871 Equestrian Court (Unit #1)
Oakville, ON L6L 6L7

Wignell Drain Subwatershed Study

City of Port Colborne, Niagara Region, Ontario

Palmer Project #
2007708

Prepared For
Elite Developments Inc.

May 8, 2024

May 8, 2024

Mahum Riaz
Project Manager
Elite Developments Inc.
3410 South Service Road, Suite 102
Burlington, ON (L7N 3T2)

Dear Mahum Riaz:

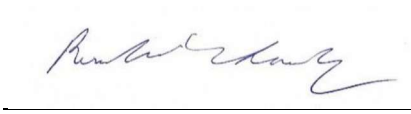
Re: Wignell Drain Subwatershed Study
Project #: 2007708

Palmer is pleased to provide a Subwatershed Study for the Lens Wignell Drain subwatershed and a small, southeast portion of the CWR Welland Canal South subwatershed, as requested by the City of Port Colborne and the Niagara Peninsula Conservation Authority (NPCA) for lands east of the City of Port Colbourne, Ontario.

Through extensive field assessments and desktop analyses, Palmer has completed a multi-disciplinary study to document and characterize the natural heritage and aquatic conditions, and the existing geomorphic and hydrogeologic forms and functions of the Lens Wignell Drain Subwatershed and the small portion of the CWR Welland Canal South subwatershed (herein collectively referred to as the “Wignell Drain Subwatershed”). In a joint effort with Odan/Detech Group Inc., a floodplain analysis was also completed for the Wignell Drain Subwatershed to direct future potential stormwater management facilities. Based on the current characterizations and data collected during the 2021, 2022, and 2023 field seasons, Palmer and Odan/Detech Group Inc. have identified opportunities for development, as well as opportunities for improving and enhancing the subwatershed through future steps. The field study was completed through a combination of site-level surveys for participating landowners (specifically for lands owned by Elite Developments Inc.) and through reconnaissance and roadside surveys where permission to access properties was not obtained from landowners within the Wignell Drain Subwatershed Study Area.

As proposed development within the subwatershed study advances through the various steps of the planning approval process, additional studies will need to be undertaken on a property-by-property basis as proposed development expands within the Wignell Drain Subwatershed Study Area. These studies may be site-specific or watershed based and should follow the recommendations of the current SWS and any necessary future addendum requirements outlined in the SWS. These additional studies may result in the refinement of natural feature / hazard land boundaries, refinement of erosion hazards, woodland assessments to determine significance, and the confirmation / absence of wetlands.

Yours truly,



Rosalind Chaundy, M.Sc.,
Senior Ecologist, Palmer

John Krpan, M.S.C.E., P.Eng.
President, The Odan/Detech Group Inc.

Dirk Janas, B.Sc.,
Principal Ecologist, Palmer

Table of Contents

List of Figures

List of Tables

List of Graphics

List of Appendices

1. Introduction

Palmer has been retained by Elite Developments Inc. to complete a Subwatershed Study (SWS) as part of a development plan application for the lands located east of the City of Port Colborne, Niagara Region (the Study Area – **Figure 1**). The Study Area, which is approximately 1,276 ha in size, is roughly situated between Chippawa Road and Lake Erie, and between Elizabeth Street and Miller Road (**Figure 1**). Elite Development Inc.-owned lands (the "Subject Lands" – seen on **Figure 1**) have undergone an Environmental Impact Study (EIS) as part of a Site Plan Approval application for the proposed development of these properties. The Subject Lands are approximately 142 ha in size and are primarily situated between Elizabeth Street, Main Street East, Lorraine Road, and Killaly Street East. Snider Road, which is an infrequently used dirt road, subdivides the Subject Lands. The proposed development for these Subject Lands includes the construction of single-family dwellings and townhouses.

The Study Area comprises the Lens Wignell Drain subwatershed and a small southeast portion of the CWR Welland Canal South subwatershed. The approximate Study Area has also been further subdivided into the Port Colborne Drain, the Wignell Drain, and the Michener Drain (EWA Engineering Inc., 2022). For the purposes of this SWS the Study Area will be referred to as the Wignell Drain Subwatershed to avoid confusion. Watercourse reaches within the Wignell Drain Subwatershed will be named according to the subwatershed.

The Wignell Drain Subwatershed Study Area currently supports quarries, agricultural fields, woodland features, wetlands, and drainage features. The Study Area is mostly surrounded by rural agricultural lands, with Lake Erie to the south and residential neighbourhoods from the City of Port of Colborne to the west. The Study Area is partially regulated by the Niagara Peninsula Conservation Authority (NPCA).

The intent of this SWS is multi-purpose. The first is to characterize the Study Area through the delineation, inventorying, and evaluation of ecological and geomorphic data in which the sensitivities and significance of existing natural heritage features will be determined through assessment. The second is to integrate Palmer's ecological and geomorphic data with hydrogeological and civil engineering data to inform development potential within the Study Area, in part through constraints mapping. The last is to use the comprehensive data to develop monitoring and mitigation measures, as well as discuss potential enhancement and management recommendations for the Wignell Drain Subwatershed Study Area overall.

HWY 140

2ND CON RD

EXISTING QUARRY

CARL RD

PROPOSED QUARRY EXPANSION AREA

SNIDER RD

MAIN ST E

ELIZABETH ST

WIGNELL DRAIN WEST TRIBUTARY

WIGNELL DRAIN EAST TRIBUTARY

KILLALY ST E

FRIENDSHIP TRAIL

LORRAINE RD

REUTER RD

LAKESHORE RD E

LAKE ERIE

LEGEND

- Watercourse [1]
- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

1 - Contains data sourced from Land Information Ontario (LIO)

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:17,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: RC
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2020) provided by Brock University GIS services.
Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Wignell Drain Subwatershed Study

TITLE: **Wignell Subwatershed Study Area**

REF. NO. 2007708-1-2

Figure 1

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

2. Policy Review

2.1 Provincial Policy Statement (2020)

The Provincial Policy Statement (PPS) provides direction to regional and local municipalities regarding planning policies for the protection and management of natural heritage features and resources (Ontario Ministry of Municipal Affairs and Housing, 2020). The PPS defines eight types of Natural Heritage Features (NHF) and adjacent areas and provides planning policies for each. Of these NHF, development is not permitted in:

- Significant Coastal Wetlands;
- Significant Wetlands in Ecoregions 5E, 6E and 7E;
- Fish Habitat, except in accordance with provincial and federal requirements; or
- Habitat of species designated as Endangered and Threatened, except in accordance with provincial and federal requirements.

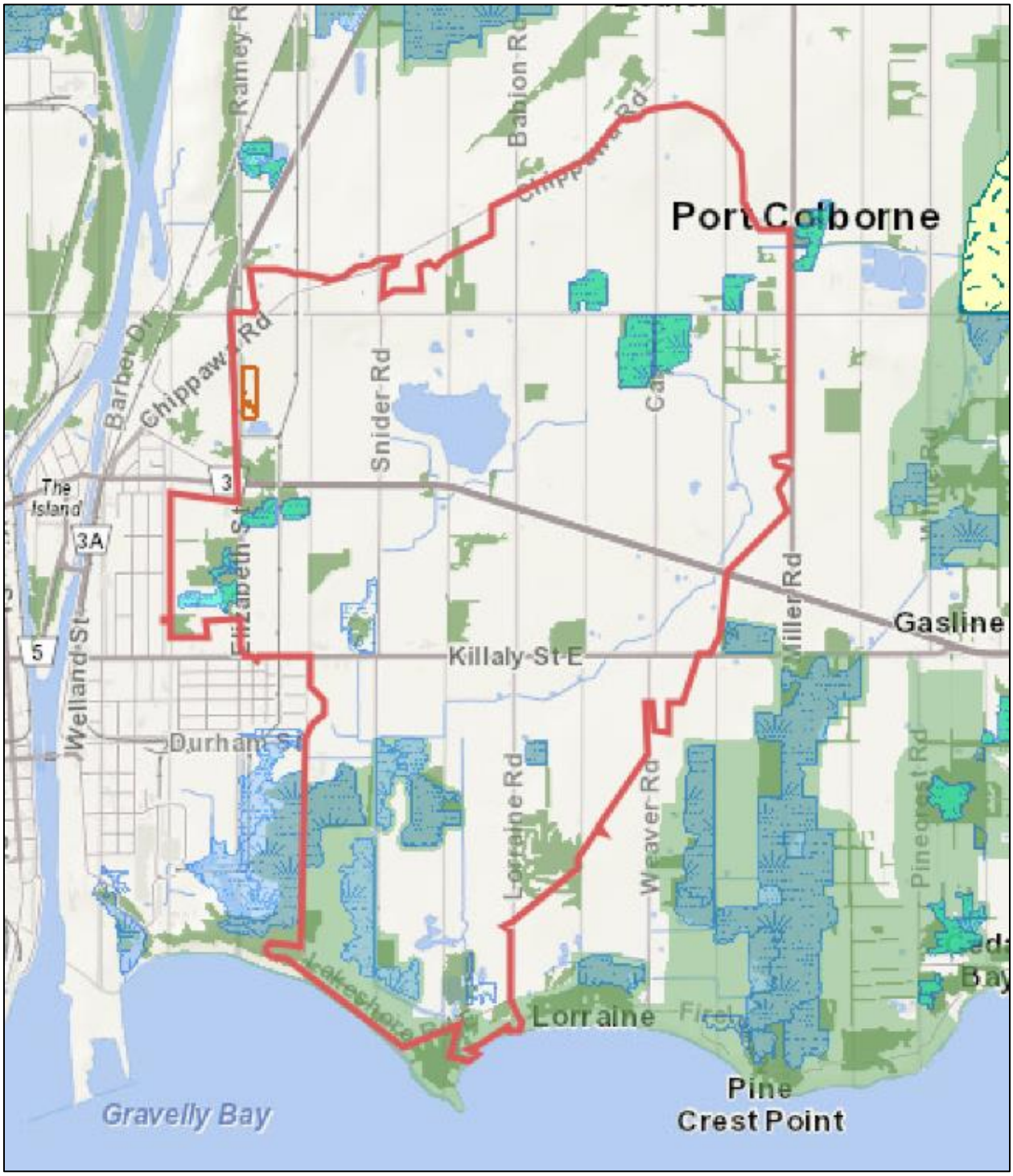
Additionally, unless it can be demonstrated through an EIS or SWS that there will be no negative impacts on the natural features or their ecological functions, development and site alteration are also not permitted in:

- Significant Wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E;
- Significant Woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
- Significant Valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
- Significant Wildlife Habitat;
- Significant Areas of Natural and Scientific Interest (ANSI);
- Other Coastal Wetlands in Ecoregions 5E, 6E and 7E; and
- Lands defined as Adjacent Lands to all the above natural heritage features.

Each of these natural heritage features is afforded varying levels of protection subject to guidelines, and in some cases, regulations.

Site-specific Relevance to the PPS

The Study Area is located within Ecoregion 7E (Crins, Gray, Uhlig, & Wester, 2009). As depicted on the Ministry of Natural Resources and Forestry (MNRF) Natural Heritage Information Centre (NHIC) mapping, there are wetlands (Non-Provincially Significant, Provincially Significant, and unevaluated), woodlands, a provincially significant Earth Science Area of Natural and Scientific Interest (ANSI, Earth Science), a Natural Heritage System (NHS), and numerous watercourses/waterbodies within and adjacent to the Study Area (**Map A**).



Map A. MNRF NHIC mapping depicts Non-Provincially Significant Wetlands (turquoise patterned layer), unevaluated wetlands (bright green patterned layer), PSWs (blue patterned layer), woodlands (dark green layer), watercourses and waterbodies (blue lines/blue layer), an NHS (light green layer), and an Earth Science ANSI (orange patterned layer) within and adjacent to the Study Area (approximate boundaries in red).

2.2 The Growth Plan for the Greater Golden Horseshoe

The *Growth Plan for the Greater Golden Horseshoe* (GGH) 2019 was approved by the Council in 2019 and underwent office consolidation in 2020. The GGH directs growth and the development to ensure economic prosperity, environmental protection, and community support (Ministry of Municipal Affairs and Housing, 2020). This is intended to direct municipalities towards the establishment of appropriate policies to maintain, restore, or enhance biodiversity and connectivity of the system and long-term ecological function (MMAH, 2020).

The GGH was developed as a supplement to the PPS, and "*builds upon the policy foundation provided by the PPS and provides additional and more specific land use planning policies to address issues facing specific geographic areas in Ontario. This Plan is to be read in conjunction with the PPS. The policies of this Plan take precedence over the policies of the PPS to the extent of any conflict, except where the relevant legislation provides otherwise.*"

The following proposed development guidelines of the Growth Plan are applicable:

4.2.2 Natural Heritage System

Within the *Natural Heritage System*:

i. new development or site alteration will demonstrate that:

- *i. there are no negative impacts on key natural heritage features or key hydrologic features or their functions;*
- *ii. connectivity along the system and between key natural heritage features and key hydrologic features located within 240 metres of each other will be maintained or, where possible, enhanced for the movement of native plants and animals across the landscape;*
- *iii. the removal of other natural features not identified as key natural heritage features and key hydrologic features is avoided, where possible. Such features should be incorporated into the planning and design of the proposed use wherever possible.*

4.2.3.1 Key Hydrologic Features, Key Hydrologic Areas and Key Natural Heritage Features of the Growth Plan prohibits the development or site alteration, outside of settlement areas, of key natural heritage features within the Natural Heritage System or within key hydrologic features. Exceptions to this guideline are provided in Section 4.2.3.1 a)-g).

4.2.4 Lands Adjacent to Key Hydrologic Features and Key Natural Heritage Features:

1. Outside settlement areas, a proposal for new development or site alteration within 120 metres of a key natural heritage feature within the Natural Heritage System for the Growth Plan or a key hydrologic feature will require a natural heritage evaluation or hydrologic evaluation that identifies a vegetation protection zone, which:

a) is of sufficient width to protect the key natural heritage feature or key hydrologic feature and its functions from the impacts of the proposed change;

b) is established to achieve and be maintained as natural self-sustaining vegetation; and

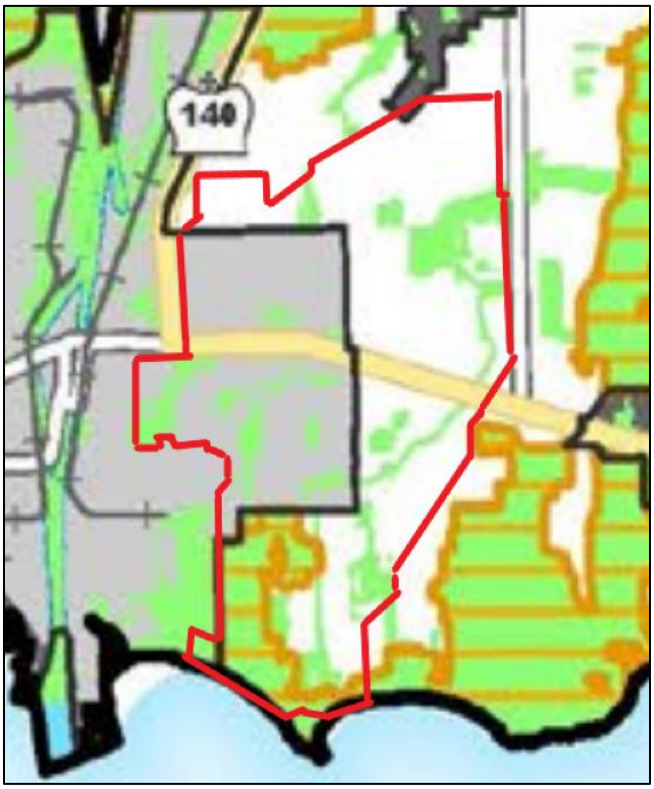
c) for key hydrologic features, fish habitat, and significant woodlands, is no less than 30 metres measured from the outside boundary of the key natural heritage feature or key hydrologic feature.

Site-Specific Relevance to the GGH

The Wignell Drain Subwatershed Study Area is within the GGH Growth Plan Area. The Study Area contain portions of the Natural Heritage System associated with the Nickel Beach Marsh Wetland PSW (**Map A**). Key Natural Heritage Features and Key Hydrologic Features (i.e., wetlands, significant woodlands, permanent / intermittent streams, lakes) within this Natural Heritage System are protected to ensure that there are no negative impacts to the features and their functions.

2.3 Niagara Region Official Plan

The Niagara Region Official Plan (OP) was recently adopted by the Regional Council in June 2022 and approved by the province in November 2022 (Niagara Region, 2022). The Regional OP sets out Natural Heritage policies in Chapter 3 – Sustainable Region. Section 3.1 outlines the objective and policies of the Regional Natural Heritage System and Water Resource System. These two systems have been integrated in the OP and are known together as the Region's Natural Environmental System (Schedule C) (**Map B**).



Map B. The Region's OP Schedule C1 depicts the Study Area (approximate boundaries in red) partially within an Urban Settlement Area (light grey layer) and a Rural Settlement Area (dark grey layer). The Region's Natural Environment System (green layer) is found throughout the Study Area, with the south portion also containing part of the Growth Plan Natural Heritage System (orange hashed layer).

As defined in the Niagara Region Official Plan (OP):

Natural Heritage Features and Areas *– means features and areas, including significant wetlands, significant coastal wetlands, other coastal wetlands, fish habitat, significant woodlands, significant valleylands, habitat of endangered species and threatened species, significant wildlife habitat, and significant areas of natural and scientific interest, which are important for their environmental and social values as a legacy of the natural landscapes of an area (modified from PPS, 2020). For the purposes of this definition, natural heritage features and areas includes other woodlands, earth science areas of natural and scientific interest (provincial and regional), and life science areas of natural and scientific interest (provincial and regional).*

Natural Heritage System *– is made up of natural heritage features and areas, wetlands, and linkages intended to provide connectivity (at the regional or 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 key natural heritage features, key hydrologic features, federal and provincial parks and conservation reserves, other natural heritage features and areas, lands that have been restored or have the potential to be restored to a natural state, associated areas that support hydrologic functions, and working landscapes that enable ecological functions to continue.*

Water Resource System *– means a system consisting of groundwater features/areas and surface water features (including shoreline areas), and their hydrologic functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption (see lists of features below).*

- *Groundwater Features*
  - *Recharge/discharge areas*
  - *Water tables*
  - *Aquifers and unsaturated zones*

- *Surface Water Features*
  - *Headwater Drainage Features (HDFs)*
  - *Recharge/discharge areas*
  - *Associated riparian lands that can be defined by their soil moisture, soil type, vegetation, or topographic characteristics.*

2.2.1 Development and Site Alteration

As per OP Section 3.1.9.5.1, *development and site alteration shall not be permitted in the following natural heritage features and areas:*

a) Provincially Significant Wetlands (PSWs)
b) Significant Coastal Wetlands
c) Significant Woodlands

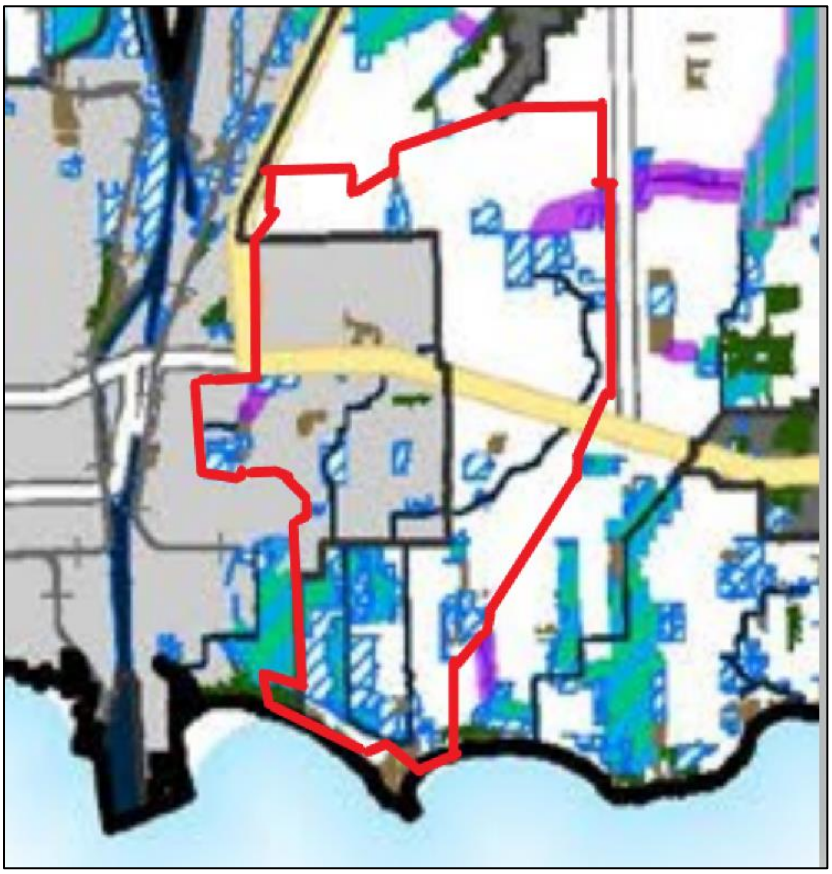
Additionally, as per OP Section 3.1.9.5.2, *development and site alteration shall not be permitted in the following natural heritage features and areas unless it has been demonstrated through an EIS that there will be no negative impacts to the natural features or their ecological functions:*

a) *Other woodlands*
b) *Significant valleylands*
c) *Significant Wildlife Habitat*
d) *ANSIs*

Furthermore, OP Section 3.1.9.5.4 states:

Notwithstanding any other policies of this Plan, development and site alteration in, and adjacent to watercourses, provincially significant wetlands, and other wetlands that are regulated by the Conservation Authority, may also be subject to the regulations and land use planning policies of the Conservation Authority. When development or site alteration is proposed in or adjacent to any watercourse, provincially significant wetland, significant valleyland, or other wetland the applicant shall contact the Conservation Authority, at which time Conservation Authority staff will advise the applicant and the Region of the land use or regulatory policies that will apply.

Schedule C2 from the OP indicates mapped natural heritage features (**Map C**).



Map C. The Region's OP Schedule C2 depicts the Study Area (approximate boundaries in red) within and adjacent to PSWs (light green layer), Other Wetlands and Non-Provincially Significant Wetlands (blue hatched layer), Significant Woodlands (dark green layer), Other Woodlands (brown layer), Linkages (purple layer), and Permanent and Intermittent Streams (thin black lines).

2.2.2 Buffers in Settlement Areas

Section 3.1.9.9.1 of the OP states that within settlement areas, mandatory buffers from natural heritage features and areas are required. The width of an ecological appropriate buffer would be determined through an EIS (or SWS) and/or hydrologic evaluation, or through the completion of a subwatershed study in support of a secondary plan or other large-scale development.

2.2.3 Linkages

Section 3.1.17.3 of the OP states that when a SWS is being undertaken, or when development or site alteration is proposed within 30 metres of a linkage shown on Schedule C2 (**Map C**), an evaluation shall be completed that:

a) Assesses the ecological features and functions of a linkage, including its vegetative, wildlife, and/or landscape features or functions.
b) Identifies appropriate boundaries/widths that permit the movement of wildlife between nearby key natural heritage features, key hydrological features, and/or natural heritage feature and areas.
c) Describes the ecological functions the linkage is intended to provide and identifies how these ecological functions can be maintained or enhanced within a development proposal.
d) Assesses the potential for compatible uses including, but not limited to, stormwater management ponds, passive recreational uses, and trails within the linkage to determine how the intended ecological functions of the linkage can be maintained or enhanced.
e) Assesses potential impacts on the linkage as a result of the development.
f) Makes recommendations on how to protect, enhance, or mitigate impacts on the linkage and its ecological functions through avoidance and planning, design, and construction practices.

2.2.4 Significant Woodlands

According to Table 4-1 of the OP's Schedule L (Natural Environment System: Components, Definitions, & Criteria), Significant Woodlands must meet the definition of an ELC forest and meet one or more of the following criteria:

1) *2 ha or greater in size*
2) *1 ha or greater in size meeting at least one of the following criteria:*
    a. *Naturally occurring (i.e., not planted) trees (as defined in the species list of Appendix D in the Greenbelt Technical Paper)*
    b. *Treed areas planted with the intention of restoring woodland*
    c. *10 or more trees per ha greater than 100 years old or 50 cm or more in diameter*
    d. *Wholly or partially within 30 m of a provincially significant wetland or habitat of an endangered or threatened species*
    e. *Overlapping or abutting one or more of the following features:*
        i. *Permanent streams or intermittent streams*
        ii. *Fish habitat*
        iii. *Significant valleylands*
3) *0.5 ha or greater in size meeting at least one of the following criteria:*
    a. *A provincially rare, treed vegetation community with an S1, S2, or S3 in its ranking by the MNRF's NHIC.*

b. Habitat of a woodland plant species with an S1, S2, or S3 in its ranking or an 8, 9, or 10 in its Southern Ontario Coefficient of Conservatism by the NHIC, consisting of 10 or more individual stems or 100 or more square meters of leaf coverage.

c. Any woodland overlapping or abutting one or more of the following features:

i. Significant wildlife habitat

ii. Habitat of threatened species and endangered species

iii. Non-Provincially Significant Wetlands

4) Any size overlapping or abutting one or more of the following features:

a. PSW

b. Life Science ANSI

2.2.5 Other Woodlands

According to Table 4-1 of the OP's Schedule L (Natural Environment System: Components, Definitions, & Criteria), Other Woodlands are a terrestrial treed area that must have ≥ 25% tree cover and meet one or more of the following criteria:

1) An average minimum width of 40 m and is ≥ 0.3 ha, measured to crown edges; or

2) Any size abutting a significant woodland, wetland, or permanent stream.

Treed areas that "abut" a significant woodland, wetland, or permanent stream are considered adjacent when located within 20 m of each other. Other woodlands are identified based on the Ecological Land Classification (ELC) methodology.

2.2.6 Other Wetlands

According to Table 4-1 of the OP's Schedule L (Natural Environment System: Components, Definitions, & Criteria), Other Wetlands include:

- All wetlands that meet an ELC wetland system classification and have not been evaluated as a PSW;
- Both evaluated non-PSWs and wetlands that have not been evaluated. These include wetlands that are regulated and wetlands that are not regulated by the Conservation Authority; and,
- Wetlands with ecological and hydrological functions and wetlands that have only have a hydrological function.

In settlement areas, Other Wetlands, which are not regulated by the Conservation Authority, require further evaluation to determine the appropriate protection or management of the feature. Within settlement areas, Other Wetlands which are not regulated by the Conservation Authority are considered to be a required component of the water resource system and are protected or managed in accordance with the policies of the Regional OP.

2.2.7 Fish Habitat

According to Table 4-1 of the OP's Schedule L (Natural Environment System: Components, Definitions, & Criteria), Fish Habitat is identified as any watercourse or waterbody identified by the MNRF or provided / approved by the Federal Department of Fisheries and Oceans (DFO) or a delegated authority of DFO (including Conservation Authorities, as appropriate).

For screening purposes, and until such time appropriate studies are completed to assess watercourses and waterbodies, Fish Habitat will be presumed to be:

- Any permanent or intermittent stream or waterbody excluding constructed and actively managed offline ponds (e.g., stormwater ponds, active farm irrigation ponds, etc.);
- Intermittent or ephemeral watercourses, or HDFs that provide contributions in terms of baseflow, material (e.g., substrates, etc.), or allochthonous inputs that are important to the maintenance of downstream fish habitat; or
- Shoreline features that provide contributions in terms of material (e.g., substrates, etc.) or allochthonous inputs that are important to the maintenance of fish habitat in the Great Lakes.

Site-specific Relevance to Region's OP

According to the Region's OP Schedule C1 (Natural Environment System Overlay and Provincial Natural Heritage Systems), the Study Area is partially within urban and rural settlement areas and contains portions of the Region's Natural Environment System and Growth Plan Natural Heritage System (**Map B**). As per the OP's policies (Section 3.1.9.9.1), within settlement areas, these natural features are to be protected with an ecological buffer. The width of an appropriate buffer for each feature will be determined though an EIS or SWS. Additionally, PSWs, Other Wetlands and Non-Provincially Significant Wetlands, Significant Woodlands, Other Woodlands, Linkages, and Permanent and Intermittent Streams are found within and/or adjacent to the Study Area (**Map C**). Furthermore, though not mapped in the Region's Schedules, Fish Habitat (Wignell Drain West Tributary) and Significant Wildlife Habitat (SWH) were noted within the Subject Lands (during the 2021/2022 field investigations) and the Study Area (during 2023 field investigations).

2.4 City of Port Colborne Official Plan

The City of Port Colborne Official Plan (OP) was approved by the Ontario Land Tribunal on November 25, 2013 (City of Port Colborne, 2013), and was updated in September 2017. The City of Port Colborne (the "City") promotes the protection, conservation, restoration, and enhancement of Natural Heritage Features within and adjacent to its boundaries. The City's Natural Heritage is shown on Schedule B of the OP, as Environmental Protection Areas (EPAs), Environmental Conservation Areas (ECAs), Streams, and Fish Habitat.

EPAs are lands that are classified as PSWs, Provincially Significant ANSIs, Significant Habitat of Threatened and Endangered Species, and Natural Hazards. ECAs are lands that are classified as Regionally Significant ANSIs, Non-Provincially Significant Wetlands, SWH, Habitats of Species of Concern, Significant Woodlands, Environmental Corridors and Linkages, Significant Valleylands, Stream Corridors, and Fish Habitat Areas.

As part of the City's OP Section 4.1.1 policies, development should maintain, enhance, or restore ecosystem health and integrity. Priority is to be given to development avoiding negative environmental impacts. If negative impacts cannot be avoided, mitigation measures will be required.

2.3.1 Woodlands

The City's OP Section 4.3.5.1 b) states that woodlands are treed areas, woodlots, or forest areas that provide environmental and economic benefits to private landowners and the public that vary in levels of significance. To be classified as significant, a woodland must:

- Contain a threatened or endangered species or species of concern,
- Be equal or greater than 2 hectares in size,
- Overlap or contain one or more significant natural heritage features, or
- Abut or be crossed by a water body greater than 2 hectares in area.

2.3.2 Fish Habitat

According to the City's OP Section 4.3.7.1 g), a naturally vegetated buffer areas of at least 30 m in width from the stable top of bank will be required adjacent to a Critical Fish Habitat. A minimum 15 m vegetative buffer from the stable top of bank will be required adjacent to Important or Marginal Fish Habitat. A buffer narrower than 15 m may be considered for Important or Marginal Fish Habitat where the EIS (or SWS) has demonstrated that there will be no harmful destruction of fish habitat.

Although types of fish habitat are not differentiated on City mapping, The 2010 Lake Erie North Shore Watershed Plan identifies that the entirety of the Wignell Drain Subwatershed Study Area is considered Important (Type 2) Fish Habitat (NPCA, 2010). No Critical (Type 1) Habitat is identified within the 2010 Lake Erie North Shore Watershed Plan (NPCA, 2010).

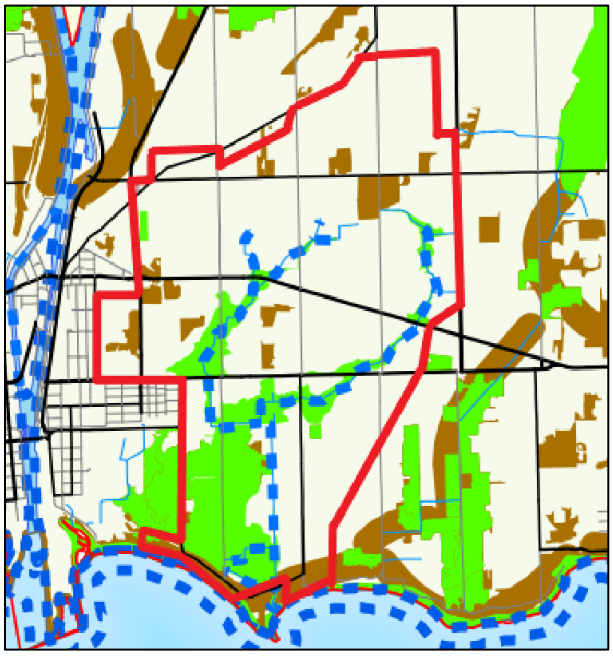
Regarding Municipal Drains, Section 4.3.7.1 h) states that where development, site alteration, or construction is proposed adjacent to a Municipal Drain a minimum buffer zone of 15 m in width measured from stable top of bank shall be required to provide access for drain maintenance.

Site-specific Relevance to the City's OP

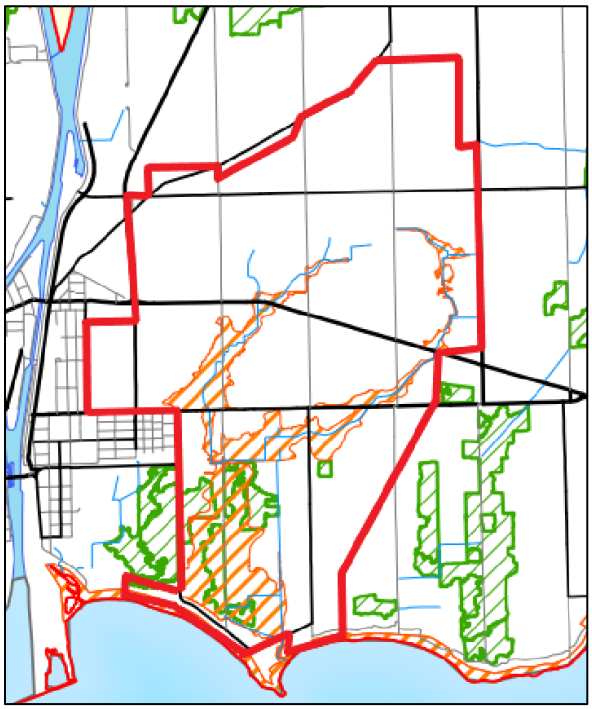
According to the OP's Schedule B (Natural Heritage) the Study Area contain EPAs, ECAs, streams, and fish habitat (**Map D**). Additionally, as depicted on the OP's Schedule B1 (Environmental Protection Area), Natural Hazard Lands and EPAs are found within and adjacent to the Study Area (**Map E**). Furthermore, the OP's Schedule B2 (Environmental Conservation Area), depicts the Study Area containing Significant Woodlands, Non-Provincially Significant Wetlands, Environmental Corridors, Fish Habitat, and Streams (**Map F**).

As per Section 4.1.1 (j) of the OP, undisturbed, vegetated buffers will be required between Natural Heritage Features and any proposed buildings or structures of adjacent development and, unless reduced buffers are determined by an EIS (or SWS), the size of the buffers shall be:

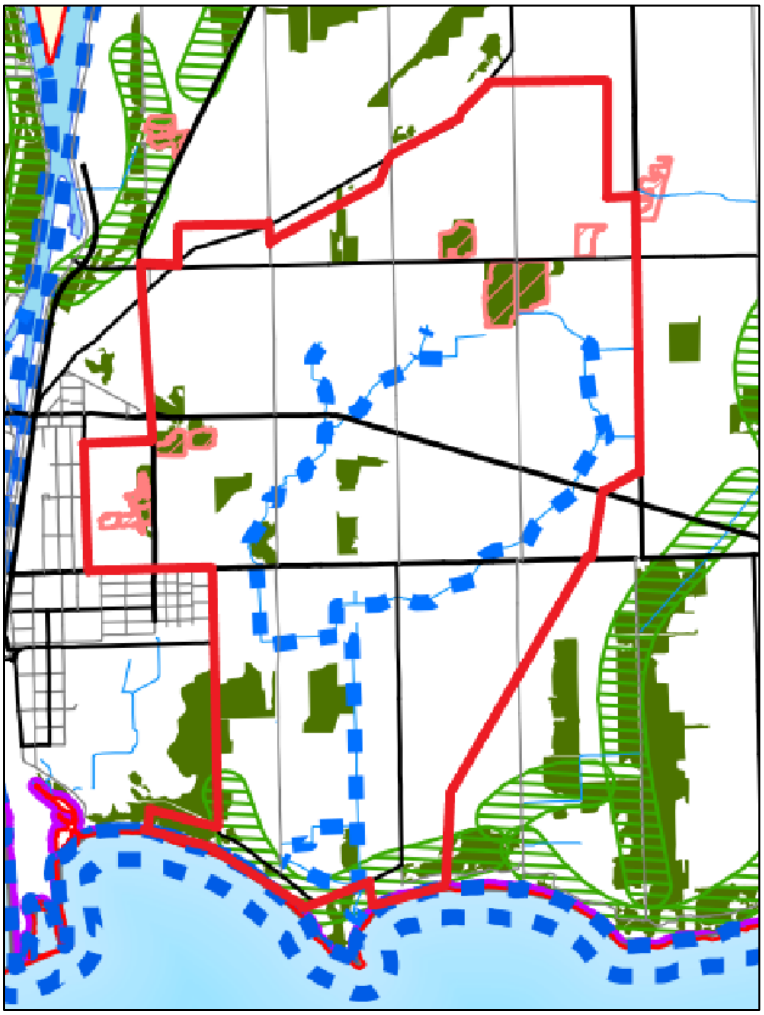
- Provincially Significant Wetlands: 120 m
- Non-Provincially Significant Wetlands: 50 m
- Fish Habitat: a) Critical: 30 m; b) Important or Marginal: 15 m
- Significant Woodlands: 50 m
- Significant Wildlife Habitat: 50 m



Map D. The City's OP Schedule B depicts the Study Area (approximate boundaries in red) containing and/or being adjacent to EPAs (green layer), ECAs (brown layer), streams (blue lines), Lake Erie (light blue layer), and fish habitat (linear blue squares). Much of the green layer is reflective of the regulated floodplain (see Map G).



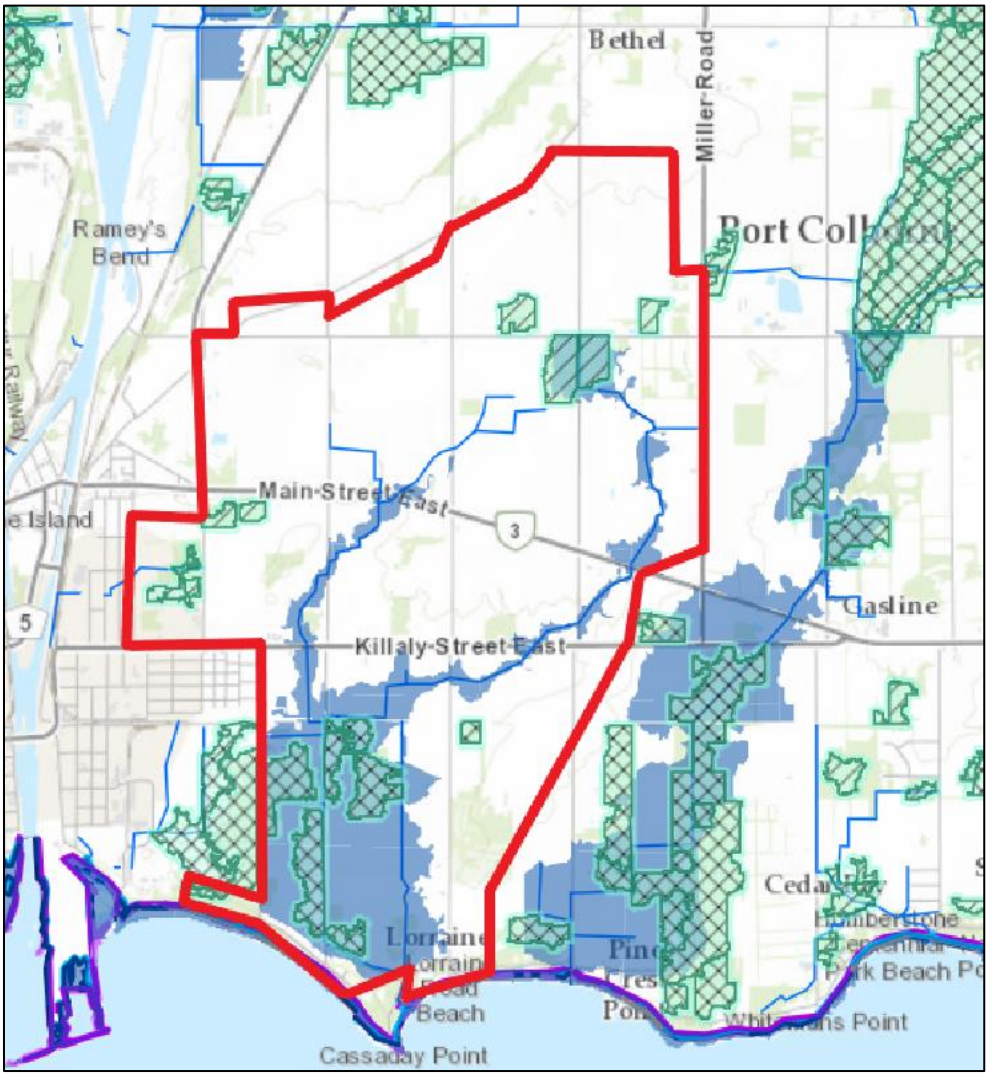
Map E. The City's OP Schedule B1 depicts Natural Hazard Lands (orange hashed layer), EPAs (green hashed layer), and streams (blue lines) within and adjacent to the Study Area (approximate boundaries in red).



Map F. The City's OP Schedule B2 depicts the Study Area (approximate boundaries in red) containing and/or being adjacent to Significant Woodlands (dark green layer), Non-Provincially Significant Wetlands (pink hashed layer), Environmental Corridors (green hashed layer), Streams (blue lines), and Fish Habitat (linear blue squares).

2.5 Niagara Peninsula Conservation Authority (NPCA)

The Conservation Authorities Act directs all Conservation Authorities to produce local regulations to streamline development approvals. Ontario Regulation (O. Reg.) 155/06 enables the NPCA to provide the Regulation of Development, Interference with Wetlands and Alteration to Shorelines and Watercourses within their jurisdiction (Niagara Peninsula Conservation Authority, 2020). Within the Study Area, areas associated with the wetland features, watercourses, and the floodplain are considered NPCA's regulated lands (**Map G**). As such, should development be proposed in these areas, they will require authorization under O. Reg. 155/06.



Map G. NPCA's Regulated Lands within and adjacent to the Study Area (approximate boundaries in red) which include floodplains (dark blue layer), PSWs (green cross hashed layer), Non-Provincially Significant Wetlands (green hashed layer), and Shorelines (dark blue and purple line).

It should be noted that the provincial Bill 23, *More Homes Built Faster Act* was passed on November 28, 2022. This bill is expected to bring changes to conservation authorities' role in permitting, planning, and development. It is Palmer's understanding that until regulations are written and implemented by the MNRF, that current conservation authorities' roles will for the most part continue as they have previously, although in our experience, this varies by Authority.

Implementation of O. Reg. 155/06 is guided by the NPCA Policy Document: Policies for Planning and Development in the Watersheds of the Niagara Peninsula Conservation Authority (NPCA, 2022). Through regulation, as expressed above, the NPCA has jurisdiction within and adjacent to wetlands, watercourses, and other hazard lands (e.g., floodplains). Applicable NPCA regulations for the Study Area are listed below:

2.4.1 Wetlands

The NPCA document *Policies for Planning and Development in the Watersheds of the NPCA* states that:

8.2.2.1 - *Unless otherwise stated in this Document, no development and/or interference shall be permitted within PSWs and any other wetland greater than 0.5 hectares in size.*

And,

8.1.2.3 - *Some wetlands within the watershed have not been evaluated and delineated under the OWES [i.e., unevaluated wetlands]. In those instances, the following policies apply:*

a) *Prior to development or site alteration on a property with an unevaluated wetland, a wetland evaluation shall be required prior to completion of an EIS (if required) or the approval process and must be approved by the MNRF.*
b) *Exceptions to (a) may be considered in cases where an appropriate natural buffer (as determined by the NPCA) is proposed between the NPCA staked wetland boundary and all site alteration and development (including grading), or small scale non-permanent development (such as small backyard sheds not requiring planning approval) which in the opinion of NPCA will have no negative impact on the ecological and hydrologic function of the wetland. These cases will only be considered for small-scale development through the work permit process and where an appropriate buffer is maintained.*

2.4.2 Buffers

Wetland Buffers

Section 8.2.3.1 of the NPCA Policy Document states:

Wetland Buffers

1) *Where development is proposed adjacent to a wetland, a minimum 30 m buffer shall be provided.*
2) *Notwithstanding Section 8.2.3.1 1), a reduction to a non-PSW buffer shall only be considered where:*
    a) *There is no other reasonable alternative; and*
    b) *Where supported by an EIS in accordance with NPCA Procedural Manual.*

Watercourse Buffers

According to Section 9.2.5.1 of the NPCA Policy Document, the following buffer requirements apply to development and site alteration adjacent to a watercourse:

a) *A 30 m buffer shall be provided where the watercourse contains permanent flow, cool water or coldwater systems, or specialized aquatic or riparian habitat (such as, but not limited to, fish spawning areas, habitat of species at risk or species of concern, forested riparian areas or Type 1 Critical Fish Habitat). Notwithstanding this requirement, the buffer may be reduced where supported by an EIS in accordance with the NPCA Procedural Manual, but in no case shall the buffer be reduced below 15 m.*
b) *A 15 m buffer shall be provided for watercourses containing intermittent flow, warmwater systems or general/impacts aquatic or riparian habitat, or Type 2 Important Fish Habitat or Type 3 Marginal*

Fish Habitat. Notwithstanding this requirement, the buffer may be reduced where supported by an EIS in accordance with the NPCA Procedural Manual.

2.4.3 Fish Habitat Classification

Based on other Watershed Plans completed by the NPCA, such as the Twenty Mile Creek Watershed Plan (located north of Port Colborne), fish habitat is classified based on the MNRF's 2000 protocol (NPCA, 2006). Fish habitat falls into one of three categories in Niagara:

- Type 1 – 'Critical': This is the most sensitive habitat and requires the highest level of protection. It includes critical spawning and rearing areas, migration routes, over-wintering areas, productive feeding areas, and habitat occupied by sensitive species.
- Type 2 – 'Important': This habitat is less sensitive and requires a moderate level of protection. These areas are considered "ideal for enhancement or restoration projects" and include feeding areas for adult fish and unspecialised spawning habitat.
- Type 3 – 'Marginal': This habitat type is considered marginal or highly degraded and does not contribute directly to fish productivity. Examples of Type 3 habitat include channelized stream and artificially created watercourses.

The 2010 Lake Erie North Shore Watershed Plan identifies that the entirety of the Wignell Drain Subwatershed Study Area is considered Important (Type 2) Fish Habitat (NPCA, 2010). No Critical (Type 1) Habitat is identified within the 2010 Lake Erie North Shore Watershed Plan (NPCA, 2010).

As outlined below, background review of previous watershed level assessment for the Wignell Drain characterize the majority of the watershed as being Important (Type 2) Fish Habitat; however, through site-specific habitat assessment, it is more likely that the watershed is composed of Important Fish Habitat areas, as well as Marginal (Type 3) Fish Habitat areas due to historical anthropogenic impacts and alterations and continuing organic inputs.

2.6 Endangered Species Act (2007)

Species designated as Endangered or Threatened by the Committee on the Status of Species at Risk in Ontario (COSSARO) are listed as Species at Risk (SAR) in Ontario (Government of Ontario, 2007). These SAR and their habitats (e.g., areas essential for breeding, rearing, feeding, hibernation, and migration) are afforded legal protection under the Endangered Species Act, 2007 (ESA). This Act is administered by the Ministry of Environment, Conservation and Parks (MECP).

The protection provisions for species and their habitat within the ESA apply only to those species listed as Endangered or Threatened on the SARO list, being Ontario Regulation 230/08 of the ESA. Species listed as Special Concern may be afforded protection through policy instruments respecting significant wildlife habitat (e.g., the PPS) as defined by the Province or other relevant authority, or other protections contained in Official Plans.

3. Study Approach

3.1 Background Review

Palmer has reviewed relevant background material to provide a focus on field investigations and ensure compliance with applicable regulations and policy. Background information collection is guided by the *Natural Heritage Information Request Guide* (Ministry of Natural Resources and Forestry, 2018). Current direction from the MNRF and MECP is to gather natural heritage information and species occurrence records from available sources; the NHIC Make Make-a-Map application being the main source of information and records from the Ministry itself (Ministry of Natural Resources and Forestry, 2021). Information gathered is recommended to be balanced and supplemented by a professional ecological review of potential habitats and characteristics of a project site.

Background review included the collection and review of relevant mapping and reports, including regulations and policies, Official Plans, and zoning by-laws; and the NHIC Make-a-Map application for species occurrences and designated area mapping. In addition to these sources, the following data sources were reviewed for the project:

- Google Earth mapping (covering approximately the last 20 years, as well as 1934)
- Lands Information Ontario base mapping and associated Ministry of Natural Resources and Forestry Make a Map: Natural Heritage Areas
- Elite Developments Port Colborne EIS materials (Palmer, September 2023)
- Natural Areas Inventory 2006 - 2009, Volume 1 and 2 (NPCA, 2010)
- Lake Erie North Shore Watershed Plan (NPCA, 2010)
- Nature for Niagara's Future (NPCA 2010-2011)
- Online citizen science databases (e.g., eBird, iNaturalist, etc.),
- DFO Aquatic SAR Map (2020)
- NHIC database for tracked species, plant communities, and wildlife concentration areas
- Lower Welland River Characterization Report (2011)
- MNDMNRF fisheries data from Fisheries Database Sites and from MNDMNRF at Vineland
- MNRF Ontario Wetland Evaluations

Following the *Information Request Guide* (MNRF, 2018), MECP advice and direction should be solicited once SAR interactions or potential interactions are identified via field investigations and analysis.

Note that while eBird and iNaturalist databases are 'citizen science' databases, they both have different type of vetting and checking process for data submitted. Thus, while it is possible that there are errors in this data, at the same time there is a level of quality control.

3.2 Agency Liaison

A Terms of Reference (TOR) was prepared for the requested SWS and was submitted to the reviewing agencies on April 13, 2022. Comments were received and multiple discussions were had between the consultants and the reviewing agencies to adequately characterize the required scope of work. A revised TOR was sent to the reviewing agencies on March 10, 2023. This TOR was accepted by the Niagara Region on May 18, 2023, with the condition that if Palmer is granted access to private lands that breeding bird

surveys are to be conducted as per protocols (where applicable). On June 2, 2023, the NPCA also accepted this TOR under the condition that Palmer completes surveys and assessments as per the provided protocols. The latest TOR and correspondence related to the TOR's acceptance can be found in **Appendix A**.

As part of the ecological surveys for the Subject Lands EIS, a senior Palmer ecologist met with staff from both the Niagara Region and the NPCA to discuss, delineate, and stake natural features. Site staking occurred on November 18, 2021 (woodland staking with the Niagara Region) and September 14, 2022 (wetland and woodland staking with the NPCA and the Niagara Region). The remaining areas outside of the Subject Lands (including watercourses and drains) were delineated and classified via a desktop analysis of aerial imagery and a review of the Natural Areas Inventory (NPCA, 2010) for the Niagara Region (**Appendix B**), with some areas being verified during ecological and geomorphic surveys.

Features within the Subject Lands are described in **Appendix C** and mapped later in the report; however, the following methods were used to delineate the numbered features:

- A1/B1 (wetland/woodland) – used existing evaluated wetland mapping with agreement from the NPCA and the Region
- A2 (SWH/wetland) – staked (NPCA)
- B2 (woodland) – staked (Region)
- B2 (interior wetland) - used air photo delineation/field observations with agreement from the NPCA and the Region
- B3 (wetland/woodland) – partly staked (NPCA) and partly used air photo delineation with agreement from the NPCA and the Region
- A3 (woodland) – staked (Region)
- A4 (woodland) – staked (Region)
- A4 (wetland) – partly staked (NPCA) and partly used air photo delineation with agreement from the NPCA and the Region

3.3 Indigenous Group, Naturalist Club, and Landowner Consultation

At the request of the reviewing agencies during the TOR process, Indigenous groups, naturalist clubs, and key landowners were contacted via letters to inform them of the SWS being conducted in the area.

The letters to six Indigenous communities requesting input were emailed by Palmer on May 4, 2023. Letters to two local naturalist groups were sent in November 2023 by Palmer. One response from an Indigenous group was received, requesting a copy of the SWS report once completed. No other responses have been received by Palmer to date from Indigenous Groups nor naturalists' groups.

Letters (jointly written by Palmer and the City) to selected landowners were sent by the City of Colborne in the last week of May 2023, requesting access to their lands within Wignell Drain Subwatershed Study Area. Selected landowners were those that appeared to have the larger natural features on their properties or which had watercourse reaches that would be useful to sample. One property owner responded granting access; this was a small property which allowed aquatic survey sampling, but not further terrestrial information could be gathered from this property.

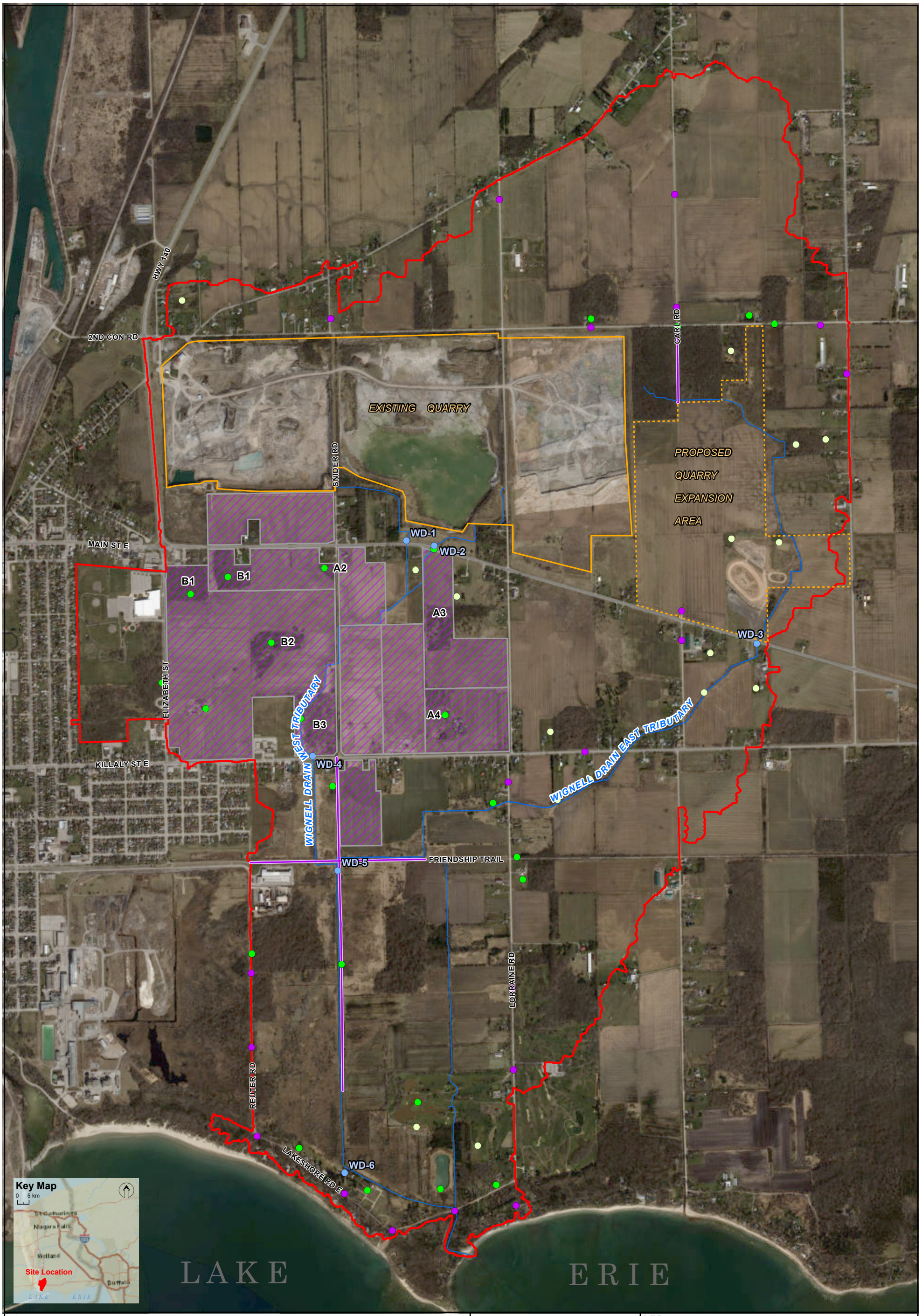
3.4 Terrestrial Surveys

Field investigations were conducted to collect existing conditions data for flora, fauna, and natural features and their hydrological and ecological functions in and adjacent to the Wignell Drain Subwatershed Study Area. Field investigations were conducted by Palmer in 2021, 2022, and 2023. Completed surveys and their associated dates are provided in **Table 1**. See **Figure 2** for bird, amphibian, and aquatic survey locations.

Table 1: Summary of Ecological Surveys (2021 - 2023)

Survey Type	Date		
	2021	2022	2023
Amphibian Breeding Surveys	-	March 18, April 12, May 18, and June 23 (on Subject Lands) April 12 and May 18 (within the Study Area outside of Subject Lands)	-
Breeding Bird Surveys	June 17 and July 5 (on most of Subject Lands)	May 31, and June 22 (areas on Subject Lands not surveyed in 2021)	June 9 (roadside and trails in areas outside Subject Lands)
Vegetation Communities and Flora	June 17, July 5, and October 19 (on Subject Lands)	March 1, April 27, August 30, August 31 (on Subject Lands)	Not conducted outside Subject Lands due to access constraints to privately owned lands.
Aquatic Assessment	June 17 and July 5 (on Subject Lands)	March 18 and May 24 (on Subject Lands)	June 12 and 14 (initial surveys). Additional habitat condition details recorded from June through October. Completed concurrently during surface water quality sampling events.
Salamander Habitat Assessment	-	March 18, and May 24 (with additional observations March 31) (on Subject Lands)	-
Snake Surveys	-	May 18, May 31, June 23, July 28, and August 30 (on Subject Lands)	-

Survey Type	Date		
	2021	2022	2023
Soil Sampling (hand-held Dutch auger)	-	August 31, September 14, and October 27 (on Subject Lands)	-
Wetland and Woodland Staking	November 18 (most woodlands completed on Subject Lands)	September 14 (wetlands and remaining woodlands on Subject Lands)	-
Surface Water Quality Sampling	-	-	June 14, July 7 and 31, August 16 and 31, September 27, October 24
Electrofishing	-	-	September 27
Benthic Sampling	-	-	June 12 and October 25



LEGEND

Aquatic, Benthic, and Fishing Sampling Location
- Logger & Field Sampling Location

Breeding Bird Survey Location
- Roadside Point Survey
- Roadside Line Survey
- Completed Survey

Amphibian Survey Location
- Surveyed Point
- Not Surveyed - *potential amphibian habitat*

- Watercourse [1]
- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

1 - Contains data sourced from both Niagara Peninsula Conservation Authority (NPCA) and Land Information Ontario (LIO)

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:17,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: KT
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2015) provided by South Western Orthophotography Project (SWOOP). Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Welland S - Wignell SWS

TITLE: **Bird, Amphibian, Fish Sampling, Benthic Invertebrate, and Aquatic Survey Sampling Locations**

Palmer | PART OF SLR

REF. NO. 2007708-2-1

Figure 2

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

3.4.1 Vegetation Communities, Flora, and Soil Sampling

Vegetation communities within the Subject Lands were mapped and described following the ELC System for Southern Ontario protocols (Lee, et al., 1998). Vegetation community boundaries were delineated on field maps through the interpretation of recent aerial photographs and refined in the field. Information collected during ELC includes dominant species cover, community structure, as well as level of disturbance, presence of indicator species, and other notable features. Botanical surveys for these vegetation communities were completed by traversing the site and recording species observed in each vegetation community, as access allowed (private properties were not entered as not permission was granted). Provincial plant status was based on the *Rare Flora of Ontario* (Oldham & Brinker, 2009) and the Natural Heritage Information Centre (Ministry of Natural Resources and Forestry, 2023). Regional plant status was based on the *Checklist of the Vascular Plants of Niagara Regional Municipality Ontario* (Oldham M. , 2010).

Access was not granted by private landowners within the Study Area. Therefore, vegetation communities outside of the Subject Lands were delineated and described to the ELC Community Class level (e.g., FOD, SWD, etc.) following a desktop review of aerial photography in combination with roadside observations.

Soil sampling (with hand-held Dutch auger) occurred on several dates in 2022 at each of the main ELC polygons in the Subject Lands, totalling 14 soil samples. Using a standard-sized soil auger, soil samples were dug to a depth which would enable the sampler to determine the soil texture and moisture regime. In some instances, it was not possible to achieve a suitable depth as resistance was encountered. This was likely due to heavy clay soils or bedrock. The following characteristics were recorded: depth of sample; presence of litter; depth and characteristics of organic layer and lower mineral layers; texture of mineral layer(s), depth of distinct mottles and gleys (if present); depth to water table (if present), and the subsequent resulting moisture regime. Soil identification and characteristics were described using Section 10 within Lee et al. (1998). Where depth of bedrock was not known, depth to bedrock was assumed to be >120 cm. Wetland community identification was ultimately based on wetland plants as per Ontario Wetland Evaluation System (OWES) and ELC (Lee et al., 1998), and the soil information was considered supplementary, further confirming the wetland evaluation. Within this SWS report, this soil information is provided as part of the ELC description of the associated vegetation community within **Appendix C**.

For lands within the Study Area, but outside the Subject Lands, soil sampling and characterization was not conducted, as this was not possible.

3.4.2 Breeding Amphibian Surveys

Amphibian breeding surveys were conducted across the Wignell Drain Subwatershed Study Area (including the Subject Lands) on April 12 and May 18, 2022, at twenty-four survey locations. A third survey was completed for one station within the Subject Lands (pond at A4 – see **Figure 2**) on June 23, 2022. Additionally, incidental observations of amphibians, amphibian calls, and egg masses were recorded, where applicable. Air photo analysis was also used to indicate areas outside of the Subject Lands which might contain breeding amphibian habitat but were not accessible due to private land ownership.

These breeding amphibian surveys were conducted in accordance with standard Marsh Monitoring Program protocols (Bird Studies Canada, 2009). Surveys were completed in the evenings between 20:30 and 23:50 h. Weather conditions were between 5ºC and 20ºC, with few clouds, no precipitation, and light

wind. Species were identified by call, and an abundance code for each species heard calling was assessed by the following the Marsh Monitoring Program protocol:

- Code 0: No calls heard.
- Code 1: Calls not overlapping or simultaneous, number of individual frogs can be counted.
- Code 2: Calls overlapping or simultaneous, number of individuals can still be distinguished, number of individual frogs cannot be counted, but a reliable estimate of numbers can be made based on location and call voices.
- Code 3: Full chorus, calls simultaneous and overlapping, numbers of calling males cannot be reasonably counted or estimated.

3.4.3 Breeding Bird Surveys

Breeding bird surveys were conducted on the Subject Lands using a roving survey method whereby the entirety of site was covered. The site was walked in such a way that the observer came within 50 m (or less) of all parts of the site at one point during the survey. Palmer conducted two breeding bird surveys, more than one week apart within the peak breeding season, on June 17 and July 5 of 2021. These surveys were conducted between 5:30 a.m. and 10:00 a.m. to coincide with the dawn chorus and were completed under suitable weather conditions when wind speeds were less than 20 km/h and there was no precipitation. The surveyor used a site map to record all bird species and individuals seen/heard, as well as the approximate locations that the individuals were observed/heard. Any flyovers or migrants were excluded from the species list.

Additional breeding bird surveys were conducted by Palmer ecologists on June 9 of 2023 within the Study Area, outside of the Subject Lands. These surveys included point observations from public roads and walking observations from the Friendship Trail and the Snider Road allowance in the southern third of the Study Area.

3.4.4 Salamander Habitat Assessment

Within the Subject Lands, in areas where potential salamander breeding habitat (i.e., vernal pools) was noted, the presence/absence of salamander eggs was documented. Surveys included flipping logs, rocks, or other objects in suitable woodland habitat in search of individuals. The location of the areas that were surveyed were recorded and includes areas A1, B1, and A4. Suitable habitat was also recorded onsite, if observed, while conducting other field activities.

For lands within the Study Area but outside the Subject Lands, salamander habitat assessments were not possible and therefore not conducted.

3.4.5 Turtle Habitat Assessment

Within the Subject Lands, in areas where potential turtle habitat was noted, the presence/absence of turtles was documented. Ecologists looked for deep, open standing water habitats that had basking opportunities and potential overwintering capabilities.

For lands within the Study Area, but outside the Subject Lands, turtle habitat assessments were not possible and therefore not conducted; however, any incidental observations of turtle species were recorded.

3.4.6 Snake Surveys

Snake surveys, conducted within the Subject Lands, involved creating artificial habitat (wood cover boards) in potentially suitable habitat areas. Snake boards were approximately 1 m by 1 m or 1 m by 2 m and about half the boards were pre-weathered. A total of 12 snake boards were placed in dry, flat, and open/semi-open areas within the forest/swamp/thicket communities of the Subject Lands. Snake boards were placed in the early spring and were subsequently checked during the 2022 spring and summer field season (see **Table 1**). Additionally, while onsite conducting other field activities, any incidental snake observations were recorded.

For lands within the Study Area, but outside the Subject Lands, snake surveys were not possible and therefore not conducted; however, any incidental observations of snake species were recorded.

3.4.7 Species at Risk

For the purposes of this report, SAR include species listed as *Endangered*, *Threatened,* or *Special Concern* under Ontario's ESA. Prior to conducting field work on the Subject Lands and the Study Area, existing SAR records were queried through the NHIC database. Habitat opportunities for SAR on the Subject Lands and in the Study Area were then assessed by comparing habitat preferences of species deemed to have potential to occur to current site conditions. The species noted during the NHIC search and others known through professional experience to have potential to occur, along with field survey results, were considered in the assessment.

3.4.8 Significant Wildlife Habitat

Prior to conducting field investigations within the Subject Lands, a *Significant Wildlife Habitat Screening Table for Niagara Region* was submitted to and accepted by the Niagara Region at their request. This screening table was completed to ensure that the Niagara Region approved the direction of future SWH studies within the Subject Lands. Following acceptance of this screening table, Palmer completed a fulsome SWH assessment on the Subject Lands using vegetation community information, as well as information gathered during field investigations. For lands within the Wignell Drain Subwatershed Study Area, but outside the Subject Lands, a similar SWH assessment was completed.

3.4.9 Roadside Mortality Observations

Observations of any road-killed wildlife (mainly reptiles and mammals) were noted and have had their locations documented. Findings of road-killed wildlife for the Subject Lands and the remaining Study Area are incorporated into this report.

3.4.10 Incidental Observations

Incidental observations of wildlife (primarily mammals and herptiles) were recorded during field investigations within the Subject Lands and the Study Area. These observations included direct sightings and indirect evidence such as nests, tracks, scat, and browse.

3.5 Aquatic Surveys

3.5.1 Aquatic Habitat

Aquatic habitat, within both the Subject Lands and the Study Area, consist of surface water features that function, ecologically, as watercourses, but are also identified as a municipal drains, and are subject to conditions under the Drainage Act. The details of the Drainage Act are not discussed in detail within this Study report, but it is understood that most, if not all, watercourses within the Study Area may be subject to periodic maintenance, including activities such as dredging or sediment removal, to ensure that the conveyance of overland drainage towards Lake Erie is maintained, and the protection of public and private lands from flooding is maintained.

Aquatic habitat assessments were initially carried out by Palmer on March 18 and May 24 of 2022 on watercourses that traverse the Subject Lands (i.e., the main portions of the Wignell Drain). In December 2022, an initial review of all watercourses within the Study Area was completed. In 2023, all watercourses (i.e., drains) flowing across the Study Area were surveyed in detail on June 12 and 14. Watercourses were continually surveyed across the 2023 monitoring season (June to October) for the water quality sampling program instituted as part of the SWS. The following characteristics of these watercourses were recorded when possible:

- Channel width and depth profile, bank height, bank stability;
- Substrate types and distribution;
- Presence of potential fish barriers;
- Riparian vegetation type and cover; and
- In-stream cover type and extent.

The characterization of watercourses within the Study Area, but outside the Subject Lands, was conducted at aquatic monitoring survey locations, where the watercourses are observable from the roadside, and at locations where Palmer has been granted access to private properties (this applies to a single property only).

3.5.2 Surface Water Quality

Surface water quality sampling and monitoring was completed at six key locations within the Wignell Drain Subwatershed Study Area during 2023 (**Figure 2**). Monitoring consisted of a combination of continuous logging and discrete grab sampling at each location.

3.5.2.1 Surface Water Quality

For discrete grab sampling, surface water samples were collected at each sample station location, packaged, and sent to an accredited lab for analysis. Discrete water sample parameters included nutrients (phosphorus and nitrogen), a comprehensive metals analysis (copper, zinc, chloride, and nickel), and physical characteristics (total suspended solids). Additional parameters including temperature, dissolved oxygen, pH, and conductivity were also gathered during discrete sampling events using a handheld multi-meter probe (YSI 556). As outlined in Section 3.5.1 above, during these surface water quality sampling events, general aquatic habitat conditions were noted visually to identify potential land use influences on the Wignell Drain Subwatershed Study Area (e.g., sedimentation from adjacent fields), as well as potential impacts to aquatic and semi-aquatic wildlife as a result of these influences.

Surface water quality results were summarized and compared to the Provincial Water Quality Objectives (PWQO). Results are summarized in Section 4.3.3 of this report.

3.5.2.2 Continuous Water Temperature

Continuous data logging of water temperatures was completed through the installation of six (6) Solinst Leveloggers, one for each monitoring station location (**Figure 2**). Alongside water temperature data, air temperature was also recorded by a Solinst Barologger at Station WD-1 for comparative purposes. The purpose of the continuous temperature monitoring was to record baseline surface water temperature fluctuations and seasonal gradients across the Wignell Subwatershed from late spring to late fall. All data logging instrumentation was installed on June 12, 2023, and continuously measured air and water temperatures at 15-minute intervals until their removal on November 2, 2023.

3.5.3 Surface Water Levels

In addition to continuous logging of water and air temperatures the Leveloggers also recorded continuous water levels at the six sample station locations (**Figure 2**). Recorded results from the pressure transducers were verified with *in situ* manual flow monitoring. Manual flow measurements were recorded along a watercourse transect while using a HACH handheld flow meter. Water pressure readings, collected by the Leveloggers, were compensated for by using air pressure measurements gathered by the Solinst Barologger installed next to Station WD-1 (**Figure 2**). Like the water temperature monitoring, water levels were also recorded from late spring to late fall (June to November). Elevations of the pressure transducers were recorded, in metres above sea level (MASL), using a mobile RTK (Real Time Kinematics) unit. Elevation levels are included in the data analysis for each station's water level.

Flow monitoring was summarized following the 2023 monitoring season to evaluate the volume of water present throughout the drainage network from season to season.

3.5.4 Fish Community Sampling

Fish community sampling (i.e., electrofishing) was conducted at the six sampling locations on September 27, 2023. Fish community sampling was completed in accordance with the Ontario Stream Assessment Protocol single-pass field procedures (Stanfield, 2017). Prior to the completion of sampling, fish collection permits were obtained from the MNRF (License No. 1104495), and sampling was completed in accordance with permit requirements.

3.5.5 Benthic Invertebrates

To accompany general water chemistry sampling and provide a more fulsome sense of water quality within the Wignell Drain Subwatershed Study Area, benthic invertebrate sampling was completed at the six sample stations on June 14 (spring event) and October 25 (fall event), 2023. Three subsamples from each station were collected in order to capture different habitat types (i.e., riffle versus pools). Samples were then sent to a qualified taxonomist to be tabulated and sorted to at least the family level.

Sample collection utilized standard methods as outlined within the OBBN Protocol Manual (Jones et al., 2005). A 500 µm mesh kick net was used to collect standardized three-minute timed 'travelling kick and sweep' samples. Care was taken to scrub coarse materials present within the sample area to remove potentially attached benthic macroinvertebrates.

Samples were subsampled using the teaspoon method until at least 100 specimens were found (or until no other specimen could be found within the sample). Specimens from each sample were identified to family level. Sample results were summarized into the following biological metrics: total number of organisms, taxa diversity, taxa richness, Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa richness, percent EPT, and Hilsenhoff's biotic index (HBI).

3.6 Landscape Connectivity

Landscape connectivity is a concept that considers the degree of connectedness of natural features and habitats when a landscape has been subject to some degree of human development. This is especially relevant to southern Ontario, south of the Canadian Shield, where most land has been altered through agricultural practices or the construction of manmade structures (including roads). A highly connected landscape is one where there is generally a higher percentage of natural cover, and which has numerous natural corridors (such as river valleys) that link larger natural areas together. Highly connected landscapes enable higher biodiversity and higher genetic diversity due to the increased species mobility, while also enabling the movement of plants (by seeds) more readily. On the contrary, landscapes with low connectivity result in lower biodiversity and genetic diversity. It is worth remembering that the science of landscape connectivity is somewhat imprecise, and it is not always clear which species use or require corridors, and under which circumstances.

A landscape connectivity analysis was undertaken in the Study Area using:

- General knowledge of the area from:
  - Elite EIS studies (Study Lands)
  - Study Area on-site observations and studies
  - Extensive professional experience of southern Ontario
- Examination of Google Earth air photography

From this was drawn an approximation of the landscape connectivity conditions of the Study Area, as well as current and potential natural heritage linkages.

3.7 Channel Morphology

3.7.1 Desktop Assessment

Initial drainage feature characterization was completed through a desktop assessment of available background reporting (EWA Engineering Inc., 2022), LiDAR-derived topographic hillshade and associated contours (LiDAR-derived Ontario Digital Terrain Model Mosaic, 2018), historical aerial imagery, and surficial geology mapping (Ontario Geological Survey, 2007). Geomorphic reaches (i.e., lengths of channel that exhibit similar characteristics with respect to parameters that influence channel form) were delineated based on the desktop assessment to guide the field assessments.

3.7.1.1 Headwater Drainage Feature Assessment

In 2022, HDFs within the Subject Lands were evaluated in accordance with the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (Toronto and Region Conservation Authority and Credit Valley Conservation, 2014). These guidelines use an integrated approach for the evaluation of

key attributes of drainage features including flow and feature form, riparian vegetation, fish and fish habitat, and terrestrial habitat. The evaluation divides HDFs into segments, with breaks between segments occurring where key attributes change.

Due to the ubiquity of potential HDFs and other small municipal drainage features within the larger Study Area and lack of property access throughout the Study Area, these features were reviewed using a desktop approach in 2023 and 2024.

3.7.2 Field Surveys

Fluvial geomorphic field assessments were completed in 2023 to 'ground-truth' desktop characterization of existing drainage features and collect detailed channel information (bankfull geometry, bed and bank materials, indicators of instability or erosion) at representative locations within the Study Area. Characterization focused on publicly accessible areas, roadside observations, and the Subject Lands (**Figure 2**). Access was requested for specific, targeted locations on private lands that would provide the most benefit to the SWS; however, access was not granted. Detailed channel information collected during the field investigations supports erosion threshold analysis and erosion hazard limit delineation.

3.7.3 Erosion Hazard Limit Delineation

The erosion hazard limit was delineated (where appropriate) for the main branches of the Wignell Drain within the Subject Lands and Study Area, in accordance with accepted procedures (Parish Geomorphic, 2004). Channel configurations in georeferenced historic and recent aerial photographs were reviewed as a basis for identifying trends in channel form and adjustment. Geomorphic form and function of the drainage features in the Study Area are a reflection of historic alterations and maintenance under the *Drainage Act*. Empirical estimates of meander belt widths were employed to account for the history of disturbance and unnatural character of the existing drainage features (municipal drains).

3.7.4 Erosion Threshold Analysis

A representative erosion threshold for the Study Area was determined based on the results of the 2023 field investigation. Erosion thresholds are determined as part of subwatershed studies to provide guidance for stormwater management planning as a target for outlet flows. Ideally, they are determined for reaches located downstream of proposed stormwater management ponds. Due to limited property access in the broader Study Area, one reach in the Subject Lands was selected for erosion threshold analysis. The reach flows permanently and exhibits a well-defined cross-section. An erosion threshold was estimated based on accepted empirical formula from applicable literature, with field observations and measurements as the necessary inputs.

3.8 Floodplain Analysis

The Floodplain Analysis work, in brief, included the following tasks:

1. Review of the City's "Wignell Watershed Hydrology and Hydraulics Report", EWA Engineers Inc., August 31, 2021.
2. Review of "NIAGARA PENINSULA CONSERVATION AUTHORITY FLOOD PLAIN MAPPING WIGNELLL DRAIN CITY OF PORT COLBORNE", NIAGARA PENINSULA CONSERVATION AUTHORITY, August 2011.

3. Comparing Province DEM (Lidar derived) to MTE Surveyors Ltd. and adjusting the Province DEM to the MTE topographic data. The adjusted Lidar DEM was used as the base line.
4. Requesting and obtaining from City the PCSWMM hydraulic models used by EWA in preparing the Wignell Watershed Hydrology and Hydraulics Report
5. Reviewing the PCSWMM model.
6. Creating a 1D/2D model (XPSWMM 2D).
7. Comparing existing conditions to that of the Subject Lands.

The following items were evaluated via the XPSWMM 1D/2D model:

- Flood elevations (Regulatory);
- Hydraulic Grade Line (HGL) at the subject areas;
- Bed shear calculations; and,
- Velocity and depth calculations (Hazard).

3.8.1 Hydraulic Analysis

XPSWMM 1D/2D Model

The model that was used for hydraulic analysis was XPSWMM as many items were transferable. The boundary conditions and 1D nodes were copied and pasted from PCSWMM to XPSWMM.

XPSWMM was run with the following scenarios:

1. Existing 0 (Base) - The existing scenario was simulated using the hydrology in the “Wignelll Watershed Hydrology and Hydraulics Report”, EWA Engineers Inc., August 31, 2021. The storms run were SCS 24 hr -100, 50, 25, 10, 5, 2-year events and AES 12 hr – 100-year event. The Lake Erie boundary condition was considered as free flow.

2. Subject Lands Developed 1 - The existing scenario was modified to simulate (add) 6 urban areas flowing to 6 SWM ponds (Subject Lands Developed). The storms run was SCS 24 hr - 100, 50, 25, 10, 5, 2-year events and AES 12 hr – 100-year event. The Lake Erie boundary condition was considered as free flow.

3. Existing 3 Lake boundary modified - The existing scenario was simulated using the hydrology in the “Wignelll Watershed Hydrology and Hydraulics Report”, EWA Engineers Inc., August 31, 2021. The Lake Erie boundary condition was 100-year Lake level + 10-year surface runoff event.

4. Subject Lands Developed 1 Lake boundary modified - The existing scenario was modified to simulate (add) 6 urban areas flowing to 6 SWM ponds (Subject Lands Developed). The Lake Erie boundary condition was 100-year Lake level + 10-year surface runoff event.

Model:

The Hydrodynamic 2D model utilized is XP2D by Innovyze. XPSWMM 1D is similar to and has the modified EPA SWMM 5 engine. SWMM 5 models can be imported and exported into XPSWMM. XP2D is a computer program for simulating depth-averaged, two and one-dimensional free-surface flows such as occurs from floods and tides. XP2D is based on the computational engine TUFLOW which was originally developed for modelling two-dimensional (2D) flows and stands for Two-dimensional Unsteady FLOW. XP2D has been dynamically linked (fully integrated) with the XPSWMM 1D solution engine.

2D: TUFLOW HPC's 2D explicit formulation assures unconditional stability. Thus, a reasonable initial time step is 1 to 5 seconds. The program will use the initial time step and divide it by 10 to start the simulation. From that point on the program will adjust.

1D: Finite difference Runge-Kutta explicit scheme. Scheme solves all terms of the St. Venant equations.

1D and 2D schemes automatically switch between upstream and downstream controlled flow regimes to represent shocks.

Prior to embarking on a 2D model routine it is customary practice to create a well-planned workflow so that major items are not missed. The pillar of this workflow is a well conceived Quality Control Check List (**Table 2**). This is only checked after the modelling takes place to ensure that the report and models are in sync.

Table 2: Quality Control Checklist

Item	Description	Checked
Modeling Log	A modeling log is highly recommended and should be a requirement on all projects. The log may be in Excel, Word, or other suitable software. A review of the modeling log is to be made by an experienced modeler. It should contain sufficient information to record model versions during development and calibration, along with observations from simulations. A model version naming and numbering system needs to be designed prior to the modeling. The version numbering system should be reflected in input data filenames to allow traceability and the ability to reproduce an old simulation if needed.	√
File Naming, Structure and Management	A review of the data file management should check: ● Files are named using a logical and appropriate system that allows easy interpretation of file purpose and content; ● A logical and appropriate system of folders is used that manages the files; ● Relative path names to be used for input files (e.g. "..\model\geometry.tgc") so that models are easily moved from one folder to another. ● Documentation of the above in, for example, the projects Quality Control Document and/or Modeling Log.	√
2D Cell Size	Check whether the 2D cell size is appropriate to reproduce the topography needed to satisfactorily meet the objectives of the study.	√
Topography	The topography review should focus on: ● Correct interrogation of DTM; ● Correct datum; ● Modifications to the base data (e.g. breaklines) have been checked. Regarding the latter, this is effectively carried out by producing a _zpt GIS check file using Write Check Files. The _zpt layer contains all modifications including any flow constriction adjustments. A DTM can be created from the Zpts using Global Mapper, or other 3D surface software, to aid in the review.	√

Item	Description	Checked
	Note: Reviewing the elevations in the .2dm file is not appropriate as only the ZH Zpt is represented in the .2dm file (the ZH elevation is not used in the hydrodynamic calculations).	
Bed Resistance Values	Bed resistance values are to be reviewed by an experienced modeler. The review should focus on checking at least one of: ● Roughness Categories in the Global Database; ● The grid "Mat" or "Manning_n" values in the grd GIS check file; or ● Specifying weir output using the weir approach. The reviewer should be looking for: ● Relative consistency between different land-use (material) types; and ● Values are within accepted calibration values.	√
Calibration / Validation	Check that the model calibration or validation is satisfactory in regard to the study objectives. Identify any limitations or areas of potential uncertainty that should be noted when interpreting the study outcomes.	√
Mass Conservation	Standard practice is to place PO flow lines at a minimum of several locations through the model. They are typically aligned roughly perpendicular to the flow direction. The locations should include lines just inside each of the boundaries. Other suitable locations are upstream and downstream of key structures, through structures and areas of particular interest. The flows are graphed, and conservation of mass checked (i.e., the amount of water entering the model equals the amount leaving allowing for any retention of water in the model). Check that any 1D flow paths crossed by a PO line are also included in the mass check. In dynamic simulations, an exact match between upstream and downstream will not occur due to retention of water; however, examination of the flow lines should reflect this phenomenon. For steady-state simulations, demonstration of reaching steady flow conditions is demonstrated when the flow entering the model equals the flow leaving the model.	√
Free-Over fall & Weir Flow	Especially if **Supercritical** is set to OFF, the percentage of free-over fall and weir flow velocity points should be checked. The review should seek to check that excessive number of points are not free-overfalling, and if so, that this is in accordance with the expected flow (e.g. weir flow over a levee) – check that the weir option is on if significant weir flow exists; and/or the effect on the overall flow patterns is minimal. The review is best carried out by: ● Monitoring the numbers after "CS" or "FO" on the screen or in the .tlf file ● Specifying flow regime output to generate the _R.dat file. This file shows the flow regime. The presence of significant areas of supercritical and/or weirs can be acceptable in large areas of sheet flow. However, care should be taken in interpreting the flow behavior in these areas, particularly if the flow is	√

Item	Description	Checked
	supercritical as complex hydraulic processes (e.g. hydraulic jumps, surcharging against buildings) can occur. Typically, most supercritical and weir flow occurs: ● Around the edge of a model where it is wetting and drying and has little influence over the general flow behavior; or ● Down steep slopes or over significant drops (e.g. over a levee).	
Hydraulic Structures	Head losses through a structure need to be validated through: ● Calibration to recorded information (if available). ● Crosschecked using desktop calculations based on theory and/or standard publications (eg. Hydraulics of Bridge Waterways). ● Crosschecked with results using other hydraulic software (e.g. HEC-RAS). Simple checks can be made by calculating the number of dynamic head losses that occur and checking that this in accordance with that expected. It is important to note that contraction and expansion losses associated with structures are modeled very differently in 1D and 2D schemes. 1D schemes rely on applying form loss coefficients, as they cannot simulate the horizontal or vertical changes in velocity direction and speed. 2D schemes model these horizontal changes and, therefore, do not require the introduction of form losses to the same extent as that required for 1D schemes. However, 2D schemes do not model losses in the vertical or fine-scale horizontal effects (such as around a bridge pier) and, therefore, may require the introduction of additional form losses. See Syme 2001b for further details.	√
Eddy Viscosity	Check that the eddy viscosity formulation and coefficient is appropriate.	√

Graphic 1 and **Graphic 2** contain the existing condition XPSWMM model. The XPSWMM model was built from the Provinces 2018 DEM, which is Lidar derived. The raw data was imported into Global Mapper (Geospatial software) where it was reviewed and edited if necessary. A digital terrain model was created in Global Mapper. Through Global Mapper a grid file (XYZ) file was created and sent to XPSWMM. XPSWMM then creates the DTM. The DTM still satisfies the theory that a good 2D model should contain for each 2D cell at least 2 vertices on average.

Graphic 3 is the post development XPSWMM model showing additional nodes added to the model representing the post development drainage areas shown in **Graphic 4**. **Graphic 5** is a close-up view of the nodes at Pond A and Pond C that have outlets crossing Elizabeth Street and Killaly Street East respectively.

Time Step:

As a rule, the time step is typically half the cell size. For steep models with high Froude numbers and supercritical flow, smaller time steps may be required. For this Study Area, this was not an issue as the Study Area is relatively flat.

If the model is operating at high Courant numbers (>10), sensitivity testing with smaller time steps to demonstrate no measurable change in results should be carried out. The occurrence of high mass errors is also an indicator of using too high a time step. It is recommended that the time step of the 2D engine be equal to or an integer multiple of the time step of the 1D calculations.
Odan Detech have adapted the following time steps to start:

1D model	1.0 sec
2D model	1.0 sec

XP2D is finite volume based, explicit formulation. As mentioned above, the program will use the initial time step and divide it by 10 to start the simulation. From that point on the program will adjust. The above noted criteria are met and there are no stability issues with the model.

Cell Size:

The cell sizes of 2D domains need to be sufficiently small to reproduce the hydraulic behavior. Based on review of benchmark studies, experience, and consultation with Innovyze, the chosen Grid size of 2.5 m is adequate. This provides enough resolution to capture local ditches and space between buildings.

Cell Roughness:

The grid roughness was set to a Manning n of 0.050 for the existing natural areas and residential lawns, as noted in **Graphic 1**. There are no urban areas where the 2D grid is provided. Therefore, a single manning n is provided. The Subject Lands were modelled as a 1D system (hydrology nodes, to storage node, with control structure) out letting to a node linked to a 2D cell.

Hydrology Parameters:

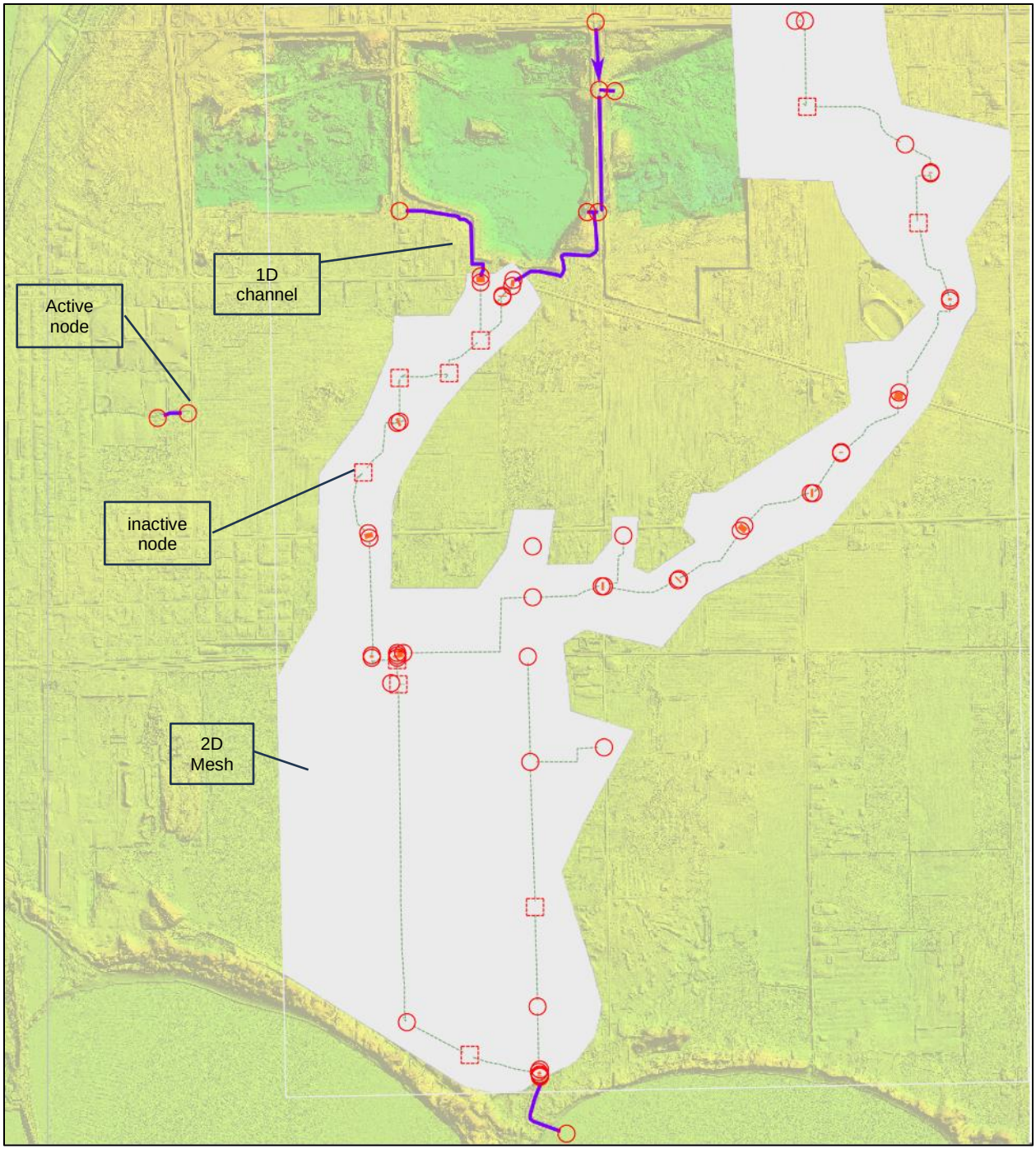
The existing XPSWMM hydrology model is the same as the PCSWMM model. Refer to **Table 3** for the post developed (Subject Lands Developed) hydrology parameters. The Post Developed model has urban runoff, and the existing tributaries are subdivided.

Table 3: Post Development Hydrology Parameters

Name	Subcatchment	Impervious Area depression storage (mm)	Pervious Area depression storage (mm)	Area ha	Width m	Slope m/m	Impervious Percentage %	Infiltration Reference	Hydrology Methods	Normal method length (m)	Normal method width (m)	measured length (m)	new width (m)
J1	1	10	5	28.75	288	0.00	4.5	M1	SWMM	437.8	328.3	280.0	513.3
J10	1	10	5	5.44	60	0.01	85.0	PC9_4	SWMM	190.5	142.8	280.0	97.2
J12	1	10	5	100.60	680	0.01	4.5	W10	SWMM	818.9	614.2	280.0	1796.4
J15	1	10	5	15.05	132	0.00	3.0	PC7	SWMM	316.8	237.6	570.0	132.0
J16	1	10	5	7.64	50	0.00	1.0	PC8	SWMM	225.7	169.3	775.0	49.3
J17	1	10	5	7.96	153	0.00	4.5	PC5	SWMM	230.4	172.8	280.0	142.1
J18	1	10	5	1.98	40	0.00	55.0	PC10	SWMM	114.9	86.2	280.0	35.4
J19	1	10	5	63.43	906	0.00	0.0	PC4-QE1	SWMM	650.3	487.7	280.0	1132.7
J2	1	10	5	26.53	420	0.00	4.5	M2	SWMM	420.5	315.4	280.0	473.7
J20	1	10	5	66.06	660	0.00	0.0	PC3-QW1	SWMM	663.6	497.7	280.0	1179.6
J21	1	10	5	19.34	198	0.01	4.5	PC1	SWMM	359.1	269.3	280.0	345.4
J21	2	10	5	36.60	374	0.00	4.7	PC2	SWMM	493.9	370.5	280.0	653.5
J22	1	10	5	58.30	511	0.01	4.5	W1	SWMM	623.4	467.6	280.0	1041.0
J23	1	10	5	77.96	488	0.01	4.5	W2	SWMM	720.9	540.7	280.0	1392.1
J24	1	10	5	18.36	275	0.00	4.5	W12	SWMM	349.9	262.4	280.0	327.9
J24	2	10	5	41.66	495	0.00	4.5	W7	SWMM	527.0	395.3	280.0	743.9
J24	3	10	5	10.02	250	0.00	4.5	WB2	SWMM	258.5	193.9	280.0	179.0
J25	1	10	5	82.31	986	0.00	4.5	W6	SWMM	740.7	555.6	280.0	1469.8
J26	1	10	5	22.30	354	0.00	4.5	W5	SWMM	385.6	289.2	280.0	398.2
J27	1	10	5	34.15	491	0.00	4.5	W14	SWMM	477.1	357.9	280.0	609.8
J28	1	10	5	41.21	330	0.00	4.5	W3	SWMM	524.2	393.1	280.0	735.9
J29	1	10	5	6.61	220	0.00	4.5	W8	SWMM	209.9	157.4	280.0	118.0
J29	2	10	5	6.88	260	0.00	4.5	WB1	SWMM	214.2	160.6	280.0	122.9
J30	1	10	5	12.04	502	0.01	4.5	W9	SWMM	283.3	212.5	280.0	214.9
J32	1	10	5	8.79	239	0.01	4.5	PC9_3	SWMM	242.0	181.5	280.0	156.9
J4	1	10	5	18.79	470	0.01	4.5	M4	SWMM	353.9	265.4	280.0	335.5
J5	1	10	5	16.71	597	0.01	4.5	M5	SWMM	333.7	250.3	280.0	298.3
J6	1	10	5	8.32	201	0.00	5.0	B1	SWMM	235.5	176.6	280.0	148.6
J7	1	10	5	41.95	411	0.01	4.5	M3	SWMM	528.8	396.6	280.0	749.1
J8	1	10	5	26.23	1380	0.03	4.5	W11	SWMM	418.2	313.6	280.0	468.4
J88	1	10	5	3.65	37	0.00	45.0	PC11	SWMM	156.0	117.0	280.0	65.2
J15.1.1	1	10	5	20.84	280	0.00	4.5	PC6	SWMM	372.7	279.5	280.0	372.1
Node56-1	1	2	5	2.00	86.6	0.02	60.0	urban	SWMM	115.5	86.6	280.0	35.7
J87	1	10	5	28.72	342.0	0.004	4.5	W13	SWMM	437.5	328.1	280.0	512.8
Node84	1	2	5	23.33	295.8	0.01	54.0	urban	SWMM	394.4	295.8	280.0	416.6
Node88	1	2	5	51.83	440.9	0.01	43.0	urban	SWMM	587.8	440.9	280.0	925.5
Node92	1	2	5	31.35	342.9	0.01	66.0	urban	SWMM	457.2	342.9	280.0	559.9
Node96	1	2	5	8.00	173.0	0.01	70.0	urban	SWMM	231.0	173.2	280.0	142.9
Node100	1	2	5	33.85	400.0	0.01	62.0	urban	SWMM	475.0	356.3	280.0	604.4
Node108	1	2	5	11.83	210.6	0.01	70.0	urban	SWMM	280.8	210.6	280.0	211.2
Node109	1	10	5	15.79	243.3	0.01	4.0	PC7	SWMM	324.4	243.3	280.0	281.9
				1143.13									

Note the two quarry areas (J19 and J20) are included in the above parameters; however, these areas were turned off in the simulation. The CN curve number of 83 was used in the urban infiltration model. The area = 1143.13 is very close to the Wignell Drain area of 1089.58 ha + 51.83 ha (flow area to south Welland, node88) = 1141.41 ha (existing conditions).

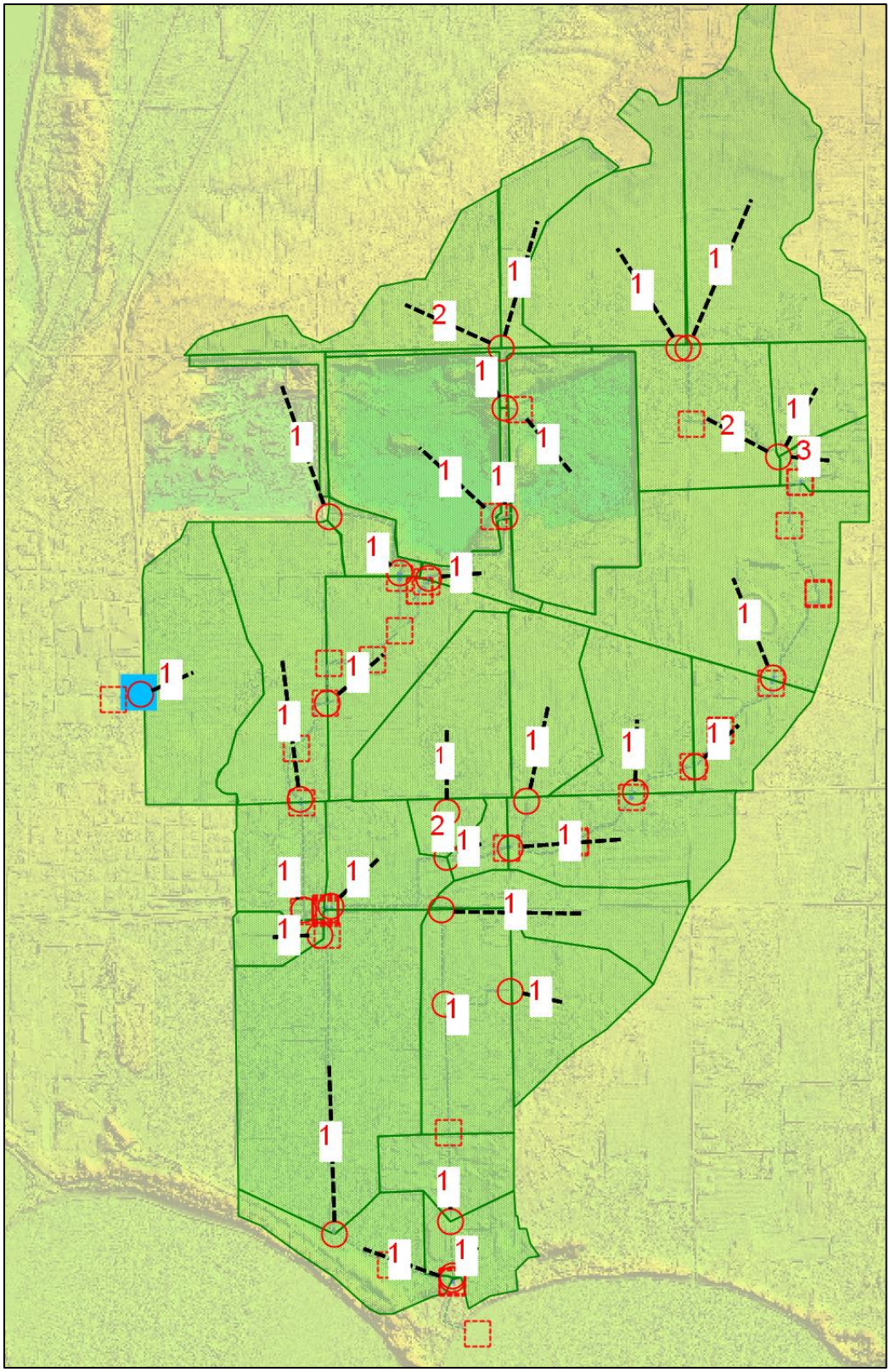
Graphic 1: XPSWMM Global Existing Model



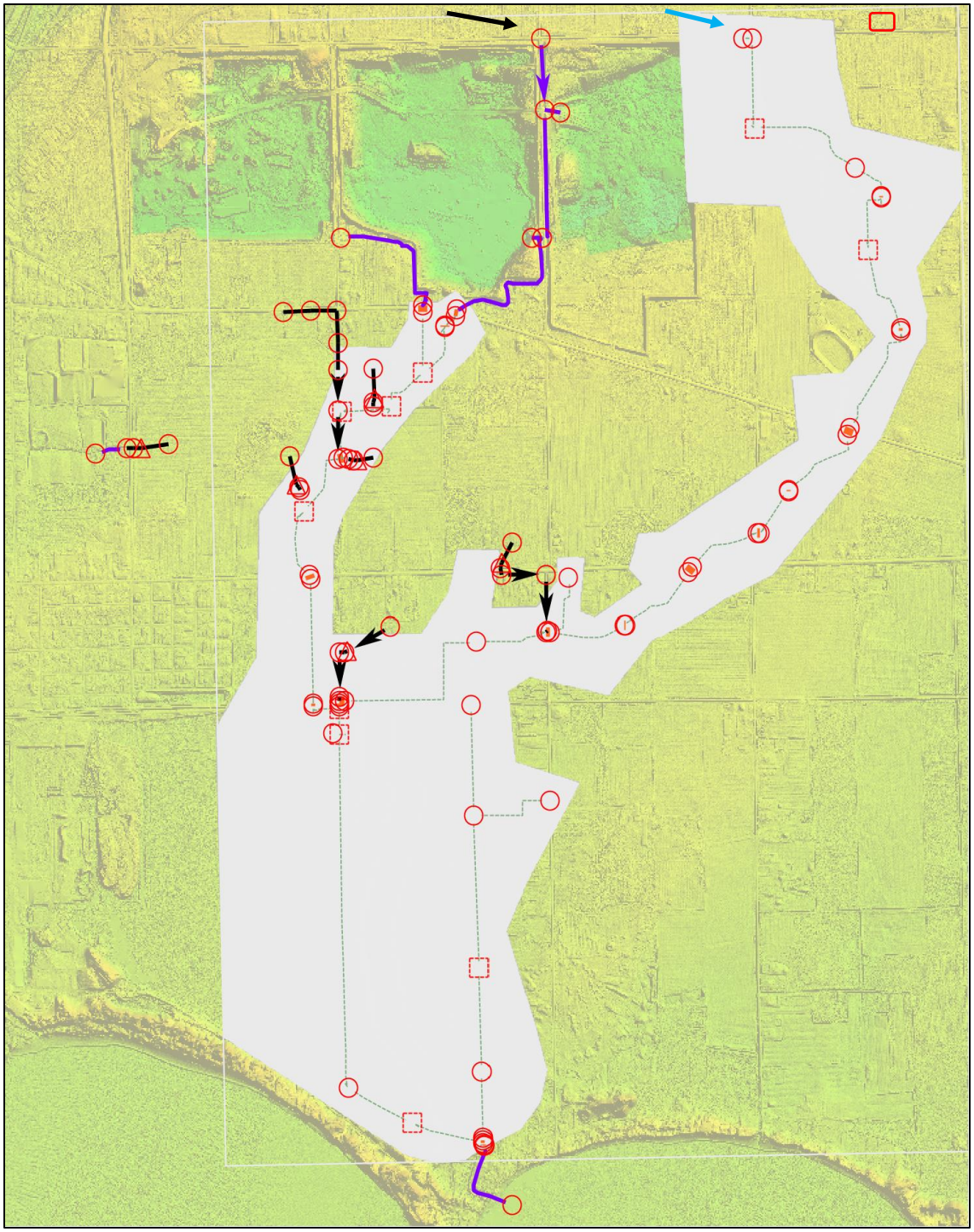
Legend: Δ - storage node, o –node/MH, Link (pipe) dummy link inactive node
Link culvert Link open channel Link orifice and or weir

Grid Manning n = 0.05

Graphic 2: XPSWMM Existing Model Showing Tributary Areas and Node Links



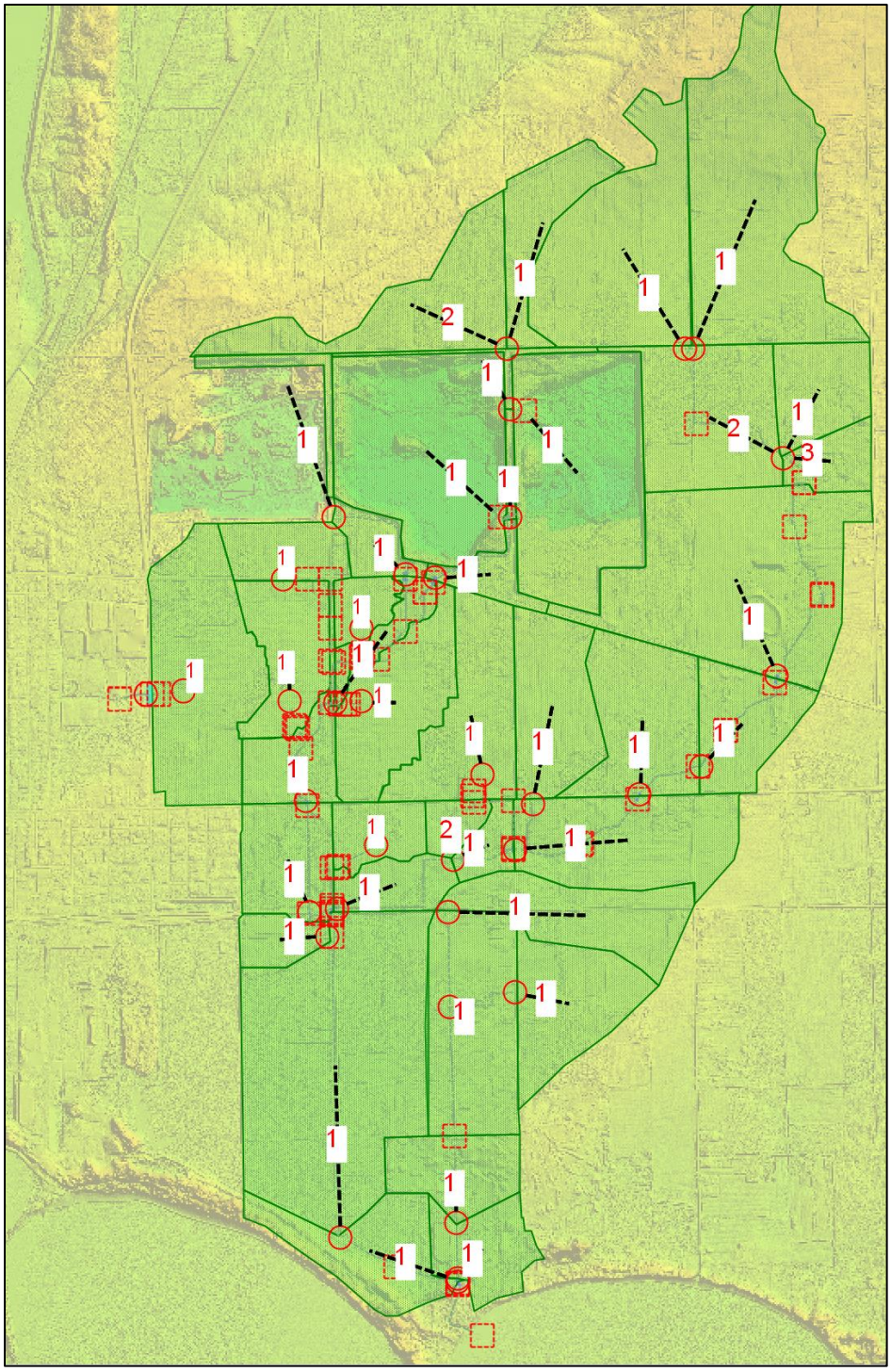
Graphic 3: XPSWMM Global Subject Lands Developed Model



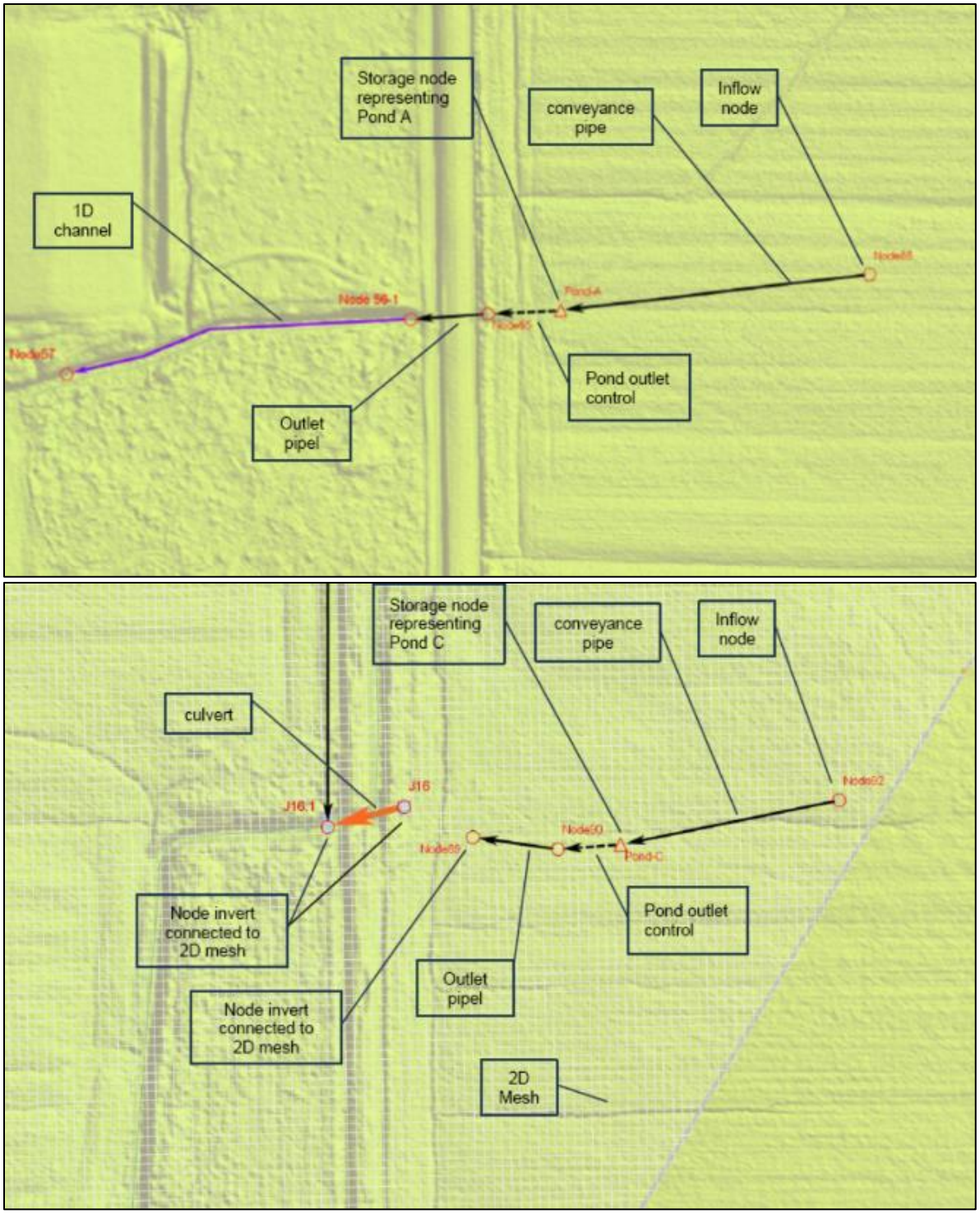
Legend: ***Δ - storage node,*** ***o –node/MH, inactive node*** ***Link (pipe)*** ***dummy link***

Link culvert Link open channel Link orifice and or weir

Graphic 4: XPSWMM Subject Lands Developed Model Showing Tributary Areas and Node Links



Graphic 5: Close Up of Urbanized XPSWMM Subject Lands Developed Model



3.8.2 Discussion of XP2D Model

The following items are (in no particular order):

1) The PCSWMM model by EWA was utilized in the XPSWMM model. The red square nodes shown in Graphic 1 above are nodes from PCSWMM representing the nodes at the end of the links. In XPSWMM Odan Detech replaced the Wignell Drain links with a 2D mesh. Thus, the red squares are the XPSWMM nodes turned off. In addition, the links were turned off. Only select channels and culvert crossings were modelled.

2) The hydrology nodes (where run-off is directed) are linked to 2D mesh if the runoff is in the valley area (Wignell Drain). If connected to pipes, they are not linked to 2D mesh.

3) The pond outlet nodes for ponds B to F are linked to the 2D mesh at the creek outfall. Pond A has no 2D mesh.

4) To accept flow from a 1D domain to a 2D domain or vise versa the nodes must be linked to the 2D mesh.

5) Culvert crossings utilize entrance loss of 0.5 and exist loss of 1.0.

6) Culvert crossing utilize manning n as per the NPCA HEC-RAS model (variable with depth)

7) HGL levels at select locations are retrieved via points 1 to 13. The points are in identical locations in the existing and post models.

8) There are no celerity issues with the model.

9) The continuity error is excellent.

10) There were no error messages from the analysis.

11) The HGL maximum at any given point in the system is the most useful result. The animation of the flow with time, best shows how the upper flows are attenuated through the system and the effect of downstream tail water if it exists.

12) Hydro-dynamic models provide the most accurate, reliable, and defensible representation of flows in the collection system. These account for varying inflows, non-coincident peak flows, in system storage, hydrograph attenuation, and tail and backwater effects. In addition, the integration with a 2D model allows accurate spill over calculations of the Flood plain along with the attenuation effects of the spill.

13) The following are the key items affecting HGL in dynamic models:

- Pipe and or channel volume,
- Length of flow, spill, and volume in the spill area,
- Runoff hydrograph (length in time and volume),
- Timing of peaks which are controlled by the above.

14) The analysis is based on clean channels. No percentage blocked.

Refer to Section 8.1 for modeling results.

3.9 Hydrogeology

3.9.1 Background Record Review

A detailed background and record review was conducted for the Study Area to delineate the regional physical setting and environmental setting. The understanding of the regional setting assists in the delineation of subwatershed conditions, data interpretation, and impact assessment. The major sources of records reviewed included, but were not limited to the Ontario Geological Survey database (physiography, geology and boreholes), the MECP database (well record, natural heritage, hydrology, source protection and environmental instruments), documents from the NPCA (watershed plan, subwatershed studies, source protection plan, stormwater criteria and etc.), and documents from the City of Port Colborne (official plan, zoning plan, permit application, well head protection policies, sewer use bylaw, etc.).

One previous study report was provided by the client, titled "*Preliminary Hydrogeological and Water Balance Investigation, Killaly Street East, Port Colborne, ON*" (EXP, 2023). The Study Area (i.e., the Subject Lands) is located within the subwatershed between Killaly Street East and the Main Street East. The study was based on:

- Sixteen (16) monitoring wells (MWs) with depths ranging from 3.05 to 6.25 m, including thirteen (13) wells screened in bedrock, one (1) well screened in overburden, and two (2) wells with the screen straddling bedrock and overburden;
- Eight (8) pairs of mini-piezometers (MPs) (one shallow and on deep) with depths ranging from 0.79 to 1.25 m;
- Hydraulic conductivity tests for fifteen (15) monitoring wells and infiltration test for three hand augured shallow holes;
- Three groundwater samples from two monitoring wells. One (1) sample was analyzed for Niagara Sewer-use By-law parameters and routine comprehensive analytical package (RCAP) parameters. A second sample was analyzed for Niagara Sewer-use By-law parameters and a third sample was analyzed for metal parameters.

The following are the major findings of the study:

- Groundwater levels measured ranged from 0.33 to 4.84 meter below ground surface (mbgs);
- The recorded groundwater and surface water levels from the MPs suggested that during the monitoring period from June to August 2021 and from March to November 2023 groundwater recharging conditions existed at MP1, MP6, MP7 and MP8, while water level data for other MPs were erratic;
- Bedrock hydraulic conductivity values (k-values) ranged from $1.0x10^{-8}$ to $1.6x10^{-5}$ m/s, while monitoring wells screened across the bedrock and overburden interface had k-values from $4.2x10^{-8}$ to $3.0x10^{-7}$ m/s. The overall geomean k-value was $7.5x10^{-7}$ m/s;
- Infiltration tests within four hand-augured, shallow holes resulted in k-values from $7.5x10^{-7}$ to $1.7x10^{-6}$ m/s with corresponding infiltrate rates from 5 to 6 mm/hour;

- Groundwater sample analytical results indicated no exceedances to sew-use bylaw limits, but three exceedances to the Ontario Provincial Water Quality Objectives (PWQO) including sulphide, total cobalt, and dissolved cobalt were documented.

The above factual data and information will be used or referred to for the current study. The borehole and well logs and the groundwater analysis certificates are provided later in this report.

3.9.2 Remote Sensing Interpretation and Terrain Analysis

Available historic aerial images were interpreted to delineate surficial features that may provide insight into groundwater recharge, discharge features, and karst development within the Study Area. Terrain Analysis (Surface Analysis) was conducted by interpreting topographic features using geographic information systems (GIS). As part of terrain analysis, a Lidar Derived Digital Terrain Model from provincial sources was used to create topographic contours for the area within 500 m from the Study Area. The topographic contours data from NPCA were also used. The topographic contours, in addition to the satellite imagery, provided a general view of terrain characteristics and formed the base of the micro-topographic analysis.

Ground-truthing, as part of the remote sensing interpretation, and terrain analysis were conducted during the study and involved walking through key areas to validate results of remote-sensing interpretation and terrain analysis, and to detect surficial and shallow features that may directly and indirectly indicate the existence of recharge and discharge features, as well as karst features under the overburden. The key areas include major watercourses, quarries, culverts, lake beaches, slopes, bedrock outcrops, and bedrock escarpment.

3.9.3 WWIS Well Record Inventory

Ontario Regulation 903, under the Ontario Water Sources Act, has required all well contractors to report drilled and bored well construction operations to the well owner and to the Ontario Government since the late 1940s. Since the late 1980s, all persons constructing dug wells were also required to complete well records. Presently, well records are required to be submitted to the Ministry to document any well construction, alteration, or abandonment of wells in Ontario. Over 790,000 well records have been submitted to the Ministry over the years with approximately 15,000 to 24000 new well records received each year. The government has well record data from 1899 to present. Due to the long history of records and seamless coverage, the geology, material properties, and groundwater information contained in well records have become a major source of data for regional groundwater conditions.

Well records within 1000 m of the Study Area boundary were queried from the MECP database of the Water Well Information System (WWIS) for the following fields: well ID, completion date, well depth, static groundwater levels, aquifer type (bedrock or overburden well), water use, pumping test result and stratigraphy. The information and data contained in these well records were used to delineate stratigraphy, bedrock topography, and general groundwater conditions within the Study Area. Results of the inventory from the MECP well records and their locations are discussed in Section 7 of this report.

3.9.4 PGMN Well and NPCA Well Inventory

The Provincial Groundwater Monitoring Network (PGMN), initiated in 2001, is a partnership program with all 36 Ontario conservation authorities and 10 municipalities (in areas not covered by a conservation authority) to collect and manage ambient (baseline) groundwater levels and quality information from key

aquifers located across Ontario. The PGMN program uses a standardized approach to monitor the 474 wells in the province-wide system. The NPCA has 15 PGMN wells located throughout the NPCA watershed in locally significant hydrogeological areas. The PGMN well closest to the Study Area is W0000289, which is located side-gradient approximately 6 km to the west of the Study Area.

In addition to PGMN wells, NPCA has its own Groundwater Monitoring Network which consists of 31 monitoring wells installed at 23 different locations across the NPCA watershed through a joint project between the NPCA and the Ontario Geological Survey (OGS). Each of the 23 locations has a groundwater monitoring well installed at the top of the bedrock in an aquifer zone commonly known as the Contact-Zone Aquifer. Three (3) of the 23 locations have a set of nested monitoring wells installed at various depths within the overburden sediments. The NPCA wells closest to the Study Area include Buchner Well and Townline Well, which are located up-gradient approximately 5.3 and 6.7 km to the northwest and the north of the Study Area respectively. Error! Reference source not found. lists a summary of the PGMN well and the NPCA wells. Well logs and well locations are discussed in Section 7 of this report.

Table 4: Summary of the PGMN Well and NPCA Wells

Well ID	W0000289	Buchner	Townline
Depth (m)	4.9	43.0	42.5
Screened Interval (m)	2.0-4.9	40.0-43.0	35.0-39.6 39.6-42.5
Screened Aquifer	Limestone	Limestone	Silt Limestone

4. Ecological Existing Conditions

4.1 Physiography

The Subject Lands and Study Area are located within the Lake Erie – Lake Ontario Ecoregion 7E (Crins, Gray, Uhlig, & Wester, 2009). This region extends from Windsor and Sarnia east to the Niagara Peninsula and Toronto, and contains shorelines of Lakes Huron, Erie, and Ontario. The Study Area lies within the physiographic region of the Haldimand Clay Plain (Chapman & Putnam, 1984), consisting of several physiographic landforms including Beaches, Sand Plains, and Limestone Plains. The underlying bedrock consists of Silurian and Devonian limestone. Unlike the majority of the Study Area, which is underlain by limestone bedrock close to ground surface, along the edge of Lake Erie there is a narrow band of sandy soils created by historical beach material.

4.1.1 Port Colborne Quarry ANSI

In the northwestern portion of the Study Area there is a provincially significant Earth Science ANSI called the Port Colborne Quarry ES ANSI (**Figure 3**). This Earth Science ANSI is wholly within the existing quarry and in an area that still sees activity, based on recent Google Earth imagery. It appears that the ANSI was originally identified in 1980 (Niagara Region, 2020).

4.2 Terrestrial Observations

4.2.1 Vegetation Communities

The vegetation communities of the Wignell Drain Subwatershed Study Area are moderately diverse, with much of the landscape composed of humanly altered lands. **Figure 3** indicates ELC communities within the Study Area. Much of the landscape is flat agricultural lands, often planted with soybeans. A small portion of these lands are old fields or pastures (green cross on **Figure 3**), while the remaining fields are croplands. There are also some residential properties within the Study Area. Agricultural lands and associated hedgerows, houses, gardens, and other anthropogenic lands are not marked on the Existing Environmental Conditions mapping (**Figure 3**). Another large component of the Wignell Drain Subwatershed Study Area are the active quarry lands in the northern portion of the Study Area (Port Colborne Quarries Inc.). This area has been shown on the ELC figure (**Figure 3**), along with an adjacent area that is proposed for quarry development. In addition to this, in the southeast portion of the Study Area, a golf course (Whiskey Run Golf Club) is present, which has also been shown in **Figure 3**.

Vegetation communities within the Subject Lands are shown in more detail because access was available to these lands. The ELC descriptions of these communities are provided in **Appendix C**. Elsewhere ELC communities are high-level as observations and descriptions were made from the roadside and/or through air photography interpretation. Apart from the extensive wetland area in the southwest portion of the Study Area, natural vegetation communities are generally small and isolated.

Two ‘Natural Areas’ as described in the Natural Areas Inventory (NAI, Vol 1.) (Niagara Peninsula Conservation Authority, 2006-2009) occur in the Wignell Drain Subwatershed Study Area (Study Site PC-04 Nickel Beach Woods and Study Site PC-16 Dann Dunes; **Appendix B**). These areas are not necessarily areas of significance but were inventoried to understand the region better. Unfortunately, the natural areas

are relatively large and, while the natural areas are mapped, each individual ELC community was not. Thus, it is generally not possible to determine which listed vegetation communities are located within the SWS Study Area and which are not. Some information; however, can be gathered from this source including that the Dann Dunes site is in a large part outside of the Wignell Drain Subwatershed Study Area.

ELC Legend

Cultural Communities
ANTH: Anthropogenic
AG: Agricultural
HE: Hedgerow
CU – Cultural
CUM1-1: Dry-Moist Old Field Meadow
CUT1: Mineral Cultural Thicket
CUW1: Mineral Cultural Woodland
CUP3 – Pine Plantation

Forest Communities
FOD2: Dry – Fresh Oak – Maple – Hickory Deciduous Forest
FOD9: Fresh – Moist Oak – Maple – Hickory Deciduous Forest
FOM – Mixed Forest

Wetland Communities
MAM – Meadow Marsh
MAM2-2: Reed Canary Grass Mineral Meadow Marsh
SWD: Deciduous Swamp
SWD3 – Maple Deciduous Swamp
SWD3-2: Silver Maple Mineral Deciduous Swamp
SWT2: Mineral Thicket Swamp
SWT2-9: Gray Dogwood Mineral Thicket Swamp
SWT2-11: Southern Arrow-wood Mineral Thicket Swamp

1 - Niagara Peninsula Conservation Authority (NPCA)
2 - Land Information Ontario (LIO)

Note: Outside of the Subject Lands, all anthropogenic areas (buildings, gardens, hedges), all agricultural fields, and most cultural communities (e.g. thickets, small CUW) not mapped.

HWY 140
2ND CON RD
MAIN ST E
KILLALY ST E
ELIZABETH ST
SNIDER RD
CARL RD
REUTER RD
MAS/SA
LORRAINE RD
FRIENDSHIP TRAIL
WIGNELL DRAIN WEST TRIBUTARY
WIGNELL DRAIN EAST TRIBUTARY
LAKESHORE RD E
Existing Quarry
Proposed Quarry Expansion Area
Golf Course
LAKE ERIE

Key Map
0 5 km
St. Catharines
Niagara Falls
Welland
Buffalo
Site Location
LAKE ERIE

LEGEND
- Old Field or Hayfield (as of 2022)
- Watercourse [1,2]
- ANSI Earth Science (Port Colborne Quarry)
- Wetland [2]
  - Evaluated - Provincially Significant
  - Evaluated - Other
  - Unevaluated
- Ecological Land Classification (ELC)
- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:17,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: RC
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2019) provided by ESRI basemapping. Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Welland S - Wignell SWS

TITLE: **Ecological Land Classification**

Palmer | PART OF SLR

REF. NO. 2007708-3-4

Figure 3

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

4.2.1.1 Forests and Swamps

Virtually all the forests and treed swamps with the Wignell Drain Subwatershed Study Area are composed of deciduous trees. Forests and swamps are discussed together because the differences between these communities (i.e., a moist treed upland and a treed swamp with short-term spring-time water) are often very subtle, even when access to lands is available and soil samples are taken. Tree species composition is often similar as well. The flat terrain and generally small-grained silty clay soils of the Wignell Drain Subwatershed Study Area play a role in this difficultly of differentiating forests and swamps. Communities that fall into this situation (i.e., may or may not be wetlands) are discussed in Section 5.2.

Tree species found in both (moist) forests and (drier) swamps include oaks (Red *Quercus rubra*, White *Q. alba*, Swamp White *Q. bicolor,* Bur *Q. macrocarpa,* and Swamp Pin *Q. palustris*), maples (Silver *Acer saccharinum*, Red *A. rubrum*, and Freeman's *A. freemanii*), Shagbark Hickory (*Carya ovata*), and Eastern White Elm (*Ulmus americana*). Many forests and swamps in the Study Area contain some component of oak, while fewer are maple dominated, with the SWD3 south of Second Concession Road as one example (**Photo 1**).

Photo 1. Maple Swamp (SWD3) south of Second Concession Road (Sept 21, 2022)

One swamp forest (SWD C on **Figure 3, Photo 2**) of the type described above is noteworthy as it appears to be mature based on roadside observations. It includes mature oak and Eastern Cottonwood (*Populus deltoides*). Northern Spicebush (*Lindera benzoin*) is among the species present in the understorey.

Photo 2. Mature oak mix deciduous swamp (SWD C) east of Reuter Road (Oct. 22, 2022)

4.2.1.2 Other Forests

This section describes some woodland types which are not prevalent and thus potentially more unusual within the Study Area.

There is only one mixed deciduous – coniferous forest in the Wignell Drain Subwatershed Study Area, excluding small areas of conifer plantation. The Mixed Forest (FOM B; **Figure 3**) is east of Lorraine Road. The conifers are pines, but due to lack of access it was not possible to determine if these are naturally occurring or planted pines.

One of the more unusual communities is the forest situated on the historical sand dune along the south edge of the Wignell Drain Subwatershed Study Area and backing onto Lake Erie (CUW/FOD E; **Figure 3**). The south side of the sand dunes is technically outside of the Study Area and is very disturbed by homes and gardens. The north side is disturbed with driveways but remains more naturalized. Unlike most of the Wignell Drain Subwatershed Study Area, sloped terrain and a different substrate (sand) are present. Thus, this community may contain native species that differ from other communities within the subwatershed. Unfortunately, invasives species are also present within this community (including Japanese Knotweed (*Fallopia japonica*) and English Ivy (*Hedera helix*)).

The Dry–Fresh Oak–Maple–Hickory Deciduous Forest (FOD2; **Figure 3**) on the mainly north-facing slope in the southwestern corner of the Study Area is less disturbed and contains Sugar Maple and Red Oak, as well as some American Beech (*Fagus grandifolia*) and Eastern Hemlock (*Tsuga canadensis*). This is the only known community of this kind in the Wignell Drain Subwatershed Study Area. A larger portion of this community continues westward offsite. The Natural Area PC-04 Nickel Beach Woods has records that

indicates that the dune-associated forests and other communities are noteworthy and are part of '*the third largest extant of dune ecosystem in the entire NPCA watershed jurisdiction'*.

The PC-16 Dann Dunes NAI description indicates that there is some old growth in PC-16; however, based on an examination of Google Earth aerial photography it appears that these old growth areas are outside of the Wignell Drain Subwatershed Study Area, likely in sub-area PC-16-07 and not within the onsite portion of PC-16-07. PC-16 reporting also describes the sand-dune forest habitats as being of interest, but within PC-16 these are outside the Wignell Drain Subwatershed Study Area.

There is a Dry-Fresh Forest (FOD4 = B2; **Figure 3**) west of Snider Road and south of Main Street East that contains numerous Black Walnuts (*Juglans nigra*) that are thought to have spread from former plantings, as well as Bitternut Hickory (*Carya cordiformis*) and other tree species. This community contains both native species (such as Bladdernut (*Staphylea trifolia*)), as well as evidence of past habitation (Common Privet (*Ligustrum vulgare*), dug wells, etc.).

4.2.1.3 Swamp Thickets and Marshes

Marshes and swamp thickets are numerous in the Study Area south of Killaly Street East (**Figure 3**). Many of the vegetation communities south of the Friendship Trail, on both sides of the Snider Road allowance that are not mapped already as PSW, are believed to either be wetland, possible wetland, or transition communities. Communities that may or may not be wetlands are discussed in Section 5.2 (e.g., Potential Wetland -CUM/CUT/SWT ELC community).

Four types of wetland designations (1. Evaluated Wetland - PSW, 2. Evaluated Wetland - not PSW, 3. Unevaluated – Palmer Identified Wetland, and 4. Potential Wetland) are discussed and mapped in Section 5.2 of this report.

Community MAM/CUM/SWT/SWT (D, **Figure 3**) is a large unit that is likely a wetland or a transition community between wetland and upland. Based on aerial photography and access along the Snider Road allowance, it is thought to primarily be a marsh, perhaps in part dominated by the invasive Common Reed – *Phragmites australis* (**Photo 3**), with scattered trees and shrubs. Aerial photography of the area shows the vegetation structure of the known and probable wetlands. The uniform blue-green areas on **Photos 4** and **5** (2018 Google Earth) are thought to be *Phragmites* dominated.

Photo 3. Phragmites dominated marsh along Snider Road allowance (Sept 21, 2022).

Photos 4 and 5. Left: Snider Road allowance south of Friendship Trail. Right: Snider Road allowance north of Lakeshore Road East (i.e. south of previous photo). The area in both photos is primarily wetlands, with blue-green uniform vegetation thought to be Phragmites australis and open water shown as light green.

The straightened Wignell Drain situated on the west side of the Snider Road allowance, south of the Friendship Trail, is one of the few open wetlands within the Wignell Drain Subwatershed Study Area. It is shown on **Photo 5** above as a light green colour, in **Photo 6** below, and as a Marsh/Shallow Aquatic (MA/SA) community on **Figure 3**. Herbaceous vegetation associated with this wetland includes Flowering Rush (*Butomus umbellatus* - a non-native invasive), *Phragmites australis*, cattail species (*Typha* sp.), and Duckweed species (*Lemna* sp).

Photo 6. Open wetland (MAS/SA) strip west of Snider Road allowance (Sept 21, 2022).

Very small areas of meadow marsh and swamp thicket may be present north of Killaly Street East in the Study Area outside of the Subject Lands. These small areas are unmapped partly due to lack of access, but also because small vegetation communities would be expected to be mapped at an EIS-level of study and not at the subwatershed level of study.

4.2.1.4 Cultural Communities

Most Cultural Thicket (CUT) and Cultural Meadow (CUM1 or old field) communities within the Wignell Drain Subwatershed Study Area are not mapped; however, these habitats are thought to cover only a small portion of the Study Area. Most of the old fields or hayfields observed are marked on **Figure 3** with a green plus sign. There are also a few small areas of planted pines. There appears to be only one large area of planted trees: Unit CUM/CUP (**Figure 3**), situated south of Second Concession Road. This community is comprised of meadow with young, planted pine and deciduous trees, in addition to naturally regenerating poplar.

4.2.1.5 Unusual or Atypical Vegetation Communities

Vegetation communities of interest have been described above under the Forest/Swamps (Section 4.2.1.1); however, one additional atypical vegetation community is the Southern Arrow-wood Mineral Thicket Swamp

(SWT2-11) community situated southwest of Main Street East and Snider Road (**Figure 3**). The small swamp thicket community was dominated by Southern Arrowood (*Viburnum recognitum*) with abundant Red-osier Dogwood and occasional European Buckhorn, Silver Maple, and Green Ash saplings. The soils in this thicket swamp were assessed to be 6 (very moist) following the methods described in Section 3.4.1. This vegetation community is considered Significant Wildlife Habitat (under the Other Rare Vegetation Community category) and is further discussed in Section 5.4.

4.2.2 Flora

A total of 129 species were recorded based on surveys within the Subject Lands and the greater Study Area. Of the identified species, about 35 (27%) are non-native, which is consistent to the percentage of non-native found in Ontario (approximately 25%) (Oldham, Bakowsky, & Sutherland, 1995). A total of 67 (52%) of species were identified as native species. At the Study Area level, a high percentage of non-native species is indicative of higher levels of disturbance. Non-native species were recorded from all vegetation community types with the highest number found in Dry-Moist Old Field Meadow (CUM1-1) and areas surrounding active agricultural lands. Highly invasive species are present in the Study Area; with perhaps the most widespread and abundant being Common Reed. A compiled plant list for the Study Area is provided in **Appendix D.** No provincially or regionally rare species were identified within the Study Area (Oldham M. , 2010; Oldham & Brinker, 2009).

Additional vascular plant species were recorded within the Study Area via iNaturalist and are included in **Appendix E.**

4.2.3 Breeding Birds

A total of 66 breeding bird species were observed (**Appendix F**) within the Wignell Drain Subwatershed Study Area. Of these bird species, seven were not confirmed to be breeding in the subwatershed (shown as F in **Appendix F**).

Of these seven species, Canada Goose (*Branta canadensis*), Chimney Swift (*Chaetura pelagica*), and Turkey Vulture (*Cathartes aura*) may have been breeding, although no definitive nesting was observed. It is thought that another two of the species (Belted Kingfisher (*Ceryle alcyon*) and Rough-winged Swallow (*Stelgidopteryx serripennis*)) were likely not nesting, due to lack of observed nesting habitat within the Wignell Drain Subwatershed Study Area. It is possible; however, that both these species nest nearby and forage within the subwatershed. In the case of Great Blue Heron (*Ardea herodias*), no colonies are thought to be present in the subwatershed. Lastly, a single male Green-winged Teal (*Anas crecca*) observed may or may not have been a nesting species.

Regardless of the lack of access to many privately-owned properties, the results of the bird surveys are thought to give a reasonably accurate representation of the breeding birds within the subwatershed. Although a few forest birds, raptors, and interior wetland species were likely missed, it is thought that a large percentage of the breeding birds found in the Wignell Drain Subwatershed Study Area were observed.

Many of the bird species observed were disturbance-tolerant species that are frequently found in rural areas (hedgerows, edges, gardens, fields, etc.) and are common and widespread in southern Ontario. The four most abundant species that were notably more abundant in the subwatershed than other species were Red-winged Blackbird (*Agelaius phoeniceus*), Song Sparrow (*Melospiza melodia*), Yellow Warbler

(*Setophaga petechia*), and American Robin (*Turdus americanus*). These species are all very common species across south and central Ontario. Also observed frequently were European Starling (S*turnus vulgaris*), Willow Flycatcher (*Empidonax traillii*), Gray Catbird (*Dumetella carolinensis*), Common Grackle (*Quiscalus quiscula*), Brown-headed Cowbird (*Molothrus ater*), and American Goldfinch (*Cardeulis tristis*). Again, these species are either 'edge' species and/or shrubland birds, common in southern Ontario. The only similarly abundant species that was not either an edge or shrub species was Common Yellowthroat (*Geothlypis trichas*), a marshland bird that was primarily observed in the southern Nickel Beach PSW and associated wetlands units.

Despite the extensive wetlands in the southern portion of the Wignell Drain Subwatershed Study Area (south of Friendship Trail), the wetland bird diversity appeared to be low. Wetland species observed included small numbers of a few waterfowl, a few herons, Tree Swallow (*Tachycineta bicolor*), Willow Flycatcher, Yellow Warbler, Red-winged Blackbird, Marsh Wren (*Cistothorus palustris* - one individual), Common Yellowthroat, and Swamp Sparrow (*Melospiza georgiana*). It is thought that although a few species were likely missed due to lack of access, that this is reflective and representative of a low diversity of wetland birds within the subwatershed. The relatively small amount of both open water (primarily along Wignell Drain itself) and cattail marshlands, as well as a high percentage of Common Reed are thought to be part of the reason for this. Un-recorded birds are expected to be common shrubland species and species of small woodlands.

Relatively few forest birds were recorded given the size of the Wignell Drain Subwatershed Study Area. This is not surprising as most woodlands within the subwatershed are small and isolated. Even typically common woodland species such as Black-capped Chickadee and Red-eyed Vireo were observed in very low numbers. In addition, few area-sensitive species, which are species that either require larger patches of habitat (whether grassland or forest) in which to breed or are generally more productive in larger patches of habitat, for the reason given above, were documented within the subwatershed (see **Appendix F** for species).

Savannah Sparrow (*Passerculus sandwichensis*) and Bobolink (*Dolichonyx oryzivorus*) were the two area-sensitive grassland/open-land species observed within the Study Area. Despite being area-sensitive, Savannah Sparrow is a very common species in southern Ontario in both active and abandoned agricultural fields. Bobolink is discussed further in the SAR section (Section 5.3) below.

Four SAR and two regionally rare species were recorded during Palmer's surveys. These are discussed in Sections 4.2.3.1 and 4.2.3.2 below.

All SAR, area-sensitive, and regionally rare species are mapped on **Figure 4**, except area-sensitive Savannah Sparrow which is not mapped due to its abundance, as noted above. It should also be noted that Marsh Wren, which is not considered a SAR, area-sensitive species, nor a regionally rare species is mapped on **Figure 4**. Based on professional experience this is a somewhat localized species that tends to breed in higher quality, larger wetlands. Only one Marsh Wren was recorded in the subwatershed. Typically, Marsh Wrens are observed in 'colonies'. As such, Palmer thought this species was worth noting.

4.2.3.1 Avian Species at Risk

Three breeding SAR birds were observed on the Subject Lands (**Figure 4**). These were the Eastern Wood-Pewee (*Contopus virens*), the Barn Swallow (*Hirundo rustica*), and the Bobolink. A fourth SAR, Chimney Swift, was observed aerial foraging; however, no nesting was observed.

Several Eastern Wood-pewee territories were recorded. This species is designated as Special Concern due to declining populations. Despite this, it is still one of the most common bird species in mid-aged to mature deciduous and mixed woodlands (of many types and sizes), and thus the observations of this species within the subwatershed are not surprising.

Barn Swallow, another Special Concern species, was also observed in a few locations within the Wignell Drain Subwatershed Study Area. This species has recently been downgraded from Threatened to Special Concern and is often found in rural landscapes, usually nesting on or in buildings and foraging over wetlands, meadows, and fields. Locations where observations were made within the subwatershed, and where suitable nesting habitat was also present, are shown on **Figure 4**. A few other locations where foraging individuals were observed, but where no nearby nesting habitat was present, were not mapped.

Two locations of Bobolink, a Threatened Species under the *ESA* (2007), in suitable nesting habitat were documented. Additionally, there were a few other fields, primarily north of 2nd Concession Road, that provided potential nesting habitat. This species is still moderately common across southern Ontario in large, old fields / hayfields.

4.2.3.2 Regionally Rare Species

Regionally rare species are based on the NPCA's Natural Areas Inventory 2006-2009 (**Appendix B**) and are ranked as Rare, Occasional or Extremely Rare. There are only two species in this category which were recorded within the Wignell Drain Subwatershed Study Area during Palmer's breeding bird surveys: the Green-winged Teal and the Tufted Titmouse.

The documented Green-winged Teal, a small species of waterfowl, may not have been a breeding individual. The Ontario Breeding Bird Atlas (2007) states that '*the presence of a lone drake in suitable habitat in late June or July does not necessarily constitute evidence of local breeding*'. This species was observed feeding in the wetland channel of Wignell Drain in the southern third of the subwatershed, along the Snider Road allowance.

The Tufted Titmouse, on the other hand, is a southern songbird of deciduous woodlands which only occurs in Ontario in some parts of the Carolinian Forest Zone (Ecoregion 7E). One of its strongholds in Ontario is the Niagara Region.

Additionally, 23 species listed as regionally uncommon were observed (**Appendix F**). The definition of Uncommon is '*observed annually on many days at a few locations in small numbers*'.

4.2.4 Non-Breeding Birds

Data from eBird indicated that there was information from the very southeast corner of the Study Area at the south end of Lorraine Road at Lake Erie. This was the only location within the Study Area with data on the eBird database. Fifty-eight species of birds have been recorded at that location between 1987 and 2022 (**Appendix E**). These include primarily non-breeding birds, such as waterfowl observed on the lake or migrating species which were likely either using the woodlands at the edge of the lake or passing along the shoreline.

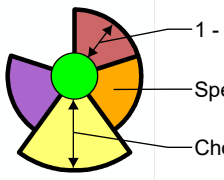
LEGEND

Aquatic, Benthic, and Fishing Sampling Diagram

Monitoring Type

- Benthic Invertebrates
- Fish Sampling
- Flow Monitoring
- Water Chemistry

Amphibian Observation Diagram



Amphibian Observation

- American Toad
- Green Frog
- Northern Leopard Frog
- Spring Peeper
- Western Chorus Frog

Aquatic, Benthic, and Fishing Sampling Location

- Logger & Field Sampling Location

Amphibian Survey Location

- Surveyed Point - *amphibian sighting*
- Surveyed Point - *no sighting*
- Incidental Observation
- Not Surveyed - *potential amphibian habitat*

Wildlife Feature

- Snake Board Location

Breeding Bird Observation

- AAAA Selected Bird Record

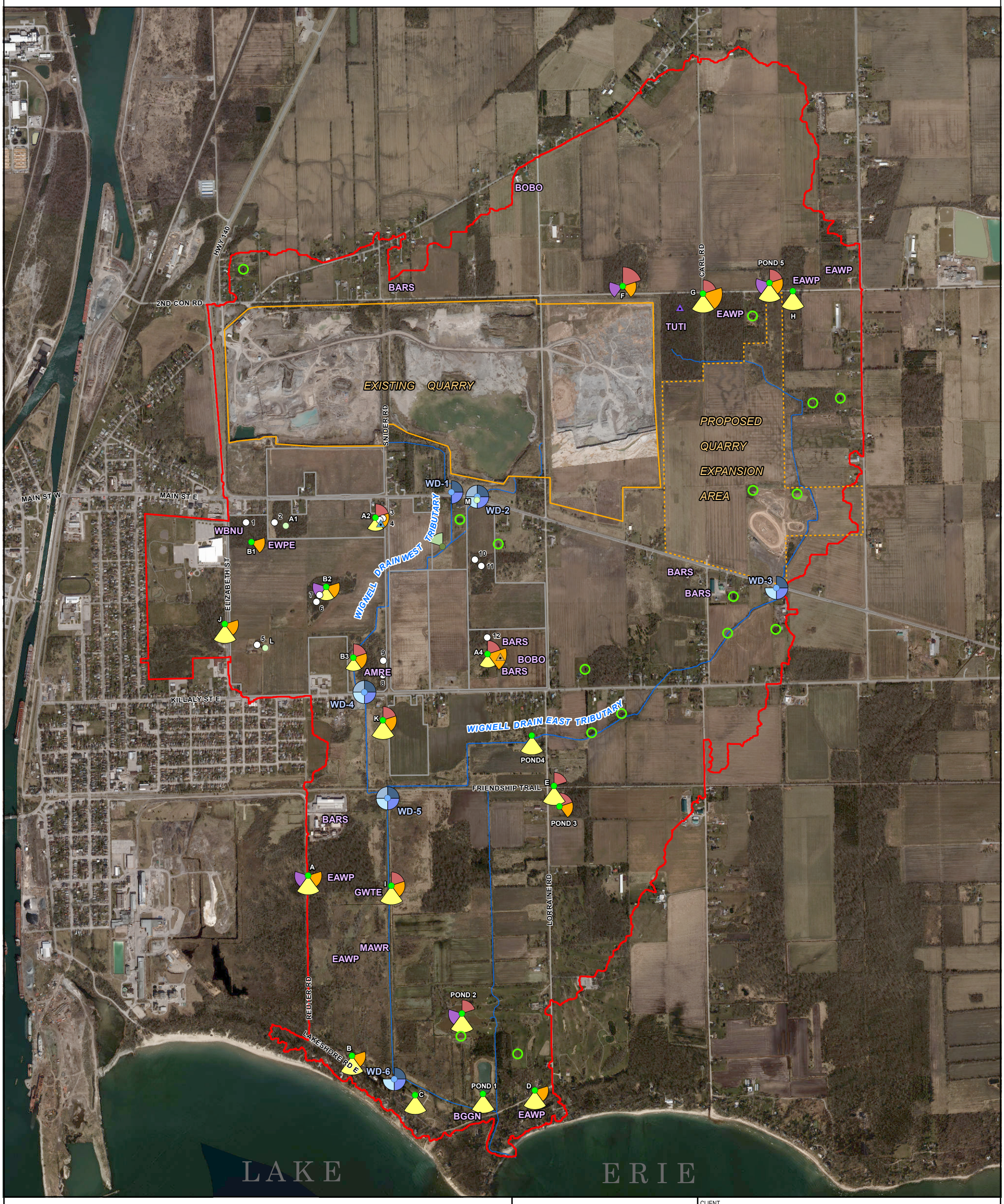
Significant Wildlife Habitat (SWH)

- Amphibian Breeding Habitat (Woodland)
- Other Rare Vegetation Communities
- Special Concern and Rare Wildlife Species

Other Features:

- Watercourse [1]
- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

1 - Contains data sourced from Land Information Ontario (LIO)

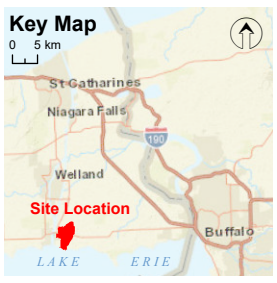


Breeding Bird Key:

Species At Risk
BARS: Barn Swallow
BOBO: Bobolink
EAWP: Eastern Wood-Pewee

Regional Interest Species
GWTE: Green-winged Teal
MAWR: Marsh Wren
TUTI: Tufted Titmouse

Forest Area-Sensitive Species
AMRE: American Redstart
BGGN: Blue-gray Gnatcatcher
WBNU: White-breasted Nuthatch



0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:20,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: KT
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2015) provided by South Western Orthophotography Project (SWOOP). Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Welland S - Wignell SWS

TITLE: **Select Wildlife Observations**

Palmer | PART OF SLR

REF. NO. 2007708-4-3

Figure 4

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

4.2.5 Breeding Amphibians

Five amphibian species were heard at the time of Palmer's 2022 calling surveys or incidentally: Spring Peeper (*Pseudacris crucifer*), Western Chorus Frog (*Pseudacris triseriata*), American Toad (*Anaxyrus americanus*), Northern Leopard Frog (*Lithobates pipiens*), and Green Frog (*Lithobates clamitans*). The latter two species were observed within the Subject Lands and are also expected to be present along the straightened southward portion of Wignell Drain.

Calling survey results are summarized in **Appendix G**. Additionally, some amphibian calls were heard during daytime surveys conducted by Palmer. On March 18, 2022, Palmer ecologists heard the calls of Northern Leopard Frogs (code: 2-2) and Western Chorus Frogs (code: 2-10) in wetland B2, and on the same date a chorus of Western Chorus Frogs in the A4 pond (**Figure 4**). Palmer ecologists incidentally heard Green Frogs (Code: 1-4) calling on May 31, 2022, and observed three Green Frog individuals, and egg masses, on June 22, 2022 within a small pond along the Wignell Drain within the Subject Lands (**Figure 4**).

Thus, calling amphibians were recorded in 22 locations (**Figure 4**). Generally, Spring Peepers were heard in choruses throughout the subwatershed area, whereas the remaining frog species were heard in smaller numbers. Higher concentrations of both frog species and numbers were recorded in larger, naturalized areas such as SWD3 (south of 2nd Concession Rd), Nickel Beach Marsh Wetland PSW, Pond 2, and Pond 5 (**Figure 4**).

4.2.6 Salamander Habitat Assessment

No salamanders (eggs or individuals) were noted within the Subject Lands during the 2022 field investigations. Additionally, no vernal pools were observed in any part of the Subject Lands on any occasion. Furthermore, no salamanders have been observed by Palmer to date within the Study Area.

4.2.7 Turtle Habitat Assessment

Only one observation of turtles was made during all of the site visits to the Subject Lands, or the remaining Study Area. Two Painted Turtles (*Chrysemys picta*) were observed in the Wignell Drain on June 9, 2023, just above the water control structure on Lakeshore Road East.

No high-quality turtle habitat was observed. That is, no sufficiently deep, open, standing water has been documented. The exceptions to this could be the Wignell Drain itself, which provides a small potential to be a movement corridor, and the pond in the A4 wetland (**Figure 2**). The latter; however, is very small and is a relatively isolated feature. Regarding nesting, turtles generally choose areas with loose substrates that are relatively close to suitable living habitat. The soils of the Subject Lands are mostly heavy clay-based soils and are therefore not considered loose. As such, no potential nesting habitat was noted within the subwatershed either.

At least one observation of Snapping Turtle (*Chelydra serpentina*) within the Study Area was recorded via iNaturalist (**Appendix E**).

4.2.8 Snakes

No evidence of snake activity was observed at any of the 12 snake board survey locations across the Subject Lands during the 2022 field investigations. Additionally, no snakes have been observed by Palmer to date within the Study Area. At least one observation of DeKay's Brownsnake (*Storeria dekayi*) was recorded via iNaturalist (**Appendix E**).

4.2.9 Roadside Mortality Observations

Minimal roadside mortality observations were made by Palmer staff during field investigations. One deceased raccoon (*Procyon lotor*) was observed along the south side of Lakeshore Road East at the water control structure.

4.2.10 Incidental Observations

The following incidental wildlife were identified in the Study Area through Palmer's background review (iNaturalist, **Appendix E**) or during Palmer's 2021, 2022, and 2023 field investigations (excluding amphibians and birds identified during breeding surveys):

Herptiles

- Painted Turtle – two individuals were observed on June 9, 2023, above the water control structure on Lakeshore Road East
- Snapping Turtle – iNaturalist
- Dekay's Brownsnake - iNaturalist

Mammals

- White-tailed Deer (*Odocoileus virginianus*) – tracks and adults observed (along Reuter Road)
- Red Squirrel (*Sciurus vulgaris*) – individuals heard calling
- Coyote (*Canis latrans*) – several individuals heard calling
- Eastern Grey Squirrel (*Sciurus carolinensis*) – black and grey individuals observed
- Northern Short-tailed Shrew (*Blarina brevicauda*) – nest observed under Snake Board #4
- Weasel (*Mustela sp*.) – along Friendship Trail on June 9, 2023
- Muskrat (*Ondatra zibethicus*) – in Wignell Drain, below Friendship Trail, on June 9, 2023
- Eastern Cottontail (*Sylvilagus floridanus*) – observed along Reuter Road
- Groundhog (*Marmota monax*) – iNaturalist

Insects

- Spicebush Swallowtail (*Papilio Troilus*) – Larvae on Spicebush in A4 wetland (northwest of Killaly Street East and Lorraine Road) on September 14, 2022
- Io Moth (*Automeris io*) - iNaturalist
- Cecropia Moth (*Hyalophora cecropia*) - iNaturalist
- Polyphemus Moth (*Antheraea polyphemus*) - iNaturalist
- Monarch (*Danaus plexippus*) - iNaturalist
- Banded Tussock Moth (*Halysidota tessellaris*) - iNaturalist
- Lesser Maple Spanworm Moth (*Macaria pustularia*) - iNaturalist
- Spongy Moth (*Lymantria dispar*) - iNaturalist
- Seven-spotted Lady Beetle (*Coccinella septempunctata*) - iNaturalist
- Black Firefly (*Lucidota atra*) - iNaturalist

- Small Engrailed (*Ectropis crepuscularia*) - iNaturalist
- Common Eastern Bumble Bee (*Bombus impatiens*) - iNaturalist
- Snowberry Clearwing (*Hemaris diffinis*) - iNaturalist
- Two-striped Grasshopper (*Melanoplus bivittatus*) - iNaturalist
- Question Mark (*Polygonia interrogationis*) - iNaturalist
- White-marked Tussock Moth (*Orgyia leucostigma*) - iNaturalist
- Red Admiral (*Vanessa atalanta*) - iNaturalist
- Hickory Tussock Moth (*Lophocampa caryae*) - iNaturalist
- Acadian Hairstreak (*Satyrium acadica*) - iNaturalist

4.3 Aquatic Observations

In general, all aquatic surveys (detailed in the following 4.3 subsections) were carried out at the six (6) sampling stations outlined on **Figure 2**. These sampling stations are detailed in Section 4.3.1 below. The positioning of the six stations provided a fulsome spatial review of the general aquatic habitat and water quality characteristics across the Wignell Drain Subwatershed Study Area and were either accessible by road rights-of-way or private access was granted (WD-6). Aquatic habitat quality is demonstrated in **Figure 5**.

4.3.1 Aquatic Habitat Survey

WD-1

The WD-1 station is located along the Main Street East corridor, approximately 340 m east of Snider Road. The station area is heavily influenced from historical road construction and drainage activities. From aerial image interpretation, the station area drains a landscape to the north, which is heavily altered from ongoing aggregate quarry activities. It is unknown to what degree the historical upstream drainage catchment was changed due to the construction of the upstream quarry pits. The WD-1 station comprises a portion of the western upstream branch of the Wignell Drain West Tributary (**Figure 2**).

Within the Study Area, the WD-1 channel enters the road right-of-way through dense vegetation (mostly *Phragmites* with interspersed cattails) before entering an existing corrugated steel pipe (CSP) culvert. Downstream of the Main Street East roadway, flow exits the culvert into dense vegetation and is then focused into a channel next to a private property. This portion of the channel appears to have localized bank hardening along the right bank. Riparian habitat is altered upstream and downstream of the culvert, with mowed ditch lines and manicured lawn that contain the occasional mature tree. The substrate within the road right-of way is mainly silts with occasional pea gravel and other introduced road materials. On both sides of the road the channel area includes graded road embankments meant to gather stormwater. Refuse and general debris were noted along the roadway. During most site visits this channel area was observed to be dry, with standing water present in the CSP culvert beneath the roadway. Overall, the presence of dense vegetation and lack of sustained flow likely precludes this reach of Wignell Drain as being considered fish habitat.

WD-2

The WD-2 station is located approximately 115 m to the east of WD-1, along the Main Street East road corridor. Like the WD-1 station, the WD-2 station represents an upstream extent of the Wignell Drain West Tributary, being the eastern upstream branch (**Figure 2**). Like the WD-1 channel, the WD-2 channel drains

an upstream landscape that is heavily altered by ongoing aggregate quarry activities. Following further review of aerial imagery, the WD-2 channel appears to be channelized upstream of the Main Street East roadway.

Within the road right-of-way, the WD-2 channel is primarily rock-lined with the presence of angular stone (i.e., rip-rap) upstream of the existing concrete box culvert. Downstream of the box culvert exists a long stagnant pool (approximately 0.3-0.4 m deep). Riparian vegetation consists mostly of *Phragmites*, with interspersed cattails. The WD-2 channel was found to be flowing during most site visits (>0.5 L/s). As outlined in Section 4.3.5. below, a single fish specimen (a Banded Killifish - *Fundulus diaphanus*) was captured during Palmer's spring benthic sampling. Combined with the relative permanency of flows observed during the 2022 and 2023 monitoring, it likely that the WD-2 channel provides direct fish habitat during most times of the year.

WD-3

The WD-3 station, located along the Main Street East road corridor, represents the Wignell Drain East Tributary, and is located approximately 1.6 km to the east of WD-2 (**Figure 2**). Using the Ontario Watershed Information Tool (OWIT; MNRF 2023), the WD-3 channel gathers drainage from an upstream catchment of approximately 264 ha (MNRF, 2023), extending north of 2nd Concession Road. Unlike other stations located along Main Street East, the WD-3 channel drains an upstream landscape that is predominantly agricultural, with interspersed woodland and wetland areas (refer to **Figure 3** for ELC units located east of open quarry areas).

Within the road right-of-way, the WD-3 is highly altered, as it traverses next to an existing parking lot upstream of Main Street East. Two manicured lawns were noted south of the roadway. Within the channel an abundance of fine sediments was observed. Several times during the 2023 monitoring year, the WD-3 channel was observed to contain turbid or cloudy flows, likely resulting from the upstream of agricultural lands. Instream vegetation consisted mostly of *Phragmites* (both upstream and downstream of the roadway), creating high channel roughness conditions. The feature itself resembles a constructed swale (i.e., a low-lying depressional feature), with gently sloped banks.

WD-4

The WD-4 channel area is located along the southern limit of the Subject Lands, along Killaly Street East, approximately 125 m west of Snider Road (**Figure 2**). The catchment area associated with the WD-4 station is comprised of agricultural lands, as well as lands influenced by ongoing quarry activities.

Like other upstream monitoring stations, the WD-4 channel exhibits high channel roughness; however, instream vegetation is predominantly composed of cattails species (*Typha* sp.). Channel substrates are predominantly silts with some sand and gravel likely deposited from the adjacent roadway. The feature itself resembles a swale with moderately sloped banks.

WD-5

The WD-5 channel area is located south of the Friendship Trail, immediately to the west of the Snider Road allowance (**Figure 2**). The WD-5 channel area is generally located downstream of the confluence between the Wignell Drain West Tributary and the Wignell Drain East Tributary. The WD-5 channel area drains an

upstream catchment that is predominantly composed of agricultural lands, with residential and industrial influences from residential subdivisions and active quarry activities respectively.
The habitat along the WD-5 station is highly altered and is consistent with large, constructed agricultural drains with uniform morphology and banks. Instream conditions generally consist of turbid, slow-flowing waters that eventually diffuse through dense vegetation approximately 35 m downstream of the Friendship Trail alignment. The watercourse here, like most sections of the Wignell Drain Subwatershed Study Area, contains instream vegetation, but little canopy cover, and thus is subject to thermal loading from direct sunlight. The riparian corridor consists of a thin, linear wetland community (ELC unit MAS/SA), flanked by wetland or cultural meadow areas (refer to **Figure 3**).

WD-6
The furthest downstream monitoring location in the Wignell Drain Subwatershed Study Area is station WD-6, located approximately 120 m north of Lakeshore Road East, at the end of the Snider Road cul-de-sac (next to Mount Saint Joseph Cemetery; see **Figure 2**). The monitoring station is located approximately 900 m upstream of the outlet into Lake Erie. Between the WD-6 station location and the Lake Erie outlet is a flow control structure, located immediately south of the Lakeshore Road East alignment.

The aquatic habitat at the WD-6 location is a relatively stagnant environment with some inflows noted at the upstream extent of the monitoring reach following rainfall activity. During the summer and fall seasons considerable instream vegetation is present, with high levels of algae also noted. The WD-6 channel area is highly altered and features a uniformed morphology and straightened alignment. The left bank of the channel is completely lined with large concrete blocks, likely to restrict any erosion along the private lands located at the northern extent of the Snider Road cul-de-sac. Visual water clarity was generally cloudy to turbid during most 2022 and 2023 site visits. From accessing the channel area during benthic invertebrate and fish community sampling visits, the substrate was found to consist of thick (up to 0.5 m) organic and silt materials. Unlike other monitoring stations located throughout the subwatershed, the riparian area did include some mature trees that provided shading to the channel area.

4.3.2 Surface Water Quality

Sample results from surface water quality sampling completed throughout the 2023 monitoring season, were compared to the Provincial Water Quality Objectives (PWQO), the standard guidelines for management of the province's water resources. If a reading is above this standard, it is considered an 'exceedance'. In general, the limits outlined in the PWQO standards are set to ensure that water quality is satisfactory for aquatic life and recreation, and that water uses which require more stringent water quality be protected on a site-specific basis. Comprehensive water quality sampling results for all parameters are provided in **Appendix H**.

From review of the surface water sample results, in the context of the PWQO limits, the following exceedances were identified:

pH
Lab-provided pH results indicated that three occurrences of pH levels that were outside of the PWQO-prescribed acceptable range of 6.5 to 8.5. The first occurrence registered a reading of 0.28 at station WD-4 during the July 6 visit. This is a highly acidic reading and is likely to be an artifact or error as no other downstream reading from the same sampling event registered a similar reading, and no subsequent

readings at this station replicated these extremely acidic conditions. Two other, separate occurrences (different locations and sample dates) registered pH levels outside of the PWQO-prescribed range; however, these were both measured between 6.4 and 6.5 and would be considered anomalous, and not the result of a chronic adverse effects from a particular source, as prior and subsequent samples did not replicate these readings. All remaining measurements of pH gathered during the 2023 monitoring period were within a range deemed acceptable by PWQO.

Copper

PWQO prescribes an upper limit threshold for copper in surface water at 0.005 mg/L. Several occurrences of copper levels in excess of the PWQO limit were recorded during the 2023 monitoring period. Elevated levels of copper were recorded throughout the Wignell Drain Subwatershed Study Area but were most commonly found to be elevated at station WD-3. Natural sources of copper in aquatic systems include geological deposits, volcanic activity, and weathering and erosion of rocks and soils. Anthropogenic sources of copper include mining activities, agricultural activities, metal and electrical manufacturing, sludge from wastewater treatment works, and pesticide use (EPA, 2023). As many of these anthropogenic sources, notably mining, agriculture, and metal manufacturing are present within the subwatershed, it is likely that man-made sources have led to an elevated presence of copper in the subwatershed's aquatic environments.

Iron

PWQO prescribes an upper limit threshold for iron in surface water at 0.3 mg/L. During the 2023 monitoring period, iron was registered at levels above the PWQO prescribed limit across the subwatershed on a frequent basis (refer to **Appendix H**). Iron was measured at its highest reading of 7.78 mg/L at station WD-3 during the September 27, 2023 sampling event and was commonly found above 1.0 mg/L at different monitoring locations on different sampling dates. The presence of iron in natural waters can be attributed to *the weathering of rocks and minerals, acidic mine water drainage, landfill leachates, sewage effluents, and iron-related industries* (Government of Canada, 2009).

Nickel

PWQO prescribes an upper limit threshold for nickel in surface water at 0.025 mg/L. During the 2023 monitoring period, nickel was registered above the PWQO-prescribed limit several times, most commonly at stations WD-3, WD-5, and WD-6 (refer to **Appendix H**). The highest instance of nickel was measured at 0.46 mg/L on August 16, 2023 at station WD-5. Many natural processes, including weathering of soil materials and bedrock, forest fires, and exudates from vegetation, release nickel into the environment (Environment Canada, 1994). Many anthropogenic sources; however, can also release nickel into the environment, most frequently through mining, smelting, and refining of base materials. Fossil fuel combustion is also a major contributor to the release of nickel into the natural environment (Environment Canada, 1994). As it relates to the Study Area, it is Palmer's understanding that nickel was historically refined at the Inco refinery (which was to the immediate west of the Study Area) for approximately 60 years, with operations ending in the 1980's (Mines and Communities, 2010). Nickel is understood to be an element that can persist in terrestrial and aquatic environments (Chau, 1995).

Zinc

PWQO prescribes an upper limit threshold for zinc in surface water at 0.03 mg/L. During the 2023 monitoring period, zinc was registered above the PWQO prescribed limit several times, almost exclusively

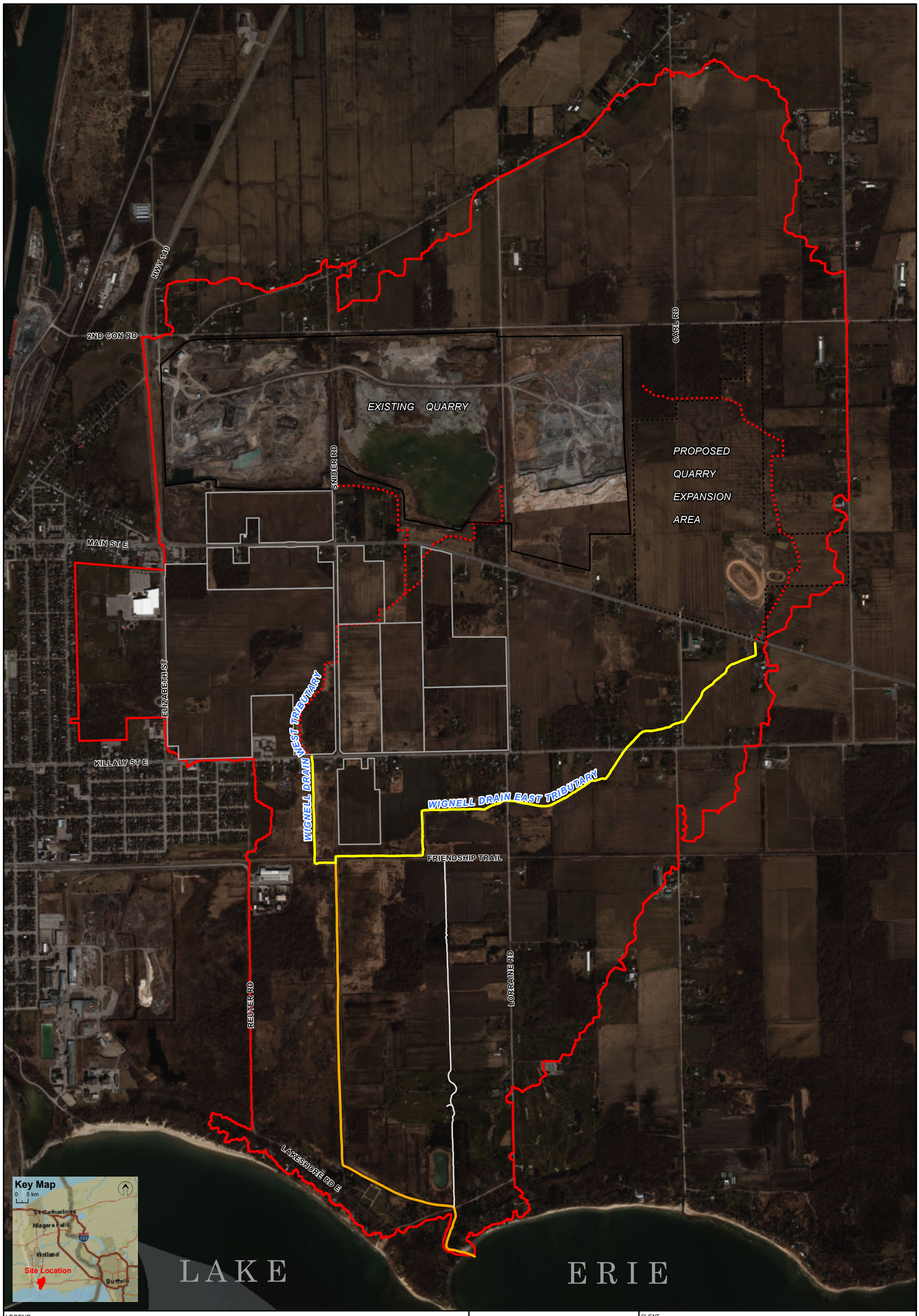
at station WD-1, and once at station WD-3 (refer to **Appendix H**). Zinc generally occurs in association with copper and lead and is commonly recovered near mining or milling operations (Canadian Council of Ministers of the Environment, 2018).

Nutrient Considerations – Phosphorus and Nitrogen

Outside of the pH and metal exceedances discussed above, all other parameters were found to be within prescribed PWQO limits. Despite this, PWQO does not assign specific upper threshold limits for all sampled water quality parameters, including phosphorus or nitrogen, the main parameters linked to excessive algae growth and associated decreases in other water quality metrics such as dissolved oxygen (NPCA, 2021).

PWQO does provide guidance on levels of phosphorus within lotic (i.e., flowing) and lentic (i.e., lakes) systems. To avoid excessive plant matter growth in rivers and streams, PWQO indicates that phosphorus levels should be maintained below 0.03 mg/L. As outlined in **Appendix H**, this limit is commonly exceeded throughout the Wignell Drain Subwatershed Study Area, and potentially high levels of phosphorus were visually evident as excessive algae growth was noted at various points, especially at station WD-6 in the southern extent of the Study Area.

PWQO does not provide specific guidance on acceptable levels of nitrogen.



LEGEND

Watercourse Habitat Assessment [1]

- permanent, Poor - *Very substancial pollution likely*
- Permanent, Fairly Poor - *Substantial pollution likely*
- Intermittent, Very Poor - *Severe organic pollution likely*
- Not Sampled due to property access restrictions

- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

1 - Contains data sourced from Land Information Ontario (LIO)

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:17,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: RC
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2020) provided by Brock University GIS services.
Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Wignell Drain Subwatershed Study

TITLE: **Flow Regime & Aquatic Habitat Quality**

Palmer PART OF SLR

REF. NO. 2007708-5-1

Figure 5

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

4.3.2.1 Continuous Water Temperature

As shown in **Appendix I**, the continuous water and air temperature results provide insight into general flow permanency where dry stream segments mirror air temperature fluctuations, and those with longer hydroperiods are buffered from diurnal temperatures fluctuations. The following summaries detail each monitoring stations water and air temperature results for the 2023 monitoring period.

WD-1

Water level records indicated minimal flow or standing water at the WD-1 monitoring station during most of the 2023 monitoring period. These observations are reflected within the continuous water temperature data where water temperature data generally mirrors air temperature data, and both are subject to the regular diurnal temperature increases during the day and decreases during evening and nighttime. Differences between air and water temperature appear similar even after significant rainfall events, likely indicating that either the WD-1 segment's upstream catchment does not capture much water, or the system conveys surface flows quickly and then quickly returns to low water level conditions.

During the summer months (July and August), daytime highs for water temperature regularly exceeded 25ºC, with several records exceeding 30ºC.

WD-2

From recorded water level data, it was noted that the WD-2 monitoring station stream segment contained flowing or standing water during most of the 2023 monitoring period. This is reflected in the continuous data, where water temperature swings are significantly smaller compared to the recorded changes in air temperature.

During the summer months, daily temperature peaks commonly exceed 25ºC, with very few exceeding 30ºC.

WD-3

Water levels within the WD-3 stream segment fluctuated significantly during the 2023 monitoring period, with dry conditions being noted often in June and early July, and again in late September. Several large increases in water level were noted from mid-July to early September, with most occurring after significant rainfall, or several smaller rainfall events. Due to the presence of water in mid-summer, the water temperature graph for WD-3 changes during the 2023 monitoring period with strong fluctuations in water and air temperature in early summer, and early fall, and relatively stable water temperatures in mid-summer.

Like monitoring station WD-2, the overall water temperatures during the summer months commonly exceed 25ºC, with very few records exceeding 30ºC.

WD-4

Water level data for monitoring station WD-4 indicated that at least minimal levels of flowing or standing water were present during most of the 2023 monitoring period. This is reflected in the overall temperature data, where water temperatures were more stable compared to the recorded air temperature data.

During the summer months, many daytime peak water temperatures were between 20 to 25ºC, with only one occurrence exceeding 30ºC.

WD-5

Water level data for monitoring station WD-5 indicated that moderate levels of flowing or standing water were present during most of the 2023 monitoring period. This is reflected in the overall temperature data, where water temperatures were considerably more stable compared to recorded air temperature data.

During the summer months, many daytime peak water temperatures were below 25ºC, with very few records exceeding 25ºC. No water temperature records for WD-5 exceeded 30ºC.

WD-6

Water level data for monitoring station WD-6 indicated that moderate levels of flowing or standing water were present during most of the 2023 monitoring period. This is reflected in the overall temperature data, where water temperatures were considerably more stable compared to the recorded air temperature data. Minimal water temperature fluctuations are noted during the summer months.

During the summer months, many daytime peak water temperatures stabilized slightly above 20ºC. No water temperature records for WD-6 exceeded 25ºC.

4.3.3 Surface Water Levels

Continuous water level data was recorded within the Wignell Subwatershed Study Area from mid-June until early November at the six monitoring stations. Graphs detailing water level information are included in **Appendix I**. Water levels were determined through compensation of water level pressure information, with air pressure information gathered at monitoring station WD-1. Water levels are referenced to elevation data collected using a mobile RTK unit and are expressed in metres above sea level (mASL). Water level data was also referenced alongside local rainfall data gathered from Environment Canada weather stations located in Port Colborne and Welland.

WD-1

Water level data recorded at the WD-1 monitoring station indicated a system that was commonly dry with no flowing or standing water present. From review of the recorded information, it appears that most increases in water level were preceded by significant rainfall or several smaller rainfall events.

WD-2

Water level data recorded at the WD-2 monitoring station reflected a stream segment that maintained a constant baseline water level (~0.1 m in depth), but also experienced consistent increases in water level to approximately 0.4 m in depth, regardless of the occurrence of precipitation events. This regular and consistent increase in water levels across the 2023 monitoring period is likely linked to regular upstream anthropogenic inputs (e.g. pumping inputs). Conversely, from review of the WD-2 data, occurrences of significant rainfall did not trigger a responding increase in water levels within the localized stream segment.

WD-3

Water level data recorded at the WD-3 monitoring station reflected a stream segment that was mostly dry during the 2023 monitoring period but had significant increases in stream flow following significant rainfall events. For increases in water level that were not preceded by significant rainfall (i.e., August 25, 2023), it is possible that other upstream surface water inputs may have been directed into the drainage network (e.g.

upstream pumping), or local rainfall events may have been isolated to the WD-3 upstream catchment and did not register on the local rainfall data being recorded in Port Colborne and Welland.

WD-4

Water level data recorded at the WD-4 monitoring station maintained a constant base water level (<0.05 m in depth), but also experienced consistent increases in water level of approximately 0.4 m of greater, regardless of the occurrence of precipitation events. This regular and consistent increase in water levels across the 2023 monitoring period is likely reflective of the upstream surface water inputs observed in flow data from the WD-2 monitoring station. However, unlike WD-2, increases in stream flow were also observed following significant rainfall events, reflecting the increases in stream flow observed from monitoring stations WD-1 and WD-3.

WD-5

Water level data recorded at the WD-5 monitoring station maintained a constant base water level (generally >0.1 m in depth). Water levels rose in response to significant rainfall events, but also exhibited 'peaks and valleys' within the data that reflected the regular increases that were observed upstream at monitoring station WD-2.

WD-6

Water levels data recorded at the WD-6 monitoring station maintained a constant base water level (approximately 0.7 m in depth on average). Water levels increased following significant rainfall events, but also exhibited some evidence of 'peaks and valleys' within the data that reflected the regular increases that were observed upstream at monitoring station WD-2. The 'peaks and valleys' observed at this station were more subtle relative to other upstream monitoring stations due to the deeper base water levels.

4.3.4 Fish Community Sampling

Fish community sampling was completed on September 27, 2023. Sampling was not completed at all stations, as some stations were found to be dry or containing excessive algae growth, which restricted the ability of to effectively sample the reach. Sampling stations that were found to be dry or containing excessive algae during one or more sampling events included stations WD-1, WD-2, WD-3, and WD-6. Fish were retrieved from stations WD-4 and WD-5 and are documented in **Table 5** below. All of these are identified as being native species to southern Ontario, except Goldfish (*Carassius auratus*) which was historically introduced from Asia and is considered invasive in Ontario (MNRF, 2022).

Fish were not captured from the WD-1, WD-2, or WD-3 stations, as outlined in **Table 5**. As outlined in the aquatic habitat survey observations detailed in Section 4.3.1, several factors including lack of baseflow and the presence of dense vegetation likely precluded fish access to these stations during fish community sampling.

Table 5: Fish Sampling Summary (September 27, 2023)

Scientific Name	Common Name	Tolerance	Thermal Preference	Stations					
				WD-1	WD-2	WD-3	WD-4	WD-5	WD-6
Fundulus diaphanus	Banded Killifish	Tolerant	Cool				3		

Scientific Name	Common Name	Tolerance	Thermal Preference	Stations					
				WD-1	WD-2	WD-3	WD-4	WD-5	WD-6
(*Ameiurus melas*)	Black Bullhead	Intermediate	Warm					1	
(*Amia calva*)	Bowfin	Intermediate	Warm					1	
(*Umbra limi*)	Central Mudminnow	Tolerant	Cool					10	
(*Carassius auratus*)	Goldfish	Tolerant	Warm					23	
(*Micropterus nigricans*)	Largemouth Bass	Tolerant	Warm					16	
(*Lepomis gibbosus*)	Pumpkinseed	Intermediate	Warm					16	

Three (3) specimens, identified as Banded Killifish (a member of the top minnow (*fundulidae*) family) following the field survey, were captured at station WD-4. As noted in Section 4.3.1 above, another Banded Killifish individual was incidentally captured during the spring benthic sampling event on June 14, 2023, at station WD-2.

As outlined in **Table 5** above, most fish were captured at station WD-5 during the 2023 fish sampling event. In addition to the various native species captured and listed above, twenty-three (23) specimens of invasive Goldfish were also captured at station WD-5.

Despite generally suitable aquatic conditions for fish habitat at station WD-6 (presence of deeper waters with instream cover), no fish were captured during the 2023 fish community sampling. The two main reasons why fish were not captured during 2023 was firstly the presence of abundant fine sediments, which when the stream segment was accessed by field staff was stirred up rendering the backpack electrofishing unit ineffective, the second was the abundant presence of in-stream algae which limited the ability to use seine nets and dip nets. The presence of abundant fine sediments within the bed of the WD-6 station segment also significantly limited field staff ability to move through the water limiting sampling capabilities.

Overall, the fish species captured throughout the Wignell Drain Subwatershed Study Area are those indicative of warmwater aquatic environments. All captured fish species are considered tolerant, or at least intermediately tolerant, to environmental perturbations and changes in water temperature and turbidity.

4.3.5 Benthic Invertebrates

The metrics calculated for the benthic invertebrates collected at each monitoring station are summarized below. Detailed benthic data is included for each monitoring station in **Appendix J**. It should be noted that benthic sampling was not completed at all stations due to dry conditions. Detailed information about each sampling station is provided below. Given that it is difficult to determine specific thresholds for the number, or percentage, of organisms for each metric that should be found in an unimpaired or impaired stream sample, sampled sites were compared to each other. The following measures were used in the tables below, to describe benthic invertebrate communities:

Taxa Richness: Indicates diversity of taxa. The number of taxa generally increases with habitat quality and water quality. Although Taxa Richness is a commonly referenced metric, it is considered a coarse indicator of stream health, and should be considered alongside other metrics to fully evaluate long-term water quality and habitat conditions.
% EPT: Percent composition of Ephemeroptera, Plecoptera, and Trichoptera (EPT). Reflects the composition of the benthic community within Families that are considered to be sensitive to water quality (i.e., a higher percentage indicates more sensitive species).

Simpson's Diversity and Equitability: The Simpson's Diversity index and equitability are related to the proportion of total organisms contributed by each taxon. Diversity and evenness are low when the benthic community is dominated by a few taxa, and higher when the number of organisms is more evenly distributed across numerous taxa. High diversity and low equitability indicate better environmental conditions, while the opposite can indicate stresses on the system.

$$D = 1 - \left(\frac{\Sigma\, n(n-1)}{N(N-1)} \right)$$

n = the total number of organisms of a particular species
N = the total number of organisms of all species

Hilsenhoff's Family Biotic Index: The Hilsenhoff's Family Biotic Index (HBI) uses the pollution tolerances of organisms to determine the level of stream impairment. For pollution, HBI generally considers organic pollution from anthropogenic sources such as wastewater, or agricultural sources such as fertilizer, and other organic herbicides, pesticides, and insecticides. Each organism is assigned a tolerance value of 0 to 10, with a value of 0 indicating that the organism has a very low tolerance to pollution and a value of 10 indicating that the organism has a very high tolerance to pollution. The index is calculated using the following formula:

$$\mathrm{HBI} = \Sigma(x_i)(t_i)\ /n$$

Where x_i is the number of organisms in the i^{th} taxon, t_i is the tolerance value of the i^{th} taxon, and n is the total number of organisms in the sample. Interpretation of the HBI Value is as shown in **Table 6**.

Table 6: Hilsenhoff's Family Biotic Index

Family Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.75	Excellent	Organic pollution unlikely
3.76-4.25	Very Good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probably
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly Poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.00	Very Poor	Severe organic pollution likely

There are known differences in the way the indices respond to human disturbance/habitat degradation (Jones C. C., 2007). For Taxa Richness, % EPT, and the Simpson's Diversity Index, a larger value implies a healthy biological community, and low values imply reduced health (Jones C. C., 2007). For HBI, a lower value implies a healthier community (Jones C. C., 2007); however, there is no "target value" since there are no reference stations in this SWS. Consequently, it can only be determined which monitoring stations have higher or lower values.

Tables 7 & **8** provide the spring and fall 2023 benthic invertebrate analysis results within the Wignell Drain Subwatershed Study Area. It should be noted that no benthic invertebrate sampling was carried out at station WD-1 during either sampling event as no water was present in the channel area. Station WD-3 was not sampled during the fall event, as the station area was found to be dry.

Table 7: Benthic Invertebrate Monitoring Results – Spring 2023

Metric	WD-2	WD-3	WD-4	WD-5	WD-6
Total Number of Organisms	868	1098	347	251	511
Taxa Richness	8	8	7	14	11
%EPT	0.00	0.00	0.00	0.01	0.01
Simpson Diversity Index	0.21	0.12	0.61	0.69	0.50
HBI	7.68	7.95	7.31	6.78	6.64

Table 8: Benthic Invertebrate Monitoring Results – Fall 2023

Metric	WD-2	WD-3	WD-4	WD-5	WD-6
Total Number of Organisms	345	N/A	380	325	95
Taxa Richness	7	N/A	5	10	8
%EPT	0	N/A	0	0.36	0.07
Simpson Diversity Index	0.49	N/A	0.75	0.72	0.58
HBI	7.33	N/A	6.85	6.29	6.26

WD-2

Overall, the analytical results for station WD-2 represents an aquatic system that is in very poor condition. Taxa richness was found to be generally low compared to other monitoring stations results, with no EPT taxa being identified in the spring or fall. In terms of diversity station WD-2 scores relatively low, with a benthic community that is dominated by a few taxa. The HBI score for the system was measured at 7.68 in the spring and 7.33 in the fall, representing a benthic community composed of mostly pollution-tolerant invertebrates. This suggests the presence of severe organic pollution.

WD-3

Overall, the analytical results for station WD-3 represents an aquatic system that in very poor condition. The analytical results reflect springtime sampling conditions only. Like WD-2, taxa richness was found to be generally low compared to other monitoring stations results, with no EPT taxa being identified in the spring. Station WD-3 presented the lowest diversity score of 0.12, highlighting the highest total number of organisms, while representing a very small number of taxa. The HBI score was the highest of any sampled

area within the Wignell Drain Subwatershed Study Area, indicating a strong likelihood of severe organic pollution.

WD-4

Overall, the analytical results for station WD-4 represents an aquatic system that is in very poor condition. Taxa richness was found to be the lowest compared to other monitoring stations results, with no EPT taxa being identified during the spring or the fall. Despite a lack of taxa richness and EPT, overall diversity at WD-4 was identified as being amongst the highest of all monitoring stations. In general, this indicates that although there was a low number of total taxa, the individual species of one taxon did not dominate the proportion of total organisms, with isopods (i.e., sow bugs), mollusks (i.e., pelecypoda), and amphipoda (i.e., scuds) representing a significant share of the total organisms. Habitat quality was identified as being poor to very poor, with spring HBI values being measured worse than the fall values.

WD-5

The analytical results for station WD-5 represent a benthic community that, relative to other monitoring stations, is somewhat healthy, but overall is representative of a fairly poor system when compared to the standard benthic metrics. Taxa richness was measured at its highest during both the spring and fall sampling events at station WD-5. The percentage of the benthic invertebrate community representing EPT species was measured at 1% during the spring, and up to 36% during the fall, with high numbers of *Ephemeroptera* (i.e., Mayfly) being counted. Diversity levels were also measured highest at station WD-5, registering some of the lowest HBI (besides station WD-6). This is representative of more sensitive, pollution-intolerant benthic invertebrate communities within the Wignell Drain Subwatershed Study Area.

WD-6

Overall, the analytical results for station WD-6 are representative of an aquatic system that is in poor condition. Relative to other stations, station WD-6 registered the second highest taxa richness values during both the spring and fall sampling events, only trailing values measured at station WD-5. Furthermore, station WD-6 was the only other station besides WD-5 to register counts for EPT with 1% of documented species being identified as EPT during the spring event and 7% during the fall event. Like station WD-5, EPT species counts were represented solely by *Ephemeroptera*. Diversity values at WD-6 registered lower than the WD-4 and WD-5 stations during both the spring and fall sampling events. Station WD-6 registered the lowest HBI values for any station within the Wignell Drain Subwatershed Study Area, reflecting a relatively sensitive benthic invertebrate community; however, still falling within the Fairly Poor to Poor categories.

4.4 Landscape Connectivity/Linkage Analysis

Landscape connectivity is a concept that considers the degree of connectedness of natural features and habitats when a landscape has been subject to some degree of human development. This is especially relevant to southern Ontario, south of the Canadian Shield, where most land has been altered through agricultural practices or the construction of manmade structures (including roads). A highly connected landscape is one where there is generally a higher percentage of natural cover, and which has numerous natural corridors (such as river valleys) that link larger natural areas together. Highly connected landscapes enable higher biodiversity and higher genetic diversity due to the increased species mobility, while also enabling the movement of plants (by seeds) more readily. On the contrary, landscapes with low connectivity result in lower biodiversity and genetic diversity. It is worth remembering that the science of landscape

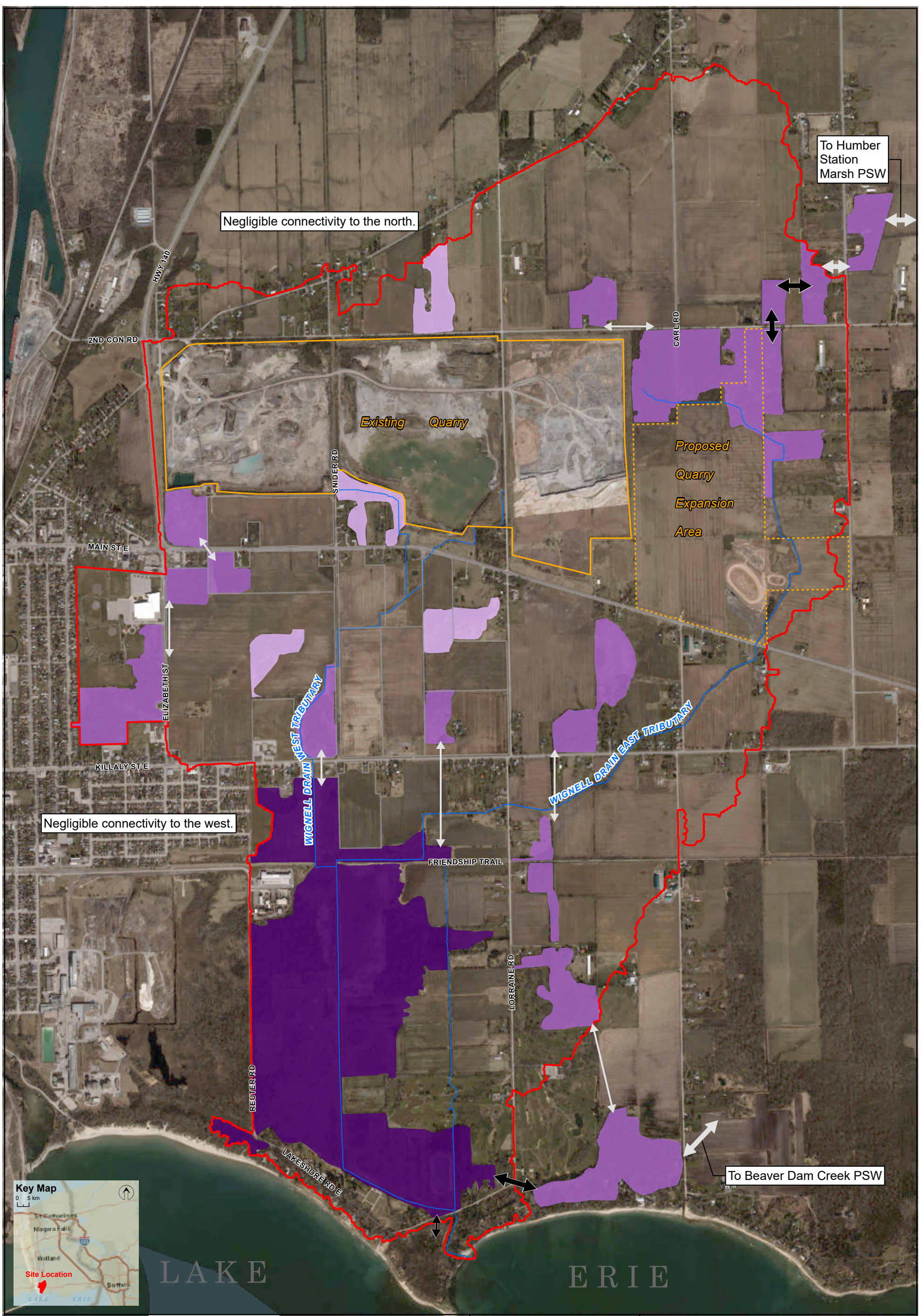
connectivity is somewhat imprecise, and it is not always clear which species use or require corridors, and under which circumstances.

Within the Wignell Drain Subwatershed Study Area, there are small to mid-sized wetlands and woodlands, as described throughout this report, as well as the larger Nickel Beach Marsh Wetland PSW in the southern region of the subwatershed. Watercourses are mainly straightened and there are no river valleys. The main natural areas and their existing connections are shown in **Figure 6.**

To the west of the Wignell Drain Subwatershed Study Area is the developed City of Port Colborne, and to the north and east there are primarily agricultural lands interspersed with some natural habitats consisting of wetlands and woodlands. Larger areas of natural or semi-natural areas outside the Study Area are Beaver Dam Creek Wetland PSW (about 2 km to the southeast) and Humberstone Muck Basin Swamp Forest Provincial Life Science Area of Natural and Scientific Interest / Humberstone Marsh PSW (about 3.5 km to the northeast).

There are relatively few natural connections either between the small and mid-sized natural features onsite or the larger features listed above. Thus, the natural features within the Wignell Drain Subwatershed Study Area are considered to have low / weak connectivity in a landscape context. Some connections between natural areas that are preferred (shorter distances or with semi-natural habitat) are shown as Moderate (black arrows on **Figure 7**). Other connections are shown as Weak (off white arrows on **Figure 6**). There are no strong connections in the current landscape (e.g., a wide and naturally linear feature (like a valley) connecting two natural areas). Wider arrows within **Figure 6** are those connections which are seen as being potentially more significant because of how they connect large natural areas. Linkages and connectivity are further discussed in Section 10.2.1 below.

Most of the wildlife present can readily cross agricultural fields and are also able to make their way through residential environments (e.g., Northern Raccoon, Striped Skunk, Grey Squirrel, etc.). Breeding birds can for the most part fly across non-connected landscapes. Improved landscape connectivity in this case has the potential to have the largest impact on the movement of smaller organisms such as insects, herptiles, and plants.



LEGEND

- Watercourse [1]
- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

Linkage (Current Connectivity, Relative Importance)

- Moderate, Less
- Moderate, More
- Weak, Less
- Weak, More

Natural Areas

- Isolated
- Mid-sized
- Large

1 - Contains data sourced from both Niagara Peninsula Conservation Authority (NPCA) and Land Information Ontario (LIO)

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:17,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: RC
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2019) provided by ESRI basemapping. Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Welland S - Wignell SWS

TITLE: **Ecological Landscape Level Connectivity**

Palmer | PART OF SLR

REF. NO. 2007708-6-1

Figure 6

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

5. Natural Heritage Feature Analysis & Assessment of Significance

Based on the assessment of significance that is included below and the natural heritage feature delineation process that was confirmed through the TOR process with the Niagara Region, the City of Port Colborne, and the NPCA, natural heritage features (including new wildlife corridor/linkages) were identified and mapped for the Wignell Drain Subwatershed Study Area. **Figures 7** and **8** indicate features that were either designated (through the EIS or SWS process on the Subject Lands) or identified through this subwatershed study. Woodlands, wetlands, and watercourses were identified within the Study Area. No valleylands have been documented to date from roadside surveys or lands where landowners have provided access.

5.1 Woodlands

Table 9 provides an assessment of the woodlands within the Wignell Drain Subwatershed Study Area, indicating which woodland meets Regional or City criteria for significance. Based on this assessment, there are 14 Significant Woodlands in the subwatershed in addition to the five Significant Woodlands identified on the Subject Lands, totaling 19 Significant Woodlands overall (**Table 9**, **Figure 7**). Subject Land woodlands, which were identified and delineated on-the-ground, are labelled A and B, while those identified through the subwatershed process are labelled C woodlands. Additional details of the five Significant Woodlands identified through the Subject Lands EIS, can be found in **Appendix C.**

Three additional woodlands have been identified as *Potential Significant Woodlands* on **Figure 7.** These *Potential Significant Woodlands* have been treated as Significant Woodlands until field verification can be completed. It should be noted that a preliminary designation is associated with this assessment of woodland significance as at the subwatershed level many of these woodlands were either not accessible (i.e., on privately-owned lands where access was not permitted) or only observable from roadways / trails (did not allow for interior habitat to be examined). Site-specific, or EIS-level, surveys would need to be conducted to confirm woodland significance within individual properties at the time of proposed development.

The definition of a woodland and the criteria for woodland significance, both at the Regional and Municipal level, are described below.

Niagara Region

According to Table 4-1 of the Regional OP's Schedule L (Natural Environment System: Components, Definitions, & Criteria), Significant Woodlands *must meet the definition of ELC forest and meet one or more of the following criteria:*

1) *2 ha or greater in size*
2) *1 ha or greater in size meeting at least one of the following criteria:*
    a. *Naturally occurring (i.e., not planted) trees (as defined in the species list of Appendix D in the Greenbelt Technical Paper)*
    b. *Treed areas planted with the intention of restoring woodland*
    c. *10 or more trees per ha greater than 100 years old or 50 cm or more in diameter*
    d. *Wholly or partially within 30 m of a provincially significant wetland or habitat of an endangered or threatened species*

e. *Overlapping or abutting one or more of the following features:*
    i. *Permanent streams or intermittent streams*
    ii. *Fish habitat*
    iii. *Significant valleylands*

3) *0.5 ha or greater in size meeting at least one of the following criteria:*
    a. *A provincially rare, treed vegetation community with an S1, S2 or S3 in its ranking by the MNRF's N.H.I.C.*
    b. *Habitat of a woodland plant species with an S1, S2 or S3 in its ranking or an 8, 9, or 10 in its Southern Ontario Coefficient of Conservatism by the NHIC, consisting of 10 or more individual stems or 100 or more sqm of leaf coverage.*
    c. *Any woodland overlapping or abutting one or more of the following features:*
        i. *Significant wildlife habitat*
        ii. *Habitat of threatened species and endangered species*
        iii. *Non-Provincially Significant Wetlands*

4) *Any size overlapping or abutting one or more of the following features:*
    a. *Provincially significant wetland*
    b. *Life Science area of natural and scientific interest*

Other Woodlands:

According to Table 4-1 of the OP's Schedule L (Natural Environment System: Components, Definitions, & Criteria), Other Woodlands are *a terrestrial treed area must have ≥ 25% tree cover and meet one or more of the following criteria:*

1) *an average minimum width of 40 m and is ≥0.3 ha, measured to crown edges; or*
2) *any size abutting a significant woodland, wetland, or permanent stream.*

Treed areas that "abut" a significant woodland, wetland or permanent stream are considered adjacent when located within 20 m of each other. Other woodlands are identified based on the Ecological Land Classification (ELC) methodology.

City of Port Colborne
The City's OP defines 'woodland' as the following:

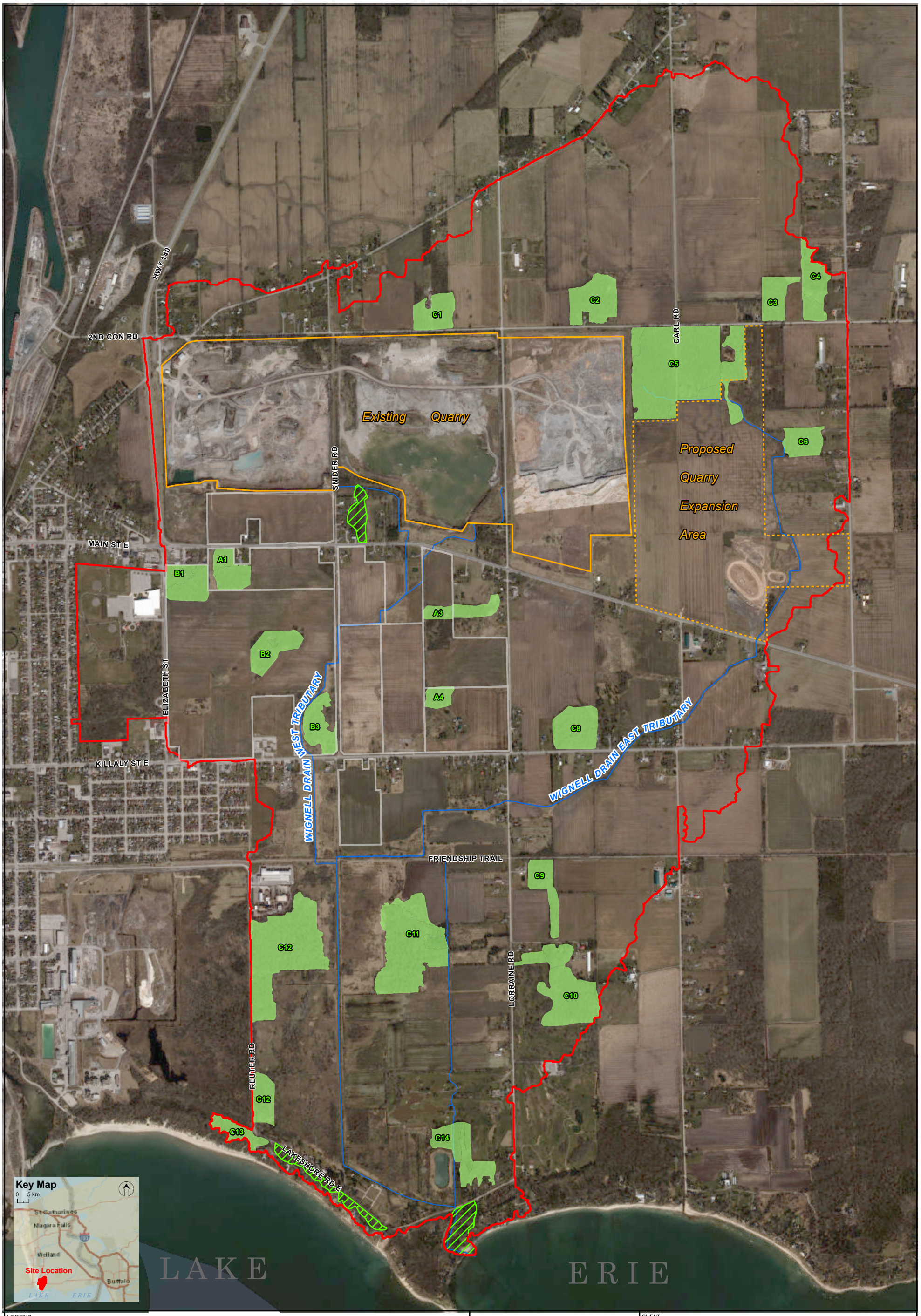
Treed areas that provide environmental and economic benefits to both the private landowner and the general public, such as erosion prevention, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include treed areas, woodlots or forested areas and vary in their level of significance at the local, regional, and provincial levels. They do not include cultivated fruit or nut orchards or plantations used for the purpose of producing Christmas trees.

The City's OP Section 4.3.5.1 b) defines 'significant woodlands' as the following:

…treed areas, woodlots or forest areas that provide environmental and economic benefits to private landowners and the public that vary in levels of significance. To be classified as significant, a woodland must:

- *Contain a threatened or endangered species or species of concern,*
- *Be equal or greater than 2 hectares in size,*

- *Overlap or contain one or more significant natural heritage features or abut or be crossed by a water body greater than 2 hectares in area.*



LEGEND

- Watercourse [1]
- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

Significant_Woodland

- Potential Significant Woodland
- Significant Woodland

1 - Contains data sourced from Land Information Ontario (LIO)

Note: Outside of the Subject Lands, all anthropogenic areas (buildings, gardens, hedges), all agricultural fields, and most cultural communities (e.g. thickets, small CUW) not mapped.

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:17,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: RC
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2019) provided by ESRI basemapping. Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Welland S - Wignell SWS

TITLE: **Significant Woodlands**

Palmer | PART OF SLR

REF. NO. 2007708-7-2

Figure 7

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

Table 9: Significant Woodland Assessment

Natural Feature Code	ELC	Size (ha)	Region Significant Woodland Policies	City Significant Woodland Policies
A4	Fresh – Moist Oak – Maple – Hickory Deciduous Forest (Oak Dominant) (FOD9a)	1.3	Meets Criteria: Woodland is > 1 ha and of 'naturally occurring' mid-late successional trees	Does not meet Criteria Mapped as Environmental Conservation Area
A1 + B1 (included together since only 20 m apart in one location)	Fresh – Moist Oak – Maple – Hickory Deciduous Forest (Oak Dominant) (FOD9) / Silver Maple Mineral Deciduous Swamp (SWD3-2) / Grey Dogwood Mineral Thicket Swamp (SWT2-9)	3.5 + 2.9 = 6.4	Meets Criteria: • Woodland is > 2 ha • Woodland is > 1 ha and of 'naturally occurring' mid-late successional trees • Woodland is > 0.5 ha and overlapping with Non-Provincially Significant Wetland	Meets Criteria: • Woodland is > 2 ha Mapped as Environmental Conservation Area
A3	Dry – Fresh Oak – Maple – Hickory Deciduous Forest (FOD2)	2.2 (including off-site area)	Meets Criteria: • Woodland is > 2 ha • Woodland > 1 ha and of 'naturally occurring' mid-late successional trees	Meets Criteria: • Woodland is > 2 ha Mapped as Environmental Conservation Area
B2	Dry - Fresh Deciduous Forest (FOD4)	3.1	Meets Criteria: • Woodland is > 2 ha • Woodland is > 1 ha and of 'naturally occurring' mid-late successional trees had a lower tree canopy cover and was excluded from woodland by Region	Meets Criteria: • Woodland is > 2 ha Mapped as Environmental Conservation Area

Natural Feature Code	ELC	Size (ha)	Region Significant Woodland Policies	City Significant Woodland Policies
B3	Deciduous Swamp (SWD)	3.1	Meets Criteria: • Woodland is > 2 ha • Woodland is > 1 ha and abutting a permanent/intermittent watercourse	Meets Criteria: • Woodland is > 2 ha Mapped as Environmental Protection Area due to being Hazard Lands
C1	FOD9: Fresh – Moist Oak – Maple – Hickory Deciduous Forest	2.99	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.
C2	SWD3: Maple Deciduous Swamp	4.45	Meets Criteria: • Woodland is > 2 ha • Overlapping with Non-Provincially Significant Wetlands May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Significant Natural Feature May meet additional *Significant Woodland* criteria.
C3	SWD/FOD9: Deciduous Swamp / Fresh – Moist Oak – Maple – Hickory Deciduous Forest	2.64	Meets Criteria: • Woodland is > 2 ha • Overlapping with Non-Provincially Significant Wetlands May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Significant Natural Feature May meet additional *Significant Woodland* criteria.
C4	CUW/CUP: Cultural Woodland / Cultural Plantation; FOD9: Deciduous Swamp /	3.82	Meets Criteria: • Woodland is > 2 ha	Meets Criteria: • Woodland is > 2 ha

Natural Feature Code	ELC	Size (ha)	Region Significant Woodland Policies	City Significant Woodland Policies
	Fresh – Moist Oak – Maple – Hickory Deciduous Forest		May meet additional *Significant Woodland* criteria.	May meet additional *Significant Woodland* criteria.
C5	SWD3: Maple Deciduous Swamp; FOD: Deciduous Forest; CUW/FOD: Cultural Woodland / Deciduous Forest	19.71	Meets Criteria: • Woodland is > 2 ha • Overlapping with Non-Provincially Significant Wetlands May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Significant Natural Feature May meet additional *Significant Woodland* criteria.
C6	FOD: Deciduous Forest	2.52	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.
C7	SWD1: Oak Mineral Deciduous Swamp; FOD9: Fresh – Moist Oak – Maple – Hickory Deciduous Forest	2.68	Meets Criteria: • Woodland is > 2 ha • Overlapping with Non-Provincially Significant Wetlands May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Significant Natural Feature May meet additional *Significant Woodland* criteria.
C8	FOD9: Fresh – Moist Oak – Maple – Hickory Deciduous Forest	4.13	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.
C9	SWD: Deciduous Swamp; FOM: Mixed Forest	2.75	Meets Criteria: • Woodland is > 2 ha	Meets Criteria: • Woodland is > 2 ha

Natural Feature Code	ELC	Size (ha)	Region Significant Woodland Policies	City Significant Woodland Policies
			• Overlapping with a Provincially Significant Wetland May meet additional *Significant Woodland* criteria.	• Overlapping with a Significant Natural Feature May meet additional *Significant Woodland* criteria.
C10	FOD: Deciduous Forest; FOM: Mixed Forest	8.11	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha May meet additional *Significant Woodland* criteria.
C11	FOD: Deciduous Forest; SWD: Deciduous Swamp	11.3	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Provincially Significant Wetland May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Significant Natural Feature May meet additional *Significant Woodland* criteria.
C12	SWD: Deciduous Swamp	12.74	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Provincially Significant Wetland May meet additional *Significant Woodland* criteria.	Meets Criteria: • Woodland is > 2 ha • Overlapping with a Significant Natural Feature May meet additional *Significant Woodland* criteria.
C13	FOD: Dry – Fresh Oak – Maple – Hickory Deciduous Forest; SWD: Deciduous Swamp	> 4	Meets Criteria: • Woodland is > 2 ha • Overlapping/abutting with a Provincially Significant Wetland	Meets Criteria: • Woodland is > 2 ha • Overlapping/abutting with a Significant Natural Feature

Natural Feature Code	ELC	Size (ha)	Region Significant Woodland Policies	City Significant Woodland Policies
			May meet additional *Significant Woodland* criteria.	May meet additional *Significant Woodland* criteria.
C14	FO/CUP: Forest / Cultural Plantation; CUP3: Pine Plantation; wetland	5.33	Meets Criteria: ● Woodland is > 2 ha May meet additional *Significant Woodland* criteria.	Meets Criteria: ● Woodland is > 2 ha May meet additional *Significant Woodland* criteria.

Potential Significant Woodlands

It should be noted that additional potentially Significant Woodlands may be present within the Wignell Drain Subwatershed Study Area but were unable to be site-verified through field work and assessed as part of this subwatershed study (**Figure 8**). For example, a vegetation community at the northeastern corner of Elizabeth Street and Main Street East was mapped as Significant Woodland on the City's OP Schedule B2; however, Palmer was unable to verify whether the community met the criteria for Significant Woodland. Other, similar scenarios may exist within the subwatershed landscape. Future site-specific surveys completed through an EIS will be required to determine whether these woodlands meet the necessary criteria to qualify as significant.

5.2 Wetlands

There are four types of wetlands identified in the Wignell Drain Subwatershed Study Area:

- Provincially Significant Wetlands (PSWs) – evaluated
- Evaluated Non-Provincially Significant Wetlands – evaluated
- Unevaluated wetlands - identified or confirmed by Palmer during field investigations, and
- Potential wetlands - assumed wetlands based on aerial imagery but could not be confirmed through field investigations

The abovementioned wetlands are mapped in **Figure 8**. Five wetlands were identified and assessed within the Subject Lands and are included in **Table 10**. Potential wetlands are mapped in **Figure 8** but are not included in **Table 10**. The policies regarding wetland protection are given below.

Provincially significant wetlands are protected under the Provincial Policy Statement.

The Region states in Section 3.1.9.5.4 of its OP:

> *When development or site alteration is proposed in or adjacent to any watercourse, provincially significant wetland, significant valleyland, or other wetland the applicant shall contact the Conservation Authority, at which time Conservation Authority staff will advise the applicant and the Region of the land use or regulatory policies that will apply.*

The Region generally defers to the NPCA for the protection of unevaluated and non-provincially significant wetlands.

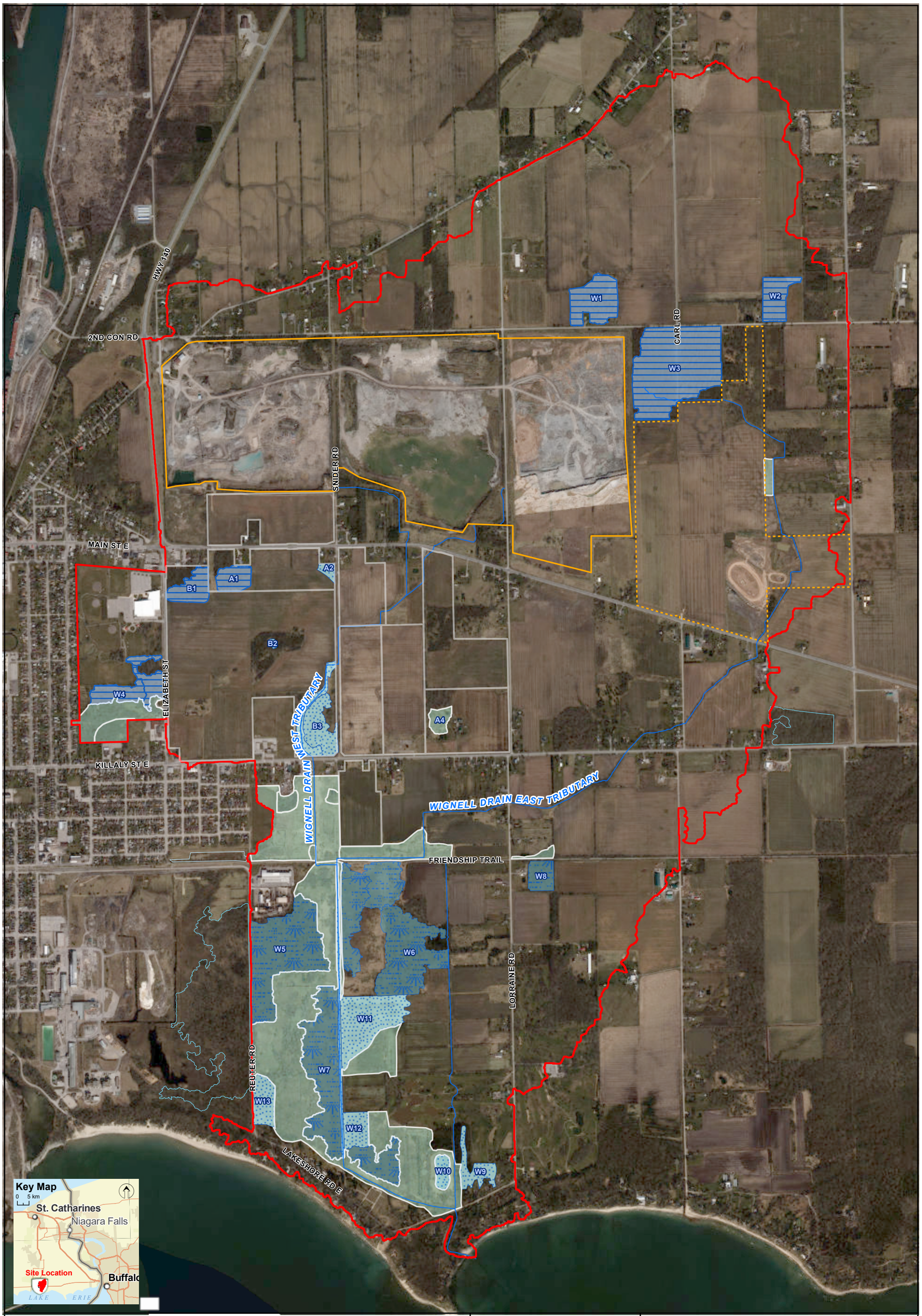
The City of Port Colborne '*promotes the protection and/or conservation and where appropriate, the restoration and enhancement of Natural Heritage Features (including wetlands) within and adjacent to its boundaries*' and its OP Section 4.1.1 policies state that:

> *Development should maintain, enhance, or restore ecosystem health and integrity. First priority is to be given to avoiding negative environmental impacts. If negative impacts cannot be avoided, mitigation measures will be required*.

The NPCA document. *Policies for Planning and Development in the Watersheds of the NPCA* (NPCA, 2022), states in Section 8.2.2.1 that "*unless otherwise stated in this Document, no development and/or site alteration shall be permitted within a wetland.*"

Based on the aforementioned policies and onsite discussions with the Niagara Region and the NPCA during field investigations on the Subject Lands, all other wetlands including non-provincially significant wetlands are protected primarily under the City and NPCA's jurisdiction.

An assessment of the basic characteristics of the wetlands (PSWs, evaluated (other) wetlands (non-provincially significant), unevaluated wetlands (identified by Palmer)) within the Wignell Drain Subwatershed Study Area is provided below in **Table 10** and on **Figure 8**.



LEGEND

- Watercourse [1]

Wetland

- Significant Wetland
- Evaluated - Other
- Unevaluated Wetland
- Potential Wetland
- Existing Quarry Footprint
- Proposed Quarry Expansion Lands
- Subject Lands (Owned by Elite Developments)
- Study Area

1 - Contains data sourced from both Niagara Peninsula Conservation Authority (NPCA) and Land Information Ontario (LIO)

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:17,000
Page Size: Tabloid (11 x 17 inches)

Drawn: SM
Checked: RC
Date: Apr 25, 2024

NORTH

Source Notes:
Imagery (2019) provided by ESRI basemapping. Contains information licensed under the Open Government Licence – Ontario.

CLIENT: Elite M.D. Developments

PROJECT: Welland S - Wignell SWS

TITLE: **Subwatershed Wetlands**

Palmer | PART OF SLR

REF. NO. 2007708-8-1

Figure 8

Document Path: G:\Shared drives\Projects 2020 (20044 to 20087)\20077 - Elite M.D. Developments\2007708 - Welland S - Wignell SWS\GIS\1_Workspace\Task 3 - Ecology Figures\(2023-03) Subwatershed Study\ArcPro Space\ArcPro Space.aprx

Table 10: Wetland Characteristics and Delineation

Natural Feature Code	Wetland Feature	Size (ha)	Delineation Method
A1 + B1 wetlands + marsh in between	Contiguous: Silver Maple Mineral Deciduous Swamp (SWD3-2) + Gray Dogwood Mineral Thicket Swamp + Reed Canary Grass Mineral Meadow Marsh (MAM2-2a)	4.8	Used existing mapping of Evaluated Non-Provincially Significant Wetlands, plus added meadow marsh situated in between.
A2	Southern Arrow-wood Mineral Thicket Swamp (SWT2-11)	0.5	Wetland staked by the NPCA with Region, and Palmer on September 14, 2022 (is also a SWH)
B3	Poplar Deciduous Swamp (SWD) + Reed Canary Grass Mineral Meadow Marsh (MAM2-2b)	5.0	Wetland partly staked by the NPCA with Region and Palmer on September 14, 2022 and remaining delineation discussed and agreed upon with Palmer, NPCA and Region using field observations and air photography
Within B2	Mineral Thicket Swamp and Mineral Meadow Marsh (SWT/MAM)	0.1	Palmer delineated using air photos (is situated wholly within a woodland feature)
A4 wetland	Mineral Thicket Swamp (SWT2) (including pond)	1.1	Delineation discussed and agreed upon with Palmer, NPCA and Region using field observations and air photography.
W1	SWD3: Maple Deciduous Swamp	4.5	Used existing mapping of Evaluated Non-Provincially Significant Wetlands.
W2	SWD/FOD9: Deciduous Swamp / Fresh – Moist Oak –Maple – Hickory Deciduous Forest	2.6	Used existing mapping of Evaluated Non-Provincially Significant Wetlands.
W3	SWD3: Maple Deciduous Swamp	15.4	Used existing mapping of Evaluated Non-Provincially Significant Wetlands.
W4	SWD1: Oak Mineral Deciduous Swamp; SWT: Swamp Thicket	3.5	Used existing mapping of Evaluated Non-Provincially Significant Wetlands.
W5 + W13	SWD: Deciduous Swamp	> 14.5	Used existing mapping of Evaluated Provincially Significant Wetlands (W5). Delineated via in-field surveys and desktop aerial imagery (W13).
W6 + W7 + W11 + W12	SWD: Deciduous Swamp; MAM/SWT: Meadow Marsh / Swamp Thicket; MAS/SA:	44.8	Used existing mapping of Evaluated Provincially Significant Wetlands (W6, W7).

Natural Feature Code	Wetland Feature	Size (ha)	Delineation Method
	Shallow Marsh / Shallow Aquatic; Wetland: undetermined		Delineated via in-field surveys and desktop aerial imagery (W11, W12).
W8	SWD: Deciduous Swamp	1.7	Used existing mapping of Evaluated Provincially Significant Wetlands.
W9	SWD: Deciduous Swamp	1.9	Used existing mapping of Unevaluated Wetlands.
W10	SA: Shallow Aquatic	1.1	Delineated via in-field surveys and desktop aerial imagery.

Like the woodlands, it should be noted that a degree of error is associated with this assessment of wetlands as at the subwatershed level many of these wetlands were either inaccessible (i.e., on privately-owned lands where access was not permitted) or only observable from roadways / trails (preventing soil testing from occurring). Site-specific, or EIS-level, surveys would need to be conducted at the time of proposed development to confirm the presence / absence of wetlands and if present determine the significance of these features.

Some provincially mapped wetland areas have been adjusted by Palmer ecologists based on field surveys. For example, the northern portion of the Evaluated (Other) Wetland west of Elizabeth Street was observed to be an upland Cultural Woodland (CUW) community during 2022 field investigations and therefore, was not shaded on **Figure 8.**

Potential Wetlands

Several potential wetland communities exist within the Wignell Drain Subwatershed Study Area but were unable to be verified in the field due to site access constraints. These communities are differentiated on **Figure 8**. Delineation and classification of wetland landscapes using aerial photography alone can prove to be challenging. Thus, these *Potential Wetlands* have been treated as wetlands at this stage of the SWS. Field verification would have to be completed outside of the subwatershed study process such as through a site-specific EIS.

5.3 Aquatic Habitat

The entirety of the subwatershed is considered to be a warmwater environment (MNRF, 2024), with the upstream portions (WD-1, WD-2, WD-3, and WD-4) functioning as intermittent systems, and the downstream portions (WD-5, WD-6) functioning as permanent systems with perennially flowing water. Results of the 2023 fish community sampling were consistent with thermal classification information, with mostly warmwater species be captured from the lower reaches of the subwatershed. Physical aquatic habitat observations were consistent as well with the warmwater thermal classification, as permanent baseflow was only documented within the lower reaches, groundwater indicators were minimal, and little to no lower or upper canopy is present throughout the subwatershed to provide shading and cooling effects and reduce thermal loading from sun exposure. The primary surface water inputs are provided through surface runoff from surrounding agricultural fields.

Consistent with NPCA Policy, a 15 m setback is assigned to stream segments located north of the Friendship Trail, as these monitoring stations were observed as being intermittent. South, or downstream of the Friendship Trail, a 30 m setback is assigned to stream segments as flow was generally observed to be flowing on a permanent basis, even during summer baseflow conditions, as described in Section 4.3.2. Comprehensive ecological constraints are detailed in Section 9 of this report.

5.4 Species at Risk

Prior to field investigations, a background review was completed for potential SAR habitat opportunities. The NHIC database, the Ontario Breeding Bird Atlas (OBBA), and the Ontario Reptile and Amphibian Atlas (ORAA) were screened for SAR records. Also, based on professional experience, it was determined that larger trees may present habitat opportunities for SAR bat species.

Based on available background information and the 2021, 2022, and 2023 field investigations, the Study Area was assessed for potential SAR habitat opportunities. The assessment was conducted by comparing habitat preferences of species deemed to have potential to occur against current site conditions, as well as integrating field survey results. This SAR habitat assessment can be found in **Appendix K**, providing a detailed description of each species' habitat (including those deemed to not have potential habitat), as well as a discussion of habitat suitability within the Study Area, potential impacts, and mitigation, where applicable. Based on the rationale provided in **Appendix K** and field observations, a total of six (6) SAR have been confirmed and a total of 22 species have been identified as having the potential to occur within the Study Area.

The following six SAR have been identified as confirmed within the Study Area, assuming eBird and iNaturalist records are accurate:

Birds

- Chimney Swift (*Chaetura pelagica*) – Threatened - observed foraging only
- Red-headed Woodpecker – Endangered – from eBird (2021) and iNaturalist (2023) records
- Eastern Wood-Pewee (*Contopus virens*) – Special Concern - Confirmed
- Barn Swallow (*Hirundo rustica*) – Special Concern - Confirmed
- Bobolink (*Dolichonyx oryzivorus*) – Threatened – Confirmed

Insects

- Monarch Butterfly (*Danaus Plexippus*) – Special Concern - Confirmed

5.5 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) can be difficult to appropriately determine at the site-specific level, as the assessment must incorporate information from a wide geographic area and consider other factors such as regional resource patterns and landscape effects. To help with site level assessments, the MNRF has developed the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E* (Ontario Ministry of Natural Resources, 2015). With the exception of wintering deer yards, which could be, and often are, considered SWH, the detailed identification and designation of SWH has not been completed in Niagara Region or the Town of Port Colborne.

SWH is defined by the MNRF in the Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources, 2000) and Natural Heritage Reference Manual (Ontario Ministry of Natural Resources, 2010), and the abovementioned Schedules and includes the following categories:

- Seasonal Concentration Areas of Animals;
- Rare Vegetation Communities or Specialized Habitats for Wildlife;
- Habitats of Species of Conservation Concern; and
- Animal Movement Corridors.

Criteria for the identification of these features are also provided in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E*. These criteria were used to provide a screening for wildlife habitat within the Study Area for potential SWH as detailed in **Appendix L**.

The Confirmed or Candidate SWH within the Study Area are summarized in **Table 11** and mapped on **Figure 4**. Potential SWH (16 categories), within the Study Area, are not mapped as part of this study, due to lack of definitive information and spatial extent.

Table 11: Candidate and Confirmed SWH

SWH Category	Candidate / Confirmed	Description
Other Rare Vegetation Communities	Confirmed	Rare vegetation communities (i.e., Southern Arrow-wood Mineral Thicket Swamp) were identified within the EIS Subject Lands and are not known, but may be, present within the Study Area. Mapped on **Figure 4**.
Amphibian Breeding Habitat (Woodland)	Confirmed	One location meets the criteria. Chorus of both Spring Peeper and Western Chorus Frog recorded in April 2022 in the SWD3 community south of Carl Road and 2nd Concession Road. Mapped on **Figure 4**.
Special Concern and Rare Wildlife Species	Candidate	Two Special Concern avian species were recorded; Eastern Wood-Pewee and Barn Swallow. Three Barn Swallow nests were observed in two buildings in the active farm area at 896 Killlaly Street East. This is the only area where three or more Barn Swallow nests were observed and thus, is the only SWH for Barn Swallow (mapped on **Figure 4**). All records of Eastern Wood-Pewee are of single territories in a treed area. Single territories are not considered SWH. One record of Green-winged Teal (Occasional), with uncertain breeding status, is not SWH. A single breeding record of Tufted Titmouse (Rare) is similarly not considered SWH. Other SWH under this category have the potential to occur.