Willow (*Salix bebbiana*) and Grey Dogwood. Herbaceous cover included Purple Loosestrife, Fox Sedge, Black Bulrush, Path Rush, Wool Grass, and Reed Canary Grass. Soil sampling encountered mottles at a depth of 20 cm but no gley or water table.	
C9	CUW1	Mineral Cultural Woodland	-	-	A small, isolated woodland near the southeast limits of the study area, surrounded by community C5 to the north, west, and south, and commercial development to the east. Glossy Buckthorn, Grey Dogwood, Bebb's Willow, White Spruce (*Picea glauca*), Eastern Cottonwood, Trembling Aspen, Scots Pine, Common Mugwort, Common Reed, and Reed Canary Grass.	(photo not available)
C10	FOD3-1	Dry-Fresh Poplar Deciduous Forest Inclusion of: CUM1-1 Dry-Moist Old Field Cultural Meadow	G5 Incl: -	S5 Incl: -	A young community found near the northeast project limits, with an inclusion of cultural meadow similar to that found in community C5. Trembling Aspen dominant with some Silver Maple and Norway Spruce (*Picea abies*).	(photo not available)

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
C11	CUS1 / CUM1-1	Mineral Cultural Savannah / Dry-Moist Old Field Cultural Meadow Complex Inclusion of: MAM2 Mineral Meadow Marsh	-	-	Highly disturbed pioneer community. Open meadow community is interspersed with patches of trees and shrubs with open understory. Canopy and subcanopy species, where present, include Freeman's Maple, Common Apple, Eastern Cottonwood, Staghorn Sumac (*Rhus typhina*), Bebb's Willow, Black Walnut, Manitoba Maple, Trembling Aspen, Sweet Cherry (*Prunus avium*), and European White Poplar (*Populus alba*). Ground cover throughout includes Canada Goldenrod, Orchard Grass (*Dactylis glomerata*), Bird's-foot Trefoil, knapweed (*Centaurea* sp.), Perennial Rye Grass (*Lolium perenne*), Common Teasel, Reed Canary Grass, and Cow Vetch. The meadow marsh inclusion is associated with a small, isolated depression. Common Water-plantain is dominant with Reed Canary Grass also abundant, and lesser amounts of Three-lobed Beggar-ticks (*Bidens tripartita*), Wool Grass, Pink Knotweed, and a spike-rush species.	
C12	FOM	Mixed Forest	-	-	Very similar to community C4, but with a significantly higher proportion of Scots Pine.	
C13	FOD7-4	Moist-Fresh Black Walnut Deciduous Forest	G4?	S2S3	Black Walnut is dominant in this community with occasional hybrid White Willow, Red Ash, and Trembling Aspen. Little-leaf Linden (*Tilia cordata*), Freeman's Maple, and Swamp White Oak are also rarely present in the canopy and subcanopy. The understory includes abundant Grey Dogwood, Riverbank Grape (*Vitis riparia*), and Glossy Buckthorn. Ground layer species that were observed include Canada Goldenrod, Kentucky Blue Grass, Moneywort, an agrimony species (*Agrimonia* sp.), Panicled Aster, Upright Yellow Wood-sorrel (*Oxalis stricta*), Ground Ivy, Wild Carrot, Timothy, and Barnyard Grass. This community type was the best fit for C13 when using the ELC system. However, given the cultural origins and management (i.e., mowing) activities, C13 is highly disturbed and does not exhibit the qualities or associate species typically associated with the natural Black Walnut lowland forest community type that is ranked as S2S3. Thus, Polygon C13 is not considered rare for the purposes of this report.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
D1	**SWD1-2** / SWD2-2	**Bur Oak Mineral Deciduous Swamp** / Red Ash Mineral Deciduous Swamp Complex	**G2G3** / G?	**S3** / S5	Bur Oak and Red Ash are each dominant in portions of this community, although most of the ash trees observed in this unit were dead or dying. Common Buckthorn is dominant in the subcanopy and understory, with Trembling Aspen, Poison-ivy, Grey Dogwood, Glossy Buckthorn, Red Maple, and Freeman's Maple also present. Ground layer includes One-sided Aster (*Aster lateriflorus* var. *lateriflorus*), Sensitive Fern, and Rough Goldenrod (*Solidago rugosa* ssp. *rugosa*). As it contains a provincially rare community type, Polygon D1 is further addressed in the Significant Wildlife Habitat portion of this study.	
D2	SWD	Mineral Deciduous Swamp	-	-	This is a young community is located adjacent to D1. Red Ash and Trembling Aspen share dominance in the canopy, with the subcanopy consisting of Red Ash, White Elm, and Scots Pine. Common and Glossy Buckthorn dominate the understory, and various grasses are dominant in the ground layer with Panicled Aster and Selfheal also abundant.	
D3	CUM1-1 / MAM2	Dry-Moist Old Field Cultural Meadow / Mineral Meadow Marsh Complex	-	-	This is a large community found through the center of Area D, east of community D2. Aquafor Beech was not granted permission to access this property, so community assessment was completed from the edge. Overall, the community appeared similar to other old field and meadow marsh communities observed in the study area. Observed species included Green Ash, Trembling Aspen, Bur Oak, Common Buckthorn, Grey Dogwood, Wild Carrot, Smooth Brome (*Bromus inermis* ssp. *inermis*), Canada Goldenrod, New England Aster, Creeping Bent Grass (*Agrostis stolonifera*), Grass-leaved Goldenrod, Fowl Blue Grass, and other common and/or non-native species common to disturbed spaces in southern Ontario.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
E1	SWD2-2	Red Ash Mineral Deciduous Swamp Complex	G?	S5	Red Ash is dominant in both canopy and subcanopy, with Red Maple, Freeman's Maple, Norway Maple, White Elm, and Common Buckthorn present in lesser amounts. Common Buckthorn dominates the understory. Panicled Aster was the most abundant species in the ground layer; other species present include Creeping Bent Grass, One-sided Aster, Canada Enchanter's Nightshade (*Circaea lutetiana* ssp. *canadensis*), Wild Strawberry, Selfheal, Canada Blue Grass (*Poa compressa*), Canada Goldenrod, and Yellow Avens (*Geum aleppicum*).	
E2	CUM1-1	Dry-Moist Old Field Cultural Meadow	-	-	Found north of community E1. Similar to other disturbed old field communities found elsewhere in the study area.	
E3	MAM2 / SWT2-9	Mineral Meadow Marsh / Grey Dogwood Mineral Thicket Swamp Complex	- / G5	- / S3S4	This community is located in a narrow corridor following a channelized drainage feature. Some portions of the community are dominated by shrubs (Gray Dogwood with Common and Glossy Buckthorn) while elsewhere the open meadow marsh community includes species such as Canada Blue Grass, Purple Loosestrife, Bittersweet Nightshade (*Solanum dulcamara*), Quack Grass (*Elymus repens*), One-sided Aster, Common Reed, and Blue Vervain. The Grey Dogwood community type was the best fit for portions of E3 when using the ELC system. However, given its context along a narrow channelized drainage feature and patchy cover complexed with meadow marsh, E3 is highly disturbed and does not exhibit the qualities typically associated with the natural thicket swamp community type that is ranked as S3S4. Thus, Polygon E3 is not considered rare for the purposes of this report.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
E4	CUW1	Mineral Cultural Woodland	-	-	A disturbed community containing Freeman's Maple, Eastern White Pine (*Pinus strobus*), Black Walnut, Northern Catalpa, Common Buckthorn, White Mulberry (*Morus alba*), White Birch (*Betula papyrifera*), and Tamarack (*Larix laricina*). The species composition of the ground layer is similar to that of old field areas documented elsewhere in the study area, with the notable addition of invasive Japanese Knotweed (*Polygonum cuspidatum*).	(photo not available)
Hedgerows						
BH1	n/a				A north-south hedgerow with good continuity separating agricultural fields. Noted species include: Pin Cherry (*Prunus pensylvanica*), Shagbark Hickory (*Carya ovata*), Gray Dogwood, Pussy Willow, Purple Loosestrife, and Narrow-leaved Cattail. Habitat at the north and south ends of the hedgerow is generally absent, meaning that the linkage potential of this feature is low.	
BH2	n/a				Some sections of this hedgerow were noted to contain high quality remnant woodland and vernal pools/wetland; coyote scat and deer tracks were observed. Plant species include: Shagbark Hickory, Pin Oak, Red Oak, Bur Oak, Swamp White Oak, Trembling Aspen, Pin Cherry, Glossy Buckthorn, Pussy Willow, and Grey Dogwood. Overall width of the hedgerow varies from approx. 5-14.5 m. Linkage potential is considered high since it links the PSW and the watercourse with additional habitat north of the study area.	
BH3	n/a				A discontinuous hedgerow containing White Elm, Red Ash, Trembling Aspen, Gray Dogwood, Pussy Willow, cattails, and various rushes.	(photo not available)

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
CH1	n/a				A small hedgerow adjacent to a residential property with low linkage potential and predicted low ecological function. Dominated by Red Ash and Norway Spruce; many of the ash trees were observed to be dead.	
CH2	n/a				Located near CH1. Bur Oak and Red Ash dominate with Riverbank Grape also noted. This hedgerow is not well-positioned to have linkage or enhancement potential, but specimen trees could be retained.	
DH1	n/a				A remnant forest area with similar overall composition as polygon D1. This hedgerow was observed to be continuous but with ~70% canopy dieback due to ash decline. Approx. 8-10 m wide, somewhat open with a wide mix of layers and plentiful berry-producing plants. The canopy consisted largely of native species (Red Ash, Freeman's Maple, Bur Oak, White Elm) with non-native species dominant in the understory (Common Buckthorn, Glossy Buckthorn, Multiflora Rose, in addition to Gray Dogwood, Riverbank Grape, and Bebb's Willow). Linkage potential is low as there is no additional habitat to the south to connect with.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
DH2	n/a				A feature similar to DH1 but somewhat more naturalized, generally 10+ m wide and fairly continuous. Documented species include: Trembling Aspen, Bur Oak, Red Ash, and Bitternut Hickory, Common Buckthorn, Glossy Buckthorn. This hedgerow provides no linkage to the south but does serve as an edge barrier for habitats to the north and east and would be beneficial to retain.	
DH3	n/a				Averages 8-10 m width with a wider section at the north end. Noted species include: Black Walnut, White Elm, Manitoba Maple, Red Ash, Sugar Maple, Red Oak, Multiflora Rose, Common Buckthorn, Glossy Buckthorn, Bebb's Willow, and Gray Dogwood. A high amount of ash mortality was noted. Generally a continuous feature with good cover and adjacent open habitat; deer trails were observed. Potentially connected with headwater drainage features. Potential for linkage with habitats to the north via polygon A2, although the connection would be interrupted by Quaker Road. Would be beneficial to retain.	
DH4	n/a				A similar feature to DH3. Raccoon and deer tracks were observed; deer trails appeared to move between DH3 and DH4 via the open field and along the road to the north. Low linkage potential due to the absence of adjacent habitats, but could potentially be enhanced and reconnected to other areas to the west via drainage features.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
EH1	n/a				Approx. 5 m wide, with a fairly continuous understory and ~30% continuous canopy cover. Low habitat potential (little cover, no evidence of wildlife usage). Low linkage potential at present but could be enhanced in association with headwater drainage features to allow some connectivity between polygon E1 and habitats north of Quaker Road. Red Ash, Manitoba Maple, White Elm, Scots Pine, Slender Willow, Multiflora Rose, Gray Dogwood, Common Buckthorn, Glossy Buckthorn, Riverbank Grape, and Staghorn Sumac were observed in this hedgerow.	
EH2	n/a				Approximately 5-8 m wide with several gaps. Contains a mix of native and exotic species: Silver Maple (planted), Red Ash, White Elm, Black Locust, Eastern White Pine, Gray Dogwood, Common Buckthorn. Similar to EH1 above, this unit has low linkage potential at present but could be enhanced in association with headwater drainage features to allow some connectivity between polygon E1 and habitats north of Quaker Road.	
EH3	n/a				Approximately 5-10 m wide, mostly continuous but with some gaps. Moderate habitat potential and vegetative quality. Contained White Ash, Red Ash, Freeman's Maple, White Elm, Manitoba Maple, White Mulberry, Common Buckthorn, Gray Dogwood, Riverbank Grape, and Thicket Creeper. There is currently low linkage potential associated with this feature.	

Polygon	Vegetation Community		Ranking		Vegetation Community Description	Representative Photo
	Code	Name	Global	Provincial		
EH4	n/a				Width and quality of this unit is highly variable. London Plane Tree (*Platanus × acerifolia*) was observed along the road. Green Ash, Common Buckthorn, and Glossy Buckthorn were also observed. Low linkage potential, but likely provides visual screening along property line to south.	
EH5	n/a				A low-diversity hedgerow mostly consisting of shrubs. Black Locust, Red Ash, White Elm, Common Buckthorn, Glossy Buckthorn, Staghorn Sumac, Gray Dogwood. Low linkage potential; although there is habitat across the road to the north, there is little associated habitat to the south with which to make a connection.	

Appendix C – Wildlife Survey Data

July 24, 2018

Kyle Horner, B.Sc.
8 Clearview St.
Guelph, ON, N1E 6C5
519-835-0944
kylejhorner@gmail.com

Welland North Secondary Breeding Bird Survey 2018

Site:

This report pertains to a study site located in Welland, Ontario. The site is bounded by Clare Ave. in the west and Niagara St. in the east, and runs approximately 500m north and south of Quaker Rd.

Methodology:

Two breeding bird surveys were conducted on the site, on May 30, 2018 and June 18, 2018 by Kyle Horner, Biologist. The surveys were conducted in accordance with the Ontario Breeding Bird Atlas (Cadman et al. 2007) protocol, occurring more than 15 days apart during the core breeding season, within 5 hours of dawn and in favourable weather. Each survey included nine, 10-minute point counts spaced evenly across the site. All bird species and individuals seen and heard were recorded, as was all breeding evidence observed for all species. This breeding evidence was used to assign a breeding status (confirmed, probable, possible, observed). The breeding evidence codes and their abbreviations are presented in Appendix 1.

Results:

The results from the two breeding bird surveys are summarized in Table 1, and presented in full in Appendix 2.

A total of 43 species were encountered during the breeding bird surveys. Of the 43 species, breeding was confirmed for 5, probable for 15 and possible for 19. The remaining 4 species were observed with no evidence of breeding.

Significant Bird Species:

All bird species encountered listed with their S-Rank for Ontario, assigned by the Natural Heritage Information Centre. Of the 43 species, 27 have a rank of S5 indicating that they are Secure (common, widespread or abundant), while 13 have a rank of S4 or Apparently Secure (uncommon but not rare; some cause for long-term concern due to declines or other factors). Three introduced species are

assigned a rank of SNA or Not Applicable, meaning they are not a suitable target for conservation activities.

Nine observed species are identified as species of regional concern according to the Ontario Landbird Conservation Plan: Lower Great Lakes/St.Lawrence Plain, North American Bird Conservation Region 13. These species are designated because they may be vulnerable due to population size, distribution, population trend, abundance and threats. Conversely, the designation of Canada Goose suggests that it may require ongoing management due to a population above the desired level.

One federally- and provincially-designated species-at-risk – Barn Swallow – was observed during the surveys. At least 5 individuals were seen on both counts, foraging over the sports fields northwest of the intersection of Rice Rd. and Quaker Rd, and over the vacant field northeast of that intersection. Two active nests were observed on a storage building in the middle of the sports field complex. A barn northeast of the intersection may represent another possible nesting site, but it could not be assessed as access was not granted to that property. Barn Swallow was designated as a Threatened species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in November 2011, and on the Species at Risk in Ontario (SARO) list in 2012.

Table 1 – Summary of Breeding Bird Survey Results for Wellington North Secondary:

Common Name	Binomial Name	Highest Breeding Evidence	Regional Concern	SRank	SARO Rank	COSEWIC Rank
American Crow	*Corvus brachyrhynchos*	**Poss (H)**	No	S5B		
American Goldfinch	*Spinus tristis*	**Prob (P)**	No	S5B		
American Robin	*Turdus migratorius*	**Conf (CF)**	No	S5B		
Baltimore Oriole	*Icterus galbula*	**Poss (S)**	Yes	S4B		
Barn Swallow	*Hirundo rustica*	**Conf (AE)**	Yes	S4B	THR	THR
Black-capped Chickadee	*Poecile atricapillus*	**Poss (S)**	No	S5		
Blue Jay	*Cyanocitta cristata*	**Poss (H)**	No	S5		
Brown-headed Cowbird	*Molothrus ater*	**Prob (P)**	No	S4B		
Canada Goose	*Branta canadensis*	**Obs (X)**	Yes	S5		
Cedar Waxwing	*Bombycilla cedrorum*	**Poss (H)**	No	S5B		
Chipping Sparrow	*Spizella passerina*	**Prob (T)**	No	S5B		
Common Grackle	*Quiscalus quiscula*	**Conf (CF)**	No	S5B		
Common Yellowthroat	*Geothlypis trichas*	**Prob (T)**	No	S5B		
Double-crested Cormorant	*Phalacrocorax auritus*	**Obs (X)**	No	S5B		
Downy Woodpecker	*Picoides pubescens*	**Poss (S)**	No	S5		
Eastern Kingbird	*Tyrannus tyrannus*	**Poss (H)**	Yes	S4B		
Eastern Phoebe	*Sayornis phoebe*	**Poss (S)**	No	S5B		
European Starling	*Sturnus vulgaris*	**Poss (H)**	No	SNA		
Gray Catbird	*Dumetella carolinensis*	**Prob (T)**	No	S4B		
Great Crested Flycatcher	*Myiarchus crinitus*	**Poss (H)**	No	S4B		
Hairy Woodpecker	*Leuconotopicus villosus*	**Poss (H)**	No	S5		
Horned Lark	*Eremophila alpestris*	**Poss (H)**	No	S5B		
House Finch	*Haemorhous mexicanus*	**Poss (H)**	No	SNA		
House Sparrow	*Passer domesticus*	**Conf (FY)**	No	SNA		
House Wren	*Troglodytes aedon*	**Prob (T)**	No	S5B		

Killdeer	*Charadrius vociferus*	**Conf (FY)**	Yes	S5B,S5N		
Mallard	*Anas platyrhynchos*	**Poss (H)**	Yes	S5		
Mourning Dove	*Zenaida macroura*	**Prob (T)**	No	S5		
Northern Cardinal	*Cardinalis cardinalis*	**Prob (T)**	No	S5		
Northern Flicker	*Colaptes auratus*	**Poss (H)**	Yes	S4B		
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	**Obs (X)**	Yes	S4B		
Red-bellied Woodpecker	*Melanerpes carolinus*	**Poss (H)**	No	S4		
Red-tailed Hawk	*Buteo jamaicensis*	**Prob (P)**	No	S5		
Red-winged Blackbird	*Agelaius phoeniceus*	**Prob (A)**	No	S4		
Ring-billed Gull	*Larus delawarensis*	**Obs (X)**	No	S5B,S4N		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	**Poss (H)**	No	S4B		
Savannah Sparrow	*Passerculus sandwichensis*	**Prob (T)**	Yes	S4B		
Song Sparrow	*Melospiza melodia*	**Prob (T)**	No	S5B		
Tree Swallow	*Tachycineta bicolor*	**Poss (H)**	No	S4B		
Warbling Vireo	*Vireo gilvus*	**Prob (T)**	No	S5B		
Wild Turkey	*Meleagris gallapavo*	**Poss (H)**	No	S5		
Willow Flycatcher	*Empidonax traillii*	**Prob (T)**	No	S5B		
Yellow Warbler	*Setophaga petechia*	**Prob (T)**	No	S5B		

References:

Cadman, M.D., Sutherland, D.A., Beck, G.G., Lepage, D., Couturier, A.R., (eds.) 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologist, Ontario Ministry of Natural Resources and Ontario Nature, Toronto.

Ontario Partners in Flight. 2008. Ontario Landbird Conservation Plan: Lower Great Lakes/St.Lawrence Plain, North American Bird Conservation Region 13. Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada.

Species at Risk Public Registry. Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Available at: http://www.cosewic.gc.ca/

Species List - Birds. Natural Heritage Information Centre. Ontario Ministry of Natural Resources and Forestry. Available at: https://www.ontario.ca/page/natural-heritage-information-centre

Species at Risk in Ontario List. Ontario Ministry of Natural Resources and Forestry. Available at: https://www.ontario.ca/environment-and-energy/species-risk-ontario-list

Appendix 1 – Breeding Evidence Codes from the Atlas of the Breeding Birds of Ontario (Cadman et al. 2007)

Status	Code	Evidence Observed
Observed	X	Species observed in its breeding season (no evidence of breeding). Presumed migrants should not be recorded.
Possible	H	Species observed in its breeding season in suitable nesting habitat.
Possible	S	Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat.
Probable	P	Pair observed in their breeding season in suitable nesting habitat.
Probable	T	Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart, at the same place.
Probable	D	Courtship or display between a male and a female or 2 males, including courtship feeding or copulation.
Probable	V	Visiting probable nest site.
Probable	A	Agitated behaviour or anxiety calls of an adult.
Probable	B	Brood patch on adult female or cloacal protuberance on adult male.
Probable	N	Nest-building or excavation of nest hole.
Confirmed	DD	Distraction display or injury feigning.
Confirmed	NU	Used nest or egg shell found (occupied or laid within the period of the study).
Confirmed	FY	Recently fledged young or downy young, including young incapable of sustained flight.
Confirmed	AE	Adults leaving or entering nest site in circumstances indicating occupied nest.
Confirmed	FS	Adult carrying faecal sac.
Confirmed	CF	Adult carrying food for young.
Confirmed	NE	Nest containing eggs.
Confirmed	NY	Nest with young seen or heard.

Appendix 2 – Full results from breeding bird surveys

See attached file – Bird Survey Data Sheet – Welland 2018.xlsx.

Code	Common Name	Binomial Name	# Individuals by Date and Point Count																				Highest Breeding Evidence by Date			Species Status			
			29-May-18										18-Jun-18										29-May-18	18-Jun-18	All Dates	Regional	SRANK	SARO	COSEWIC
			1	2	3	4	5	6	7	8	9	IN	1	2	3	4	5	6	7	8	9	IN							
AMCR	American Crow	*Corvus brachyrhynchos*			4			2	2			4			1		1						Poss (H)	Poss (H)	**Poss (H)**	No	S5B		
AMGO	American Goldfinch	*Spinus tristis*	3	8	4	1	1	1		1	2			1	2		2	6	2		1		Prob (P)	Poss (S)	**Prob (P)**	No	S5B		
AMRO	American Robin	*Turdus migratorius*	3	2	5	1		3	4	5	3	4	5	3		2	1	1		4	3		Poss (S)	Conf (CF)	**Conf (CF)**	No	S5B		
BAOR	Baltimore Oriole	*Icterus galbula*	2	2		1		1		1			1			1							Poss (S)	Poss (H)	**Poss (S)**	Yes	S4B		
BARS	Barn Swallow	*Hirundo rustica*	5										4	1									Conf (AE)	Conf (AE)	**Conf (AE)**	Yes	S4B	THR	THR
BCCH	Black-capped Chickadee	*Poecile atricapillus*	1				2	1															Poss (S)		**Poss (S)**	No	S5		
BLJA	Blue Jay	*Cyanocitta cristata*	1		3	1	2	2	1	1	2				1		3			2	1		Poss (H)	Poss (H)	**Poss (H)**	No	S5		
BHCO	Brown-headed Cowbird	*Molothrus ater*			1				1			3	1	1	3	2	3		2				Prob (P)	Prob (P)	**Prob (P)**	No	S4B		
CANG	Canada Goose	*Branta canadensis*	3			15																	Obs (X)		**Obs (X)**	Yes	S5		
CEDW	Cedar Waxwing	*Bombycilla cedrorum*				6	2		2	2		2		1					3				Poss (H)	Poss (H)	**Poss (H)**	No	S5B		
CHSP	Chipping Sparrow	*Spizella passerina*	1								2		1	1						1	2		Poss (S)	Poss (S)	**Prob (T)**	No	S5B		
COGR	Common Grackle	*Quiscalus quiscula*	17	2		2	1	6		2	1	6	3	2	1	8		9	6	5	1		Poss (H)	Conf (CF)	**Conf (CF)**	No	S5B		
COYE	Common Yellowthroat	*Geothlypis trichas*	1	2		1	2					1					1	2					Poss (S)	Poss (S)	**Prob (T)**	No	S5B		
DCCO	Double-crested Cormorant	*Phalacrocorax auritus*				1																	Obs (X)		**Obs (X)**	No	S5B		
DOWO	Downy Woodpecker	*Picoides pubescens*	1		1								2		1	1			1				Poss (S)	Poss (H)	**Poss (S)**	No	S5		
EAKI	Eastern Kingbird	*Tyrannus tyrannus*	1																	2			Poss (H)	Poss (H)	**Poss (H)**	Yes	S4B		
EAPH	Eastern Phoebe	*Sayornis phoebe*					1																Poss (S)		**Poss (S)**	No	S5B		
EUST	European Starling	*Sturnus vulgaris*		1	2		1	3		1	1	2	24	4		1	1	2	4	5	4		Poss (H)	Poss (H)	**Poss (H)**	No	SNA		
GRCA	Gray Catbird	*Dumetella carolinensis*				1	1		1	1		1			1	1	1			1	1		Poss (S)	Poss (S)	**Prob (T)**	No	S4B		
GCFL	Great Crested Flycatcher	*Myiarchus crinitus*													1					1				Poss (H)	**Poss (H)**	No	S4B		
HAWO	Hairy Woodpecker	*Leuconotopicus villosus*										1											Poss (H)		**Poss (H)**	No	S5		
HOLA	Horned Lark	*Eremophila alpestris*																		1				Poss (H)	**Poss (H)**	No	S5B		
HOFI	House Finch	*Haemorhous mexicanus*					1												1				Poss (H)	Poss (H)	**Poss (H)**	No	SNA		
HOSP	House Sparrow	*Passer domesticus*					1	2				14						4					Poss (H)	Conf (FY)	**Conf (FY)**	No	SNA		
HOWR	House Wren	*Troglodytes aedon*				1						1			2	1							Poss (S)	Poss (S)	**Prob (T)**	No	S5B		
KILL	Killdeer	*Charadrius vociferus*	1		1			2	2	2	1		4	1			1	1	1	2			Prob (A)	Conf (FY)	**Conf (FY)**	Yes	S5B,S5N		
MALL	Mallard	*Anas platyrhynchos*	1	2																1			Poss (H)	Poss (H)	**Poss (H)**	Yes	S5		
MODO	Mourning Dove	*Zenaida macroura*	2	3			1		2	7	2		3	3	2		4	2	2	4	5		Poss (S)	Poss (S)	**Prob (T)**	No	S5		
NOCA	Northern Cardinal	*Cardinalis cardinalis*			1	3	2	1	1	2	2	3	1		1	2	2	1	2	2	2		Poss (S)	Prob (P)	**Prob (T)**	No	S5		
NOFL	Northern Flicker	*Colaptes auratus*																	1					Poss (H)	**Poss (H)**	Yes	S4B		
NRWS	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*								2													Obs (X)		**Obs (X)**	Yes	S4B		
RBWO	Red-bellied Woodpecker	*Melanerpes carolinus*													1									Poss (H)	**Poss (H)**	No	S4		
RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1		1		2								1		2			2			Prob (P)	Prob (P)	**Prob (P)**	No	S5		
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*	11	6	6	3	5	2	4	2	1	9		5	2	4	9	5	5	2	2		Prob (P)	Prob (A)	**Prob (A)**	No	S4		
RBGU	Ring-billed Gull	*Larus delawarensis*	6	2	6	1	2	1					2		1	1	3	4		3	2		Obs (X)	Obs (X)	**Obs (X)**	No	S5B,S4N		
RBGR	Rose-breasted Grosbeak	*Pheucticus ludovicianus*				1						1		1									Poss (H)	Poss (H)	**Poss (H)**	No	S4B		
SAVS	Savannah Sparrow	*Passerculus sandwichensis*	1									1	2	1	1			1					Poss (S)	Poss (S)	**Prob (T)**	Yes	S4B		
SOSP	Song Sparrow	*Melospiza melodia*	1	5	3	2	3	2	1	2	2			3	3		4	2	1	2	1		Poss (S)	Poss (S)	**Prob (T)**	No	S5B		
TRES	Tree Swallow	*Tachycineta bicolor*															1							Poss (H)	**Poss (H)**	No	S4B		
WAVI	Warbling Vireo	*Vireo gilvus*	1		2		1	1							1								Poss (S)	Poss (S)	**Prob (T)**	No	S5B		
WITU	Wild Turkey	*Meleagris gallapavo*																	1					Poss (H)	**Poss (H)**	No	S5		
WIFL	Willow Flycatcher	*Empidonax traillii*	1	2	1	2								3		1							Poss (S)	Poss (S)	**Prob (T)**	No	S5B		
YEWA	Yellow Warbler	*Setophaga petechia*		1	3	1		1				2			3	2	1						Poss (S)	Poss (S)	**Prob (T)**	No	S5B		

AMPHIBIAN DATA FORM

Please write legibly.

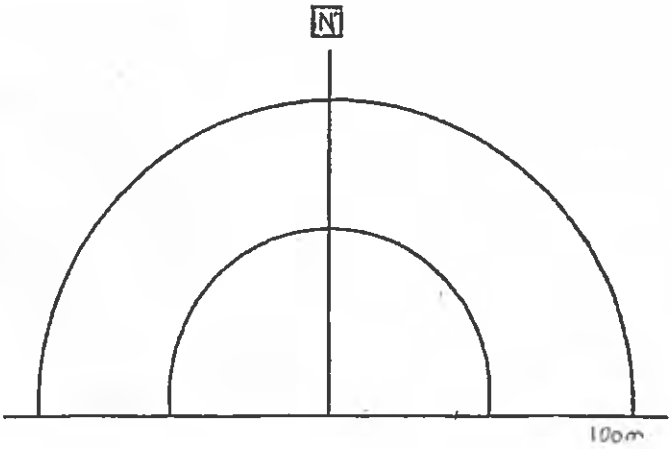
Observer: L Karlewicz	Route Name: WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 1	Survey #: 1	Start time (e.g. 2127 h): 2030
Beaufort Wind Scale: 1	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 10
Water Temp. (°C or °F): —	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: ~~None~~ ___ ~~Two observers~~ ___ ~~5-minute & 5-minute surveys~~ ___		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

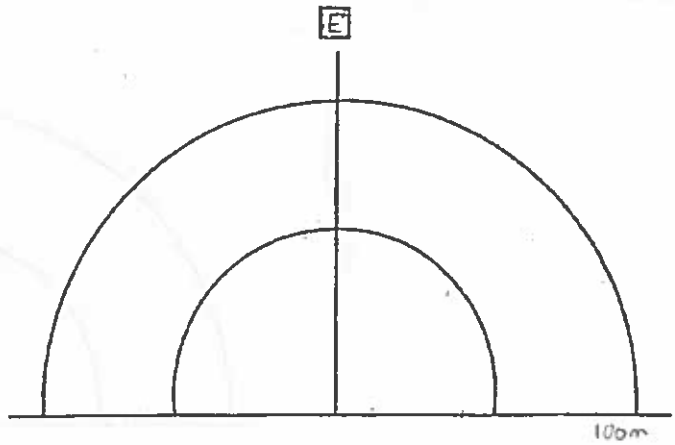
Observer: L Karlewicz	Route Name: WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 2	Survey #: 1	Start time (e.g. 2127 h): 2035
Beaufort Wind Scale: 1	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 10
Water Temp. (°C or °F):	Precip: None/dry __ Damp __ Haze __ Fog __ Drizzle __ Rain __	
Validation studies you are participating in: ~~None __ Two observers __ 3-minute & 5-minute surveys __~~		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

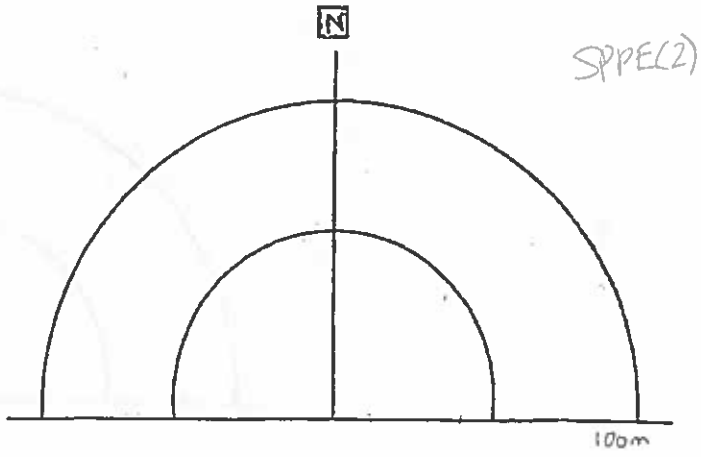
Please write legibly.

Observer: L Karlewicz	Route Name: WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 3	Survey #: 1	Start time (e.g. 2127 h): 2039
Beaufort Wind Scale: 1	Cloud Cover (10ths): 1	Air Temp. (°C or °F): 10
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: ~~None ___ Two observers ___ 3-minute & 5-minute surveys ___~~		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE	2	3-4?		
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

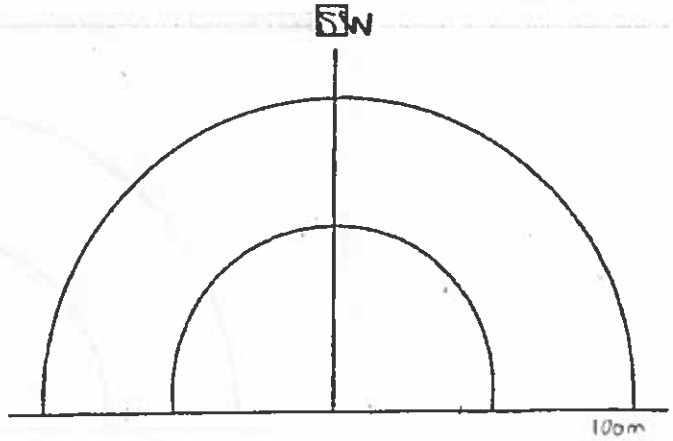
Observer: L. Kaiewicz	Route Name: WELLANDSWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 4	Survey #: 1	Start time (e.g. 2127 h): 2044
Beaufort Wind Scale: 1	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 10
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: ~~None ___ Two observers ___ 3-minute & 5-minute surveys ___~~		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

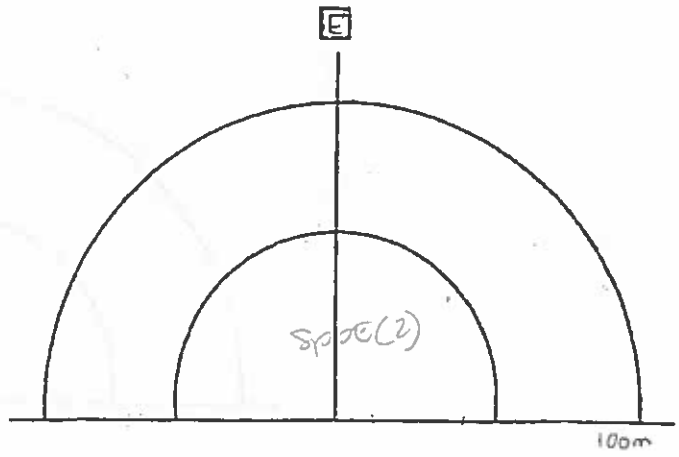
Please write legibly.

Observer: L KARLEWICZ	Route Name: WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 5	Survey #:	Start time (e.g. 2127 h): 2048
Beaufort Wind Scale:	Cloud Cover (10ths):	Air Temp. (°C or °F): 10
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: None ___ Two observers ___ 3-minute & 5-minute surveys ___		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE	2	3		
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

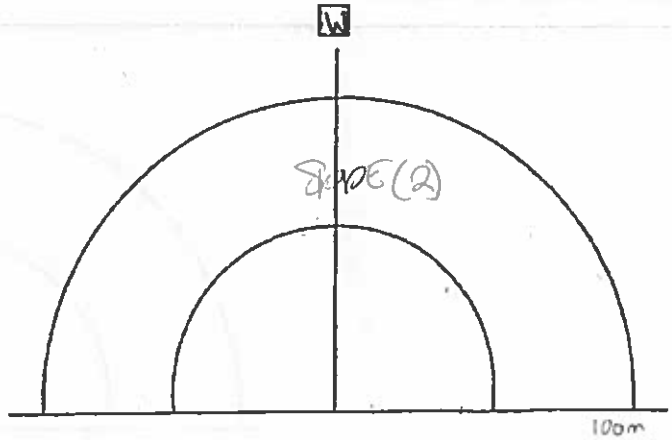
Please write legibly.

Observer: L KARLEWICZ	Route Name: WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 6	Survey #: 1	Start time (e.g. 2127 h): 2055
Beaufort Wind Scale: 1	Cloud Cover (10ths): 1	Air Temp. (°C or °F): 11
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: None ___ Two observers ___ 3-minute & 5-minute surveys ___		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE	2	4-5		
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

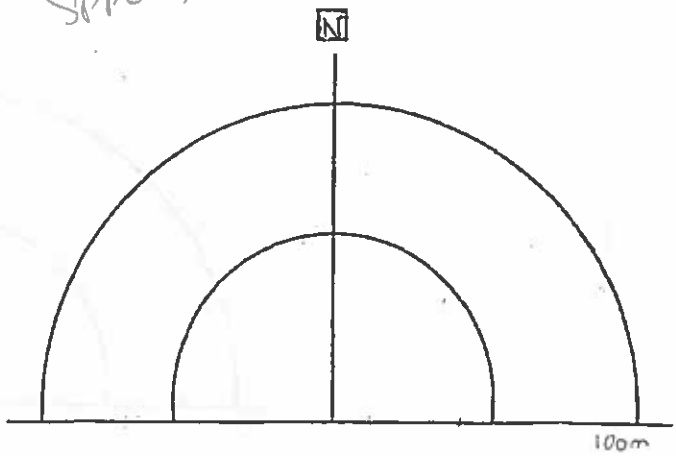
Observer: L. KARLEWICZ	Route Name: WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 7	Survey #: 1	Start time (e.g. 2127 h): 2105
Beaufort Wind Scale: 1	Cloud Cover (10ths): 1	Air Temp. (°C or °F): 11
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: ~~None ___ Two observers ___ 3-minute & 5-minute surveys ___~~		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE	2	347		
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

SPPE(2)



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

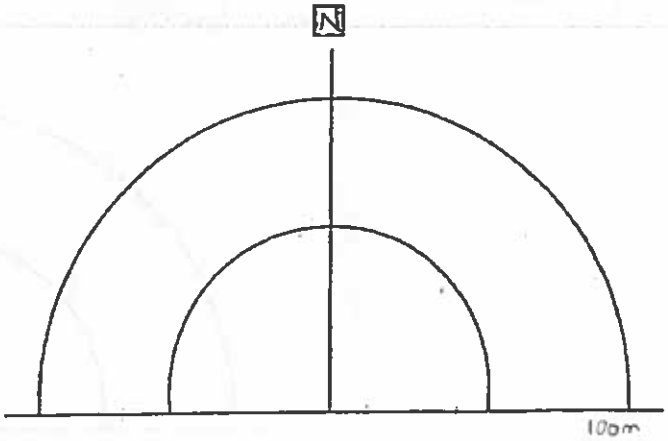
Observer: L. KARLEWICZ	Route Name: WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 8	Survey #: 1	Start time (e.g. 2127 h): 2114
Beaufort Wind Scale:	Cloud Cover (10ths):	Air Temp. (°C or °F): 11
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

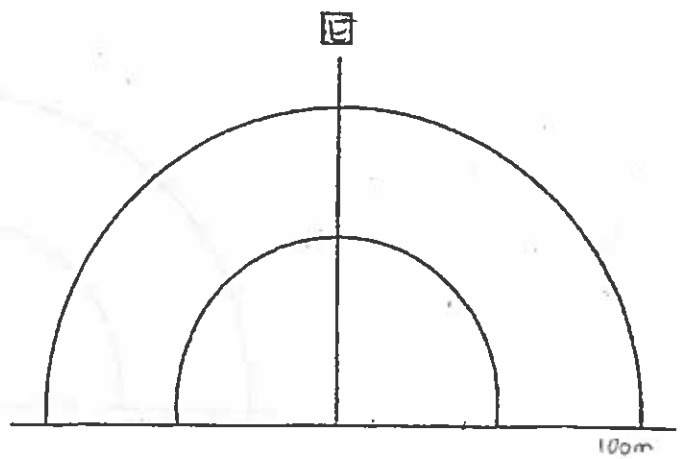
Observer: L KARLEWICZ	Route Name:. WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 9	Survey #: 1	Start time (e.g. 2127 h): . 2120
Beaufort Wind Scale: 1	Cloud Cover (10ths): 1	Air Temp. (°C or °F): 11
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: ~~None~~ ___ Two observers ___ ~~3-minute & 5-minute surveys~~ ___		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

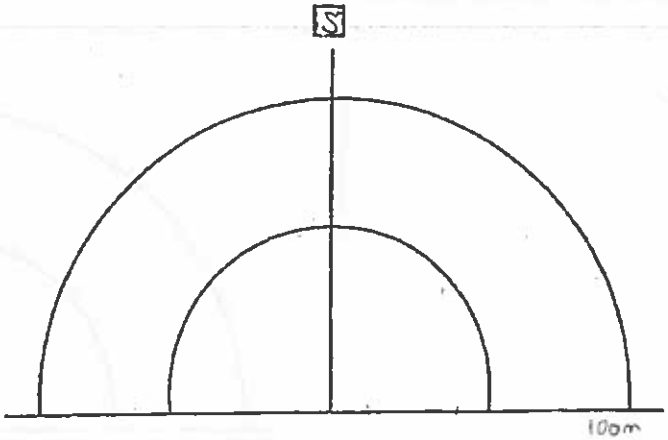
Observer: LKARLEWICZ	Route Name:. WELLAND SWS	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 10	Survey #: 1	Start time (e.g. 2127 h): . 2124
Beaufort Wind Scale: 1	Cloud Cover (10ths): 1	Air Temp. (°C or °F): 11
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: None ___ Two observers ___ ~~3-minute & 5-minute surveys~~ ___		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL	✓			

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

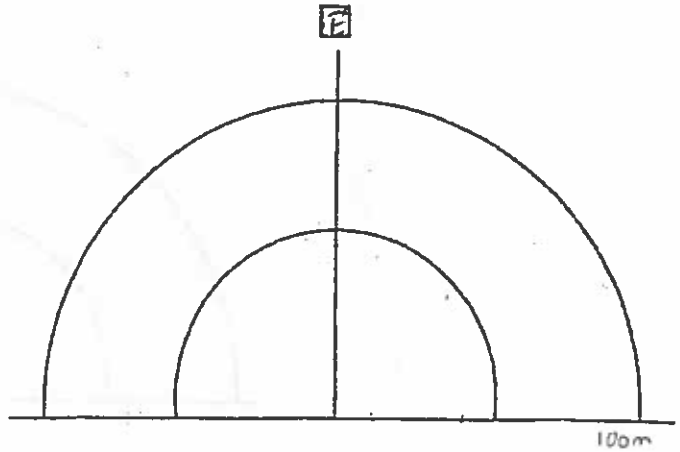
Observer: L KARLEWICZ	Route Name: WELLAND SW15	Date (yr-mm-dd): 18-04-24
Station #: (A-H): 11	Survey #: 1	Start time (e.g. 2127 h): 2128
Beaufort Wind Scale: 1	Cloud Cover (10ths): 1	Air Temp. (°C or °F): 1 1
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: ~~None~~ ___ ~~Two observers~~ ___ ~~3-minute & 5-minute surveys~~ ___		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

Observer: L. Kalewir 2	Route Name: Welland 825	Date (yr-mm-dd): May 22/18
Station #: (A-H): 1	Survey #: 2	Start time (e.g. 2127 h): 2100
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

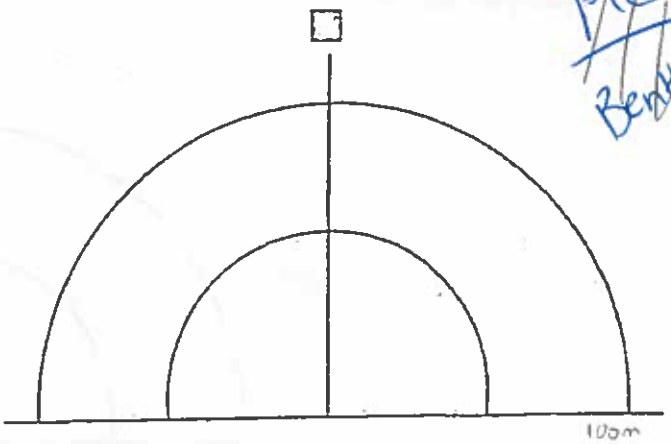
Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls

P/C
Benthics



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

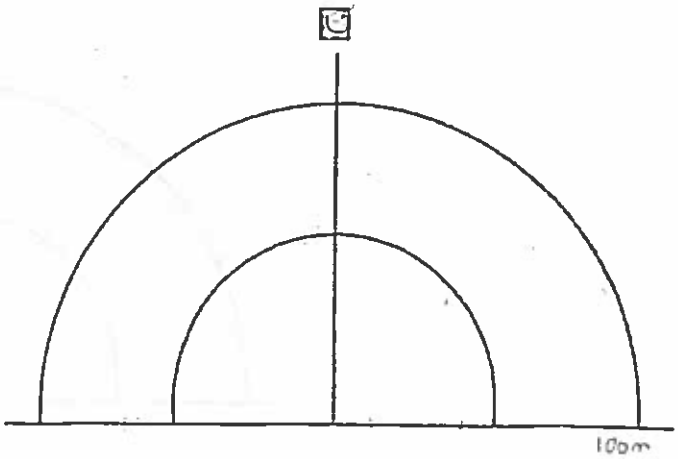
Observer: LY	Route Name: W. SWS	Date (yr-mm-dd): May 22 18
Station #: (A-H): 2	Survey #: 2	Start time (e.g. 2127 h): 2105
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in state or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

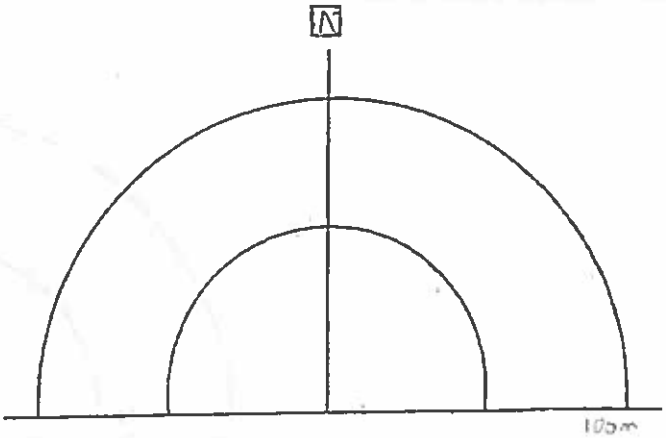
Observer: LIC	Route Name: W. SNS	Date (yr-mm-dd): May 22/18
Station #: (A-H): 3	Survey #: 2	Start time (e.g. 2127 h): 2111
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in code or changes in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

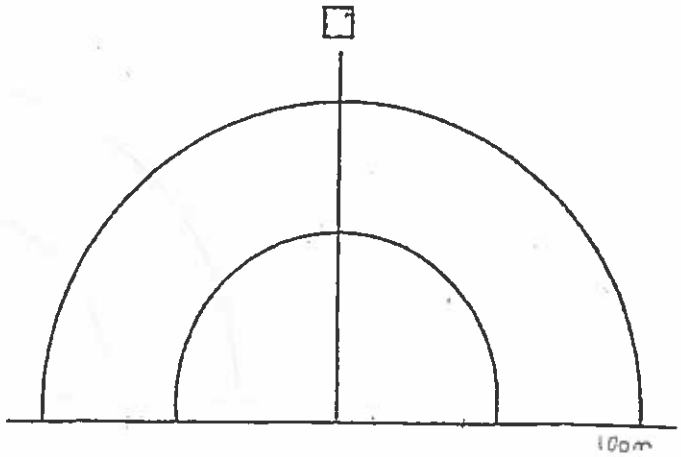
Observer: LK	Route Name: LS-8455	Date (yr-mm-dd): Mar 22/18
Station #: (A-H): 4	Survey #: 2	Start time (e.g. 2127 h): 2116
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

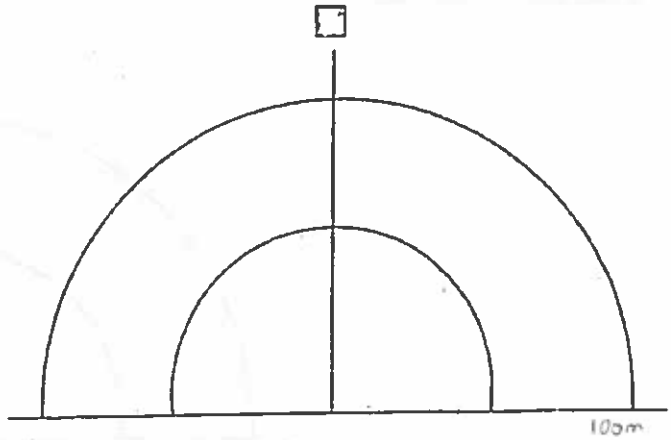
Observer: LK	Route Name: WS SWS	Date (yr-mm-dd): May 22/19
Station #: (A-H): 5	Survey #: 2	Start time (e.g. 2127 h): 2122
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in code or changes in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form

AMPHIBIAN DATA FORM

Please write legibly.

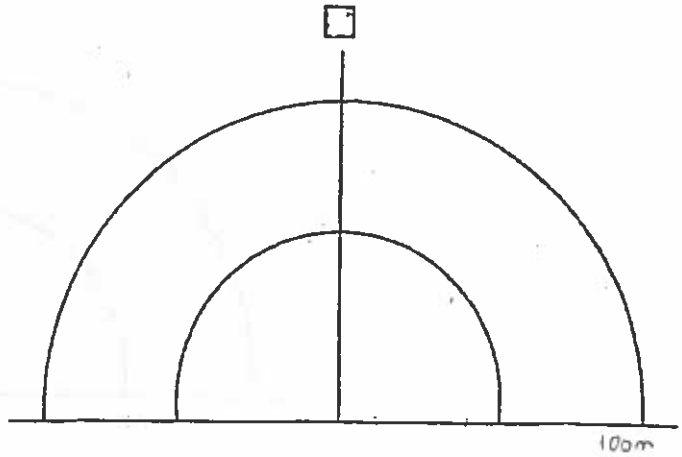
Observer: LC	Route Name: W. SWS	Date (yr-mm-dd): May 22/14
Station #: (A-H): 6	Survey #: 2	Start time (e.g. 2127 h): 2129
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

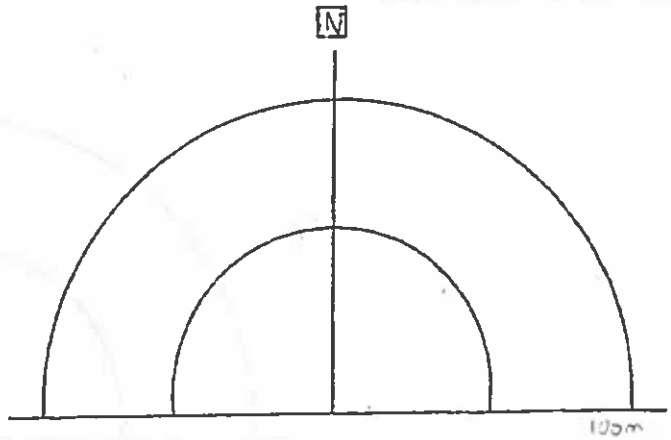
Observer: LK	Route Name: LN. SWS	Date (yr-mm-dd): May 22/18
Station #: (A-H): 7	Survey #: 2	Start time (e.g. 2127 h): 2129
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in state or changes in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

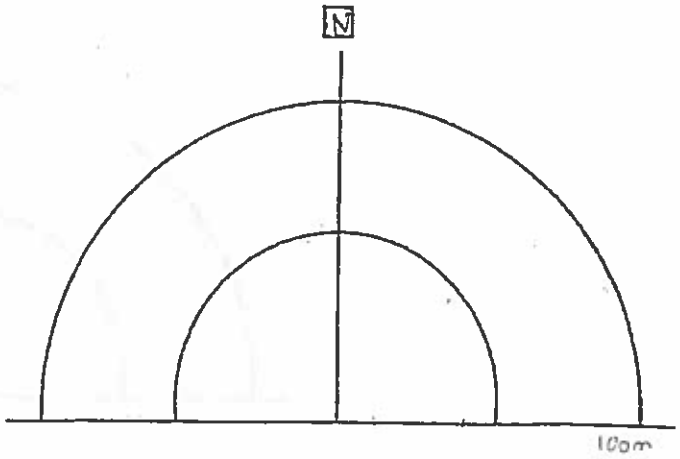
Observer: LIC	Route Name: W. SWS	Date (yr-mm-dd): May 22/16
Station #: (A-H): 8	Survey #: 2	Start time (e.g. 2127 h): 2134
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 14
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

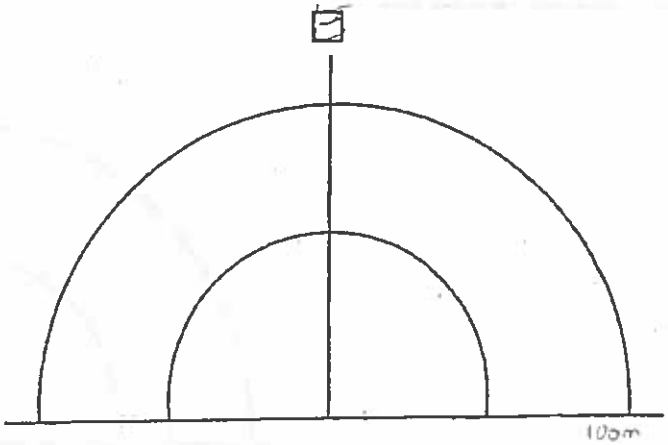
Observer: LK	Route Name: W. SWS	Date (yr-mm-dd): May 22/19
Station #: (A-H): 9	Survey #: 2	Start time (e.g. 2127 h): 2138
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form

AMPHIBIAN DATA FORM

Please write legibly.

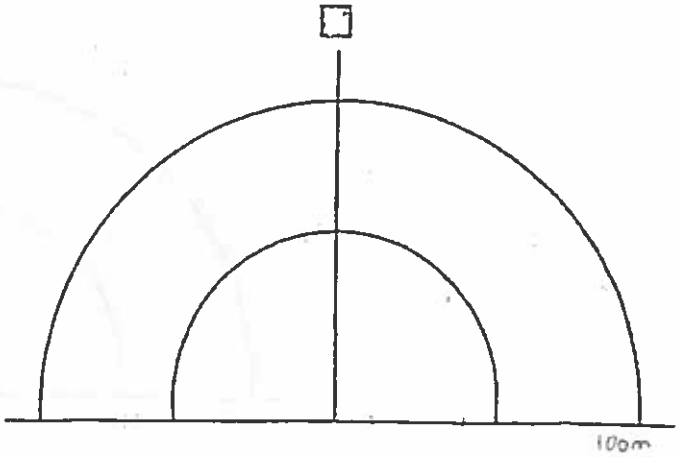
Observer: LC	Route Name: W. Sus	Date (yr-mm-dd): May 22/19
Station #: (A-H): 10	Survey #: 2	Start time (e.g. 2127 h): 2143
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	COTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

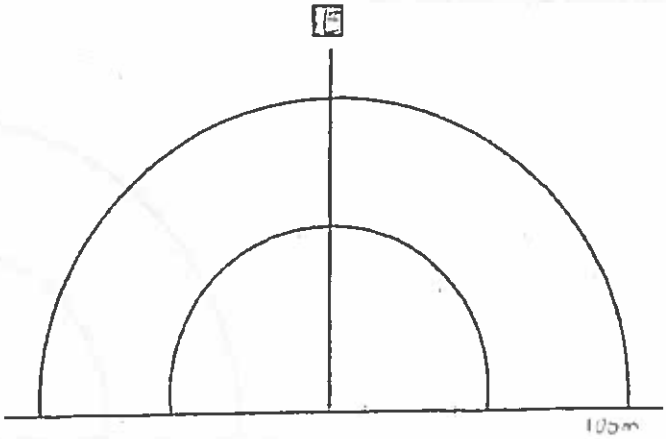
Observer: LK	Route Name: EW, SWS	Date (yr-mm-dd): May 22/18
Station #: (A-H): 11	Survey #: 2	Start time (e.g. 2127 h): 2147
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 15
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in code or changes in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form

AMPHIBIAN DATA FORM

Please write legibly.

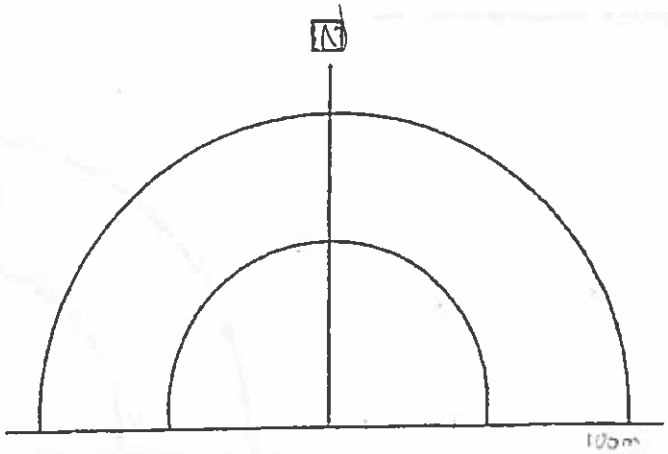
Observer: K	Route Name: W-SWS	Date (yr-mm-dd): June 26/18
Station #: (A-H):	Survey #: 3	Start time (e.g. 2127 h): 2131
Beaufort Wind Scale:	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 10
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in: None ___ Two observers ___ 3-minute & 5-minute surveys ___		
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	COTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in code or changes in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form

AMPHIBIAN DATA FORM

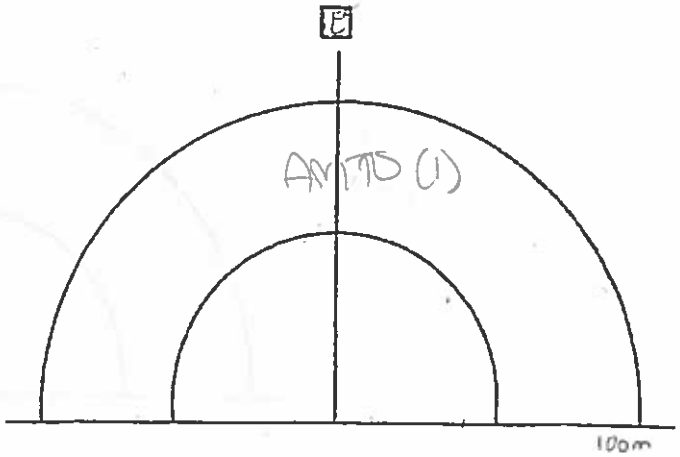
Please write legibly.

Observer: LK	Route Name: W.SWS	Date (yr-mm-dd): June 26/19
Station #: (A-H): 2	Survey #: 3	Start time (e.g. 2127 h): 2134
Beaufort Wind Scale: 1	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO	1	1		
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

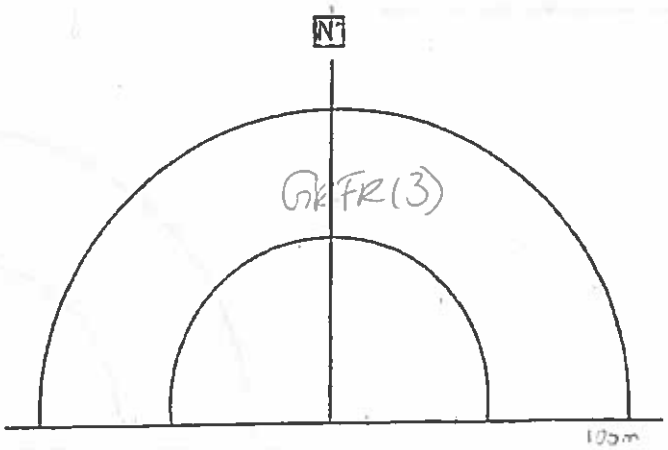
Please write legibly.

Observer: LK	Route Name: W. SWS	Date (yr-mm-dd): June 26/18
Station #: (A-H): 3	Survey #: 3	Start time (e.g. 2127 h): 2139
Beaufort Wind Scale: 1	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR	1	3		
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

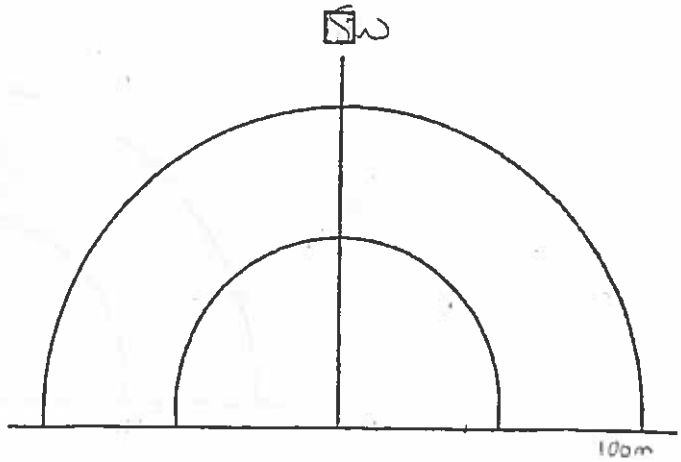
Observer: LY	Route Name: W.SHS	Date (yr-mm-dd): June 26/18
Station #: (A-H): A	Survey #: 3	Start time (e.g. 2127 h): 2143
Beaufort Wind Scale: 1	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	COTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

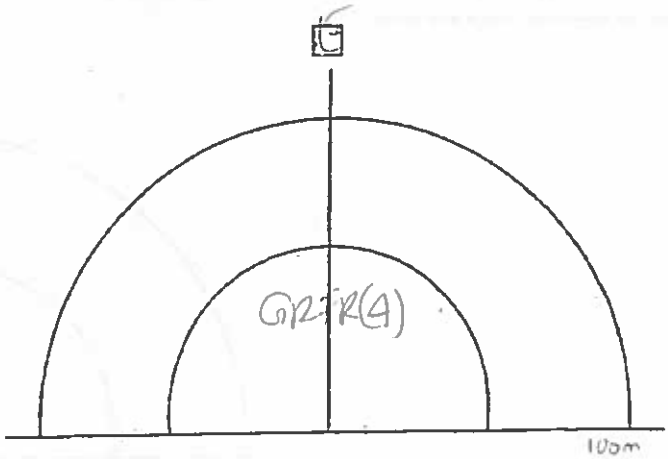
Please write legibly.

Observer: LK	Route Name: W. SWS	Date (yr-mm-dd): June 26/19
Station #: (A-H): 5	Survey #: 3	Start time (e.g. 2127 h): 2147
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	COTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR	1	4		
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form

AMPHIBIAN DATA FORM

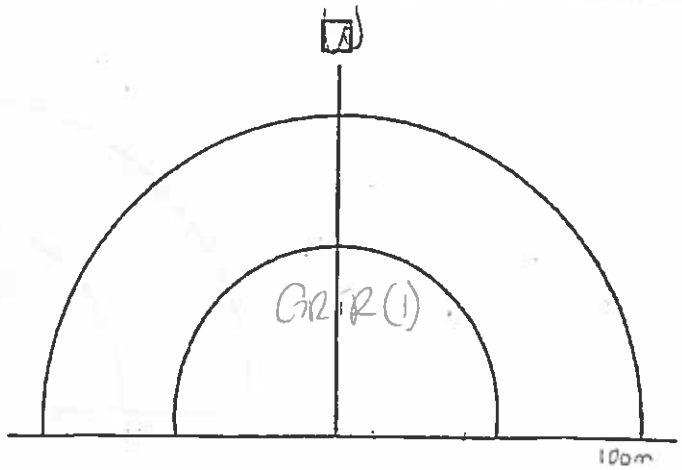
Please write legibly.

Observer: LE	Route Name: W.SWS	Date (yr-mm-dd): June 24/19
Station #: (A-H): 6	Survey #: 3	Start time (e.g. 2127 h): 2150
Beaufort Wind Scale: 2	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR	1	3		
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

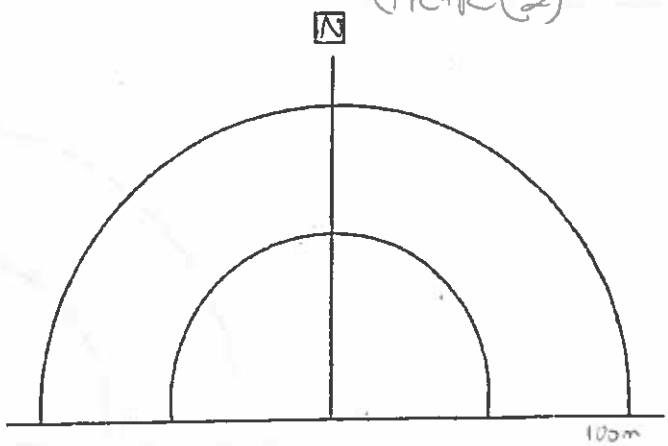
Observer: LK	Route Name: W-SWS	Date (yr-mm-dd): June 2018
Station #: (A-H): 7	Survey #: 3	Start time (e.g. 2127 h): 21[illegible]
Beaufort Wind Scale: 2	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR	1	2		
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in state or changes in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

GRFR(2)



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

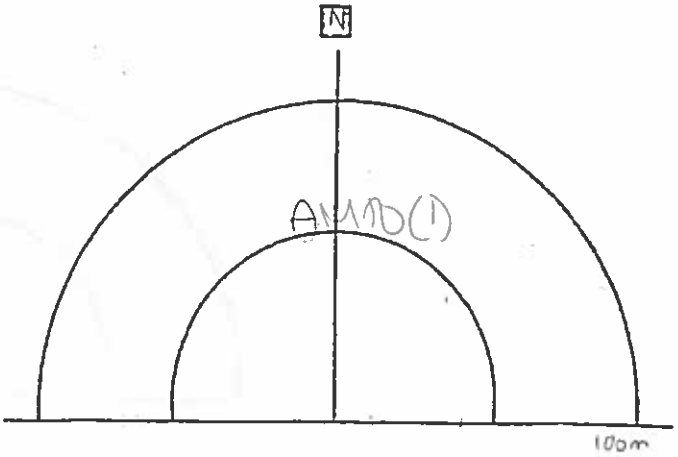
Please write legibly.

Observer: LK	Route Name: LW-SWB	Date (yr-mm-dd): June 26 2018
Station #: (A-H): 8	Survey #: 3	Start time (e.g. 2127 h): 2159
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 10
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO	1	2		
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

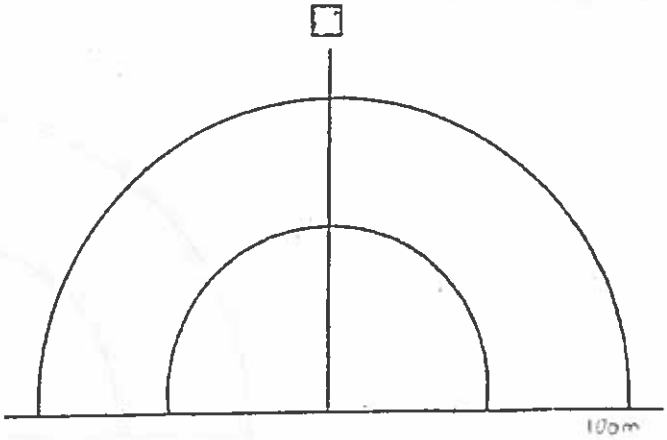
Observer: UK	Route Name: WOSWS	Date (yr-mm-dd): June 26/18
Station #: (A-H): 9	Survey #: 3	Start time (e.g. 2127 h): 2205
Beaufort Wind Scale: 2	Cloud Cover (10ths): 10	Air Temp. (°C or °F): 10
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

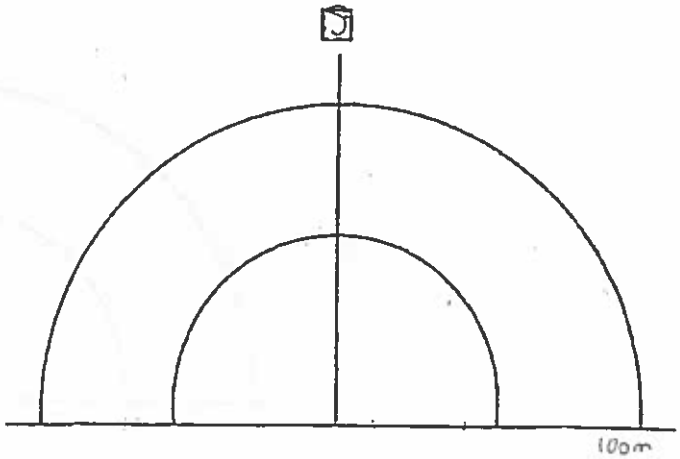
Observer: LK	Route Name: W-SW3	Date (yr-mm-dd): June 26/18
Station #: (A-H): 10	Survey #: 3	Start time (e.g. 2127 h): 2010
Beaufort Wind Scale: 2	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, change in code or change in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

AMPHIBIAN DATA FORM

Please write legibly.

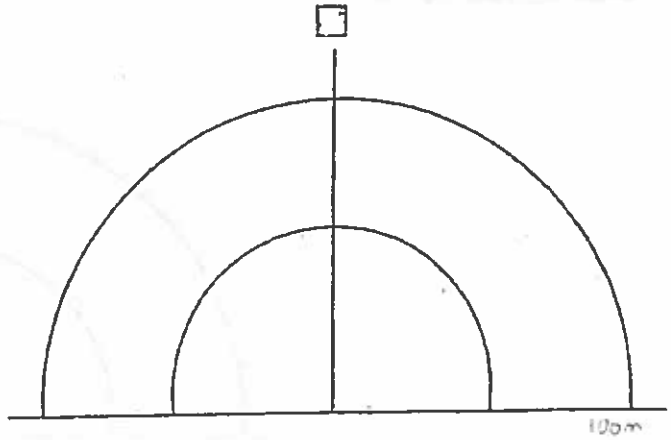
Observer: LC	Route Name: W-SWS	Date (yr-mm-dd): June 24/18
Station #: (A-H): 11	Survey #: 3	Start time (e.g. 2127 h): 2015
Beaufort Wind Scale: 2	Cloud Cover (10ths): 20	Air Temp. (°C or °F): 20
Water Temp. (°C or °F):	Precip: None/dry ___ Damp ___ Haze ___ Fog ___ Drizzle ___ Rain ___	
Validation studies you are participating in:	None ___ Two observers ___ 3-minute & 5-minute surveys ___	
Remarks:		

Species Name	Code	First 3 minutes		Next 2 minutes*	
		Code	Count	Code	Count
American Toad	AMTO				
Fowler's Toad	FOTO				
Gray Treefrog	GRTF				
Cope's Gray Treefrog	CGTF				
Spring Peeper	SPPE				
Chorus Frog	CHFR				
Blanchard's Cricket Frog	BCFR				
Wood Frog	WOFR				
N. Leopard Frog	NLFR				
Pickerel Frog	PIFR				
Green Frog	GRFR				
Mink Frog	MIFR				
Bullfrog	BULL				

* Only record new species, changes in code or changes in count.

CALL LEVEL CODES	
0 =	None heard (record zeroes, not blanks)
1 =	Males can be counted individually without error
2 =	Calls overlap each other, but numbers can be reliably estimated
3 =	Calls overlap each other too much to estimate numbers

no calls



Marsh Monitoring Program Amphibian Data Form.

Appendix D – Species at Risk Screening

Species		COSEWIC /SARA Status	SARO Status	G-Rank	S-Rank	Source	Habitat Requirements	Assessment of Species Occurrence in Study Area
Scientific Name	**Common Name**							
BIRDS								
Empidonax virescens	Acadian Flycatcher	END	END	G5	S2, S3B	Welland SAR List (MNRF 2018)	Generally requires large areas of mature, undisturbed forest; avoids the forest edge; found in well wooded swamps and ravines.	**Unlikely Present:** Not documented in the study area during breeding bird surveys. The study area does not contain any large areas of undisturbed forest habitat.
Riparia riparia	Bank Swallow	THR	THR	G5	S4B	MNRF Corresp. (Denyes 2018); Welland SAR List (MNRF 2018)	Sand, clay or gravel riverbanks or steep riverbank cliffs; lakeshore bluffs or easily crumbled sand or gravel; gravel pits, road cuts, grassland or cultivated fields that are close to water. Nesting sites are limiting factor for species presence.	**Unlikely Present:** Not documented in the study area during breeding bird surveys and no suitable nesting habitat is present in the study area.
Hirundo rustica	Barn Swallow	THR	THR	G5	S4B	**Aquafor Beech (2018);** Welland SAR List (MNRF 2018)	Prefers farmland, lake/river shorelines, wooded clearings, urban populated areas, rocky cliffs and wetlands. They nest inside or outside buildings, under bridges and in road culverts, or on rock faces and caves.	**Confirmed Present:** This species was observed during breeding bird surveys in the study area. At least five individuals were seen foraging over the sports fields northwest of Rice Rd./Quaker Rd. intersection, and over the vacant field northeast of that intersection. Two active nests were observed on a storage building in the middle of the sports field complex. A barn northeast of the intersection may represent another possible nesting site, but it could not be assessed as access was not granted to that property.
Chlidonias niger	Black Tern	NAR	SC	G4G5	S3B	Welland SAR List (MNRF 2018)	Generally prefer large freshwater marshes and wetlands with cattails; nest either on floating material in a marsh or on the ground very close to water	**Unlikely Present:** Not documented in the study area during breeding bird surveys and no suitable nesting habitat is present in the study area.
Dolichonyx oryzivorus	Bobolink	THR	THR	G5	S4B	Welland SAR List (MNRF 2018)	COSEWIC (2010, p. iv) defines bobolink habitat as follows: "Since the conversion of the prairie to cropland and the clearing of the eastern forests, the Bobolink has nested in forage crops…The bobolink also occurs in various grassland habitats including wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, remnants of uncultivated virgin prairie (tallgrass prairie), no-till cropland, small-grain fields, restored surface mining sites and irrigated fields in arid regions." Requires large tracts of grassland habitat (>50 ha).	**Potentially Present:** This species was not documented in the study area during breeding bird surveys. However, agricultural fields and cultural meadows are present in the study area and could support this species in future, especially if agricultural fields are allowed to go fallow.
Cardellina canadensis	Canada Warbler	THR	SC	G5	S4B	Welland SAR List (MNRF 2018)	An interior forest species; dense, mixed coniferous, deciduous forests with closed canopy, wet bottomlands of cedar or alder; shrubby undergrowth in cool moist mature woodlands; riparian habitat; usually requires at least 30 ha.	**Unlikely Present:** Not documented in the study area during breeding bird surveys. Interior forest habitat is not present in the study area.
Chaetura pelagica	Chimney Swift	THR	THR	G5	S4B, S4N	MNRF Corresp. (Denyes 2018); Welland SAR List (MNRF 2018)	Historically found in deciduous and coniferous, usually wet forest types, all with a well-developed, dense shrub layer. Now, most are found in urban areas in large, uncapped chimneys.	**Unlikely Present:** Not observed in the study area during breeding bird surveys.

Species		COSEWIC /SARA Status	SARO Status	G-Rank	S-Rank	Source	Habitat Requirements	Assessment of Species Occurrence in Study Area
Scientific Name	Common Name							
Chordeiles minor	Common Nighthawk	THR	SC	G5	S4B	Welland SAR List (MNRF 2018)	Open areas with little to no ground vegetation, such as logged or burned-over areas, forest clearings, rock barrens, peat bogs, and lakeshores. Although the species also nests in cultivated fields, orchards, urban parks, mine tailings, and along gravel roads and railways, they tend to occupy natural sites.	**Unlikely Present:** Not documented in the study area during breeding bird surveys. All of the open areas in the study area are anthropogenic and not naturally occurring, so while it is possible that Common Nighthawk might occur in the study area, it is thought unlikely based on the stated habitat preferences.
Sturnella magna	Eastern Meadowlark	THR	THR	G5	S4B	Welland SAR List (MNRF 2018)	Open grasslands with dense ground cover, hay fields, meadows, fallow fields. Generally requires large tracts of grassland (>50 ha) but has been observed to use mosaics of smaller grassland areas, pastures, and similar.	**Potentially Present:** This species was not documented in the study area during breeding bird surveys. However, agricultural fields and cultural meadows are present in the study area and could support this species in future, especially if agricultural areas are allowed to go fallow.
Caprimlugus vociferus	Eastern Whip-poor-will	THR	THR	G5	S4B	Welland SAR List (MNRF 2018)	Dry, open, deciduous woodlands of small to medium trees; oak or beech with lots of clearings and shaded leaflitter; wooded edges, forest clearings with little herbaceous growth; pine plantations; associated with >100 ha forests; may require 500 to 1000 ha to maintain population.	**Unlikely present:** Although some of the forest habitat in the study area may have features which match the habitat characteristics for this species, all forests are small and fragmented and do not provide the total area of habitat indicated necessary to support a population.
Contopus virens	Eastern Wood-Pewee	SC	SC	G5	S4B	MNRF Corresp. (Denyes 2018); Welland SAR List (MNRF 2018); NHIC Public Database	Associated with deciduous and mixed forests. Within mature and intermediate age stands it prefers areas with little understory vegetation as well as forest clearings and edges.	**Potentially Present:** Not observed during breeding bird surveys, but suitable habitat is present in the study area.
Vermivora chrysoptera	Golden-winged Warbler	THR	SC	G4	S4B	Welland SAR List (MNRF 2018)	Generally prefer early successional habitat; shrubby, grassy abandoned fields with small deciduous trees bordered by low woodland and wooded swamps; alder bogs; deciduous, damp woods; shrubbery clearings in deciduous woods with saplings and grasses; brier-woodland edges; requires >10 ha of habitat	**Potentially Present:** Not documented in the study area during breeding bird surveys. The site does contain early successional and shrub thicket habitat types, although these are dominated by non-native plants and have a strong history of disturbance.
Ammodramus henslowii	Henslow's Sparrow	END	END	G4	SHB	Welland SAR List (MNRF 2018)	Large, fallow, grassy area with ground mat of dead vegetation, dense herbaceous vegetation, ground litter and some song perches; neglected weedy fields; wet meadows; cultivated uplands; a moderate amount of moisture needed; requires a minimum tract of grassland of 40 ha, but usually in areas >100 ha. Tends to avoid fields that have been grazed or are crowded with trees and shrubs, instead preferring dense, tall grasslands where it can more easily conceal its small ground nest.	**Unlikely present**: Some suitable habitat types are present in the study area but not likely in the quantity necessary to support this species. Henslow's Sparrow has all but vanished as a breeding species in Ontario, and its provincial status (SHB) indicates that it is a historical observation.
Ixobrychus exilis	Least Bittern	THR	THR	G4G5	S4B	Welland SAR List (MNRF 2018)	Deep marshes, swamps, bogs; marshy borders of lakes, ponds, streams, ditches; dense emergent vegetation of cattail, bulrush, sedge; nests in cattails; intolerant of loss of habitat and human disturbance.	**Unlikely Present:** Not documented in the study area during breeding bird surveys and no suitable nesting habitat is present in the study area.

Species		COSEWIC /SARA Status	SARO Status	G-Rank	S-Rank	Source	Habitat Requirements	Assessment of Species Occurrence in Study Area
Scientific Name	Common Name							
Colinus virginianus	Northern Bobwhite	END	END	G4G5	S1	NHIC Public Database	Grassland, prairie or hay fields with woody cover in form of thickets, tangles of vines, shrubs; fence rows or woodland edges; cropland growing corn, soybeans or small grains and clover or grass; well-drained sandy or loamy soil; pond edges. It is generally believed that the only natural population of this species in Ontario occurs on Walpole Island.	**Unlikely Present:** This species was not documented on the site during breeding bird surveys, and the study area does not fall into the known current Ontario range for this species. Although potentially suitable habitat types are present in the study area (e.g., fence rows, cropland) it is thought unlikely that Northern Bobwhite will occur in the study area.
Melanerpes erythrocephalus	Red-Headed Woodpecker	THR	SC	G5	S4B	Welland SAR List (MNRF 2018)	COSEWIC (2007c, p. iv) defines red-headed woodpecker habitat as follows: "The Red-headed Woodpecker is found in a variety of habitats, including oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemeteries, beaver ponds and burns." Requires cavity trees with at least 40 cm dbh; requires about 4 ha for a territory.	**Unlikely Present:** Not documented in the study area during breeding bird surveys. Potentially suitable habitat is present in woodlots on the site, although unlikely in the quantity required for establishment of a territory; the largest wooded area (community C4) is a young community composed mostly of shrubs and not >40 cm dbh trees.
Euphagus carolinus	Rusty Blackbird	SC	SC	G4	S4B	eBird (record dated 2012)	Openings in coniferous woodlands bordering bodies of water; tree- bordered marshes, beaver ponds, muskegs, bogs, fens or wooded swamps; stream borders with alder, willow; wooded islands on lakes.	**Confirmed Present (non-breeding):** This species was reported in the study area via the eBird database, with the observation dated November 2012. Rusty Blackbird breeds in northern Ontario but is often observed passing through southern Ontario during migration, which is undoubtedly the source of the reported observation. It could be found resting in or passing through the study area during spring or fall migration.
Asio flammeus	Short-eared Owl	SC	SC	G5	S2N S4B	Welland SAR List (MNRF 2018)	Grasslands, open areas or meadows that are grassy or bushy; marshes, bogs or tundra; ground nester; destruction of wetlands by drainage for agriculture is an important factor in the decline of this species; home range 25 -125 ha; requires 75-100 ha of contiguous open habitat. Winter habitat includes large open areas within woodlots, stubble fields, fresh and saltwater marshes, weedy fields, dumps, gravel pits, rock quarries, and shrub thickets. Southern Ontario falls within the year-round range of this species so individuals could be encountered both during and outside of the breeding season.	**Potentially Present:** Some potentially suitable habitat is present in the study area. Although the study area likely doesn't contain contiguous habitat in sufficient area to establish a breeding territory, it is though feasible that the site could support over-wintering birds.
Hylocichla mustelina	Wood Thrush	THR	SC	G5	S4B	Welland SAR List (MNRF 2018)	Nests mainly in second-growth and mature deciduous and mixed forests, with saplings and well-developed understory layers. Prefers large forest mosaics, but may also nest in small forest fragments.	**Potentially Present:** Not documented in the study area during breeding bird surveys. However, suitable habitat is present in forested areas throughout the study area and Wood Thrush could feasibly be found in the study area in future.
Icteria virens	Yellow-breasted Chat	END	END	G5	S2B	Welland SAR List (MNRF 2018)	Thickets, tall tangles of shrubbery beside streams, ponds; overgrown bushy clearings with deciduous thickets; nests above ground in bush, vines etc. Breeds in areas of dense shrubs including abandoned farm fields, powerline corridors, fencerows, forest edges and openings, and stream edges.	**Potentially Present:** Not documented in the study area during breeding bird surveys. However, potentially suitable habitat is located in the study area, and this species could feasibly be encountered on the site in future.

Species		COSEWIC /SARA Status	SARO Status	G-Rank	S-Rank	Source	Habitat Requirements	Assessment of Species Occurrence in Study Area
Scientific Name	**Common Name**							
INSECTS								
Danaus plexippus	Monarch	END	SC	G5	S2N, S4B	**Aquafor Beech (2018)**; Welland SAR List (MNRF 2018)	Exist primarily where milkweed (*Asclepias spp.*), the obligate larval host plant, and other wildflowers exist. This includes abandoned farmland, roadsides and other open spaces.	**Confirmed Present:** Adult monarchs were observed in open portions of the site.
Bombus affinis	Rusty-patched Bumble Bee	END	END	G1	S1	Welland SAR List (MNRF 2018)	Generally inhabits a range of diverse habitats including mixed farmland, sand dunes, marshes, urban and wooded areas. It usually nests underground in abandoned rodent burrows.	**Unlikely Present:** Since 2002, this species has only been recorded in Ontario at Pinery Provincial Park.
Pieris virginiensis	West Virginia White	No status	SC	G3?	S3	Welland SAR List (MNRF 2018)	Generally prefer moist, deciduous woodlands. The larvae feed only on the leaves of the two-leaved toothwort (*Cardamine diphylla*), which is a small, spring-blooming plant of the forest floor.	**Unlikely Present:** Two-leaved Toothwort was not documented in the study area.
MAMMALS								
Myotis leibii	Eastern Small-footed Myotis	END	END	G4	S2S3	Welland SAR List (MNRF 2018)	Overwintering habitat: Caves and mines that remain above 0°C. Maternal Roosts: primarily under loose rocks on exposed rock outcrops, crevices and cliffs, and occasionally in buildings, under bridges and highway overpasses, and under tree bark.	**Overwintering Habitat Not Present:** Caves and mines are not present within the study area. **Maternity Roosts Potentially Present**: It is not known if maternity roosting habitat is present within the study area. According to the most recent *Survey Protocol for Species at Risk Bats within Treed Habitats* (MNRF, 2017), "any coniferous, deciduous, or mixed wooded ecosite, including treed swamps, that includes trees at least 10 cm dbh should be considered suitable maternity roost habitat", to be confirmed through further study. Woodlands are present in the study area, and may provide potentially suitable habitat (i.e. tree snags with cracks, crevices, cavities, loose bark, etc.) for bats.
Myotis lucifugus	Little Brown Myotis	END	END	G5	S4	Welland SAR List (MNRF 2018)	Overwintering habitat: Caves and mines that remain above freezing. Maternal roosts: Often associated with buildings (attics, barns, etc.). Occasionally found in trees (25-44 cm dbh).	
Myotis septentrionalis	Northern Myotis	END	END	G4	S3	Welland SAR List (MNRF 2018)	Overwintering habitat: Caves and mines that remain above 0°C. Maternal Roosts: Often associated with cavities of large diameter trees (25-44 cm dbh). Occasionally found in structures (attics, barns etc.)	
Perimyotis subflavus	Tri-coloured Bat	END	END	G5	S3?	Welland SAR List (MNRF 2018)	Overwintering habitat: Caves and mines that remain above 0°C. Maternal Roosts: Can be in trees or dead clusters of leaves or arboreal lichens on trees. May also use barns or similar structures.	
PLANTS								
Castanea dentata	American Chestnut	END	END	G4	S2	MNRF Corresp. (Denyes 2018); Welland SAR List (MNRF 2018); NHIC Public Database	Moist to well-drained forests on sand, occasionally heavy soils.	**Unlikely Present:** This species was not identified during the vegetation surveys undertaken in 2018. Background sources noted American Chestnut in wetlands/forest areas to the north of the study area, but these data were dated and were not confirmed during this study.

Species		COSEWIC /SARA Status	SARO Status	G-Rank	S-Rank	Source	Habitat Requirements	Assessment of Species Occurrence in Study Area
Scientific Name	Common Name							
Phegopteris hexagonoptera	Broad Beech Fern	SC	SC	G5	S3	Welland SAR List (MNRF 2018); NHIC Public Database	Shady areas of beech and maple forests where the soil is moist or wet.	**Unlikely Present:** Not identified during the vegetation surveys undertaken in 2018.
Juglans cinerea	Butternut	END	END	G4	S2?	**Aquafor Beech (2018)**; Welland SAR List (MNRF 2018); NHIC Public Database	Generally grows in rich, moist, and well-drained soils often found along streams. It may also be found on well-drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests as well as in hedgerows. MNRF considers Butternut habitat includes suitable lands within 50 m of a Butternut tree.	**Confirmed Present:** Four specimens were identified in vegetation community A1 during 2018 surveys.
Cornus florida	Eastern Flowering Dogwood	END	END	G5	S2?	**Aquafor Beech (2018)**; MNRF Corresp. (Denyes 2018); Welland SAR List (MNRF 2018); NHIC Public Database	Generally grows in deciduous and mixed forests, in the drier areas of its habitat, although it is occasionally found in slightly moist environments. Also grows around edges and hedgerows.	**Confirmed Present:** Identified in vegetation community A1 during the surveys undertaken in 2018.
Smilax rotundifolia	Round-leaved Greenbrier	THR	THR	G5	S2	Welland SAR List (MNRF 2018)	Generally grows in open moist to wet woodlands, often growing on sandy soils. Habitat is variable.	**Unlikely Present:** This species was not identified during the vegetation surveys undertaken in 2018.
Hibiscus moscheutos	Swamp Rose-mallow	SC	SC	G5	S3	Welland SAR List (MNRF 2018)	Generally grows in open, coastal marshes, but it is also sometimes found in open wet woods, thickets and drainage ditches	**Unlikely Present:** This species was not identified during the vegetation surveys undertaken in 2018.
Eurybia divaricata	White Wood Aster	THR	THR	G5	S1	**Aquafor Beech (2018);** MNRF Corresp. (Denyes 2018) Welland SAR List (MNRF 2018)	Generally grows in open, dry, deciduous forests. It has been suggested that it may benefit from some disturbance, as it often grows along trails.	**Confirmed Present:** This species was identified in vegetation community A1 (estimated 55 stems).

Species		COSEWIC /SARA Status	SARO Status	G-Rank	S-Rank	Source	Habitat Requirements	Assessment of Species Occurrence in Study Area
Scientific Name	**Common Name**							
REPTILES								
Emydoidea blandingii	Blanding's Turtle	THR	THR	G4	S3	Welland SAR List (MNRF 2018)	Generally occur in freshwater lakes, permanent or temporary pools, slow-flowing streams, marshes and swamps. They prefer shallow water that is rich in nutrients, organic soil and dense vegetation. Adults are generally found in open or partially vegetated sites, and juveniles prefer areas that contain thick aquatic vegetation including sphagnum, water lilies and algae. They dig their nest in a variety of loose substrates, including sand, organic soil, gravel and cobblestone. Overwintering occurs in permanent pools that average about one metre in depth, or in slow-flowing streams.	**Unlikely Present:** This species was not identified during the field investigations. Wetland habitat in the study area tends to be small, shallow marsh and meadow marsh patches, lacking the open pools and dense vegetation that is preferred by this species.
Plestiodon fasciatus	Common Five-lined Skink	END	END	G5	S2	Welland SAR List (MNRF 2018)	Generally occur near dunes, fields, and deciduous forests. This species is generally associated with relatively open environments. The Carolinian population occurs in only a very small area close to the shorelines of lakes Erie, St. Clair, and Huron.	**Unlikely Present:** Not identified during field investigations completed in 2018. Considered unlikely to be present given the marginally suitable habitat conditions and the location of the site outside of the known Carolinian population range.
Thamnophis sauritus	Eastern Ribbonsnake	SC	SC	G5	S3	Welland SAR List (MNRF 2018)	COSWEIC (2002b, p. iv) defines ribbonsnake habitat as follows: "The Northern Ribbonsnake is semi-aquatic and most frequently found along wetland edges. Quiet, shallow water with low surrounding cover is preferred, although areas with good exposure to sunlight are also required. Gravid females may move away from water before nesting, as females and juveniles are occasionally found in upland areas."	**Potentially Present:** Not identified during field investigations completed in 2018. Potentially suitable habitat is present in the in the study area, however, including riparian areas adjacent to the creek wetlands.
Sistrurus catenatus	Massassauga Rattlesnake	END	END	G4	S1	Welland SAR List (MNRF 2018)	Carolinian population (two small populations are found in the Wainfleet Bog on the northeast shore of Lake Erie and near Windsor). Generally occur in habitats ranging from tall grass prairie to cedar bogs to shorelines. All habitats require canopies that are not too open, but they also require access to spots where they can get warm enough to effectively digest their food and reproduce. Sufficient moisture is also required for them to survive the winter, so they are often associated with wetlands or small, wet depressions in the terrain.	**Unlikely Present**: The study area is not found near the known Carolinian population locations for this species; there is no habitat connection/corridor between the study area and Wainfleet Bog to the south.

Species		COSEWIC /SARA Status	SARO Status	G-Rank	S-Rank	Source	Habitat Requirements	Assessment of Species Occurrence in Study Area
Scientific Name	Common Name							
Chelydra serpentina	Snapping Turtle	SC	SC	G5	S3	MNRF Corresp. (Denyes 2018); Welland SAR List (MNRF 2018); Ontario Reptile and Amphibian Atlas	Generally inhabit shallow waters where they can hide under the soft mud and leaf litter. Nesting sites usually occur on gravely or sandy areas along streams. Snapping turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.	**Unlikely Present**: Numerous sightings have been recorded in the vicinity of the study area by the ORAA public database (10 km square), as recently as 2018, and Snapping turtle was identified in background information for the Niagara Street Cataract Road Woodlot Wetland Complex PSW. The study area contains only a small portion of this PSW, however, and the site generally lacks areas of permanent shallow water that would be preferred by Snapping Turtle. Watercourse channels and wetland areas were observed to be seasonally quite dry in the study area.
MOLLUSC								
Quadrula quadrula	Mapleleaf Mussel	SC	THR	G5	S2	Welland SAR List (MNRF 2018)	Usually found in medium-to-large rivers with slow-to-moderate currents and firmly packed sand, coarse gravel or clay/mud bottoms (substrates). In Canada, the Channel Catfish (*Ictalurus punctatus*) is the most likely host fish. (DFO, 2018)	**Not Present:** Potentially suitable habitat is not present within the study area. Watercourses in the study area tend to be small, shallow, and/or intermittent. At most, drainage features in the study area indirectly support downstream habitat that may be associated with this species.
FISH								
Esox americanus vermiculatus	Grass Pickerel	SC	SC	G5	S3	Welland SAR List (MNRF 2018)	Generally occur in wetlands with warm, shallow water and an abundance of aquatic plants; occur in the St. Lawrence River, Lake Ontario, Lake Erie, and Lake Huron	**Not Present:** The specified habitat type is not present in the study area. At most, drainage features in the study area indirectly support downstream habitat that may be associated with this species.
Erimyzon sucetta	Lake Chubsucker	END	THR	G5	S2	Welland SAR List (MNRF 2018)	Generally prefer marshes, wetlands and lakes with clear, still waters and abundant aquatic plants	**Not Present:** The specified habitat type is not present in the study area. At most, drainage features in the study area indirectly support downstream habitat that may be associated with this species.

Appendix E – Significant Wildlife Habitat Assessment

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Waterfowl Stopover and Staging Areas (Terrestrial) **Rationale:** Habitat important to migrating waterfowl.	American Black Duck Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1, CUT1, plus evidence of annual spring flooding from melt water or run-off within these Ecosites. Fields with seasonal flooding and waste grains in the Long Point, Rondeau, Lk. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	Fields with sheet water during Spring (mid-March to May). • Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. • Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available.	Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • Any mixed species aggregations of 100 or more individuals required. • The flooded field ecosite habitat plus a 100-300m radius, dependant on local site conditions and adjacent land use is the significant wildlife habitat. • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • SWH MIST Index #7 provides development effects and mitigation measures.	**Not Present:** Evidence of spring sheet flooding in open fields was not observed.
Waterfowl Stopover and Staging Areas (Aquatic) **Rationale:** Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district.	Canada Goose Cackling Goose Snow Goose American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Green-winged Teal Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Canvasback Ruddy Duck	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water)	Studies carried out and verified presence of: • Aggregations of 100 or more of listed species for 7 days, results in > 700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH • The combined area of the ELC ecosites and a 100m radius area is the SWH • Wetland area and shorelines associated with sites identified within the SWHTG Appendix K are significant wildlife habitat. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWH MIST Index #7 provides development effects and mitigation	**Not Present:** The study area does not contain any large ponds or open-water watercourses that would provide stopover or staging habitat for waterfowl.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Shorebird Migratory Stopover Area **<u>Rationale:</u>** High quality shorebird stopover habitat is extremely rare and typically has a long history of use.	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBO1 BBO2 BBS1BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. • Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. • Sewage treatment ponds and storm water ponds do not qualify as a SWH. <u>Information Sources</u> • Western hemisphere shorebird reserve network. • Canadian Wildlife Service (CWS) Ontario Shorebird Survey. • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Natural Heritage Information Centre (NHIC) Shorebird Migratory Concentration Area	Studies confirming: Presence of 3 or more of listed species and > 1000 shorebird use days during spring or fall migration period. (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period) • Whimbrel stop briefly (<24hrs) during spring migration, any site with >100 Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #8 provides development effects and mitigation measures.	**Not Present**: The study area does not include the extensive mud flats or shallow, weedy shorelines that are required for this habitat type.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Raptor Wintering Area **<u>Rationale:</u>** Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl **<u>Special Concern:</u>** Short-eared Owl Bald Eagle	<u>Hawks/Owls</u>: Combination of ELC Community Series; need to have present one Community Series from each land class; Forest: FOD, FOM, FOC. Upland: CUM; CUT; CUS; CUW. Bald Eagle: Forest community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area).	• The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. • Raptor wintering (hawk/owl) sites need to be >20 ha with a combination of forest and upland. • Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15 ha) with adjacent woodlands • Field area of the habitat is to be wind swept with limited snow depth or accumulation. • Eagle sites have open water and large trees and snags available for roosting <u>Information Sources</u>: • OMNRF Ecologist or Biologist • Naturalist clubs • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Results of Christmas Bird Counts • Reports and other information available from Conservation Authorities.	Studies confirm the use of these habitats by: • One or more Short-eared Owls or; One of more Bald Eagles or; At least 10 individuals and two of the listed hawk/owl species • To be significant a site must be used regularly (3 in 5 years) for a minimum of 20 days by the above number of birds. • The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #10 and • #11 provides development effects and mitigation measures.	**Not present**: The study area does not contain any large, low-disturbance open habitats adjacent to woodlands.
Bat Hibernacula **<u>Rationale:</u>** Bat hibernacula are rare habitats in all Ontario landscapes.	Big Brown Bat Tri-coloured Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	• Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. • Active mine sites should not be considered as SWH • The locations of bat hibernacula are relatively poorly known. <u>Information Sources</u> • OMNRF for possible locations and contact for local experts • Natural Heritage Information Centre (NHIC) Bat Hibernaculum • Ministry of Northern Development and Mines for location of mine shafts. • Clubs that explore caves (eg. Sierra Club) • University Biology Departments with bat experts.	• All sites with confirmed hibernating bats are SWH. • The area includes 200m radius around the entrance of the hibernaculum for most development types and 1000m for wind farms. • Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects". • SWH MIST Index #1 provides development effects and mitigation measures.	**Not present**: there are no caves, mines, or similar features in the study area.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	

Bat Maternity Colonies
 	
<u>Rationale:</u>
Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.
	Big Brown Bat
	Silver-haired Bat
		Maternity colonies considered SWH are found in forested Ecosites.
		
		All ELC Ecosites in ELC Community Series:
		FOD FOM SWD SWM
			• Maternity colonies can be found in tree cavities, vegetation and often in buildings (buildings are not considered to be SWH).
			• Maternity roosts are not found in caves and mines in Ontario.
			• Maternity colonies located in Mature deciduous or mixed forest stands with >10/ha large diameter (>25cm dbh) wildlife trees
			Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 or class 1 or 2.
			• Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred.
			
			<u>Information Sources</u>
			• OMNRF for possible locations and contact for local experts
			• University Biology Departments with bat experts.
				• Maternity Colonies with confirmed use by;
				  • >10 Big Brown Bats
				  • >5 Adult Female Silver- haired Bats
				• The area of the habitat includes the entire woodland or a forest stand ELC Ecosite or an Ecoelement containing the maternity colonies.
				Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects".
				• SWH MIST Index #12 provides development effects and mitigation measures.
					Candidate: There is potential for bat species to be using treed habitats within the study area as maternity roosting habitat.

Turtle Wintering Areas **<u>Rationale:</u>** Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle **<u>Special Concern:</u>** Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles; ELC Community Classes; SW, MA, OA and SA, ELC Community Series; FEO and BOO Northern Map Turtle; Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat.	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH. <u>Information Sources</u>: • EIS studies carried out by Conservation Authorities. • Field Naturalists Clubs • OMNRF Ecologist or Biologist • Natural Heritage Information Centre (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significant. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant. • The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep- water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar. – May). Congregation of turtles is more common where wintering areas are limited and therefore significant. • SWH MIST Index #28 provides development effects and mitigation measures for turtle wintering habitat.	**Not present**: Deep water habitat suitable for overwintering turtles is absent in the study area.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Reptile Hibernaculum **Rationale:** Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	**Snakes:** Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake **Special Concern:** Milksnake Eastern Ribbonsnake	For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Rock Barren, Crevice, Cave, and Alvar sites may be directly related to these habitats. Observations or congregations of snakes on sunny warm days in the spring or fall is a good indicator.	• For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. • Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line. Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. Information Sources • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs • University herpetologists • Natural Heritage Information Centre (NHIC)	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. near potential hibernacula (e.g., foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct) • Note: If there are Special Concern Species present, then site is SWH Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population (i.e. strong hibernation site fidelity). Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30 m radius area is the SWH • SWH MIST Index #13 provides development effects and mitigation measures for snake hibernacula.	**Candidate**: No potential hibernacula were documented during field investigations. However, due to the size of the study area additional surveys would be required to confirm the absence of candidate habitat. No Talus, Rock Barren, Crevice, Cave, or Alvar community types are present within the study area; however, there is potential for hibernaculum that may occur in burrows, rock piles, old stone fences, abandoned crumbling foundations, and wetlands.
Colonially - Nesting Bird Breeding Habitat (Bank and Cliff) **Rationale:** Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles, cliff faces, bridge abutments, silos, barns. Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed/permitted Mineral Aggregate Operation. Information Sources Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas • Bird Studies Canada; *NatureCounts* http://www.birdscanada.org/b irdmon/ • Field Naturalist Clubs.	Studies confirming: • Presence of 1 or more nesting sites with 8 or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50m radius habitat area from the peripheral nests • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #4 provides development effects and mitigation measures	**Not present**: Suitable steep banks and slopes were not observed in the study area.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Colonially - Nesting Bird Breeding Habitat (Tree/Shrubs) **Rationale;** Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night-Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. Information Sources • Ontario Breeding Bird Atlas, colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from Conservation Authorities. • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of 2 or more active nests of Great Blue Heron or other listed species. • The habitat extends from the edge of the colony and a minimum 300m radius or extent of the Forest Ecosite containing the colony or any island <15.0ha with a colony is the SWH • Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells • SWH MIST Index #5 provides development effects and mitigation measures.	**Not present**: Evidence of nest colonies in suitable wetland habitat was not observed in the study area.
Colonially - Nesting Bird Breeding Habitat (Ground) **Rationale:** Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird) MAM 1-6 MAS 1-3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. Information Sources • Ontario Breeding Bird Atlas, rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from Conservation Authorities. • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern. • Presence of 5 or more pairs for Brewer's Blackbird. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant. • The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH • Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #6 provides development effects and mitigation measures.	**Not present**: The required habitat is not present in the study area.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	**Habitat Criteria and Info. Sources**	**Defining Criteria**	
Migratory Butterfly Stopover Areas **<u>Rationale:</u>** Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.	Painted Lady Red Admiral <u>Special Concern</u> Monarch	Combination of ELC Community Series; need to have present one Community Series from each land class: <u>Field</u>: CUM CUT CUS <u>Forest</u>: FOC FOD FOM CUP Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present, and will be located within 5 km of Lake Erie or Lake Ontario. • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south. The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes <u>Information Sources</u> • MNRF District Offices • Natural Heritage Information Centre (NHIC) • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs • Toronto Entomologists Association • Conservation Authorities	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct). MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/day, significant variation can occur between years and multiple years of sampling should occur. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD. • MUD of >5000 **or** >3000 with the presence of Painted Ladies or Red Admirals is to be considered significant. • SWH MIST Index #16 provides development effects and mitigation measures.	**Not Present:** The site is not located within 5 km of Lake Erie or Lake Ontario.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Landbird Migratory Stopover Areas **<u>Rationale:</u>** Sites with a high diversity of species as well as high numbers are most significant.	All migratory songbirds: Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/default.asp?lang=En&n=42 1B7A9D-1 All migrant raptors species: Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Woodlots >5 ha in size and within 5 km of Lake Erie and Lake Ontario. If woodlands are rare in an area of shoreline, woodland fragments 2-5 ha can be considered for this habitat • If multiple woodlands are located along the shoreline those woodlands <2km from Lake Erie and Lake Ontario are more significant • Sites have a variety of habitats; forest, grassland and wetland complexes. • The largest sites are more significant • Woodlots and forest fragments are important habitats to migrating birds, these features located along the shore and located within 5km of Lake Erie and Lake Ontario are Candidate SWH. <u>Information Sources</u> • Bird Studies Canada • Ontario Nature • Local birders and field naturalist clubs • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the habitat by >200 birds/day and with >35 spp with at least 10 bird spp. recorded on at least 5 different survey dates. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (Mar to May) and fall (Aug to Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #9 provides development effects and mitigation measures.	**Not Present:** The site is not located within 5 km of Lake Erie or Lake Ontario.
Deer Winter Congregation Areas **<u>Rationale:</u>** Deer movement during winter in the southern areas of Eco-region 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions cxlviii	White-tailed Deer	All Forested Ecosites with these ELC Community Series; FOC FOM FOD SWC SWM SWD Conifer plantations much smaller than 50 ha may also be used.	• Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots >50ha • Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands. • Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha. • Woodlots with high densities of deer due to artificial feeding are not significant. <u>Information Sources</u> • MNRF District Offices. • LIO/NRVIS	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF. • Use of the woodlot by white- tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF • Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques, ground or road surveys. or a pellet count deer density survey. • SWH MIST Index #2 provides development effects and mitigation measures.	**Not Present:** MNRF data did not identify deer winter congregation habitat in the study area. Note, however, that a Stratum 2 deer wintering area was identified just north of the study area, connected to the forest habitat in Area A.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Cliffs and Talus Slopes **<u>Rationale:</u>** Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock >3m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris	Most cliff and talus slopes occur along the Niagara Escarpment. <u>Information Sources</u> • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field Naturalist Clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes • SWH MIST Index #21 provides development effects and mitigation measures.	**Not Present**: The required vegetation community types were not identified during vegetation community surveys.
Sand Barren **<u>Rationale:</u>** Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry	ELC Ecosites: SBO1, SBS1, SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket- like (SBS1), or more closed and treed (SBT1). Tree cover always ≤ 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered, but less than 60%.	A sand barren area >0.5ha in size. <u>Information Sources</u> • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic sp.). • SWH MIST[cxlix] Index #20 provides development effects and mitigation measures.	**Not Present**: The required vegetation community types were not identified during vegetation community surveys.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Alvar **<u>Rationale:</u>** Alvars are extremely rare habitats in Ecoregion 7E.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 **Five Alvar Indicator Species:** 1) *Carex crawei* 2) *Panicum philadelphicum* 3) *Eleocharis compressa* 4) *Scutellaria parvula* 5) *Trichostema brachiatum* These indicator species are very specific to Alvars within Ecoregion 7E	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plants. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover.	An Alvar site > 0.5 ha in size. Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie. <u>Information Sources</u> • Alvars of Ontario (2000), Federation of Ontario Naturalists. • Ontario Nature – Conserving Great Lakes Alvars. • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Staff. • Field Naturalist Clubs. • Conservation Authorities.	• Field studies that identify four of the five **Alvar Indicator Species** at a Candidate Alvar site is Significant. • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic sp.). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses • SWH MIST Index #17 provides development effects and mitigation measures.	**Not Present**: The required indicator plant species were not identified during vegetation surveys. Open meadow and thicket habitats in the study area are all highly disturbed and dominated by common/ non-native old field species.
Old Growth Forest **<u>Rationale:</u>** Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old Growth forests are characterized by heavy mortality or turnover of over-storey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	Woodland area is >0.5ha <u>Information Sources</u> • OMNRF Forest Resource Inventory mapping • OMNRF Districts. • Field Naturalist Clubs • Conservation Authorities • Sustainable Forestry License (SFL) companies will possibly know locations through field operations. • Municipal forestry departments	Field Studies will determine: • If dominant trees species of the are >140 years old, then the area containing these trees is Significant Wildlife Habitat • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities (cut stumps will not be present) • The area of forest ecosites combined or an eco-element within an ecosite that contain the old growth characteristics is the SWH. • Determine ELC vegetation types for the forest area containing the old growth characteristics • SWH MIST Index #23 provides development effects and mitigation measures.	**Not Present**: Old growth forest was not identified during vegetation community surveys.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Savannah **<u>Rationale:</u>** Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60% In ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	No minimum size to site. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. <u>Information Sources</u> • Natural Heritage Information Centre (NHIC) has location data available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	Field studies confirm one or more of the Savannah indicator species listed in Appendix N should be present • Note: Savannah plant spp. list from Ecoregion 7E should be used. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic sp.). • SWH MIST Index #18 provides development effects and mitigation measures.	**Not Present:** Cultural savannah habitat was identified complexed with cultural meadow in community C11. However, this community is CUS1 and this type is not listed with the eligible communities for SWH.
Tallgrass Prairie **<u>Rationale:</u>** Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover In ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	No minimum size to site. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. <u>Information Sources</u> • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalists Clubs. • Conservation Authorities.	Field studies confirm one or more of the Prairie indicator species listed in Appendix N should be present. Note: Prairie plant spp. list from Ecoregion 7E should be used • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic sp.). • SWH MIST Index #19 provides development effects and mitigation measures.	**Not Present:** This vegetation community was not identified during vegetation community surveys.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Other Rare Vegetation Communities **Rationale:** Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG. Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG. • Area of the ELC Vegetation Type polygon is the SWH. • SWH MIST Index #37 provides development effects and mitigation measures.	Confirmed: Several provincially rare vegetation community types were documented in the study area. • FOD9-5, Fresh-Moist Bitternut Hickory Deciduous Forest, S3S4 • FOD7-4, Moist-Fresh Black Walnut Deciduous Forest, S2S3 • SWD1-2, Bur Oak Mineral Deciduous Swamp, S3 • SWT2-9, Grey Dogwood Mineral Thicket Swamp Complex, S3S4
Waterfowl Nesting Area **Rationale:** Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 **Note: includes adjacency to Provincially Significant Wetlands**	A waterfowl nesting area extends 120 m from a wetland (> 0.5 ha) or a wetland (>0.5ha) and any small wetlands (0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur. • Upland areas should be at least 120 m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites. Information Sources • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. Reports and other information available from Conservation Authorities	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards, or; • Presence of 10 or more nesting pairs for listed species including Mallards. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWH MIST Index #25 provides development effects and mitigation measures.	**Not present**: Concentrations of indicator species have not been documented in the study area.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat **<u>Rationale:</u>** Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey **Special Concern** Bald Eagle	FOD FOM FOC SWD SWM SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands	Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. • Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. • Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). <u>Information Sources</u> • Natural Heritage Information Centre (NHIC) compiles all known nesting sites for Bald Eagles in Ontario. MNRF values information (LIO/NRVIS) will list known nesting locations. Note: data from NRVIS is provided as a point and does not represent all the habitat. • Nature Counts, Ontario Nest Records Scheme data. • OMNRF District. • Check the Ontario Breeding Bird Atlas or Rare Breeding Birds in Ontario for species documented • Reports and other information available from Conservation Authorities. • Field Naturalists clubs	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area. • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH, maintaining undisturbed shorelines with large trees within this area is important. For a Bald Eagle the active nest and a 400-800 m radius around the nest is the SWH. Area of the habitat from 400-800m is dependent on site lines from the nest to the development and inclusion of perching and foraging habitat • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for $\geq$3 years or suspected of not being used for >5 years before being considered not significant. • Observational studies to determine nest site use, perching sites and foraging areas need to be done from early March to mid-August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" SWH MIST Index #26 provides development effects and mitigation measures	**Not Present**: Nests were not observed in the study area, nor was either Osprey or Bald Eagle documented during breeding bird surveys. The study area does not contain open water ponds, rivers, or similar which would support hunting by these species.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Woodland Raptor Nesting Habitat **<u>Rationale:</u>** Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC SWM SWD CUP3	All natural or conifer plantation woodland/forest stands >30ha with >4ha of interior habitat. Interior habitat determined with a 200m buffer Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. <u>Information Sources</u> • OMNRF Districts. • Check the Ontario Breeding Bird Atlas [CCV] or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of 1 or more active nests from species list is considered significant. Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha area of habitat is the SWH. (the 28 ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) • Barred Owl – A 200m radius around the nest is the SWH • Broad-winged Hawk and Coopers Hawk – A 100m radius around the nest is the SWH. • Sharp-Shinned Hawk – A 50m radius around the nest is the SWH. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWH MIST Index #27 provides development effects and mitigation measures.	**Not Present**: Interior forest habitat is not present within the study area. Stick nests were not observed at any point during field investigations.
Turtle Nesting Areas **<u>Rationale:</u>** These habitats are rare and when identified will often be the only breeding site for local populations of turtles.	Midland Painted Turtle **Special Concern:** Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m) or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. • For an area to function as a turtle nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. <u>Information Sources</u> • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Centre (NHIC) • Field Naturalist Clubs	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH. • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependent on slope, riparian vegetation and adjacent land use is the SWH. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30-100m area of habitat. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles nesting is a recommended method. • SWH MIST Index #28 provides development effects and mitigation measures for turtle nesting habitat.	**Not Present**: The study area was not considered to provide much possible turtle habitat for any species. Watercourses and wetlands were often seasonally dry. Open, gravelly slopes, sand banks, and similar features were not observed during field investigations.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Seeps and Springs **<u>Rationale:</u>** Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams.	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system. Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species. <u>Information Sources</u> • Topographical Map. • Thermography. • Hydrological surveys conducted by Conservation Authorities and MOE. • Field Naturalists Clubs and landowners. • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.	Field Studies confirm: Presence of a site with 2 or more seeps/springs should be considered SWH. • The area of an ELC forest ecosite or an ecoelement within ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat. • SWH MIST Index #30 provides development effects and mitigation measures	**Not Present**: No evidence of seeps and springs was observed in the study area.
Amphibian Breeding Habitat (Woodland). **<u>Rationale:</u>** These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians	• Presence of a wetland, pond or woodland pool (including vernal pools) >500m^2 (about 25m diameter) within or adjacent (within 120m) to a woodland (no minimum size). Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat <u>Information Sources</u> • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations • Field Naturalist clubs • Canadian Wildlife Service Amphibian Road Call Survey • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm; • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog species with Call Level Codes of 3. A combination of observational study and call count surveys will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • The habitat is the wetland area plus a 230m radius of woodland area . If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWH MIST [cxlix] Index #14 provides development effects and mitigation measures.	**Not Present:** Amphibian call surveys completed within the study area did not document the listed indicator species in the required numbers to be considered SWH.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Amphibian Breeding Habitat (Wetlands) **Rationale:** Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario landscapes.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.	• Wetlands>500m^2 (about 25m diameter), supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. Bullfrogs require permanent water bodies with abundant emergent vegetation. Information Sources • Ontario Herpetofaunal Summary Atlas (or other similar atlases) • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog/toad species with Call Level Codes of 3. **or;** Wetland with confirmed breeding Bullfrogs are significant. The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST Index #15 provides development effects and mitigation measures.	**Not Present:** Amphibian call surveys completed within the study area did not document the listed indicator species in the required numbers to be considered SWH.
Woodland Area-Sensitive Bird Breeding Habitat **Rationale:** Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Pileated Woodpecker **Special Concern:** Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs old) forest stands or woodlots >30 ha. (Interior forest habitat is at least 200 m from forest edge habitat.) Information Sources • Local birder clubs. • Canadian Wildlife Service (CWS) for the location of forest bird monitoring. • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species. • Note: any site with breeding Cerulean Warblers or Canada Warblers is to be considered SWH. Conduct field investigations in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #34 provides development effects and mitigation measures.	**Not Present:** Potentially suitable habitat (i.e. interior forest) is not present within the study area. The listed indicator species were not observed during breeding bird surveys.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Marsh Breeding Bird Habitat **<u>Rationale:</u>** Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan **Special Concern:** Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	• Nesting occurs in wetlands. • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. <u>Information Sources</u> • OMNRF District and wetland evaluations. • Field Naturalist clubs • Natural Heritage Information Centre (NHIC) Records. • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas.	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren **or** breeding by any combination of 4 or more of the listed species. • Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH. • Area of the ELC ecosite is the SWH. • Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #35 provides development effects and mitigation measures	**Not present**: No large areas of shallow water marsh are present in the study area; meadow marsh habitats tend to be seasonally dry. No evidence of the indicator species was documented during breeding bird surveys.
Open Country Bird Breeding Habitat **<u>Rationale:</u>** This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow **Special Concern** Short-eared Owl	CUM1 CUM2	Large grassland areas (includes natural and cultural fields and meadows) >30 ha • Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years). • Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. • The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. <u>Information Sources</u> • Agricultural land classification maps, Ministry of Agriculture. • Local bird clubs. • Ontario Breeding Bird Atlas • EIS Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species. • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #32 provides development effects and mitigation measures	**Not present**: Indicator species Savannah Sparrow was identified at multiple locations during breeding bird surveys, with up to 2 individuals at one location, highest breeding evidence "probable". This is not sufficient evidence to confirm the presence of SWH.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Shrub/Early Successional Bird Breeding Habitat **Rationale:** This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat for some bird species	Large field areas succeeding to shrub and thicket habitats >10 ha in size. • Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live- stock pasturing in the last 5 years). • Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species. • Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources • Agricultural land classification maps, Ministry of Agriculture. • Local bird clubs. • Ontario Breeding Bird Atlas • Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species. • A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat. • The area of the SWH is the contiguous ELC ecosite field/thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" • SWH MIST Index #33 provides development effects and mitigation measures.	**Not Present**: "Common" target species Willow Flycatcher was identified at multiple locations during breeding bird surveys, with up to 3 individuals at one location (highest breeding evidence: "probable"). This is not sufficient evidence to confirm the presence of SWH.
Terrestrial Crayfish **Rationale:** Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare.	Chimney or Digger Crayfish; (*Fallicambarus fodiens*) Devil Crayfish or Meadow Crayfish; (*Cambarus diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above meadow marsh ecosites can be used by terrestrial crayfish.	Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish. Constructs burrows in marshes, mudflats, meadows, the ground can't be too moist. Can often be found far from water. • Both species are a semi- terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. Information Sources • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites Area of ELC ecosite or an ecoelement area of meadow marsh or swamp within the larger ecosite area is the SWH. • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult • SWH MIST Index #36 provides development effects and mitigation measures.	**Not Present**: Evidence of target species (i.e. crayfish chimneys) were not observed during field studies.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Potential for Candidate and/or Confirmed SWH on Subject Property
		ELC Ecosite Codes	Habitat Criteria and Info. Sources	Defining Criteria	
Special Concern and Rare Wildlife Species **Rationale:** These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern (SC) and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites Information Sources • Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species lists with element occurrences data. • NHIC Website "Get Information": http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat or foraging habitat. • SWH MIST Index #37 provides development effects and mitigation measures.	Confirmed: Special Concern species observed or documented in the study area include: • **Monarch** (SC), found throughout in open habitats • **Rusty Blackbird** (SC), reported via eBird in association with the Niagara Street Cataract Road Woodlot Wetland Complex PSW

APPENDIX G – Public Consultation and Indigenous Engagement Summary Report by SGL

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Introduction

As part of the phase one engagement strategy for the North West Welland Secondary Plan, two Public Information Centres (PICs) were held on June 18th and June 19th 2018. Day one focused on the Secondary Plan process and studies conduct to date, it engaged Landowners in the afternoon and the Public in the evening with a total of 21 people attending. Followed by day two which focused on Urban Design Principles to create Complete Communities and a proposed neighbourhood structure options discussion; a Steering Committee meeting and workshop were conducted in the afternoon followed by the second Public Information Centre in the evening with a total of 14 people attending. A summary of the public comments from both sessions is provided below, followed by the presentations given at both PICs and the comment boards filled out by attendees at the second PIC.

Summary of Public Information Centre #1

June 18th, 2018 Landowners Meeting (Held from 2 pm – 3:30 pm)

On Monday, June 18, 2018, SGL Planning and Design hosted the North West Welland Secondary Plan Public Information Centre (PIC) #1 at the City of Welland's City Hall. SGL staff first met with landowners for an informal introduction and discussion on the purpose of the Secondary Plan and Urban Boundary Expansion.

SGL began the session by providing a description of the Secondary Plan process, which included an explanation of:

- the strategy for the development of the Secondary Plan,
- an overview of the uses that could be accommodated within the plan,
- the amount of space that could be allocated for each area specific land use, and
- the importance of understanding the existing environmental conditions of the site, which requires additional studies.

A total of 10 landowners attended this working session. Questions posed by landowners included the following:

Q: What is the timeline of the Secondary Plan process?

A: The timeline for the Secondary Plan process depends on multiple factors. Typically, the process may take up to two years or more, before any development applications are submitted. The study process timeline is influenced heavily by timelines for environmental features of concern to be studied.

Q: What is causing the demand for development in the area?

A: Housing and affordability pressures in the GTA may be one factor as to why demand is occurring in Niagara Region as a whole. Additionally, industrial growth is anticipated in the City, including new industrial plants from General Electric and Athena Donair (food processing).

Q: What will happen to the Welland Soccer field currently within the study area?

A: The Welland Soccer Field currently within the study area has been sold on condition.

June 18th, 2018 Public Meeting (Held from 6 pm – 9 pm)

The first Public Information Session took place in Welland's City Hall from 6pm – 9pm. This session was open to the public and followed a similar presentation format as the landowner's meeting. The meeting's presentation can be found in *appendix G1*.

SGL began the presentation by introducing the Study team, outlining the bounds of the Study Area, providing a contextual understanding of the study area compared to land designations of surrounding municipalities, defining the Secondary Plan, outlining other studies that will be part of this process, and the overall Study timeline.

Following the introduction, the project team presented their initial findings of the Study Area as presented in the following pages.

The presentation was concluded with an introduction to a "world café" session, where participants could take turns speaking with project team members, who led the varying studies associated with the project, for a five-minute period, after which participants were encouraged to speak to another consultant. The topics covered included:

- Natural Heritage,
- Floodplain & Natural Hazards,
- Agricultural Impact,
- Archaeological & Cultural Resources,
- Municipal Servicing,
- Transportation, and
- Land Needs.

Summary of Public Information Centre #2

June 19th, 2018 Steering Committee Meeting (Held from 2 pm – 3:30 pm)

On Tuesday, June 19th, 2018, SGL facilitated the second PIC session for the North West Welland Secondary Plan Study. The afternoon session included an informal meeting with the Steering Committee, where two Community Design Approaches were presented for initial discussion and comment.

The first observation for both options was the anticipated increase in traffic for the Rice Road and Quaker Road intersections due to the proposed mixed-use designation. The intention for the intersection is to act as a main hub, where traffic calming measures shall be applied to deter drivers from using Rice Road as a throughway. Although slated to be expanded to a 4-lane "complete street," both Rice Road and Quaker Road shall be designed to limit "highway like" road conditions and speeds. Instead, drivers shall be encouraged to use Niagara Street as a main throughway. The presence of two schools also aids in traffic calming. As such, it is logical to facilitate further traffic calming measures in this intersection.

The location of the proposed Mixed Use area was also discussed. The intention is to provide small scale live-work units, in order to increase the viability of commercial uses in the area. City staff noted that the City of Welland contains an oversupply of commercial units in the nearby mall and around the City.

It was observed that Option 1 was a pedestrian oriented and walkable design, whereas Option 2 was a vehicle-oriented design. The same person also posed a question regarding options for phasing development, in order to encourage development on an "as-needed" basis. Phasing was observed as a more feasible for Option 1. Participants felt that both options should be designed as "gateway" features attracting residents from nearby Pelham, and generally supporting the planned development pattern of Pelham as well.

Option 1 was preferred for some members of the Steering Committee based on its delineated Mixed-Use configuration, and its spreading on three corners of Rice Road and Quaker Road. It was suggested a study of the Binbrook community in Hamilton would be useful as a precedence for how the North West Welland area may develop based on its configuration of roundabouts and denser neighbourhood commercial centre.

Stan Matthew from AE observed that Option 2 was a "less risky" option due to its centralized facilities, and reduction of sprawl within the Study Area. Jordan Frost from AE posed a question regarding the distribution of density along cells, from one cell to another. It was explained that the methodology of concentrating densities in the middle of the cell, tapering out to lower densities and then increasing in density as one travels closer to another central cell. Ensuring that neighbourhoods have appropriate variation in density and scale, and preventing a "wall" condition along streets.

One person suggested to create an east-west trail system within the established NHS, connecting the Secondary Plan community to the existing Summerlea neighbourhood, was discussed. The trail, connecting from the east end of the Study Area's NHS to the existing municipally designated park/easement within the Summerlea community, was envisioned to be a pedestrian or emergency vehicle access only pathway connecting the Study Area to the broader local and regional contexts. Bollards installed at the edge of the municipally owned easement would prevent regular vehicular access, while providing for bike and pedestrian use.

Jordan suggested modifying Community Design Approach #2 to shift the large destination park to the area north of the proposed Mixed-Use designation, west of Rice Road. Based on the existing high number of parks within the City of Welland, totaling approximately 43, a "destination park" may not be needed for the Study Area.

With regards to the inclusion of stormwater management ponds, it was commented that the inclusion of these ponds is generally undesirable or challenging and should only be used in strategic areas. It was suggested that bioswales spread over a larger area may be more appropriate for runoff management. Some areas within public parks may also contain stormwater management ponds.

Housing impacts for Niagara College were considered for both Options, with the consideration for an increase in student housing. City staff informed the Committee that overall, the demand for student housing is reaching a plateau throughout several cities. As such, an excessive supply of student housing is not required.

June 19th, 2018 Steering Committee Meeting (Held from 6 pm – 9 pm)

The evening session followed the same presentation structure as the earlier Steering Committee meeting presentation. The meeting's presentation can be found in *appendix G2*.

Several questions were asked by participants, including the following:

> Q: If the Secondary Plan process may only go forward after approval from the Region in 2019, is it possible that everything said at this meeting will be overruled or changed?
>
> A: The Region is part of the Secondary Plan process and is funding half of the required studies. As such, this Secondary Plan process will inform the final Secondary Plan which is presented to the Region for approval. If the Urban Boundary Expansion required for the Secondary Plan is rejected by the Region, City staff have the opportunity to appeal the decision to the LPAT.
>
> Q: Will lands highlighted as Mixed-use be expropriated from landowners?
>
> A: Landowners may choose to stay on their properties as long as they would like, and will not be required to sell their property once the Secondary Plan is approved. The Secondary Plan informs required development patterns once landowners decide to sell. New developments will have to respect the development patterns envisioned for the area, which may include higher density mixed use areas at certain locations.
>
> Q: Fenwick backs onto this Secondary Plan. How will this plan coordinate with other municipalities?
>
> A: The Secondary Plan will consider the existing and planned context it is surrounded by. The final draft Community Design Approach will also coordinate with the Region to ensure plans are cohesive and consistent with the future development intents of the surrounding areas.

After the presentation, participants were asked to complete several activities which included constructing a vision statement, selecting the most preferred housing and open space types through a visual survey, and commenting on the two Community Design Approach Options.

The following presents a summary of comments provided:

Vision Statement Summary

Overall, residents emphasized the desire for greater trail connections within the Secondary Plan Area. Participants are generally supportive of development, supporting the inclusion of single detached dwellings and townhouses along collector roads. The Vision Statement Boards can be found in *appendix G3*.

Additional insights made from the three tables of participants included:

- A desire for more development, consisting of single detached dwellings and townhomes
- Creating additional trails and walkways including
    - An east/west trails along the drainage swale and,
    - Connecting the Bauer and Milkweed Trail
- A 30 metre ROW for arterial and collector roads
- Maintaining natural heritage
- Integrating multicultural and the various ages of people into the design features (i.e library, café, bocce ball, small parks, equal accessibility, small stores, walk in clinic)
- Creating an area to live, grow, and retire

Visual Survey Summary

Participants were asked to indicate the types of Housing and Open Spaces they would like to see as Welland grows by selecting the images they preferred of Open Spaces, Neighbourhood Node housing types, Neighbourhood Residential housing types, and Village Residential housing types.

Overall, participants prefer 2 storey single detached housing within the village residential area, 2 storey single detached housing within the neighbourhood residential area, 3 storey mixed use commercial/residential units within the neighbourhood node, and an open space area which contains stormwater management ponds and trails. The Visual Survey Boards can be found in *appendix G4*.

A breakdown of the insights made by the three participating groups is as follows:

<u>Table 1's Preferred Pictures Under Each Category</u>

- Village Residential: Picture 2
- Neighbourhood Residential: Pictures 1, 3, and 4
- Neighbourhood Node: N/A
- Open Space: Picture 3

Table 2 (1st group) Preferred Pictures Under Each Category

- Village Residential: Pictures 1, 2 (maintain trees), 4
- Neighbourhood Residential: Picture 1
- Neighbourhood Node: Pictures 1 and, 2 (voted twice), 3 (voted twice), and 4 (all east of Rice Road)
- Open Space: Pictures 1, 3, and 4 (Picture 2 shows too much concrete)

Table 2 (2nd group) Preferred Pictures Under Each Category

- Village Residential: Pictures 1, 2 (maintain trees), and 4
- Neighbourhood Residential: Picture 1
- Neighbourhood Node – Pictures 1, 2, 3, and 4 (all east of Rice Road)
- Open Space – Pictures 1, 3, and 4 (Picture 2 shows too much concrete)

Community Design Approach Options Summary

Participants were asked to identify which building and design characteristics are most valued for the Study Area by providing their insights on the Draft Community Design Approach Options in terms of the option's strengths, Weaknesses and Opportunities. Draft Community Design Approach option one and option two were provided on maps for participants to draw and comment on. The Community Design Approach Boards can be found in *appendix G5*.

The following is a list of the comments provided:

Table 1

Community Design Approach 1:

- Preferred approach
- Would like to see towns for students, trail connection to Fonthill, and bike lanes
- Parks are ideal, too much money for large park

Community Design Approach 2:

- Bush was cleared
- Driving range
- Not environmentally sensitive
- Ash trees are dying

Table 2

Strengths:

- Open Space Distribution
  - Integrate Natural Heritage spaces
  - Integrate community outdoor space (soccer, basketball) or community gardens
  - Community gardens – splash pad

- Road System Network

    - Sidewalks on spines and arterials
    - Bike lanes integrated – connect to existing streets trails
    - Street Lighting effective lighting solar lights
    - Merrit Road – Potential as an arterial

- Location of Housing Types
    - Maintain bungalow style townhouses
    - Bike lanes integrated – connect to existing streets trails

- Extent of Village Character
    - Sidewalks on spines and arterials
    - Bike lanes integrated – connect to existing streets trail

Weakness:

- Road System Network

Opportunities:

- Open Space Distribution
    - Community gardens – splash pad
    - Sport fields
    - Outdoor activities space

- Road System Network
    - Do not open closed end road (i.e. Summerslea, and Montgomery)

- Location of Housing Types
    - Group homes
    - Institutional footprint

- Extent of Village Character
    - Small stores, cafes
    - Maintain look density

Table 3

General Comments:

1. Minimal impact on residential use for soccer dome compared to all other properties
2. Why are there only 2 designs?
3. Natural Heritage mapping at 450 Rice is inaccurate (See "Map Comment" 1)

Other Comments:

- Why is the soccer dome property the only plot of land to be deemed solely residential?

Map Comments

1. In Design Approach one a participant noted that there has been no surface water evident in 30 years in the "Natural Heritage System" located on the north east corner of Quaker Road and Rice Road, and that the area has no natural drainage.
2. The owner of a parcel of land located at 450 Rice Road is not in favour of Designer Approach two. They would like to see as much residential as possible
3. In Design Approach two a request was made to move the parkette located at the northeast corner of Quaker Road and Rice Road across street to the soccer dome property.

Summary of Engagement with Indigenous Communities

Indigenous Engagement Program

The Indigenous engagement program for the North West Welland Secondary Plan project followed the approach of separate and direct engagement with rights-bearing Indigenous communities or organizations. A list of Indigenous communities or organizations that have established or potential Aboriginal or Treaty rights within the Study Area, or who have an established interest in the region, has been consolidated from several sources, including contact lists maintained by the Region of Niagara and ASI. Based on these criteria, four nations or organizations were contacted about the project:

- Haudenosaunee Confederacy Chiefs Council
- Métis Nation of Ontario
- Mississaugas of the Credit First Nation
- Six Nations of the Grand River First Nation Elected Council

Engagement with rights-bearing Indigenous communities or organizations as it relates to the North West Welland Secondary Plan began in June 2018 with the circulation of a project notice by mail and email to designated contacts at the four identified nations. The Notice describes the decision to undertake the project, its goals and timeline, as well as providing a contact for the City of Welland and the location of the project materials on the City of Welland website. Additionally, the notice invites recipients to contact the City if they have any preliminary comments on the project or would like to organize a meeting to discuss the project further. These recipients were then contacted by a representative of the project team in July 2018 to confirm that they had received the notice and answer any preliminary questions. All contacts confirmed that they had received the notice and the consultation staff at Haudenosaunee Confederacy Chiefs Council, the Mississaugas of the Credit First Nation, and the Six Nations of the Grand River First Nation Elected Council requested that the draft Stage 1 Archaeological Assessment Report be circulated to them once complete.

The draft Stage 1 Archaeological Assessment report was circulated to the three nations or organizations that requested it in July 2018. A representative of the project team followed up

with the three groups in September 2018 to request feedback on the report. At this point, no comment has been received on the draft Stage 1 Archaeological Assessment report.

Meetings with Indigenous Consultation Staff

One First Nation requested to meet with the City of Welland in relation to the North West Welland Secondary Plan project. Following the circulation of the draft Stage 1 Archaeological Assessment Report in July 2018, the Mississaugas of the Credit First Nation Department of Consultation and Accommodation requested a meeting with members of the project team, the City of Welland, and the Region of Niagara to discuss this project.

This meeting took place on September 13, 2018 at the Department of Consultation and Accommodation office in Hagersville, Ontario. The meeting began with a presentation of the history of the Mississaugas of the Credit First Nation by the Nation's Traditional Knowledge and Land Use Coordinator. Following this, the project team described the rationale for undertaking this secondary planning study, the scope of the project and timeline, and preliminary results. The presentation provided on the North West Welland Secondary Plan Study on September 13, 2018 can be found in appendix G5.

Consultation staff from the Mississaugas of the Credit First Nation responded that the Nation has an interest in the project and expressed their expectation for future involvement in any fieldwork related to the project as well as the request to review and comment on any environmental planning and design options for the project. In particular, the Nation communicated to the City of Welland that they would like to have Field Liaison Representatives for any remaining environmental monitoring fieldwork or archaeological fieldwork as it relates to the North West Welland Secondary Plan project.

Immediately following this meeting, the Archaeological Operations Supervisor for the Mississaugas of the Credit First Nation sent the Field Liaison Representative Participation Agreement to the Manager of Policy Planning at the City of Welland outlining the costs associated with field participation. The City of Welland responded to this request on September 28, 2018 stating that the City would be happy to provide funds to allow for field participation and provided the date for the final portion of fieldwork remaining, scheduled for October 1, 2019. However, given scheduling and administrative constraints, the Nation were not able to provide a Field Liaison Representative for this fieldwork but stated that they would expect to be invited to participate in any future field assessment as it relates to the project.

Future Steps

The City of Welland is committed to continued engagement with identified Indigenous communities or organizations and additional updates and requests for input will be sent to each designated contact over the course of the study process. Meetings to further discuss the project will be conducted upon request. A record of engagement will be compiled and

presented in the final document along with a full record of correspondence with communities as it relates to this project.

The presentation provided on the North West Welland Secondary Plan Study on September 13, 2018 can be found in *appendix G5*.

Attachment G1 - Presentation for Public Information Centre #1

North West Welland

SECONDARY PLAN STUDY

PUBLIC INFORMATION SESSION # 1 - BACKGROUND STUDY

June 18, 2018

SGL Planning & Design Inc. - AgPlan Limited - Associated Engineering - AquaforBeech - ASI – Hemson Consulting

TODAY'S AGENDA

1. Introduction
2. Project Process & Schedule
3. Background Studies
4. Group Discussions

1 INTRODUCTION

North West Welland Secondary Plan Study

CONSULTING TEAM

SGL Planning & Design Inc
Project Management
Ute Maya-Giambattista
Paul Lowes

Aquafor Beech Ltd.
Natural Heritage & Subwatershed
Dave Maunder
Ash Baron
Peter Hebert

AgPlan Ltd.
Agriculture
Michael Hoffman

ASI
Cultural & Built Heritage
Rebecca Sciarra
Eric Beales
James Neilson

Associated Engineering
Servicing & Transportation
Jeff Suggett
Stan Matthew
Jordan Frost

Hemson
Financial Viability Analysis
Jason Bevan
Julia Cziraky

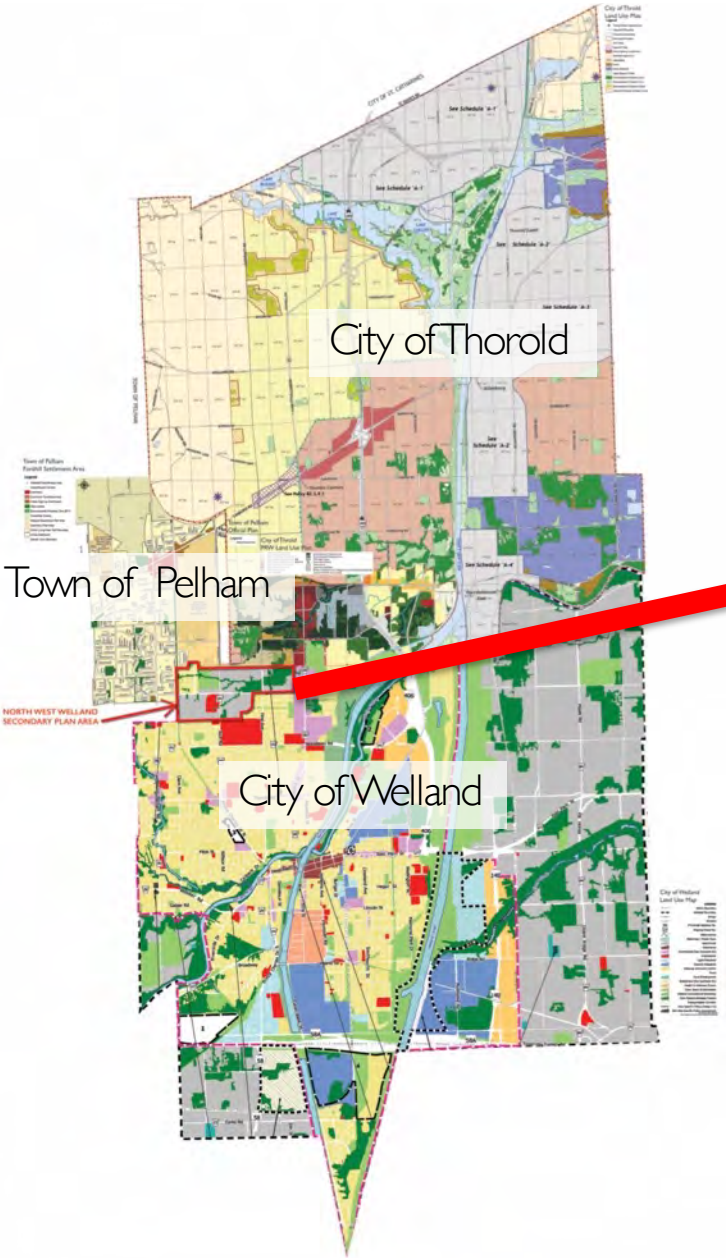
SGL Planning & Design Inc.
Land Use Planning
Paul Lowes
Yasaman Soofi

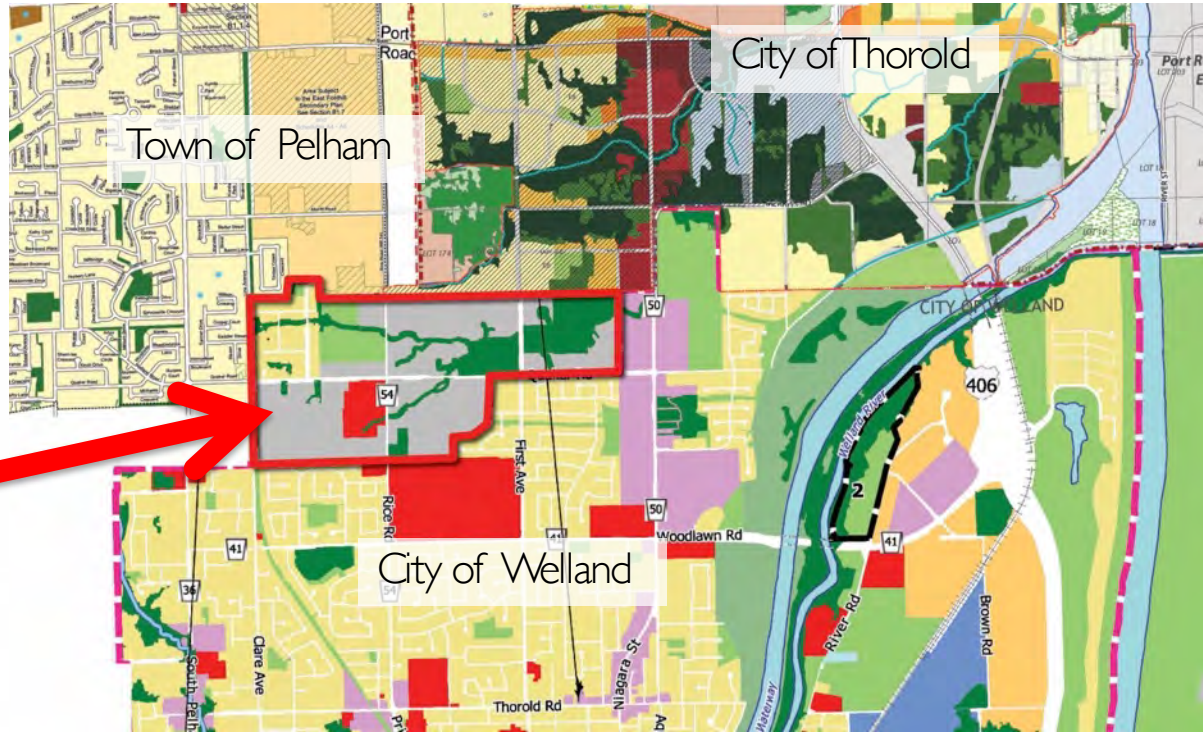
SGL Planning & Design Inc.
Urban Design
Ute Maya-Giambattista
Shikha Jagwani
Yasaman Soofi

STUDY AREA

The purpose of this study is to develop a strategy to ***guide the future growth and development*** in North West Welland through a ***Secondary Plan*** and ***Urban Design Guidelines***

STUDY AREA - CONTEXT





- North West Welland Study Area is surrounded by Built-Up Areas in:
  - Town of Pelham,
  - City of Thorold, and
  - City of Welland

TYPE OF STUDY

A Secondary Plan is a long-term land use planning tool which:

- *Helps direct and shape the future of a specific area; and,*
- *Provides more detail than the Official Plan.*

A Secondary Plan specifies:

- *Which **land uses** may be permitted;*
- *What **shape and size** of buildings are permitted;*
- ***How** development is **integrated with the surrounding neighbourhood;***
- ***Design objectives** for new buildings or additions;*
- *How developments may **address the public street;** and,*
- *What the public **streetscape** looks like:*
    - *Sidewalks, boulevards, bike lanes, street width, etc.*

TYPE OF STUDY

As part of the Secondary Plan we are conducting the following studies:

- Natural Heritage Study
- Floodplain and Natural Hazard Lands Study
- Agricultural Impact Assessment Study
- Archaeological and Cultural Resource Assessment
- Municipal Servicing
- Transportation Study
- Land Needs Assessment

2 PROJECT PROCESS & SCHEDULE

North West Welland Secondary Plan Study

STUDY SCHEDULE

PHASE 1. (FEBRUARY – JUNE 2018)

DATA COLLECTION, BACKGROUND REVIEW AND GROWTH DIRECTIVES

1. *Study Background Presentation - June 18th*
2. Update Presentation to Council - July 24

PHASE 2. (JUNE – NOVEMBER 2018)

LAND USE PLAN

1. *Visioning Workshop - June 19th*
2. Update Presentation to Council - January 2019

PHASE 3. (NOVEMBER 2018 – MARCH 2019)

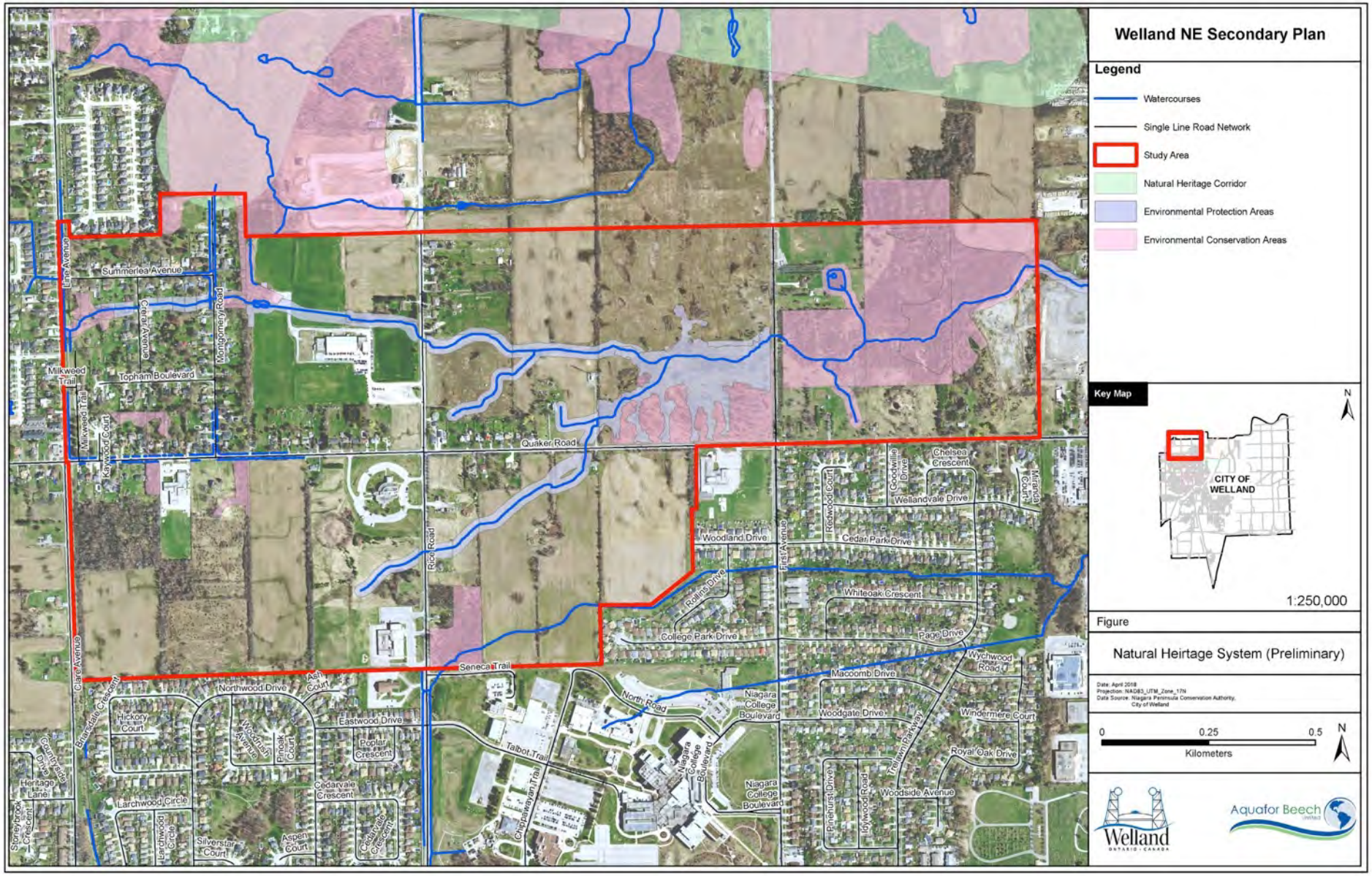
SECONDARY PLAN POLICY DEVELOPMENT

1. Present Preferred Option – January 2019
2. Council Presentation – March 2019

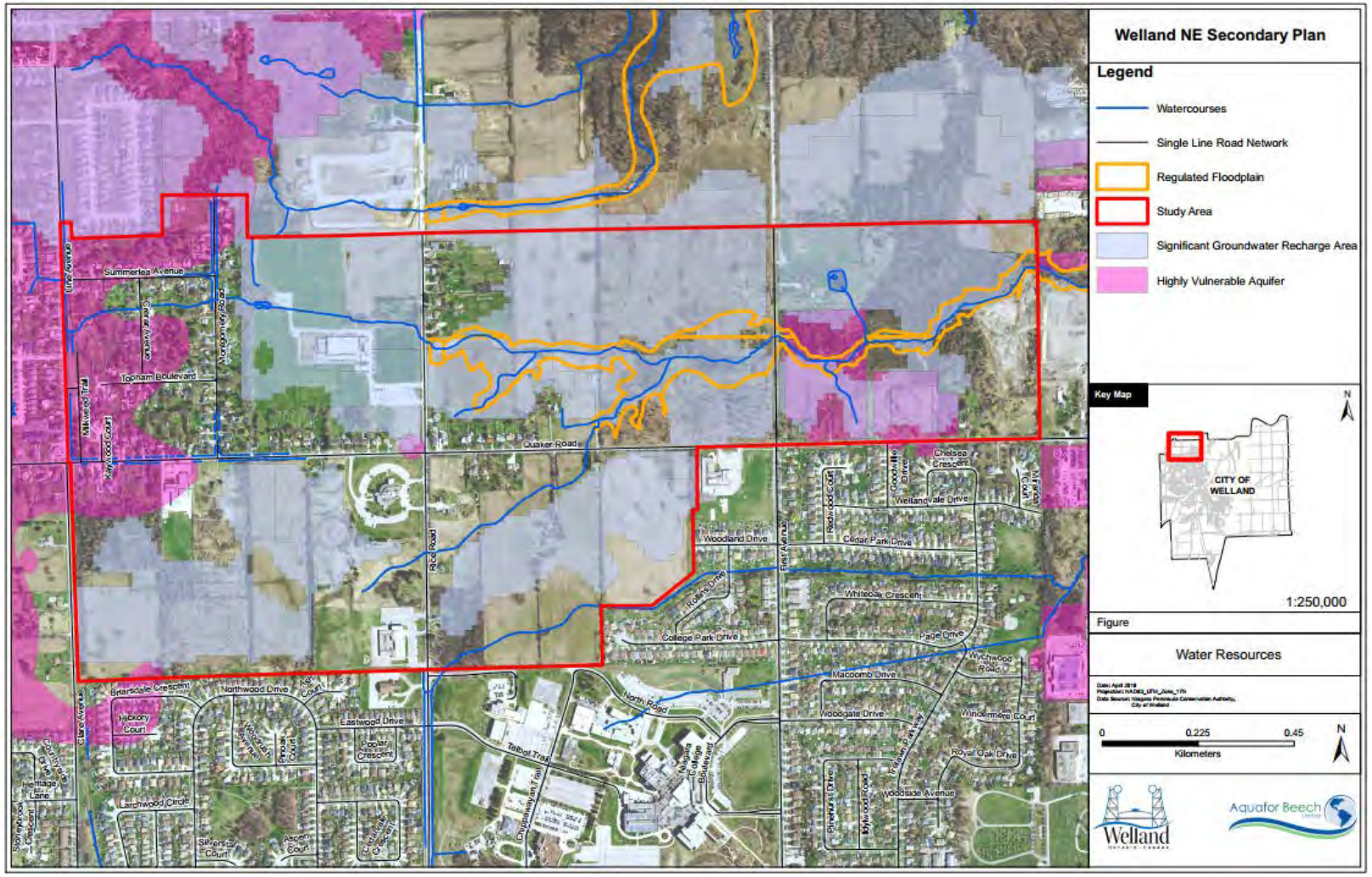
3 BACKGROUND STUDIES

North West Welland Secondary Plan Study

NATURAL HERITAGE SYSTEM



TERRAIN HYDROLOGY



- Floodplain mapping undertaken by Aquafor Beech in 2010 as part of the Central Welland Floodplain Mapping Study
- Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers delineated through Niagara Peninsula Source Protection

AGRICULTURAL CHARACTERISTICS

1. **What agricultural characteristics are present?**
   - Soils with what soil potential/soil capability
   - Agricultural and non-agricultural uses and agricultural infrastructure
   - Livestock operations and Minimum Distance Separation
   - Planning designations

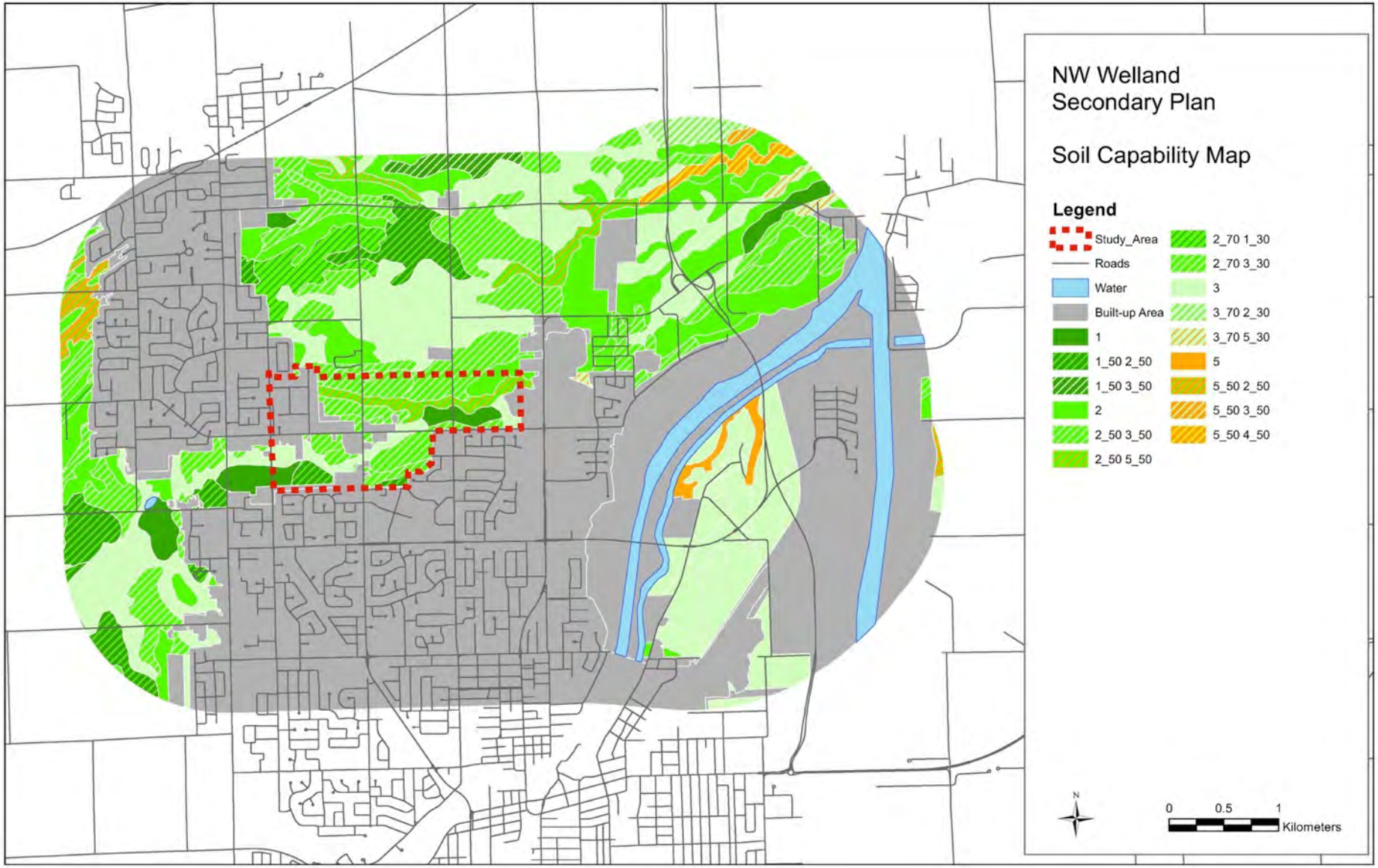
2. **Are there observed trends in agricultural land use and livestock production in the past 30 years?**

3. What is the significance of the agricultural observations as well as trends?

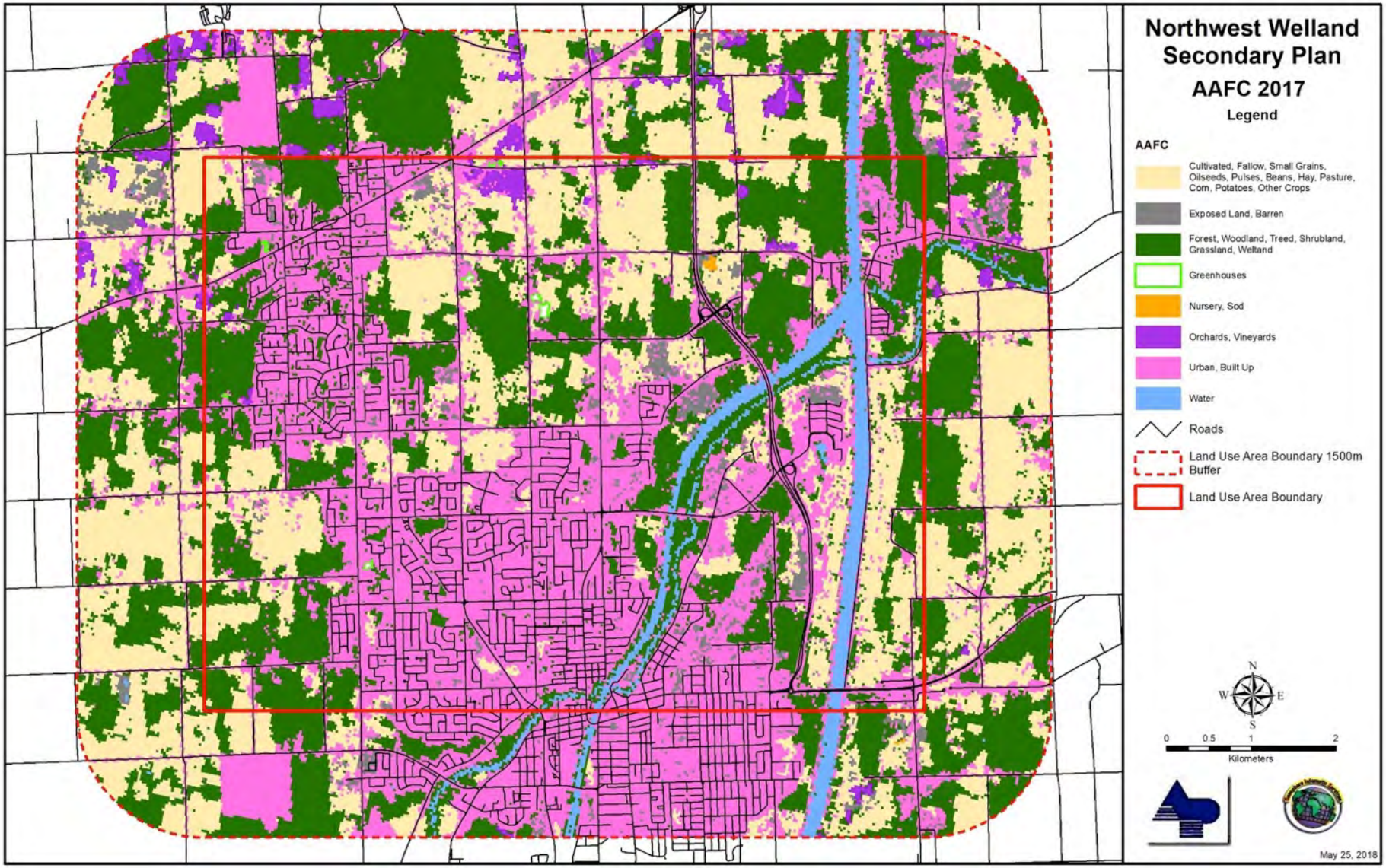
4. Can the significant agricultural observations reasonably be used to influence the outcome of the Secondary Plan study?

WE ARE CURRENTLY AT STEPS ONE AND TWO ABOVE

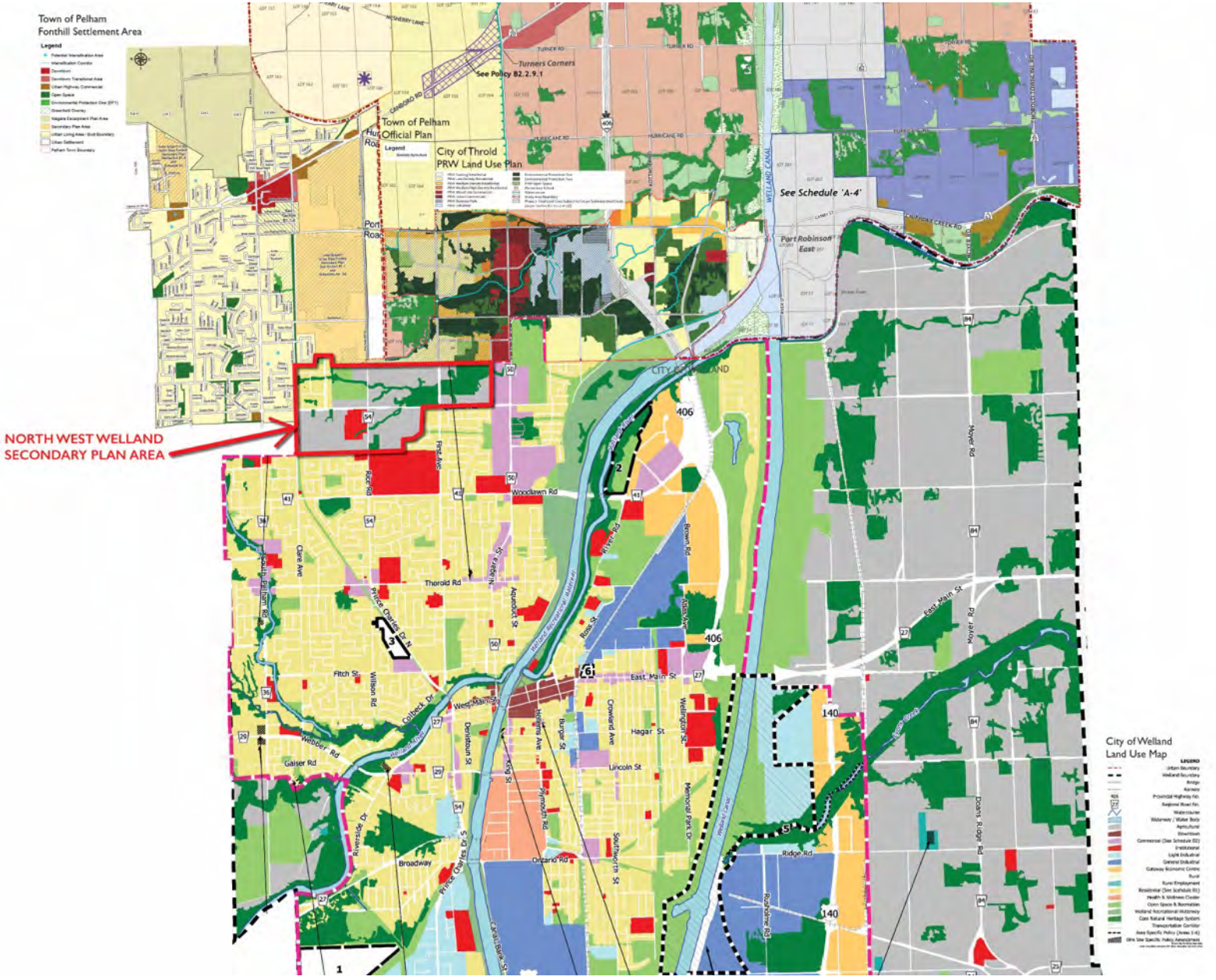
AGRICULTURAL CHARACTERISTICS



AGRICULTURAL CHARACTERISTICS



AGRICULTURAL CHARACTERISTICS



AGRICULTURAL CHARACTERISTICS

Observations in the study area and adjacent lands:

1. Soil capability is predominantly prime when excluding Natural Heritage Systems (which is typical of much of the countryside in south central to southwestern Ontario).

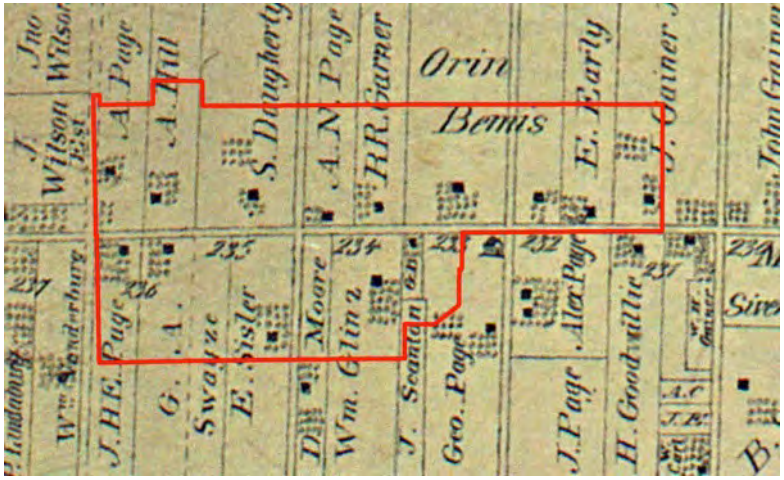
2. The study area and adjacent lands are not part of a specialty crop area.

3. Livestock and manure production as well as fruit and vegetable production are relatively low and have been decreasing over the past 30 years.

4. Agricultural infrastructure in the study area is minimal and there are no Minimum Distance Separation conflicts.

5. The study area is adjacent to existing and planned non-agricultural uses on four sides.

HISTORY: QUAKER ROAD



1876

1907

- An important transportation route since the early 1800s
- Served as the roadway to the Quaker village in Pelham
- Many Quakers settled along the route
- The first school was constructed in 1816 and relocated to the site of the current Quaker Road Public School in 1861
- An 1899 Globe and Mail article mentions the road as a stop for slaves on the Underground Railroad

PROCESS

- Determine if there are any existing heritage properties in the area.

- Compile historical research;
  - Census materials, land abstracts
  - Maps/aerial photography
  - Newspapers, books, photographs.

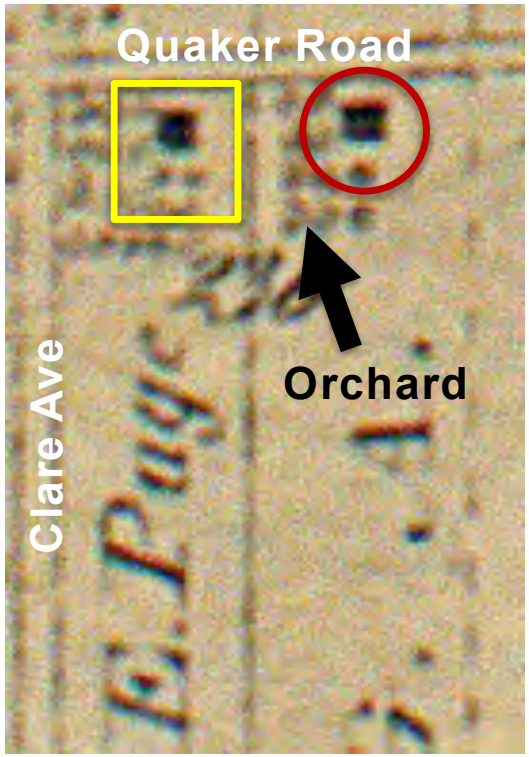
- Compile all relevant municipal, regional, and provincial heritage policies.

- Conduct a site visit to document the existing study area.

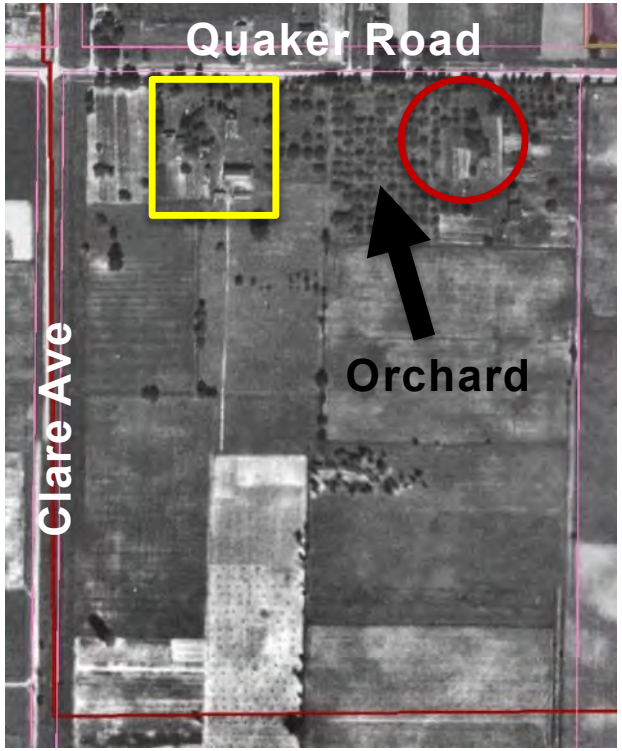
- Analyze the study area to determine if any properties potentially contain cultural heritage value;
  - Buildings built before 1934 will be noted and may require further evaluation.

- Provide recommendations for consideration within the Secondary Plan;
  - Properties included for the Secondary Plan will not automatically be considered heritage buildings as part of this process.

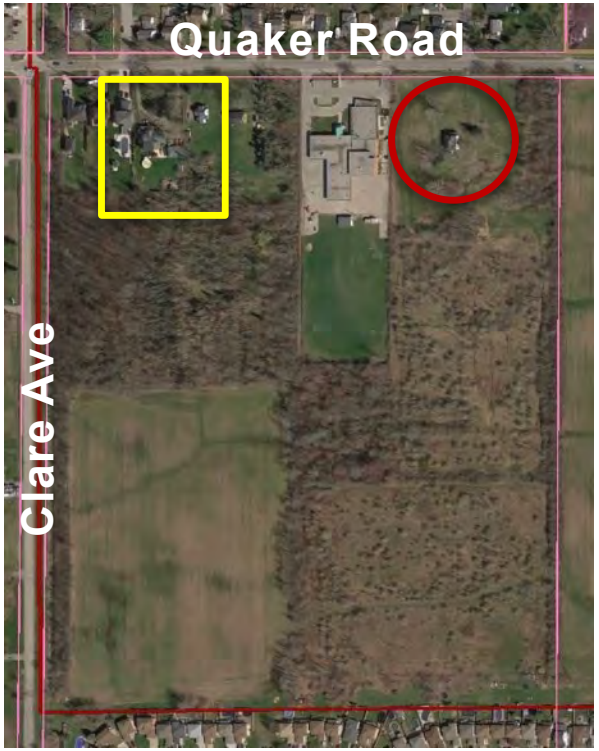
PROCESS



1876



1934



2018

- Compare and contrast historical maps and aerial photos to find extant features.
- Approximately a dozen buildings built before 1934 have been found.
- Three historical transportation routes have been found (Quaker Road, Steve Bauer Trail, and Milkweed Trail).

NEXT STEPS

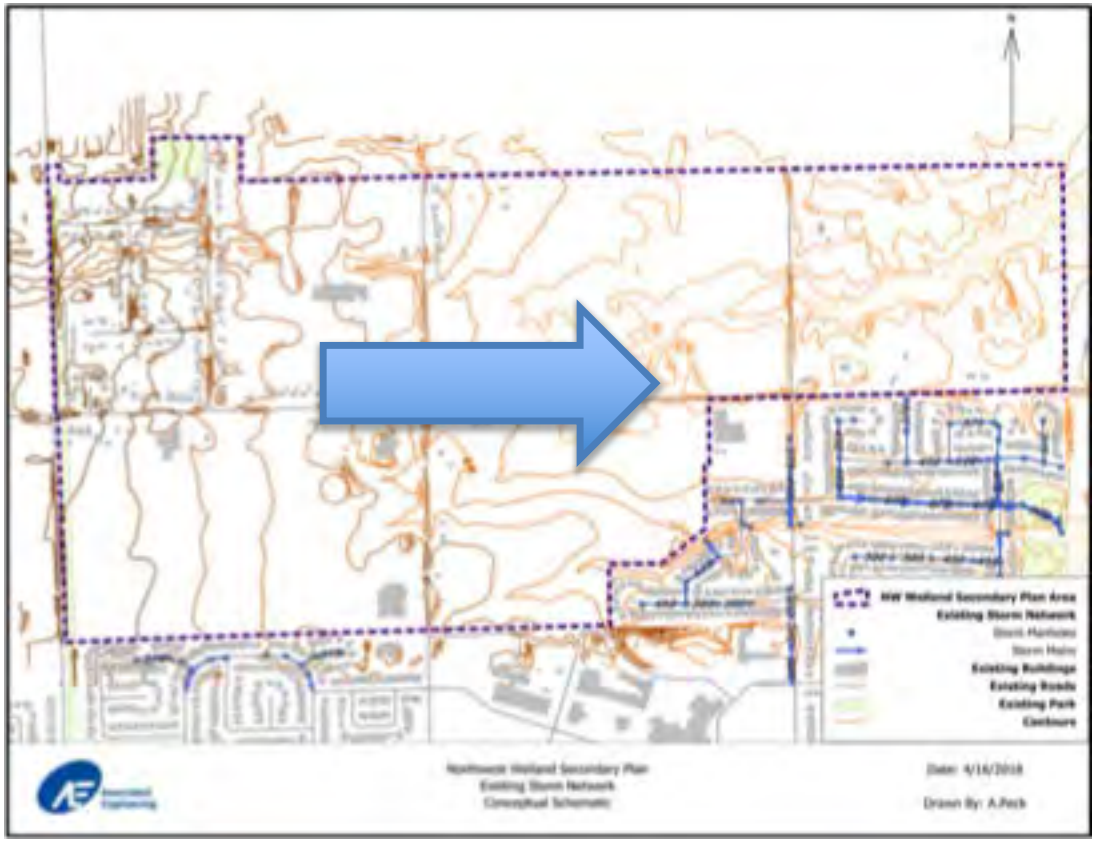
- Uncover additional information from the public;
  - Do you have old photos, stories, or information that you would like to share?
- Finalize a list of properties with potential cultural heritage value within the study area.
- Develop recommendations for the design components of the secondary plan and for the incorporation of potential cultural heritage resources.
- Do you have any specific concerns about cultural heritage in the area?
  - How should cultural heritage be incorporated into the Secondary Plan?

MUNICIPAL SERVICING: WATER

- Study Area is fed from Shoalt's Drive Reservoir / Pumping Station (Welland WTP)
- 300mm Dia. Regional trunk watermain flows east-west along Quaker Rd
- 150mm Dia. watermain flows north on Rice Rd from Quaker Rd
- 200mm Dia. watermain flows south on Rice Rd from Quaker Rd
- No flow along 1st Ave in Study Area
- Could leverage existing services in the Study Area to service new development

MUNICIPAL SERVICING: STORM DRAINAGE

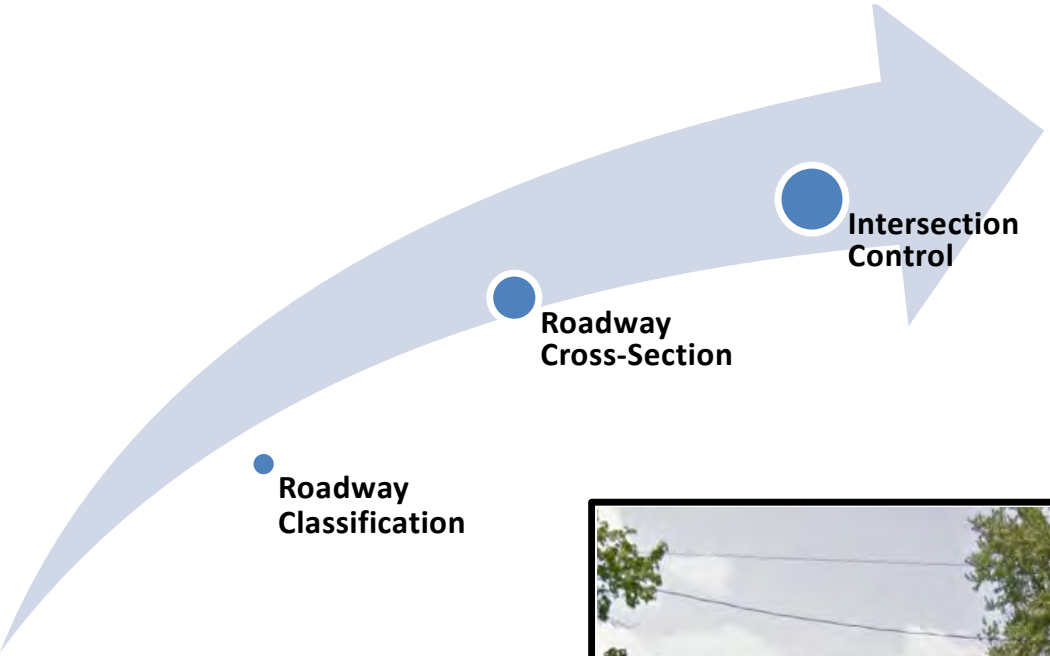
- Two (2) main drainage channels convey runoff from west to east
- Culverts crossing Rice Rd and First Ave aid conveyance of runoff downstream
- Runoff drains to Welland Canal
- Erosion and sediment control will likely be a concern
- Flood hazard zones adjacent to streams draining through Study Area
- Large portion of study area identified as "significant groundwater recharge areas"
- May consider storm pipe network for servicing the Study Area

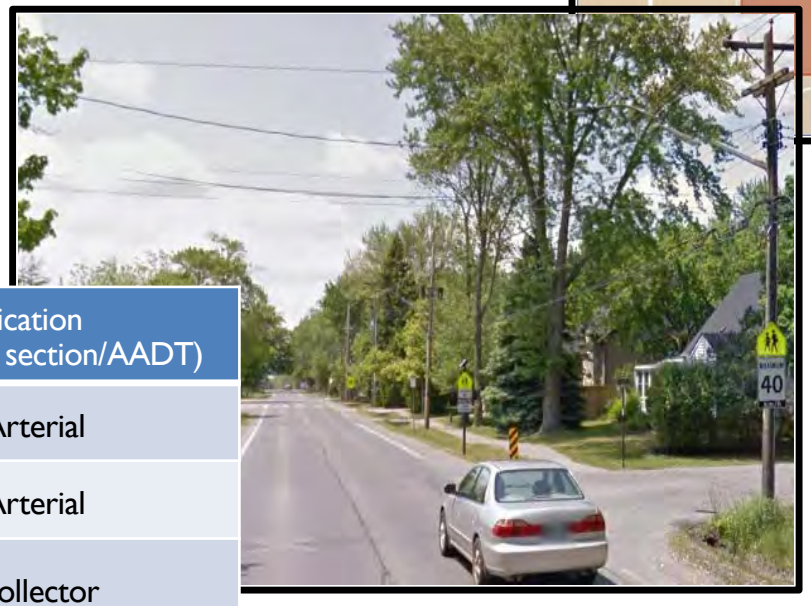


MUNICIPAL SERVICING: SANITARY

- Treatment at Welland WWTP
- Existing sanitary system appears to service some of the Study Area
- The Niagara Region Master Servicing Plan (2017) has a planned future upgrade for Quaker Rd sanitary sewer and Towpath SPS
- May leverage the Region's planned upgrades to service the Study Area

TRANSPORTATION



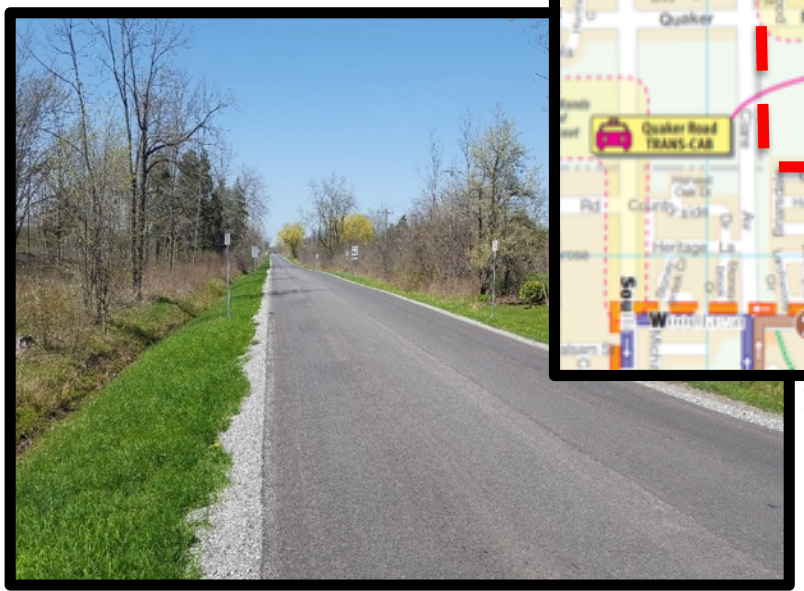


Road	Classification (based on cross section/AADT)
Quaker Road	Rural Arterial
Rice Road (R.R. 54)	Rural Arterial
First Avenue (n. of Quaker Road)	Rural Collector
First Avenue (s. of Quaker Road)	Urban Collector

TRANSPORTATION

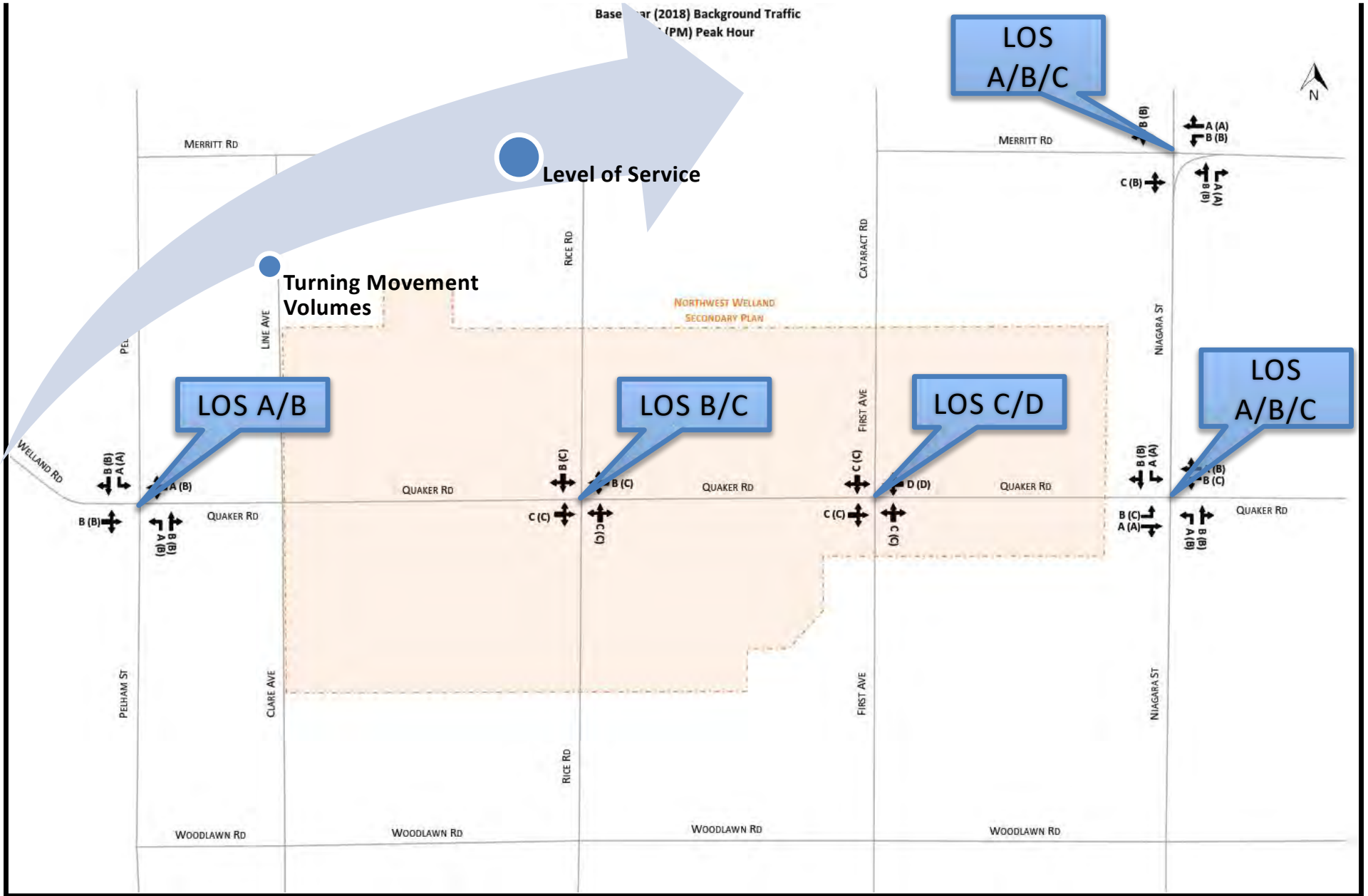
- Active Transportation Facilities
- Transit Routes and Facilities
- Surrounding Developments

- East Fonthill Secondary Plan
- West Port Robinson Secondary Plan
- Niagara College Welland Campus
- Regional Road 37 (Merritt Road) Extension

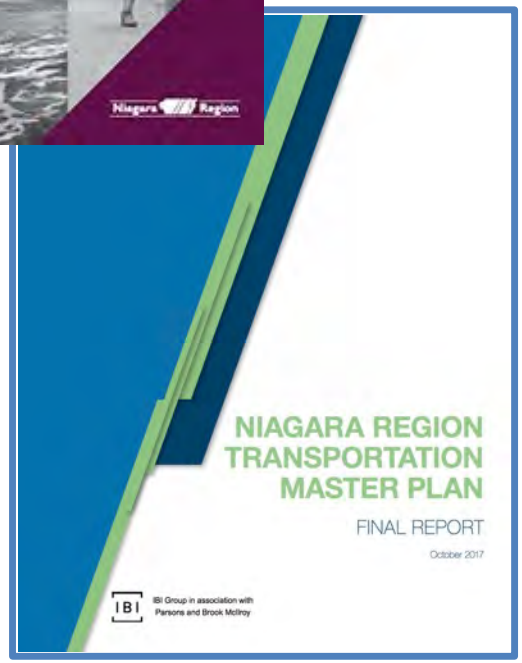


Quaker Road TRANS-CAB
Quaker Road TRANS-CAB
Quaker
Rd
Rice
Rd
Eastwood Dr
Northwood Dr
Niagara College
First Ave
Rd
Quaker
Rd
Niagara
Rd
Rd
Rd

TRANSPORTATION



REGIONAL LAND USE POLICY



NIAGARA REGIONAL OFFICIAL PLAN, 2014

4.C.5 To ensure that *Designated Greenfield Areas* will be planned as **compact, complete** communities by:

- Providing opportunities for **integrated, mixed land uses;**
- Creating street patterns that are fine-grained and in a grid pattern **supporting transit and active transportation;** and,
- Ensuring Greenfield development is **sequential, orderly and contiguous** with existing built-up areas.

NIAGARA TRANSPORTATION MASTER PLAN, 2007

4.1 Need for a street network that is safe and walkable for all ages, and that **does not divide neighbourhoods**

6.3 Roads and streets under the jurisdiction of Region of Niagara will be planned and designed using a **'complete corridor'** approach

LOCAL LAND USE POLICY

KEY POLICIES OF THE LOCAL OFFICIAL PLAN:

3.2 Growth objectives include:

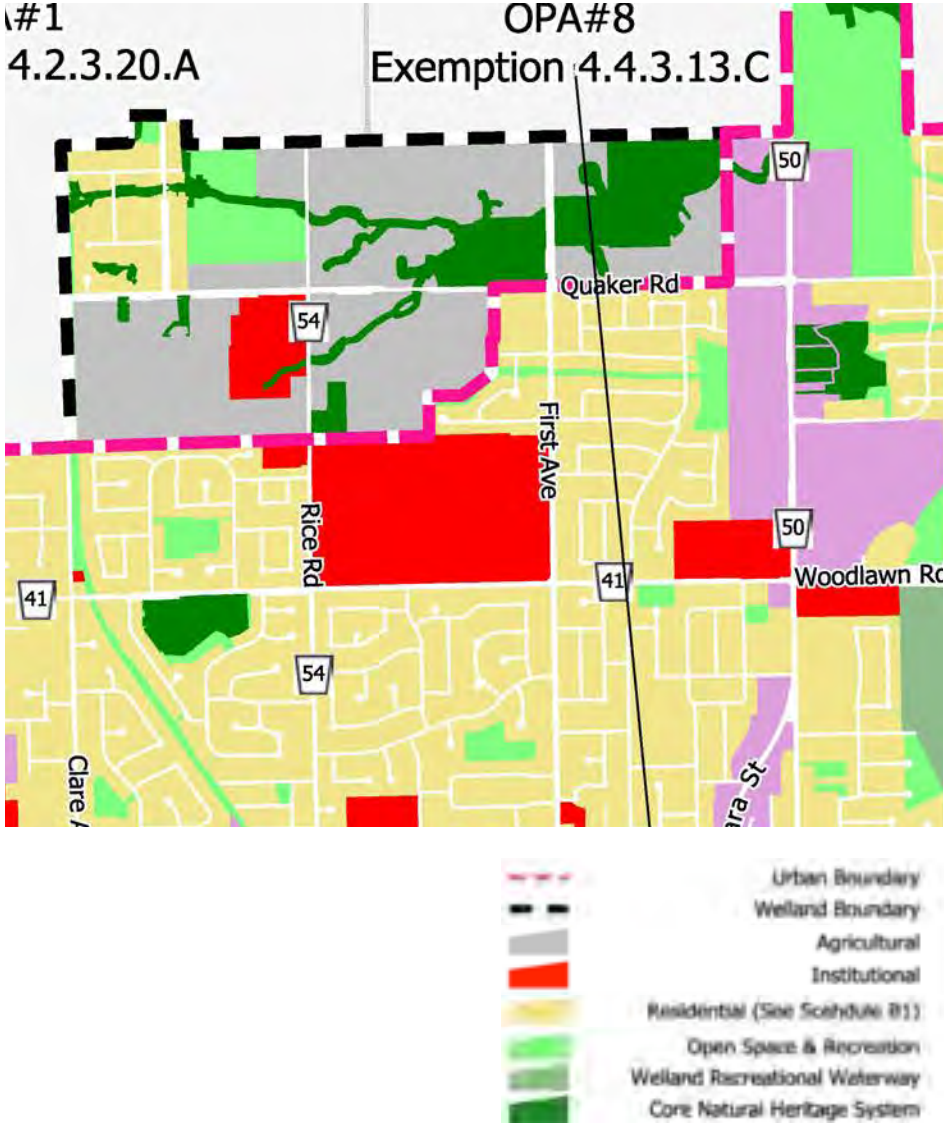
vi) Building of **compact, mixed-use, transit supportive, pedestrian friendly** areas within the *Built Up Area* and **Greenfield Areas**; and,

viii) Ensuring the availability of a sufficient supply of designated employment and residential land to **meet the City's projected long-term growth.**

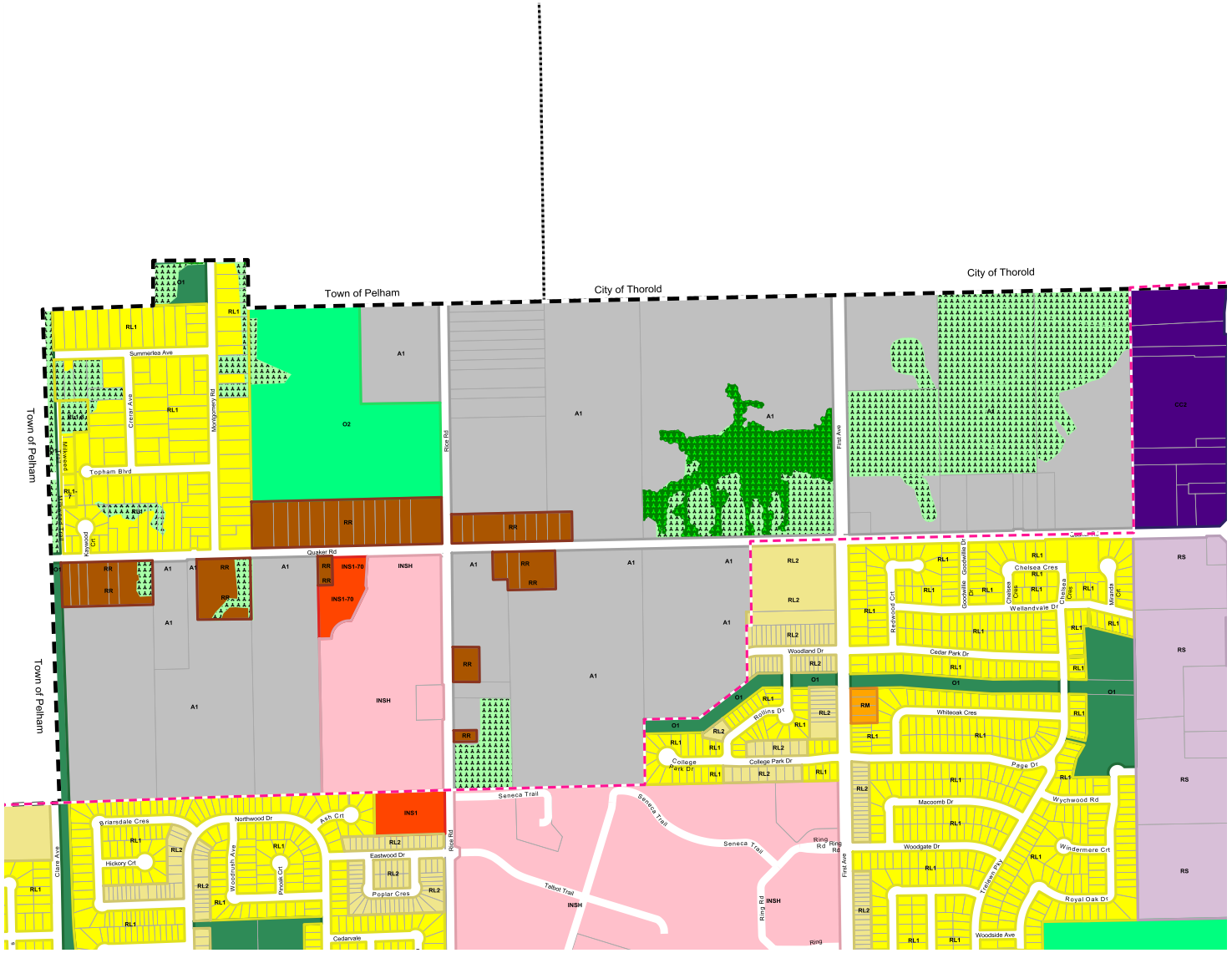
3.4.2.3 The remaining lands which lie between the Urban Boundary and the Built Boundary represent **Greenfield Areas.**

4.2.3.2 New neighbourhoods will be planned to support the Region's density target of a **combined 50 residents and jobs per gross hectare** on designated Greenfield lands.

New *Growth Plan* will require a density target of a **combined 80 persons and jobs per gross hectare**



LOCAL LAND USE POLICY



Welland
ONTARIO • CANADA

City of Welland Zoning By-law 2017-117 Excerpt

Zone Categories

Residential Zones

- RL1 Residential Low Density 1
- RL2 Residential Low Density 2
- RM Residential Medium Density
- RH Residential High Density

Commercial Zones

- DMC Downtown Mixed Use Centre
- RS Regional Shopping Node
- CC1 Community Commercial Node
- CC2 Community Commercial Corridor
- NC Neighbourhood Commercial

Open Space Zones

- O1 Neighbourhood Open Space
- O2 Community Open Space
- WRW Welland Recreational Waterway
- EP Environmental Protection Overlay
- Environmental Conservation Overlay

Institutional and Community Wellness Zones

- INS1 Community Institutional
- INSH Health and Wellness

Industrial Zones

- L1 Light Industrial
- G1 General Industrial
- GEC Gateway Economic Centre

Agricultural and Rural Zones

- A1 Agricultural
- RR Rural Residential
- RE Rural Employment

Other Zones

- RT Railway Transportation
- R1 Refer to Zoning By-law 2667

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Infrastructure and Development Services
Planning Division

Z:\MAPPING\GIS\Zoning\Zoning-Bylaw-2017-117.map

"The information contained in this map may represent unintended errors or distortions of fact and the City of Welland (the City) makes no representations or warranties, express or implied, as to the accuracy or completeness of the data and all information should be verified independently. No part of these drawings, or information, or hard copies made from them may be reproduced and/or distributed without written permission from the City."

LAND NEEDS STUDY:

- Identifies the City's available land supply in the Built-Up and Greenfield Areas
- Determines the anticipated land capacity required to accommodate forecasted growth
- Confirms the need for the North West Welland lands

- Niagara Region conducting Regional Municipal Comprehensive Review to guide growth to 2041
  - Intensification target of 50% for Welland
  - 50% of growth to take place in Designated Greenfield Area

- Two studies conducted to forecast population growth in Welland:
  - Niagara Region MCR
  - Watson & Associates Review of MCR (2017)

LAND NEEDS STUDY

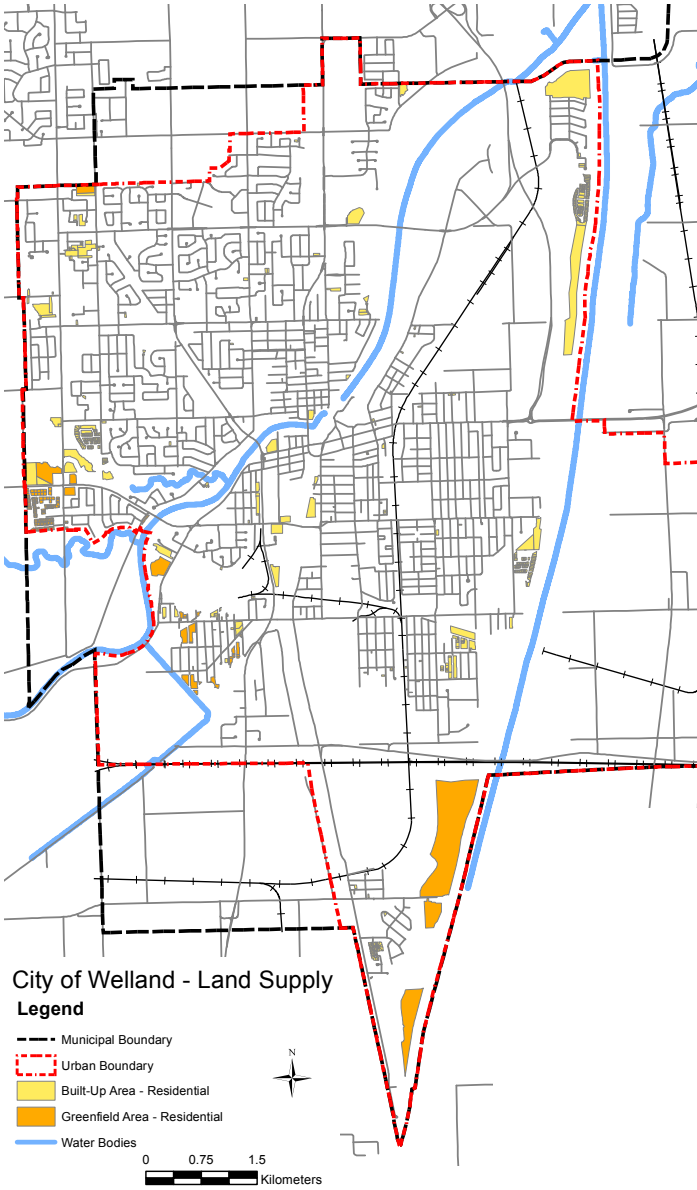
- Forecasted Growth for the City of Welland from 2016-2041:

	Population Growth (people)	50 % of Units in DGA
Niagara Region MCR (2016)	13,640	2,660
Watson & Associates Review of MCR (2017)	17,640 to 18,640	3,400

- Remaining land capacity in BUA and DGA = 167 ha

- City can accommodate approx. 1,389 – 2,022 units in DGA on these lands.

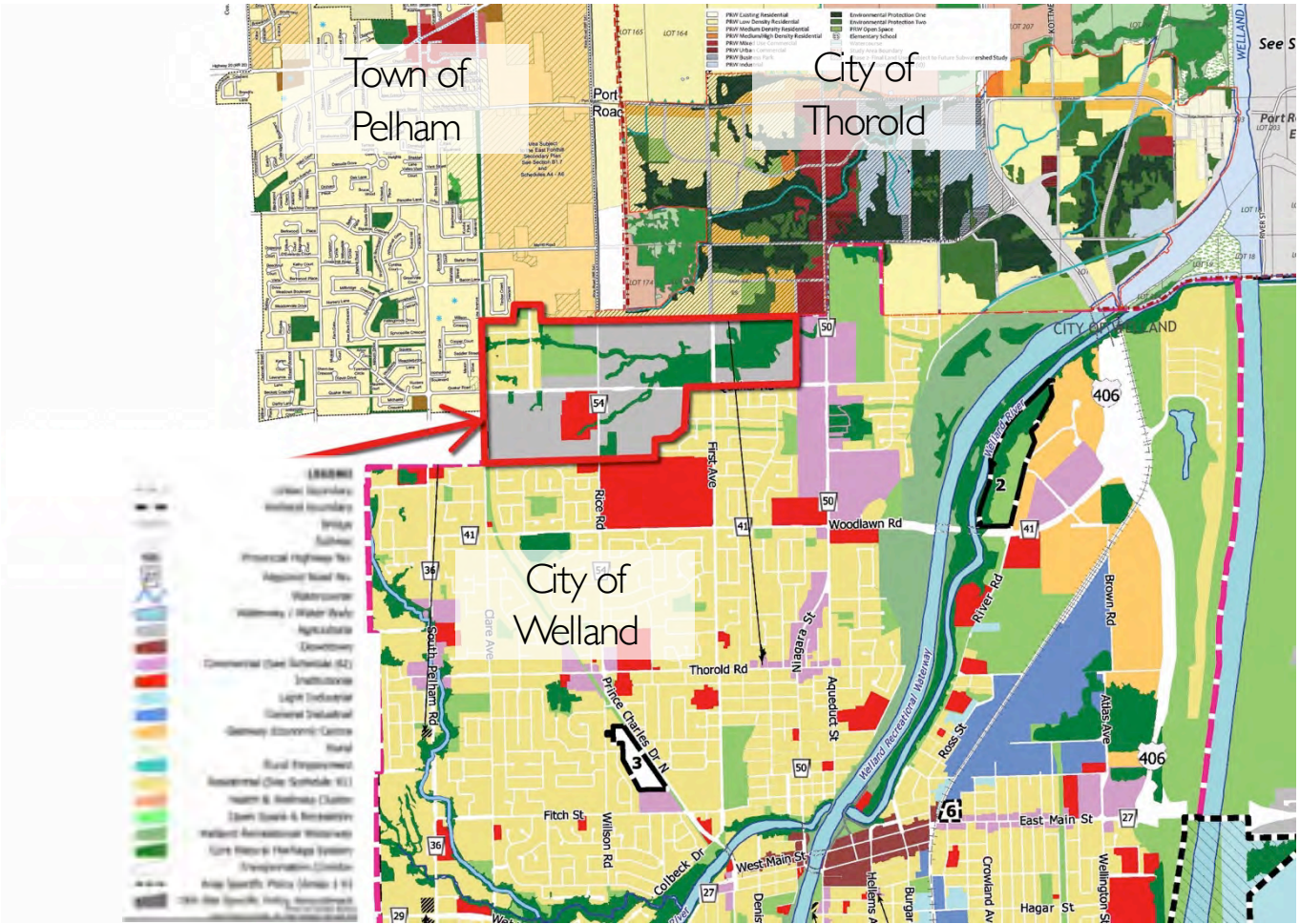
- Shortfall of 1,271 – 1,378 units



CITY OF WELLAND EXISTING LAND CAPACITY

Estimated Developable Area
North West Welland = 109 ha

- 50 persons + jobs / ha = 1,962 units
- 80 persons + jobs / ha = 3,270 units



4 GROUP DISCUSSIONS

North West Welland Secondary Plan Study

World Café Workshop:

- Rotate between the following tables (5mins/table):
  - Natural Heritage Study
  - Floodplain & Natural Hazard Lands Study
  - Agricultural Impact Assessment Study
  - Archaeological & Cultural Resource Assessment
  - Municipal Servicing
  - Transportation Study
  - Land Needs Assessment

- **Share your ideas and ask questions!**

Attachment G2 - Presentation for Public Information Centre #2

North West Welland

SECONDARY PLAN STUDY

PUBLIC INFORMATION SESSION NO. 2 - VISIONING WORKSHOP

June 19th, 2018

SGL Planning & Design Inc. - AgPlan Limited - Associated Engineering - AquaforBeech - ASI – Hemson Consulting

TODAY'S AGENDA

1. Introduction
2. Study Process & Schedule
3. Elements that Shape Community Design: Design Principles
4. Elements that Shape Community Design: Land Use Policy
5. Elements that Shape Community Design: Site Context
6. Community Structure: Two Approaches
7. Your Input

North West Welland Secondary Plan Study

1 INTRODUCTION

North West Welland Secondary Plan Study

CONSULTING TEAM

SGL Planning & Design Inc
Project Management
Ute Maya-Giambattista
Paul Lowes

Aquafor Beech Ltd.
Natural Heritage & Subwatershed
Dave Maunder
Ash Baron
Peter Hebert

AgPlan Ltd.
Agriculture
Michael Hoffman

ASI
Cultural & Built Heritage
Rebecca Sciarra
Eric Beales
James Neilson

Associated Engineering
Servicing & Transportation
Jeff Suggett
Stan Matthew
Jordan Frost

Hemson
Financial Viability Analysis
Jason Bevan
Julia Cziraky

SGL Planning & Design Inc.
Land Use Planning
Paul Lowes
Yasaman Soofi

SGL Planning & Design Inc.
Urban Design
Ute Maya-Giambattista
Shikha Jagwani
Yasaman Soofi

STUDY AREA

The purpose of this study is to develop a strategy to ***guide the future growth and development*** in North West Welland through a ***Secondary Plan*** and ***Urban Design Guidelines***

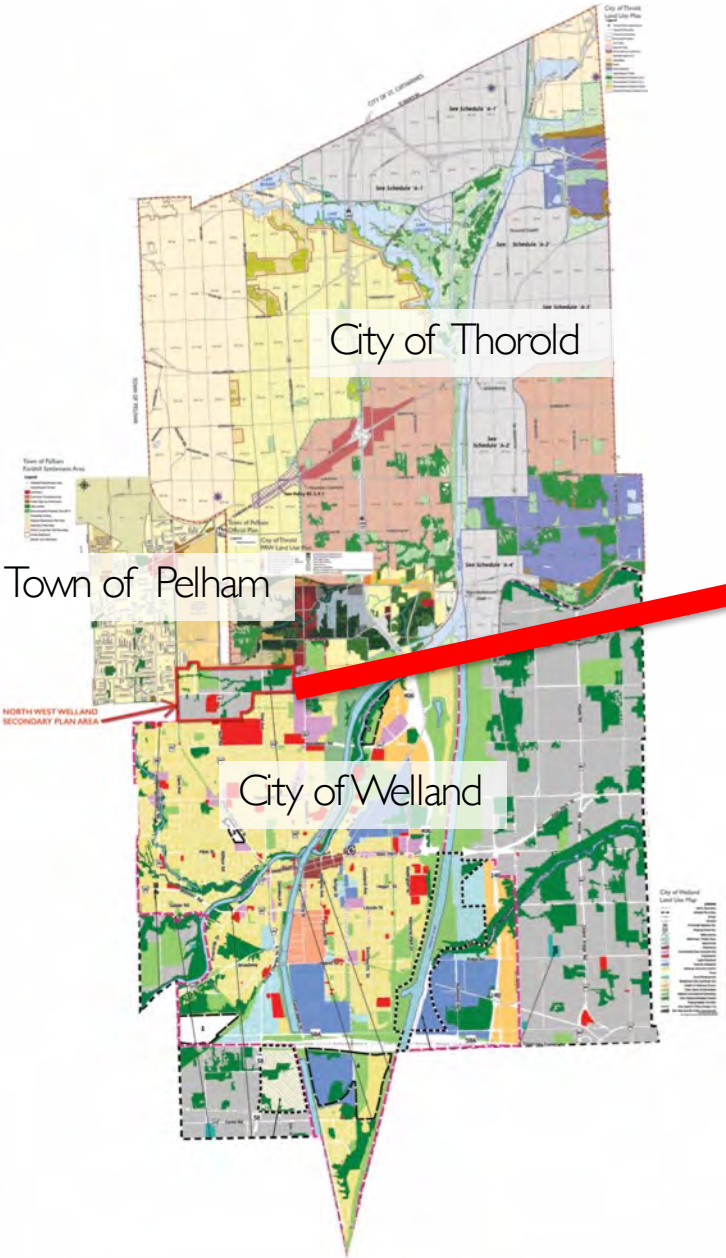
STUDY PURPOSE

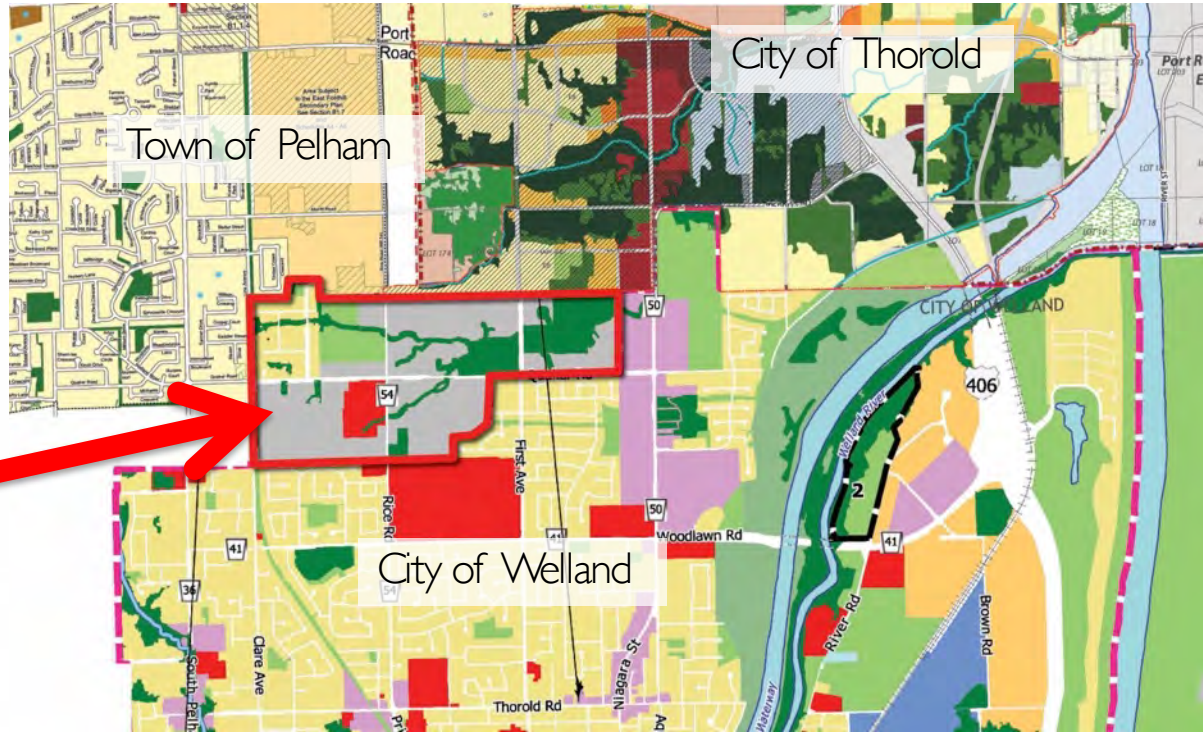
Complete Community

"Complete communities are communities that meet people's needs and daily living by providing convenient access to an appropriate mix of jobs, services, a full range of housing, and community infrastructure including affordable housing, schools, recreation and open space for residents."

Welland OP

STUDY AREA - CONTEXT





- North West Welland Study Area is surrounded by Built-Up Areas

TYPE OF STUDY

A Secondary Plan is a long-term land use planning tool which:

- *Helps direct and shape the future of a specific area; and,*
- *Provides more detail than the Official Plan.*

A Secondary Plan specifies:

- *Which **land uses** may be permitted;*
- *What **shape and size** of buildings are permitted;*
- ***How** development is **integrated with the surrounding neighbourhood;***
- ***Design objectives** for new buildings or additions;*
- *How developments may **address the public street;** and,*
- *What the public **streetscape** looks like:*
    - *Sidewalks, boulevards, bike lanes, street width, etc.*

TYPE OF STUDY

As part of the Secondary Plan we are conducting the following studies:

- Natural Heritage Study
- Floodplain and Natural Hazard Lands Study
- Agricultural Impact Assessment Study
- Archaeological and Cultural Resource Assessment
- Municipal Servicing
- Transportation Study
- Land Needs Assessment

2 STUDY PROCESS & SCHEDULE

North West Welland Secondary Plan Study

STUDY SCHEDULE

PHASE 1. (FEBRUARY – JUNE 2018)

DATA COLLECTION, BACKGROUND REVIEW AND GROWTH DIRECTIVES

1. *Study Background Presentation - June 18th*
2. Update Presentation to Council - July 24

PHASE 2. (JUNE – NOVEMBER 2018)

LAND USE PLAN

1. *Visioning Workshop - June 19th*
2. Update Presentation to Council - January 2019

PHASE 3. (NOVEMBER 2018 – MARCH 2019)

SECONDARY PLAN POLICY DEVELOPMENT

1. Present Preferred Option – January 2019
2. Council Presentation – March 2019

3 ELEMENTS THAT SHAPE COMMUNITYDESIGN: DESIGN PRINCIPLES

North West Welland Secondary Plan Study

COMMUNITY DESIGN PILLARS

1

protect and enhance **natural heritage features and corridors** within a broader linked natural heritage system

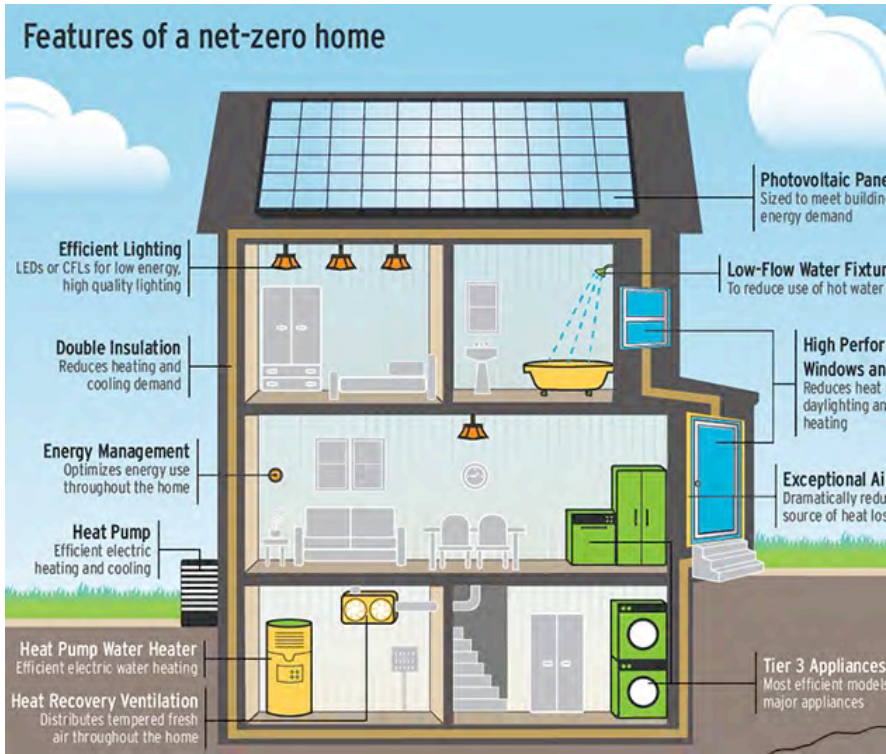
2 conserve, protect and integrate **built and cultural heritage elements**

built heritage

cultural heritage landscapes: historic roads

3 Implement **sustainable community design** initiatives that ensure:

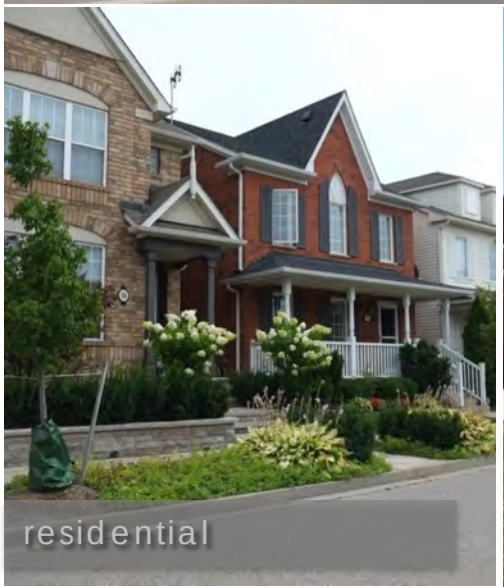
- the maintenance and improvement of the quality of surface water and ground water and **conservation of water resources** and,
- adaptation to **climate change.**



4

Establish Placemaking Strategies that contribute to the creation of a unique community by providing for a **variety of land use** opportunities to include mixed use commercial, employment and residential land uses as well as, institutional land uses are located within the area.

live-work units


residential

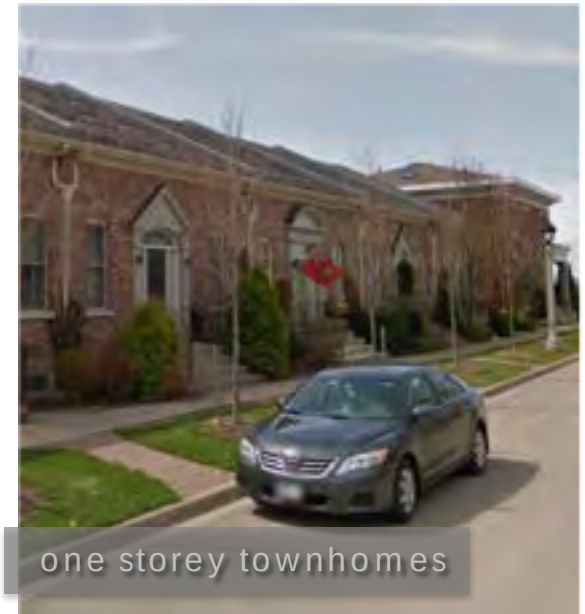
institutional: schools

5

Establish Placemaking Strategies that contribute to the creation of a unique community by ensuring there is an adequate supply of **diverse housing types** which cater to the wide variety of its residents needs.

two storey townhomes

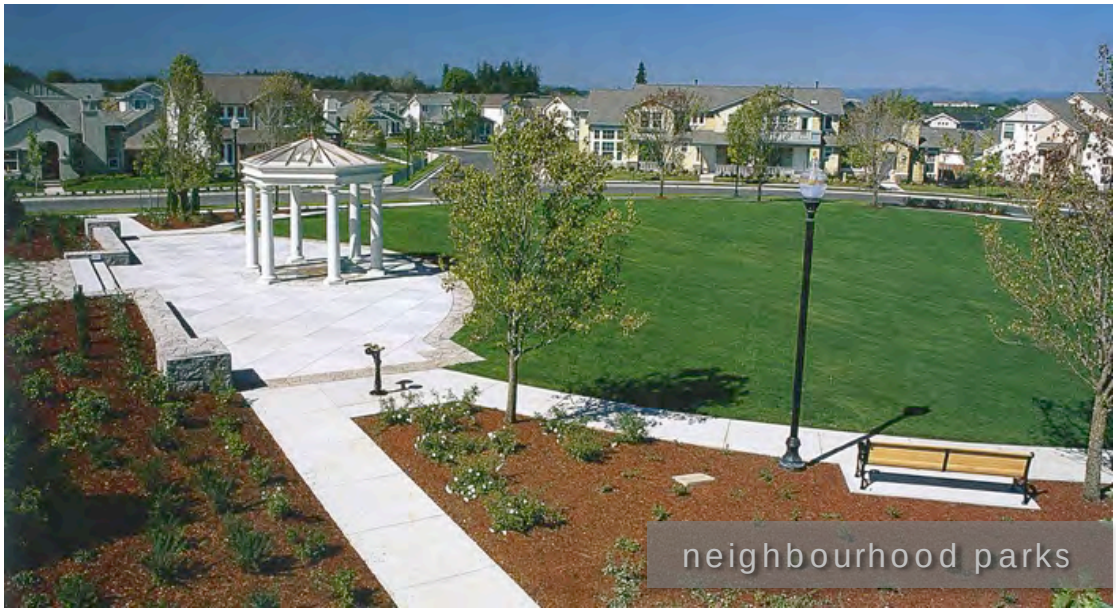
single detached houses

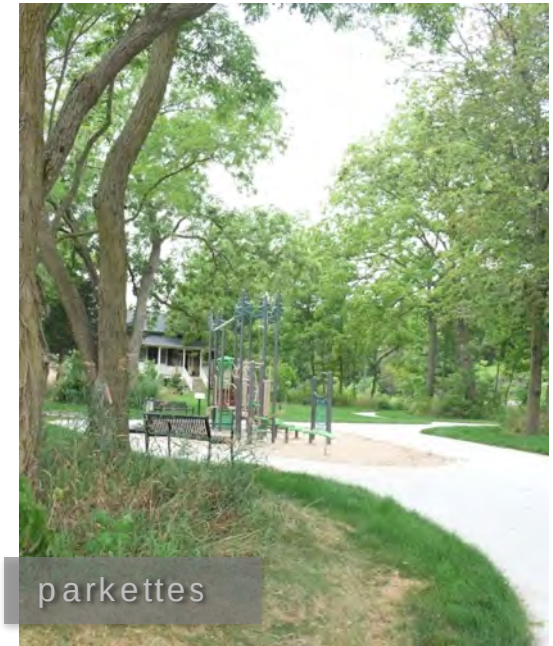

one storey townhomes

duplex

6

Establish Placemaking Strategies that contribute to the creation of a unique community by ensuring there is an adequate supply and variety of **open space** opportunities for people of all ages and abilities.


neighbourhood parks


parkettes

trails

7

Promote Physical Health by:

- providing **active transportation** options through convenient access to **public transportation** and safe and convenient **pedestrian and cycling networks** and,
- developing a continuous and connected **open space, pedestrian realm and trail system** that links the study area to the broader context.

Image by Sherman Wong

8

Promote Mental Health by:

- providing **community amenity options** that support citizens needs to include **art and culture** events and activities for all ages with an emphasis on youth- and senior-driven activities and,

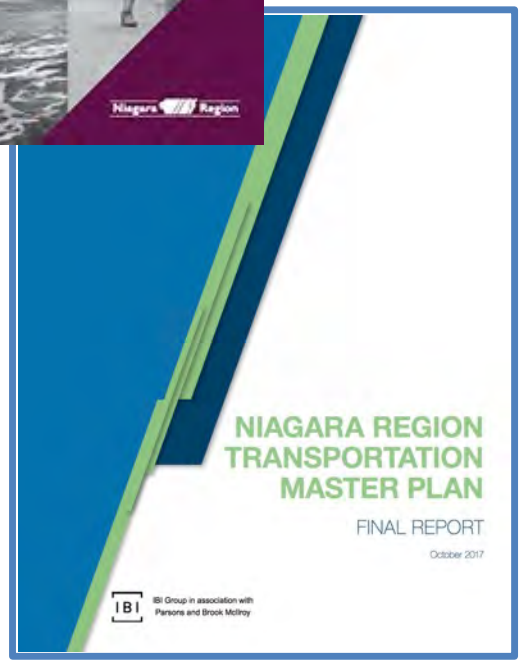
- providing **Universally Accessible** design measures in the planning of new neighbourhoods.

public amenities for all ages and abilities

4 ELEMENTS THAT SHAPE DESIGN: LAND USE POLICY

North West Welland Secondary Plan Study

REGIONAL LAND USE POLICY



NIAGARA REGIONAL OFFICIAL PLAN, 2014

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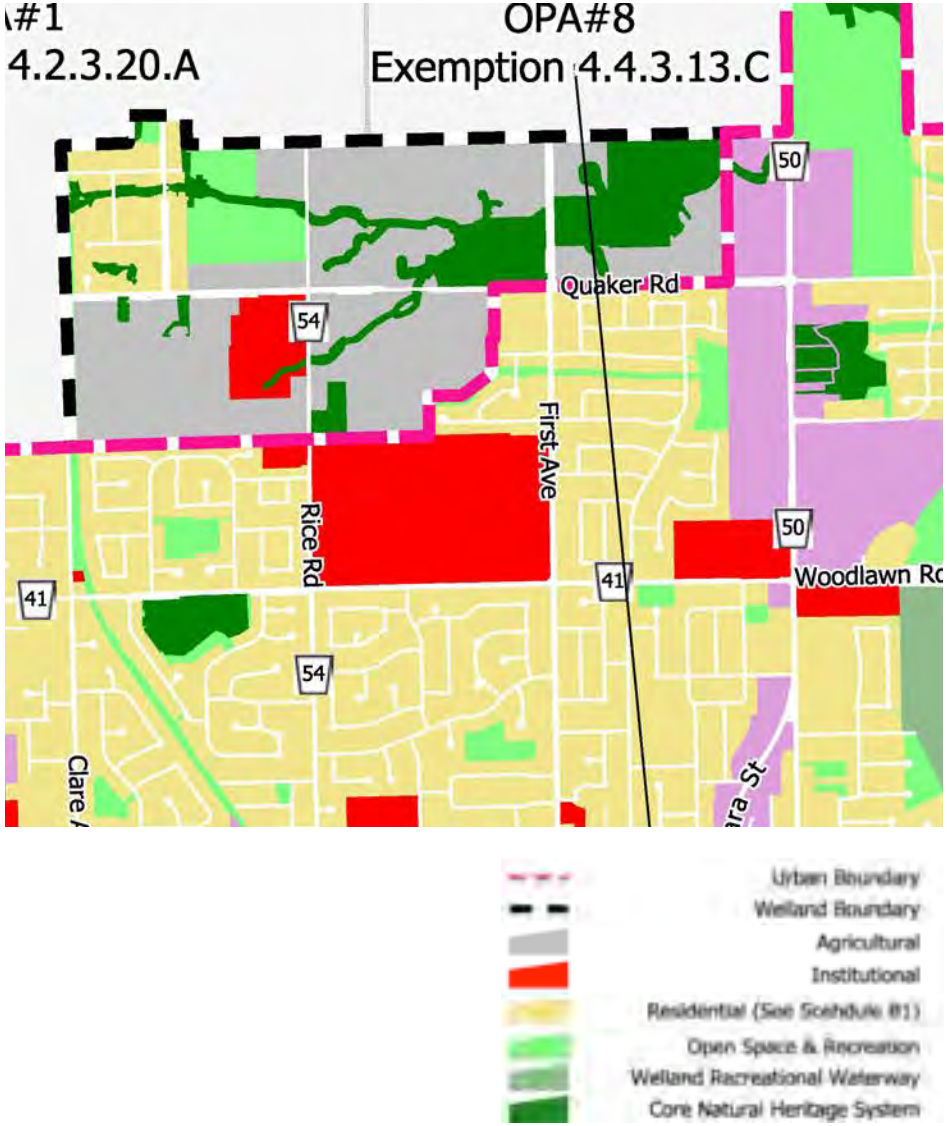


20 UNITS PER HECTARE = 50 PERSONS AND JOBS PER GROSS HECTARE

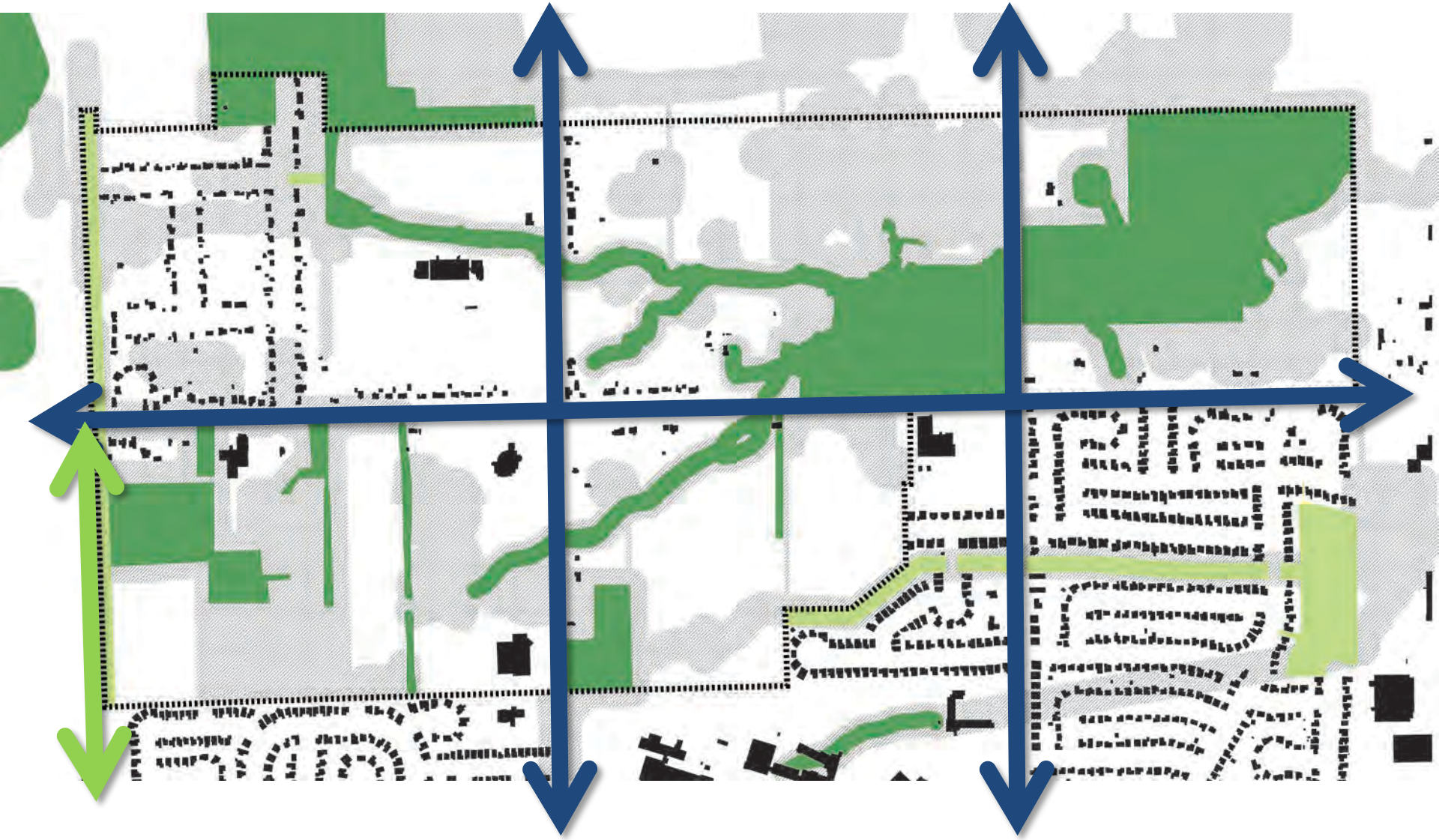
5 ELEMENTS THAT SHAPE DESIGN: SITE CONTEXT

North West Welland Secondary Plan Study

ENVIRONMENTAL FEATURES

NATURAL HERITAGE

ROAD NETWORK



5 SITE CONTEXT

QUAKER ROAD

5 SITE CONTEXT

QUAKER ROAD

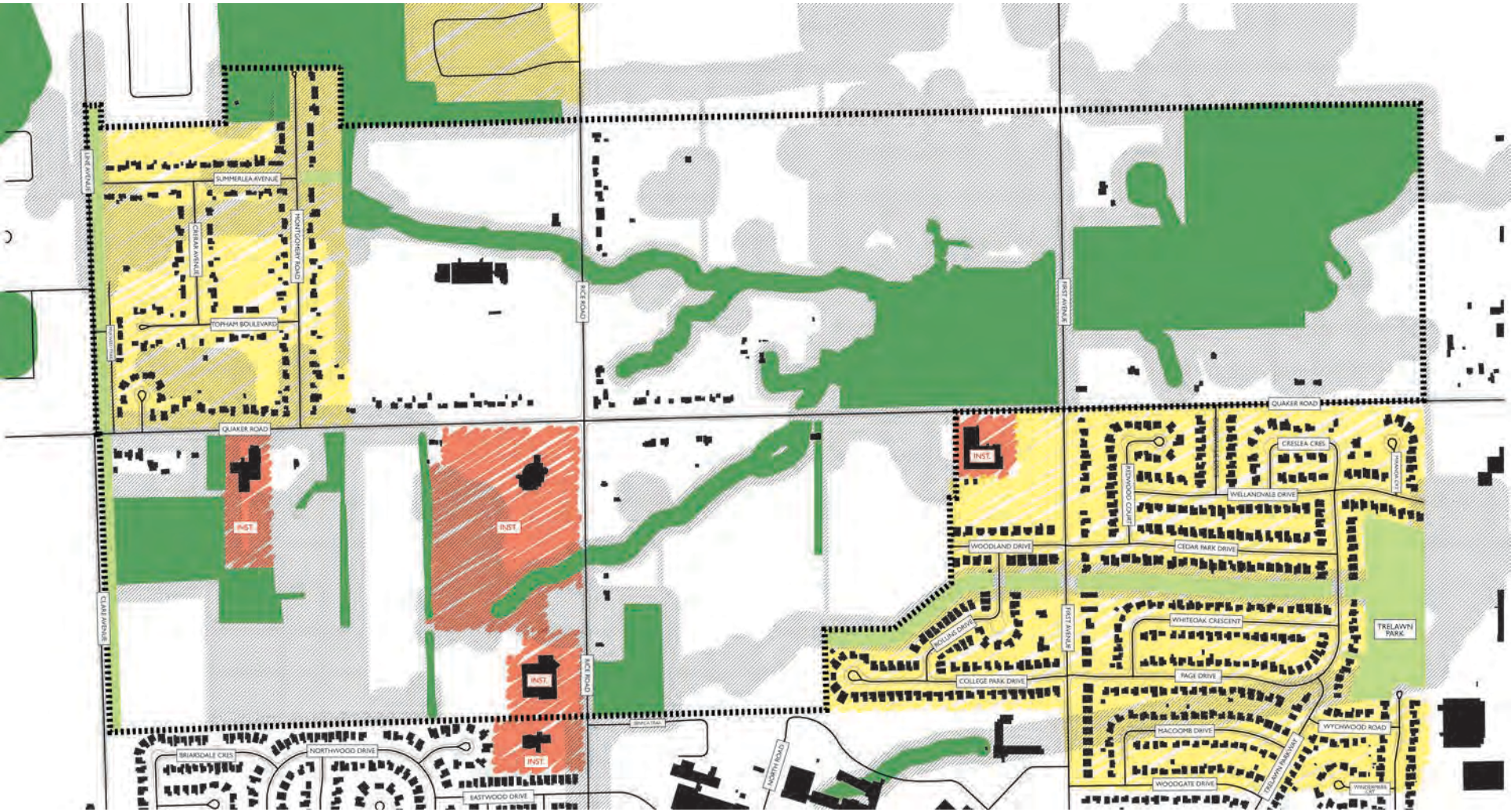
5 SITE CONTEXT

RICE ROAD

5 SITE CONTEXT

FIRST AVENUE

EXISTING LAND USES



LINE AVENUE
SUMMERLEA AVENUE
CEDAR AVENUE
MONTGOMERY ROAD
TOPHAM BOULEVARD
QUAKER ROAD
RICE ROAD
FIRST AVENUE
INST.
CLARE AVENUE
NORTHWOOD DRIVE
BRIARSDALE CRES
EASTWOOD DRIVE
NORTH ROAD
WOODLAND DRIVE
CEDAR PARK DRIVE
WELLANDVALE DRIVE
CRESLEA CRES
HAWKCROFT
WHITEOAK CRESCENT
TRELAWN PARK
PAGE DRIVE
COLLEGE PARK DRIVE
ROLLINS DRIVE
MACOMB DRIVE
WOODGATE DRIVE
WYCHWOOD ROAD
TRELAWN PARKWAY

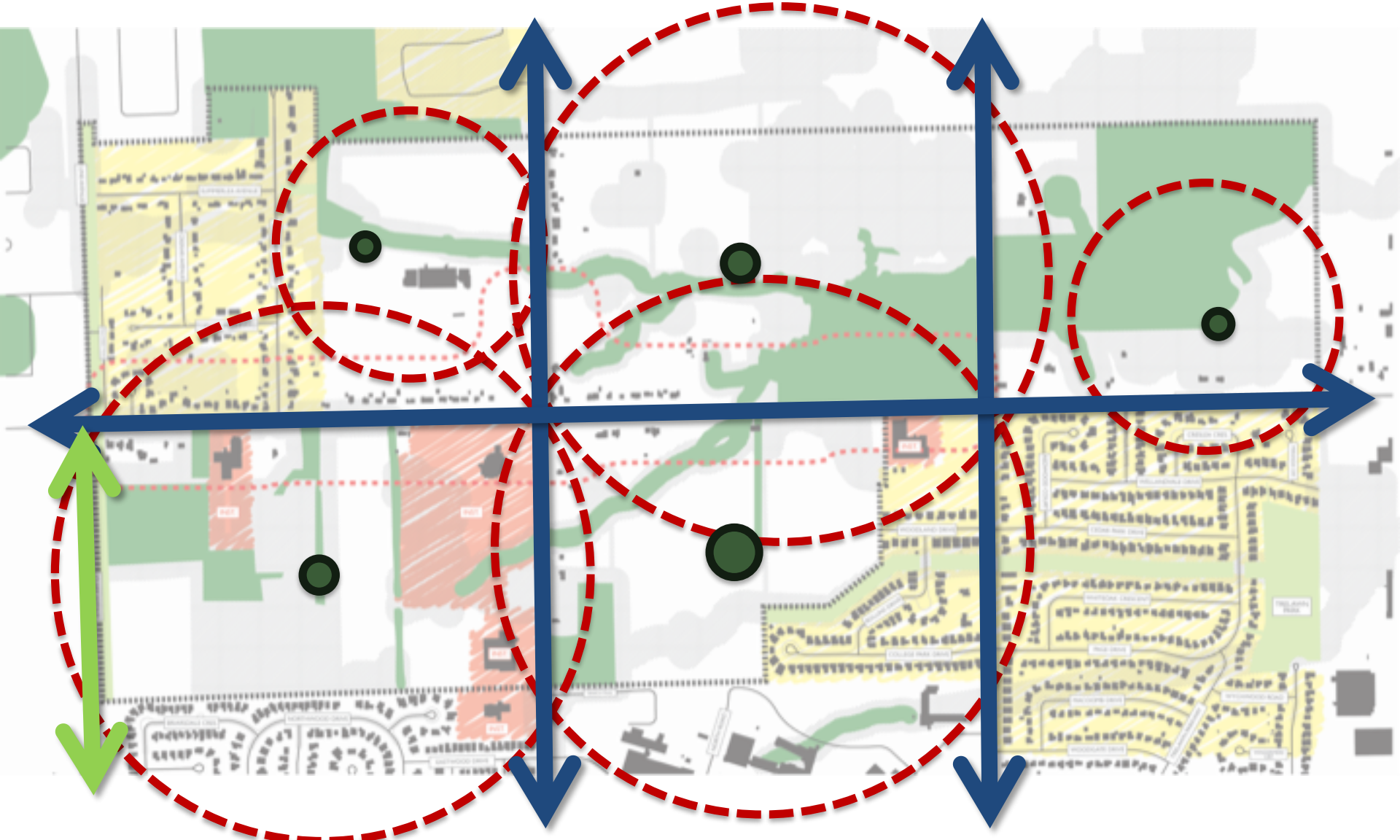
BUILT FORM

BUILT FORM

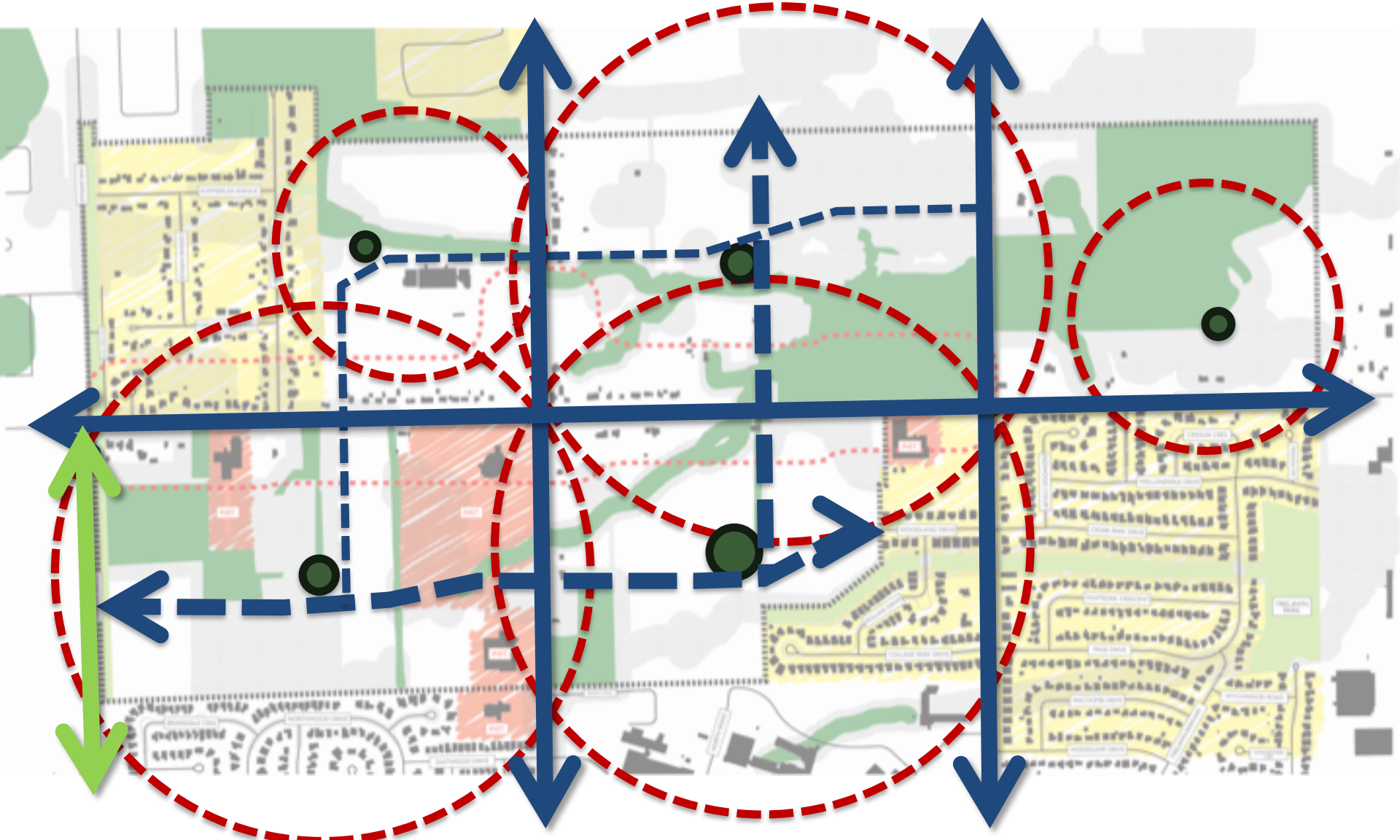
6 COMMUNITY STRUCTURE: TWO APPROACHES

North West Welland Secondary Plan Study

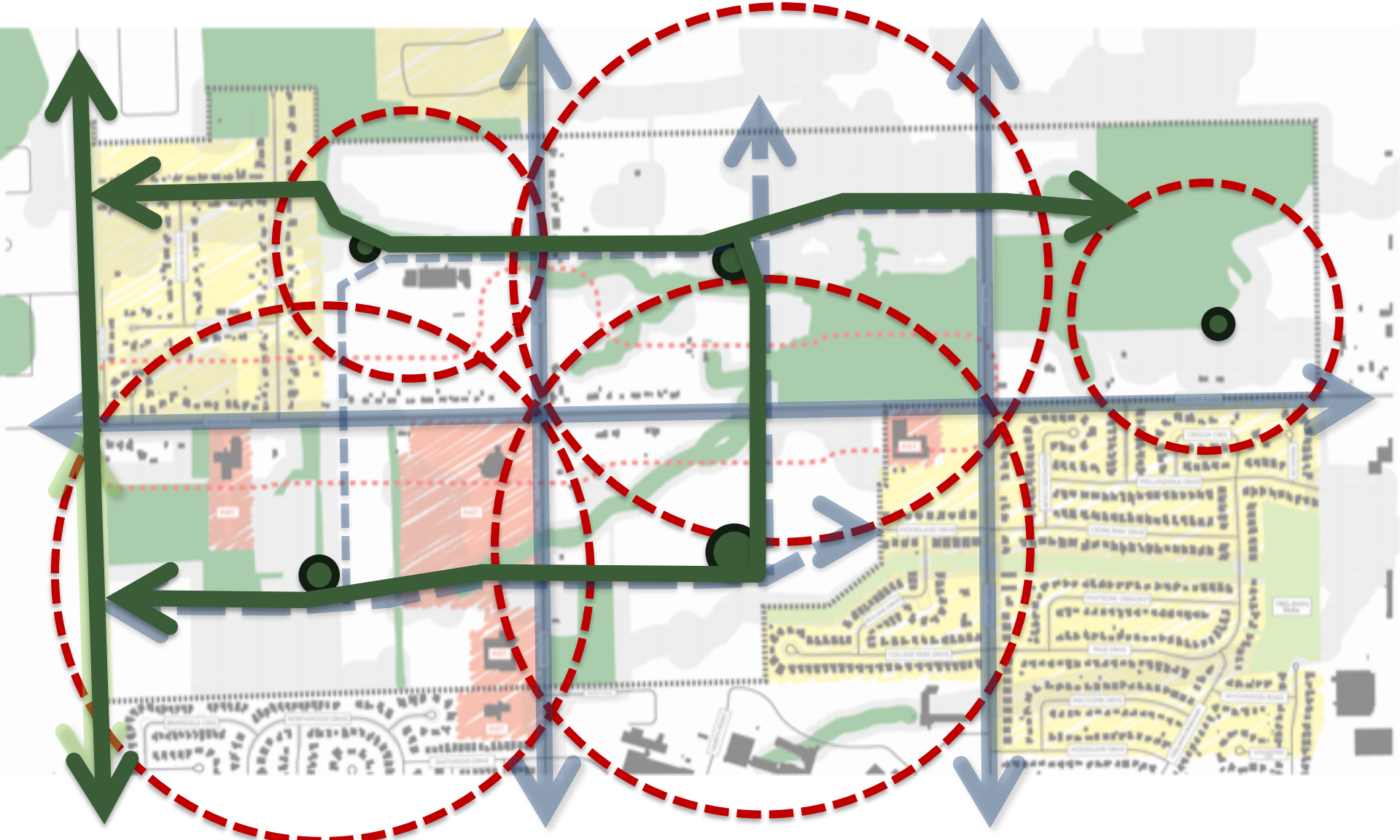
COMMUNITY STRUCTURE APPROACH #1



COMMUNITY STRUCTURE APPROACH #1



COMMUNITY STRUCTURE APPROACH #1



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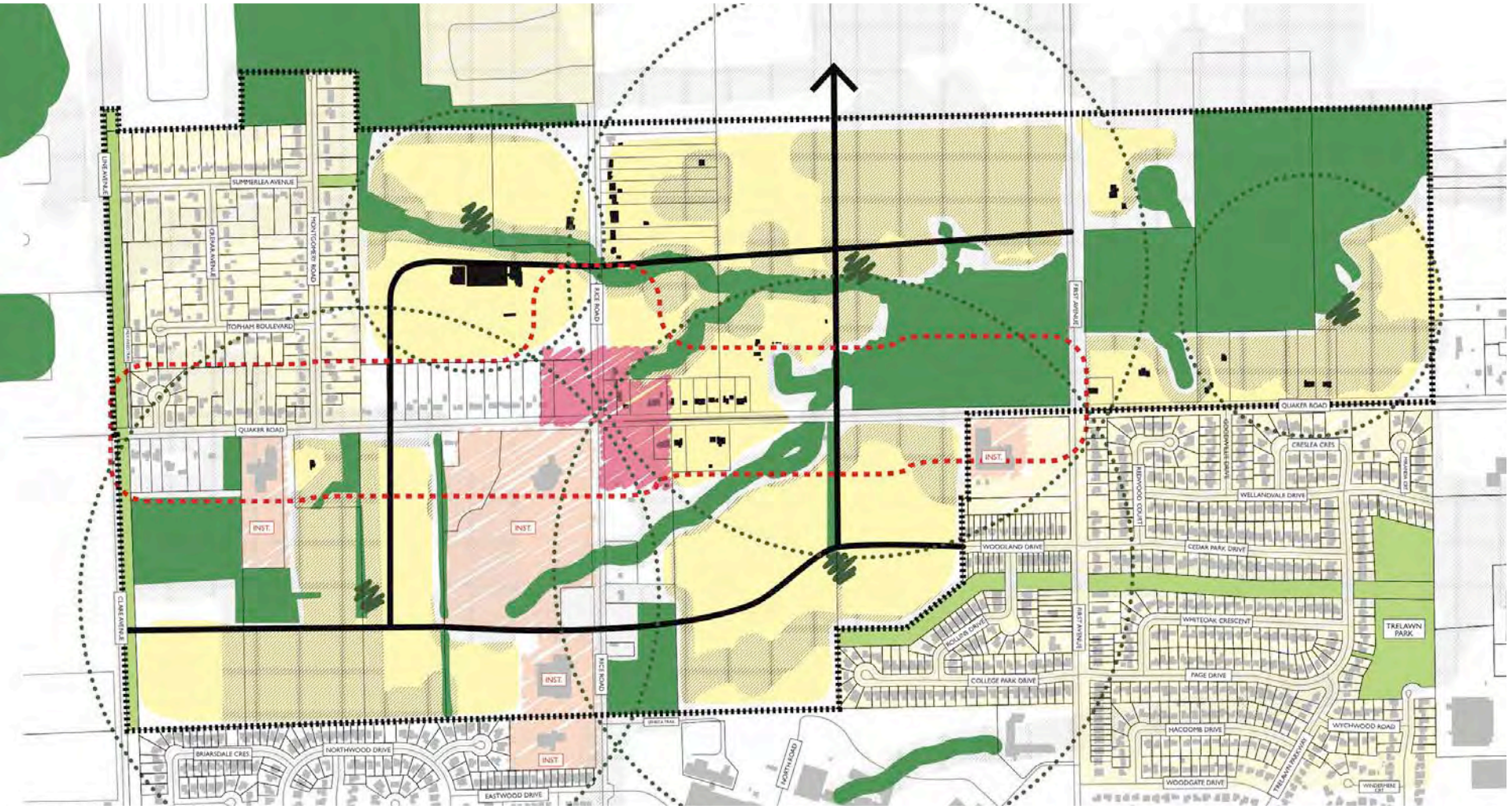


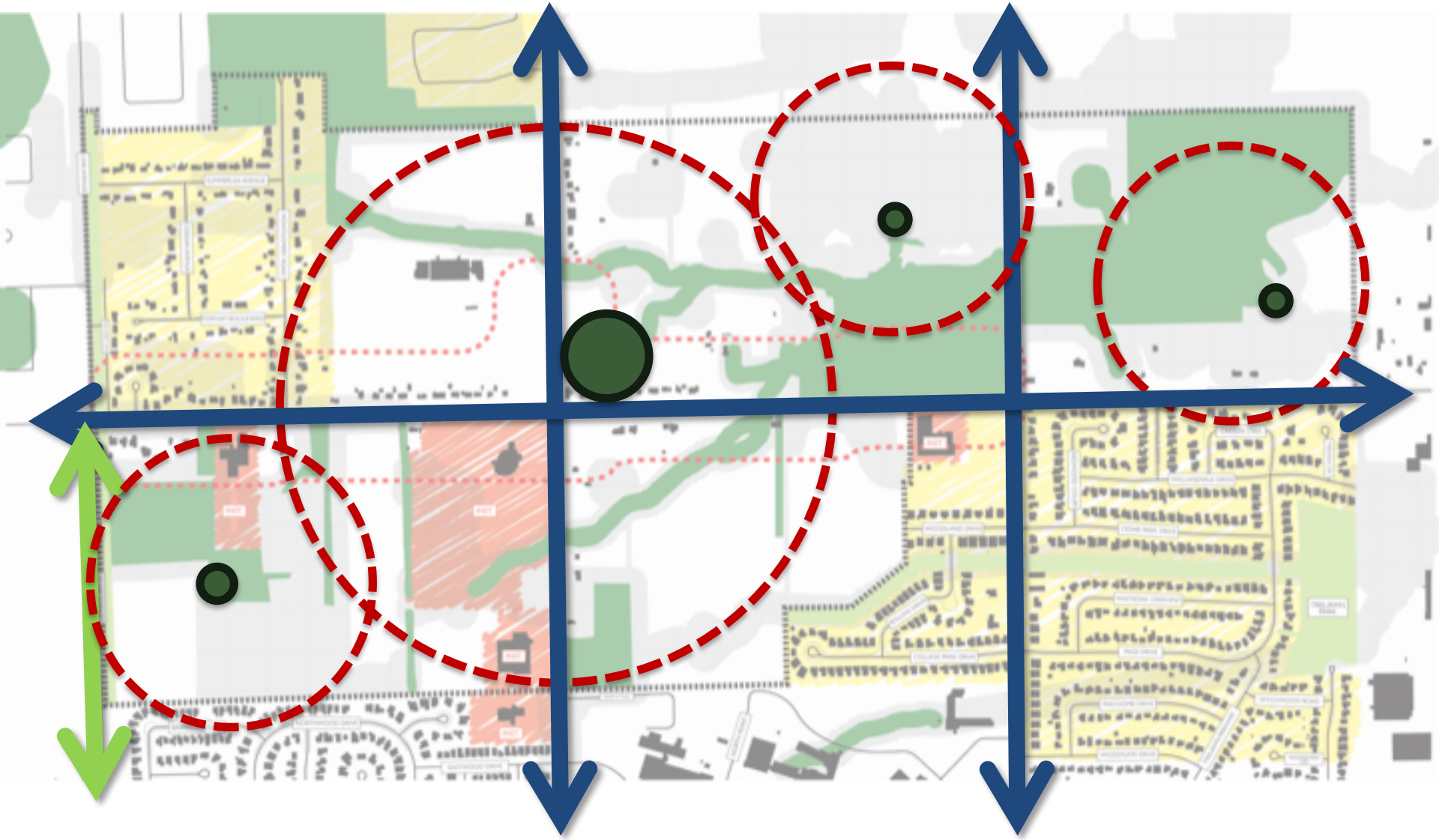
LEGEND

- Quaker Road Character Zone
- Internal Collector Roads
- Neighbourhood Node
- Institutional Use
- Residential Use
- Natural Heritage System
- Open Space
- Environmental Areas Subject to Further Study
- Open Space Centre (Neighbourhood Parkette)
- 5 Minute (500 metre) Walking Radius

SGL Planning & Design Inc.

0 50 100 N

COMMUNITY STRUCTURE APPROACH #2



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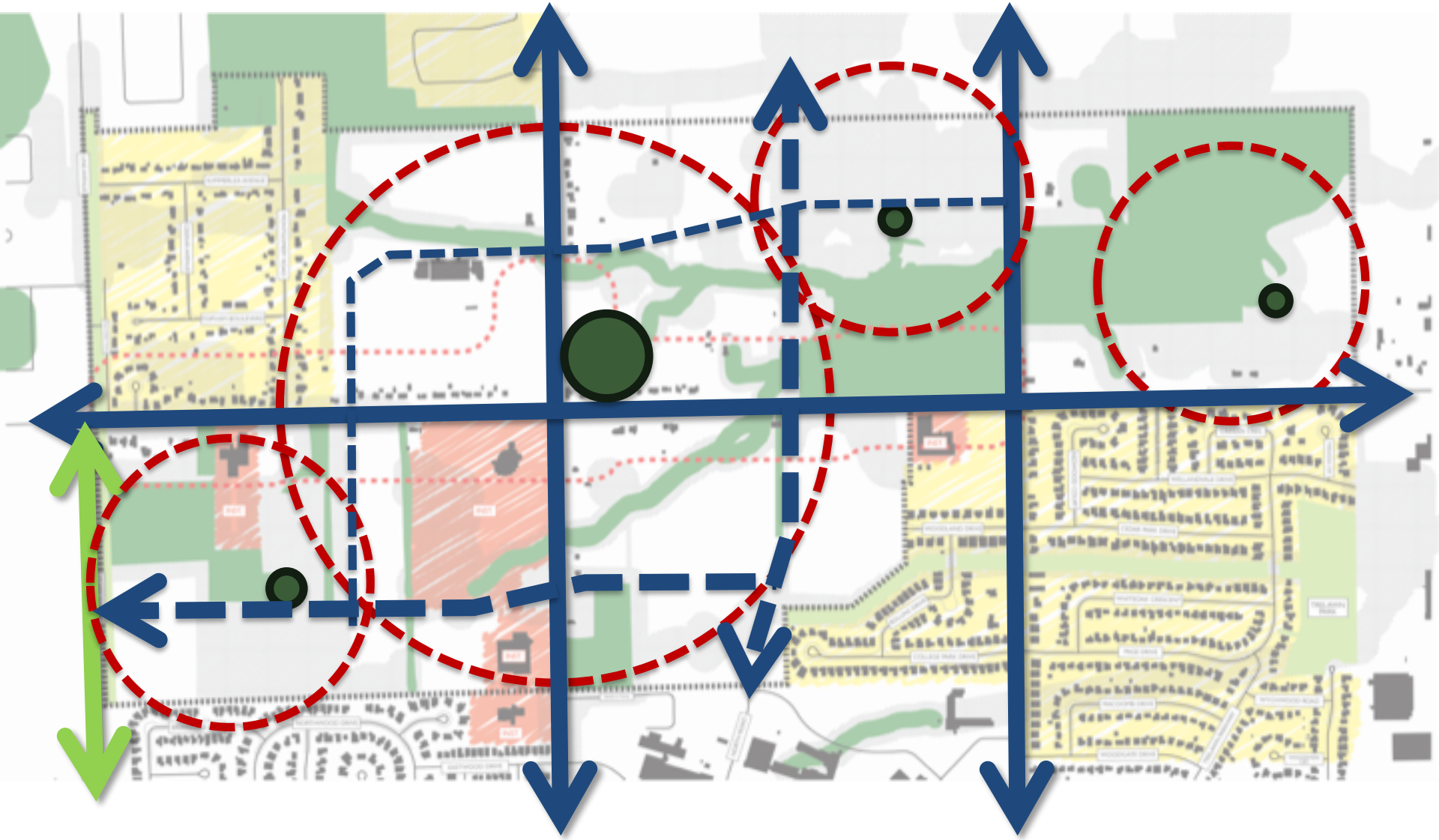

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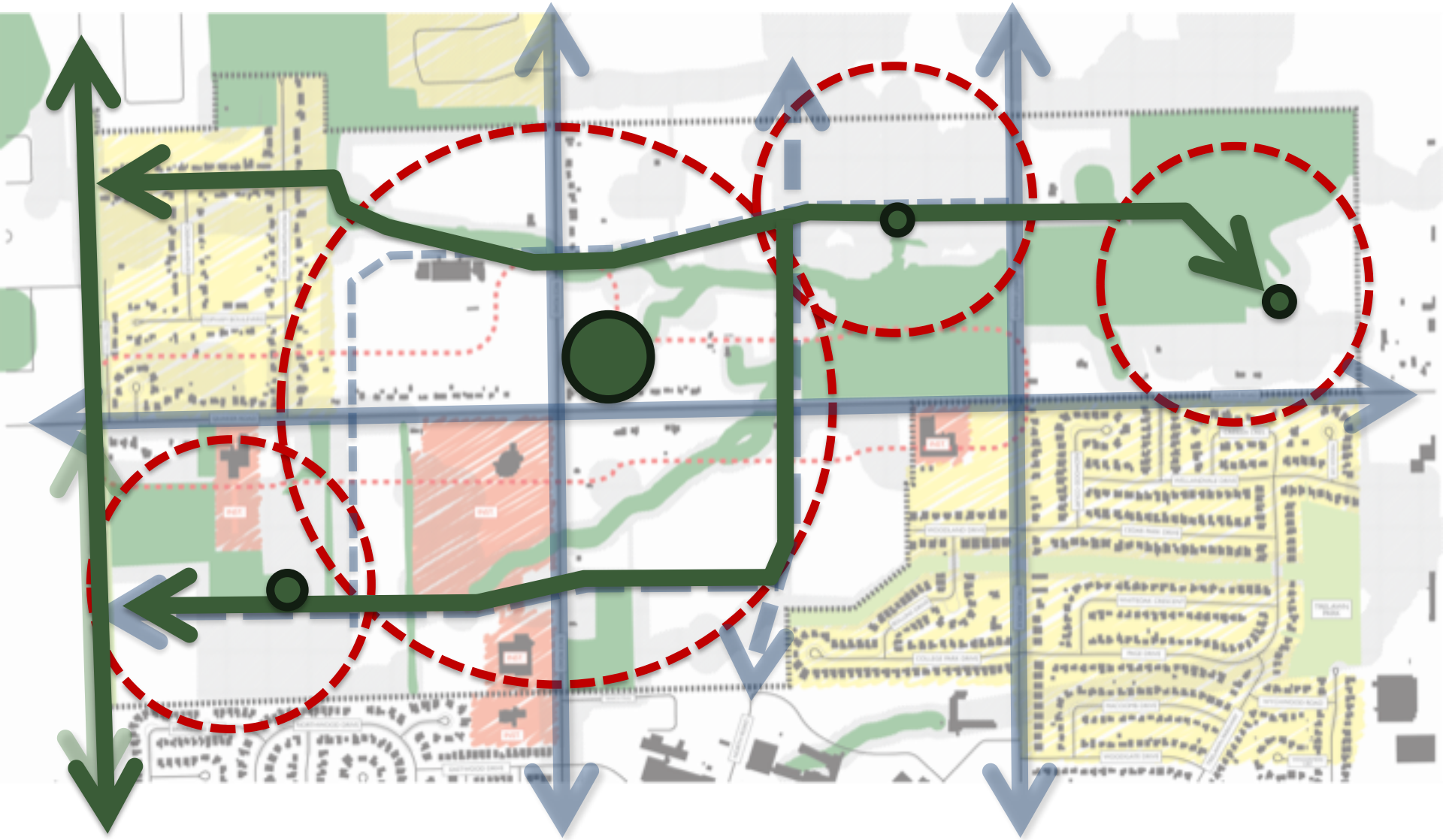

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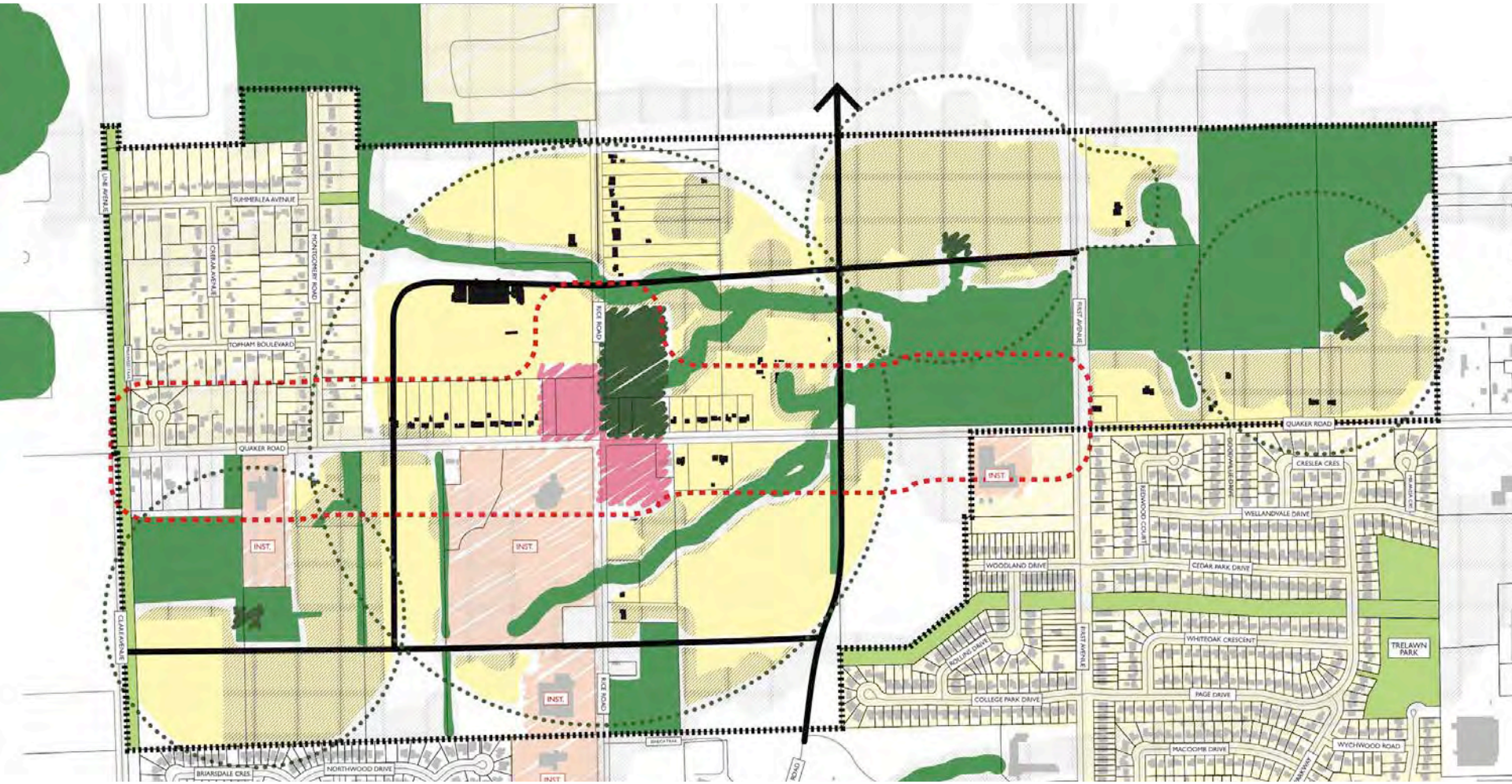

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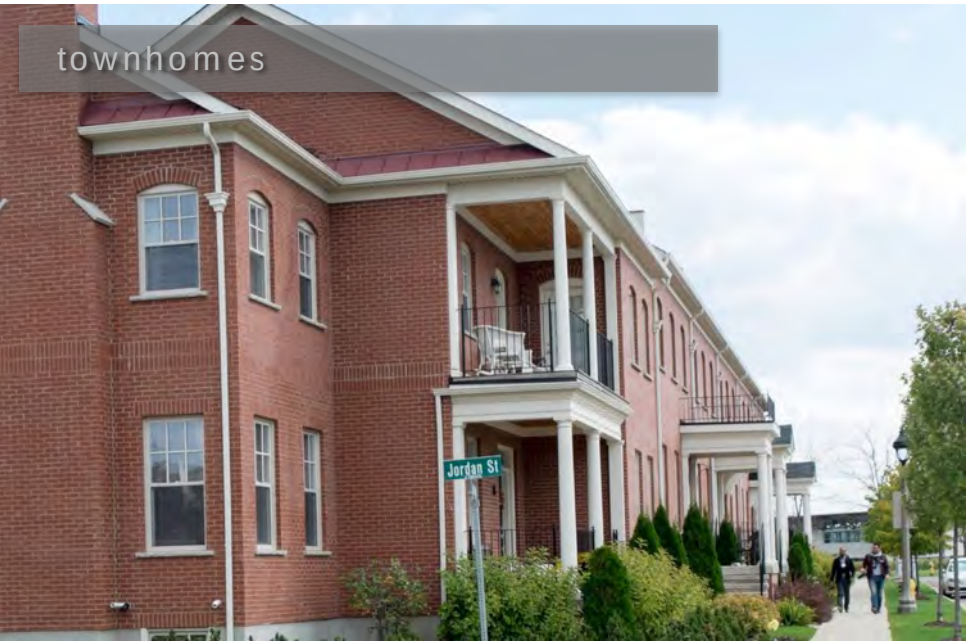
0 50 100 N

RESIDENTIAL TYPOLOGIES: VILLAGE RESIDENTIAL

RESIDENTIAL TYPOLOGIES: NEIGHBOURHOOD RESIDENTIAL

front drive single detached homes

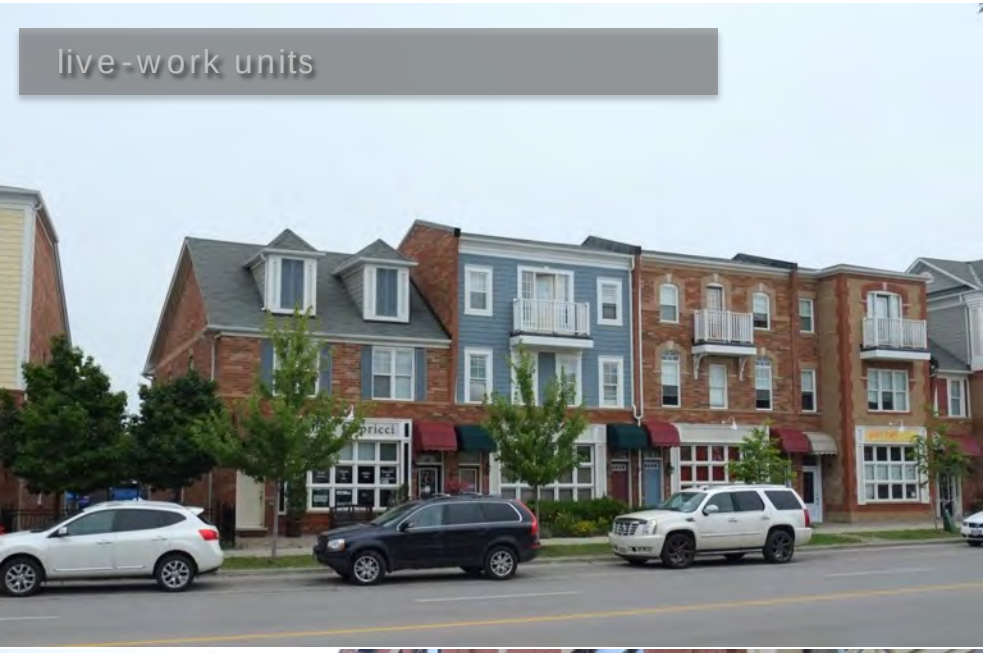
laneway single detached homes



townhomes

laneway single detached homes

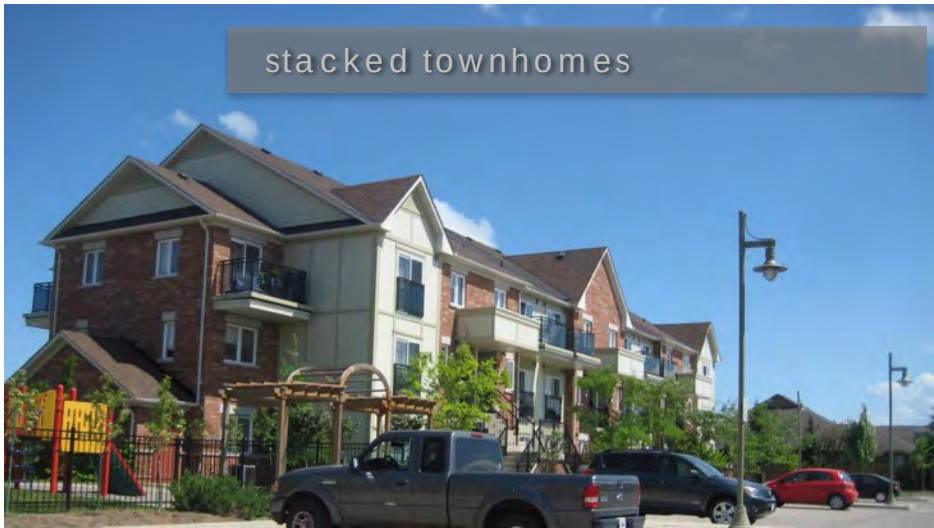
MIXED USE TYPOLOGIES: NEIGHBOURHOOD NODE



live-work units

commercial + townhomes

commercial + townhomes



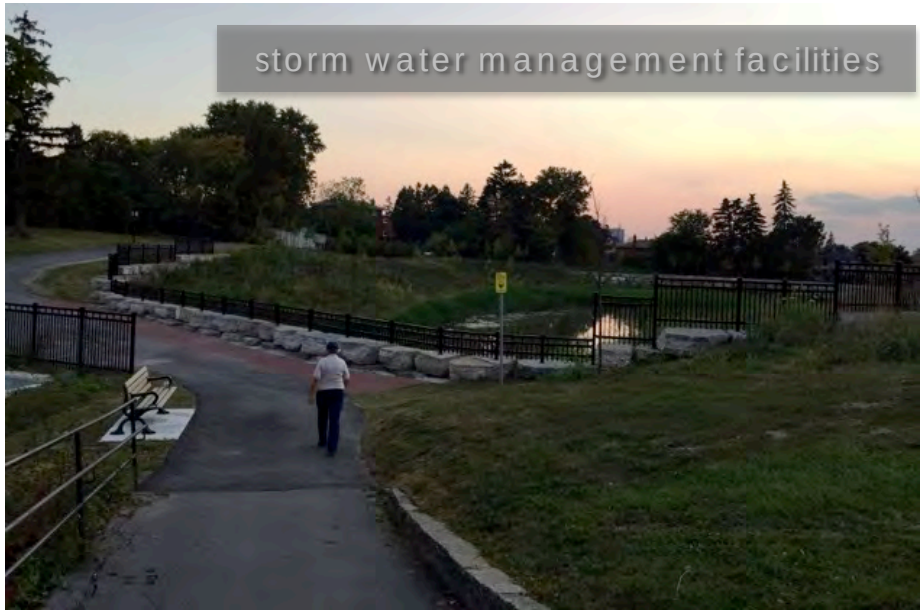
stacked townhomes

OPEN SPACE TYPOLOGIES

neighbourhood park

parkettes

parkettes


storm water management facilities

ROAD TYPOLOGIES: ARTERIALS

Arterial/collector as SPINE

Arterial/collector as DIVIDER

ROAD TYPOLOGIES: LOCAL ROADS

7 YOUR INPUT

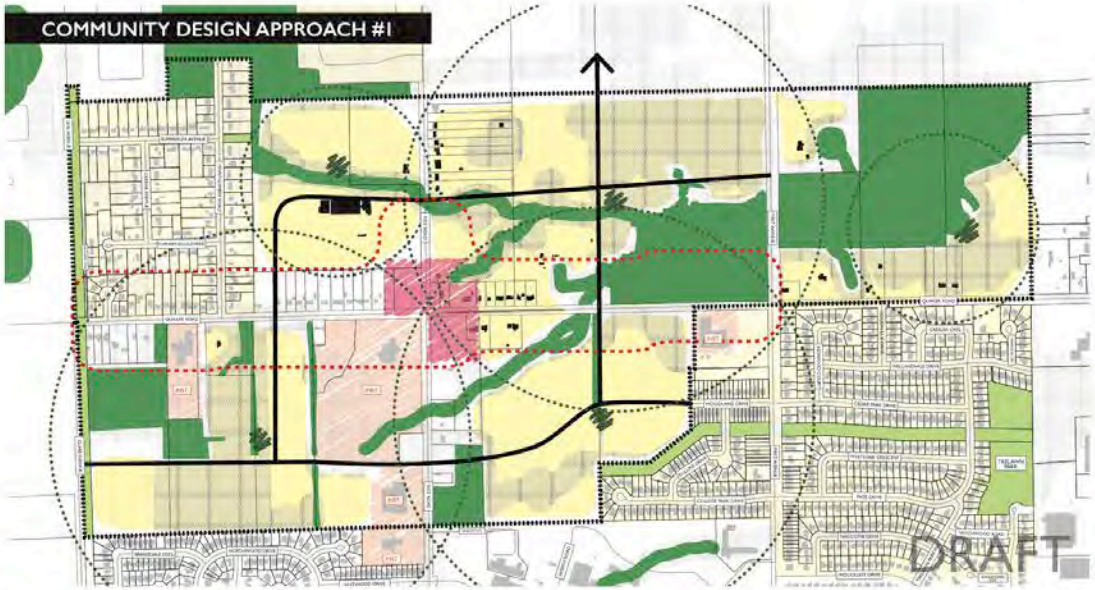
North West Welland Secondary Plan Study

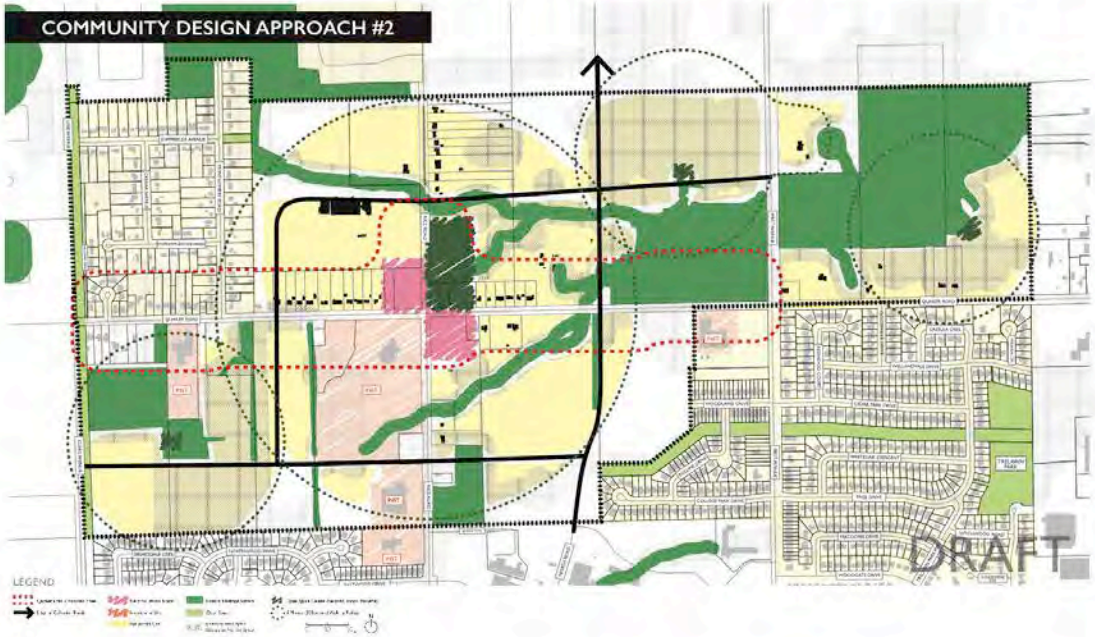
VISION STATEMENT

- Create a vision statement for North West Welland that ***envisions*** the community's ***open space, road*** and ***land use systems*** and how it will ***integrate*** with the adjacent neighbourhoods and surrounding context.
- Aim of a vision statement:
  - clarify our study's direction and purpose;
  - describe our outcome and goals;
  - set standards for achieving our vision;
  - and create a vivid image in our minds that provokes emotion and excitement about the future of the study area!
- Use the sustainability and design principles to guide you in developing your vision statement.

7 YOUR INPUT

STRENGTHS, WEAKNESSES AND OPPORTUNITIES





North West Welland SECONDARY PLAN STUDY

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Floodplain and Natural Hazard Lands Study
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Archaeological and Cultural Resource Assessment
Municipal Servicing
Transportation Study
Land Needs Assessment

As part of this process, we need your help to understand which building and design characteristics are most valued for the Study Area.
Please use the space below to provide your insights into the DRAFT Community Design Approach Options' **Strengths**, **Weaknesses**, and **Opportunities**:

STRENGTHS	OPEN SPACE DISTRIBUTION	ROAD SYSTEM NETWORK
	LOCATION OF HOUSING TYPES	EXTENT OF VILLAGE CHARACTER
WEAKNESSES	OPEN SPACE DISTRIBUTION	ROAD SYSTEM NETWORK
	LOCATION OF HOUSING TYPES	EXTENT OF VILLAGE CHARACTER
OPPORTUNITIES	OPEN SPACE DISTRIBUTION	ROAD SYSTEM NETWORK
	LOCATION OF HOUSING TYPES	EXTENT OF VILLAGE CHARACTER
OTHER COMMENTS		

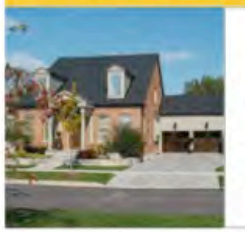
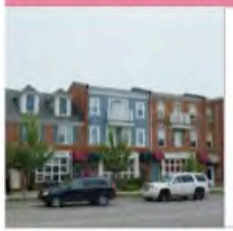
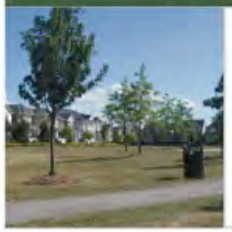
STRENGTHS, WEAKNESSES AND OPPORTUNITIES

North West Welland SECONDARY PLAN STUDY

SGL Planning & Design • AgPlan Limited • Associated Engineering • AquaforBeech • ASI • Hemson Consulting

Table # _____

Please indicate the types of Housing and Open Spaces you would like to see as Welland grows

VILLAGE RESIDENTIAL	NEIGHBOURHOOD RESIDENTIAL	NEIGHBOURHOOD NODE	OPEN SPACE
			

Attachment G3 - Vision Statement Boards

VISION STATEMENT

1

1. Envision the types of **community spaces, roads and land use systems** you want to see in North West Welland. Use the following **Community Design Principles** to guide you:

1 Protect and enhance **natural heritage features and corridors** within a broader linked natural heritage system

2 Conserve, protect and integrate **built and cultural heritage elements**

3 Implement **sustainable community design** initiatives that ensure **conservation of water resources** and adaptation to **climate change**

4 Establish Placemaking Strategies that contribute to the creation of a unique community by providing for a **variety of land uses** located within the area

5 Establish Placemaking Strategies that contribute to creating a unique community by ensuring there are **diverse housing types** that cater ~~to the wide variety of~~ its residents needs

6 Establish Placemaking Strategies that contribute to creating a unique community that has an adequate supply and variety of **open space** opportunities for people of all ages and abilities

7 Promote Physical Health by providing **active transportation** options and developing a continuous and **connected open space, pedestrian realm and trail system** that links the community

8 Promote Mental Health by providing **community amenity options** that support citizens needs. Provide **Universally Accessible** design measures when planning new neighbourhoods

2. Create your vision statement for the North West Welland Secondary Plan :

more development = single family; townhouse along road
East/West trail along drainage swale
30 m ROW for arterial + collector roads

109 ha.

VISION STATEMENT

2

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2. Create your vision statement for the North West Welland Secondary Plan :

MAINTAIN AS MUCH AS NATURAL HERITAGE AS POSSIBLE
APPROACH #1 KEEP WHAT IS THERE AND ADD PARK ALONG EASTERN BOUNDARY OF MONTGOMERY HOMES
CREATE A WALKWAY

VISION STATEMENT

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2. **Create your vision statement for the North West Welland Secondary Plan :**

VISION STATEMENT

3

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2. Create your vision statement for the North West Welland Secondary Plan :

INTEGRATING MULTI CULTURAL AND THE VARIOUS AGES OF PEOPLE INTO THE DESIGN FEATURES

ie) - LIBRARY - SMALL PARKS
- CAFE - EQUAL ACCESSIBILITY
- BOCCE BALL - SMALL STORES - WALK IN CLINIC

* ONE AREA TO LIVE/GROW/AND RETIRE
* CONNECTING BAUER AND MILKWEED TRAIL

North West Welland

SECONDARY PLAN STUDY

SGL Planning & Design • AgPlan Limited • Associated Engineering • AquaforBeech • ASI • Hemson Consulting

Attachment G4 - Vision Survey Boards

Table # 1

North West Welland SECONDARY PLAN STUDY

SGL Planning & Design • AgPlan Limited • Associated Engineering • AquaforBeech • ASI • Hemson Consulting

Please indicate the types of Housing and Open Spaces you would like to see as Welland grows

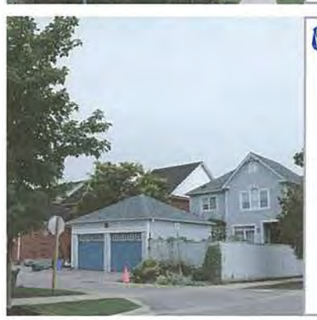
VILLAGE RESIDENTIAL	NEIGHBOURHOOD RESIDENTIAL	NEIGHBOURHOOD NODE	OPEN SPACE
			

Table # 2

North West Welland SECONDARY PLAN STUDY

SGL Planning & Design • AgPlan Limited • Associated Engineering • AquaforBeech • ASI • Hemson Consulting

Please indicate the types of Housing and Open Spaces you would like to see as Welland grows

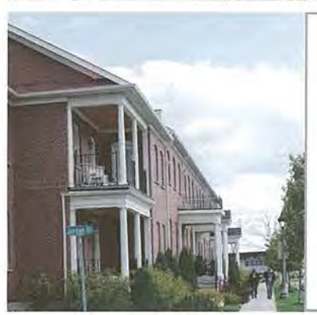
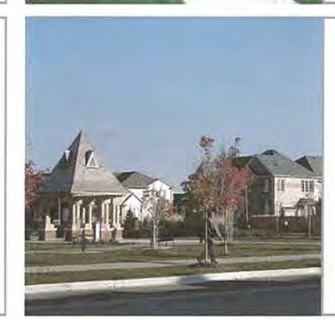
VILLAGE RESIDENTIAL	NEIGHBOURHOOD RESIDENTIAL	NEIGHBOURHOOD NODE	OPEN SPACE
✓ Trees	✓	East of Rice	✓
✓ Maintain Trees		East of Rice	To Much Concrete
	 X	East of Rice	 ✓
✓	X	East of Rice.	✓

Table # 2

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Please indicate the types of Housing and Open Spaces you would like to see as Welland grows

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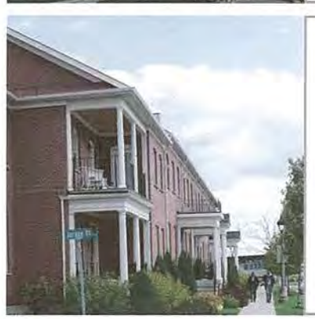
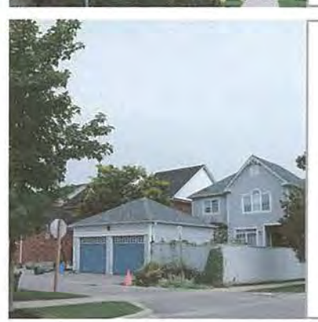
		✓	Too much concrete.
		✓	
			✓

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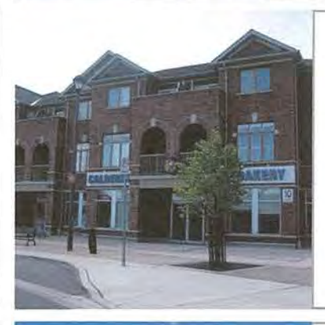
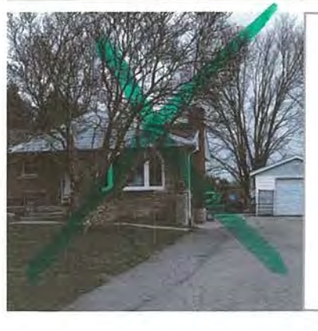
	✓	✓	✓
		✓	✓
✓			✓
	✓		✓

Attachment G5 – Community Design Approach Boards

North West Welland SECONDARY PLAN STUDY

SGL Planning & Design • AgPlan Limited • Associated Engineering • AquaforBeech • ASI • Hemson Consulting

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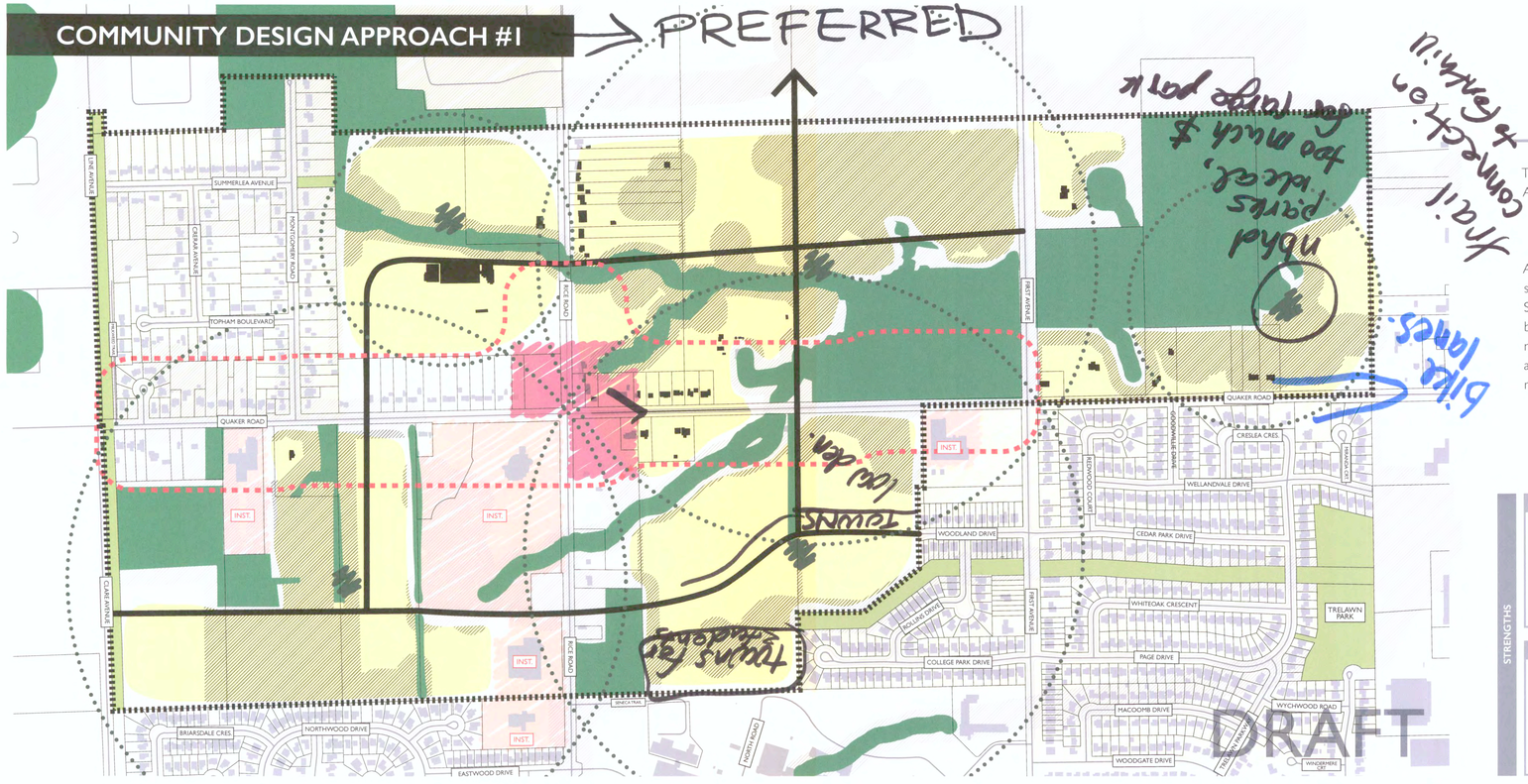

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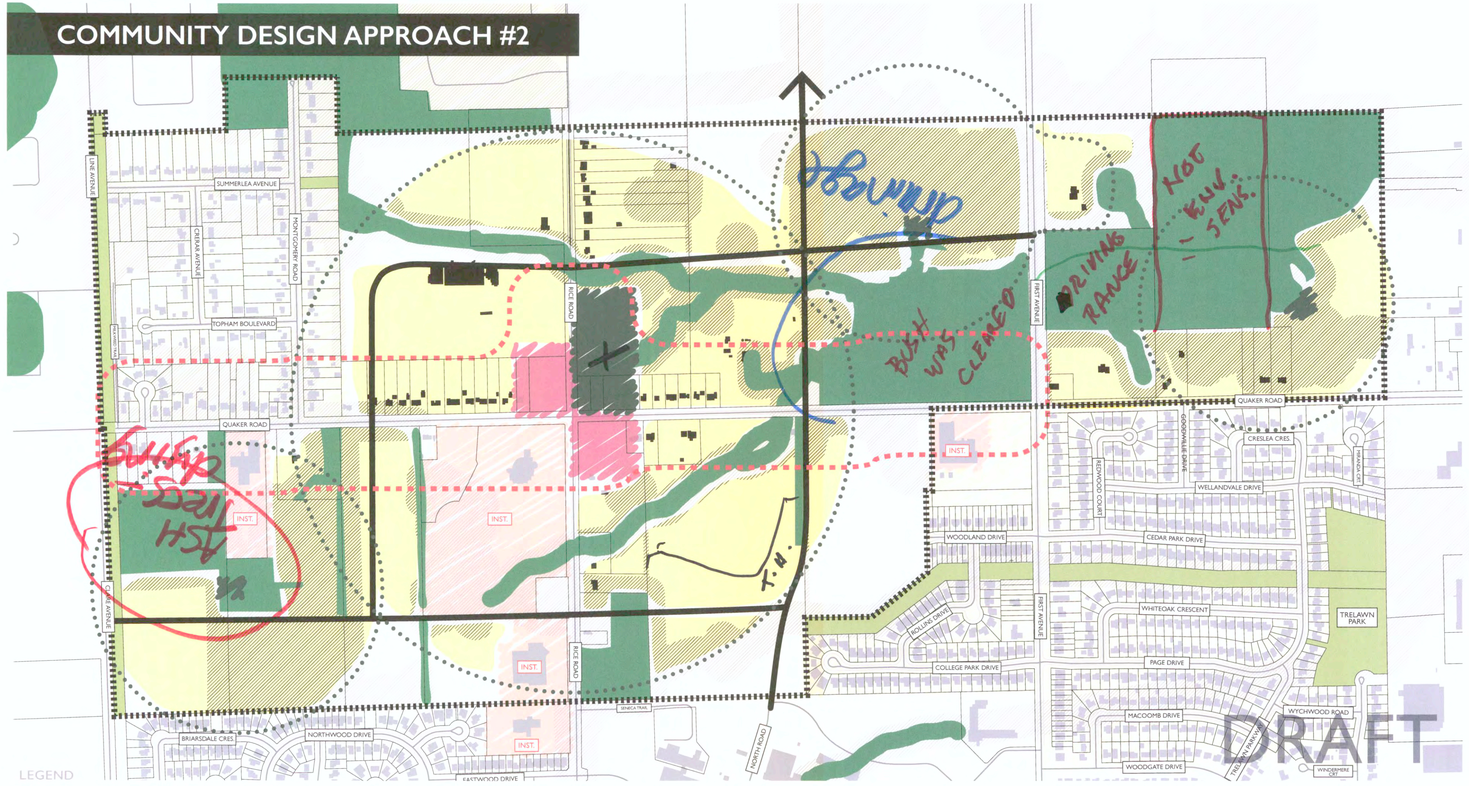

STRENGTHS

OPEN SPACE DISTRIBUTION	ROAD SYSTEM NETWORK

LOCATION OF HOUSING TYPES	EXTENT OF VILLAGE CHARACTER

WEAKNESSES

OPEN SPACE DISTRIBUTION	ROAD SYSTEM NETWORK

LOCATION OF HOUSING TYPES	EXTENT OF VILLAGE CHARACTER

OPPORTUNITIES

OPEN SPACE DISTRIBUTION	ROAD SYSTEM NETWORK

LOCATION OF HOUSING TYPES	EXTENT OF VILLAGE CHARACTER

OTHER COMMENTS

North West Welland SECONDARY PLAN STUDY

SGL Planning & Design • AgPlan Limited • Associated Engineering • AquaforBeech • ASI • Hemson Consulting

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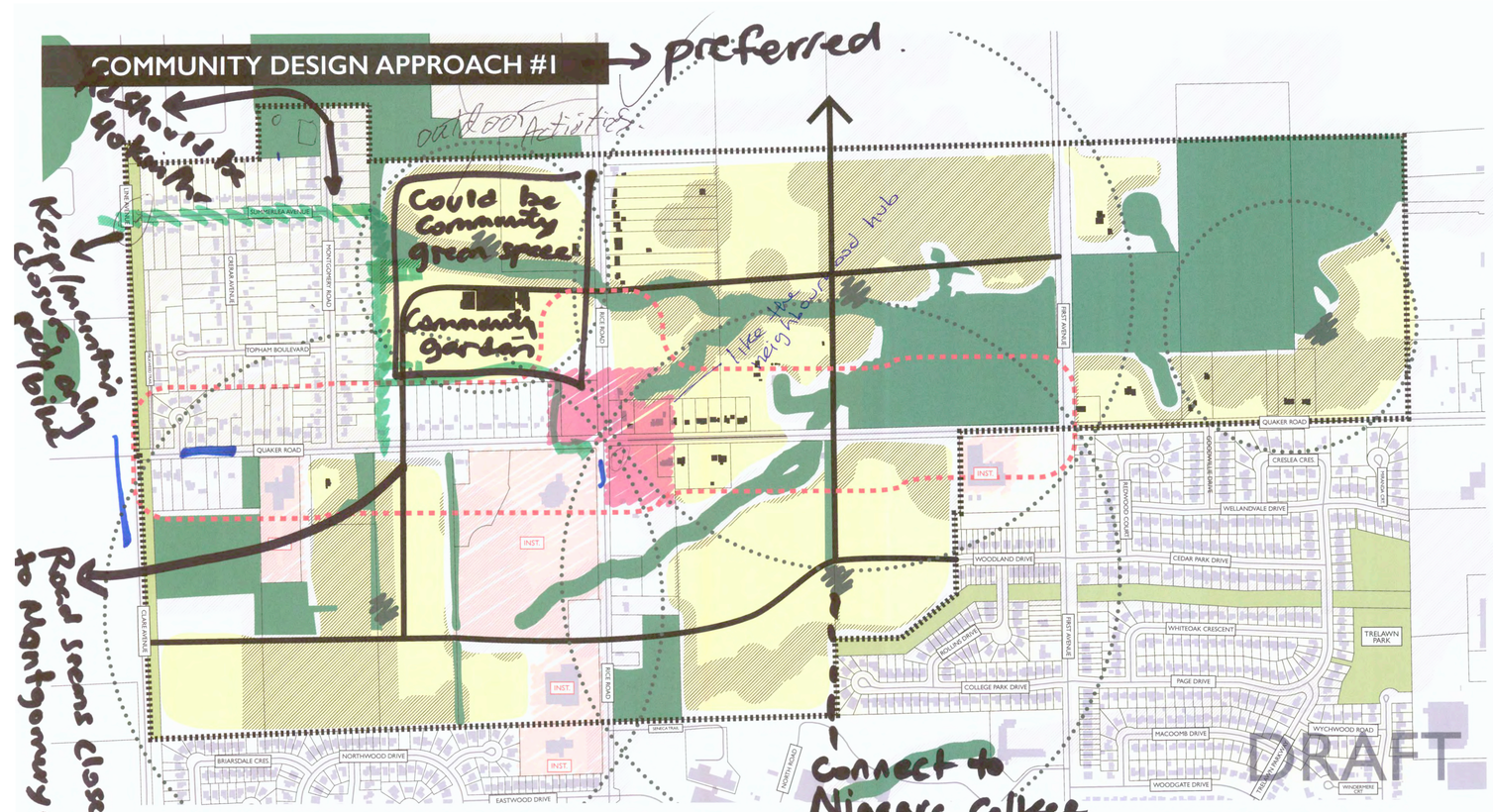
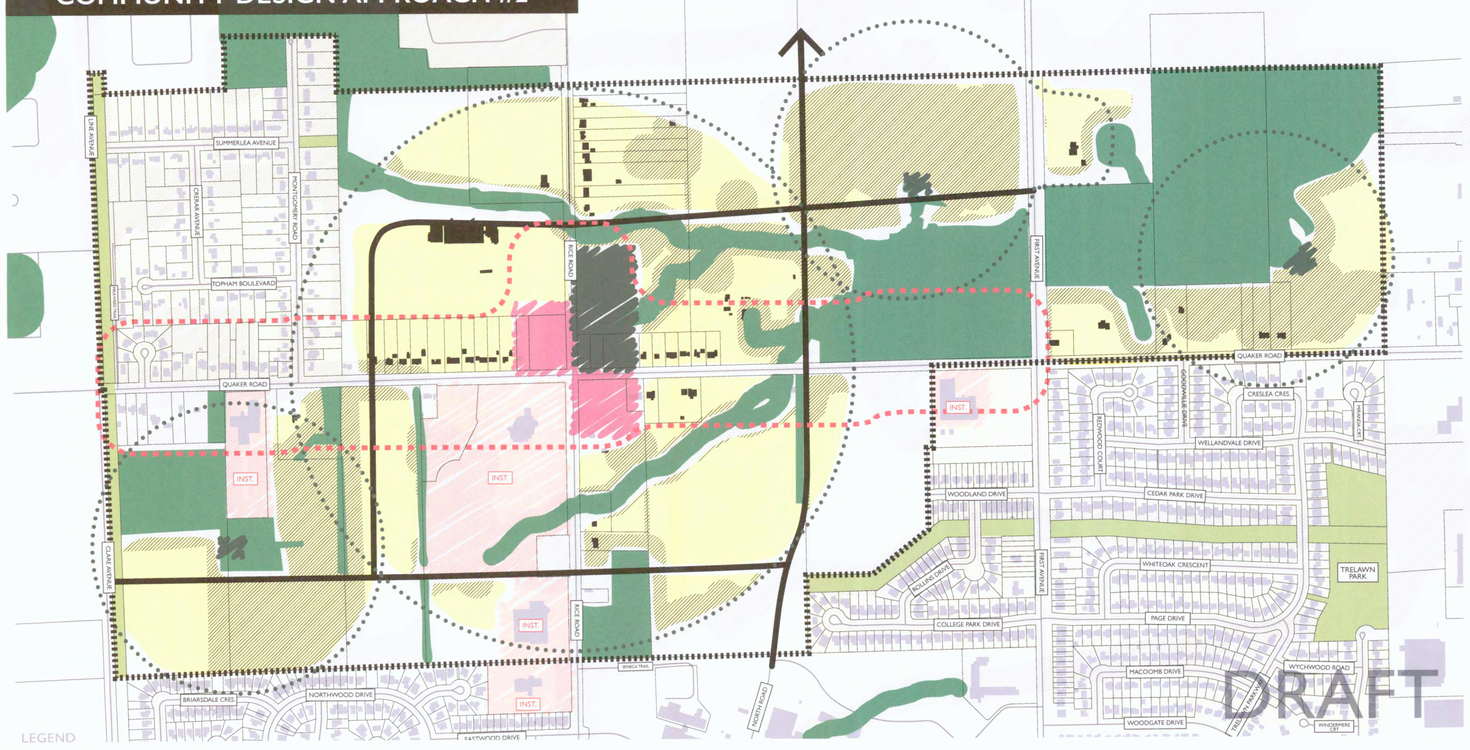


COMMUNITY DESIGN APPROACH #2



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- Open Space
- Environmental Areas Subject to Further Study
- Open Space Centre (Neighbourhood Parkette)
- ≤ 3 Minute (500 metre) Walking Radius

0 50 100 metres

N

The City of Welland in collaboration with the Region of Niagara has launched a three phased study to develop a Secondary Plan for the North West Welland Secondary Plan Area. The study area, located along Quaker Road, is defined by the Niagara College Welland Campus to the south, Line Avenue and Clare Avenue to the west, the boundaries of the City of Thorold and the Town of Pelham to the north and the back-property line of lands fronting onto Niagara Street to the east.

What is a Secondary Plan?

A Secondary Plan is a long-term land use planning tool which helps direct and shape the future of a specific area. Providing more detail than the Official Plan, the Secondary Plan specifies which land uses may be permitted, what shape and size of buildings are permitted, and how development can be integrated with the surrounding neighbourhood. The Secondary Plan also directs design objectives for new buildings or additions, how buildings may address the public street, and what the public streetscape may look like (determining sidewalk widths, design of boulevards, bike lanes, road widths, and more).

What Other Studies Will Be Part Of This Process?

Natural Heritage Study
Floodplain and Natural Hazard Lands Study
Agricultural Impact Assessment Study
Archaeological and Cultural Resource Assessment
Municipal Servicing
Transportation Study
Land Needs Assessment

As part of this process, we need your help to understand which building and design characteristics are most valued for the Study Area.
Please use the space below to provide your insights into the DRAFT Community Design Approach Options' ***Strengths***, ***Weaknesses***, and ***Opportunities***:

STRENGTHS

OPEN SPACE DISTRIBUTION

INTERGRATE NATURAL HERITAGE HERITAGE SPACES EVES OPENED
COMMUNITY OUTDOOR SPACE (SOCCER/BASEBALL) OR COMMUNITY GARDENS

ROAD SYSTEM NETWORK

SIDEWALKS ON SPINE AND ARTERIALES.
BIKE LANES INTERGRATED – CONNECT TO EXISTING STREETS + TRAILS
STREET LIGHTING EFFECTIVE LIGHTING SOLAR LIGHTS
- Merritt Road - Potential as an Arterial

LOCATION OF HOUSING TYPES

MAINTAIN BUNGALOW STYLES TOWN HOUSES NOT TALL HOMES BEHIND SUMMERLEA ASSOCIATION
APARTMENTS LOW RISE
HOUSING TYPES TO ARE IN PLACE EAST OF RICE RD.
3 STOREY NO HIGHER

EXTENT OF VILLAGE CHARACTER

Maintain this in the whole study area

WEAKNESSES

OPEN SPACE DISTRIBUTION

ROAD SYSTEM NETWORK

TRAFFIC HEAVY NIAGARA COLLEGE

LOCATION OF HOUSING TYPES

EXTENT OF VILLAGE CHARACTER

OPPORTUNITIES

OPEN SPACE DISTRIBUTION

- Community gardens - Splash Pad.
- Sport fields
- outdoor activities space.

ROAD SYSTEM NETWORK

DO not open closed end roads i.e. Summerlea, Topham Montgomery.

LOCATION OF HOUSING TYPES

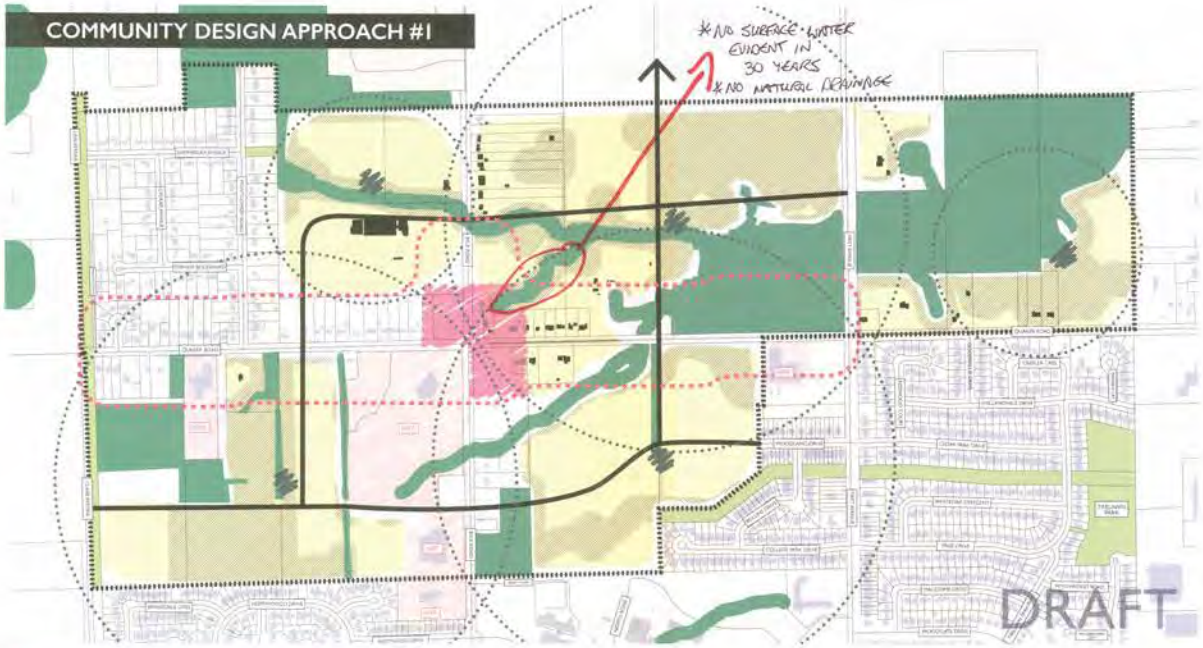
- Group homes
- Institutional Footprint increase. w/ existing.

EXTENT OF VILLAGE CHARACTER

- Small Stores cafes,
- Maintain low Density.

OTHER COMMENTS

COMMUNITY DESIGN APPROACH #1



COMMUNITY DESIGN APPROACH #2

North West Welland SECONDARY PLAN STUDY

The City of Welland in collaboration with the Region of Niagara has launched a three phased study to develop a Secondary Plan for the North West Welland Secondary Plan Area. The study area, located along Quaker Road, is defined by the Niagara College Welland Campus to the south, Line Avenue and Clare Avenue to the west, the boundaries of the City of Thorold and the Town of Pelham to the north, and the back property line of lands fronting onto Niagara Street to the east.

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As part of this process, we need your help to understand which building and design characteristics are most valued for the Study Area. Please use the space below to provide your insights into the DRAFT Community Design Approach Options' **Strengths**, **Weaknesses**, and **Opportunities**.

STRENGTHS

OPEN SPACE DISTRIBUTION

ROAD PATTERN NETWORK

(Participant name and address whited out)

CONCERNED ABOUT:

1) MINIMAL IMPACT ON RESIDENTIAL USE FOR SOCCER DOME COMPARED TO ALL OTHER PROPERTIES

2) WHY IS THERE ONLY 2 DESIGNS?

3) NATURAL HERITAGE MAPPING AT 450 RICE IS INACCURATE (SEE DESIGN #1 COMMENT)

WEAKNESSES

OPEN SPACE DISTRIBUTION

ROAD PATTERN NETWORK

LOCATION OF HOUSING TYPES

OPPORTUNITIES

OPEN SPACE DISTRIBUTION

ROAD PATTERN NETWORK

LOCATION OF HOUSING TYPES

OTHER COMMENTS

WHY IS THE SOCCER DOME PROPERTY THE ONLY PLOT OF LAND TO BE DEEMED TO BE SOLELY RESIDENTIAL?

Attachment G6 – Presentation for the Mississaugas of the New Credit First Nations Consultation

North West Welland

SECONDARY PLAN STUDY

PRESENTATION TO MISSISSAUGAS OF THE NEW CREDIT FIRST NATION

September 13, 2018

SGL Planning & Design Inc. - AgPlan Limited - Associated Engineering - AquaforBeech - ASI – Hemson Consulting

TODAY'S AGENDA

1. Introduction
2. Project Process & Schedule
3. Elements that Shape Community Design: Background Studies
4. Elements that Shape Community Design: Design Principles
5. Elements that Shape Community Design: Land Use Policy
6. Elements that Shape Community Design: Site Context

1 INTRODUCTION

North West Welland Secondary Plan Study

CONSULTING TEAM

SGL Planning & Design Inc

Project Management
Ute Maya-Giambattista
Paul Lowes

Aquafor Beech Ltd.

Natural Heritage & Subwatershed
Dave Maunder
Ash Baron
Peter Hebert

AgPlan Ltd.

Agriculture
Michael Hoffman

ASI

Cultural & Built Heritage
Rebecca Sciarra
Eric Beales
James Neilson

Associated Engineering

Servicing & Transportation
Jeff Suggett
Stan Matthew
Jordan Frost

Hemson

Financial Viability Analysis
Jason Bevan
Julia Cziraky

SGL Planning & Design Inc.

Land Use Planning
Paul Lowes
Yasaman Soofi

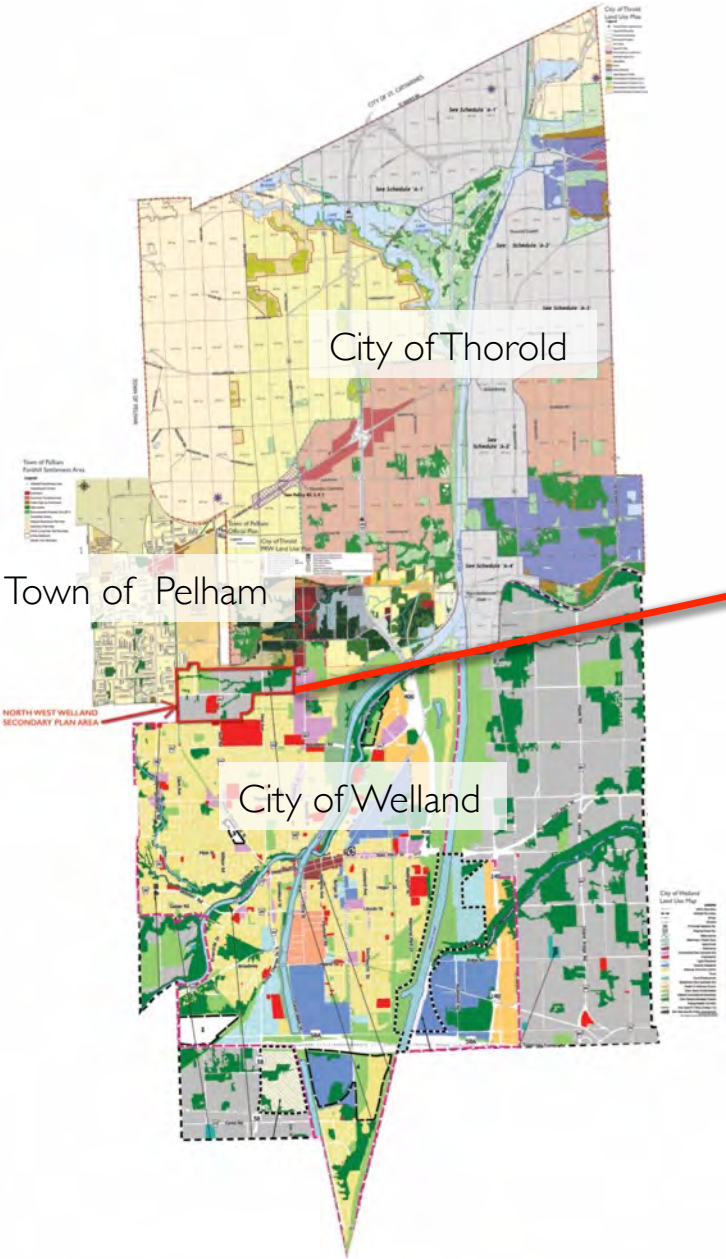
SGL Planning & Design Inc.

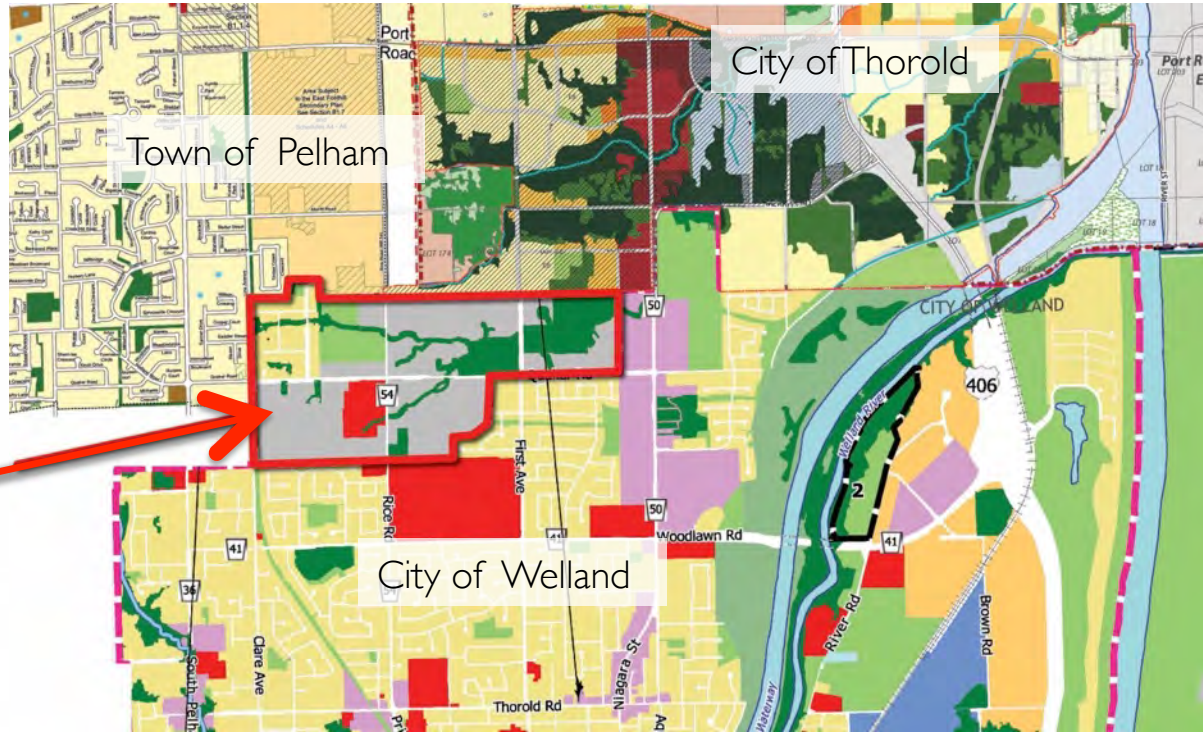
Urban Design
Ute Maya-Giambattista
Shikha Jagwani
Yasaman Soofi

STUDY AREA

The purpose of this study is to develop a strategy to ***guide the future growth and development*** in North West Welland through a ***Secondary Plan*** and ***Urban Design Guidelines***

STUDY AREA - CONTEXT





- North West Welland Study Area is surrounded by Built-Up Areas in:
  - Town of Pelham,
  - City of Thorold, and
  - City of Welland

TYPE OF STUDY

A Secondary Plan is a long-term land use planning tool which:

- *Helps direct and shape the future of a specific area; and,*
- *Provides more detail than the Official Plan.*

A Secondary Plan specifies:

- *Which **land uses** may be permitted;*
- *What **shape and size** of buildings are permitted;*
- ***How** development is **integrated with the surrounding neighbourhood;***
- ***Design objectives** for new buildings or additions;*
- *How developments may **address the public street;** and,*
- *What the public **streetscape** looks like:*
    - *Sidewalks, boulevards, bike lanes, street width, etc.*

TYPE OF STUDY

As part of the Secondary Plan we are conducting the following studies:

- Natural Heritage Study
- Floodplain and Natural Hazard Lands Study
- Agricultural Impact Assessment Study
- Archaeological and Cultural Resource Assessment
- Municipal Servicing
- Transportation Study
- Land Needs Assessment

2 PROJECT PROCESS & SCHEDULE

North West Welland Secondary Plan Study

STUDY SCHEDULE

PHASE 1. (FEBRUARY – JUNE 2018)

DATA COLLECTION, BACKGROUND REVIEW AND GROWTH DIRECTIVES

1. *Study Background Presentation - June 18th*
2. Update Presentation to Council - July 24

PHASE 2. (JUNE – NOVEMBER 2018)

LAND USE PLAN

1. *Visioning Workshop - June 19th*
2. Update Presentation to Council - January 2019

PHASE 3. (NOVEMBER 2018 – MARCH 2019)

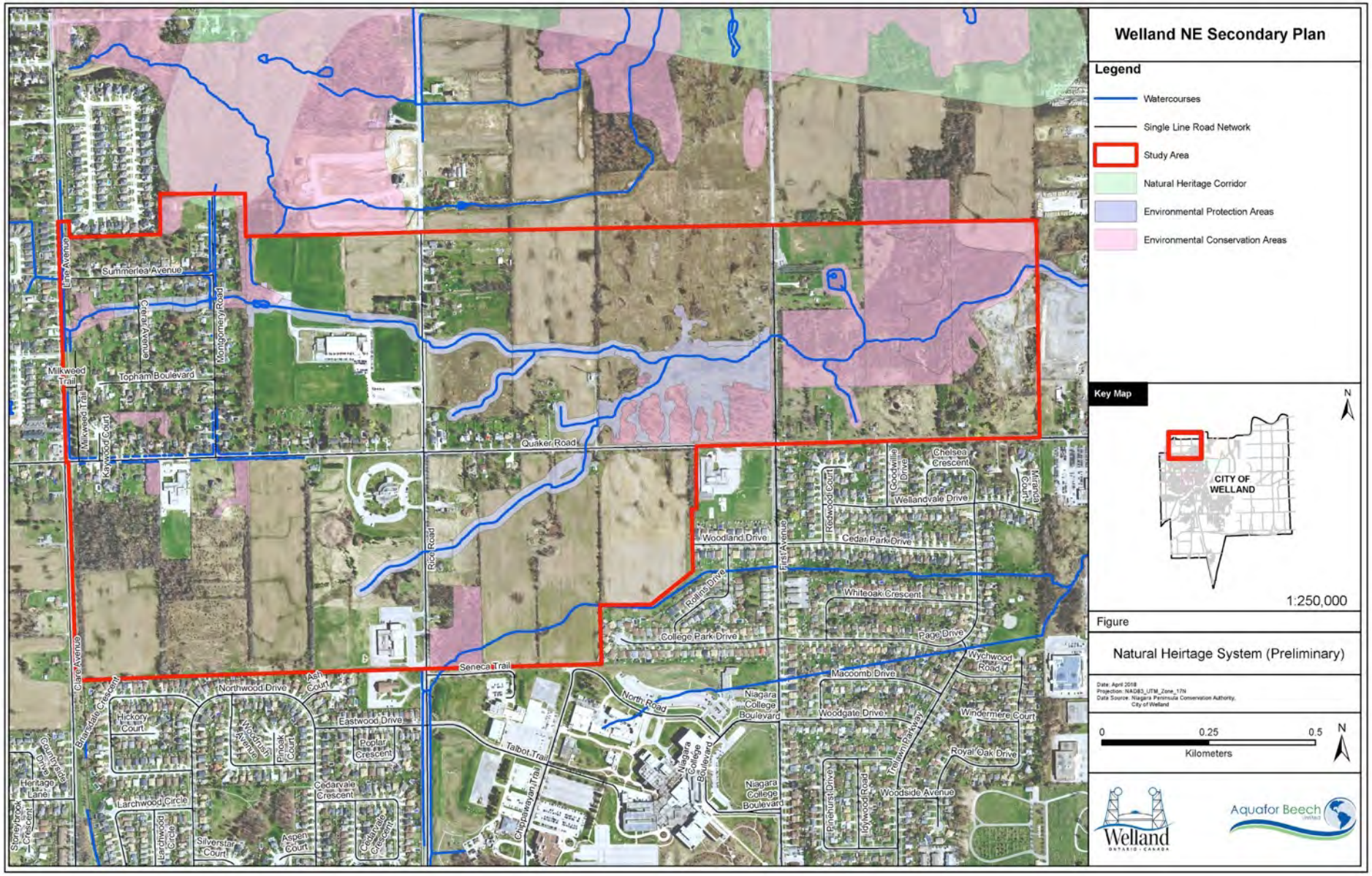
SECONDARY PLAN POLICY DEVELOPMENT

1. Present Preferred Option – January 2019
2. Council Presentation – March 2019

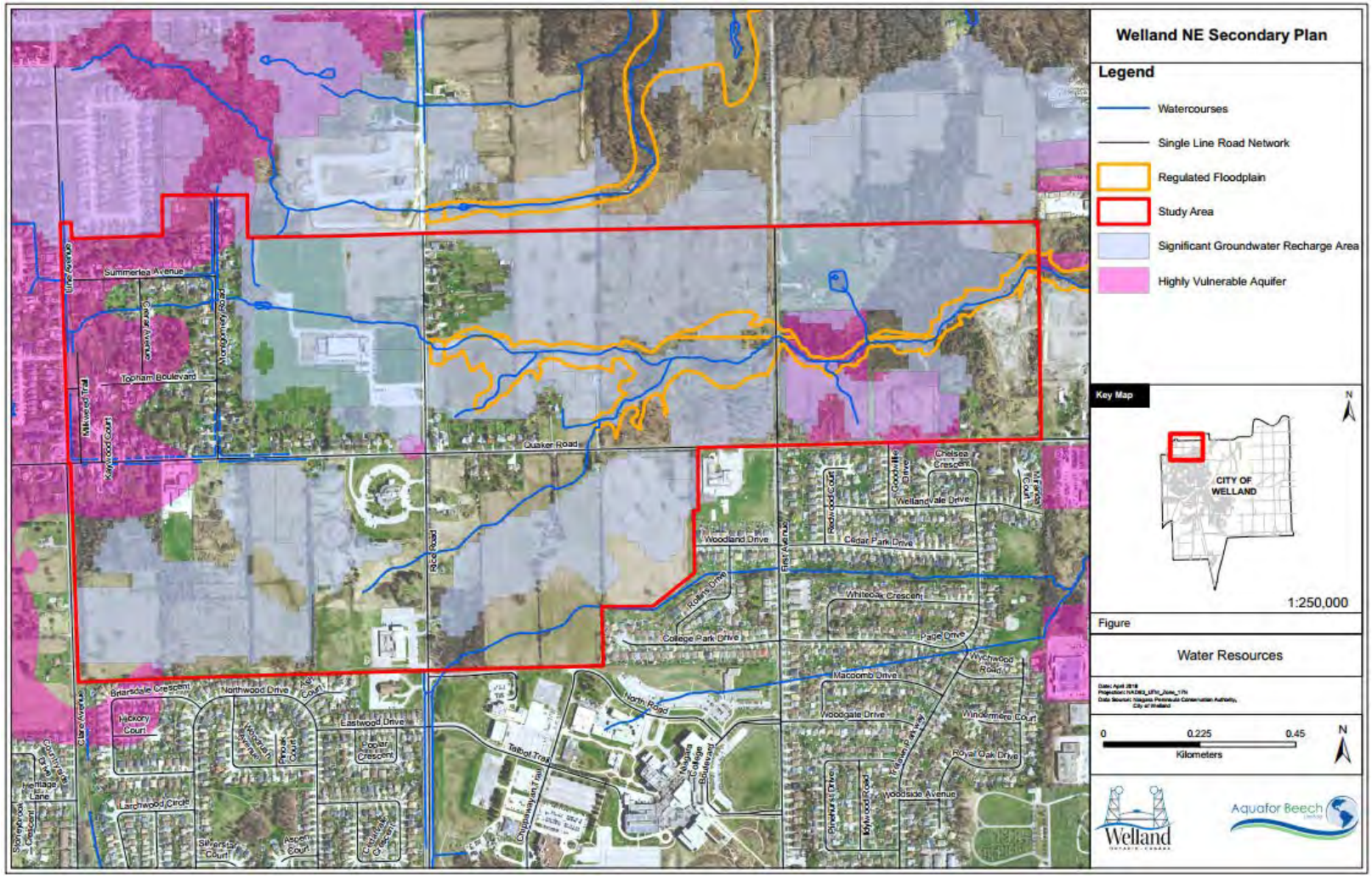
3 BACKGROUND STUDIES

North West Welland Secondary Plan Study

NATURAL HERITAGE SYSTEM



TERRAIN HYDROLOGY



- Floodplain mapping undertaken by Aquafor Beech in 2010 as part of the Central Welland Floodplain Mapping Study
- Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers delineated through Niagara Peninsula Source Protection

AGRICULTURAL CHARACTERISTICS

1. **What agricultural characteristics are present?**
   - Soils with what soil potential/soil capability
   - Agricultural and non-agricultural uses and agricultural infrastructure
   - Livestock operations and Minimum Distance Separation
   - Planning designations

2. **Are there observed trends in agricultural land use and livestock production in the past 30 years?**

3. What is the significance of the agricultural observations as well as trends?

4. Can the significant agricultural observations reasonably be used to influence the outcome of the Secondary Plan study?

WE ARE CURRENTLY AT STEPS ONE AND TWO ABOVE

AGRICULTURAL CHARACTERISTICS

Observations in the study area and adjacent lands:

1. Soil capability is predominantly prime when excluding Natural Heritage Systems (which is typical of much of the countryside in south central to southwestern Ontario).

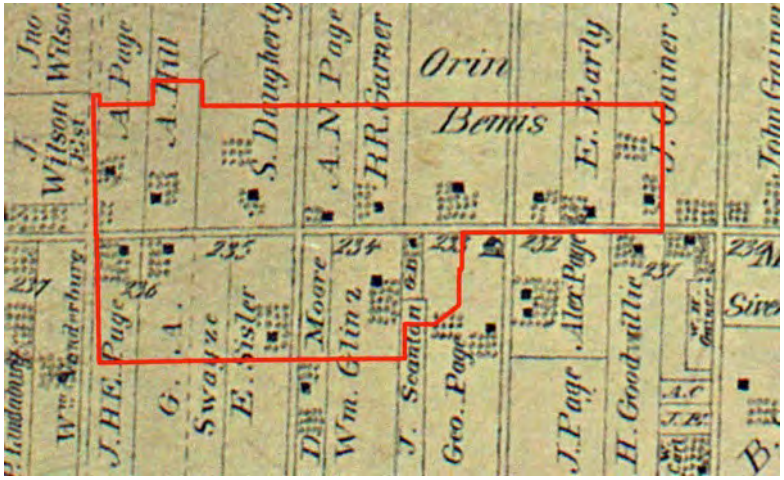
2. The study area and adjacent lands are not part of a specialty crop area.

3. Livestock and manure production as well as fruit and vegetable production are relatively low and have been decreasing over the past 30 years.

4. Agricultural infrastructure in the study area is minimal and there are no Minimum Distance Separation conflicts.

5. The study area is adjacent to existing and planned non-agricultural uses on four sides.

HISTORY: QUAKER ROAD

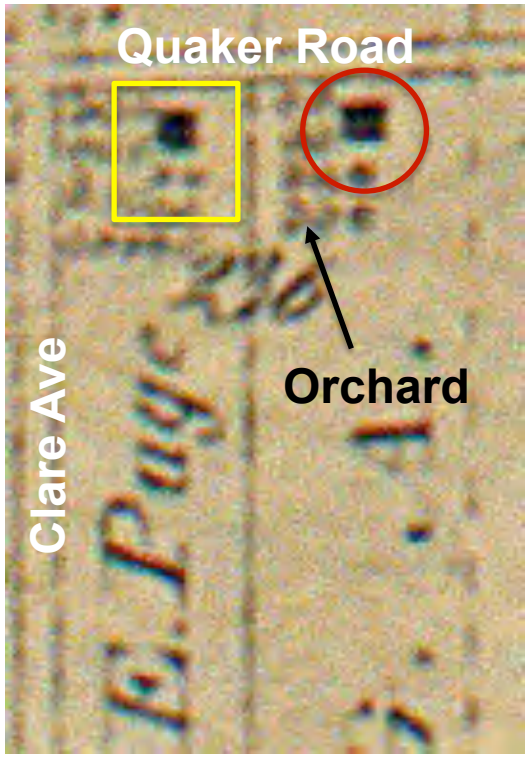


1876

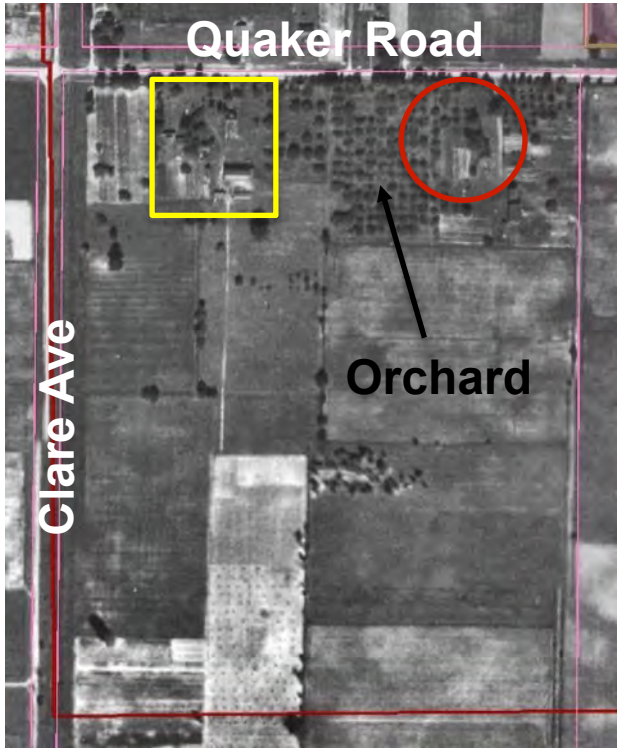
1907

- An important transportation route since the early 1800s
- Served as the roadway to the Quaker village in Pelham
- Many Quakers settled along the route
- The first school was constructed in 1816 and relocated to the site of the current Quaker Road Public School in 1861
- An 1899 Globe and Mail article mentions the road as a stop for slaves on the Underground Railroad

PROCESS



1876



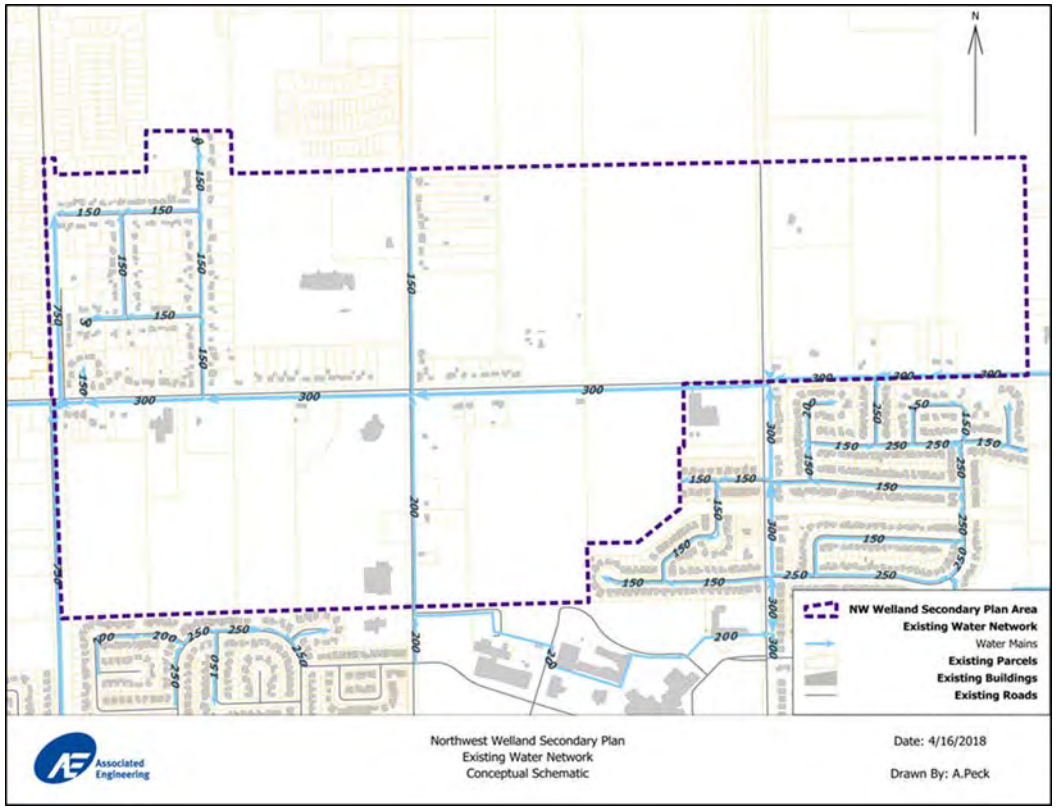
1934

2018

- Compare and contrast historical maps and aerial photos to find extant features.
- Approximately a dozen buildings built before 1934 have been found.
- Three historical transportation routes have been found (Quaker Road, Steve Bauer Trail, and Milkweed Trail).

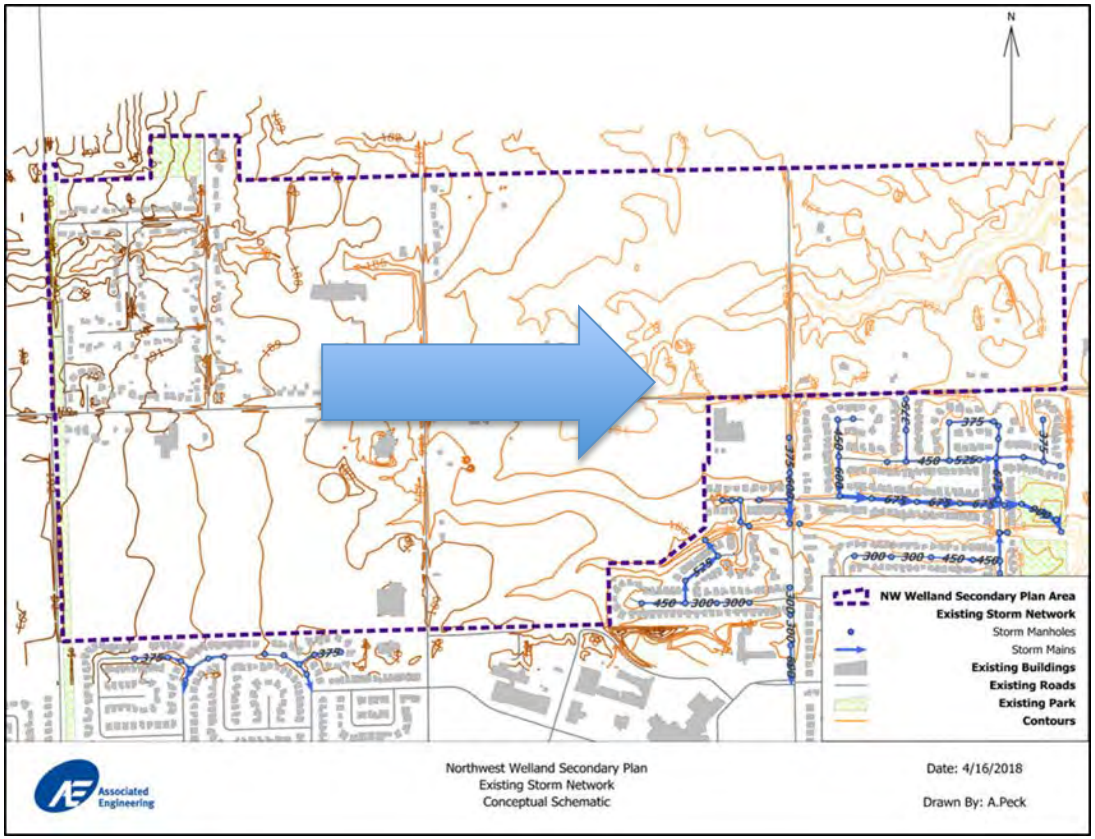
MUNICIPAL SERVICING: WATER

- Study Area is fed from Shoalt's Drive Reservoir / Pumping Station (Welland WTP)
- 300mm Dia. Regional trunk watermain flows east-west along Quaker Rd
- 150mm Dia. watermain flows north on Rice Rd from Quaker Rd
- 200mm Dia. watermain flows south on Rice Rd from Quaker Rd
- No flow along 1st Ave in Study Area
- Could leverage existing services in the Study Area to service new development



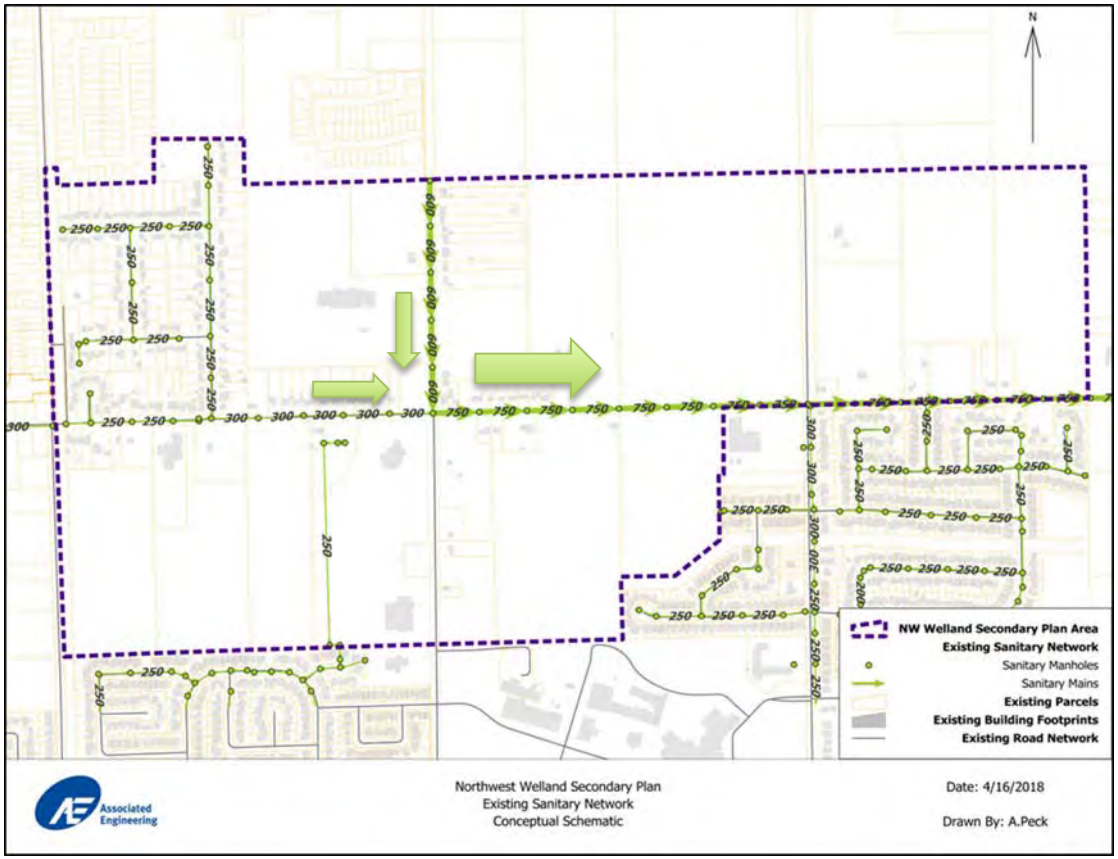
MUNICIPAL SERVICING: STORM DRAINAGE

- Two (2) main drainage channels convey runoff from west to east
- Culverts crossing Rice Rd and First Ave aid conveyance of runoff downstream
- Runoff drains to Welland Canal
- Erosion and sediment control will likely be a concern
- Flood hazard zones adjacent to streams draining through Study Area
- Large portion of study area identified as "significant groundwater recharge areas"
- May consider storm pipe network for servicing the Study Area

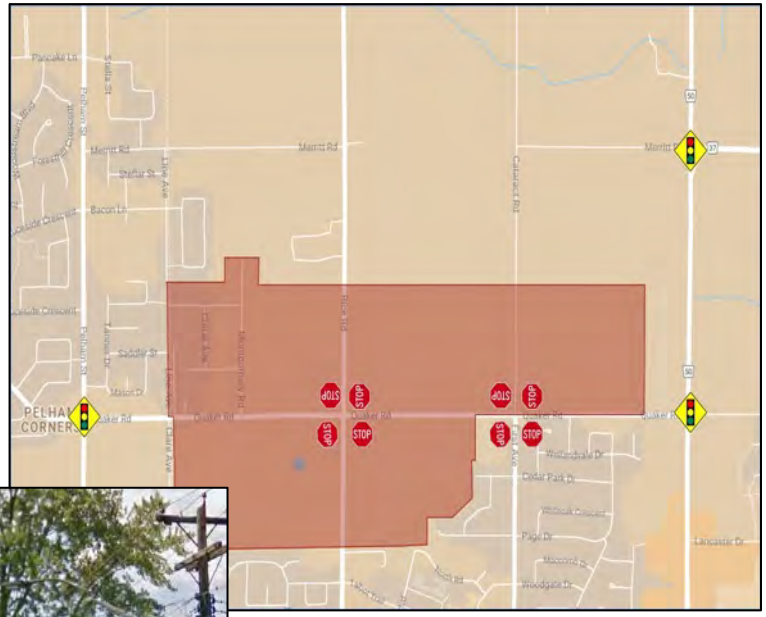


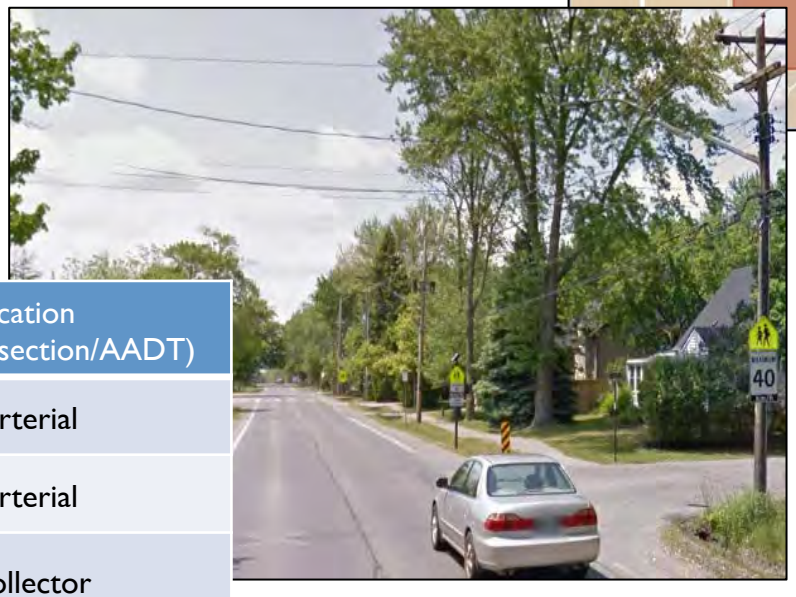
MUNICIPAL SERVICING: SANITARY

- Treatment at Welland WWTP
- Existing sanitary system appears to service some of the Study Area
- The Niagara Region Master Servicing Plan (2017) has a planned future upgrade for Quaker Rd sanitary sewer and Towpath SPS
- May leverage the Region's planned upgrades to service the Study Area



TRANSPORTATION





Road	Classification (based on cross section/AADT)
Quaker Road	Rural Arterial
Rice Road (R.R. 54)	Rural Arterial
First Avenue (n. of Quaker Road)	Rural Collector
First Avenue (s. of Quaker Road)	Urban Collector

TRANSPORTATION

Surrounding Developments

Transit Routes and Facilities

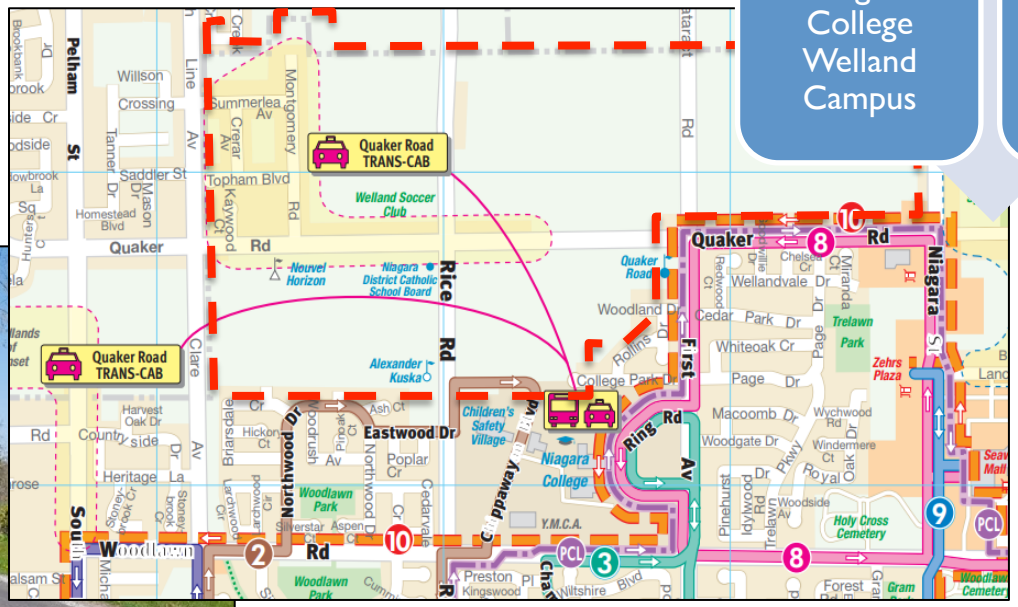
Active Transportation Facilities

East Fonthill Secondary Plan

West Port Robinson Secondary Plan

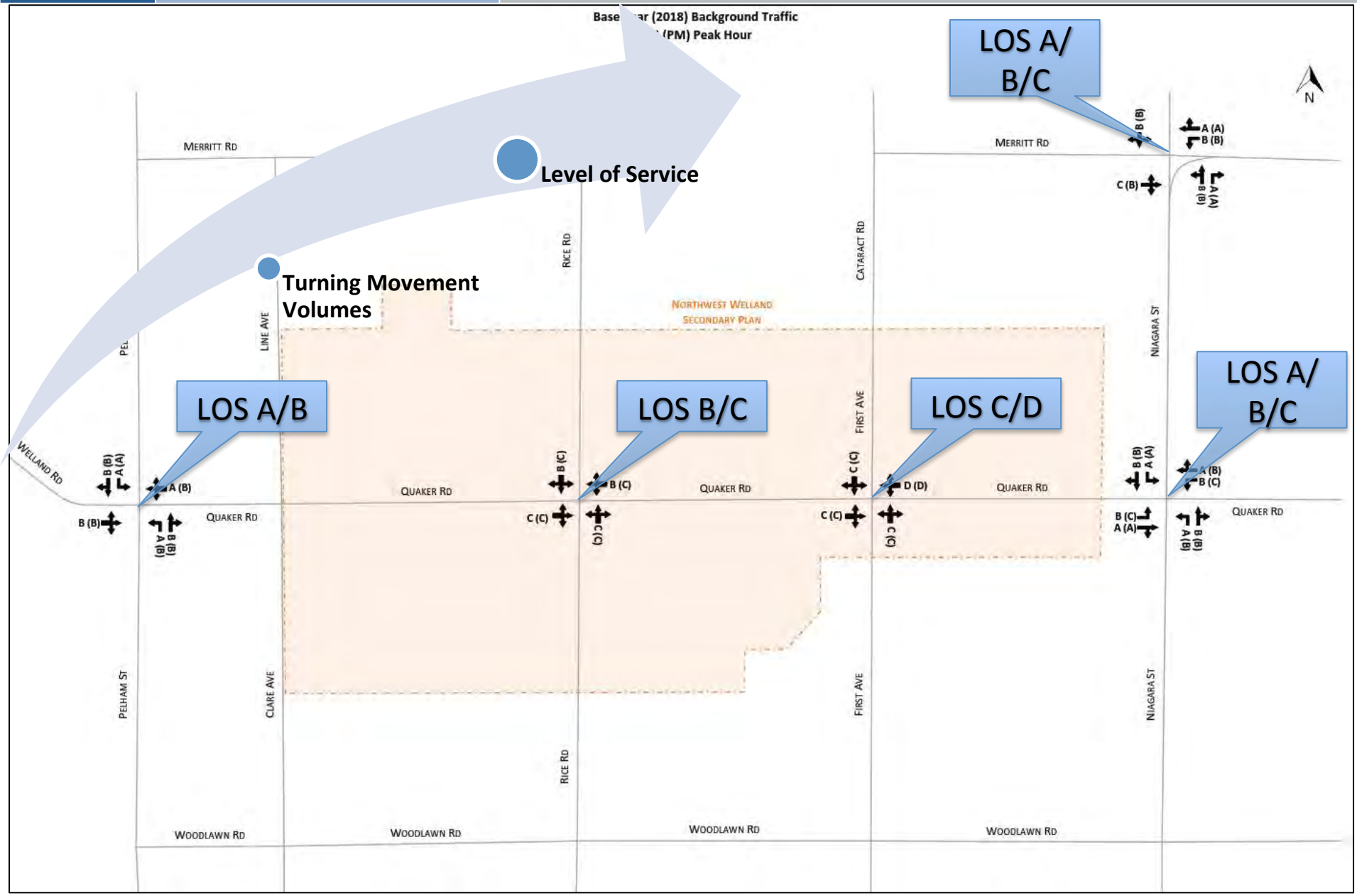
Niagara College Welland Campus

Regional Road 37 (Merritt Road) Extension



2 – Rice Road
3 – First Avenue
8 – Woodlawn
9 – Niagara
10 – West Community
PCL – Port Colborne Link

TRANSPORTATION



4 ELEMENTS THAT SHAPE COMMUNITYDESIGN: DESIGN PRINCIPLES

North West Welland Secondary Plan Study

COMMUNITY DESIGN PILLARS

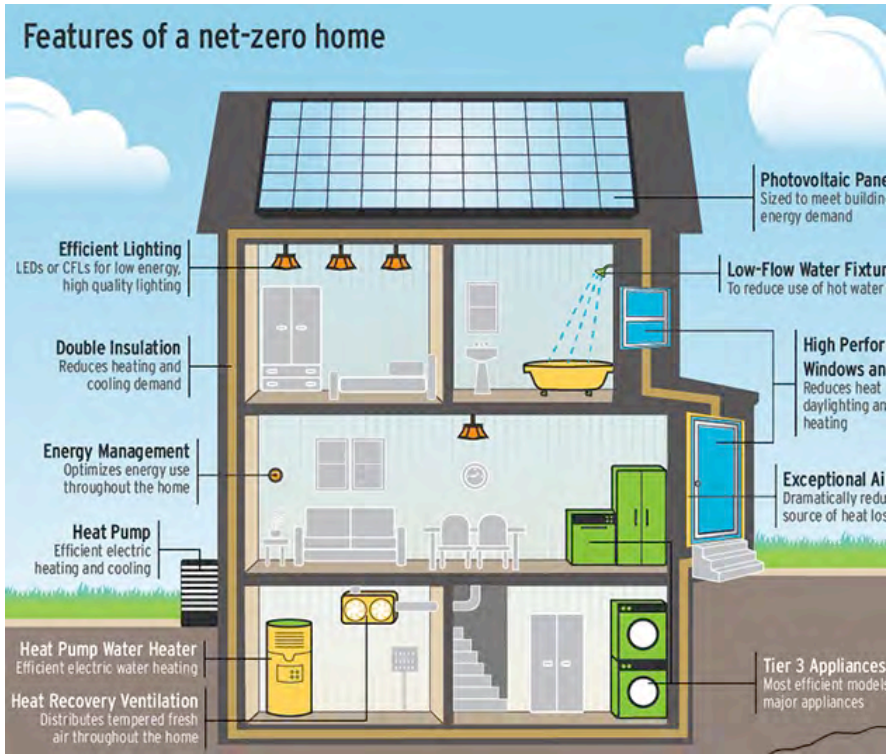
1

protect and enhance **natural heritage features and corridors** within a broader linked natural heritage system

2 conserve, protect and integrate **built and cultural heritage elements**

3 Implement **sustainable community design** initiatives that ensure:

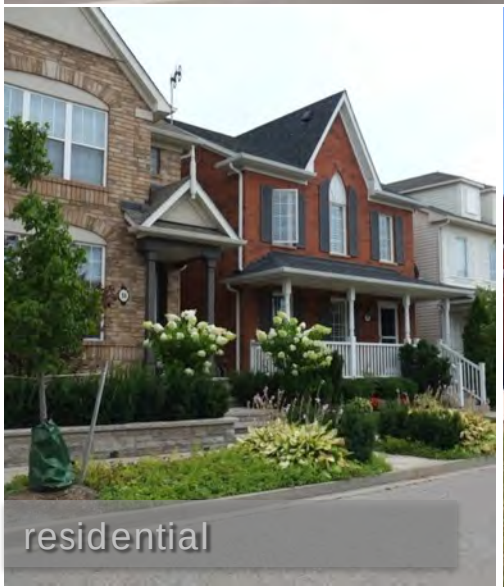
- the maintenance and improvement of the quality of surface water and ground water and **conservation of water resources** and,
- adaptation to **climate change.**



4

Establish Placemaking Strategies that contribute to the creation of a unique community by providing for a **variety of land use** opportunities to include mixed use commercial, employment and residential land uses as well as, institutional land uses are located within the area.

live-work units

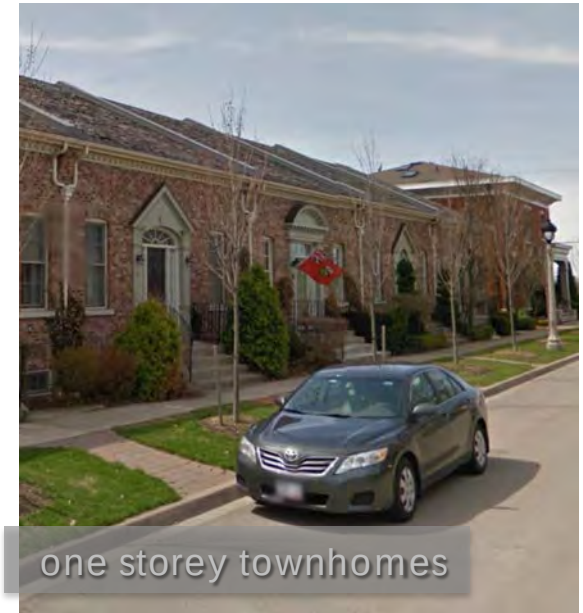

residential

institutional: schools

5 Establish Placemaking Strategies that contribute to the creation of a unique community by ensuring there is an adequate supply of **diverse housing types** which cater to the wide variety of its residents needs.

two storey townhomes

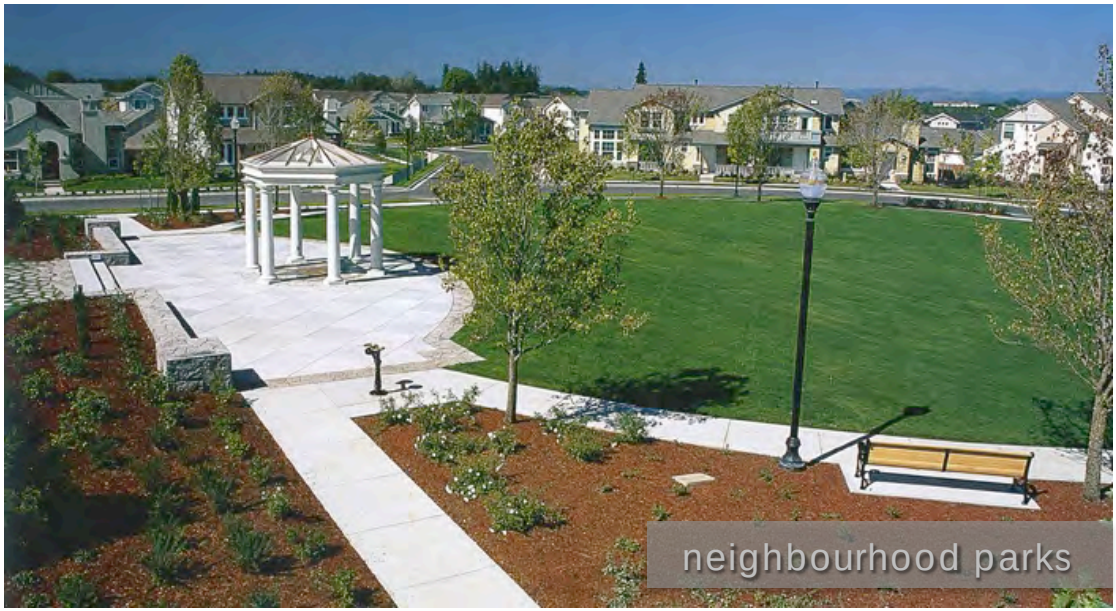
single detached houses


one storey townhomes

duplex

6

Establish Placemaking Strategies that contribute to the creation of a unique community by ensuring there is an adequate supply and variety of **open space** opportunities for people of all ages and abilities.


neighbourhood parks

parkettes

trails

7

Promote Physical Health by:

- providing **active transportation** options through convenient access to **public transportation** and safe and convenient **pedestrian and cycling networks** and,
- developing a continuous and connected **open space, pedestrian realm and trail system** that links the study area to the broader context.

Image by Sherman Wong

alternatives to the car

8

Promote Mental Health by:

- providing **community amenity options** that support citizens needs to include **art and culture** events and activities for all ages with an emphasis on youth- and senior-driven activities and,

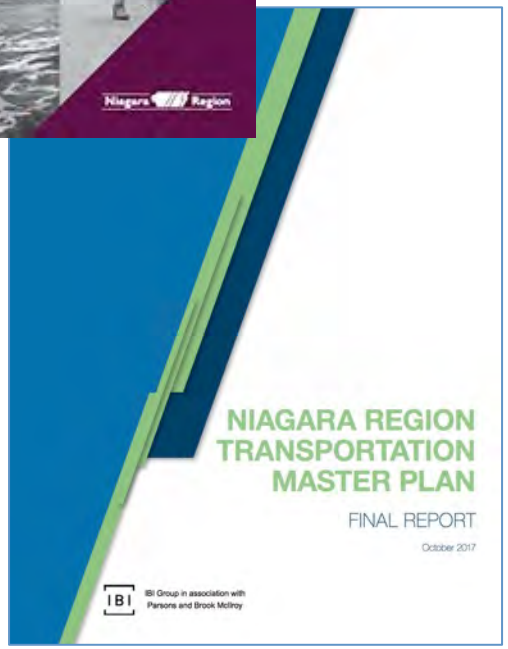
- providing **Universally Accessible** design measures in the planning of new neighbourhoods.

public amenities for all ages and abilities

5 ELEMENTS THAT SHAPE DESIGN: LAND USE POLICY

North West Welland Secondary Plan Study

REGIONAL LAND USE POLICY



NIAGARA REGIONAL OFFICIAL PLAN, 2014

4.C.5 To ensure that *Designated Greenfield Areas* will be planned as **compact, complete** communities by:

Providing opportunities for **integrated, mixed land uses;**
Creating street patterns that are fine grained and in a grid pattern **supporting transit and active transportation;** and,
Ensuring Greenfield development is **sequential, orderly and contiguous** with exiting built-up areas.

NIAGARA TRANSPORTATION MASTER PLAN, 2007

4.1 Need for a street network that is safe and walkable for all ages, and that **does not divide neighbourhoods**

6.3 Roads and streets under the jurisdiction of Region of Niagara will be planned and designed using a '**complete corridor**' approach

KEY POLICIES OF THE LOCAL OFFICIAL PLAN:

3.2 Growth objectives include:

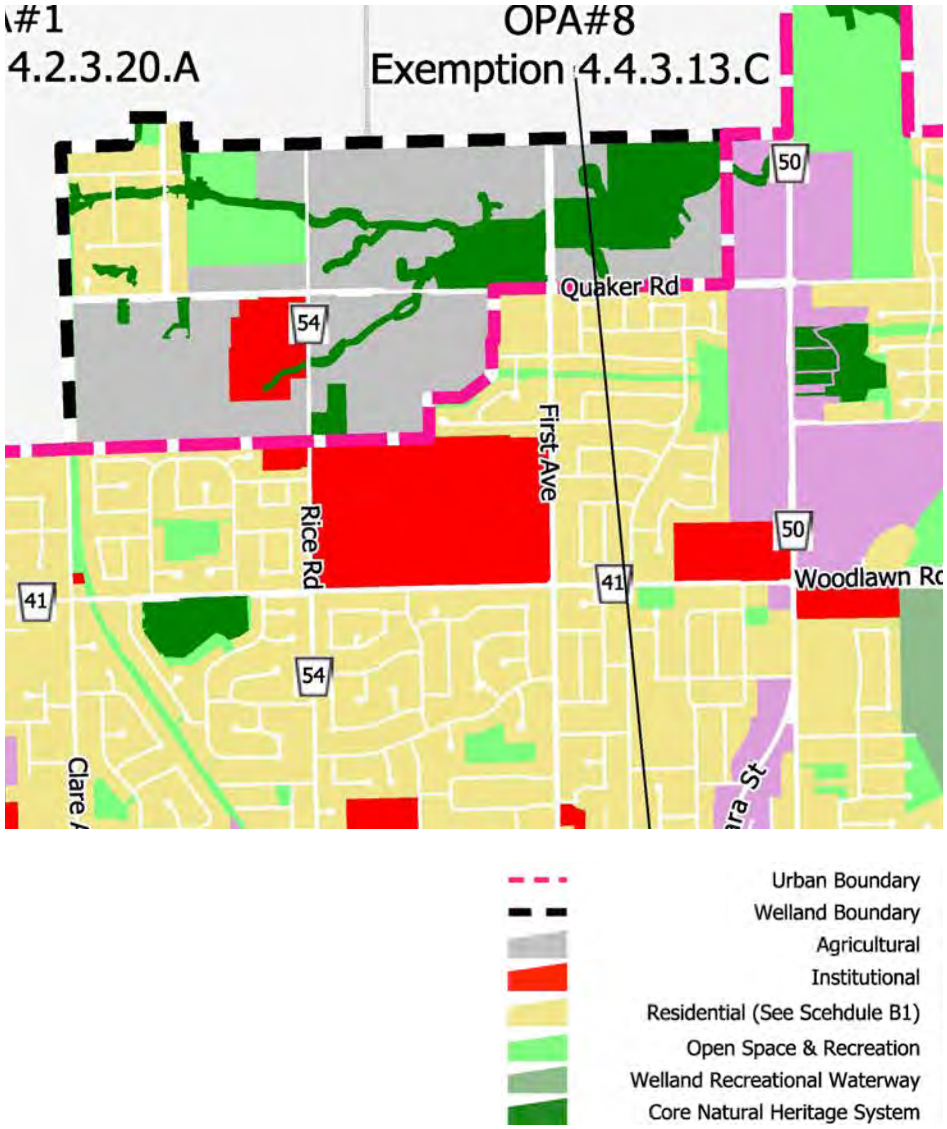
vi) To build **compact, mixed-use, transit supportive, pedestrian friendly** areas within the *Built Up Area* and **Greenfield Areas**

viii) To ensure the availability of a sufficient supply of designated employment and residential land to **meet the City's projected long term growth**

3.4.2.3 The remaining lands which lie between the Urban Boundary and the Built Boundary represent **Greenfield Areas.**

4.2.3.2 New neighbourhoods will be planned to support the Region's density target of a **combined 50 residents and jobs per gross hectare** on designated Greenfield lands.

New *Growth Plan* will require a density target of a **combined 80 persons and jobs per gross hectare**

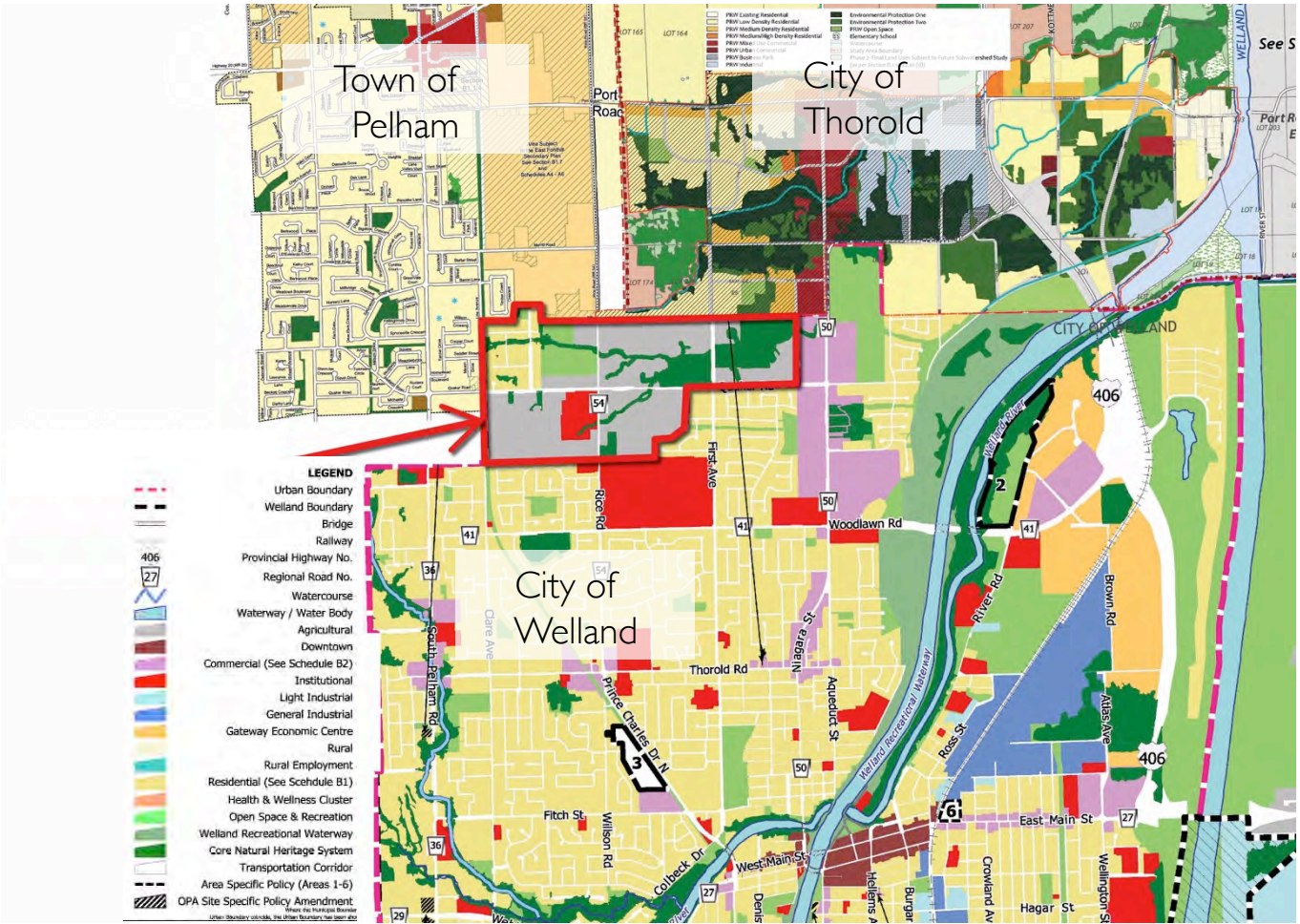


CITY OF WELLAND EXISTING LAND CAPACITY

Estimated Developable Area = 109 ha

North West Welland

- 80 persons + jobs / ha = 3,270 units



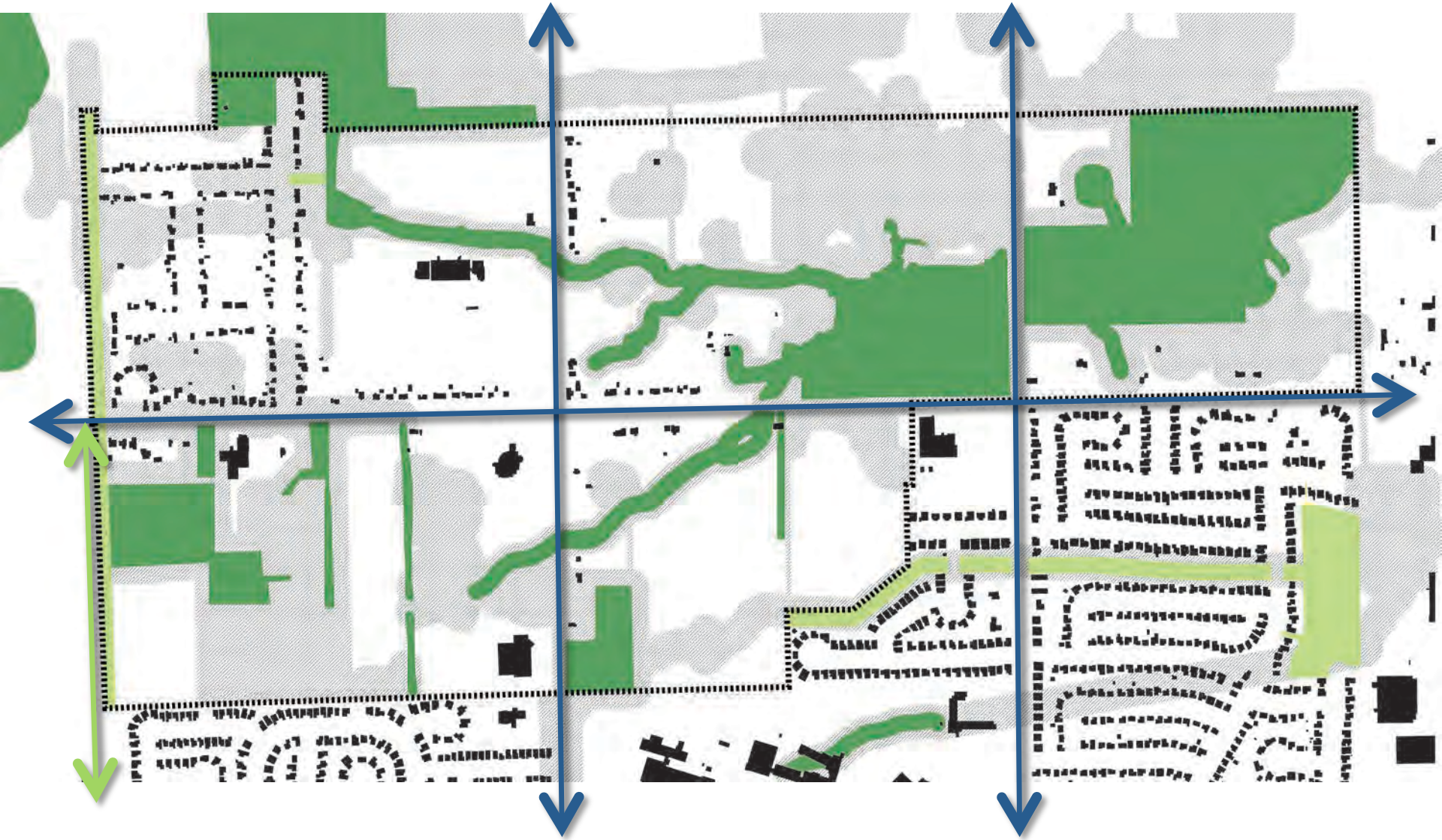
6 ELEMENTS THAT SHAPE DESIGN: SITE CONTEXT

North West Welland Secondary Plan Study

ENVIRONMENTAL FEATURES

NATURAL HERITAGE

ROAD NETWORK



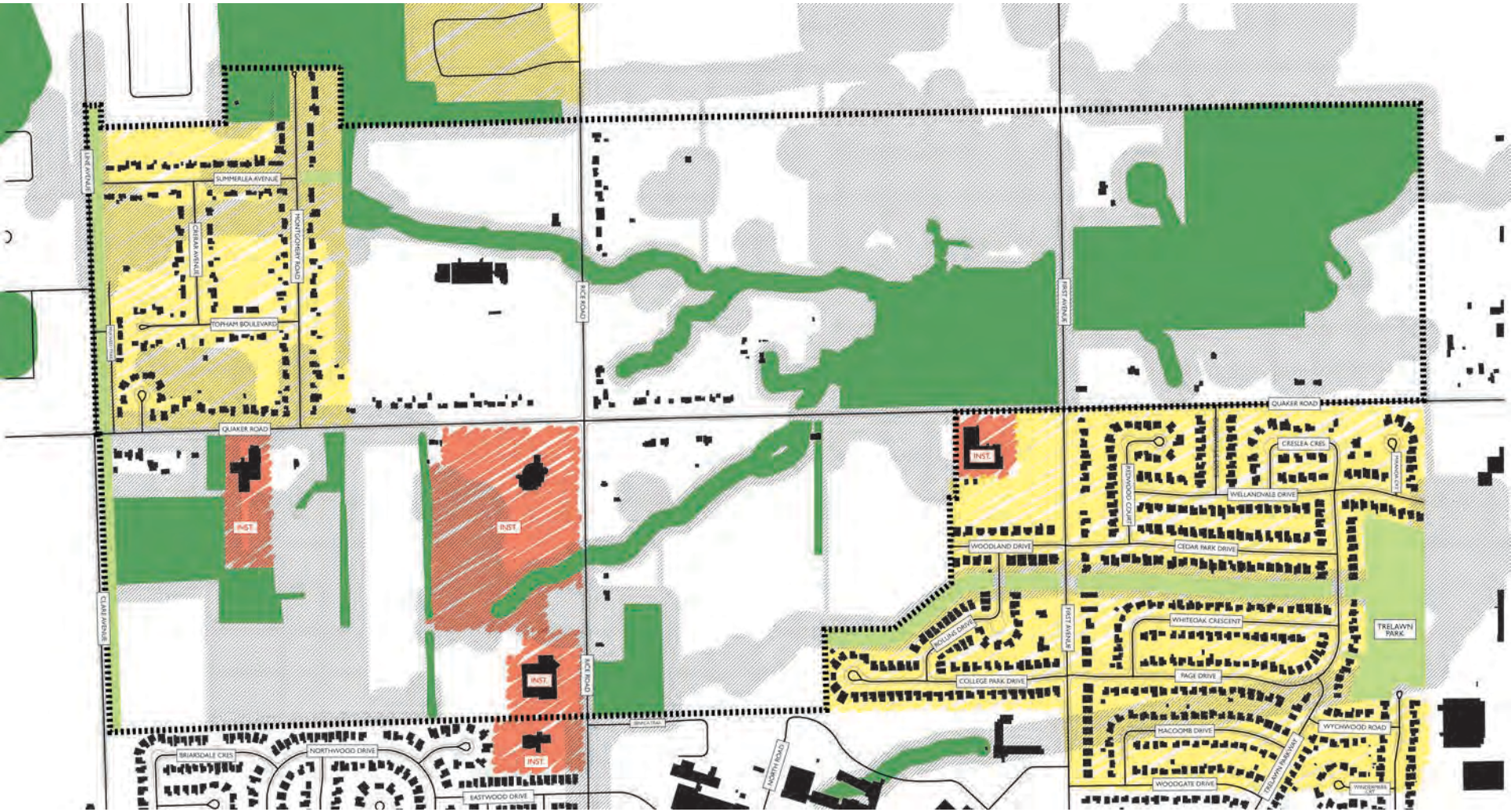
QUAKER ROAD

QUAKER ROAD

RICE ROAD

FIRST AVENUE

EXISTING LAND USES



LINE AVENUE
SUMMERLEA AVENUE
CEDAR AVENUE
MONTGOMERY ROAD
TOPHAM BOULEVARD
QUAKER ROAD
RICE ROAD
FIRST AVENUE
INST.
CLARE AVENUE
NORTHWOOD DRIVE
BRIARSDALE CRES
EASTWOOD DRIVE
NORTH ROAD
WOODLAND DRIVE
CEDAR PARK DRIVE
WELLANDVALE DRIVE
CRESLEA CRES
WHITEOAK CRESCENT
COLLEGE PARK DRIVE
PAGE DRIVE
MACOMB DRIVE
WOODGATE DRIVE
WYCHWOOD ROAD
TRELAWN PARK
TRELAWN PARK MEWS

BUILT FORM

BUILT FORM