Final Draft Environmental Study Report (ESR)

City of Kitchener
Biehn Drive Municipal Class Environmental Assessment

November 2024

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EXECUTIVE SUMMARY

ENVIRONMENTAL ASSESSMENT PROJECT

The City of Kitchener (City) has undertaken a Schedule C Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension in the City of Kitchener. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The Study has developed and evaluated alternatives for the alignment of the Biehn Drive extension, intersection locations/type and municipal services while minimizing environmental, social, and cultural impacts of the project. Biehn Drive is a Major Collector Road in the City of Kitchener Official Plan. The previous sanitary sewer network has been constructed to accommodate the future service areas to connect directly to Biehn Drive. No other alternative exists for the sanitary sewer network other than to connect to Biehn Drive. The study determined the need for the road, confirming its inclusion in the OP and transportation master plan.

Problem and Opportunity Statement

The planned extensions of Strasburg Road and Robert Ferrie Drive combined with new development will result in changes to the traffic demands and patterns within the Doon South and Brigadoon communities. To address those changes, the City of Kitchener Transportation Master Plan and Official Plan have identified an extension of Biehn Drive from its current terminus to Robert Ferrie Drive. The Study has revisited the need for an extension of Biehn Drive and evaluated potential alignment alternatives if an extension of Biehn Drive is still recommended. The Study has considered the natural, social environments and the future land use in the Study Area. The study is assessing the road network to provide safe, reliable transportation access to communities within Doon South and Brigadoon considering vehicular, pedestrian, cycling and truck routes. The road project is being completed as a Schedule C undertaking.

The Project provides the opportunity to:

- Improve accessibility to the local community by providing additional network links;
- Define a multi-modal transportation plan to support travel within the local neighbourhoods; and
- Allow development to proceed on lands that currently require the infrastructure requirements to be defined prior to developing the land use plan.

In parallel, the City is planning for new municipal services that are required to serve future development to the south. The future watermain and sanitary trunk sewer crossing of the Provincially Significant Wetland (PSW) from the existing services at the end of Biehn Drive are being completed as a Schedule B project.

Study Area

The study area is illustrated in **Figure E-1**. The “Local Study Area” extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension. The “Broader Study Area” includes the surrounding areas to

consider traffic effects in adjacent neighbourhoods as well as broader alternatives through adjacent neighbourhoods.

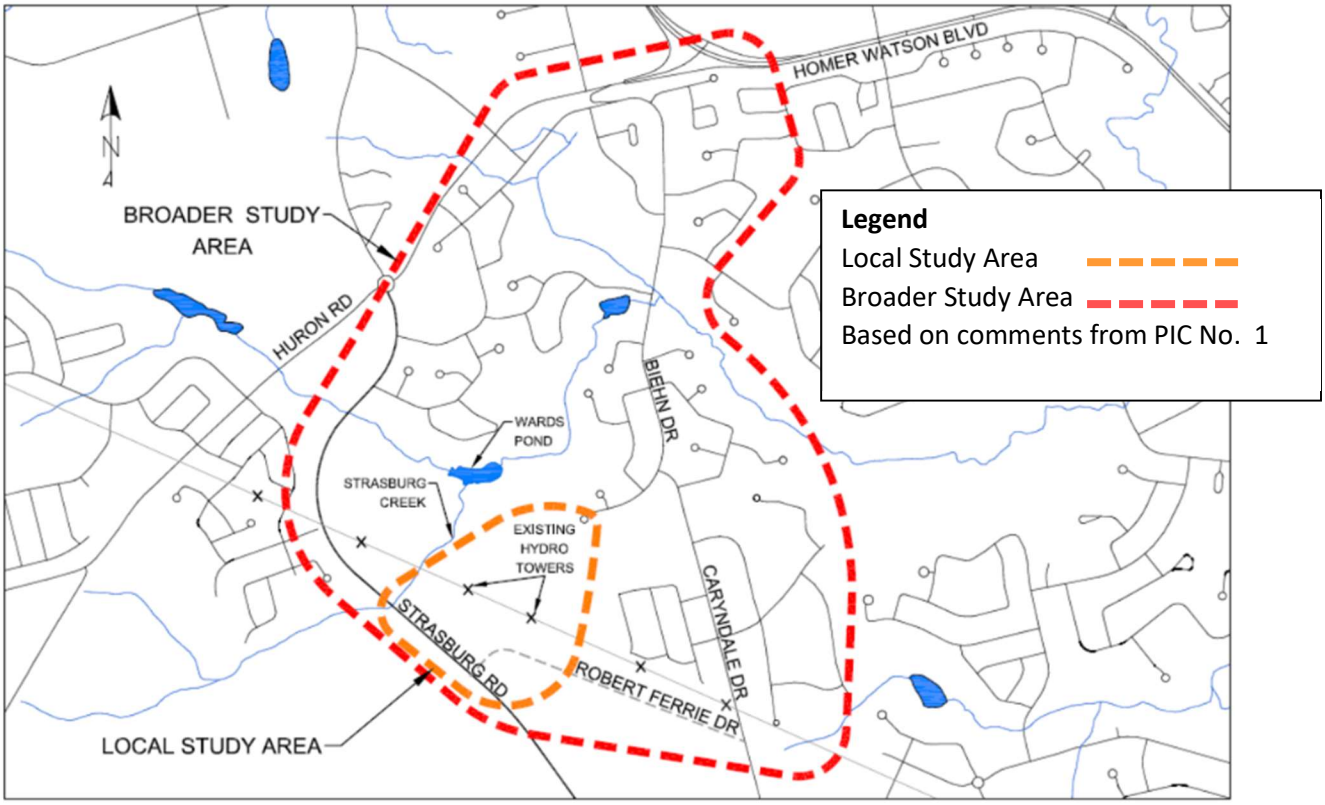


Figure E-1: Study Area

MUNICIPAL CLASS EA PROCESS

This project was undertaken to satisfy the Provincial EA Act following the "Municipal Class Environmental Assessment" process for a Schedule C project as amended by the Municipal Class EA 2015. This document specifies the procedures required to plan specific road projects according to an approved planning process.

The Class EA process was undertaken in a series of phases commencing with problem identification and culminating in the filing of this ESR.

The Class EA process includes an evaluation of all reasonable alternatives and the selection of a preferred alternative(s) with acceptable effects (including avoidance and mitigation of any residual adverse effects) on the natural and social/cultural environments. The Municipal Class EA process entails five phases:

Phase 1: Identify the Problem

Phase 2: Alternative Solutions

Phase 3: Alternative Design Concepts for the Preferred Solution

Phase 4: Environmental Study Report (ESR)

Phase 5: Implementation

CONSULTATION

The public consultation approach used several techniques to proactively involve the public. The study was carried out in consultation with staff from the City of Kitchener, external agencies, stakeholders and the public.

The EA process included circulating a draft Study Design describing the proposed methodology for the Class EA at the start of the study. The draft Study Design was circulated to external agencies and was available to the general public through posting on the City website. The final Study Design is included in **Appendix A**. The Study Design circulation was completed as a discretionary public consultation, Step 1.2 of the Municipal Class EA Planning and Design Process.

A combined Community Café/Public Information Centre Event and a Public Information Centre were held during the study to present the project, the assessment of alternatives and the Technically Preferred Plan. These meetings were an integral component of the study – seeking input and comments from the local community/stakeholders. As a result, the following two major community issues were raised during the Study.

1) Community disruption (vehicular traffic) to existing residents.

   Based on community input, an additional alternative using Caryndale Drive was added and carried forward through the evaluation. The study has evaluated the effect of community traffic accessing the arterial road network using either the Biehn Drive or the Caryndale Drive route. Based on the Caryndale Drive route being designated a minor collector and having an elementary school along this route, the study recommendation is to maintain the Official Plan transportation system and utilize Biehn Drive (Major Collector) for the link to the arterial road network for the community. There will be minor effects for residents currently living at the end of Biehn Drive; however, these residents previously purchased properties on a designated Major Collector that was illustrated in the City's Official Plan.

2) Environmental effects to the Provincially Significant Wetland (PSW).

   The EA has documented the need for an infrastructure link across the PSW. The length of the crossing has been minimized in the selection of the corridor and the cross section and right-of-way width have been reduced to minimize the environmental effects of the project. The EA commits to these measures when the project is implemented through Detail Design and Construction.

Indigenous Peoples engagement was undertaken as part of the study. The Indigenous consultation (Rightsholders identified by MECP to be contacted) between the Study Team and the respective individual indigenous communities and their responses/ requests have been tracked by means of an Excel spreadsheet. A separate spreadsheet has been created for field visits involving Indigenous communities requesting to be involved. The engagement included sharing archaeological studies and a field review of the final Recommended Plan with Six Nations of the Grand River. The City respects that this consultation is a Nation-to-Nation

contact with the City representing the Crown. The First Nations are Rights Holders and are separate and distinct from Public Stakeholders.

All Indigenous communities listed in the previously mentioned spreadsheet will be sent notification of the Notice of Study Completion and the 30-day review period. The contact and any response will be used to update the spreadsheet. The spreadsheet will continue to be updated into and during the next phases of Detail Design and construction regarding their notification of future permits that have the potential to affect their interests. The City commits to continued liaison with the Six Nations Grand River which has identified an interest in the project and the environmental mitigation plan. No other community identified themselves during the consultation to date.

Council Resolution

ANALYSIS AND EVALUATION

The evaluation of alternatives was completed in a two-step process. The initial step was to consider and validate previous decisions of the Transportation Master Plan as alternative planning solutions. For this study, the alternative planning solutions included:

- Alternative 1 - Do Nothing
- Alternative 2 - Transportation Demand Management (TDM)
- Alternative 3 - Use of Existing Local Roads
- Alternative 4 - Limit Land Use Development
- Alternative 5 - Extend Biehn Drive

Based on the preliminary review of Alternative Planning Solutions, Use of Existing Local Roads and Extend Biehn Drive were recommended for further evaluation. Transportation Demand Management was not carried forward as a standalone solution but will be incorporated with the preferred alternative as part of the recommended plan.

Generation of Preliminary Design Alternatives

A “long list” of preliminary design alternatives was generated, based on identified needs, to ensure consideration of a wide range of transportation alternatives (i.e. all reasonable alternatives are considered). The preliminary alternatives were categorized under 3 groups:

a. Alignment Alternatives (road and sanitary sewer and municipal services)
b. Cross Section Alternatives
c. Intersection Alternatives

Preliminary design alternatives were developed for each group of alternatives. These alternatives were presented to the public at the PIC’s and was expanded based on comments received from the public. Alternatives are described in **Section 6.0**.

The Project Team participated in and reviewed the analysis and evaluation for all alternatives. The Technically Preferred Alternative (TPA) was presented to the public at the second PIC.

RECOMMENDED PLAN

Following PIC No.2, the TPA was subject to refinements based on community input as described in **Section 6.5**.

The recommendations from the EA have included three aspects to the project being carried forward including:

- Design of municipal services (trunk sanitary sewer and watermain) on an alignment which will extend services on Biehn Drive to service development lands to the south.
- Extension of an active transportation multi-use pathway (MUP) and sidewalk linking Biehn Drive southerly to the planned community development to the south and creation of a connection to Strasburg Road and Robert Ferrie Drive.
- Extension of a roadway link southerly from Biehn Drive providing improved access to the existing and planned development.

The environmental assessment and preliminary design have included supporting studies for traffic, geotechnical investigations and environmental design to support these three components. A key aspect of the project is that the lands are currently under private ownership and part of future development. The EA is seeking environmental clearance for the following:

- Acquisition of private property for the extension of Biehn Drive,
- Integration of the development lands to the south for the creation of a collector road corridor within the development (Biehn Drive extension),
- New roundabout intersection control on the future Robert Ferrie Drive,
- Improve the distribution of traffic within the local neighbourhoods, and
- To improve accessibility, particularly for pedestrians and cyclists.

The primary aspects of the Biehn Drive extension has been to design a new utility and transportation corridor as shown in **Figure E-2** which has been located along the eastern edge of a large Provincially Significant Wetland (PSW) complex while minimizing the severance of the PSW. Design mitigation for the project within the wetland will include:

- Microtunnelling or directional drilling of the trunk sanitary sewer and watermain under the wetland area with launch and exit shafts reducing changes to the groundwater table and disturbance to subsurface soils.
- Modifying the City's collector road standard to reduce the cross-section width through the PSW to minimize loss within the PSW.
- Bio-engineering of wetland restoration areas to offset the loss to the PSW from the new street alignment at a 1:1 ratio (minimum).

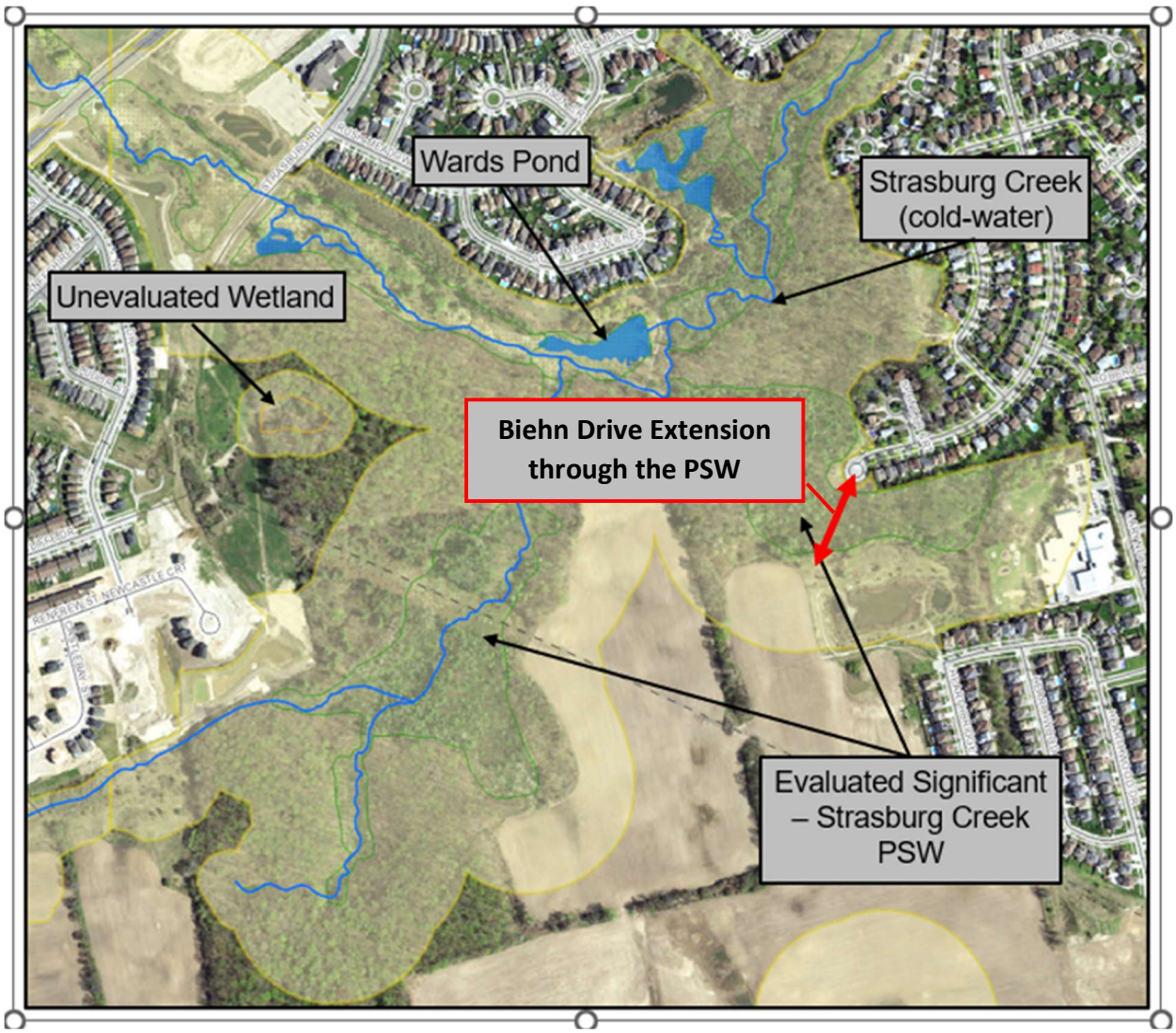


Figure E-2: Location Plan Biehn Drive Extension

The need and justification for the project is two-fold:

1) The new street connection will share the traffic demand from existing neighbourhoods. Longer range development to the south will generate more trips to/from the south than occur today. The transportation plan includes future roads such as the extension of Strasburg Road, Robert Ferrie Drive and the future Dundee Road crossing of Highway 401 (as defined in the Region of Waterloo Transportation Master Plan). There will be significantly more development (population and employment) to the south, including within the City of Cambridge/Municipality of North Dumfries. The province has established a 2051 Plan (legislation) that the Region and City must meet these population and employment targets, and much of this growth is going to be to the south and west (as defined in the Provincial Places to Grow Plan). What does this mean? If existing neighbourhoods have 4 collector streets to exit and enter the communities (as proposed) there will be less traffic on anyone single street. If Biehn Dive is extended, then both

it and Caryndale Drive will share the traffic demand for trips towards the west/south. This may add a modest volume of traffic on Biehn Drive but this has been planned as a major collector as part of the Official Plan. This transportation plan has been in place for over 30 years before any of the property owners purchased houses on this street.

2) The new municipal corridor will provide the distribution network for a watermain and trunk sanitary sewer that will also be necessary for future development. This development is required by the Province's Place to Grow Plan.

   The extension of Robert Ferrie will be a necessary part of the transportation plan. However, it will not replace the need for the Biehn Drive link because it does not serve the same trip origins and destinations.

   With respect to the sensitivity of crossing a PSW the final recommendations included several mitigation measures including: an alignment as close to the eastern boundary of the PSW as possible, narrowing the width of the road within the PSW to reduce disturbance, providing a wildlife passage under the road, using microtunnelling of municipal services to avoid changes to the water table and an innovative road design which will float the new road on top of the existing wetland using geotextile and geogrid. Organic soils as defined by the geotechnical boreholes will be salvaged and replaced in areas of wetland restoration. The design will be a demonstration project for best practices of environmental engineering. The Provincial Policy Statement of the Province may preclude development within PSW's but there is an exemption for road and utility infrastructure were justified by an Environmental Assessment.

   One of the most significant changes that has occurred over the last 30 years is to change the alignment of the Biehn Drive crossing from proceeding directly westerly from Biehn Drive across the larger wetland complex to Strasburg Road. It has been modified to cross the most eastern boundary possible as illustrated in **Figure E-2.** Doing so avoids the large centroid of the wetland complex.

The profile of the new road is proposed to be elevated to be above the ground water to avoid affecting the water table near adjacent houses. During the detail design temporary dewatering will be defined based on microtunnelling or direct drilling exit and entry shafts minimizing impacts to adjacent houses.

Further mitigation for the road extension will be the removal of the existing cul-de-sac to reinstate PSW in this area and the creation of wetland restoration on the south side of the wetland to provide a 1:1 (or greater) replacement of wetland loss.

The Biehn Drive Extension Recommended Plan includes:

- New 2-lane road connecting the current Biehn Drive terminus to the future Robert Ferrie Drive
  - Alignment will be east of the Hydro Tower
  - Cross section will include 3.3 m lanes with curb/gutter (0.5 m)
- Active transportation improvements will include:

    - 3.0 m MUT on the east side and a 1.5 m sidewalk on the west of the road from Robert Ferrie Drive to existing terminus of Biehn Drive.
    - Boulevard (varying width, minimum 1.0 m)
    - Potential pedestrian crossing at the south edge of the wetland:
- Roundabout at the intersection of Biehn Drive and Robert Ferrie Drive (per the recommendations of the Robert Ferrie Drive Environmental Assessment)
- Installation of municipal services beneath the road alignment including:
    - Sanitary trunk sewer (500-525 mm diameter)
    - Storm sewer
    - Watermain (300 mm diameter)
- Natural environment mitigation including:
    - Construction of one box culvert for the provision of wildlife passage under the Biehn Drive extension in the area of the Strasburg Creek PSW (final sizing, design and number of crossings to be defined in detail design). The Biehn Drive Wildlife Crossing Technical Memorandum is included in **Appendix D.**
    - Implementation of permanent wildlife fencing (to be confirmed by scoped EIS during detail design).
    - Stormwater quality control using the existing stormwater management pond as well as an oil grit separator at the northern outlet to the PSW.
    - Target desirable compensation for wetland loss including:
        - 10:1 tree replacement on PSW Adjacent Lands (Developer's approval required)
        - 1:1 wetland replacement (on-site), refer to **Appendix D**.
        - 2:1 wetland replacement (off-site) (not required)

The feasibility for compensation to be reviewed with the future determination of the offsets from the PSW to development lands as an opportunity for naturalization and well as the re-naturalization of the removal of the existing cul-de-sac on Biehn Drive.

The Recommended Plan is illustrated in **Figure E-3.** It incorporates Preliminary Design mitigation measures for the project which are described in **Section 7.0**.

The timeline for implementation of the project is expected to be within the 5-year capital program.

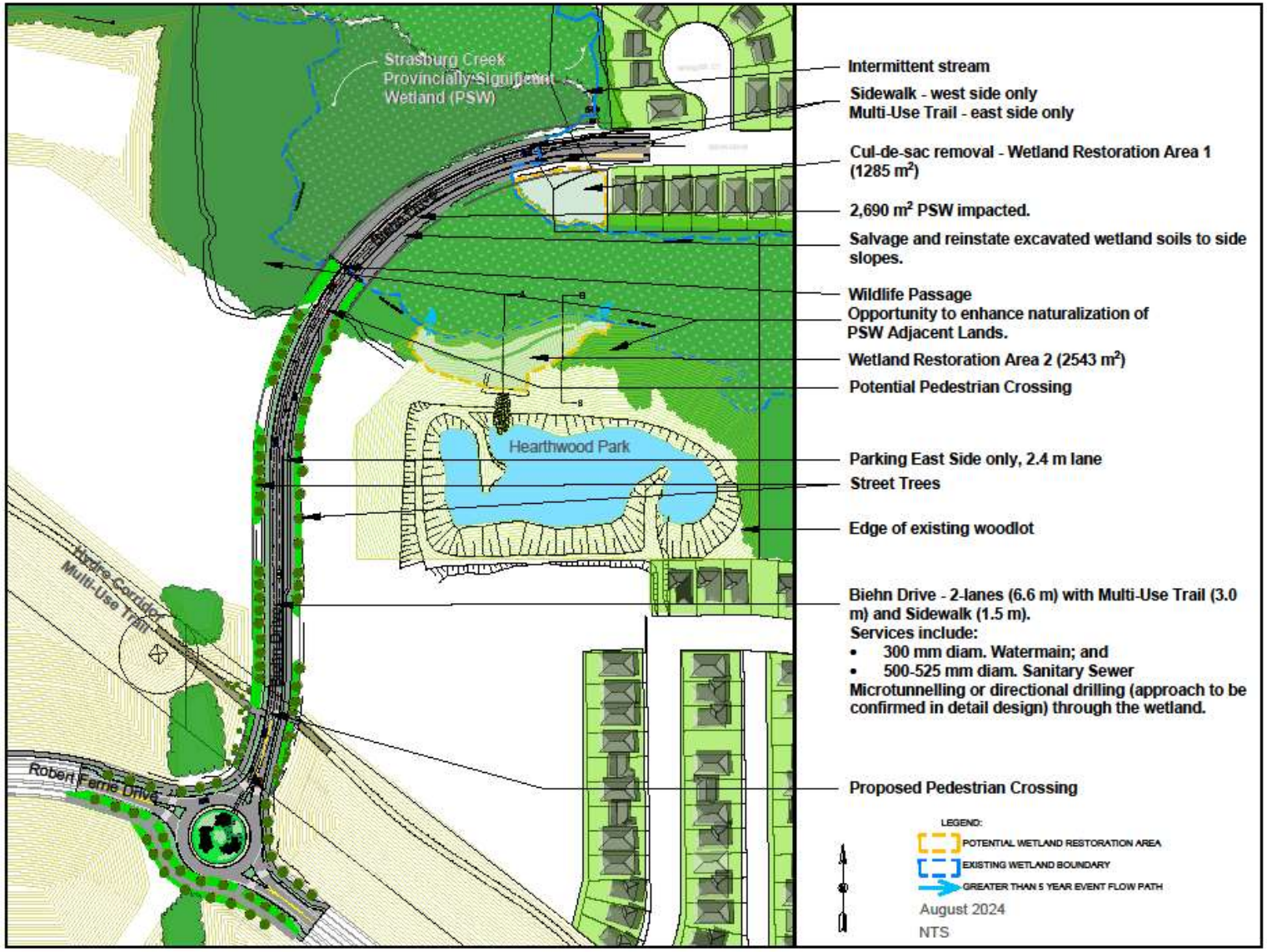


Figure E-3: Recommended Plan

1.0 INTRODUCTION

The City of Kitchener (City) has undertaken a Schedule C Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension in the City of Kitchener. This is following the identification of this roadway in the City's Transportation Master Plan (TMP) and Official Plan (OP). The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The Study has developed and evaluated alternatives for the alignment of the Biehn Drive extension, intersection locations/type and municipal services while minimizing environmental, social, and cultural impacts of the project. Biehn Drive is a Major Collector Road in the City of Kitchener Official Plan. The previous sanitary sewer network has been constructed to accommodate the future service areas to connect directly to Biehn Drive. No other alternative exists for the sanitary sewer network other than to connect to Biehn Drive.

This Environmental Study Report (ESR) documents the transportation/servicing need and the Recommended Plan to address current and future operational needs, considering all modes of travel and incorporating environmental mitigation measures as required. The road extension will be a key link in the Brigadoon community transportation/servicing network and will provide all users (pedestrians, bicycles, and vehicular traffic) with a safe and efficient route to travel from neighbourhoods to the arterial road network now that Strasburg Road has been constructed to the planned extension of Robert Ferrie Drive.

1.1 Study Area

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**. The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension. Following the Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods as well as broader alternatives that had not been originally considered in the Draft Study Design.

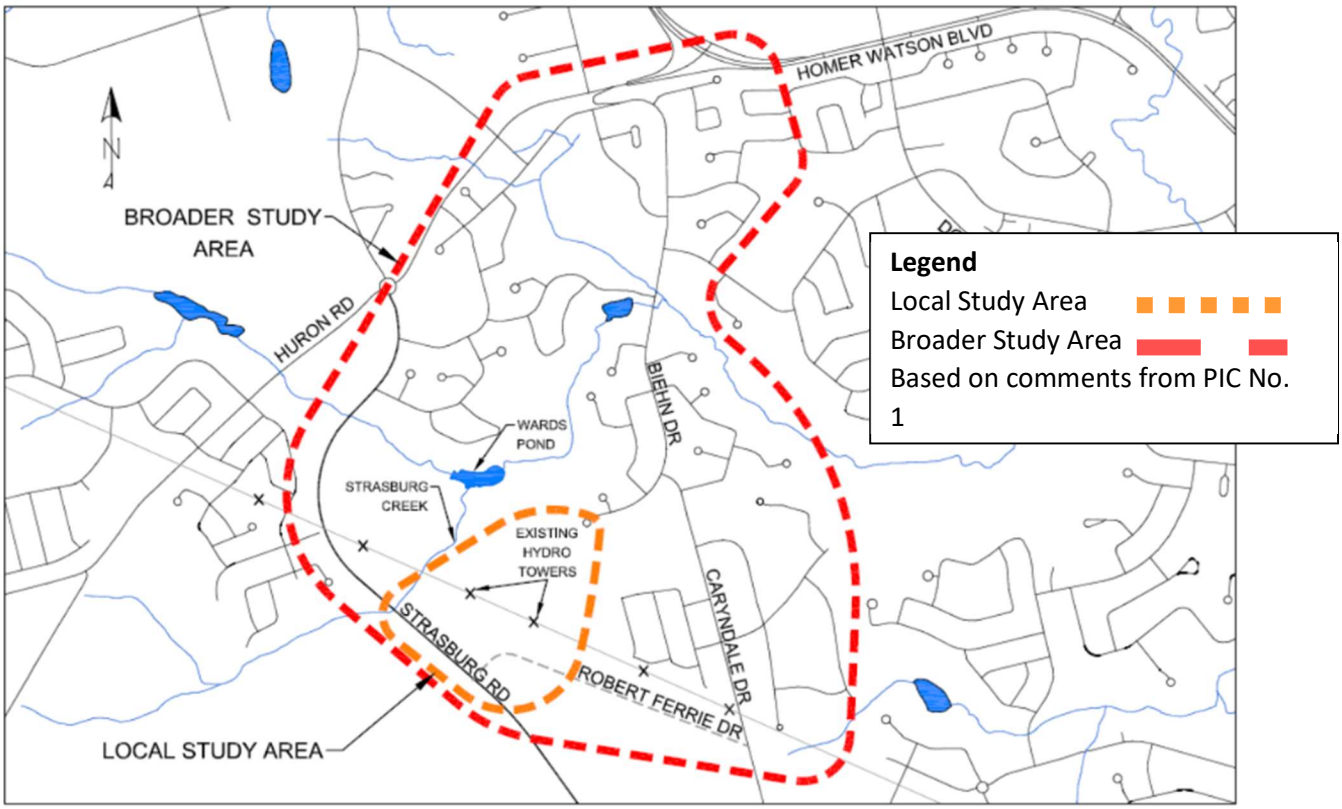


Figure 1: Study Area

1.2 Background

Since the mid-2000's the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener have planned for area development and evolving transportation and municipal servicing needs. Several planning documents including the Official Plan and Transportation Master Plan (TMP) have identified the need to extend Biehn Drive southerly to the Robert Ferrie Drive extension and ultimately to Strasburg Road for use as both a collector road and for municipal services. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan. This link would accommodate vehicles to and from the Brigadoon community and would help reduce traffic on other local streets within the community (Caryndale Drive and the northern section of Biehn Drive). A separate Biehn Drive Traffic Calming Study was completed in 2021.

A collector road collects traffic from local streets within the community and provides connectivity to high tier arterial roads including Strasburg Road.

Background studies have previously been completed within the Study Area to document the proposed land uses, planned transportation networks, sanitary master plan and existing issues. These reports are summarized in the following sections.

1.2.1 Official Plan and Land Use

The City of Kitchener Official Plan (2014) documents the policies for growth, development, and land use within the City. Map 3 of the Official Plan identifies the land in the Study Area as Natural Heritage Conservation and Low-Rise Residential:

- Natural Heritage Conservation: This land use designation is used to protect and/or conserve natural heritage features and their ecological functions. This designation includes Provincially Significant Wetlands (PSW).
- Low-Rise Residential: This land use designation accommodates a range of low-density housing types including single detached dwellings, semi-detached dwellings, townhouses, low-rise multiple dwellings etc.

In addition to the general land use classifications, there is a Specific Policy Area (SPA) along the hydro corridor in the Brigadoon subdivision (SPA 45). This SPA states:

> *"Notwithstanding the Open Space land use designation and policies on the Hydro Corridor in the Brigadoon Subdivision (30T-88006) shared uses on hydro rights-of-way including open space links, parking lots or other uses accessory to adjacent land uses in accordance with Policy 14.C.1.37 and Policy 15.D.10.1 i) will be permitted."*

1.2.2 City of Kitchener Transportation Master Plan

The Kitchener Integrated Transportation Master Plan (TMP) (2013, IBI Group) identifies the need to extend Biehn Drive from its current terminus. The TMP recommended that Biehn Drive be extended westerly to Strasburg Road. This recommendation was modified in subsequent planning documents and EAs to recommend connection to the Robert Ferrie Drive extension instead, with the final determination to be defined by an EA (the current Study). The current study has validated the previous TMP conclusions and recommendations of the transportation need for the Biehn Drive extension.

1.2.3 Region of Waterloo Transportation Master Plan

The Region of Waterloo's Moving Forward 2018 Master Plan (IBI Group, 2019) outlines the needs for active transportation, transit and Regional roads. This report identifies Biehn Drive as an Existing Local Route for Grand River Transit.

1.2.4 Kitchener Growth Management Plan (KGMP)

The Kitchener Growth Management Plan (KGMP) (2019) provides a framework to ensure that the City has "direct, proper and orderly development within the boundary". The Plan prioritizes areas for development based on the supply of developable lands and existing infrastructure.

The extension of Biehn Drive, including a sanitary sewer, is identified in the Plan as a major remaining initiative for the Brigadoon community. There are two developments planned/proposed within this area (see **Figure 2**). A requirement for development of the lands, labelled 33 and 34 on **Figure 2,** is the extension of sanitary services and the Biehn Drive connection.

The Sanitary Master Plan (August 2024) was updated at the conclusion of the EA study.

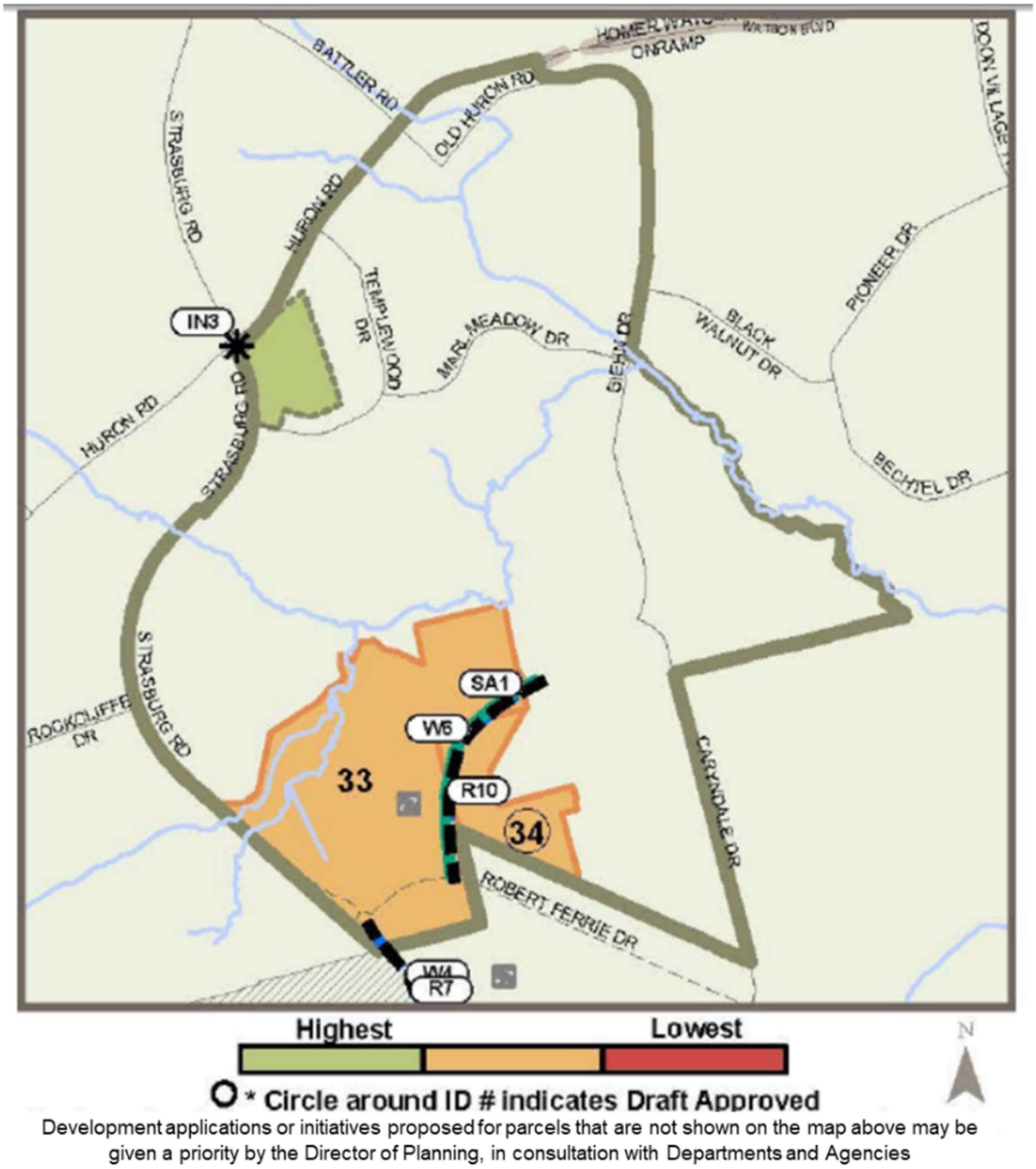


Figure 2: Growth Area Subplan for Brigadoon (Kitchener Growth Management Plan, 2019)

1.2.5 Brigadoon Community Plan

The Brigadoon Community Plan (2004) documents the principles for the development of the Brigadoon Community. This plan identifies that the development of lands east and west of the future Biehn Drive extension "shall require the construction of Strasburg Road and the Biehn Drive extension".

1.2.6 Integrated Sanitary Master Plan (ISAN-MP)

The City of Kitchener completed the Integrated Sanitary Master Plan in August 2024. All previous construction of the sanitary network has been built to accommodate the future services areas to connect directly to Biehn Drive. No other alternative exists for the sanitary network other than to connect to Biehn Drive.

1.2.7 Integrated Stormwater Management Master Plan (ISWM-MP)

The City of Kitchener's Integrated Stormwater Management Master Plan (ISWM-MP) (Aquafor Beach, 2016) identifies the prioritization of works for the City's overall Stormwater Master Plan. This report indicates that the Study Area is located within the Strasburg Creek subwatershed. This was identified as a Priority 4 subwatershed, which is an area where intensification should provide sufficient buffers to maintain the natural hydrologic cycle.

1.2.8 Provincial Policy Statements

The Kitchener Official Plan and subsequent planning studies have been carried out in accordance with the Provincial Policy Statement (PPS) at the time of their creation. Within this Report, Section 3.2.4 Proposed /Approved Development outlines the undertaking's compliance with the "*A Place to Grow: Growth Plan for the Greater Golden Horseshoe* (2020)". In addition, Section 3.1.1 Terrestrial and Aquatic acknowledges the Strasburg Creek Provincially Significant Wetland (PSW) complex and the design efforts to minimize the footprint and long-term impact on this PSW complex. Finally, the evaluation process considered the impact on the PSW complex of the various alternatives in arriving at the Recommended Plan.

The Study recommendations are consistent with the PPS which allows infrastructure works within a PSW when there is a demonstrated need for a project following an Environmental Assessment. With the exception of the Do Nothing Alternative, all alternatives require crossing the PSW. The planned sanitary system for all future planned development (south of the PSW) has been planned to outlet on the north side of the PSW at Biehn Drive. The need for the development areas to the south is consistent with the Province's Places to Grow legislation defining growth targets to 2050. The land use plan is documented in the City and Region's Official Plans.

The following insert is the reference from the PPS defining infrastructure as separate and distinct from other forms of development:

> **Development:** means the creation of a new lot, a change in land use, or the construction of buildings and structures requiring approval under the *Planning Act*, but does not include:
> a) activities that create or maintain *infrastructure* authorized under an environmental assessment process;
> b) works subject to the *Drainage Act*; or
> c) for the purposes of policy 2.1.4(a), underground or surface mining of *minerals* or advanced exploration on mining lands in *significant areas of mineral potential* in Ecoregion 5E, where advanced exploration has the same meaning as under the *Mining Act*. Instead, those matters shall be subject to policy 2.1.5(a).

Below is the definition of "infrastructure" in the Provincial Policy Statement:

> **Infrastructure:** means physical structures (facilities and corridors) that form the foundation for development. *Infrastructure* includes: sewage and water systems, septage treatment systems, stormwater management systems, waste management systems, electricity generation facilities, electricity transmission and distribution systems, communications/telecommunications, transit and transportation corridors and facilities, oil and gas pipelines and associated facilities.

The project includes the construction of sewage works (sanitary sewer) and surface transportation access for the community. The project recommendations are to cross the PSW utilizing a reduced cross section and context sensitive design to minimize the residual effects of the project on the PSW.

1.2.9 Additional Reports

Additional background reports that were reviewed as part of the Study include:

- City of Kitchener Standard Specifications
- City of Kitchener Standard Drawings
- Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services
- Strasburg Road Extension Environmental Study Report
- South Strasburg Gravity Trunk Sanitary Sewer Project File
- East Side Lands Sanitary Servicing Environmental Study Report

- Doon South Pumping Station Draft Environmental Study Report
- Robert Ferrie Drive Extension Environmental Study Report
- Biehn Drive Extension and Need Justification Review
- Doon South Community Plan
- Huron Community Plan
- Southwest Kitchener Urban Area Studies - Community Master Plan
- Doon South - Brigadoon Transportation Network and Corridor Study
- Doon South Community and Broader Study Area Traffic Impact Study
- City of Kitchener Cycling and Trails Master Plan
- Huron Industrial Development Transportation Planning and Engineering Study
- Strasburg Creek Flood Control Environmental Study Report
- State of the Watershed (SOW) Report Upper Blair Creek
- Cumulative Effects Monitoring – Blair Creek Case Study
- Revised Final Stormwater Management Report Doon Creek – Robert Ferrie Drive Extension
- City of Kitchener Stormwater Management Facility Retrofit, Class EA and Preliminary Design Brief
- Upper Blair Creek (Kitchener) Functional Drainage Study Final Report

1.3 Problem and Opportunity Statement

The planned extensions of Strasburg Road and Robert Ferrie Drive combined with new development will result in changes to the traffic demands and patterns within the Doon South and Brigadoon communities. To address those changes, the City of Kitchener Transportation Master Plan and Official Plan have identified an extension of Biehn Drive from its current terminus to Robert Ferrie Drive. The Study has revisited the need for an extension of Biehn Drive and evaluated potential alignment alternatives if an extension of Biehn Drive is still recommended. The Study has considered the natural, social environments and the future land use in the Study Area. The study is assessing the road network to provide safe, reliable transportation access to communities within Doon South and Brigadoon considering vehicular, pedestrian, cycling and truck routes. The road project is being completed as a Schedule C undertaking.

The Project provides the opportunity to:

- Improve accessibility to the local community by providing additional network links;
- Define a multi-modal transportation plan to support travel within the local neighbourhoods; and
- Allow development to proceed on lands that currently require the infrastructure requirements to be defined prior to developing the land use plan.

In parallel, the City is planning for new municipal services that are required to serve future development to the south. The future watermain and sanitary trunk sewer crossing of the Provincially Significant Wetland (PSW) from the existing services at the end of Biehn Drive are being completed as a Schedule B project.

2.0 STUDY PROCESS

The *Environmental Assessment Act* of Ontario (EA Act) provides for "the protection, conservation and wise management in Ontario of the environment"[1]. Municipal infrastructure projects, including road projects, within the Province of Ontario must follow the process prescribed by the EA Act. The EA process includes: the identification of the problem/opportunity; evaluation and selection of the preferred alternative while minimizing environmental effects; and consultation with stakeholders in the decision-making process. This is a self-assessment process that includes mandatory public consultation.

The environmental impacts of municipal projects are varied. Therefore, projects are classified into Schedules based on the scope and complexity of the project as well as the estimated capital cost. This Study was completed to satisfy the Municipal Class EA process for a Schedule C Study. It reviewed and validated the recommendations from the previous Transportation Master Plan. Schedule C projects generally include the construction or new facilities and major expansions to existing facilities with the potential for significant environmental effects.

At the start of the Study, a Study Design document was prepared that described the previous Master Plan phases, the proposed work plan, public consultation and process to be followed to complete the remaining phases of the Class Environmental Assessment. The Final Study Design report, included in **Appendix A,** was initially circulated in draft form for public and agency comment and revised based on input received.

2.1 Class Environmental Assessment Process

The Class EA document specifies the procedures required to plan specific transportation projects according to an approved planning process. The Study approach included the Ministry of the Environment, Conservation and Parks (MECP) five guiding principles for EA studies, namely:

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

The Class EA Process was undertaken in a series of phases commencing with problem identification and culminating in the filing of an Environmental Study Report.

The Planning and Design Process for the Municipal Class EA is illustrated in **Figure 3**. The Class EA process includes an evaluation of all reasonable alternatives and the selection of a preferred alternative(s) with acceptable effects (including avoidance and mitigation of any residual effects) on the natural and social/cultural environments. The Municipal Class EA process entails five phases.

[1] Municipal Class Environmental Assessment, Municipal Engineers Association (2015)

The following is the specific breakdown of tasks by phase for a Class EA project.

Phase 1: Identify the Problem (completed as part of the City's TMP)

Step 1: Identification and description of the problem or opportunity.

Step 2: Discretionary public consultation.

Phase 2: Alternative Solutions (Steps 1 to 8 completed as part of the City's TMP)

Step 1: Identification of all alternative solutions to the problem.

Step 2: Identify the Study Area and a general inventory of the natural, social and cultural environments.

Step 3: Identification of the net positive and negative effects of each alternative solution.

Step 4: Review and validation oof alternative solutions.

Step 5: Identification of reasonable design alternatives for the preferred solution

Step 6: Public consultation

Step 7: Confirmation of design alternatives, finalization of Draft Study Design Report for work program, and refinements to or addition of design alternatives to be carried forward to Phase 3.

Step 8: Selection of the preferred solution.

Step 9: Draft Study Design available on the City's website – added activity to initiate this Study.

Step 10: Initial Community Café'/PIC No. 1 added activity under this Study to review/validate previous TMP recommendations and present preliminary design alternatives for public and agency comment before Phase 3 activities are initiated. Draft Study Design Report finalized after PIC No. 1.

Phase 3: Alternative Design Concepts for the Preferred Solution

Step 1: Identification of alternative designs.

Step 2: Preparation of a detailed inventory of the natural, social and economic environments.

Step 3: Identification of the potential impacts of the alternative designs.

Step 4: Evaluation of the alternative designs.

Step 5: Selection of preferred design.

Step 6: Public consultation at PIC No. 2.

Phase 4: Alternative Design Concepts for the Preferred Solution

Step 1: Completion of the ESR.

Step 2: 30-day public review period.

Step 3: Filing of the ESR and Notice of Completion.

Phase 5: Implementation

Future phase, after this Study.

The Municipal Class EA process is illustrated in **Figure 3**. This Study has been completed to the end of Phase 4 of the Municipal Class EA process. The project will be approved for design and construction if no written concerns are submitted during the 30-day public review period. Construction will be subject to obtaining permits and approvals during the future Detail Design Phase 5 of the project.

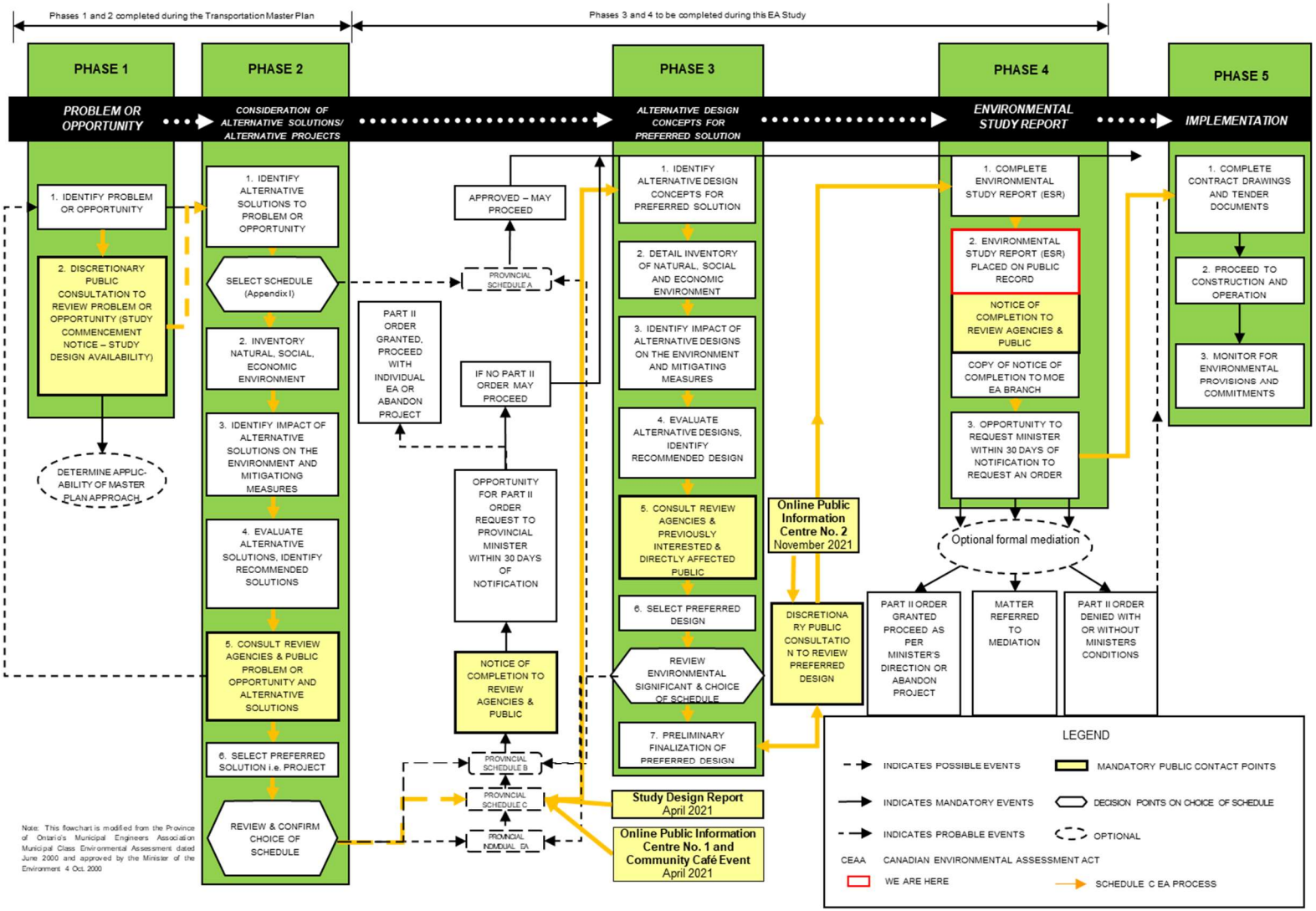


Figure 3: Municipal Class EA Process

2.2 Description of Planning Alternatives

Planning Alternatives represent alternative ways or methods of addressing the Problem and Opportunity Statement specific to this study. These reflect different strategies and include the "Do Nothing" approach (maintaining the status quo, i.e. not addressing the Problem and Opportunity Statement). The consideration of all reasonable alternatives is a guiding principle for EA studies.

The analysis and evaluation process involves a 2-step decision-making process. Initially the study documents the evaluation of Planning Alternatives (alternative project types or alternative strategies to address the problem) followed by the subsequent evaluation of preliminary design alternatives. The preliminary Design alternatives include the Biehn Drive extension alignment, sanitary sewer alignment, cross section, and intersection alternatives.

The Planning alternatives were previously considered by the City of Kitchener Transportation Master Plan which identified the extension of Biehn Drive as a City Street Capacity Improvement. This TMP completed Phases 1 and 2 of the Class EA process, including the evaluation of Alternative Planning Solutions. The TMP recommended this project as the "implementation of new streets in southwest Kitchener Urban Areas Study Community Master Plan, including extension of Biehn Drive between Biehn Drive and Robert Ferrie Drive".

In reviewing this previous decision, the following Planning Alternatives were assessed:

- Do Nothing: This alternative would maintain the existing road network and would not extend Biehn Drive and not provide a bundled sanitary and municipal service corridor.
- Transportation Demand Management (TDM): Reduces vehicular traffic demand (encourages alternative work hours, work at home and active modes of transportation). Does not address the need for a municipal service corridor.
- Use of Local Roads: Encourage the use of other local roads to reduce the need to extend Biehn Drive. Local roads are generally not designed or maintained to accommodate high traffic volumes. This alternative does not address the parallel requirement for a municipal services corridor.
- Limit Land Use Development: Limit any new residential, commercial or industrial development and therefore reduce the generation of new trips. This does not achieve the Provincial mandate of the *Places to Grow Act* which directs the Region and City to create future development lands with specific targets to be achieved.
- Extend Biehn Drive: Provides a long-term solution for improved traffic operations for all modes of travel (pedestrians, cyclists, transit and local community traffic) and safety and/or provision of municipal services. It allows a bundling of municipal services in a common corridor which is required to service the expansion areas to the south to meet the Provincial *Places to Grow Act* mandate.

Based on the preliminary review of Alternative Planning Solutions, "Transportation Demand Management" and "Extend Biehn Drive" (including the bundling of the proposed trunk sanitary sewer, maintenance roadway/multi-use path and watermain from Biehn Drive to Robert Ferrie Drive) are recommended. The Use of Local Roads was not a standalone solution but based on community input was carried forward as a modified approach of using two corridors

(Alternative 4 carried forward using Caryndale Drive for traffic and using a municipal servicing corridor across the PSW including a MUP / service corridor for maintenance equipment to access the watermain and sanitary sewer infrastructure). This approach validates and supports the previous TMP recommendations.

The evaluation of the Alternatives to the Undertaking (Planning Alternatives) for this Study is shown in **Table 1.**

Table 1: Planning Alternatives

Screening Criteria	Alternative 1: Do Nothing	Alternative 2: TDM	Alternative 3: Use of Existing Local Roads	Alternative 4: Limit Development	Alternative 5: Extend Biehn Drive
Transportation	Does not address forecast traffic demand. Results in increased volumes on local roads.	May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure.	Local roads not designed to accommodate increased volumes. Caryndale Drive is not designated as a major collector and as such should not be expected to carry additional traffic.	May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth.	Accommodates all modes of transportation.
Environmental	No impacts.	No or low impacts. Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes).	Low impacts. Creates disruption to properties on local roads that would experience an increase in traffic.	No impacts.	Low to medium Environmental effect possible with new corridor. Magnitude of effects will depend on environmental mitigation.
City Planning Objectives	Does not meet objectives/ recommendations in City Planning document or support the	Supports objective to encourage active transportation and alternate modes. Does not support the *Provincial*	Does not meet objectives/ recommendations in City Planning documents.	Does not meet objectives/ recommendations in City Planning documents.	Supports the recommendations for the extension of Biehn Drive in OP and TMP.

Screening Criteria	Alternative 1: Do Nothing	Alternative 2: TDM	Alternative 3: Use of Existing Local Roads	Alternative 4: Limit Development	Alternative 5: Extend Biehn Drive
	Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services).	*Places to Grow Act* requirement to create additional development areas (including municipal services).	Does not support the Provincial Places to Grow Act requirement to create additional development areas (including municipal services).	Does not support the Provincial Places to Grow Act requirement to create additional development areas (including municipal services).	Supports the Provincial Places to Grow Act requirement to create additional development areas (including municipal services).
Recommendations	Not recommended but carried forward as a baseline to compare other alternatives.	Recommended as a complementary solution. This is not a standalone solution.	Following PIC No. 1 there was public support to carry forward this alternative. This is not a standalone solution. See Alternative 4 which is a combination of Use of Local Roads and a New Municipal Servicing Corridor.	Not recommended.	Recommended to be carried forward for further study (new road and/or municipal services).

2.3 Consultation Program

Over the course of the Study, input was solicited from the public, stakeholders, agencies and Rights Holders (Indigenous Communities). Input was collected through meetings, the project website, and discussions/communication with interested parties. The Study approach was to work collaboratively with interested parties to address issues and reach a consensus on the preferred design.

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

2.3.1 Notices

Notices for the Study were advertised on the City's website, mailed/emailed to the project contact list, and published as follows:

- Study Commencement and Community Café/Public Information Centre No. 1 – The Waterloo Region Record on March 26, 2021
- Public Information Centre No. 2 – The Waterloo Region Record on October 29, 2021
- Public Information Centre No. 3 - The Waterloo Region Record on June 14, 2024
- Notice of Study Completion - <<DATE>>

In addition, a newsletter was distributed to all properties within the Broader Study Area to present background information and respond to frequently asked questions following the Community Café/PIC No. 1.

See **Appendix B** for copies of the study notices and newsletter. **Appendix C** includes select correspondence received from interested individuals, ministries, agencies, and Indigenous Peoples.

2.3.2 Contact List

A public/agency mailing list was developed at the start of the Study and was updated throughout the duration. The following Sections identify the stakeholders, agencies and communities contacted.

2.3.3 Stakeholder Consultation

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

- Ministry of the Environment, Conservation and Parks (MECP)
- Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF)
- Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)
- Ministry of Municipal Affairs and Housing (MMAH)
- Infrastructure Ontario (IO)
- Transport Canada (TC)
- Ministry of Indigenous Affairs
- Grand River Conservation Authority (GRCA)
- Emergency Services

- Utilities
- School Boards/Bus Services
- Other Stakeholders (as identified)

2.3.4 Indigenous Peoples Consultation

The City of Kitchener has a constitutional duty to consult with Indigenous Communities with traditional land use or interests within the Study Area. Notices were sent to the Indigenous Communities within the vicinity of the Study Area notifying them of the Study start-up and key milestones. Those contacted included:

- Six Nations of the Grand River (SNGR)
- Metis Nation of Ontario
- Mississaugas of the Credit First Nation
- Haudenausaunee Chiefs Confederacy Council (HCCC) represented by Haudenosaunee Development Institute (HDI)
- Huron Wendat Nation

A meeting (January 5, 2022) a site visit (February 18, 2022) and an on-line meeting (July 4, 2024) were held with Six Nations of the Grand River (SNGR) during the EA.

The City of Kitchener has committed to keeping all Indigenous Communities updated on the progress of the projects and will invite Indigenous field monitors to participate during future environmental fieldwork. The final archaeological report, which provided clearance of the project limits, was submitted both to the Ministry Sport, Tourism and Culture Industries and SNGR, HCCC (represented by HDI) and Mississaugas of the Credit First Nation.

2.4 Public Meetings

A combined Community Café Event/Public Information Centre (PIC) and two Public Information Centres were held online during the Study to present the project, the assessment of alternatives and the Technically Preferred Plan. These meetings were an integral component of the Study – seeking input and comments from the local community/stakeholders. Public and agency representatives were encouraged to provide input/feedback. City of Kitchener and consultant staff were available to respond to any verbal comments/questions at the online events and during the subsequent 2-week comment period.

See **Appendix B** for the Community Café and Public Information Centre Summary Reports.

2.4.1 Community Café Event/ PIC No. 1

A combined Community Café and PIC was held virtually (by video webinar) on April 20, 2021 from 6:30 to 8:00 pm. The Community Café was an informal event for the public and stakeholders to facilitate conversation about issues that matter to the community. Four topics were chosen as discussion points to consider the concerns of the public including: traffic operation, pedestrians/cyclists, intersection design and neighbourhood concerns.

The Community Café process followed the principles of the 'World Café' philosophy; namely that people want to talk together about issues that matter and secondly, that as they talk

together, they can collectively achieve greater wisdom. The Community Café is an effective conversational method for fostering dialogue, accessing collective intelligence and creating innovative possibilities for action. Discussion from the event was recorded and used an input for subsequent steps in the EA Study.

Based on input from the Community Café and PIC No.1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods and to consider a new transportation alternative, Caryndale Drive.

2.4.2 Public Information Centre No. 2

The second PIC was held virtually (by video webinar) on November 17, 2021 from 6:30 to 8:00 pm. The PIC presented information on the Municipal Class EA Process, traffic, preliminary design alternatives, effects and mitigation, the Technically Preferred Alternative, and next steps.

Nine comment sheets/emails were received following the PIC.

2.4.3 Public Information Centre No. 3

The third PIC was held in-person June 20, 2024 from 7:00 to 9:00 pm and included exhibits and an opportunity to speak to the consultant and City of Kitchener staff. The PIC presented information on the Municipal Class EA Process, new studies on traffic, the environment and geotechnical assessments, as well as the preliminary design alternatives, effects and mitigation, the Technically Preferred Alternative, and next steps.

A total of 50 individuals attended the PIC. Eighteen (18) comment sheets and emails were received during and after the comment period.

2.4.4 Environmental Committee Meetings

Two (2) meetings were held with the Environmental Committee on June 17, 2021, and in October 2021 as well as it was presented to the Region of Waterloo Environmental Committee on November 29, 2021. These meetings provided updates regarding the study's progress and findings.

2.4.5 Council Resolution

3.0 EXISTING CONDITIONS

The existing conditions of the natural and built environment, land use and property, and socio-economic environment are described in this Section.

3.1 Natural Environment

Detailed environmental studies were available from the 2021 WSP EIS of the Strasburg Creek wetland including: wildlife survey locations, vegetation and woodland limits, natural heritage features, breeding bird surveys, flora and fauna. From the 2021 surveys the Black Ash was identified as a threatened species before it was designated as a SAR in 2024.

3.1.1 Terrestrial and Aquatic

The north section of the Study Area (adjacent to the current terminus of Biehn Drive) is located within the Strasburg Creek Provincially Significant Wetland (PSW) Complex. The Strasburg Creek PSW unit at Biehn Drive is a wooded swamp dominated by mature hardwoods. A desktop background information review including an EIS for the wetland did not identify the presence of any terrestrial or aquatic Species at Risk (SAR); however, in January 2024 the Black Ash was added to the list of SAR species. The site reviews did identify suitable habitat conditions for bats within the swamp (roosting trees throughout) and for a variety of SAR songbirds on the lands currently under cultivation to the south. The general location of the Biehn Drive extension within the PSW is shown on **Figure 4.**

No open bodies of water were in the vicinity that would indicate turtle presence in the area and their presence would likely be only transitory due to the closed canopy and lack of basking areas. Other reptiles and amphibians (frogs, salamanders, snakes, etc.) would be expected to be common. Yellow Birch (*Betula alleghaniensis*), now an uncommon tree species in many parts of southern Ontario, is well represented in the wetland and surrounding woodlands, as are Eastern Hemlock (*Tsuga canadensis*), Black Ash (*Fraxinus nigra*) and White Pine (*Pinus strobus*), all of which include large specimens. A grouping of mature Aspen Poplars (*Populus spp*.) occurs at the south boundary of the woodlot where the roadway extension will exit the PSW.

Supporting Threatened Bat Species: A baseline species-level field survey of bat presence was conducted on the evening of August 14, 2024, to identify the species of bat present over the wetlands near the proposed alignment. Acoustic monitoring identified the following species: Big Brown Bat (Eptesicus fuscus), Eastern Red Bat (Lasiurus borealis), Hoary Bat (Lasiurus cinereus), Little Brown Myotis (Myotis lucifugus), Silver-haired Bat (Lasionycteris noctivagans) and Tri-Colored bat (Perimyotis subflavus). As of August 15, 2024, the Eastern Red Bat, Hoary Bat, and Silver-haired Bat are designated as Species at Risk (SAR) under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Additionally, the Tri-colored Bat and Little Brown Myotis are listed as Species at Risk in Ontario (SARO).

During the field surveys, several cavity trees were observed along the historic property line west of the proposed alignment. These will not be impacted by this infrastructure expansion work, however cavity trees and old buildings (e.g., barns, cabins, sheds) are well known to provide roosting habitat for several bat species. Many bat species are threatened or endangered due to loss of habitat and other issues. For example, most old barns, houses and sheds in urbanizing areas are removed for space,

safety or aesthetic reasons during land development, resulting in loss of habitat for bats, barn swallows, rodents and snakes. The most significant component of disappearing bat habitat is large empty cavities that provide maternal roosting spaces as they nurse their young

The Natural Environment Site Overview Technical Memorandum is provided in **Appendix D**.

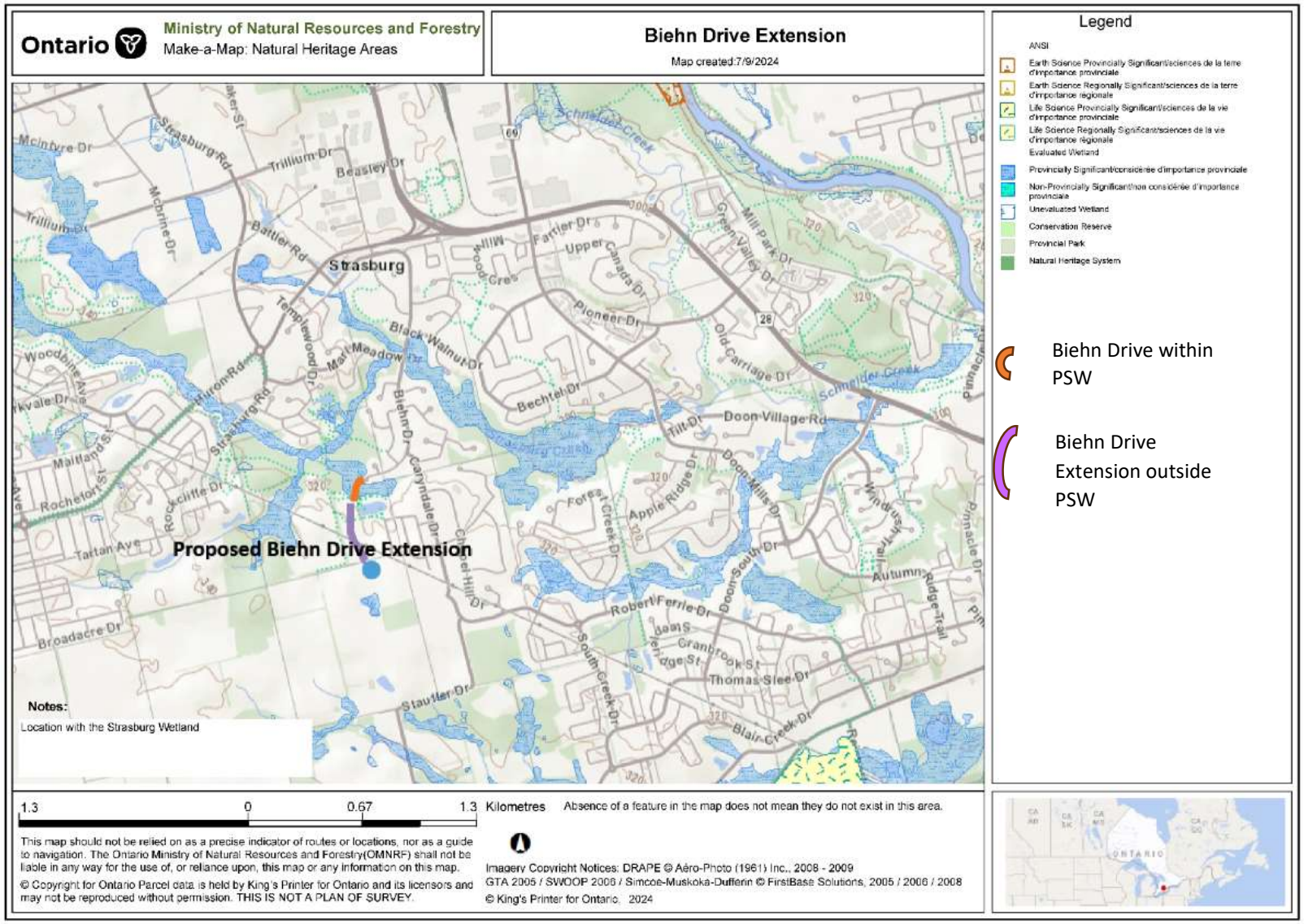


Figure 4: Biehn Drive Extension within the Strasburg Provincially Significant Wetland

3.1.2 Cultural Heritage

The MHTSCI Checklist to screen Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes was completed and determined that no properties within the Study Area are recognized as a heritage property or to have cultural heritage value. The completed checklist is provided in **Appendix E.**

3.1.3 Archaeology

The Study Area for the proposed Biehn Drive extension and sanitary trunk sewer extension in the City of Kitchener was subject to previous Stage 1 and 2 archaeological assessments conducted prior to the current project. The eastern portion was assessed by AAL in 2009 (P013-519-2009) and the western portion was assessed by ARA in 2021 (P007-1187-2021). Both of these assessments identified several archaeological sites, but none of them met the MHSTCI criteria for requiring any additional archaeological assessment. The 2021 report was completed with the participation of the HCCC (represented by HDI), the Six Nations of the Grand River Elected Council, and the Mississauga of the Credit First Nation, and all three communities reviewed the report and had no concerns with the recommendations made.

Based on the previous work completed, there are no outstanding archaeological concerns for the current project.

3.1.4 Sourcewater Protection

The Study Area is located within the Grand River Source Protection Area and is subject to the Grand River Source Protection Plan. Parts of the Study are located within:

- Wellhead protection area B (WHPA-B) with a vulnerability score of 8;
- Wellhead protection area C (WHPA-C) with a vulnerability score of 6;
- Wellhead protection area D (WHPA-D) with a vulnerability score of 4;
- Significant Groundwater Recharge Area with a vulnerability score of 2; and
- Significant Groundwater Recharge Area with a vulnerability score of 4.

These areas are illustrated on **Figure 5**. The Grand River Source Protection Plan identifies policies to protect municipal drinking water against existing and future threats in compliance with the *Clean Water Act, 2006* (Ontario Regulation 287/07). The *Clean Water Act* requires municipalities to notify Source Protection Authorities and Committees when the municipalities receive applications that could create or modify a transport pathway.

Figure 5: Wellhead Protection Areas (WHPA)

The City is required to protect against source water threats. Source protection policies which apply to this Study are summarized in the Grand River Source Protection Plan (Chapter 10 – Region of Waterloo). All applicable policies identified in the Grand River Source Protection Plan need to be followed during and post construction.

3.1.5 Climate Change

The recommendations of the ESR considered the impacts of climate change and the effectiveness of adaptation strategies to reduce the City's vulnerability. Strategies being implemented as part of or in conjunction with this ESR include:

- The expansion of cycling infrastructure to encourage active transportation;
- Improved access to transit services and the potential to provide transit services along the corridor in the future; and
- Low impact design to meet the City's water retention target and mitigate increased precipitation due to climate change.

The extension of Biehn Drive is not anticipated to produce an increase or decrease in greenhouse gas emissions based on the following:

- Vehicle trips along the corridor will be generated by: a redistribution of cars from existing roads (the extension has the potential to shorten vehicle trips by providing a more direct route to/from destinations); and new trips generated by future development in Kitchener

(these trips would be added to the transportation network regardless of the Biehn Drive extension).
- The construction will not be a significant source of greenhouse gasses.
- The addition of multi-use trails/boardwalks will encourage more active transportation along the corridor and will have a beneficial long-term effect on greenhouse gas emissions.

3.1.6 Air Quality

The construction of the road extension is not expected to generate additional trips within the municipality's transportation network (trips within the neighbourhood will move from Caryndale Drive to the Biehn Drive extension) and therefore air quality changes and increases in greenhouse gas emissions are not anticipated. It will however provide greater opportunity for active transportation and with that a potential reduction in vehicle emissions.

3.2 Technical Investigations

3.2.1 Drainage

Groundwater monitoring wells from earlier investigations are located near the current southwest terminus of Biehn Drive on the edge of the PSW unit. A concrete headwall with twin 1.2 m culvert inlets in the wetland boundary at the south end of the roadway directs wetland drainage and local storm sewer flows from Biehn Drive to an outlet pipe 25 m north of the road, where it becomes a permanently flowing tributary connecting with Strasburg Creek. The floor of the wetland in the immediate vicinity of the culvert entrance was wet with scattered ephemeral pools extending south. Several seasonal channels could be made out within the wetland approaching the culverts from the southwest and southeast.

3.2.2 Utilities

A Hydro One transmission corridor, including a transmission tower, is located within the Study Area. A 15 m offset area around the Hydro One transmission tower is required for Hydro One maintenance and access roads.

3.2.3 Noise

A Noise Assessment was completed utilizing the STAMSON 5.04 noise software program to determine 16-hour and 8-hour nighttime equivalent sound levels (Leq) for the roadway traffic. The assessment was performed in accordance with the MECP's Noise Assessment Criteria (NPC-300) and MTO's Environmental Guide for Noise. The noise assessment was completed using three representative receiver sites, as shown in **Figure 6.** The receiver sites were located in an Outdoor Living Area (OLA) in the backyard during the day and the plane of the window of a bedroom for nighttime assessments.

It is projected that no receiver sites (residential properties) will experience sound level changes greater than 5 dBA and no receiver site will have a total sound level of over 65 dBA. The forecast sound levels for daytime and nighttime meets the objective of 55 dBA and no mitigation is required.

See **Appendix F** for the Noise Assessment Report.

Figure 6: Representative Receiver Sites

3.2.4 Proposed / Approved Development

Future growth is occurring within the Kitchener area, and the lands adjacent to the Study Area. This growth is identified within the Official Plan, Kitchener Growth Management Plan and as approved in the Province of Ontario's *A Place to Grow: Growth Plan for the Greater Golden Horseshoe (August 2020)*. The Growth Plan for the Greater Golden Horseshoe was prepared and approved under the *Places to Grow Act*, 2005 and Amendment 1 took effect on August 28, 2020.

The successful realization of this vision centres on effective collaboration between the Province, other levels of government, Indigenous Peoples, residents, private and non-profit sectors across all industries, and other stakeholders. The policies of this Plan regarding how land is invested are based on the following principles:

- Support the achievement of complete communities that are designed to support healthy and active living and meet people's needs for daily living throughout an entire lifetime.
- Prioritize intensification and higher densities to make efficient use of land and infrastructure and support transit viability.

The Places to Grow Plan targets the Region of Waterloo to achieve a population threshold of 923,000 and an employment threshold of 470,000 by 2051.

3.3 Additional Studies

Following PIC 2 in November 15 to 29, 2021, three additional studies were carried out to fully understand the traffic and natural heritage impacts anticipated with the extension of Biehn Drive. These studies included an updated traffic analysis of the Doon South and Brigadoon communities, a survey for Black Ash trees which were listed as a Species at Risk in January 2024 and geotechnical

investigations assessing dewatering and trenchless technology assessments for constructing municipal services beneath the Strasburg Creek Wetland. These studies updated the evaluation methodology and added significant criteria which were not considered in the original evaluation of road alignments carried out in October 2021. The Analysis and Evaluation Report has been updated to reflect the recent findings and include documentation of the "Do Nothing" alternative. This report documents the revised evaluation of the Preliminary Design Alternatives.

3.3.1 City of Kitchener Doon South Community Area Transportation Study

The purpose of this study was to confirm the need and justification for the Biehn Drive extension and the implications of not proceeding with this project.[2] The findings and conclusion are briefly listed as follows:

- Caryndale Drive currently functions as a major neighbourhood community collector (although designated as a minor collector street). It provides the only connection between Biehn Drive and Robert Ferrie Drive.
- Caryndale Drive in combination with Biehn Drive and Robert Ferrie Drive provides the only route through the western area of the Doon South neighbourhood between New Dundee Road and Huron Road to the south.
- The future extension of Robert Ferrie Drive west to Strasburg Road, and the extension of Strasburg Road south to New Dundee Road will increase traffic volumes on Caryndale Drive by providing a new link to Caryndale Drive from Strasburg Road (if Biehn Drive is not connected to Robert Ferrie Drive).
- The extension of Biehn Drive to Robert Ferrie Drive will ensure Carnydale Drive functions as the minor neighbourhood collector street it was constructed to be and as it is designated in the City of Kitchener Official Plan. It will provide an alternate route to the Caryndale Drive corridor. As such, it will balance traffic demands onto both Biehn Drive and Carnydale Drive.

The Doon South Community Area is shown in **Figure 7.**

3.3.2 Black Ash Tree Identification

A Site Reconnaissance of the portion of the Strasburg Creek Provincially Significant Wetland (PSW) within the Study Area was undertaken on October 23, 2024, to identify Black Ash trees.[3] Six trees are considered potential Black Ash within the preferred road alignment, four were classified as potential Black Ash due to the absence of leaves, which limits identification, and two exhibit stronger potential based on distinct bark characteristics. Refer to **Appendix D**.

The *Endangered Species Act*, 2007 (ESA) protections for Black Ash came into force on January 26, 2024. Ontario's new regulations apply to healthy Black Ash, in designated regions, that appear to have survived exposure to the Emerald Ash Borer (EAB). These regions encompass various municipalities, counties, townships, and cities, including Kitchener in the Region of Waterloo. Ontario's habitat protection prohibitions are applicable to a radial distance of 30 metres around Black Ash.

[2] City of Kitchener Doon South Community Area Transportation Study, by Paradigm Transportation Solutions Limited 02/2024.
[3] Black Ash Tree Identification Update - October 23, 2024

3.3.3 Hydrogeology Assessment

Cambium Inc. (Cambium) is pleased to provide BT Engineering (the client) with a dewatering assessment to present the background review, groundwater levels, and dewatering estimates in support of the proposed roadway extension of Biehn Drive. Due to the presence of the Strasburg Creek Wetland Complex across the linear infrastructure alignment, some of the installation will be completed using trenchless horizontal directional drilling (HDD) or microtunnelling. Based on the geotechnical recommendations the future detail design construction dewatering will minimize effects outside the work zone. This is intended to lower the groundwater levels in the excavation area in order to ensure a dry working condition for the placement of linear infrastructure such as storm and sanitary sewers and watermains. Refer to **Appendix I.**

Where construction dewatering is required in amounts in excess of 400,000 L/day, a Permit To Take Water (PTTW) must be obtained. For temporary construction dewatering (six months or less) greater than 50,000 L/day but less than 400,000 L/day, registration through Environmental Activity and Sector Registry (EASR) is required. Based on the estimated dewatering rate for each 50 m trench segment of 249,300 L/day (including a safety factor) and the estimated dewatering rate for each receiving pit of 235,000 L/day (including a safety factor), an EASR registration will be required as dewatering rates exceed 50,000 L/day. Additionally, if multiple excavations are dewatering simultaneously, dewatering rates could exceed 400,000 L/day and a Permit to Take Water (PTTW) may be required.

The proposed trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area. Refer to **Appendix J**. Trenchless construction would normally require less or no dewatering than traditional open cut installations.

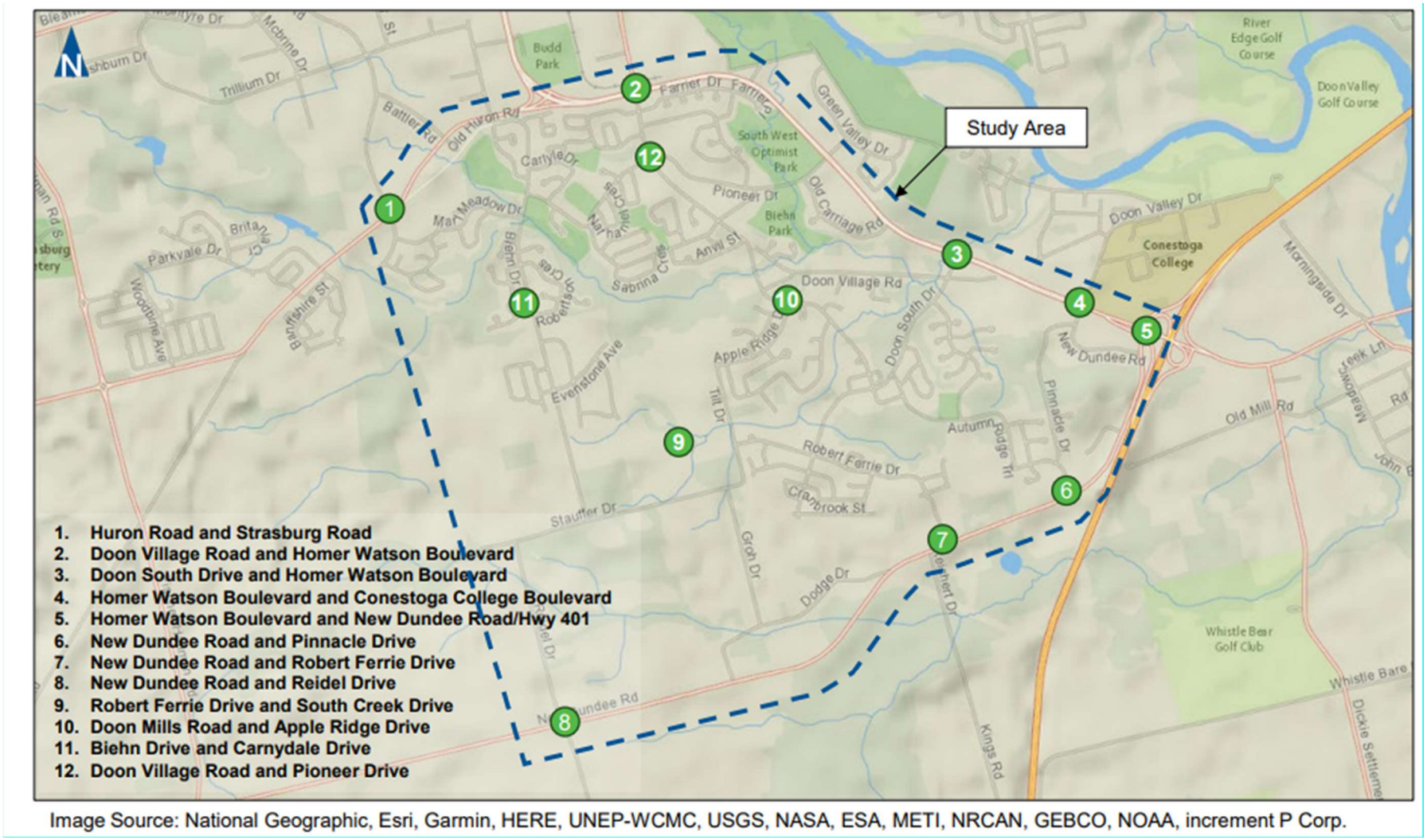


Figure 7: City of Kitchener Doon South Study Area and Intersections

4.0 TRAFFIC

The extension of Biehn Drive has been part of the integrated land use and transportation plan for the larger community for decades.

The new street is needed to evenly distribute traffic movements into and out of neighbourhoods to the arterial road network. Multiple connections from the arterial road network are desirable to reduce the traffic volumes on any one street, reduce the travel distance from any house to the arterial road network, and provide multiple access points for emergency services to each neighbourhood. If Biehn Drive is not extended, there will be increased traffic on adjacent streets (i.e. Caryndale Drive, Templewood Drive, and Biehn Drive northeast of the Study Area). Diversion of traffic from a neighborhood to go through other neighbourhoods is not desirable because of the disruption to other communities.

The extension of Biehn Drive will be possible when Robert Ferrie Drive is extended to the Strasburg Road arterial to provide a western arterial street to service neighbourhoods to the east. The construction of Strasburg Road and the new Biehn Drive link will mean that traffic will no longer need to travel a longer distance on circuitous routes through adjacent neighbourhoods to reach an arterial road network. The new link will reduce traffic volumes in other neighbourhoods and provide a new route to serve the neighbourhood currently near the termination of Biehn Drive. The traffic demand to destinations to the south and west will increase as development levels achieve the 2051 Places to Grow Plan with expansion areas in these areas.

4.1 Previous Studies

The Biehn Drive extension has been included in the City's planning documents since the late 1980's. The extension is part of the integrated land use and transportation plan for the Brigadoon community that will provide for convenient travel from neighbourhoods to the arterial road network. The transportation and land use studies that have led to this plan have included (chronologically):

1. Brigadoon Community Plan (1989);
2. Official Plan Amendment No. 98 (1991);
3. Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994);
4. Kitchener Planning and Development Staff Report PD95/51 (1994);
5. Updated Brigadoon Community Plan (2005);
6. Kitchener Integrated Transportation Master Plan (2013);
7. Robert Ferrie Drive Extension Environmental Assessment (2014); and
8. Official Plan Amendment No. 103 (March 21, 2019).

These previous studies have developed an integrated land use and transportation plan that provides a reasonable distribution of traffic volumes on collector streets into and out of neighbourhoods and considers all modes of transportation (vehicular, pedestrian and cyclists).

4.1.1 Previous Need and Justification Review (2014)

The Biehn Drive Extension Need and Justification Report was completed by Paradigm Transportation Solutions in June 2014. This Report identified that eliminating the Biehn Drive extension would result in:

- Inefficiencies in the road network and backtracking/out-of-way travel for residents in the Doon South/Brigadoon communities;
- Insufficient capacity to accommodate the forecast traffic demands at the 2031 planning horizon; and
- Increased traffic on adjacent streets (i.e. Caryndale Road, Templewood Drive, and Biehn Drive (northeast of the Study Area)). These roads would be operating at traffic levels above their road classifications.

The Report concluded that eliminating Biehn Drive would be a fundamental design change to the Doon South/Brigadoon communities and would result in significant impacts to adjacent roads and other neighbourhoods, and that the Biehn Drive extension is therefore required.

This conclusion was validated by the Paradigm February 2024 Traffic Peer Review.

4.2 Road Classification

Road networks are categorized into four levels based on their function and capacity as a hierarchy with increasing design standards:

- Local streets - function to provide access to land/driveways (shown as grey in **Figure 8)**. These are typically low speed and accommodate pedestrians and parking on-street. Examples of these types of streets in the community include McLeod Court and Kilkerran Crescent.
- Collector streets - function to collect traffic from several local streets and provide access to arterial streets (shown as orange and brown in **Figure 8**). These streets typically separate pedestrians and vehicles and have moderate traffic volumes. Examples of these types of streets in the community include Caryndale Drive and Biehn Drive.
- Arterial streets - carry higher volumes of traffic and truck traffic (shown as purple in **Figure 8**). Examples of these types of streets in the community include Huron Road and Strasburg Road.
- Highways and freeways - provide linkages between communities (shown in blue in **Figure 8**). Highways and freeways are high speed and accommodate inter-regional trips.

The City's Official Plan (November 2014) identifies Biehn Drive as a Major Community Collector Street.

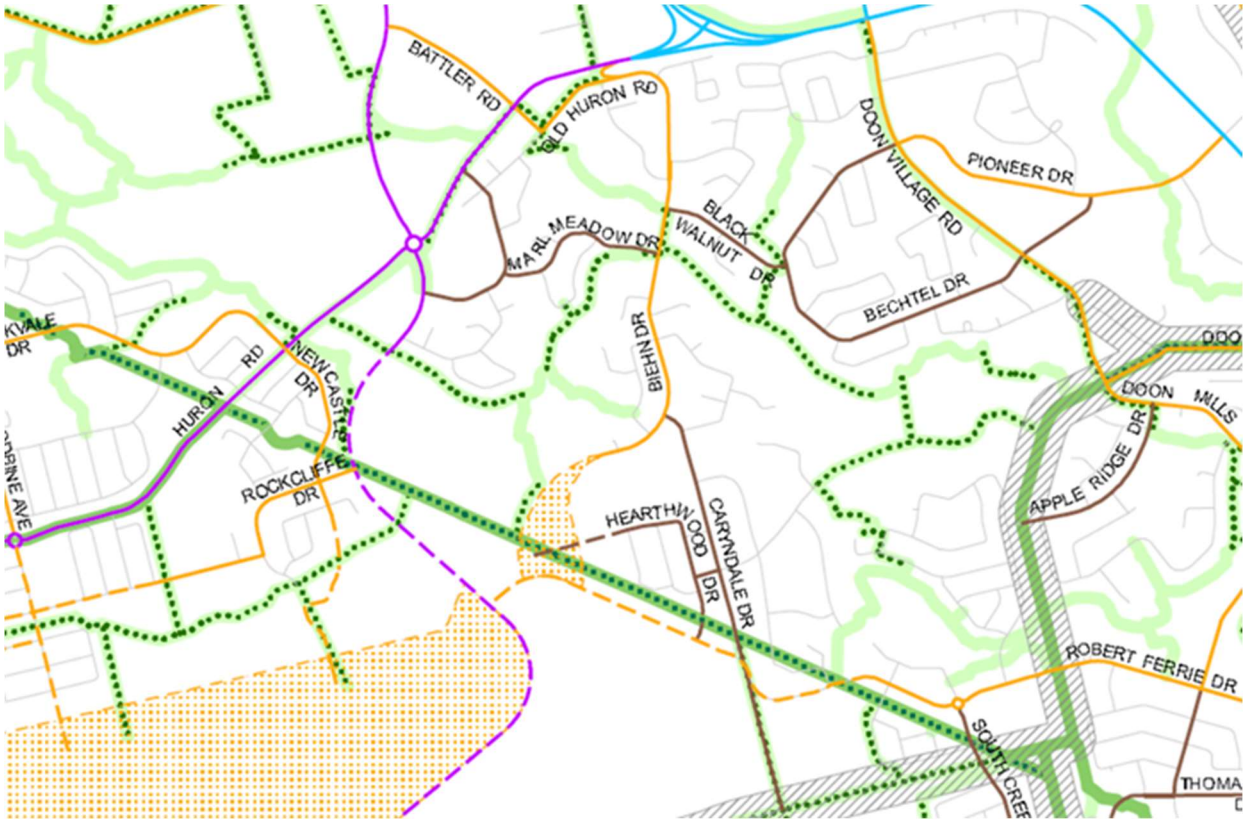


Figure 8: Road Network

4.3 Projected Traffic Volumes

The Broader Study Area (bound by Strasburg Road and Huron Road) includes 4 community neighbourhoods (see **Figure 9)**. Each of these neighbourhoods, with exception of the Biehn Drive South neighbourhood (Neighbourhood 3) has a collector road to provide them a direct link to the arterial road system. If the new Biehn Drive link is not constructed, traffic from Neighbourhood 3 will continue to go through adjacent neighbourhoods using Caryndale Drive (Zone 4). This was never intended as part of the land use plan for the broader residential area.

4.3.1 Trip Generation

Traffic volumes along the Biehn Drive extension were forecast based on existing traffic volumes and the daily traffic generated by the 4 existing adjacent neighbourhoods. Daily trip generation rates developed by the Institute of Transportation Engineers Trip Generation Manual (11th Edition) were utilized. Trip generation for the existing neighbourhoods is summarized in **Table 2**.

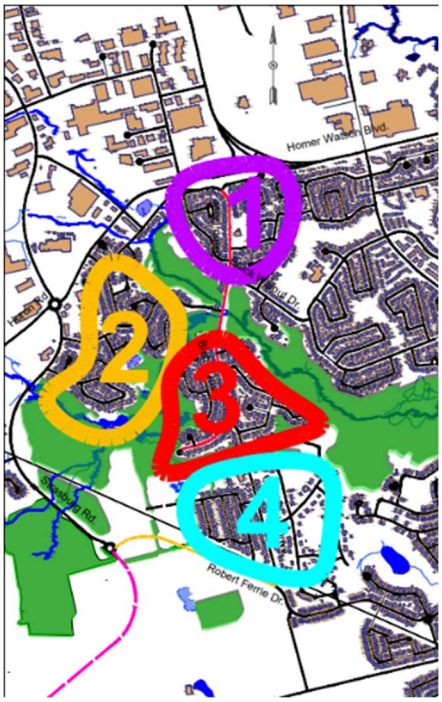


Figure 9: Existing Neighbourhood Areas

Table 2: BTE Trip Generation Rates of Existing Neighbourhoods (2024)

Neighbourhood	Approximate Number of Dwelling Units	ITE Trip Generation Rate	Total Daily Vehicle Trips
Neighbourhood 1 (Biehn Drive North Neighbourhood)	260	Single-Family Detached Housing 9.43 Daily Trip Generation Rate/Dwelling Unit	2452
Neighbourhood 2 (Marl Meadow Neighbourhood)	475		4480
Neighbourhood 3 (Biehn Drive South Neighborhood)	265		2490
Neighbourhood 4 (Caryndale Neighbourhood)	225		2122

Alignment alternatives for Biehn Drive include two scenarios:

- Scenario 1 includes an extension of Biehn Drive for vehicular traffic; and
- Scenario 2 does not include the extension of Biehn Drive beyond an extension for the sanitary sewer, associated servicing and a multi-use trail (vehicle trips would continue to use existing roads including Caryndale Drive).

The primary travel routes to the arterial road network are shown in **Figure 10**.

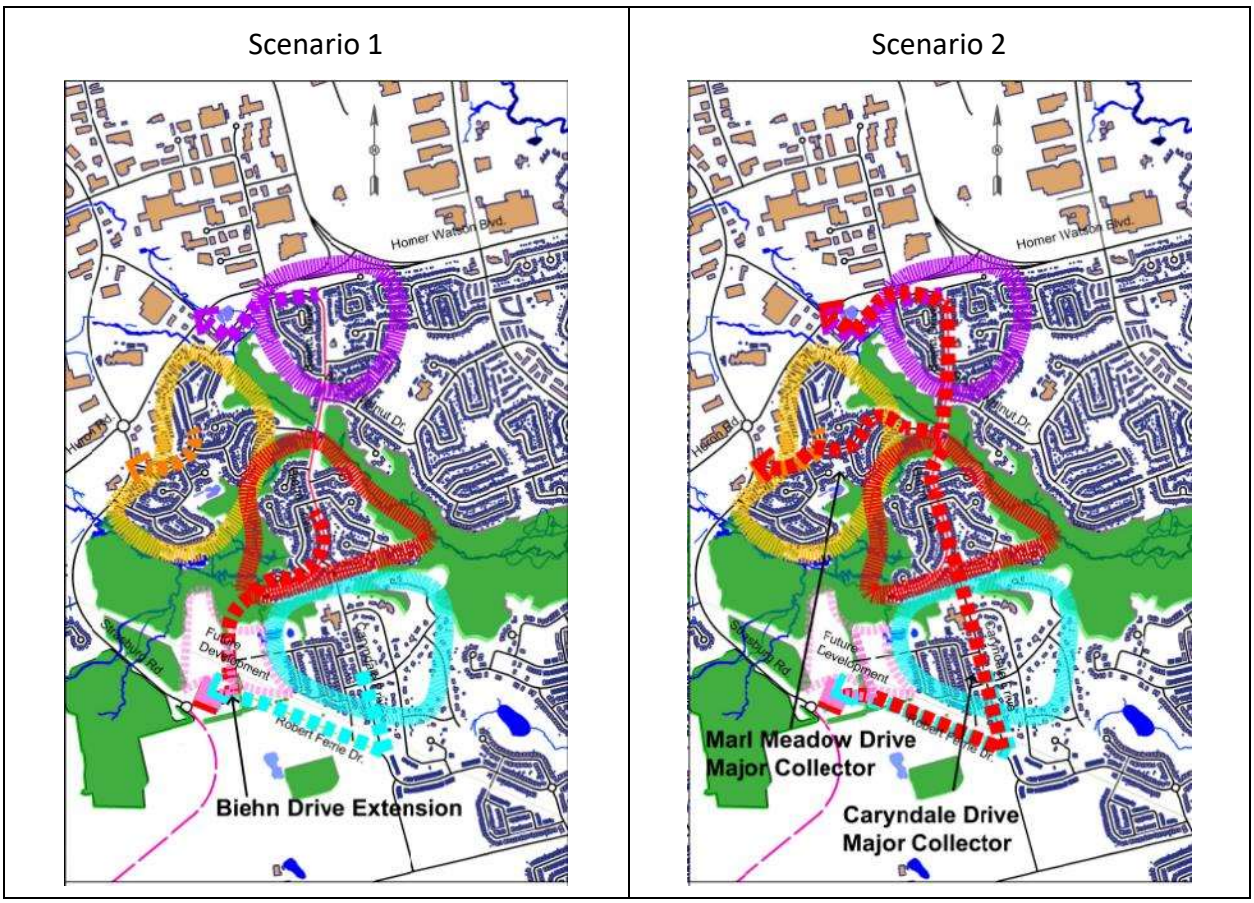


Figure 10: Primary Neighbourhood Access Routes

The trip distribution and assignment of traffic to Biehn Drive under Scenario 1 and Caryndale Drive under Scenario 2 are summarized in **Table 3**. The projected trip distribution is based on future travel patterns based on proposed improvements to the road network (i.e. Robert Ferrie Drive extension and opening and extension of Strasburg Road). When the Strasburg Road and Robert Ferrie Drive extensions are constructed and opened, drivers will select the shortest route/fastest route to their destinations utilizing the arterial road network. It will result in traffic avoiding the traffic calming measures in the vicinity of the school on Caryndale Drive.

Table 3: BTE Trip Distribution and Assignment (2024)				
Scenario	**Origin / Destination Neighbourhood**	**Distribution**		**Number of Vehicle Trips**
Scenario 1 – Extension of Biehn Drive **(Location – Current Biehn Drive Terminus)**	Neighbourhood 2 (Marl Meadow Neighbourhood)	Trips to/from the south via Robert Ferrie Drive	5%	224
	Neighbourhood 3 (Biehn Drive South Neighborhood)	Trips to/from the south Robert Ferrie Drive	90%	2,258
			Total=	2,482
Scenario 2 – Without Biehn Drive Extension **(Location – Caryndale Drive north of Robert Ferrie Drive)**	Neighbourhood 2 (Marl Meadow Neighbourhood)	Trips to/from the south via Caryndale Drive	5%	224
	Neighbourhood 3 (Biehn Drive South Neighborhood)	Trips to/from the south via Caryndale Drive	50%	1,250
	Neighbourhood 4 (Caryndale Neighbourhood)	Trips to/from Robert Ferrie Drive	90%	1,909
			Total=	3,383

Under Scenario 1 (extension of Biehn Drive), Biehn Drive is projected to have a daily traffic volume between 2,500 to 3,000 vehicles/day (at the current terminus (cul-de-sac)) with an allowance for potential daily variation in traffic flows. To the south of the Provincially Significant Wetland, traffic volumes will increase as Biehn Drive will then include additional traffic from the future development lands north of Robert Ferrie Drive. These volumes are within the acceptable range of a major collector roadway in the City's TMP.

Under Scenario 2 (no extension of Biehn Drive), Caryndale Drive will have a daily traffic volume of approximately 3,500 vehicles/day (north of Robert Ferrie Drive). Caryndale Drive currently carries increased traffic as it is used by motorists on Robert Ferrie Drive to access the arterial road network along Biehn Drive North. The extension of Robert Ferrie Drive to Strasburg Road, without an extension of Biehn Drive, would reverse the flow of that current traffic demand on Caryndale Drive, as residents in the area of Biehn Drive would use Caryndale Drive (a minor collector street which includes an elementary school) to access Robert Ferrie Drive and Strasburg Road.

From a traffic operation and safety perspective, Scenario 1 is preferred.

5.0 SANITARY SEWER

A Technical Memorandum was prepared to present the definition of the sanitary drainage area and the estimated peak flow at the proposed connection to the existing sanitary trunk sewer on Biehn Drive. This is included in **Appendix G.**

The sanitary drainage area/tributary area includes the lands designated for urban development (see **Figure 11**) and excludes the lands designated as Rural and Agricultural. The sanitary trunk sewer drainage area includes 64.0 ha. The design criteria for sanitary servicing meets the requirements of the City of Kitchener's Development Manual.

The sanitary sewer extension will follow the alignment of the Biehn Drive extension. The required sanitary sewer pipe size is 525 mm diameter. No other alternative is available for the sanitary sewer alignment. The green agricultural land identified in **Figure 11** has subsequently been added to the expansion areas in the secondary plan and the sanitary servicing should be reviewed at the detail design stage for this additional tributary area.

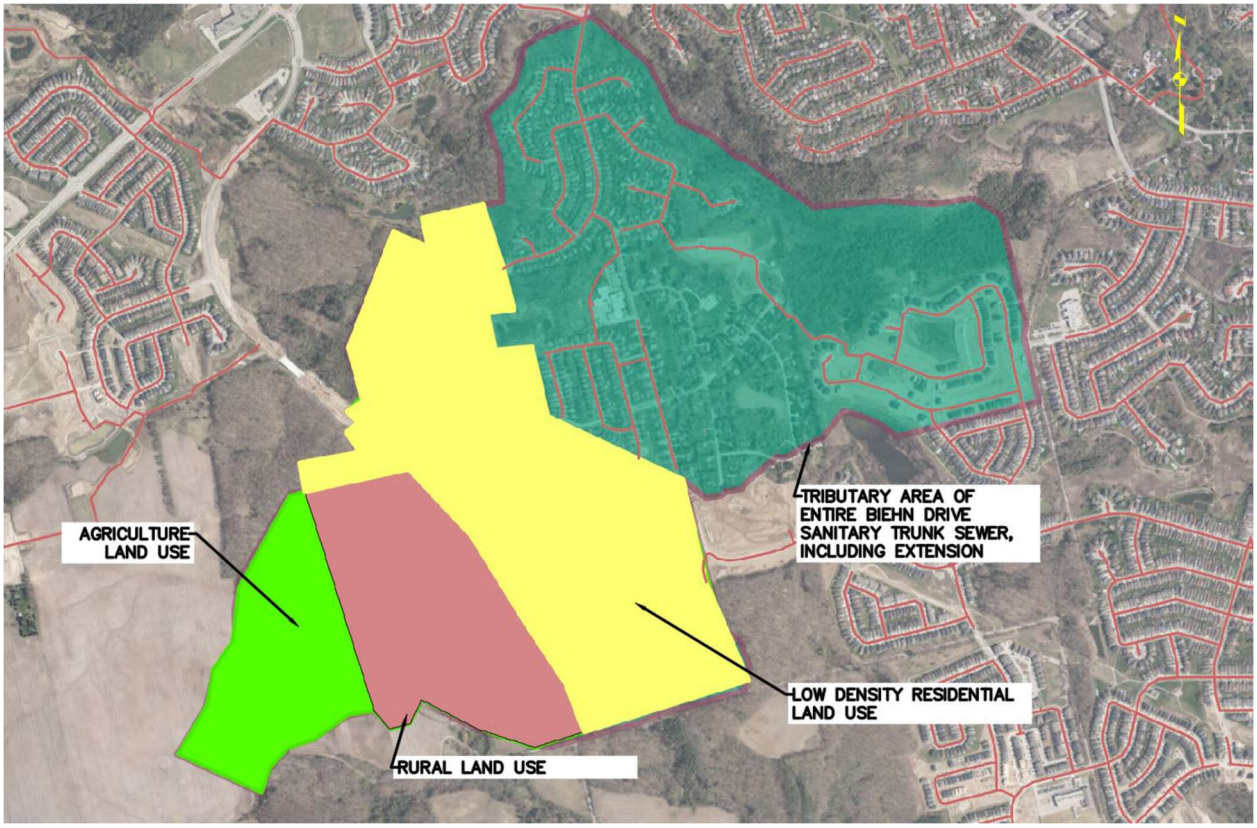


Figure 11: Tributary Area Based on Land Uses per the Official Plan

6.0 EVALUATION OF ALTERNATIVES

The evaluation of alternatives was completed using both quantitative and qualitative assessments to compare the net effects and performance of the alternatives.

The quantitative assessment used various global factors and a weighted additive score methodology to mathematically evaluate the alternatives being considered. The methodology is referred to as the Multi Attribute Trade-off System (MATS).

The qualitative evaluation method measured the relative differences and compared the advantages and disadvantages of each alternative using evaluation criteria. The evaluation criteria looked at the effects each alternative had on the natural, social/cultural, economic and physical elements in the Study Area.

The Analysis and Evaluation Report detailing the evaluations for each alternative is included in **Appendix H** and is summarized in this section.

6.1 Preliminary Design Alternatives

The analysis and evaluation process is a central requirement of the Class EA process. In adhering to this process, several alternatives were generated for consideration which would improve traffic operations through the broader Study Area to meet existing and future traffic and active transportation demands.

A “long list” of alternatives was generated, based on identified needs, to ensure consideration of a wide range of transportation alternatives (i.e. all reasonable alternatives are considered). The preliminary design alternatives were categorized under 3 groups:

1. Alignment Alternatives (road and sanitary sewer and municipal services)
2. Cross Section Alternatives
3. Intersection Alternatives

6.1.1 Coarse Screening Alignment Evaluation

The Preliminary Alignment Alternatives presented to the public at PIC No. 1 and are shown in **Figure 12**. An additional Alignment, Alternative 4 using existing roadways, was added following input from PIC No. 2 and included a proposed 3 m Multi Use Trail linking Biehn Drive to Robert Ferrie Drive to limit impacts to the PSW. The Do Nothing was included as a baseline to compare other alternatives. All the alternatives carried forward to the detailed evaluation were considered by the Study Team to be reasonable alternatives to the Planning Solution and are listed in **Table 4**.

Table 4: Preliminary Alignment Alternatives

Alternative	Description
Do Nothing	Existing - Caryndale Drive/use of trenchless technology for municipal services.
Alternative 1	Connect Biehn Drive to Robert Ferrie Drive - East Alignment
Alternative 2	Connect Biehn Drive to Robert Ferrie Drive - Central Alignment
Alternative 3	Connect Biehn Drive to Strasburg Road - West Alignment
Alternative 4	Existing - Caryndale Drive Provide an Active Transportation Link Municipal Trunk Sewer to follow Alternative 1

The coarse screening of Alignment Alternatives is shown in **Table 5.**

The preliminary alignment alternatives will include a trunk sanitary sewer in conjunction with the road extension alternatives. It is noted that some of the alternative alignments for the trunk sewer may diverge from the road alignment alternatives. The Class EA process for extension of the sanitary sewer is a Schedule B process. However, the EA for the road and sanitary sewer will be combined into a single document and will be documented in an ESR. This EA is being undertaken concurrently with the Sanitary Sewer Master Plan.

6.1.2 Short Listed Alignment Alternatives Evaluation

Figure 13 illustrates the three (3) alignment alternatives that were carried forward following the coarse screening.

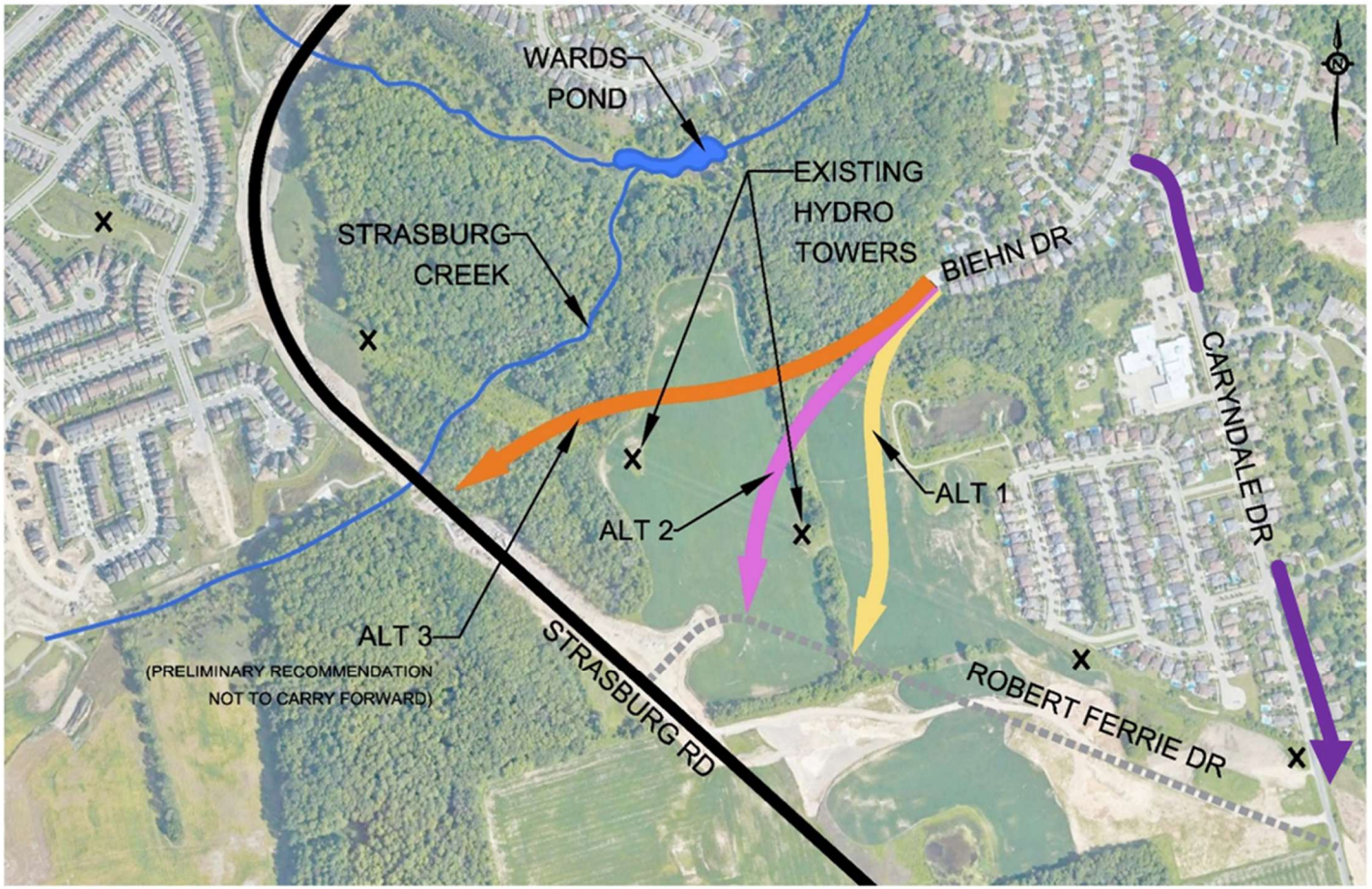


Figure 12: Preliminary Alignment Alternatives

NTS

Legend

Future Roadway Alignment

Table 5: Coarse Screening of Alignment Alternatives

Screening Criteria	Do Nothing	Alternative 1	Alternative 2	Alternative 3: Strasburg Road Connection	Alternative 4: Existing - Caryndale Drive
Does this alternative satisfy forecast traffic demand, improve safety, and address all modes of transportation?	Does not meet forecast traffic demand, improve safety nor address all modes of transportation.	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Strasburg Road. Accommodates all modes.	Provides a north-south connection to Strasburg Road. Accommodates all modes. However, there are increased levels of traffic on local roads.
Does the approach result in significant impacts to the natural environment?	No impacts.	Minor impacts to the woodlot/PSW (~0.3 ha).	Minor impacts to the woodlot/PSW (~0.3 ha).	Significant impacts to the woodlot/PSW (~1.3 ha).	No impacts.
Is the approach affordable for the City to implement?	Affordable alternative.	No significant difference.	No significant difference.	Higher cost - requires an intersection onto Strasburg Road (arterial).	Affordable alternative.
Does this alternative comply with the recommendations of the City's planning documents (I.e., TMP, OP, KGMP)	This alternative does not comply with the recommendations of the City's planning documents.	This alternative complies with the recommendations of the City's planning documents.	This alternative complies with the recommendations of the City's planning documents.	Does not comply with the recommendations of the Official Plan or Growth Management Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible.	This alternative does not comply with the recommendations of the City's planning documents.
Recommendation:	Carry forward as a base line to compare alternatives. ✓	Carry forward for further evaluation. ✓	Carry forward for further evaluation ✓	Do not carry forward ✗	Carry forward for further evaluation ✓

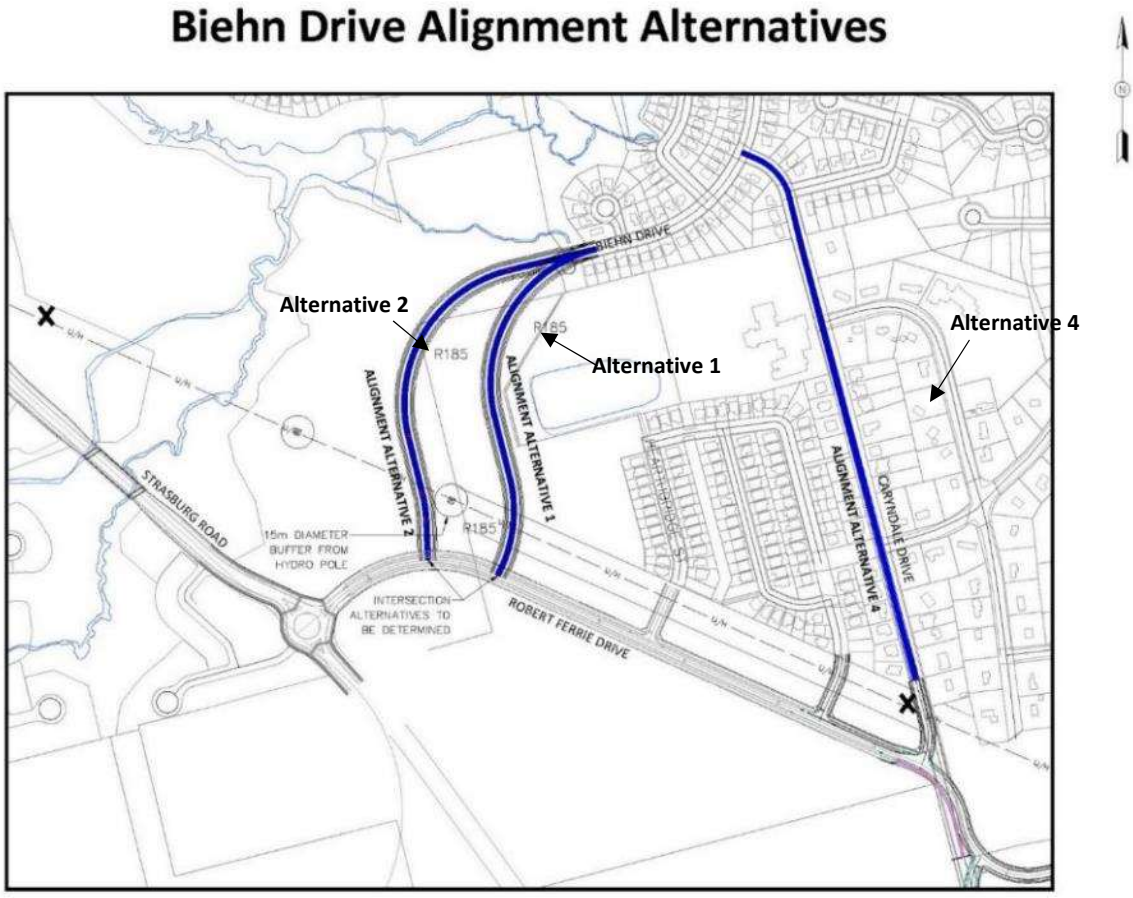


Figure 13: Short Listed Alignment Alternatives

6.1.3 Long List of Criteria - Alignment

A long list of sub-factors was established for each of the main factor categories to allow for the identification of all potential benefits and impacts. The relative measured effect of each criterion is also defined to ensure that the significance of each criterion (factor group or sub-factor) is recognized in the evaluation process.

Sub-factors are measurable criteria under a factor group. For example, under the category/factor group "Transportation", sub-factors relate to measurable transportation differences among alternatives. Using the Transportation factor group as an example, sub-factors may relate to safety or traffic operations measures for the identification of benefits and impacts.

Six categories or factors were selected which were used for each evaluation. Within each of these factor groups are sub-criteria, described as sub-factors, which define the measure and the relative differences of magnitude of impact or benefit. The factor groups include:

- Traffic and Transportation
- Natural Environment
- Cultural Environment
- Socio-Economic Environment

- Land Use and Property
- Cost

Within each of these categories (factor groups) are sub-factors which define the measure and the relative differences of magnitude of impact. The sub-factors were developed from a long list created by the Study Team (Consultants and City Staff). Where there were no measurable or meaningful differences between alternatives, and it is agreed that the alternatives are generally equal with respect to this criterion, then the sub-factor is not carried forward. When the Evaluation Team (Consultants and City Staff) considered the impacts were double counted among one or more criteria, then only one criterion was selected to be carried forward.

The long list of evaluation criteria that will not be carried forward are found in **Appendix H**. For a sub-factor to be carried forward, the sub-factor must:

- Be a measure of a meaningful difference among alternatives.
- Capture a measurable difference among alternatives.
- Not "double count" the effect that was measured under another sub-factor.
- Describe a difference in performance or an effect on the natural or social environment that the Technical Advisory Committee (Consultants and City Staff) considered necessary to be included in the decision-making process.

The selection of the sub-factors to address the goal of the study, are comprehensive enough to describe all aspects of the effects of the project, and do not double-count sub-factors.

6.1.4 Short Listed Criteria

Sub-factors selected to evaluate the alternatives including their definitions and scores are described in **Appendix H**.

6.1.5 Preferred Alignment Alternative

The Evaluation Team members were responsible for completing separate weighting exercises which provided independent perspectives of the relative importance of factor groups and sub-factors for each specific evaluation. The results of the weighting exercise are illustrated in **Figure 14** and **Figure 15.**

6.2 Technically Preferred Alternative

The Technically Preferred Alternative (TPA) is Alternative 1, which is the best-balanced solution, refer to **Table 6**. It provides the best transportation performance while minimizing natural and social environmental impacts. A limited number of Black Ash trees have been identified along the corridor, however the city's best efforts to combat the Emerald Ash Borer has had limited success. The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors.

The TPA is shown in **Figure 16**. This recommendation minimizes the impacts to the PSW and provides a direct connection to Robert Farrie Drive. The trunk sewer and municipal water services will be extended southerly from Biehn Drive.

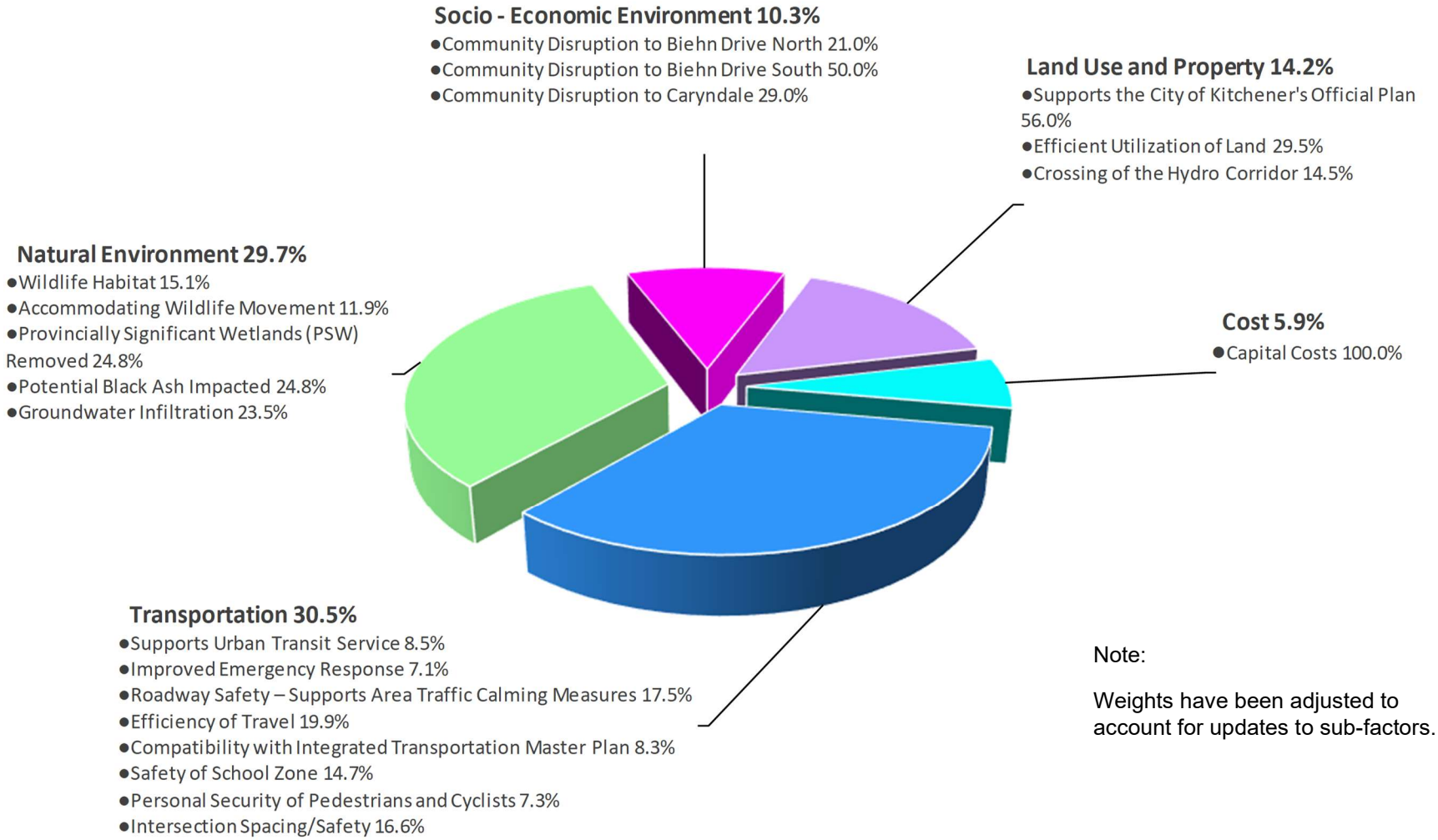


Figure 14: Global Factor and Sub-factor Weights

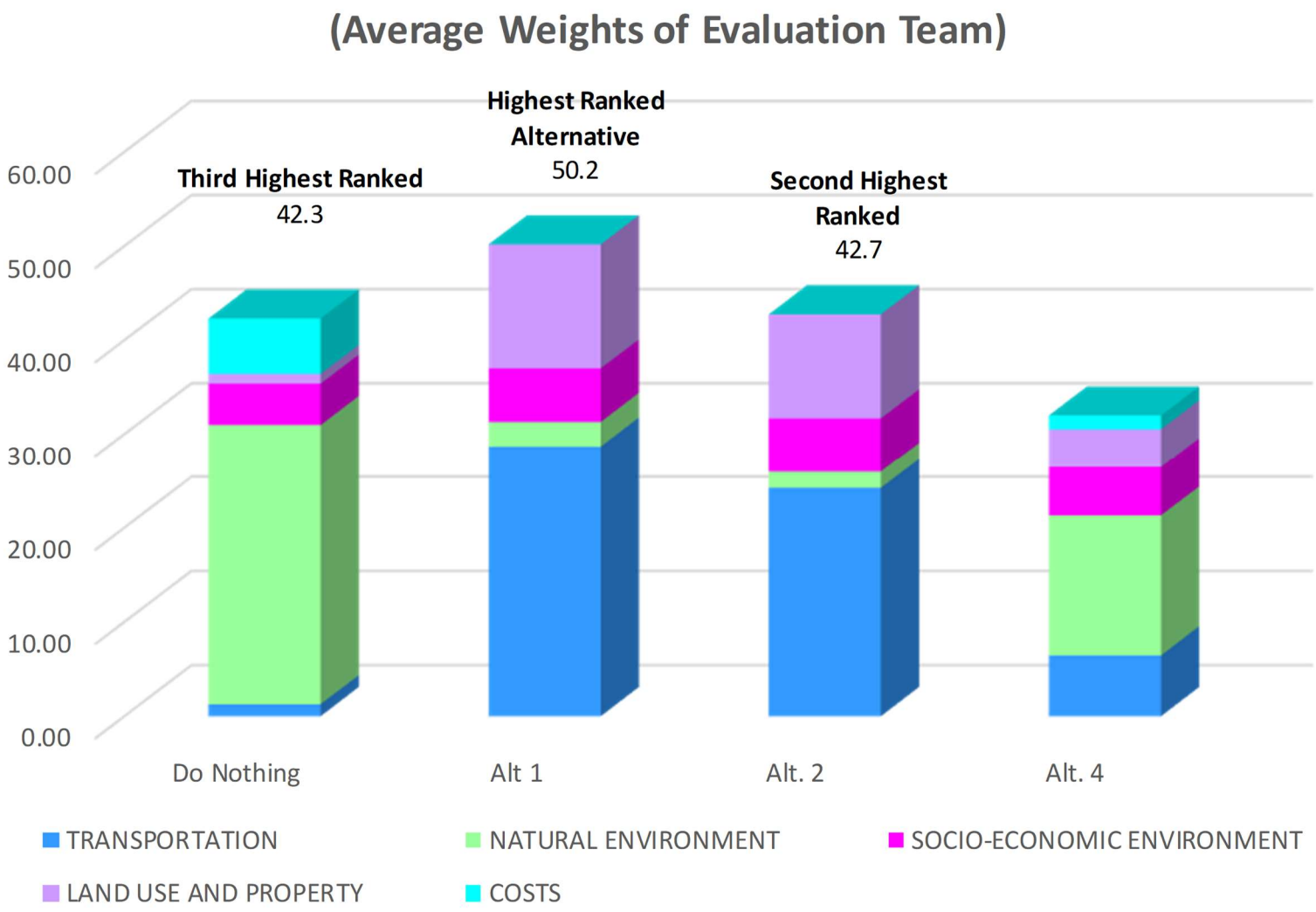


Figure 15: Alternative Totals

Table 6: Summary of Technical Recommendations

Do Nothing	Alternative 1: Extend Biehn Drive to Robert Ferrie Drive east of Hydro Tower	Alternative 2: Extend Biehn Drive to Robert Ferrie Drive west of Hydro Tower	Alternative 4: Existing Caryndale Drive and a Multi-Use Path crossing the PSW
Not recommended. The Do Nothing alternative fails to address the traffic volume and safety concerns along Caryndale Drive which should be expected to increase when the extension of Strasburg Road to New Dundee Road provides alternative access to Highway 401. Caryndale Drive will continue to accommodate a higher volume of traffic and will be forced to function as a major collector street. The limited number of Black Ash trees in the PSW will continue to decline due to the Emerald Ash Borer. ✗	Recommended as the **Preferred Transportation Solution**. Alternative 1 is the best-balanced solution. It provides the best transportation performance while minimizing natural and social environmental impacts. A limited number of Black Ash trees have been identified along the corridor, however the city's best efforts to combat the Emerald Ash Borer has had limited success. The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors. ✓	Not recommended. Although this alternative provides comparable transportation performance to Alternative 1 the environmental impacts are much greater. ✗	Not recommended. Caryndale Drive, classified as a minor neighbourhood collector street, will be forced to function as a major collector street. The neighbourhood was not designed for Caryndale Drive to continue to carry increasing volumes of vehicle traffic. ✗

6.2.1 Corridor Sensitivity Testing

To validate the weighting exercise, a sensitivity testing program was undertaken to determine whether the Technically Preferred Alternative (TPA) would have changed if a particular factor group was assigned a higher or lower importance than the group average. This ensures greater confidence in the selection process. The results of the sensitivity testing are shown in **Table 7**.

Table 7: Summary of Sensitivity Tests

Summary of Sensitivity Tests

Alternatives			Do Nothing	Alt 1	Alt. 2	Alt 4
	WEIGHT	Score:	42.3	50.2	42.7	32.0
Ranking			3	1	2	4
TRANSPORTATION	High	45.00%	3	1	2	4
	Low	20.00%	1	2	3	4
NATURAL ENVIRONMENT	High	40.00%	1	2	3	4
	Low	20.00%	3	1	2	4
SOCIO-ECONOMIC ENVIRONMENT	High	15.00%	2	1	3	4
	Low	10.00%	2	1	3	4
LAND USE AND PROPERTY	High	20.00%	3	1	2	4
	Low	10.00%	2	1	3	4
COST	High	10.00%	2	1	3	4
	Low	2.00%	3	1	2	4

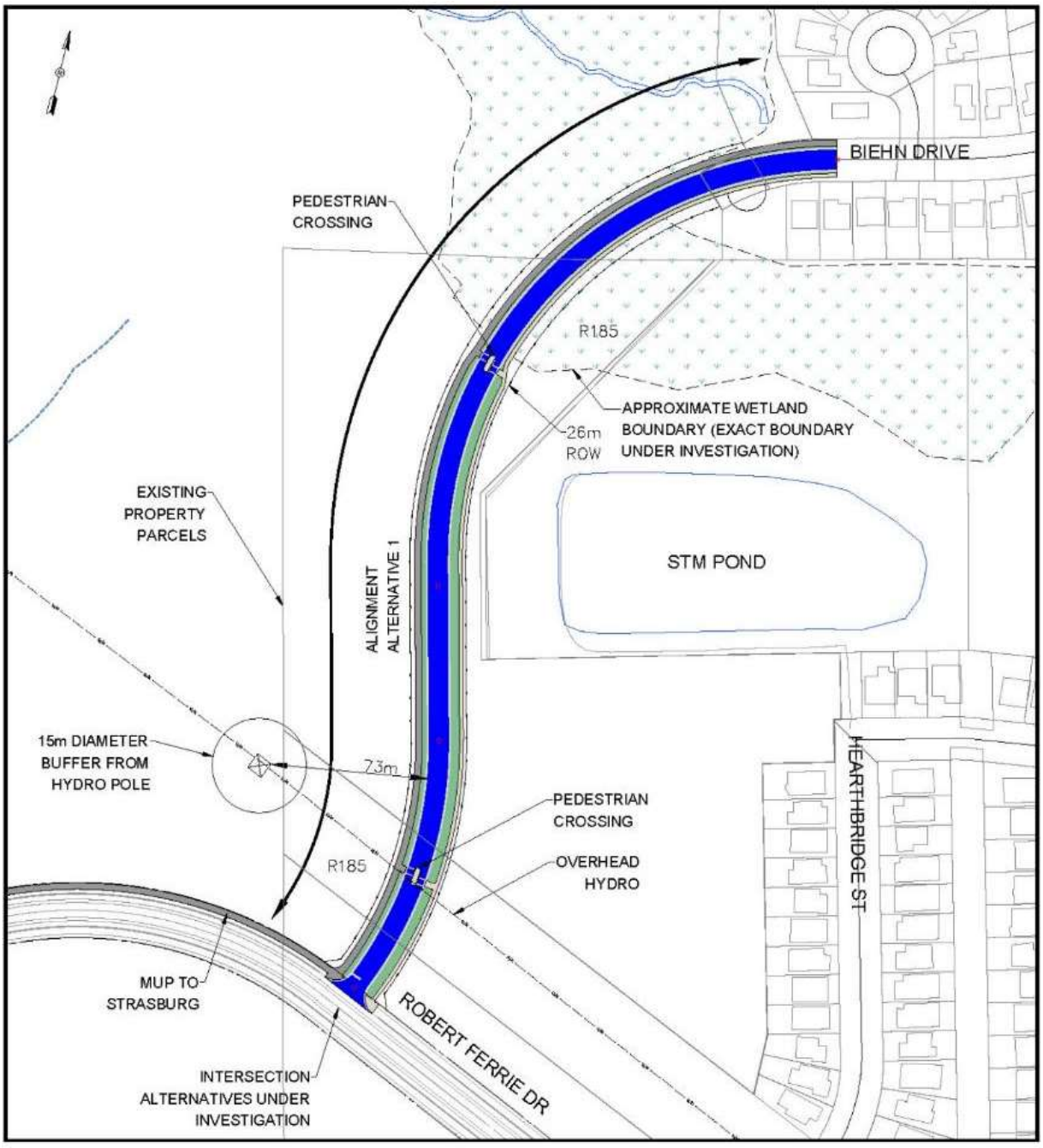


Figure 16: Technically Preferred Alternative

6.3 Cross Section Alternatives

Two (2) cross section alternatives were considered for Biehn Drive outside the limits of the wetland, refer to **Appendix H**:

1. Alternative 1 – 26 m Major Collector with In-boulevard Cycling Facilities; and
2. Alternative 2 - 26 m Major Collector with Bike Lanes.

6.3.1 Technically Recommended Cross Section

The preliminary evaluation of the cross-section alternatives is shown in **Table 8**. Alternatives were developed to reflect the City of Kitchener's Complete Streets guidelines. The recommended cross section is Alternative 1 with multi-use trails as shown in **Figure 18**.

Table 8: Cross Section Evaluation

Evaluation Criteria	Alternative 1 – 26 m ROW with Multi-use Trail	Alternative 2 – 26 m ROW with Bike Lanes
Active Transportation	MUTs are preferred by the greatest proportion of cyclists (interested but concerned). Greater network continuity for cyclists with the future MUT along the Hydro corridor and potential to connect to the MUTs along Strasburg Road. ✓	Better accommodates pedestrians by separating pedestrians and cyclists. Increased conflict between cyclists and access to/from parked vehicles. ✗
Traffic Calming	The reduced pavement width would better promote lower travel speeds. ✓	A wider asphalt surface would be less effective in reducing travel speeds. ✗
Impacts to Natural Environment / Storm Water Quality	All alternatives considered equal.	All alternatives considered equal.
Impacts to Developable Lands	All alternatives considered equal.	All alternatives considered equal.

Evaluation Criteria	Alternative 1 – 26 m ROW with Multi-use Trail	Alternative 2 – 26 m ROW with Bike Lanes
Cost	MUTs are more cost effective to construct with reduced pavement thickness and granulars. ✓	Wider roadway pavement structure increases construction cost. ✗
Recommendation:	Carry Forward **Alternative 1** ✓	

6.4 Intersection Alternatives

A roundabout is proposed at the intersection of Biehn Drive and Robert Ferrie Drive. This recommendation is consistent with the approved plan identified in the Robert Ferrie Drive Class Environmental Assessment. Additional justification for the preferred alignment and the recommendation of a roundabout at this location includes:

- To limit queuing (due to the proximity to Strasburg Road) and to accommodate pedestrian crossings.
- To accommodate access to future development south of Robert Ferrie Drive.
- At Black Walnut Drive, Biehn Drive traffic volumes would be reduced by an average of approximately 2,500 vehicles/day.
- On Caryndale Drive, south of Biehn Drive, traffic volumes would be reduced by an average of approximately 500 to 1,000 vehicles/day.
- The houses along Biehn Drive, between Caryndale and the existing cul-de-sac will experience an increase in traffic ranging from 2,000 to 3,000 vehicles/day.
- Strasburg Road has been constructed and will provide a western arterial road to service the community.
- With implementation of the proposed Biehn Drive extension, traffic will not have to take a circuitous route through neighbourhoods to reach the arterial road network.

6.5 Conclusions and Recommendations

The following are updated 2024 preliminary recommendations from the EA based on new data sources that included, the geotechnical investigation, the 2023 field inventory of ash trees, an analysis of the long-term Emerald Ash borer impacts on ash tree mortality in North America and City of Kitchener as well as the 2024 Doon South Community Area Transportation Study.

- Based on the 2023 geotechnical investigations it is feasible for the sanitary sewer and watermain without surficial construction to cross the PSW.

- The 2024 Doon South Community Area Transportation Study confirmed the recommendations of the current Transportation Master Plan, 2013 reflected in the Official Plan, 2019, for the long-term use of Biehn Drive and its extension as a major collector in the City.
- The 2024 provincial designation of the Black Ash trees as a Species at Risk (SAR) is now reflected in the recommendations.

The following is the preferred approach for the planned improvements:

- Caryndale Drive will continue to be utilized until the extension of the Biehn Drive link is constructed.
- The health of the Black Ash trees is to be monitored.
- Development south of the PSW be permitted to proceed.
- That a right-of-way continue to be protected at the intersection of Biehn Drive and Robert Ferrie Drive for a future roundabout.
- The land acquisition should include the Right-of-Way required for municipal services and a road corridor.
- The alignment of the servicing corridor for the trunk sanitary sewer and watermain to follow the alignment for the road corridor.
- If Black Ash trees are impacted due to construction, the City will compensate for the loss. Compensation to be determined by Ministry of Environment Conservation and Parks (MECP).

6.6 Technically Preferred Plan

The Technically Recommended Plan (TPP) includes the recommended cross section, refer to **Figure 17**. This recommendation conforms to the City of Kitchener's Official Plan and Integrated Transportation Master Plan and accommodates the associated municipal servicing. It minimizes the impacts to the Provincially Significant Wetland by eliminating the on-street parking and provides a high level of land use planning efficiency to the lands available for development. In addition, this alternative redistributes vehicles travelling to Robert Ferrie Drive from Caryndale Drive and Brigadoon Public School to Biehn Drive, a designated Major Collector in the City of Kitchener.

A multi-use trail (MUT) on the north side of Robert Ferrie Drive was not identified in the previous EA but is recommended as part of this EA to provide for active transportation along the short section of Robert Ferrie Drive in place of a sidewalk, noting:

- MUT's have already been placed on the portion of the east leg of the Strasburg Road roundabout which has been constructed.
- It would provide better network continuity (providing a MUT connection between the MUTs on Strasburg Road and the MUTs on Biehn Drive).

- At the time the Robert Ferrie Drive EA was being completed, MUTs on Biehn Drive had not been identified.

The TPP was presented at PIC No. 3. Following the PIC, the TPP was subject to refinements based on input from the public, stakeholders and Indigenous Communities. These include:

- Outside the wetland, the cross section (see **Figure 18**) will be reduced to 23.5 m through the subdivision, reducing the width of the boulevard on the east side to accommodate the MUT.
- Through the wetland, the cross section (see **Figure 19**) will be identical to the cross section beyond the PSW, except that it will be revised to:
    - Remove the Multi-Use Trail (MUT) from the north (west) side of the road.
    - Minimize the footprint to 14.5 m through the wetland.
    - Provision for a wildlife passage culvert within the PSW.
    - No Parking within the PSW.
    - Lighting with full cut-off fixtures.
- Opportunity to enhance naturalization of PSW Adjacent Lands.
- Opportunity to replace the PSW within the Study Area.

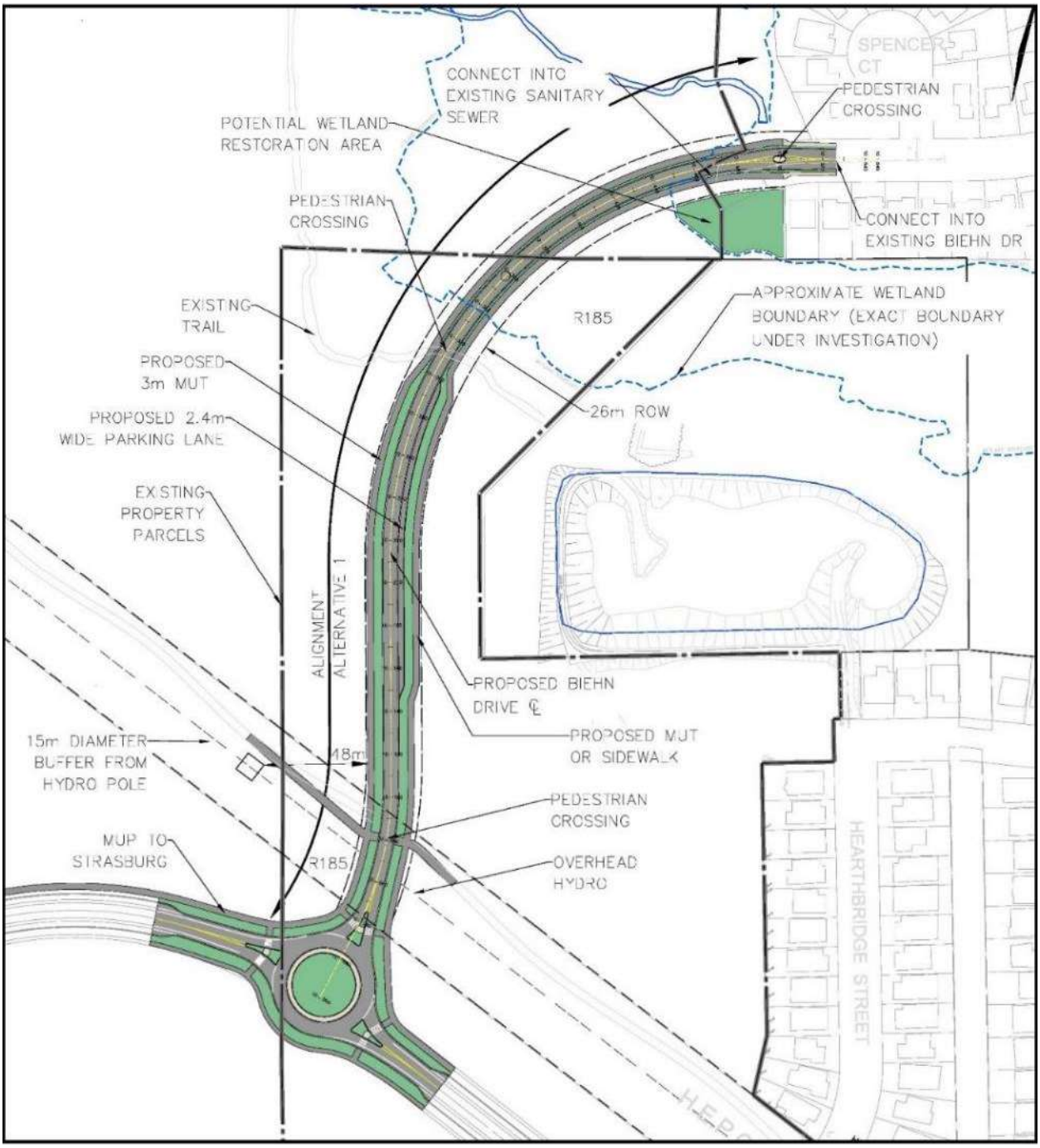


Figure 17: Technically Preferred Plan

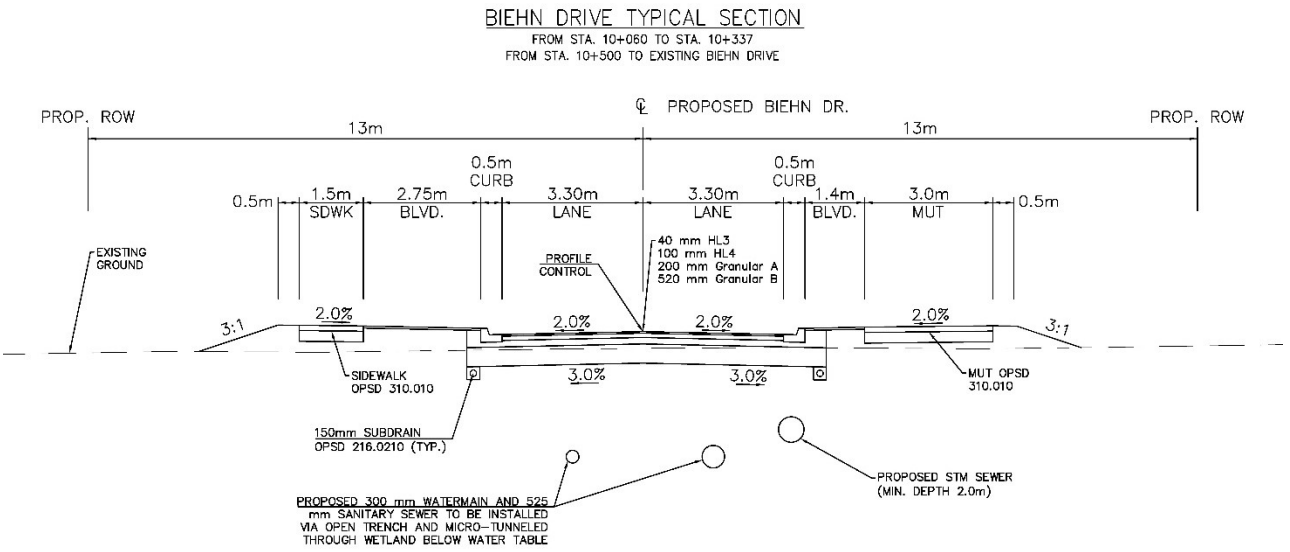


Figure 18: Typical Cross Section Outside the Wetland

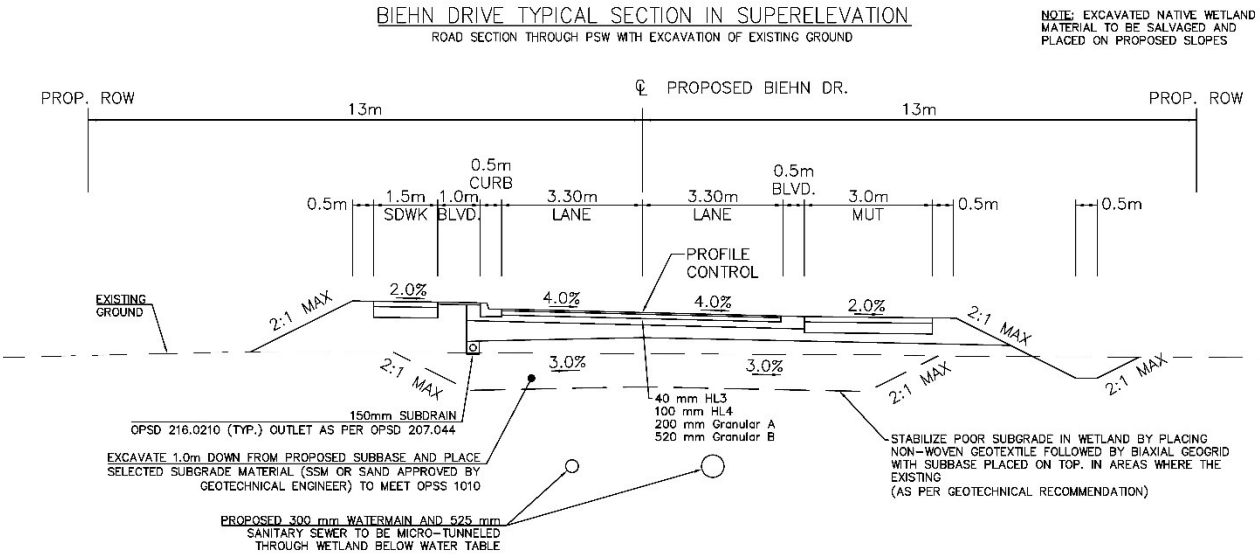


Figure 19: Typical Cross Section Through Wetland

7.0 RECOMMENDED PLAN EFFECTS, MITIGATION MEASURES AND FUTURE RECOMMENDATIONS

Following PIC 3 it was recommended that TPP, Biehn Drive Extension be carried forward as the Recommended Plan, refer to **Figure 20.** The benefits to this alignment are:

- Provides the best transportation performance while minimizing natural and social environmental impacts.
- A limited number of Black Ash trees have been identified along the corridor however the city's best efforts to combat the Emerald Ash Borer has had limited success. Health of the trees will be monitored. The city will comply with compensation determined by MECP.
- The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors. Mitigation to include 1:1 replacement on-site.

7.1 Endorsement of the Recommended Plan

The Recommended Plan was presented to the City of Kitchener Council where it was endorsed on XXXX XX, 2024. The resolution is included in **Appendix L**. The plan was then carried forward as the Recommended Plan.

7.2 Recommended Plan

The final Recommended Plan is shown on **Figure 20** and illustrated in detail in **Section 8.0**.

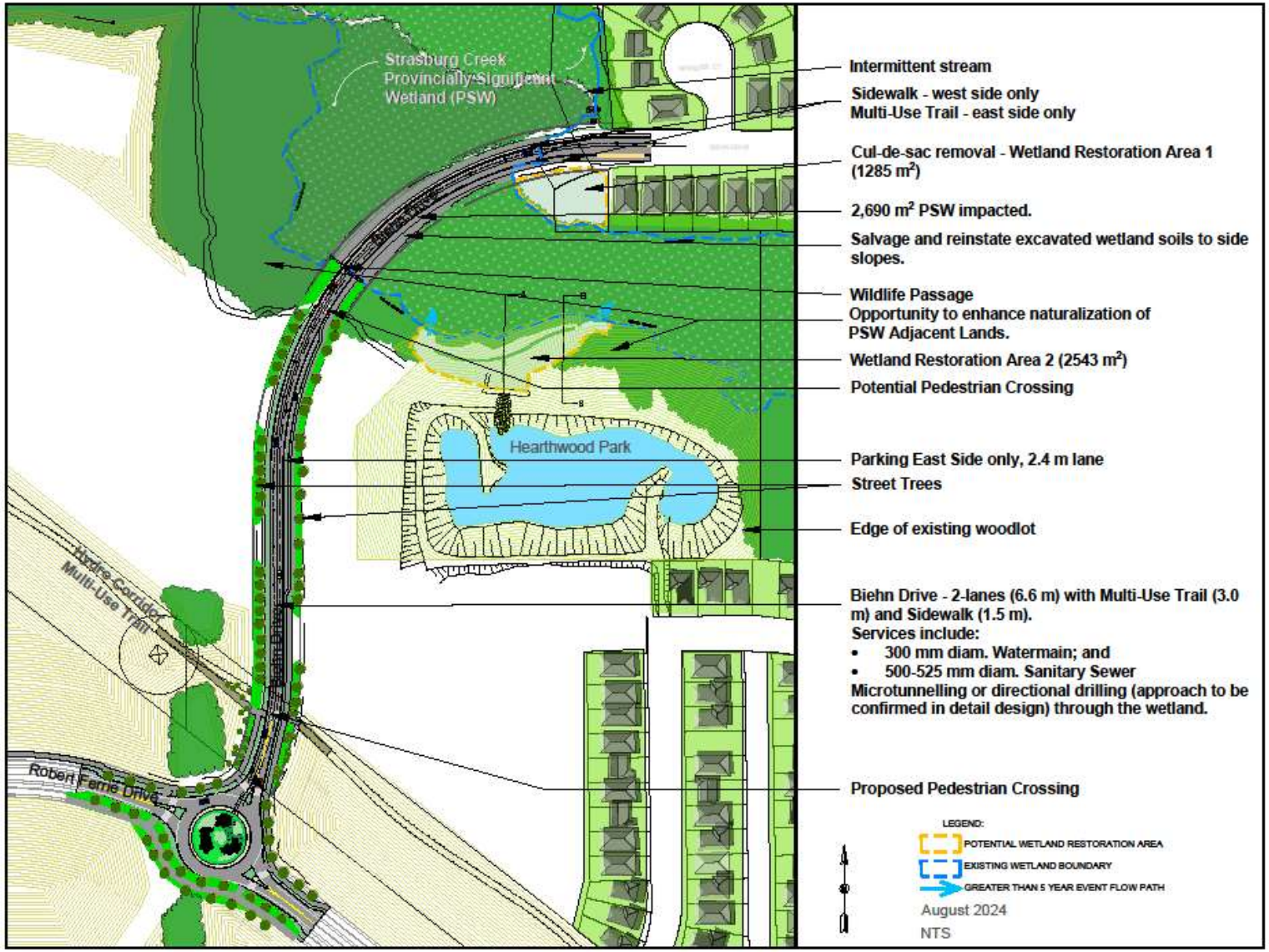


Figure 20: Recommended Plan

The Biehn Drive Recommended Plan includes:

- New 2-lane road connecting the current Biehn Drive terminus to the future Robert Ferrie Drive
  - Alignment will be east of the Hydro Tower
  - Cross section will include 3.3 m lanes with curb/gutter (0.5 m)
- Active transportation improvements will include:
  - 3.0 m MUT on the east side of the road from Robert Ferrie Drive to the wetland (see Statement of Flexibility **Section 7.3**).
  - 1.5 m sidewalk on the west side from the Hydro Easement to Biehn Drive terminus.
  - Boulevard (varying width, minimum 1.0 m)
  - Potential pedestrian crossing at the south edge of the wetland.
- Roundabout at the intersection of Biehn Drive and Robert Ferrie Drive (per the recommendations of the Robert Ferrie Drive Environmental Assessment).
- Installation of municipal services beneath the road alignment including:
  - Sanitary trunk sewer (500-525 mm diameter)
  - Storm sewer
  - Watermain (300 mm diam.)
- Natural environment mitigation including:
  - Construction of one concrete box culvert with a 1.0 m span and 1.0 m rise for the provision of wildlife passage under the Biehn Drive extension in the area of the Strasburg Creek PSW (final sizing, design and number of crossings to be defined in detail design). The Biehn Drive Wildlife Crossing Technical Memorandum is included in **Appendix D.**
  - Installation of permanent wildlife fencing
  - Stormwater quality control of northern outlet to the PSW (oil grit separator)
  - Target desirable compensation for wetland loss including:
    - 10:1 tree replacement
    - 1:1 wetland replacement (on-site)
    - 2:1 wetland replacement (off-site) (if required)
    - The feasibility for compensation to be further reviewed with the future determination of the offsets from the PSW to development lands as an opportunity for naturalization and include the re-naturalization of the removal of the existing cul-de-sac on Biehn Drive.

The Recommended Plan is illustrated in **Figure 20.**

7.2.1 Infrastructure

The sanitary sewer extension will follow the alignment of the Biehn Drive extension. The required sanitary sewer pipe size is 525 mm diameter and installed by microtunnelling or directional drilling. The watermain extension will follow the alignment of the Biehn Drive extension and be installed with microtunnelling or directional drilling.

7.3 Statement of Flexibility

The Recommended Plan contains key features with flexibility for refinements during detail design including:

- Minor adjustments to the vertical profile and cross section through the development lands during detail design.
- Minor adjustments to the sidewalk and MUT through the PSW to minimize impacts to the natural environment and include input from the EIS to be completed during detail design.
- Selection of the surface type/material of the sidewalk and MUT through the wetland. This will be determined during detail design.

Modifications to the size, location and number of wildlife passages based on consultation with Indigenous Peoples and GRCA during detail design.

7.4 Effects and Mitigation

The effects on the environment were considered in accordance with the Municipal Class EA process and are described below. The EA Addendum highlights several factors that will need to be considered during detailed design and project implementation. This will include impacts to private property, archaeological artifacts, excessive noise during construction, management of excess soils, species at risk, utilities, vegetation, lighting, drainage, natural gas and groundwater monitoring wells. All these factors will be considered, and mitigated as required, throughout the course of detailed design and project implementation.

The following sections provide a description of the effects and mitigation proposed with the Recommended Plan.

7.4.1 Natural Environment

7.4.1.1 Groundwater

A trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area. There will only be dewatering requirements for the road construction for the north culvert and oil grit separator. Refer to **Appendix J.**

7.4.1.2 Terrestrial and Aquatic Environment

No open bodies of water were in the vicinity that would indicate turtle presence in the area and their presence would likely be only transitory due to the closed canopy and lack of basking areas. No direct impacts to fish or fish habitat are anticipated.

Suitable Category 2 and Category 3 habitat for Blandings Turtle exists along Strasburg Creek on average 310 m distance from the proposed Biehn Drive alignment, which is within their range of known summer wanderings. therefore, consideration of their presence as "transitory habitat" a possibility, and erected temporary, trenched-in turtle control fencing during the geotechnical borehole testing in July 2023. During detailed design the City will review if permanent wildlife exclusion fencing along either side of the roadway is appropriate, and will

consider other mitigation measures.

Black Ash is identified as a SAR species, was confirmed to be present. Four trees were classified as potential Black Ash due to the absence of leaves, which limits identification, and two exhibit stronger potential based on distinct bark characteristics. within the recommended right-of-way. The health of these trees will be monitored. Compensation to be determined by MECP.

The placement of permanent exclusion fencing and additional (more than one) associated wildlife passages under the road are to be considered during Detail Design.

Any clearing and grubbing should be completed outside of the active breeding bird season of April 1 to August 31. If this is not possible, clearing and grubbing should occur under the supervision of an environmental professional, and only after the specific trees and vegetation needing removal have been screened for nesting birds or roosting bats.

Bats are present over the wetlands near the proposed alignment. Acoustic monitoring identified the following species: Big Brown Bat (Eptesicus fuscus), Eastern Red Bat (Lasiurus borealis), Hoary Bat (Lasiurus cinereus), Little Brown Myotis (*Myotis lucifugus*), Silver-haired Bat (*Lasionycteris noctivagans*) and Tri-Colored bat (*Perimyotis subflavus*). As of August 15, 2024, the Eastern Red Bat, Hoary Bat, and Silver-haired Bat are designated as Species at Risk (SAR) under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Additionally, the Tri-colored Bat and Little Brown Myotis are listed as Species at Risk in Ontario (SARO).

A bat condo structure similar to that shown in **Figure 21** is proposed for construction at the southeastern corner of the wetland, along the edge of the tree line. Bat condos are capable of providing roosting spaces for up to 6,000 individuals and are considered appropriate for community-scale projects such as a wetland restoration. Depending on the location selected, a structure here may be partially shaded (< 6 hrs./day) yet with open flyways over the restored wetland and the stormwater wetland above which should provide optimal forage habitat for bats as insects emerge from the water each night.

Provide cut-off illumination through the PSW.

Figure 21: Maternal Bat Roosting Structure Built at the Rouge National Park

7.4.1.3 Sourcewater Protection

All applicable policies identified in the Grand River Source Protection Plan need to be followed during and post construction.

The City will protect against sourcewater threats including:

- Salt impact assessment to design roads and sidewalks to minimize the need for repeat application of road salts, and to ensure the handling and storage of road salts doesn't become a significant drinking water threat
- Reducing roadway platform requiring salt (reduced lane widths, eliminating shoulders by inclusion of urban curbs and elimination of east MUT).
- Ensure that the removal and storage of snow doesn't become a significant drinking water threat
- Spill Prevention, contingency plans and emergency response plans during construction
- Ensure discharge from a stormwater management facility does not become a significant drinking water threat
- Compliance with the Salt Management Plan to reduce potential for salt related surface water run-off and groundwater infiltration

7.4.1.4 Climate Change

The extension of Biehn Drive is not anticipated to produce an increase or significant decrease in greenhouse gas emissions.

7.4.1.5 Air Quality

The extension of Biehn Drive is not anticipated to produce an increase or significant decrease in greenhouse gas emissions.

Potential for temporary lower air quality during construction. The construction of the road extension is not expected to generate adverse air quality as the contractor will be required to maintain the construction equipment in good working order.

MECP recommends that non-chloride dust suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada, March 2005.

7.4.1.6 Offset Wetland Restoration

The preferred Biehn Drive extension is proposed to cross the Strasburg Creek Provincially Significant Wetland (PSW) resulting in impacts to the wetland. Best effort has been made to mitigate the impacts, most notably by adjusting the vertical road profile, and horizontal cross roadway section to reduce the footprint in the wetland. Approximately 2,690 m^2 of wetlands will be permanently lost through the construction of the roadbed. Stakeholder feedback indicated that this was one of the most important concerns of the new transportation infrastructure.

A high-level review was undertaken of the lands surrounding the Strasburg Creek Provincially Significant Wetland (PSW) to identify restoration sites of potential wetland restoration. The following two sites were recommended for wetland restoration:

Restoration Area 1 entails the removal of a cul-de-sac located at the southerly end of Biehn Drive. A plan view of the conceptual wetland is provided on **Figure 20**, along with two sections are found in **Appendix D**.

Restoration Area 2 is an open area of tree canopy that lies roughly 100 m east of the proposed Biehn Road situated north of, and below, the Hearthwood Natural Area stormwater wetland management (SWM)facility. A plan view of the conceptual wetland is provided on **Figure 20** along with two sections in **Appendix D**, to be further refined during detailed design. The side slope lying south to the SWM pond is not included in the calculation of proposed wetland area.

Net Offsetting Wetland Compensation: The Restoration Area 1 will net approximately 1,285 m^2 after accounting for slope losses. Restoration Area 2 will net approximately 2,543 m^2 plus the retained 10 m wide existing forest edge. These areas will be further refined during detailed design. Together these two areas net approximately 3,828 m^2 of restored wetlands, more than offsetting the loss of 2,690 m^2 of Provincially Significant Wetlands, resulting in a finished gain: loss ratio of roughly 1.4: 1 exceeding the minimum 1:1 goal.

7.4.2 Cultural Environment

No properties within the Study Area are recognized as a heritage property or to have cultural heritage value.

7.4.2.1 Stage 2 Archaeological Assessment

Based on the previous work completed, there are no outstanding archaeological concerns for the current project it is noted that:

- Should previously undocumented archaeological resources be discovered, they may indicate a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological assessment, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with Ontario Regulation 30/11, the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the MCM should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act.*

7.4.3 Socio-Economic Environment

7.4.3.1 Noise

It is projected that no receiver sites (residential properties) will experience sound level changes greater than 5 dBA and no receiver site will have a total sound level of over 65 dBA. The forecast sound levels for daytime and nighttime meets the objective of 55 dBA and no mitigation is required.

The City commits to monitor noise complaints with the opening of Biehn Drive. If the noise complaints last beyond the initial experience of the road opening, then traffic counts will be undertaken to compare with the ESR noise calculation traffic projections. Based on the comparison, the City will assess if any noise mitigation measures are required, technically feasible and cost effective.

7.4.4 Land Use and Property

Property acquisition or a land dedication will be required for the extension of Biehn Drive. This will be coordinated between the property owner (developer) and the City as part of the development planning and approvals process.

Property negotiations are also required to implement the tree replacement mitigation measure of 10:1 in the areas within the PSW Adjacent Lands.

7.4.5 Summary of Effects and Mitigation

Key issues and Preliminary Design features and associated mitigation measures have been identified and are summarized in **Table 9**.

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

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
1.0	**Transportation**		
1.1	Traffic Calming	Increase in traffic speeds at the current Biehn Drive terminus.	To control traffic speeds and provide a more pedestrian friendly environment: • Lane widths have been reduced to 3.3 m – identified as the City's new preferred standard for major collector street • A centre pedestrian refuge island and crosswalk at the south end of existing Biehn Drive as a traffic calming measure and to transition to the narrower lane widths on the proposed extension
2.0	**Natural Environment**		
2.1	Erosion and Sediment Control	Downstream impacts to Strasburg Creek cold water fish habitat and impacts to ephemeral/intermittent features in the PSW.	Erosion and sediment control should be installed to mitigate sediment transport into the downstream Strasburg Creek or the piped stormwater system under and north of Biehn Drive. As indirect fish habitat is present in the Study Area in the form of overland flow, particular attention should be paid to stabilizing erodible soil during construction and associated clearing and grubbing. An erosion and sediment control specialist should be on site during construction to ensure the proper installation of these controls.
2.2	Water Quality	Decrease in water quality in Strasburg Creek from stormwater runoff.	A stormwater management plan is being developed to reduce chloride loading into the watercourse and to cool stormwater prior to its outlet into this cold-water system.

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			Direction of stormwater from the new roadway to the existing stormwater pond (drainage area from the pond southerly) Inclusion of an oil grit separator at the northern/eastern outlet to the PSW.
2.3	Wildlife Habitat	Loss of wildlife habitat including removal of vegetation and tree canopy.	To reduce impacts to nocturnal wildlife, lighting will be reduced along this portion of the road and will include mitigation measures to limit dispersal into the adjacent wetland and woodland areas (use of cut-off lighting). A bat condo structure is proposed for construction at the southeastern corner of the wetland, along the edge of the tree line, Refer to **Section 7.4.1.2**.
2.4	Accommodating Wildlife Movement	Reduced ability of animals to cross from one portion of the wetland/woodland to another due to the new road construction.	It is recommended that permanent exclusion fencing and one or more associated wildlife passages under the road be considered during Detail Design. Wildlife passages should take into consideration a suitable Openness Ratio for the target species/wildlife type (i.e. amphibians and small mammals) as described in **Appendix D.**
2.5	Species at Risk	Impacts to Species at Risk and loss of habitat.	An updated assessment for SAR listed in the *Endangered Species Act* (ESA) and *Species at Risk Act* (SARA) will be completed during Detail Design since it is the responsibility of the proponent to ensure that Species at Risk (SAR) are not killed, harmed, or harassed, and that their habitat is not damaged or destroyed through the proposed activities to be carried out on the site. If the proposed activities cannot avoid impacting protected species and their

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			habitats, then the proponent will need to apply for an authorization under the *Endangered Species Act* (ESA). If the proponent believes that their proposed activities are going to have an impact or are uncertain about the impacts, they should contact SAROntario@ontario.ca to undergo a formal review under the ESA. The Eastern Red Bat, Hoary Bat, and Silver-haired Bat are designated as Species at Risk (SAR) under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Additionally, the Tri-colored Bat and Little Brown Myotis are listed as Species at Risk in Ontario (SARO). Ensure that tree clearing activities occur outside of the bat active window (May to October). Black Ash SAR have been confirmed in the Study Area based on field investigations completed by BTE. There will be continued monitoring of the condition of the Black Ash. Compensation to be determined. Ontario's habitat protection prohibitions are applicable to a radial distance of 30 metres around Black Ash. Submit an information Gathering Form (IFG) to the Species At Risk Branch during design on how the project may impact SAR. Suitable Category 2 and Category 3 habitat for Blandings Turtle exists along Strasburg Creek on average 310 m distance from the proposed Biehn Drive alignment, which is within their range of known summer wanderings.

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			therefore, consideration of their presence as "transitory habitat" a possibility, and erected temporary, trenched-in turtle control fencing during the geotechnical borehole testing in July 2023. During detailed design the City will review if permanent wildlife exclusion fencing along either side of the roadway is appropriate, and will consider other mitigation measures.
2.6	Significant Woodlands and Specimen Trees	Loss of Significant Woodlands and Specimen Trees.	Inventory trees to be removed and replace at a ratio of 10:1 within the PSW adjacent lands. Limit trees to be removed and avoid if possible significant trees.
2.7	Provincially Significant Wetlands	Loss of Provincially Significant Wetland.	Target desirable compensation for wetland loss including: • 10:1 tree replacement • 1:1 wetland replacement (on-site) • 2:1 wetland replacement (off-site) (not required) The feasibility for compensation to be reviewed with the future determination of the offsets from the PSW to development lands as an opportunity for naturalization and include the re-naturalization of the removal of the existing cul-de-sac on Biehn Drive. • The Detail Design should consider narrowing of the roadway corridor through the wetland area where feasible. • Reconstruct PSW as per the Recommended Plan on-site at a ratio of 1:1 (or greater). • Salvage and reuse wetland material.

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
2.8	Migratory Bird Nesting	Disturbances to birds during the nesting season.	Detail Design and Construction Recommendation: Any clearing and grubbing should be completed outside of the active breeding bird season of April 1 to August 31. If this is not possible, clearing and grubbing should occur under the supervision of an environmental professional, and only after the specific trees and vegetation needing removal have been screened for nesting birds or roosting bats.
2.9	Groundwater – Wellhead Protection Sensitivity Areas Groundwater – Infiltration		The City will protect against sourcewater threats including: • Salt impact assessment to design roads and sidewalks to minimize the need for repeat application of road salts, and to ensure the handling and storage of road salts doesn't become a significant drinking water threat • Reducing roadway platform requiring salt (reduced lane widths, eliminating shoulders by inclusion of urban curbs and elimination of east MUT). • Ensure that the removal and storage of snow doesn't become a significant drinking water threat • Spill Prevention, contingency plans and emergency response plans during construction • Ensure discharge from a stormwater management facility does not become a significant drinking water threat • Compliance with the Salt Management Plan to reduce potential for salt related surface water run-off and groundwater infiltration

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
2.10	Dewatering	Requirements for dewatering disposal	A groundwater and surface water monitoring program and contingency plan are required before, during, and after the proposed dewatering/construction activities irrespective of the dewatering/construction methods to be implemented due to the sensitivity of the PSW. Dewatering will be determined during detail design.
2.11	Floodplain Storage	Loss of floodplain storage.	Reduced footprint in wetland by reducing lane widths and use of urban cross section.
2.12	Permits and Approvals	Requirements for environmental permits and approvals.	**Permit to Take Water (PTTW):** The category of PTTW that may be required depends on the level of risk associated with the proposed water taking, source of water, rate/volume of water to be taken, purpose, etc. Further details can be found on the MECP website: https://www.ontario.ca/page/permits-take-water. In addition, the "Guide to Permit to Take Water Application Form" outlines procedures for applying to the MECP's Permit to Take Water (PTTW) including the approach for filling in the required application form and the type of supporting documentation/studies to be submitted: https://www.ontario.ca/page/guide-permit-take-water-application-form. The Water Taking and Transfer regulation O. Reg. 387/04 can also provide further guidance: https://www.ontario.ca/laws/regulation/040387. **Environmental Activity and Sector Registry (EASR):**

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			The guide provides information on EASR as it pertains to water takings for eligible highway projects and transit projects, construction site dewatering and pumping tests: https://www.ontario.ca/page/water-taking-user-guide-environmental-activity-and- sector-registry. For the proposed water taking activity to be eligible to register on EASR, it must meet the criteria set out in O.Reg. 63/16: https://www.ontario.ca/laws/regulation/160063 **Endangered Species Act:** An updated assessment for SAR listed in the Endangered Species Act (ESA) will be completed during Detail Design since it is the responsibility of the proponent to ensure that SAR are not killed, harmed, or harassed, and that their habitat is not damaged or destroyed through the proposed activities to be carried out on the site. Based on the EA study recommendations there will be a loss of Black Ash trees if they remain healthy until the start of construction. Health monitoring of these trees will be undertaken during the detail design. It is expected that there will be a requirement to apply for an authorization under the ESA **Species at Risk Act:** Parks Canada and Environment and Climate Change Canada should be consulted regarding permitting requirements under the federal Species at Risk Act (SARA). **Conservation Authorities Act (1990)**

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			The Grand River Conservation Authority (GRCA) regulates development and interference with wetlands, shorelines and other hazard lands under Ontario Regulation 150/06 of the Conservation Authorities Act (1990). A permit will be required from GRCA prior to construction. An application should be submitted once final drawings and additional plans (construction dewatering plan, site restoration plan, etc.) are completed during the detailed design phase.
2.13	Noise and Vibration	Potential for elevated long and short-term noise levels.	**Long Term**: The City commits to monitor noise complaints with the opening of Biehn Drive. If the noise complaints last beyond the initial experience of the road opening, then traffic counts will be undertaken to compare with the ESR noise calculation traffic projections. Based on the comparison, the City will assess if any noise mitigation measures are required, technically feasible and cost effective. **Short Term**: The construction contract will include restrictions on construction activities for night-time works and heavy vehicles will be restricted to accessing from Strasburg Road.
2.14	Air Quality - Construction	Potential for temporary decreased air quality during construction.	The construction of the road extension is not expected to generate adverse air quality as the contractor will be required to maintain the construction equipment in good working order.

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			MECP recommends that non-chloride dust suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada, March 2005.
2.15	Excess Materials and Waste	New Environment Protection Act Regulation - phased implementation.	• Excess generation will be minimized through promoting contractor salvage, recycling and re-use in the contract tender documents, where appropriate. • Manage and dispose of excess materials generated in accordance with OPSS 180 (General Specification for the Management and Disposal of Excess Material) and MOE's Protocol for the Management of Excess Material in Road Construction and Maintenance. • Manage contaminated material in accordance with O. Reg. 153/04 and O. Reg. 406/19 and the MECP's current documents: • Management of Excess Soil – A Guide for Best Management Practices (2014); and • Comply with the Soil Management and Excess Soil Quality Standards (2022).
3.0	**Cultural Environment**		
3.1	Archaeological Impacts		• Should previously undocumented archaeological resources be discovered, they may indicate a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological assessment, in compliance with Section 48 (1) of the *Ontario Heritage Act*. • The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with Ontario Regulation 30/11, the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the MCM should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act.*
4.0	**Land Use and Property**		
4.1	Property Requirements	Need for property acquisition or land dedication for the new road right-of-way.	Property acquisition or a land dedication will be required for the extension of Biehn Drive. This will be coordinated between the property owner (developer) and the City as part of the development planning and approvals process.

Table 9: Effects and Mitigation			
No.	**Factor**	**Environmental Issues and Potential Effects**	**Proposed Mitigation Measures**
			Permission to plant trees on developer lands is required for tree replacement on PSW Adjacent Lands (30 m within the wetland boundary).

7.5 Monitoring

As the proponent, the City of Kitchener will commit to a Monitoring Program for this project as part of the Detail Design and Construction phases. An environmental firm specializing in monitoring programs will be part of the Detail Design team and Construction team to ensure the continuity of the environmental measures outlined in**Table 9**.

The Monitoring Program will address the Class Document requirements as set out in Section A.4.2.1 including:

- Key impacts to be monitored.
- Monitoring requirements during detail design, construction and during the operation of Biehn Drive.
- The period during which monitoring will be necessary.
- Frequency and timing of surveys, the location of monitoring sites and the methods of data collection, analysis and evaluation.
- The content, manner and form in which records of monitoring data are to be prepared and retained.
- Where and for how long monitoring records and documentation will be on file, specific requirements for monitoring appropriate to the particular circumstances and conditions under which the project will be implemented.
- How unexpected environmental effects identified during monitoring will be addressed.

Wetland Restoration Post Construction Monitoring: A three-year post-construction monitoring program is proposed for implementation. The monitoring program is to start following a one-year period to allow the seeded areas and salvaged wetland soils the opportunity to begin the process of recovery before a critical assessment is made. Many of the planted trees will be deciduous, which can be difficult to establish, particularly in wet organic soils. Mandatory replanting/overplanting should be included in the detailed design to optimize the wetland area coverage, and so that there is more than one generation of plant materials to improve survival in case of drought/ excessive wet conditions. Up to 20 % of the plant material may need replanting annually during the monitoring period, with the rates being determined by the results of the monitoring.

Monitoring of the habitats created can be more challenging as they may be below ground (i.e. herpetofauna hibernaculum) or are only used at night (i.e. fox den). Monitoring the flow of bat species in and out of the bat condo, best done around sunset, will chart the population using the structure during the month of June when roosting is most prevalent. Mid-winter surveys may also be warranted if the structure is insulated.

Monitoring reports will be due by December 31st of each year, and pending disclosure rules under the *Endangered Species Act*, will be made public on the City website and reported to https://batwatch.ca/.

7.6 30-Day Review

Following the Notice of Study Completion there is a minimum 30-day period during which documentation may be reviewed and comments and input can be submitted to the proponent.

The public may request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Section 16(6) of the Environmental Assessment act. In addition, the Minister may issue an order on their own initiative within a specified time period. The Director of the Environmental Assessment Branch will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on the project.

The Notice of Study Completion, for this study, will contain directions on how an individual or group can communicate their concerns to the Minister of the Environment. Conservation and Parks. These directions are outlined below and in the public Notice.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- A Section 16 order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights; or
- The Director has issued a Notice of Proposed Order regarding the project.

Outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, a Section 16 order request on those matters should be addressed in writing to:

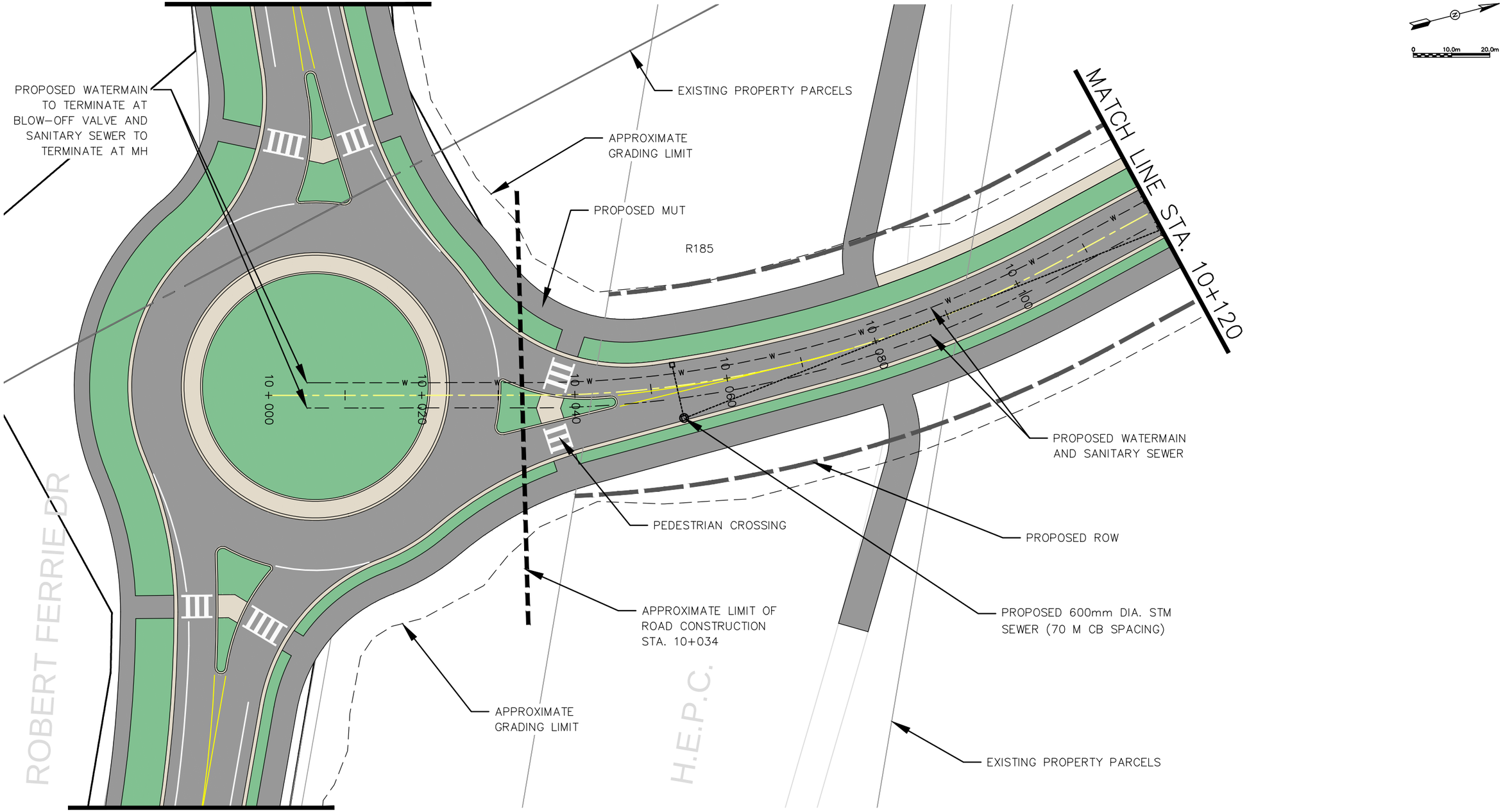
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON M7A 2J3
minister.mecp@ontario.ca

Director, Environmental Assessment and Permissions Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, ON M4V 1P5
EABDirector@ontario.ca

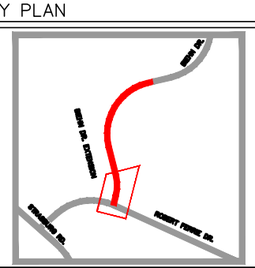
7.7 Future Activities

Following Class EA clearance and a 30-day public review period, if there are no objections, this project, or any individual element of this project, may proceed to Detail Design and Construction after obtaining the necessary environmental permits and approvals, and subject to availability of funding and construction priorities. Mitigation measures listed in **Section 7.0** are to be incorporated during Detail Design and Construction, as appropriate. The timeline for implementation is expected to be within the 5-year capital program.

8.0 PLATES



KEY PLAN



NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

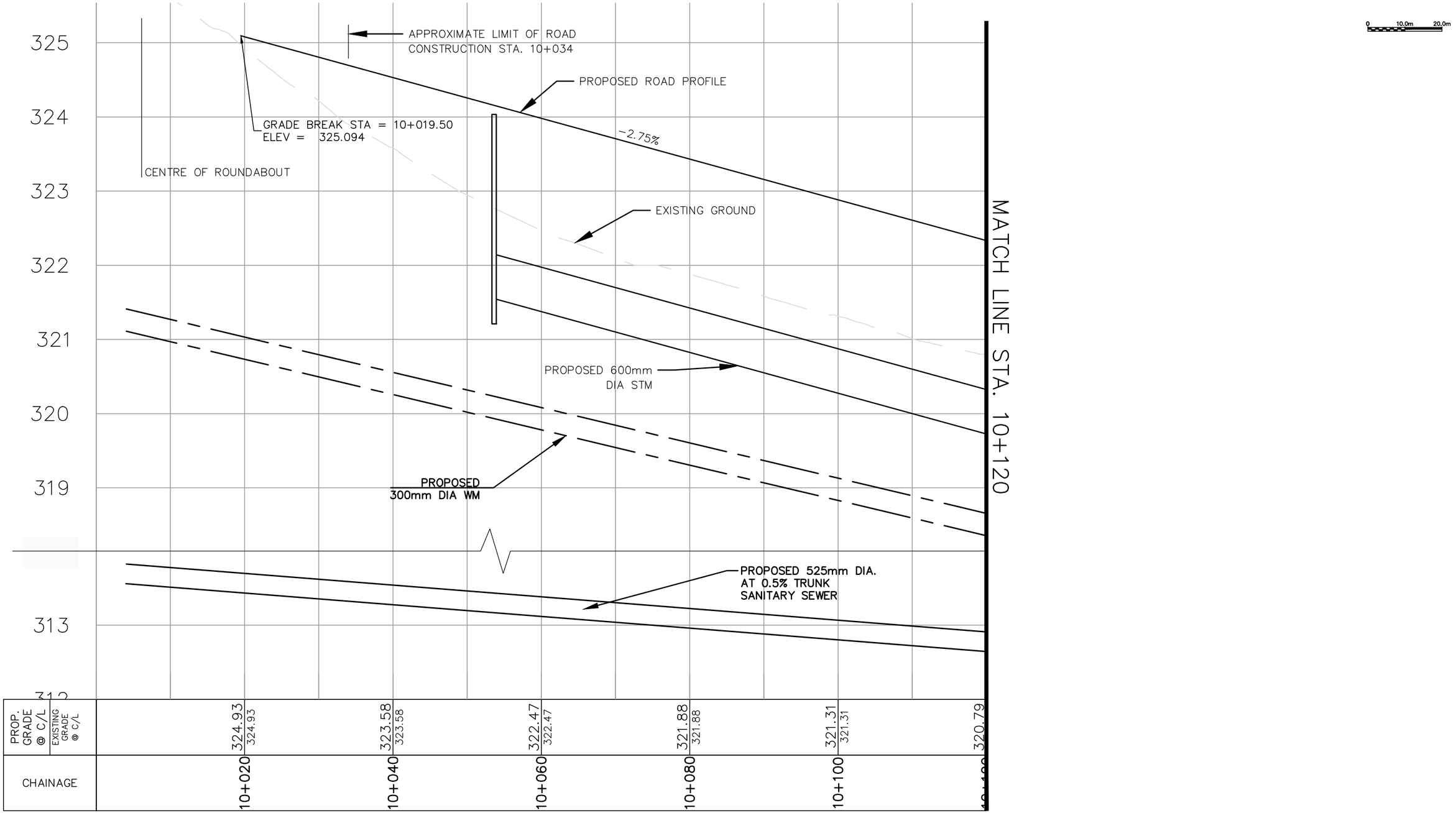
PRELIMINARY ROAD DESIGN

PLATES – PLAN
FROM STA. 10+000 TO STA. 10+120

BT ENGINEERING

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

CONTRACT 21–003 SHEET NO. C–001



NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

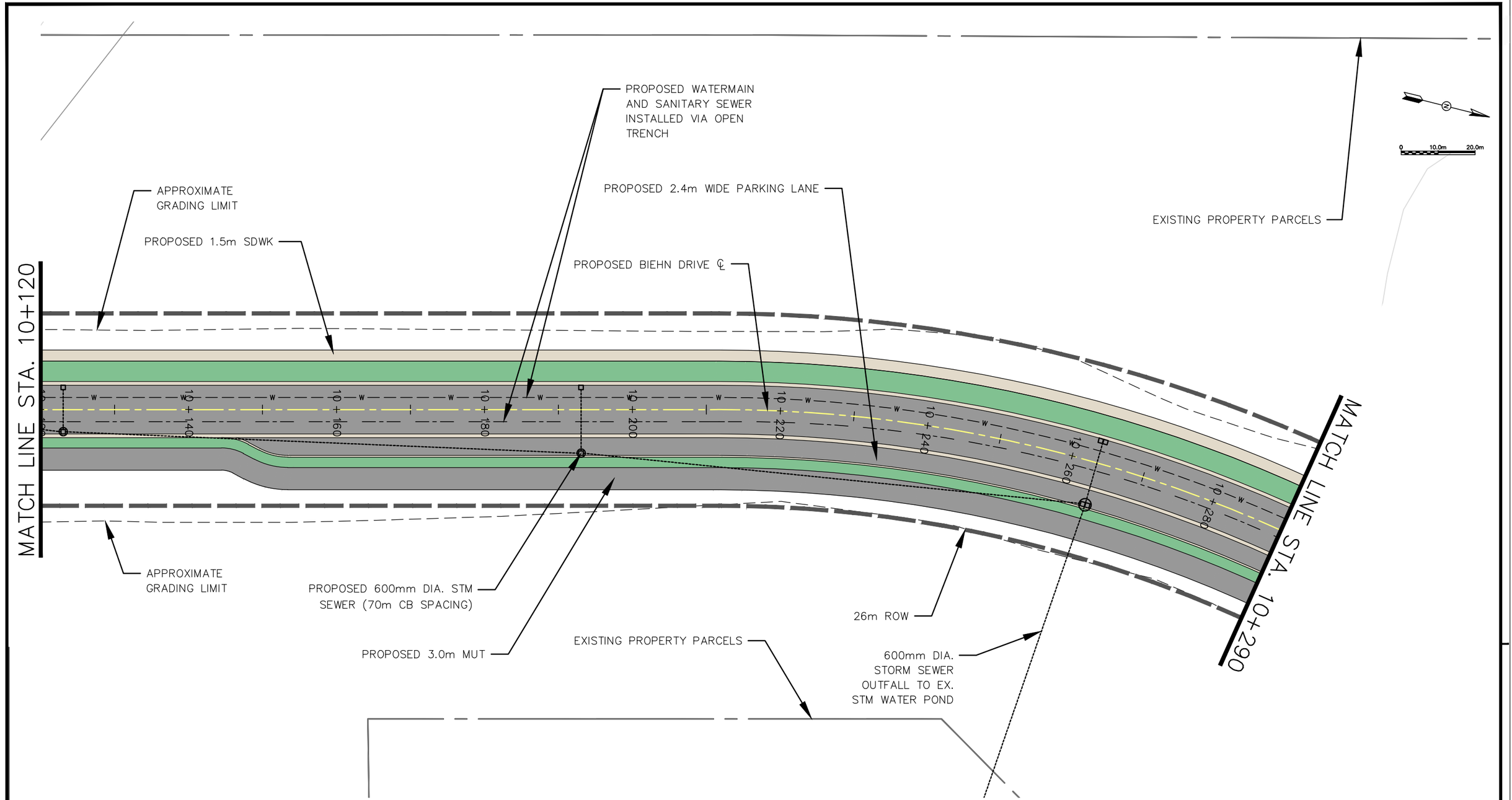
PLATES – PROFILE
FROM STA. 10+000 TO STA. 10+120

BT ENGINEERING

BTE

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

CONTRACT 21–003 SHEET NO. C–002



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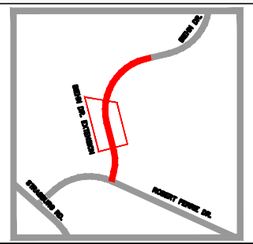


NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

PLATES
FROM STA. 10+120 TO STA. 10+290

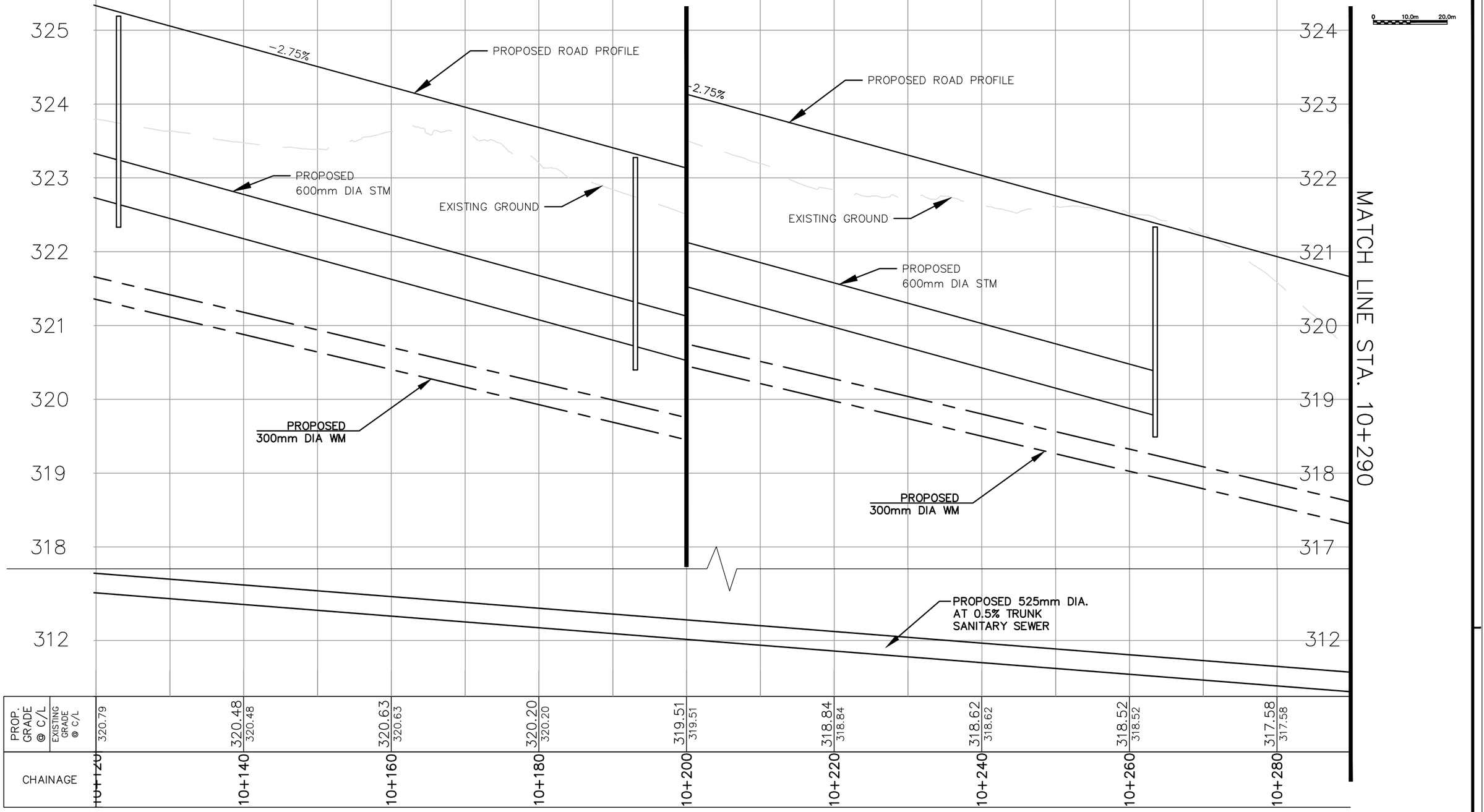
BT ENGINEERING

BTE

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

CONTRACT 21-003

SHEET NO. C-003



NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

PLATES – PROFILE
FROM STA. 10+120 TO STA. 10+290

BT ENGINEERING

BTE

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

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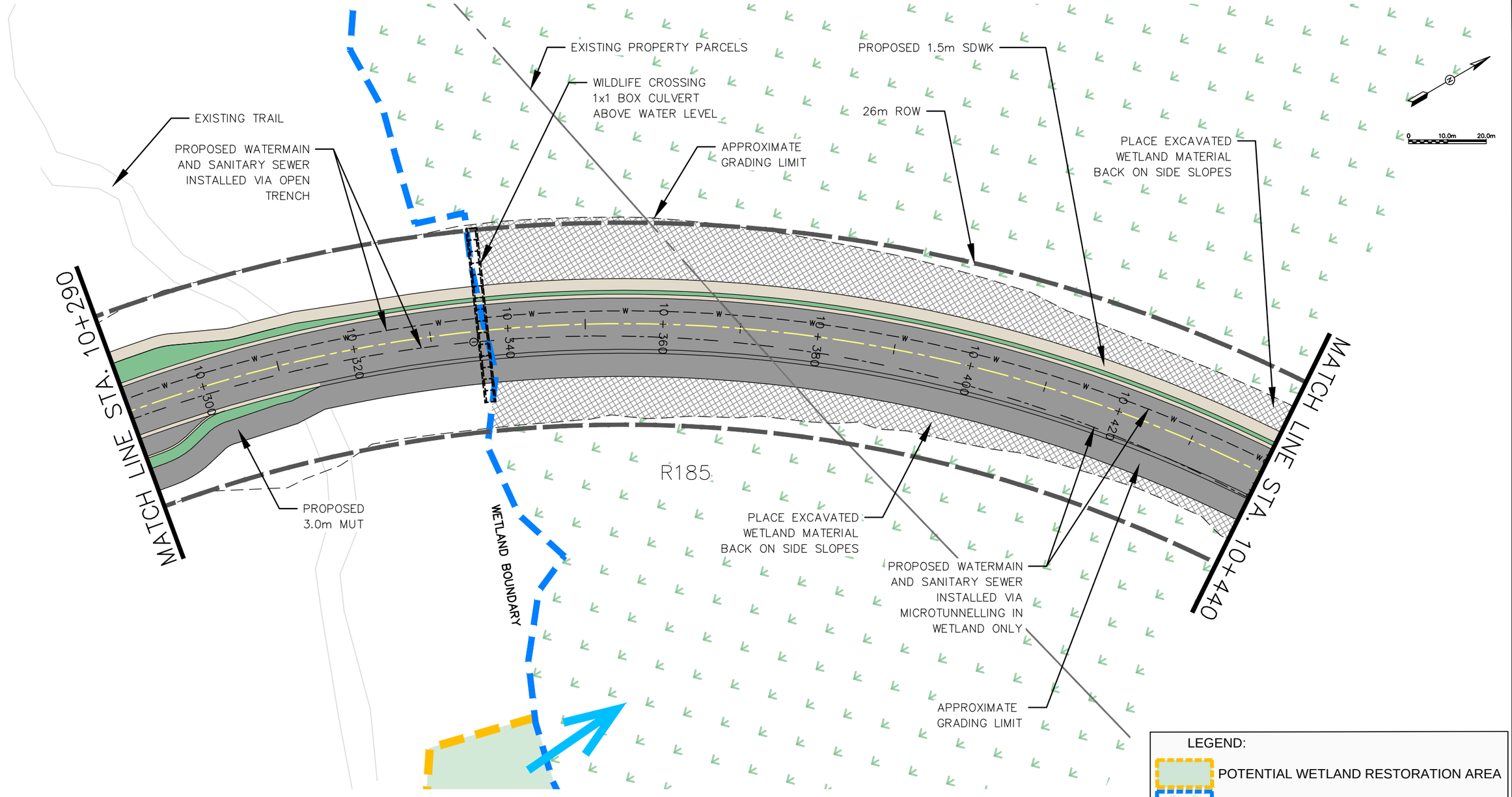

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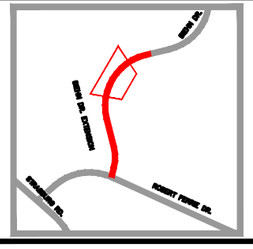


NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

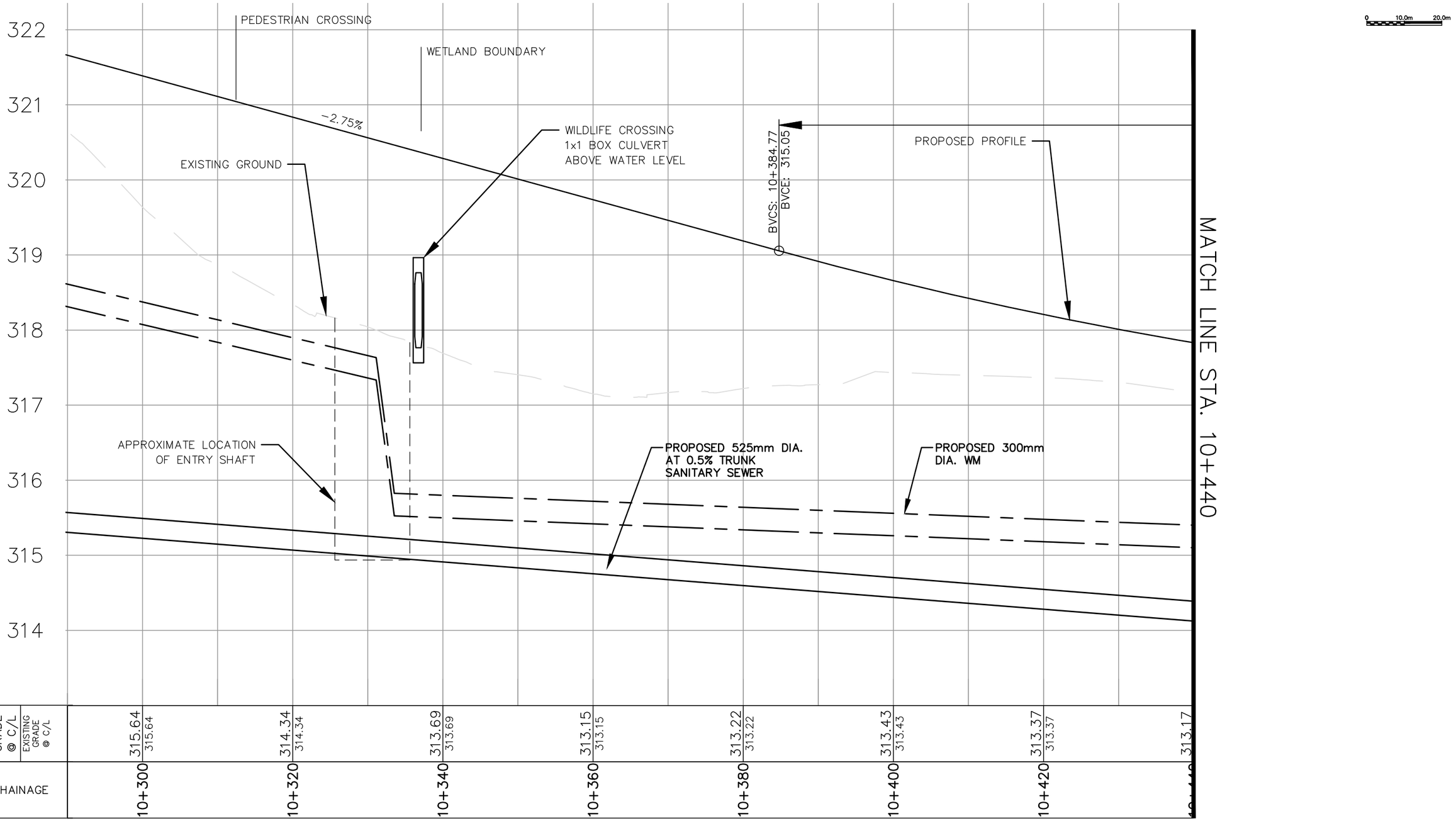
PLATES
FROM STA. 10+290 TO STA. 10+440

BT ENGINEERING

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

CONTRACT 21-003

SHEET NO. C-005



NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

PLATES – PROFILE
FROM STA. 10+290 TO STA. 10+440

BT ENGINEERING

BTE

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

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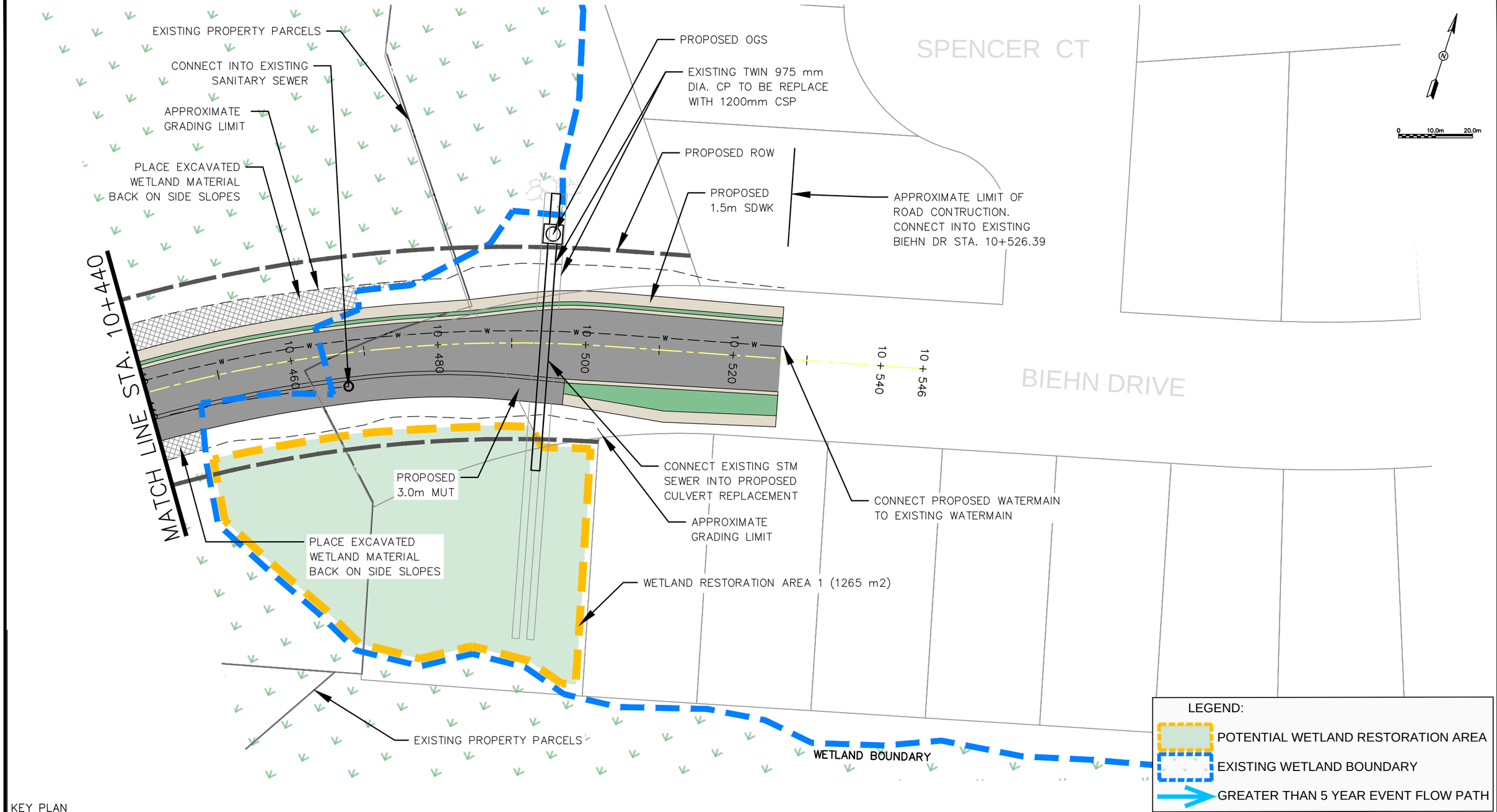

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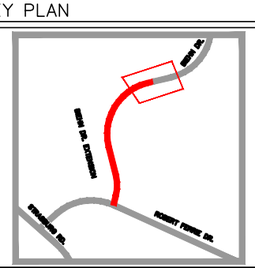

NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

PLATES
FROM STA. 10+440 TO STA. 10+526.39

BT ENGINEERING

BTE

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

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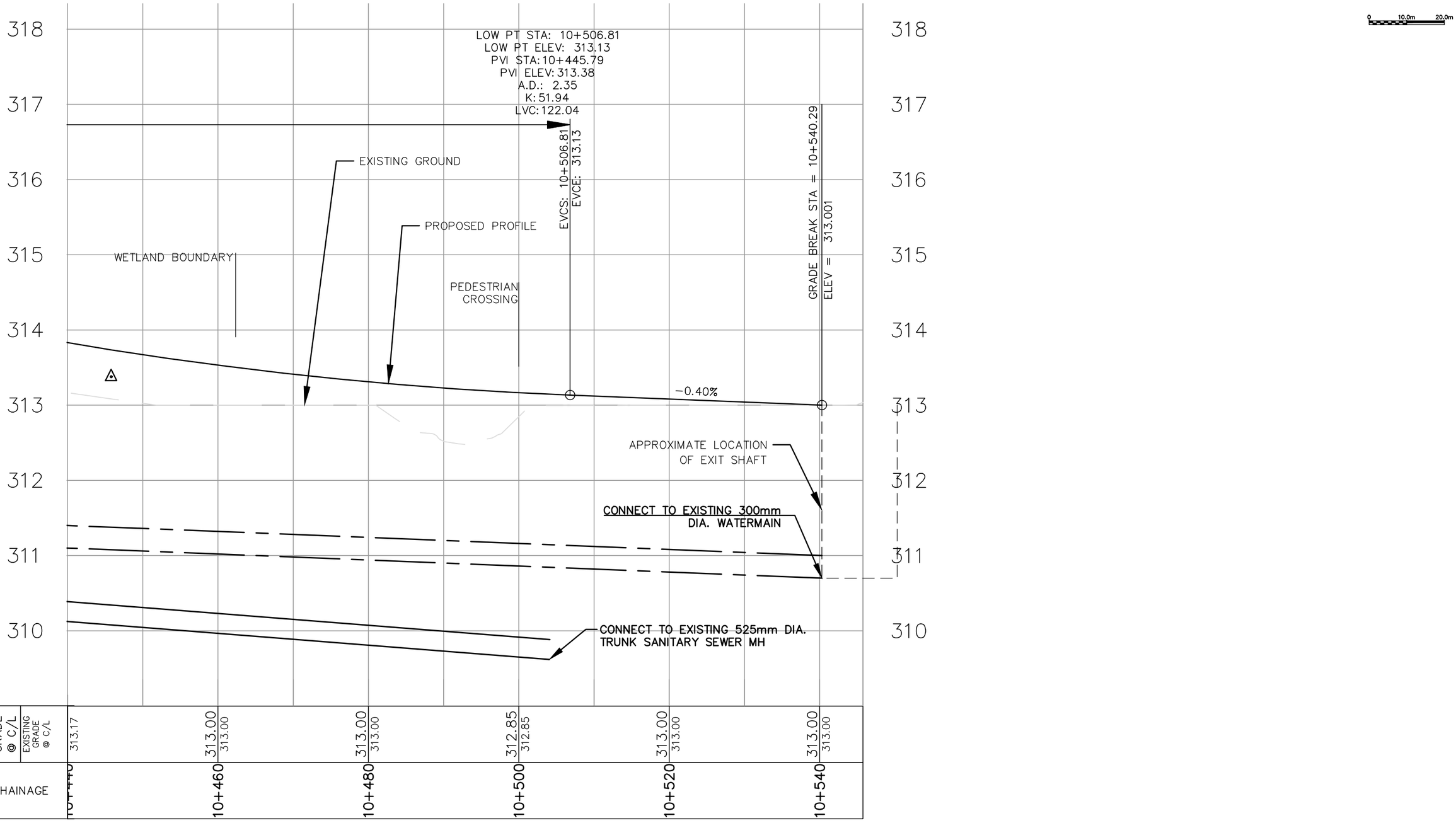

NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

PLATES – PROFILE
FROM STA. 10+440 TO STA. 10+526.39

BT ENGINEERING

BTE

HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

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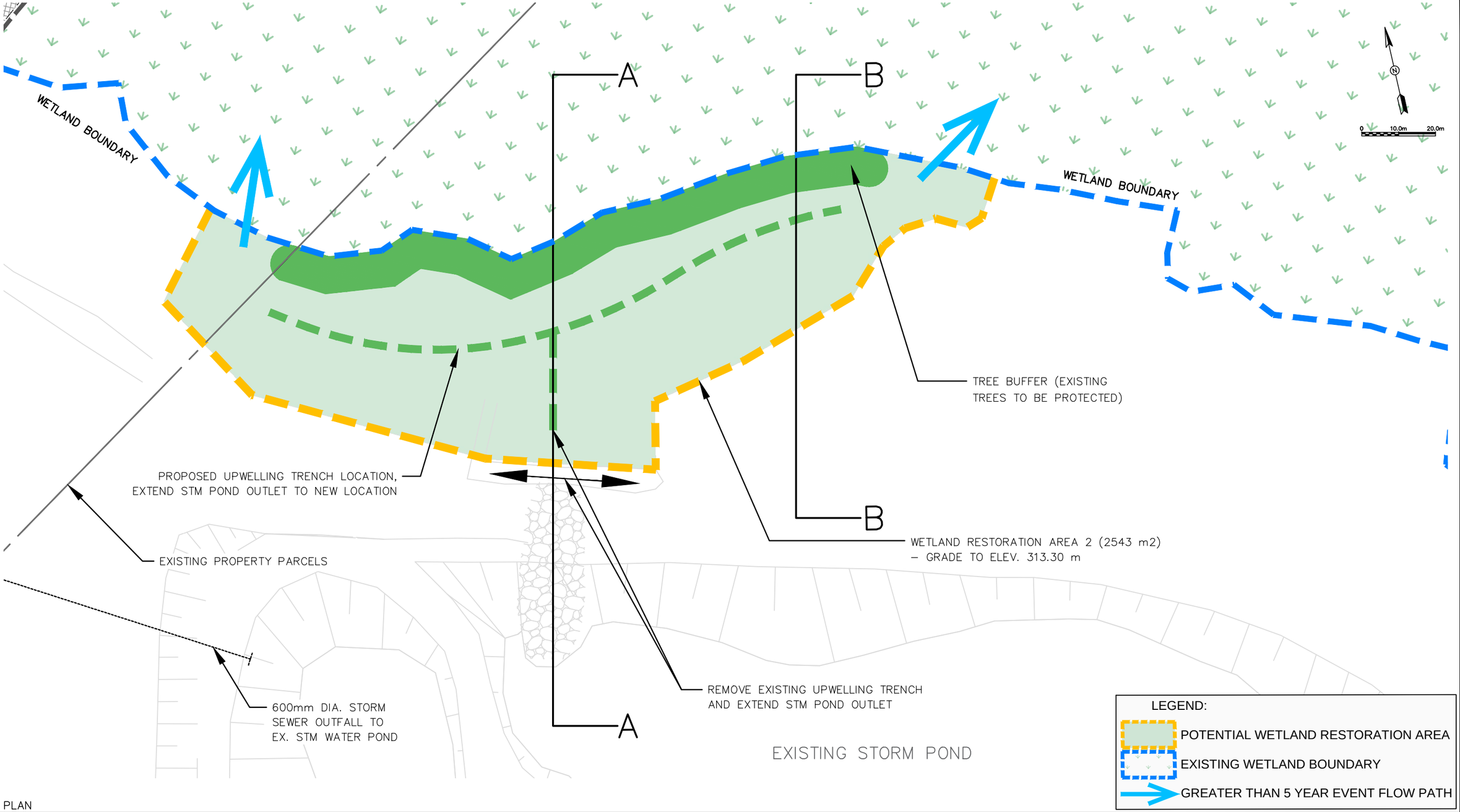

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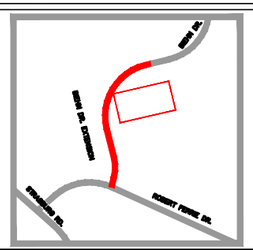


NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

ADDITIONAL WETLAND RESTORATION AREA

BT ENGINEERING

BTE

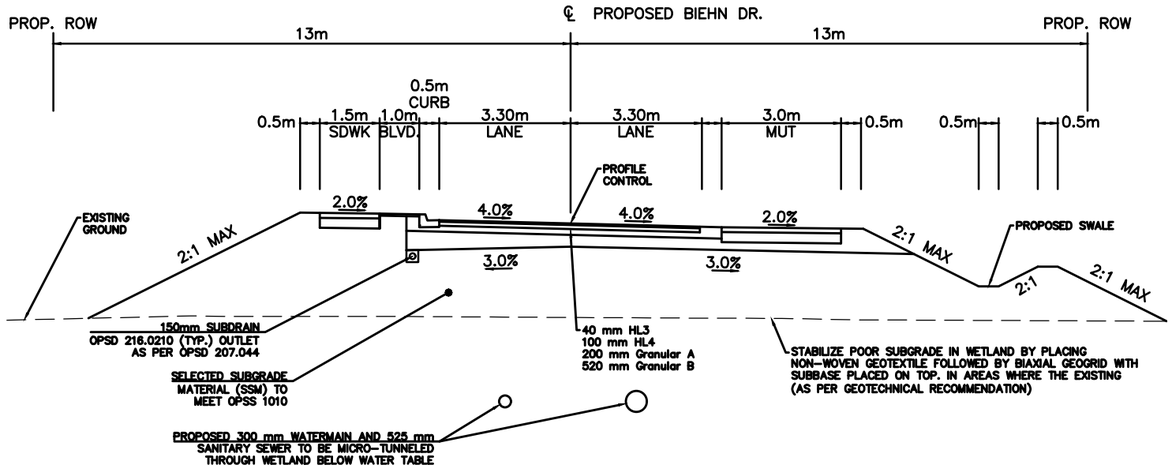
HORZ.	1:500
VERT.	1:50
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

CONTRACT 21–003 SHEET NO. C–009

BIEHN DRIVE TYPICAL SECTION IN SUPERELEVATION

ROAD SECTION THROUGH PSW FROM STA. 10+337 TO STA. 10+500

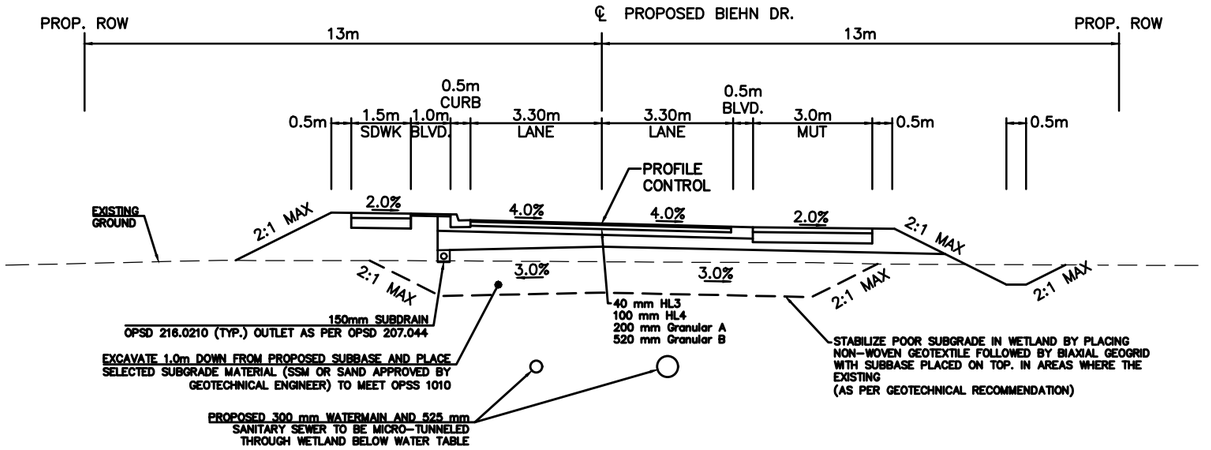
NOTE: EXCAVATED NATIVE WETLAND MATERIAL TO BE SALVAGED AND PLACED ON PROPOSED SLOPES



BIEHN DRIVE TYPICAL SECTION IN SUPERELEVATION

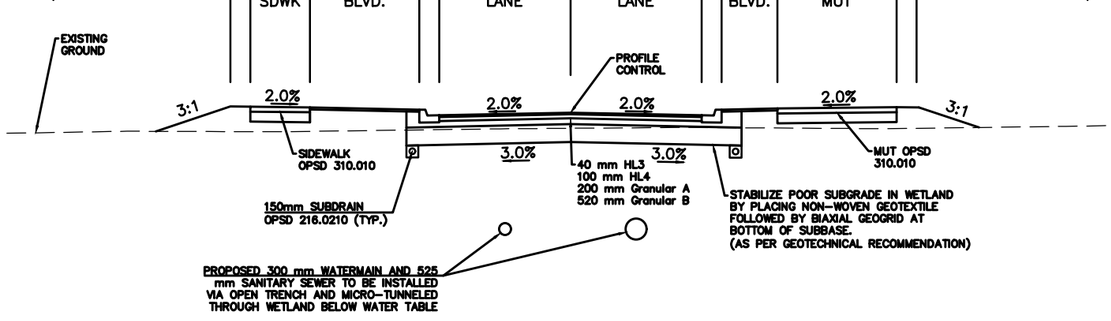
ROAD SECTION THROUGH PSW WITH EXCAVATION OF EXISTING GROUND

NOTE: EXCAVATED NATIVE WETLAND MATERIAL TO BE SALVAGED AND PLACED ON PROPOSED SLOPES



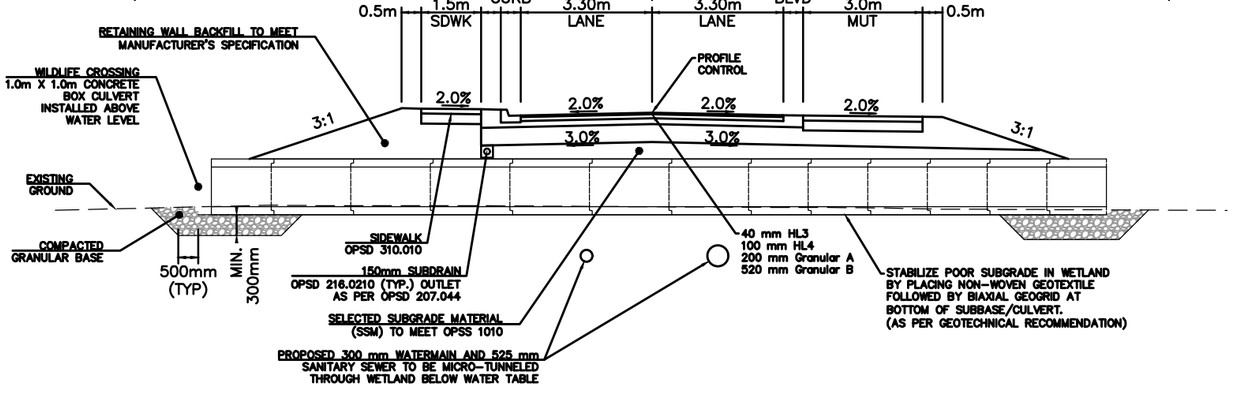
BIEHN DRIVE TYPICAL SECTION

FROM STA. 10+060 TO STA. 10+337
FROM STA. 10+500 TO EXISTING BIEHN DRIVE



BIEHN DRIVE TYPICAL SECTION

ROAD OVER WILDLIFE PASSAGE



NO.	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

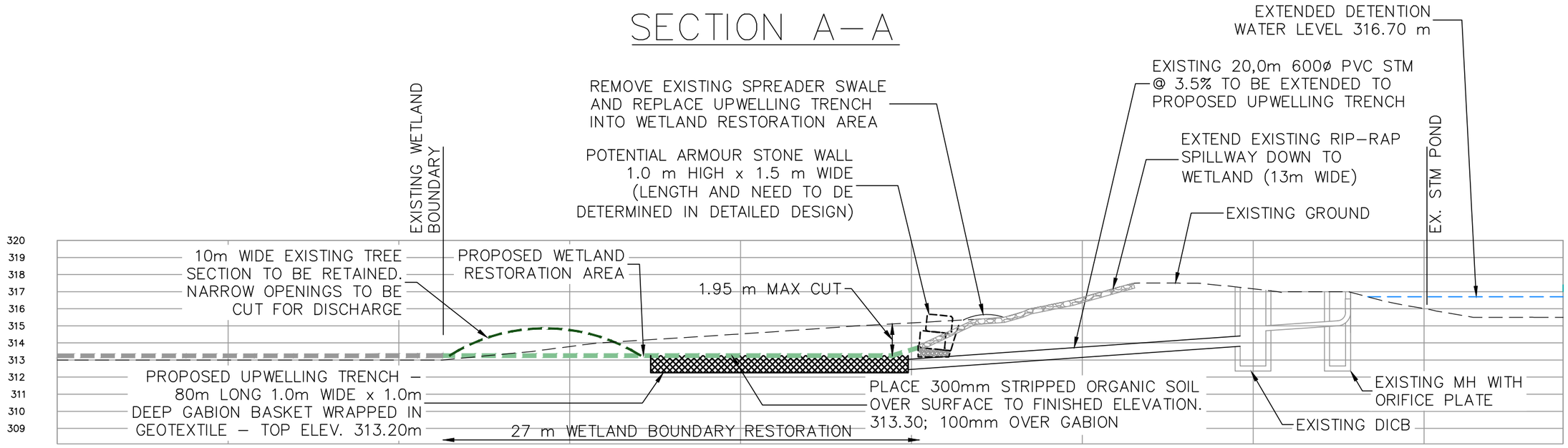
TYPICAL CROSS SECTIONS

BT ENGINEERING

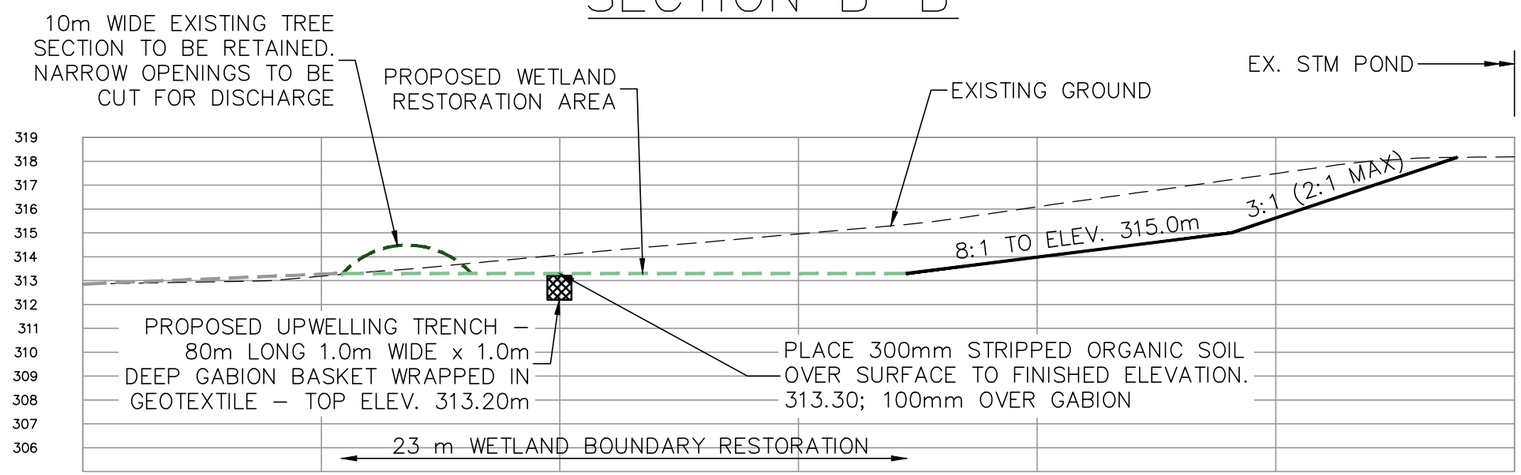
HORZ.	1:150
VERT.	1:150
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

CONTRACT 21-003 SHEET NO. C-010

SECTION A–A



SECTION B–B



	REVISIONS	DATE	APPROVED
1.	ESR	SEP/24	S.J.T.

BIEHN DRIVE

PRELIMINARY ROAD DESIGN

WETLAND RESTORATION SECTIONS

BT ENGINEERING

BTE

HORZ.	1:250
VERT.	1:250
DRAWN	A.D.
DESIGN	A.D.
REVIEWED	S.J.T.
DATE	2024/09/03

CONTRACT 21–003 SHEET NO. C–011

Appendix A

Study Design

BT ENGINEERING

Study Design Report, Revision 1

Biehn Drive Municipal Class Environmental Assessment

November 2021

Submitted by:

BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5

Table of Revisions

No.	Date	Revision
1	April 30, 2021	Section 4.3.2.1.7 Cultural Environment revised to: Potential Built Heritage Resources and Cultural Heritage Landscapes will be evaluated for the entire study area prior to the selection of preferred alternatives and summarized in the ESR. This review will identify all known or potential built heritage resources and cultural heritage landscapes (BHR/CHLs). If resources are present, a cultural heritage assessment report will be completed with the potential project impacts to BHR/CHLs identified and strategies will be provided to mitigate identified impacts. These mitigation measures will inform project planning and design. An Archaeological assessment (AA) will be undertaken by an archaeologist licenced under the *Ontario Heritage Act*, who is responsible for submitting the report directly to the Ministry of Heritage Sport, Tourism and Culture Industries (MHSTCI). A Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition, and contacting MHSTCI to find out whether there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and determine whether additional archaeological assessment is necessary (e.g. Stages 2, 3, and 4).
2	June 7, 2021	Section 5.0 and 5.1 to add Alternative 4.
3	June 7, 2021	Section 1.1 revised to include a local and broader Study Area.
4	June 7, 2021	Section 2.1 revised to: Future development within the Doon South and Brigadoon communities requires a defined alignment for the extension of Biehn Drive to Robert Ferrie Drive as part of the area road network. In order to determine the road alignment, this Study will consider the natural, social environments and the future land use in the Study Area. The extension of Biehn Drive and the associated municipal servicing has been a longstanding part of the integrated plan for the Brigadoon neighbourhood. The planned extension will improve local access to Strasburg Road to safely and reliably accommodate all modes of transportation including vehicular, pedestrians, and cyclists, and provide access to potential future transit. By defining the future road and municipal servicing plans, the subsequent land use plans can be completed by developers.
5	June 7, 2021	Section 2.2 revised to: … The extension of Biehn Drive, in conjunction with the extensions

		of Robert Ferrie Drive and Strasburg Road, will result in a more balanced distribution of the existing neighbourhood traffic, increasing the traffic volumes along a short section of Biehn Drive while reducing the volumes that are currently using other neighbourhood streets. The EA will undertake community consultation and mitigating measures will be developed to reduce the impacts on the community and control traffic speeds…
6	June 7, 2021	Section 2.3 revised to: • Reduced traffic demand on other neighbourhood streets including Biehn Drive (to the north), Caryndale Drive and Marl Meadow Drive/ Teeplewood Drive resulting in reduced community disruption and improved road safety;
7	July 11, 2021	Section 4.2.3.1.6 Natural Environment revised to include a detailed Terms of Reference (TOR).
8	November 2, 2021	Section 6.0 Schedule updated.

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1.0 Introduction

The City of Kitchener (City) has initiated a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The focus of the Study will be to consider alternatives for the alignment of the Biehn Drive extension, intersection locations and designs and municipal services while minimizing environmental, social, and cultural impacts of the project.

This report, the initial public document for the Municipal Class Environmental Assessment, presents a description of the work plan, preliminary alternatives, consultation plan and overall study process. It outlines the EA planning process and describes the key activities required to complete the Study. The Study Design will be circulated to various agencies and the Study's Technical Advisory Committee (TAC) and is available to the public on the City's website for review and comment.

Note: At the time of release of the Study Design Report, the Province of Ontario has implemented restrictions on public gatherings to deal with the COVID-19 pandemic, and as such the distribution of materials is relying on web-based communications with the public. Subsequent stages of the study may revert to conventional public events to review the sequential planning decisions of the study.

1.1 Study Area

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.

The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension.

Based on comments from the public at the Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods.

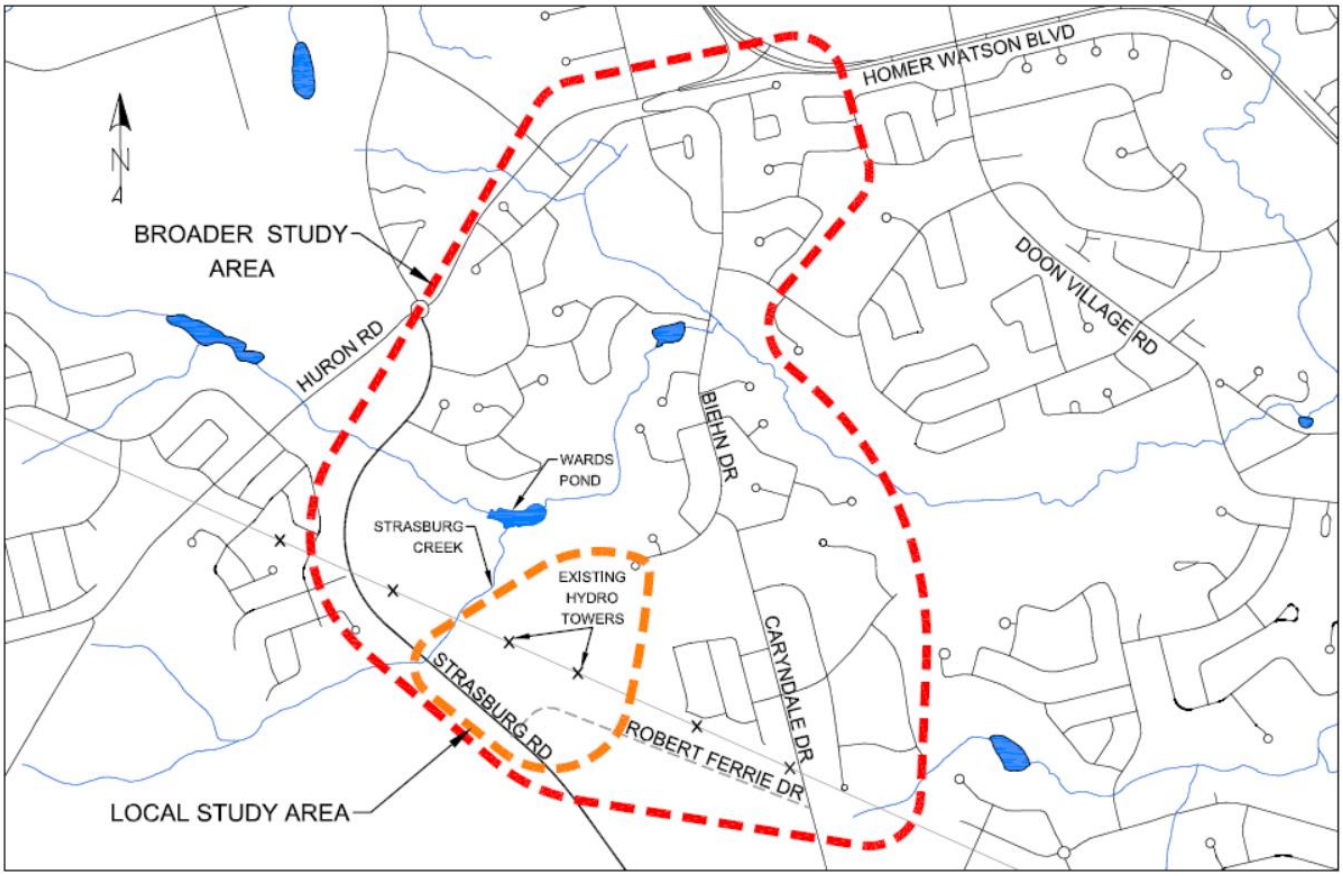

Figure 1: Study Area

1.2 Study Background

Since the mid-2000's the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener have planned for area development and evolving transportation needs. Several planning documents including the Official Plan and Transportation Master Plan (TMP) have identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension and ultimately to Strasburg Road. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan Amendment. This link would accommodate vehicles to and from the Brigadoon community, and would help mitigate cut-through traffic on local streets within the community. A collector road collects traffic from local roads within the community and provides connectivity to high tier arterial roads including Strasburg Road.

1.2.1 Background Studies

Background Studies have been completed within the Study Area to document the proposed land uses, transportation networks and existing issues. These reports are summarized in the following sections.

1.2.1.1 Official Plan and Land Use

The City of Kitchener Official Plan (2014) documents the policies for growth, development, and land use within the City. Map 3 of the Official Plan identifies the land in the Study Area as Natural Heritage Conservation and Low-Rise Residential:

- Natural Heritage Conservation: This land use designation is used to protect and/or conserve natural heritage features and their ecological functions. This designation includes Provincially Significant Wetlands.
- Low-Rise Residential: This land use designation accommodates a range of low-density housing types including single detached dwellings, semi-detached dwellings, townhouses, low-rise multiple dwellings etc.

In addition to the general land use classifications, there is a Specific Policy Area (SPA) along the hydro corridor in the Brigadoon subdivision (SPA 45). This SPA states:

> *"Notwithstanding the Open Space land use designation and policies on the Hydro Corridor in the Brigadoon Subdivision (30T-88006) shared uses on hydro rights-of-way including open space links, parking lots or other uses accessory to adjacent land uses in accordance with Policy 14.C.1.37 and Policy 15.D.10.1 i) will be permitted."*

1.2.1.2 City of Kitchener Transportation Master Plan

The Kitchener Integrated TMP (2013, IBI Group) identifies the need to extend Biehn Drive from its current terminus. The TMP recommended that Biehn Drive be extended westerly to Strasburg Road. This recommendation was modified in subsequent planning documents and EAs to recommend connection to the Robert Ferrie Drive extension instead, with the final determination to be defined by an EA (the current study).

1.2.1.3 Region of Waterloo Transportation Master Plan

The Region of Waterloo's Moving Forward 2018 Master Plan (IBI Group, 2019) outlines the needs for active transportation, transit and Regional roads. This report identifies Biehn Drive as an Existing Local Route for Grand River Transit; however, the 2021 GRT System Transit Map no longer includes this link (Route 16 Stasburg-Belmont follows Biehn Drive from Old Huron Road to Black Walnut Drive).

1.2.1.4 Kitchener Growth Management Plan (KGMP)

The Kitchener Growth Management Plan (KGMP) (2019) provides a framework to ensure that the City has “direct proper and orderly development within the boundary”. The Plan prioritizes areas for development based on the supply of developable lands and existing infrastructure.

The extension of Biehn Drive, including a sanitary sewer, is identified in the Plan as a major remaining initiative for the Brigadoon community. There are two developments planned/proposed within this area (see **Figure 2**). A requirement for development of the lands, labelled 33 and 34 on **Figure 2,** is the extension of sanitary services and the Biehn Drive connection.

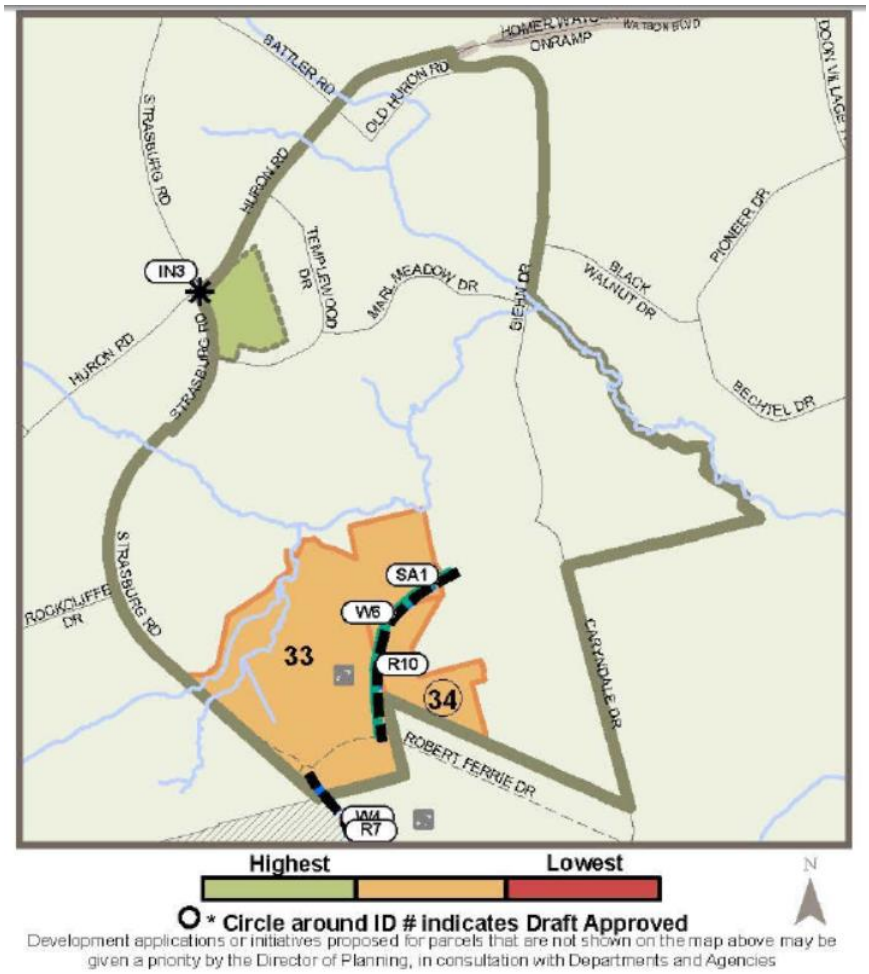

Figure 2: Growth Area Subplan for Brigadoon (Kitchener Growth Management Plan, 2019)

1.2.1.5 Brigadoon Community Plan

The Brigadoon Community Plan (2004) documents the principles for the development of the Brigadoon Community. This plan identifies that the development of lands east and west of the

future Biehn Drive extension “shall require the construction of Strasburg Road and the Biehn Drive extension”.

1.2.1.6 Sanitary Sewer Master Plan

The City of Kitchener is currently completing a Sanitary Sewer Master Plan.

1.2.1.7 Integrated Stormwater Management Master Plan (ISWM-MP)

The City of Kitchener’s Integrated Stormwater Management Master Plan (ISWM-MP) (Aquafor Beach, 2016) identifies the prioritization of works for the City’s overall stormwater master plan. This report identifies that the Study Area is located within the Strasburg Creek subwatershed. This was identified as a Priority 4 subwatershed, which is an area where intensification should provide sufficient buffers to maintain the natural hydrologic cycle.

1.2.1.8 Additional Reports

Additional background reports that will be reviewed as part of the study will include, as a minimum:

- City of Kitchener Standard Specifications
- City of Kitchener Standard Drawings
- Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services
- Strasburg Road Extension Environmental Study Report
- South Strasburg Gravity Trunk Sanitary Sewer Project File
- East Side Lands Sanitary Servicing Environmental Study Report
- Doon South Pumping Station Draft Environmental Study Report
- Robert Ferrie Drive Extension Environmental Study Report
- Biehn Drive Extension and Need Justification Review
- Doon South Community Plan
- Huron Community Plan
- Southwest Kitchener Urban Area Studies - Community Master Plan
- Doon South - Brigadoon Transportation Network and Corridor Study
- Doon South Community and Broader Study Area Traffic Impact Study
- City of Kitchener Cycling and Trails Master Plan
- Huron Industrial Development Transportation Planning and Engineering Study
- Strasburg Creek Flood Control Environmental Study Report
- State of the Watershed (SOW) Report Upper Blair Creek
- Cumulative Effects Monitoring – Blair Creek Case Study
- Revised Final Stormwater Management Report Doon Creek – Robert Ferrie Drive Extension
- City of Kitchener Stormwater Management Facility Retrofit, Class EA and Preliminary Design Brief
- Upper Blair Creek (Kitchener) Functional Drainage Study Final Report

2.0 Need and Justification

2.1 Problem and Opportunity Statement

Future development within the Doon South and Brigadoon communities requires a defined alignment for the extension of Biehn Drive to Robert Ferrie Drive as part of the area road network. In order to determine the road alignment, this Study will consider the natural, social environments and the future land use in the Study Area. The extension of Biehn Drive and the associated municipal servicing has been a longstanding part of the integrated plan for the Brigadoon neighbourhood. The planned extension will improve local access to Strasburg Road to safely and reliably accommodate all modes of transportation including vehicular, pedestrians, and cyclists, and provide access to potential future transit. By defining the future road and municipal servicing plans, the subsequent land use plans can be completed by developers.

The Study will provide the opportunity to: improve accessibility to the local community by providing additional network links; define a multi-modal transportation plan to support travel within the local neighbourhoods and; allow development to proceed on lands that currently require the roadway plan to be defined prior to developing the land use plan.

2.2 Key Issues and Constraints

Key issues and constraints that will be addressed as part of this study include:

- **Impacts on the Existing Community:** The existing Brigadoon community is an established residential area with low ambient sound levels and low traffic volumes on Biehn Drive. The extension of Biehn Drive, in conjunction with the extensions of Robert Ferrie Drive and Strasburg Road, will result in a more balanced distribution of the existing neighbourhood traffic, increasing the traffic volumes along a short section of Biehn Drive while reducing the volumes that are currently using other neighbourhood streets. The EA will undertake community consultation and mitigating measures will be developed to reduce the impacts on the community and control traffic speeds. Measures may include traffic calming measures, pedestrians/cyclist facilities, and mitigation for noise impacts.
- **Natural Environment:** The EA will investigate the protection of surrounding terrestrial and aquatic habitat and will establish mitigation for any potential impacts to the natural environment. There is potential for Species at Risk (SAR) to be present in the adjacent woodlots and the Strasburg Creek Provincially Significant Wetland (PSW). Additionally, two cold-water systems (Strasburg Creek and Blair Creek) flow to the north of south of the Study limits. The provision of wildlife passage will be a key consideration for this work, as will mitigation of potential stormwater impacts to the Strasburg Creek system.

- **Transportation**: The EA will determine a preferred road corridor that will address long-term municipal infrastructure requirements and safely accommodate road users. In addition, the EA will need to consider the proximity to adjacent intersections on Robert Ferrie Drive and the need to accommodate trucks through the roundabout.
- **Active Transportation:** Active modes of transportation will need to be accommodated with separate facilities to provide the highest level of service and safety (multi use pathways, sidewalks, bicycle lanes and/or raised cycle tracks).
- **Planned/Proposed Development:** The extension of Biehn Drive will need to consider any proposed plans of subdivision and the potential network of future local streets.

2.3 Opportunities

The benefits from the completion of the EA study will include:

- Improved emergency service access to local community;
- Reduced traffic demand on other neighbourhood streets including Biehn Drive (to the north), Caryndale Drive and Marl Meadow Drive/ Teeplewood Drive resulting in reduced community disruption and improved road safety;
- Provision of active transportation linkages; and
- Establish the future road location which will allow planning and approvals for subdivisions.

3.0 Study Process

This Study will complete the remaining phases of the Municipal Schedule C Class EA Study which was initiated by the TMP. The Study will meet all requirements of the Municipal Class EA by establishing the need and justification for the project, considering all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and proactively involving the public in defining a Recommended Plan. The study will culminate in the filing of an Environmental Study Report (ESR) and provide environmental clearance to the City to proceed with the project, subject to permits and approvals that will occur during the future detail design stage of the project.

3.1 Guiding Principles

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

- Consider all reasonable alternatives;
- Provide a comprehensive assessment of the environment;
- Utilize a systematic and traceable evaluation of net effects;
- Undertake a comprehensive public consultation program; and

- Provide a clear and concise documentation of the decision-making process and the public consultation program.

3.2 Environmental Assessment Act Requirements

The Environmental Assessment will follow the Class EA process, thereby meeting the requirements of the Municipal Class Environmental Assessment (2000 as amended in 2007, 2011 and 2015). The Study is being initiated as a Municipal Schedule C project based on the range on anticipated effects and capital cost of the project.

The Schedule C project will include two public meetings (a combined Community Café Event/Public Information Centre (PIC No. 1 and a second PIC) and conclude with the preparation of an ESR. The public will be provided with a 30-day ESR review period at the Study conclusion.

As the initial step in the Class EA process, this Study Design Report is being made available to the public. This is a discretionary Step of the Municipal Class EA process, as illustrated in **Figure 3** following Phase 2 of the Class EA process. This additional step is similar to the Step 1.2 activity in that it provides the context for a project where there has been a lag in time since the TMP was completed. The public and agencies will have this initial opportunity to comment on the proposed approach and previous TMP recommendations. The Class EA process does not have a public review period for TMP's following Phase 2, and this current study provides an opportunity for project specific comments.

3.3 EA Phases

The Municipal Class EA Process is illustrated in **Figure 3**. The following is the breakdown of tasks, by phase, for a Municipal Schedule C project:

Phase 1: Identify the Problem (completed as part of the City's TMP)

- Step 1: Identification and description of the problem or opportunity.
- Step 2: Discretionary public consultation.

Phase 2: Alternative Solutions (Steps 1 to 8 completed as part of the City's TMP)

- Step 1: Identification of alternative solutions to the problem.
- Step 2: Identify the study area and a general inventory of the natural, social and cultural environments.
- Step 3: Identification of the net positive and negative effects of each alternative solution.
- Step 4: Review and validation of alternative solutions.
- Step 5: Identification of reasonable design alternatives for the preferred solution.
- Step 6: Public consultation

- Step 7: Confirmation of design alternatives, finalization of Study Design for work program, and refinements to or addition of design alternatives to be carried forward to Phase 3.
- Step 8: Selection of the preferred solution
- Step 9: Study Design available on the City's website – added activity to initiate this current study.
- Step 10: Initial Community Café/PIC No. 1 added activity under this study to review/validate previous TMP recommendations and present preliminary design alternatives for public and agency comment before Phase 3 activities are initiated.

Phase 3: Alternative Design Concepts for the Preferred Solution

- Step 1: Identification of alternative designs.
- Step 2: Preparation of a detailed inventory of the natural, social and economic environments.
- Step 3: Identification of the potential impacts of the alternative designs.
- Step 4: Evaluation of the alternative designs.
- Step 5: Selection of preferred design.
- Step 6: Public consultation at PIC No. 2.

Phase 4: Environmental Study Report (ESR)

- Step 1: Completion of the ESR.
- Step 2: 30-day public review period.
- Step 3: Filing of the ESR and Notice of Completion.

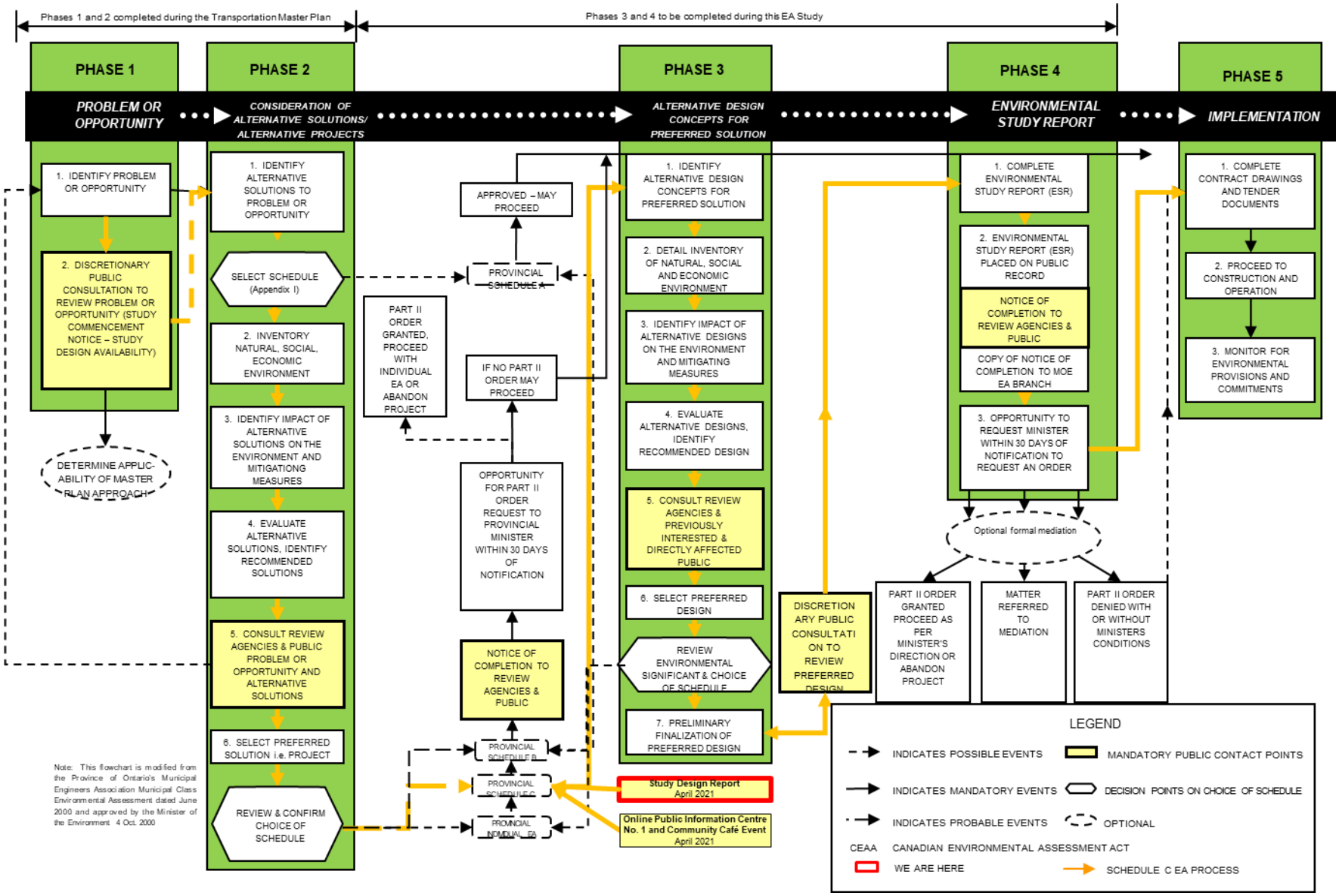

Figure 3: Municipal Class EA Process

4.0 Study Approach

Over the course of the study, input will be solicited from the public, stakeholders, agencies and Indigenous Communities. Input will be gathered through meetings, the project website, and discussions/communication with interested parties. The approach is to work collaboratively with interested parties to address issues and reach a consensus on the Recommended Plan.

4.1 Consultation Program

The Consultation Program identifies the opportunities for the Technical Advisory Committee (TAC) to discuss the Study with the public/stakeholders, agencies and Indigenous Communities. This Study will use several processes to engage with interested parties and provide an opportunity for input. The Consultation Program will include:

- Notices published in local newspapers, issued as media releases and directly mailed/emailed to the study mailing list at key points over the course of the study including:
    - Notice of Study Commencement at the study start-up
    - PIC No. 1/Community Café and PIC No. 2
    - Notice of Study Completion to announce the start of the 30-day public review period
- Communication and coordination with agencies/consultants to obtain background information for input into the study and to obtain required approvals/permits
- Study updates on the project webpage located on the City's website
- Project Team Meetings with City staff
- Meetings with affected property owners, local residents, businesses and Indigenous Communities

4.1.1 Public Consultation

The study will use several techniques to proactively involve the public including a Community Café event, PIC and meetings with external stakeholders. Meetings will be organized with the stakeholders and may include adjacent landowners and other affected businesses or associations. These meetings will include representatives from the City and the consultant team.

Two public meetings will be held. The first public meeting will be a combined Community Café event and PIC No. 1. This event will follow the principles of the World Café philosophy and will engage the public and stakeholders in discussion on their perspectives and interests in the study. The Community Café is a simple yet effective conversational method for fostering dialogue, accessing collective intelligence, and creating innovative possibilities for action. The

Café will be an informal event facilitating conversation by providing participants with a comfortable and welcoming environment.

The second public meeting will be PIC No. 2, which will present the evaluation of design alternatives and the Technically Preferred Alternative (TPA) for the Study Area. Council members will be provided PIC materials in advance of the meeting and the consultant will be available to present to Council in advance of the public meeting.

The public meetings will be an integral component of the study - seeking input and comments from the public and stakeholders. There will be an opportunity for the public to comment on the study at any time. All information will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* (2009). Anyone interested in the study will be added to the study mailing list upon request.

4.1.2 Agency Consultation

Agencies/Ministries will be contacted at the start of the study to inform them of Study Commencement and to circulate this Study Design. As the study progresses, meetings will be held with select agencies (as required) to review the study and obtain approvals in accordance with the Municipal Class EA. Agencies will include:

- Ministry of the Environment, Conservation and Parks
- Ministry of Natural Resources and Forestry
- Ministry of Indigenous Relations and Reconciliation
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Infrastructure Ontario
- Department of Fisheries and Oceans
- Grand River Conservation Authority
- Transport Canada
- Emergency Services
- School Boards/Bus Services
- Other Stakeholders (as identified)

4.1.3 Indigenous Peoples Consultation

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

- Identification of interested/affected Indigenous Peoples early in the decision-making process;

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

Indigenous Peoples will be consulted throughout the duration of the Study.

4.2 Work Program

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

4.2.1 Phase 1: Identify the Problem

This phase of the Study will include: establishing the Study scope, schedule and approach with the Project Team and agencies; issuing the Notice of Study Commencement; the collection and organization of background information; reviewing and documenting existing conditions; and the transportation analysis to identify operational, safety and traffic concerns.

In addition, the following Community Engagement tools will be undertaken to proactively engage stakeholders early in the Study:

- **Study Design**: This Study Design presents: the Problem/Opportunity Statement; the consultation plan; project schedule; and identifies the scope of the Study's technical requirements, design standards and proposed evaluation criteria. This document is available for public/agency review and will help establish the foundation for all remaining environmental planning and public consultation processes.

  After the first PIC and based on comments received, the draft Study Design Report will be finalized and placed on the City's website as the Final Study Design Report.

- **Community Café/ PIC No. 1**: This event will be a collaborative community involvement tool that goes beyond the conventional information exchange at public meetings. The event will focus on listening to the community in small group discussions (without the study team in the dialogue) to build consensus on the issues and desires of the community.

4.2.2 Phase 2: Alternative Planning Solutions

The consideration of all reasonable alternatives is a guiding principle for EA studies. The Biehn Drive extension, sanitary sewer alignment, cross section, and intersection alternatives will be generated through discussions with the City, agencies and the general public.

The analysis and evaluation process involves a 2-step decision-making process. Initially the study documents the analysis and evaluation of Alternatives to the Undertaking (alternative project types or alternative strategies to address the problem) followed by the subsequent assessment of preliminary design alternatives.

The City of Kitchener TMP previously identified the extension of Biehn Drive as a City Street Capacity Improvement. This TMP completed Phase 1 and 2 of the Class EA process, including the evaluation of Alternative Planning Solutions. The TMP recommended this project as the "implementation of new streets in southwest Kitchener Urban Areas Study Community Master Plan, including extension of Biehn Drive between Biehn Drive and Robert Ferrie Drive".

4.2.3 Phase 3: Alternative Design Concepts for the Preferred Planning Solution

Preliminary Design Alternatives will be generated for the Preferred Alternative Planning Solution (Biehn Drive Extension) based on an inventory of the natural, social and cultural environment and results of technical investigations.

4.2.3.1 Environmental Inventories and Technical Investigations

Environmental inventories and technical investigations will be completed to assess the impacts of alternative design concepts. These investigations are described in **Sections 4.2.3.1.1** to **Section 4.2.3.1.7**.

4.2.3.1.1 Transportation and Traffic

Transportation/traffic analysis will be completed using a Complete Streets approach considering the needs of pedestrians, cyclists, motorists, goods movement including farm vehicles (if applicable) and transit services. The traffic analysis will assess existing and future traffic demand to the end of the Official Plan horizon. The study will provide recommendations for: intersection control (roundabout vs. signalized), pedestrian crossings, spacing of intersections with local streets and roadway cross section requirements (lane requirements, sidewalks and/or multi-use paths, continuation of existing bicycle lanes or transition to raised cycle tracks and potential traffic calming measures).

The traffic report will also provide recommendations on the timing of the improvements. This analysis will be used to identify the preliminary design level of geometric needs of the various alternatives (i.e. storage lengths, auxiliary lanes, signal/traffic controls, etc.) and in addition, will be used to evaluate the impacts/benefits of the various competing alternatives for the horizon years.

4.2.3.1.2 Sanitary Sewer

The Project Team will develop the design of the trunk sanitary sewer in conjunction with the alternative road extension alternatives. It is noted that some of the alternative alignments for

the trunk sewer may diverge from the road alignment alternatives. The Class EA process for extension of the sanitary sewer is a Schedule B process. However, the EA for the road and sanitary sewer will be combined into a single document and will be documented in an ESR. This EA is being undertaken concurrently with the Sanitary Sewer Master Plan.

The preliminary design tasks will include preliminary design of the trunk sanitary sewer, including confirmation of drainage areas and design flows; drainage design, including hydraulic design of the crossings; and stormwater management design, including 30% design of stormwater management facilities and Low Impact Development measures.

4.2.3.1.3 Stormwater Management and Municipal Servicing

The Project Team will undertake a Stormwater Management (SWM) Plan and Report taking into consideration previously completed studies including the Strasburg Creek Flood Control Environmental Study Report and the Upper Blair Creek Functional Drainage Study. The work will include preliminary hydrologic and hydraulic modelling of the existing and proposed conditions and development of a SWM strategy in sufficient detail to satisfy regulatory concerns and obtain approvals in concept.

The preliminary design tasks will include: drainage design, including hydraulic design of the crossings; and stormwater management design, including 30% design of stormwater management facilities and Low Impact Development measures.

4.2.3.1.4 Geotechnical and Hydrogeological

Geotechnical information and published geological data from the area will be reviewed. In addition, three boreholes will be advanced along the proposed extension alignment. A soil investigation program will be completed to determine a soil characterization.

Geotechnical information and published geological data from the area will be reviewed. A geotechnical assessment of the alternatives will be completed.

4.2.3.1.5 Social Environment

An inventory of existing land uses within the Study Area will be undertaken. This will include documentation of agricultural/residential development (access, emergency services, trails, etc.) and utility corridor land uses. The inventory will also include consideration and identification of future land uses such as developments, right-of-way requirements, future transit and transportation facilities and development that could be implemented complying with existing planning documents. Any land use changes that have occurred will be documented.

In addition, an acoustical assessment for this project will be completed to determine the effects of the project beyond the local Study Area and will reflect traffic volume increases forecast along the existing Biehn Drive corridor. The assessment will determine existing daytime and

nighttime sound level contours and future sound levels associated with the road extension for areas within existing residential (noise sensitive) land uses.

4.2.3.1.6 Natural Environment

The natural environmental team will review desktop/background information to identify any known natural features and complete field investigations in the spring and summer of 2021 to document existing conditions in the Study Area. A detailed Terms of Reference (TOR) is described below and will be submitted to the Grand River Conservation Authority for their review and comment. These TOR are based on a preliminary field visit conducted with the landowner.

A field visit was completed in the spring of 2021 with the landowner's environmental consultant (WSP) to determine what environmental inventories have been completed for the Study Area and to walk the proposed alignments for the Biehn Drive extension. Comprehensive surveys have been conducted over a number of years and the following information will be made available to BTE in support of the MCEA process:

- Wetland delineation GPS coordinates/shapefiles;
- Significant Wildlife Habitat (SWH) identified in the study area;
- Species at Risk (SAR) habitats and screening; and
- Ecological Land Classification (ELC) mapping.

Based on conversations with WSP and GRCA, the wetland delineation has not been field verified by GRCA staff. As such, a site visit will be scheduled for the summer of 2021 to stake the portion of wetland within the Biehn Drive extension Study Area in cooperation with WSP and GRCA. A digital file showing the approved wetland limits will be provided to GRCA and will form the basis for comparison of alternatives from a natural environmental perspective. Field work conducted in the summer of 2021 will also document the locations of Black Ash (*Fraxinus nigra*), a species soon to be listed under the *Endangered Species Act* (ESA) and identify future requirements for surveys during Detailed Design.

A Terrestrial and Aquatic Existing Conditions report will be prepared based on the 2021 field investigations and work previously completed by WSP in the Study Area. In addition to describing existing conditions, the report will quantify the anticipated extent of disturbance to the surrounding Provincially Significant Wetland (PSW) based on each alternative alignment of the roadway and/or sewer.

4.2.3.1.7 Cultural Environment

Potential Built Heritage Resources and Cultural Heritage Landscapes will be evaluated for the entire study area prior to the selection of preferred alternatives and summarized in the ESR.

This review will identify all known or potential built heritage resources and cultural heritage landscapes (BHR/CHLs). If resources are present, a cultural heritage assessment report will be completed with the potential project impacts to BHR/CHLs identified and strategies will be provided to mitigate identified impacts. These mitigation measures will inform project planning and design.

An Archaeological assessment (AA) will be undertaken by an archaeologist licenced under the *Ontario Heritage Act*, who is responsible for submitting the report directly to the Ministry of Heritage Sport, Tourism and Culture Industries (MHSTCI). A Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition, and contacting MHSTCI to find out whether there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and determine whether additional archaeological assessment is necessary (e.g. Stages 2, 3, and 4).

4.2.3.2 Evaluation of Alternatives

Preliminary Design Alternatives will be evaluated using a qualitative evaluation process. Through this process, evaluation criteria will be identified including potential factors such as roadway level of service, traffic safety, accessibility, property impacts, socio-economic environment, natural environment, cultural heritage, technical aspects/construction complexity and implementation.

The evaluation and analysis will identify all improvement alternatives and associated cost estimates including lifecycle costs, alternative construction/material options, proposed timeline and innovative solutions. This document will be presented to the public for input at PIC No. 2. Following the PIC, refinements will be made to the Technically Preferred Alternative (TPA) (if applicable) and the refined alternative will become the Recommended Plan.

4.2.4 Phase 4: Environmental Study Report (ESR)

The preparation of the draft and final EA report will follow the format and content for an ESR as required by the Municipal Class EA document. The ESR will document the study methodology, findings, public involvement and recommendations. The report will provide recommendations on the phasing of the proposed works and preliminary cost estimates. The public will be notified of the availability of the ESR for a 30-day public review period.

5.0 Preliminary Design Alternatives

This Section describes Preliminary Design Alternatives for the extension of Biehn Drive. As an initial step in the generation of alternatives this Study has identified the groups of alternatives below.

Three alternatives were presented at Public Information Centre (PIC) No. 1 and to residents at the Community Café event. Based on comments received from attendees at the Community Café, a fourth alternative has been added for the subsequent evaluation. Alternative 4 will use existing collector roads to move vehicular traffic within the Doon South and Brigadoon communities. The project will include an extension of Biehn Drive for a maintenance road for the new sanitary sewer extension and an active transportation link as per the Official Plan.

- Road Alignments (see **Figure 4**)
  - Alternative 1: Connect to Robert Ferrie Drive east of Hydro One transmission tower
  - Alternative 2: Connect to Robert Ferrie Drive west of Hydro One transmission tower
  - Alternative 3: Connect directly westerly to Strasburg Road
  - Alternative 4: Use Existing Collector Roads
- Sanitary Sewer Alignments
  - Following the future Biehn Drive alignment
  - Following a separate alignment
- Intersection Type:
  - Conventional signalized
  - Unsignalized
  - Roundabout control
- Cross Section:
  - Urban cross section with sidewalk/multi-use trail (MUT)
  - Semi-urban cross section with MUT
- Traffic Calming Measures
  - Chicanes
  - Medians
  - Narrower driving lanes
  - Median bulb-outs

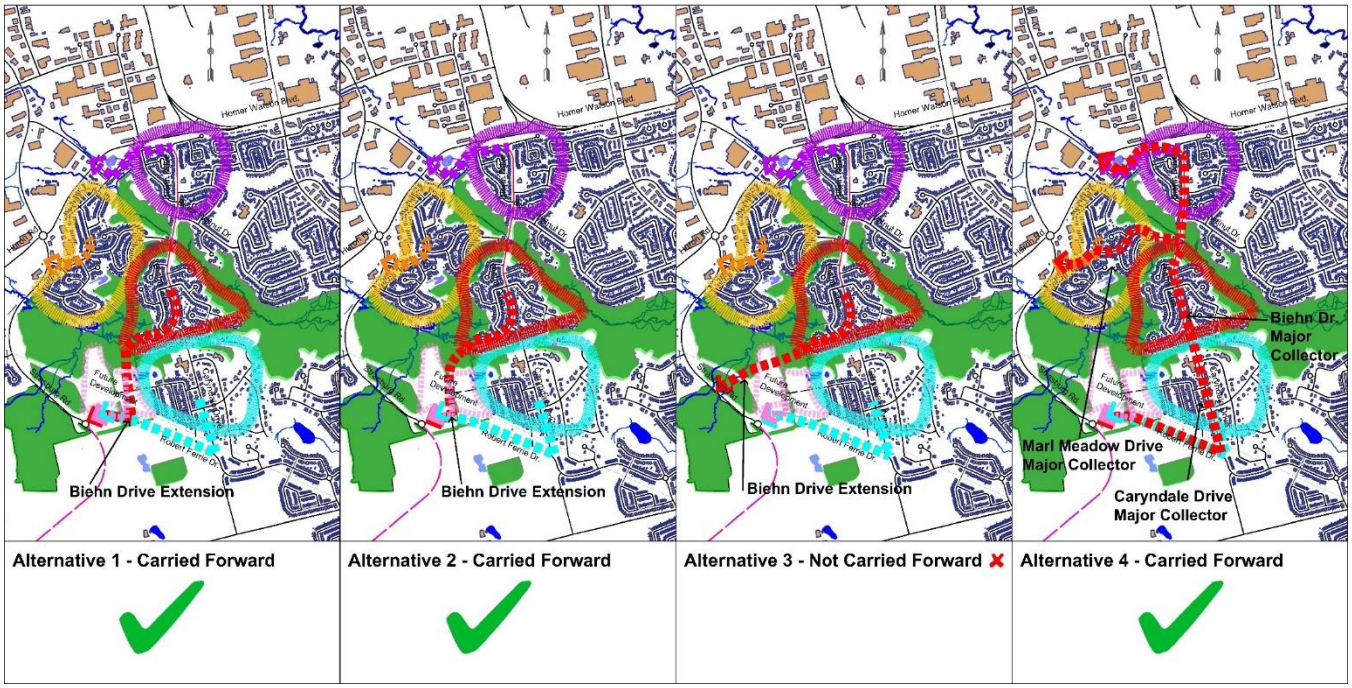

Figure 4: Preliminary Design Alternatives

5.1 Preliminary Coarse Screening of Alignment Alternatives

A coarse screening evaluation of the Preliminary Design Alternatives for the extension of Biehn Drive has been completed to compare the performance, effects and compliance with the City's planning documents, and screen out alternatives which do not address the objectives of the study or are significantly inferior to other competing alternatives.

The evaluation criteria ranking legend is provided below. The evaluation of alternatives is provided in **Table 1**.

✘	-	✓
Poor	**Fair**	**Good**

Table 1: Evaluation of Preliminary Alignment Alternatives

	Alternative 1: Connect to Robert Ferrie Drive east of Hydro Tower		Alternative 2: Connect to Robert Ferrie Drive west of Hydro Tower		Alternative 3: Connect to Strasburg Road		Alternative 4: Use of Existing Collector Roads
Transportation							
Does this alternative satisfy forecast traffic demand, improve safety, and address all modes of transportation?	✓	This alternative would provide a north-south connection to Robert Ferrie Drive to accommodate all modes. This alternative will accommodate vehicles to/from the Brigadoon community and will reduce cut-through traffic on local roads.	✓	This alternative would provide a north-south connection to Robert Ferrie Drive to accommodate all modes. This alternative will accommodate vehicles to/from the Brigadoon community and will reduce cut-through traffic on local roads.	-	This alternative would provide an east-west connection to Strasburg Road to accommodate all modes. This alternative will accommodate vehicles to/from the Brigadoon community.	✗	This alternative does not provide an east-west connection to Strasburg Road to accommodate vehicular traffic. This alternative will accommodate pedestrians/cyclists to/from the Brigadoon community. A maintenance road will also be constructed to provide access to the municipal services.
Environment							
Does the approach result in significant impacts to the natural environment?	-	This alternative will result in minor impacts to the woodlot/wetland.	-	This alternative will result in minor impacts to the woodlot/wetland.	✗	This alternative will result in significant impacts to the woodlot/wetland.	✓	This alternative will have the smallest footprint in the woodlot/wetland.
Affordability							
Is the approach affordable to the City to implement?	-	No significant difference.	-	No significant difference.	-	No significant difference.	✓	This alternative eliminates the collector road resulting in lower capital and maintenance/operation costs.
Compliance with City Planning							

Documents						
Does this alternative comply with the recommendations of the City's planning documents (i.e., TMP, OP, KGMP)	✓ This alternative complies with the recommendations of the City's planning documents.	✓ This alternative complies with the recommendations of the City's planning documents.	✗	This alternative does not address the recommendations of the Official Plan or Growth Management Plan. This alternative was originally recommended in the City's Transportation Master Plan; however, this recommendation was modified in the Official Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible.	✗	This alternative does not address the recommendations of the Official Plan or Growth Management Plan. This alternative is being considered based on public input provided at Community Café / PIC No. 1.
Recommendation:	✓ Carry forward for further evaluation	✓ Carry forward for further evaluation			✓	Carry forward for further evaluation

Based on the preliminary coarse screening of alternatives, it is recommended that Alternative 3: Connect to Strasburg Road not be carried forward. This alternative would have significant environmental impacts and does not comply with the recommendations of the City's Official Plan or Growth Management Plan. It is recommended that the extension of Biehn Drive only consider connections to the extension of Robert Ferrie Drive.

6.0 Study Schedule

A schedule for this Study is shown below in **Table 2**.

Table 2: Study Schedule

Task	Date
Project Start-Up Meeting	January 2021
Study Commencement Notice	Winter 2021
Information Gathering	Winter 2021
Environmental Review	Winter/Spring 2021
Study Design	March 2021
Public Information Centre No. 1/ Community Café	Spring 2021
Analysis and Evaluation of Alternatives	Summer/Fall 2021
Public Information Centre No. 2	November 2021
Preparation of ESR	Fall/Winter 2021
Municipality Review of ESR	Winter/Spring 2021/2022
30-day Public Review Period	Spring 2022

Glossary of Terms

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

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

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

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

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

Appendix B

Record of Consultation

BT ENGINEERING

Community Café Summary Report

Biehn Drive Municipal Class Environmental Assessment

May 2021

Submitted by:
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
519-672-2222

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1.0 INTRODUCTION

This report summarizes the results of the comments received at the online Community Café carried out by BT Engineering Inc. (BTE) in support of the Municipal Class Environmental Assessment (EA) Study for the extension of Biehn Drive in the City of Kitchener.

At the time of the Community Café, the Province of Ontario implemented restrictions on public gatherings to deal with the COVID-19 pandemic, and as such the meeting relied on web-based communications.

The Environmental Assessment (EA) and land use planning for this road link have been ongoing for several decades, and the previous Transportation Master Plan and current Official Plan have identified this project. The TMP completed Phases 1 and 2 of the Municipal Class EA. The current study is completing the subsequent Phases 3 to 5 of the Municipal Class EA and has been initiated by the City of Kitchener to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The Study will evaluate alternatives for the alignment of the Biehn Drive extension, intersection locations and designs, and municipal services while minimizing the environmental, social, and cultural impacts of the project.

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.

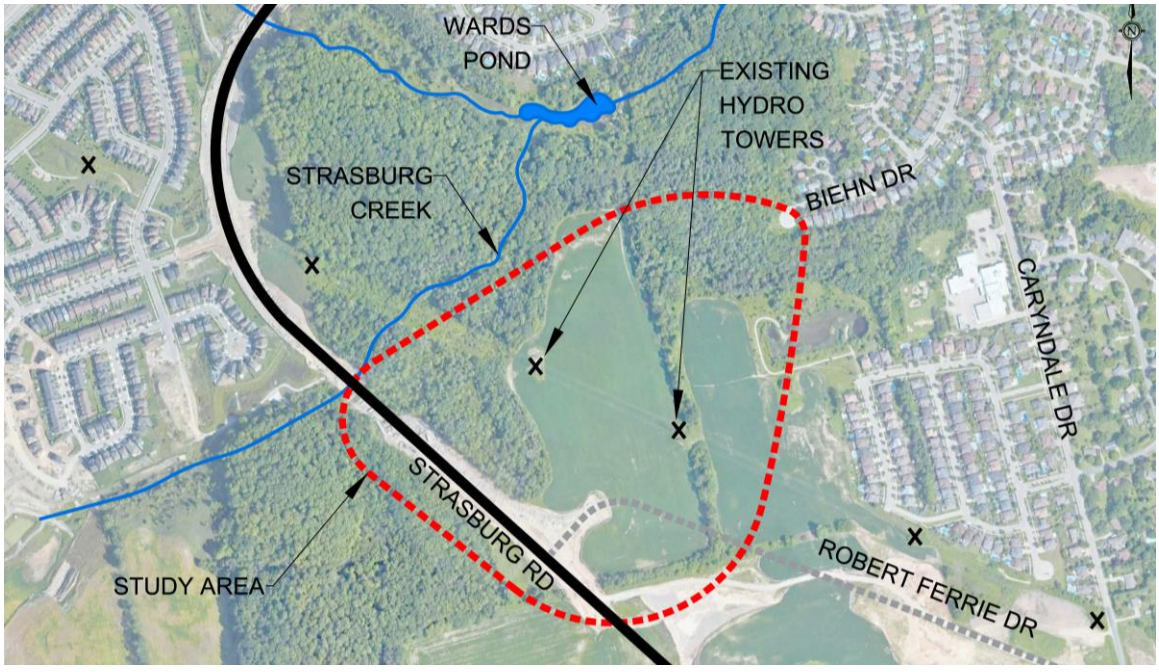


Figure 1: Study Area

The online Community Café event was held on April 20, 2021. Notices and invitations were sent out prior to the event and copies are included in **Appendix A**. The Community Café was conducted with key stakeholders and the public as part of the Environmental Assessment process. Thirty-two (32) people attended the Community Café event.

1.1 History of the Biehn Drive Extension

The Biehn Drive extension has been included in City planning documents since the late 1980's. It first appeared in the Brigadoon Community Plan in 1989 and was identified as a necessary connection between the Brigadoon Community and Strasburg Road.

Following this Community Plan, the road link was adopted into the City's Official Plan as Amendment No. 98 in 1991. The extension has been identified in every subsequent Official Plan, Transportation Master Plan and area planning study including:

- Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994)
- Kitchener Planning and Development Staff Report PD95/51 (1994)
- Updated Brigadoon Community Plan (2005)
- Kitchener Integrated Transportation Master Plan (2013)

In recent years, the extension of Biehn Drive was reviewed as part of the Robert Ferrie Drive Environmental Assessment (EA). A Need and Justification Review was completed in 2014 as part of this EA and concluded that the extension to Robert Ferrie Drive as well as the extension of Biehn drive were both necessary collector roads to accommodate the transportation needs of the Brigadoon/Doon South communities.

This recommendation was included in the Official Plan Amendment No. 103 in March 21, 2019.

2.0 METHODOLOGY

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

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

The Community Café was an informal event that facilitated conversation by providing participants with a comfortable and welcoming environment. Informational exhibits were prepared in advance of the Café and were available on the City's website. Copies of the exhibits are provided in **Appendix B**.

The event was organized to create a dialogue about issues that matter to the stakeholders and community. Each conversation was chosen to consider the most important parameters of the project and the desired goals of the participants. Four discussion topics were provided to reflect the concerns of the community. As participants discussed each topic, key ideas and perspectives were exchanged, providing new insights to the project.

A facilitator encouraged all participants to contribute to the conversation and to remain focused on the topic being discussed.

The four topics chosen to be discussed during the event were:

1. Traffic Operations
2. Pedestrians/Cyclists
3. Intersection Design
4. Neighbourhood Concerns

2.1 Opening Presentation

The Community Café event began with an introductory presentation from Mr. Steve Taylor, Consultant Project Manager, (see the Café Presentation in **Appendix C**). Mr. Taylor introduced the project and provided background information including the project issues, approach and process.

Following the project introduction, Mr. Taylor explained the process and objectives of the Community Café event. The participants were then moved to small breakout rooms to begin discussion on the applicable topics.

3.0 TOPIC DISCUSSIONS

In each breakout room, a topic of conversation was provided for discussion. Each topic had several questions associated with the topic; however, the conversation often diverged from the given questions. This allowed for conversation to flow freely and created an encouraging environment for all participants to contribute ideas and perspectives. It also provided the participants an opportunity to direct the conversation to issues that are relevant to their actual concerns.

The following sections summarize the ideas and comments expressed during the event. The comments are listed based on the discussion topic of the table.

3.1 Topic 1: Traffic Operations

Question 1: What intersection/roadway improvements would you like to see with the extension of Biehn Drive?

- General opposition to the extension of Biehn Drive from residents living on Biehn Drive.
    - The proposed extension of Biehn Drive should not be considered as a “done deal”.
    - Extension of Biehn Drive will have massive impacts on residents. This has already happened to Caryndale Drive with the extension of Robert Ferrie Drive.
    - The EA should not be initiated until Robert Ferrie Drive extension is constructed. This would allow the City to collect traffic information instead of relying on projections.
    - Consideration should be given to changes in travel patterns with more workers working from home.
    - Road users are already set in their traffic patterns. The extension is not required. Two collector roads in such close proximity are redundant.
- The extension is not considered to be required because the neighbourhood is already connected to Robert Ferrie Drive at Caryndale Drive.
- Participants noted they were aware of the project and want to ensure that the road extension will protect the natural, social and cultural environments.
    - The project has been documented in various City planning documents for approximately 20 years.
    - The proposed extension of Biehn Drive has always been part of planned area development and the plan was in place when many of the area residents purchased their homes.
    - The understanding is that the Biehn Drive and Robert Ferrie Drive Extensions are interconnected projects that would be delivered together, benefiting area traffic.
- The potential for increased traffic volume on Biehn Drive was also a concern; there were conflicting opinions that the traffic volumes on Biehn Drive would increase while

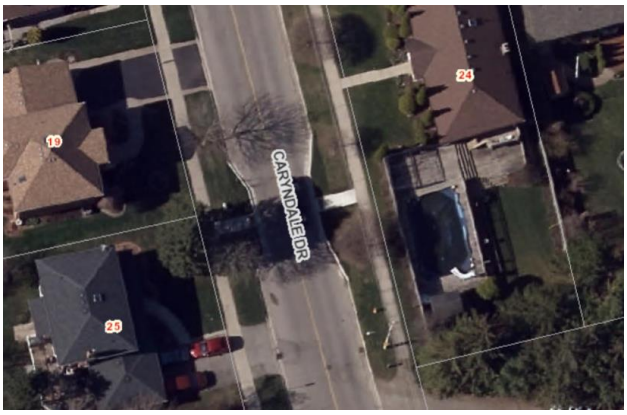
others acknowledged that the traffic volumes on sections of Biehn Drive can be expected to decrease.
    - The planned extensions of Biehn Drive and Robert Ferrie Drive would combine to redirect traffic away from Caryndale Drive and existing Biehn Drive.
- Conflicting opinions were expressed regarding access to the arterial road network:
    - That there is no problem driving north to Huron Road from within the neighbourhood; versus
    - The shorter distance to the Strasburg Road Extension would be a convenient alternative that they would use.
- Preference for Alternative 1; however, participants did not support the road or services extension.
- Consideration should be given to creating a cul-de-sac on the south side of the Provincially Significant Wetland to service the development instead of extending Biehn Drive.
- Consideration should be given to extending Biehn Drive for active transportation uses only. This would limit impacts to the natural environment and improve connectivity of the trail network.
- The opportunity for transit service through the neighbourhood, with the planned extension, would benefit existing area traffic.

Question 2: Do you have any safety concerns related to the future extension of Biehn Drive (i.e. speed, volumes, cut-through traffic)?

- There are existing safety concerns on Caryndale Road and Biehn Drive because of high speeds and traffic volumes.
    - Support for reducing the posted speed on Biehn Drive.
    - Support for making the area a Community Safety Zone or School Safety Zone.
- There are safety concerns at the corner of Biehn Drive and Caryndale Road because approximately 25% of cars at the intersection don’t stop. This a safety issue for the school.
- There is already a high collision rate at Robertson Crescent and Biehn Drive.
- Need to maintain a safe area for vulnerable road users.
    - There are several schools located in close proximity to the Study Area.
    - Neighbourhood children frequently use the current Biehn Drive cul-de-sac for activities. The dead-end creates a safe space for children.
- Concern for increased traffic volumes as a result of the proposed development north of Robert Ferrie Drive on the existing farmland.
    - Would the road alignment alternatives support different development scenarios (i.e. housing, commercial, large apartment buildings, traffic generators)?
- There is a lot of truck traffic on the existing Biehn Drive. Truck traffic should not be allowed on the extension.

Question 3: Should traffic calming features be included (i.e. medians, speed humps)?

- High speeds are an issue on Biehn Drive. Controlling traffic speed on Biehn Drive was noted to be a major concern for many individuals.
- Mitigation with narrowing roads and signs bolted to street create more of a road hazard than slowing people down. More traffic in the neighbourhood increases the chances of an injury/accident. Kids walking to school and people walking in the neighbourhood are at risk already.
- The traffic calming measures constructed on Caryndale Drive are ineffective and create more confusion for drivers (see photos below).
    - Drivers don't know how to navigate the mini roundabout constructed.
    - Drivers don't know if they are required to stop at the crosswalk. Crosswalks should be signed and have flashing lights to alert drivers.



- Centre medians are more cosmetically appealing and reflect the neighbourhood character, additional green space/grassed area.
- Narrowing roads/chicanes/medians are road hazards. Narrowing lanes forces traffic together. Chicanes would be difficult for snow removal and aren't aesthetically appealing.
- Speed humps work to slow down traffic, but drivers weave around them creating a safety concern.
- Any traffic calming measure implemented must ensure it will not impact emergency services operations.
- Support for a curvilinear alignment to slow down drivers.
- Potential to have a 90-degree bend at the existing Biehn Drive cul-de-sac to slow drivers down as they approach the future extension.

3.2 Topic 2: Pedestrians/Cyclists

Question 1: What are the main safety concerns for pedestrians/cyclists along the extension of Biehn Drive?

- Biehn Drive and the future extension are not safe because of traffic volumes and speed.
- Active transportation facilities need to be safe for children and people with disabilities.
    - There are three group homes in this area for people with disabilities.
    - There are multiple schools located in close proximity.
    - There is a day-care close to the Study Area, and they frequently walk to the dead-end.
- Crossings need to be provided to allow kids and vulnerable road users a way to cross the street.
    - Consider installing pedestrian cross-overs.

Question 2: Should active transportation facilities be provided along the Biehn Drive extension, and if so which type (i.e. MUT, sidewalk)?

- A multi-use trail from Robert Ferrie Drive to the existing end of Biehn Drive would be preferred.
    - A MUT provides a safe space for all road users.
    - There are a lot of children with bikes in the area; children's safety is a very important consideration for the project.
- Extending sidewalks along both sides of the proposed extension, as exists along existing Biehn Drive, was also suggested.

Question 3: How should cycling be accommodated in the corridor?

- There are no facilities for cyclists along the existing Biehn Drive.
    - If cycling facilities were built, they wouldn't be continuous.
- A separated cycling lane with dividers looks bad and doesn't create a welcoming environment for all cyclists.
- Pedestrians and cyclists to be separated from vehicular traffic.
- There should be a boulevard/separation between vehicular lanes and active transportation facilities.
- Preference to reduce the width of the boulevard through the wetland to protect the natural environment.

Question 4: How should linkages be made to the existing trail system?

- It was noted that there has already been an increase in the number of pedestrians using area trails.
- It is important to maintain the existing trail system and linkages to parks/schools, natural features etc.
    - Access needs to be maintained between residential areas and public spaces.
- There is an informal trail that exits the Parkwood Estates development. It should be continued. The trail would need to cross Biehn Drive to get to the other side.

3.3 Intersection Design

Question 1: Are there concerns about implementing a roundabout at the new intersection with the future extension of Robert Ferrie Drive?

- Support for a full-size roundabout at the Biehn Drive/Robert Ferrie Drive extension.
  - Allows for continuous traffic flow.
  - A roundabout would reduce traffic speeds.
- Concern for the proximity of the roundabouts on Robert Ferrie Drive at Biehn Drive and Strasburg Road.
- Concern for pedestrian safety at roundabouts

3.4 Neighbourhood Concerns

Question 1: What are the community concerns with respect to the existing neighbourhood (i.e. noise, visual intrusion etc.)?

- Concern for the cost of the project to City taxpayers.
- The majority of impacts will be on residents located west of Caryndale Road. These residents will experience increased traffic volumes, noise and pollution in front of their homes.
- The out-of-way travel to Robert Ferrie Drive is short enough that the extension is not needed.
- Concern for construction traffic in the neighbourhood
- Investigation of the natural environment, cultural heritage significance and archaeological potential of the area is required.
- Parking on the existing Biehn Drive should be maintained.
- Benefits of the proposed extension would include improved Emergency Vehicle Access to the existing neighbourhood.

Question 2: Do you have any environmental concerns for the natural areas being crossed by the project?

- The wetland attracts many visitors. The community doesn't want to lose this asset.
  - The wetland contributes to the mental and physical health of the residents and should be maintained.
  - People move to the area because of the wetland. It is the most important feature of the community.
  - The park area serves the community and should be protected.
  - The increased number of pedestrians already using area trails is already an impact on the environment.
- Concern for impacts to the natural environment and the PSW.

    - How will a road be maintained through a wetland without being washed out/compromised continuously?
    - There are branches of Strasburg Creek that are located beneath the proposed Biehn Drive extension.
        - Construction of a new road and sanitary sewer will impact the flow of water.
        - The water table is already very high and some residents have sump pumps running year round. The water table has been stable (no huge flood events) but does cutting into the environmental area impact the water table? If the water table rises, flooding basements would be inevitable.
        - Concern for sediment contamination in watercourses during construction.
- Developers have historically not protected the environment. They need to follow regulations and protect the natural habitat during construction.
    - Developers should not be allowed to build houses in the wetland.
    - A buffer should be maintained between the development and the wetland.
- The road will interrupt existing wildlife corridors.
    - Deer, foxes, ducks etc. are frequently seen in the wetland. The past winter was the best winter for deer – they follow behind the existing houses and through the environmental areas towards the Grand River.
    - Species at Risk (SAR) need to be identified and protected.
    - A rare salamander was found in the woodlot.
- There is a need to protect existing trees/vegetation.
    - It is Kitchener's policy to not cut trees and encourage tree growth - how is this road extension lining up with that?
        - It was suggested that the proposed extension violates the City of Kitchener's Strategic Plan for the Environment.
    - Any tree removed for this project should be replaced at two or three times the number.
    - Replacement trees should be native species. Avoid Norway maples.
- Concern for the impact to existing wells.
    - The health of the City's water supply should be considered.
- Concern for the increased impermeable area because of increased asphalt.
    - This will result in more salt entering the wetland.
- Support for a wildlife crossing (tunnel under Biehn Drive).

4.0 COMMENT SHEETS

Six comment sheets were received in advance of the Community Café and during the subsequent two-week comment period. These comments are summarized in **Table 1** and, with the exception of personal information, are provided in **Appendix D**.

Table 1: Summary of Written Comments

Comment	Number of Respondents	Comment Sheet No.
Opposition to the extension of Biehn Drive.	3	1, 2, 3
Current cul-de-sac is a quiet, safe spot without heavy traffic	1	1
The natural environment and trails in the Study Area are important features of the area.	3	1, 3, 4
Concern for the impacts to the natural environment as a result of the extension.	5	1, 2, 3, 4, 5
Concern for impacts to the water table.	3	2, 3, 5
Is there a need for the extension once traffic is diverted to Robert Ferrie Drive and Strasburg Road?	2	1, 2
Consider providing only municipal services (i.e. water, storm and sanitary sewer) through the extension (no road).	2	1, 3
Some residents in the area were not aware that the extension was planned.	1	2
Future consultation with residents should clarify that the extension will be built so there isn't confusion over other alternatives being considered.	1	2
Additional traffic studies should be completed or made available for the Study Area.	1	2
It is discouraging that the City is more focused on serving developers instead or preserving green space/quiet neighbourhoods.	1	2
The City is violating its own strategic plan to protect the natural environment if Biehn Drive is extended.	1	3
More transparency is required regarding the evaluation of alternatives (i.e. environmental impacts). Mitigation measures must also be described in the EA.	1	3
Concern for the cost of the extension.	1	3
Consider providing a road through the development that does not connect to Biehn Drive (cul-de-sac before the wetland).	4	2, 4, 5, 6
Traffic speeds/volumes are already an issue on Biehn Drive. The extension will make this worse.	1	5

5.0 SUMMARY AND NEXT STEPS

The discussion presented in this report represents the opinions and input of the meeting participants. This input reflects perspectives of local residents along Biehn Drive who may not have been unaware or do not support the community planning that was predicated on providing a westerly connection of Biehn Drive to Strasburg Road as part of the transportation and land use plan since the 1980's. The key messages from attendees that were summarized at the end of the meeting include:

- Can earlier decisions be reviewed including not extending Biehn Drive (change the traffic planning to divert this traffic to other communities/streets)?
- Can the link be solely for active transportation?
- Can the need for the street extension be communicated to those living near the extension?
- Create a context sensitive project that recognizes the environmental significance of the Provincially Significant Wetland.
- Traffic calming of any project should achieve a slow and safe road for those living along Biehn Drive.

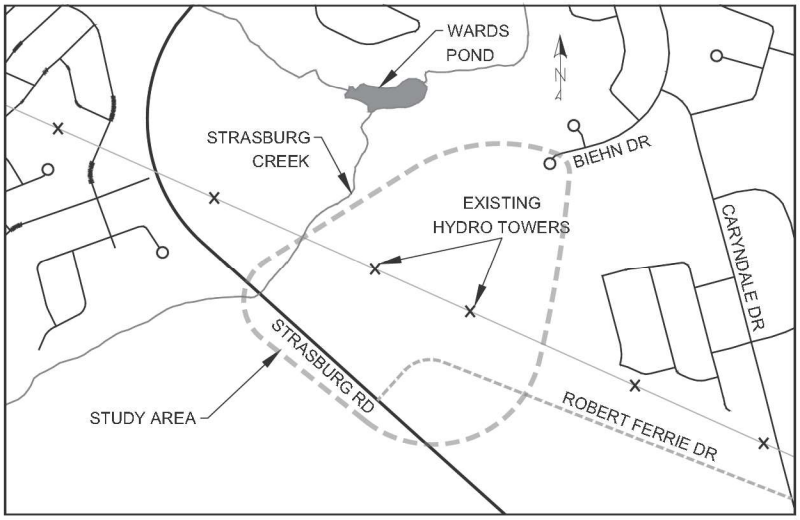
This discussion will be used as input by the Project Team for subsequent steps in the Study. At this stage of the study no decisions have been made.

Readers of the report are cautioned that the recorded ideas and discussions are unsubstantiated, may or may not be feasible, and require development. They do, however, represent an effort for the early identification of the issues and alternatives for the project that are consistent with the values and opinions of the meeting participants.

Appendix A

Notice of Study Commencement and Community Café

Notice of Study Commencement and Community Café
City of Kitchener
Biehn Drive Extension Environmental Assessment



INTRODUCTION

The City of Kitchener has retained BT Engineering Inc. to undertake an Environmental Assessment (EA) Study for the extension of Biehn Drive from the existing terminus 300 m west of Caryndale Drive to the future Robert Ferrie Drive extension. The Study will evaluate alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the recommendations in the City of Kitchener Transportation Master Plan.

STUDY PROCESS

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

PUBLIC CONSULTATION

Study Design Report: A draft Study Design Report has been prepared that describes the study background, approach, process, alternatives and consultation program. The draft Study Design Report is available on the City's website at: https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx

Community Café: An online Community Café event will be held to help define the study scope and issues. The goal of the Community Café event is to engage the public/stakeholders on their perspectives and interests in the Study. **To register for the Community Café, please contact Steve Taylor or Eric Riek.**

The online Community Café will be held as follows:

Date: April 20, 2021
Time: 6:30 to 8:00 pm
Location: Register by email to be sent the Virtual Meeting Room (Zoom) Link

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

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

Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
Tel: 519-672-2222
Email: stevenj.taylor@bteng.ca

Eric Riek, C.E.T.
City Project Manager
City of Kitchener
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
Email: eric.riek@kitchener.ca

This notice issued on March 26, 2021.

Appendix B

Community Café Exhibits

BT ENGINEERING
BTE

Welcome!
City of Kitchener
Biehn Drive Extension
Class Environmental Assessment

Thank you for participating in the Online Public Information Centre (PIC) for the City of Kitchener's Class Environmental Assessment (EA) for the extension of Biehn Drive and the sanitary trunk sewer.

At the present time, the Province of Ontario has implemented restrictions on public gatherings to deal with the COVID-19 pandemic. As a result, this Public Information Centre is relying on web-based communications. Should you have any questions regarding the study, please contact the City or Consultant Project Managers.

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

Comments can be submitted by emailing stevenj.taylor@bteng.ca and/or eric.riek@kitchener.ca by **May 4, 2021**.

KITCHENER

Introduction

The City of Kitchener has initiated a Class Environmental Assessment (EA) Study for the extension of Biehn Drive and the sanitary trunk sewer from the current terminus of Biehn Drive (approximately 60 m west of Spencer Court) southerly to the future Robert Ferrie Drive Extension.

This Study will complete the planning and preliminary design steps of the Municipal Class EA by conducting a transportation needs assessment, generating and evaluating planning alternatives, and proactively involving the public in defining a recommended plan for improvements.

This Study is being completed as a Municipal Schedule C Class EA undertaking based on the range of anticipated effects. A Draft Study Design Report describing the study process has been made available for agency and public comments and is available on the City's website.

Class Environmental Assessment (Class EA) Process

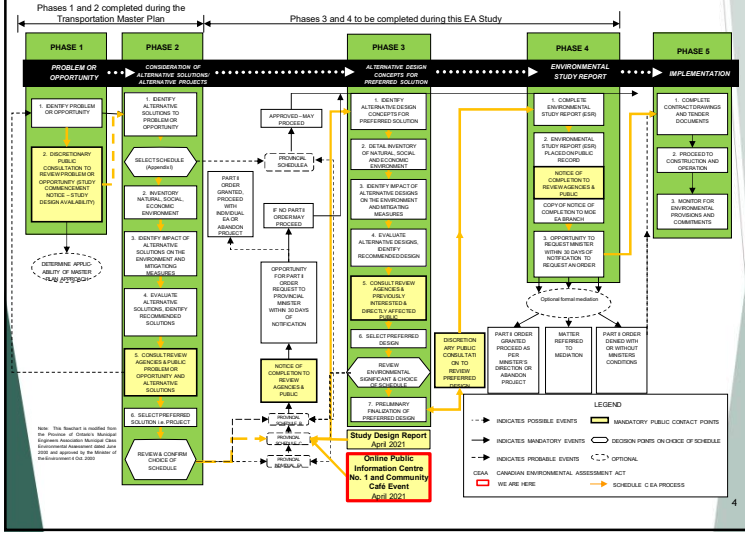
This study is being initiated as a Municipal Schedule C project as defined by the Municipal Class Environmental Assessment (MCEA). Consultation is a key component of the Class EA process. The goal of consultation is to provide stakeholders and affected individuals opportunities to make their interests and concerns known to the project team throughout the EA process. The early identification of issues and concerns allows the project team to investigate with the goal of, if possible, resolving the concern.

At the completion of the EA process, an Environmental Study Report (ESR) will be produced. The Report will document key components of the study: need and justification; the range and types of consultation; natural and socio-economic environmental inventories; evaluation of alternatives; selection of the recommended alternative; and supporting reports produced for the project. Upon the completion of the ESR, the public and interested stakeholders will be made aware of 30-day public review of the Report.

If, after viewing the future ESR and having made your concerns known to the project team, you still have concerns during the 30-day review period, you have rights under the *Environmental Assessment Act*. These rights will be outlined in the public notice advising of the 30-day public review period.

The Municipal Class EA process is illustrated on the following exhibit.

Municipal Class EA Process



Background

Since the mid-2000's, the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener have been planned to accommodate area development and evolving transportation needs. Several planning documents including the City's Official Plan and Transportation Master Plan (TMP) have identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan. This link would accommodate vehicles to and from the Brigadoon community, and would help mitigate cut-through traffic on local streets within the community. A collector road collects traffic from local roads within the community and provides connectivity to arterial roads including Strasburg Road.

Biehn Drive Extension as identified in the Official Plan (Integrated Transportation System)

Problem and Opportunity Statement

Future development within the Doon South and Brigadoon communities requires a defined alignment for the extension of Biehn Drive to Robert Ferrie Drive as part of the area road network. In order to determine the road alignment, this Study will consider the natural, social environments and the future land use in the Study Area. The extension of Biehn Drive is required to accommodate municipal servicing, and safely and reliably accommodate all modes of transportation including vehicular, pedestrians, cyclists and trucks. By defining the future road and municipal servicing plans, the subsequent land use plans can be completed by developers.

The Study will provide the opportunity to: improve accessibility to the local community by providing additional network links; define a multi-modal transportation plan to support travel within the local neighbourhoods; and allow development to proceed on lands that currently require the roadway to be defined prior to developing the land use plan.

Study Considerations

- **Existing Community**
  - Changes in sound levels
  - Changes in traffic volumes on Biehn Drive
  - Potential mitigation may include traffic calming measures, pedestrians/cyclist facilities, and mitigation of noise impacts.
- **Natural Environment**
  - Potential for Species at Risk (SAR) in woodlots and the Strasburg Creek Provincially Significant Wetland (PSW)
  - Two cold-water systems: Strasburg Creek (immediately north of the Study Area) and Blair Creek (900 m south of the Study Area).
  - Minimize footprint within, and impacts to, the Strasburg Creek system.
- **Transportation**
  - Improvements are required to address long-term traffic operations.
- **Active Transportation:**
  - Active modes of transportation will require separated facilities to service all ages and abilities as identified in the Cycling and Trails Master Plan.
  - This could include multi-use pathways, sidewalks, buffered bicycle lanes and/or raised cycle tracks.

Assessment of Alternative Planning Solutions

Alternative Planning Solutions (Alternatives to the Undertaking) represent alternative ways or methods of addressing the problem to be solved by the project. In determining the preferred undertaking for the City, the following Planning Solutions were evaluated:

✗ Do Nothing: This alternative would maintain the existing road network and would not extend Biehn Drive.

✓ Transportation Demand Management (TDM): Reduces vehicular traffic demand (encourages alternative work hours, work at home and active modes of transportation).

✗ Greater Use of Local Roads: Encourage the use of local roads to reduce the need to extend Biehn Drive. Local roads are generally not designed or maintained to accommodate high traffic volumes.

✗ Limit Land Use Development: Limit any new residential, commercial or industrial development and therefore reduce the generation of new trips.

✓ Extend Biehn Drive: Provides a long-term solution for improved traffic capacity, operations and safety.

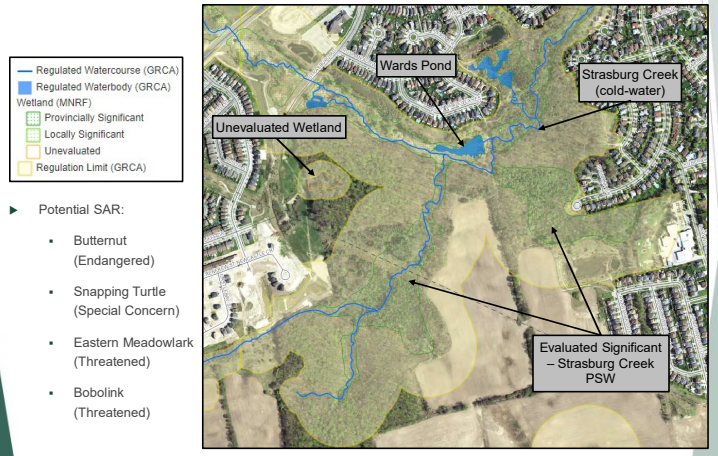
Based on the preliminary review of Alternative Planning Solutions, "**Transportation Demand Management"** and **"Extend Biehn Drive"** are recommended. This Planning Solution addresses the problem statement by improving transportation service and safety.

The evaluation is documented on the following exhibit for public review and comment. All comments received will be reviewed and considered before proceeding with the Study and the evaluation of TDM (Active Transportation Improvements) and New Infrastructure alternatives.

Assessment of Alternative Planning Solutions

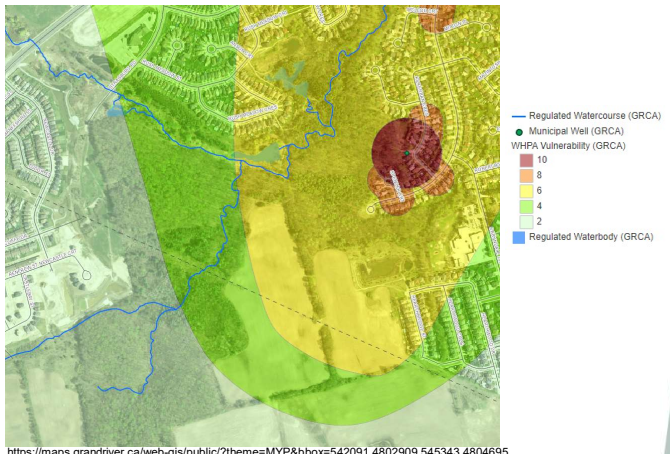
Screening Criteria	Alternative 1: Do Nothing	Alternative 2: TDM	Alternative 3: Local Roads	Alternative 4: Limit Development	Alternative 5: Extend Biehn Drive
Transportation	Does not address forecast traffic demand. Results in increased volumes on local roads.	May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure.	Local roads not designed to accommodate increased volumes.	May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth.	Accommodates all modes of transportation.
Environmental	No impacts.	No or low impacts. Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes).	Low impacts. Creates disruption to properties on local roads that would experience an increase in traffic.	No impacts.	Low to medium environmental effect possible with new corridor. Magnitude of effects is subject to environmental mitigation.
City Planning Objectives	Does not meet objectives/ recommendations in City Planning documents.	Supports objective to encourage active transportation and alternate modes.	Does not meet objectives/ recommendations in City Planning documents.	Does not meet objectives/ recommendations in City Planning documents.	Supports the recommendations for the extension of Biehn Drive in OP and TMP.
Recommendations	Not recommended. ✘	Recommended as a complementary solution. ✓	Not recommended. ✘	Not recommended. ✘	Recommended to be carried forward. ✓

Existing Conditions
Natural Environment



- Potential SAR:
  - Butternut (Endangered)
  - Snapping Turtle (Special Concern)
  - Eastern Meadowlark (Threatened)
  - Bobolink (Threatened)

Existing Conditions
Well Head Protection Area



https://maps.grandriver.ca/web-gis/public/?theme=MYP&bbox=542091,4802909,545343,4804695

Preliminary Design Alternatives

Preliminary design alternatives for the extension of Biehn Drive were categorized into 5 groups:

Alignment Alternatives	Intersection Alternatives	Sanitary Sewer Alignments	Cross Section Alternatives	Traffic Calming Alternatives
Connect to Robert Ferrie Drive east of Hydro Tower	Signalized	On Road Alignment	Urban Cross Section with sidewalk/ Separated Bike Facilities	Chicanes
Connect to Robert Ferrie Drive west of Hydro Tower	Unsignalized	New Alignment	Semi-Urban Cross Section with Separated Bike Facilities	Median
Connect to Strasburg Road	Roundabout			Narrower Driving Lanes
				Median Bulb-Out

These groups of alternatives are presented on the following exhibits.

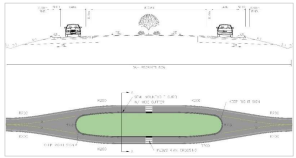
Traffic Calming Alternatives

Traffic calming measures, to control speed and discourage through traffic, will be considered along the extension of Biehn Drive, and will further support future recommendations for the Biehn Drive Traffic Calming Study being completed to the north of the Biehn Drive extension. These may include:

Speed Humps/Cushions or Raised Crosswalks

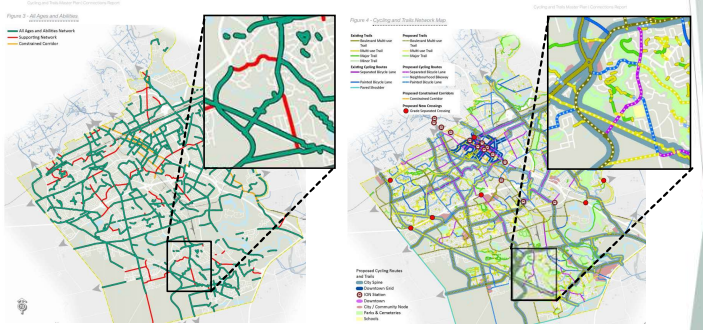
Centre Median

Chicanes



Median Bulb-outs

Cycling and Trails Master Plan



- Identified Cycling Facilities on Biehn Drive to be for all Ages and Abilities.
- Proposed Separated Bicycle Lanes on Biehn Drive with Multi-Use Trails along Strasburg Road and the Hydro Corridor.

Types of Separated Bicycle Facilities

Accommodating all ages and abilities of cyclists along the proposed extension of Biehn Drive could consider a variety of alternatives. These may include:

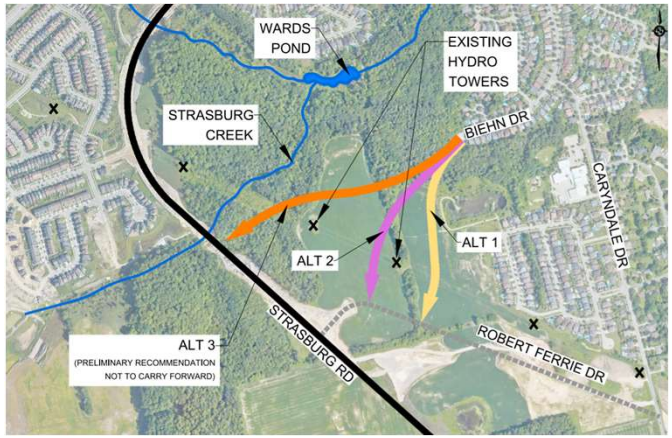
Boulevard Multi-Use Trails

Buffered Bike Lanes

Raised Cycle Tracks

Although Separated Bike lanes/Cycle Tracks were identified in the CTMP, consideration of Boulevard MUTs would be an extension of the facilities on Strasburg Road and along the Hydro Corridor and could transition to another type of future facility along existing Biehn Drive if necessary.

Alignment Alternatives

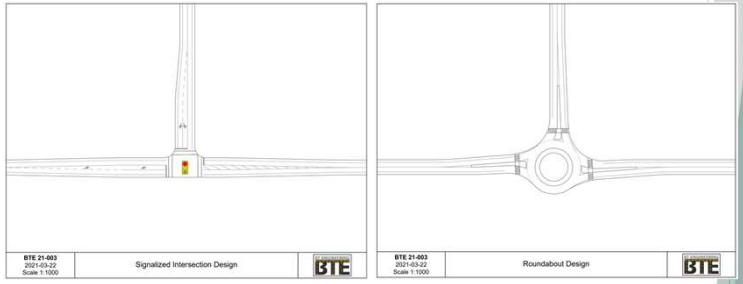


Alignment Alternatives

Coarse Screening

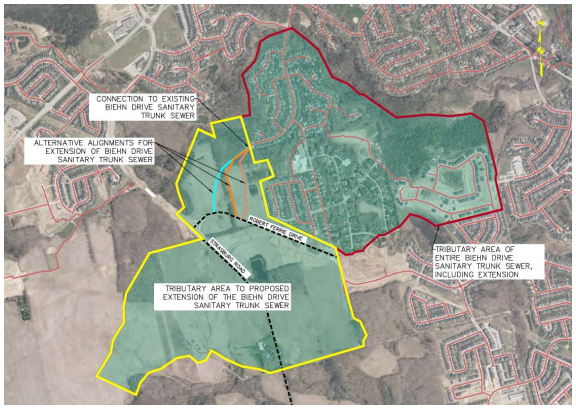
Screening Criteria	Alternative 1: Connect to Robert Ferrie Drive east of Hydro Tower	Alternative 2: Connect to Robert Ferrie Drive west of Hydro Tower	Alternative 3: Strasburg Road Connection
Does this alternative satisfy forecast traffic demand, improve safety, and address all modes of transportation?	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Strasburg Road. Accommodates all modes.
Does the approach result in significant impacts to the natural environment?	Minor impacts to the woodlot/PSW (~0.3 ha).	Minor impacts to the woodlot/PSW (~0.3 ha).	Significant impacts to the woodlot/wetland (~1.3 ha).
Is the approach affordable for the City to implement?	No significant difference.	No significant difference.	Higher cost - requires an intersection onto Strasburg Road (arterial).
Does this alternative comply with the recommendations of the City's planning documents (i.e., TMP, OP, KGMP)	This alternative complies with the recommendations of the City's planning documents.	This alternative complies with the recommendations of the City's planning documents.	Does not comply with the recommendations of the Official Plan or Growth Management Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible.
Recommendation:	Carry forward for further evaluation ✓	Carry forward for further evaluation ✓	Do not carry forward ✗

Intersection Alternatives



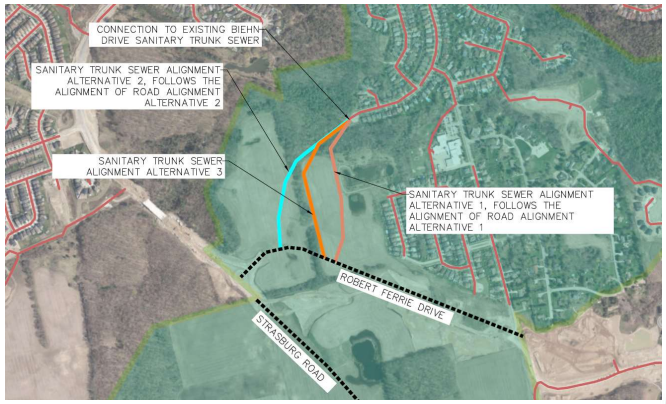
Sanitary Trunk Sewer Extension Alternatives

The trunk sanitary sewer will extend from the existing Biehn Drive cul-de-sac to the future Robert Ferrie Drive Extension. The trunk sewer will serve the area shown.



Sanitary Trunk Sewer Extension Alternatives

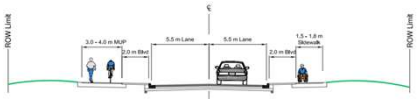
Three alternative alignments will be considered. They are shown schematically in the figure.



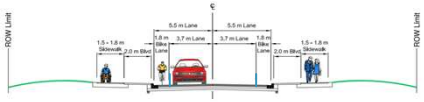
Potential Cross Section Alternatives

Could include but not be limited to:

Urban with multi-use path and sidewalk



Urban with sidewalk and buffered bike lanes



Semi-urban with multi-use path and paved shoulder

The planned extension of Biehn Drive is proposed to:

- Not provide direct driveway access. This will improve safety for cyclists and pedestrians,
- Not permit on-street parking.

Access to residential lots and on-street parking would be provided along local roads within the adjacent community.

The preferred cross section will consider LID measures for stormwater management within the ROW.

Analysis and Evaluation

Alternatives will be evaluated following this Public Information Centre. The following long list of evaluation criteria (factor groups and subfactors) is being considered for the assessment of the alternatives:

Natural Environment
Air quality
Species at Risk (SAR)
Cold / cool / and warmwater fish habitat impacted
Water quality – stormwater runoff
Migratory bird nesting impact/loss of existing vegetated areas
Provincially significant natural areas and habitat (i.e. Provincially Significant Wetlands)
Regionally significant natural areas and wildlife habitat (i.e. woodlots, non provincially significant wetlands, fauna and flora)
Natural habitat impacted (e.g. specimen trees removed)
Groundwater
Climate change
Land Use and Property
Property required (Residential)
Property required (Agricultural)
Property required (Commercial)
Cost
Capital cost
Future life cycle cost
Utility relocation

Social and Cultural Environment
Historic archaeological potential
Prehistoric archaeological potential areas impacted
Built heritage sites impacts
Cultural landscape features
Noise impacts
Vibration impacts
Excess materials management
Water wells impacted
Lighting and visual impacts
Economic environment
Transportation
Traffic operations - delays
Safety - collision potential
Safety – design consistency
Movement of goods
Pedestrian access
Ability to accommodate cyclists
Emergency vehicle access

Next Steps

Following this meeting we will:

- Review all comments
- Carry out environmental inventories and technical investigations
- Complete the analysis and evaluation of alternatives
- Hold Public Information Centre No. 2

We want to hear from you!

- Please provide comments by filling out the comment form or by contacting the City's representative or the consultant below:

Steve Taylor, P.Eng.	**Eric Riek, C.E.T.**
EA Project Manager	City Project Manager
BT Engineering Inc.	City of Kitchener
509 Talbot Street	200 King Street West
London, Ontario N6A 2S5	Kitchener, ON N2G 4G7
Tel: 519-672-2222	Tel: 519-741-2200 ext. 7330
Email: stevenj.taylor@bteng.ca	Email: eric.riek@kitchener.ca

Please provide your comments on or before **May 4, 2021.**

Thank you for your participation in the study.

- To receive updates on the project, request that your name/e-mail be added to the mailing list.
- Your input into this study is valuable and appreciated.

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

Appendix C

Community Café Presentation

Biehn Drive Extension and Sanitary Trunk Sewer Extension

ONLINE COMMUNITY CAFÉ

APRIL 2021

1

Meeting Overview

- Project Introduction
- Community Café Overview
- Café Roundtable Discussions
- Final Wrap-up

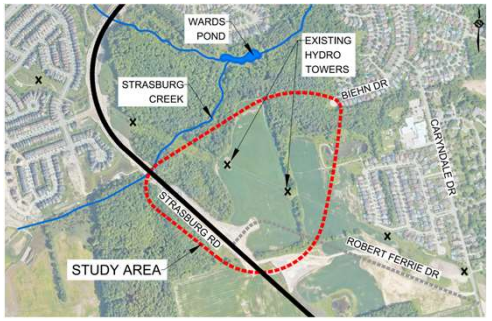
2

Project Introduction

3

Project Introduction

- This Study will be undertaken as a Schedule C Municipal Class Environmental Assessment for the extension of Biehn Drive from its current terminus to the future Robert Ferrie Drive Extension
- The Study will also include the extension of the trunk sanitary sewer, watermain and storm sewers (Schedule B)



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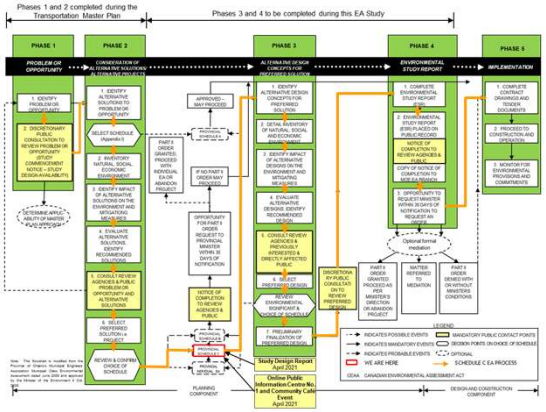
Class EA Process

Biehn Drive Extension

"Construction of new roads or other linear paved facilities (e.g. HOV lanes)" > 2.4 m – Schedule C

Sanitary Sewer Extension:

"Establish, extend or enlarge a sewage collection system and all works necessary to connect the system to an existing sewage outlet where such facilities are not in an existing road allowance or an existing utility corridor." – Schedule B



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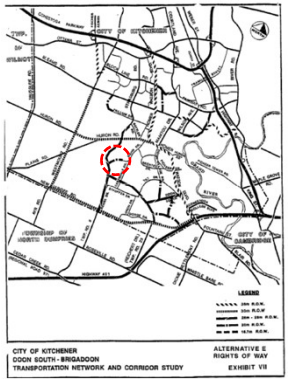
Background Information

- Community Plans for the Doon South and Brigadoon areas have established the need for the extension of Biehn Drive
- This has been documented in the Official Plan and Transportation Master Plan
- The new road link will accommodate all modes of transportation (vehicles, trucks, pedestrians and cyclists)



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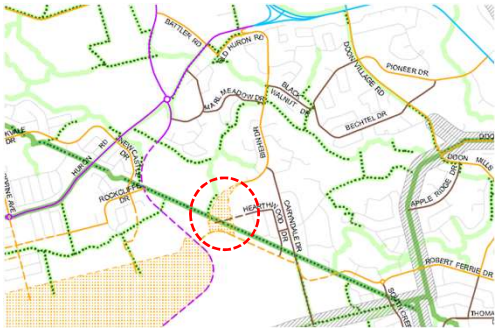
Official Plan – Integrated Transportation System



7

Key Issues

- **Impacts on the Existing Community**: The existing Brigadoon community is an established residential area with low ambient sound levels and low traffic volumes on Biehn Drive
  - Walking, cycling and parking are prevalent along Biehn Drive

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Key Issues

- **Natural Environment** : The EA will investigate the protection of surrounding terrestrial habitat and will establish mitigation for any potential impacts to the natural environment
  - There is potential for SAR in the woodlots

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Key Issues

- **Social and Cultural Environment:**
  - Maintain access to adjacent properties
  - Mitigate impacts to property owners and road users during and post construction (i.e. noise, air quality, safety)
  - Consideration of vulnerable road users (i.e. pedestrians, cyclists and transit)
  - Potential property impacts to residential and agricultural lands
  - Archaeological and cultural heritage resources (the Study Area is located within the Haldimand Tract)

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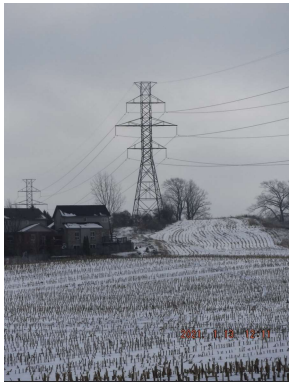
Key Issues

- Other issues include:
  - Proximity to adjacent intersections on Robert Ferrie Drive and the need to accommodate trucks through the roundabout
  - Consideration of any proposed plans of subdivision/utilization of development land and the potential network of future local streets
  - Potential utility conflicts including the east-west hydro corridor and the vertical clearance to existing aerial lines
  - Consideration and assessment of potential traffic calming measures to assist in controlling traffic speeds



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Preliminary Design Alternatives

- Several groups of preliminary design alternatives will be developed and evaluated:

Alignment Alternatives	Intersection Alternatives	Sanitary Sewer Alignments	Cross Section Alternatives	Traffic Calming Alternatives
Connect to Robert Ferrie Drive east of Hydro Tower	Signalized	On Road Alignment	Urban Cross Section with sidewalk/ Separated Bike Facilities	Chicanes
Connect to Robert Ferrie Drive west of Hydro Tower	Unsignalized	New Alignment	Semi-Urban Cross Section with Separated Bike Facilities	Median
Connect to Strasburg Road	Roundabout			Narrower Driving Lanes
				Median Bulb-Out

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Preliminary Design Alternatives

Alignment Alternatives

13

Preliminary Design Alternatives

Separated Bicycle Facility Alternatives

Boulevard Multi-Use Trails

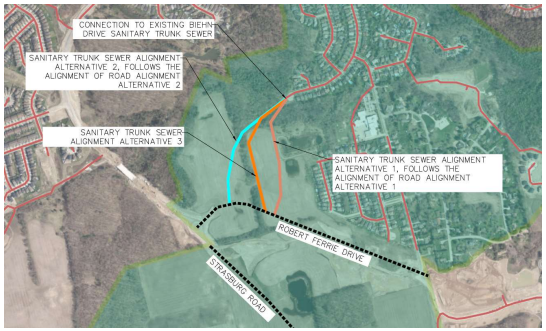
Buffered Bike Lanes

Raised Cycle Tracks

14

Preliminary Design Alternatives

Sanitary Sewer Alignment Alternatives



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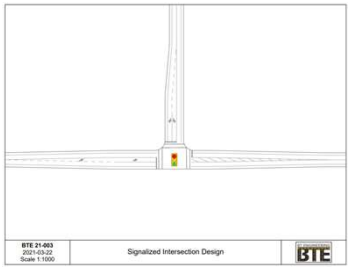
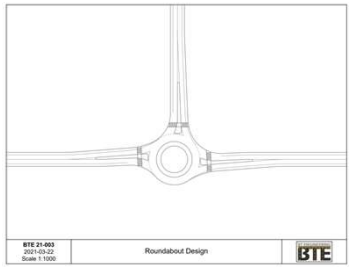
Preliminary Design Alternatives

Intersection Alternatives





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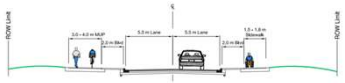
Preliminary Design Alternatives
Cross Section Alternatives

Urban with multi-use path and sidewalk



Urban with sidewalk and buffered bike lanes

Semi-urban with multi-use path and paved shoulder

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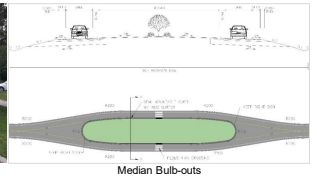
Preliminary Design Alternatives

Traffic Calming Alternatives

Speed Humps/Cushions or Raised Crosswalks

Centre Median

Chicanes



Median Bulb-outs

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Community Café

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Community Café Process

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

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Café Approach

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

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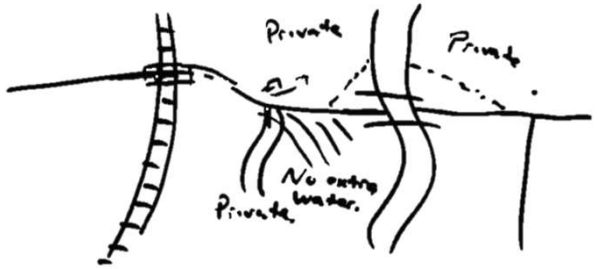
Sample Doodle



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Small Group Discussions

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Tonight's Café Discussion Topics

- Traffic Operations
- Pedestrians/Cyclists
- Intersection Design
- Impacts to Neighbourhood

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Schedule and Next Steps

25

Next Steps

1. Needs analysis and presentation of Draft Study Design Report (SDR)
2. Environmental inventories and technical investigations to be used as input for the evaluation
3. Analysis and evaluation of alternatives
4. Selection of Recommended Plan – preferred alignment and consideration of refinements and mitigation for the Recommended Plan
5. Present Preliminary Design of Recommended Plan at PIC No. 2

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Study Schedule

Task	Date
Project Start-Up Meeting	January 2021
Study Commencement Notice	Winter 2021
Information Gathering	Winter 2021
Environmental Review	Winter/Spring 2021
Study Design	February 2021
Public Information Centre No. 1/ Community Café	Spring 2021
Analysis and Evaluation of Alternatives	May/June 2021
Preparation of ESR	Summer/Fall 2021
Public Information Centre No. 2	Summer/Fall 2021
City Review of ESR	September/November 2021
30-day Public Review Period	October/November 2021

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Community Café Wrap-up

- Additional information can be found at:

https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx

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Appendix D

Community Café Comment Sheets

From: [redacted]
Sent: Wednesday, March 31, 2021 7:40 PM
To: Eric Riek <Eric.Riek@kitchener.ca>; stevenj.taylor@bteng.ca
Subject: [EXTERNAL] Biehn Dr extension

Hi Eric and Steve,

Can I please get the link for the virtual discussion regarding this extension?

I know there'll probably be the chance to share opinions but the current cul de sac is a wonderful quiet spot to take kids for a walk and let them run around without the heavy traffic that is near our place on Biehn. Not to mention there is a scattering of great trails through that area that allows us to enjoy the woods.

As is, it will already be a big change when subdivisions inevitably get built in the farm fields to the south west of the end of Biehn, but it would be wonderful if there wasn't also a road directing traffic through this area too.

I'd be interested to first see the numbers on how much traffic will get diverted to the Robert ferrie extension when it meets up with the Strasburg extension, as my gut would be that it would help take some of the traffic away from the north end of biehn. I can't see the cars from the area south of caryndale on Biehn adding that much to the traffic on Biehn, I would assume the majority is the other more dense subdivisions to the north of caryndale and would only get added to with the new houses on Robert ferrie.

So to me the Robert ferrie to Strasburg extension makes sense as it will disturb no more forest than it already has (the section that Strasburg has cut through with the bridge). But I don't see the benefit of extending Biehn Drive as well.

If there is the need to divert or run water and or sewer lines from the end of Biehn to connect to Robert ferrie, perhaps there is a option of just running the lines through without the additional cut needed for a full road plus sidewalks.

[redacted]

Re: Biehn Dr extension

[redacted]

Wed 4/21/2021 11:46 AM

To: Steve Taylor (London) <stevenj.taylor@bteng.ca>
Cc: eric.riek@kitchener.ca <eric.riek@kitchener.ca>; Katherine Scott <katherine.scott@bteng.ca>

Hi all,

Not sure how these community cafes typically go, and how they compare in the Zoom format vs in person, but I think the main takeaway for me was how much of the study group was opposed to the Biehn road extension. I think it's a hard stance to take that the extension will benefit more residents than those that it will hinder/negatively impact.

The concern about affecting the water table is a valid one especially for those that back onto that wetland, and I think the biggest issue for me is how small an area of farmland would actually be accessed by this extension. I don't see the benefit of the access off of Biehn vs directing it all towards Robert Ferrie and Strasburg.

That being said, it sounds like decisions have already been made in the past, though it's definitely interesting to hear how many people on the cafe said they've lived 20+ years in the area and how many were surprised that the extension had already been approved.

I think the descriptions of the paper pamphlet as well as the language used last night by the moderators gave the impression that there was still room for input regarding whether the extension would happen or not. Might have been a bit smoother to say right off the bat, the extension has been approved and is going ahead. This discussion is to get feedback on what that extension would look like.

However, I know from my end being a relatively new resident (5+ years), it is frustrating not having any say in whether the extension happens or not since this discussion has been in the works for so long. And for a project that's been so long in the works, I'm surprised there isn't more data on the existing traffic volumes and the expected volumes when new housing is built and if the extension is built to show what is being used to determine that the extension will in fact cause less traffic on Biehn instead of more.

I find communities like this one where a residential area is almost circled by green space are few and far between and it's pretty discouraging that the city/planners seem more focused on serving new developments vs preserving green space and quiet neighborhoods. I don't think anyone can argue that even the best designed subdivision these days provides a nicer atmosphere than the section of neighborhood at the end of Biehn Dr.

Like I said in the breakout group, I'm not opposed to the development of the farmload beyond the wetland, that is something that we all assume will happen at some point. But there was already a swath of green space that was cut through for the Strasburg extension, and all the new development will already crowd around the greenspace that is left. So I find it hard to justify the Biehn extension for the amount of farmland available for development to the south of the current end of Biehn.

[redacted]

Biehn Drive Extension Class Environmental Assessment and April 20, 2021 Community Café Comments

Land use planning matters.

The Grand River Conservation Authority (GRCA). has confirmed that the area behind our house and the existing Cull de Sac is part of the Provincially Significant Strasburg Creek Wetland Complex. According to the City of Kitchener (C of K) Notice of Study and Community Café, “The study will consider all reasonable alternatives with acceptable effects on the natural, social and cultural environments”. The C of K Strategic Plan for the Environment states “our strategic plan for the environment shows how we will put the environment first, reduce our carbon emissions and preserve our planet. We work to develop and maintain an ecologically diverse open space network that incorporates typical naturally occurring landscapes, significant natural features and the urban forest, all of which embody our natural heritage. We protect our water supply by working with the Region of Waterloo and the Grand River Conservation Authority to replenish and protect our water and wetlands”. If Biehn Drive is extended the C of K is violating its own Strategic Plan for the Environment. It is time for C of K staff and elected officials to lead, not continue as in the past.

Area residents have lived in a wet area for 30 years How is the C of K going to ensure we do not get more water on our properties and in our basements if the wetlands are tampered with? What is the Contingency Plan if this occurs? Documentation of the contingency plan is only fair to existing residents.

Page 9 of the Environmental Assessment (EA)

Alternative 5: Extend Biehn Drive Environmental “Low to medium environmental effect possible with new corridor. Management of effects is subject to environmental mitigation”.

Background data and methodology on how this rating was achieved must be included as part of the EA. As it reads now, the rating is only an opinion of the author(s).

“Magnitude of effects is subject to environmental mitigation.” What does this mean? Environmental mitigation steps must also be documented in the EA.

Page 13 of the EA: Biehn Drive Traffic Calming Study

Please provide the modelling data and any other information for this study as it becomes available.

During the Community Café it was pointed out many times that the proposed extension of Biehn Drive does nothing for the existing residents. We do not want the road extended. Extending Biehn Drive is an unnecessary expense.

It was also pointed out on numerous occasions in the Café that if water and sewer connections are required to the existing infrastructure on Biehn Drive a road is not required to do this. The connections could be done with an easement.

In conclusion the entire EA and Community Café is slanted towards the extension of Biehn Drive. The environment and wishes of existing area residents must be considered. Does the C of K lead and follow its Strategic Plan for the Environment or do mistakes from the past continue?

Biehn Drive City Café and Environmental Assessment Comments

The City of Kitchener invited interested residents to a Community Café Zoom meeting April 20 to discuss the extension of Biehn Drive. Many people talked at the meeting. We ask that you come to a decision with an open mind. Please take into account the comments the people have made.

Kitchener has a decision to make. On one hand the extension of Biehn, which involves plowing through the Provincially Significant Strasburg Creek Wetland Complex. On the other hand, planning a new route through the new subdivision, leaving the wetland alone.

The wetland at the end of Biehn Drive is loved by our family. It is part of our neighbourhood. We have lived here for 31 years and have seen the trees from all our windows. We have seen the forest change through the seasons, seen the mature trees moving in the wind, seen the sunset through their branches. The land behind our house and around the circle is extremely wet. It is a true wetland with its unique and complex biodiversity.

Kitchener can be archaic or Kitchener can be progressive. Archaic-disregard nature. Stick to a plan that was devised 30 years ago. Progressive- see the value of this wetland and change with the times.

Unfortunately, the forest that joins our wetland has already been altered by the removal of trees and the paving of Strasburg Road right through it. The forest was sliced in half.

How many wetlands in the City of Kitchener and Waterloo Region have been lost during all these years of development?

We hope you will save this one. Please do so before it is too late, and all that is left are regrets.

Sincerely,

[redacted]

From: [redacted]
Sent: April 23, 2021 4:28 PM
To: Steve Taylor (London) <stevenj.taylor@bteng.ca>
Cc: eric.riek@kitchener.ca <eric.riek@kitchener.ca>
Subject: Re: Biehn drive extension assessment zoom meeting

Hi Steve
I did not receive a Zoom link for the Community Cafe on April 20.
Even though I was not able to take part in the discussions I am still interested in the plans for the Biehn Extension.
I wonder how much influence local residents actually will have on developing a design.

I have read the draft report on the website and have some thoughts.
-It refers to Biehn as becoming a major collector road - It already is. The speed of the traffic on Biehn has already become dangerous. If the extension is built the problem will increase. It will create the need for added "calming" devices installed to slow drivers down. At the moment cars have to stop to turn onto Caryndale. That slows the raceway down a bit.
- Mention is made of "cut through" traffic. What streets are those? Biehn is the main road through.
- what is going to happen to the wildlife corridor behind Biehn? If it gets disturbed for a road, the wildlife will be cut off from their pond access and roaming areas. Their habitat has already been disturbed by the Strasburg Extension construction.
- How will the swamp recharge area be handled? This is a sensitive area.
- Could the developers not access servicing off Hearthwood or Robert Ferrie?

Please add me to the study's mailing list.

[redacted]

Katherine Scott

From: [redacted]
Sent: April 22, 2021 1:04 PM
To: Katherine Scott
Subject: RE: Biehn Drive | Online Community Cafe (April 20, 2021)

I have one add on suggestion please

Would it be possible to build the road towards Biehn dr. and just stopping short of wetlands? You could build a cul de sac? This would allow development for most of area

Thanks

[redacted]

Sent from Mail for Windows 10

From: Katherine Scott
Sent: April 12, 2021 11:24 AM
Cc: Steve Taylor (London); Eric Riek
Subject: Biehn Drive | Online Community Cafe (April 20, 2021)

Good morning,

Thank you for registering for the Biehn Drive Extension Class Environmental Assessment (EA) Community Cafe Event. The online Community Cafe is scheduled for April 20, 2021 from 6:30 to 8:00 pm. The meeting will be held on Zoom and can be accessed via the following link: https://us02web.zoom.us/j/88151905825

I will also forward a meeting invite to update your calendar.

Please let me know if you have any comments or concerns in advance of the call.

Thanks,

Katherine Scott

BT ENGINEER

509 Talbot Street

London, Ontario N6A 2S5

katherine.scott@bteng.ca

(519) 672-2222

Newsletter

Biehn Drive Extension

1. BIEHN DRIVE EXTENSION CLASS ENVIRONMENTAL ASSESSMENT

The City of Kitchener (City) is conducting a Class Environmental Assessment (EA) Study for the extension of Biehn Drive southerly to the Robert Ferrie Drive. The Biehn Drive extension will include a trunk sanitary sewer, storm sewer/ditches and watermain. The Study is evaluating alternatives for the alignment of the Biehn Drive extension, intersection locations and designs, and municipal services, while minimizing natural, social, cultural and land use impacts. The Study Area is illustrated on the **Figure 1, Study Area**.

Figure 1: Study Area

2. NEED AND JUSTIFICATION

The extension of Biehn Drive has been part of the integrated land use and transportation plan for the larger community. The City of Kitchener Official Plan (November 2014) identifies Biehn Drive as a Major Community Collector Street, shown in yellow. Refer to **Figure 2, Future Road Network**. Collector streets function to collect traffic from several local streets and provide access to arterial streets, shown in purple.

The previous studies that have led to this plan have included:

1) Brigadoon Community Plan (1989);
2) Official Plan Amendment No. 98 (1991);
3) Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994);
4) Kitchener Planning and Development Staff Report PD95/51 (1994);
5) Updated Brigadoon Community Plan (2005);
6) Kitchener Integrated Transportation Master Plan (2013);
7) Robert Ferrie Drive Extension Environmental Assessment (2014); and
8) Official Plan Amendment No. 103 in March 21, 2019.

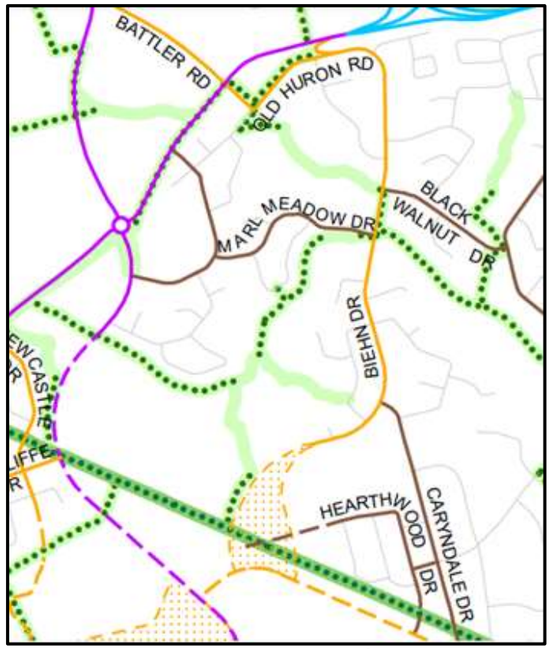


Figure 2: Future Road Network (OP Map 11 - Integrated Transportation System)

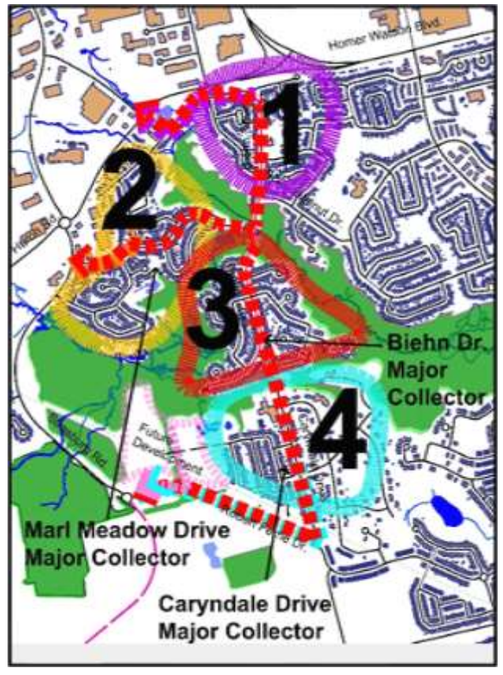


Figure 3: Community Neighbourhoods

3. WHAT IS THE TRAFFIC RATIONALE FOR THE BIEHN DRIVE EXTENSION?

During the recently held Community Café event, residents on Biehn Drive questioned the transportation justification for the street extension. Many previous transportation studies have described the need for an adequate collector road network for access to the community.

The individual neighbourhoods are shown in **Figure 3**. These neighbourhoods are bounded by Strasburg Road and Huron Road, each an arterial road. Close convenient access to the arterial road network will minimize traffic on any one collector road and provide greater safety. To demonstrate the rationale for the current plan (Biehn Drive extension), the four neighbourhoods and the average travel distance of each to the arterial road system are as follows:

Neighbourhood 1 (purple): average distance to Huron Road is approximately 800 metres.

Neighbourhood 2 (yellow): average distance to Strasburg Road is approximately 450 metres.

Neighbourhood 3 (red): average current distance to Strasburg Road is approximately 1200 metres, and 1300 metres to Huron Road.

Neighbourhood 4 (blue): average distance to Strasburg Road is approximately 600 metres.

If the new Biehn Drive link is not constructed, traffic from Neighbourhood 3 will continue to go through an adjacent neighbourhood.

4. PREVIOUS NEED AND JUSTIFICATION REVIEW (2014)

The Biehn Drive Extension Need and Justification Report was completed by Paradigm Transportation Solutions in June 2014. This report identified that eliminating the Biehn Drive extension would result in:

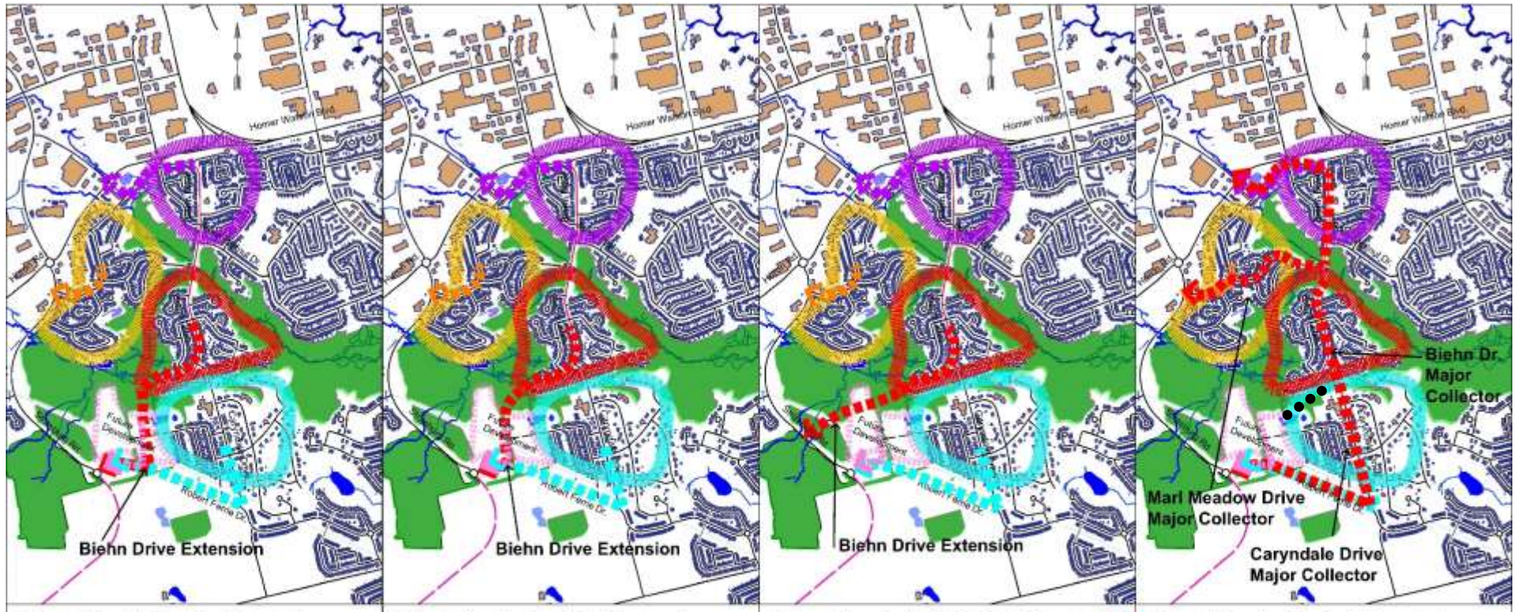
- Inefficiencies in the road network and backtracking/out-of-way travel for residents in the Doon South/Brigadoon communities;
- Insufficient capacity to accommodate the forecast traffic demands at the 2031 planning horizon; and
- Increased traffic on adjacent streets (i.e. Caryndale Drive, Templewood Drive, and Biehn Drive, northeast of the Study Area). These roads would be operating at traffic levels above their road classifications.

The Report concluded that eliminating Biehn Drive would be a fundamental design change to the Doon South/Brigadoon communities and would result in significant impacts to adjacent roads and other neighbourhoods, and that the Biehn Drive extension is therefore required

5. ALTERNATIVES

Three alternatives were presented at Public Information Centre (PIC) No. 1 and to residents at the Community Café event. Based on comments received by attendees at the Community Café, a fourth alternative has been added for the subsequent evaluation. The preliminary transportation alternatives for the study are shown on **Figure 4** below:

New: Alternative 4 will use existing collector roads to move vehicular traffic within the Doon South and Brigadoon communities, as shown in the figure below. With Alternative 4, these collector roads will serve traffic from their local neighbourhoods as well as Neighbourhood 3 (red). The project will include an extension of Biehn Drive for a maintenance road for the new sanitary sewer extension and an active transportation link as per the Official Plan.



Alternative 1 - Carried Forward ✓	Alternative 2 - Carried Forward ✓	Alternative 3 - Not Carried Forward ✘	Alternative 4 - Carried Forward ✓
Extension of Biehn Drive to Strasburg Road east of Hydro One transmission tower	Extension of Biehn Drive to Strasburg Road west of Hydro One transmission tower	Extension of Biehn Drive to Strasburg Road directly westerly to Strasburg Road (**not carried forward** based on higher relative environmental impacts)	Use existing collector roads in adjacent neighbourhoods to access the arterial roads ●●●● Sanitary sewer and active transportation link

Figure 4: Alternatives

6. FREQUENT QUESTIONS AND ANSWERS

Answers to questions we received at the initial community engagement are provided on the City's website at https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx#Frequently-asked-questions

NEXT STEPS

Next steps in the Class Environmental Assessment (EA) process are:

- Carry out environmental inventories and technical investigations;
- Complete the analysis and evaluation of alternatives;
- Hold Public Information Centre No. 2;
- Document the recommendations in the Environmental Study Report; and
- 30-day public review period of the Environmental Study Report.

There is an opportunity for public input at any point during the EA process. Comments and questions can be sent to the City and Consultant representatives below. All information is being collected in accordance with the *Freedom of Information and Privacy Act*.

Steve Taylor, P.Eng.	**Eric Riek, C.E.T.**
EA Project Manager	City Project Manager
BT Engineering Inc.	City of Kitchener
509 Talbot Street	200 King Street West
London, Ontario N6A 2S5	Kitchener, ON N2G 4G7
Tel: 519-672-2222	Tel: 519-741-2200 ext. 7330
Email: stevenj.taylor@bteng.ca	Email: eric.riek@kitchener.ca

Public Information Centre No. 2 Summary Report

Biehn Drive Municipal Class Environmental Assessment

December 2021

Submitted by:
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
519-672-2222

Table of Contents

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1.0 INTRODUCTION

The City of Kitchener (City) has initiated a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive Extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain.

The Class EA Study will complete all required phases of the Municipal Class Environmental Assessment. The study will: establish the need and justification for the improvements; complete environmental inventories; establish a baseline to compare alternatives; consider all reasonable alternatives; and proactively involve the public in defining a recommended plan for improvements.

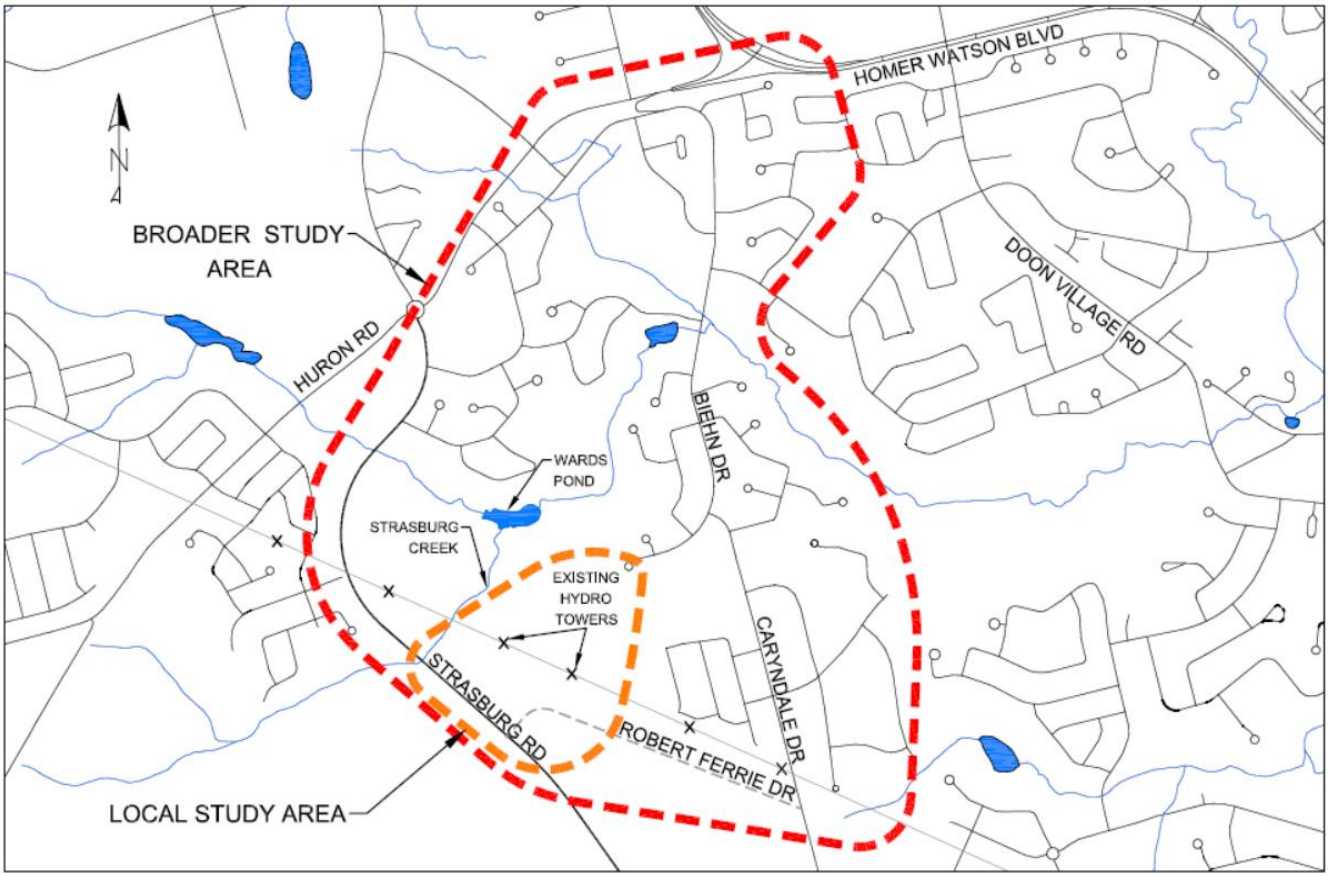
Based on the range of anticipated effects and capital cost of the project, the study is being conducted as a Municipal Schedule C Class EA. At the completion of the project, an Environmental Study Report will be prepared for a 30-day public review period.

Public Information Centre (PIC) No. 2 for this Study was held online from November 15 to November 29, 2021. A “live” virtual meeting was held on November 17, 2021 from 6:30 to 8:00 pm and included a presentation and a question and answers session. The Public Information Centre presented information on background information, the analysis and evaluation of alternatives, and the technically preferred alternative.

All members of the public and interest groups were invited to view the Online Public Information Centre material and were encouraged to provide a written response to any issues or concerns.

1.1 Study Area

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension. Based on comments from the public at the Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods.



Legend

Local Study Area

Broader Study Area

Based on comments from PIC No. 1

Figure 1: Project Location

2.0 PUBLIC AND AGENCY CONSULTATION

One of the key aspects of the study is to provide the public, interested parties, affected agencies and municipalities with the opportunity for input. In order to ensure this objective is met, a public and agency notification program was undertaken. The program includes a number of communication mechanisms, discussed in the following sections.

2.1 Individual Property Owner Contacts

Notices were mailed to property owners within the study area, inviting them to attend the online Public Information Centre. The notice was also distributed electronically to members of the public/ stakeholders that had identified an interest in the study or requested to be on the mailing list.

2.2 Indigenous Peoples Contacts

Notices were sent to the Indigenous Peoples in the vicinity of the Study Area, inviting them to attend the online PIC. Notices were sent to the following:

- Huron Wendat Nation
- Haudenosaunee Confederacy Chiefs Council
- Metis Nation of Ontario
- Six Nations of the Grand River
- Mississaugas of the Credit First Nation

2.3 Newspaper Notice

Notices of the Public Information Centre were published in The Record on October 29, 2021.

The newspaper notice is in **Appendix A**.

2.4 Agency and Stakeholder Contacts

The following ministries, agencies and stakeholders were invited to attend the online PIC:

- Ministry of the Environment, Conservation and Parks
- Ministry of Natural Resources and Forestry
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Environment Canada, Ontario Region
- Infrastructure Ontario
- Ministry of Agriculture, Food and Rural Affairs
- Ministry of Indigenous Affairs
- Grand River Conservation Authority
- Emergency Services
- Utilities
- Regional Municipality of Waterloo

3.0 PIC COMMENTS

PIC Exhibits were provided online for public/agencies to view at their convenience. A copy of the PIC exhibits is provided in **Appendix B**.

Nine (9) comment sheets and emails were received during and after the comment period. Copies of the comments, excluding personal information, are provided in **Appendix C**.

3.1 Summary of Comments

The comments received and discussions held during the Public Information Centre are summarized below in **Table 1**.

Table 1: Summary of Written Comments

Comment	Number of Respondents	Comment Sheet No.
Support for extension of Biehn Drive to Robert Ferrie Drive.	2	1, 5
Concern for prioritizing road improvements and development over the environment and not preserving green areas.	4	2, 4, 6, 7
Opposition to constructing a parking lane and multi use path on the Biehn Drive extension to minimize disruption to the wetland and preserve the environment.	1	3
Concern for community disruption and increased traffic volumes, and identifying the need for traffic calming measures.	4	4, 6, 7, 9
Concern for sightlines of vehicles entering/exiting driveways along the existing Biehn Drive.	2	7, 8
Concern that the publics' input was not included in the decision making process and selection of the preferred alternative.	3	6, 7, 8
Opposition to the extension of Biehn Drive extension and concern that the roadwork does not align with the City of Kitchener's strategic plan for environmental protection.	1	8
Concern that private properties will flood due to permanent disruptions to the wetland.	2	4, 8
Emergency access/response should rely on response time instead of access.	1	4
People shortcut through Marl Meadow Drive and Templewood Drive to Strasburg Road or Huron Road. This should be taken into consideration in the evaluation for efficiency of travel and community disruption to Biehn Drive north.	1	4
Concern regarding the negative impacts on Strasburg Creek which connects to the wetland.	1	4

Request to redo the evaluation of alternatives after removing traffic from Caryndale South and Doon South since it will be accommodated by the Robert Ferrie Drive extension.	1	4
Concern that Alternative 4 was not fairly evaluated and evaluation criteria were prejudiced against this criterion. Concerns include: • Introducing a second access road to Street A on the north side of the hydro tower for this alternative. • Need to consider proper development of the lands south of the PSW. • Traffic will be support by the extension of Robert Ferrie Drive.	1	4

4.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The main comments or concerns, both verbal (i.e. phone calls, virtual meetings) and written, from the public information centre include:

- Disruption to the environment/wetland and prioritizing transportation needs over the environment
- Support for the project and the need for the Biehn Drive extension
- Negative impacts on Strasburg Creek which connects to the wetland
- Impacts to drainage and groundwater levels due to possible wetland and environment disruption
- Consider greater use of Caryndale Drive to carry additional traffic and have more community traffic reach Strasburg Road using Robert Ferrie Drive as opposed to Biehn Drive

Recommendations for Future Actions

Actions for future review and consideration in the design include:

- Consideration of sightlines of vehicles entering/exiting driveways along the existing Biehn Drive
- Consideration for modifications to the cross section to minimize wetland disruption (i.e. removing the multi-use pathway, narrower boulevards and parking lanes)

Appendix A

Newspaper Notice

BT ENGINEERING

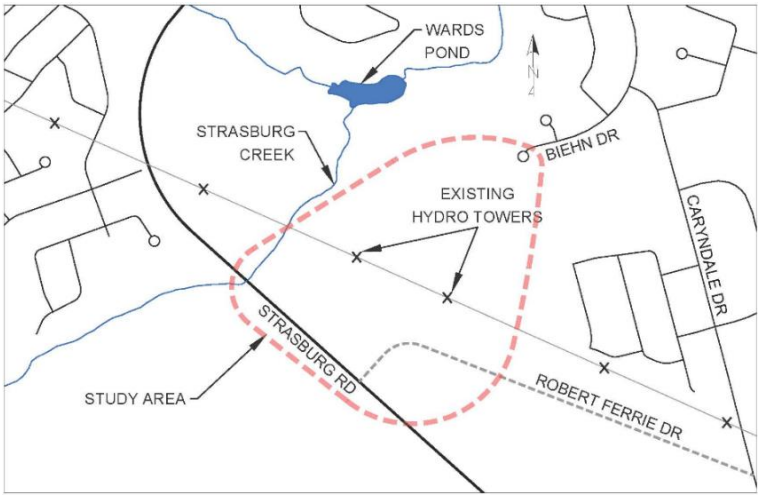
Notice of Online Public Information Centre (PIC)

City of Kitchener

Biehn Drive Extension Environmental Assessment Study

INTRODUCTION

The City of Kitchener is conducting an Environmental Assessment (EA) Study for the extension of Biehn Drive from the existing terminus 300 m west of Caryndale Drive to the future Robert Ferrie Drive extension. The Study will evaluate alternatives for alignment, cross sections, intersections, and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the recommendations in the City of Kitchener Transportation Master Plan.



STUDY PROCESS

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

PUBLIC CONSULTATION

The City wishes to ensure that anyone interested in this study has the opportunity to be involved and provide input. The City has scheduled a second online Public Information Centre (PIC) meeting for this project that will include a series of exhibits that present background information, the evaluation of alternatives and the Technically Preferred Alternative. At the present time, this PIC is relying on web-based communications due to restrictions on public gatherings. Comments on the information presented can be provided by contacting the City or consultant project managers' email addresses listed below.

The PIC will be held for a two-week period, with a "live" virtual Zoom meeting on November 17, 2021. **To register for the Zoom meeting, please contact Steve Taylor or Eric Riek.** The Online Public Information Centre is scheduled for:

PIC Date: November 15 to 29, 2021

Virtual Zoom Meeting Date: November 17, 2021 from 6:30 to 8:00 PM

Website: https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx

There is an opportunity at any time during the Class EA process for interested persons to provide comments. Early identification of individual and group concerns greatly aids in addressing these

concerns. All information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act* (2009). With the exception of personal information, all comments will become part of the public record. Persons will be advised of future communication opportunities by newspaper public notice, email notice and posting on the City website.

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

Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
Tel: 519-672-2222
Email: stevenj.taylor@bteng.ca

Eric Riek, C.E.T.
City Project Manager
City of Kitchener
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
Email: eric.riek@kitchener.ca

Appendix B

PIC Exhibits

BT ENGINEERING

Welcome!
City of Kitchener
Biehn Drive Extension
Class Environmental Assessment

Thank you for participating in the Online Public Information Centre (PIC) for the City of Kitchener's Class Environmental Assessment (EA) for the extension of Biehn Drive and the sanitary trunk sewer.

At the present time, the Province of Ontario has implemented restrictions on public gatherings to deal with the COVID-19 pandemic. As a result, this Public Information Centre is relying on web-based communications. Should you have any questions regarding the study, please contact the City or Consultant Project Managers.

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

Comments can be submitted by emailing stevenj.taylor@bteng.ca and/or eric.riek@kitchener.ca by **November 29, 2021**.

KITCHENER

1

Purpose of Public Information Centre

The purpose of this meeting is to:

- Present the evaluation of alternatives.
- Obtain comments on the Technically Preferred Alternative.
- Obtain comments on the proposed mitigation plan.
- Identify any remaining areas of concern.

2

2

Introduction

The City of Kitchener has retained BT Engineering Inc. to undertake an Environmental Assessment (EA) Study for the extension of Biehn Drive from its current terminus to the future Robert Ferrie Drive Extension. The Study includes the extension of the trunk sanitary sewer, watermain and storm sewers to Robert Ferrie Drive, to serve areas to the south.

The City has completed Phases 1 and 2 of the Municipal Class EA through the Transportation Master Plan, which has been reviewed and summarized in this study. Phases 3 and 4 of the Municipal Class EA are being completed by developing and evaluating alternative designs and completing the Environmental Study Report, while proactively involving the public and stakeholders in defining a recommended plan for improvements.

This Study is being completed as a Schedule C undertaking, based on the range of anticipated effects, and the proposed infrastructure extension will be completed as a Schedule B. The Study Design Report describing the study process has been made available for agency and public comments and on the website.

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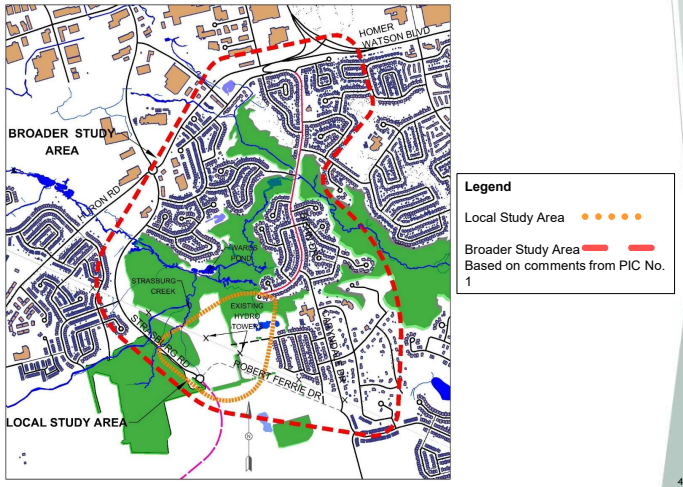
EA Study Area



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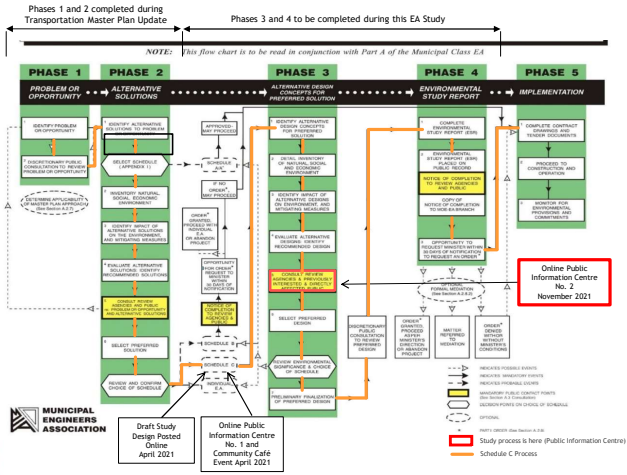
Municipal Class Environmental Assessment



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Background Studies

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

1. Brigadoon Community Plan (1989);
2. Official Plan Amendment No. 98 (1991);
3. Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994);
4. Kitchener Planning and Development Staff Report PD95/51 (1994);
5. Updated Brigadoon Community Plan (2005);
6. Kitchener Integrated Transportation Master Plan (2013);
7. Robert Ferrie Drive Extension Environmental Assessment (2014); and
8. Official Plan Amendment No. 103 in March 21, 2019.

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

6

Background Information

- Community Plans for the Doon South and Brigadoon areas have established the need for the extension of Biehn Drive
- This has been documented in the Official Plan and Transportation Master Plan
- The new road link will accommodate all modes of transportation (vehicles, trucks, pedestrians and cyclists)

Why is the project needed?

- Needed to evenly distribute traffic to the arterial road network.
- Multiple connections to arterial roads reduce the traffic volumes in any one neighbourhood and the travel time, and improve access for emergency services.
- Currently, existing traffic from Biehn Drive must travel through adjacent neighbourhoods.
- To provide a sanitary and water service corridor.

Why is it being implemented now?

- Strasburg Road has been constructed and will provide a western arterial street to service the community.
- With implementation of the proposed Biehn Drive extension, traffic will not have to take a circuitous route through neighbourhoods to reach the arterial road network.
- Required to accommodate future development.

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Existing Conditions

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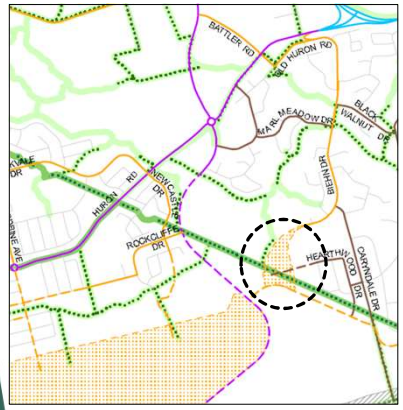
Official Plan – Integrated Transportation System



Source: City of Kitchener Official Map 11 Integrated Transportation System, 2014

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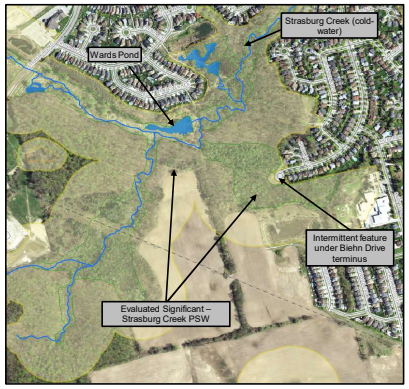
Natural Environment

Overview:

- Strasburg Creek Provincially Significant Wetland
- Intermittent overland flow through the wetland
- Strasburg Creek
- Wildlife habitat
- Specimen trees



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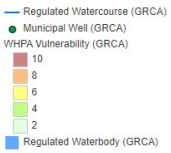
Well Head Protection Area



https://maps.grandriver.ca/web-gis/public/?theme=MYP&bbox=542091,4802909,545343,4804695

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Preliminary Design Alternatives

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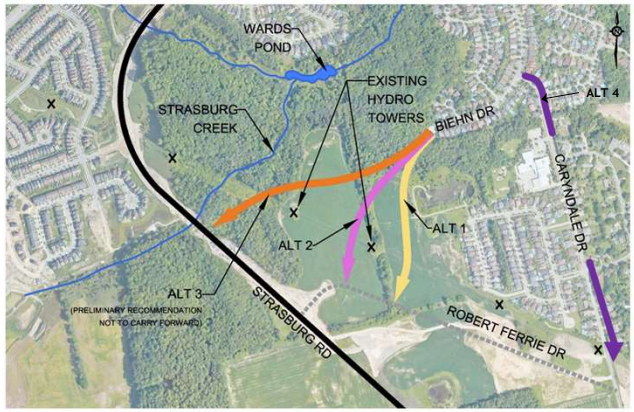
Preliminary Alignment Alternatives

Alternative 4 added following PIC No. 1



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Coarse Screening of Alignment Alternatives

Coarse Screening of Alignment Alternatives				
Screening Criteria	Alternative 1: Connect to Robert Ferrie Drive east of Hydro Tower	Alternative 2: Connect to Robert Ferrie Drive west of Hydro Tower	Alternative 3: Strasburg Road Connection	Alternative 4: Connect Biehn Drive to Robert Ferrie Drive – Via Caryndale Drive
Does this alternative satisfy forecast traffic demand, improve safety and address all modes of transportation?	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Strasburg Road. Accommodates all modes.	Provides a north-south connection to Strasburg Road. Accommodates all modes. However, there are increased levels of traffic on local roads.
Does the approach result in significant impacts to the natural environment?	Minor impacts to the woodlot/PSW (~0.3 ha).	Minor impacts to the woodlot/PSW (~0.3 ha).	Significant impacts to the woodlot/wetland (~1.3 ha).	No impacts.
Is the approach affordable for the City to implement?	No significant difference.	No significant difference.	Higher cost - requires an intersection onto Strasburg Road (arterial).	Affordable alternative.
Does this alternative comply with the recommendations of the City's planning documents (i.e., TMP, OP, KGMP)	This alternative complies with the recommendations of the City's planning documents.	This alternative complies with the recommendations of the City's planning documents.	Does not comply with the recommendations of the Official Plan or Growth Management Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible.	This alternative does not comply with the recommendations of the City's planning documents.
Recommendation:	✓ Carry forward for further evaluation	✓ Carry forward for further evaluation	✗ Do not carry forward	✓ Carry forward for further evaluation

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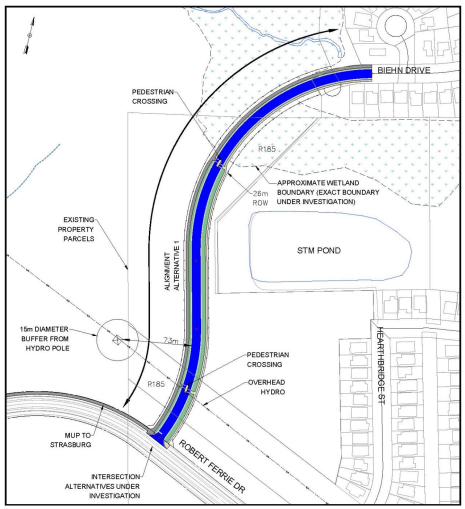
Alignment Alternative 1

Connect Biehn Drive to Robert Ferrie Drive – East Alignment



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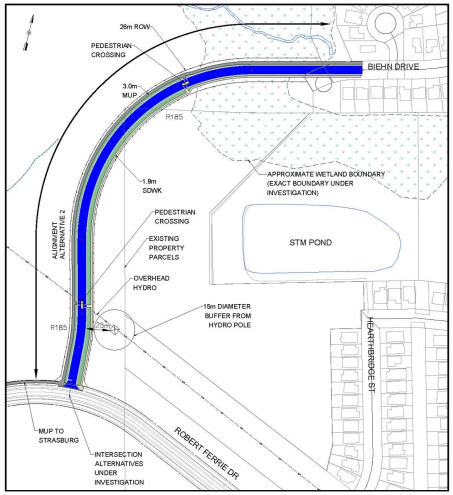
Alignment Alternative 2

Connect Biehn Drive to Robert Ferrie Drive – Central Alignment



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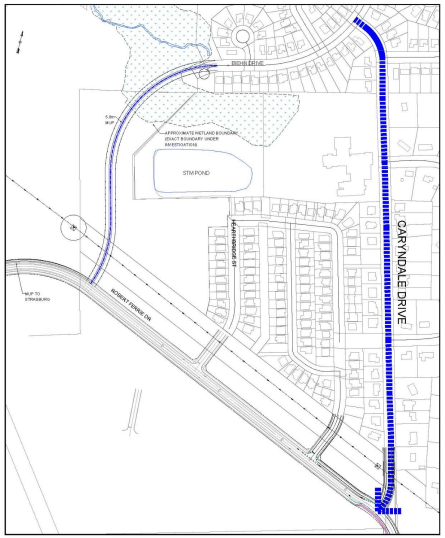
Alignment Alternative 4

Connect Biehn Drive to Robert Ferrie Drive – Via Caryndale Drive



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Analysis and Evaluation Alignment Alternatives

The analysis and evaluation of the alternatives has been undertaken using a quantitative evaluation methodology. Seven global evaluation factor were considered:

- Transportation
- Natural Environment
- Cultural Environment
- Socio-Economic Environment
- Land Use and Property
- Cost
- Engineering

- The factor groups are made up of measurable criteria (sub-factors) used to identify relevant benefits and impacts.
- They define a unit of measure and the relative differences between alternatives.
- Evaluation data was collected from literature reviews of background documentation and environmental inventories completed for this project.
- The results are presented on the following exhibits and documented in the Analysis and Evaluation Report, available upon request.

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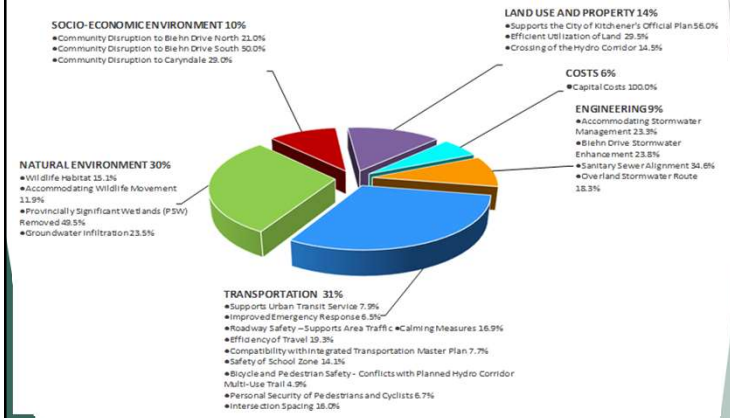
Evaluation - Global Factor Weights and Sub-factor Weights



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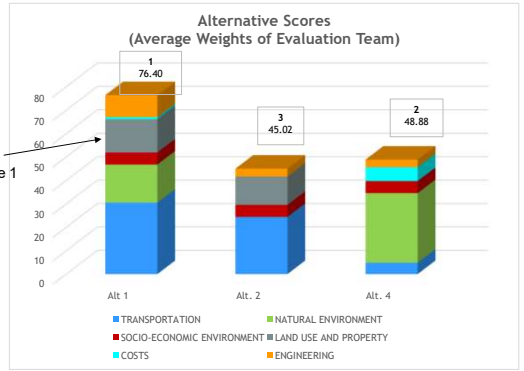
Alignment Alternatives - Scores

Technically Preferred Alternative Alternative 1



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Sensitivity Testing

Alternatives			Alt 1	Alt. 2	Alt. 4
FACTORS	WEIGHT	Score:	76.40	45.02	48.88
Ranking			1	3	2
TRANSPORTATION	High	45.00%	1	2	3
	Low	20.00%	1	3	2
NATURAL ENVIRONMENT	High	40.00%	1	3	2
	Low	20.00%	1	2	3
SOCIO-ECONOMIC ENVIRONMENT	High	15.00%	1	3	2
	Low	10.00%	1	3	2
LAND USE AND PROPERTY	High	20.00%	1	2	3
	Low	10.00%	1	3	2
COST	High	10.00%	1	3	2
	Low	2.00%	1	2	3
ENGINEERING	High	15.00%	1	3	2
	Low	5.00%	1	3	2

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Cross Section Alternative Evaluation

Alternatives were developed to reflect the City of Kitchener's Complete Streets guidelines.

Evaluation Criteria	Alternative 1 – 26 m ROW with Multi-use Trail ✓	Alternative 2 – 26 m ROW with Bike Lanes
Active Transportation	MUTs are preferred by the greatest proportion of cyclists (interested but concerned). Greater network continuity for cyclists with the future MUT along the Hydro corridor and potential to connect to the MUTs along Strasburg Road	Better accommodates pedestrians by separating pedestrians and cyclists Increased conflict between cyclists and access to/from parked vehicles
Traffic Calming	The reduced pavement width would better promote lower travel speeds	Wider asphalt surface would be less effective in reducing travel speeds
Impacts to Natural Environment / Storm Water Quality	All alternatives considered equal.	All alternatives considered equal.
Impacts to Developable Lands	All alternatives considered equal.	All alternatives considered equal.
Cost	MUTs are more cost effective to construct with reduced pavement thickness and granulars	Wider roadway pavement structure increases construction cost

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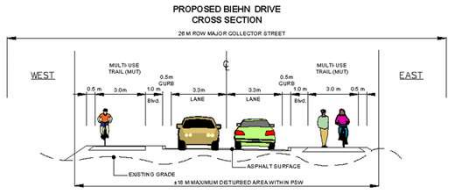
Preferred Cross Section

CROSS SECTION ALTERNATIVE 1



TYPICAL PSW SECTION

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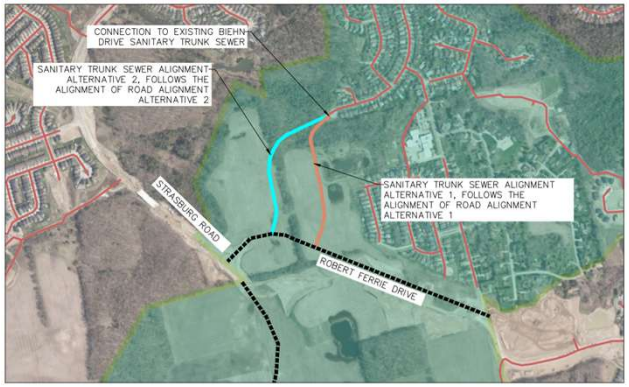
Preliminary Design Alternatives

- Two (2) Sanitary Sewer Alignment Alternatives were considered.
- The Preferred Sanitary Sewer alignment matches the Preferred Road Alignment Alternative 1.



24

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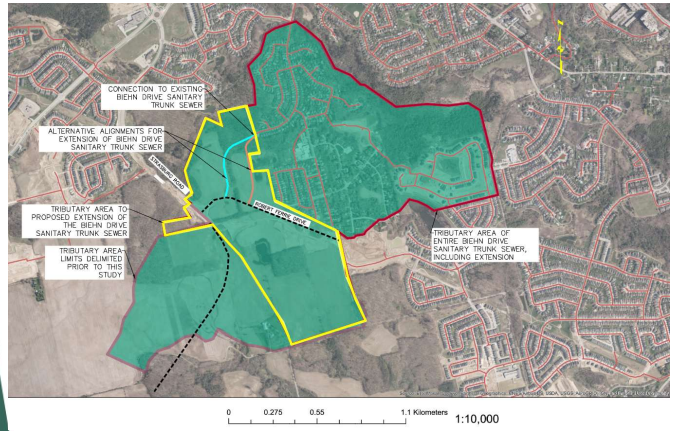
Preliminary Design Alternatives

- Sanitary Sewer service area



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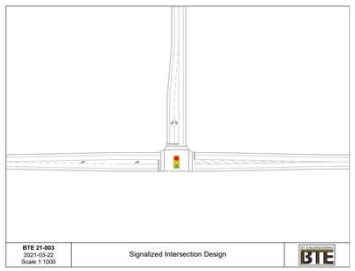
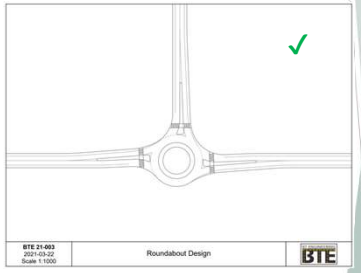
Preliminary Design Alternatives
Intersection Alternatives
Biehn Drive and Robert Ferrie Drive





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Traffic Projections

The proposed extension of Biehn Drive is projected to:

- Carry an average of 2500–3000 vehicles/day, well within its capacity as a major collector road,
- Result in a more balanced redistribution of area traffic volumes, providing relief (reducing the traffic volumes) on other area roads including Caryndale Drive and the north segment of Biehn Drive, which are both currently overutilized.

A roundabout is proposed at the intersection of Biehn Drive and Robert Ferrie Drive:

- Consistent with the approved plan identified in the Robert Ferrie Drive Class Environmental Assessment
- Due to the proximity to Strasburg Road (to limit queuing) and to accommodate pedestrian crossings
- To accommodate access to future development south of Robert Ferrie Drive.

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Technically Preferred Alternative

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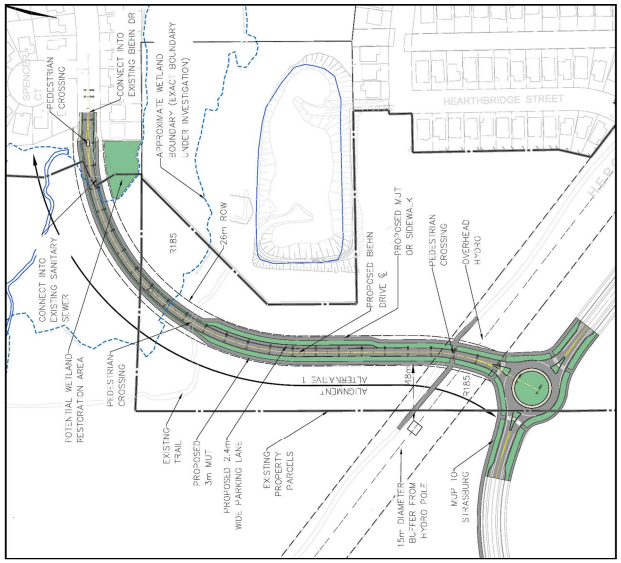
Preferred Alignment Alternative



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Mitigation Table

Issue/Concern Potential Effects	Concerned Agency	Proposed Mitigation (prevent, lessen or remedy potential detrimental environmental effects)
Loss of Provincially Significant Wetland (PSW)	GRCA	• Wetland Restoration in vacant lot on Biehn Drive. • Narrowing of roadway through PSW. • Utilize Best Management Practices and limit disturbance to wetlands and vegetation. • Limit vegetation removal, where feasible. • Protect vegetation to remain using tree protection.
Wildlife Crossing	GRCA	Provide equalization culverts and permanent, directional wildlife fencing to permit wildlife passage across roadway.
Groundwater	MECP	Avoid draw-down of water table by ensuring the bottom of granulars are above original ground.
Fish Habitat: downstream impacts to Strasburg Creek cold water fish habitat	GRCA, NDMNRF	• Provide erosion and sediment controls. • Minimize the delivery of sediments and associated pollutants to receiving watercourses. • Minimize the impact of road salt on the local vegetation and receiving watercourses. • Minimize the impact of increased flows on receiving watercourses. • Minimize potential erosion within the drainage system, and within the local receiving watercourses.

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Mitigation Table

Issue/Concern Potential Effects	Concerned Agency	Proposed Mitigation (prevent, lessen or remedy potential detrimental environmental effects)
SAR	MECP	• Undertake targeted, specialized SAR surveys during Detail Design as required depending on species conservation status designations as they exist at that time. At this time, no SAR have been identified in the Study Area. • Ensure the design and construction complies with the *Endangered Species Act* (ESA, 2007)
Migratory Birds	NDMNRF	Any clearing and grubbing should be completed outside of the active breeding bird season of April 1 to August 31.
Turtles and Turtle Habitat	NDMNRF	• Install silt fencing before turtle nesting season (May 15 to Sept. 30). • Protect and buffer active nests. • Avoid groundwater alteration in nearby wetlands between October 1 and April 1 during turtle hibernation.
Water Quality and Stormwater	MECP	Provide a Stormwater Management Plan.
Significant Woodlots	NDMNRF	Avoid specimen trees and limit tree clearing.

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Mitigation Table

Issue/Concern Potential Effects	Concerned Agency	Proposed Mitigation (prevent, lessen or remedy potential detrimental environmental effects)
Noise	City	Municipal Noise By-laws are to be followed during construction adjacent to residential areas.
Management of Surplus Materials	MECP	OPSS 180 apply MECP "Management of Excess Materials in Road Construction and Maintenance Guidelines". Management and Disposal of Wet Soils.
Traffic calming	City	• Narrowing of cross section • Reduced lane widths • Provision of a roundabout to assist in controlling speeds
Lighting	GRCA	Provide cut-off lighting through PSW.
Utilities		Liaison during detail design.
Changes to Emergency Services		Liaison during detail design.

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Next Steps

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Next Steps

Following this Public Information Centre we will:

- Review all online Public Information Centre comments and prepare a Summary Report
- Develop refinements to the Technically Preferred Alternatives (if required) based on public comments
- Prepare the Environmental Study Report (ESR)
- Initiate 30-day public review period of the ESR

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Your Involvement

How can you remain involved in the Study?

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

Thank you for your participation in this online Public Information Centre.

Your input into this study is valuable and appreciated.

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

For More Information Please Contact:

Steve Taylor, P.Eng.
BT Engineering Inc., Project Manager
Email: stevenj.taylor@bteng.ca
Phone: 519-672-2222

Eric Riek, C.E.T.
City of Kitchener, Project Manager
Development Engineering
Email: eric.riek@kitchener.ca
Phone: 591-741-2200 ext. 7330

Please submit any questions or comments to the contacts listed above by **November 29, 2021**.

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Appendix C

Comment Sheets

BT ENGINEERING

1

[redacted]
Sent: Wednesday, May 19, 2021 5:49 PM
To: Christine Michaud <Christine.Michaud@kitchener.ca>
Cc: Eric Riek <Eric.Riek@kitchener.ca>
Subject: [EXTERNAL] Biehn Road Extension Project

Hi Christine

We received your letter today regarding the proposed Biehn Drive extension project. As you mentioned in your letter, this project has been on the books for a long time. We have lived in the area for 30 years and were made aware of this plan in the early 1990's.

From the tone of your letter it appears that the vocal group of people opposed to this project have caught your attention more so than the group of us who want the extension to go ahead as planned. This is a classic case of "NIMBYism" where the home owners didn't complete their due diligence when they moved into their residences. Looking at the Biehn Drive dead end it is obvious that there was always a plan to continue the road.

The people opposed to these changes [redacted] must realize that their own homes were also once part of the rural area that made way for progress when the Brigadoon area was built. There have been many changes to this part of Kitchener since we have lived here. The fields and forests we used to hike in around here have been developed and new areas have been opened up for people to live in this part of the city. It is unfortunate that people can't see beyond their own yards to understand the city needs to grow and it can't always be in someone else's neighbourhood. As you know most of the undeveloped land left in Kitchener is in the south west and perhaps if people don't want to see development, they should move to more established areas.

We hope you will support the planning department in their efforts to proceed with the plans to finally bring this project to fruition. I know as a local politician it can be difficult to support a well planned project when a very vocal group of potential voters are opposed to it, but giving in to a NIMBY mentality is not the way a city progresses.

Thank you for keeping us in the loop about the status of the Biehn Road extension project.

[redacted]

2

[redacted]
Sent: November 17, 2021 4:18 PM
To: Steve Taylor (London) <stevenj.taylor@bteng.ca>; eric.riek@kitchener.ca <eric.riek@kitchener.ca>
Cc: [redacted]
Subject: Biehn Drive Extension for Discussion Nov 17 2021

Eric,
As per the Freedom of Information Act, provide the GRCA assessments from the past 3 decades. You have completely left them out, and therefore your EA is incomplete. These need to be aligned with the content of the latest options you have provided in the PowerPoint presentation online.

Also, I find this EA a complete failure in light of the COP 26 which was also a failure.

You may consider yourselves part of the problem here where we continue to clear forests which are in short supply on earth now while you line your pockets. Maybe you take clean air for granted these days. Did you know CO2 levels have risen 400% over the past century because of forest removal?

Shame on you for doing this.

Perhaps you should take half an hour and come out to the walking trail in this area around Wards Pond and see the beauty of the area which many families enjoy. Instead of having the vision to promote the Doon area as a green oasis within the City of Kitchener, you only seek to honour promises from Mayor Cardillo signed over to the contractors to over-develop Kitchener as they see fit. But that is ancient history I guess. Again, shame on you. This is a scandal which you are all part of.

It's such a shame.

[redacted]

3

[redacted]
Sent: November 18, 2021 10:06 AM
To: Steve Taylor (London) <stevenj.taylor@bteng.ca>
Cc: Eric Riek <eric.riek@kitchener.ca>
Subject: Biehn Drive extension

[redacted] and am opposed to the extension through this Algonquin like wetland.

Re: proposed Preferred Cross section on page 23 of the plan;

If the plan is to minimize disruption to the wetland, why is a parking lane shown in the schematic as well as multi use paths on either side of the road? Would this not add an increase of traffic and invasion of the wetland?
There are already natural trails through the wetland and wooded areas.
For the preservation of this environment, it needs to be left natural.
IF a road is approved by council, that's all it should be, a ROAD.

Sent from my iPhone

4

[redacted]
Sent: Monday, November 29, 2021 9:07:06 PM
To: Eric Riek <Eric.Riek@kitchener.ca>; Christine Michaud <Christine.Michaud@kitchener.ca>
Subject: [EXTERNAL] Comments, Questions and Concerns about Biehn Drive Extension Environmental Assessment

Good evening Eric and Christine,

Following the Virtual Zoom Meeting on Nov 17th, we were invited to provide feedback and comments. Please find below my comments, questions and concerns about the Biehn Drive Extension Environmental Assessment (EA).

The EA's evaluation weights set the Transportation weight at 31% and the Natural Environment at 30%. On June 24, 2019 the City of Kitchener's city council unanimously voted to declare a climate emergency. Since then, Canada has also made several statements, including at COP26, about reducing our impact on climate which is to be achieved through the preservation of the natural environment. On the transportation side, the City of Kitchener had made no such emergency declaration. As a result, how can a weight for the Natural Environment being less than Transportation make any sense when the emergency declaration and the statements from the Federal Government are taken into consideration? The Natural Environment weight should be much greater than the Transportation weight if we hope to have some kind of decent environment to live in for the decades to come.

The EA mentions the need to distribute the traffic evenly in the arterial road network. Where is the analysis of the current situation? One can observe in the morning the vast majority of the traffic coming down Caryndale towards Biehn Drive and then go north on Biehn. There is some traffic going from Biehn Drive and up Caryndale but did BTE check to make sure they are not simply going to the school? If going to the school, extending Biehn drive will not change this. For the traffic coming down Caryndale and going north on Biehn, it seems to be sourced from the south end of Caryndale and Doon South neighborhoods. Why should the residents of Biehn Drive be forced to have the residents of other neighborhoods go through ours? Is it possible that the traffic other neighborhood (north of Brigadoon) think is coming from Biehn is simply flowing through Biehn and coming from communities south of Biehn? This is where the opening of Robert Ferrie Drive to Strasburg will fix this situation and improve school zone safety on Caryndale. All the extension of Biehn Drive would do with the traffic situation is substantially and permanently damage to Provincial Significant Wetlands (PSW) at the end of Biehn Drive.

The EA project manager (Steven Taylor) mentioned during the Nov 17th meeting an increase of about 2,500 vehicles per day, where did this come from? He also mentioned the north side of Biehn Drive was being overused. The Biehn Drive Extension Need and Justification Review conducted by Paradigm Transportation Solutions (page 4) in 2014 mentions that by 2031, Biehn drive would be handling 8,100 vehicles per day (in excess of capacity as mentioned in that review) which factored in the development of Robert Ferrie Drive. This is a **substantial** increase

compared to what BTE is mentioning. Also, at the Biehn Drive traffic calming meeting of Nov 23, Steve Ryder made a comment about the traffic on Biehn Drive being appropriate/acceptable since the road is a collector road. So, which one is it? Is it overused, fine or are the residents of Biehn Drive about to have a massive increase that will destroy the safety of the Biehn south neighborhood and the PSW?!

For alternative 4, why is the south side of the PSW not showing any development? A court could be developed on that side while ensuring the PSW does not have a street going through it to minimize the environmental impact. Proper drainage could be implemented to ensure stormwater is properly directed to the Storm Water Management pond that is currently beside the wet lands. This would help to provide a more fair comparison to alternative 1 and would increase the scoring for both the Land Use and the Engineering global factors.

This section of comments, questions and concerns factors in the Analysis and Evaluation Report for the Biehn Drive Extension EA

For the Improved Emergency Response (pg 70), why is the evaluation done on an access basis when normally response to something is calculated based on time? All emergency services determine their performance on time to the location where the emergency is happening. What is the current response time to the various neighborhoods and what would be the impact of each option?

For the Roadway Safety – Supports Area Traffic Calming Measures (pg 71), has the impact of Robert Ferrie being built been factored in the evaluation? Since the majority of traffic on Biehn is coming from the south end of Caryndale and Doon South, the minute Robert Ferrie would be open, a lot of this traffic flow should go away. Extending Biehn Drive will have a marginal impact (if any) on the traffic from south Caryndale and Doon South (which is a major issue) compared to Robert Ferrie opening.

For the Efficiency of Travel (pg 72), was the shortcut a lot of people take from Biehl Drive through Marl Meadow Drive and Templewood Drive to Strasburg Road or Biehn Drive through Marl Meadow Drive and Templewood Drive to Huron Road taken into account? If not, how would this impact the ratings for the various alternatives?

For the Safety of School Zone (pg 74), was the impact of opening Robert Ferrie drive and the reduction of the traffic coming down from South Caryndale and Doon South been factored in? This has a direct impact on how many vehicles go through the school zone especially in the morning. If factored in, how would it impact the rating of the various alternatives?

For the Bicycle and Pedestrian Safety - Conflicts with Planned Hydro Corridor Multi-Use Trail (pg 75), Caryndale is already crossing the hydro corridor. Alternative 4 is being unfairly impacted by including this already existing crossing. Also, Alternative 4 is further being unfairly designed (bordering on flagrant) for this part of the assessment by introducing a second access road to Street A (pg 77) on the north side of the hydro tower. This second access road from Robert

Ferrie Drive would be about 50 meters from where Biehn Drive (south portion that would not cross PSW) would connect. There is no need for this second access road since it was not included in the other alternatives. As a result, all alternatives are going to introduce the same number of new crossings. What would be the impact to the overall rating of eliminating this item since it is the same for all alternatives?

For the Personal Security of Pedestrians and Cyclists (pg 78), Alternative 4 is not being treated fairly since it does not need Multi-Use Pathway (MUP) connections because there is no continuous road being put through!! It has something even better, a dedicated walkway for pedestrians and cyclists, as shown on page 58, which doubles as access for the utilities!!! As a result, the way this criterion is set up is prejudicial to Alternative 4. Therefore, what would be the impact on the overall rating of eliminating this item?

The ratings for Wildlife Habitat (pg 80), Accommodating Wildlife Movement (pg 82), Provincially Significant Wetlands Removed (pg 85) and Groundwater Infiltration (pg 87) clearly demonstrate that Alternative 1 and 2 would have negative impacts on the environment. How is the over $2 million investment by the City of Kitchener (as mentioned in The Record on April 11, 2020) in Strasburg Creek and saving the brook trout being protected? The PSW at the end of Biehn Drive links right into this creek and having a through road will impact not only the PSW but by extension Strasburg Creek. How many more millions will it be to reverse the negative impacts of this through road?

For the Community Disruption to Biehn Drive North (pg 88), was the fact that a substantial part of the traffic on Biehn Drive North is the result of traffic coming from Caryndale South and Doon South? How would it impact the rating if this traffic was removed from the analysis since it will be handled by Robert Ferrie Drive? Also, are the shortcuts a lot of people take from Biehl Drive through Marl Meadow Drive and Templewood Drive to Strasburg Road or Biehn Drive through Marl Meadow Drive and Templewood Drive to Huron Road taken into account? If not, how would this impact the ratings for the various alternatives?

For the Efficient Utilization of Future Development Land (pg 96), was the proper development of the lands for Alternative 4(removal of the through road going through the PSW from Alternative 1) factored into the rating? If so, please demonstrate. If not, what would be the impact to the rating of Alternative 4?

For the Crossing of the Hydro Corridor (pg 97), Alternative 4 is being unfairly designed (bordering on flagrant) for this part of the assessment. The crescent should give on the portion of Biehn Drive South (between PSW and Rebert Ferrie Drive since it would not go through the PSW) just like for Alternative 1. The only difference between Alternative 1 and Alternative 4 for these evaluation criteria should be the removal of the through road going through the PSW. There is no need for this second access road as demonstrated by its exclusion from the other alternatives. As a result, all alternatives are going to introduce the same number of new crossings. What would be the impact to the overall rating of eliminating this item since it is the same for all alternatives?

For the Accommodating Stormwater Management (pg 99), has the proper development of the lands south of the PSW been factored in for Alternative 4 (removal of the through road going through the PSW from Alternative 1)? What is the impact on the rating of Alternative 4 if this is factored in?

For the Biehn Drive Stormwater Enhancement (pg 100), has the impact of the natural absorption of the stormwater been factored in? That is nature doing what it does well when there is little human interruption. What is the impact on the rating of Alternative 4 if this is factored in?

For the Overland Stormwater Management Route (pg 103), has the proper development of the lands south of the PSW been factored in for Alternative 4 (removal of the through road going through the PSW from Alternative 1)? What is the impact on the rating of Alternative 4 if this is factored in?

Thank you for the opportunity to make comments and ask questions that will become part of the public record on this important issue.

5

[redacted]
Sent: Wednesday, November 17, 2021 8:09:20 PM
To: Eric Riek <Eric.Riek@kitchener.ca>
Subject: Biehn

The EA for Biehn fixes the location of the RF roundabout. That is why the EA for Biehn has to be completed now.

Sent from my iPhone

6

[redacted]

Sent: November 21, 2021 9:37 PM
To: Steve Taylor (London) <stevenj.taylor@bteng.ca>; Eric Riek <eric.riek@kitchener.ca>; Christine Michaud <christine.michaud@kitchener.ca>
Subject: Re: Biehn Dr extension

Christine, Steve, Eric,

Please forward my message on to whoever else you need.

First of all, I'm not used to these kind of processes, but my gut reaction to Wednesday's meeting was I don't see the point of involving the public when you're just talking for the first 45 min about what your choice is and not actually going to change it or reconfigure or do anything about it based on all of our concerns. At that point, it seems like a massive waste of time and money, which as always brings a lot of doubt about our tax dollars being used effectively and to our benefit.

Have you had that many residents reaching out to say that they are excited and hopeful for the Biehn Dr extension? I find it hard to believe that a majority of residents feel that way. Especially when we presented specific concerns and recommendations that were either not answered or not met, how does it not come across that you have a jaded/biased perspective on transportation vs the environment.

So, I'm in the structural eng field, and when someone doesn't trust my design they can ask for my calcs. I'd like to see how your report numbers were assigned, because on the one hand I understand you are saying you are an impartial consulting company hired by the city to do an assessment, but on the other hand, your report and designs determine how the city and council will be swayed. And there is someone human who is assigning factors to things. Saying transportation is rated higher than the environment sounds an awful lot like that person is more focused on moving cars around the region than preserving the little green space we have left. Which is directly contradicting what the region and most reputable scientists would recommend as they declare a state of emergency when it comes to global warming.

It also seems like the focus is making the cars per day numbers etc work out in your theoretical models vs listening to the residents that experience the traffic day to day. The current traffic level on Biehn is tolerable and would be better with speed control. I understand you're using future numbers to run these models, but how will future numbers be larger than what they are now, there's no area to add housing in these neighborhoods. Our decisions affect people in the future, and who in the future is going to be happy about having Biehn not be a cul de sac. People living on Caryndale as well as Biehn know what the existing traffic level is when they buy and speed calming has and will been done to make it better.

Back to the graphs and tables in the presentation, I find it extremely convenient that the alternative 1 got a score of 1 for every item. Even someone making up numbers would vary the scores so it doesn't look suspicious.

Also the housing land use brown factor is 0 for alt 4? You can still make road access from the south from Robert Ferrie. To me assigning an actual realistic value for the land use factor to alternative 4 would bring alternative 1 and 4 closer in score.

End of the day, it's not just the trails that exist in this protected area, it's the way Biehn ends in a woodlot that creates a beautiful bubble at the end for the neighborhood to enjoy. And as many times as you want to say how you're the experts and the numbers check out and this is the best technical recommendation for the project, just means that you're more and more ignoring the effect on the people that actually live in the area and benefit from what you're recommending be destroyed.

7

[redacted]
Sent: Thursday, November 25, 2021 4:23 PM
To: Eric Riek <Eric.Riek@kitchener.ca>
Cc: Christine Michaud <Christine.Michaud@kitchener.ca>
Subject: [EXTERNAL] Biehn Drive Extension Class Environmental Assessment Comments

Good afternoon Eric,

My comments are attached.

[redacted]

ATTACHMENT:

I want to say how disappointed I am in the City of Kitchener. You have shown us you want to choose development over environment. And you have chosen to disrupt a quiet community for a highway going past our homes. And make no mistake, when Biehn is finished, there will be hundreds, if not thousands of commuters coming up from the 401, using Biehn Drive as a shortcut from Strasburg to Homer Watson. You will have a huge problem on your hands, but then, the damage will be done, and there will be no solution. (Or maybe, you just won't care.)

There is another situation that I am upset about. Again, it shows a lack of consideration for the residents of this area. You gave us options for the route of the road, and then chose the one you, or the developer, preferred. Do we not get a say in anything? Why show us the alternatives if you don't give us the opportunity to have at least have a say in the decision- making process?

Everything here seems slanted, dictatorial. When did City of Kitchener become so narrow minded?

[redacted] Our unsettling concern is that either option does not give us a good sightline of the road. Coming out of our driveway will be very hazardous. The bend of the road coming out from the forest seems much too abrupt.

Let's finish Robert Ferrie first and then see if the extension is necessary.

[redacted]

8

[redacted]
Sent: Saturday, November 27, 2021 9:22:16 AM
To: Eric Riek <Eric.Riek@kitchener.ca>
Cc: Christine Michaud <Christine.Michaud@kitchener.ca>
Subject: [EXTERNAL] November 17, 2021 Public Information Centre Comments

Good morning Eric,

My comments are attached.

Have a great weekend.

Regards,

[redacted].

ATTACHMENT:

Biehn Drive Extension
Class Environmental Assessment
November 17, 2021 Public Information (PIC) Centre Comments

The Grand River Conservation Authority (GRCA). has confirmed that the area behind our house and the existing Cull de Sac is part of the Provincially Significant Strasburg Creek Wetland Complex. According to the City of Kitchener (C of K) Notice of Study and Community Café, "The study will consider all reasonable alternatives with acceptable effects on the natural, social and cultural environments". The C of K Strategic Plan for the Environment states "our strategic plan for the environment shows how we will put the environment first, reduce our carbon emissions and preserve our planet. We work to develop and maintain an ecologically diverse open space network that incorporates typical naturally occurring landscapes, significant natural features and the urban forest, all of which embody our natural heritage. We protect our water supply by working with the Region of Waterloo and the Grand River Conservation Authority to replenish and protect our water and wetlands". If Biehn Drive is extended the C of K is violating its own Strategic Plan for the Environment. It is time for C of K staff and elected officials to lead, not continue as in the past.

Area residents have lived in a wet area for 30 years How is the C of K going to ensure we do not get more water on our properties and in our basements if the wetlands are tampered with? What is the Contingency Plan if this occurs? Documentation of the contingency plan is only fair to existing residents.

The Environmental Assessment (EA) is inherently flawed towards transportation and **must be redone.** On Page 19 of the EA Evaluation – Global Factor Weights and Sub-factor weights show Transportation 31% and Natural Environment 30%. This is wrong! The Natural Environment must be rated much higher and the scores recalculated. Current examples of what climate change is doing to Canada in British Columbia and Nova Scotia are front page news.

Robert Ferrrie Drive was not even planned when the initial extension of Biehn Drive was approved. Why not wait until Robert Ferrie Drive is extended to Strasburg Road and after a sufficient time period for residents to use this new alternative, then evaluate the need to extend Biehn Drive? As discussed on numerous occasions a road is not required for watermain and sewer installation. This can be done with an easement.

If the extension of Biehn Drive is approved by Council, area residents must have a voice on which alternative is chosen. This is only fair to the existing residents, many of whom are long term residents.

As discussed in Tuesday's (November 23) Traffic Calming Review – Biehn Drive, our section of Biehn was not included in the review and traffic calming measures the same as the rest of Biehn would be done after construction. This is wrong and not fair to the existing residents of our section of Biehn.

[redacted] If Biehn Drive is extended with the preferred alternative (Alternative1) and corresponding sharp curve, will there be appropriate sight lines for us and close neighbours to get out of and into our driveways safely?

9

[redacted]

Sent: November 24, 2021 7:58 PM
To: Eric Riek <Eric.Riek@kitchener.ca>
Cc: Steve Taylor (London) <stevenj.taylor@bteng.ca>; Christine Michaud <Christine.Michaud@kitchener.ca>
Subject: Re: Re: Biehn Dr extension

Eric,

In the biehn Dr traffic calming presentation last night, they mentioned that major collectors in the area are designed for around 5000 to 8000 a day
They also mentioned that Biehn Dr traffic numbers are in line or bit less than the standard major collector numbers.

This seems to conflict with the concept that is one of the main proponents for proposing the biehn Dr extension, as the extension presentation seemed to say Biehn Dr numbers are far above what they should be. And that it will just get worse even when robert ferrie extension is made.

Do you have more exact numbers regarding Biehn Dr traffic and what it should be? I wasn't able to find it in this report you sent

Appendix C

Select Correspondence

BT ENGINEERING

Ministry of Heritage, Sport, Tourism and Culture Industries

Programs and Services Branch
401 Bay Street, Suite 1700
Toronto, ON M7A 0A7
Tel: 437.239.3404

Ministère des Industries du Patrimoine, du Sport, du Tourisme et de la Culture

Direction des programmes et des services
401, rue Bay, Bureau 1700
Toronto, ON M7A 0A7
Tél: 437.239.3404

Ontario

April 28, 2021 EMAIL ONLY

Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc. 509 Talbot Street
London, ON N6A 2S5
stevenj.taylor@bteng.ca

MHSTCI File	**:**	**0013923**
Proponent	**:**	**City of Kitchener**
Subject	**:**	**Notice of Commencement – MCEA Schedule C**
Project	**:**	**Biehn Drive Extension**
Location	**:**	**City of Kitchener**

Dear Steve Taylor:

Thank you for providing the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) with the Notice of Study Commencement and the Draft Study Design Report completed by BTE Engineering Inc. (dated March 2021) for the above-referenced project. MHSTCI's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage.

Under the EA process, the proponent is required to determine a project's potential impact on cultural heritage resources.

Project Summary
The Biehn Drive Extension EA Study is being conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015). The Transportation Master Plan (TMP) has previously completed Phases 1 and 2 of the Class EA; this Study will review the previously completed phases and complete Phases 3 and 4.

Identifying Cultural Heritage Resources
While some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Cultural heritage resources are often of critical importance to Indigenous communities. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to them.

Project Comments
MHSTCI has reviewed the above referenced notice and draft Study Design Report and has the following comments:

Archaeological Resources
Section 4.2.3.1.7 of the draft Study Design Report (2nd paragraph) indicates that a Stage 1 archaeological assessment (AA) will be completed as part of this undertaking.

A Stage 1 AA shall be completed prior to any ground disturbing activities and prior to the issuance of the notice of completion. MHSTCI recommends that any additional assessments be completed as early as possible during detailed design phase.

Approval authorities (such as a municipality or MECP) typically wait to receive the ministry's review letter for an archaeological assessment report before issuing a decision on the application as it can be used, for example, to document that due diligence has been undertaken.

Archaeological assessment reports may identify site locations which are considered sensitive and not to be made public. To this end, the licensed archaeologist is required to record sensitive data, such as site location, in a separate Supplementary Documentation Report. MHSTCI understands that the proponents like to share information as part of the environmental assessment process for accountability and transparency purposes. Therefore, MHSTCI recommends that the final report be posted on the website without the Supplementary Documentation and with MHSTCI's letter indicating that the report has been entered into the Ontario Public Register of Archaeological Report.

The results of the AA will be summarized in the ESR, i.e. the Executive Summary of each AA report provides a brief summary of the work completed and the recommendations for next steps, whether for further archaeological assessment, in which case the report will include a map that identifies those areas, or for no further assessment. The ESR must also include clear commitments to undertake any further AA stages recommended, and a timeline for their completion.

We recommend revising the 2nd paragraph as follows:

- Archaeological assessment(s) (AA) will be undertaken by an archaeologist licenced under the *Ontario Heritage Act*, who is responsible for submitting the report directly to MHSTCI for review.
- Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition and contacting MHSTCI to find out whether, or not, there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and determine whether additional archaeological assessment is necessary (e.g. Stage 2,3,4).

Built Heritage Resources and Cultural Heritage Landscapes

Section 4.2.3.1.7 (1st paragraph) indicates that a technical memorandum on cultural heritage resources will be completed as part of this undertaking.

MHSTCI recommends that all known or potential built heritage resources and cultural heritage landscapes be identified prior to the selection of preferred alternatives.

A Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment shall be undertaken for the entire study area (not a technical memo) prior to the selection of preferred alternatives and summarized in the Environmental Study Report. This study will:

1. Describe the existing baseline cultural heritage conditions within the study area by identifying all known or potential built heritage resources and cultural heritage landscapes, including a historical summary of the study area. MHSTCI has developed screening criteria that may assist with this exercise: *Criteria for Evaluating for Potential Built Heritage Resources and Cultural Heritage Landscapes*.

2. Identify preliminary potential project-specific impacts on the known and potential built heritage resources and cultural heritage landscapes that have been identified. The report should include a description of the anticipated impact to each known or potential built heritage resource or cultural heritage landscape that has been identified.

3. Recommend measures to avoid or mitigate potential negative impacts to known or potential built heritage resources and cultural heritage landscapes. The proposed mitigation measures are to inform the next steps of project planning and design.

MHSTCI recommends revising the 1st paragraph as follows:

- A Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment will be undertaken for the entire study area prior to the selection of preferred alternatives and summarized in the ESR. This study will identify all known or potential built heritage resources and cultural heritage landscapes (BHR/CHLs); and include a historical summary of the study area. Potential project impacts to BHR/CHLs will be identified and strategies will be provided to mitigate identified impacts. These mitigation measures will inform project planning and design.

Environmental Assessment Reporting
All technical cultural heritage studies and their recommendations are to be addressed and incorporated into EA projects.

Thank you for consulting MHSTCI on this project and please continue to do so throughout the EA process. If you have any questions or require clarification, do not hesitate to contact me.

Sincerely,

Joseph Harvey
Heritage Planner
joseph.harvey@Ontario.ca

Copied to: Eric Riek, City Project Manager, City of Kitchener
Katherine Scott, BT Engineering Inc

Hydro One Networks Inc
483 Bay St
Toronto, ON

May 21, 2021

Re: Biehn Drive Extension Class Environmental Assessment Study

Attention:
Steve Taylor, P.Eng. EA
Project Manager
BT Engineering Inc.

Thank you for sending us notification regarding (Biehn Drive Extension Class Environmental Assessment Study). The Secondary Land Use group is aware of this project. Please continue construction conversations with Lana Kegel, Hydro One Senior Real Estate Coordinator. Please inform us when you have more detailed drawings. Note that this response does not constitute approval for your plans and is being sent to you as a courtesy to inform you that we must continue to be consulted on your project.

In addition to the existing infrastructure mentioned above, the applicable transmission corridor may have provisions for future lines or already contain secondary land uses (e.g., pipelines, watermains, parking). Please take this into consideration in your planning.

Also, we would like to bring to your attention that should (Biehn Drive Extension Class Environmental Assessment Study) result in a Hydro One station expansion or transmission line replacement and/or relocation, an Environmental Assessment (EA) will be required as described under the Class Environmental Assessment for Minor Transmission Facilities (Hydro One, 2016). This EA process would require a minimum of 6 months for a Class EA Screening Process (or up to 18 months if a Full Class EA were to be required) to be completed. Associated costs will be allocated and recovered from proponents in accordance with the Transmission System Code. If triggered, Hydro One will rely on studies completed as part of the EA you are current undertaking.

Consulting with Hydro One on such matters during your project's EA process is critical to avoiding conflicts where possible or, where not possible, to streamlining processes (e.g., ensuring study coverage of expansion/relocation areas within the current EA). Once in receipt of more specific project information regarding the potential for conflicts (e.g., siting, routing), Hydro One will be in a better position to communicate objections or not objections to alternatives proposed.

If possible at this stage, please formally confirm that Hydro One infrastructure and associated rights-of-way will be completely avoided, or if not possible, allocate appropriate lead-time in your project schedule to collaboratively work through potential conflicts with Hydro One, which ultimately could result in timelines identified above.

In planning, note that developments should not reduce line clearances or limit access to our infrastructure at any time. Any construction activities must maintain the electrical clearance from the

transmission line conductors as specified in the Ontario Health and Safety Act for the respective line voltage.

Be advised that any changes to lot grading or drainage within, or in proximity to Hydro One transmission corridor lands must be controlled and directed away from the transmission corridor.

Please note that the proponent will be held responsible for all costs associated with modifications or relocations of Hydro One infrastructure that result from your project, as well as any added costs that may be incurred due to increased efforts to maintain said infrastructure.

We reiterate that this message does not constitute any form of approval for your project. Hydro One must be consulted during all stages of your project. Please ensure that all future communications about this and future project(s) are sent to us electronically to secondarylanduse@hydroone.com

Sent on behalf of,

Secondary Land Use
Asset Optimization
Strategy & Integrated Planning
Hydro One Networks Inc.

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

Ontario

May 20, 2021

Eric Riek
Project Manager
City of Kitchener

Re: **Biehn Drive Extension EA**
City of Kitchener
Municipal Class EA
Response to Notice of Commencement

Dear Eric Riek,

This letter is in response to the Notice of Commencement for the above noted project. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the City of Kitchener has indicated that the study is following the approved environmental planning process for a Schedule C project under the Municipal Class Environmental Assessment (Class EA).

The **updated (February 2021)** attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please address all areas of interest in the EA documentation at an appropriate level for the EA study. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule. **Further information is provided at the end of the Areas of Interest document relating to recent changes to the Environmental Assessment Act through Bill 197, Covid-19 Economic Recovery Act 2020.**

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project:

- Mississaugas of the Credit First Nation
- Six Nations of the Grand River (both Elected Council and Haudenosaunee Confederacy Chiefs Council)

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process". Additional information related to Ontario's Environmental Assessment Act is available online at: www.ontario.ca/environmentalassessments.

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information, including the MECP's expectations for EA report documentation related to consultation with communities.

The proponent must contact the Director of Environmental Assessment Branch (EABDirector@ontario.ca) under the following circumstances subsequent to initial discussions with the communities identified by MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities
- You have reason to believe that your proposed project may adversely affect an Aboriginal or treaty right
- Consultation with Indigenous communities or other stakeholders has reached an impasse
- A Part II Order request is expected on the basis of impacts to Aboriginal or treaty rights

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

A draft copy of the report should be sent directly to me prior to the filing of the final report, allowing a minimum of 30 days for the ministry's technical reviewers to provide comments.

Please also ensure a copy of the final notice is sent to the ministry's West Central Region EA notification email account (eanotification.swregion@ontario.ca) after the draft report is reviewed and finalized.

Should you or any members of your project team have any questions regarding the material above, please contact me at joan.delvillarcuicas@ontario.ca or 365-889-1180.

Yours truly,

Joan Del Villar C
Regional Environmental Assessment Coordinator – West Central Region

cc Katy Potter, Supervisor, Environmental Assessment Services, MECP
Steve Taylor, P. Eng. EA Project Manager, BT Engineering Inc

Attach: Areas of Interest
A Proponent's Introduction to the Delegation of Procedural Aspects of Consultation with Aboriginal Communities

AREAS OF INTEREST (v. February 2021)

It is suggested that you check off each section after you have considered / addressed it.

☐ **Planning and Policy**

- Projects located in MECP Central Region are subject to **A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020).** Parts of the study area may also be subject to the Oak Ridges Moraine Conservation Plan (2017), Niagara Escarpment Plan (2017), Greenbelt Plan (2017) or Lake Simcoe Protection Plan (2014). Applicable plans and the applicable policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.

- The **Provincial Policy Statement (2020)** contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

☐ **Source Water Protection**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

- If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use this mapping tool: http://www.applications.ene.gov.on.ca/swp/en/index.php. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the "Map Legend" bar on the left. The mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information
For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario's website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional "local" threat activities, as approved by the MECP.

- **Climate Change**

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

    1. Consider during the assessment of alternative solutions and alternative designs, the following:
        a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
        b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
    2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

Air Quality, Dust and Noise

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

Ecosystem Protection and Restoration

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
    - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands,

significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.
  - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
  - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, you may consider the provisions of the Rouge Park Management Plan if applicable.

Species at Risk

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

Surface Water

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

    - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
    - Watershed information, drainage conditions, and other relevant background information
    - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
    - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

Groundwater

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16.* These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

Excess Materials Management

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

Contaminated Sites

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP's D-4 guideline for land use considerations near landfills and dumps.
    - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada's website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

Servicing, Utilities and Facilities

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP's Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

Mitigation and Monitoring

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the

project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

Consultation

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

Class EA Process

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Part II Order Requests under the Environmental Assessment Act, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

Amendments to the EAA through the Covid-19 Economic Recovery Act, 2020

Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address (for projects in MECP Southwest Region, the email is eanotification.swregion@ontario.ca).

The public has the ability to request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters should be addressed in writing to:

Minister Jeff Yurek
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

A PROPONENT'S INTRODUCTION TO THE DELEGATION OF PROCEDURAL ASPECTS OF CONSULTATION WITH ABORIGINAL COMMUNITIES

DEFINITIONS

The following definitions are specific to this document and may not apply in other contexts:

Aboriginal communities – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

Consultation – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

Crown – the Ontario Crown, acting through a particular ministry or ministries.

Procedural aspects of consultation – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

Proponent – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

I. PURPOSE

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

II. WHY IS IT NECESSARY TO CONSULT WITH ABORIGINAL COMMUNITIES?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers issuing a permit, authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

III. THE CROWN'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

IV. THE PROPONENT'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent's consultation activities and documentation of those activities. The consultation process informs the Crown's decision of whether or not to approve a proposed project or activity.

A proponent's role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

a) What might a proponent be required to do in carrying out the procedural aspects of consultation?

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;
- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

b) What documentation and reporting does the Crown need from the proponent?

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;
- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;
- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

V. WHAT ARE THE ROLES AND RESPONSIBILITIES OF ABORIGINAL COMMUNITIES' IN THE CONSULTATION PROCESS?

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:

- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;
- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

VI. WHAT IF MORE THAN ONE PROVINCIAL CROWN MINISTRY IS INVOLVED IN APPROVING A PROPONENT'S PROJECT?

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

(Via E-mail Only)

October 16, 2024

Gordon Bell
Senior Environmental Planner
BTEng. Inc
gord.bell@bteng.ca

Steve Taylor
Project Manager
BTEng Inc
stevenj.taylor@bteng.ca

Re: City of Kitchener, Biehn Drive Extension EA
Municipal Class Environmental Assessment – Schedule C
Project Review Unit Comments – Final Draft Environmental Study Report

Dear Project Team,

Thank you for providing the ministry with an opportunity to comment on the draft Environmental Study Report (Report) for the above noted Class Environmental Assessment (EA) project. Our understanding is that in order to improve accessibility to the local community; accommodate the required and previously planned sanitary sewer extension; and allow development to proceed on lands that currently require the roadway ROW plan to be defined prior to developing the land use plan, The City of Kitchener (the proponent) has determined that the preferred solution is to extend Biehn Drive and connect it to Robert Ferrie Drive east of Hydro Tower. The Biehn Drive extension will include a trunk sanitary sewer, storm sewer/ditches and watermain.

The Ministry of the Environment, Conservation and Parks (ministry) provides the following comments for your consideration.

Notice of Completion

1. The Notice of completion and any follow- up correspondence should be included in the final Environmental Study Report.

Groundwater

2. No detailed hydrogeologic assessment was provided in the EA report. The Section 3.3.3 Hydrogeologic Assessment in the EA report provided some discussion regarding possible dewatering requirements as part of the construction project. It is reported that "The proposed trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area. Refer to Appendix J. Trenchless construction would normally require less or no dewatering than traditional open cut installations.". However, Appendix J in the EA report is about Hydrological Investigation, but no dewatering related discussion was provided.

3. The Section 7.4.1.1 Groundwater in the EA report mentioned that "A trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area. There will only be dewatering requirements for the road construction for the north culvert and oil grit separator". At the end of Appendix A Borehole Logs, a report titled "Dewatering Assessment, Biehn Drive Extension, City of Kitchener, Ontario, dated March 14, 2024, Prepared by Cambium Inc for BT Engineering" was provided. There should be a specific reference (i.e., a specific Appendix) for this dewatering assessment in the EA report.

4. The above dewatering assessment report provided detailed hydrogeologic information including dewatering calculations and assumptions for dewatering calculations. The report also discusses the possible dewatering permits (i.e., EASR verses Category 3 PTTW Application) to be required during construction phases. The dewatering assessment report provides Dewatering Estimates for 50 m Trench segment and Receiving Pit, where maximum dewatering volume is estimated to be less than 125,000 l/day with a zone of influence of 70 m. A safety factor of 2 was applied and the estimated dewatering rate per each receiving pit (i.e., 50 m trench) is estimated at 235,000 L/day or 2.72 L/sec. However, the safety factor 2 and projected dewatering rate was not considered for the predicted ZOI (i.e., 70 m). The report considers overland flow to natural environment as a possible dewatering discharge option, which needs to consider treatment of groundwater due to exceedance of several metals including arsenic comparing PWQO.

Overall, the preliminary dewatering assessment seems reasonable.

5. It is understood that a detailed hydrogeologic investigation report will be submitted during the Category 3 PTTW application. MECP will provide comments as part of the proposed Category 3 PTTW application, specifically impacts of dewatering on the surrounding water resources including the PSW and required monitoring (i.e., surface water and groundwater monitoring) and contingency plan for the protection of applicable receptors including PSW and other water users within the projected zone of influence due to dewatering. It is important to highlight that a groundwater and surface water monitoring program and contingency plan is required before, during, and after the proposed dewatering/construction activities irrespective of the dewatering/construction methods to be implemented due to the sensitivity of the PSW.

6. MECP will also comment on the treatment of dewatering discharge and impact of dewatering discharge on the natural environment/aquatic environments within the PSW. The proposed dewatering discharge option (i.e., discharge on natural environment) needs to acquire appropriate permits, where applicable.

Species at Risk

7. Though the ESR provides information on Black Ash and some mitigation information, further action should be considered to avoid impacts to Black Ash within the development footprint. Please refer to the Black Ash assessment guidelines to ensure proper actions are taken to avoid contravening the ESA, 2007.

8. The assessment of Black Ash was conducted in December, which is outside of the appropriate window for a full health evaluation. Ideally, this should have been done between late spring and early fall when the trees are in leaf, and key health indicators are visible. A follow-up assessment during the growing season would provide a more accurate evaluation of the trees' condition.

9. Butternut has been identified as a species at risk within the study area; however, no further information or mitigation measures are provided in the ESR. It is recommended that butternut surveys be conducted by a qualified Butternut Health Expert (BHE) during the appropriate timing window to confirm the absence or presence of this species. Please refer to the Butternut assessment guidelines.

10. There is no clear commitment to ensuring that construction activities occur outside of the bat active window (May to October). MECP would expect the project to follow timing restrictions to avoid disturbing SAR bats during sensitive periods.

11. The document touches on long-term monitoring to assess the effectiveness of bat mitigation measures but does not give much detail. MECP would expect ongoing monitoring to ensure that the mitigation strategies, like the installation of roosting structures, are effective in supporting SAR bats and that adaptive management strategies are in place to address any unforeseen impacts.

12. MECP has records of Blanding's Turtle presence within the project area, including Category 2 and 3 habitats identified within the study boundaries. The ESR does not address potential impacts or include any mitigation measures for this species. It is recommended that the project include an assessment of Blanding's Turtle habitat and appropriate mitigation strategies to ensure compliance with the ESA, 2007.

13. Given the potential impacts this project may have on species at risk, I recommend that an an Information Gathering Form (IGF) be completed and submitted to the Species at Risk Branch (SAROntario@ontario.ca). This step will help ensure that proper authorization is secured under the ESA, 2007 before proceeding with the project. It is ultimately the client's responsibility to ensure that their activities do not contravene the ESA, 2007.

Surface Water

14. The site is located in the Upper Grand River watershed. Strasburg Creek, a cold waterbody is located in the study area but not directly affected but the road extension. A portion of the proposed roadway would cross the Strasburg Creek Provincially Significant Wetland (PSW) Complex. The Strasburg Creek PSW is a wooded swamp dominated by mature hardwoods and the report notes it is a cold-water system.

15. Approximately 2,690 m2 of wetlands will be permanently lost through the construction of the roadbed. In response, it is proposed to restore two areas adjacent to the wetland of ~1,285 m2, and 2,543 m2 (for a total 3,828 m2), plus the retained 10 m wide forest edge. Specifics would be discussed in the detailed design, but the area is noted to well exceed the minimum 1:1 goal. GRCA's permits might be required regarding this wetland destruction and compensation.

16. Direct impacts during construction are noted to be mitigated with trenchless construction for the municipal services, with dewatering only required for the north culvert and oil grit separator. The discharge location is to be decided and may be overland with flow to the wetland. This activity may require MECP permit/approval.

17. During construction, erosion and sedimentation measures are required and are noted in the ESR. The concentrations of most metals, including zinc, thallium, lead, nickel, iron, cadmium, arsenic, and silver in the unfiltered groundwater sample exceeded the PWQO values. A discharge and sampling program was recommended including a limit of total suspended solids (TSS) of 25 mg/L.

18. As part of the Permit to Take Water application, or any EASR registration, confirmation of hydrogeologic conditions, sedimentation and erosion controls in a discharge plan, and exact design of the compensative wetland should be provided. GRCA's concurrence on the compensation wetland will be required. A monitoring and sampling plan should be created to ensure there is no discharge to the natural environment of groundwater with metals exceeding the PWQO.

19. Stormwater quality control will be provided with the existing stormwater management pond as well as an oil grit separator at the northern outlet to the PSW. Current and future drainage volumes to be accommodated by the new road were not described, but Item 2.2 of Table 9 Effects and Mitigation notes stormwater management plan is being developed to reduce chloride loading into the watercourse and to cool stormwater prior to its outlet. It is not clear where this stormwater pond outlets into and could be clarified to ensure all required measures are taken. The ESR includes the Integrated Stormwater Management Master Plan which recommends control of the 25-year and 100-year storm events post-development volumes and peak flows to pre-development levels, and notes enhanced (Level 1) water quality protection for the watershed. All these stormwater works will require MECP approval since they outlet to the natural environment.

Noise and Vibration

20. In comments on the draft ESR from 2022 the ministry inquired whether the City of Kitchener was planning on reassessing the noise after construction in response to community concern, your response (in the 'comments response' memo sent in August 2022) was as follows, "In Noise and Vibration in Table 8, under a new Factor for Cultural Environment, a commitment will be made to monitor noise complaints with the opening of Biehn Drive. If the noise complaints last beyond the initial experience of the road opening, then traffic counts will be undertaken to compare with the ESR noise calculation traffic projections. Based on the comparison, the City will assess if any noise mitigation measures are required, technically feasible and cost effective." The 2024 ESR does not contain the above commitment or an equivalent statement in either Table 9 (the equivalent of Table 8 in the 2022 ESR) or in section 3.2.3 Noise.

Thank you for circulating this draft Report for the ministry's consideration. Please document the provision of the draft Report to the ministry as well as this Project Review Unit Comments letter in the final report, and please provide an accompanying response letter to support our review of the final report. A copy of the final Notice should be sent to the ministry's West Central Region EA notification email account (eanotification.wcregion@ontario.ca).

Should you or any members of your project team have any questions regarding the material above, please contact me at Joan.DelVillarCuicas@ontario.ca.

Sincerely,

Joan Del Villar Cuicas
Regional Environmental Planner
Project Review Unit, Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Park

Grand River Conservation Authority

Administration Centre: 400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

Phone: 519-621-2761 Toll free: 1-866-900-4722 Fax: 519-621-4844 www.grandriver.ca

April 14, 2021

Eric Riek, C.E.T., Project Manager
City of Kitchener
Via email: eric.riek@kitchener.ca

Re: Biehn Drive Extension Municipal Class Environmental Assessment Schedule C
Biehn Drive to future Robert Ferrie Drive, City of Kitchener

Dear Mr. Riek,

Grand River Conservation Authority (GRCA) staff have received a Notice of Study Commencement in regards to the above-noted Municipal Class Environmental Assessment (Class EA). The study area contains features of interest to the GRCA, including the Provincially Significant Strasburg Creek Wetland Complex, tributaries of the Grand River, floodplain, slope erosion hazard, and the associated allowances to these features. Please allow this correspondence to act as notice that we have an interest in the Class EA and wish to participate in the study review.

Please be further advised that a GRCA permit pursuant to Ontario Regulation 150/06 will be required for any of the proposed works that fall within the GRCA regulated areas. We recommend that you contact our office early in the study process to discuss permitting requirements.

If you have any questions or concerns, please do not hesitate to contact **Jenn Simons, Intermediate Planner, at 519-621-2763 ext. 2230** or jsimons@grandriver.ca.

Sincerely,

Melissa Larion, MCIP, RPP
Supervisor of Resource Planning
Grand River Conservation Authority

JS/ml

c.c. Steve Taylor, BT Engineering Inc.(via email)

Fw: Biehn Drive Extension Class Environmental Assessment Study | Notice

Steve Taylor (London) <stevenj.taylor@bteng.ca>

Mon 2021-04-12 8:28 AM

To: Julia Hoglund <julia.hoglund@bteng.ca>
Cc: Katherine Scott <katherine.scott@bteng.ca>

Save this in the select correspondence appendix.
Steve

BT ENGINEERING
BTE

Steve Taylor P.Eng., M.Eng., CVS-LIFE, P.E.
President
509 Talbot Street
London, Ontario
N6A 2S5
E-Mail: stevenj.taylor@bteng.ca
Phone: 519-672-2222
FAX: 1-613-280-1305
Toll Free: 1-855-228-4813
[www.bteng.ca]www.bteng.ca

From: Kevin Schimus <Kevin.Schimus@enbridge.com>
Sent: April 12, 2021 7:36 AM
To: Katherine Scott <katherine.scott@bteng.ca>
Cc: Steve Taylor (London) <stevenj.taylor@bteng.ca>; Eric Riek <Eric.Riek@kitchener.ca>; Gord Bell <gord.bell@bteng.ca>
Subject: RE: Biehn Drive Extension Class Environmental Assessment Study | Notice

Good morning Katherine,

Enbridge Gas Inc. does not have any existing or proposed infrastructure in this area. Please contact Kitchener Utilities Gas for gas information in this area. I can be removed from distribution list and future communications re: this project. Thanks.

Regards,

Kevin Schimus
Sr. Advisor, Construction and Project Management
Southeast Region Construction and Growth

Enbridge Gas Inc
Cell: 519-635-9488 | Kevin.Schimus@enbridge.com
603 Kumpf Drive, Waterloo, Ontario, N2V 1K3

enbridgegas.com
Safety. Integrity. Respect. Inclusion.

From: Katherine Scott <katherine.scott@bteng.ca>
Sent: Wednesday, March 31, 2021 8:55 AM
Cc: Steve Taylor (London) <stevenj.taylor@bteng.ca>; Eric Riek <Eric.Riek@kitchener.ca>; Gord Bell <gord.bell@bteng.ca>
Subject: [External] Biehn Drive Extension Class Environmental Assessment Study | Notice

Good morning,

The City of Kitchener has initiated a Class Environmental Assessment for the Biehn Drive Extension and Sanitary Trunk Sewer Extension. The attached Notice provides additional information on the Study and the availability of background materials.

Please let me know if you have any additional questions or concerns.

Thanks,

Katherine Scott

BT ENGINEERING

509 Talbot Street
London, Ontario N6A 2S5
katherine.scott@bteng.ca
(519) 672-2222

Katherine Scott

From: MNRF Ayl Planners (MNRF) <MNRF.Ayl.Planners@ontario.ca>
Sent: April 15, 2021 1:56 PM
To: Steve Taylor (London); Eric Riek
Cc: Gord Bell; Katherine Scott
Subject: RE: Biehn Drive Extension Class Environmental Assessment Study | Notice
Attachments: 21-003 Kitchener Biehn Dr Commencement-Café Letters Laura W, MNRF QC.pdf; NHGuide_MNRF_2019-04-01.pdf

Ministry of Natural Resources and Forestry **Ministère des Richesses naturelles et des Forêts**

Ontario

April 15, 2021

Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
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Email: stevenj.taylor@bteng.ca

Eric Riek, C.E.T.
City Project Manager
City of Kitchener
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
Email: eric.riek@kitchener.ca

Subject: Biehn Drive Extension Class Environmental Assessment Study | Notice

The Ministry of Natural Resources and Forestry (MNRF) received the attached notice for the proposed Biehn Drive Extension project. Thank you for circulating this information to our office, however, please note that we have not completed a screening of natural heritage or other resource values for the project at this time. Please also note that it is your responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws or other agency approvals.

This response provides information to guide you in identifying and assessing natural features and resources as required by applicable policies and legislation, and engaging with the MNRF for advice as needed.

Natural Heritage & Endangered Species Act

In order to provide the most efficient service possible, the attached Natural Heritage Information Request Guide has been developed to assist you with accessing natural heritage data and values from convenient online sources.

It remains the proponent's responsibility to complete a preliminary screening for each project, to obtain available information from multiple sources, to conduct any necessary field studies, and to consider any potential environmental impacts that may result from an activity. We wish to emphasize the need for the proponents of development activities to complete screenings prior to contacting the Ministry or other agencies for more detailed technical information and advice.

The Ministry continues to work on updating data housed by Land Information Ontario and the Natural Heritage Information Centre, and ensuring this information is accessible through online resources. Species at risk data is regularly being updated. To ensure access to reliable and up to date information, please contact the Ministry of the Environment, Conservation and Parks at SAROntario@ontario.ca.

Petroleum Wells & Oil, Gas and Salt Resource Act

There may be petroleum wells within the proposed project area. Please consult the Ontario Oil, Gas and Salt Resources Library website (www.ogsrlibrary.com) for the best known data on any wells recorded by MNRF. Please reference the 'Definitions and Terminology Guide' listed in the publications on the Library website in order to better understand the well information available. Any oil and gas wells in your project area are regulated by the *Oil, Gas and Salt Resource Act*, and the supporting regulations and operating standards. If any unanticipated wells are encountered during development of the project, or if the proponent has questions regarding petroleum operations, the proponent should contact the Petroleum Operations Section at POSRecords@ontario.ca or 519-873-4634.

Public Lands Act & Lakes and Rivers Improvement Act

Some projects may be subject to the provisions of the *Public Lands Act* or the *Lakes and Rivers Improvement Act*. Please review the information on MNRF's web pages provided below regarding when an approval is required or not. Please note that many of the authorizations issued under the *Lakes and Rivers Improvement Act* are administered by the local Conservation Authority.

- For more information about the *Public Lands Act*: https://www.ontario.ca/page/crown-land-work-permits
- For more information about the *Lakes and Rivers Improvement Act*: https://www.ontario.ca/document/lakes-and-rivers-improvement-act-administrative-guide

The MNRF would appreciate the opportunity to review any draft reporting completed in support of this project when it becomes available.

If you have any questions or concerns, please feel free to contact me.

Sincerely,
Karina

Karina Černiavskaja, District Planner
Ministry of Natural Resources and Forestry
Email: MNRF.Ayl.Planners@ontario.ca

Ontario

As part of providing accessible customer service, please let me know if you have any accommodation needs or require communication supports or alternate formats.

From: Katherine Scott <katherine.scott@bteng.ca>
Sent: March-31-21 8:48 AM
To: MNRF Ayl Planners (MNRF) <MNRF.Ayl.Planners@ontario.ca>
Cc: Steve Taylor (London) <stevenj.taylor@bteng.ca>; Gord Bell <gord.bell@bteng.ca>; Eric Riek <Eric.Riek@kitchener.ca>
Subject: Biehn Drive Extension Class Environmental Assessment Study | Notice

Good morning,

The City of Kitchener has initiated a Class Environmental Assessment for the Biehn Drive Extension and Sanitary Trunk Sewer Extension. The attached Notice provides additional information on the Study and the availability of background materials.

Please let me know if you have any additional questions or concerns.

Thanks,

Katherine Scott

BT ENGINEER

509 Talbot Street

London, Ontario N6A 2S5

katherine.scott@bteng.ca

(519) 672-2222

From:
Sent: January 3, 2022 2:45 PM
To: Steve Taylor (London) <stevenj.taylor@bteng.ca>
Cc: eric.riek@kitchener.ca <eric.riek@kitchener.ca>
Subject: Biehn Drive Extension

Hello Steven and Eric,

We do not believe that the Biehn Extension is needed at this time. A more sensible approach is to allow the connection of Robert Ferrie Dr to Strasburg Rd. Once that has been done, then another study can be completed if necessary.

We need to protect wet lands and environmental protected areas as the city is expecting taxpayers to do. We are referring to the new “Natural Heritage Conservation” zoning that effects private property of landowners. We, as well as our neighbours, have been good stewards of our properties yet have seen the city approve development that has destroyed many acres of natural area.

We remember the sales pitch regarding LRT. This was to curb urban sprawl and development and here we are finding more ways to build more and more roads to accommodate vehicular traffic using polluting fossil fuels!

Gentleman, it’s time to do the right thing for us and future generations.

Thankyou for your time.

Ron&Diane Mckelvie

Hydro One Networks Inc.
Facilities & Real Estate Services
P.O. Box 4300
Markham, ON L3R 5Z5
www.HydroOne.com

Courier:
185 Clegg Road
Markham, ON L6G 1B7

Technical Considerations for Hydro One Electrical Transmission Corridors

Your project may involve proposed works on Hydro One electrical transmission corridors or rights-of-way (ROW). Hydro One strives to work with proponents to review secondary land use proposals on the ROWs so that they are compatible with the safety and maintenance requirements of its high-voltage equipment. The Hydro One transmission network can consist of steel lattice towers, monopoles, twin wood poles, overhead conductors.

When preparing a proposal, there are a number of technical considerations that should be kept in mind. A number of these are outlined below. Please note that this is not intended to be a comprehensive list of requirements, but aims to serves as a guideline to prepare a proposal. Reviews for each proposal are conducted individually by Hydro One and may require several weeks or months to complete depending on the complexity of the proposal.

Technical Considerations:

Grading, Drainage and Stormwater Management

- Grading changes must not result in standing water anywhere along the corridor, and especially not within 15m radial zone of transmission structures.
- No fill material may be placed on the ROW without written approval from Hydro One.
- Catch basins that are not positioned within a paved roadway are not permitted.
- Stormwater management (SWM) ponds placed under 115 and 230 kV transmission lines cannot exceed two-thirds of the corridor width.
- SWM ponds under 500 kV transmission lines cannot exceed one-third of the corridor width.
- SWM ponds must be designed to withstand the effects of 100-year storm conditions.

Roads and Parking

- Roads crossing the ROW should be perpendicular to the hydro corridor.
- Roads off ROW should stay 15m clear of transmission structures.
- Curb cuts or access gates should be provided for Hydro One maintenance vehicles.
- Parking facilities on 115 kV and 230 kV ROWs should be restricted to passenger vehicles only. Large truck and trailer parking is generally not permitted.
- Parking facilities are generally not permitted under 500 kV ROWs.
- Transmission towers near roads and parking areas must be protected by standard highway barriers.

Vertical Clearances

- Transmission conductors (wires) are dynamic in nature. They can sag lower to the ground depending on parameters such as ambient temperature and operating conditions.
- Minimum vertical clearances must be maintained from the maximum design sag levels of the conductors (worst-case scenario). Hydro One will review these clearances as they are case-specific and not immediately apparent by observation alone.

Access to Structures

- An unhindered, minimum 6-metre wide access path to facilities on the corridor must be provided for maintenance vehicles.
- A 15-metre clear working radius around transmission structures is required in order to maintain access for vehicles carrying out routine maintenance.
- A 3-metre radius around each tower footing must be left unpaved for access to the footing.

Pipelines & Underground Facilities

- All underground facilities must be designed to withstand the loading conditions created by heavy maintenance vehicles that may be used by Hydro One.
- The ROW must be restored to pre-construction condition once the project is completed.
- Excavation using heavy machinery is prohibited within 10 metres of tower footings to protect foundations. Within 10 metres, excavation must be carried out by hand or by use of a VAC system.
- Pipelines on ROWs must adhere to the provisions of CSA Standard C22.3 No. 6.

Landscape Plantings

- Plantings which grow to a maturity height over 4 metres are not permitted on the ROW. Hydro One has a 'Compatible Species List' which can be provided. It must be noted that plantings should not be planted in such a way as to impede access to the transmission towers. An area of 15 metres around transmission towers should be kept clear of shrubs to permit Hydro One access to towers.

Other Requirements

- Buildings and permanent structures are not permitted on corridor lands.
- Flammable or hazardous materials may not be stored on ROWs.
- Consideration should be given to minimizing the use of conductive (metallic) material where alternatives exist (e.g. fences).
- The proponent is responsible for all costs of modifying, relocating, or monitoring Hydro One assets as a result of the proposal.
- Grounding studies, induction studies, spark discharge and / or step touch potential studies may be required to confirm that the proposal will not conflict with the Hydro One electrical infrastructure. The cost of these studies, our review of the completed studies, and any mitigation measures required as a result of these studies, will be will be borne by the Proponent.

Property Rights: Who is the landowner?

- Transmission corridor lands can be owned by private landowners, Municipalities, Province of Ontario (Infrastructure Ontario), railway companies, and First Nations and Métis communities.
- Hydro One Networks Inc. owns the transmission components/network.
- Hydro One Networks Inc. has rights either registered on land title or by legislation to operate the transmission network.

Property Rights: What Agreements do you require?

Contact Hydro One Real Estate Services at 1.888.231.6657 for the Real Estate Coordinator for your municipality. The Real Estate Coordinator arranges for Hydro One review of your proposal, advises of documentation and provides the Agreements.

Appendix D

Environmental Investigations

BT ENGINEERING

BT ENGINEERING
509 Talbot Street
London, ON N6A 2S5
519-672-2222

MEMORANDUM

TO:	File	**DATE:**	November 8, 2024
FROM:	Ryan Coady, Biologist, BT Engineering Inc.	**PROJECT #:**	21-003
PROJECT:	Kitchener Biehn Drive Extension Class Environmental Assessment		
SUBJECT:	Black Ash Tree Identification Update - October 23, 2024		

1.0 INTRODUCTION

The City of Kitchener (City) has retained BT Engineering Inc. (BTE) for the Class Environmental Assessment (EA) and Preliminary Design for the Biehn Drive extension project. The Biehn Drive Extension project in the City of Kitchener aims to extend the local road west and south through a portion of the Strasburg Creek Provincially Significant Wetland (PSW) to connect with Robert Ferrie Drive. A Municipal Class Environmental Assessment (MCEA) has been conducted, confirming the necessity of the project, and selecting a technically preferred alternative for the corridor alignment. The Study Area encompasses a wooded swamp within the PSW unit, surrounded by privately owned land slated for residential development. Recent biological surveys identified potential Black Ash (*Fraxinus nigra*) within the Study Area which are likely to be impacted by the proposed alignment for the Biehn Drive extension (**Figure 1**).

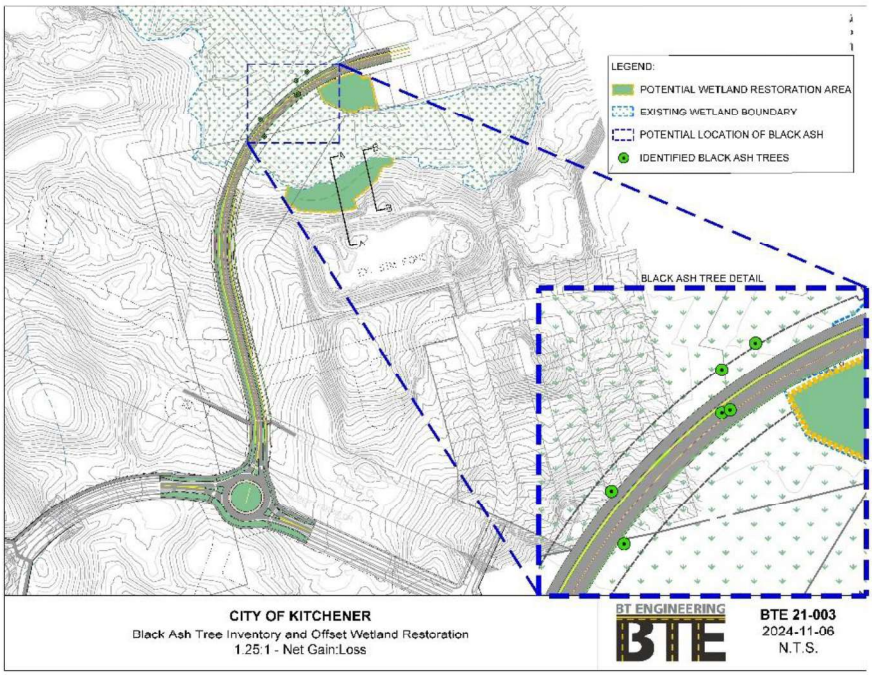

Figure 1: Study Area with Detail Design and Potential Black Ash Tree Locations

Endangered Species Act

The Endangered Species Act, 2007 (ESA) protections for Black Ash underwent a two-year temporary suspension upon its inclusion in the Species at Risk in Ontario (SARO) list in January 2022, according to Ontario Regulation 23/22. The purpose of this suspension was to create a strategy for the protection and recovery of Black Ash, considering the threat posed by the invasive Emerald Ash Borer (EAB - *Agrilus planipennis*). EAB is an invasive beetle that destroys over 99% of trees it infests. Once infested, trees usually succumb within two to three years, though they can die within months of the initial EAB detection.

Following the end of the temporary suspension on January 25, 2024, Ontario has implemented regulations that will set out how ESA protections will apply to Black Ash: O. Reg. 6/24: Limitations on Section 9 Prohibitions and O. Reg. 7/24: Amending O. Reg. 832/21 (Habitat). These regulations were filed on January 24, 2024, and they came into force on January 26, 2024. A summary is provided below.

Ontario's new regulations apply a targeted approach to Black Ash protection by restricting the application of species protection prohibitions outlined in subsection 9(1)(a) of the ESA to healthy Black Ash that appear to have survived exposure to the EAB. A healthy Black Ash is characterized by having survived EAB exposure, maintaining a healthy condition, and possessing a trunk diameter at breast height of at least 8 cm. In addition, ESA protection is limited to specific areas within the province that have witnessed notable EAB-caused mortality of Black Ash. These regions encompass various municipalities, counties, townships, and cities, including Kitchener in the region of Waterloo.

Ontario's habitat protection prohibitions outlined in subsection 10(1) of the ESA are applicable to a radial distance of 30 meters around Black Ash protected under clause 9(1)(a) of the ESA. This means activities within this radius would be subject to restrictions to protect the habitat of Black Ash. Certain existing conditional exemptions are available for eligible activities that impact Black Ash. Ontario Regulation 242/08 sets out the guidelines pertaining to these exemptions based on section 9(1)(a) and 10(1) of the ESA. To assist proponents with planning for their activities, the Ministry of the Environment, Conservation and Parks (MECP) has added Black Ash to the list of species under the eligible conditional exemptions within the registration system.

During the Kitchener Biehn Drive Extension Environmental Assessment (EA) & Preliminary Design project the Ontario governments temporary suspension on ESA protections for Black Ash was still on going (Ontario Regulation 230/08). During this time, proponents were not required to seek authorizations for activities that impact Black Ash and its habitat.

The City's Response to EAB

Upon the initial identification of EAB in the City, approximately 1,400 ash species were treated with TreeAzin®. TreeAzin is a botanical insecticide developed by the Canadian Forest Service and works by making trees less appealing to EAB, ultimately reducing damage from the reproductive process of the beetle. The goal of treatments from TreeAzin is to extend the trees life as long as possible, but the insecticide can't stop eventual decline and death from EAB. To reduce the risk posed by trees near properties affected by EAB the City has also removed approximately 5,000 trees as of 2022.

Within the group of trees initially treated with TreeAzin, the rapid decline of trees due to EAB was evident. By 2017 of the original 1,400 treated trees only 1,000 trees remained alive, and by the end of 2021, fewer than 300 trees were still alive and under treatment.

2.0 PURPOSE

The City requested that BTE provide an inventory of Black Ash on the proposed alignment and update the existing Environmental Impact Study (EIS).

A Site Reconnaissance along the Biehn Drive proposed alignment, as well as a 3 m strip adjacent to the east and west sides of the alignment was undertaken on December 11, 2023, and October 23, 2024, to identify Black Ash. The tree identification in December 2023 was conducted for BTE by an Ecologist in accordance with A Field Guide to Trees of Ontario - Royal Ontario Museum (ROM) (2023). Black Ash trees and saplings were identified based on bark, bud, and leaf scar patterns. In October 2024, a Biologist at BTE conducted a follow-up review of these trees, applying the same methodology as the previous site visit. This assessment also included additional leaf identification, made possible by the increased presence of foliage due to the time of year. Identification was further aided by new guidelines made available by the Ministry of Natural Resources (MNR) in June 2024, titled "How to Conduct a Health Assessment of Black Ash (*Fraxinus nigra*) for the Purposes of the Endangered Species Act, 2007 (ESA)". This Technical Memorandum provides a summary of the results of the Black Ash ID within the Study Area included in the Preliminary Design for the Biehn Drive extension.

3.0 RESULTS

In December 2023, approximately 21 candidate Black Ash trees and saplings were identified based on bark, bud, and leaf scar patterns. A full description, including location details and a representative photo of the candidate Black Ash trees, is provided in the December 11, 2023, Black Ash Identification Memo (**Attachment 1**).

On October 23, 2024, these trees were reviewed to confirm their identification and further assess their health. After re-evaluation of these trees, it was determined that several were misidentified and are not Black Ash. Trembling Aspen (*Populus tremuloides*), Sugar Maple (*Acer saccharum*) and American Elms (*Ulmus americana*) include some of the species which were mistakenly identified as Black Ash. Fifteen trees were therefore screened from further analysis.

Currently, six trees are considered potential Black Ash within the preferred road alignment, four were classified as potential Black Ash due to the absence of leaves, which limits identification, and two exhibit stronger potential based on distinct bark characteristics. Two representative photos of each of the remaining 6 trees can be found below (see **Photo 1** through **Photo 12**).

Latitude, longitude, and UTM coordinates for each tree are listed in **Table 1**.

If Alternative 1 proceeds, BTE recommends a comprehensive field assessment during the detail design phase to reassess the health and confirm the Black Ash status of trees over 8 cm within the Study Area. This assessment will inform any subsequent submissions to the Ministry of the Environment, Conservation and Parks for Species at Risk approvals.

Photo 1: Tree 3 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.

Photo 2: Tree 3 - Candidate Black Ash, October 23, 2024. Photo 1 of 2. The red circle identifies the potential Black Ash.

Photo 3: Tree 5 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.

Photo 4: Tree 5 - Candidate Black Ash, October 23, 2024. Photo 2 of 2.

Photo 5: Tree 10 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.

Photo 6: Tree 10 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.

Photo 7: Tree 12 - Candidate Black Ash, October 23, 2024. Photo 1 of 2. Note the flagging tape to indicate a black ash tree applied in 2023 was not present when this photo was taken.

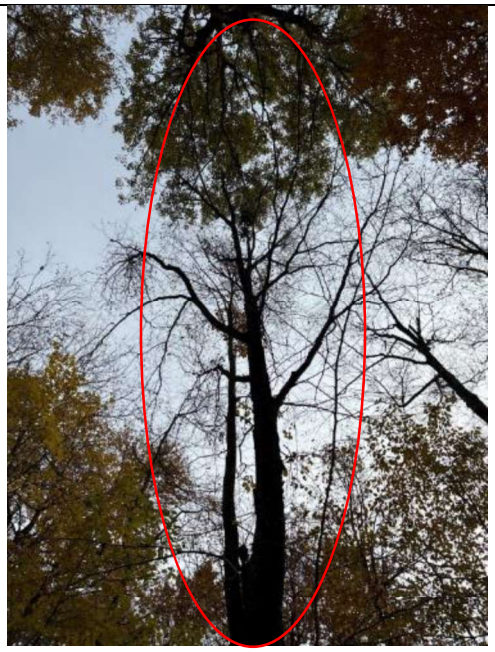

Photo 8: Tree 12 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.

Photo 9: Tree 18 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.

Photo 10: Tree 18 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.

Photo 11: Tree 19 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.

Photo 12: Tree 19 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.

Table 1: Potential Black Ash Tree Approximate Location Information

Identifier	Latitude	Longitude	UTM Zone	UTM Easting	UTM Northing
Tree 3	43.385545	-80.459164	17 T	543806.07	4803772.38
Tree 5	43.385469	-80.459297	17 T	543795.35	4803763.87
Tree 10	43.385124	-80.459732	17 T	543760.36	4803725.33
Tree 12	43.384972	-80.459684	17 T	543764.36	4803708.47
Tree 18	43.385345	-80.459298	17 T	543795.36	4803750.10
Tree 19	43.385353	-80.459265	17 T	543798.02	4803751.01

4.0 CLOSING

The Black Ash tree identification update, conducted on October 23, 2024, confirmed the presence of six candidate Black Ash along the proposed Biehn Drive alignment that met the identification criteria according to the Royal Ontario Museum's Tree Identification Guide and health assessments based on Ministry of Natural Resources (MNR) guidelines published in June 2024. As recommended, a comprehensive assessment during the detail design phase is advised to confirm species identification and assess tree health to ensure compliance with the *Endangered Species Act*. This information will also support the preparation of subsequent submissions to MECP regarding Species at Risk authorizations for the Biehn Drive extension project.

Prepared by:

Ryan Coady, M.Sc., Biologist
BT Engineering Inc.

Reviewed by:

Shawn R Taylor, M.Sc., R.P.Bio.
BT Engineering Inc.

Attachments: 1. Black Ash Tree Identification Memorandum - December 11, 2023

BT ENGINEERING
509 Talbot Street
London, ON N6A 2S5
519-672-2222

MEMORANDUM

TO:	Eric Riek, Project Manager, Development Engineering, City of Kitchener	**DATE:**	August 19, 2024
FROM:	Steve Taylor, CEO, BT Engineering Inc.	**PROJECT #:**	21-003
PROJECT:	Kitchener Biehn Drive Extension Class Environmental Assessment		
SUBJECT:	Wetland Restoration Candidate Site Evaluation and Conceptual Design		

1.0 INTRODUCTION

The City of Kitchener (City) retained BT Engineering Inc. (BTE) to complete a Class Environmental Assessment (EA) and Preliminary Design for a proposed extension of Biehn Drive. The Biehn Drive Extension in the City of Kitchener has been a long-standing part of the area's transportation plan that would extend the major collector road west and south through a portion of the Strasburg Creek Provincially Significant Wetland (PSW) to connect with Robert Ferrie Drive. A Municipal Class Environmental Assessment (MCEA) has been conducted, confirming the need for the project, and selecting a technically preferred alternative for the corridor alignment. The Study Area encompasses a forested swamp, one lobe within the larger PSW complex, surrounded by urban areas and privately owned land slated for residential development (**Figure 1**).

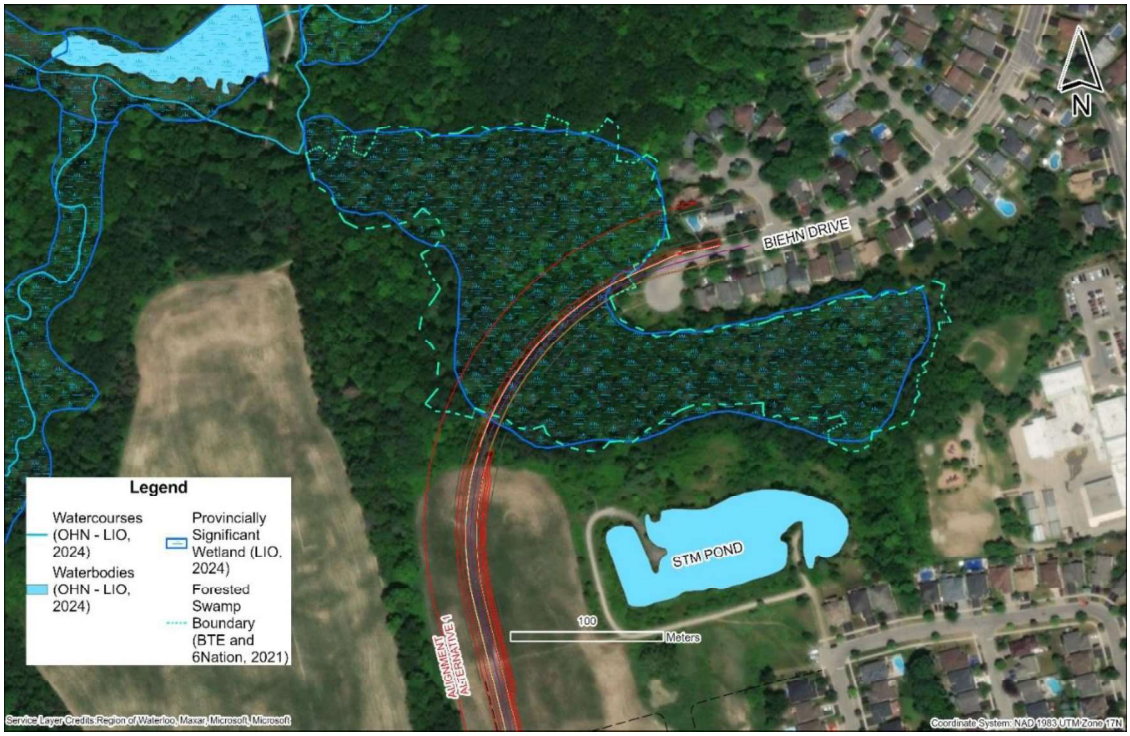

Figure 1: Study Area - Strasburg Creek Provincially Significant Wetland Complex

Through discussions with the Six Nations of the Grand River (**Attachment 4**) and holding three public consultations, one of the most frequent comments we received was regarding the concern over the removal of PSW. To compensate for this wetland loss, BTE is now exploring the creation of new wetland restoration areas, ensuring at least a 1:1 wetland replacement ratio, to meet the objective of "No net loss of habitat". A critical component is to identify sites that have access to a consistent, sustainable supply of flowing water, and that are contiguous with the existing wetlands, given the long-term plans for development of the area.

2.0 PURPOSE

On July 9, 2024, BTE's Senior and Junior biologists conducted a site reconnaissance to investigate potential areas for wetland restoration. The reconnaissance included areas along the Biehn Drive proposed alignment, as well as a 3 m strip adjacent to the east and west sides of the alignment. Adjacent lands, including the perimeter of the nearby Hearthwood Storm Water Management (SWM) wetland (**Figure 1**) were investigated. The results of the geotechnical investigations (Cambium, April 2024) along the road alignment were reviewed to aid in understanding the surrounding geophysical region, surface and subsurface soil structure, and the relative elevations of the water table below ground level (**Attachment 2**). These are important considerations in the siting and construction of offset wetlands as generally it may be said that if the hydraulics and soils are suitable, a wetland will come about naturally.

Specifically, following a high-level review of consultation input, digital terrain mapping, air photography, technical reports, the vegetation surveys (EIS - BTE, 2024), field experience and the discussions held during the public and agency reviews, BTE focussed on four potential areas for siting the offset wetlands. The review was not restricted to just the roadway alignment, but the overall wetland ecosystem south of Strasburg Creek, where enhancing the wetland through direct action would be the most beneficial to the ecosystem, but also actions removing hinderances to water and nutrient flows (dam, midden, placed soils and abandoned fences) can also be an effective restoration tool.

During the high-level review, BTE investigated where reductions in road construction impacts to the wetland could be made to avoid unnecessary loss of productive wetland. As a result, BTE staff have proposed adjusting the vertical road profile to reduce the lateral fill requirements, narrowing the roadway cross section where feasible and considering restrictive methods of construction through the wetland. BTE staff has determined that following these adjustments, roughly 2,690 m^2 of PSW will be permanently impacted. Loss of PSW is not a prohibited activity while undertaking transportation infrastructure in Ontario, as BTE has detailed elsewhere, but consultation has suggested that at least a 1:1 offset ratio be considered. Impacts to the wetland ecosystem resulting from the potential road construction, are detailed in the Environmental Impact Study report under separate cover; however, some of the mitigation recommendations found within the EIS may be implemented as part of the wetland restoration work identified here.

It is our objective therefore to identify one or more potential sites where offsetting wetlands may be constructed that are contiguous with the existing wetlands, are sustainable with a reliable water source and meet with the existing wetland type. The 'type', is a mineral forest swamp wetland of decomposed leaf and wood detritus over sand, supported by groundwater static below ground. These are typically seasonally wet wetlands, with little free water or pooling at the surface, that may be expected to be quite dry and fully shaded during the summer months, depending on local weather conditions, runoff from snow melt or event

flows and the density of the tree cover. Being under a canopy of deciduous trees in dense shade, the plant community is comprised of water-tolerant herbaceous plants (e.g. ferns, Jewelweed, Herb Robert) rather than aquatic macrophytes (e.g. Cattail, Bulrush, pond weeds, etc.) which depend on permanently standing or flowing water in full sunlight. The constructed wetlands should be of similar nature to match the ecological processes of the existing PSW and avoid the introduction of new plant species. Collection of native seeds, at the time of maturity, from the existing wetland is an appropriate part of the restoration strategy.

Four potential sites were chosen following our high-level review (**Figure 2**):

- Area 1 - removal of engineered granular fill placed on the west side of the alignment to create the *cul de sac* where Biehn Drive currently ends.
- Area 2a - east of Biehn Road below the Hearthwood Natural Area stormwater wetland management facility which discharges to the edge of the wetland; modifying the infiltration trench system (Stantec designed, 1999).
- Area 2b – an opening in the canopy west of the proposed Biehn Road extension below a future storm drainage outlet.
- Area 3 - an historic roadbed built along the property line west of the alignment, extending north to the Strasburg Mill Pond dam; an old roadbed with fence lines may persist that inhibits natural resource (flora, fauna, nutrients) flows through the wetland.

This Technical Memorandum provides a summary of the results of the site reconnaissance, preliminary interpretations of the physical environment as they relate to siting an offset wetland, or where other actions may be taken to benefit the wetland ecosystem and conceptual layouts of feasible wetland designs.

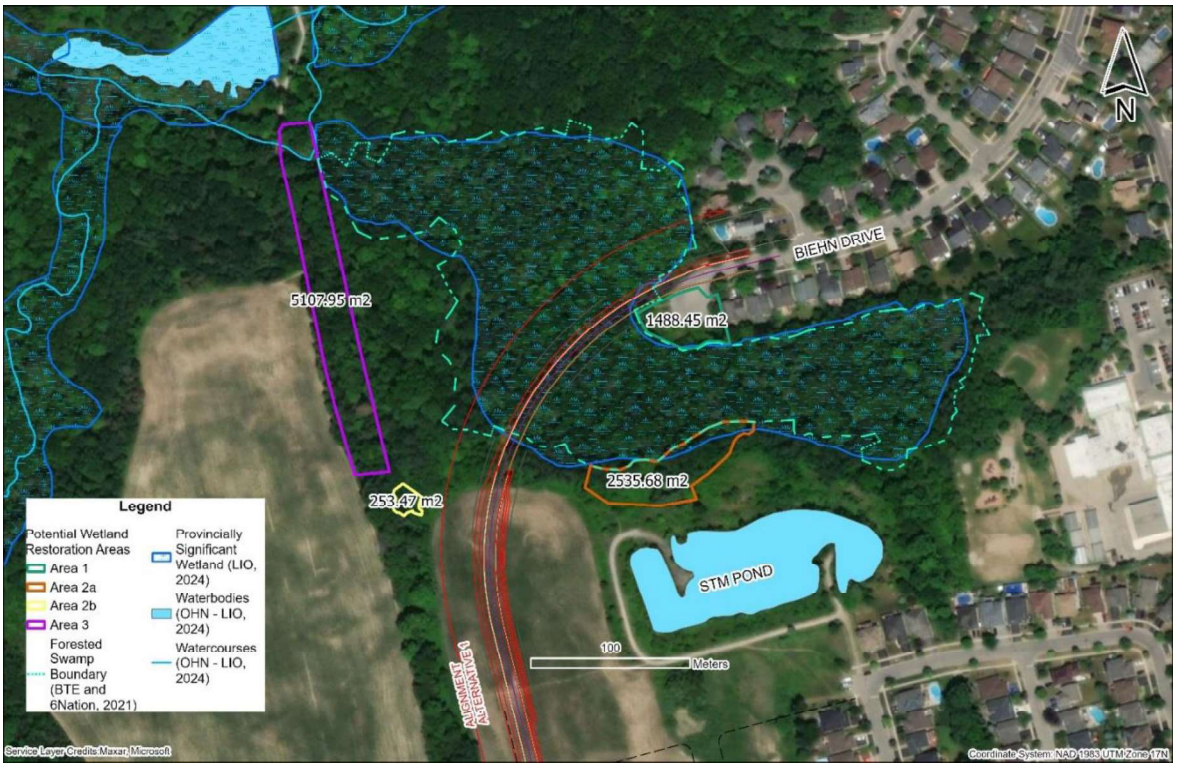

Figure 2: Potential Wetland Restoration Areas

3.0 OBSERVATIONS AND ASSESSMENT

A portion of the proposed alignment was cleared during the fall of 2023 to provide access for geotechnical boreholes. Additional clearing will be necessary for construction to proceed once the final alignment profile has been determined. Boreholes had also been advanced in 2022 along the edge of the wetland and have similar relevance herein. After a lengthy period of stabilization, ground water levels were measured in the observation wells on March 11, 2024 (Cambium, 2024). As a result of the recent clearing, the surficial soils are exposed and the availability of free water at the surface could be easily determined during the field investigations on July 9, 2024.

Area 1 - *Cul de Sac*

Borehole BH 202-23 within the *cul de sac* is most relevant to Area 1 investigations. It was advanced through asphalt into compacted fill, showing no underlying organic peat, which would have been stripped when the roadway was originally built. Not surprisingly, blow counts are relatively high (42 / 20) because of the compacted fill, but these rapidly reduce (<10) when encountering the underlying silty sand. Groundwater was observed at elevation 311.8, below the original ground elevation of 312.5, so roughly 0.7mbgs (meters below ground surface). The road profile is planned to match existing at 312.9 m with minimal side slopes.

There is no significant vegetation or other natural resources within this potential area that would be of concern if removed or altered. Google Earth™ images from 1985 show this area as former wetland, so the pre-existing hydraulic conditions are favourable for restoration of the wetland here. A sustainable water supply will result as the road is constructed, oil / grit separators are installed, and runoff is directed here. It is therefore feasible to create a forested swamp wetland system here with the removal of the asphalt and fill, replaced with suitable soil layers over a high-water table and suitable plantings. The area available is 1,488 m^2, however roughly 15-20% of this space will be for side slopes and to save existing trees around the outer margin. Where trees are removed, reuse of the root mass (e.g., root wads, tree tangles, inverted roots, mammal den) to create habitat for amphibians, small mammals including bats and birds will be used to diversify the habitat until the transplanted trees have grown in. Turtle species are not known to reside in this part of the wetland complex (ESR by BTE, 2024) so enhancement of their generalized habitat (open water) will not be an objective.

Due to the proximity of a residence immediately adjacent, gentle sloping with a denser vegetative screen / buffer zone is recommended along the northeast side. Consultation with the landowner of this residence is suggested to discuss the opportunities and constraints of living beside the constructed wetland ecosystem. For example, we would not want his or her grass clippings and yard waste dumped here to decompose, ultimately encroaching on the wetland, yet they may be helpful in anecdotal monitoring of the use of the area by wildlife.

Based on the expected proximity to the road, and adjacent residence, and the necessary grading of the slopes, we expect the net area of restored functional wetland at approximately 1,200 m^2 or 0.12 ha.

Area 2a - Hearthwood Stormwater Wetland Outlet

Borehole BH206-23 is the closest to Areas 2a and 2b, although BH 205-23, BH 204-23 and BH101-22 are also representative (Cambium, 2024). The boreholes in the previously undisturbed wetland indicate roughly 80

cm of peat overlying numerous layers of fine sand to silty sands consistent with the sand-dune nature of the Waterloo Sand Hills geophysical region. The drill blow counts in BH 206-23 are very low (<5) suggesting the subsurface soils are very loose and uncompacted. Initial groundwater readings were taken when advancing the boreholes, but the readings in March 2024 after a lengthy period of stabilization are expected to better reflect the actual field conditions today. Ferns and jewelweed are abundant indicating a water table close to the surface. No groundwater discharge (ie. springs) were observed. Groundwater ranged from 0.15 – 0.67 mbgs (Cambium Borehole logs: **Attachment 2**). The spring and early summer of 2024 has been consistently wet, so these levels may be somewhat higher than the norm, but there was very little free water at the ground surface on July 10 2024, other than where machinery had disturbed the surface. No standing water, springs or flowing watercourse was observed in this lobe of the wetland. Rather than pure peat as reported by Cambium, which is a derivation of decomposed sphagnum moss, the organic soils at the surface have been generated from deciduous leaf litter and wood mass decomposition, accumulated over many centuries. These soils will retain and hold water when saturated but will also readily dry out when water is not present. Shade nears 100% throughout most of the growing months, so the understory components of the wetland are relatively sporadic.

The Hearthwood Stormwater Management (SWM) wetland has a unique outlet design seldom seen elsewhere within Southern Ontario. The design shown in **Figure 3** (Stantec, 1999) was quite advanced at the time of implementation around the year 2001. Rather than a standard surface discharge from a concrete storm sewer outlet to a receiving watercourse, this design created an infiltration chamber comprised of a 'T' shaped 25 m perforated pipe lain within a 1X1m stone filled gabion basket, wrapped with geotextile and backfilled with the native sand. It is apparent, seeing it in the field today that the system has worked well, although it is slowly being overgrown with a few large Crack Willow trees and the flow spreader, intended to disperse high flow (Regional Storm) discharge, was circumvented long ago. A clear flow path to the north now exists that circumvents this barrier. **Photo 7** and **Photo 8** in **Attachment 1** show the area of exfiltration, and the swale where water has been coming to the surface for many years, effecting the pattern of herbaceous plant growth. **Photo 9** shows a detailed picture of a hole where the gabion stone can be seen below the rootzone of the swale.

The design by Stantec (**Attachment 5**) specifies the dimensions of the side slopes (5:1 around pond; backside 3:1 to swale), top elevation (217.7) and top width (4.0m) that control high event flows from exiting the pond. These must be maintained to sustain the integrity of the fill slopes, but a considerable volume of sand fill exists outside of these requirements, from an overly wide top width and shallow slopes down towards the forest edge and wetland. Several planted specimen trees (<10), specifically Black Walnut and White Pine grow on these slopes but can be relocated if necessary, using a tree-spade if staged well. We have walked the area to define the edge of the tree line and to describe a general area that could be utilized as a wetland.

Storm event water, up to the 5-year storm event, clarified by the stormwater wetland above, would be the water source through gravity flow with some modifications to the outlet chamber and infiltration trench. Small storm event flows will continue to infiltrate to the soils below the restored wetland and into the groundwater reserves. Larger event flows will overflow the infiltration trench once the underlying soils are saturated and be routed broadly over the wetland. Once the proposed wetland basin fills to capacity, water will flow through the existing tree line at specified locations managed to reduce the risk of erosion.

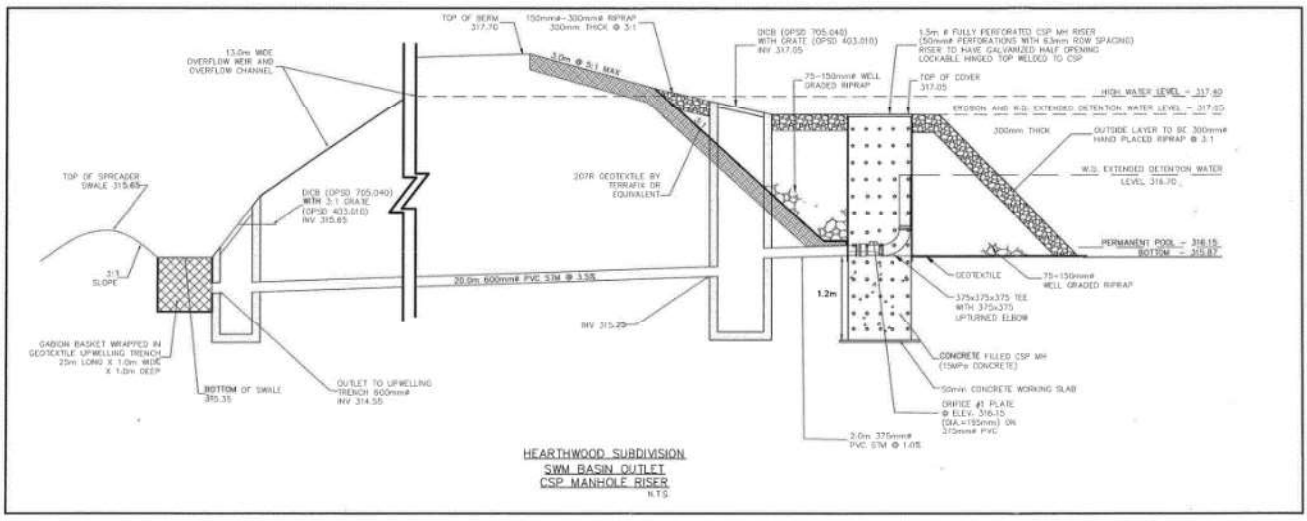

Figure 3: Hearthwood Subdivision SWM Basin Outlet Configuration
Design Credit: Stantec Consultants, 1999.

Given the underlying loose sandy soils of high porosity, creating a wetland with a water level at the same elevation as the swale (315.35) would require lining the constructed wetland basin with an impervious layer, either 1.0 m of clay or an artificial membrane (HDPE plastic, butylated rubber) to inhibit downward percolation of water. This would inevitably create a perched marsh wetland that would not function either hydraulically nor ecologically to be the same type as the existing wetland and may conflict with the objectives of offset compensation on a like-for-like 1:1 basis. Ideally, the offset wetland outside of the delineated wetland edge should closely match the elevations of the existing topography within the limits of the delineated wetland, and that runs parallel to the area disturbed for the SWM creation 20+ years ago. Based on the 1985 Google Earth™ image, which is unclear, it appears that although the SWM facility was not constructed on the wetland, it is likely that the excavated fill disposed along the north side was very close to impacting the wetland, or at a minimum into the forested edges.

The top of the infiltration chamber/bottom of the swale is currently at an elevation of 315.35, and the invert of the connecting pipe is 314.55, which sets the upper range of the wetland to avoid backwater effects restricting the outlet of the SWM outfall. Therefore, the upper water levels of the wetland grading should be restricted to below this range.

Reviewing available topography data from high resolution air photo interpretation, and survey data from the road alignment at 313.0 and considering the gradient of the valley fading south to north, we estimate the nearby wetland elevations are approximately 313.3 +/- 0.2 m. More accurate survey data will be required if this potential site moves forward to detailed design.

Field work identified open areas in the tree canopy that were explored to site a wetland. Several (4-5) large Crack Willow are rooted in the existing infiltration trench, reducing its' effectiveness, but evidence on the ground show that the trench remains operational despite this obstruction. The trees and roots should be removed in either case to ensure the free flow of water. Few other trees exist in this open area.

Concept Design Components - Area 2a

A plan view of the conceptual wetland is provided in **Attachment 3**, along with two sections. These are highly schematic drawings intended for discussion. They would be refined further during detailed design, and from input of the ongoing consultation with stakeholders. The conceptual area covers 2,543 m^2 of which approximately 5- 10% of the area would be required for side slope adjustments along the south side. Additional to this area is a 10 m wide band of existing trees that are to be maintained as a buffer to the native wetland. As portions of the native wetland were filled during the SWM pond construction, we do expect to expose native organic soils that are likely to be saturated and under anaerobic decomposition. Once exposed to oxygen again, they can be revitalized as part of the base wetland soil resources moving forward. Generally, during construction the soils will be graded relatively level, but not precisely, allowing for the natural lumps and mounds that make good wetland ground conditions. We therefore expect the finished wetland net area could be approximately 2,300 m^2 or 0.23 ha at a finished surface elevation of 313.3 +/- 0.2 m.

BTE suggests replacing the existing infiltration trench (which worked well) with one of our own design, that extends through the middle of the new wetland rather than along one side tight to the toe of slope. The working concept plans for a future water level elevation of 313.3 as this is slightly higher up the valley than at the road crossing and below the range noted above. The existing trench elevation would be lowered so the top of the pipe/ gabion is at 313.2 down the centre of the wetland, encouraging both exfiltration to the surface and infiltration to the groundwater reserves depending on the rate of gravity discharge from the upstream SWM facility. Lateral branching may be incorporated, like a reverse leaching tile bed, to disperse the flows over a wide area during moderate to high flow events. High flow events will be routed over the wetland and through the surrounding tree buffer. A hydraulic analysis will be required during detailed design to confirm the necessary flow rates originating in the SWM facility water source, modified for this purpose.

Organic soil stripped from the existing alignment could be reused here - 300 mm deep over the native sand base to meet the finished grade of 313.3; 100 mm over the infiltration trench. The objective is to have water upwelling into the wetland sporadically throughout the length, not flowing overland from a single point source as it is today. This arrangement may allow for much lower gradient slopes around the wetland edges - which ideally should be on the order of 12:1 or 8:1 max.

The wetland footprint would seek to reduce tree cutting within the existing edge that currently buffers the wetland. A 10 m vegetative buffer zone of existing pioneer tree species, measured from the existing wetland delineation, is proposed to help manage water and nutrients flowing between the restored and native wetlands. Water flows in the wetland should go predominantly south from the existing SWM outlet, rather than to the north, to maintain a longer flow path and keep the placed soils moist. A south outlet squeezed through the tree edge to retain the root mass will be configured not more than 300 mm width & depth. Outlet banks will be around 313.6 masl - so storm event water is initially held, then slowly discharged at a trickle, but release moderate intensity storm events at a greater rate of discharge. Higher storm event flows, occasionally released overland by the SWM pond, would require splitting the outflows going north (consistent along the existing flow path) as well as south through the tree buffer. A north outlet swale will be set higher around 313.7 +/- 0.2. If suitable, the existing flow path that is already well protected with stone, tree roots and

vegetation will continue to be used without modification. Hydraulic velocities, tractive forces, outlet dimensions and impact on valley flood lines would be determined during detailed design.

Optimally, creation of a wetland with standing water like a cattail marsh is not needed as that is not the character of the natural wetlands here, but as the soils settle, the planted vegetation matures, and animals manipulate the environment, the restored wetland can be expected to develop some shallow pools, hummocks, holes and naturally formed channels. These random occurrences help create biodiversity and should be allowed to form. Shallow pools within forested wetlands can over time become valuable habitats, known as vernal pools which are critically important for amphibians such as frogs, toads and salamanders. We have observed young frogs and toads here, but salamanders at the present time do not seem to have enough pooled-water habitat resources to occupy this lobe of the Strasburg Creek Wetland Complex.

Native organic soils, stripped from the road alignment would be reused as the primary soil source, and will contain a variable seed bank to emerge following construction. The success of this can be sporadic however, and preferably maturing seed of the native wetlands should be collected during the summer and fall seasons and then broadcast over the restored wetlands to supplement the tree plantings. Agency consultation has identified a local service providing seed collection and the type of restoration services that may be employed here; Kayanase Plant Nursery is located in the Grand River Watershed in Ohsweken Ontario, Southeast of Brantford. For seed collection, timing is critical, suggesting that a short-term, separate contract will need to be established which proceeds well before the principal infrastructure contract.

With an already mature, retained 10 m tree buffer along the northern edge and with long, shallow slopes on the southern edge, the wetland would be primarily exposed to morning shade and mid-day to afternoon sunlight until grown in. Native tree species that tolerate wet conditions, and thrive in sandy soils (e.g., Red Maple, Yellow Birch, American Beech, Black Walnut, Eastern Cottonwood, etc.) are to be considered for planting. Shrubs should be avoided in favour of trees, maintaining consistency with the type of wetland to be restored. As with Area 1, habitat structures can be created through the re-use of tree roots, large woody debris and stone. Above-ground habitat can be created for bird perching, insect-predator avoidance, small mammals (dens) as well as below-ground hibernaculum established for reptiles (snakes), some amphibians and ground nesting small mammals. Habitat structures will be located and specified during detailed design using previously implemented configurations.

A considerable volume of fill, of mixed origin will need to be removed from site for disposal or use elsewhere. The volumes, haul route and destination will be determined during detailed design.

Supporting Threatened Bat Species

A baseline species-level field survey of bat presence was conducted on the evening of August 14, 2024, to identify the species of bat present over the wetlands near the proposed alignment. Acoustic monitoring identified the following species: Big Brown Bat (*Eptesicus fuscus*), Eastern Red Bat (*Lasiurus borealis*), Hoary Bat *(Lasiurus cinereus*), Little Brown Myotis (*Myotis lucifugus*), Silver-haired Bat (*Lasionycteris noctivagans*) and Tri-Colored bat (*Perimyotis subflavus*). As of August 15, 2024, the Eastern Red Bat, Hoary Bat, and Silver-haired Bat are designated as Species at Risk (SAR) under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Additionally, the Tri-colored Bat and Little Brown Myotis are listed as Species at Risk in Ontario (SARO).

During field surveys several cavity trees were observed along the historic property line west of the proposed alignment. These will not be impacted by this infrastructure expansion work, however cavity trees and old buildings (e.g., barns, cabins, sheds) are well known to provide roosting habitat for several bat species. Many bat species are threatened or endangered due to loss of habitat and other issues. For example, most old barns and sheds in urbanizing areas are removed for space, safety or aesthetic reasons during land development, resulting in a loss of habitat for bats, barn swallows, rodents and snakes. The most significant component of disappearing bat habitat are large empty cavities that provide maternal roosting spaces as they nurse their young.

As restored wetland 2a will be relatively isolated from human interaction and away from the new roadway, a bat condo structure similar to that shown in **Figure 4** is proposed for construction at the southeastern corner of the wetland, along the edge of the treeline. Bat condos are capable of providing roosting spaces for up to 6,000 individuals and are considered appropriate for community scale projects such as a wetland restoration. Depending on the location, the structure may be partially shaded (< 6 hrs/day) yet with open flyways over the restored wetland and the stormwater wetland above which should provide optimal forage habitat for bats. The structures may also provide habitat for barn swallows and other species that prefer old buildings to nest. Owls also like to roost in cavities, but to avoid predation of the bats, the owls are excluded from entry. Protection from domestic cats and vandalism is also a factor in the design and siting. Wetland 2a is close to open water, but also well away from ambient light sources, both important considerations in siting bat habitats. The bats are not expected to overwinter in the bat condo, but in a Region where natural caves may not be readily available; by insulating the bat condo with a double outer wall and suitable organic fibre filling, this structure may provide a new overwintering site, however this factor should be considered experimental and not a well researched expectation.

Figure 4: Maternal Bat Roosting (Bat Condo) Built at the Rouge River National Park

Area 2b - North Outlet Swale

This area was walked by staff biologists on July 9. Area 2b has a small area, about 250 sq m east of the property line which is a shrub thicket - so not a highly valued vegetation unit. A natural swale runs along the property line here for a short distance and can be used for low level treatment of drainage. A well used, broad (unmanaged) pathway runs on the east side. Area 2b is perched well above the wetland elevation, and being so small, high and dry, the area could not be effectively graded for use as decent sized wetland offset. On the other side of the pathway there is a very nice stand of semi-mature maple trees, densely spaced; preferably this should be retained as part of the existing wetland complex and not be further disturbed.

Area 2b therefore is not a good potential site for an offset wetland, but if looking for a runoff destination, it could be built as a bioremediation swale/rain garden, or a vegetated infiltration gallery to treat the road runoff with spill to the existing swale. Any of these options are feasible here.

Area 3 - Historic Road Wetland Rehabilitation

Area 3 we were looking at because, from the archaeology documents, it appeared there may be an old farm laneway, with a remnant roadbed running through the wetland that could be rehabilitated. Often the old corduroy roads cross wetlands, with old fences, barbed wire and trash middens along the way. A cleanup and rehabilitation of these features can sometimes be used in *lieu* of constructed works. We walked this route, but it is thickly treed, very biodiverse and we could find nothing to warrant further interest.

4.0 MONITORING

A three-year post-construction monitoring program is recommended for implementation. The monitoring program is to start following a one-year grow-in period to allow the seeded areas and salvage wetland soils the opportunity to begin the process of recovery before a critical assessment is made. Many of the planted trees will be deciduous, which are difficult to establish, particularly in wet organic soils. A mandatory replanting / overplanting schedule should be included in the detailed design to optimise the wetland area coverage, and so that there is more than one generation of plant materials to improve survival in case of drought / excessive wet conditions. Up to 20 % of the plant material may need replanting annually during the monitoring period, with the rates being determined by the results of the monitoring.

Monitoring of the habitat structures created can be more challenging as they may be below ground (ie. herpetofauna hibernaculum) or are only used at night (ie. fox den). Monitoring the bat species using the bat condo, best done around sunset, will chart the population using the structure during the month of June when roosting is most prevalent. Mid-winter surveys may also be warranted if the structure is insulated and occupied.

Monitoring reports will be due by December 31st of each year, and pending disclosure rules under the Endangered Species Act, will be made public on the City website and reported to https://batwatch.ca/.

5.0 CLOSING

Four potential sites were reviewed for construction of offsetting wetlands that could be created to closely match the forested swamp lobe encountered in this part of the Strasburg Creek Provincially Significant Wetland Complex. A primary requirement is a consistent supply of water, which will exist for three of the potential sites. Two of the potential sites show good promise and we have conceptualized designs that seem feasible and able to offset the wetland impacts of the Biehn Drive extension. Area 1 and Area 2a is therefore recommended to move forward to preliminary and detailed design as the infrastructure project proceeds.

The restoration of Area 1 will net approximately 1,200 m^2 after accounting for slope losses and tree preservation. The restoration of Area 2a will net approximately 2,300 m^2 outside of the retained existing forest edge. These areas will be further refined during detailed design. Together these two areas net approximately 3,500 m^2 of restored wetlands, more than offsetting the loss of 2,690 m^2 of Provincially Significant Wetlands, resulting in a finished gain : loss ratio of roughly 1.3 : 1. The surplus proposed herein is

intended to recover a small amount of the wetland losses that have occurred historically in the region as a result of land and infrastructure development. By adding in key habitat structures such as herptile hibernaculum, woody perches and a bat maternal roosting house the overall objectives of mitigating the impacts caused by the Trunk Sewer and Biehn Drive roadway expansion as it crosses the Strasburg Creek PSW would be effectively met or exceeded.

A three-year post-implementation monitoring program is recommended, beginning one full year after construction has ended to allow for a grow-in period. Annual reporting is recommended, to assess the success of the wetland plants, hydraulic functions, habitat features, natural plant regeneration. The use of the bat maternal roosting structure is an additional element that the monitoring program should emphasize.

Prepared by:

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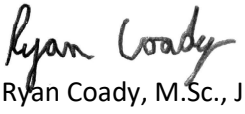
Reviewed by:



Ryan Coady, M.Sc., Junior Biologist
BT Engineering Inc.

Attachments*:*

1. Wetland Restoration Photographic Record
2. Geotechnical Investigation, Borehole Locations and Bore Logs (Cambium, 2024)
3. Conceptual Layout Drawings: Area 2a Plan and Sections
4. Meeting Notes: Consultation with Six Nations General Wildlife Trust Group (July 4, 2024, Zoom Call)
5. Two Schematic Drawings of Hearthwood SWM Wetland Layout (Stantec, 1999)

List of References:

Bat Watch Canada, Undated. Citizen counts of bat communities within Canada and United States. Accessed Aug 7, 2024. https://batwatch.ca/.

Cambium, March 14 2024. Geotechnical Investigation, Proposed Trunk Sewer, Biehn Drive South Extension, Kitchener. March 14, 2024.

City of Kitchener, 2024. Scoped Environmental Impact Study (EIS) Report, Biehn Drive Municipal Class Environmental Assessment. BT Engineering, March 2024.

Community Bat Programs of B.C., 2017. Building Homes for Bats.

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Parks Canada, Undated. Helping Bats Find a Home. https://parks.canada.ca/nature/science/especes-species/domicile-home. Accessed July 16, 2024.

Stantec, 1999. Design drawings; Hearthwood Stormwater Wetland, City of Kitchener; Plan view grading plan and layout of outlet control schematic.

Zammitt, A.E and Tupman, K. M., 2019. Spatial relationships between key natural heritage and hydrological features within the Grand River Watershed. Grand River Conservation Authority Technical Memorandum, Sept 13, 2019.

Attachment 1

Wetland Restoration Photographic Record

BT ENGINEERING

Wetland Restoration Photo Record

Photo 1: Hearthwood Stormwater Wetland Main Embayment

Photo 2: Hearthwood Stormwater Wetland - Outlet Point

Photo 3: Hearthwood Stormwater Wetland - Main Embayment Looking South from Split

Photo 4: Hearthwood Stormwater Wetland - Main Embayment Looking West from Outlet

Wetland Restoration Photo Record

Photo 5: Hearthwood Stormwater Wetland - Main Embayment Looking Northwest

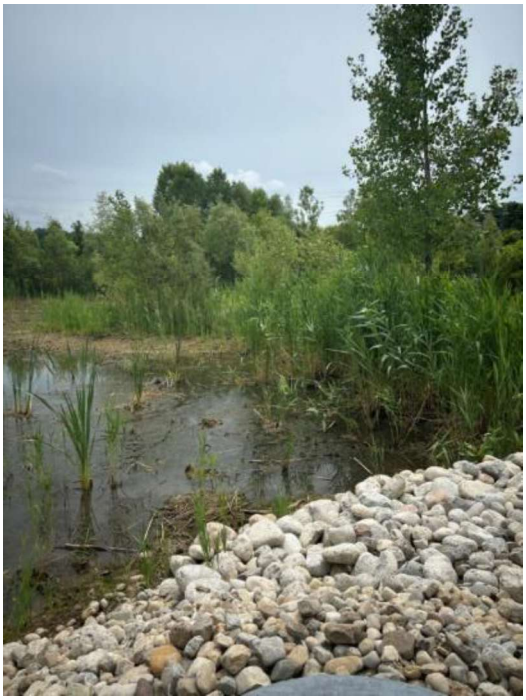

Photo 6: Hearthwood Stormwater Wetland Outlet - Signs of Excessive Debris Collection Being Removed

Photo 7: Hearthwood SWM Infiltration Trench - Underlies the Darker Patches

Photo 8: Hearthwood SWM Infiltration Trench - Flow Spreader on Right Side

Wetland Restoration Photo Record

Photo 9: Hearthwood SWM Infiltration Trench - Gabion Stone can be seen Through Hole

Photo 10:Hearthwood SWM Infiltration Trench - Four Large Crack Willows Rooted in Gabion; Flow Path Around the Spreader

Photo 11: Fill Slope Mounded Up Outside of SWM Pond

Photo 12: White Pines and Black Walnut that could be Tree Spaded and Replanted

Wetland Restoration Photo Record

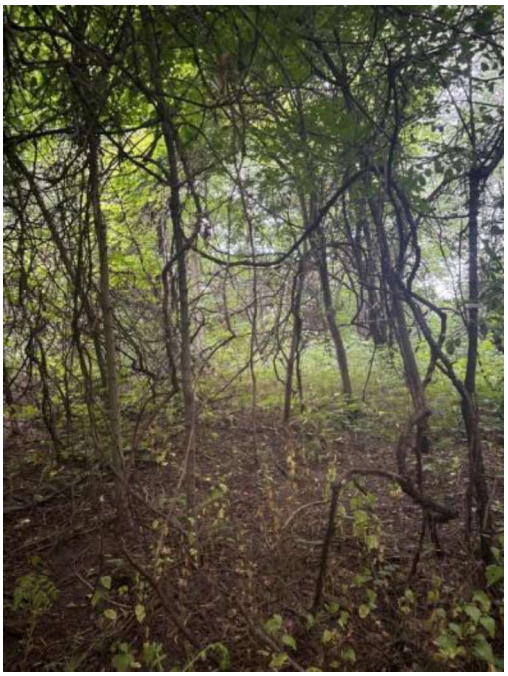

Photo 13: Area 2b Shrub Tangle - Small 250 m^2 Area of Opportunity for LID Water Treatment

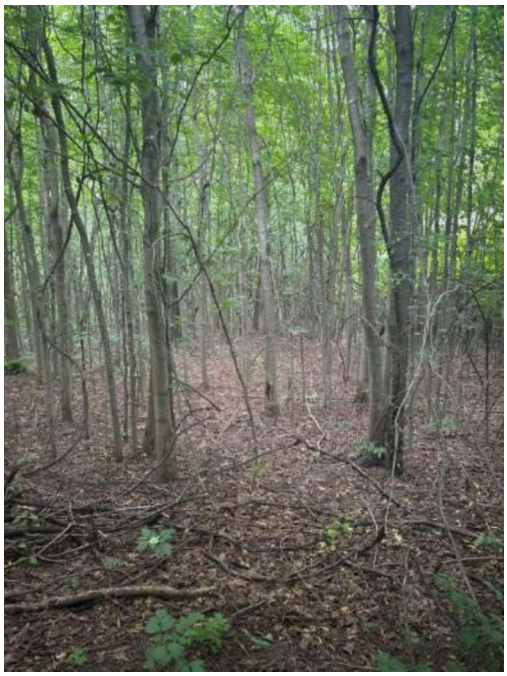

Photo 14: Dense Stand of Semi-Mature Maple Trees - Avoid Development

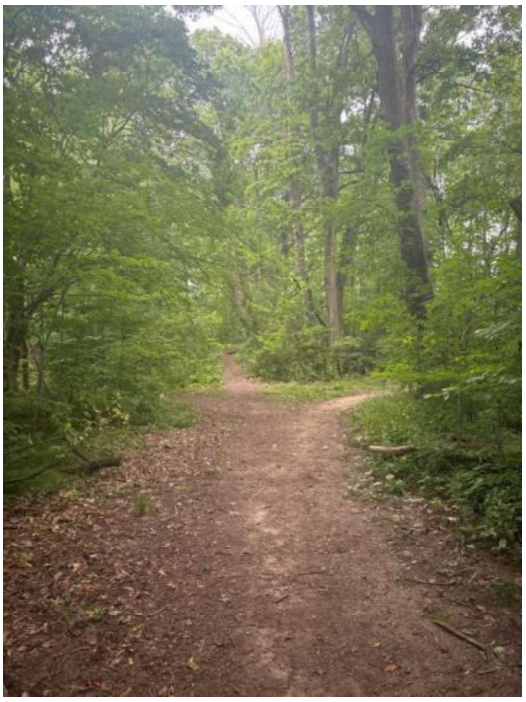

Photo 15: Natural Unmanaged Trail

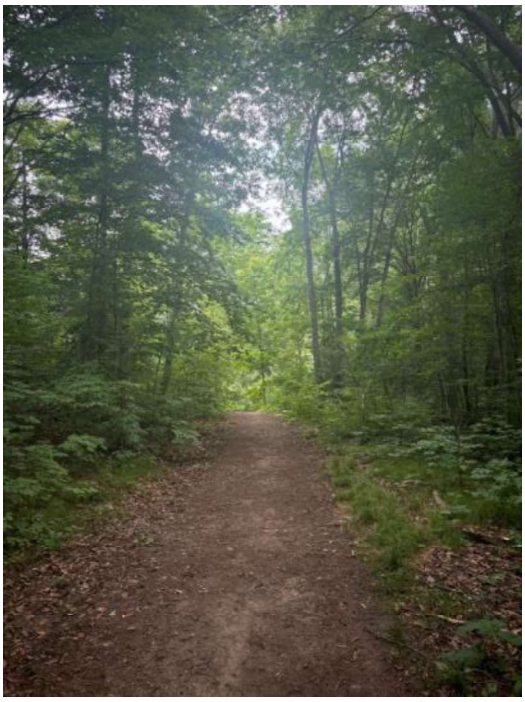

Photo 16: Natural Unmanaged Trail

Attachment 2

Geotechnical Investigation, Borehole Locations and Bore Logs
(Cambium, 2024)

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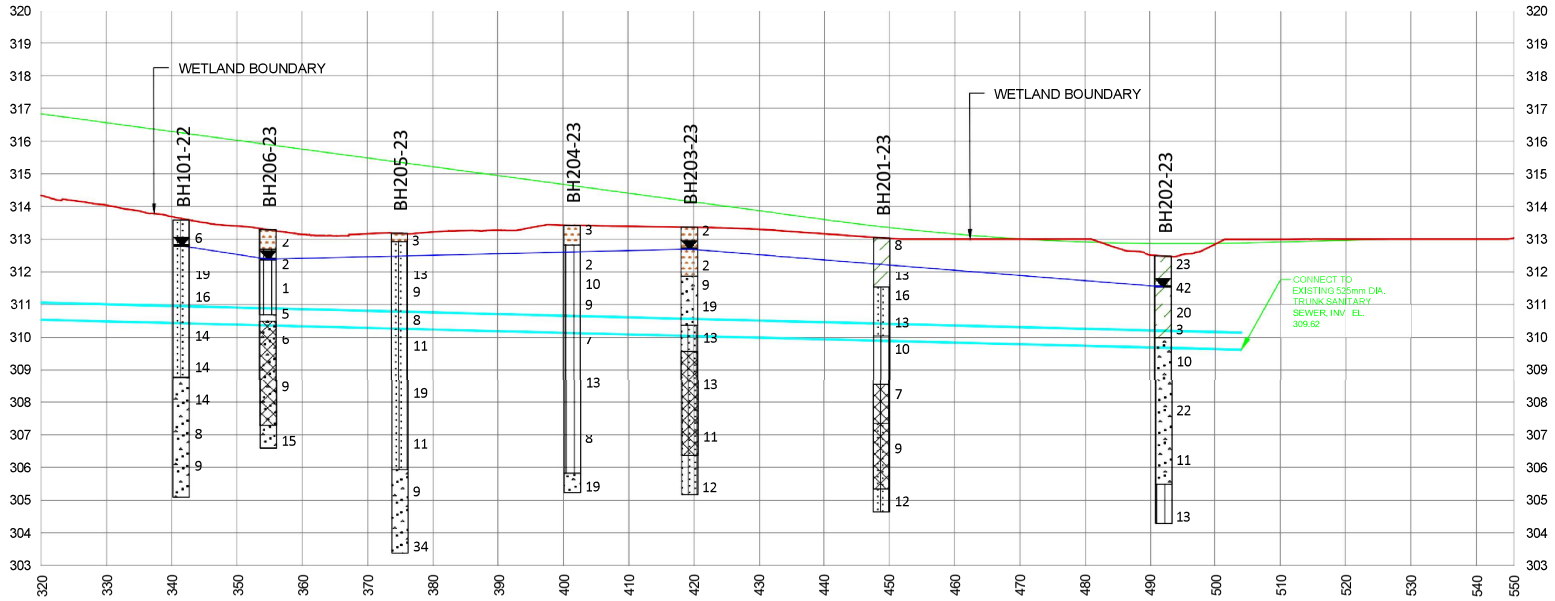
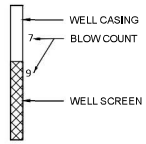


GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

LEGEND

- WATER LEVEL INDICATOR
- FILL
- PEAT
- SILT
- SILTY SAND
- SAND
- WATER LEVEL
- GROUND SURFACE
- PROPOSED SURFACE GRADING
- PROPOSED SEWER



Notes:
1. Survey completed by Cambium Inc. December 6, 2023
2. Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.

194 Sophia Street
Peterborough, Ontario, K9H 1E5
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www.cambium-inc.com

PROFILE CROSS SECTION

Project No.:	Date:
11969-002	December 2023
	Rev.:
Horizontal Scale:	Vertical Scale:
N/A	N/A
Drawn By:	Checked By:
MAT	ZL

Figure: 3

Attachment 3

Conceptual Layout Drawings: Area 2a Plan and Sections

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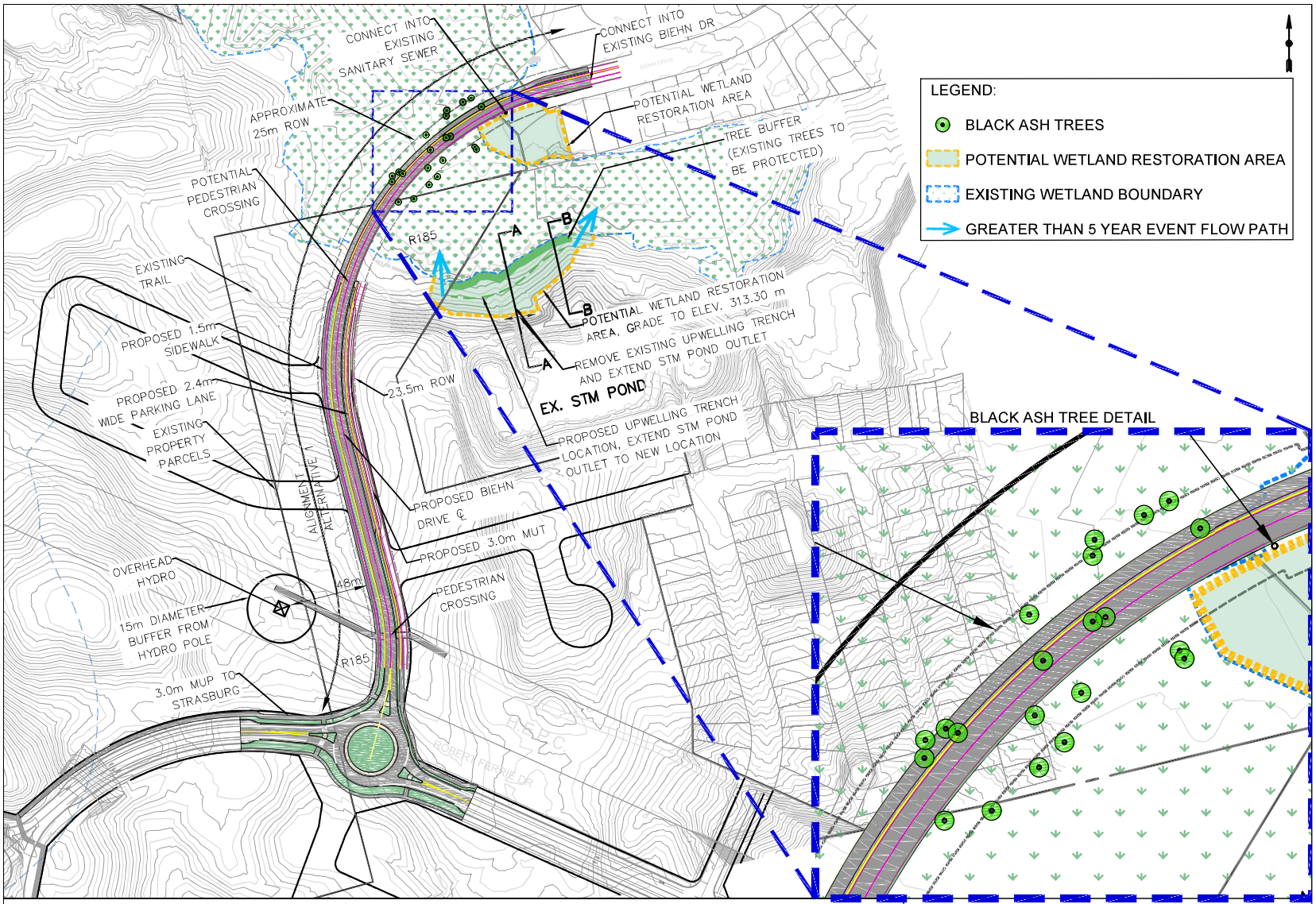


CITY OF KITCHENER

Black Ash Tree Inventory and Offset Wetland Restoration

1.25:1 - Net Gain:Loss

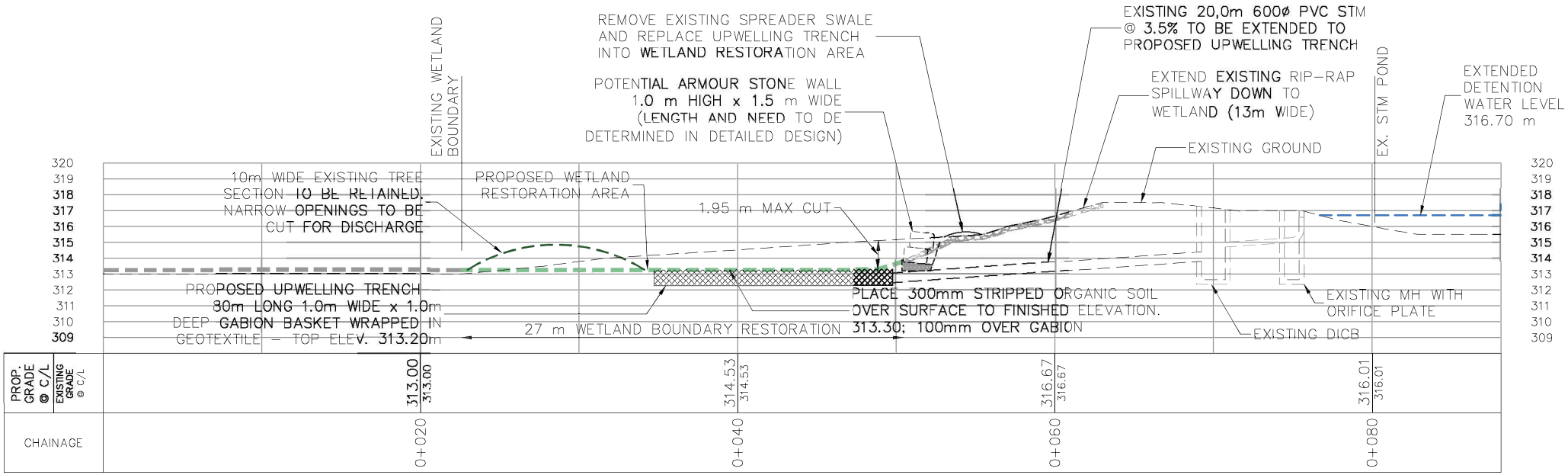
BT ENGINEERING

BTE 21-003

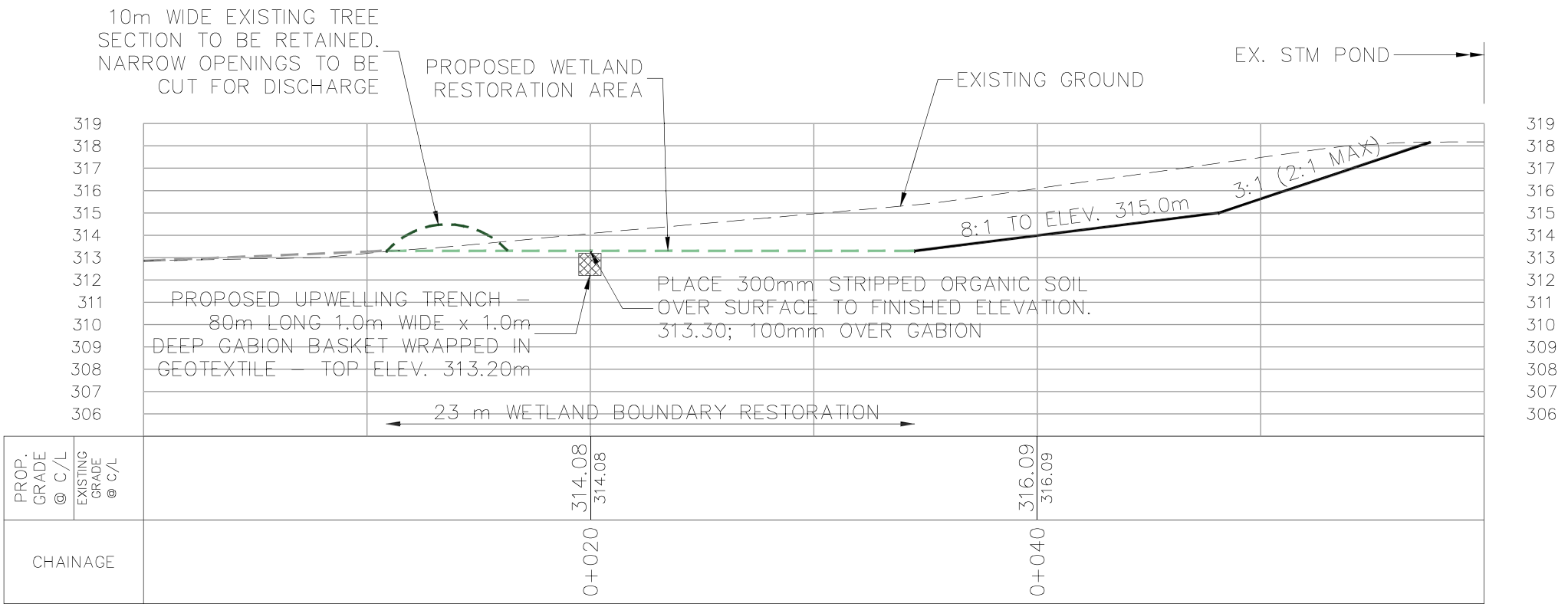
2024-07-29

N.T.S.

SECTION A–A


EXISTING WETLAND BOUNDARY
REMOVE EXISTING SPREADER SWALE AND REPLACE UPWELLING TRENCH INTO WETLAND RESTORATION AREA
POTENTIAL ARMOUR STONE WALL 1.0 m HIGH x 1.5 m WIDE (LENGTH AND NEED TO DE DETERMINED IN DETAILED DESIGN)
EXISTING 20,0m 600ø PVC STM @ 3.5% TO BE EXTENDED TO PROPOSED UPWELLING TRENCH
EXTEND EXISTING RIP-RAP SPILLWAY DOWN TO WETLAND (13m WIDE)
EXISTING GROUND
EX. STM POND
EXTENDED DETENTION WATER LEVEL 316.70 m
10m WIDE EXISTING TREE SECTION TO BE RETAINED. NARROW OPENINGS TO BE CUT FOR DISCHARGE
PROPOSED WETLAND RESTORATION AREA
1.95 m MAX CUT
PROPOSED UPWELLING TRENCH 30m LONG 1.0m WIDE x 1.0m DEEP GABION BASKET WRAPPED IN GEOTEXTILE – TOP ELEV. 313.20m
27 m WETLAND BOUNDARY RESTORATION
PLACE 300mm STRIPPED ORGANIC SOIL OVER SURFACE TO FINISHED ELEVATION. 313.30; 100mm OVER GABION
EXISTING MH WITH ORIFICE PLATE
EXISTING DICB
320
319
318
317
316
315
314
313
312
311
310
309
PROP. GRADE @ C/L
EXISTING GRADE @ C/L
313.00
313.00
314.53
314.53
316.67
316.67
316.01
316.01
CHAINAGE
0+020
0+040
0+060
0+080

SECTION B–B


10m WIDE EXISTING TREE SECTION TO BE RETAINED. NARROW OPENINGS TO BE CUT FOR DISCHARGE
PROPOSED WETLAND RESTORATION AREA
EXISTING GROUND
EX. STM POND
8:1 TO ELEV. 315.0m
3:1 (2:1 MAX)
PROPOSED UPWELLING TRENCH – 80m LONG 1.0m WIDE x 1.0m DEEP GABION BASKET WRAPPED IN GEOTEXTILE – TOP ELEV. 313.20m
PLACE 300mm STRIPPED ORGANIC SOIL OVER SURFACE TO FINISHED ELEVATION. 313.30; 100mm OVER GABION
23 m WETLAND BOUNDARY RESTORATION
319
318
317
316
315
314
313
312
311
310
309
308
307
306
PROP. GRADE @ C/L
EXISTING GRADE @ C/L
314.08
314.08
316.09
316.09
CHAINAGE
0+020
0+040

Attachment 4

Meeting Notes: Consultation with Six Nations General Wildlife Trust Group (July 4, 2024, Zoom Call)

BT ENGINEERING

MEETING NOTES

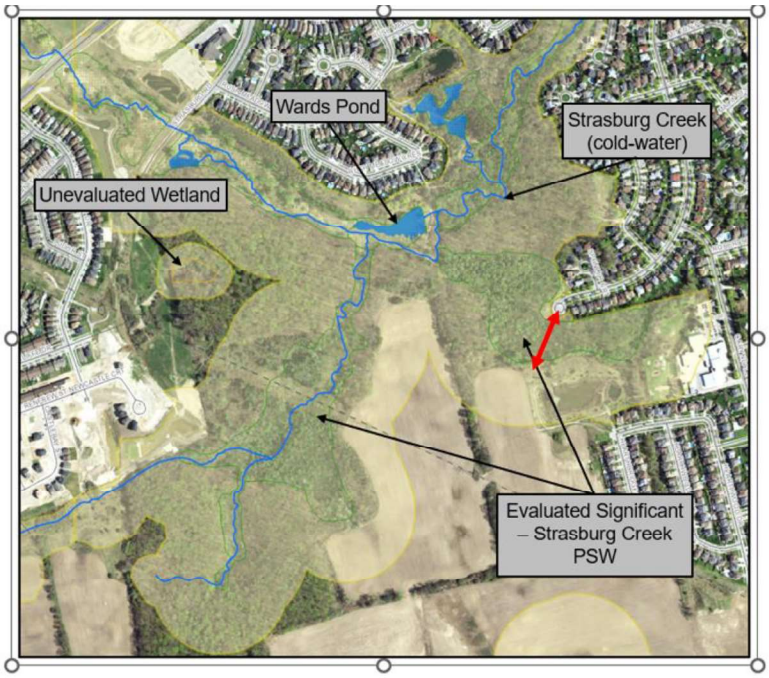
BT ENGINEERING BTE	**Project Name:** Biehn Drive and Sanitary Sewer Extension - Class Environmental Assessment	**Project Number:** 21-003

TYPE/NUMBER:	Six Nations of the Grand River (SNGR) Meeting No. 3
DATE:	July 4, 2024
LOCATION/TIME:	Zoom Virtual Meeting, 9:00 am
PURPOSE:	Public Information Centre (PIC) #3 Meeting

NAME	COMPANY	PROJECT ROLE
PRESENT:		
Peter Graham	Six Nations of the Grand River (SNGR)	Consultation Supervisor
Lauren Jones	SNGR	Manager Wildlife Institute Office
Lauren Vanderlingen	SNGR	Wildlife and Stewardship Office Technician
Daylon Gee	SNGR	Land Use Technician
Dawn Russell	SNGR	Consultation Administrative
Steve Taylor	BT Engineering Inc. (BTE)	Project Manager
Kristine Dimoff	BTE	Environmental Planner
Stephen Brook	BTE	Traffic Lead
Ryan Coady	BTE	Terrestrial
Shawn Taylor	BTE	Senior Biologist
Sonia Fiorini	BTE	Environmental Planner
DISTRIBUTION:		
All Present		

Item		Action
1.0	**Introductions and Project Update**	
1.1	The consultant provided an overview presentation of the history of the EA and environmental elements. See **Attachment 1** for the presentation. It was explained that the land over which the project is located is privately held. Environmental studies have been completed by the developers' consultants. These studies have been reviewed and utilized by BTE but are the property of the developers. Both archaeological and natural environmental studies were completed and are illustrated in the presentation. The archaeological studies have been shared with Six Nations. WSP completed the detailed Environmental Impact Statement (EIS) and BTE will request permission for it to be shared with the Six Nations.	BTE BTE
2.0	**Environmental**	

Item		Action
2.1	The presentation illustrated the detailed EIS survey by WSP of the natural environment in the Provincially Significant Woodlot (PSW) including: • Vegetation and Woodlots • Wildlife survey From the EIS detailed surveys Black Ash was identified as a Threatened species within the Study Area. In January 2025 the Black Ash was elevated to an Endangered Species. BTE have completed more detailed surveys of the Black Ash and have presented these findings at the third PCC. The existing Stormwater management pond to the east of the new road alignment treats stormwater from adjacent subdivisions before	
2.2	With respect to the sensitivity of crossing a Provincially Significant Wetland the final recommendations included several mitigation measures including: • an alignment as close to the eastern boundary of the PSW as possible, • narrowing the road design within the PSW • providing a wildlife passage under the road • using micro-tunnelling of municipal services to avoid changes to the water table • innovative road design which will float the new road on top of the existing wetland soils using geotextile and geogrid. • Restoration of wetland The design will be a demonstration project for environmental engineering best practices. The Provincial Policy Statement precludes development within PSW's but for road and utility infrastructure can be constructed in a PSW were justified by an Environmental Assessment. One of the most significant changes that has occurred over the last 30 years is to change the alignment of the road crossing from preceding directly westerly from Biehn Drive across the larger wetland to Strasburg Road. It has been modified to cross the most eastern boundary possible as illustrated below in red. Doing so avoids the large centroid of the wetland complex	

Item		Action
		
2.3	The profile of the new road is proposed to be elevated to be above the ground water to avoid influencing the water table near adjacent houses. Further mitigation for the road extension will be the removal of the existing cul-de-sac to reinstate PSW in this area. We are also investigating wetland restoration/creation opportunities to balance the wetland loss from the project.	
2.4	Mr. Taylor explained that the need for this project is two-fold including providing water and sanitary connections for development areas to the south and for transportation linkages for the community. The trigger for the development is the Province's Places to Grow Act, which mandates levels of population and employment (2051 plan). A major development area in the City of Kitchener is south of this area.	
3.0	**Evaluation of Alternatives**	
3.1	The City completed a Transportation Master Plan (TMP) identifying this project. The current EA is completing the remaining phases of the Class EA. This includes identification of alternatives, evaluation of alternatives and public, stakeholder and rights holder consultation. The technical recommendation is for Alternative 1 with mitigation.	
4.0	**Discussions**	
4.1	The Six Nations requested a copy of the EIS	

Item		Action
4.2	It was agreed that the Draft Environmental Study Report (ESR) can be circulated for their review. The draft is planned to be completed in 2025.	
4.3	The Provincial Policy Statement (PPS) exempts a road project which is defined as Infrastructure, not Development.	
4.4	Black Ash Trees have been treated with insecticide within the City but are in decline. The Emerald Ash Bore is infesting trees in the City. Lauren encourages the data to be inclusive with Black Ash Tree, as trees [under 8cm diameter at breast height (DBH)] can be the key to reestablish the Black Ash Trees. BTE will monitor all Black Ash Trees (through growth) and will include data in the ESR and commitments for future monitoring.	BTE
4.5	Lauren suggested that Six Nations has a resource company– Kayanase (on reserve restoration company and greenhouse). They can help with the wetland restoration including providing planting material or seed harvesting /seed capturing. The use of this company can help to build relationship and trust with Six Nations)	
4.6	Lauren asked if the road structure will be above the native peat. Will the ESR document how the road would handle flooding. How flooding will impact the soil. Steve answered that the road profile is elevated to both allow a wildlife crossing culvert and to be above the wetland. Based on it being above the wetland surface the road will not flood. The design is predicated on returning rainwater back to the wetland (Low Impact Design (LID) principles). The wildlife culvert would equalize the water elevation on both sides of the road in any substantial rainfall event.	BTE
4.7	Lauren requested a bat assessment (provincially the Little Brown Myotis bat is designated). Four federally listed species to be confirmed if in the area. Encouraging species specific mitigation.	BTE
4.8	Request wildlife fencing to direct species to the wildlife crossing. It should be maintained regularly. Or usage of signage seasonally for when wildlife crossings are present.	
5.0	**Mitigation**	
5.1	Six Nation's desired compensation requirements: a. 10:1 tree replacement b. 1:1 wetland replacement (on-site) c. 2:1 wetland replacement (off-site)	

Item		Action
	It was confirmed that the restoration of the wetland from the cul-de-sac will not achieve the 1:1 replacement. Further areas will be investigated and added if possible. This area is the first restoration area to be considered as it was formerly wetland.	
5.2	Lauren, asking about survey's done in the area, Ecological Land Classification (ELC). The EIS to be provided if permission is obtained. Lauren commented, putting a road through a PSW there is the impact from winter maintenance. Can that stretch of road not be salted, or seasonal closures. Can the effect be monitored pre and post construction. Steve said there are different approaches to reducing salt and there is no known means to remove the road salt from the runoff. The most practical means are use of sand (which has a low percentage of salt to remove moisture) or "pre-wetting the road" to reduce the volume of salt applied. Those are the two common approaches. As a collector street the use of salt is low. These alternate approaches to winter maintenance will be noted in the ESR.	BTE
6.0	**Next Steps**	
	• Refinements to Technically Preferred Plan will be investigated based on input from PIC 3. This will include consideration of the feasibility of secondary areas for wetland restoration • Document the recommendations in the ESR • 30 Day public review • EA Clearance to proceed with detail design	BTE

Prepared by:

Sonia Fiorini
Environmental Planner

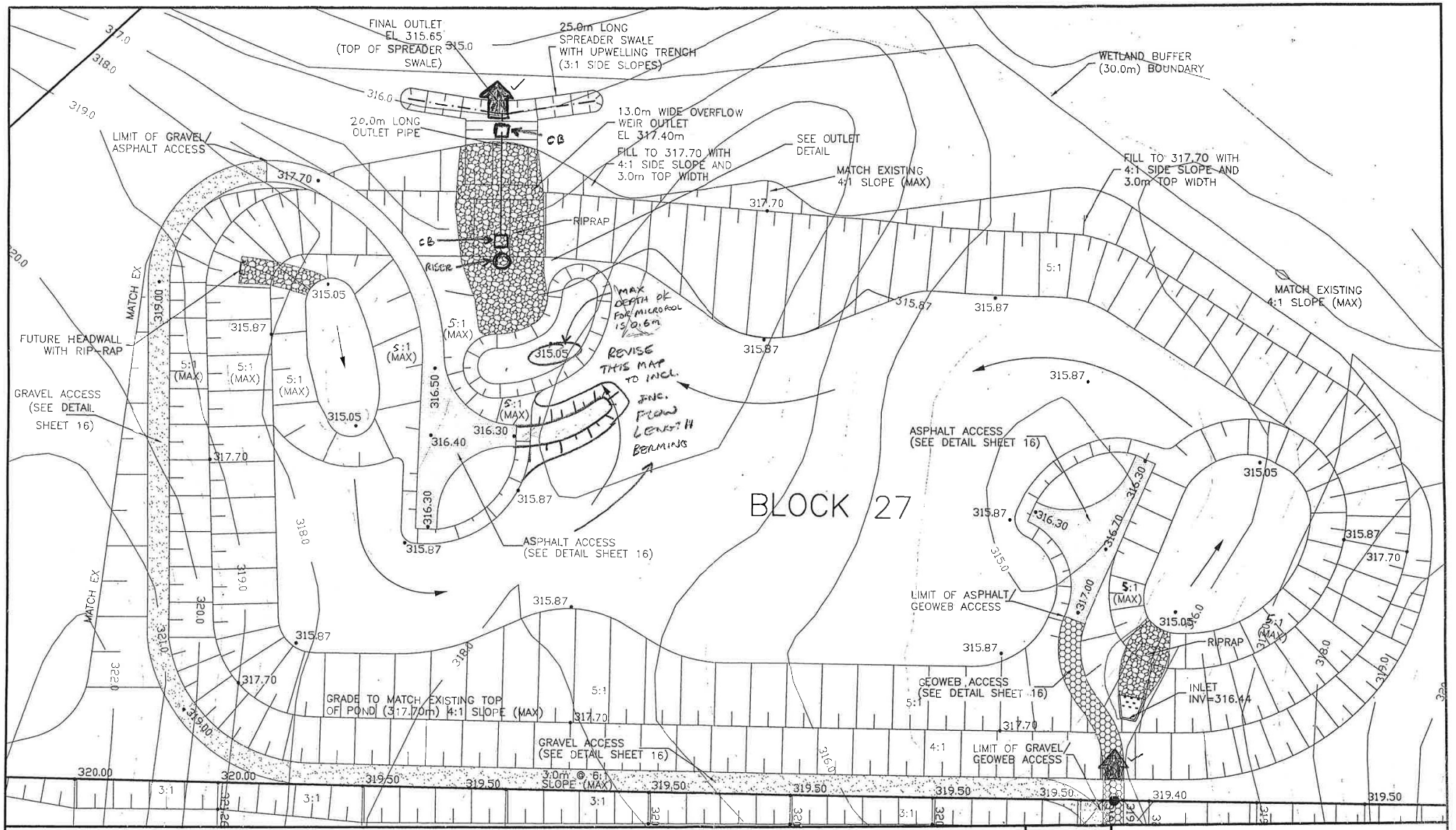
Sent via email

Attachments: 1. Meeting Presentation

Attachment 5

Two Schematic Drawings of Hearthwood SWM Wetland Layout
(Stantec, 1999)

BT ENGINEERING



LEGEND:

TOP OF FACILITY (TOP OF QUANTITY STORAGE) = 317.70m
QUANTITY STORAGE VOLUME = 6868m
W.Q. EXTENDED DETENTION EL. = 316.30m - SEE FIG. OK
W.Q. EXTENDED DETENTION STORAGE = 1510m³
TOP OF W.Q./EROSION EXTENDED DETENTION STORAGE (EDWL) = 317.05m
TOTAL EXTENDED DETENTION STORAGE = 9242m³

TOP OF PERMANENT POOL (PPWL) = 316.15m
BOTTOM OF PERMANENT POOL = 315.87m
PERMANENT POOL (DEAD) STORAGE = 2828m³

MAJOR FLOW ROUTE THRU FACILITY.

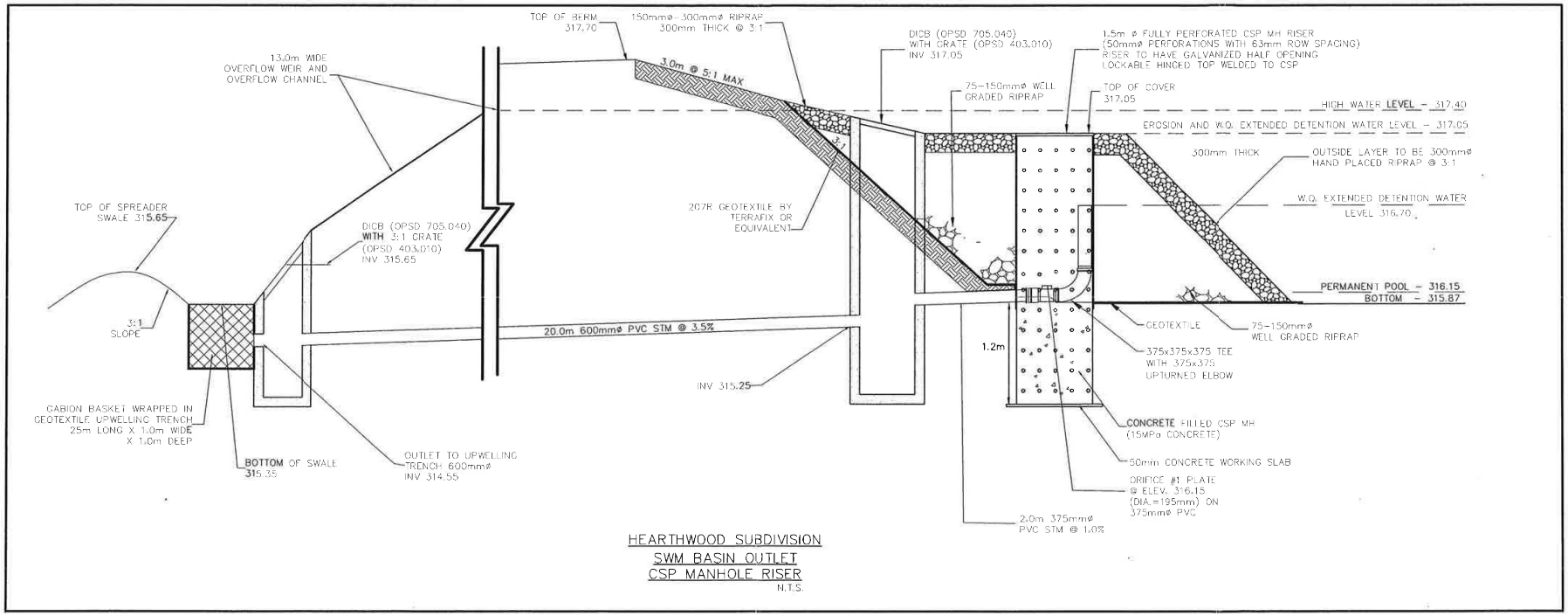
Stantec

HEARTHWOOD SUBDIVISION

STORMWATER MANAGEMENT
WETLAND SWM FACILITY

DATE:	SCALE:	PROJECT No.	FIGURE No.
99.09.23	1:500	60309383	FIGURE 1

mf-99.09.23-93835WM3



HEARTHWOOD SUBDIVISION
SWM BASIN OUTLET
CSP MANHOLE RISER
N.T.S.

Stantec

HEARTHWOOD SUBDIVISION

STORMWATER MANAGEMENT OUTLET DETAILS
WETLAND SWM FACILITY

DATE:	SCALE:	PROJECT No.	FIGURE No.
99.09.24	N.T.S.	60309383	FIGURE 2

AH-99.04.23-9383SWM2

BT ENGINEERING
509 Talbot Street
London, ON N6A 2S5
519-672-2222

MEMORANDUM

TO:	File	DATE:	April 8, 2022
FROM:	Rudi Warmé, P.Eng., BTE	PROJECT #:	21-003
CC:	Steve Taylor, Stephen Brook, BTE		
PROJECT:	City of Kitchener Biehn Drive Extension Municipal Class Environmental Assessment		
SUBJECT:	Natural Environment Overview and Assessment		

1.0 BACKGROUND

Biehn Drive is a local road at present in a residential area of the City of Kitchener with its southern terminus currently located on the edge of a unit of the Strasburg Creek Provincially Significant Wetland (PSW) Complex. The Study Area is illustrated in **Figure 1**. The City proposes to extend Biehn Drive west and south through a portion of the PSW to connect with a pre-defined alignment of Robert Ferrie Drive. A Municipal Class Environmental Assessment (MCEA) has recently been completed for the project, which confirmed the need for the undertaking, identified alternative solutions, and selected a technically preferred alternative (TPA) for the corridor alignment.

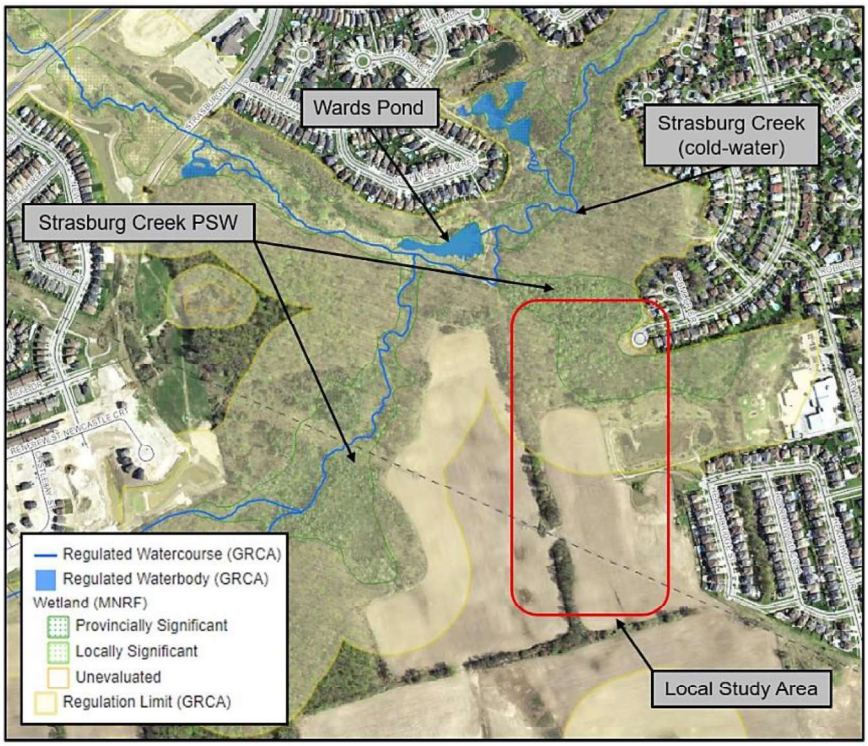


Figure 1: Study Area

A March 25, 2021, site visit was undertaken by BT Engineering Inc. (BTE) biologists to identify aquatic and terrestrial features of the natural environment within and adjacent to the roadway extension corridor to Robert Ferrie Drive. The site was inspected once more on August 26, 2021 with City of Kitchener, Grand River Conservation Authority (GRCA) and the landowners' representatives, including biologists from WSP Canada Group. The PSW

boundaries were delineated and staked in the vicinity of the proposed road extension to accurately define the drip lines of the adjacent woodlot edges.

An additional visit was completed on February 18, 2022, with Six Nations of the Grand River (SNGR) representatives to walk the staked centreline alignment of the road corridor and discuss potential wetland offsetting suggestions. The alignment of a proposed multi use trail (MUT) through the PSW within the west right-of-way was also discussed.

2.0 DISCUSSION

The Strasburg Creek PSW unit at Biehn Drive appears as a wooded swamp, with mature hardwoods dominant. The PSW, surrounding woodlands and farmlands are privately owned and slated for residential development in the future. Black Ash (*Fraxinus nigra*), Barn Swallow (*Hirunda rustica*) and Eastern Wood Pewee (*Satophaga ruticilla*) were identified in recent biological surveys of surrounding areas by the landowners' representatives. A BTE desktop background information review did not identify the presence of any other terrestrial or aquatic species at risk (SAR); however, the site reviews did identify suitable habitat conditions for bats within the swamp (roosting trees throughout) and for a variety of SAR listed songbirds including Eastern Meadowlark (*Sturnella magna*) and Bobolink (*Dolichonyx oryzivorus*) on the lands currently under cultivation to the south.

A concrete headwall with twin 1.2 m culvert inlets in the wetland boundary at the south end of the roadway directs wetland drainage and local storm sewer flows from Biehn Drive to an outlet pipe 25 m north of the road, where it becomes a permanently flowing tributary connecting with Strasburg Creek. The floor of the wetland in the immediate vicinity of the culvert entrance was wet with scattered ephemeral pools extending south. Several seasonal channels could be made out within the wetland approaching the culverts from the southwest and southeast. It appears unlikely that fish habitat extends into the PSW, although the culvert approaches were lined with small diameter river stone following the culvert installation.

No permanent open bodies of water are in the vicinity that would indicate possible year round turtle presence in the area. Their occurrence in this PSW unit would probably be only transitory due to the closed canopy and lack of basking areas. Other reptiles and amphibians (frogs, salamanders, snakes, etc.) would, however, be expected to be common. Yellow Birch (*Betula alleghaniensis*), now an uncommon tree species in many parts of southern Ontario, is well represented in the wetland and surrounding woodlands, as are Eastern Hemlock (*Tsuga canadensis*), Black Ash (Threatened) and White Pine (*Pinus strobus*), all of which include large specimens. A grouping of mature Aspen Poplars (*Populus spp*) occurs at the south boundary of the woodlot where the roadway extension will exit the PSW.

The land elevation rises immediately south of the wetland boundary where it abuts to the east the Hearthwood Park stormwater pond and a well-used multi use trail. Informal, connecting pathways presently wind through the wetland and adjacent wooded areas linking neighborhoods.

The TPA centreline and ROW limits have now been staked through the PSW and continue southwest over the gently rolling terrain of cultivated fields and across the hydro corridor before connecting to the future Robert Ferrie Drive.

3.0 IMPACTS, MITIGATION AND WETLAND OFFSETTING OPPORTUNITIES

The cleared ROW width of the Biehn Drive extension will be limited to approximately 10 m through the PSW section to minimize tree removal and wetland impacts beyond the roadway. A semi urban roadway (mountable curbs/gutters, no storm sewer) is recommended for the approximate 160 m length through

the PSW to maintain the natural setting (see **Figure 2**). Sidewalks will not extend through the PSW section. Rather, a proposed multi use trail will meander through the PSW avoiding specimen trees and connect at each end with paved pathway/sidewalk. The roadway surface will be slightly elevated above the surrounding wetland to permit placement of cross culverts to minimize surface drainage interference. Use of porous pavement through the PSW should be further explored. A suitably designed wildlife passage beneath the roadway will also be accommodated.

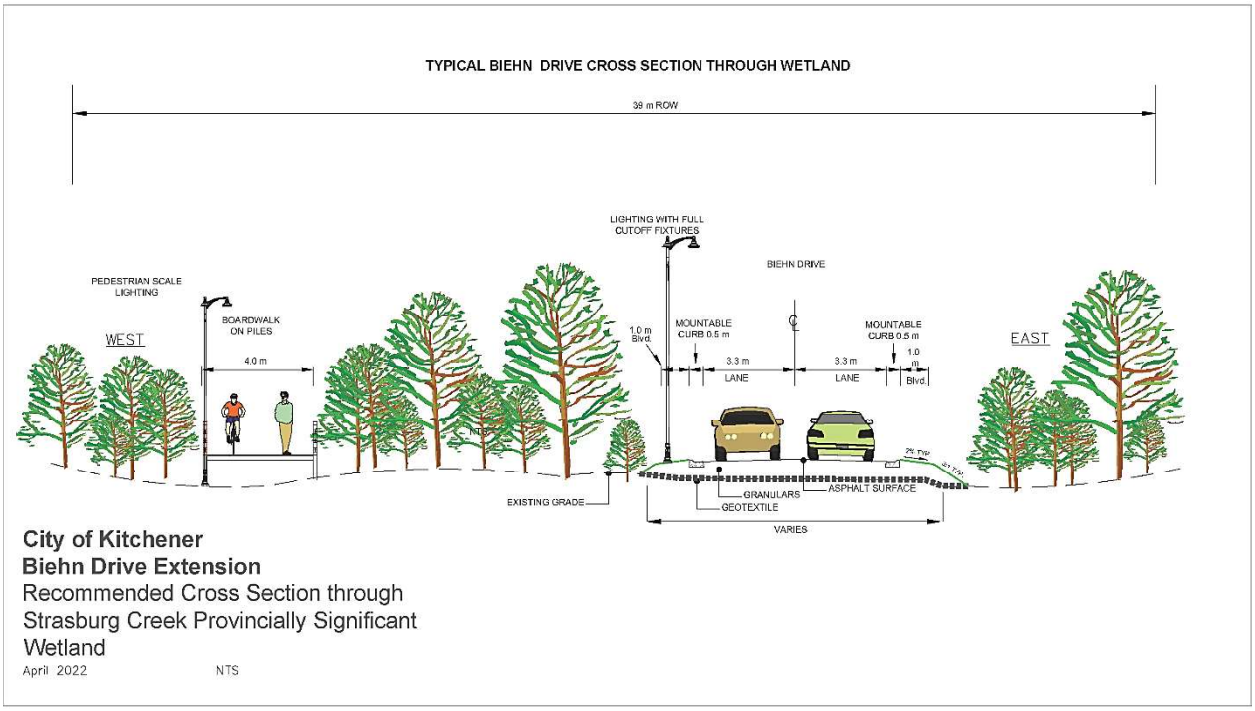


Figure 2: Typical Recommended Roadway Section

The road extension will be constructed to "float" on a geomembrane system placed over the wetland surface. The actual road alignment may be adjusted closer to the east ROW to maximize undisturbed woodlot width to the west and accommodate the MUT. The recommended, municipally owned ROW width will be 39 m through the PSW and beyond to Robert Ferrie Drive.

Although it appears the selected roadway extension alignment will miss much of the significant vegetation within the PSW, there will inevitably some removal of mature trees, disturbances to surface drainage, and loss of habitat features for resident fauna within the identified corridor. In addition to the new Biehn Drive extension, the work will also include installation of a sanitary sewer. Care will be required during its installation to avoid contamination impacts and impacts to the identified regional aquifer. A trenchless installation methodology is recommended.

SNGR suggestions from their site walk include investigations into alternatives to the use of asphalt or stone dust for construction of the MUT (an elevated boardwalk has been illustrated), considerations that the proposed wildlife crossing be sized to accommodate up to medium sized mammals, a preferred 10:1 tree replacement, and 1:1 wetland replacement on-site or 2:1 wetland replacement off-site.

There may be some opportunity to provide offsetting for wetland area and tree losses by re-using salvaged wetland soils/vegetation for re-naturalization in areas adjacent to the extension that will become undevelopable as a result of the works. Three potential locations have been initially identified:

the remnant Biehn Drive cul-de-sac; the isolated lands between PSW and Hearthwood stormwater pond and the current PSW boundary; and, tree plantings in suitable wetland setback buffer areas between the new housing and the PSW.

4.0 CONCLUSIONS

The Biehn Drive roadway extension will result in limited impacts to the PSW following the application of the recommended mitigation and offsetting measures, which will be further developed during detail design stage.

Attachments: A – Site Photographs

Attachment A - Site Photographs

Twin 1.2 m culverts (above) with a river stone entrance apron at the headwall (below) cross under the Biehn Drive cul-de-sac and connect to a permanent Strasburg Creek tributary to the north

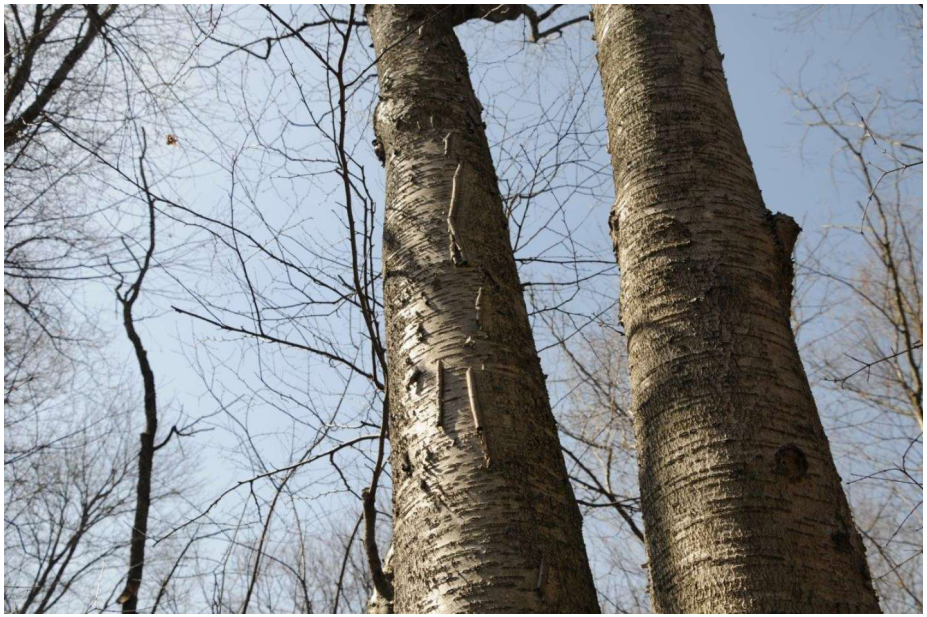
A concrete headwall and twin culverts at the PSW drainage outlet can just be seen in the shade in the centre background (above). The Strasburg Creek tributary channel extends north and west (below) meandering through the woodland to eventually connect with the main creek

The floor of the wetland in the immediate vicinity of the culvert entrance was wet, with scattered ephemeral pools in the surrounding area

Several channels could be made out within the wetland approaching the culverts from the southwest (above) and southeast (below)

Bat roosting trees were noted throughout the PSW (above). Yellow Birch, an uncommon species, is well represented (below)

Eastern Hemlock (above, with young tree below) and White Pine are also represented in the PSW, including several large specimens



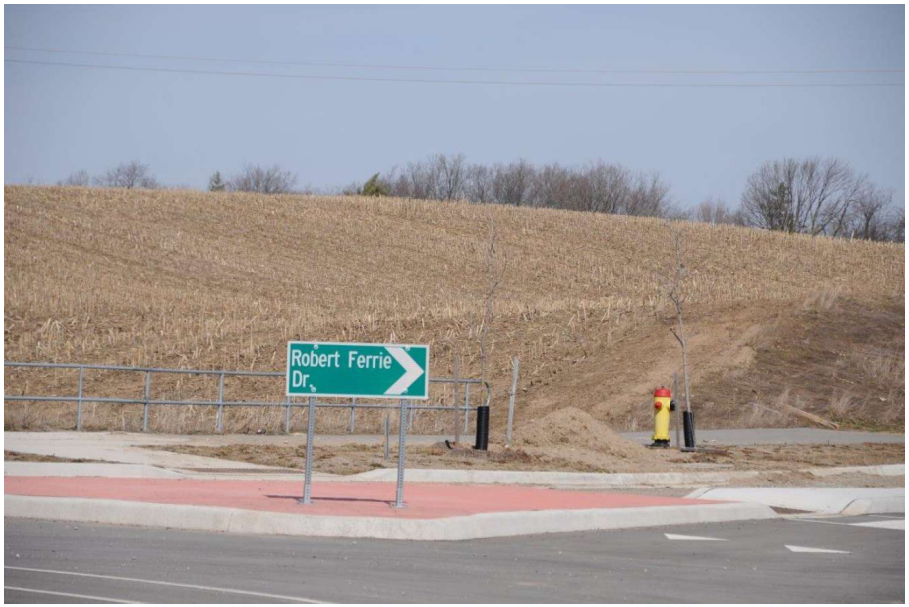
The land elevation quickly rises (below) as one moves south across the wetland boundary. The Hearthwood Park stormwater pond (below) and well used public trail are immediately south of the PSW

Pedestrian trails (above) and informal connecting pathways through the wetland and woodlot areas (below) link neighborhoods

Numerous mature trees are scattered through the PSW (above), including a grouping of large aspens beginning to leaf out at the approximate location where the road extension will exit the wetland. Note the trail along the edge of the woods (below)

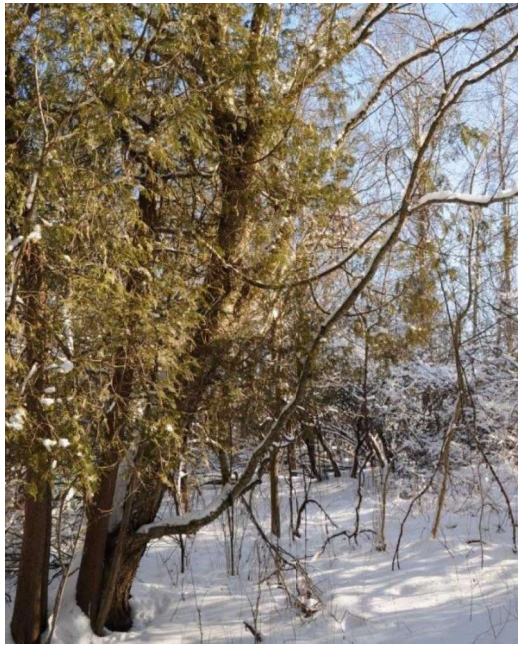
View southwest across the corn fields towards the Robert Ferrie Drive roundabout location beyond along the proposed extension alignment

View north along the newly constructed, closed section of Strasburg Road (above). View northeast along the Robert Ferrie Drive alignment towards the Biehn Drive extension connection (below)



Stakes identify the roadway ROW limits (red, above) and centreline alignment (yellow, below) through the PSW at the Biehn Drive cul-de-sac

Staked alignment in the central portion of the PSW. A large Yellow Birch appears to be one of the few mature trees which will be lost (below)



Roadway extension alignment as it exits the PSW south boundary (above). Alignment stakes and borehole/monitoring well locations extend south across the fields towards the Robert Ferrie Drive alignment (below)

Appendix E

Cultural Heritage

BT ENGINEERING

Ontario

Ministry of Tourism, Culture and Sport

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area:
  - is a recognized heritage property
  - may be of cultural heritage value
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

Processes covered under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

Cultural Heritage Evaluation Report (CHER)

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a qualified person(s) (see page 5 for definitions) to undertake a cultural heritage evaluation report (CHER).

The CHER will help you:

- identify, evaluate and protect cultural heritage resources on your property or project area
- reduce potential delays and risks to a project

Other checklists

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages for more detailed information and when completing this form.

Project or Property Name

Biehn Drive Extension and Sanitary Trunk Inc.

Project or Property Location (upper and lower or single tier municipality)

City of Kitchener, Regional Municipality of Waterloo

Proponent Name

BT Engineering

Proponent Contact Information

Katherine Scott, katherine.scott@bteng.ca

Screening Questions

	Yes	No
1. Is there a pre-approved screening checklist, methodology or process in place?	☐	☑

If Yes, please follow the pre-approved screening checklist, methodology or process.

If No, continue to Question 2.

Part A: Screening for known (or recognized) Cultural Heritage Value

	Yes	No
2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value?	☐	☑

If Yes, do **not** complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

If No, continue to Question 3.

	Yes	No
3. Is the property (or project area):		
a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?	☐	☑
b. a National Historic Site (or part of)?	☐	☑
c. designated under the *Heritage Railway Stations Protection Act*?	☐	☑
d. designated under the *Heritage Lighthouse Protection Act*?	☐	☑
e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?	☐	☑
f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?	☐	☑

If Yes to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No, continue to Question 4.

Part B: Screening for Potential Cultural Heritage Value

	Yes	No
4. Does the property (or project area) contain a parcel of land that:		
a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque?	☐	☑
b. has or is adjacent to a known burial site and/or cemetery?	☐	☑
c. is in a Canadian Heritage River watershed?	☐	☑
d. contains buildings or structures that are 40 or more years old?	☐	☑

Part C: Other Considerations

	Yes	No
5. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):		
a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?	☐	☑
b. has a special association with a community, person or historical event?	☐	☑
c. contains or is part of a cultural heritage landscape?	☐	☑

If Yes to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
  - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

For more information, see the Ministry of Tourism, Culture and Sport's Ontario Heritage Toolkit or Standards and Guidelines for Conservation of Provincial Heritage Properties.

In this context, the following definitions apply:

- **qualified person(s)** means individuals – professional engineers, architects, archaeologists, etc. – having relevant, recent experience in the conservation of cultural heritage resources.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may already be in place for identifying potential cultural heritage resources, including:

- one endorsed by a municipality
- an environmental assessment process e.g. screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport (MTCS) under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s.B.2.]

Part A: Screening for known (or recognized) Cultural Heritage Value

2. Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

Respond 'yes' to this question, if all of the following are true:

A property can be considered not to be of cultural heritage value if:

- a Cultural Heritage Evaluation Report (CHER) - or equivalent - has been prepared for the property with the advice of a qualified person and it has been determined not to be of cultural heritage value and/or
- the municipal heritage committee has evaluated the property for its cultural heritage value or interest and determined that the property is not of cultural heritage value or interest

A property may need to be re-evaluated, if:

- there is evidence that its heritage attributes may have changed
- new information is available
- the existing Statement of Cultural Heritage Value does not provide the information necessary to manage the property
- the evaluation took place after 2005 and did not use the criteria in Regulations 9/06 and 10/06

Note: Ontario government ministries and public bodies [prescribed under Regulation 157/10] may continue to use their existing evaluation processes, until the evaluation process required under section B.2 of the Standards & Guidelines for Conservation of Provincial Heritage Properties has been developed and approved by MTCS.

To determine if your property or project area has been evaluated, contact:

- the approval authority
- the proponent
- the Ministry of Tourism, Culture and Sport

3a. Is the property (or project area) identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value e.g.:

i. designated under the *Ontario Heritage Act*

- individual designation (Part IV)
- part of a heritage conservation district (Part V)

Individual Designation – Part IV

A property that is designated:

- by a municipal by-law as being of cultural heritage value or interest [s.29 of the *Ontario Heritage Act*]
- by order of the Minister of Tourism, Culture and Sport as being of cultural heritage value or interest of provincial significance [s.34.5]. **Note**: To date, no properties have been designated by the Minister.

Heritage Conservation District – Part V

A property or project area that is located within an area designated by a municipal by-law as a heritage conservation district [s. 41 of the *Ontario Heritage Act*].

For more information on Parts IV and V, contact:

- municipal clerk
- Ontario Heritage Trust
- local land registry office (for a title search)

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ii. subject of an agreement, covenant or easement entered into under Parts II or IV of the *Ontario Heritage Act*

An agreement, covenant or easement is usually between the owner of a property and a conservation body or level of government. It is usually registered on title.

The primary purpose of the agreement is to:

- preserve, conserve, and maintain a cultural heritage resource
- prevent its destruction, demolition or loss

For more information, contact:

- Ontario Heritage Trust - for an agreement, covenant or easement [clause 10 (1) (c) of the *Ontario Heritage Act*]
- municipal clerk – for a property that is the subject of an easement or a covenant [s.37 of the *Ontario Heritage Act*]
- local land registry office (for a title search)

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iii. listed on a register of heritage properties maintained by the municipality

Municipal registers are the official lists - or record - of cultural heritage properties identified as being important to the community.

Registers include:

- all properties that are designated under the *Ontario Heritage Act* (Part IV or V)
- properties that have not been formally designated, but have been identified as having cultural heritage value or interest to the community

For more information, contact:

- municipal clerk
- municipal heritage planning staff
- municipal heritage committee

---

iv. subject to a notice of:

- intention to designate (under Part IV of the *Ontario Heritage Act*)
- a Heritage Conservation District study area bylaw (under Part V of the *Ontario Heritage Act*)

A property that is subject to a **notice of intention to designate** as a property of cultural heritage value or interest and the notice is in accordance with:

- section 29 of the *Ontario Heritage Act*
- section 34.6 of the *Ontario Heritage Act.* **Note**: To date, the only applicable property is Meldrum Bay Inn, Manitoulin Island. [s.34.6]

An area designated by a municipal by-law made under section 40.1 of the *Ontario Heritage Act* as a **heritage conservation district study area**.

For more information, contact:

- municipal clerk – for a property that is the subject of notice of intention [s. 29 and s. 40.1]
- Ontario Heritage Trust

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v. included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties

Provincial heritage properties are properties the Government of Ontario owns or controls that have cultural heritage value or interest.

The Ministry of Tourism, Culture and Sport (MTCS) maintains a list of all provincial heritage properties based on information provided by ministries and prescribed public bodies. As they are identified, MTCS adds properties to the list of provincial heritage properties.

For more information, contact the MTCS Registrar at registrar@ontario.ca.

3b. Is the property (or project area) a National Historic Site (or part of)?

National Historic Sites are properties or districts of national historic significance that are designated by the Federal Minister of the Environment, under the *Canada National Parks Act*, based on the advice of the Historic Sites and Monuments Board of Canada.

For more information, see the National Historic Sites website.

3c. Is the property (or project area) designated under the *Heritage Railway Stations Protection Act*?

The *Heritage Railway Stations Protection Act* protects heritage railway stations that are owned by a railway company under federal jurisdiction. Designated railway stations that pass from federal ownership may continue to have cultural heritage value.

For more information, see the Directory of Designated Heritage Railway Stations.

3d. Is the property (or project area) designated under the *Heritage Lighthouse Protection Act*?

The *Heritage Lighthouse Protection Act* helps preserve historically significant Canadian lighthouses. The Act sets up a public nomination process and includes heritage building conservation standards for lighthouses which are officially designated.

For more information, see the Heritage Lighthouses of Canada website.

3e. Is the property (or project area) identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office?

The role of the Federal Heritage Buildings Review Office (FHBRO) is to help the federal government protect the heritage buildings it owns. The policy applies to all federal government departments that administer real property, but not to federal Crown Corporations.

For more information, contact the Federal Heritage Buildings Review Office.

See a directory of all federal heritage designations.

3f. Is the property (or project area) located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?

A UNESCO World Heritage Site is a place listed by UNESCO as having outstanding universal value to humanity under the Convention Concerning the Protection of the World Cultural and Natural Heritage. In order to retain the status of a World Heritage Site, each site must maintain its character defining features.

Currently, the Rideau Canal is the only World Heritage Site in Ontario.

For more information, see Parks Canada – World Heritage Site website.

Part B: Screening for potential Cultural Heritage Value

4a. Does the property (or project area) contain a parcel of land that has a municipal, provincial or federal commemorative or interpretive plaque?

Heritage resources are often recognized with formal plaques or markers.

Plaques are prepared by:

- municipalities
- provincial ministries or agencies
- federal ministries or agencies
- local non-government or non-profit organizations

For more information, contact:

- municipal heritage committees or local heritage organizations – for information on the location of plaques in their community
- Ontario Historical Society's Heritage directory – for a list of historical societies and heritage organizations
- Ontario Heritage Trust – for a list of plaques commemorating Ontario's history
- Historic Sites and Monuments Board of Canada – for a list of plaques commemorating Canada's history

4b. Does the property (or project area) contain a parcel of land that has or is adjacent to a known burial site and/or cemetery?

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulations, Ontario Ministry of Consumer Services – for a database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, adjacent means contiguous or as otherwise defined in a municipal official plan.

4c. Does the property (or project area) contain a parcel of land that is in a Canadian Heritage River watershed?

The Canadian Heritage River System is a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage.

Canadian Heritage Rivers must have, and maintain, outstanding natural, cultural and/or recreational values, and a high level of public support.

For more information, contact the Canadian Heritage River System.

If you have questions regarding the boundaries of a watershed, please contact:

- your conservation authority
- municipal staff

4d. Does the property (or project area) contain a parcel of land that contains buildings or structures that are 40 or more years old?

A 40 year 'rule of thumb' is typically used to indicate the potential of a site to be of cultural heritage value. The approximate age of buildings and/or structures may be estimated based on:

- history of the development of the area
- fire insurance maps
- architectural style
- building methods

Property owners may have information on the age of any buildings or structures on their property. The municipality, local land registry office or library may also have background information on the property.

Note: 40+ year old buildings or structure do not necessarily hold cultural heritage value or interest; their age simply indicates a higher potential.

A building or structure can include:

- residential structure
- farm building or outbuilding
- industrial, commercial, or institutional building
- remnant or ruin
- engineering work such as a bridge, canal, dams, etc.

For more information on researching the age of buildings or properties, see the Ontario Heritage Tool Kit Guide Heritage Property Evaluation.

Part C: Other Considerations

5a. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) is considered a landmark in the local community or contains any structures or sites that are important to defining the character of the area?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has potential landmarks or defining structures and sites, for instance:

- buildings or landscape features accessible to the public or readily noticeable and widely known
- complexes of buildings
- monuments
- ruins

5b. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) has a special association with a community, person or historical event?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has a special association with a community, person or event of historic interest, for instance:

- Aboriginal sacred site
- traditional-use area
- battlefield
- birthplace of an individual of importance to the community

5c. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) contains or is part of a cultural heritage landscape?

Landscapes (which may include a combination of archaeological resources, built heritage resources and landscape elements) may be of cultural heritage value or interest to a community.

For example, an Aboriginal trail, historic road or rail corridor may have been established as a key transportation or trade route and may have been important to the early settlement of an area. Parks, designed gardens or unique landforms such as waterfalls, rock faces, caverns, or mounds are areas that may have connections to a particular event, group or belief.

For more information on Questions 5.a., 5.b. and 5.c., contact:

- Elders in Aboriginal Communities or community researchers who may have information on potential cultural heritage resources. Please note that Aboriginal traditional knowledge may be considered sensitive.
- municipal heritage committees or local heritage organizations
- Ontario Historical Society's "Heritage Directory" - for a list of historical societies and heritage organizations in the province

An internet search may find helpful resources, including:

- historical maps
- historical walking tours
- municipal heritage management plans
- cultural heritage landscape studies
- municipal cultural plans

Information specific to trails may be obtained through Ontario Trails.

1.0 SCREENING FOR KNOWN CULTURAL HERITAGE VALUE

Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

No; the Subject Property has never been previously evaluated and found not to be of cultural heritage value.

Is the property (or project area):

a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?

No; the Subject Property has not been designated under the *Ontario Heritage Act* (OHA). There are no Ontario Heritage Trust conservation easements on or adjacent to the Subject Property.[1] The Subject Property is not included on the City of Kitchener Heritage Inventory.[2] It is not subject to a notice of intention to designate under Part IV of the OHA, or notice of a Heritage Conservation District study area bylaw under Part V of the OHA. There are no provincial heritage properties located on the Subject Property.

b. a National Historic Site (or part of)?

No; the Subject Property has not been identified as a National Historic Site. There are three National Historic Sites in Kitchener; they are not located on the Subject Property.[3]

c. designated under the Heritage Railway Stations Protection Act?

No; the Subject Property has not designated under the Heritage Railway Stations Protection Act. There is one Historic Railway Station in Kitchener (126 Weber Street); it is not located on the Subject Property.[4]

d. designated under the Heritage Lighthouse Protection Act?

No; the Subject Property has not been designated under the Heritage Lighthouse Protection Act. There are no Heritage Lighthouses located in Kitchener.[5]

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[1] OHT n.d.: Ontario Heritage Act Register
[2] City of Kitchener n.d.
[3] Parks Canada n.d.
[4] Parks Canada n.d.
[5] Parks Canada n.d.

e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?

No; the Subject Property has not been identified as a Federal Heritage Building. There are four Federal Heritage Buildings in Kitchener (15 Duke Street, 528 Wellington Street North, 437 Tower Road, and 166 Frederick Street); it is not located on the Subject Property.[6]

f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?

No; the Subject Property is not located within a UNESCO World Heritage site. There are no UNESCO World Heritage sites located in Kitchener.[7]

[6] Parks Canada n.d.
[7] UNESCO n.d.

2.0 SCREENING FOR POTENTIAL CULTURAL HERITAGE VALUE

Does the property (or project area) contain a parcel of land that:

a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque?

No; the Subject Property is not the subject of a municipal, provincial, or federal commemorative or interpretive plaque. Of the 8 federal plaques in Kitchener, none is located on the subject property.[8] Of the provincial plaques in Kitchener, none is located on the subject property.[9] There are currently no municipal plaques located on the subject property.

b. has or is adjacent to a known burial site and/or cemetery?

No; the Subject Property does not contain, nor is it adjacent to, a known burial site and/or cemetery.[10]

c. is in a Canadian Heritage River watershed?

No; The Subject Property contains a portion of Strasburg Creek, until its confluence with a downstream with Schneider Creek. Schneider Creek, in turn, is a tributary of the Grand River, which was designated as a Canadian Heritage River in 1994.[11] The designation refers to "the 290 km-long Grand River and its major tributaries, the Nith, Conestogo, Speed and Eramosa." As Strasburg Creek is tributary of Schneider Creek which is not included in the designation as a major tributary, the Subject Property does not meet this criterion.

d. contains buildings or structures that are 40 or more years old?

No; there are no buildings or structures located on the Subject Property. Structures were present until the 1950s associated with the road allowance that transects the study area from north to south. These structures are no longer present.

[8] Parks Canada n.d.
[9] OHT n.d.: Plaque Database
[10] BAO n.d.; CanadaGenWeb n.d.
[11] Canadian Heritage Rivers System 2017; Grand River Conservation Authority n.d.

3.0 OTHER CONSIDERATIONS

Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):

a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?

No; the Subject Property is not considered a landmark.

b. has a special association with a community, person or historical event?

No; it is not known or suggested that the Subject Property meets this criterion.

c. contains or is part of a cultural heritage landscape?

No; the Subject Property does not contain, nor is it part of, a cultural heritage landscape as identified by the City of Kitchener.[12]

[12] City of Kitchener 2014

4.0 RECOMMENDATION

Based on the assessment of the Subject Property against the MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, the Subject Property was not found to meet the screening criteria for either known or potential heritage value. No further heritage studies are recommended.

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Appendix F

Noise Report

BT ENGINEERING

Noise Assessment Report

Biehn Drive Municipal Class Environmental Assessment

March 2022

Submitted by:
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5

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1.0 INTRODUCTION

The City of Kitchener (City) is conducting a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The purpose of this report is to review the noise impacts from vehicular sources on existing noise sensitive land uses for the proposed Biehn Drive Extension. The Study Area is shown on **Figure 1**.

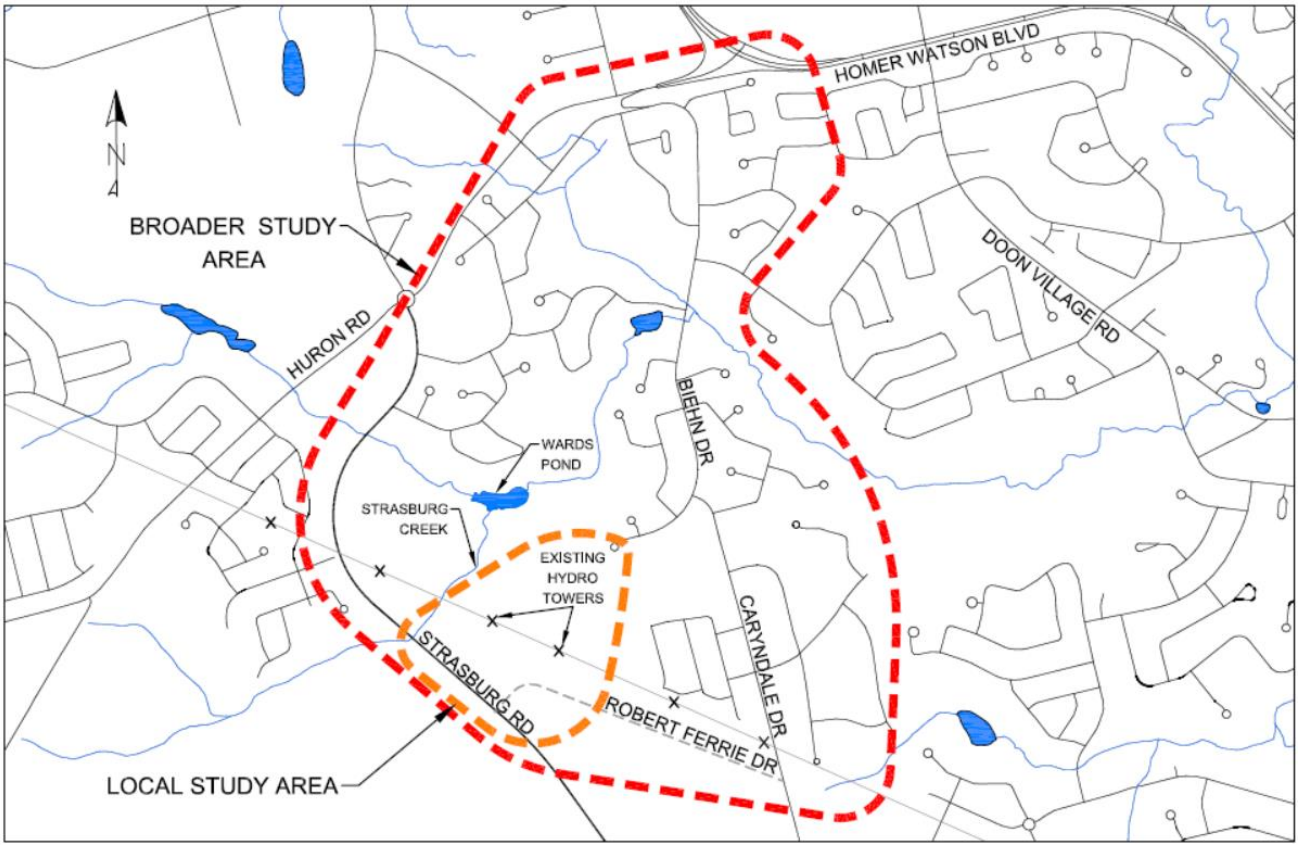

Figure 1: Site Location

Since the mid-2000's, the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener have planned for area development and evolving transportation needs. Several planning documents including the Official Plan and Transportation Master Plan (TMP) have identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension and ultimately to Strasburg Road. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan Amendment. This link would accommodate vehicles to and from the Brigadoon community and would help mitigate cut-through traffic on local streets within the community. It would function as a collector street, which collects traffic from local streets within the community and provides connectivity to high tier arterial streets including Strasburg Road.

2.0 METHODOLOGY

This evaluation was conducted within the Study Area to determine the impact to adjacent residential dwelling units as well as what (if any) mitigation measures should be incorporated in the final design, as a component of the EA process.

The noise assessment utilized the STAMSON 5.04 noise software program to determine 16-hour daytime and 8-hour nighttime equivalent sound levels (Leq) for the roadway traffic. The assessment was performed in accordance with the Ministry of the Environment, Conservation and Park's (MECP's) Noise Assessment Criteria (NPC-300) and MTO's Environmental Guide for Noise. The noise assessment was completed using three representative receiver sites, as shown in **Figure 2**. The receiver sites were located in an Outdoor Living Area (OLA) in the backyard during the day and the plane of the window of a bedroom for nighttime assessments.

Figure 2: Representative Receiver Sites

A mitigation assessment is carried out for any receiver sites where the proposed roadworks will result in a noise level increase of greater than 5 dBA 10 years after construction (2040), or above 65 dBA. This assesses mitigation (noise control) measures within the right-of-way for noise sensitive receivers.

3.0 TRAFFIC INPUT DATA

Traffic volumes were provided by the City of Kitchener, see **Appendix A**. The traffic counts were completed in 2018/2019. Biehn Drive and Caryndale are collector roads and are not truck routes, therefore only local deliveries will travel on the roads. Heavy truck volumes are assumed to be 0% and medium truck volumes are assumed to be 3%. An 80/20 daytime/nighttime split for traffic volumes was used for the acoustical assessment.

The construction of the Biehn Drive Extension is expected to change vehicular traffic patterns in the neighbourhood. It is likely that the extension will result in a more balanced redistribution of area traffic volumes, providing relief (reducing the traffic volumes) on other area roads including Caryndale Drive and the north segment of Biehn Drive. **Table 1** summarizes the AADT volumes at the three representative receiver sites within the study area.

Table 1: AADT Volumes at Representative Receiver Sites

Receiver Site	Future AADT (Without Extension)	Future AADT (With Extension)
371 Biehn Drive	960	3000
260 Biehn Drive	5900	2950
453 Caryndale Drive	3000	1500

Additional input to the STAMSON model included:

- The intermediate ground surface (hard surface reflects sound, soft surface absorbs sound);
- Distance, in metres, from the source to the receiver, using the centreline of the road as the source;
- The angle at which the receiver (apartment) intercepts the source (roadway and/or railway), measured relative to the perpendicular line between the source and the receiver;
- Receiver height (standard is 1.5 m above ground level during the daytime and 4.5 m above ground or storey level bedroom during the nighttime);
- Existing buildings which provide effective shielding of roadway or railway noise;
- Posted speed limit – the speed limit for Biehn Drive and Caryndale Drive is 50 km/h within the study limits;

- Depth of woods (0-30 m, 30-60 m, 60 m or more);
- Roadway grade (slope);
- Topography (hills, flatlands); and
- Existing attenuation due to shielding from barriers (natural or man-made).

Biehn Drive is a 2-lane collector roadway extending from Old Heron Road and terminating within the Study Area west of Caryndale Drive. Caryndale Drive is a 2-lane collector roadway extending from Biehn Drive to Stauffer Drive. The speed limit of both roadways is 50 km/h.

4.0 ANALYSIS OF EXISTING AND FUTURE SOUND LEVELS

A future year was selected with and without the Biehn Drive extension. The 16-hour equivalent daytime sound levels and 8-hour nighttime sound levels were forecast for three receiver sites with and without the project, calculated using the STAMSON noise software program. These are shown in **Table 2.**

Table 2: Existing and Future Sound Levels

Receiver Site	Existing Daytime Without Extension (16 h) Sound Level, Leq (dBA)	Existing Nighttime Without Extension (8 h) Sound Level, Leq (dBA)	Future Daytime With Extension (16 h) Sound Level, Leq (dBA)	Future Nighttime With Extension (8 h) Sound Level, Leq (dBA)
371 Biehn Drive	45*	45	50	48
260 Biehn Drive	51	49	48	46
453 Caryndale Drive	48	46	45*	43

* Sound levels are estimated to be 45 dBA and reflect south level measurements obtained on site by BTE. 45 dBA is the minimum urban daytime sound level standard accepted by MECP.

The forecast ambient sound levels at the proposed site have been reviewed comparing equivalent sound level criterion from MECP's Noise Assessment Criteria (NPC-300) for noise sensitive areas. The MECP criteria are summarized below in **Table 3**. The STAMSON outputs are included in **Appendix B**.

Table 3: MECP's Noise Assessment Criteria (NPC-300)

Criteria 1:	Outdoor Sound Level Criteria: The significance of a noise impact for day-time noise levels is assessed by using the objective of 55 dBA (7 a.m. to 11 p.m.) for both road and rail sources combined. These levels are established as acceptable noise levels for outdoor recreation areas of developments adjacent to transportation noise (roads, transit, light rail, and rail).
Criteria 2:	Plane of Window (Sleeping Quarters): Outdoor nighttime (8 h) roadway and rail noise levels at the plane of a bedroom (3rd storey) window must not exceed 60 dBA, otherwise air conditioning is required. If the nighttime rail noise exceeds 55 dBA or the roadway rail noise exceeds 60 dBA, acoustical materials are required in the design and construction of the building.

5.0 MITIGATION REQUIREMENTS

The criterion for mitigation has utilized the MECP Provincial guideline for sound levels in a residential area. Based on all daytime and nighttime sound levels being below 55 dBA, no mitigation is required.

6.0 CONCLUSIONS

The forecast sound levels for daytime and nighttime are below 55 dBA and no mitigation is required.

Report prepared by:

Darcie Dillon, P.Eng.

Reviewed and approved by:

Steven Taylor, P.Eng.

Appendix A

Traffic Counts

BT ENGINEERING

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - ##Demo?##, Biehn Drive btwn Kilkerran & Caryndale Rd (##)<50>
Date - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	##Demo?##	11468	3520	2498	2867	##Demo?##
East	7125	5460	1665	##Demo?##	1365	833
West	7863	##Demo?##	1855	1311	1502	928
Days	##Demo?##	4	2	6	4	##Demo?##

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	47.8	47.9	47.6	km/h
Median speed	##Demo?##	48.4	48.1	km/h
85% speed	54.8	##Demo?##	55.0	km/h

PSL = 60 km/h

Class				
Class (*##Demo?##*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	585	3.903%	496	##Demo?##
2 - PC	7547	50.35%	5637	##Demo?##
3 - 2A-4T	976	6.512%	791	##Demo?##
4 - BUS	41	0.274%	38	##Demo?##
5 - 2A-6T	138	0.921%	122	##Demo?##
6 - 3A-SU	509	3.396%	352	##Demo?##
7 - 4A-SU	5132	34.24%	3977	##Demo?##
8 - <5A DBL	3	0.020%	3	##Demo?##
9 - 5A DBL	6	0.040%	6	##Demo?##
10 - >6A DBL	3	0.020%	3	##Demo?##
11 - <6A MULTI	0	0.000%	0	##Demo?##
12 - 6A MULTI	0	0.000%	0	##Demo?##
13 - >6A MULTI	48	0.320%	43	##Demo?##

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**##Demo?##**	**Sat**	**Sun**
East	804	##Demo?##	0	1601	1311	871	##Demo?##
West	805	1929	0	##Demo?##	1543	1031	824
Combined	1609	##Demo?##	0	3332	2854	1902	##Demo?##
AM Pk East	54	154	-	##Demo?##	68	64	48
PM Pk East	##Demo?##	195	-	228	138	##Demo?##	71
AM Pk West	60	245	##Demo?##	187	145	96	85
PM Pk ##Demo?##	77	209	-	155	##Demo?##	80	75
Days	1	1	##Demo?##	1	1	1	1

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - Biehn Dr, Biehn Dr btwn Marl Meadow & Mcleod Crt <50 kmh>(13)
Date - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	28021	21223	6798	4670	5306	3399
East	16862	12767	4095	2810	3192	2048
West	11159	8456	2703	1860	2114	1352
Days	6	4	2	6	4	2

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	52.6	52.7	52.3	km/h
Median speed	52.6	52.6	52.2	km/h
85% speed	58.6	58.6	58.5	km/h

PSL = 60 km/h

Class				
Class (*Scheme F3*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	213	0.760%	171	42
2 - PC	24192	86.34%	18251	5941
3 - 2A-4T	1745	6.227%	1369	376
4 - BUS	57	0.203%	52	5
5 - 2A-6T	281	1.003%	238	43
6 - 3A-SU	94	0.335%	72	22
7 - 4A-SU	1397	4.986%	1029	368
8 - <5A DBL	1	0.004%	1	0
9 - 5A DBL	12	0.043%	12	0
10 - >6A DBL	3	0.011%	3	0
11 - <6A MULTI	0	0.000%	0	0
12 - 6A MULTI	0	0.000%	0	0
13 - >6A MULTI	26	0.093%	25	1

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
East	1795	3798	0	3921	3253	2145	1950
West	1210	2542	0	2520	2184	1457	1246
Combined	3005	6340	0	6441	5437	3602	3196
AM Pk East	135	326	-	294	195	164	137
PM Pk East	180	409	-	468	301	165	177
AM Pk West	98	277	-	226	186	128	117
PM Pk West	120	266	-	233	182	117	105
Days	1	1	-	1	1	1	1

Report created 10:52 Monday, September 9, 2019 using MTE version 5.0.2.0 - Template not certified by MetroCount

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - Caryndale Drive, Caryndale Drive btwn Chapel Hill Drive @ Hearthway Street (17) <50km.h>
Date - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	12962	9656	3306	2160	2414	1653
East	5796	4261	1535	966	1065	768
West	7166	5395	1771	1194	1349	886
Days	6	4	2	6	4	2

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	47.9	47.8	48.1	km/h
Median speed	50.0	50.0	50.8	km/h
85% speed	60.8	60.5	61.2	km/h

PSL = 60 km/h

Class				
Class (*Scheme F3*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	264	2.0%	174	90
2 - PC	9250	71.4%	6710	2540
3 - 2A-4T	1932	14.9%	1480	452
4 - BUS	83	0.6%	79	4
5 - 2A-6T	239	1.8%	194	45
6 - 3A-SU	147	1.1%	115	32
7 - 4A-SU	1040	8.0%	899	141
8 - <5A DBL	0	0.0%	0	0
9 - 5A DBL	1	0.0%	0	1
10 - >6A DBL	0	0.0%	0	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	6	0.0%	5	1

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
East	1111	1017	0	1114	1019	854	681
West	1315	1241	0	1444	1395	995	776
Combined	2426	2258	0	2558	2414	1849	1457
AM Pk East	87	81	-	75	73	51	42
PM Pk East	119	122	-	123	92	75	57
AM Pk West	152	147	-	143	134	74	72
PM Pk West	141	124	-	152	139	81	60
Days	1	1	-	1	1	1	1

Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - Caryndale Drive, Caryndale Drive btwn Robertson Crescent @ Chapel Hill Drive (19) <40km.h>
Date - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	16449	12546	3903	2742	3137	1952
East	7980	6070	1910	1330	1518	955
West	8469	6476	1993	1412	1619	997
Days	6	4	2	6	4	2

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	45.3	44.2	49.0	km/h
Median speed	46.8	45.7	49.3	km/h
85% speed	54.4	53.6	55.8	km/h

PSL = 60 km/h

Class				
Class (*Scheme F3*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	247	1.5%	167	80
2 - PC	13812	84.0%	10430	3382
3 - 2A-4T	2013	12.2%	1619	394
4 - BUS	139	0.8%	133	6
5 - 2A-6T	201	1.2%	167	34
6 - 3A-SU	22	0.1%	22	0
7 - 4A-SU	12	0.1%	7	5
8 - <5A DBL	0	0.0%	0	0
9 - 5A DBL	2	0.0%	0	2
10 - >6A DBL	0	0.0%	0	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	1	0.0%	1	0

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
East	1493	1556	0	1538	1483	1077	833
West	1536	1661	0	1642	1637	1107	886
Combined	3029	3217	0	3180	3120	2184	1719
AM Pk East	134	128	-	130	125	68	55
PM Pk East	142	153	-	162	141	98	74
AM Pk West	176	171	-	159	160	88	77
PM Pk West	181	179	-	178	164	83	68
Days	1	1	-	1	1	1	1

Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - ##Demo?##, Biehn Drive btwn Kilkerran & Caryndale Rd (##)<50>
Date - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	##Demo?##	11468	3520	2498	2867	##Demo?##
East	7125	5460	1665	##Demo?##	1365	833
West	7863	##Demo?##	1855	1311	1502	928
Days	##Demo?##	4	2	6	4	##Demo?##

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	47.8	47.9	47.6	km/h
Median speed	##Demo?##	48.4	48.1	km/h
85% speed	54.8	##Demo?##	55.0	km/h

PSL = 60 km/h

Class				
Class (*##Demo?##*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	585	3.903%	496	##Demo?##
2 - PC	7547	50.35%	5637	##Demo?##
3 - 2A-4T	976	6.512%	791	##Demo?##
4 - BUS	41	0.274%	38	##Demo?##
5 - 2A-6T	138	0.921%	122	##Demo?##
6 - 3A-SU	509	3.396%	352	##Demo?##
7 - 4A-SU	5132	34.24%	3977	##Demo?##
8 - <5A DBL	3	0.020%	3	##Demo?##
9 - 5A DBL	6	0.040%	6	##Demo?##
10 - >6A DBL	3	0.020%	3	##Demo?##
11 - <6A MULTI	0	0.000%	0	##Demo?##
12 - 6A MULTI	0	0.000%	0	##Demo?##
13 - >6A MULTI	48	0.320%	43	##Demo?##

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**##Demo?##**	**Sat**	**Sun**
East	804	##Demo?##	0	1601	1311	871	##Demo?##
West	805	1929	0	##Demo?##	1543	1031	824
Combined	1609	##Demo?##	0	3332	2854	1902	##Demo?##
AM Pk East	54	154	-	##Demo?##	68	64	48
PM Pk East	##Demo?##	195	-	228	138	##Demo?##	71
AM Pk West	60	245	##Demo?##	187	145	96	85
PM Pk ##Demo?##	77	209	-	155	##Demo?##	80	75
Days	1	1	##Demo?##	1	1	1	1

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - Biehn Dr, Biehn Dr btwn Marl Meadow & Mcleod Crt <50 kmh>(13)
Date - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	28021	21223	6798	4670	5306	3399
East	16862	12767	4095	2810	3192	2048
West	11159	8456	2703	1860	2114	1352
Days	6	4	2	6	4	2

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	52.6	52.7	52.3	km/h
Median speed	52.6	52.6	52.2	km/h
85% speed	58.6	58.6	58.5	km/h

PSL = 60 km/h

Class				
Class (*Scheme F3*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	213	0.760%	171	42
2 - PC	24192	86.34%	18251	5941
3 - 2A-4T	1745	6.227%	1369	376
4 - BUS	57	0.203%	52	5
5 - 2A-6T	281	1.003%	238	43
6 - 3A-SU	94	0.335%	72	22
7 - 4A-SU	1397	4.986%	1029	368
8 - <5A DBL	1	0.004%	1	0
9 - 5A DBL	12	0.043%	12	0
10 - >6A DBL	3	0.011%	3	0
11 - <6A MULTI	0	0.000%	0	0
12 - 6A MULTI	0	0.000%	0	0
13 - >6A MULTI	26	0.093%	25	1

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
East	1795	3798	0	3921	3253	2145	1950
West	1210	2542	0	2520	2184	1457	1246
Combined	3005	6340	0	6441	5437	3602	3196
AM Pk East	135	326	-	294	195	164	137
PM Pk East	180	409	-	468	301	165	177
AM Pk West	98	277	-	226	186	128	117
PM Pk West	120	266	-	233	182	117	105
Days	1	1	-	1	1	1	1

Report created 10:52 Monday, September 9, 2019 using MTE version 5.0.2.0 - Template not certified by MetroCount

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - Caryndale Drive, Caryndale Drive btwn Chapel Hill Drive @ Hearthway Street (17) <50km.h>
Date - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	12962	9656	3306	2160	2414	1653
East	5796	4261	1535	966	1065	768
West	7166	5395	1771	1194	1349	886
Days	6	4	2	6	4	2

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	47.9	47.8	48.1	km/h
Median speed	50.0	50.0	50.8	km/h
85% speed	60.8	60.5	61.2	km/h

PSL = 60 km/h

Class				
Class (*Scheme F3*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	264	2.0%	174	90
2 - PC	9250	71.4%	6710	2540
3 - 2A-4T	1932	14.9%	1480	452
4 - BUS	83	0.6%	79	4
5 - 2A-6T	239	1.8%	194	45
6 - 3A-SU	147	1.1%	115	32
7 - 4A-SU	1040	8.0%	899	141
8 - <5A DBL	0	0.0%	0	0
9 - 5A DBL	1	0.0%	0	1
10 - >6A DBL	0	0.0%	0	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	6	0.0%	5	1

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
East	1111	1017	0	1114	1019	854	681
West	1315	1241	0	1444	1395	995	776
Combined	2426	2258	0	2558	2414	1849	1457
AM Pk East	87	81	-	75	73	51	42
PM Pk East	119	122	-	123	92	75	57
AM Pk West	152	147	-	143	134	74	72
PM Pk West	141	124	-	152	139	81	60
Days	1	1	-	1	1	1	1

Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

Traffic Summary

Station # - Caryndale Drive, Caryndale Drive btwn Robertson Crescent @ Chapel Hill Drive (19) <40km.h>
Date - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

Volume						
	Total	**Weekday**	**Weekend**	**ADT**	**AWDT**	**AWET**
Combined	16449	12546	3903	2742	3137	1952
East	7980	6070	1910	1330	1518	955
West	8469	6476	1993	1412	1619	997
Days	6	4	2	6	4	2

Speed				
	All Days	**Weekdays**	**Weekend**	
Mean speed	45.3	44.2	49.0	km/h
Median speed	46.8	45.7	49.3	km/h
85% speed	54.4	53.6	55.8	km/h

PSL = 60 km/h

Class				
Class (*Scheme F3*)	**All Days**	**%**	**Weekdays**	**Weekend**
1 - CYCLE	247	1.5%	167	80
2 - PC	13812	84.0%	10430	3382
3 - 2A-4T	2013	12.2%	1619	394
4 - BUS	139	0.8%	133	6
5 - 2A-6T	201	1.2%	167	34
6 - 3A-SU	22	0.1%	22	0
7 - 4A-SU	12	0.1%	7	5
8 - <5A DBL	0	0.0%	0	0
9 - 5A DBL	2	0.0%	0	2
10 - >6A DBL	0	0.0%	0	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	1	0.0%	1	0

Average Daily Volume							
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
East	1493	1556	0	1538	1483	1077	833
West	1536	1661	0	1642	1637	1107	886
Combined	3029	3217	0	3180	3120	2184	1719
AM Pk East	134	128	-	130	125	68	55
PM Pk East	142	153	-	162	141	98	74
AM Pk West	176	171	-	159	160	88	77
PM Pk West	181	179	-	178	164	83	68
Days	1	1	-	1	1	1	1

Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0

Appendix B

STAMSON Outputs

BT ENGINEERING

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:08:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260DNO Time Period: 16 hours
Description: 260 Biehn Drive Daytime No Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 4578 veh/TimePeriod
Medium truck volume : 142 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 50.73 + 0.00) = 50.73 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	58.30	0.00	-6.11	-1.46	0.00	0.00	0.00	50.73

Segment Leq : 50.73 dBA

Total Leq All Segments: 50.73 dBA

TOTAL Leq FROM ALL SOURCES: 50.73

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:51:12
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260DYES Time Period: 16 hours
Description: 260 Biehn Drive Daytime with Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 2289 veh/TimePeriod
Medium truck volume : 71 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 47.72 + 0.00) = 47.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	55.29	0.00	-6.11	-1.46	0.00	0.00	0.00	47.72

Segment Leq : 47.72 dBA

Total Leq All Segments: 47.72 dBA

TOTAL Leq FROM ALL SOURCES: 47.72

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:17:01
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260NNO Time Period: 8 hours
Description: 260 Biehn Drive Nighttime No Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 1145 veh/TimePeriod
Medium truck volume : 35 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 48.65 + 0.00) = 48.65 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	55.27	0.00	-5.26	-1.35	0.00	0.00	0.00	48.65

Segment Leq : 48.65 dBA

Total Leq All Segments: 48.65 dBA

↟

TOTAL Leq FROM ALL SOURCES: 48.65
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:52:24
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260NYES Time Period: 8 hours
Description: 260 Biehn Drive Nighttime with Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 572 veh/TimePeriod
Medium truck volume : 18 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 45.67 + 0.00) = 45.67 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	52.29	0.00	-5.26	-1.35	0.00	0.00	0.00	45.67

Segment Leq : 45.67 dBA

Total Leq All Segments: 45.67 dBA

↟

TOTAL Leq FROM ALL SOURCES: 45.67
↟

STAMSON 5.0 NORMAL REPORT Date: 08-02-2022 09:07:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371DNO Time Period: 16 hours
Description: 371 Biehn Drive Daytime No Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 621 veh/TimePeriod
Medium truck volume : 19 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Results segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 44.76 + 0.00) = 44.76 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	49.60	0.00	-3.39	-1.46	0.00	0.00	0.00	44.76

Segment Leq : 44.76 dBA

Total Leq All Segments: 44.76 dBA

↟

TOTAL Leq FROM ALL SOURCES: 44.76
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:50:23
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371DYES Time Period: 16 hours
Description: 371 Biehn Drive Daytime with Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 2328 veh/TimePeriod
Medium truck volume : 72 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 50.51 + 0.00) = 50.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	55.36	0.00	-3.39	-1.46	0.00	0.00	0.00	50.51

Segment Leq : 50.51 dBA

Total Leq All Segments: 50.51 dBA

↟

TOTAL Leq FROM ALL SOURCES: 50.51
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:17:35
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371NNO Time Period: 8 hours
Description: 371 Biehn Drive Nighttime No Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 310 veh/TimePeriod
Medium truck volume : 10 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 45.05 + 0.00) = 45.05 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	49.67	0.00	-3.27	-1.35	0.00	0.00	0.00	45.05

Segment Leq : 45.05 dBA

Total Leq All Segments: 45.05 dBA

↟

TOTAL Leq FROM ALL SOURCES: 45.05
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:51:56
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371NYES Time Period: 8 hours
Description: 371 Biehn Drive Nighttime with Extension

Road data, segment # 1: Biehn Drive

Car traffic volume : 582 veh/TimePeriod
Medium truck volume : 18 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive

Source height = 0.50 m

ROAD (0.00 + 47.72 + 0.00) = 47.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	52.35	0.00	-3.27	-1.35	0.00	0.00	0.00	47.72

Segment Leq : 47.72 dBA

Total Leq All Segments: 47.72 dBA

↟

TOTAL Leq FROM ALL SOURCES: 47.72
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:09:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 453DNO Time Period: 16 hours
Description: 453 Caryndale Daytime No Extension

Road data, segment # 1: Caryndale Dr

Car traffic volume : 2328 veh/TimePeriod
Medium truck volume : 72 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Caryndale Dr

Source height = 0.50 m

ROAD (0.00 + 47.79 + 0.00) = 47.79 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	55.36	0.00	-6.11	-1.46	0.00	0.00	0.00	47.79

Segment Leq : 47.79 dBA

Total Leq All Segments: 47.79 dBA

↟

TOTAL Leq FROM ALL SOURCES: 47.79
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:53:06
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 453DYES Time Period: 16 hours
Description: 453 Caryndale Daytime with Extension

Road data, segment # 1: Caryndale Dr

Car traffic volume : 1164 veh/TimePeriod
Medium truck volume : 36 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Caryndale Dr

Source height = 0.50 m

ROAD (0.00 + 44.78 + 0.00) = 44.78 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	52.35	0.00	-6.11	-1.46	0.00	0.00	0.00	44.78

Segment Leq : 44.78 dBA

Total Leq All Segments: 44.78 dBA

↟

TOTAL Leq FROM ALL SOURCES: 44.78
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:13:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 453NNO Time Period: 8 hours
Description: 453 Caryndale Nighttime No Extension

Road data, segment # 1: Caryndale Dr

Car traffic volume : 582 veh/TimePeriod
Medium truck volume : 18 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Caryndale Dr

Source height = 0.50 m

ROAD (0.00 + 45.73 + 0.00) = 45.73 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	52.35	0.00	-5.26	-1.35	0.00	0.00	0.00	45.73

Segment Leq : 45.73 dBA

Total Leq All Segments: 45.73 dBA

↟

TOTAL Leq FROM ALL SOURCES: 45.73
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:54:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 8 hours
Description:

Road data, segment # 1: Caryndale Dr

Car traffic volume : 310 veh/TimePeriod
Medium truck volume : 10 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Segment # 1: Caryndale Dr

Source height = 0.50 m

ROAD (0.00 + 43.05 + 0.00) = 43.05 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	49.67	0.00	-5.26	-1.35	0.00	0.00	0.00	43.05

Segment Leq : 43.05 dBA

Total Leq All Segments: 43.05 dBA

↑

TOTAL Leq FROM ALL SOURCES: 43.05
↑
↑

Appendix G

Biehn Drive Trunk Sanitary Sewer Extension
Technical Memorandum

BT ENGINEERING

TECHNICAL MEMORANDUM

TO:	Steve Taylor, P.Eng.	**OUR REF.:**	SN0447
FROM:	Leonardo Sanchez, P.Eng.	**DATE:**	March 31, 2022
COPY:	Katherine Scott, P.Eng.		

RE: **City of Kitchener**
Biehn Drive Trunk Sanitary Sewer Extension

The purpose of this Technical Memorandum is to present the initial design of the proposed trunk sanitary sewer extension of the existing sanitary trunk sewer on Biehn Drive.

Existing Sanitary Sewer

The original drainage area for the entire system was defined in the City's GIS system and is shown on Figure 1. The Strasburg-Biehn drainage area is part of the Schneider sanitary system and includes 209.1 ha. The undeveloped portion of the drainage area that is denoted as tributary to the existing sanitary trunk sewer at the proposed extension covers 128.9 ha.

The existing Biehn Drive trunk sanitary sewer is a 525 mm diameter pipe at the current end of the system. The existing pipe has capacity for 186 litres per second (l/s) flowing half-full, which corresponds to the peak flow that would be produced by the undeveloped tributary area if it was developed as low density residential.

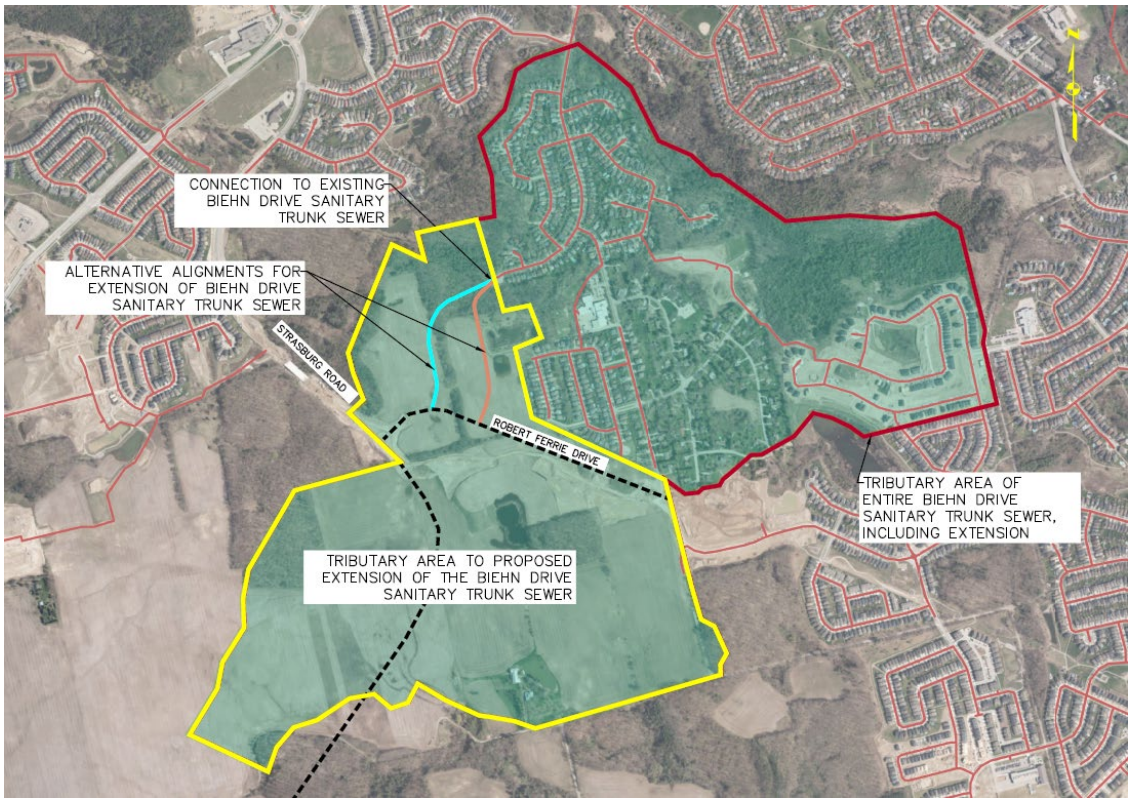

Figure 1 - Original Sanitary Sewer Tributary Area

The City's Official Plan designates the lands within the original drainage area as shown on Figure 2. The lands designated as Rural and Agricultural drain naturally to the adjacent watershed and will not be connected to the sanitary trunk sewer. Therefore, these lands can be considered to be non-tributary.

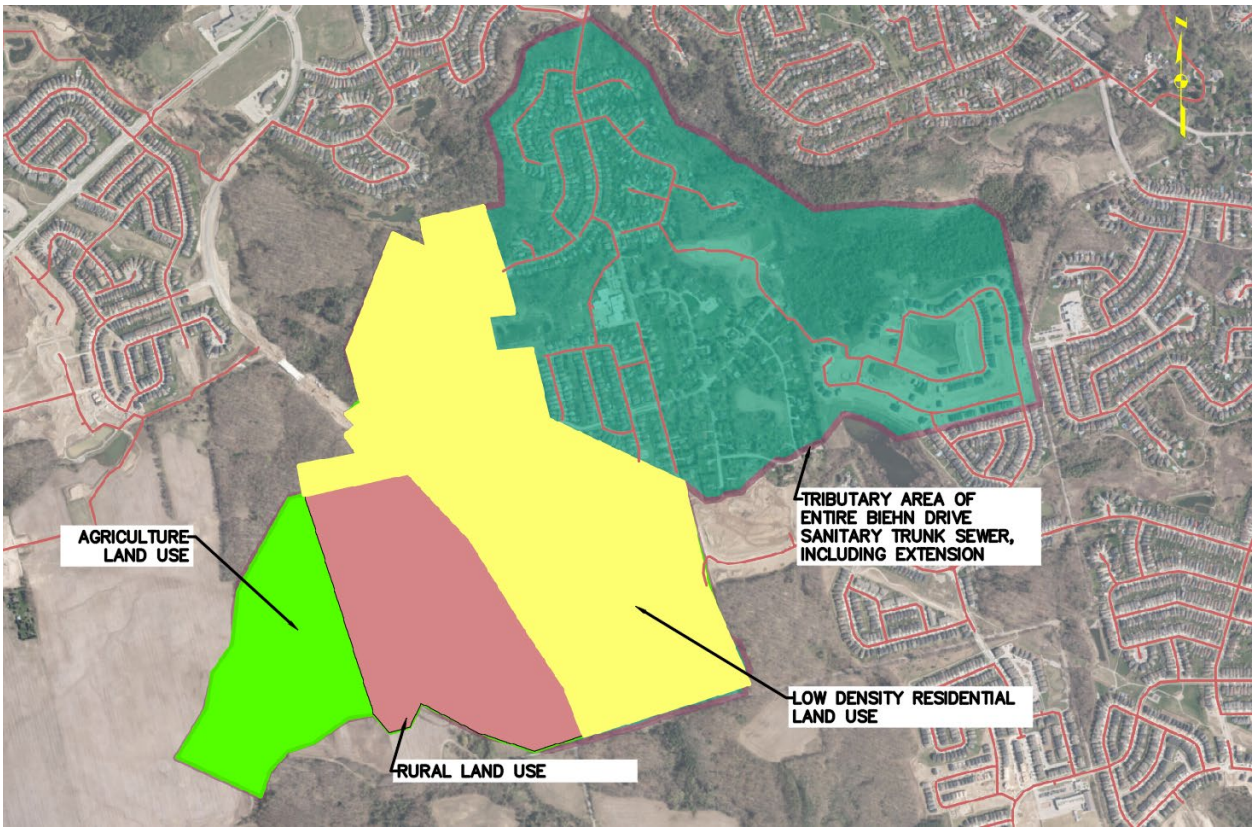

Figure 2 - Land Uses per Official Plan

Therefore, the revised sanitary drainage area was modified to include only the lands that are designated for urban development. The revised sanitary trunk sewer drainage area, shown on Figure 3, includes 72.0 ha.

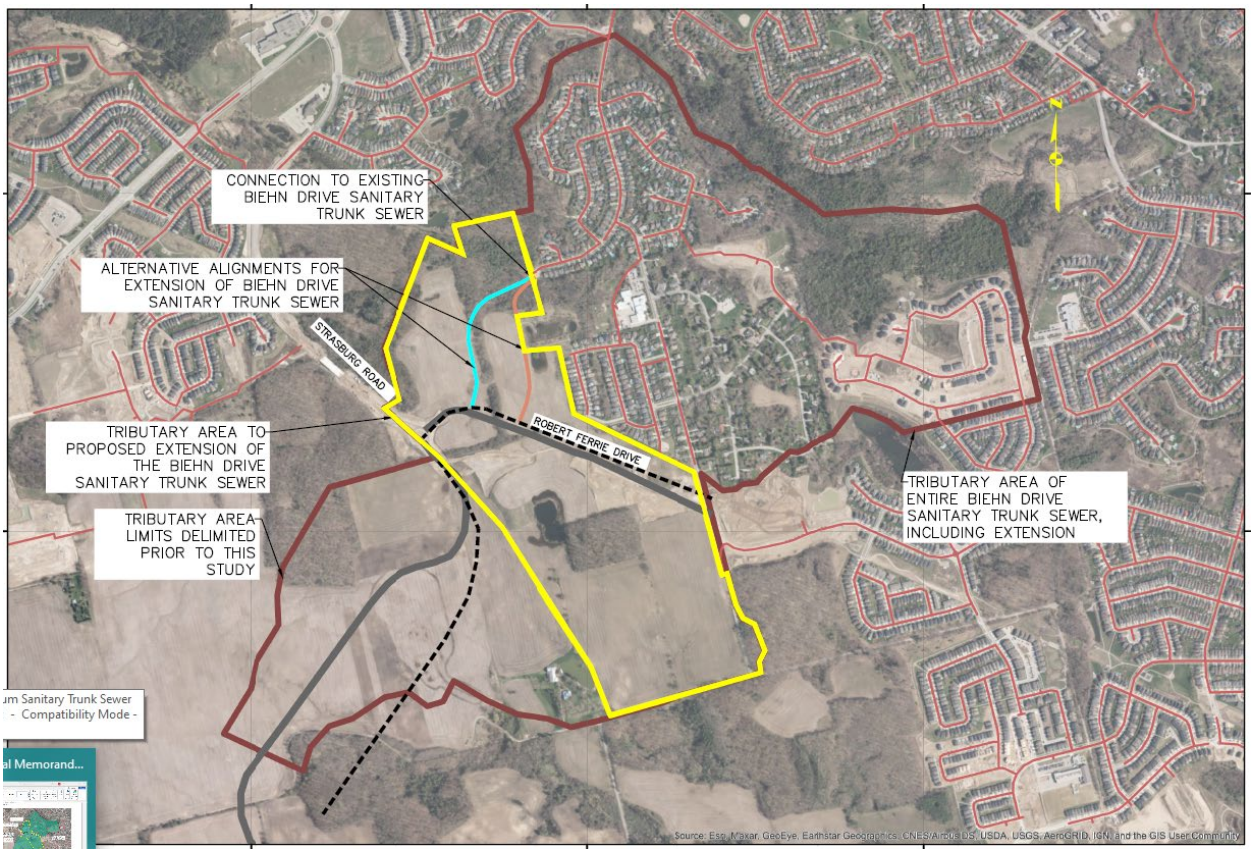

Figure 3 - Revised Sanitary Trunk Sewer Drainage Area

Population Estimate

The Official Plan designates the urban areas within the sanitary trunk sewer drainage area as Low Density Residential, which allows for a maximum of 30 dwellings per hectare. Based on the drainage area of 72.0 ha, the total number of dwellings is 1920. This is a conservative estimate, given that it does not subtract the area required for roadways, parks, and schools. However, given that the proposed development is not fully defined, it represents a reasonable estimate.

Statistics Canada 2016 Census data show that the average number of persons per dwelling in the Region is 2.6 persons. On this basis, the population of the revised drainage area is 5016 persons.

Estimated Sanitary Sewage Flow

The 2021 Development Manual of the City of Kitchener provides the design criteria for sanitary servicing. Based on the Kitchener Development Manual, the average flow per capita for new sanitary sewers is 305 litres per day (305 l/cap/day). The peak flow in the sanitary sewer must be calculated using a Peaking Factor Formula (the Harmon Formula) related to the serviced population.

In addition to the average sewage flow, the sanitary sewer must have hydraulic capacity to accommodate a minimum flow resulting from inflow and infiltration (I/I flow). The required I/I flow is 0.15 l/s/ha.

On this basis, the peak flowrate at the junction of the trunk sewer extension and the existing sewer is 67 l/s.

It should be noted that the existing sanitary trunk sewer has a hydraulic capacity of 168 l/s, which is appropriate for the larger drainage area of 127.3 ha.

Alternative Sanitary Trunk Sewer Alignments

Two Sanitary Sewer Alignment Alternatives were considered, as shown on Figure 4.

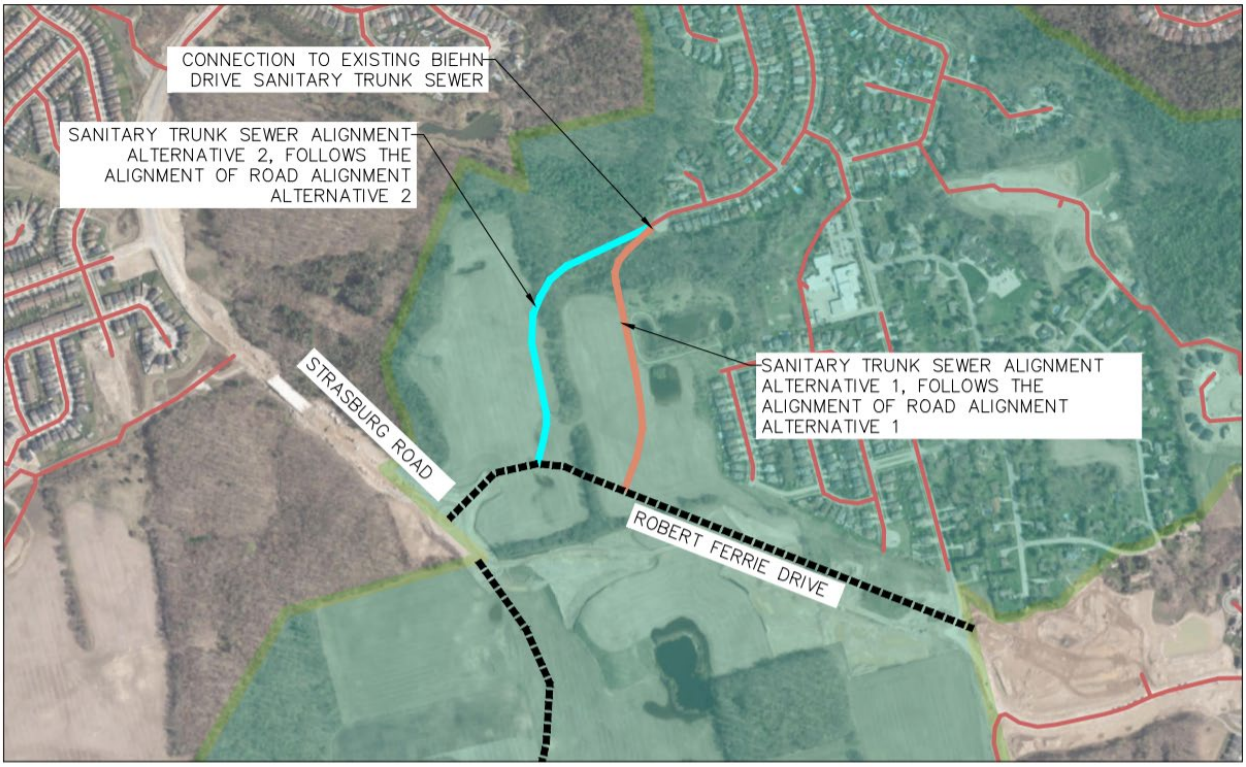

Figure 4 - Sanitary Sewer Alignment Alternatives

The two alternative alignments were evaluated in conjunction with the analysis and evaluation of the road alignment alternatives, as discussed in the Environmental Study Report. Based on the evaluation of alternatives, the Technically Preferred Sanitary Sewer Alignment Alternative is Sanitary Sewer Alignment 1.

New Sanitary Trunk Sewer

The new trunk sanitary sewer will follow the alignment of the Biehn Drive extension to Robert

Ferrie Drive. Based on the sanitary drainage area, the new trunk sewer will be designed for a peak flow of 67 l/s, and will be installed at a grade of 0.50% to allow connection of the areas of the sewershed located south of Robert Ferrie Drive. The required trunk sanitary sewer pipe will be a 500 mm diameter HDPE pipe or a 525 mm diameter pipe. The type of pipe will be confirmed in the preliminary design.

Figure 5 shows an approximate alignment of a future sanitary sewer that would serve the southern portion of the sewershed. Figure 6 shows the ground and sewer profiles along the same alignment. The maximum depths could be up to 21 m.

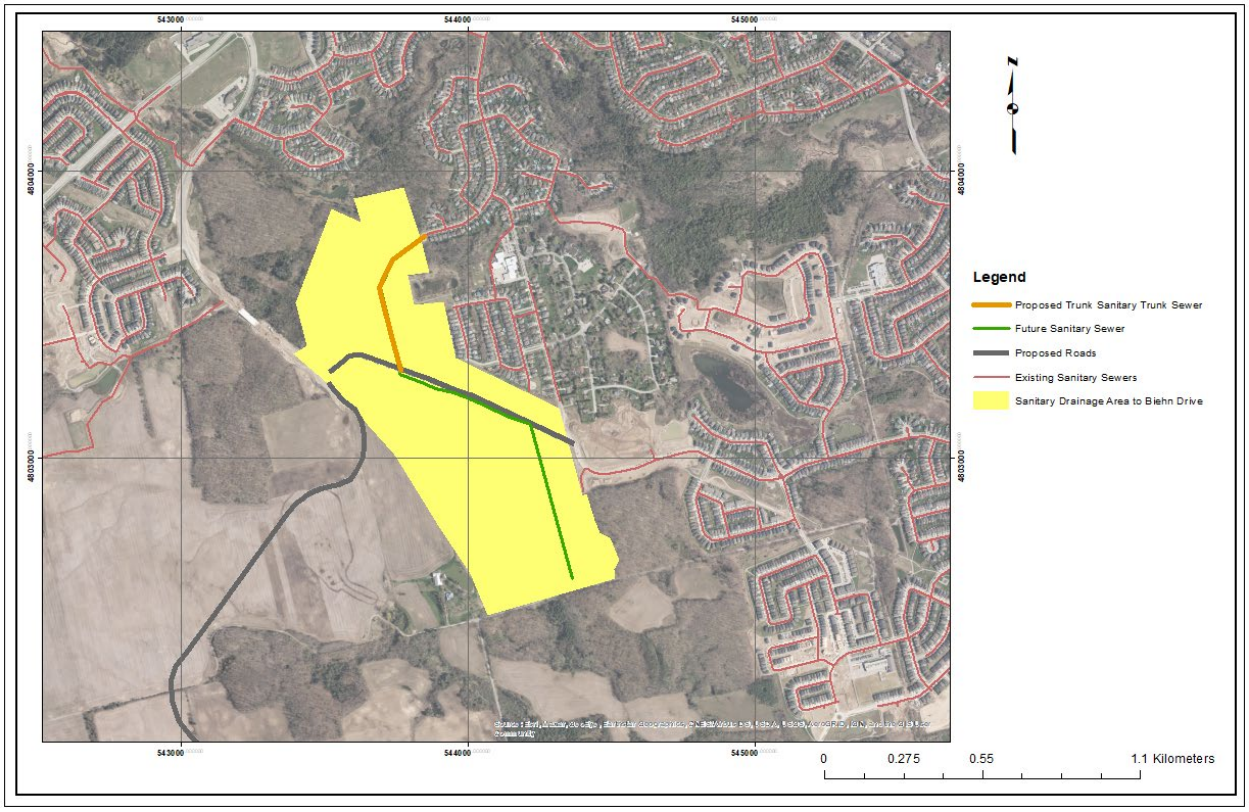

Figure 5 - Future Sanitary Sewer

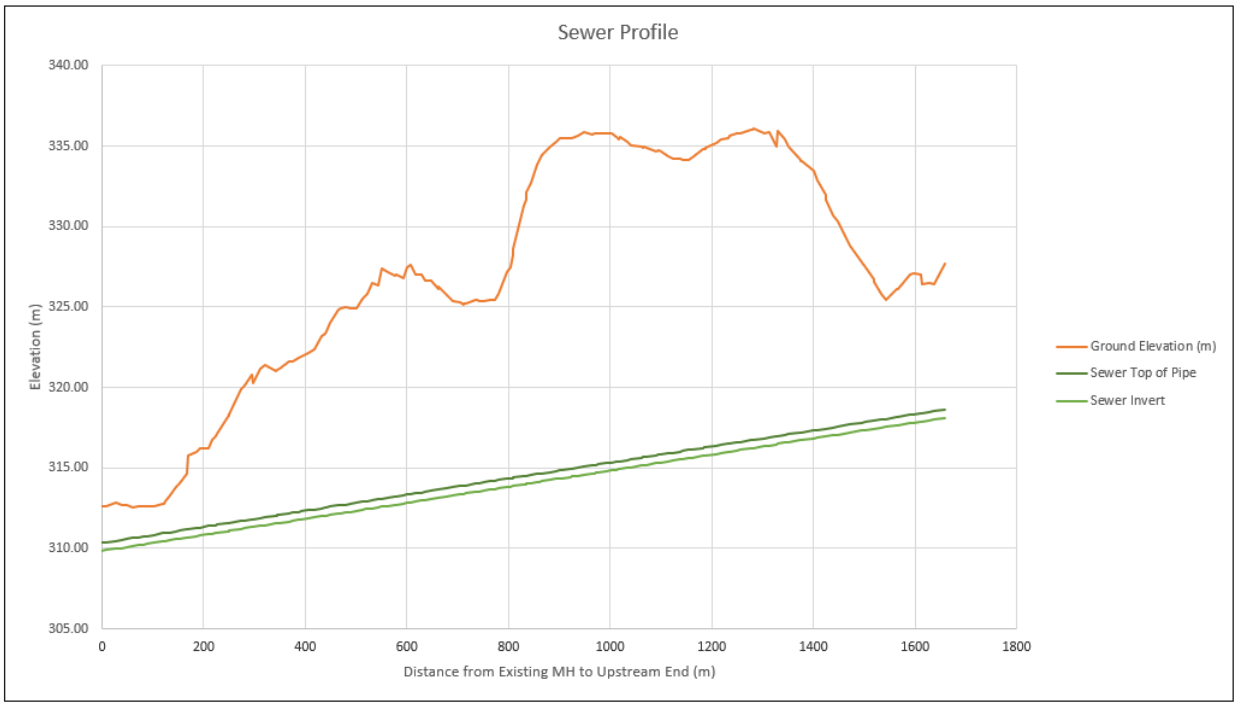

Figure 6 - Future Sewer Profile

Although it is possible to install the pipe at the depth shown, other options may be more appropriate to serve this area in the future. For example, the southern half of the tributary area may require a pumping station and forcemain. Alternatively, the City may wish to consider draining the southern portion to the adjacent New Dundee sewershed, if the hydraulic capacity of that system permits. However, to provide for the possibility that the entire system connects to the proposed Biehn Drive trunk sanitary sewer extension, the sewer needs to set at the lowest feasible grade.

Additional details will be provided in the preliminary design.

Prepared by

Leonardo Sanchez, P.Eng.

Appendix H

Analysis and Evaluation Report

BT ENGINEERING

Updated Analysis and Evaluation Report

City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment

August 2024, Revision 1

Submitted by:
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
519-672-2222

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1.0 INTRODUCTION

This report supersedes the original Analysis and Evaluation Report REV. 3 February 28, 2023.

The City of Kitchener (City) is undertaking a Class Environmental Assessment (EA) Study of the extension of Biehn Drive southerly to the proposed extension of Robert Ferrie Drive. The extension of Biehn Drive will include a trunk sanitary sewer and a watermain. The Study involves evaluation of alternatives for the alignment of the Biehn Drive extension, the location and design of intersections, and municipal services, while minimizing natural, social, cultural and land use impacts. This report describes the revised evaluation of the Preliminary Alignment Alternatives carried forward following Public Information Centre (PIC) No. 2 and the additional studies carried out by the City of Kitchener.

1.1 Problem and Opportunity Statement

The planned extensions of Strasburg Road and Robert Ferrie Drive combined with new development will result in changes to the traffic demands and patterns within the Doon South and Brigadoon communities. To address those changes, the City of Kitchener Transportation Master Plan and Official Plan have identified an extension of Biehn Drive from its current terminus to Robert Ferrie Drive. The Study has revisited the need for an extension of Biehn Drive and evaluated potential alignment alternatives if an extension of Biehn Drive is still recommended. The Study has considered the natural, social environments and the future land use in the Study Area. The study is assessing the road network to provide safe, reliable transportation access to communities within Doon South and Brigadoon considering vehicular, pedestrian, cycling and truck routes. The road project is being completed as a Schedule C undertaking.

The Project provides the opportunity to:

- Improve accessibility to the local community by providing additional network links;
- Define a multi-modal transportation plan to support travel within the local neighbourhoods; and
- Allow development to proceed on lands that currently require the infrastructure requirements to be defined prior to developing the land use plan.

In parallel, the City is planning for new municipal services that are required to serve future development to the south. The future watermain and sanitary trunk sewer crossing of the Provincially Significant Wetland (PSW) from the existing services at the end of Biehn Drive are being completed as a Schedule B project.

1.2 Study Area

The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension.

Comments received from the public at the combined Community Café and PIC No. 1, indicated that the Study Area should be expanded to include a Broader Study Area and consider traffic effects in adjacent neighbourhoods. The Study Area is illustrated in **Figure 1.**

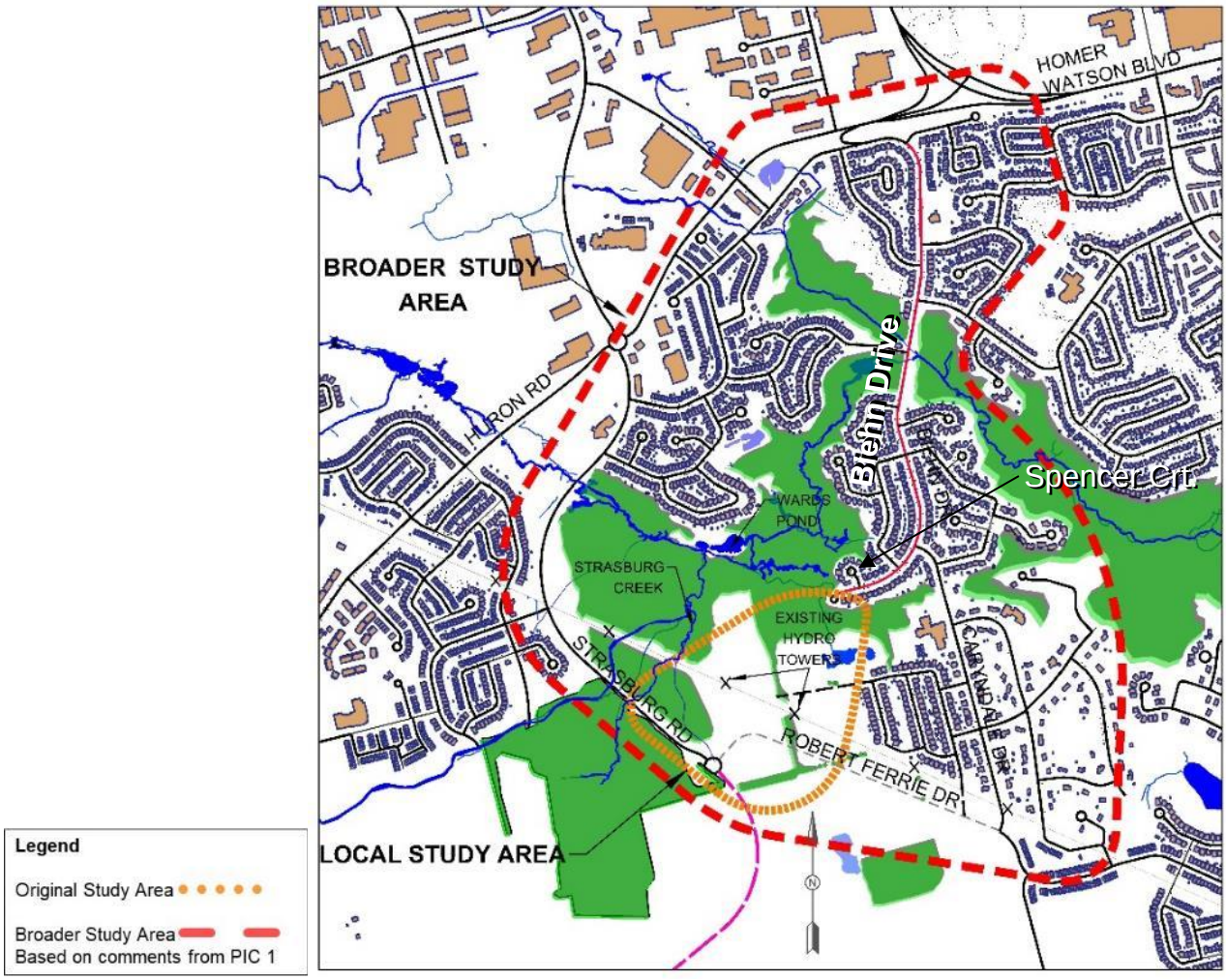


Figure 1: Study Area

1.3 Study Introduction

This study was initiated as a Municipal Schedule C project as defined by the Municipal Class Environmental Assessment (MCEA). The Study involves evaluating alternative alignments for Biehn Drive to serve the Brigadoon Community located in the southwest portion of the City of Kitchener. The extension of Biehn Drive has long been a part of the integrated land use and transportation plan for the larger community. The City of Kitchener Official Plan (November 2014) identifies Biehn Drive as a Major Community Collector Street, shown in orange, refer to **Figure 2**. Collector streets function to collect traffic from local streets and provide access to arterial streets, shown in orange.

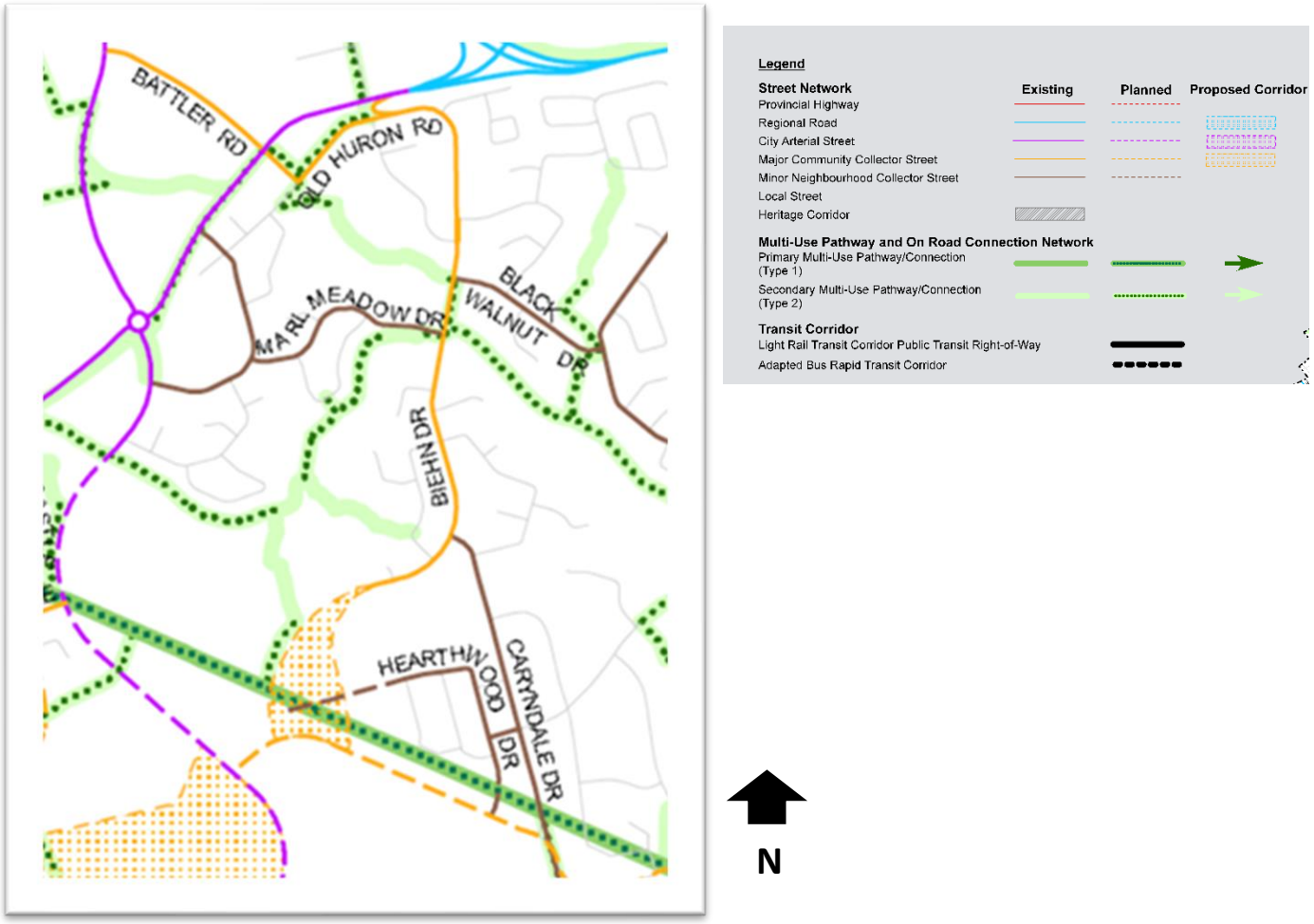


Figure 2: Future Road Network

Source: City of Kitchener Official Plan: A Complete & Healthy Kitchener November 19, 2014 OP Map 11 - Integrated Transportation System.

1.4 Background

Since the mid-2000's, the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener involved plans for area development and evolving transportation needs. The 2014 Official Plan and the (add date) Transportation Master Plan (TMP) identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension and ultimately to Strasburg Road. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan Amendment. This link would accommodate vehicles to and from the Brigadoon community and would help mitigate cut-through traffic on local streets within the community. A collector road would collect traffic from local roads within the community and provide connectivity to high tier arterial roads including Strasburg Road.

1.5 Additional Studies

Following PIC 2 in November 15 to 29, 2021, three additional studies were carried out to fully understand the traffic and natural heritage impacts anticipated with the extension of Biehn Drive. These studies included an updated traffic analysis of the Doon South and Brigadoon communities, a survey for Black Ash trees which were listed as a Species at Risk in January 2024 and a dewatering assessment for constructing municipal services beneath the Strasburg Creek Wetland. These three studies significantly altered the evaluation methodology and added significant criteria which was not considered in the original evaluation of road alignments carried out in October 2021. The Analysis and Evaluation Report has been updated to reflect the recent findings. This report documents the revised evaluation of the Preliminary Design Alternatives.

1.5.1 City of Kitchener Doon South Community Area Transportation Study

The purpose of this study was to confirm the need and justification for the Biehn Drive extension and the implications of not proceeding with this project.[1] The findings and conclusion are briefly listed as follows:

- Caryndale Drive functions as a major neighborhood community collector. It provides the only westerly connection between Biehn Drive and Robert Ferrie Drive.
- Caryndale Drive in combination with Biehn Drive and Robert Ferrie Drive provides the only continuous route through the western area of the Doon South neighbourhood between New Dundee Road and Huron Road.
- The future extension of Robert Ferrie Drive west to Strasburg Road, and the extension of Strasburg Road south to New Dundee Road is likely to redistribute (and increase) traffic volumes on Caryndale Drive by providing a new link to Caryndale Drive from Strasburg Road (if Biehn Drive is not connected to Robert Ferrie Drive).
- The extension of Biehn Drive to Robert Ferrie Drive will ensure Carnydale Dive functions as a minor neighbourhood collector street, as described in the City of Kitchener Official Plan and will provides an alternate route to the Caryndale Drive corridor.

The Doon South Community Area is shown in **Figure 3.**

[1] City of Kitchener Doon South Community Area Transportation Study, by Paradigm Transportation Solutions Limited 02/2024.

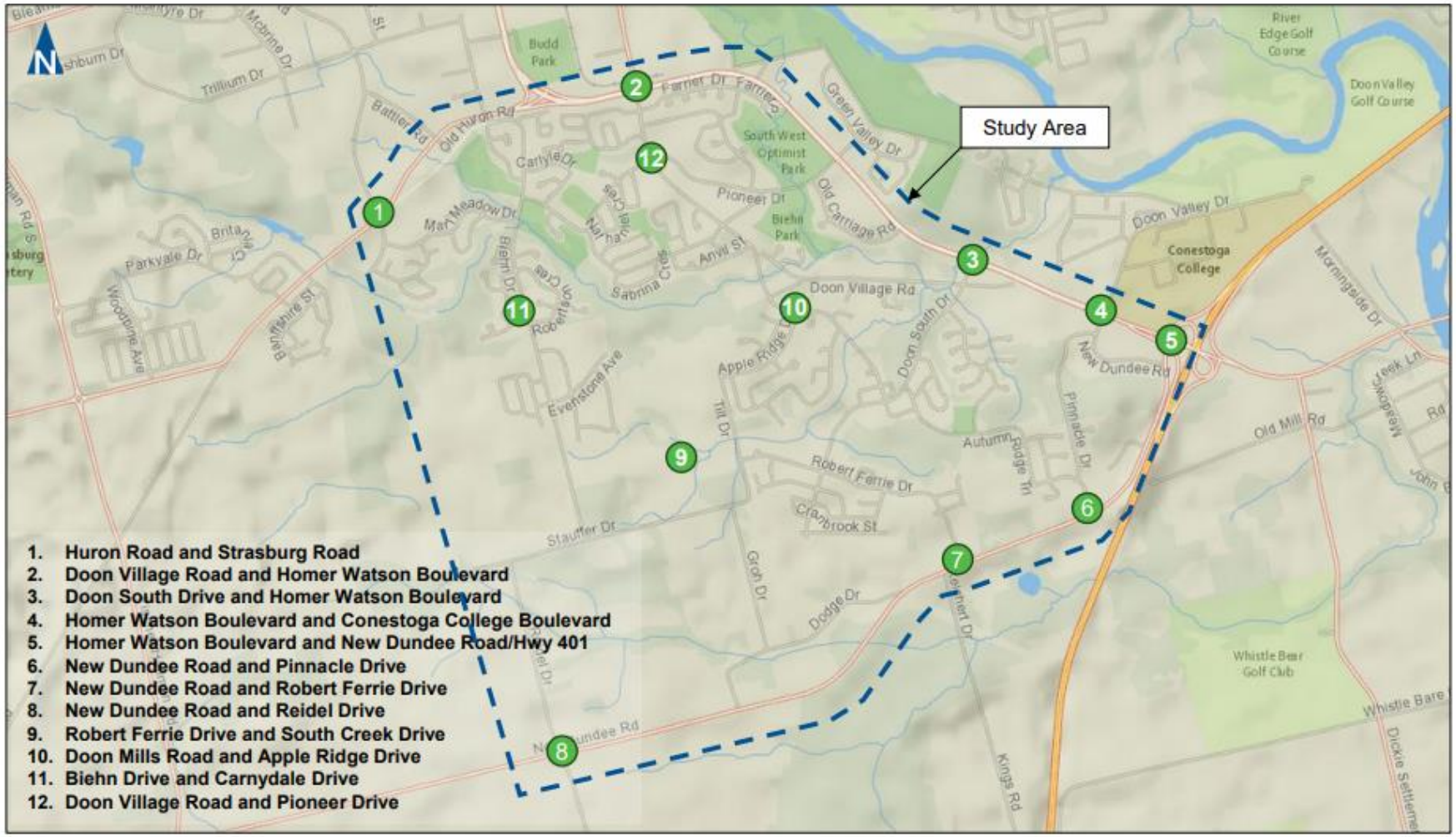


Figure 3: City of Kitchener Doon South Study Area and Intersections

1.5.2 Black Ash Tree Identification

A Site Reconnaissance of the portion of the Strasburg Creek Provincially Significant Wetland (PSW) within the Study Area was undertaken on October 23, 2024, to identify Black Ash trees.[2] Six trees are considered potential Black Ash within the preferred road alignment, four were classified as potential Black Ash due to the absence of leaves, which limits identification, and two exhibit stronger potential based on distinct bark characteristics. .

The *Endangered Species Act*, 2007 (ESA) protections for Black Ash came into force on January 26, 2024. Ontario's new regulations apply to healthy Black Ash that appear to have survived exposure to the Emerald Ash Borer (EAB). These regions encompass various municipalities, counties, townships, and cities, including Kitchener in the region of Waterloo. Ontario's habitat protection prohibitions are applicable to a radial distance of 30 metres around Black Ash.

1.5.3 Hydrogeology Assessment

A trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area.[3]

[2] Black Ash Tree Identification Update - October 23, 2024

[3] Geotechnical Investigation – Proposed Trunk Sewer, Biehn Drive South Extension, Kitchener, by Cambium December 20, 2023

2.0 ALTERNATIVES TO THE UNDERTAKING – PLANNING ALTERNATIVES

2.1 Description of Planning Alternatives

Planning Alternatives represent alternative ways or methods of addressing the Problem and Opportunity Statement specific to this study. These reflect different strategies and include the "Do Nothing" approach (maintaining the status quo, i.e. not addressing the Problem and Opportunity Statement). The consideration of all reasonable alternatives is a guiding principle for EA studies.

The analysis and evaluation process involves a 2-step decision-making process. Initially the evaluation of Planning Alternatives (alternative project types or alternative strategies to address the problem) are identified followed by the subsequent evaluation of preliminary design alternatives. The preliminary design alternatives include the Biehn Drive extension alignment, sanitary sewer alignment, cross section, and intersection alternatives.

The Planning alternatives were previously considered in the City of Kitchener Transportation Master Plan, 2013, which identified the extension of Biehn Drive as a City Street Capacity Improvement. The TMP was developed following Phases 1 and 2 of the Class EA process, including the evaluation of Alternative Planning Solutions. The TMP includes recommendations for the "implementation of new streets in southwest Kitchener Urban Areas Study Community Master Plan, including the extension of Biehn Drive between Biehn Drive and Robert Ferrie Drive".

In reviewing the TMP recommendations, the following Planning Alternatives were assessed:

- Do Nothing: This alternative would maintain the existing road network and would not extend Biehn Drive and not provide a bundled sanitary and municipal service corridor.
- Transportation Demand Management (TDM): Reduces vehicular traffic demand (encourages alternative work hours, work at home and active modes of transportation). Does not address the need for a municipal service corridor. TDM will be accomplished by the inclusion of a multi-use path adjacent to the roadway.
- Use of Local Roads: Encourage the use of other local roads to reduce the need to extend Biehn Drive. Local roads are generally not designed or maintained to accommodate high traffic volumes. This alternative does not address the parallel requirement for a municipal services corridor.
- Limit Land Use Development: Limit any new residential, commercial or industrial development and therefore reduce the generation of new trips. This does not achieve the Provincial mandate of the Places to Grow Act which directs the Region and City to create future development lands with specific targets to be achieved.
- Extend Biehn Drive: Provides a long-term solution for improved traffic operations for all modes of travel (pedestrians, cyclists, transit and local community traffic) and safety. It allows a bundling of municipal services in a common corridor which is required to service the expansion areas to the south to meet the Provincial Places to Grow Act mandate.

Based on the preliminary review of Alternative Planning Solutions, "Transportation Demand Management" and "Extend Biehn Drive" (including the bundling of the proposed trunk sanitary

sewer, maintenance roadway/multi-use path and watermain from Biehn Drive to Robert Ferrie Drive) are recommended. The Use of Local Roads was not a standalone solution but based on community input was carried forward as a modified approach of using two corridors (Alternative 4 carried forward using Caryndale Drive for traffic and using a municipal servicing corridor across the PSW). This approach validates and supports the previous TMP recommendations.

The evaluation of the Alternatives to the Undertaking (Planning Alternatives) for this Study is shown in **Table 1.**

The long list of alternatives and the coarse screening evaluation of alternatives was presented to the public at PIC No. 1 in early 2021. Following PIC No. 1 and the public's opportunity to comment, the Preliminary Alignment Alternatives were coarse screened, and the recommended alternatives were carried forward for a detailed evaluation. The coarse screening of the long list of alternatives and a description of the evaluation results will be documented in the final Environmental Study Report (ESR).

The Preliminary Alignment Alternatives (Alternative Methods of implementing the Preferred Planning Alternative) that are proposed to be considered for the recommended Planning Solution are: TDM; Use Existing Roads; and Extend Biehn Drive.

Table 1: Planning Alternatives

Screening Criteria	Do Nothing	TDM	Use of Existing Local Roads	Limit Development	Extend Biehn Drive (Road and servicing corridor)
Transportation	Does not address forecast traffic demand. Results in increased volumes on local roads.	May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure.	Local roads not designed to accommodate increased volumes. Caryndale Drive is not designated as a major collector and as such should not be expected to carry additional traffic.	May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth.	Accommodates all modes of transportation.
Municipal Services (Water and Trunk Sanitary Sewer for future development)	Does not accommodate future development.	Does not accommodate future development.	Does not accommodate future development.	Does not accommodate future development.	Accommodates future development.
Environmental	No impacts.	No or low impacts. Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes).	Low impacts. Creates disruption to properties on local roads that would experience an increase in traffic.	No impacts.	Low to High Servicing: Low Roadway: High environmental effect possible with new corridor. Magnitude of effects will depend impact on PSW and SAR tree species.

Screening Criteria	Do Nothing	TDM	Use of Existing Local Roads	Limit Development	Extend Biehn Drive (Road and servicing corridor)
City Planning Objectives	Does not meet objectives/ recommendations in City Planning document or support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services).	Supports objective to encourage active transportation and alternate modes. Does not support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services).	Does not meet objectives/ recommendations in City Planning documents. Does not support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services).	Does not meet objectives/ recommendations in City Planning documents. Does not support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services).	Supports the recommendations for the extension of Biehn Drive in OP and TMP. Supports the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services).
Recommendations	Not recommended but carried forward as a baseline to compare other alternatives. ✓	Recommended as a complementary solution. This is not a standalone solution. ✓	Following PIC No. 1 there was public support to carry forward this alternative. This is not a standalone solution. See Extend Biehn Drive which is a combination of Use of Local Roads and a New Municipal Servicing Corridor. ✓	Not recommended. ✗	Recommended to be carried forward for further study, for both municipal services and a transportation connection. ✓

✓ **Recommended Planning Solutions for further evaluation**

3.0 EVALUATION METHODOLOGY

3.1 Alignment Alternatives Evaluation Methodology

For the evaluation of the alignment alternatives, the study utilized a formal quantitative evaluation methodology described as the Multi Attribute Trade-off System (MATS). The use of this multi-criteria decision analysis involves establishing utility scores for each alternative on each criterion. The utility scores allow a translation of units of measure to a non-dimensional number that allows scores to be added between factor groups/sub-factors. The scores are then totalled using a system of weights to determine an overall ranking for each alternative.

A detailed description of the evaluation methodology used in this study for selecting the Technically Preferred Alignment is provided in **Appendix A**.

The quantitative approach for the evaluation of Alignment Alternatives is consistent with the Ministry of Environment, Conservation and Parks (MECP) practices for the evaluation of numerous and complex alternatives. This approach uses an analytical approach that measures scores based on a mathematical relationship, i.e., the degree of subjectivity by the evaluation team is minimized. This traceable process allows the evaluation team and the opportunity to assess trade-offs involved in the evaluation and use this information to support the decision-making process. The evaluation criteria include:

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

4.0 EVALUATION OF ALTERNATIVES

4.1 Coarse Screening Alignment Evaluation

4.1.1 Preliminary Alignment Alternatives

The Preliminary Alignment Alternatives presented to the public at PIC No. 1 are shown in **Figure 4**. An additional Alignment, Alternative 4 using existing roadways, was added following input from PIC No. 2. All the alternatives were carried forward to the detailed evaluation were considered by the Study Team to be reasonable alternatives to the Planning Solution and are listed in **Table 2**.

Table 2: Preliminary Alignment Alternatives

Alternative	Description
Do Nothing	Existing - Caryndale Drive
Alternative 1	Connect Biehn Drive to Robert Ferrie Drive - East Alignment
Alternative 2	Connect Biehn Drive to Robert Ferrie Drive - Central Alignment
Alternative 3	Connect Biehn Drive to Strasburg Road - West Alignment
Alternative 4	Existing - Caryndale Drive Provide an Active Transportation Link Municipal Trunk Sewer to follow Alternative 1

The coarse screening of Alignment Alternatives is shown in **Table 3.**

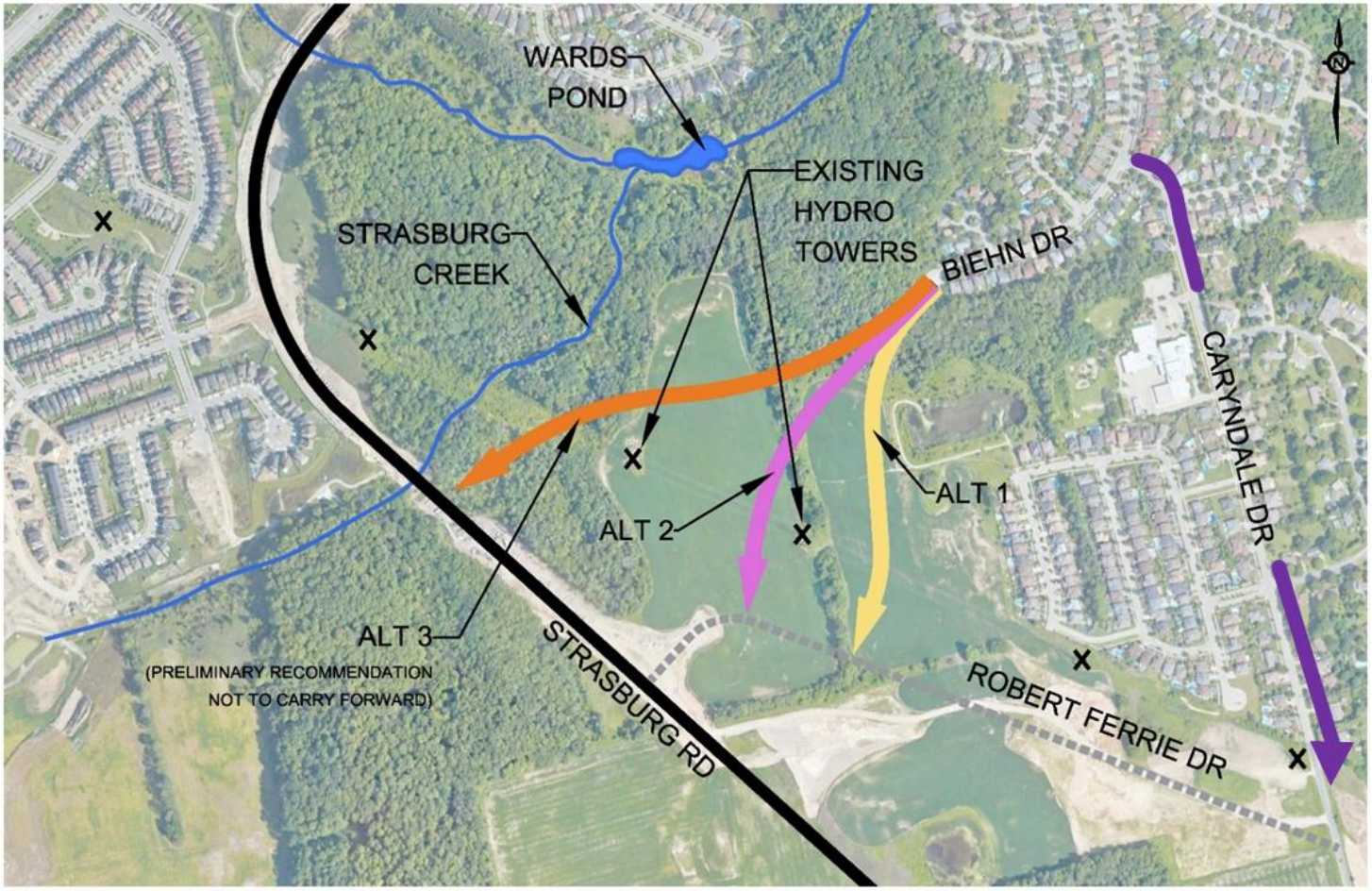
The preliminary alignment alternatives will include a trunk sanitary sewer in conjunction with the alternative road extension alternatives. It is noted that some of the alternative alignments for the trunk sewer may diverge from the road alignment alternatives. The Class EA process for extension of the sanitary sewer is a Schedule B process. However, the EA for the road and sanitary sewer will be combined into a single document and will be documented in an ESR. This EA is being undertaken concurrently with the Sanitary Sewer Master Plan.

In addition, following PIC No. 2, Alternative 4 was revised and no longer had a proposed Multi Use Pathway linking Biehn Drive to Robert Ferrie Drive to limit impacts to the PSW.

4.1.2 Short Listed Alignment Alternatives Evaluation

Figure 5 illustrates the three (3) alignment alternatives that were carried forward following the coarse screening. The short-listed Alignment Corridor Alternatives are shown in **Appendix B**. Alternative 4 was added following public comments received at PIC No.1 and the Do Nothing was included as a baseline to compare other alternatives.

Figure 4: Preliminary Alignment Alternatives



NTS

Legend

Future Roadway Alignment

Table 3: Coarse Screening of Alignment Alternatives					
Screening Criteria	**Do Nothing**	**Alternative 1: Extend Biehn Dr. to Robert Ferrie Drive east of Hydro Tower**	**Alternative 2: Extend Biehn Dr. to Robert Ferrie Drive west of Hydro Tower**	**Alternative 3: Strasburg Road Connection**	**Alternative 4: Existing - Caryndale Drive**
Does this alternative satisfy forecast traffic demand, improve safety, and address all modes of transportation?	Does not meet forecast traffic demand, improve safety nor address all modes of transportation.	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive.	Provides a north-south connection to Strasburg Road. Accommodates all modes.	Provides a north-south connection to Strasburg Road. Accommodates all modes. However, there are increased levels of traffic on local roads.
Does the approach result in significant impacts to the natural environment?	No impacts.	Minor impacts to the woodlot/PSW (~0.3 ha).	Minor impacts to the woodlot/PSW (~0.3 ha).	Significant impacts to the woodlot/PSW (~1.3 ha).	No impacts.
Is the approach affordable for the City to implement?	Affordable alternative.	No significant difference.	No significant difference.	Higher cost - requires an intersection onto Strasburg Road (arterial).	Affordable alternative.
Does this alternative comply with the recommendations of the City's planning documents (I.e., TMP, OP, KGMP)	This alternative does not comply with the recommendations of the City's planning documents.	This alternative complies with the recommendations of the City's planning documents.	This alternative complies with the recommendations of the City's planning documents.	Does not comply with the recommendations of the Official Plan or Growth Management Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible.	This alternative does not comply with the recommendations of the City's planning documents.
Recommendation:	Carry forward as a base line to compare alternatives. ✓	Carry forward for further evaluation. ✓	Carry forward for further evaluation ✓	Do not carry forward ✗	Carry forward for further evaluation ✓

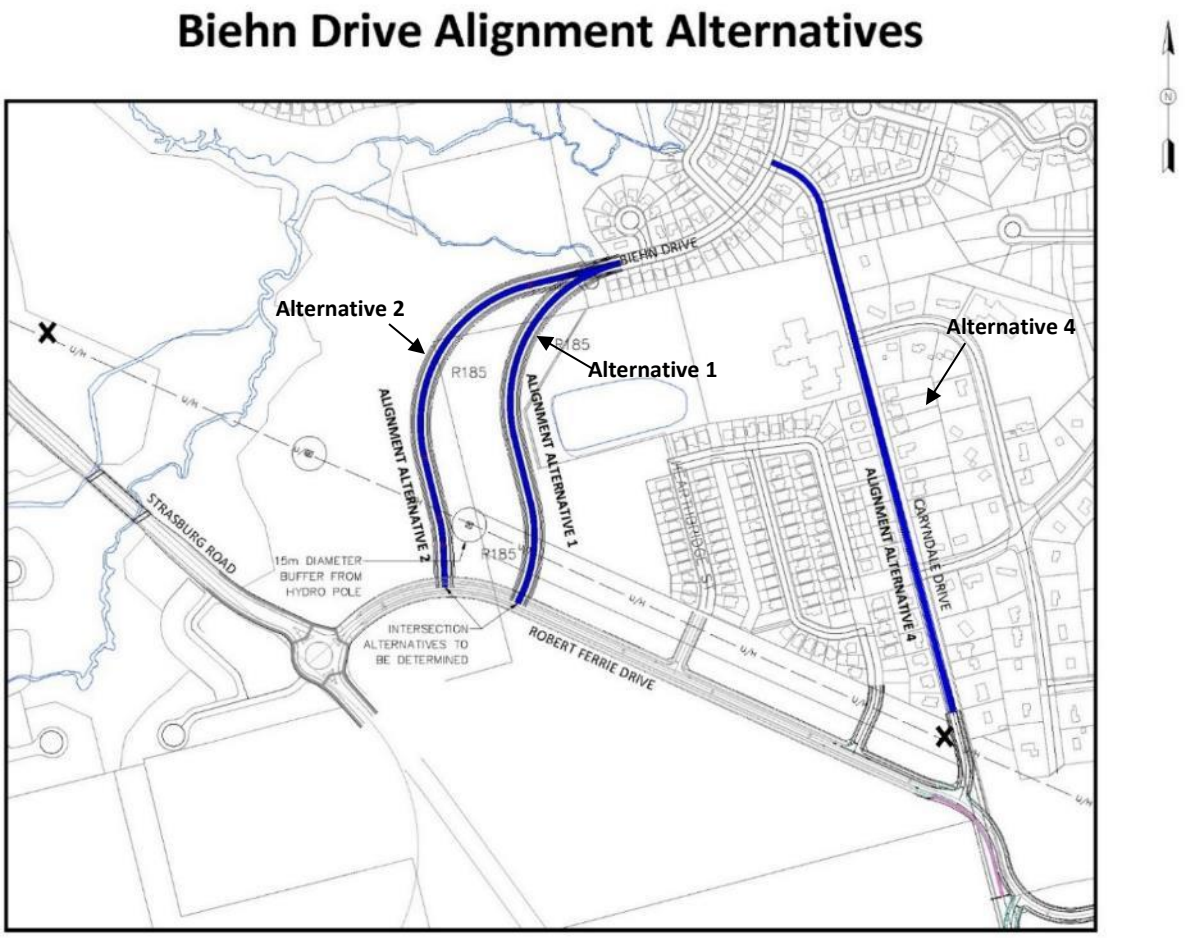


Figure 5: Short Listed Alignment Alternatives

4.1.3 Long List of Criteria - Alignment

A long list of sub-factors was established for each of the main factor categories to allow for the identification of all potential benefits and impacts. The relative measured effect of each criterion is also defined to ensure that the significance of each criterion (factor group or sub-factor) is recognized in the evaluation process.

Sub-factors are measurable criteria under a factor group. For example, under the category/factor group "Transportation", sub-factors relate to measurable transportation differences among alternatives. Using the Transportation factor group as an example, sub-factors may relate to safety or traffic operations measures for the identification of benefits and impacts.

Six categories or factors were selected which were used for each evaluation. Within each of these factor groups are sub-criteria, described as sub-factors, which define the measure and the relative differences of magnitude of impact or benefit. The factor groups include:

- Traffic and Transportation
- Natural Environment
- Cultural Environment

- Socio-Economic Environment
- Land Use and Property
- Cost

Within each of these categories (factor groups) are sub-factors which define the measure and the relative differences of magnitude of impact. The sub-factors were developed from a long list created by the Study Team (Consultants and City Staff). Where there were no measurable or meaningful differences between alternatives, and it is agreed that the alternatives are generally equal with respect to this criterion, then the sub-factor is not carried forward. When the Evaluation Team (Consultants and City Staff) considered the impacts were double counted among one or more criteria, then only one criterion was selected to be carried forward.

The long list of evaluation criteria that will not be carried forward are found in **Appendix C**. For a sub-factor to be carried forward, the sub-factor must:

- Be a measure of a meaningful difference among alternatives.
- Capture a measurable difference among alternatives.
- Not "double count" the effect that was measured under another sub-factor.
- Describe a difference in performance or an effect on the natural or social environment that the Technical Advisory Committee (Consultants and City Staff) considered necessary to be included in the decision-making process.

The selection of the sub-factors to address the goal of the study, are comprehensive enough to describe all aspects of the effects of the project, and do not double-count sub-factors.

4.1.4 Short Listed Criteria

Sub-factors selected to evaluate the alternatives including their definitions and scores are described in **Appendix D**.

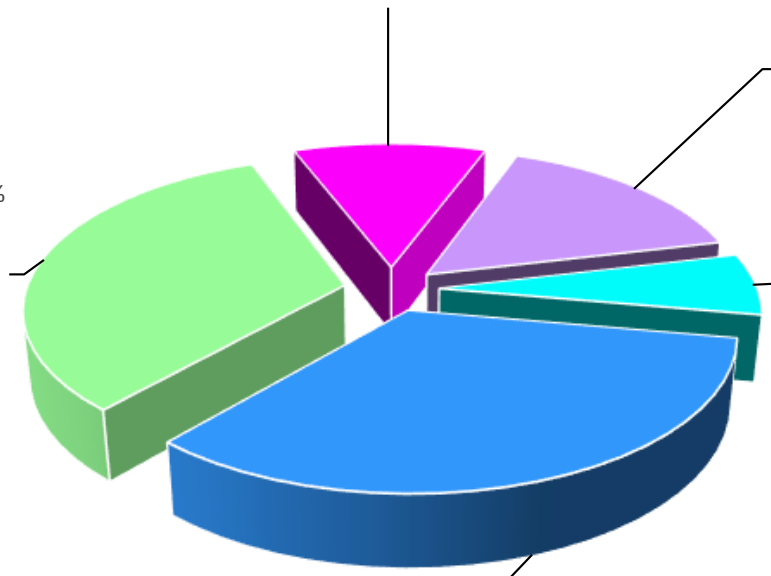
4.1.5 Preferred Alignment Alternatives

The Evaluation Team members were responsible for completing separate weighting exercises which provided independent perspectives of the relative importance of factor groups and sub-factors for each specific evaluation. The results of the weighting exercise are illustrated in **Figure 6** and **Figure 7.**

4.2 Technically Recommended Plan

Alternative 1 is the best-balanced solution, refer to **Table 4**. It provides the best transportation performance while minimizing natural and social environmental impacts. A limited number of Black Ash trees have been identified along the corridor however the city's best efforts to combat the Emerald Ash Borer has had limited success. The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors.

Alternative 1 is recommended as the Technically Preferred Plan and is shown in **Figure 8**. This recommendation minimizes the impacts to the PSW and provides a direct connection to Robert Farrie Drive. The trunk sewer and municipal water services will be extended southerly from Biehn Drive.



Socio - Economic Environment 10.3%
- Community Disruption to Biehn Drive North 21.0%
- Community Disruption to Biehn Drive South 50.0%
- Community Disruption to Caryndale 29.0%

Land Use and Property 14.2%
- Supports the City of Kitchener's Official Plan 56.0%
- Efficient Utilization of Land 29.5%
- Crossing of the Hydro Corridor 14.5%

Natural Environment 29.7%
- Wildlife Habitat 15.1%
- Accommodating Wildlife Movement 11.9%
- Provincially Significant Wetlands (PSW) Removed 24.8%
- Potential Black Ash Impacted 24.8%
- Groundwater Infiltration 23.5%

Cost 5.9%
- Capital Costs 100.0%

Transportation 30.5%
- Supports Urban Transit Service 8.5%
- Improved Emergency Response 7.1%
- Roadway Safety – Supports Area Traffic Calming Measures 17.5%
- Efficiency of Travel 19.9%
- Compatibility with Integrated Transportation Master Plan 8.3%
- Safety of School Zone 14.7%
- Personal Security of Pedestrians and Cyclists 7.3%
- Intersection Spacing/Safety 16.6%

Note:

Weights have been adjusted to account for updates to sub-factors.

Figure 6: Global Factor and Sub-factor Weights

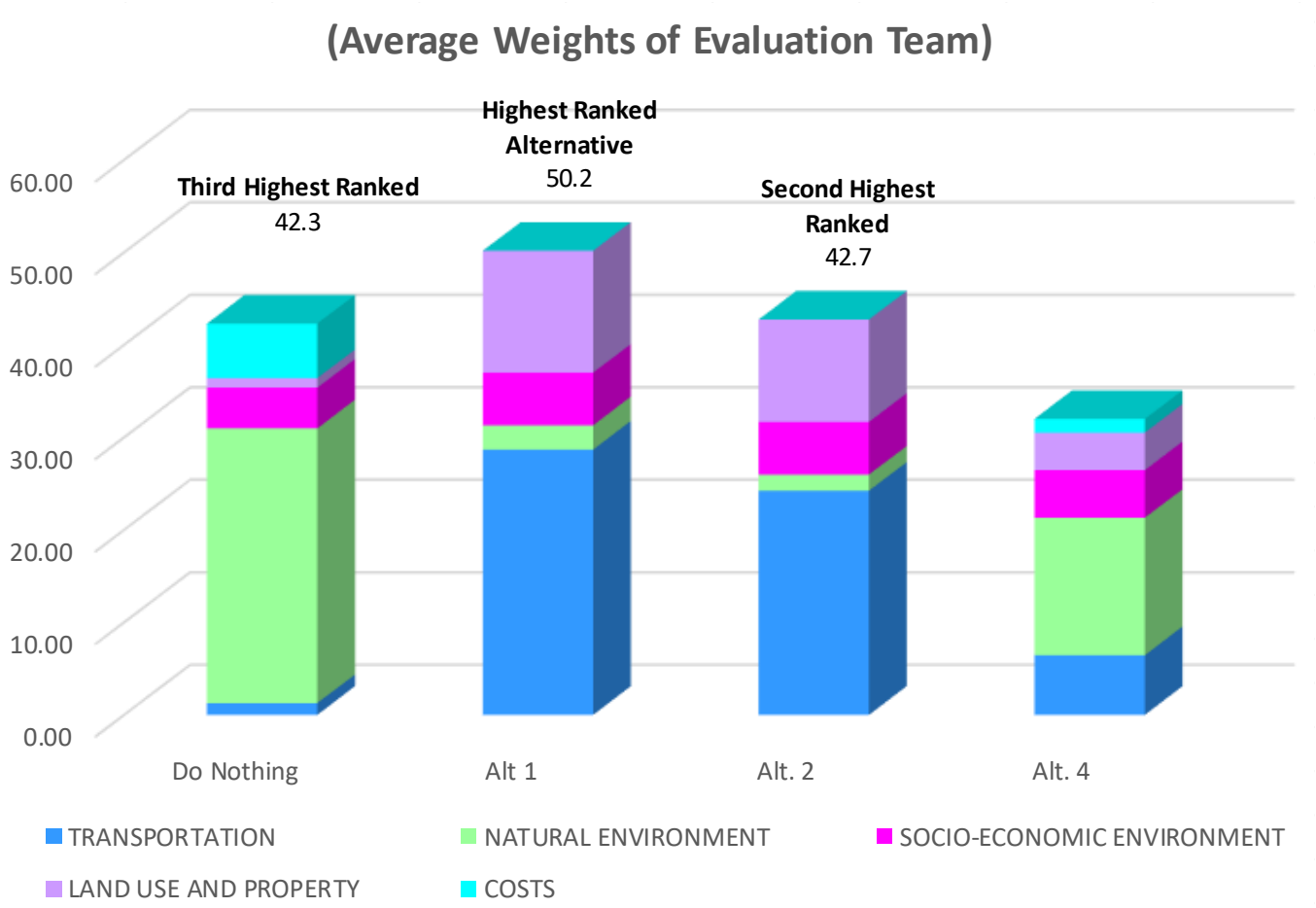


Figure 7: Alternative Totals

Table 4: Summary of Technical Recommendations

Do Nothing	Alternative 1: Extend Biehn Drive to Robert Ferrie Drive east of Hydro Tower	Alternative 2: Extend Biehn Drive to Robert Ferrie Drive west of Hydro Tower	Alternative 4: Existing Caryndale Drive and a Multi-Use Path crossing the PSW
Not recommended. The Do Nothing alternative fails to address the traffic volume and safety concerns along Caryndale Drive which should be expected to increase when the extension of Strasburg Road to New Dundee Road provides an alternative access to Highway 401. Caryndale Drive will continue to accommodate a higher volume of traffic and forced to function as a major collector street. The limited number of Black Ash trees in the PSW will continue to decline due to the Emerald Ash Borer. ✗	Recommended as the **Preferred Transportation Solution**. Alternative 1 is the best-balanced solution. It provides the best transportation performance while minimizing natural and social environmental impacts. A limited number of Black Ash trees have been identified along the corridor however the city's best efforts to combat the Emerald Ash Borer has had limited success. The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors. ✓	Not recommended. Although this alternative provides comparable transportation performance to Alternative 1 the environmental impacts are much greater. ✗	Not recommended. Caryndale Drive, classified as a minor neighbourhood collector street, will be forced to function as a major collector street. The neighbourhood was not designed for Caryndale Drive to continue to carry increasing volumes of vehicle traffic. ✗

4.2.1 Corridor Sensitivity Testing

To validate the weighting exercise, a sensitivity testing program was undertaken to determine whether the Technically Preferred Alternative (TPA) would have changed if a particular factor group was assigned a higher or lower importance than the group average. This ensures greater confidence in the selection process. The results of the sensitivity testing are shown in **Table 5**.

Table 5: Summary of Sensitivity Tests

Summary of Sensitivity Tests

Alternatives			Do Nothing	Alt 1	Alt. 2	Alt 4
	WEIGHT	Score:	42.3	50.2	42.7	32.0
Ranking			3	1	2	4
TRANSPORTATION	High	45.00%	3	1	2	4
	Low	20.00%	1	2	3	4
NATURAL ENVIRONMENT	High	40.00%	1	2	3	4
	Low	20.00%	3	1	2	4
SOCIO-ECONOMIC ENVIRONMENT	High	15.00%	2	1	3	4
	Low	10.00%	2	1	3	4
LAND USE AND PROPERTY	High	20.00%	3	1	2	4
	Low	10.00%	2	1	3	4
COST	High	10.00%	2	1	3	4
	Low	2.00%	3	1	2	4

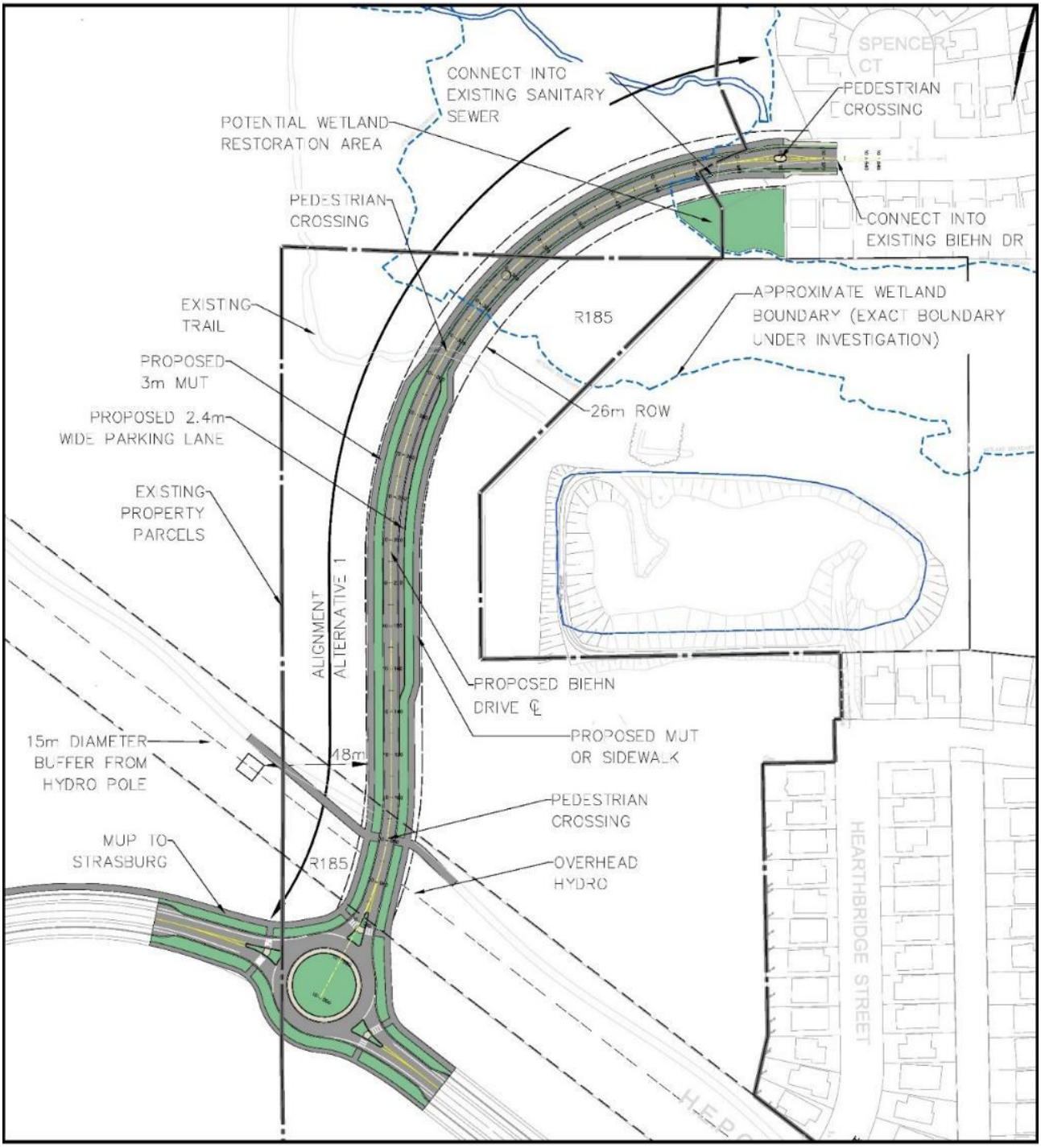


Figure 8: Technically Preferred Alternative

4.3 Cross Section Alternatives

Two (2) cross section alternatives were considered for Biehn Drive outside the limits of the wetland.

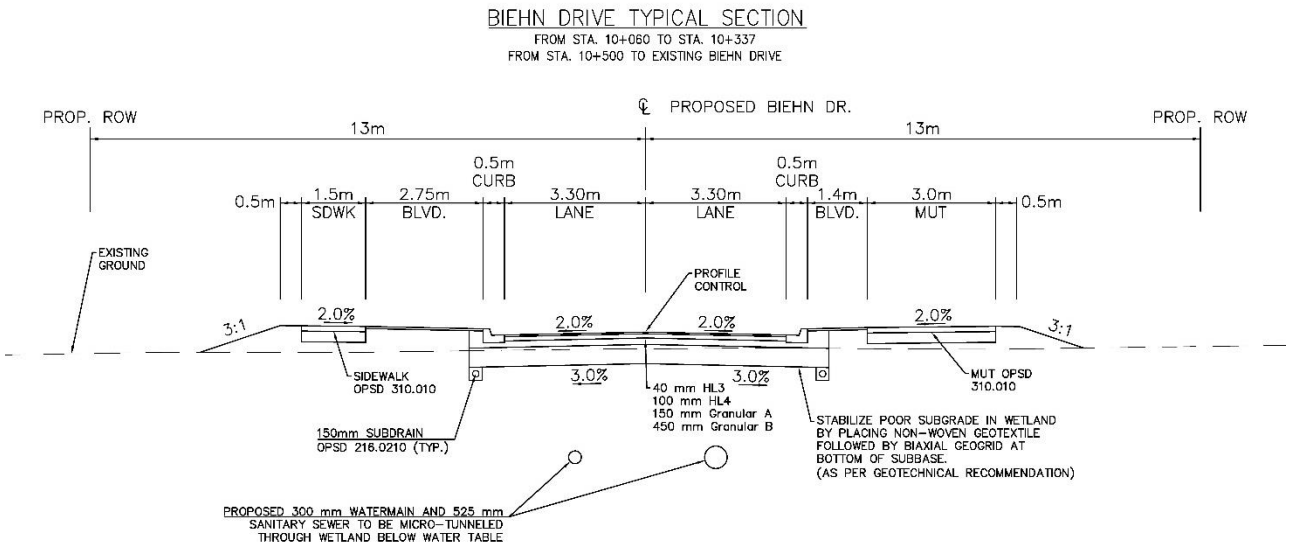
1. Alternative 1 – 26 m Major Collector with In-boulevard Cycling Facilities; and
2. Alternative 2 - 26 m Major Collector with Bike Lanes.

4.4 Technically Recommended Cross Section

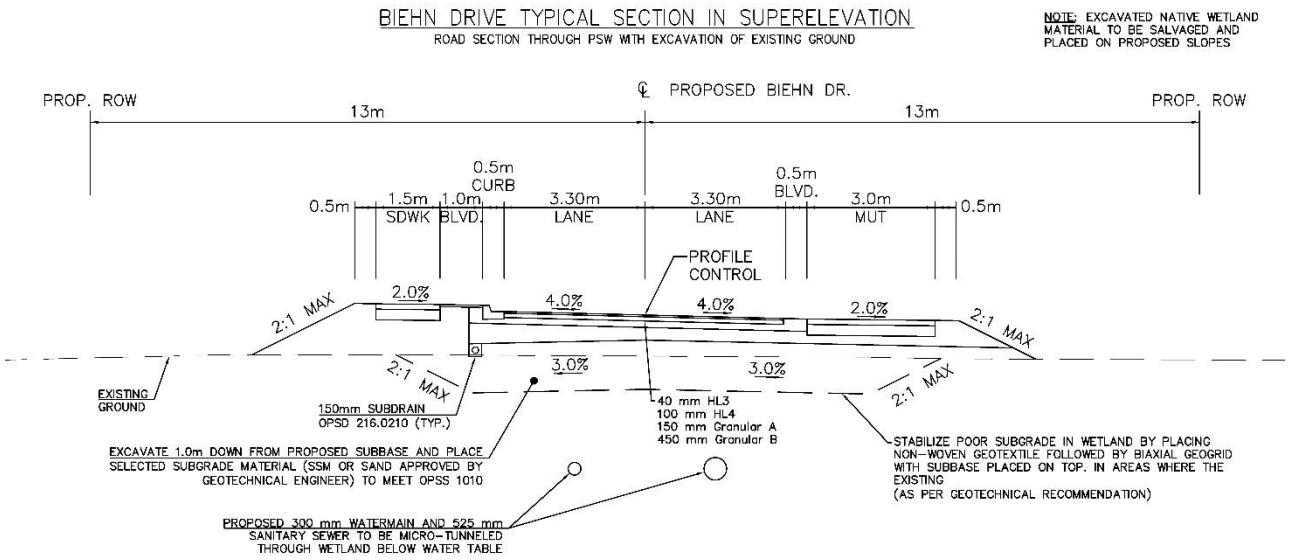
The preliminary evaluation of the cross section alternatives is shown in **Table 6**. Alternatives were developed to reflect the City of Kitchener's Complete Streets guidelines. The recommended cross section is Alternative 1 with multi-use trails as shown in **Figure 9**.

Table 6: Cross Section Evaluation

Evaluation Criteria	Alternative 1 – 26 m ROW with Multi-use Trail	Alternative 2 – 26 m ROW with Bike Lanes
Active Transportation	MUTs are preferred by the greatest proportion of cyclists (interested but concerned). Greater network continuity for cyclists with the future MUT along the Hydro corridor and potential to connect to the MUTs along Strasburg Road. ✓	Better accommodates pedestrians by separating pedestrians and cyclists. Increased conflict between cyclists and access to/from parked vehicles. ✗
Traffic Calming	The reduced pavement width would better promote lower travel speeds. ✓	Wider asphalt surface would be less effective in reducing travel speeds. ✗
Impacts to Natural Environment / Storm Water Quality	All alternatives considered equal.	All alternatives considered equal.
Impacts to Developable Lands	All alternatives considered equal.	All alternatives considered equal.
Cost	MUTs are more cost effective to construct with reduced pavement thickness and granulars. ✓	Wider roadway pavement structure increases construction cost. ✗
Recommendation:	Carry Forward **Alternative 1** ✓	



Typical Cross Section Outside the Wetland



Typical Cross Section Through Wetland

Figure 9: Recommended Cross Sections

4.5 Conclusions and Recommendations

The following are updated 2024 preliminary recommendations from the EA based on new data sources that included, the geotechnical investigation, the 2023 field inventory of ash trees, an analysis of the long-term Emerald Ash borer impacts on ash tree mortality in North America and City of Kitchener as well as the 2024 Doon South Community Area Transportation Study.

- Based on the 2023 geotechnical investigations it is feasible for the sanitary sewer and watermain without surficial construction to cross the PSW.
- The 2024 Doon South Community Area Transportation Study confirmed the recommendations of the current Transportation Master Plan, 2013 reflected in the Official Plan, 2019, for the long-term use of Biehn Drive and its extension as a major collector in the City.
- The 2024 provincial designation of the Black Ash trees as a Species at Risk (SAR) is now reflected in the recommendations.

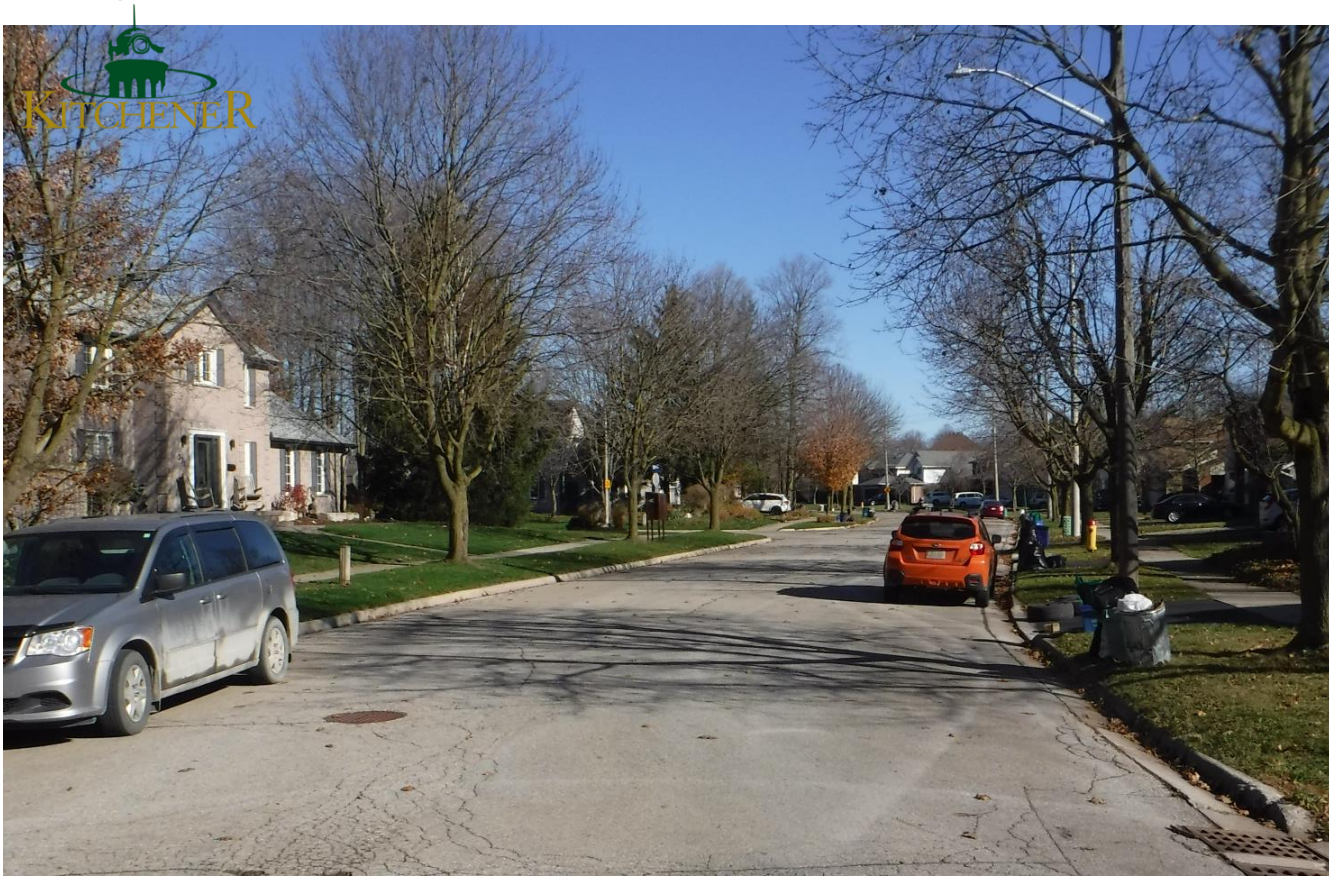
The following is the preferred approach for the planned improvements:

- Caryndale Drive will continue to be utilized until the extension of the Biehn Drive link is constructed.
- The health of the Black Ash trees are to be monitored.
- Development south of the PSW be permitted to proceed.
- That a right-of-way continue to be protected at the intersection of Biehn Drive and Robert Ferrie Drive for a future roundabout.
- The land acquisition should include the Right-of-Way required for municipal services and a road corridor.
- The alignment of the servicing corridor for the trunk sanitary sewer and watermain to follow the alignment for the road corridor.
- If Black Ash trees are impacted due to construction, the City will compensate for the loss. Compensation to be determined by Ministry of Environment Conservation and Parks.

Appendix A

Evaluation Methodology

BT ENGINEERING
BTE



Evaluation Methodology Report

Biehn Drive Municipal Class Environmental Assessment Study

August 2024, Revision 3

Submitted by:
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5

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1.0 INTRODUCTION

The City of Kitchener (City) has initiated a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The focus of the Study will be to consider alternatives for the alignment of the Biehn Drive extension, intersection locations and designs and municipal services while minimizing environmental, social, and cultural impacts of the project.

1.0 STUDY PROCESS

This Study will complete the remaining phases of the Municipal Schedule C Class EA Study which was initiated by the TMP. The Study will meet all requirements of the Municipal Class EA by establishing the need and justification for the project, considering all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and proactively involving the public in defining a Recommended Plan. The study will culminate in the filing of an Environmental Study Report (ESR) and provide environmental clearance to the City to proceed with the project, subject to permits and approvals that will occur during the future detail design stage of the project.

The Analysis and Evaluation process is a requirement of the EA process, based on the Ministry of the Environment, Conservation and Park's (MECP) Evaluation Methods in Environmental Assessment. [1]

This document describes the qualitative and quantitative methods of evaluation and which approaches will be utilized for different groups of alternatives for this study.

An evaluation method may be defined as a formal procedure for establishing an order of preference among alternatives. The use of a formal evaluation method has two main advantages: it provides a better basis for decision-making than would otherwise exist and it results in reasons for decisions that, on examination, can be traced.

The selection of an evaluation method should consider the following generic factors:

- Various evaluation methods have different capabilities which support different planning processes that may be better suited to a particular project or stage of the EA.
- With any particular planning process, all the steps (such as identifying alternatives, selecting criteria, consulting and involving interested parties, as well as evaluating) must be reasonable and provide a systematic assessment of the net effects of the project.

[1] Evaluation Methods in Environmental Assessment, Ministry of Environment, 1990.

The selection of the appropriate evaluation methodology depends upon the:

- Complexity of the decision-making;
- Number of alternatives;
- Number of criteria; and
- Sensitivity of the decision.

These issues are described in the following sections which explain the rationale for utilizing the most appropriate evaluation methodology in each stage of the EA study.

2.0 STUDY AREA

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.

The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension.

Based on comments from the public at the Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods.

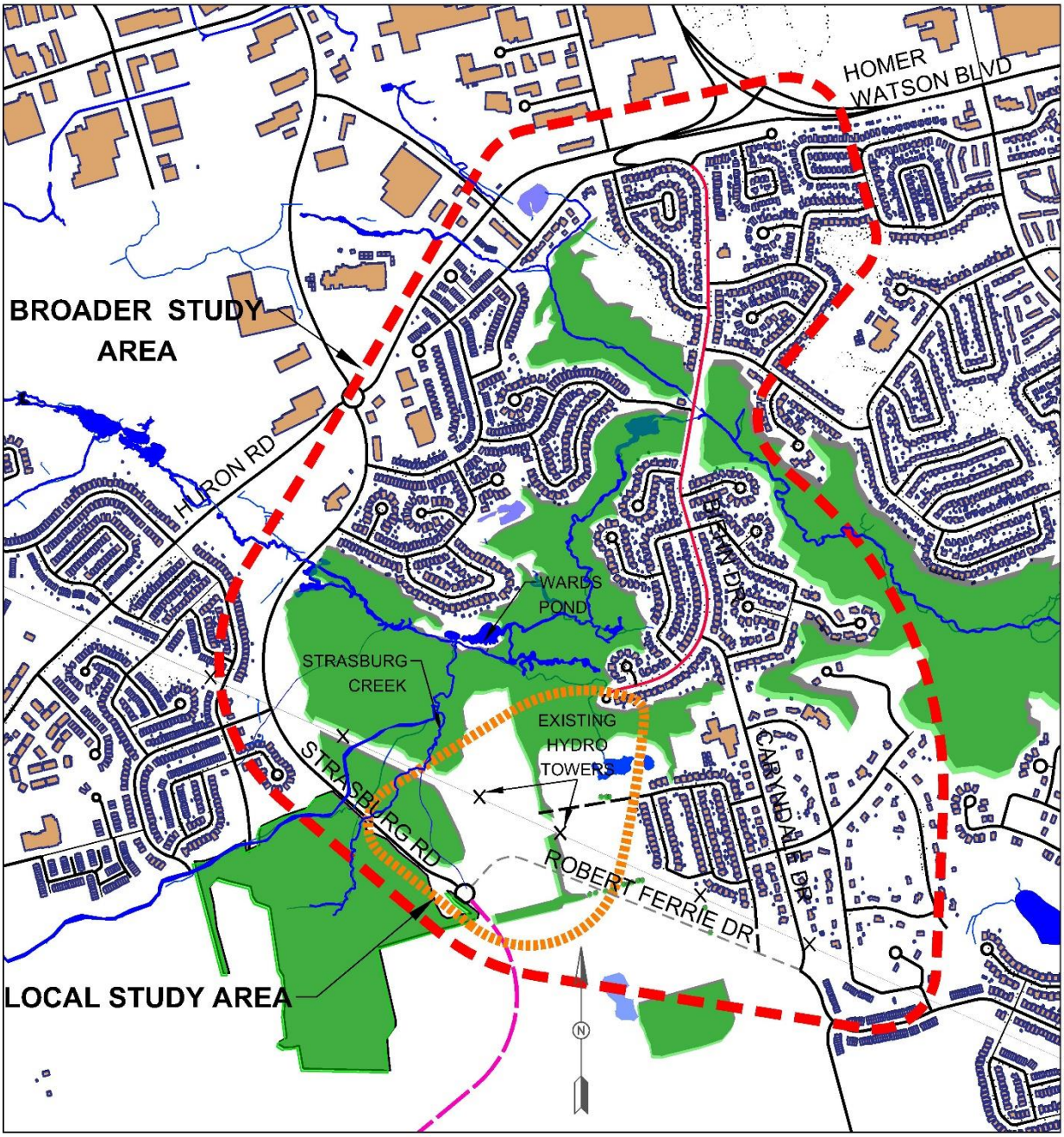


Figure 1: Study Area

3.0 PARTICIPATION

Public participation is a key component to the success of this project. Early public involvement is encouraged to establish a sound understanding of the public's concerns and views, to identify areas of concern and major study issues, and to establish a working relationship with the public that is amicable and cooperative rather than adversarial.

The City of Kitchener has a constitutional duty to consult with Indigenous Communities with traditional land use or interests within the Study Area. Clear, effective and timely consultation with Indigenous Communities is essential to ensure the success of the project.

3.1 Public, Property Owner, and Stakeholder Consultation

The public will be engaged through the use of three Public Information Centres (PIC) meetings and one-on-one meetings with directly affected property owners. This includes meetings and consultation with utilities, businesses and stakeholders that have an interest in providing comments on the design.

3.2 Indigenous Peoples Consultation

MECP has identified the Indigenous Peoples communities to be consulted during this study. Indigenous Peoples will be sent invitations by way of a notice to all public events such as the Community Café and PICs and will also be extended the offer to be met separately, if desired.

4.0 QUALITATIVE EVALUATION METHODOLOGY

A qualitative evaluation method involves describing impacts in narrative terms, or through qualitative measures, without the explicit specification of criteria, ratings or weights. This method, also known as “professional judgment” is widely used in EA’s to assess “Alternative Planning Solutions”. For example, an EA involving the selection of a corridor might evaluate alternative routes in considerable detail using a formal quantitative evaluation, but the evaluation of “Alternatives To” might be done using a simpler qualitative approach. See Error! Reference source not found. for a sample qualitative evaluation.

A challenge of the qualitative approach is the difficulty in recognizing when a comparison will have intuitive choice or universal support (public), i.e. a simple decision easily accepted. A qualitative approach may also be less defensible and could be subject to criticism. Should the public or stakeholders question these early decisions, additional information may be required to substantiate or detail the rationale for the early decisions. When alternatives are not systematically compared against a specified set of criteria, it may be difficult to follow how the decision was made and what evidence supports it.

Some advantages of using a qualitative approach over a quantitative approach include greater simplicity, reduced time and cost, and ease of presentation to the public. A qualitative approach is often used to evaluate alternatives where there is a straightforward conclusion and low public concern. The qualitative approach is also suitable where there are few alternatives and few criteria where there are measurable and meaningful differences between alternatives being considered.

Table 1: Planning Alternatives

Screening Criteria	Do Nothing	TDM	Use of Existing Local Roads	Limit Development	Extend Biehn Drive
Transportation	Does not address forecast traffic demand. Results in increased volumes on local roads.	May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure.	Local roads not designed to accommodate increased volumes. Caryndale Drive is not designated as a major collector and as such should not be expected to carry additional traffic.	May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth.	Accommodates all modes of transportation.
Environmental	No impacts.	No or low impacts. Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes).	Low impacts. Creates disruption to properties on local roads that would experience an increase in traffic.	No impacts.	Low to medium Environmental effect possible with new corridor. Magnitude of effects will depend on environmental mitigation.
City Planning Objectives	Does not meet objectives/ recommendations in City Planning document or support the Provincial *Places to Grow Act*	Supports objective to encourage active transportation and alternate modes. Does not support the Provincial *Places to Grow Act* requirement to create	Does not meet objectives/ recommendations in City Planning documents. Does not support the Provincial *Places to Grow Act*	Does not meet objectives/ recommendations in City Planning documents. Does not support the Provincial *Places to Grow Act*	Supports the recommendations for the extension of Biehn Drive in OP and TMP. Supports the Provincial *Places to Grow Act*

Screening Criteria	Do Nothing	TDM	Use of Existing Local Roads	Limit Development	Extend Biehn Drive
	requirement to create additional development areas (incuding municipal services).	additional development areas (including municipal services).	requirement to create additional development areas (including municipal services).	requirement to create additional development areas (including municipal services).	requirement to create additional development areas (including municipal services).
Recommendations	Not recommended but carried forward as a baseline to compare other alternatives. ✓	Recommended as a complementary solution. This is not a standalone solution. ✓	Following PIC No. 1 there was public support to carry forward this alternative. This is not a standalone solution. See Extend Biehn Drive which is a combination of Use of Local Roads and a New Municipal Servicing Corridor. ✓	Not recommended. ✗	Recommended to be carried forward for further study. ✓

✓ **Recommended Planning Solutions for further evaluation**

Where there are few criteria, such as in Error! Reference source not found., it is generally a cceptable to use a qualitative analysis because the trade-offs are clear and understandable. The more rigorous definition of the attributes of each alternative, as would be possible using a quantitative approach, is not required because there are a limited number of evaluation factors.

For this study, the qualitative approach will be used to assess Alternatives to the Undertaking and for the Coarse Screening of the initial long list of Preliminary Design Alternatives.

The use of a more comprehensive evaluation technique becomes necessary as the complexity increases (i.e. number of alternatives and number of criteria). In these situations, as described in **Section 5.0**, this study will utilize a quantitative approach.

5.0 QUANTITATIVE EVALUATION METHODOLOGY

Key principles of the EA Act and MECP's Guidelines on Environmental Assessment Planning and Approval are that there be accountability and traceability. A quantitative evaluation method allows both of these key principles to be addressed. A quantitative method based on the "Weighted Additive Method" utilizing utility measurements based on the "Likert Scale" will be used for this study and is also referred to as the "Multi-Attribute Trade-off System" (MATS).

The Weighted Additive Method has proven to be well suited for the evaluation of complex groups of alternatives. The methodology allows for sensitivity testing and the ability to answer "what if" questions. It is used on projects where the decision-making process is faced with either a large number of alternatives or a large number of competing criteria for the alternatives being evaluated.

The Weighted Additive Method is consistent with MECP practices for the evaluation of alternatives. It avoids many of the pitfalls associated with qualitative assessments by using an analytical approach that measures scores based on a mathematical relationship, i.e. the degree of subjectivity by the evaluators (i.e. the Technical Advisory Committee (TAC)) is minimized. A traceable process allows the TAC and public an opportunity to assess trade-offs involved in the evaluation and use this information in the decision-making process. In addition, this quantitative method allows sensitivity tests to be performed to determine if the highest ranked alternative is affected by changing the weights (perspective of importance) of the assessment factors.

For this study, preliminary design alternatives will be compared and scores assigned to each of the various assessment factors, and a sensitivity-testing program will be completed in consultation with the public and external agency interaction.

When using the Weighted Additive Method, each member of the TAC assigns a weight to the global factors and sub-factors. The Average TAC Weight is assigned to each of the

alternatives. The alternative with the highest score is selected as the Technically Preferred Alternative (TPA). The steps followed to arrive at an overall score for each alternative are shown in **Figure 2**.

This systematic approach includes the following steps:

- Collection of data/environmental inventories
- Development of a long list of reasonable alternatives (including coarse screening alternatives that are not feasible or unreasonable in comparison to those being carried forward)
- Public Information Centre (PIC) / Community Café No. 1
- Development of a long list of global evaluation criteria/performance sub-factors
- Short listing of sub-factors to those where there are meaningful differences among the alternatives to be compared
- Establishing Social Utility Functions (Performance Factors or Function Forms) for the short-listed sub-factors
- Weighting of Evaluation Criteria (assigning importance based on the specific set of alternatives)
- Rating of Alternatives
- Sensitivity Testing
- Selection of TPAs
- Public Information Centre No. 2
- Preliminary Design Alternatives for the Preferred Corridor Alternative
- Quantitative evaluation of the Preliminary Design Alternatives
- Public Information Centre No. 3
- Refinements to the Technically Preferred Plan (TPP)
- Recommended Plan

These steps, as they relate to this project, are briefly described in the following sections.

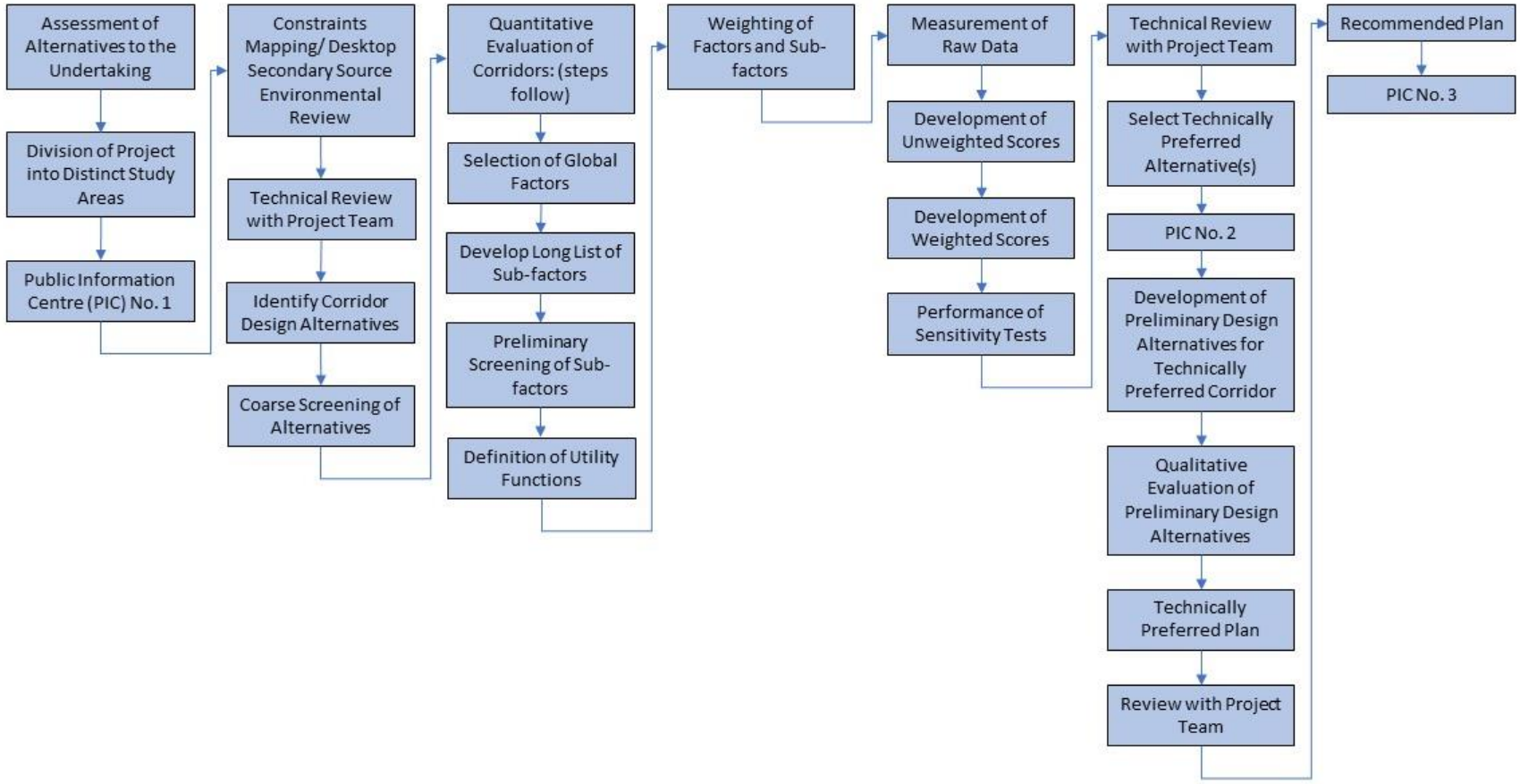


Figure 2: Study Evaluation Process

5.1 Evaluation Criteria – Factors

The initial step in the evaluation is to develop evaluation criteria from which alternatives will be assessed. This is a two-step process that involves the selection of a "global" group of factors and a number of "local" sub-factors under the global groups.

The global factors groups will be presented to the public and, following this consultation, will be accepted as describing the broad definition of the environment to be evaluated. Global factors considered for this study may include:

- Traffic and Transportation;
- Natural Environment;
- Cultural Environment;
- Socio-Economic Environment;
- Land Use and Property; and
- Cost.

While these factor groups are the starting point for the evaluation, one or more factors may be removed if it is determined that there is no sub-factor in this category i.e. there is not a meaningful and measurable difference between the alternatives being assessed in this category. When a particular factor is carried forward, then one or more sub-factors are considered under this group. These sub-factors are the individual descriptors for the evaluation. The selection of the sub-factors is very important to the decision-making process because they must adequately describe the issue to be evaluated and the alternatives being compared. See **Table 2** for a sample preliminary listing of sub-factors for Transportation. Any information regarding an alternative, where there are differences among alternatives, is incorporated into the decision-making process by including it as a sub-factor. The benefit to incorporating two levels of evaluation criteria (global factors and local sub-factors) is the prevention of the unbalancing of the evaluation (that could occur by adding more criteria under one group). Weights are assigned to the global factors to eliminate any possibility of skewing the results by selecting a large number of sub-factors in one particular factor group.

Table 2: Long List of Sub-factors

Factors and Sub-Factors	Carried Forward?
Transportation	
Delays (during construction)	✗
Supports Urban Transit Service	✓
Improved Emergency Response	✓
Fuel Consumption	✗
Road User Costs	✗

Factors and Sub-Factors	Carried Forward?
Roadway Operation and Safety – Supports Area Traffic Calming Measures	✓
Roadway Safety - Collision Potential at Intersections	✗
Active Transportation Connectivity – Conflicts through Communities	✗
Active Transportation – Proximity to Community Facilities	✗
Bicycle – Conflicts with Existing Bicycle Routes	✗
Flexibility for Future Expansion	✗
Horizontal Curvature	✗
Vertical Curves	✗
Minimum Radius of Curves	✗
Skewed Intersections / Angle of Skewed Intersections	✗
Level of Service on Local Roads	✗
Efficiency of Travel	✓
Compatibility with Integrated Transportation Master Plan	✓
Safety of School Zone	✓
Ability to Maintain Existing Roadway Classification	✗
Bicycle and Pedestrian Safety – Conflicts with Planned Hydro Corridor Multi-Use Trail	✓
Personal Security of Pedestrians and Cyclists	✓
Intersection Spacing	✗
Robert Ferrie Drive Intersection Location to Accommodate Future Development	✓

Generally, the process begins by establishing a long list of potential sub-factors through discussions with the public, community associations, the TAC and interest groups or from previous studies of the same nature. Then, for each group of alternatives being evaluated, the sub-factors are reviewed and screened by eliminating those that are considered equal

among alternatives being considered as well as those that do not apply to the Study Area, based on the site inventories carried out.

Table 3 provides a sample of a typical Global Factor, Sub-Factor, Unit and Utility Function Type from a Transportation Study. Similar Global Factor, Sub-factor and Utility functions will be developed for this study.

Table 3: Typical Evaluation Factor and Sub-Factors

Global Factor	Sub-Factor	Unit	Utility Function Type
Natural Environment	Wildlife Habitat	ha	Linear
	Accommodating Wildlife Movement	Preferred/Not Preferred	Stepped Function
	Provincially Significant Wetlands (PSW) Removed	ha	Linear
	Groundwater Infiltration	ha	Linear

5.2 Factor and Sub-factor Weights

The selection of weights for the factors and the sub-factors is based on assessments by the TAC of their relative importance. Within a group of factors, inevitably there is an ordering, with some factors having more importance than others. This is accounted for by each individual assigning a weight to each factor, which is reflected in the "Factor Weight" and "Sub-Factor Weight" columns. An example of typical results is shown in **Table 4**.

Table 4: Sample TAC Average Weights for a Factor Group and Sub-Factors in that Group

Factors	TAC	
	Factor Weight	Sub-Factor Weight
Traffic and Transportation	30.50%	
Supports Urban Transit Service		7.90%
Improved Emergency Response		6.50%
Roadway Safety – Supports Area Traffic Calming Measures		16.90%
Efficiency of Travel		19.30%

Table 4: Sample TAC Average Weights for a Factor Group and Sub-Factors in that Group		
Factors	**TAC**	
	Factor Weight	**Sub-Factor Weight**
Compatibility with Integrated Transportation Master Plan		7.70%
Safety of School Zone		14.10%
Bicycle and Pedestrian Safety - Conflicts with Planned Hydro Corridor Multi-Use Trail		4.90%
Personal Security of Pedestrians and Cyclists		6.70%
Intersection Spacing		16.00%
	Total	**100%**

As shown in **Table 4**, the group of evaluators judged the Traffic and Transportation Factor Group to be valued at 30.5% of the overall importance of the decision between the alternatives being considered.

Within each Factor Group the sum of the percentage weights of all sub-factors listed under each factor totals 100%. As shown in **Table 4** several of the sub-factors were judged to be more important/less important when compared to each other for this specific evaluation of alternatives being considered.

The weights for each factor and sub-factor are determined by averaging the weights assigned by the TAC (Evaluation Committee). Each member gives a judgement of the importance of each global factor and local sub-factor (a percentage value) based on his or her personal assessment and professional judgement, considering the net effects and input of stakeholders and the public.

There is usually a range of perspectives in deciding the weights (importance) of factors and sub-factors. Every person assigning weights has a personal perspective and understanding of the scope of the project. Hence, there is an advantage to having a diversified team of professionals with varied backgrounds performing the evaluation.

The weighting of each of the global factors is shown in **Figure 3**. The weighting of sub-factors within each factor group would be a similar distribution among the available sub-factors.

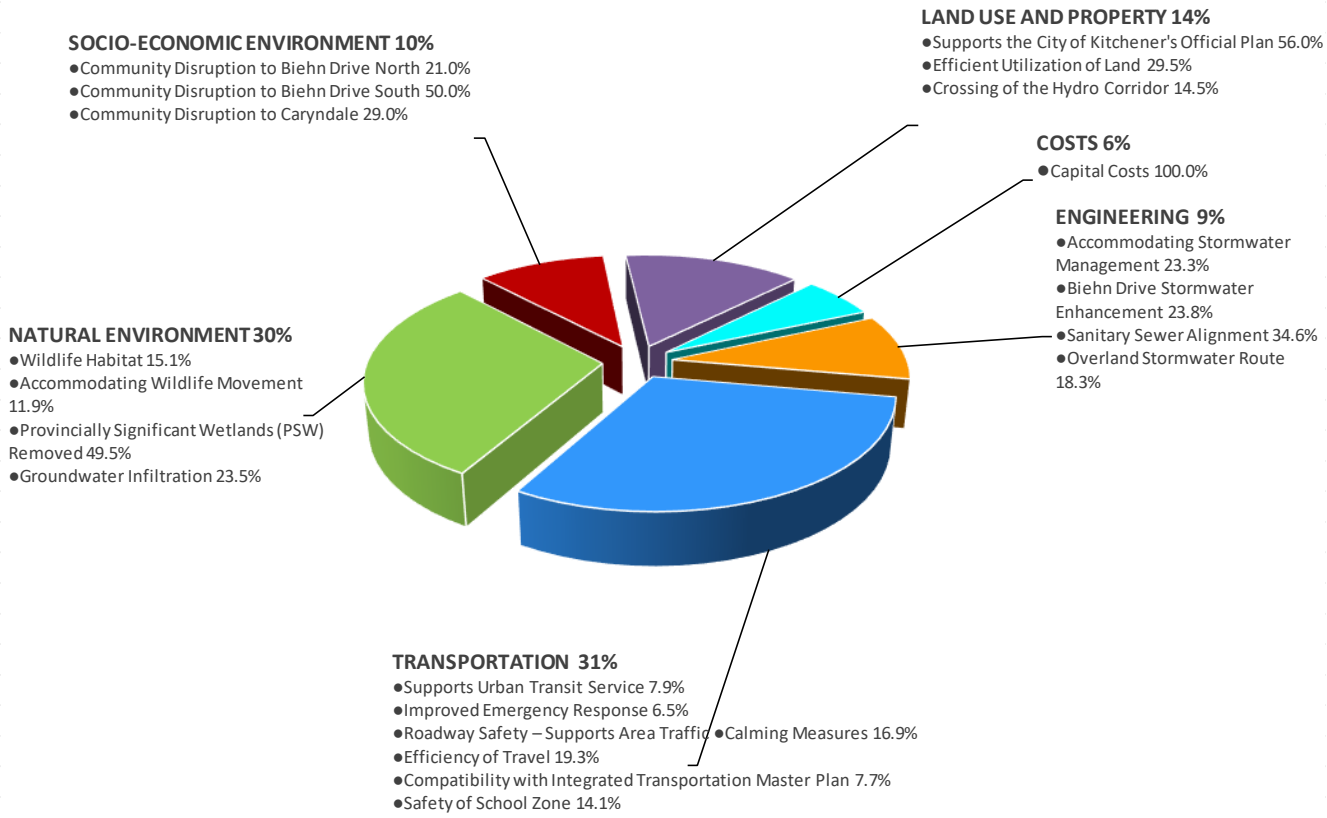


Figure 3: Sample Weighting of Global Factors

5.3 Social Utility Functions

The Weighted Additive Method used to evaluate alternatives relates the performance or attractiveness of alternatives using a mathematical relationship. This includes two variables: the first is the raw data or measured or modelled data, and the second is the utility or utility score, which is the measure of attractiveness of the alternative.

For this project, the relationship between these two variables is described, as shown in **Figure 4**, by either a dichotomous, stepped, or linear social utility function. A dimensionless utility score between zero (0) and 1 is assigned to an alternative for each sub-factor. The shape of this function can vary from linear to stepped or exponential and is defined by a subject area specialist.

The use of utility curves or functions is a step that transforms each of the measured effects to a dimensionless number and measure of utility. This step is required because the effects of each sub-factor are measured in different units (length, area, time, volume, dollars etc.). To produce a mathematical measure of the performance, each effect is translated to a measure of utility. The combined effect or performance of each alternative is a measure of utility (attractiveness) which is a dimensionless measure. The utility function (also commonly described as performance factor or function form) defines the relationship of effect to the

attractiveness (utility). These utility functions are defined by subject area specialists in their field of study.

Examples of Social Utility Functions for the “Community Disruption to Biehn Drive North” and “Improved Emergency Response“ sub-factor definitions are shown in **Figure 5.**

A dichotomous utility function enables the decision-maker to establish criteria that presents an “either–or” situation (desirable or undesirable, negative or positive, present or absent). If it is decided beforehand that a “yes” answer is desirable, then a utility score of one would be assigned to this criterion, otherwise zero would be assigned. One or zero are the available alternatives; no other utility score is available.

A linear function is used to convert scores for sub-factors that have varying measurements. Given a measurement, a unique utility score between zero and one can be assigned to a sub-factor. The slope of the linear utility function can be negative or positive depending on the desirability of the impact.

Figure 4: Sample Utility Functions

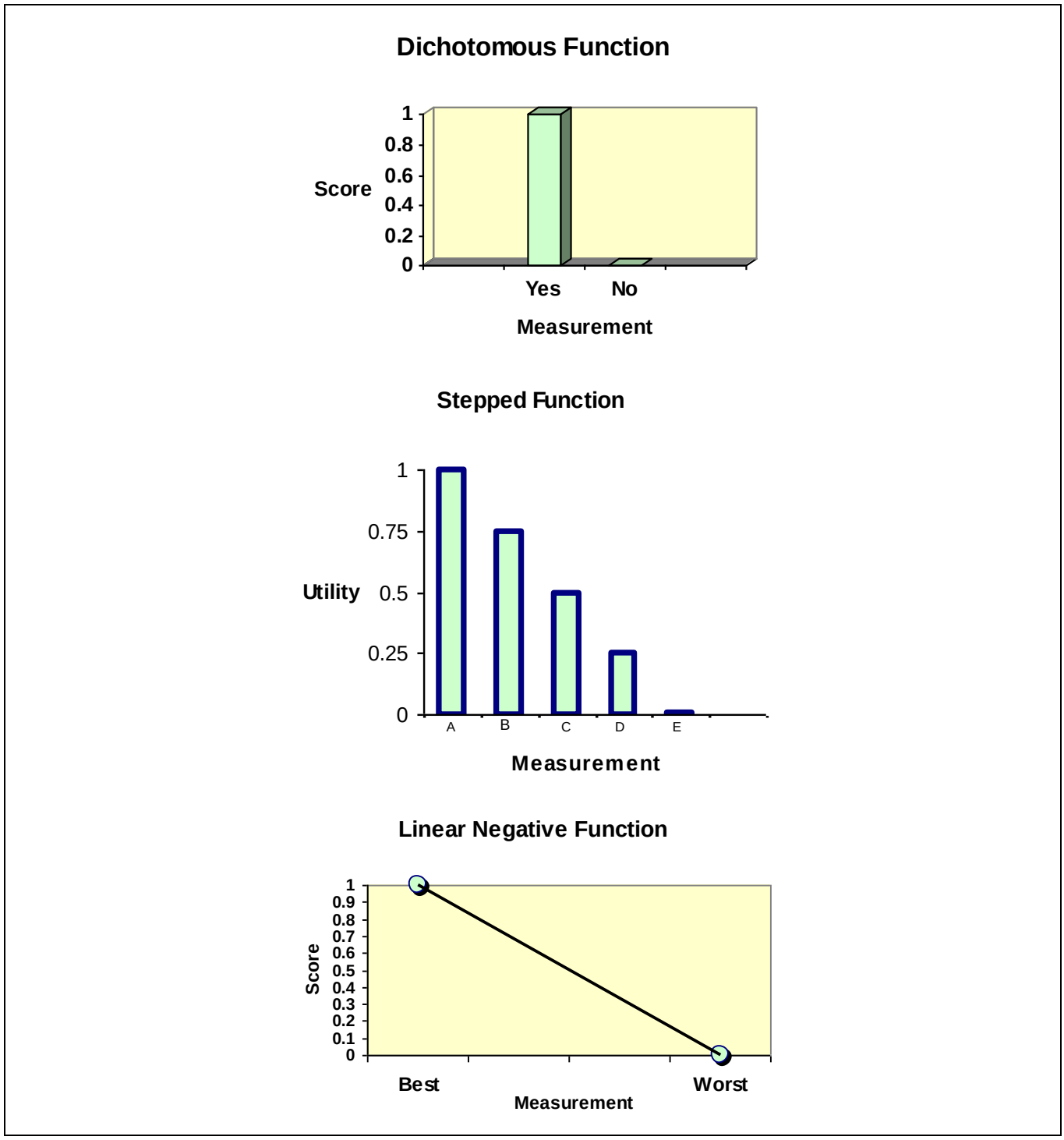
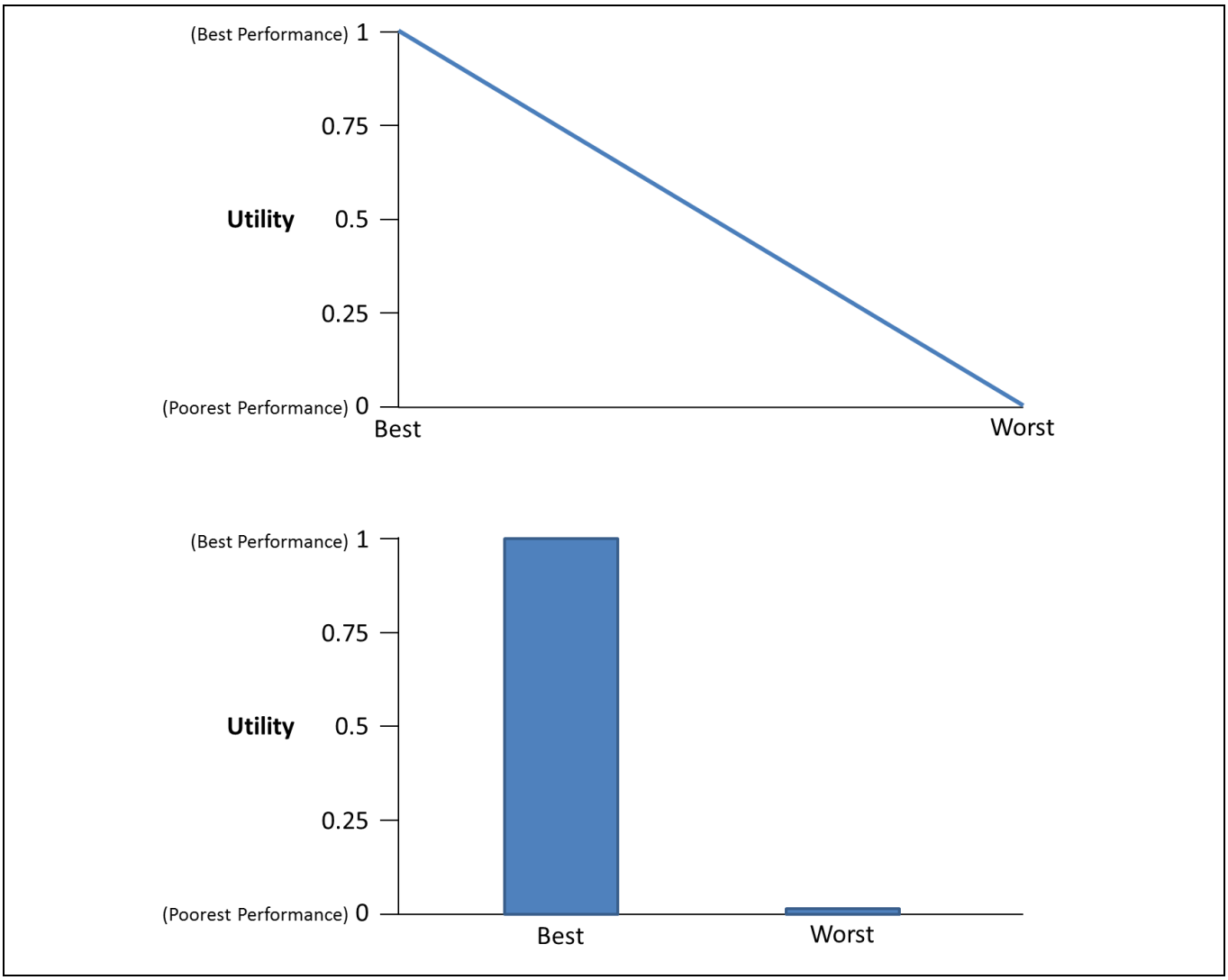


Figure 5: Social Utility Function



5.4 Weighted Score

The total un-weighted utility score of a given alternative can be expressed as:

U (Alternative A) = $\varnothing_1 X_1 + \varnothing_2 X_2 \ldots\ldots + \varnothing_n X_n$, where

U (A) = Total un-weighted utility score for Alternative A

$\varnothing_1$ = attractiveness with respect to parameters

X_1 = measurement of parameter X

Weighted scores are computed using the weights selected by the TAC. The weighted score for each alternative under a specific sub-factor is calculated as follows:

(weighted score) = (utility score x [(factor weight) x (sub-factor weight)])

Using this approach, a generic weighted attractiveness function can be expressed as:

U_w (Alternative A) = $U_1W_1 + U_2W_2 + \ldots. + U_nW_n$

OR

U_w (Alternative A) = $W_1\varnothing_1X_1 + W_2\varnothing_2X_2 \ldots. + W_n\varnothing_nX_n$

Where: U = Total un-weighted utility score for Alternative A

U_w (A) = Total weighted utility score for Alternative A

W_1= Weighted parameter (factor weight x sub-factor weight)

$\varnothing_1$ = Attractiveness with respect to parameter 1

X_1 = Measurement of parameter

The weighted scores of all the sub-factors are then added to give total score for each alternative.

$$U_w(A) = \sum_{X=1}^{n} W_n\varnothing_nX_n$$

5.5 Rating Alternatives

Following the selection of evaluation factors and sub-factors, measurements of the impacts are made using topographic plans, field surveys, and numerical modelling. These

measurements result in data being available under each of the evaluation criteria from which ratings are made for each alternative.

The Weighted Additive Method focuses on the differences of the alternative, addresses the complexity of the base data collected and provides a traceable and defensible decision-making process. This process is a numerical calculation where alternative scores are determined through the use of a mathematical relationship to equate impacts to scores. It eliminates any possible subjective opinions of scores for alternatives because the team does not estimate the score for an alternative.

The scores for each alternative under each of the respective sub-factors are normalized based on measured impacts. Social utility functions are defined to relate impacts to the attractiveness of an alternative. This means that under each sub-factor, the alternative receives an un-weighted rating of between zero and one based on these measurements. The mathematical relationships for calculating scores are developed in consultation with the TAC.

5.6 Sensitivity Testing Program

It should be recognized that the scope of the evaluation and determination of weights for the evaluation criteria are a matter of personal and professional judgement. Accordingly, it is considered essential to conduct sensitivity testing to determine the effect of changing weights assigned to each criterion.

To test how sensitive the outcome of the evaluation is with respect to the assigned weights (i.e. would the result have changed if different weights were used), a sensitivity testing program is undertaken. This results in greater confidence in the selection process and reduces the potential that the average weights bias the outcome of the evaluation.

Often, there is a diversity of opinion in the group as to what weight is appropriate for a factor or sub-factor. When an average weight is used to capture the preferences of the group it loses valuable information on the range of values of the group. To test the range of perspective of the TAC, the highest and lowest weights suggested by anyone in the group are defined as a reasonable range of weights to test. A series of sensitivity tests are performed for the evaluation of alternatives. This allows the team an opportunity to assess the outcome of the evaluation if different weights (different perspectives of importance) are assigned to the factors and sub-factors from the average weights defined by the TAC members. In this way, trade-offs can be identified, credibility can be achieved with the public, and “what if” questions can be answered quickly. See **Figure 6** for an example of the typical range of project team weights and **Table 5** for the ranking of alternatives.

Following the above methodology, a series of tests can be performed varying the weights for each global factor. These tests include:

- Average TAC Team Weight
- Highest Weight by any Team Member
- Lowest Weight by any Team Member

Following this series of tests, the results can be reviewed to assess whether the preferred alternative changes when the weights are varied.

Using this information alone is not the only justification for selecting a particular alternative, but it does provide a level of confidence in the selection. This information is used in the decision-making process before the TPAs are recommended to be carried forward.

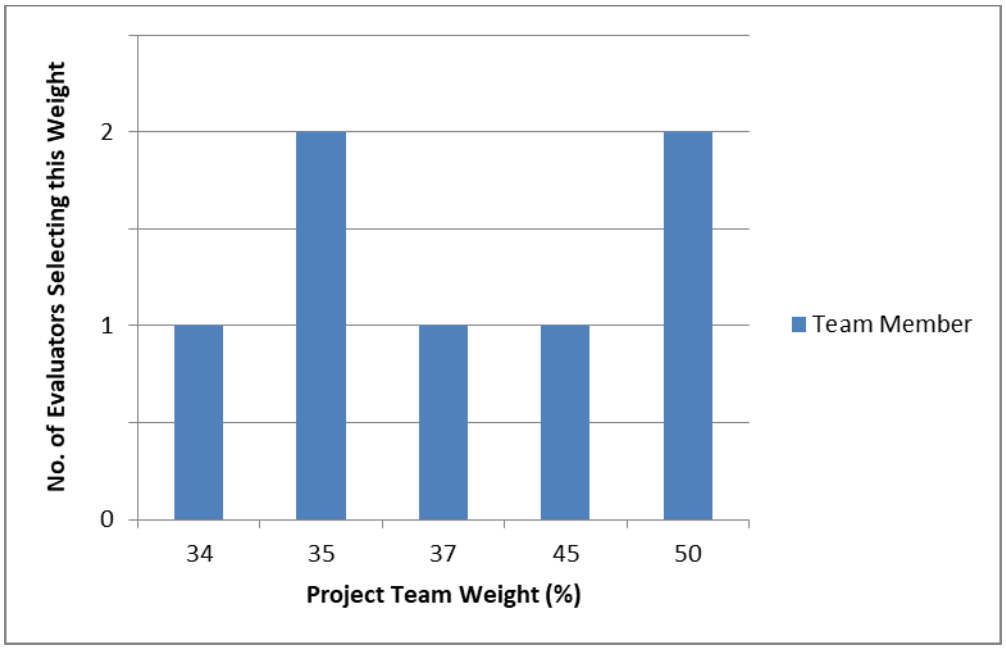


Figure 6: Sample Range of Weights for Traffic and Transportation

Table 5: Sensitivity Test Results

Alternatives			**Alt 1**	**Alt. 2**	**Alt. 4**
FACTORS	WEIGHT	Score:	76.40	45.02	48.88
Ranking			**1**	**3**	**2**
TRANSPORTATION	High	45.00%	1	2	3
	Low	20.00%	1	3	2
NATURAL ENVIRONMENT	High	40.00%	1	3	2
	Low	20.00%	1	2	3
SOCIO-ECONOMIC ENVIRONMENT	High	15.00%	1	3	2
	Low	10.00%	1	3	2
LAND USE AND PROPERTY	High	20.00%	1	2	3
	Low	10.00%	1	3	2
COST	High	10.00%	1	3	2
	Low	2.00%	1	2	3
ENGINEERING	High	15.00%	1	3	2
	Low	5.00%	1	3	2

5.7 Selection of Technically Preferred Alternative (TPA)

The TPA identifies the preferred solution by considering the technical analysis, environmental considerations and comments of all study participants.

The TPA is then presented to the public and external stakeholders. This allows for any comments or questions regarding the proposed design.

It should be recognized that the information and conclusions obtained using the evaluation method are only tools used to assist in the evaluation process and identifying trade-offs. In the end, it is the TAC (Evaluation Committee) which makes the final decision on the selection of the TPA, using both the information obtained throughout the evaluation process and their individual experience and expertise, and through additional input from senior management on funding availability or other program constraints.

The findings of the analysis and evaluation process will be included as a component of the EA Process and documented in the Environmental Study Report. The principles and methodology of the EA process assist the TAC in the analysis and evaluation of alternatives and the selection of the TPA. The public and government agencies have the opportunity to provide input throughout the course of the study.

Glossary of Terms

AASHTO	American Association of State and Highway Transportation Officials
Adjacent	Adjacent indicates lying near MTO or Municipal roadway rights-of-way, although not necessarily contiguous to them.
Aesthetics	Methods of providing visual relief and appealing characteristics to planned noise barriers thorough the application of landscaping designs.
Alternative	Well-defined and distinct course of action that fulfils a given set of requirements. The EA Act distinguishes between "Alternatives to the Undertaking" and "Alternative Methods of Carrying out the Undertaking".
Coarse Screening	Initial screening of a group of alternatives. Also see Screening.
COH	Community Open House
Criterion (Criteria)	Explicit feature or consideration used for comparison of alternatives.
Dichotomous Utility Function	A utility function that represents a desirable or undesirable response from a criterion (yes/no, present/absent, true/false).
Dimensionless Number	A number that does not have a unit of measurement, such as length (m), time (s), mass (kg) associated with it. Examples include Utility Score and Overall Score.
Do Nothing Alternative	This alternative is a mandatory requirement of the Class EA. This alternative is the null or no action alternative and it becomes the baseline to which all alternatives are compared.
Double Counting	Unintentional accounting for a particular factor or attribute more than once in the evaluation.
EA	Environmental Assessment
Environmental Study Report (ESR)	This report is prepared in compliance with the EA Act requirements and the Ministry of the Environment and Climate Change for acceptance, approval, informational or monitoring purposes and the public record.
Evaluation	The outcome of a process that appraises the advantages and disadvantages of alternatives.
Evaluation Criteria	See Criteria.

Evaluation Process	The process involving the identification of criteria, rating of predicted impacts, assignment of weights to criteria, aggregation of weights, and rating to produce an ordering of preference of alternatives.
Factor	See Global Factors.
Function Form	See Utility Function
Global Factors	The main categories of factors, (i.e. Transportation, Economic Environment, Natural Environment, Social and Cultural, Land Use and Property and Cost). All sub-factors are components or a subset of global factors.
Linear Utility Function	A function that can be defined using a linear equation of the form: y = a + bx, where y is the dependent variable (raw score) x is the independent variable (measurement) b is the slope of the function, and a is the y intercept, normalized in this study to be equal to one or zero
Matrix	A rectangular array of criteria and values.
MATS	Multi-Attribute Trade-off System
MECP	Ministry of the Environment, Conservation and Parks
Mitigation	Taking actions that either remove or alleviate to some degree the negative impacts associated with the implementation of alternatives.
MTO	Ministry of Transportation of Ontario
Overall Score	The final value of an alternative's score derived by summing all of the weighted scores.
Performance Factor	See Utility Function
Ranking	The ordering of alternatives from first to last for comparison purposes.
Raw Data	The measurement of the impact, or measured data, under each criterion.
Risk	Probability that a given outcome will or will not materialize. Distinct from uncertainty in that the alternative outcomes are known or defined and that the probability of each is measureable.

Screening	Process of eliminating alternatives from further consideration, which do not meet minimum conditions or categorical requirements.
Sensitivity Tests	A series of tests to assess the robustness of the evaluation and alternative scores.
Step Function	A utility function can be defined by several linear functions within separate ranges that have a slope equal to zero. For this study, two step functions are used: Case A: y = 1, for x = desirable and y = 0, for x = undesirable Case B: y = 1 for x = desirable, y = 0.5 for x = medium performance and y = o for x = undesirable
Sub-factor	A single criterion used for the evaluation. Each sub-factor is grouped under one of the factors.
TAC	Technical Advisory Committee
TPA	Technically Preferred Alternative
Traceability	Characteristic of an evaluation process which enables its development and implementation to be followed with ease.
Utility Function	A function (linear, step, dichotomous) that represents the Utility Score versus the criterion measurement or desirableness.
Utility Score	The “y” value derived from the Utility Function of the measurement of the impact induced by a particular alternative’s criterion. A measurement of the usefulness or attractiveness of an alternative with respect to an individual evaluation criterion based on its measured effect (a number between 0 and 1). The utility score is dimensionless.
Weight	The importance attributed to a criterion relative to other criterion. The value of the weight is expressed in a percentage and the sum of all criterion weights is equal to 100%.
Weighted Additive Method	The method used in the quantitative evaluation of alternatives, which reduces the project’s numerous criteria into a dimensionless number for each alternative suitable for comparison.
Weighted Score	A raw score that has been multiplied by the criterion weights. The weighted scores reflect the social value or importance of the specific group providing weights.

Appendix B

Short-Listed Alignment Corridor Alternatives

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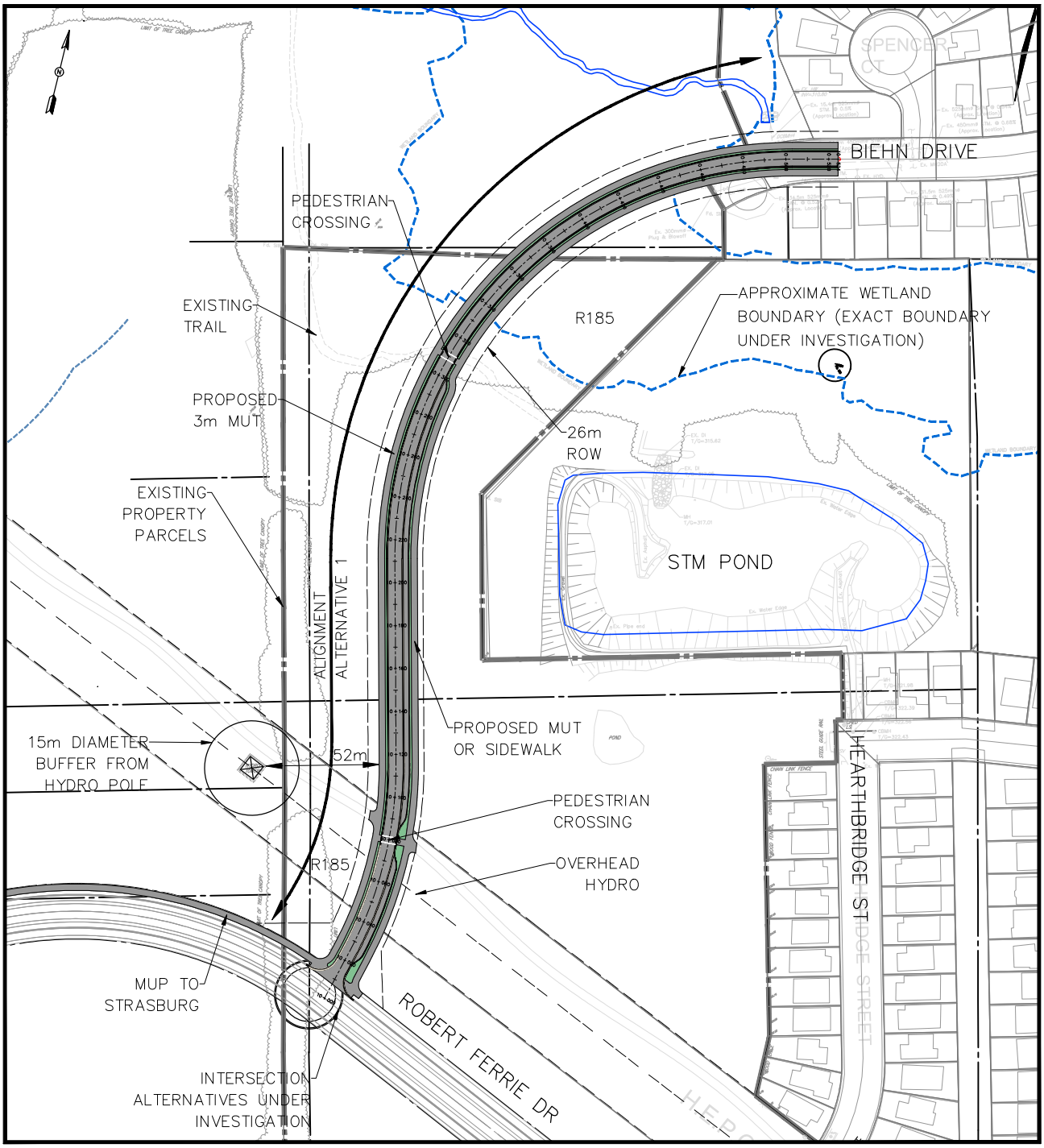
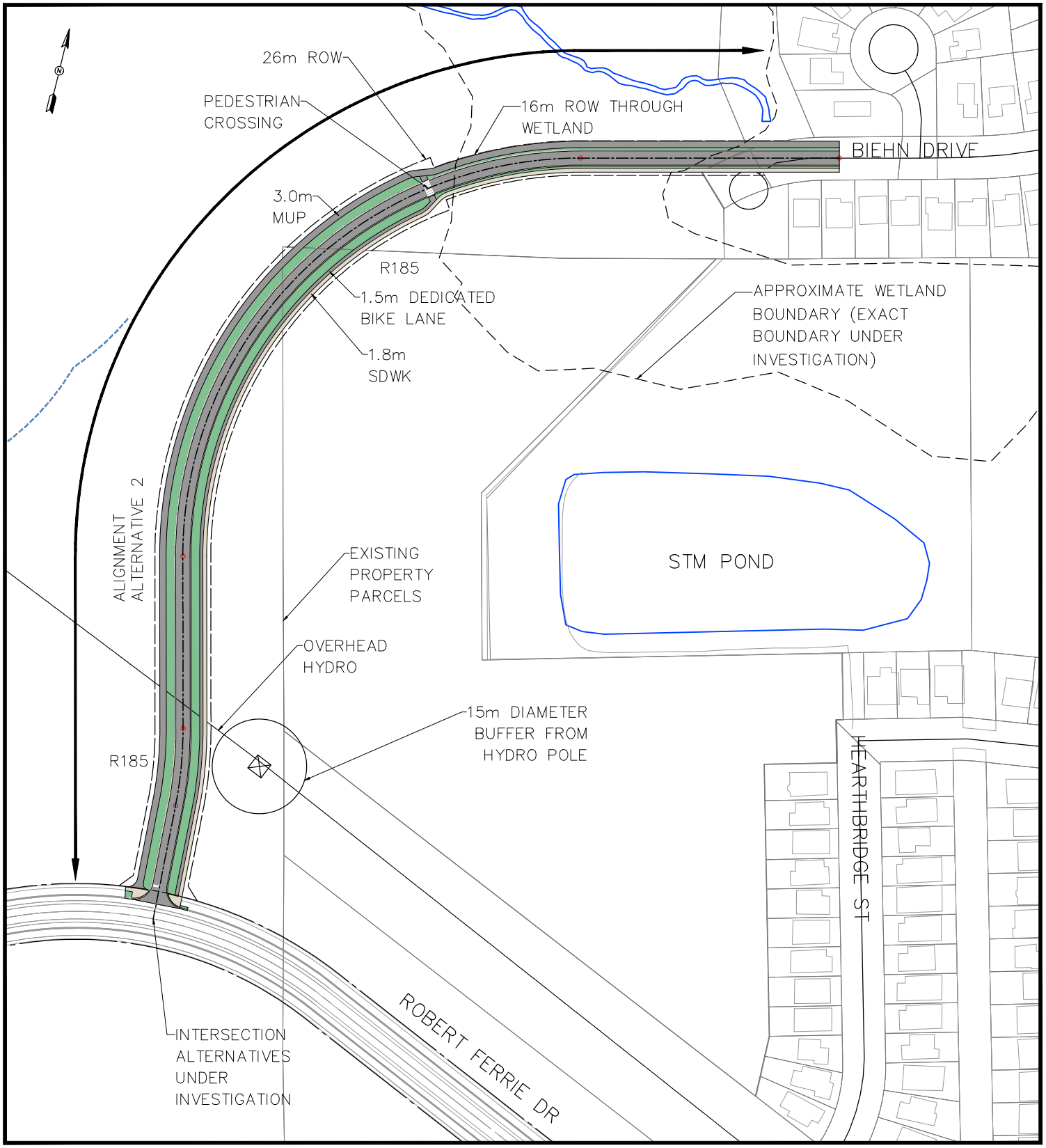
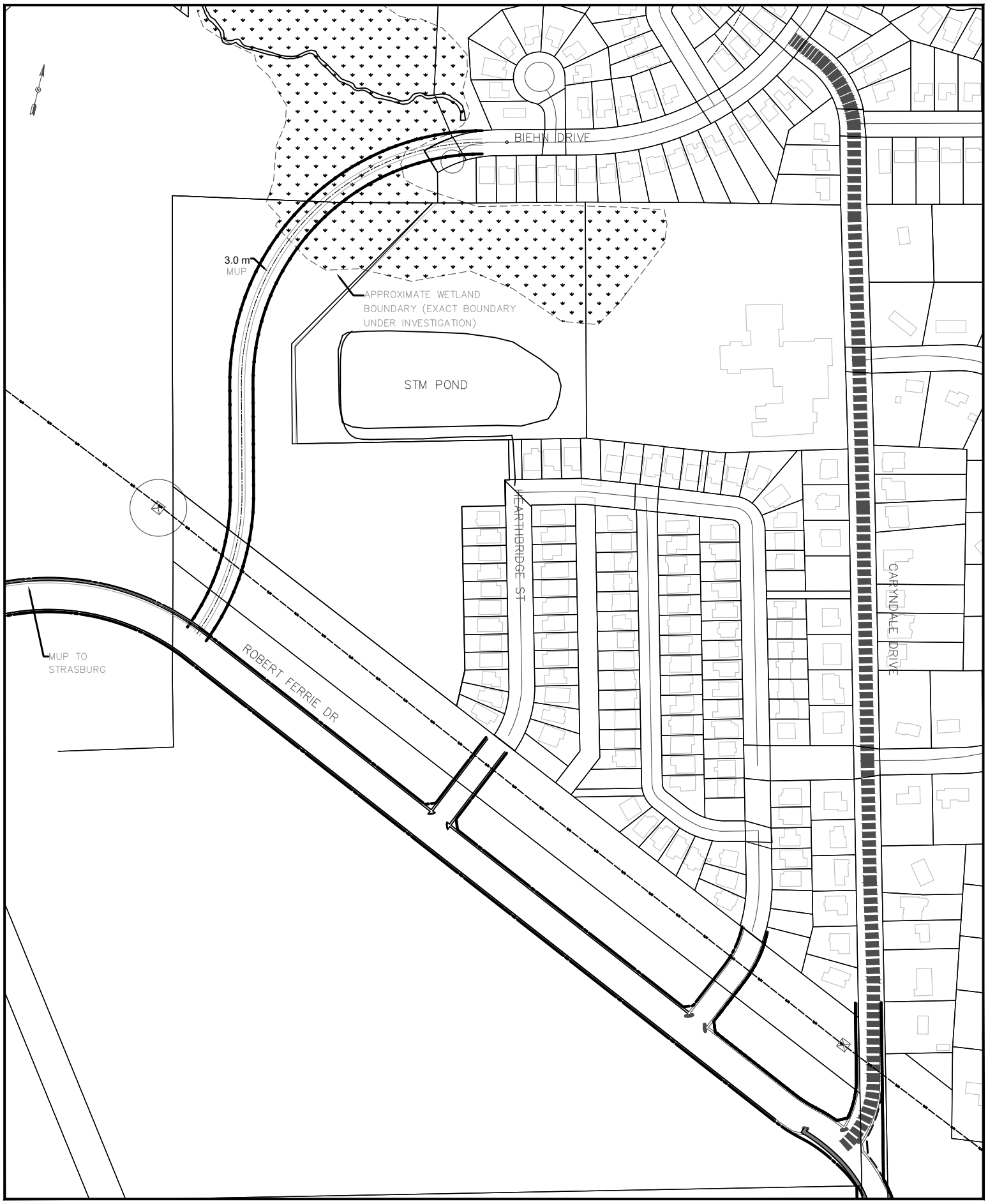
BIEHN DRIVE – ALTERNATIVE 1 – TPA



BIEHN DRIVE – ALTERNATIVE 2



BIEHN DRIVE – ALTERNATIVE 4



Appendix C

Long List of Evaluation Criteria

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Alignment Alternatives
Long List of Evaluation Criteria

Factors and Sub-Factors	Unit of Measure	Carried Forward ?	Remarks
Transportation			
Delays (during construction)	veh-h	✗	All equal
Supports Urban Transit Service	High/Medium / Low	✓	
Improved Emergency Response	Yes/No	✓	
Fuel Consumption	l (litres)	✗	Measured under travel time
Road User Costs	$	✗	Measured under travel time
Roadway Safety	Length (m)	✓	
Roadway Safety - Collision Potential at Intersections	Number	✗	
Active Transportation Connectivity - Conflicts through Communities	Length (km)	✗	All equal. All alternatives provide an active transportation link extension from Biehn Drive westerly.
Active Transportation - Proximity to Community Facilities	number	✗	Covered above
Bicycle - Conflicts with Existing Bicycle Routes	Length (km)	✗	See Active Transportation criterion
Flexibility for Future Expansion	Yes/No	✗	
Horizontal Curvature	degrees of deflection	✗	
Vertical Curves	Number	✗	Meets City standards
Minimum Radius of Curves	m	✗	Meets City standards
Skewed Intersections / Angle of Skewed Intersections	Number	✗	
Level of Service on Local Roads	High/Low	✗	Measured under Efficiency of Travel
Efficiency of Travel	High/Medium /Low	✓	
Compatibility with Integrated Transportation Master Plan	Yes/No	✓	
Safety of School Zone	Yes/No	✓	
Ability to Maintain Existing Roadway Classification	Yes/No	✗	

Factors and Sub-Factors	Unit of Measure	Carried Forward ?	Remarks
Bicycle and Pedestrian Safety - Conflicts with Planned Hydro Corridor Multi-Use Trail	No. of Crossings	✗	
Personal Security of Pedestrians and Cyclists	Yes/No	✓	
Intersection Spacing	m	✓	
Robert Ferrie Drive Intersection Location to Accommodate Future Development	Length (m)	✗	
Natural Environment			
Climate Change - Change in Greenhouse Gas Emissions	Tonnes/year	✗	
Sustainability - Use of Natural Resources to Construct Project	ha	✗	
Aquatic Species at Risk Potential Habitat Impacted	Number of Occurrences	✗	Confirmed by field inventories and mapping.
Potential Species at Risk Potential Habitat Impacted	Number	✗	Potential for Butternut, Black Ash and Myotis species.
Significant Woodlands Removed	ha	✗	
Other Woodlands and Woodlots Removed (does not include significant woodlands)	ha	✗	
Warm / Cool Water Fish Habitat Impacted	m^2	✗	Potential for ephemeral or intermittent watercourses in PSW.
Cold Water Fish Habitat Impacted	m^2	✗	Downstream impacts to Strasburg Creek cold water fish habitat. Confirmed in field that all are equal.
Loss of Fish Habitat	m^2	✗	Measured above.
Water Quality (Stormwater Surface Runoff)	ha	✗	All equal.
Drainage Courses Crossed	Number	✗	Included under Cool/Cold and Warm Water Fish Habitat Impacted and Warm water Fish Habitat Impacted above.

Factors and Sub-Factors	Unit of Measure	Carried Forward ?	Remarks
Stormwater Management Measures (Quantity and Quality Control)	Developed/ undeveloped	✗	All equal. Mitigation for stormwater (road and land development) will include temporal and LID technology.
Type of Soil for Stormwater Management	Type	✗	All equal
Drainage: Road Grades (Slope)	%	✗	All equal. Meets standards.
Wildlife Habitat	ha	✓	
Accommodating Wildlife Movement	Preferred/Not Preferred	✓	
Migratory Bird Nesting Impact	Yes/No	✗	Mitigation measures applied.
Area of Natural and Scientific Interest Removed	ha	✗	No ANSIs.
Provincially Significant Wetland (PSW) Removed	ha	✓	Strasburg Creek PSW
Potential Black Ash Impacted	ha	✓	
Groundwater Infiltration	ha	✓	Strasburg Creek PSW
Conservation of Tree Canopy	ha	✗	Measured under Provincially Significant Wetland Removed
Adjacent Lands Removed	ha	✗	
Fragmentation of PSW	ha	✗	All equal. Each of the alternatives will cross the PSW in the approximate same location. As such, the resultant fragmentation will be nearly identical. Alternative 3 was not carried forward, in part, because it had a larger fragmentation and multiple wetland crossings.
Wetlands Removed	ha	✗	See above.
Unevaluated Wetlands Removed	ha	✗	
Aggregate Resource Area Removed	ha	✗	
Groundwater – Wellhead Protection Sensitivity Areas (WHPA) Vulnerability (GRCA) Area 4	ha	✗	All equal. Sanitary sewer trench to include mitigation (clay seals) to avoid groundwater flow.

Factors and Sub-Factors	Unit of Measure	Carried Forward ?	Remarks
Loss of Flood Plain Storage - Regulated Areas	ha	X	Outside the floodplain.
Kitchener Core Natural Heritage Features/Region Core Environmental Features Impacted, Map 6 Natural Heritage System City of Kitchener Official Plan	ha	X	Included in the PSW criteria.
Specimen Trees	Number	X	All equal
Cultural Environment			
Designated Heritage Property Impacted	ha	X	Not Applicable
Heritage Property Listed in Register Impacted	ha	X	Not Applicable
Heritage Property Impacted (not Designated or Listed)	ha	X	Not Applicable
Heritage Buildings Impacted	Number	X	Not Applicable
Impact to Heritage Landscape Features (fence rows, tree lines, etc.)	High/ Medium/ Low	X	Not Applicable
Cemeteries Impacted	Number	X	See Registered Archaeological Sites
Pre-contact Sites	Number	X	See Registered Archaeological Sites
Post-contact Sites	Number	X	See Registered Archaeological Sites
Mapped 19th Century Structures (no longer standing)	Number	X	Double counted with Post contact sites
Cultural Landscape Features Impacted (not Designated or Registered Historical Properties)	Number of Settlement Areas	X	Not Applicable
Area of Archaeological Potential	ha	X	All equal.
Socio-Economic Environment			
Air Quality (Sensitive Receptors)	Number of Sensitive Receptors	X	All equal.
Sound Level Increases (greater than 55 dBA)	Number	X	No increase.
Sound Level Increases (less than 55 dBA)	Number	X	No increase.

Factors and Sub-Factors	Unit of Measure	Carried Forward ?	Remarks
Vibration Impacts	Number	✗	Measured under Sound Level Increases
Proximity to Hearthwood Park	Number	✗	All equal, avoided.
Emergency Response	Yes/No	✗	Refer to Transportation
Community Festivals Impacted	Yes/No	✗	Avoided
Potential School Pick-up/Drop-off Locations	Number of schools	✗	See Community Disruption.
Community Disruption - Biehn Drive North	Distance (km) through Neighbour-hoods	✓	
Community Disruption - Biehn Drive South	Distance (km) through Neighbour-hoods	✓	
Community Disruption - Caryndale Drive	Distance (km) through Neighbour-hoods	✓	
Institutions Impacted	Number	✗	Brigadoon Public School Considered under Transportation subfactors.
Visual Intrusion to Adjacent Residents	Number	✗	Considered under community disruption.
Pits and Quarries Impacted	Number	✗	
Farming Activity Impacted	hectares	✗	Interim use only. To be redeveloped
Businesses Impacted	Number	✗	
Land Use and Property			
Supports City of Kitchener's Official Plan	Yes/No	✓	
Residences Partially Impacted	Number	✗	
Residential Buyouts	Number	✗	
Low Rise Residential Property Required	ha	✗	All equal. City of Kitchener Official Plan, supported by landowner.
Institutional Property Required	ha	✗	City of Kitchener Official Plan

Factors and Sub-Factors	Unit of Measure	Carried Forward ?	Remarks
Natural Heritage Conservation Property Required	ha	✗	City of Kitchener Official Plan, Measured under Natural Environment
Park Property (Hearthwood Park) Required	ha	✗	City of Kitchener Official Plan
Mineral Aggregate Resource Areas	ha	✗	City of Kitchener Official Plan
Commercial Property Required	ha	✗	Employment Areas are avoided. City of Kitchener Official Plan
Rural Property Required	ha	✗	City of Kitchener Official Plan
New Utility Corridor Crossing Required	Number	✗	Considered under Cost
Communication Towers Impacted	Number	✗	Communication towers are avoided.
Natural Heritage System/Major Open Space Required	ha	✗	Measured under Natural Environment
Hydrology/Hydraulics: Land Uses Upstream of Road	ha	✗	To be determined at a later date
Former Landfill Sites/Potential Site of Environmental Concern Impacted	Number	✗	To be determined at a later date.
Planned Primary Multi-Use Pathway/Connection (Type 1) Impacted, Map 11 Integrated Transportation System City of Kitchener OP	Number	✗	All equal. Trail system is accommodated.
Planned Secondary Multi-Use Pathway/Connection (Type 2) Impacted, Map 11 Integrated Transportation System City of Kitchener OP	Number	✗	All equal. Trail system is accommodated.
Efficient Utilization of Future Development Land	High/ Medium / Low	✓	Measures the efficiency for development.
Crossing of the Hydro Corridor	No. of Crossings	✓	
Property Required	ha	✓	
Cost			
Capital Cost	$	✓	
Operating Costs	$	✗	
Life Cycle Cost	$	✗	

Factors and Sub-Factors	Unit of Measure	Carried Forward ?	Remarks
Engineering			
Stormwater Runoff	High / Medium / Low	X	
Accessibility for maintenance of sanitary sewer	High/low	X	
Biehn Drive Stormwater Enhancement	High/High-Medium /Low	X	
Sanitary Sewer Alignment	Yes/No	X	
Overland Stormwater Management Route	Order of Magnitude	X	

Appendix D

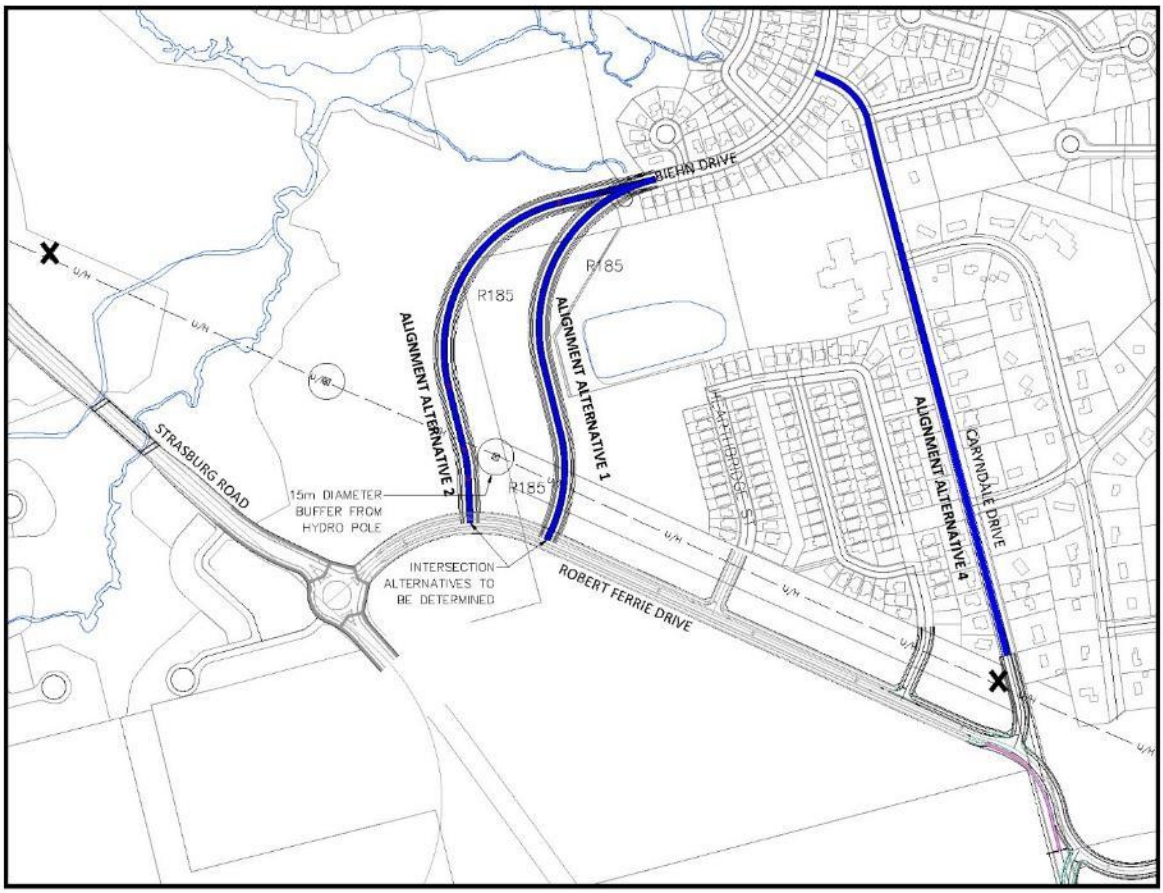
Sub-Factor Definitions

BT ENGINEERING
BTE

Biehn Drive Alignment Alternatives

Alternative	Description
Do Nothing	Existing - Caryndale Drive
Alternative 1	Connect Biehn Drive to Robert Ferrie Drive – East Alignment
Alternative 2	Connect Biehn Drive to Robert Ferrie Drive – Central Alignment
Alternative 4	Existing - Caryndale Drive Provide an Active Transportation Link Municipal Trunk Sewer to follow Alternative 1

Biehn Drive Alignment Alternatives



Scoring Legend based on the Likert system:

	Score
Extreme Negative impact / Highly Unsatisfactory	0.00
Negative impact (Intermediate)	0.25
Neutral / No change / No impact	0.50
Positive Impact (Intermediate)	0.75
Extreme Positive Impact / Highly Satisfactory	1.00

Transportation

Supports Urban Transit Service

Definition: This sub-factor measures the ability to accommodate future transit service, supporting City and Regional Transportation Master Plan objectives to promote alternative travel modes and to support planned area development.

Mitigation: None.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	1
Alternative 2	0.75
Alternative 4	0.25

Transportation

Improved Emergency Response

Definition: This sub-factor considers the benefit to emergency response. To improve the emergency response to the neighbourhood, the provision of alternative routes with an additional access to the community is preferred.

Mitigation: None.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	1
Alternative 2	1
Alternative 4	0

Transportation

Roadway Safety

Definition: This sub-factor measures the length of area collector roads where traffic volumes would be reduced, supporting existing and planned neighbourhood traffic calming measures to improve traffic safety. Alternatives which benefit the greatest length of existing collector roads are preferred.

Mitigation: Implementation of additional traffic calming measures including the potential use of roundabout control can be considered where traffic volumes would not be reduced.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	1
Alternative 2	1
Alternative 4	0.25

Transportation

Compatibility with Integrated Transportation Master Plan

Definition: This sub-factor measures the compatibility with the Integrated Transportation Master Plan which was the basis for the approval of all existing area development. Those alternatives which will result in a more even distribution of traffic consistent with the current roadway classifications are preferred.

This sub-factor considers the existing roadway classifications and the potential requirement to reclassify Caryndale Drive from a minor collector to a major collector. Those alternatives which would allow the existing classifications to be maintained and would not require Caryndale Drive to be reclassified to a major collector are preferred.

Mitigation: None.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	1
Alternative 2	1
Alternative 4	0

Transportation

Safety of School Zone

Definition: This sub-factor considers traffic safety within area School Safety zones. Those alternatives which avoid passing the Brigadoon Public School located on Caryndale Drive are preferred.

Mitigation: Additional traffic calming to further control traffic speeds and increased enforcement.

Use of school crossing guards.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	1
Alternative 2	1
Alternative 4	0.25

Transportation

Personal Security of Pedestrians and Cyclists

Definition: This sub-factor considers the personal security of pedestrians and cyclist where there is a multi-use path adjacent to a roadway. Those alternatives with a multi-use path adjacent to the roadway are preferred.

Mitigation: None.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	0.75
Alternative 2	0.75
Alternative 4	0.25

Transportation

Intersection Spacing/Safety

Definition: This subfactor considers the standard spacing of intersections (250 m) along Robert Ferrie Drive and the effects that closely spaced intersections can have upon traffic operations and vehicle conflicts due to traffic queuing on future development north of Robert Ferrie Drive. The measurement for this sub-factor is in metres. Alternatives that satisfy intersection spacing standards and avoid directing traffic through closely spaced intersections are preferred.

Minimum TAC intersection spacing 250 m.

Mitigation: None.

Alternatives:

Alternative	Score
Do Nothing	0.25
Alternative 1	0.75
Alternative 2	0
Alternative 4	0.25

Natural Environment

Wildlife Habitat

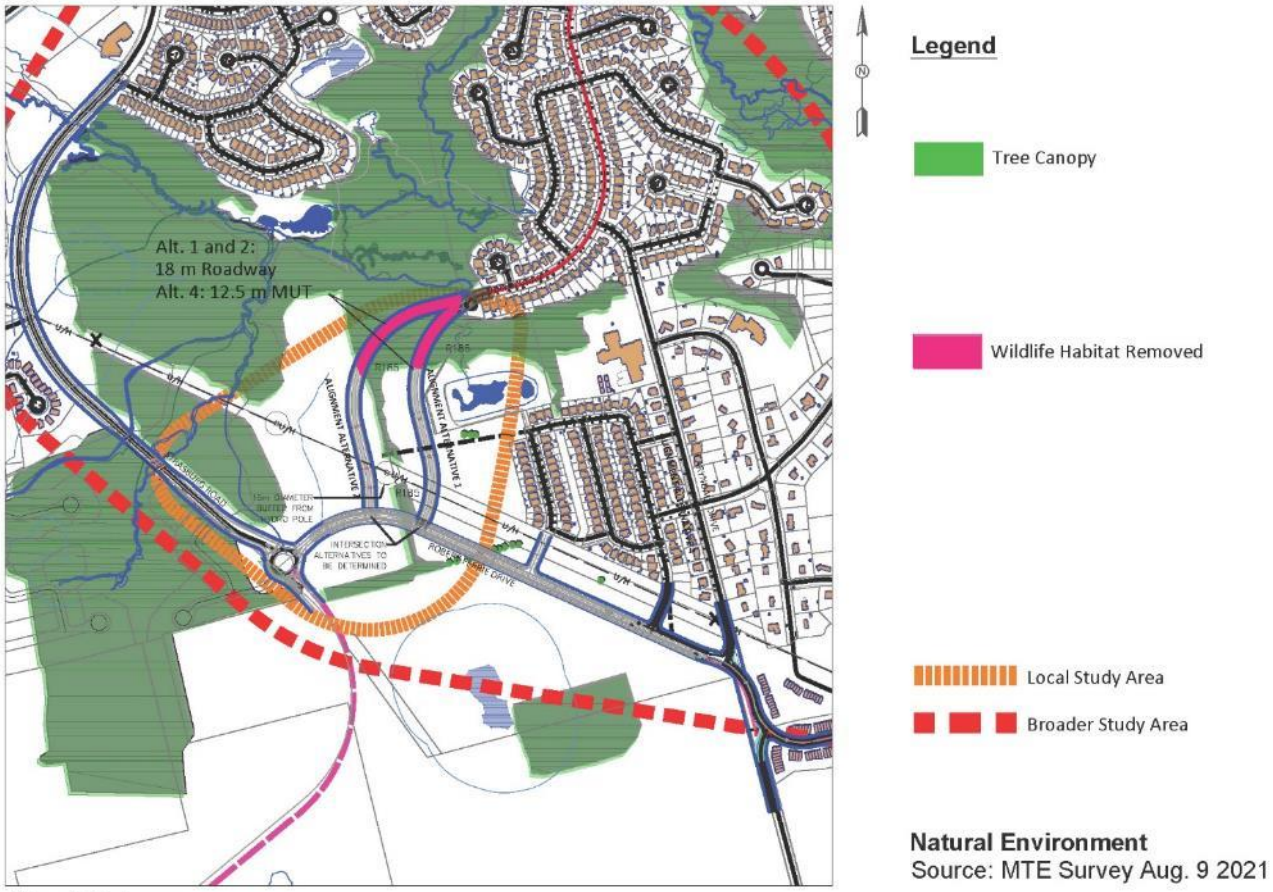
Definition: This sub-factor measures the removal of Wildlife Habitat within the right-of-way, along any of the proposed alternative Alignments.

Those alternatives that remove the least amount of wildlife habitat are preferred.

Mitigation: To be considered for the Technically Preferred Alternative using Best Management Practises and identify enhancement opportunities.

Alternatives:

Alternative	Score
Do Nothing	1
Alternative 1	0
Alternative 2	0
Alternative 4	0.5



City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment
NTS

Natural Environment

Accommodating Wildlife Movement

Definition: This sub-factor measures the impact on wildlife habitats crossings. The measurement for this sub-factor is the width of the right-of-way and level of traffic for each alternative. The alternative with a narrow right-of-way width and least amount of traffic is preferred.

Do Nothing: No traffic

Alternative 1: Traffic and 26 m ROW 6.6 m paved street and provides a wildlife culvert.

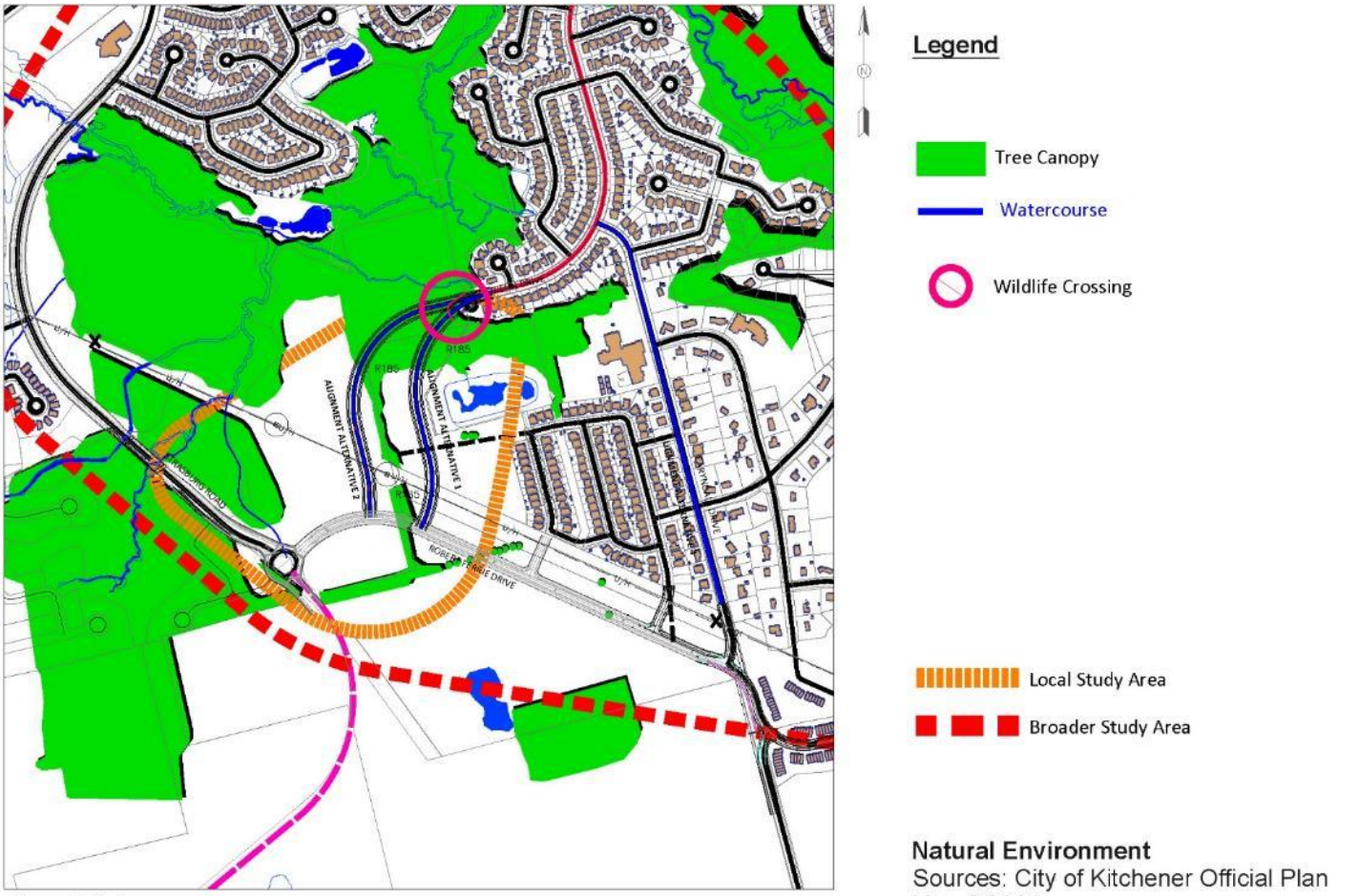
Alternative 2: Traffic and 26 m ROW 6.6 m paved street.

Alternative 4: No traffic.

Mitigation: Provide or enhance alternative wildlife crossings along the alignment.

Alternatives:

Alternative	Score
Do Nothing	1
Alternative 1	0.25
Alternative 2	0
Alternative 4	0.5



City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment
NTS

Natural Environment
Sources: City of Kitchener Official Plan Map 6 2014.
GRCA Open Data License V2 Regulatory Floodplain

Natural Environment

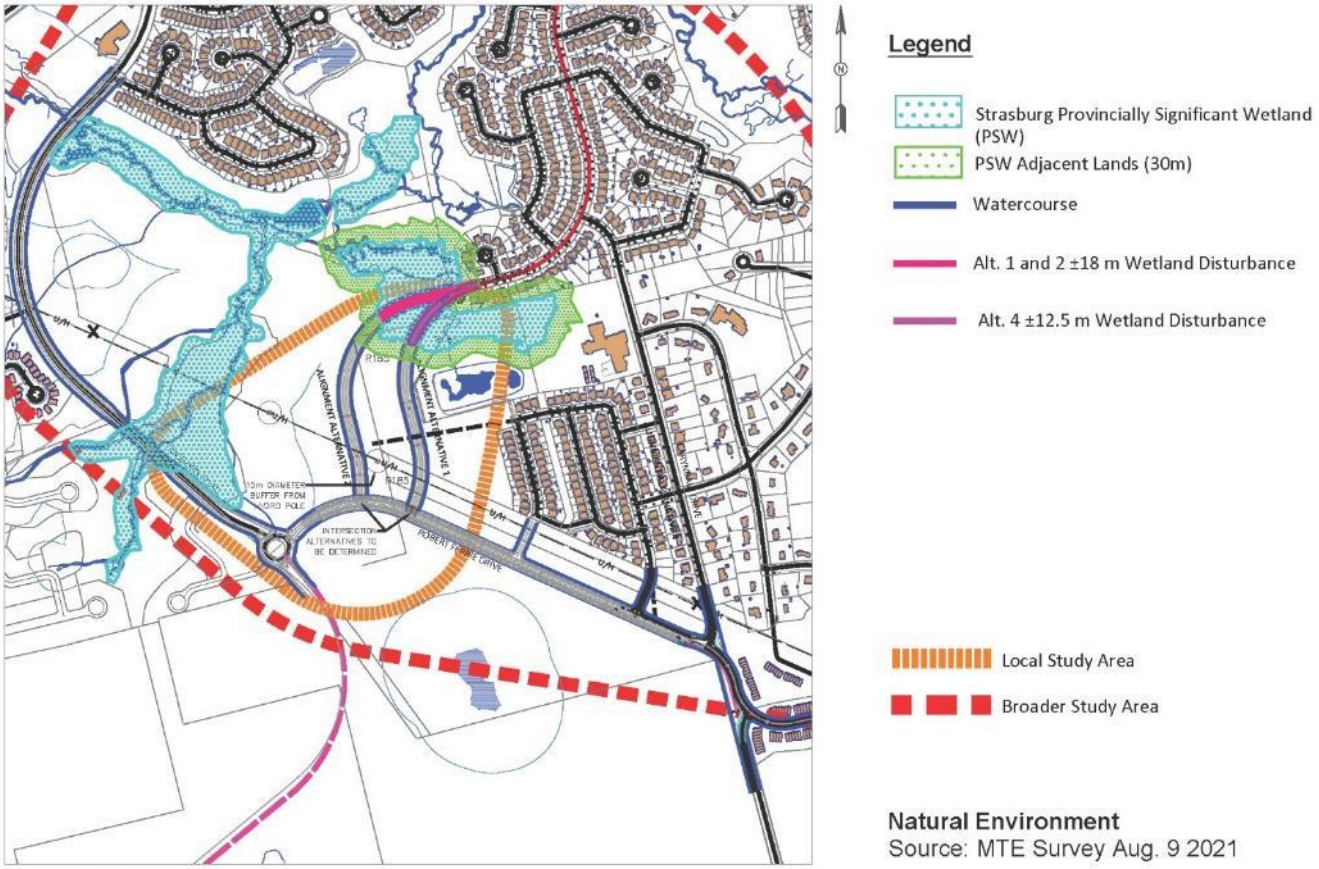
Provincially Significant Wetlands Removed

Definition: This sub-factor measures the removal of Provincially Significant wetlands, including the removal of the tree canopy. The removal of wetland and tree canopy can result in direct habitat loss, may contaminate adjacent habitat, and may also alter existing stream flow and hydrologic patterns. The measurement for this sub-factor is in hectares. Those alternatives that affect the least area of wetlands and tree canopy are preferred.

Mitigation: Develop a wetland mitigation plan prior to construction. The plan will detail pre- and post-construction methodology and practices to prevent contamination or alteration to existing wetland conditions and enhancements or creation opportunities.

Alternatives:

Alternative	Score
Do Nothing	1
Alternative 1	0
Alternative 2	0
Alternative 4	0.5



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Municipal Class Environmental Assessment
NTS

Natural Environment

Potential Black Ash Impacted

Definition: This sub-factor measures the potential impact to Black Ash, recently added to the Species at Risk. The City has committed to provide compensation for any loss of Black Ash trees. Those alternatives that affect the least area of Black Ash are preferred.

Mitigation: Compensation.

Alternatives:

Alternative	Score
Do Nothing	1
Alternative 1	0
Alternative 2	0
Alternative 4	0.5

Natural Environment

Groundwater Infiltration of Rainfall

Definition: This sub-factor measures the loss of water permeable area within the Provincially Significant wetlands. The removal of permeable wetland area can result in direct reduction in groundwater and may also alter existing stream flow and hydrologic patterns. The measurement for this sub-factor is in hectares. Those alternatives that affect the least area are preferred.

Mitigation: Introduce LID treatment to allow water infiltration.

Alternatives:

Alternative	Score
Do Nothing	1
Alternative 1	0.25
Alternative 2	0.25
Alternative 4	0.5

Socio-Economic Environment

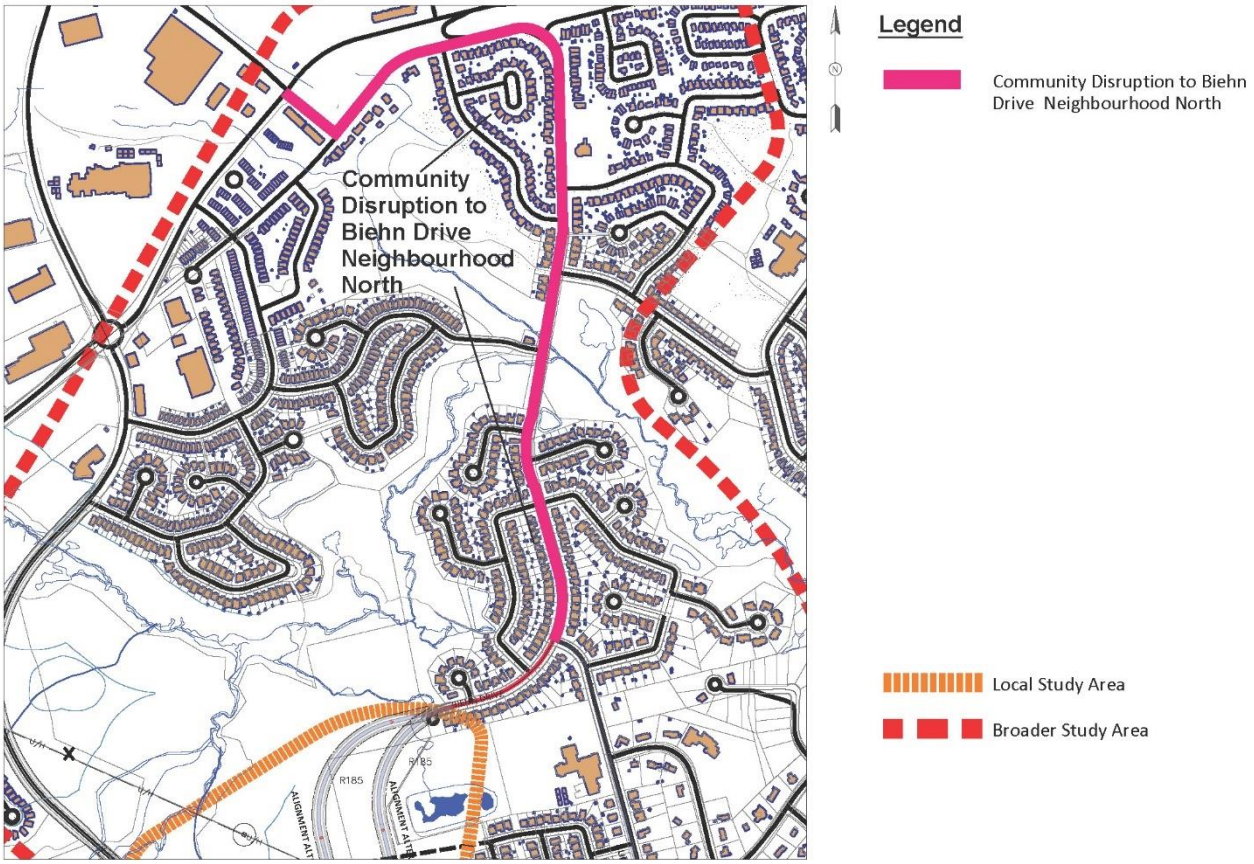
Community Disruption to Biehn Drive North

Definition: This sub-factor measures the impact to neighbourhoods. The measurement for this sub-factor is the length of corridor within the Biehn Drive north neighbourhood. Those alternatives that impact the least number of kilometres within the Biehn Drive north neighbourhood are preferred.

Mitigation: None. (Traffic calming measures are already being developed for implementation.)

Alternatives:

Alternative	Score
Do Nothing	0.5
Alternative 1	1
Alternative 2	1
Alternative 4	0.5



City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment
NTS

Socio-Economic Environment

Socio-Economic Environment

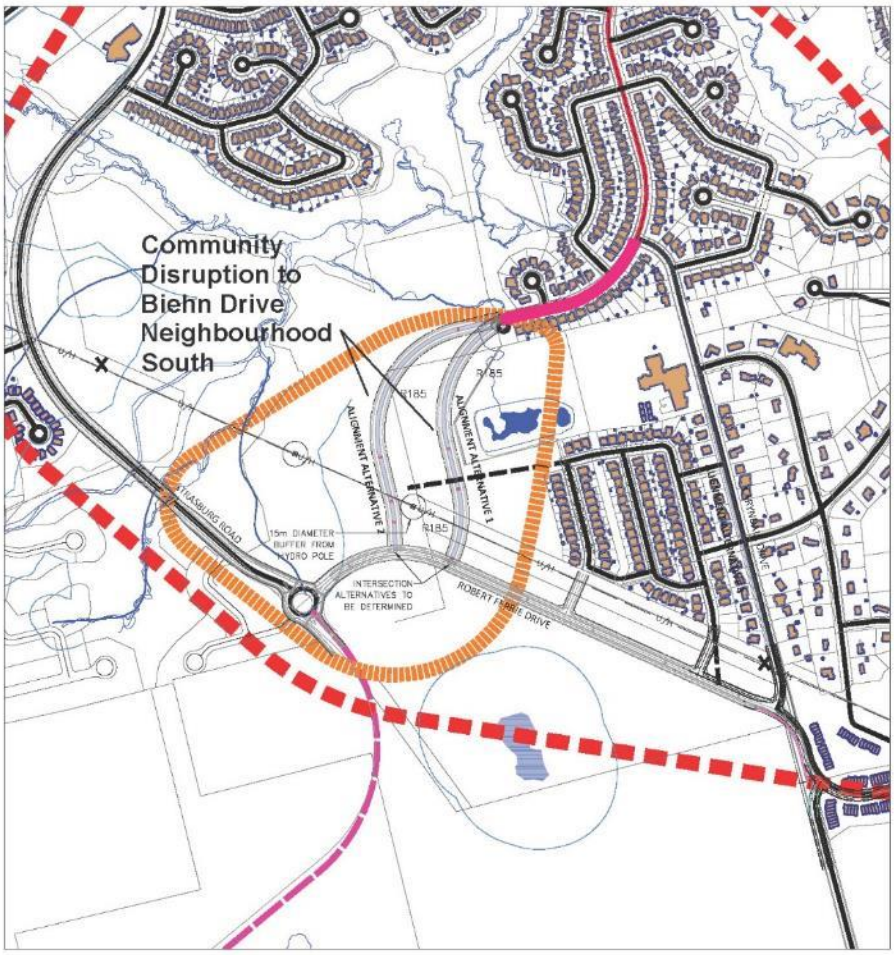
Community Disruption to Biehn Drive South

Definition: This sub-factor measures the impact to neighbourhoods. The measurement for this sub-factor is the length of corridor within the Biehn Drive south neighbourhood. Those alternatives that impact the shortest section within the Biehn Drive south neighbourhood are preferred.

Mitigation: Traffic calming measures.

Alternatives:

Alternative	Score
Do Nothing	0.5
Alternative 1	0.25
Alternative 2	0.25
Alternative 4	0.5



City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment
NTS

Socio-Economic Environment

Socio-Economic Environment

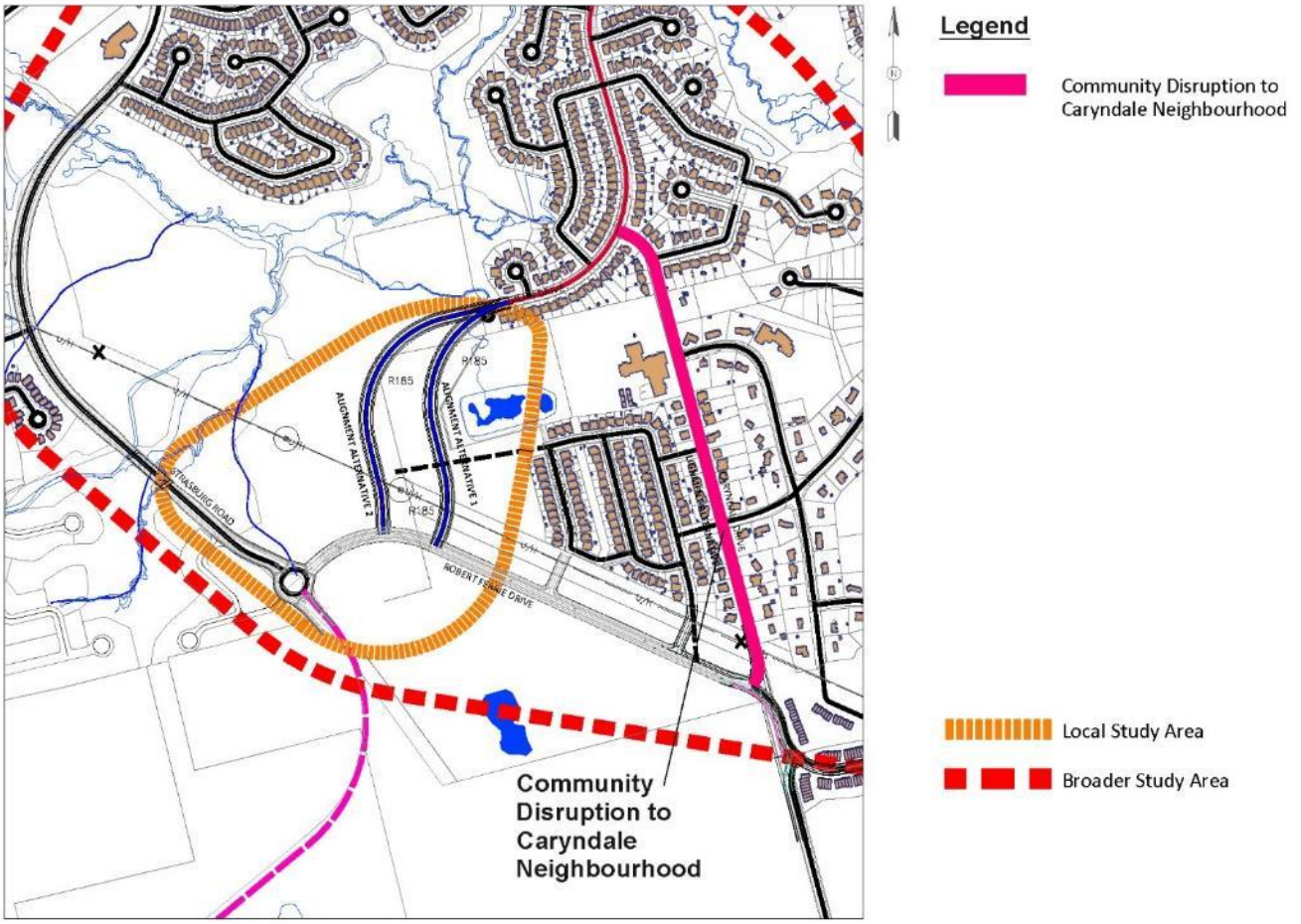
Community Disruption to Caryndale

Definition: This sub-factor measures the impact to neighbourhoods. The measurement for this sub-factor is the length of corridor within the Caryndale neighbourhood. Those alternatives that impact the least number of kilometres within the Caryndale neighbourhood are preferred.

Mitigation: None. (Traffic calming measures have already been implemented.)

Alternatives:

Alternative	Score
Do Nothing	0.25
Alternative 1	0.75
Alternative 2	0.75
Alternative 4	0.5



City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment
NTS

Socio-Economic Environment

Land Use and Property

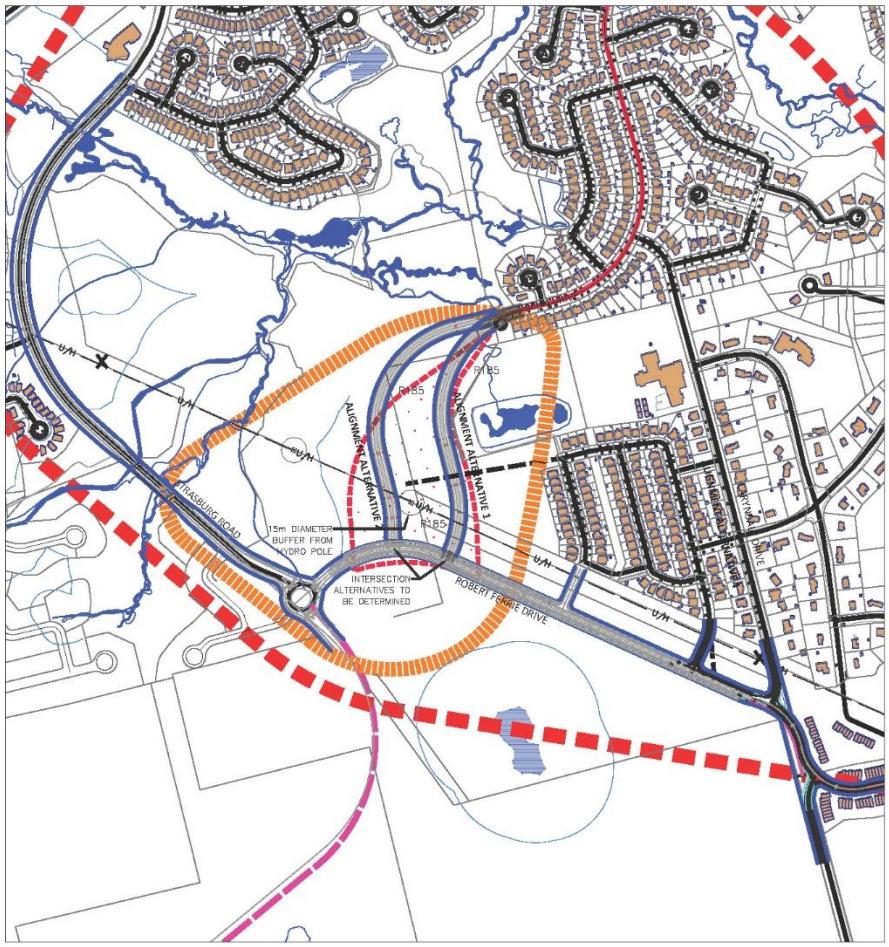
Supports the City of Kitchener's Official Plan

Definition: This sub-factor measures whether the alignment alternative supports the City of Kitchener Official Plan. The measurement for this sub-factor is Yes/ No. Those alternatives that support the Official Plan, which was the basis for all existing development, are preferred.

Mitigation: None.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	1
Alternative 2	1
Alternative 4	0.25



Legend

Biehn Drive Extension Area
Source: City of Kitchener Official Plan Schedule B 2014.

Local Study Area

Broader Study Area

City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment
NTS

Land Use

Land Use and Property

Efficient Utilization of Land

Definition: This sub-factor measures whether the alignment alternative supports the efficient use of lands. Those alternatives that best support access and maximize the land available for development are preferred.

Mitigation: None.

Alternatives:

Alternative	Score
Do Nothing	0
Alternative 1	1
Alternative 2	0.5
Alternative 4	0.25

Land Use and Property

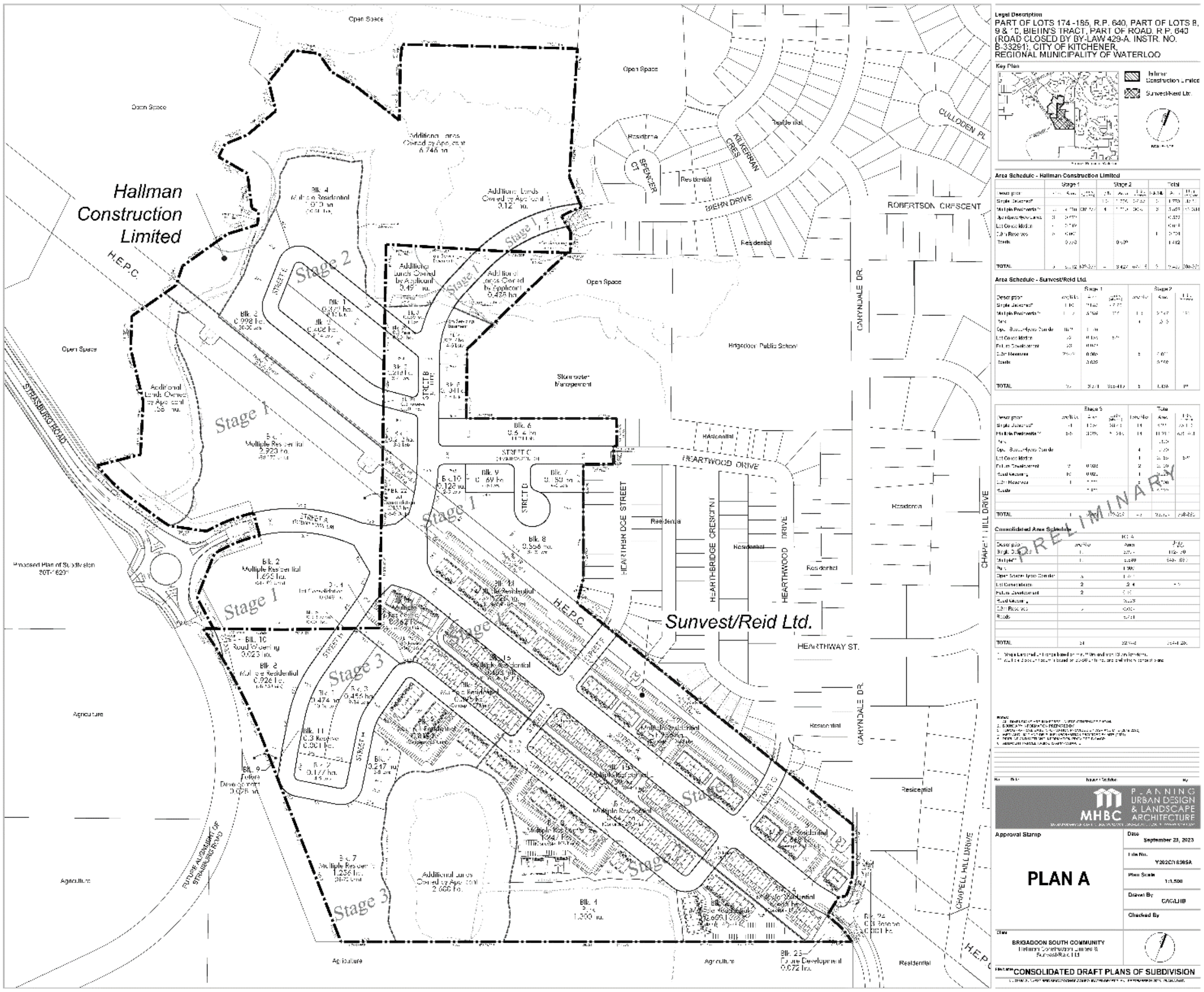
Crossing of the Hydro Corridor

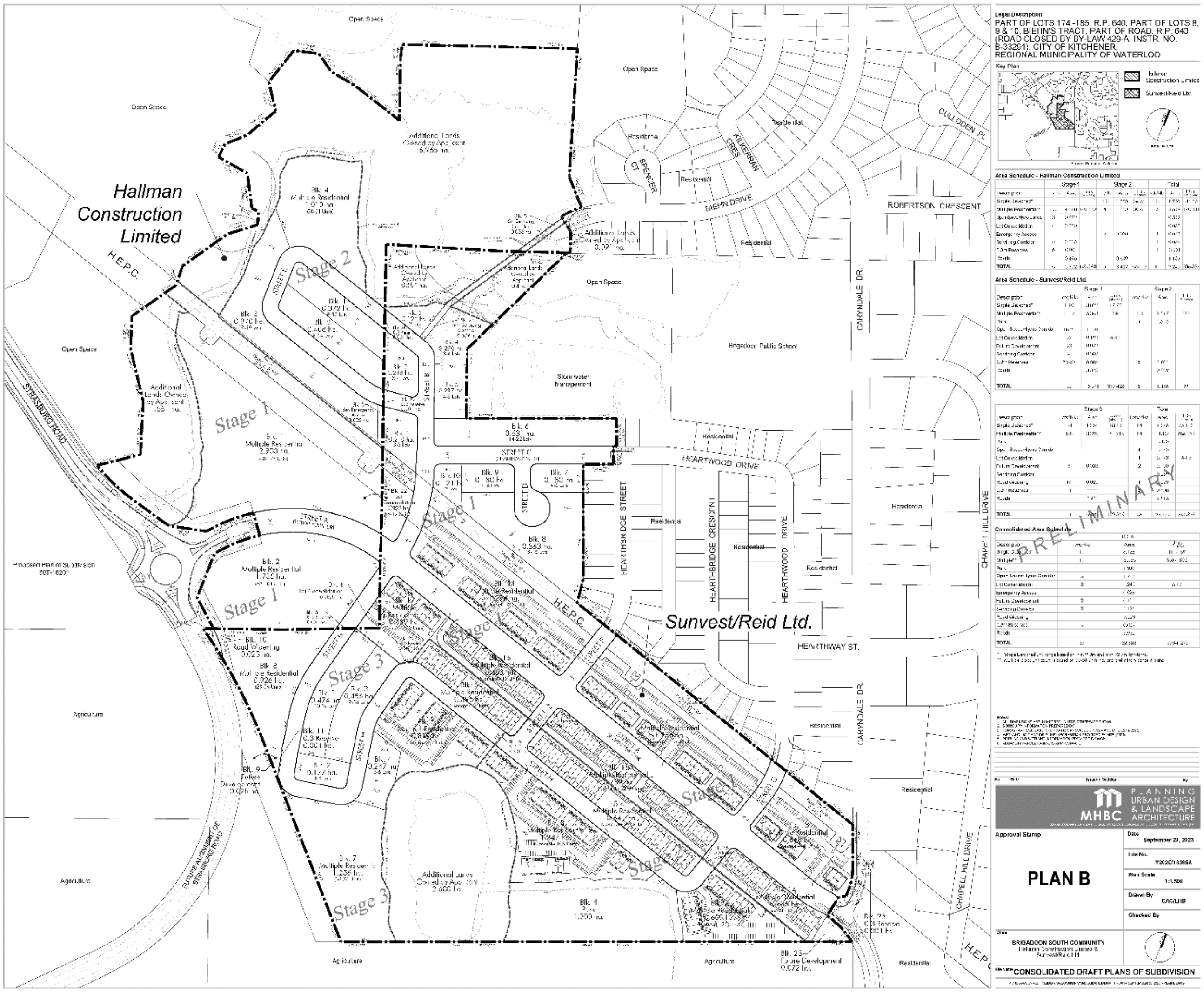
Definition: This sub-factor measures the number of crossings of the hydro corridor. The hydro corridor is a high voltage transmission line. Each crossing/conflict with the hydro corridor will require additional approval from Hydro One. The proposed extension of Biehn Drive would result in one crossing of the hydro corridor. Alternatives with the least number of hydro corridor crossings are preferred. A revised subdivision plan has only one crossing resulting in all the alternatives are equal.

Mitigation: Limit parking under the transmission lines.

Alternatives:

Alternative	Score
Do Nothing	0.5
Alternative 1	0.5
Alternative 2	0.5
Alternative 4	0.5


Hallman Construction Limited
Sunvest/Reid Ltd.
H.E.P.C.
Stage 1
Stage 2
Stage 3
Open Space
Agriculture
Residential
Stormwater Management
Brigadoon Public School
BIEHN DRIVE
ROBERTSON CRESCENT
CULLODEN PL
CARYNDALE DR.
HEARTWOOD DRIVE
HEARTHWAY ST.
CHAPEL HILL DRIVE
STRASBURG ROAD
PRELIMINARY
PLAN A
MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
BRIGADOON SOUTH COMMUNITY
CONSOLIDATED DRAFT PLANS OF SUBDIVISION
Legal Description
PART OF LOTS 174-185, R.P. 640, PART OF LOTS 8, 9 & 10, BIEHN'S TRACT, PART OF ROAD, R.P. 640 (ROAD CLOSED BY BY-LAW 429-A, INSTR. NO. B-33291), CITY OF KITCHENER, REGIONAL MUNICIPALITY OF WATERLOO
Key Plan
Area Schedule - Hallman Construction Limited
Area Schedule - Sunvest/Reid Ltd.
Consolidated Area Schedule
Approval Stamp


Hallman Construction Limited
Sunvest/Reid Ltd.
PLAN B
CONSOLIDATED DRAFT PLANS OF SUBDIVISION
BRIGADOON SOUTH COMMUNITY
MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
PRELIMINARY
Stage 1
Stage 2
Stage 3
H.E.P.C.
STRASBURG ROAD
BIEHN DRIVE
ROBERTSON CRESCENT
CARYNDALE DR.
CHAPEL HILL DRIVE
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HEARTHWAY ST.
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Agriculture
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Stormwater Management
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PART OF LOTS 174-185, R.P. 640, PART OF LOTS 8, 9 & 10, BIEHN'S TRACT, PART OF ROAD, R.P. 640 (ROAD CLOSED BY BY-LAW 429-A, INSTR. NO. B-33291), CITY OF KITCHENER, REGIONAL MUNICIPALITY OF WATERLOO
Key Plan
Area Schedule - Hallman Construction Limited
Area Schedule - Sunvest/Reid Ltd.
Consolidated Area Schedule
Approval Stamp
Date September 23, 2020
Plan Scale 1:1,500
Drawn By
Checked By

Cost

Capital Cost

Definition: This sub-factor measures the total capital cost of the alternative (including land purchasing, permitting, etc.). Cost estimates are for the alternative alignments in 2023. Those alternatives with the lowest capital cost are preferred.

Mitigation: Not applicable.

Alternatives:

Alternative	Score
Do Nothing	1
Alternative 1	0
Alternative 2	0
Alternative 4	0.25

Appendix I

Geotechnical Investigation

BT ENGINEERING

Geotechnical Investigation - Proposed Trunk Sewer, Biehn Drive South Extension, Kitchener

March 14, 2024

Prepared for:
BT Engineering

Cambium Reference: 11969-002

CAMBIUM INC.

866.217.7900

cambium-inc.com

Table of Contents

List of Embedded Tables

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List of Appendices

1.0 Introduction

Cambium Inc. (Cambium) was retained by BT Engineering (Client) to complete a geotechnical investigation in support of the Class EA & Preliminary Design for Biehn Drive Extension and Sanitary Trunk Sewer Extension in Kitchener, Ontario. A site location plan is appended as Figure 1 of this report.

It is understood that the City of Kitchener is proposing to install new 525 mm diameter trunk sewer to support the upcoming residential construction along the proposed roadway extension and to connect to the existing sewer on Biehn Drive from its current terminus, approximately 60 metres west of Spencer Court, southerly to the future Robert Ferrie Drive Extension. It is also understood that the proposed construction of the trunk sewer will be using trenchless technology through the known wetland area present on the Site. Based on preliminary design, the approximate length of the alignment within wetland will be 188 m (from station 10+338 to 10+526). And the trunk sewer is expected to be installed to depths of 2.5 to 3.5 m below existing grade in this section.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions by means of a number of boreholes and based on the findings to provide geotechnical recommendations for the design and construction of the proposed sanitary trunk sewer.

2.0 Methodology

2.1 Previous Investigation

Cambium completed a geotechnical investigation in 2022 on the property south of wetland to determine the subsurface and groundwater conditions. The previous investigation consisted of six boreholes at the Site to a maximum depth of 8.2 m below ground surface (mbgs), cumulating in our report entitled "*Geotechnical Investigation Report – Biehn Drive Extension, Kitchener, ON*" dated April 14, 2022. Four of these boreholes were outfitted with monitoring wells, one of which (BH101-22) is located near the southern edge of the wetland. In the preparation of this report and in addition to the borehole investigation under the current assignment, reference has been made to factual information contained in that report.

2.2 Borehole Investigation

Cambium completed a borehole investigation at the Site in August and September 2023. A total of six boreholes, designated as BH201-23 through BH206-23, were advanced into the subsurface at predetermined locations. These boreholes were terminated depths of 6.7 to 9.8 m below ground surface (mbgs). The locations and elevations of the boreholes were obtained using a Realtime Kinematic Unit (RTK) using a site benchmark (BM). The BM is recognized as the top of BH101-22, which was corrected to geodetic elevation during previous investigation. The borehole locations are shown on Figure 2 of this report.

Drilling and sampling was completed using a track-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight solid stem augers with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive soils. Soil samples were collected at approximately 0.75 m intervals to 3 m deep and 1.5 m intervals after.

The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage.

Open boreholes were checked for groundwater and general stability prior to backfilling. Monitoring wells were installed in boreholes BH202-23, BH203-23, and BH206-23 in order to measure stabilized groundwater levels. The other boreholes were backfilled and sealed in accordance with Ontario Regulation (O.Reg.) 903, as amended, and the property was reinstated to pre-existing conditions.

Borehole logs are provided in Appendix A. Site soil and groundwater conditions are described, and geotechnical recommendations are discussed in the following sections of this report.

2.3 Physical Laboratory Testing

Physical laboratory testing, including six particle size distribution analyses (LS-702, 705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Moisture content testing was completed on all soil samples. Testing results are presented in Appendix B and are discussed in Section 3.0.

3.0 Subsurface Conditions

The detailed soil profiles encountered in the boreholes are indicated on the attached borehole logs in Appendix A. It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations.

In summary, the subsurface conditions consist of a peat or fill underlain by a sand to silty sand soil which is interbedded with silt and sand and silt deposits. A brief description of each soil type was provided in following sections.

3.1 Pavement Structure

Borehole BH202-23 was advanced in the existing pavement on Biehn Drive. 70 mm of asphalt was observed at the surface, overlying approximately 2.4 m of sand and gravel fill material. This sand and gravel was brown in colour and appears to be granular fill. SPT N values in the fill ranged from 20 to 42 indicating a compact to dense relative density. The moisture contents in the fill ranged from 4% to 7%.

3.2 Peat

In most of the boreholes advanced within wetland, the surficial soil consisted of a black peat material containing high amounts of organic material. The thickness of the peat ranged from 0.3 to 1.5 m deep with an average thickness of approximately 0.8 m. SPT N values of 2 to 3 in the peat indicated a very loose relative density.

3.3 Sand Fill

In borehole BH201-23, a layer of sand fill was observed at the surface extending to a depth of approximately 1.5 mbgs. The sand fill contained some gravel and was described as moist at the time of the investigation. Moisture contents in the sand fill were approximately 5%. SPT N values observed in this material ranged from 8 to 13 indicating a loose to compact relative density.

3.4 Sand, Silty Sand

A non-cohesive sand to silty sand was observed in all boreholes. This sand to silty sand appears to be the dominant soil type across the Site, and boreholes BH201-23, BH203-23, BH204-23, and BH205-23 terminate in this soil. The sand to silty sand was generally described as light brown to brown in colour and had trace to some gravel and clay inclusions. At the time of the investigation, the soil was described as moist to wet with natural moisture contents ranging from 12% to 21%. The SPT N values in the material on average range from 2 to 34, however on average the SPT N values were between 10 and 20. This generally indicates a compact relative density.

Laboratory particle size distribution analyses were completed for one sample of the sand and silty sand deposits. The analysis results are summarized in Table 1 with details provided in Appendix B.

Table 1 Particle Size Distribution Analysis – Sand, Silty Sand

Borehole and Sample	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH202-23 SS5	3.0 – 3.5	Sand some Silt trace Clay	0	80	17	3	18.9

3.5 Sandy Silt, Silt, Silt and Sand

Non-cohesive deposits described as silt, sandy silt, and silt and sand were observed in all boreholes except borehole BH203-23. This silt to sandy silt was observed at varying depths within the boreholes and was either interbedded in the sand to silty sand, or a transitionary layer between the sand to silty sand and the surficial peat. These deposits were brown in colour and described as moist to wet at the time of the investigation. Moisture contents in the sandy silt and silt soils ranged from 14% to 23%. SPT N values ranged from 7 to 15 indicating a loose to compact relative density.

A laboratory particle size distribution analysis was completed for three samples of the sandy silt, silt, and sand and silt soil. The analysis results are summarized in Table 2 with details provided in Appendix B.

Table 2 Particle Size Distribution Analysis – Sandy Silt, Silt, Silt and Sand

Borehole and Sample	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH204-23 SS6	4.6 – 5.2	Sandy Silt some Clay	0	24	62	14	20.3
BH205-23 SS4	2.3 – 2.9	Silt and Sand some Clay	0	38	44	18	16.9
BH206-23 SS7	6.1 – 6.7	Sand and Silt trace Clay trace Gravel	5	45	41	9	19.0

3.6 Cohesive Deposits

Pockets of cohesive deposit described as clay and silt, silt were observed in BH101-23 and BH104-23 through BH106-23, interbedded in the sand to silty sand soils. In borehole BH204-23, this cohesive silt soil underlying the peat contained trace organic matter and ash. These cohesive deposits were generally grey in colour, with moisture contents ranging from 15% to 27%. SPT N-values measured within the cohesive deposits ranged from 1 to 10 indicating a very soft to firm consistency.

A laboratory particle size distribution analysis was completed for two samples of the cohesive deposits. The analysis results are summarized in Table 3 with details provided in Appendix B.

Table 3 Particle Size Distribution Analysis – Cohesive Deposits

Borehole and Sample	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH201-23 SS6	4.6 – 5.2	Clay and Silt trace Sand trace Gravel	1	6	46	47	26.0
BH206-23 SS3	1.5 – 2.1	Silt some Clay some Sand	0	11	75	14	27.7

3.7 Groundwater

Short term groundwater was observed in four boreholes upon completion of drilling from depths of approximately 0.6 to 0.9 mbgs.

Monitoring wells were installed in boreholes BH202-23, BH203-23, and BH206-23 and the stabilized groundwater was measured. A monitoring well was also installed in the previous

geotechnical investigation on site, denoted BH101-22, and the stabilized groundwater was also measured in this well. Groundwater levels are outlined in Table 4. It should be noted that groundwater levels at the site may fluctuate seasonally and in response to climatic events.

Table 4 Groundwater Level in Monitoring Wells

Borehole	Date	Water Level (mbgs)	Groundwater Elevation (masl)
BH202-23	October 13, 2023 March 11, 2024	0.95 0.67	311.63 311.91
BH203-23	October 13, 2023 March 11, 2024	0.26 0.15	312.69 312.80
BH206-23	October 13, 2023 March 11, 2024	0.19 -0.14	312.38 312.71
BH101-22	October 13, 2023 March 11, 2024	0.60 0.38	312.82 313.04

4.0 Geotechnical Considerations

The following recommendations are based on the borehole information and are intended to assist the client and its designer. Recommendations should not be construed as providing instructions to contractors, who should form their own opinions about site conditions. It is possible that subsurface conditions beyond the borehole locations may vary from those observed. If significant variations are found before or during construction, Cambium should be contacted so that we can reassess our findings, if necessary.

4.1 Excavations

It is anticipated that the installation of the proposed trunk sewer pipe will be using trenchless technique. In some cases, if open trench excavations are used, all excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). Due to shallow groundwater table, any loose silty sand, sand, sandy silt, silt should be classified as Type 4 soils. Open trenches in such soils below the water table will be unstable and the base of the excavations will be disturbed, therefore the excavation will likely require shoring and dewatering/depressurization using advance well-point dewatering system to lower the groundwater to below the base of the excavations. Shoring should be designed in accordance with the latest Canadian Foundation Engineering Manual and must be reviewed by a qualified geotechnical engineer.

While use of trench boxes is an effective and economical trench-support method, it is not usually intended to shore up or otherwise support trench walls, they are meant to protect workers in case of a cave-in. When using the trench boxes, excavation should be done so that the space between the trench box and the excavation is minimized. Any space between the box and the trench wall needs to be backfilled and compacted. Trench boxes need to be installed expediently.

4.2 Dewatering

A Permit to Take Water (PTTW) or registration in the Environmental Activity and Sector Registry (EASR) will likely be required depending on the volume of water displaced from the

site. Excavation work, particularly any trench excavation, should be carried out in sections to control the daily volume of seepage. The elevation of the groundwater table will vary due to seasonal conditions and in response to heavy precipitation events. In order to minimize predictable water issues and costs, it is recommended that excavation and in-ground construction be performed in drier seasons. It is noted that incident precipitation into an excavation would also need to be handled along with the expected groundwater and included in the dewatering rate.

The detailed dewatering assessment was provided in Cambium's Dewatering and Discharge Plan report submitted under separate cover.

4.3 Bedding and Cover

The native subgrade (with inspection and approval) will provide adequate support for pipes with the bedding requirements. The bedding material should consist of OPSS Granular A material, placed in accordance with City Standards. The bedding and cover material shall be placed in maximum 150 mm thick lifts and should be compacted to at least 100% of SPMDD. For wet trench conditions, Clear stone bedding wrapped in filter fabric is required. Clear stone bedding placed directly on subgrade is prohibited. In both cases, particular care must be taken to ensure adequate compaction below the haunches of the new pipe. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to 100% of SPMDD.

4.4 Trench Backfill and Compaction

The non-cohesive soils encountered on site such as sand, silty sand, sand, and silt not containing organics or any other deleterious material, are expected to be suitable as backfill in trenches provided that the actual or adjusted moisture content at the time of construction is within a range that permits compaction to required densities. Some moisture content adjustments may be required depending upon seasonal conditions. Geotechnical inspections and testing are required to confirm acceptable quality.

Some cohesive soils including clayey silt, sandy clayey silt, and silt soils, however, will be difficult to handle and will require the use of heavy compactors for proper compaction, which

will be difficult to operate within the narrow confines of service trenches and in such conditions, it may be more economical to use imported backfill.

The backfill should be placed in maximum 200 mm thick loose lifts and compacted to a minimum of 98% SPMDD to within 1.0 metre of the final grade. The upper 1.0 metre below the final grade should be compacted to a minimum of 98% SPMDD. In confined areas the layer thickness will have to be reduced to utilize smaller compaction equipment efficiently.

4.5 Trenchless Through Known Wetland

4.5.1 Geotechnical Conditions

The anticipated subsurface conditions for the proposed 525 mm trunk sewer installed at an invert elevation between 309.5 m and 310.5 m are very loose to compact silty sand, sand, sandy silt, as observed in boreholes along the proposed alignment. The tunneling for the trunk sewer will be located approximately 2 m to 3 m below the prevailing groundwater level. In general, the subsurface soils consisting of sand, silty sand, and sand and silt could yield considerable seepage. Specific excavation requirements must be evaluated in terms of the expected mixed soil and groundwater seepage conditions. Inferred subsurface profiles along the tunneling alignment are presented in Figure 3.

Based on Terzaghi's Classification for Soils in Tunnelling, the very loose to compact silty sand, sand, sandy silt below the groundwater table falls within the "flowing" soil type. The soil lacks sufficient cohesion or cementation, and the behavior is more subjective and can easily run or flow into the excavation.

4.5.2 Trenchless Methods

Tunnelling shall be undertaken in accordance with OPSS 415 and any applicable regional standards. Consideration was given to tunnelling methods such as horizontal directional drilling, pipe ramming, jack-and-bore, and microtunnelling. The feasibility of the following methods was evaluated:

- Horizontal Directional Drilling (HDD) is not recommended in view of size of tunneling and the potential for frac-out to the sensitive environment of the wetland.
- Pipe ramming method is not recommended due to the need for advance dewatering to maintain the stability of the tunnel face.
- Jack-and-bore is not viable option due to its open face nature which will not cope with flowing ground conditions.
- Microtunnelling (MTBM) will be the preferred tunneling methodology subject to equipment availability. MTBM consists of a relatively small diameter tunnelling boring machine advanced at the lead end of the pipe which is steered from the entry shaft to the exit shaft. MTBM is typically capable of balancing the earth and water pressures at the tunnel face and would not require the use of advance dewatering to prevent excessive ground disturbance or settlement of the ground above.

Selection of an appropriate methodology for trenchless installation should be the responsibility of the specialized contractor and will depend upon the relative costs and risks associated with each method. The experience of the contractor is of primary importance. The contractor must submit a detailed work plan, including the proposed methodology for boring, maintenance of alignment, and disposal of cuttings.

All trenchless work should be carried out by a specialized contractor with similar experience. It is recommended that the geotechnical aspects of the contractor's work plan for the proposed undercrossing be reviewed by Cambium, prime consultant and the City. The proposed procedures should include a description of the potential loss of ground, and calculation of the maximum settlement in relation to the Contractor's method and equipment, alternative/remedial measures when review level of measurement is reached, and contingency/remedial measures when alert level of measurement is reached Settlement monitoring of the ground surface at critical locations would need to be carried out prior to, during and subsequent to tunneling to document any effects of installing the undercrossing. In addition, it would be prudent to have the tunneling operations supervised by the geotechnical engineer.

4.5.3 Shaft Structure

It is assumed that 6 metres diameter entrance and exit shafts are proposed to construct the trunk sewer. For the proposed shaft excavations, overburden soils above the ground water table may be cut back to a stable inclination if space restrictions permit. OHSA soil types for open cut excavations are provided in Section 4.1. Where excavations cannot be sloped, or where sloped cuts are not economical, the excavations may be supported through a completely shored excavation. An experienced shoring engineer must be retained to design the shoring system prior to commencement of construction. The shoring system should be designed in accordance with OPSS 539 and Canadian Foundation Engineering Manual (4th edition). Soil parameters for use in the shoring design are provided in Table 5. Appropriate surcharge such as a uniform loading of minimum 12 kPa should also be considered in the design.

Table 5 Soil Parameters for Shoring Design

Soil	Bulk Unit Weight γ (kN/m3)	Internal Friction Angle Φ' (º)	Active earth pressure coefficient Ka (Rankine)	Passive earth pressure coefficient Kp (Rankine)	At-rest earth pressure coefficient Ko (Rankine)
Peat / Loose Fill	16.0	24	0.42	2.37	0.59
Loose to Compact Sand, Silty Sand, Sandy Silt. Silt	19.0	26	0.39	2.56	0.56

Basal instability can occur when a high hydraulic gradient is created as a result of water flowing into the excavation through the base of the excavation. In consideration of existing pore pressure heads, basal instability of the shaft excavations must be considered, and depressurization of the underlying materials may be required. The subsoils are loose to compact such that poses certain risk, also it may contain pressurized layers that may cause localized instability and heave of the base, and related construction problems. In general, the porewater pressure at the top of the pervious layer should not exceed 70% of the total vertical stress at the top of the pervious layer. If this condition cannot be satisfied, then a greater penetration depth of shoring (sheet pile or caisson wall) and dewatering at greater depth will

be required. The lower layers of the soil may be difficult to dewater due to low hydraulic conductivity nature, therefore, eductor (or ejector) well system may be required in the shaft areas to reduce pressure head to the base level of the excavation or to a minimum level to preclude basal heave.

4.6 Site Preparation for Potential New Road

Whether a new road will be built on top of the trunk sewer is under discussion. Based on the current design, a grade raise up to 2.5 m in wetland area may be anticipated.

Topsoil or organic material (i.e. peat, organic silt, or other soils with organic matter) should be removed completely regardless of depth. The subgrade should be proof rolled with heavy roller and identified with the unacceptable deformed areas. The identified areas should be repaired by additional sub-excavation and placement of acceptable granular material. Consideration may be given to stabilizing the poor subgrade by placing a non-woven geotextile (Terrafix 270R or equivalent) and a biaxial geogrid (Terrafix TBX2000 or equivalent) at the pavement subgrade (bottom of the subbase). The geotextile should be placed below the geogrid to avoid interfering with confinement of the subbase material. During subgrade preparation, care must be taken not to unnecessarily disturb the layer below the designed pavement subgrade, as the geogrid and relatively thick base course / stabilization layer are intended to account for marginal subgrade conditions. Also, it is recommended that a geotechnical engineer evaluate the pavement subgrade during construction to ensure the proper preparation of subgrade and installation of geogrid. The geogrid should be extended minimum 500 mm beyond edge of granular base on both sided of roadway. A minimum overlap of 300 mm is recommended for adjacent geogrids. Geogrids are recommended to be installed in accordance with the manufacturer guidelines.

An alternative option is to retain a specialized contractor to utilize various techniques to improve the existing soil. One of the typical methods, Controlled Modulus Columns (CMC), this improvement option involves boring columns to competent soil and backfilling with either pumped grout or concrete. The installed CMC elements are overlain with a

structural/engineered fill pad (typically 150 – 300 mm thick compacted granular material) prior to construction of the road bases.

4.7 Design Review and Inspections

Cambium should be provided the opportunity to review the design drawings, prior to next stage of tendering and construction, to ensure that all pertinent geotechnical-related factors have been addressed.

5.0 Closing

Please note that this report is governed by the attached qualifications and limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned.

Cambium Inc.

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Senior Project Manager – Geotechnical

DocuSigned by:
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Stuart Baird, M.Eng., P.Eng.
Director – Geotechnical

kl/zl

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6.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

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A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

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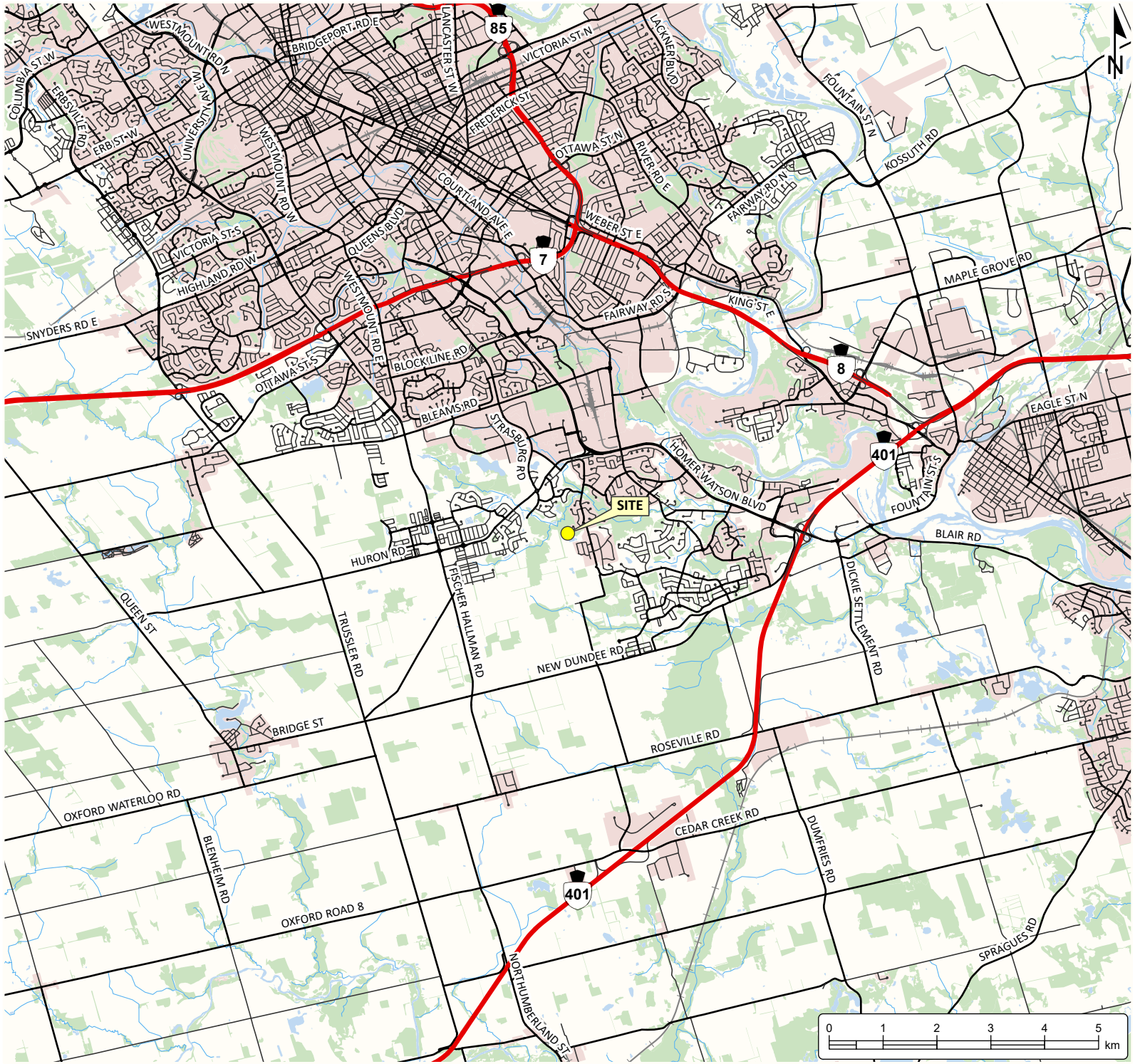
Appended Figures



GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- First Nations Reserve
- Provincial Park
- Water Area
- Wooded Area
- Built Up Area

Notes:
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SITE LOCATION PLAN

Project No.: 11969-002		Date: December 2023 Rev.:	
Scale: 1:100,000		Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: ZL	Figure:	1

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GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

LEGEND

- Benchmark
- Borehole
- Monitoring Well
- Contours (5m Interval)
- Provincially Significant Wetlands
- Section Profile

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BOREHOLE LOCATION PLAN

Project No.: 11969-002		Date: December 2023	Rev.:
Scale: 1:1,500		Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: ZL	Figure: 2	

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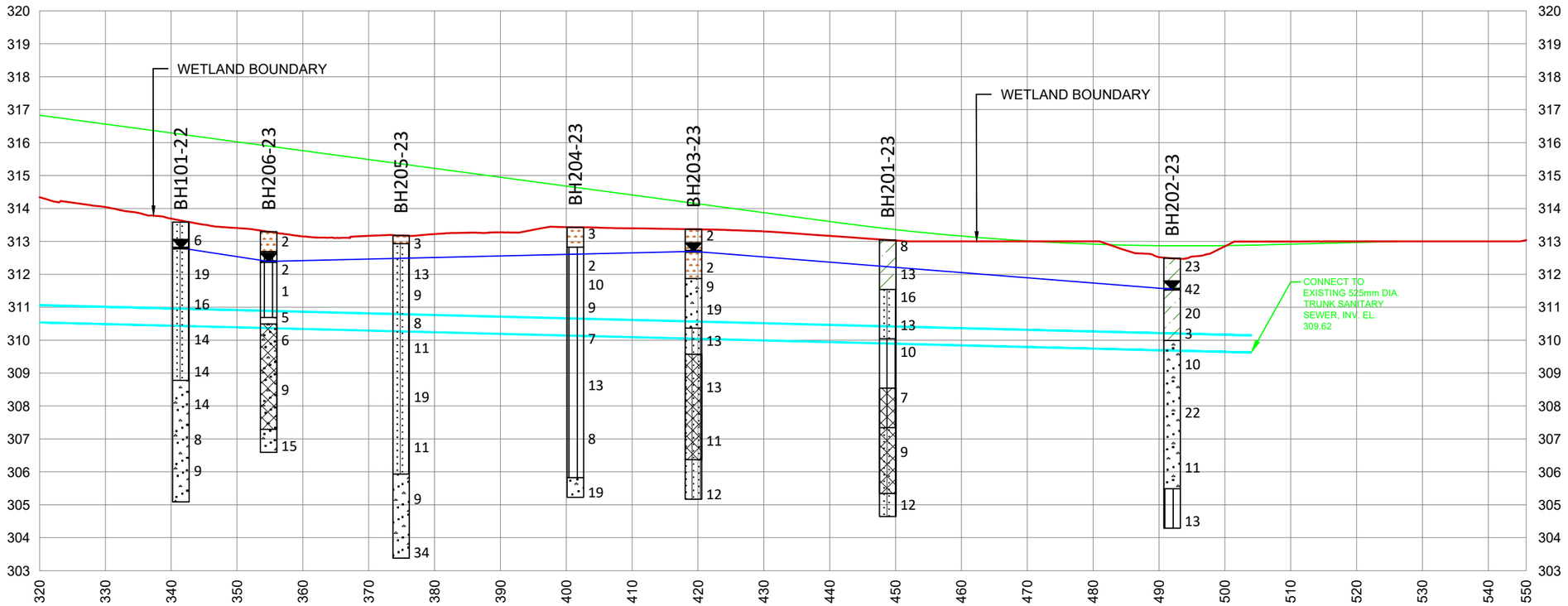
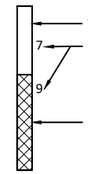


GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

LEGEND

- WATER LEVEL INDICATOR
- FILL
- PEAT
- SILT
- SILTY SAND
- SAND
- WATER LEVEL
- GROUND SURFACE
- PROPOSED SURFACE GRADING
- PROPOSED SEWER



Notes:
1. Survey completed by Cambium Inc. December 6, 2023
2. Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.

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PROFILE CROSS SECTION

Project No.:	Date:	December 2023
11969-002	Rev.:	
Horizontal Scale: N/A	Vertical Scale: N/A	
Drawn By: MAT	Checked By: ZL	Figure: 3

Appendix A
Borehole Logs

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.8 mASL
UTM: 17T **N:** 4803760 **E:** 543814

Log of Borehole: BH201-23
Page: 1 of 2
Date Completed September 29, 2023

Elevation (m) / Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) — SPT (N) 20 40 60 80	Well Installation	Log Notes
312.8 / 0		**FILL:** (SP) SAND, some gravel; brown (FILL); non-cohesive, moist, loose		1	SS	50	8	4.9%	8		
312.3 / 0.5											
311.8 / 1				2	SS	0	13		13		Borehole caved to ~0.9 mbgs upon completion of drilling
			311.35 / 1.45								
311.3 / 1.5		**(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact		3	SS	100	16	14.2%	16		Borehole caved multiple times at ~1.5 mbgs during drilling.
310.8 / 2											
310.3 / 2.5				4	SS	75	13	16.9%	13		Groundwater level first encountered at ~2.3 mbgs during drilling
			309.83 / 2.97								
309.8 / 3		**(ML) sandy SILT:** (ML) Sandy SILT, trace clay; brown; non-cohesive, wet, compact		5	SS	75	10	20.5%	10		
309.3 / 3.5			309.29 / 3.51								
		(ML) SILT: (CL/ML) CLAY and SILT, trace sand, trace gravel; grey; cohesive, W~PL, stiff to firm									
308.8 / 4											
308.3 / 4.5		Cobbles removed during augering		6	SS	10	7	26.0%	7		
307.8 / 5											
307.3 / 5.5			307.16 / 5.64								
		(SM) SILTY SAND: (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact									
306.8 / 6											
306.3 / 6.5				7	SS	50	9	15.5%	9		
		Cobbles removed during augering									
305.8 / 7											
305.3			305.3 / 7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	1	6	46	47

1m = 24 units

Logged By: EC **Input By:** EC

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.8 mASL
UTM: 17T **N:** 4803760 **E:** 543814

Log of Borehole: BH201-23
Page: 2 of 2
Date Completed: September 29, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.3	7.5											
			(SM) SILTY SAND: (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact	304.57	8	SS	0	12	16.9%	12		
304.8	8		Borehole terminated @ 8.2 mbgs due to target depth achieved.	8.23								
304.3	8.5											
303.8	9											
303.3	9.5											
302.8	10											
302.3	10.5											
301.8	11											
301.3	11.5											
300.8	12											
300.3	12.5											
299.8	13											
299.3	13.5											
298.8	14											
298.3	14.5											
297.8												

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	1	6	46	47

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Tricone
Elevation: 312.6 mASL
UTM: 17T **N:** 4803766 **E:** 543859

Log of Borehole: BH202-23
Page: 1 of 2
Date Completed: August 1, 2023

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa nat V. rem V. 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
312.6	0	**ASPHALT:** ~70 mm thick	312.52 / 0.08							Cap	
		FILL: (SP/GP) SAND and GRAVEL; brown (Granular Fill); non-cohesive, moist, compact to very loose		1	SS	45	25	4.9%	25		
312.1	0.5										
311.6	1			2	SS	90	42	5.4%	42	Bentonite Plug	Groundwater level measured in monitoring well at a depth of ~0.95 mbgs on October 13, 2023
311.1	1.5										
				3	SS	45	20	6.8%	20		
310.6	2										
			310.16							Riser	
310.1	2.5	**(SM) SILTY SAND:** (SM) SILTY SAND; light brown; non-cohesive, wet, very loose	2.44 / 309.7	4	SS	90	3	34.5%	3		Groundwater level first encountered at a depth of ~2.3 mbgs during drilling
309.6	3	**(SW) SAND:** (SP) SAND, trace to some silt, trace clay, none to trace gravel/cobble; brown to light brown; non-cohesive, wet, loose to compact	2.9	5	SS	35	10	18.9%	10		
309.1	3.5										
308.6	4										
308.1	4.5			6	SS	65	22	15.4%	22	Sand Pack	
307.6	5										
307.1	5.5										
306.6	6										
				7	SS	100	11	16.8%	11	PVC Screen	
306.1	6.5										
305.6	7		305.51								
		(ML) SILT: (ML) SILT, some sand; brown; non-cohesive, wet, compact	7.09 / 305.1								
305.1			7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 5	0	80	17	3

1m = 24 units

Logged By: SN **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Tricone
Elevation: 312.6 mASL
UTM: 17T **N:** 4803766 **E:** 543859

Log of Borehole: BH202-23
Page: 2 of 2
Date Completed: August 1, 2023

SUBSURFACE PROFILE				SAMPLE							
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.1 / 7.5		**(ML) SILT:** (ML) SILT, some sand; brown; non-cohesive, wet, compact — 304.52	8	SS	100	13	23.8%	13	Sand Pack, PVC Screen	
304.6 / 8		Borehole terminated @ 8.1 mbgs due to target depth achieved. — 8.08								
304.1 / 8.5										
303.6 / 9										
303.1 / 9.5										
302.6 / 10										
302.1 / 10.5										
301.6 / 11										
301.1 / 11.5										
300.6 / 12										
300.1 / 12.5										
299.6 / 13										
299.1 / 13.5										
298.6 / 14										
298.1 / 14.5										
297.6										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 5	0	80	17	3

1m = 24 units

Logged By: SN **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 313 mASL
UTM: 17T **N:** 4803744 **E:** 543791

Log of Borehole: BH203-23
Page: 1 of 2
Date Completed September 29, 2023

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa nat V. rem V. 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
313	0	**(PT) PEAT:** PEAT, none to trace sand; black; non-cohesive, moist, very loose		1	SS	5	2	31.8%	2	Cap	Groundwater level measured in monitoring well at a depth of ~0.26 mbgs on October 13, 2023
312.5	0.5										
312	1			2	SS	40	2	33%	2		Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling
			311.55								
311.5	1.5	**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet, loose to compact	1.45	3	SS	60	9	16.9%	9	Bentonite Plug / Riser	
311	2										Borehole caved to a depth of ~2.1 mbgs upon completion of drilling
310.5	2.5			4	SS	60	19	14.6%	19		
			310.03								
310	3	**(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact	2.97	5	SS	50	13	15.2%	13		Groundwater first encountered at a depth of ~3.0 mbgs during drilling
309.5	3.5										
309	4										
308.5	4.5			6	SS	60	13	16.9%	13	Sand Pack / PVC Screen	
308	5										
307.5	5.5										
307	6										
306.5	6.5			7	SS	50	11	17.7%	11		
306	7										
305.5			305.5							Cap	
	7.5										

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 313 mASL
UTM: 17T **N:** 4803744 **E:** 543791

Log of Borehole: BH203-23
Page: 2 of 2
Date Completed September 29, 2023

Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.5 — 7.5										
305 — 8		**(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact — 304.77	8	SS	60	12	15.6%	12		
		Borehole terminated @ 8.2 mbgs due to target depth achieved. — 8.23								
304.5 — 8.5										
304 — 9										
303.5 — 9.5										
303 — 10										
302.5 — 10.5										
302 — 11										
301.5 — 11.5										
301 — 12										
300.5 — 12.5										
300 — 13										
299.5 — 13.5										
299 — 14										
298.5 — 14.5										
298										

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.6 mASL
UTM: 17T **N:** 4803730 **E:** 543781

Log of Borehole: BH204-23
Page: 1 of 2
Date Completed September 28, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V. rem V.) — 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
312.6	0		**(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose	311.91 / 0.69	1	SS	5	3	21%	3		
312.1	0.5		**(ML) SILT:** (ML) SILT and ASH; white to light grey, trace organic matter; cohesive, W~PL, very soft	311.58 / 1.02	2	SS	60	2	50.4%	2		Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling
311.6	1		**(SW) SAND:** (SP) SAND, trace silt; grey; non-cohesive, wet, very loose	311.15 / 1.45								
311.1	1.5		**(SM) SILTY SAND:** (SM) SILTY SAND; brown, trace organics, oxidation stains; non-cohesive, moist, stiff	310.39 / 2.21	3	SS	65	10	17.6%	10		
310.6	2		**(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey; cohesive, W<PL, stiff	309.86 / 2.74	4	SS	75	9	17.6%	9		
310.1	2.5											
309.6	3		**(ML) sandy SILT:** (ML) Sandy SILT, some clay; brown; non-cohesive, wet, loose		5	SS	75	7	19.8%	7		Groundwater first encountered at a depth of ~3.0 mbgs during drilling
309.1	3.5											
308.6	4											
308.1	4.5				6	SS	60	13	20.3%	13		Borehole caved to a depth of ~4.6 mbgs upon completion of drilling
307.6	5											
307.1	5.5											
306.6	6											
306.1	6.5				7	SS	50	8	14.5%	8		
305.6	7			305.44 / 7.16								
305.1			**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact	305.1 / 7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	0	24	62	14

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.6 mASL
UTM: 17T **N:** 4803730 **E:** 543781

Log of Borehole: BH204-23
Page: 2 of 2
Date Completed September 28, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa nat V. rem V. 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.1	7.5		**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact	304.37	8	SS	25	19	15.3%	19		
304.6	8											
304.1	8.5		Borehole terminated @ 8.2 mbgs due to target depth achieved.	8.23								
303.6	9											
303.1	9.5											
302.6	10											
302.1	10.5											
301.6	11											
301.1	11.5											
300.6	12											
300.1	12.5											
299.6	13											
299.1	13.5											
298.6	14											
298.1	14.5											
297.6												

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	0	24	62	14

1m = 24 units

Logged By: EC **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.7 mASL
UTM: 17T **N:** 4803712 **E:** 543759

Log of Borehole: BH205-23
Page: 1 of 2
Date Completed September 28, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V. rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
312.7	0		**(PT) PEAT:** PEAT; black; non-cohesive, moist, loose	312.4 / 0.3	1	SS	10	3	77.8%	3		
312.2	0.5		**(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey to dark grey, some organic matter; cohesive, W<PL, very soft	312.01 / 0.69								
311.7	1		**(SM) SILTY SAND:** (SM) SILTY SAND, trace clay, trace gravel; brown; non-cohesive, wet compact to loose		2	SS	70	13	14.5%	13		Groundwater level at ~0.9 mbgs upon completion of drilling
311.2	1.5			310.92 / 1.78	3	SS	50	9	13.4%	9		
310.7	2		**(ML) SILT:** (ML/SP) SILT and SAND, some clay; brown to light brown; non-cohesive, moist, stiff									Borehole caved to ~2.1 mbgs upon completion of drilling
310.2	2.5				4	SS	60	8	16.9%	8		
309.7	3		**(SM) SILTY SAND:** (SM) SILTY SAND, trace to some clay; light brown to brown; non-cohesive, wet, compact	309.73 / 2.97	5	SS	85	11	17.9%	11		Groundwater first encountered at a depth of ~3.0 mbgs during drilling
309.2	3.5											
308.7	4											
308.2	4.5				6	SS	50	19	19.5%	19		
307.7	5											
307.2	5.5											
306.7	6				7	SS	50	11	21%	11		
306.2	6.5											
305.7	7			305.54 / 7.16								
305.2			**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense	305.2 / 7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 4	0	38	44	18

1m = 24 units

Logged By: EC **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.7 mASL
UTM: 17T **N:** 4803712 **E:** 543759

Log of Borehole: BH205-23
Page: 2 of 2
Date Completed September 28, 2023

Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.2 — 7.5										
304.7 — 8		**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense	8	SS	50	9	14.6%	9		
304.2 — 8.5										
303.7 — 9										
303.2 — 9.5		302.95	9	SS	0	34	14.8%	34		Second spoon completed in this sample depth due to low recovery
302.7 — 10		Borehole terminated @ 9.8 mbgs due to target depth achieved. 9.75								
302.2 — 10.5										
301.7 — 11										
301.2 — 11.5										
300.7 — 12										
300.2 — 12.5										
299.7 — 13										
299.2 — 13.5										
298.7 — 14										
298.2 — 14.5										
297.7										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 4	0	38	44	18

1m = 24 units

Logged By: EC **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.6 mASL
UTM: 17T **N:** 4803696 **E:** 543750

Log of Borehole: BH206-23
Page: 1 of 1
Date Completed September 30, 2023

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI / % Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. rem V.) / SPT (N) (20 40 60 80)	Well Installation	Log Notes
312.6	0	**(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose	311.99	1	SS	5	2	65%	2	Cap	Groundwater level measured in monitoring well at a depth of ~0.19 mbgs on October 13, 2023
312.1	0.5										
		(ML) SILT: (ML) SILT, some clay, some sand; dark grey to grey, trace to no organics; cohesive, W~PL to W>PL, very soft to firm	0.61								
311.6	1			2	SS	10	2	18.9%	2	Bentonite Plug	Groundwater level at a depth of ~0.6 mbgs upon completion of drilling
311.1	1.5									Riser	
				3	SS	20	1	27.7%	1		
310.6	2										
310.1	2.5		309.91	4	SS	50	5	15.8%	5		Groundwater level at a depth of ~2.3 mbgs during drilling
		(SM) SILTY SAND: (SM) SILTY SAND, some clay; brown; non-cohesive, wet, loose	2.69 / 309.63								
309.6	3	**(SW) SAND:** (SP) SAND, some clay; brown; non-cohesive, very saturated, loose	2.97	5	SS	20	6	12%	6		Borehole caved to a depth of ~3.0 mbgs upon completion of drilling
309.1	3.5									Sand Pack	
308.6	4										
308.1	4.5									PVC Screen	
				6	SS	0	9	18.1%	9		
307.6	5										
307.1	5.5		306.96								
		(SW) SAND: (SP/ML) SAND and SILT, trace clay, trace gravel; brown; non-cohesive, wet, compact	5.64								
306.6	6										
306.1	6.5		305.89	7	SS	50	15	19%	15		
		Borehole terminated @ 6.7 mbgs due to target depth achieved.	6.71								
305.6	7										
305.1											

1m = 24 units

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 7	5	45	41	9
SS3	0	11	75	14

Logged By: EC **Input By:** EC

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Kingston
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Log of Borehole: BH101-22

Client:	BT Engineering, London	**Project Name:**	Geotechnical Investigation	**Project No.:**	11969-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	January 20, 2022
Location:	Biehn Drive Extension	**UTM:**	17T 543732 E, 4803683 N	**Elevation:**	313.42 mASL

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
314 / -1									Cap	
313 / 0		TOPSOIL: Dark brown silt topsoil, some organics, moist, loose	1A	SS	50	6			Monument	
			1B	SS						
		SILTY SAND: Brown silty sand, moist, loose							Water level at 0.41 mbgs on on Feb 04, 2022	
312 / 1		SAND: Brown sand, some silt, trace gravel, wet, compact	2	SS	65	19				
		SILTY SAND: Brown silty sand, some gravel, trace clay, APL, stiff	3	SS	35	16			PVC Riser	GSA SS3: 19% Gravel 52% Sand 26% Silt 3% Clay
311 / 2									Bentonite Plug	
			4	SS	50	14				
310 / 3			5	SS	80	14				
309 / 4										
		SAND: Reddish brown sand, moist, compact	6	SS	100	14				
308 / 5										
307 / 6		-Wet, loose	7	SS	80	8			Sand Pack	
									PVC Screen	
306 / 7										
305 / 8			8	SS	50	9			Cap	Water level at 2.1 mbgs upon completion
		Borehole terminated at 8.2 mbgs in SAND								

Logged By: TA **Input By:** KL

Appendix B
Physical Laboratory Results

Grain Size Distribution Chart

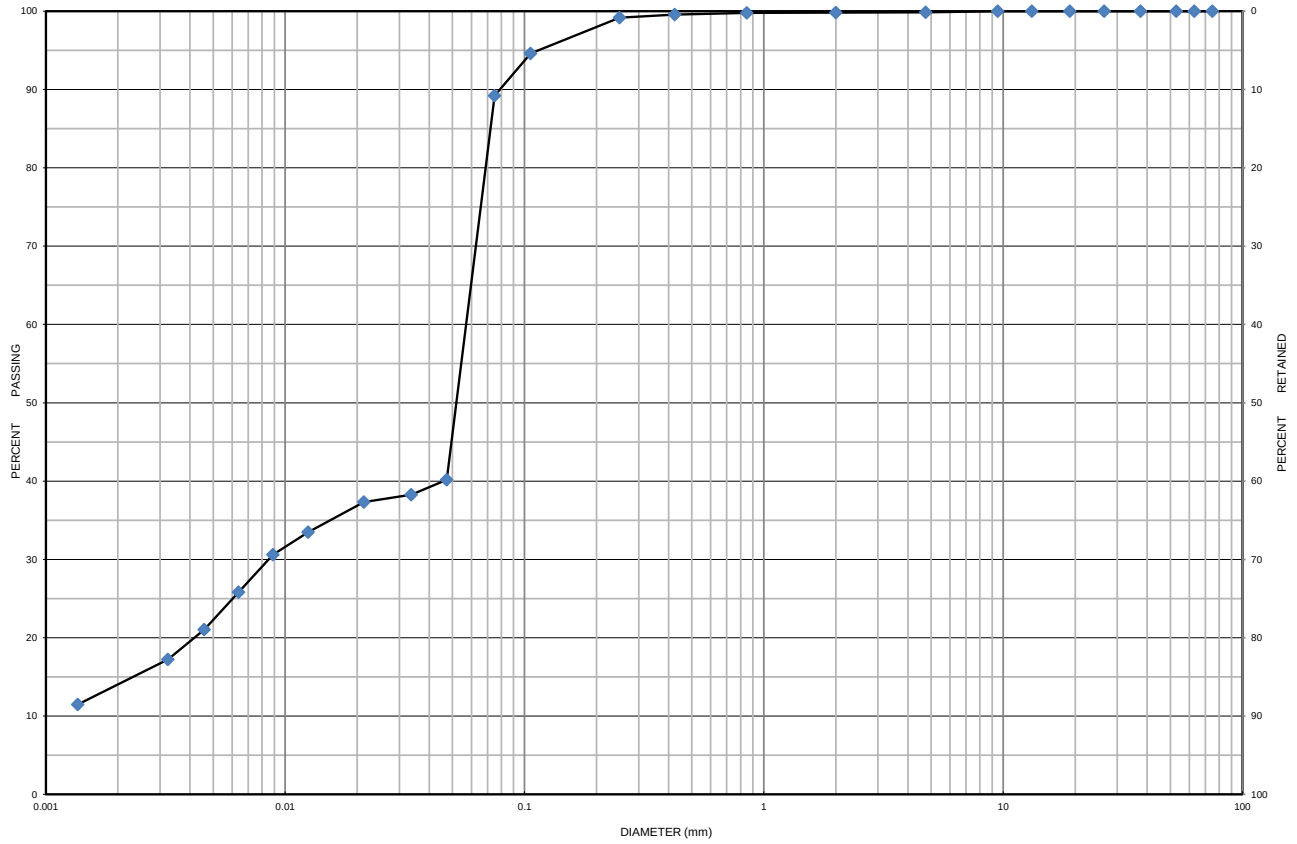
Project Number: *11969-002* **Client:** *BT Engineering (London)*

Project Name: *Biehn Dr Trunk Sewer, Kitchener*

Sample Date: *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

Location: *BH 206-23 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-23-1719*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 206-23	SS 3	1.5 m to 2.1 m	0	11	75	14	27.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt some Clay and Sand	ML	0.0570	0.0086	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *October 31, 2023*

(Senior Project Manager)

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Grain Size Distribution Chart

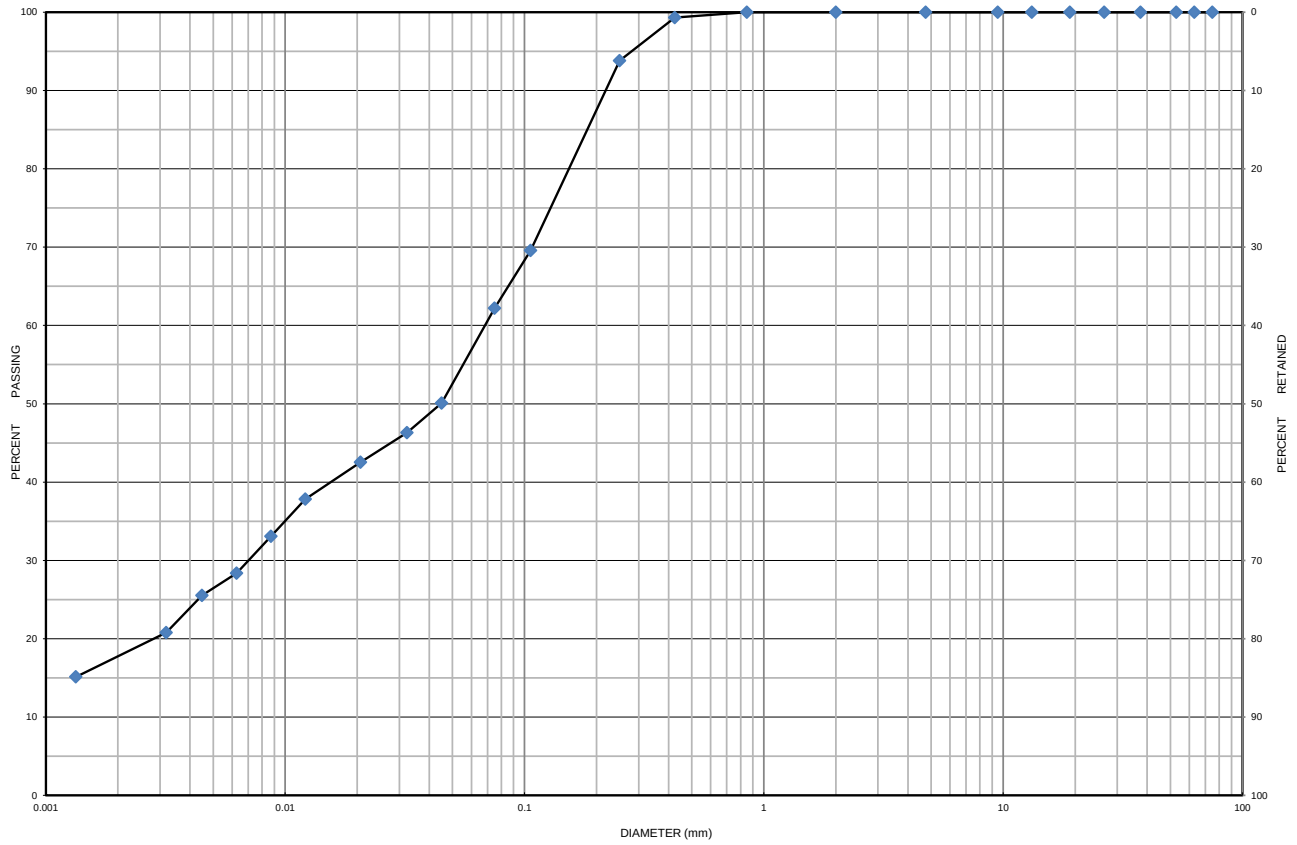
Project Number: *11969-002* **Client:** *BT Engineering (London)*

Project Name: *Biehn Dr Trunk Sewer, Kitchener*

Sample Date: *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

Location: *BH 205-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-1720*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 205-23	SS 4	2.3 m to 2.9 m	0	38	44	18	16.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt and Sand some Clay	ML	0.069	0.007	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *October 31, 2023*

(Senior Project Manager)

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Grain Size Distribution Chart

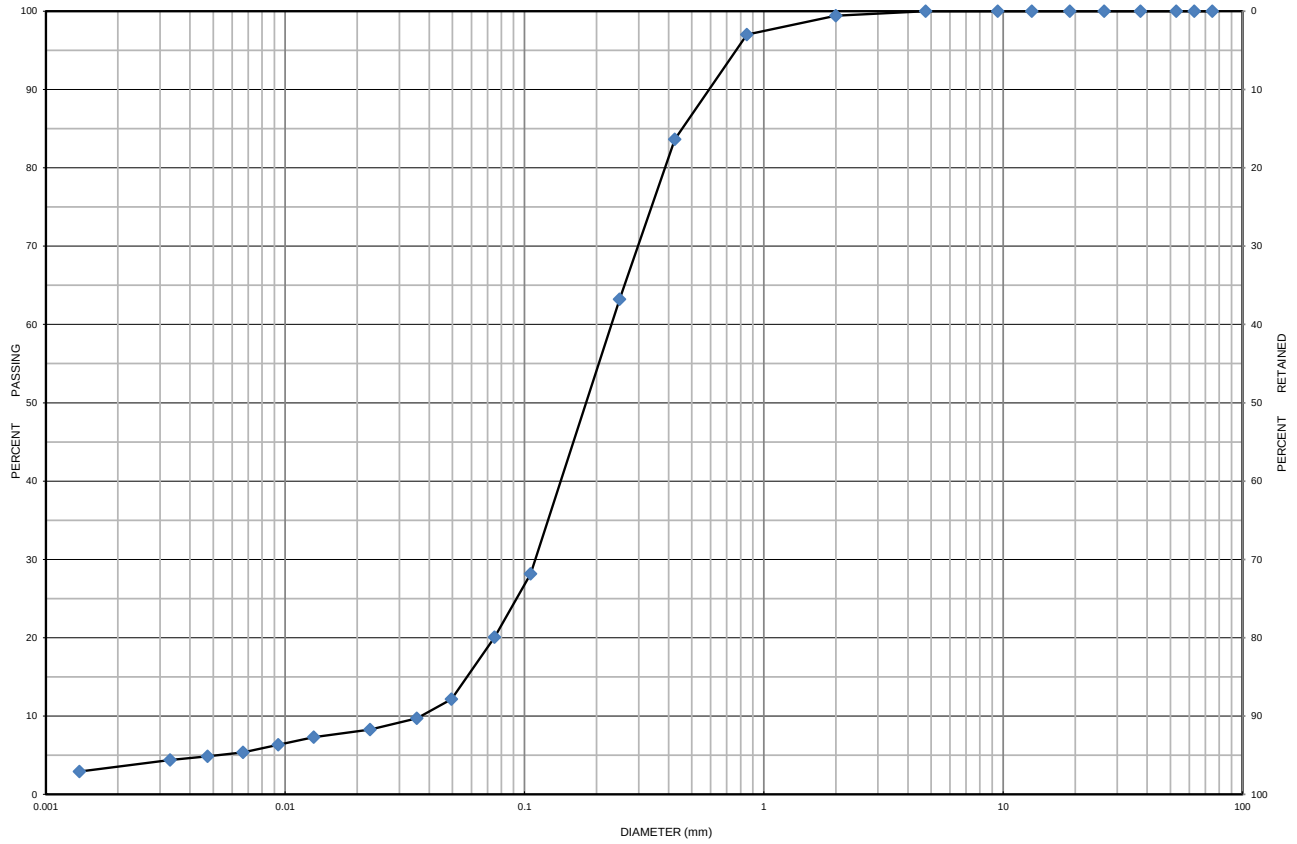
Project Number: *11969-002* **Client:** *BT Engineering (London)*

Project Name: *Biehn Dr Trunk Sewer, Kitchener*

Sample Date: *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

Location: *BH 202-23 SS 5* **Depth:** *3 m to 3.5 m* **Lab Sample No:** *S-23-1716*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 202-23	SS 5	3 m to 3.5 m	0	80	17	3	18.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand some Silt trace Clay	SM	0.240	0.120	0.037	6.49	1.62

Additional information available upon request

Issued By: _____ *Date Issued:* *October 31, 2023*

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Grain Size Distribution Chart

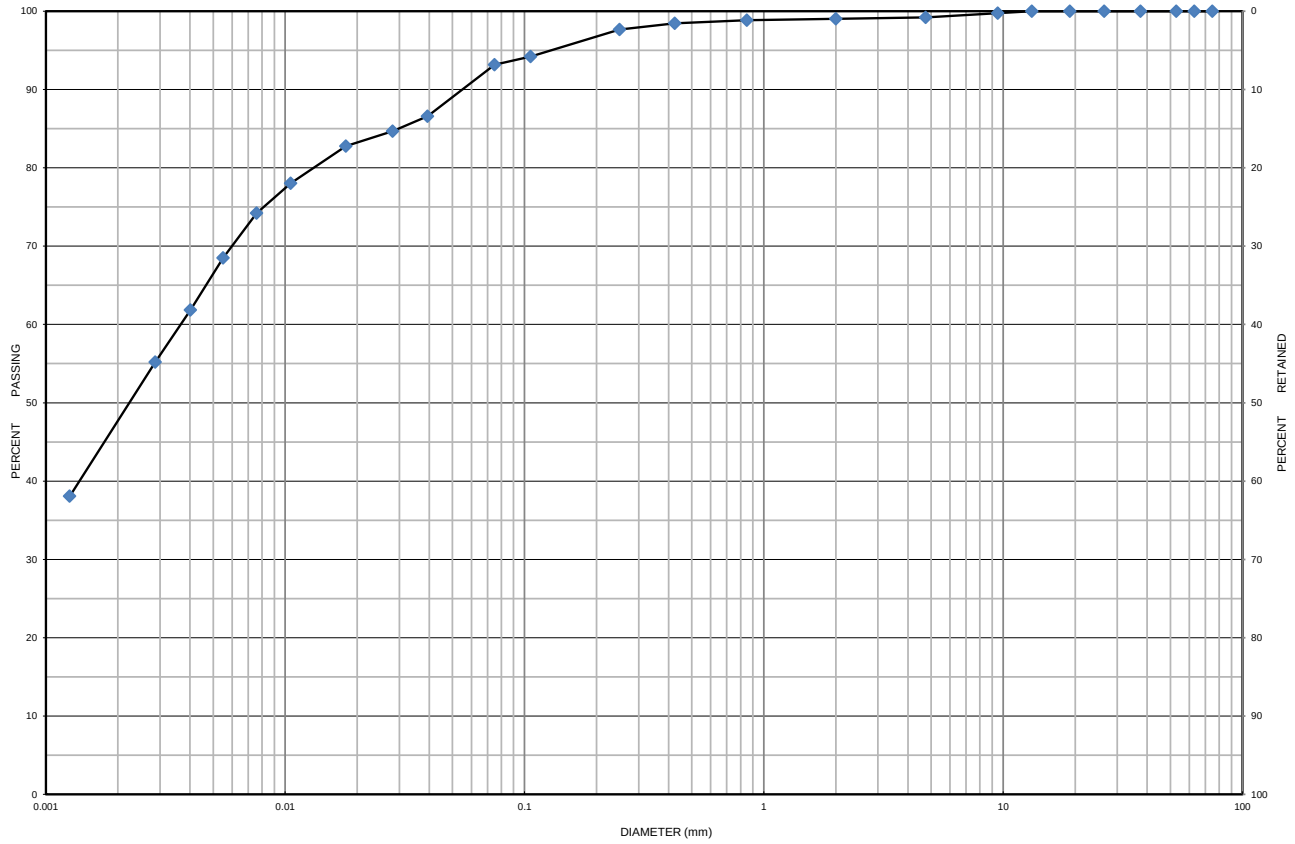
Project Number: *11969-002* **Client:** *BT Engineering (London)*

Project Name: *Biehn Dr Trunk Sewer, Kitchener*

Sample Date: *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

Location: *BH 201-23 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-23-1715*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 201-23	SS 6	4.6 m to 5.2 m	1	6	46	47	26.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clay and Silt trace Sand trace Gravel	CL	0.0036	-	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *October 31, 2023*

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Grain Size Distribution Chart

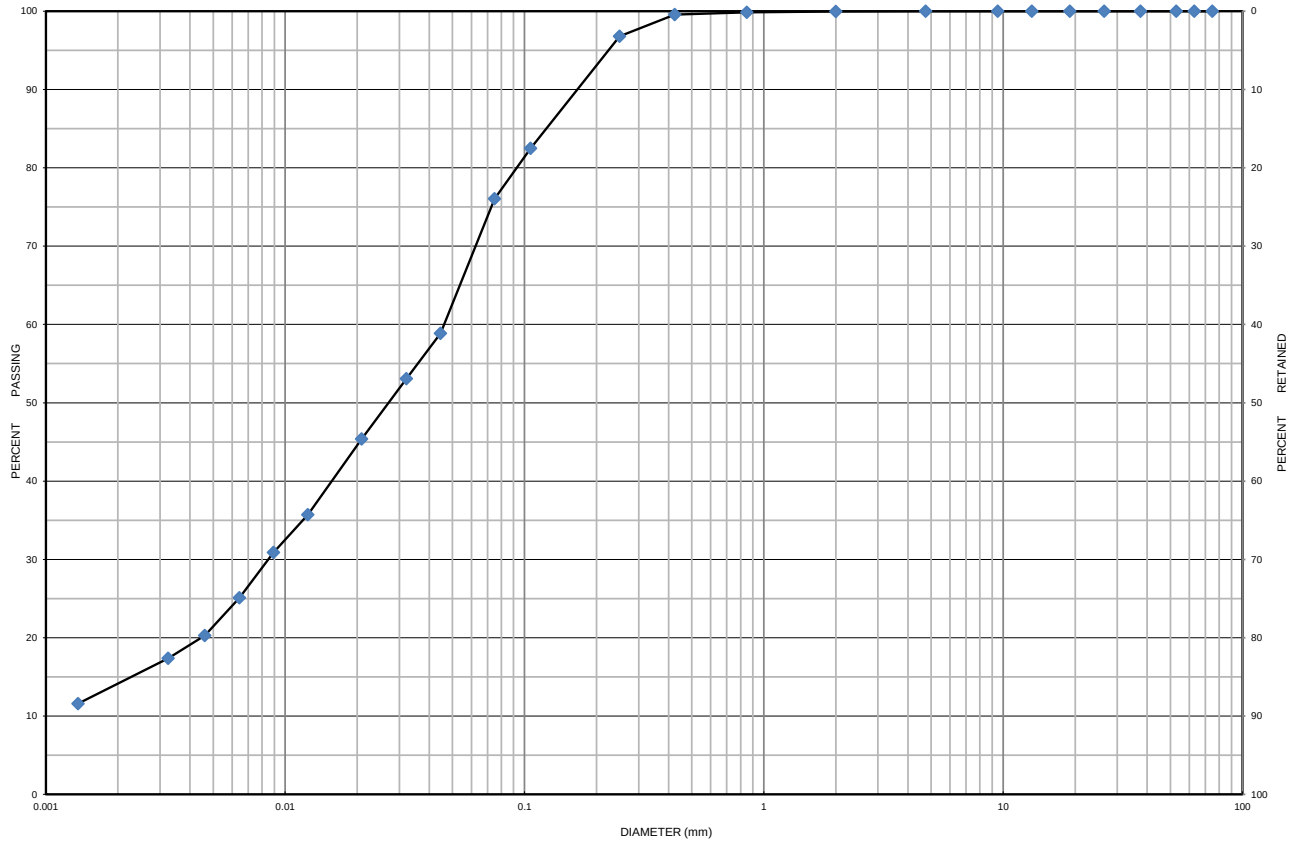
Project Number: *11969-002* **Client:** *BT Engineering (London)*

Project Name: *Biehn Dr Trunk Sewer, Kitchener*

Sample Date: *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

Location: *BH 204-23 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-23-1717*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 204-23	SS 6	4.6 m to 5.2 m	0	24	62	14	20.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt some Clay	ML	0.0460	0.0085	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *October 31, 2023*

(Senior Project Manager)

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Grain Size Distribution Chart

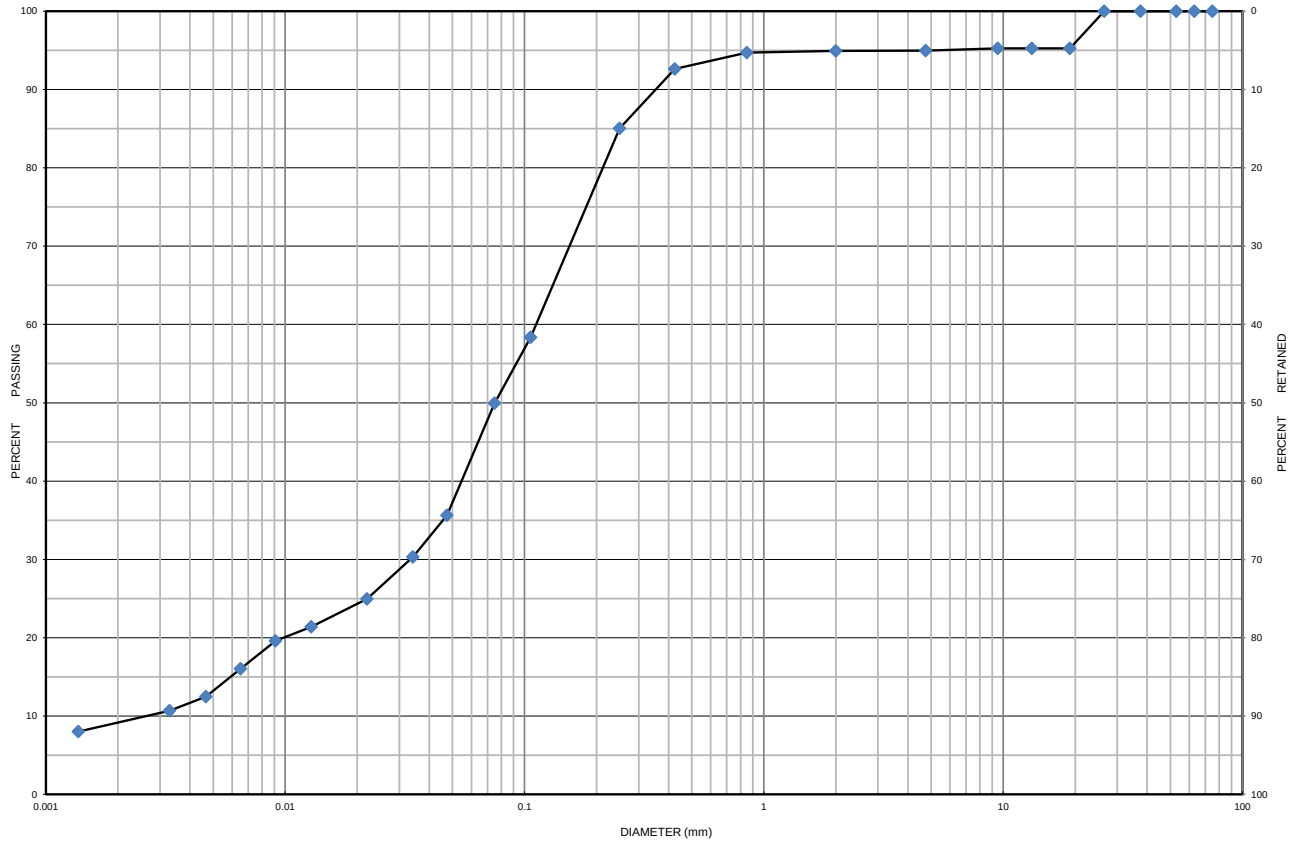
Project Number: *11969-002* **Client:** *BT Engineering (London)*

Project Name: *Biehn Dr Trunk Sewer, Kitchener*

Sample Date: *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

Location: *BH 206-23 SS 7* **Depth:** *6.1 m to 6.7 m* **Lab Sample No:** *S-23-1718*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 206-23	SS 7	6.1 m to 6.7 m	5	45	41	9	19.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt trace Clay trace Gravel	SM	0.1200	0.0340	0.0026	46.15	3.71

Additional information available upon request

Issued By: _____ *Date Issued:* *October 31, 2023*

(Senior Project Manager)

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Appendix J

Dewatering Assessment

BT ENGINEERING

Dewatering Assessment, Biehn Drive Extension, City of Kitchener, Ontario

March 14, 2024

Prepared for:
BT Engineering

Cambium Reference: 1969-002

CAMBIUM INC.

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1.0 Introduction

Cambium Inc. (Cambium) is pleased to provide BT Engineering (the client) with dewatering assessment to present the background review, groundwater levels, and dewatering estimates in support of the proposed roadway extension of Biehn Drive. The extension is from Biehn Drive's current terminus, approximately 60 m west of Spencer Court, south to the future Robert Ferrie Drive Extension located in the City of Kitchener Ontario (referred to herein as the Site).

It is understood that the works will also include a trunk sanitary sewer, storm sewers and a watermain, in addition to the roadway extension. Groundwater levels and a dewatering assessment is required for the construction and placement of linear infrastructure such as storm and sanitary sewer along the roadway at the proposed Biehn Drive Extension. Due to the presence of the Strasburg Creek Wetland Complex across the linear infrastructure alignment, some of the installation will be completed using trenchless horizontal directional drilling (HDD). A site location plan is included in Figure 1 and the construction alignment and profile is included in Appendix A.

The purpose of the dewatering investigation was to obtain information about the subsurface conditions by means of a number of boreholes and based on the findings provide recommendations pertaining to the geotechnical design of the new features.

1.1 Scope of Work

The scope of work for the dewatering assessment included the following tasks:

- **Well Installation and Water Level Measurement:** Seven boreholes which were advanced at the Site as part of the geotechnical investigation and four of the boreholes were completed as monitoring wells to allow for measurement of stabilized groundwater levels and to facilitate hydrogeological testing.
- **Single Well Hydraulic Tests (SWHT) and Analysis:** SWHTs were completed at each monitoring wells to provide estimates of hydraulic conductivity of the native soils for dewatering calculations.

- **Estimation of Dewatering Requirements:** The volume of water required for dewatering at the Site was estimated using borehole information, results obtained from SWHT analysis, and watermain excavation design parameters.
- **Assessment of Water Taking Registration Requirements:** An assessment of Permit to Take Water (PTTW) and/or Environmental Activity Sector Registry (EASR) registration requirements was completed based on the dewatering volume estimated for the Site.
- **Groundwater Sampling and Analysis for Discharge Characterization:** One groundwater quality sample was collected and submitted for laboratory analysis and compared against Provincial Water Quality Objective (PWQO) Standards for overland discharge flow.
- **Report preparation:** A dewatering assessment report was prepared presenting the results, findings, and recommendations of this investigation.

2.0 Well Installation and Testing

2.1 Past Investigation

2.1.1 Peto MacCallum Geotechnical Investigations

Previous geotechnical investigations were completed by Peto MacCallum Ltd. during December 1986 and November 2020. One shallow monitoring well was installed to a depth of 4.6 m below ground surface (mbgs) during December 1986. The soils encountered were mainly topsoil consisting of silt and trace gravel up to a maximum depth of 1.6 mbgs, followed by sand and gravel to installed depth. Depth to water level ranged between 2.40 mbgs and 2.90 mbgs.

Two monitoring wells MW108-20 and MW109-20 were installed closer to the Biehn Drive Extension during the November 2020 geotechnical investigation; however, a detailed geotechnical report or monitoring well logs were not available at the time of this report's preparation. Available borehole logs and a borehole location plan are provided in Appendix B.

It should be noted that Peto MacCallum completed the investigation for the entire proposed development at the Site. The focus of the current dewatering assessment is confined to the Biehn Drive Extension roadway only.

2.1.2 MTE Consultants Geotechnical Investigation

MTE Consultants completed a geotechnical investigation during December 2019 and January 2020 for the entire development at the Site. During the investigation, a total of eleven monitoring wells were installed on the entire development area. Monitoring wells MW104-20, MW105-20, MW108-20, and MW109-20 were installed closer to and along the alignment of Biehn Drive Extension. Detailed geotechnical report was not made available at the time of this report's preparation. Only borehole logs and a site location plan were provided by the client.

Based on the sub-surface soils encountered at the Site, silty sand to sand was the predominant soil type across the Site. All the borehole logs and the site location plan are included in Appendix C.

A long-term, 12-months monitoring was completed at the Site and based on the water level data provided by MTE (Appendix C), depth to water levels ranged between 4.64 mbgs and 6.72 mbgs at all the monitoring wells, except monitoring well MW105-20. As this monitoring well was situated within a wetland area, the water levels ranged from 0.61 mbgs to 0.95 mbgs.

2.1.3 Previous Cambium Geotechnical Investigation

Cambium completed a geotechnical investigation on this property in 2022 to determine the subsurface and groundwater conditions. This previous investigation consisted of 6 boreholes at the Site to a maximum depth of 8.2 m below ground surface (mbgs), cumulating in our report entitled "*Geotechnical Investigation Report – Biehn Drive Extension, Kitchener, ON*" dated April 14, 2022. Three of these boreholes were outfitted with monitoring wells (BH101-22, BH104-22, and BH106-22) and were monitored as part of this hydrogeological investigation. The previous borehole locations and the previous borehole logs are included in Appendix D.

Based on the results of this borehole investigation, subsurface conditions at the Site generally consist of a layer topsoil, overlying a native deposit consisting of silty sand to sand. Groundwater measurements were taken from the monitoring wells two weeks after completion of drilling on February 4, 2022, and groundwater levels ranged from 0.41 mbgs to 4.10 mbgs, and BH106-22 was dry during the monitoring event.

2.2 Results of Current Subsurface Investigations

Cambium completed a supplemental borehole investigation at the Site on September 28, 29, 30 and August 1, 2023, in order to understand the groundwater and hydrogeologic conditions across the wetland feature. A total of six boreholes, designated as BH201-23 through BH206-23, were advanced into the subsurface at predetermined locations. These boreholes were terminated at depths of 6.7 to 9.8 m below ground surface. Three of these boreholes were outfitted with monitoring wells (BH202-23, BH203-23, and BH205-23) and were monitored as part of this hydrogeological investigation. The borehole locations are shown on Figure 2 of this report and the borehole logs are included in Appendix D.

The locations and elevations of the boreholes were obtained using a Realtime Kinematic Unit (RTK) using a site benchmark (BM). The BM is recognized as the top of the southeast corner concrete pad for a generator found just south of the hydrant at the south end at Cobbledick Road, which has elevation of 85.44 m based on the existing topographic survey provided by the client.

In summary, the subsurface conditions consist of a peat or pavement buildup underlain predominantly by a sand to silty sand deposits.

2.3 Groundwater Levels

Cambium completed on-site water level monitoring for the well that they installed on three occasions: February 4, 2022, October 10, 2023, and March 11, 2024. Well construction details and water levels are summarized in Table 1.

Table 1 Well Details and Water Levels

Well		BH101-22	BH104-22	BH106-22	BH202-23	BH203-23	BH206-23
Top of Pipe Elevation (masl)		314.51	322.18	325.83	312.43	314.19	313.70
Ground Surface Elevation (masl)		313.42	320.99	324.77	312.58	312.95	312.57
Stick-up (m)		1.09[1]	1.19	1.06	-0.15	0.91	1.02
February 4, 2022	Water Level (mbgs)	0.41	4.10	Dry	-	-	-
	Groundwater Elev.(masl)	313.01	316.89	-	-	-	-
October 10, 2023	Water Level (mbgs)	0.60	In-accessible	In-accessible	0.95	0.26	0.19
	Groundwater Elev.(masl)	312.82	-	-	311.63	312.69	312.38
March 11, 2024	Water Level (mbgs)	0.38	4.04	5.66	0.67	0.15	-0.14
	Groundwater Elev.(masl)	313.04	316.95	319.11	311.91	312.80	312.71

1. *Stick-up value was measured at 1.04 m on October 13, 2023, due to minor subsidence of the monitoring well.*

Groundwater levels ranged between -0.14 mbgs to 5.66 mbgs, with equivalent elevations of 311.63 masl and 319.11 masl. It is noted that the deeper water levels measured at BH104-22

and BH106-22 are interpreted to be due to elevational difference between the boreholes and is situated farther away from the low-lying Strasburg Creek Wetland Complex. The other four wells monitor water levels within the wetland complex or immediately adjacent to and reported water levels are much closer to the ground surface; the water level reported from BH206-23 (within the wetland complex) was reported at 0.14 metres above ground surface, indicating that the shallow water table has risen up to the surface water levels within the wetland complex during the spring months.

Water levels are expected to fluctuate with seasonal variation. As discussed above, MTE consultants conducted a long-term water level monitoring program for the entire development (not just the extension area); the water levels from their two closest monitoring wells to the extension area (MW104-20 and MW109-20) reported peak water levels in late April/early May and that the seasonal fluctuation from spring high to summer/fall low was approximately 1 m to 1.5 m (Appendix C).

The water elevations measured on October 10, 2023 and March 11, 2024, from the monitoring wells installed within the wetland (BH101-22, BH203-23, and BH206-23) reported similar elevations that are higher than the elevation at the adjacent monitoring well, BH202-23. This indicates that the groundwater within the shallow unconfined aquifer in the wetland complex has slight upward gradients as indicated by the high water levels.

2.4 Single Well Hydraulic Tests

The hydraulic conductivity (k-value) of the soils were estimated based on the results obtained from the single well response tests (slug tests). Aquifer response test (slug tests/single well response tests) was conducted on February 4, 2022, for the old Cambium well and on October 11, 2023, for the newly installed Cambium wells. Either falling head test or rising head tests were performed in the monitoring wells BH101-22, BH104-22, BH202-23, BH203-23, and BH206-23. Results of hydraulic conductivity tests are presented below in Table 2 and analytical data is included in Appendix E.

Table 2 Results of Estimated Hydraulic Conductivity as per Slug Test

Monitoring well	Estimated Hydraulic Conductivity (m/sec)	Tested Soil Type
BH101-22	3.59×10^{-6}	Sand, Silty Sand and trace Clay
BH104-22	3.08×10^{-6}	Sand, trace Silt and Clay
BH202-23	1.10×10^{-5}	Sand, trace to some Silt, trace Clay
BH203-23	8.65×10^{-6}	Silty Sand
BH206-23	1.55×10^{-6}	Sand, some Clay

The hydraulic conductivity was estimated utilizing Aquifer Test Pro slug test software using the Hvorslev method. The estimated hydraulic conductivities ranged between 1.15×10^{-6} m/sec and 1.10×10^{-5} m/sec and the geometric mean of hydraulic conductivity was calculated at 4.39×10^{-6} m/sec.

2.5 Open Cut and Trenchless Construction Methods

A hydrogeologic cross section (Figure 3) was prepared depicting the existing ground surface profile, lithology, water levels, and the alignment of the proposed new 525 mm trunk sewer across the wetland complex.

The alignment on either side of the wetland complex will use traditional open cut excavation and the sewer alignment across the creek would entirely be a trenchless construction method using either by a microtunnelling or horizontal directional drilling (HDD) method of installation (see Section 3.5 for more details).

Microtunnelling is a pit launched technique with extreme accuracy and low risk, but however, has a high upfront costs. On the other hand, the HDD is surface launched making it a cost effective technique.

Based on Figure 3, the proposed trunk sewer alignment will intercept soils that range from silt to silty sand, with trace to some clay. The ground surface elevation varies somewhat across the alignment, but the average ground surface elevation within the wetland area is approximately 313.25 masl.

The dewatering estimates for both open-cut and trenchless construction and an evaluation of excavation methods are described below in Section 3.0.

3.0 Dewatering Assessment – Open Cut Excavation

Construction dewatering is intended to lower the groundwater levels in the excavation area in order to ensure a dry working condition for the placement of linear infrastructure such as storm and sanitary sewers and watermains.

The requirements for construction dewatering generally depend on the Site's soil and groundwater conditions including soil type, soil permeability or hydraulic conductivity, local groundwater levels, and the design of the proposed works, such as the foundation and/or excavation elevation, as well as the size of proposed structure / excavation.

3.1 Excavation Design Parameters

The proposed development works include the installation of linear infrastructure along the proposed road extension. The proposed alignment and profile of linear excavation was included in Appendix A.

3.1.1 Trench Segments

Traditional open cut trench excavation methods will be used for the installation of linear infrastructure from 10+000 to 10+320. For this dewatering calculation, it is assumed that all trench excavations will be 2 m wide, and that the linear infrastructure installation will be conducted in 50 m segments. Based off the alignment drawings provided, the bottom of the linear infrastructure elevation at 10+000 is approximately 312.00 masl, and it dips down to approximately 310.50 masl by 10+320.

As determined through the water levels recorded by Cambium on February 4, 2022, October 10, 2023, and March 11, 2024, the water levels within the area of the wetland complex are very shallow; however, the water levels dropped to 316.95 masl at BH104-22 on March 11, 2024, which is located about 100 m south of the wetland complex. This water elevation is representative of spring water elevations and was used for this dewatering assessment. This water elevation is also similar to the elevations recorded at MW109-20 within MTE Consultants long-term water level monitoring program. The water elevation of 316.95 masl be used for the dewatering assessment for the open cut excavation from 10+000 to 10+320.

To facilitate safe working conditions, water levels will be lowered to 1 m below the invert of proposed sewer line at each excavation. To be conservative, it is assumed that water levels will be lowered to 309.50 masl for each trench segment; therefore, a drawdown of 7.45 m was used for this dewatering assessment.

The thickness of the aquifer within this area is unknown. For the purposes of this dewatering assessment, it was assumed that the aquifer extends several metres below the base of the construction excavation, and an aquifer thickness of 12 m was used.

3.1.2 Pilot Holes or Entry & Exit Shafts

Due to the presence of the wetland, it is proposed that microtunnelling methods will be used from approximately 10+320 to 10+500. However, to initiate the microtunnelling, two receiving pits (one on each side of the wetland) will need to be excavated. It is assumed that each receiving pit will have a radius of 6 m or have a length and width of 6 m and will extend to 6 mbgs. Therefore, to ensure safe working conditions, groundwater levels will be lowered to 7 mbgs (1 m below the base of the excavation).

The shallowest water level measured at the Site were on March 11, 2024, at -0.14 mbgs. Therefore, it is known that the spring groundwater levels are above, at, or just below the ground surface and therefore, groundwater level is considered at ground surface and was used for this dewatering assessment. A total of 7 m of drawdown is anticipated at the Site.

The thickness of the aquifer within the wetland complex area is considered as the same aquifer thickness of 12 m that was used for this dewatering assessment.

3.2 Estimated Construction Dewatering Rates (50 m Trench Segment)

A modified Dupuit-Forchheimer equation was used to estimate the dewatering rate required for the proposed linear trench excavation (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln(R_0/r_s)} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right]$$

$Where$:

$Q = dewatering\ rate\ (m^3/s)$

$K = hydraulic\ conductivity\ (m/s)$

$H = initial\ hydraulic\ head\ in\ aquifer\ (m)$

$h = target\ hydraulic\ head\ (initial\ hydraulic\ head - target\ drawdown)\ (m)$

$R_0 = zone\ of\ influence\ (from\ excavation\ center) = 3000(H-h)\sqrt{K}\ (m)$

$r_s = equivalent\ single\ well\ radius = width\ of\ trench/2\ (m)$

$x = unit\ length\ of\ trench\ (m)$

$L = distance\ to\ line\ source\ = R_0/2(m)$

The radius of influence for each excavation was estimated from soil hydraulic conductivity using the method of Sichardt (1930). In conditions of low hydraulic conductivity, where R_0 is calculated to be less than r_s , the denominator of the first right hand term of the above equation is amended to be $\ln((R_0 + r_s)/r_s)$.

A summary of calculated dewatering rates, given a target depth to water of 309.50 masl and a unit trench length of 50 m, is provided in Table 3. Detailed calculations are provided in Appendix F.

Table 3 Calculated Construction Dewatering Rates – 50 m Trench Segment

	Hydraulic Conductivity (K)	Zone of Influence (R_0)	Dewatering Rate (Q)	
	(m/s)	(m)	L/day	L/s
Minimum	1.15 x10^{-6}	24	32,400	0.37
Maximum	1.10 x10^{-5}	74	124,700	1.44
Geom. Mean	4.39 x10^{-6}	47	70,700	0.82

Given a maximum estimated hydraulic conductivity of 1.10 x10^{-5} m/s, the estimated R_0 for dewatering is 75 m and the estimated construction dewatering rate is 124,700 L/day or 1.44 L/s.

It is noted that the above equation is designed to represent steady state pumping conditions. In general, at the beginning of the pumping, the pumping rate required to lower Site water levels to acceptable levels may be greater than the rate estimated for steady state conditions as incoming water replaces the volume of excavated soils. Additionally, the above equation does

not account for any precipitation that may occur during the construction process. To account for these factors and the uncertainty of the aquifer thickness, a safety factor of 2 was applied and the estimated dewatering rate per unit trench length is estimated at 249,300 L/day or 2.89 L/sec.

3.3 Estimated Construction Dewatering Rates (Receiving Pit)

A modified Dupuit-Forchheimer equation was used to estimate the dewatering rate required for the proposed square excavation (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln(R_0/r_s)}$$

$Where$:

$Q = dewatering\ rate\ (m^3/s)$

$K = hydraulic\ conductivity\ (m/s)$

$H = initial\ hydraulic\ head\ in\ aquifer\ (m)$

$h = target\ hydraulic\ head\ (initial\ hydraulic\ head - target\ drawdown)\ (m)$

$R_0 = zone\ of\ influence\ (from\ excavation\ center) = 3000(H - h)\sqrt{K}\ (m)$

$r_s = equivalent\ single\ well\ radius$

For square excavations, the equivalent radius (r_s)can be determined as the radius of a circle with the same area as the excavation, or with the same perimeter as the excavation.

Here, the equivalent area method was used such that

$$r_s = \sqrt{\frac{ab}{\pi}}$$

A summary of calculated dewatering rates, given a target depth to water of 7.0 mbgs, and a length and width of 6.0 m, is provided in Table 4. Detailed calculations are provided in Appendix F.

Table 4 Calculated Construction Dewatering Rates – Per Receiving Pit

	Hydraulic Conductivity (K)	Zone of Influence (R_0)	Dewatering Rate (Q)	
	(m/s)	(m)	L/day	L/s
Minimum	1.15×10^{-6}	23	19,600	0.23
Maximum	1.10×10^{-5}	70	117,500	1.36
Geom. Mean	4.39×10^{-6}	44	55,300	0.64

Given a maximum estimated hydraulic conductivity of 1.10×10^{-5} m/s, the estimated R_0 for dewatering is 70 m and the estimated construction dewatering rate is 117,500 L/day or 1.36 L/s.

It is noted that the above equation is designed to represent steady state pumping conditions. In general, at the beginning of the pumping, the pumping rate required to lower Site water levels to acceptable levels may be greater than the rate estimated for steady state conditions as incoming water replaces the volume of excavated soils. Additionally, the above equation does not account for any precipitation that may occur during the construction process. To account for these factors and the uncertainty of the aquifer thickness, a safety factor of 2 was applied and the estimated dewatering rate per each receiving pit is estimated at 235,000 L/day or 2.72 L/sec.

3.4 Assessment of Required Regulatory Permits or Registration

Any construction dewatering or other water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) (Ontario Regulation 387/04 and/or Ontario Regulation 63/16) and/or the Environmental Protection Act (Registrations under Part II.2).

Where construction dewatering is required in amounts in excess of 400,000 L/day, a Permit To Take Water (PTTW) must be obtained. For temporary construction dewatering (six months or less) greater than 50,000 L/day but less than 400,000 L/day, registration through Environmental Activity and Sector Registry (EASR) is required.

Based on the estimated dewatering rate for each 50 m trench segment of 249,300 L/day (including a safety factor) and the estimated dewatering rate for each receiving pit of 235,000 L/day (including a safety factor), an EASR registration will be required as dewatering rates

exceed 50,000 L/day. Additionally, if multiple excavations are dewatering simultaneously, dewatering rates could exceed 400,000 L/day and a PTTW may be required.

It is imperative that daily dewatering rates be monitored (or the dewatering of stagnant water in the construction excavation estimated) to ensure that the short-term dewatering rates are less than 400,000 L/day. If the rates are greater than 400,000 L/day, operations would be required to cease until a Permit to Take Water (PTTW) was acquired.

3.1.4 Zone of Influence

The dewatering calculations include estimates of the horizontal distance away from the walls of each excavation where the influence of water withdrawal will be negligible (i.e., the length to zero drawdown).

The length to zero drawdown from the construction excavation to accommodate each 50 m linear infrastructure was calculated at about 74 m from the walls of the construction excavations and at about 70 m from the walls of the construction excavation for each receiving pit (Appendix F). The area included within the length to zero drawdown from the excavation is the zone of influence (ZOI).

The ZOI predominantly encompasses open land with no known structure or infrastructure; however, there are existing houses within the calculated ZOI within the northern end of the road extension. During construction dewatering activities, the areas adjacent to the construction excavations should be monitored regularly for land settlement and stability.

3.5 Trenchless Horizontal Directional Drilling (HDD)

Trenchless construction consists of installing pipes such as sewer lines and watermains via tunneling under a highway, a waterbody, a wetland etc. Trenchless construction should be considered in areas where conventional open-trench construction methods are undesirable. Trenchless construction usually includes tunneling using a jacked, non man-entry microtunnel boring machine (MTBM), (usually referred to as “microtunnelling), and horizontal directional drilling (HDD) also known as directional boring. Open trenching, as in this case, will be done all the way up to the point where horizontal drilling started. The crossing of the wetland complex

using HDD primarily consists of drilling a small diameter pilot hole (~ 6 inch to 8 inch) along the drilling path and then enlarging / reaming the pilot hole up to a diameter which can facilitate the pipe string pull-back (generally 1.5 times pipe diameter). Microtunnelling boring machine can usually create tunnels from 0.5 m to 4 m in diameter and includes a vacuum extraction system which promotes a cleaner environment and little to no dewatering along the path.

Microtunnelling will be launched from receiving pits on either side of the wetland complex (dewatering for each receiving pit calculated in Section 3.3).

Directional drilling is best suited for clays. Soft to hard clays are the preferred soils for HDD applications, although its use in cohesionless fine sands and silts is also acceptable (Gokhale & Iseley, 1997). Soils containing more than 50% gravel or loose soils are generally unsuitable (Hair, 1994). Directional boring should not be conducted in soils that contain material with particle diameters greater than 3”, since these particles are too large to be suspended in the drilling fluid (Gelinas, et al., 2010). HDD can be used successfully underwater, in saturated soils, under permafrost, and in a soil that is likely to erode (Hashash, 2011).

The following hydrogeologic information is required for the selection of the trenchless method:

- The presence and depth of gravels, cobbles, boulders, loose sand, soft clay etc.,
- Soil and rock stratigraphy and depth to bedrock,
- Groundwater levels and elevations, groundwater conditions such as unconfined or confined, and
- The presence of expansive or collapsible materials.

Accordingly, a cross section was prepared (Figure 3) to depict the existing geologic and hydrogeologic conditions across the proposed trenchless alignment. The length of trenchless excavation extends approximately 120 m (from 10+340 to 10+460) between the boreholes BH201-23, BH203-23 through BH206-23, and BH101-22 and the lithology along the alignment predominantly consists of silt to silty sand with trace clay throughout.

A length of about 120 m of the sewer and waterman installation will be below the water table. Groundwater is being discharged to the wetland complex at an approximate elevation of 312.6

to 313.0 masl. The deepest point of alignment will be at an elevation of approximately 309.62 masl under the Creek, and therefore, the maximum height of water column above the deepest part of sewer line will be about 3.38 m.

It should be noted that trenchless construction would normally require less or no dewatering than traditional open cut installations. Drilling fluid is used to suspend and remove the soil cuttings and also to stabilize the hole, reduce friction and control soil pressure below the surface.

4.0 Water Quality Assessment

Groundwater samples were collected from the monitoring well BH101-22 on February 4, 2022, and were submitted for chemical analysis in order to identify compliance issues (if any) when compared to Provincial Water Quality Objective (PWQO) parameters. Groundwater sample was collected in unfiltered form and submitted to SGS Laboratories for chemical analysis. SGS has been accredited by Canadian Association for Laboratory Accreditation (CALA). The laboratory analytical results are presented in Appendix G.

The chemical results were tabulated in Table 5 indicating parameter exceedances in comparison to the guideline values.

Table 5 Guideline Violation of Groundwater Samples Compared to PWQO (µg/L)

Sample ID	Filtration	Parameter	Measured Concentration	Guideline Value
BH101-22	Unfiltered	Zinc	**856**	30
BH101-22	Unfiltered	Thallium	**0.80**	0.3
BH101-22	Unfiltered	Lead	**153**	5
BH101-22	Unfiltered	Nickel	**127**	25
BH101-22	Unfiltered	Iron	**130000**	300
BH101-22	Unfiltered	Cadmium	**1.64**	0.2
BH101-22	Unfiltered	Arsenic	**26.6**	5
BH101-22	Unfiltered	Silver	**0.4**	0.1

Note: Bolded values exceeding the applicable standard.

Based on the results of the chemical analysis, the following comments on the groundwater quality are provided.

- The concentrations of most metals, including zinc, thallium, lead, nickel, iron, cadmium, arsenic, and silver in the unfiltered groundwater sample, exceeded the PWQO guideline values.
- The groundwater dewatering contractor should verify the quality of the filtered sample before being discharged as over land flow to the nearby wetland.

- If discharged as overland flow, the concentration of total suspended solids (TSS) should not exceed 25 mg/L concentrations. Standard discharge mitigation BMP for TSS (discharge running through fine mesh filter bags) must be utilized during construction as TSS is expected to be very high due to the type of construction activities at the site.

5.0 Recommendations

Cambium recommends the following as part of this assessment.

- As EASR registration will be required prior to the initiation of any dewatering activities. A dewatering and discharge plan should be prepared to support the EASR registration.
- If simultaneous excavations are planned (multiple trench segments and/or receiving pits), a PTTW registration will be required.
- Regardless, is imperative that daily dewatering rates be monitored (or the dewatering of stagnant water in the construction excavation estimated) to ensure that the short-term dewatering rates are less than 400,000 L/day. If the rates are greater than 400,000 L/day, operations would be required to cease until a Permit to Take Water (PTTW) was acquired.
- If possible, during the period of active dewatering, water levels should be monitored within the excavation footprints and in the existing monitoring wells to confirm the estimated zone of influence.
- All daily water takings and discharge rates shall be recorded both manually once a day and using continuous data logging devices (continuously recording flow meters with totalizing function) and maintained for the purpose of the mandatory water taking reporting.
- If dewatered groundwater is to be discharged as overland flow, the concentration of total suspended solids (TSS) should not exceed 25 mg/L concentrations. Standard discharge mitigation plan for TSS (discharge running through fine mesh filter bags) must be utilized during construction as TSS is expected to be very high due to the type of construction activities at the site.
- During construction dewatering activities, the areas adjacent to the construction excavations should be monitored regularly for land settlement and stability issues.
- The proposed trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland Complex, based on hydrogeologic conditions assessed across the area.

6.0 Closing

We trust that the information in this submission meets your current requirements. If you have any questions regarding the contents of this report, please contact the undersigned.

All information received from the Client in the preparation of the report has been assumed correct and Cambium assumes no responsibility for the accuracy, completeness, or workmanship of any such information.

Respectfully submitted,

Cambium Inc.

DocuSigned by:
6AAA0661AAA8459...

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Project Coordinator

DocuSigned by:
Sudhakar Kurli
3611EDDBEA134BF...

Sudhakar Kurli, M.Sc., P.Geo.
Project Manager/Hydrogeologist

\\cambiumincstorage.file.core.windows.net\projects\11900 to 11999\11969-002 BT Eng (London) - Geo & HydroG - Kitchener\Deliverables\REPORT - HydroG\Final\2024-03-14 Dewatering Assessment, Biehn Drive Extension, Kitchener.docx

7.0 References

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Kyrieleis, W. a. (1930). *Grundwasserabsenkung bei Fundierungsarbeiten.* Berlin: Springer.

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8.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

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Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

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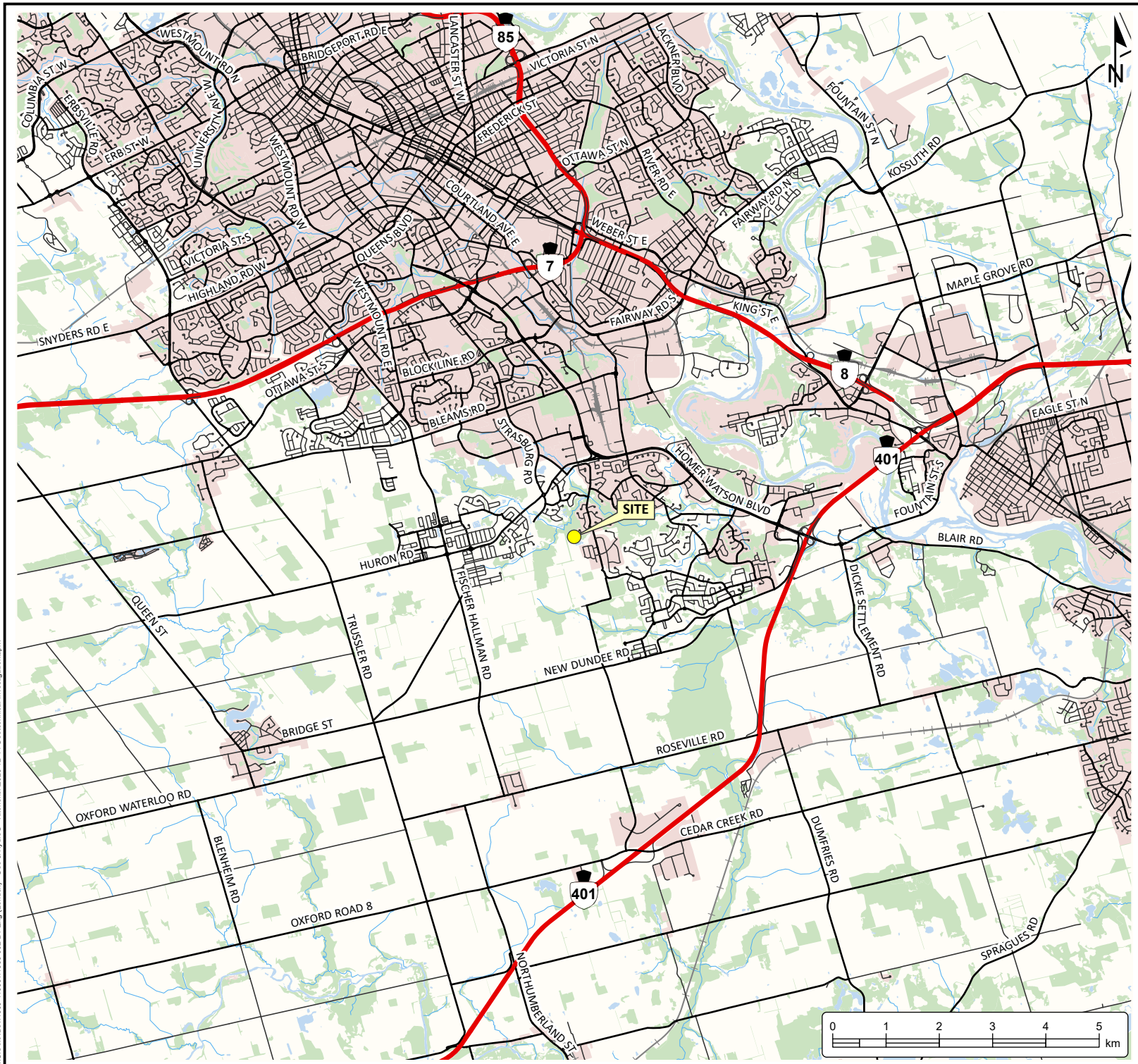
Appended Figures



DEWATERING ASSESSMENT

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- First Nations Reserve
- Provincial Park
- Water Area
- Wooded Area
- Built Up Area

Notes:
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SITE LOCATION PLAN

Project No.: 11969-002		Date: December 2023 Rev.:	
Scale: 1:100,000		Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: SK	Figure:	1

O:\GIS\MXDs\11900-11999\11969-002 BT Eng (London) - Geo & HydroG - Kitchener\2023-12-14 Geotechnical Investigation.aprx

DEWATERING ASSESSMENT

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

LEGEND

- Benchmark
- Borehole
- Monitoring Well
- Contours (5m Interval)
- Provincially Significant Wetlands
- Section Profile

Notes:
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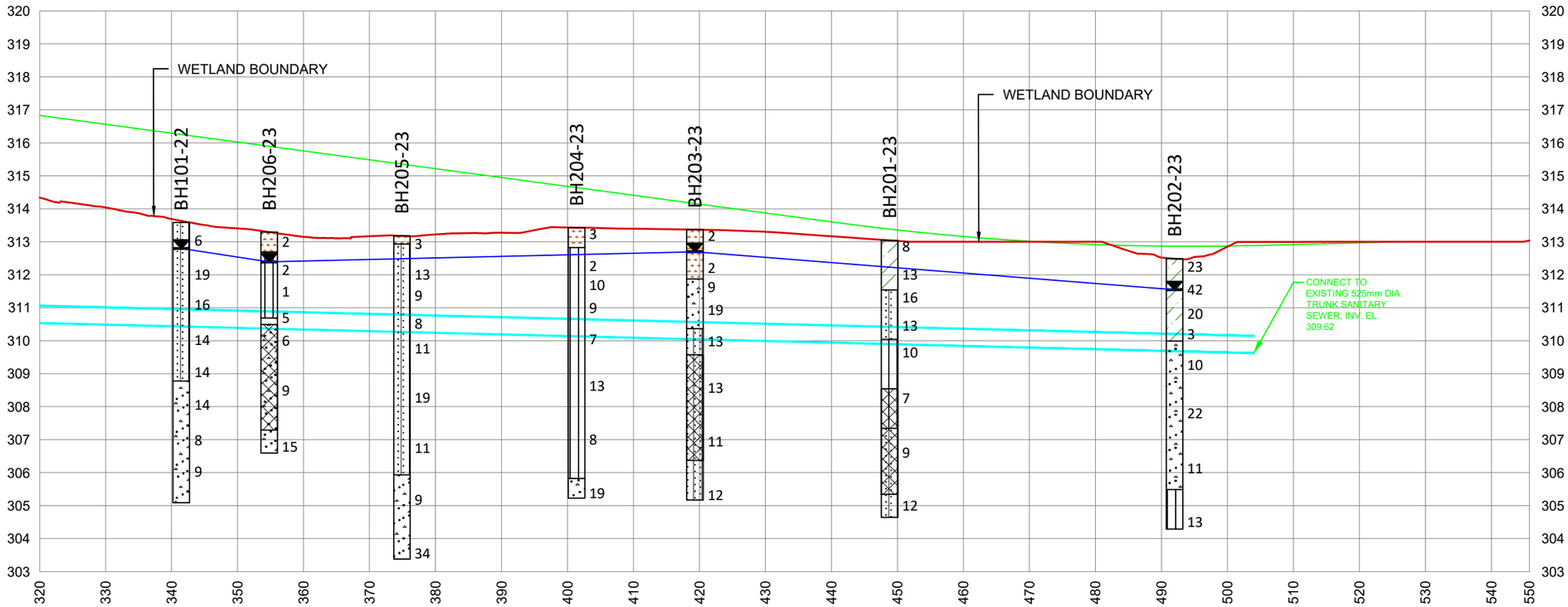
www.cambium-inc.com

BOREHOLE LOCATION PLAN

Project No.: 11969-002		Date: December 2023	Rev.:
Scale: 1:1,500		Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: SK	Figure: 2	

O:\GIS\MXDs\11900-11999\11969-002 BT Eng (London) - Geo & HydroG - Kitchener\2023-12-14 Geotechnical Investigation.aprx



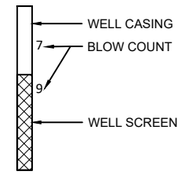
DEWATERING ASSESSMENT

BT ENGINEERING

Biehn Drive Kitchener, Ontario

LEGEND

- WATER LEVEL INDICATOR
- FILL
- PEAT
- SILT
- SILTY SAND
- SAND
- WATER LEVEL
- GROUND SURFACE
- PROPOSED SURFACE GRADING
- PROPOSED SEWER



Notes:
1. Survey completed by Cambium Inc. December 6, 2023
2. Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.

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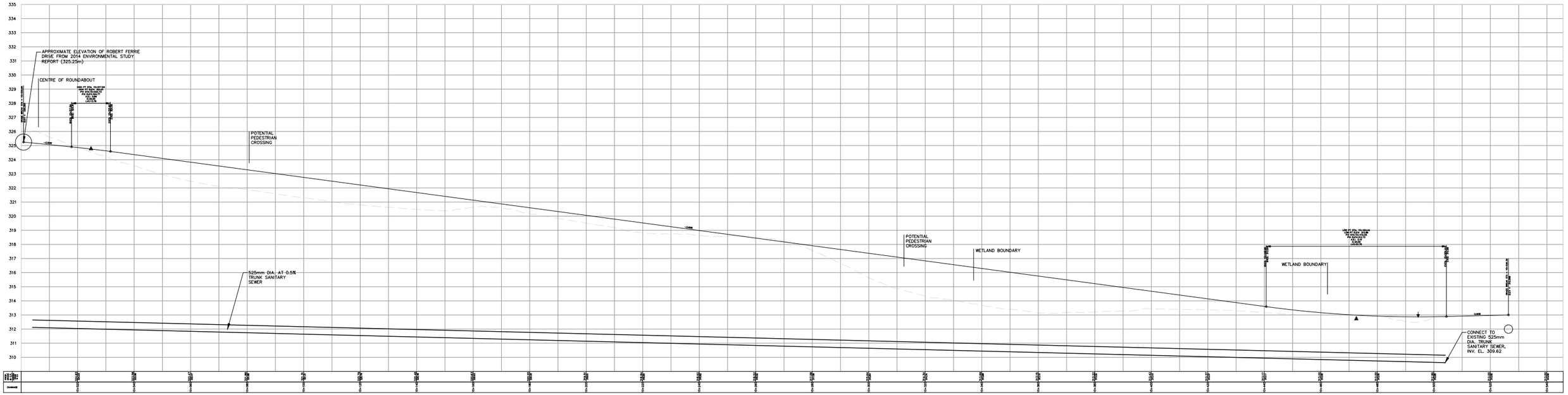
PROFILE CROSS SECTION

Project No.:	Date:
11969-002	December 2023
	Rev.:
Horizontal Scale:	Vertical Scale:
N/A	N/A
Drawn By:	Checked By:
MAT	SK
Figure:	
3	

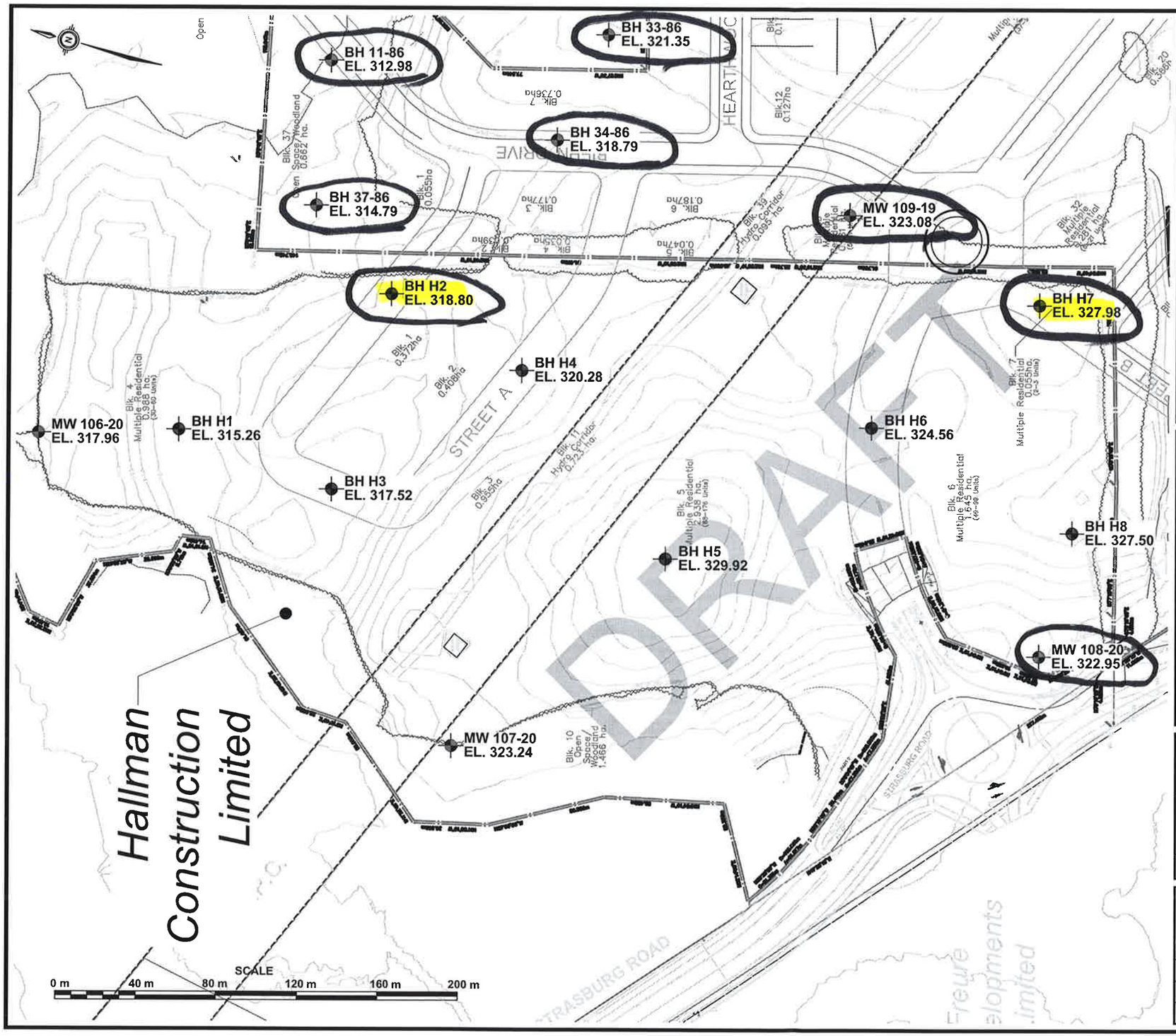
Appendix A

Linear Alignment and Profile



Appendix B

Borehole Logs (Peto MacCallum)



KEY PLAN

LEGEND:

- BOREHOLE LOCATION
- PREVIOUS INVESTIGATION BOREHOLE / MONITORING WELL
  PML REF: 86F423

REFERENCE:

BOREHOLE LOCATION PLAN REPRODUCED FROM DRAWING SUPPLIED BY CLIENT.

NOTES:

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE BOREHOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE BOREHOLES MAY VARY.

THE BOREHOLE LOCATIONS AND GEODETIC ELEVATIONS WERE SURVEYED WITH A SOKKIA GCX3 REAL TIME KINEMATIC RECEIVER CONNECTED TO THE GLOBAL NAVIGATION SATELLITE SYSTEM.

HALLMAN CONSTRUCTION LIMITED

BRIGADOON SOUTH SUBDIVISION

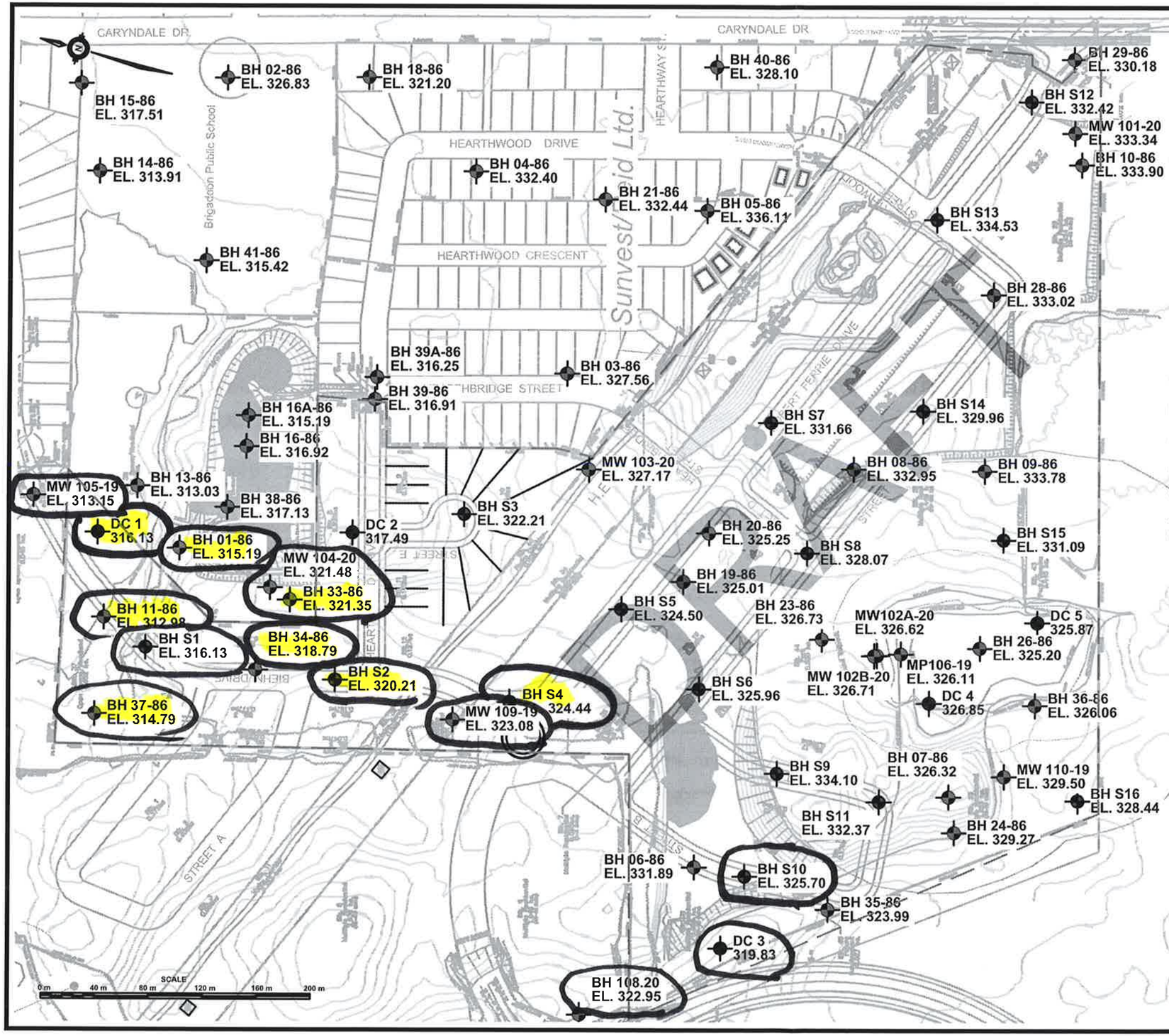
HALLMAN LANDS

KITCHENER, ONTARIO

BOREHOLE LOCATION PLAN

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	D. BRICE	DATE	SCALE	PML REF.	DWG. NO.
CHECKED	W. LOGHRIN	FEBRUARY 2021	AS SHOWN	20KF063A	1
APPROVED	G. MITCHELL				



KEY PLAN

LEGEND:

- BOREHOLE LOCATION
- DYNAMIC CONE PENETRATION TEST
- PREVIOUS INVESTIGATION BOREHOLES / MONITORING WELLS
  PML REF: 86F423

REFERENCE:

TEST HOLE LOCATION PLAN REPRODUCED FROM DRAWING SUPPLIED BY CLIENT.

NOTES:

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE TEST HOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE TEST HOLES MAY VARY.

THE TEST HOLE LOCATIONS AND GEODETIC ELEVATIONS WERE SURVEYED WITH A SOKKIA GCX3 REAL TIME KINEMATIC RECEIVER CONNECTED TO THE GLOBAL NAVIGATION SATELLITE SYSTEM.

SUNVEST CONSTRUCTION LIMITED

BRIGADOON SOUTH SUBDIVISION
SUNVEST LANDS
KITCHENER, ONTARIO

TEST HOLE LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	D. BRICE	DATE	SCALE	PML REF.	DWG. NO.
CHECKED	W. LOGHRIN	APRIL 2021	AS SHOWN	20KF063B	1
APPROVED	W. LOGHRIN				

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. DC-1

PROJECT Brigadoon South Subdivision - Sunvest Reid Lands
LOCATION Kitchener, Ontario
BORING METHOD
BORING DATE
PML REF. 20KF063B
ENGINEER W. Loghrin
TECHNICIAN

SOIL PROFILE			SAMPLES				SHEAR STRENGTH (kPa)			GROUND WATER OBSERVATIONS AND REMARKS
DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	+FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT; w_P w w_L; WATER CONTENT (%) 10 20 30 40	UNIT WEIGHT kN/m³	GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
SURFACE ELEVATION										

0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. DC-3

PROJECT Brigadoon South Subdivision - Sunvest Reid Lands
LOCATION Kitchener, Ontario
BORING METHOD Dynamic Cone Penetration Test
BORING DATE
PML REF. 20KF063B
ENGINEER W. Loghrin
TECHNICIAN R. Bhavsar

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST ×●; 20 40 60 80	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30 40	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
0.0	SURFACE ELEVATION 319.83 See BH 35-86 for soil stratigraphy					319				
1.0						318				
2.0						317				
3.0						316				
4.0						315				
5.0						314				
6.0						313				
7.0						312				
8.0						311				
9.0						310				
10.0						309				
11.0						308				
12.0						307				
13.0						306				
14.0						305				
15.0	CONTINUED									

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. DC-3

PROJECT Brigadoon South Subdivision - Sunvest Reid Lands
LOCATION Kitchener, Ontario
BORING METHOD Dynamic Cone Penetration Test
BORING DATE
PML REF. 20KF063B
ENGINEER W. Loghrin
TECHNICIAN R. Bhavsar

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
15.0	CONTINUED FROM PREVIOUS PAGE						50 100 150 200; 20 40 60 80	10 20 30 40		
16.1	DYNAMIC CONE TERMINATED AT 16.1 m					304				

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. S-2

PROJECT Brigadoon South Subdivision - Sunvest Reid Lands
LOCATION Kitchener, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE 11/24/20
PML REF. 20KF063B
ENGINEER W. Loghrin
TECHNICIAN R. Bhavsar

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 320.21				
0.0	320.21	TOPSOIL: Dark brown silt, some sand, trace clay, rootlets, moist		1	SS	3
0.51	319.70	SILTY SAND: Loose brown silty sand, trace gravel, trace clay, moist		2	SS	6
1.0				3	SS	5
2.0						
2.2	318.0	becoming compact		4	SS	29
3.0						
3.0	317.2	becoming wet		5	SS	30
4.0						
4.1	316.1	SAND: Compact to dense brown sand, some silt, trace to some gravel, wet		6	SS	30
5.0						
6.0				7	SS	35
7.0						
8.0				8	SS	17
8.7	311.5	becoming very dense, occasional wet silt layers		9	SS	56
9.0						
10.0						
10.2	310.0	becoming loose		10	SS	5
11.0						
11.3	308.9	BOREHOLE TERMINATED at 11.3 m				
12.0						
13.0						
14.0						
15.0						

ELEVATION SCALE: 320, 319, 318, 317, 316, 315, 314, 313, 312, 311, 310, 309

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Sampler wet from 4.6 m to completion.

Upon Completion of augering, Cave @ 4.9 m, Free water @ 3.1 m.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. S-4

PROJECT Brigadoon South Subdivision - Sunvest Reid Lands
LOCATION Kitchener, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE 11/24/20
PML REF. 20KF063B
ENGINEER W. Loghrin
TECHNICIAN R. Bhavsar

DEPTH (metres)	ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 324.44			
0.31	324.13	TOPSOIL: Dark brown silt, some sand, trace gravel, rootlets, moist	1A 1B	SS	4
1.00	323.44	SANDY SILT: Loose brown sandy silt, trace gravel, moist	2	SS	6
		SAND: Compact brown sand, trace to some gravel, trace silt, moist	3	SS	15
2.2	322.2	becoming dense	4	SS	34
			5	SS	48
			6	SS	34
			7	SS	38
			8	SS	33
8.7	315.7	GRAVELLY SAND: Dense to very dense brown gravelly sand, trace silt, wet	9	SS	38
			10	SS	72/280mm
11.3	313.1	BOREHOLE TERMINATED at 11.3 m			

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Sampler wet from 9.1 m to completion.

Upon Completion of augering,
Cave @ 7.9 m,
Free water @ 7.7 m.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. S-10

PROJECT Brigadoon South Subdivision - Sunvest Reid Lands
LOCATION Kitchener, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE 11/27/20
PML REF. 20KF063B
ENGINEER W. Loghrin
TECHNICIAN R. Bhavsar

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 325.70				
0.15	325.55	TOPSOIL: Dark brown silt, trace sand, trace clay, rootlets, moist		1	SS	6
		CLAYEY SILT: Stiff brown clayey silt, trace gravel, trace sand, DTPL				
0.97	324.73	SILT: Compact brown silt, some sand, trace gravel, trace clay, moist		2	SS	12
				3	SS	13
2.2	323.5	CLAYEY SILT: Stiff to very stiff brown clayey silt, trace gravel, trace sand, DTPL to APL		4	SS	13
				5	SS	20
4.1	321.6	becoming grey, very stiff to hard		6	SS	22
				7	SS	35
7.8	317.9	SILTY SAND: Dense brown silty sand, trace gravel, trace clay, wet		8	SS	34
8.2	317.5	BOREHOLE TERMINATED at 8.2 m				

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

Upon Completion of augering,
No cave,
No free water.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. H-7

PROJECT Brigadoon South Subdivision - Hallman Lands
LOCATION Kitchener, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE 11/26/20
PML REF. 20KF063A
ENGINEER W. Loghrin
TECHNICIAN R. Bhavsar

DEPTH (metres) / ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
	SURFACE ELEVATION 327.98			
0.20 / 327.78	TOPSOIL: Dark brown clayey silt, trace sand, rootlets, moist	1	SS	2
0.69 / 327.29	CLAYEY SILT: Soft brown clayey silt, trace sand, APL			
	SILTY SAND: Loose brown silty sand, trace gravel, trace clay, moist	2	SS	7
1.5 / 326.5	becoming compact	3	SS	20
		4	SS	20
3.0 / 325.0	becoming dense	5	SS	40
4.1 / 323.9	becoming very dense	6	SS	56
		7	SS	59
8.2 / 319.8	BOREHOLE TERMINATED at 8.2 m	8	SS	50

SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon Completion of augering,
No cave,
No free water.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. H-2

PROJECT Brigadoon South Subdivision - Hallman Lands
LOCATION Kitchener, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE 11/25/20
PML REF. 20KF063A
ENGINEER W. Loghrin
TECHNICIAN R. Bhavsar

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	SAMPLE TYPE	"N" VALUES
		SURFACE ELEVATION 318.80				
0.20	318.60	TOPSOIL: Brown silt, some sand, trace clay, rootlets, moist		1A	SS	1
0.69	318.11	SILT: Very loose brown silt, trace sand, trace clay, moist to wet		1B		
1.5	317.3	CLAYEY SILT: Very stiff brown clayey silt, trace sand, trace gravel, DTPL to APL		2	SS	28
		becoming soft to stiff, some sand, APL		3	SS	8
				4	SS	2
3.6	315.2			5	SS	10
4.1		SAND: Brown sand, some silt, trace clay, trace gravel, wet				
	314.7	CLAYEY SILT: Stiff grey clayey silt, some sand, trace gravel, APL to WTPL		6	SS	11
				7	SS	11
8.2				8	SS	8
	310.6	BOREHOLE TERMINATED at 8.2 m				

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

ELEVATION SCALE: 318, 317, 316, 315, 314, 313, 312, 311

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Sampler wet from 3.1 m to completion.

Upon Completion of augering, Cave @ 6.1 m, Free water @ 4.7 m.

NOTES

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 1 & 2

JOB NAME: PROPOSED RESIDENTIAL SUBDIVISION — JOB No.: 86 F 423
LOCATION: Biehn Drive, Kitchener, Ontario — BORING DATE: 1986 12 11 & 12 — ENGINEER: G. Mitchell
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: D. Kelly

DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m N VALUES	SHEAR STRENGTH C_u / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST (BLOWS/0.3m: 20, 40, 60, 80)	LIQUID LIMIT W_L, PLASTIC LIMIT W_P, WATER CONTENT W (W_P — W — W_L; WATER CONTENT %: 10, 20, 30)	GROUNDWATER OBSERVATIONS AND REMARKS
	BOREHOLE 1 GROUND ELEVATION: 315.19								
0.45	TOPSOIL: Dark brown silt, organics, very moist		315	1	SS	6			
1.20	SAND AND GRAVEL: Compact brown fine to medium sand and gravel, little silt, moist		314	2	SS	11			
1.5	SAND: Compact to dense brown fine sand, numerous sandy silt seams, wet to saturated			3	SS	21			
			313	4	SS	44			
3.0			312	5	SS	38			
			311						
4.5 4.55	BOREHOLE TERMINATED AT 4.55 m			6	SS	25			Upon completion of drilling, borehole caved to 0.75 m with no free water
	BOREHOLE 2 GROUND ELEVATION: 326.83								
0.0									
0.60	TOPSOIL: Dark brown silt, organics, moist		326						
	SILT: Very loose brown silt, trace sand, wet			1	SS	2			
1.5 1.65			325	2	SS	6			
2.75	SAND: Loose to compact brown silty fine sand, moist — Occasional gravel seams		324	3	SS	21			
3.0				4	SS	26			
			323						
4.5 4.55	Becoming dense to very dense		322	5	SS	53*			
			321						
6.0 6.10	Occasional silt seams			6	SS	54			Following Sample 6, sampler wet
			320						
7.5			319	7	SS	42			
			318						
9.0 9.15	BOREHOLE TERMINATED AT 9.15 m			8	SS	35			Upon completion of drilling, borehole open with no free water

NOTES:
* Sampler overfilled.
Borehole 2: Bulk sample taken from 1.65 to 3.00 m

CHECKED BY: gk

PML/504A

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 6

JOB NAME PROPOSED RESIDENTIAL SUBDIVISION — JOB No. 86 F 423
LOCATION Biehn Drive, Kitchener, Ontario — BORING DATE 1986 12 15 — ENGINEER G. Mitchell
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN D. Kelly

DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m N VALUES
	BOREHOLE 6					
	GROUND ELEVATION: 331.89					
0.10	TOPSOIL: Dark brown sandy silt, organics, moist			1	SS	2
	SAND: Loose to compact brown fine to medium sand, little silt, moist		331	2	SS	7
1.5			330	3	SS	12
			329	4	SS	18
3.0				5	SS	16
			328			
4.5			327	6	SS	15
			326			
6.10	Occasional sandy silt seams and coarse sand seams			7	SS	24
			325			
7.5			324	8	SS	23
			323	9	SS	15
9.15	BOREHOLE TERMINATED AT 9.15 m					
10.5						
12.0						
13.5						
15.0						
16.5						
18.0						

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3m 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling, borehole open with no free water

NOTES: Bulk sample taken from 1.50 to 4.50 m

CHECKED BY gh

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 11 & 12

JOB NAME PROPOSED RESIDENTIAL SUBDIVISION — JOB No. 86 F 423
LOCATION Biehn Drive, Kitchener, Ontario — BORING DATE 1986 12 12 — ENGINEER G. Mitchell
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN D. Kelly

DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	SAMPLES: NUMBER	SAMPLES: TYPE	BLOWS/0.3m N VALUES	GROUNDWATER OBSERVATIONS AND REMARKS
	BOREHOLE 11 GROUND ELEVATION: 312.98						
0.55	TOPSOIL: Black silt, organics, very moist			1	SS	2	43%
	SAND: Loose to compact brown fine sand, little silt, occasional silt seams, saturated		312	2	SS	18	Water level at surface
1.5			311	3	SS	20	
3.0			310	4	SS	12	
			309	5	SS	19	
4.5 4.55				6	SS	9	
	BOREHOLE TERMINATED AT 4.55 m						Upon completion of drilling, borehole caved to 0.55 m with water level at surface
6.0							
	BOREHOLE 12 GROUND ELEVATION: 313.18						
0.0	PEAT: Black fibrous peat, saturated		313	1	SS	1	385%
1.10	MARL: Grey marl, saturated		312	2	SS	2	172%
1.5 1.60	SAND: Loose to compact brown fine to medium sand, little silt, saturated		311	3	SS	18	56%
3.0			310	4	SS	13	Water level at surface
			309	5	SS	26	
4.5 4.55				6	SS	9	
	BOREHOLE TERMINATED AT 4.55 m						Upon completion of drilling, borehole caved to 0.30 m with water level at surface
6.0							

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3m 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

NOTES:
Water samples taken in Borehole 11.

CHECKED BY

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 33 & 34

JOB NAME PROPOSED RESIDENTIAL SUBDIVISION — JOB No. 86 F 423
LOCATION Biehn Drive, Kitchener, Ontario — BORING DATE 1986 12 14 — ENGINEER G. Mitchell
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN D. Kelly

DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	SAMPLES: NUMBER	TYPE	BLOWS/0.3m N VALUES
	BOREHOLE 33 GROUND ELEVATION: 321.35					
0.45	TOPSOIL: Dark brown sandy silt, organics, moist		321	1	SS	7
	SAND: Compact to dense brown fine sand, little silt, very moist to moist		320	2	SS	12
				3	SS	28
			319			
2.75				4	SS	43
	Becoming very dense fine to medium sand, damp		318	5	SS	67*
4.00						
4.55	SILT TILL: Very hard brown clayey silt, little sand and gravel, D.T.P.L.		317	6	SS	65*
	BOREHOLE TERMINATED AT 4.55 m					
	BOREHOLE 34 GROUND ELEVATION: 318.79					
0.60	TOPSOIL: Dark brown silt, organics, very moist		318	1	SS	3
1.20	SILT: Loose brown silt, little clay, trace sand, wet			2	SS	8
	SAND AND GRAVEL: Compact to dense brown fine to coarse sand and gravel, moist to wet		317	3	SS	44
2.70			316	4	SS	42
	Becoming saturated			5	SS	27
3.25	SAND: Compact to dense grey medium to coarse sand, saturated		315			
4.55				6	SS	41
	BOREHOLE TERMINATED AT 4.55 m		314			

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ○
STANDARD PENETRATION TEST ●
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT %: 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling, borehole open with no free water

Bentonite Seal
Native Backfill
12 mm PVC Pipe
Piezometer Tip

Upon completion of drilling, borehole caved to 2.55 m with no free water

PIEZOMETER READINGS:

1987 01 11: 2.40 m
1987 02 19: 2.90 m

NOTES: * Sampler overfilled.

CHECKED BY gk

PML/504A

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 35 & 36

JOB NAME: PROPOSED RESIDENTIAL SUBDIVISON — JOB No. 86 F 423
LOCATION: Biehn Drive, Kitchener, Ontario — BORING DATE: 1986 12 15 — ENGINEER: G. Mitchell
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: D. Kelly

BOREHOLE 35
GROUND ELEVATION: 323.99

DEPTH in METRES	DESCRIPTION	ELEVATION	SAMPLE NUMBER	SAMPLE TYPE	BLOWS/0.3m N VALUES
0.45	TOPSOIL: Dark brown sandy silt, organics, moist		1	SS	5
	SAND: Loose to compact brown fine to medium sand, little gravel, moist to damp	323	2	SS	5
1.5		322	3	SS	11
3.0		321	4	SS	9
			5	SS	27
4.00		320			
4.55	Becoming very dense		6	SS	65
	BOREHOLE TERMINATED AT 4.55 m				

Upon completion of drilling, borehole caved to 4.00 m with no free water

BOREHOLE 36
GROUND ELEVATION: 326.06

DEPTH in METRES	DESCRIPTION	ELEVATION	SAMPLE NUMBER	SAMPLE TYPE	BLOWS/0.3m N VALUES
0.42	TOPSOIL: Black sandy silt, organics, very moist		1	SS	7
	SAND: Very loose to compact brown fine sand, little silt, saturated	325	2	SS	2
1.5			3	SS	8
2.10		324			
	Becoming grey with occasional cobbles		4	SS	54*
3.35		323	5	SS	24
	SILT: Very stiff grey clayey silt, trace sand, D.T.P.L.	322			
4.55			6	SS	20
	BOREHOLE TERMINATED AT 4.55 m				

Upon completion of drilling, borehole caved to 1.15 m and wet

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT %: 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

NOTES: * Driving on cobble.

CHECKED BY: gh

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 37 & 38

JOB NAME: PROPOSED RESIDENTIAL SUBDIVISION — JOB No.: 86 F 423
LOCATION: Biehn Drive, Kitchener, Ontario — BORING DATE: 1986 12 12 — ENGINEER: G. Mitchell
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: D. Kelly

DEPTH in METRES	DESCRIPTION	GRAPHIC	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m N VALUES	GROUNDWATER OBSERVATIONS AND REMARKS
	BOREHOLE 37 GROUND ELEVATION: 314.79						
0.45	TOPSOIL: Dark brown silt, organics, very moist			1	SS	2	Water level at surface
	SILT: Compact brown sandy silt, saturated		314	2	SS	12	
1.50							
	SAND: Compact to dense brown fine sand, occasional coarse sand seams, saturated		313	3	SS	26	
			312	4	SS	33	
				5	SS	28	
3.65			311				
	Becoming grey fine to coarse sand			6	SS	27	
4.55	BOREHOLE TERMINATED AT 4.55 m		310				Upon completion of drilling, borehole caved to 1.35 m with no free water
	BOREHOLE 38 GROUND ELEVATION: 317.13						
0.60	TOPSOIL: Dark brown to black silt, organics, very moist			1	SS	4	
	SILT: Loose to compact brown sandy silt, trace clay, very moist to saturated		316	2	SS	12	
				3	SS	8	
			315	4	SS	3	
3.00							
	SAND: Loose brown fine sand, little silt, saturated		314	5	SS	2	
			313				
4.55				6	SS	10	
	BOREHOLE TERMINATED AT 4.55 m						Upon completion of drilling, borehole caved to 3.00 m with no free water Wet at 3.00 m

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P — W — W_L
WATER CONTENT %: 10 20 30

NOTES

CHECKED BY: gk

Appendix C

Borehole Logs (MTE Consultants)

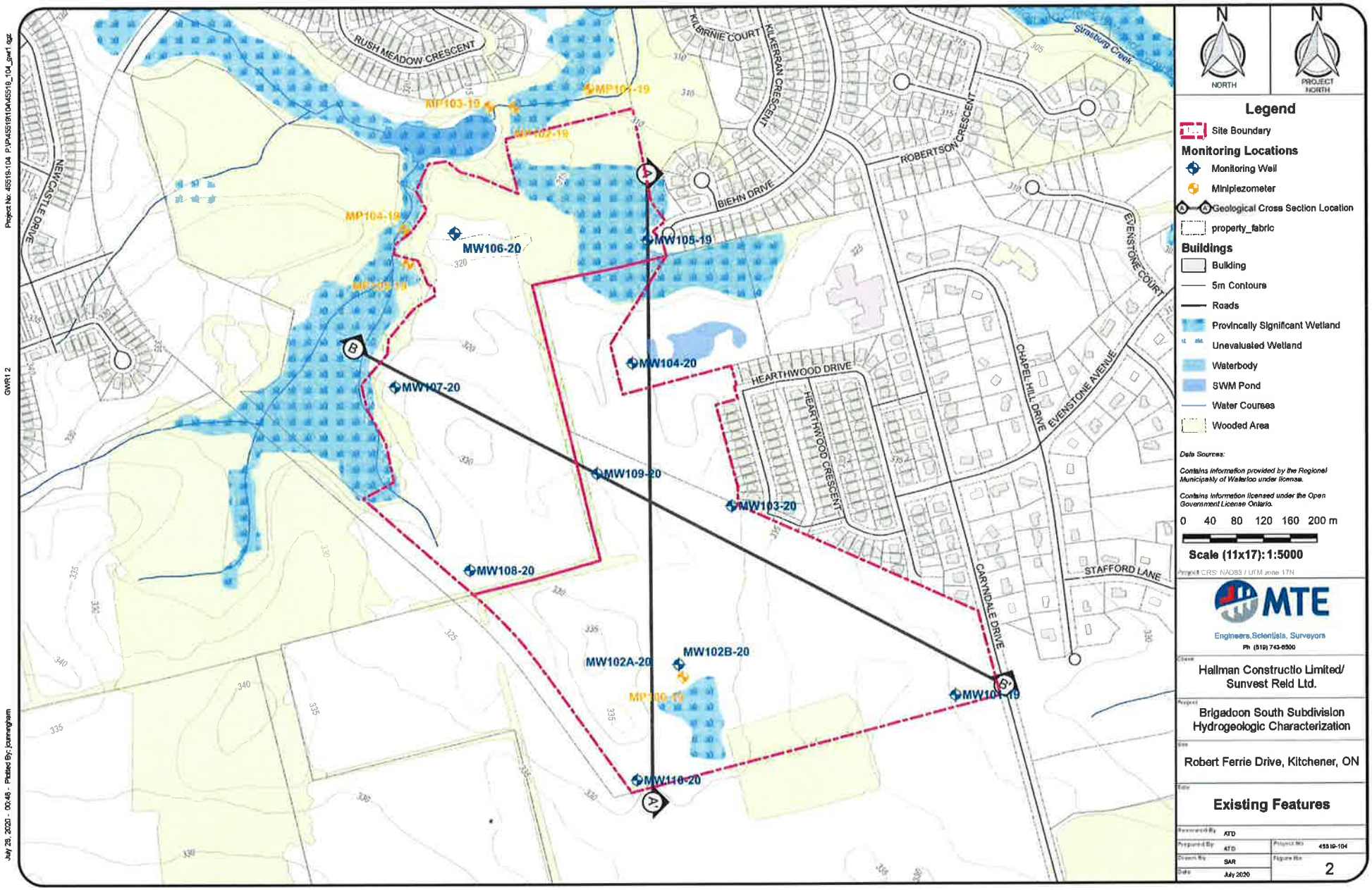


Table 1: Manual Water Levels

ID	MW101-19		MW102A-20		MW102B-20		MW103-20		MW104-20		MW105-19	
TOC Elevation (mAMSL)	334.27		327.65		327.66		328.17		322.56		314.09	
GS Elevation (mAMSL)	333.34		326.62		326.71		327.17		321.48		313.15	
Date	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs
10-Dec-19	16.57	15.64	NI	-	NI	-	NI	-	NI	-	NI	#VALUE!
4-Feb-20	16.61	15.68	9.79	8.76	2.96	2.02	10.60	9.60	6.09	5.01	1.55	0.61
11-Feb-20	16.51	15.58	9.80	8.77	2.96	2.02	10.57	9.57	6.09	5.01	1.60	0.66
2-Jun-20	16.27	15.34	9.67	8.63	2.94	2.00	10.46	9.46	6.09	5.01	1.67	0.73
1-Sep-20	16.68	15.75	10.04	9.01	4.60	3.65	10.77	9.77	6.44	5.36	1.89	0.95
27-Nov-20	17.03	16.10	10.40	9.37	5.09	4.15	11.14	10.14	6.68	5.60	1.59	0.65
5-Mar-21	17.28	16.35	10.61	9.58	4.55	3.60	11.34	10.34	6.80	5.72	1.64	0.70
3-Jun-21	17.26	16.33	10.60	9.57	4.04	3.10	11.36	10.36	6.80	5.72	1.79	0.85
10-Sep-21	17.55	16.62	10.81	9.78	dry		11.57	10.57	7.02	5.94	1.82	0.88
17-Nov-21	17.48	16.55	10.81	9.78	4.66	3.72	11.55	10.55	6.93	5.85	1.65	0.71

ID	MW106-20		MW107-20		MW108-20		MW109-20		MW110-20	
TOC Elevation (mAMSL)	319.08		324.32		324.02		324.08		330.32	
GS Elevation (mAMSL)	317.90		323.25		322.95		323.09		329.50	
Date	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs
10-Dec-19	NI	-	NI	-	NI	-	NI	-	NI	-
4-Feb-20	5.46	4.28	7.51	6.43	5.71	4.64	6.77	5.78	5.13	4.31
11-Feb-20	5.48	4.30	7.50	6.42	damaged		6.76	5.77	5.12	4.30
2-Jun-20	5.50	4.32	7.48	6.40	5.98	4.91	6.70	5.71	5.24	4.42
1-Sep-20	5.62	4.44	7.78	6.70	6.40	5.33	7.03	6.04	5.84	5.02
27-Nov-20	5.53	4.35	8.05	6.97	6.80	5.73	7.35	6.36	6.24	5.42
5-Mar-21	5.55	4.37	8.19	7.11	6.93	5.86	7.51	6.52	6.28	5.46
3-Jun-21	5.59	4.41	8.18	7.10	6.86	5.79	7.50	6.51	6.07	5.25
10-Sep-21	5.65	4.47	8.37	7.29	7.16	6.09	7.71	6.72	6.50	5.68
17-Nov-21	5.59	4.41	8.33	7.25	7.09	6.02	7.69	6.70	6.34	5.52

ID	MP101-19 - in		MP101-19 - out		MP102-19		MP102-19 - out		MP103-19		MP103-19 - out	
TOC Elevation (mAMSL)	-		-		310.43		310.43		313.16		313.16	
GS Elevation (mAMSL)	-		-		309.27		-		311.89		-	
Date	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs
10-Dec-19	1.09	-0.01	1.04	-0.06	1.51	0.35	0.93	-0.23	1.56	0.29	0.91	-0.36
4-Feb-20	-	-	-	-	-	-	-	-	-	-	-	-
11-Feb-20	1.10	0.00	1.10	0.00	0.90	-0.26	0.97	-0.19	1.07	-0.20	frozen	-
2-Jun-20	destroyed		destroyed		0.92	-0.25	0.98	-0.18	1.11	-0.16	0.92	-0.36
1-Sep-20	destroyed		destroyed		0.98	-0.18	1.00	-0.16	1.41	0.13	0.92	-0.35
27-Nov-20	destroyed		destroyed		0.86	-0.30	0.95	-0.21	1.15	-0.12	0.91	-0.36
5-Mar-21	destroyed		destroyed		0.91	-0.25	0.95	-0.21	1.05	-0.22	frozen	
3-Jun-21	destroyed		destroyed		0.95	-0.21	0.99	-0.17	1.13	-0.14	0.90	-0.37
10-Sep-21	destroyed		destroyed		0.93	-0.23	0.97	-0.19	0.78	-0.49	0.47	-0.80
17-Nov-21	destroyed		destroyed		0.84	-0.32	0.94	-0.22	0.78	-0.49	0.55	-0.72

ID	MP104-19		MP104-19 - out		MP105-19		MP105-19 - out		MP106-19		MP106-19 - out	
TOC Elevation (mAMSL)	314.27		314.27		314.91		314.91		327.19		327.19	
GS Elevation (mAMSL)	313.05		-		313.67		-		326.09		-	
Date	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs
10-Dec-19	0.82	-0.40	1.02	-0.20	2.00	0.76	1.13	-0.11	1.72	0.62	0.98	-0.12
4-Feb-20	-	-	-	-	-	-	-	-	-	-	-	-
11-Feb-20	0.84	-0.38	1.10	-0.12	frozen		frozen		frozen		frozen	
2-Jun-20	0.84	-0.39	1.07	-0.15	1.30	0.06	1.18	-0.06	0.82	-0.29	0.82	-0.28
1-Sep-20	0.88	-0.34	1.09	-0.13	1.45	0.21	dry	-	1.75	0.65	dry	
27-Nov-20	0.82	-0.40	1.01	-0.21	1.14	-0.10	1.16	-0.08	1.66	0.56	dry	
5-Mar-21	frozen		1.06	-0.16	frozen		dry		1.71	0.61	dry	
3-Jun-21	0.86	-0.36	1.07	-0.15	1.25	0.01	dry		1.69	0.59	dry	
10-Sep-21	0.89	-0.33	1.08	-0.14	1.24	0.00	dry		1.76	0.66	dry	
17-Nov-21	0.85	-0.37	1.06	-0.16	1.15	-0.09	1.16	-	dry		dry	

Notes:
NM = not measured
NI = not installed
TOC = top of casing
GS = ground surface
N/A = not applicable
- in = groundwater level measured inside mini-piezometer
- out = surface water level measured outside mini-piezometer
mAMSL = meters above mean sea level
mbtoc = meters below top of casing
Monitoring well TOC and Ground Surface elevations surveyed May, 2020

Table 2: Manual Water Elevations

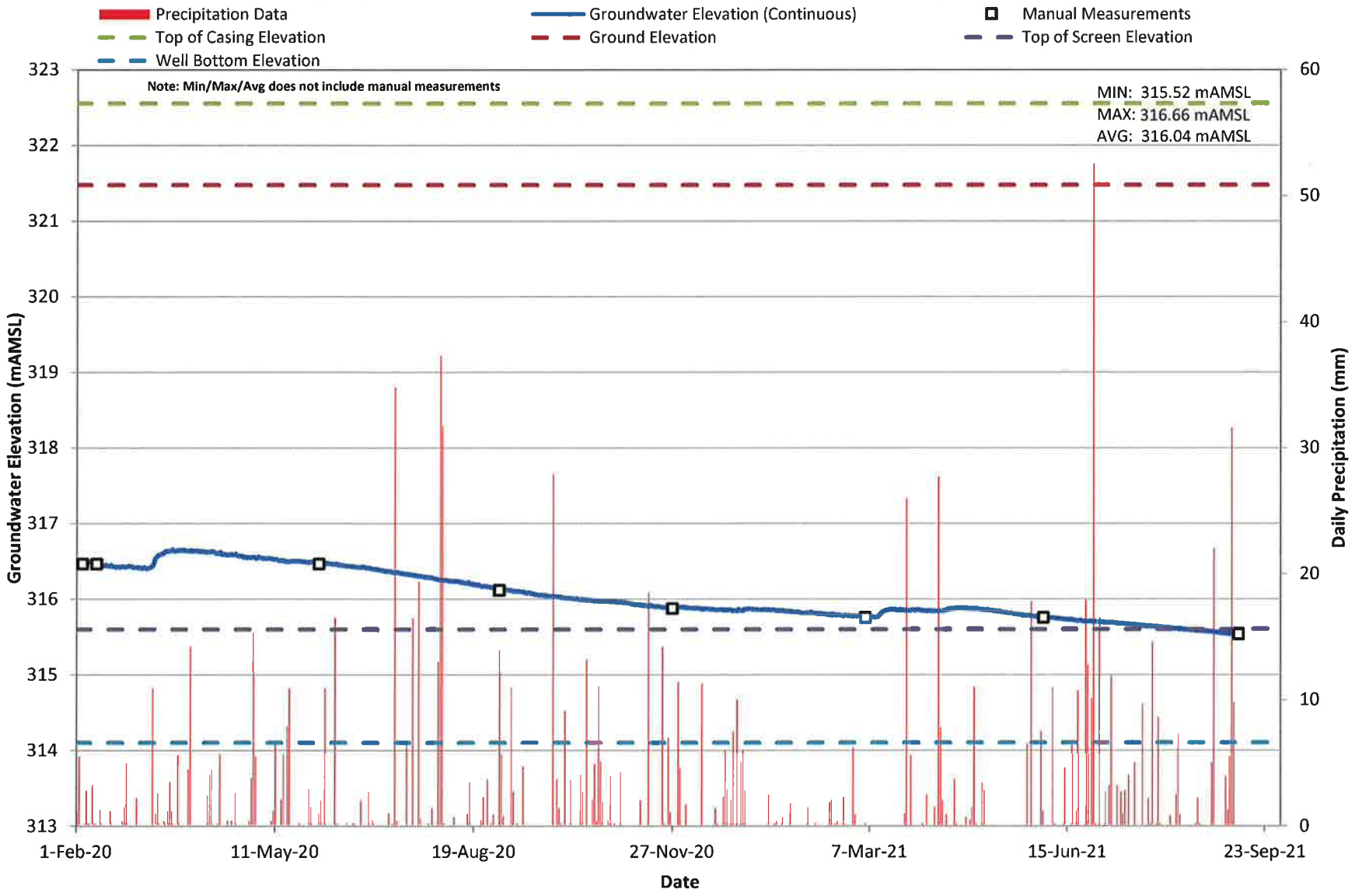
ID	MW101-19	MW102A-20	MW102B-20	MW103-20	MW104-20	MW105-19	MW106-20	MW107-20	MW108-20	MW109-20	MW110-20
TOC Elevation (mAMSL)	334.27	327.65	327.66	328.17	322.56	314.09	319.08	324.32	324.02	324.08	330.32
GS Elevation (mAMSL)	333.34	326.62	326.71	327.17	321.48	313.15	317.90	323.25	322.95	323.09	329.50
10-Dec-19	317.70	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
4-Feb-20	317.66	317.86	324.70	317.57	316.47	312.54	313.62	316.81	318.31	317.31	325.19
11-Feb-20	317.76	317.85	324.70	317.60	316.47	312.49	313.60	316.82	NM	317.32	325.20
2-Jun-20	318.00	317.98	324.72	317.71	316.47	312.42	313.58	316.84	318.04	317.38	325.08
1-Sep-20	317.59	317.61	323.06	317.40	316.12	312.20	313.46	316.55	317.62	317.05	324.48
27-Nov-20	317.24	317.25	322.57	317.03	315.88	312.50	313.55	316.27	317.22	316.73	324.08
5-Mar-21	316.99	317.04	323.11	316.83	315.76	312.45	313.53	316.13	317.09	316.57	324.04
3-Jun-21	317.01	317.05	323.62	316.81	315.76	312.30	313.49	316.14	317.16	316.58	324.25
10-Sep-21	316.72	316.84	dry	316.60	315.54	312.27	313.43	315.95	316.86	316.37	323.82
17-Nov-21	316.79	316.84	323.00	316.62	315.63	312.44	313.49	315.99	316.93	316.39	323.98

ID	MP101-19-in	MP101-19-out	MP102-19-in	MP102-20-out	MP103-19-in	MP103-19-out	MP104-19-in	MP104-19-out	MP105-19-in	MP105-19-out	MP106-19-in	MP106-19-out
TOC Elevation (mAMSL)	0.00	0.00	310.43	310.43	313.16	313.16	314.27	314.27	314.91	314.91	327.19	327.19
GS Elevation (mAMSL)	0.00	-	309.27	-	311.89	-	313.05	-	313.67	-	326.09	-
10-Dec-19	-1.09	-1.04	308.92	309.50	311.60	312.25	313.45	313.25	312.91	313.78	325.47	326.21
4-Feb-20	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11-Feb-20	-1.10	-1.10	309.53	309.46	312.09	Frozen	313.43	313.17	Frozen	Frozen	Frozen	Frozen
2-Jun-20	Destroyed		309.52	309.45	312.05	312.25	313.43	313.20	313.61	313.73	326.38	326.37
10-Sep-21	Destroyed		309.45	309.43	311.76	312.24	313.39	313.18	313.46	dry	325.44	dry
27-Nov-20	Destroyed		309.57	309.48	312.01	312.25	313.45	313.26	313.77	313.75	325.53	dry
5-Mar-21	Destroyed		309.52	309.48	312.11	frozen	frozen	313.21	frozen	dry	325.48	dry
3-Jun-21	Destroyed		309.48	309.44	312.03	312.26	313.41	313.20	313.66	dry	325.50	dry
10-Sep-21	Destroyed		309.50	309.46	312.38	312.69	313.38	313.19	313.67	dry	325.43	dry
17-Nov-21	Destroyed		309.57	309.48	312.01	312.25	313.45	313.26	313.77	313.75	325.53	dry

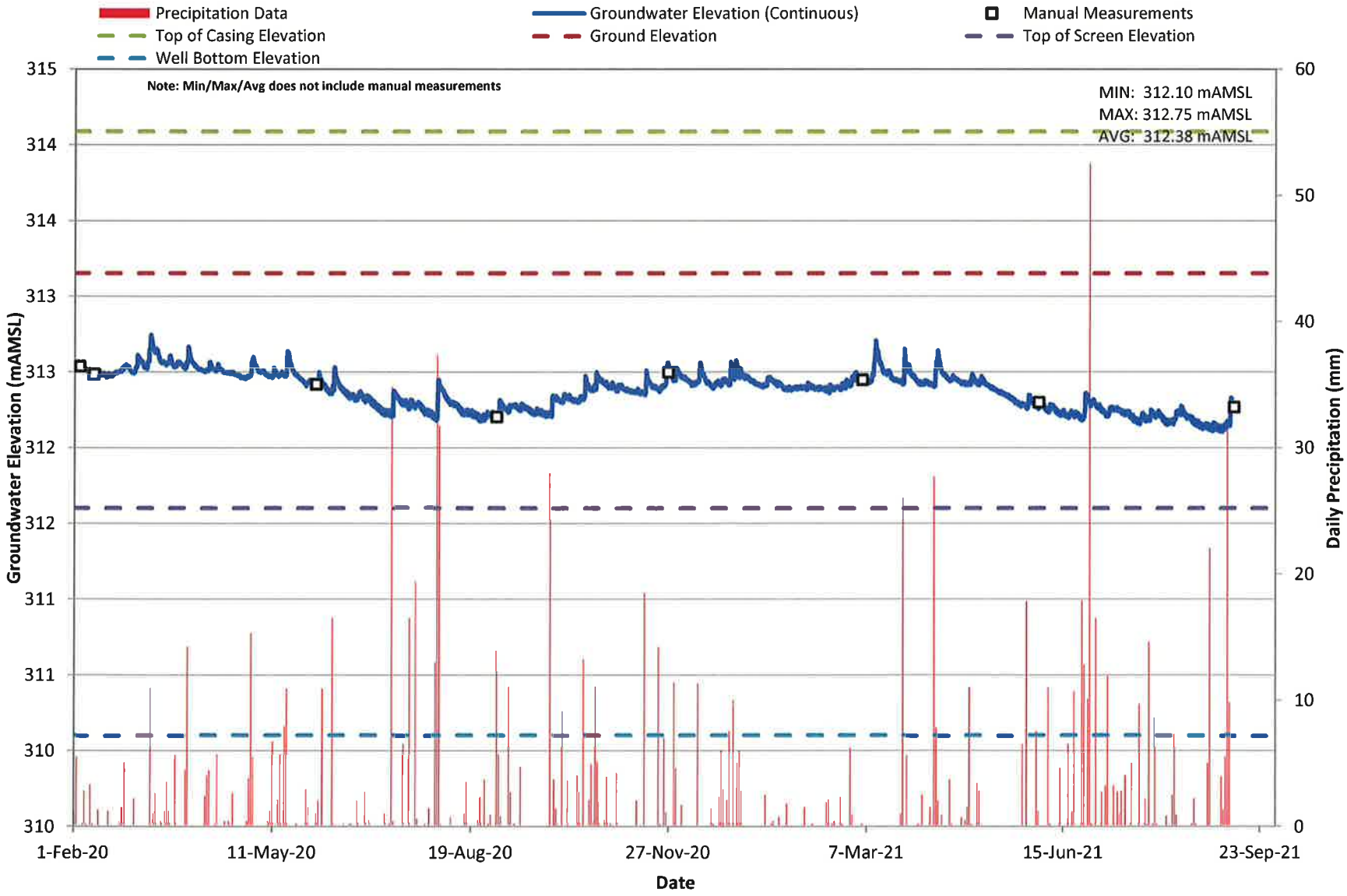
Notes:
NM = not measured
NI = not installed
TOC = top of casing
GS = ground surface
- in = groundwater level measured inside mini-piezometer
- out = surface water level measured outside mini-piezometer

mAMSL = meters above mean sea level
mbtoc = meters below top of casing
Monitoring well TOC and Ground Surface elevations surveyed May, 2020

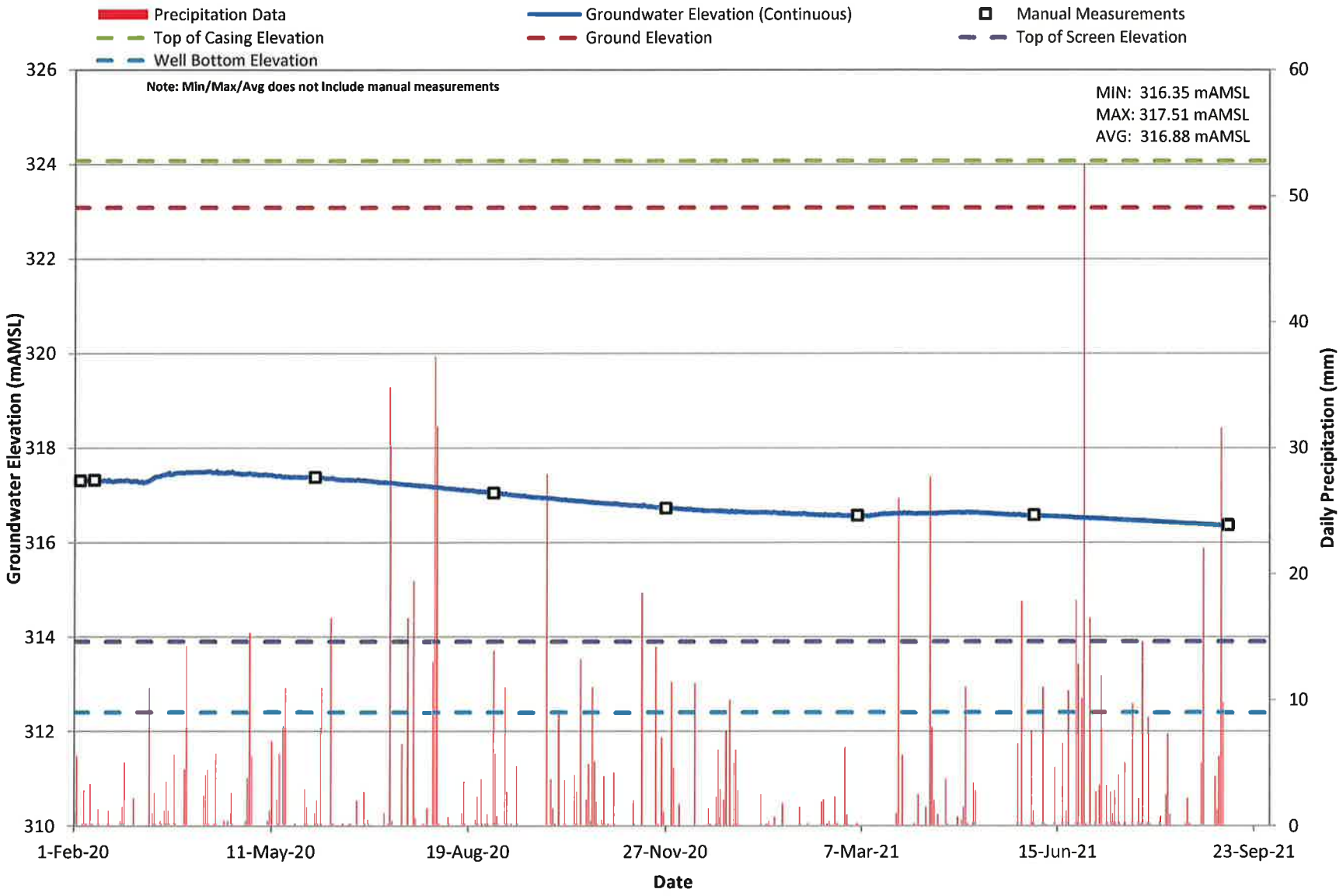
Hydrograph 5: Groundwater Elevations (mAMSL) - MW104-20



Hydrograph 6: Groundwater Elevations (mAMSL) - MW105-19



Hydrograph 10: Groundwater Elevations (mAMSL) - MW109-20



ID Number: MW104-20

Project Name: Brigadoon South

Project No: 45519-104

Client: Sunvest/Reid Ltd.

Site Location: Kitchener, Ontario

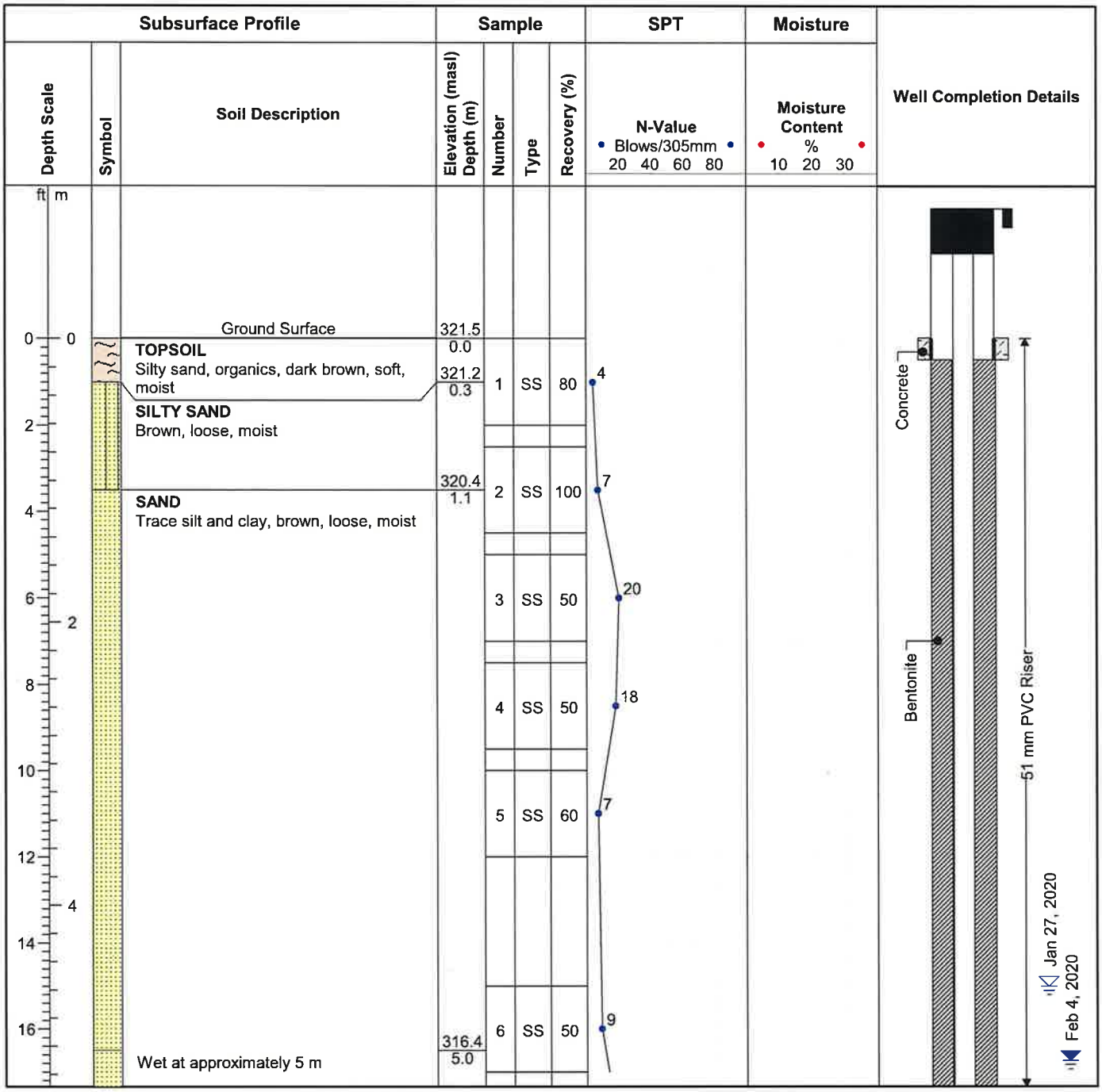
Date Completed: 1/27/2020

Drilling Contractor: Geo-Environmental

Drill Rig: CME M75-3

Drill Method: Hollow Stem Auger

Protective Cover: Monument



Field Technician: KNR

Drafted by: KNR

Reviewed by:

MTE

MOE Well Tag: A287241
Easting: 543796
Northing: 4803568

ID Number: MW104-20

Project Name: Brigadoon South

Project No: 45519-104

Client: Sunvest/Reid Ltd.

Site Location: Kitchener, Ontario

Date Completed: 1/27/2020

Drilling Contractor: Geo-Environmental

Drill Rig: CME M75-3

Drill Method: Hollow Stem Auger

Protective Cover: Monument

Subsurface Profile			Sample				SPT	Moisture	
Depth Scale	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content % 10 20 30	Well Completion Details
18									
20	6			7	SS	100	31		
22									
24									
26	8			8	SS	100	38		
28		Drilling Terminated	313.2 / 8.2						
30									
32	10								
34									
36									

Sand Pack

51mm Slotted Screen

Field Technician: KNR

Drafted by: KNR

Reviewed by:

MTE

MOE Well Tag: A287241
Easting: 543796
Northing: 4803568

ID Number: MW105-19

Project Name: Brigadoon South

Project No: 45519-104

Client: Hallman Construction Ltd.

Site Location: Kitchener, Ontario

Date Completed: 12/2/2019

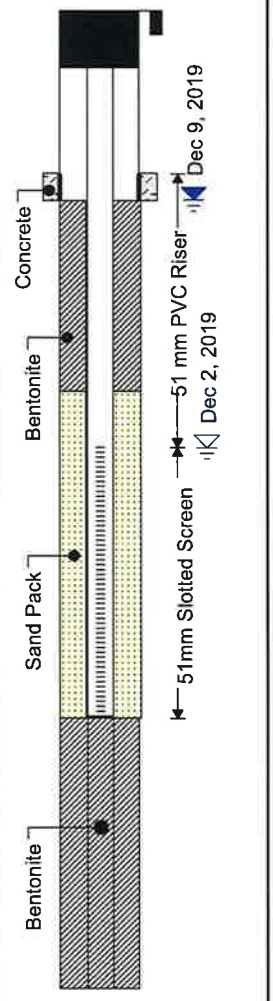
Drilling Contractor: Geo-Environmental

Drill Rig: CME M75-3

Drill Method: Hollow Stem Auger

Protective Cover: Monument

Depth Scale	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	N-Value (Blows/305mm)	Moisture Content (%)
ft / m		Ground Surface	313.2 / 0.0					
0 / 0		**TOPSOIL** Silty sand, dark brown, loose, moist						
		SAND Brown, loose, moist		1	SS	25	8	
2			312.2 / 0.9					
		SILTY SAND Trace clay, brown, moist, loose		2	SS	50	17	
4			311.6 / 1.5					
		Wet at approximately 1.5 m		3	SS	90	12	
6 / 2								
8				4	SS	100	7	
10			309.8 / 3.4	5	SS	100	7	
12		**CLAYEY SILT** Trace sand, brown, soft, moist	309.3 / 3.8					
4		**SAND** Brown, loose, wet		6	SS	25	0	
14			308.6 / 4.6					
		Drilling Terminated						
16								



Field Technician: KNR

Drafted by: KNR

Reviewed by:

MTE

MOE Well Tag #A279204
Easting: 543819
Northing: 4803753

Sheet: 1 of 1

ID Number: MW108-20

Project Name: Brigadoon South

Project No: 45519-104

Client: Hallman Construction Ltd.

Site Location: Kitchener, Ontario

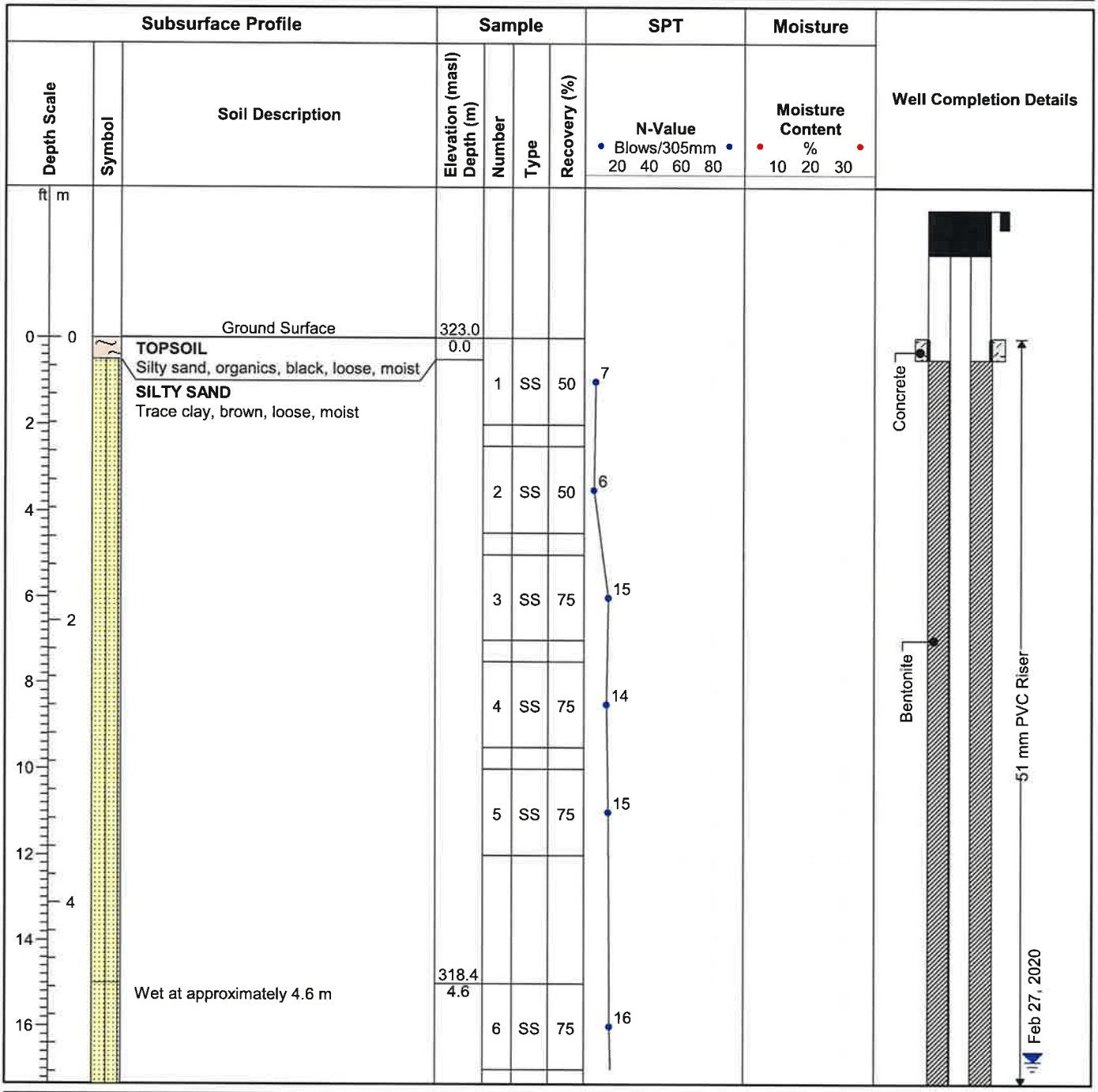
Date Completed: 2/27/2020

Drilling Contractor: Geo-Environmental

Drill Rig: CME M75-3

Drill Method: Hollow Stem Auger

Protective Cover: Monument



Field Technician: KNR

Drafted by: KNR

Reviewed by:

MTE

MOE Well Tag: A287234
Easting: 543553
Northing: 4803257

ID Number: MW108-20

Project Name: Brigadoon South

Project No: 45519-104

Client: Hallman Construction Ltd.

Site Location: Kitchener, Ontario

Date Completed: 2/27/2020

Drilling Contractor: Geo-Environmental

Drill Rig: CME M75-3

Drill Method: Hollow Stem Auger

Protective Cover: Monument

Depth Scale	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Recovery (%)	SPT N-Value (Blows/305mm)	Moisture Content %	Well Completion Details
18									
20	6			7	SS	80	19		
22									
24									
26	8			8	SS	90	9		
28									
30		**SAND** Some silt, brown, loose, saturated	313.8 9.1	9	SS	100	10		
32	10	Drilling Terminated	313.2 9.8						
34									
36									

Well Completion Details: Sand Pack; Bentonite; 51mm Slotted Screen

Field Technician: KNR

Drafted by: KNR

Reviewed by:

MTE

MOE Well Tag: A287234
Easting: 543553
Northing: 4803257

ID Number: MW109-20

Project Name: Brigadoon South

Project No: 45519-104

Client: Sunvest/Reid Ltd.

Site Location: Kitchener, Ontario

Date Completed: 1/27/2020

Drilling Contractor: Geo-Environmental

Drill Rig: CME M75-3

Drill Method: Hollow Stem Auger

Protective Cover: Monument

Depth Scale (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Recovery (%)	SPT N-Value (Blows/305mm)	Moisture Content (%)	Well Completion Details
0 / 0		Ground Surface	323.1						
		TOPSOIL Silty sand, black, loose, moist	0.0	1	SS	25	7		
2		**SILTY SAND** Some clay, brown, soft, moist		2	SS	80	6		
4			321.6						
6 / 2		**CLAYEY SILT** Trace sand, brown, soft, loose, wet	1.5	3	SS	90	18		
			320.8						
8		**SILTY SAND** Trace clay, brown, compact, moist	2.3	4	SS	100	18		
10				5	SS	100	21		
12 / 4									
14			318.5						
16		**CLAYEY SILT** Trace sand, grey, compact, moist	4.6	6	SS	80	18		
18									

Concrete

Bentonite

51 mm PVC Riser

Jan 27, 2020

Field Technician: KNR

Drafted by: KNR

Reviewed by:

MTE

MOE Well Tag: A246045
Easting: 543743
Northing: 4803402

ID Number: MW109-20

Project Name: Brigadoon South

Project No: 45519-104

Client: Sunvest/Reid Ltd.

Site Location: Kitchener, Ontario

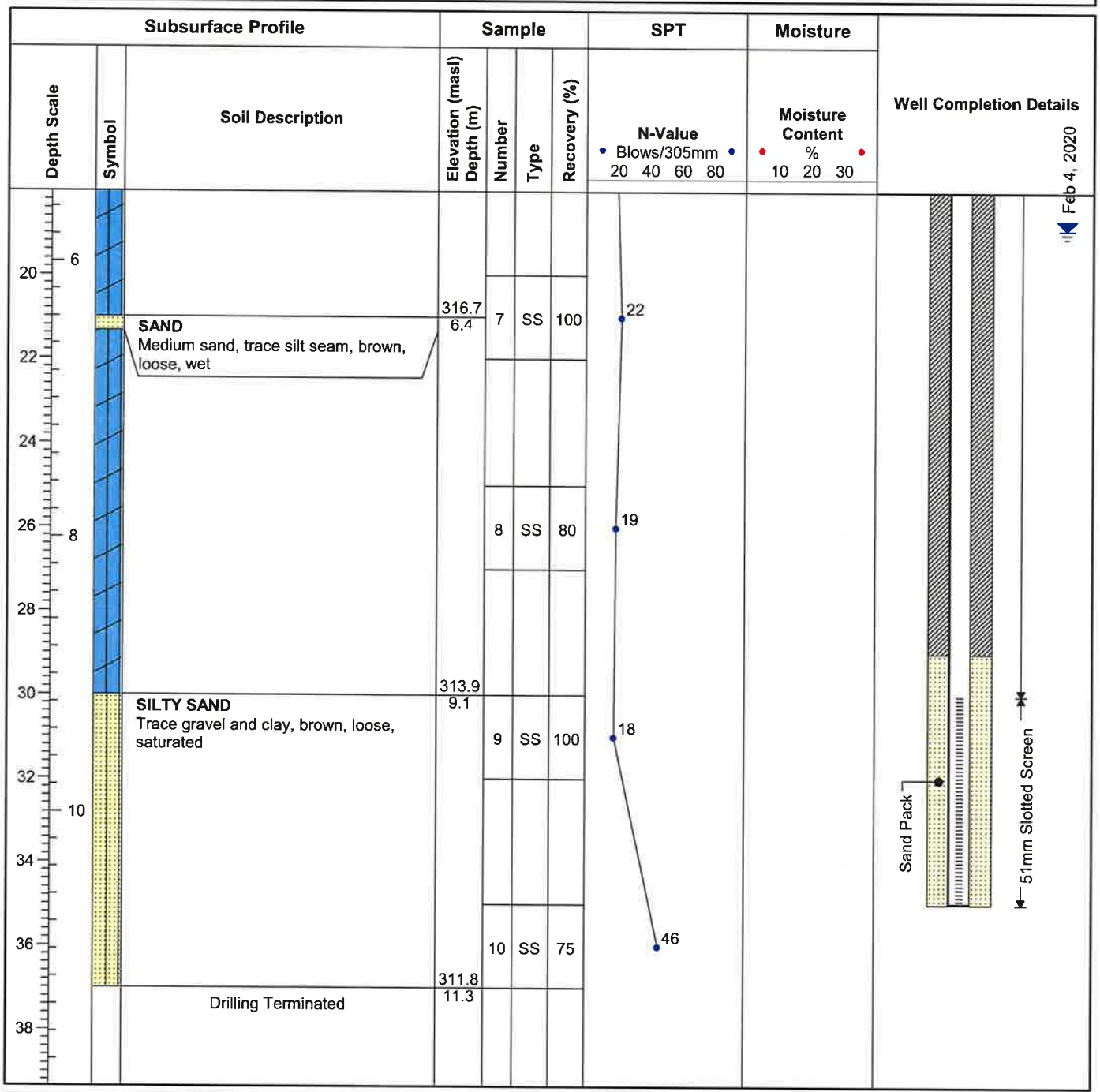
Date Completed: 1/27/2020

Drilling Contractor: Geo-Environmental

Drill Rig: CME M75-3

Drill Method: Hollow Stem Auger

Protective Cover: Monument



Field Technician: KNR

Drafted by: KNR

Reviewed by:

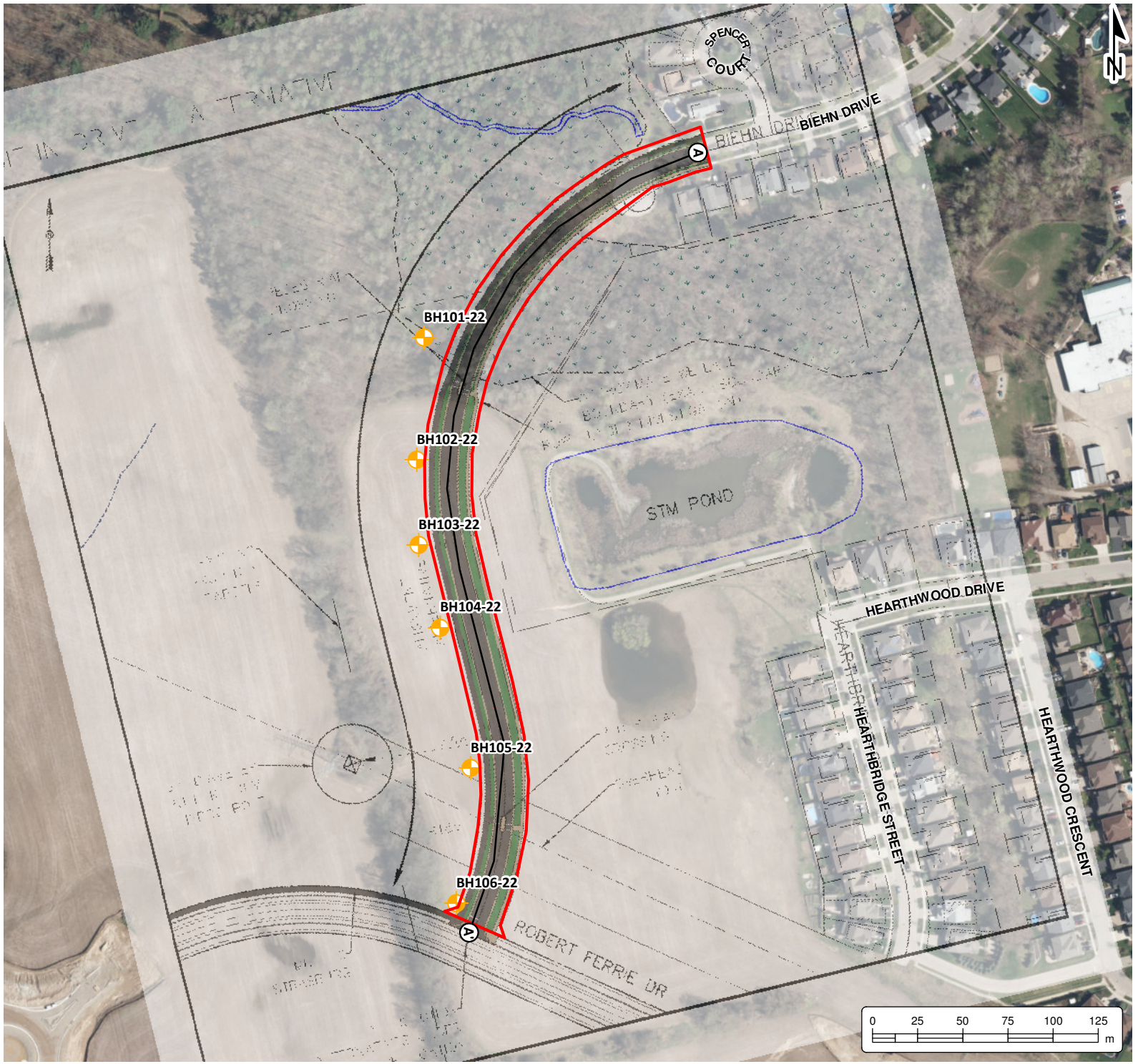
MTE

MOE Well Tag: A246045
Easting: 543743
Northing: 4803402

Sheet: 2 of 2

Appendix D

Borehole Logs (Cambium)



HYDROGEOLOGICAL ASSESSMENT

CITY OF KITCHENER
Biehn Drive
Kitchener, Ontario

LEGEND

- Borehole
- Cross Section
- Site (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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Peterborough, Ontario, K9H 1E5
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LINEAR INFRASTRUCTURE EXCAVATION AREA

Project No.: 11969-001		Date: February 2022 Rev.:	
Scale: 1:3,000		Projection: NAD 1983 UTM Zone 17N	
Created by: ACS	Checked by: SK	Figure:	4

O:\GIS\MXDs\11900-11999\11969-001 City of Kitchener - Hydrogeological Assessment - geological Assessment, Kitchener\2022-01-31 FIG 4 - Linear Infrastructure Excavation Area.mxd

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Log of Borehole: BH101-22

Client:	BT Engineering, London	**Project Name:**	Geotechnical Investigation	**Project No.:**	11969-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	January 20, 2022
Location:	Biehn Drive Extension	**UTM:**	17T 543732 E, 4803683 N	**Elevation:**	313.42 mASL

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
314	-1									Cap	
	0		TOPSOIL: Dark brown silt topsoil, some organics, moist, loose	1A	SS	50	6			Monument	
313				1B	SS					Water level at 0.41 mbgs on on Feb 04, 2022	
	1		SILTY SAND: Brown silty sand, moist, loose								
312			SAND: Brown sand, some silt, trace gravel, wet, compact	2	SS	65	19				
	2		SILTY SAND: Brown silty sand, some gravel, trace clay, APL, stiff	3	SS	35	16			PVC Riser	
311				4	SS	50	14			Bentonite Plug	GSA SS3: 19% Gravel 52% Sand 26% Silt 3% Clay
	3										
310				5	SS	80	14				
	4										
309											
	5		SAND: Reddish brown sand, moist, compact	6	SS	100	14				
308											
	6		-Wet, loose							Sand Pack	
307				7	SS	80	8			PVC Screen	
	7										
306											
	8			8	SS	50	9			Cap	Water level at 2.1 mbgs upon completion
305			Borehole terminated at 8.2 mbgs in SAND								

Logged By: TA **Input By:** KL

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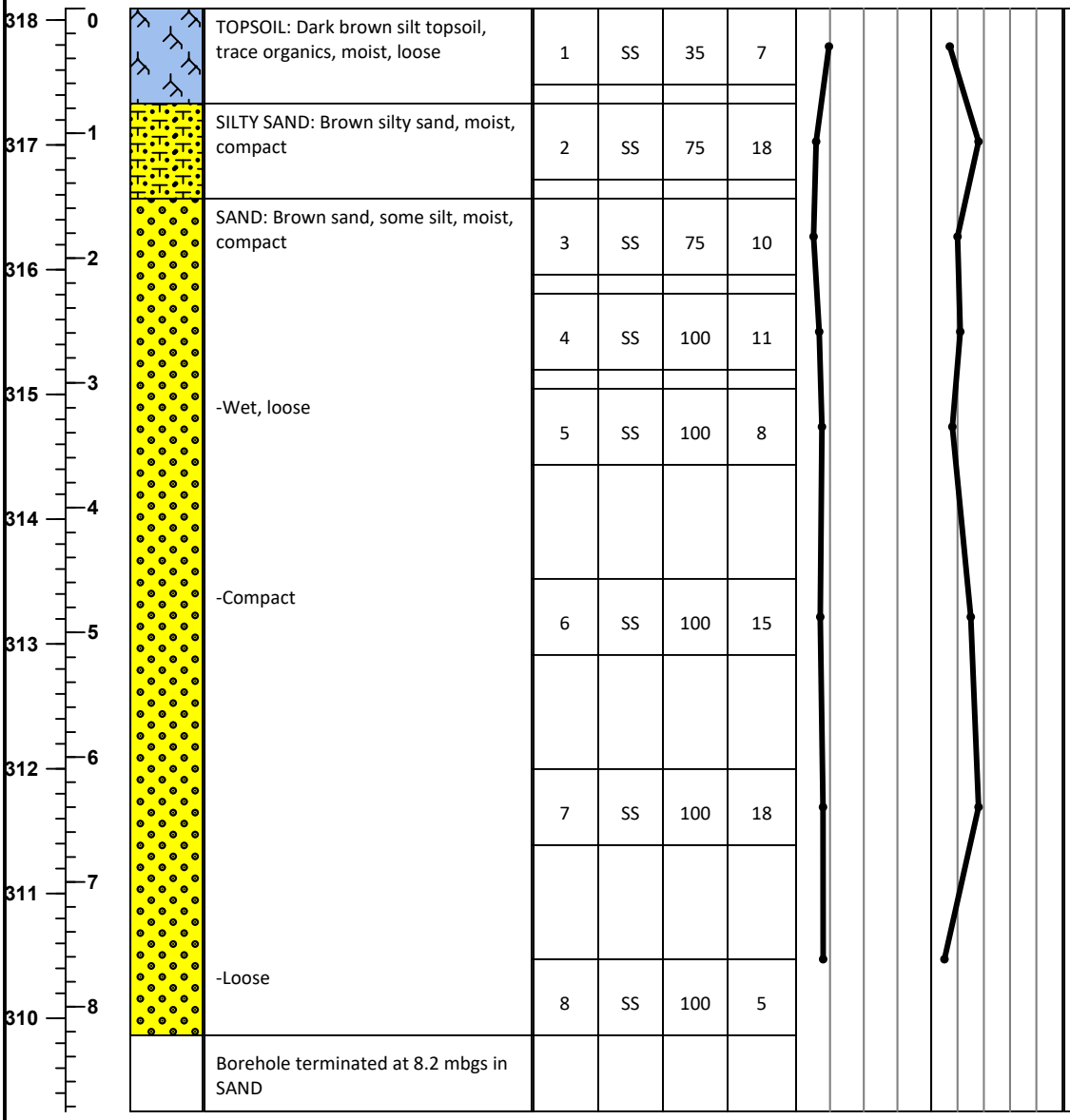
Log of Borehole: BH102-22

Client:	BT Engineering, London	**Project Name:**	Geotechnical Investigation	**Project No.:**	11969-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	January 20, 2022
Location:	Biehn Drive Extension	**UTM:**	17T 543728 E, 4803615 N	**Elevation:**	318.09 mASL

Elevation (m)	Depth	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
318	0	TOPSOIL: Dark brown silt topsoil, trace organics, moist, loose	1	SS	35	7		
317	1	SILTY SAND: Brown silty sand, moist, compact	2	SS	75	18		
		SAND: Brown sand, some silt, moist, compact	3	SS	75	10		
316	2		4	SS	100	11		
315	3	-Wet, loose	5	SS	100	8		
314	4							
		-Compact	6	SS	100	15		
313	5							
312	6		7	SS	100	18		
311	7							
		-Loose	8	SS	100	5		Water level at 3.0 mbgs upon completion
310	8	Borehole terminated at 8.2 mbgs in SAND						



Logged By: TA **Input By:** KL

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Log of Borehole: BH103-22

Client:	BT Engineering, London	**Project Name:**	Geotechnical Investigation	**Project No.:**	11969-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	January 21, 2022
Location:	Biehn Drive Extension	**UTM:**	17T 543729 E, 4803568 N	**Elevation:**	318.67 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
318 / 0		TOPSOIL: Dark brown silty topsoil, some organics, moist, loose	1	SS	100	8				
318 / 1		SAND: Light brown sand, moist, loose	2A	SS	75	7				
			2B	SS						
317 / 2		-Trace gravel, compact	3	SS	100	30				
316 / 3		-some gravel, dense	4	SS	75	44				
315 / 4		-Wet, compact	5	SS	50	29				
314 / 5		-trace gravel	6	SS	100	29				
313 / 6		-Saturated, dense	7	SS	100	44				
312 / 7										
311 / 8		-Grey	8	SS	100	33				Water level at 4.6 mbgs upon completion
310		Borehole terminated at 8.2 mbgs in SAND								

Logged By: TA **Input By:** KL

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Log of Borehole: BH104-22

Client:	BT Engineering, London	**Project Name:**	Geotechnical Investigation	**Project No.:**	11969-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	January 20, 2022
Location:	Biehn Drive Extension	**UTM:**	17T 543741 E, 4803522 N	**Elevation:**	319.86 mASL

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
	-1							Cap	
320	0		TOPSOIL: Dark brown silt topsoil, trace organics, trace brick, moist, loose	1	SS	100	9	Monument	
319	1		SAND: Dark brown to brown sand, moist, loose	2	SS	100	2		
318	2			3	SS	100	10	PVC Riser Bentonite Plug	
317	3		-compact	4	SS	100	9		
316	4			5	SS	100	24		
315	5		-Brown, some gravel, trace silt and clay, wet, very dense	6	SS	100	51	Water level at 4.15 mbgs on Feb 04, 2022 Sand Pack PVC Screen	GSA SS6: 16% Gravel 73% Sand 9% Silt 2% Clay
314	6		-Dense	7	SS	100	30		
313	7							Cap	
312	8		-Saturated	8	SS	100	36		Borehole open and dry upon completion
			Borehole terminated at 8.2 mbgs in SAND						

Logged By: TA **Input By:** KL

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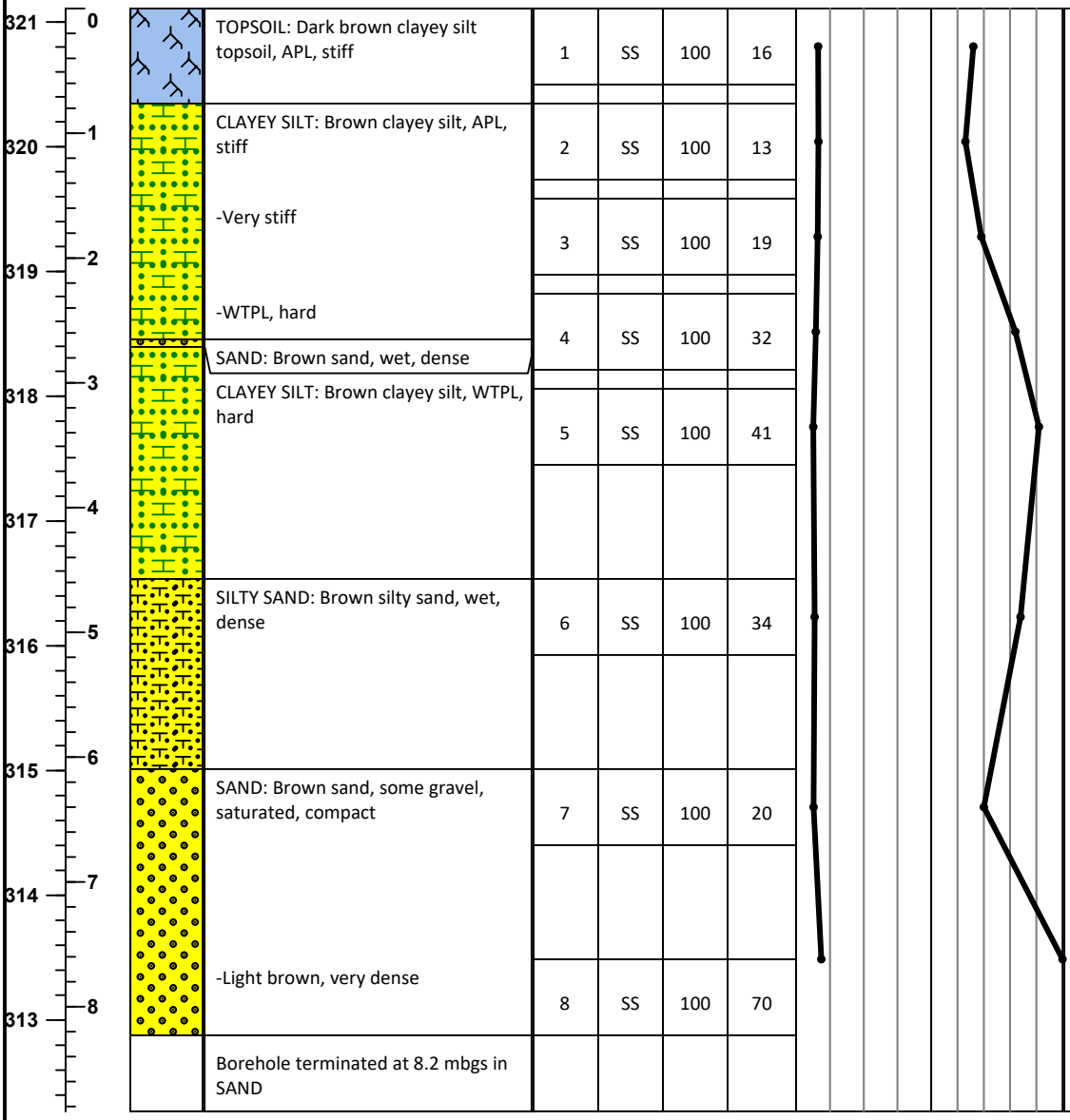
Log of Borehole: BH105-22

Client:	BT Engineering, London	**Project Name:**	Geotechnical Investigation	**Project No.:**	11969-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	January 21, 2022
Location:	Biehn Drive Extension	**UTM:**	17T 543758 E, 4803444 N	**Elevation:**	321.11 mASL

Elevation	Depth (m)	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
321	0		TOPSOIL: Dark brown clayey silt topsoil, APL, stiff	1	SS	100	16		
320	1		CLAYEY SILT: Brown clayey silt, APL, stiff	2	SS	100	13		
			-Very stiff	3	SS	100	19		
319	2		-WTPL, hard	4	SS	100	32		
			SAND: Brown sand, wet, dense						
318	3		CLAYEY SILT: Brown clayey silt, WTPL, hard	5	SS	100	41		
317	4								
			SILTY SAND: Brown silty sand, wet, dense	6	SS	100	34		
316	5								
315	6		SAND: Brown sand, some gravel, saturated, compact	7	SS	100	20		
314	7								
			-Light brown, very dense	8	SS	100	70		Water level at 4.6 mbgs upon completion
313	8		Borehole terminated at 8.2 mbgs in SAND						



Logged By: TA **Input By:** KL

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Log of Borehole: BH106-22

Client:	BT Engineering, London	**Project Name:**	Geotechnical Investigation	**Project No.:**	11969-001
Contractor:	Drilltech	**Method:**	Solid Stem Auger	**Date Completed:**	January 21, 2022
Location:	Biehn Drive Extension	**UTM:**	17T 543750 E, 4803369 N	**Elevation:**	324.77 mASL

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
	-1							Cap	
325	0		TOPSOIL: Dark brown silt topsoil, some organics, moist, compact	1	SS	100	13	Monument	
324	1		SAND: Brown sand, some silt, trace gravel, trace clay, moist, compact	2	SS	100	20		
323	2			3	SS	100	19	PVC Riser Bentonite Plug	
322	3		-Dense	4	SS	100	27		GSA SS4: 3% Gravel 76% Sand 18% Silt 3% Clay
321	4			5	SS	100	39		
320	5		-No gravel, wet, compact	6	SS	100	19		
319	6			7	SS	100	29	Sand Pack PVC Screen	
318	7								
317	8		-Trace gravel	8	SS	100	23	Cap Well is dry on Feb 04, 2022	Borehole open and dry upon completion
316			Borehole terminated at 8.2 mbgs in SAND						

% Moisture: 25 50 75

SPT (N) / DCPT: 10 20 30 40

Logged By: TA **Input By:** KL

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Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.8 mASL
UTM: 17T **N:** 4803760 **E:** 543814

Log of Borehole: BH201-23
Page: 1 of 2
Date Completed September 29, 2023

Elevation (m) / Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa nat V. rem V. 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
312.8 — 0		**FILL:** (SP) SAND, some gravel; brown (FILL); non-cohesive, moist, loose		1	SS	50	8	4.9%	8		
312.3 — 0.5											
311.8 — 1				2	SS	0	13		13		Borehole caved to ~0.9 mbgs upon completion of drilling
			311.35								
311.3 — 1.5		**(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact	1.45	3	SS	100	16	14.2%	16		Borehole caved multiple times at ~1.5 mbgs during drilling.
310.8 — 2											
310.3 — 2.5				4	SS	75	13	16.9%	13		Groundwater level first encountered at ~2.3 mbgs during drilling
			309.83								
309.8 — 3		**(ML) sandy SILT:** (ML) Sandy SILT, trace clay; brown; non-cohesive, wet, compact	2.97	5	SS	75	10	20.5%	10		
			309.29								
309.3 — 3.5		**(ML) SILT:** (CL/ML) CLAY and SILT, trace sand, trace gravel; grey; cohesive, W~PL, stiff to firm	3.51								
308.8 — 4											
308.3 — 4.5		Cobbles removed during augering		6	SS	10	7	26.0%	7		
307.8 — 5											
307.3 — 5.5			307.16								
		(SM) SILTY SAND: (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact	5.64								
306.8 — 6											
306.3 — 6.5				7	SS	50	9	15.5%	9		
		Cobbles removed during augering									
305.8 — 7											
305.3			305.3								
			7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	1	6	46	47

1m = 24 units

Logged By: EC **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.8 mASL
UTM: 17T **N:** 4803760 **E:** 543814

Log of Borehole: BH201-23
Page: 2 of 2
Date Completed September 29, 2023

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI; 25 50 75; % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.); 20 40 60 80; SPT (N) 20 40 60 80	Well Installation	Log Notes
305.3 / 7.5		**(SM) SILTY SAND:** (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact (304.57)	8	SS	0	12	16.9%	12		
304.8 / 8										
304.3 / 8.5		Borehole terminated @ 8.2 mbgs (8.23) due to target depth achieved.								
303.8 / 9										
303.3 / 9.5										
302.8 / 10										
302.3 / 10.5										
301.8 / 11										
301.3 / 11.5										
300.8 / 12										
300.3 / 12.5										
299.8 / 13										
299.3 / 13.5										
298.8 / 14										
298.3 / 14.5										
297.8										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	1	6	46	47

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Tricone
Elevation: 312.6 mASL
UTM: 17T **N:** 4803766 **E:** 543859

Log of Borehole: BH202-23
Page: 1 of 2
Date Completed: August 1, 2023

SUBSURFACE PROFILE				SAMPLE							
Elevation (m) / Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI; % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80; SPT (N) 20 40 60 80	Well Installation	Log Notes
312.6 / 0		**ASPHALT:** ~70 mm thick	312.52 / 0.08							Cap	
312.1 / 0.5		**FILL:** (SP/GP) SAND and GRAVEL; brown (Granular Fill); non-cohesive, moist, compact to very loose		1	SS	45	25	4.9%	25		
311.6 / 1				2	SS	90	42	5.4%	42	Bentonite Plug	Groundwater level measured in monitoring well at a depth of ~0.95 mbgs on October 13, 2023
311.1 / 1.5				3	SS	45	20	6.8%	20		
310.6 / 2			310.16 / 2.44							Riser	Groundwater level first encountered at a depth of ~2.3 mbgs during drilling
310.1 / 2.5		**(SM) SILTY SAND:** (SM) SILTY SAND; light brown; non-cohesive, wet, very loose	309.7 / 2.9	4	SS	90	3	34.5%	3		
309.6 / 3		**(SW) SAND:** (SP) SAND, trace to some silt, trace clay, none to trace gravel/cobble; brown to light brown; non-cohesive, wet, loose to compact		5	SS	35	10	18.9%	10		
309.1 / 3.5											
308.6 / 4											
308.1 / 4.5				6	SS	65	22	15.4%	22	Sand Pack	
307.6 / 5											
307.1 / 5.5											
306.6 / 6				7	SS	100	11	16.8%	11	PVC Screen	
306.1 / 6.5											
305.6 / 7			305.51 / 7.09								
305.1		**(ML) SILT:** (ML) SILT, some sand; brown; non-cohesive, wet, compact	305.1 / 7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 5	0	80	17	3

1m = 24 units

Logged By: SN **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Tricone
Elevation: 312.6 mASL
UTM: 17T **N:** 4803766 **E:** 543859

Log of Borehole: BH202-23
Page: 2 of 2
Date Completed: August 1, 2023

SUBSURFACE PROFILE			SAMPLE						
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) — 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.1 — 7.5		**(ML) SILT:** (ML) SILT, some sand; brown; non-cohesive, wet, compact — 304.52	8	SS	100	13	23.8%	13	Sand Pack, PVC Screen	
304.6 — 8		Borehole terminated @ 8.1 mbgs due to target depth achieved. — 8.08								
304.1 — 8.5										
303.6 — 9										
303.1 — 9.5										
302.6 — 10										
302.1 — 10.5										
301.6 — 11										
301.1 — 11.5										
300.6 — 12										
300.1 — 12.5										
299.6 — 13										
299.1 — 13.5										
298.6 — 14										
298.1 — 14.5										
297.6										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 5	0	80	17	3

1m = 24 units

Logged By: SN **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 313 mASL
UTM: 17T **N:** 4803744 **E:** 543791

Log of Borehole: BH203-23
Page: 1 of 2
Date Completed September 29, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa nat V. rem V. 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
313	0		**(PT) PEAT:** PEAT, none to trace sand; black; non-cohesive, moist, very loose		1	SS	5	2	31.8%	2	Cap	Groundwater level measured in monitoring well at a depth of ~0.26 mbgs on October 13, 2023
312.5	0.5											
312	1				2	SS	40	2	33%	2		Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling
				311.55								
311.5	1.5		**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet, loose to compact	1.45	3	SS	60	9	16.9%	9	Bentonite Plug	
311	2										Riser	
310.5	2.5				4	SS	60	19	14.6%	19		Borehole caved to a depth of ~2.1 mbgs upon completion of drilling
				310.03								
310	3		**(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact	2.97	5	SS	50	13	15.2%	13		Groundwater first encountered at a depth of ~3.0 mbgs during drilling
309.5	3.5											
309	4											
308.5	4.5				6	SS	60	13	16.9%	13	Sand Pack	
308	5											
307.5	5.5										PVC Screen	
307	6											
306.5	6.5				7	SS	50	11	17.7%	11		
306	7										Cap	
305.5				305.5								
	7.5											

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 313 mASL
UTM: 17T **N:** 4803744 **E:** 543791

Log of Borehole: BH203-23
Page: 2 of 2
Date Completed September 29, 2023

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.5 / 7.5										
305 / 8		**(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact — 304.77	8	SS	60	12	15.6%	12		
		Borehole terminated @ 8.23 mbgs due to target depth achieved. — 8.23								
304.5 / 8.5										
304 / 9										
303.5 / 9.5										
303 / 10										
302.5 / 10.5										
302 / 11										
301.5 / 11.5										
301 / 12										
300.5 / 12.5										
300 / 13										
299.5 / 13.5										
299 / 14										
298.5 / 14.5										
298										

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.6 mASL
UTM: 17T **N:** 4803730 **E:** 543781

Log of Borehole: BH204-23
Page: 1 of 2
Date Completed September 28, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V. ✦ rem V. ⊕) — 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
312.6	0		**(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose	311.91 / 0.69	1	SS	5	3	21%	3		Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling
312.1	0.5		**(ML) SILT:** (ML) SILT and ASH; white to light grey, trace organic matter; cohesive, W~PL, very soft	311.58 / 1.02	2	SS	60	2	50.4%	2		
311.6	1		**(SW) SAND:** (SP) SAND, trace silt; grey; non-cohesive, wet, very loose	311.15 / 1.45								
311.1	1.5		**(SM) SILTY SAND:** (SM) SILTY SAND; brown, trace organics, oxidation stains; non-cohesive, moist, stiff	310.39 / 2.21	3	SS	65	10	17.6%	10		
310.6	2		**(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey; cohesive, W<PL, stiff	309.86 / 2.74	4	SS	75	9	17.6%	9		
310.1	2.5		**(ML) sandy SILT:** (ML) Sandy SILT, some clay; brown; non-cohesive, wet, loose		5	SS	75	7	19.8%	7		Groundwater first encountered at a depth of ~3.0 mbgs during drilling
309.6	3											
309.1	3.5											
308.6	4											
308.1	4.5				6	SS	60	13	20.3%	13		Borehole caved to a depth of ~4.6 mbgs upon completion of drilling
307.6	5											
307.1	5.5											
306.6	6											
306.1	6.5				7	SS	50	8	14.5%	8		
305.6	7			305.44								
305.1			**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact	305.1 / 7.16 / 7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	0	24	62	14

1m = 24 units

Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.6 mASL
UTM: 17T **N:** 4803730 **E:** 543781

Log of Borehole: BH204-23
Page: 2 of 2
Date Completed September 28, 2023

SUBSURFACE PROFILE			SAMPLE						
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI; % Moisture 25 50 75	Shear Strength Cu, kPa (nat V., rem V.); SPT (N) 20 40 60 80	Well Installation	Log Notes
305.1 / 7.5		**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact — 304.37	8	SS	25	19	15.3%	19		
304.6 / 8										
304.1 / 8.5		Borehole terminated @ 8.2 mbgs due to target depth achieved. — 8.23								
303.6 / 9										
303.1 / 9.5										
302.6 / 10										
302.1 / 10.5										
301.6 / 11										
301.1 / 11.5										
300.6 / 12										
300.1 / 12.5										
299.6 / 13										
299.1 / 13.5										
298.6 / 14										
298.1 / 14.5										
297.6										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 6	0	24	62	14

1m = 24 units

Logged By: EC **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.7 mASL
UTM: 17T **N:** 4803712 **E:** 543759

Log of Borehole: BH205-23
Page: 1 of 2
Date Completed September 28, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V. rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
312.7	0		**(PT) PEAT:** PEAT; black; non-cohesive, moist, loose	312.4 / 0.3	1	SS	10	3	77.8%	3		
312.2	0.5		**(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey to dark grey, some organic matter; cohesive, W<PL, very soft	312.01 / 0.69								
311.7	1		**(SM) SILTY SAND:** (SM) SILTY SAND, trace clay, trace gravel; brown; non-cohesive, wet compact to loose		2	SS	70	13	14.5%	13		Groundwater level at ~0.9 mbgs upon completion of drilling
311.2	1.5			310.92 / 1.78	3	SS	50	9	13.4%	9		
310.7	2		**(ML) SILT:** (ML/SP) SILT and SAND, some clay; brown to light brown; non-cohesive, moist, stiff									Borehole caved to ~2.1 mbgs upon completion of drilling
310.2	2.5				4	SS	60	8	16.9%	8		
309.7	3		**(SM) SILTY SAND:** (SM) SILTY SAND, trace to some clay; light brown to brown; non-cohesive, wet, compact	309.73 / 2.97	5	SS	85	11	17.9%	11		Groundwater first encountered at a depth of ~3.0 mbgs during drilling
308.7	4											
308.2	4.5				6	SS	50	19	19.5%	19		
307.7	5											
307.2	5.5											
306.7	6				7	SS	50	11	21%	11		
306.2	6.5											
305.7	7			305.54 / 7.16								
305.2			**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense	305.2 / 7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 4	0	38	44	18

1m = 24 units

Logged By: EC **Input By:** EC

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.7 mASL
UTM: 17T **N:** 4803712 **E:** 543759

Log of Borehole: BH205-23
Page: 2 of 2
Date Completed September 28, 2023

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa nat V. rem V. 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
305.2	7.5		**(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense		8	SS	50	9	14.6%	9		
304.7	8											
304.2	8.5											
303.7	9											
303.2	9.5			302.95	9	SS	0	34	14.8%	34		Second spoon completed in this sample depth due to low recovery
302.7	10		Borehole terminated @ 9.8 mbgs due to target depth achieved.	9.75								
302.2	10.5											
301.7	11											
301.2	11.5											
300.7	12											
300.2	12.5											
299.7	13											
299.2	13.5											
298.7	14											
298.2	14.5											
297.7												

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 4	0	38	44	18

1m = 24 units

Logged By: EC **Input By:** EC

CAMBIUM

Client: BT Engineering
Contractor: DrillTech Drilling
Project No.: 11969-002
Location: Biehn Drive, Kitchener

Project Name: Biehn Drive Trunk Sewer, Kitchener
Method: Track Mounted Solid Stem Auger
Elevation: 312.6 mASL
UTM: 17T **N:** 4803696 **E:** 543750

Log of Borehole: BH206-23
Page: 1 of 1
Date Completed September 30, 2023

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa (nat V. rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
312.6	0	**(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose	311.99	1	SS	5	2	65%	2	Cap	Groundwater level measured in monitoring well at a depth of ~0.19 mbgs on October 13, 2023
312.1	0.5										
		(ML) SILT: (ML) SILT, some clay, some sand; dark grey to grey, trace to no organics; cohesive, W~PL to W>PL, very soft to firm	0.61								
311.6	1			2	SS	10	2	18.9%	2	Bentonite Plug	Groundwater level at a depth of ~0.6 mbgs upon completion of drilling
311.1	1.5									Riser	
				3	SS	20	1	27.7%	1		
310.6	2										
310.1	2.5			4	SS	50	5	15.8%	5		Groundwater level at a depth of ~2.3 mbgs during drilling
			309.91								
		(SM) SILTY SAND: (SM) SILTY SAND, some clay; brown; non-cohesive, wet, loose	2.69								
309.6	3		309.63								Borehole caved to a depth of ~3.0 mbgs upon completion of drilling
		(SW) SAND: (SP) SAND, some clay; brown; non-cohesive, very saturated, loose	2.97	5	SS	20	6	12%	6		
309.1	3.5									Sand Pack	
308.6	4										
308.1	4.5									PVC Screen	
				6	SS	0	9	18.1%	9		
307.6	5										
307.1	5.5		306.96								
		(SW) SAND: (SP/ML) SAND and SILT, trace clay, trace gravel; brown; non-cohesive, wet, compact	5.64								
306.6	6										
306.1	6.5		305.89	7	SS	50	15	19%	15		
		Borehole terminated @ 6.7 mbgs due to target depth achieved.	6.71								
305.6	7										
305.1											

1m = 24 units

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS 7	5	45	41	9
SS3	0	11	75	14

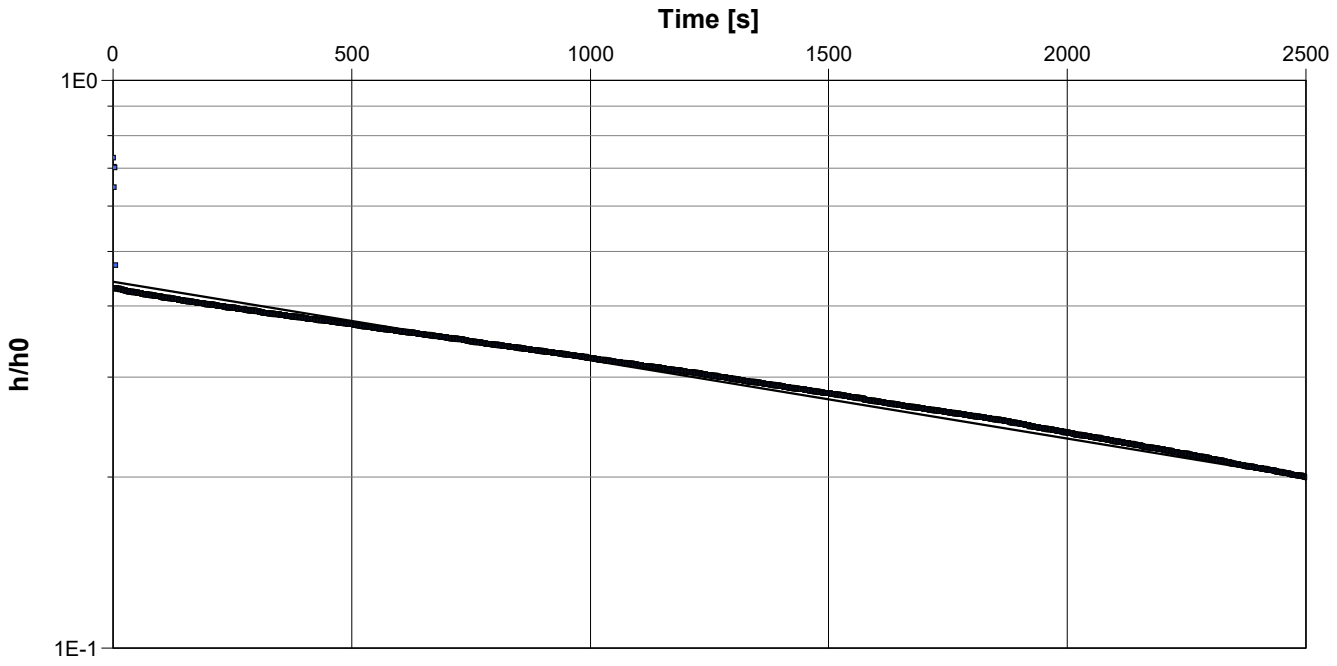
Logged By: EC **Input By:** EC

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Appendix E
SWHT Results

Cambium Inc. 135 Bayfield St #102, Barrie, ON L4M 3B3	**Slug Test Analysis Report**
	Project: Dewatering Assessment- Biehn Dr. Ext.
	Number: 11969-001
	Client: BT Engineering

Location: Biehn Drive, City of Kitchener	Slug Test: MW101-22	Test Well: MW101-22
Test Conducted by: Chris Malliaros		Test Date: 2/4/2022
Analysis Performed by:	Hvorslev	Analysis Date: 2/9/2022
Aquifer Thickness: 7.04 m		

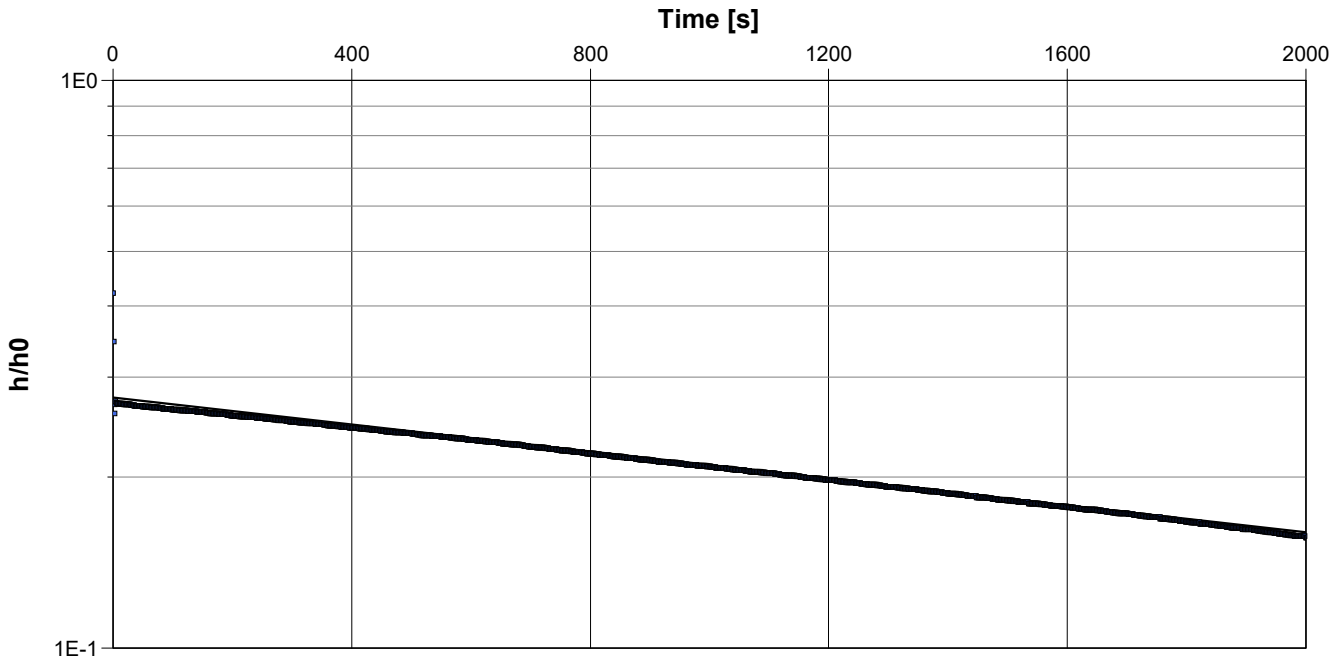


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-22	3.59×10^{-6}	

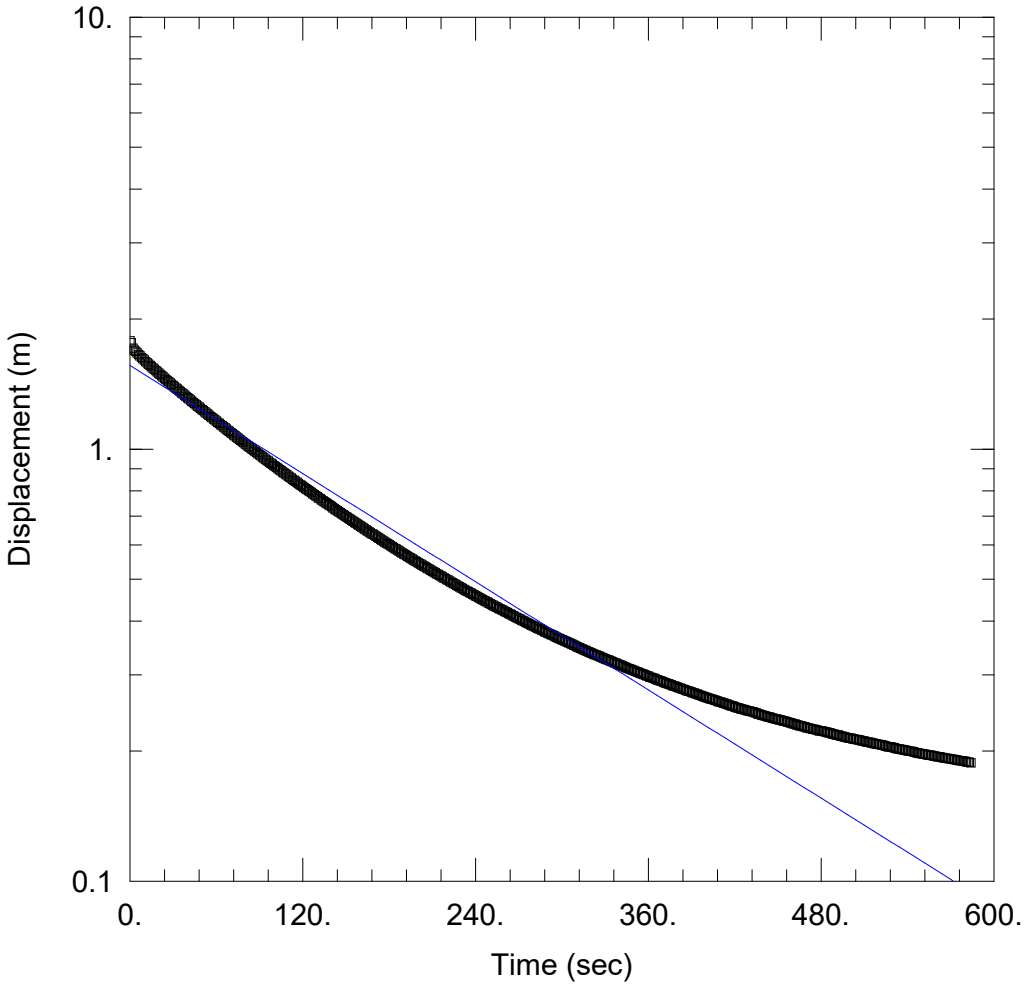
Cambium Inc. 135 Bayfield St #102, Barrie, ON L4M 3B3	**Slug Test Analysis Report**
	Project: Dewatering Assessment- Biehn Dr. Ext.
	Number: 11969-001
	Client: BT Engineering

Location: Biehn Drive, City of Kitchener	Slug Test: MW104-22	Test Well: MW104-22
Test Conducted by: Chris Malliaros		Test Date: 2/4/2022
Analysis Performed by: Sudhakar Kurli	Hvorslev	Analysis Date: 2/9/2022
Aquifer Thickness: 2.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW104-22	3.08×10^{-6}	



RISING HEAD TEST

Data Set:
Date: 10/23/23 Time: 13:11:09

PROJECT INFORMATION

Company: BT Engineering
Client: City of Kirchener
Project: 11969-002
Location: Biehn Dr, South Extension
Test Well: BH202-23
Test Date: 2023-10-11

AQUIFER DATA

Saturated Thickness: 7.06 m Anisotropy Ratio (Kz/Kr): 1.

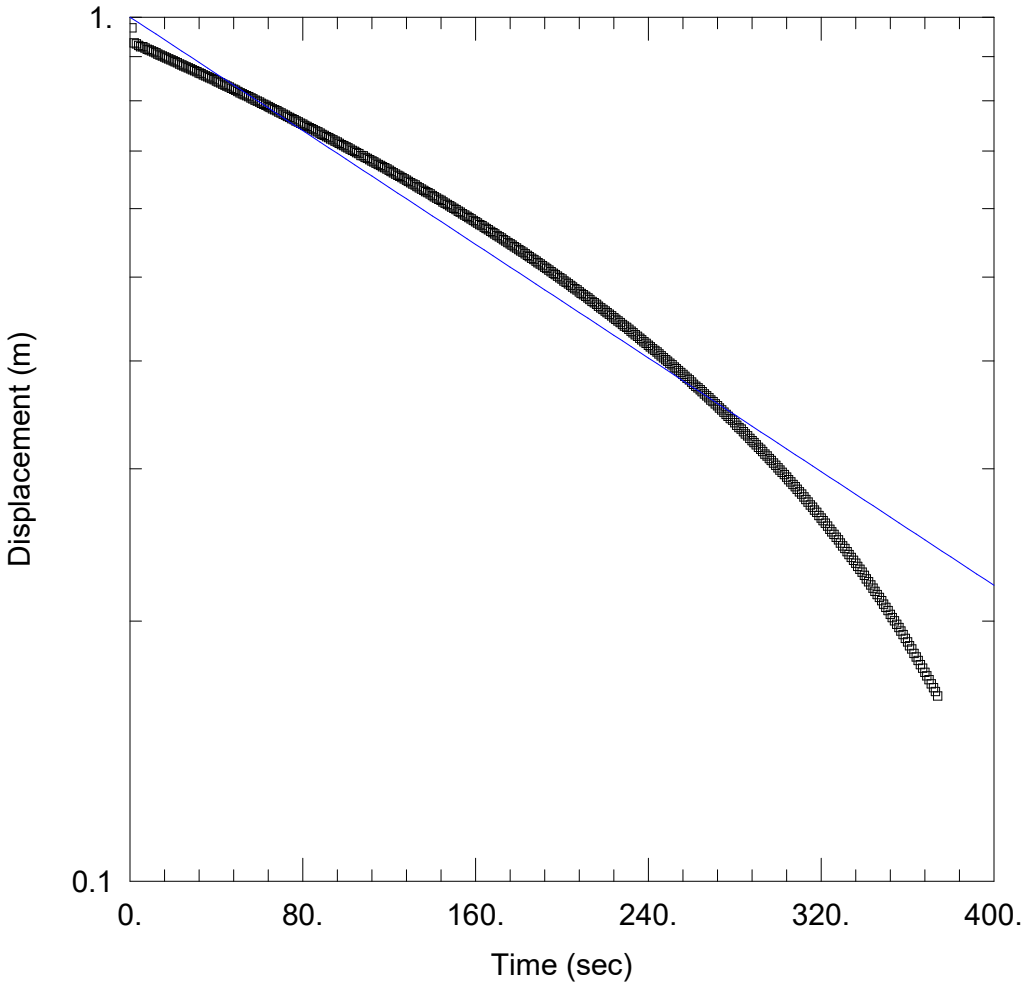
WELL DATA (BH202-23)

Initial Displacement: 1.78 m
Total Well Penetration Depth: 7.06 m
Casing Radius: 0.05 m
Static Water Column Height: 7.06 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.097E-5 m/sec y0 = 1.562 m



WELL TEST ANALYSIS

Data Set:
Date: 10/23/23 Time: 13:19:43

PROJECT INFORMATION

Company: BT Engineering
Client: City of Kirchener
Project: 11969-002
Location: Biehn Dr, South Extension
Test Well: BH203-23
Test Date: 2023-10-11

AQUIFER DATA

Saturated Thickness: 6.23 m Anisotropy Ratio (Kz/Kr): 1.

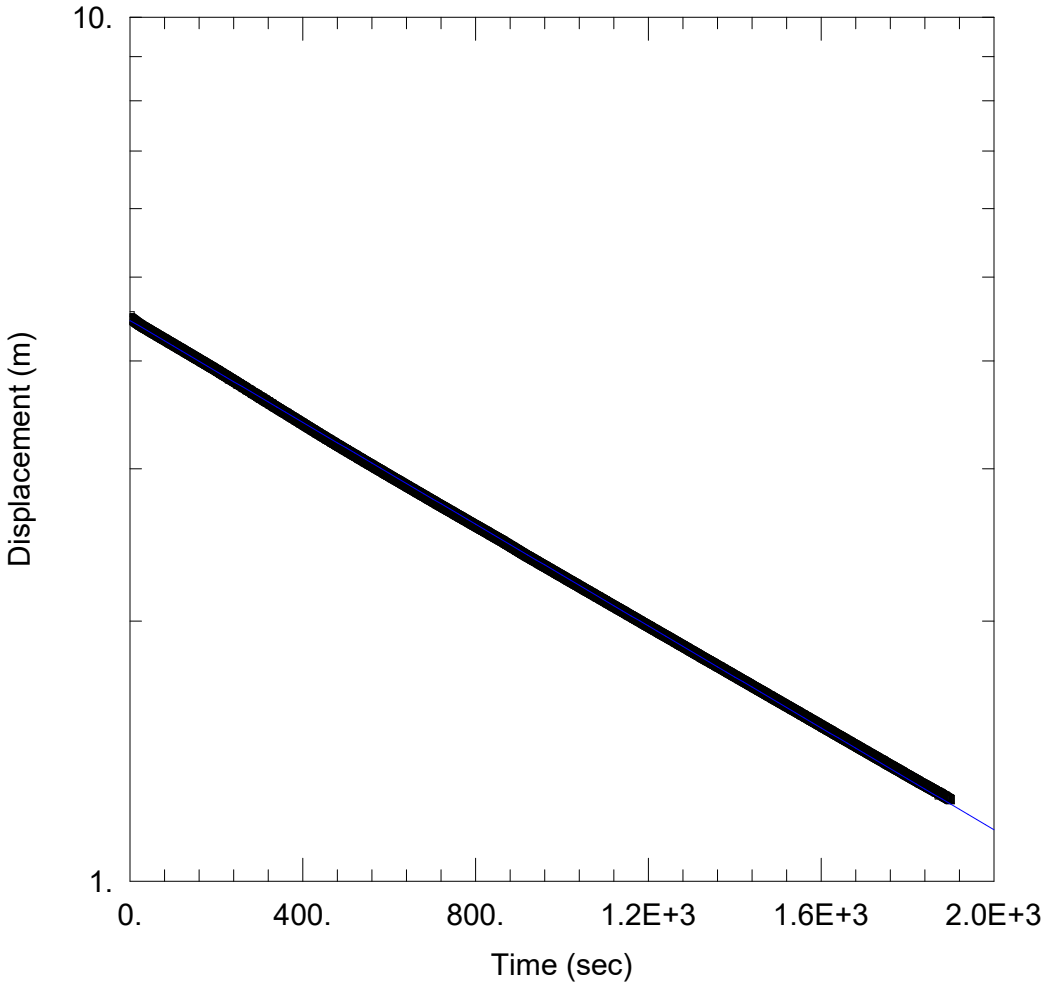
WELL DATA (BH203-23)

Initial Displacement: 1.36 m
Total Well Penetration Depth: 7.4 m
Casing Radius: 0.05 m
Static Water Column Height: 6.23 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 8.647E-6 m/sec y0 = 1. m



RISING HEAD TEST

Data Set:
Date: 10/23/23 Time: 13:43:13

PROJECT INFORMATION

Company: BT Engineering
Client: City of Kirchener
Project: 11969-002
Location: Biehn Dr, South Extension
Test Well: BH206-23
Test Date: 2023-10-11

AQUIFER DATA

Saturated Thickness: 5.59 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH206-23)

Initial Displacement: 4.51 m
Total Well Penetration Depth: 5.59 m
Casing Radius: 0.05 m
Static Water Column Height: 5.59 m
Screen Length: 3. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.55E-6 m/sec y0 = 4.455 m

Appendix F
Dewatering Estimates

DEWATERING CALCULATIONS - 50 m TRENCH SEGMENT

Modified Dupuit-Forchheimer Equation: unconfined flow into a linear excavation.
Calculations assume no flow boundary at aquifer base

Excavation Area		Initial depth to groundwater	Target Depth to groundwater	Depth to Base of Aquifer	Unit length of trench (a)	Width of Trench (b)	Hydraulic Conductivity (K)	s	R_o	$L = R_o/2$	$r_s = b/2$	$\ln(R_o/r_s)$ [If $r_s<R_o$] or $\ln((R_o+r_s)/r_s)$ [If $r_s>=R_o$]	H	h = H-s	Q_{ends}	Q_{trench}	Q_{total}		
		mbgs	mbgs	mbgs	m	m	m/s	m	m	m	m	-	m	m	m^3/s	m^3/s	m^3/s	L/s	L/d
Elongated Trench @ 50 m Increments	Min	4.04	11.5	12.0	50	2	1.15E-06	7.45	23.97	11.98	1.00	3.18	7.96	0.51	0.000072	0.000303	**0.000375**	**0.37**	**32,360**
	Max	4.04	11.5	12.0	50	2	1.10E-05	7.45	74.13	37.06	1.00	4.31	7.96	0.51	0.000506	0.000936	**0.001443**	**1.44**	**124,661**
	Avg	4.04	11.5	12.0	50	2	4.39E-06	7.45	46.83	23.41	1.00	3.85	7.96	0.51	0.000226	0.000592	**0.000818**	**0.82**	**70,658**

s = target drawdown (initial - target depth to groundwater) (m)
R_o = radius of influence of construction dewatering/pumping (m)
L = distance to line source (m)
r_s = equivalent single well radius (m)
H = Initial hydraulic head in aquifer (m)
h = hydraulic head at radius of well (m)
Q = construction dewatering rate (m^3/s)

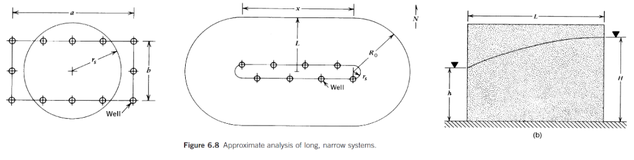


Figure 6.8 Approximate analysis of long, narrow systems.

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \quad (6.10b)$$

x = unit length of trench

$R_o = 3000*s*\sqrt{K}$

Source: Kyrieleis, W. and Sichardt, W. "Grundwasserabsenkung bei Fundierungsarbeiten" Springer, Berlin, 1930

Source: Powers, J. Patrick, et al. "Construction dewatering and groundwater control." (2007)

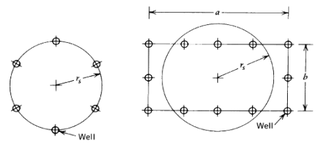
Dewatering Assessment, Biegn Drive Extension, City of Kitchener, Ontario
BT Engineering
Cambium Reference: 11929-002

DEWATERING CALCULATIONS - RECEIVING PIT

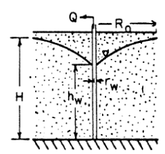
Modified Dupuit-Forchheimer Equation: unconfined flow into a rectangular excavation.
Calculations assume no flow boundary at aquifer base

Excavation Area		Initial depth to groundwater	Target Depth to groundwater	Depth to Base of Aquifer	Trench Length (a)	Trench Width (b)	Hydraulic Conductivity (K)	s	R_o	$r_s = \sqrt{(ab/\pi)}$	$\ln(R_o/r_s)$ [If $r_s<R_o$] or $\ln((R_o+r_s)/r_s)$ [If $r_s>=R_o$]	H	h_w = H-s	Q_{total}		
		mbgs	mbgs	mbgs	m	m	m/s	m	m	m	-	m	m	m^3/s	L/s	L/d
Rectangular trench with dimensions 6 m x 6 m	Minimum K	0	7.0	12.0	6	6	1.15E-06	7.00	22.52	3.39	1.90	12.00	5.00	**0.000227**	**0.23**	**19,602**
	Maximum K	0	7.0	12.0	6	6	1.10E-05	7.00	69.65	3.39	3.02	12.00	5.00	**0.001360**	**1.36**	**117,493**
	Geometric mean K	0	7.0	12.0	6	6	4.39E-06	7.00	44.00	3.39	2.56	12.00	5.00	**0.000640**	**0.64**	**55,287**

s = target drawdown (initial - target depth to groundwater) (m)
R_o = radius of influence of construction dewatering/pumping (m)
r_s = equivalent single well radius (m)
H = Initial hydraulic head in aquifer (m)
h = hydraulic head at radius of well (m)
Q = construction dewatering rate (m^3/s)



$$r_s = \sqrt{\frac{ab}{\pi}}$$



Radial flow, water table aquifer

$$Q_w = \frac{\pi K(H^2 - h_w^2)}{\ln R_o / r_w}$$

(from Table 6.1, pg 67)

*Use $r_w = r_s$ for rectangular excavations

$R_o = 3000*s*\sqrt{K}$

Source: Kyrieleis, W. and Sichardt, W. "Grundwasserabsenkung bei Fundierungsarbeiten" Springer, Berlin, 1930

Source: Powers, J. Patrick, et al. "Construction dewatering and groundwater control." (2007)

Appendix G

Laboratory Certificate of Analysis

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B22-03453

Report To:

Cambium Environmental
135 Bayfield Street, Unit 102
Barrie ON L4M 3B3
Attention: Sudhakar Kurli

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 04-Feb-22
DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:

P.O. NUMBER: 11969-001
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Alkalinity (as CaCO3)	1	Holly Lane	SYL	07-Feb-22	A-ALK-03 (o)	SM 2320B
Anions	1	Holly Lane	VK	08-Feb-22	A-IC-01 (o)	SM4110C
pH	1	Holly Lane	SYL	07-Feb-22	A-PH-01 (o)	SM 4500H
A - Wet Chem	1	Kingston	ach	07-Feb-22	A-TPTKN-001 (P)(k)	E3516.2
BOD	1	Kingston	bbr	07-Feb-22	C-BOD-001 (k)	SM 5210B
Metals - ICP-OES	1	Holly Lane	AHM	09-Feb-22	D-ICP-01 (o)	SM 3120
Metals - ICP-MS	1	Holly Lane	TPR	08-Feb-22	D-ICPMS-01 (o)	EPA 200.8

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Fax: 705-252-5746

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DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11969-001
WATERWORKS NO.

	Client I.D.		BH101-22				PWQO	
	Sample I.D.		B22-03453-1				Interim PWQO	PWQO
	Date Collected		04-Feb-22					
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		7.94					8.5
Alkalinity(CaCO3) to pH4.5	mg/L	5	241					
Hardness (as CaCO3)	mg/L	1	2990					
BOD(5 day)	mg/L	3	< 3					
Chloride	µg/L	500	11700					
Nitrite (N)	µg/L	50	320					
Nitrate (N)	µg/L	50	2610					
Nitrate + Nitrite (N)	µg/L	50	2900					
Phosphorus-Total	µg/L	10	**4890**				10	
Arsenic	µg/L	0.1	**26.6**				5	5
Cadmium	µg/L	0.015	**1.64**				0.1	0.2
Calcium	µg/L	20	976000					
Cobalt	µg/L	0.1	**66.5**				0.9	
Copper	µg/L	0.1	**207**				5	
Iron	µg/L	5	**130000**					300
Lead	µg/L	0.02	**153**				1	5
Magnesium	µg/L	20	135000					
Nickel	µg/L	0.2	**127**					25
Silver	µg/L	0.1	**0.4**					0.1
Sodium	µg/L	200	7200					
Thallium	µg/L	0.05	**0.80**				0.3	0.3
Uranium	µg/L	0.05	4.24				5	
Vanadium	µg/L	0.1	**120**				6	

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DATE RECEIVED: 04-Feb-22
DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11969-001
WATERWORKS NO.

	Client I.D.		BH101-22				PWQO	
	Sample I.D.		B22-03453-1				Interim PWQO	PWQO
	Date Collected		04-Feb-22					
Parameter	**Units**	**R.L.**						
Zinc	µg/L	5	**856**				20	30
Zirconium	µg/L	3	**19**				4	

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

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Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 04-Feb-22
DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11969-001
WATERWORKS NO.

Summary of Exceedances

Interim PWQO

BH101-22	Found Value	Limit
Zirconium (µg/L)	19	4
Zinc (µg/L)	856	20
Vanadium (µg/L)	120	6
Thallium (µg/L)	0.80	0.3
Phosphorus-Total (µg/L)	4890	10
Lead (µg/L)	153	1
Copper (µg/L)	207	5
Cobalt (µg/L)	66.5	0.9
Cadmium (µg/L)	1.64	0.1
Arsenic (µg/L)	26.6	5

Provincial Water Quality Objectives

BH101-22	Found Value	Limit
Zinc (µg/L)	856	30
Thallium (µg/L)	0.80	0.3
Lead (µg/L)	153	5
Nickel (µg/L)	127	25
Iron (µg/L)	130000	300
Cadmium (µg/L)	1.64	0.2
Arsenic (µg/L)	26.6	5
Silver (µg/L)	0.4	0.1

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Appendix K

Hydrological Investigation

BT ENGINEERING

TECHNICAL MEMORANDUM

TO: Steve Taylor, P.Eng. **OUR REF.:** SN0441

FROM: Leonardo Sanchez, P.Eng. **DATE:** April 7, 2022

COPY: Katherine Scott, P.Eng.

RE: **City of Kitchener, Biehn Drive Extension**
Drainage and Stormwater Management

The purpose of this Technical Memorandum is to present the results of the Drainage and Stormwater Management Study for the Biehn Drive Extension EA.

Background Information

Hearthwood Subdivision, Detailed Stormwater Management Design Report, Stantec Consulting Ltd., September 1999.

This report provides the stormwater management design for the subdivision and the existing stormwater management facility. The subdivision extent as it was originally planned in 1999 is shown in Figure 1. Only a part of the subdivision was constructed.

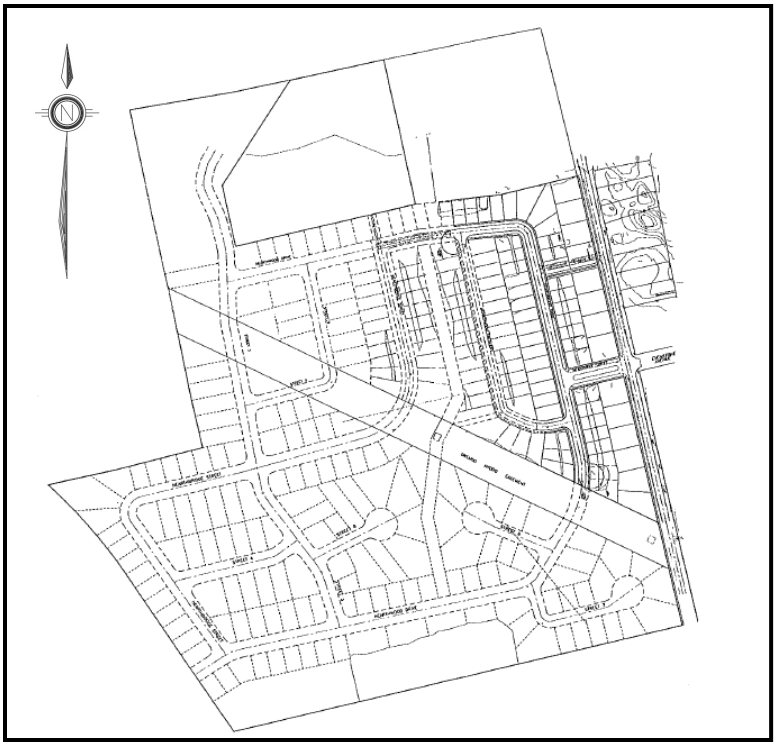


Figure 1 - Hearthwood Subdivision - June 1999

The stormwater management wetland SWM facility was designed, according to the 1999 report, to provide control of post-development flows and runoff volumes for all events up to and including the 5-year storm event for a total developed land area of 37.75 ha, and to provide control of all storms greater than the 5-year storm event, up to the 100-year storm event, for a total of 44.4 ha.

The stormwater management criteria used for the design are discussed below.

Water Quality and Watercourse Erosion Control

Due to the Provincially Significant Wetland that receives the runoff, Enhanced (Level 1) water quality protection was selected for the site.

The recommendation of the Strasburg Creek Master Watershed Plan (MWP) was to intercept through infiltration or extended detention the runoff generated by a 25 mm two-hour rainfall.

Also based on the MWP, runoff volumes and peak flows were to be controlled to pre-development values for the 5-year storm, to minimize the erosion potential of post-development flows.

The MWP also recommended providing 236 m^3 of extended detention for a hectare of development with a runoff coefficient of 0.55.

Stormwater Quantity Control

The Strasburg Creek MWP recommended control of the 25-year and 100-year storm events post-development volumes and peak flows to pre-development levels.

At-Source Infiltration

Based on the requirements of the MWP, infiltration was to be provided for 12 mm of runoff from impervious land uses within 4 days following each rainfall event.

Integrated Stormwater Management Master Plan (ISWM-MP), Aquafor Beech Ltd., May 2016

The purpose of the ISWM-MP was to serve as a decision support tool and methodology for the prioritization of works, and to provide the means for establishing stormwater management guidelines to 2030. It addressed existing urban areas of the City and recommended remedial measures to improve overall environmental performance, increases efficiencies and reduce costs. Although the ISWM-MP was not focused on new development, it provided guidance for future policies.

The report also recommended the City's current approach to stormwater management, which focuses on runoff prevention, natural system preservation, and provision of green infrastructure in combination with conventional SWM approaches. The report also addressed the effects of climate change and the methods to manage its impacts within the City.

The ISWM-MP has six elements that are the core of the plan:

a. Pollution prevention and municipal practices that can help to prevent impacts before they occur.
b. Supporting existing neighbourhoods, homes and businesses while managing stormwater

at the same time.

c. Improving the way local roads and laneways treat runoff by constructing Low Impact Development controls such as bioswales or perforated pipes as part of routine road works.
d. Maintaining and improving existing stormwater management facilities, as well as constructing new ones as part of park rehabilitations.
e. Restoring local creeks.
f. Better managing urban flooding particularly with the threat of climate change.

Stormwater Management Policy, Policy MUN-UTI-2003, approved November 21, 2016

This policy applies to all decision making related to any form of construction on municipal and private lands. The policy addresses:

a. Stormwater Infiltration in the context of source protection planning.
This component defines where and how LID controls can safely be implemented in the context of the approved source protection policy under the *Clean Water Act*.

b. Stormwater Volume Criteria and Targets
This component outlines the minimum stormwater volume criteria and the application of general stormwater management targets for new development, redevelopment, and linear projects.

c. Stormwater Management Fee
This component addresses the financial contributions required from proponents that cannot meet the stormwater management targets due to site restrictions (e.g. shallow bedrock, high groundwater, brownfields, etc.).

Existing Conditions

The study area is located within the Strasburg Creek watershed. The catchments draining to the end of the existing Biehn Drive are shown on **Figure 2**. Catchment EX1 drains directly to the provincially significant wetland, while Catchment EX2 drains to the outlet to the PSW via the existing Hearthwood stormwater management facility.

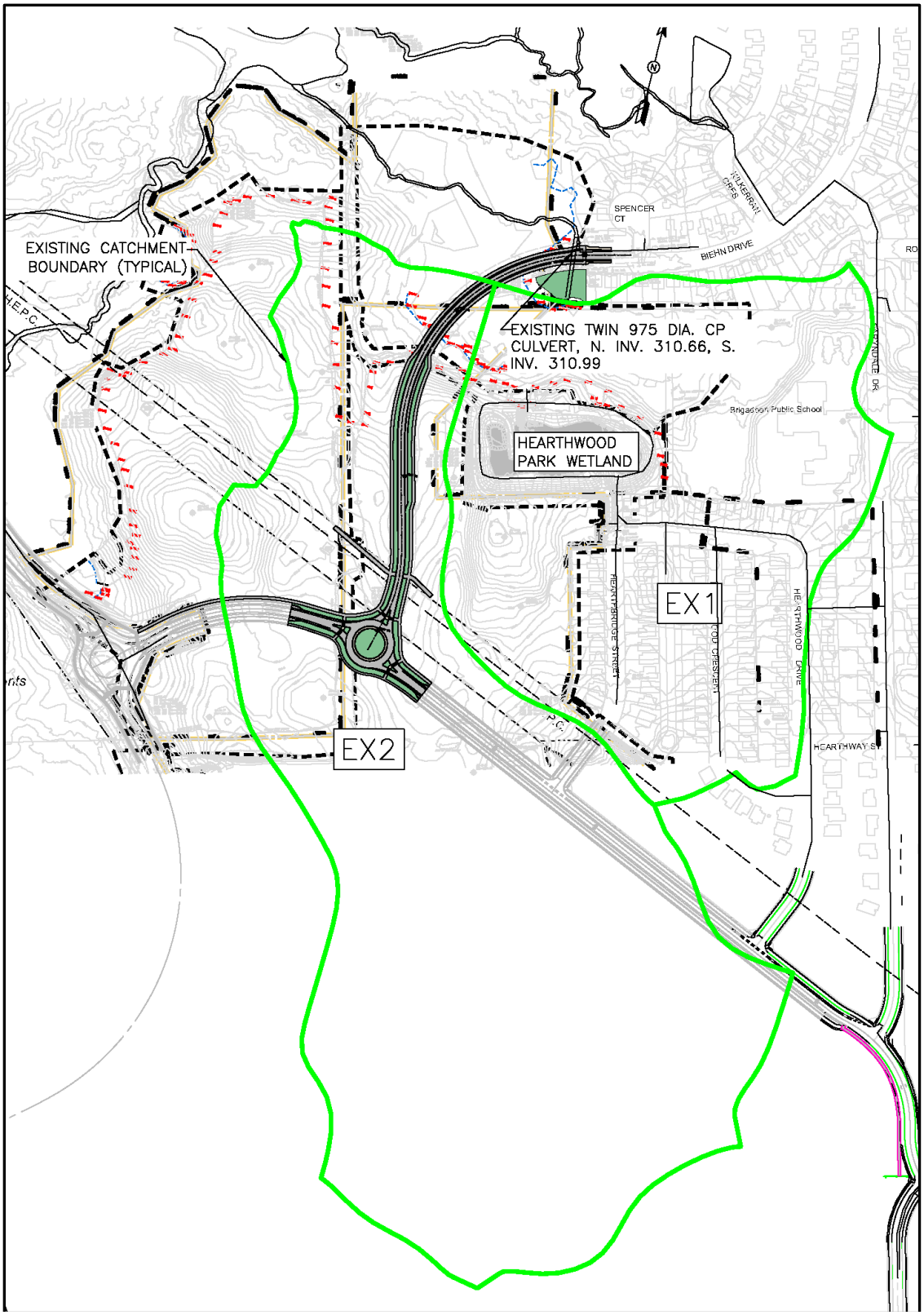


Figure 2 - Existing Catchments

Proposed Conditions

The future development, shown on **Figure 3**, includes part of the proposed Biehn Drive extension. Stormwater from the future development, including the length of Biehn Drive located therein, will be managed by directing runoff to the existing Hearthwood SWM wetland. It is understood that the SWM wetland will be modified if required to accommodate the runoff from the subdivision.

The proposed profile of the Biehn Drive extension is shown on **Figure 4**. The segment of Biehn Drive between the roundabout at Robert Ferrie Drive and Station 10+300 will drain to the existing Heathwood SWM wetland. From Station 10+300 to Station 10+532 (the connection to the existing Biehn Drive), the road will drain via a storm sewer to the outlet at the road sag.

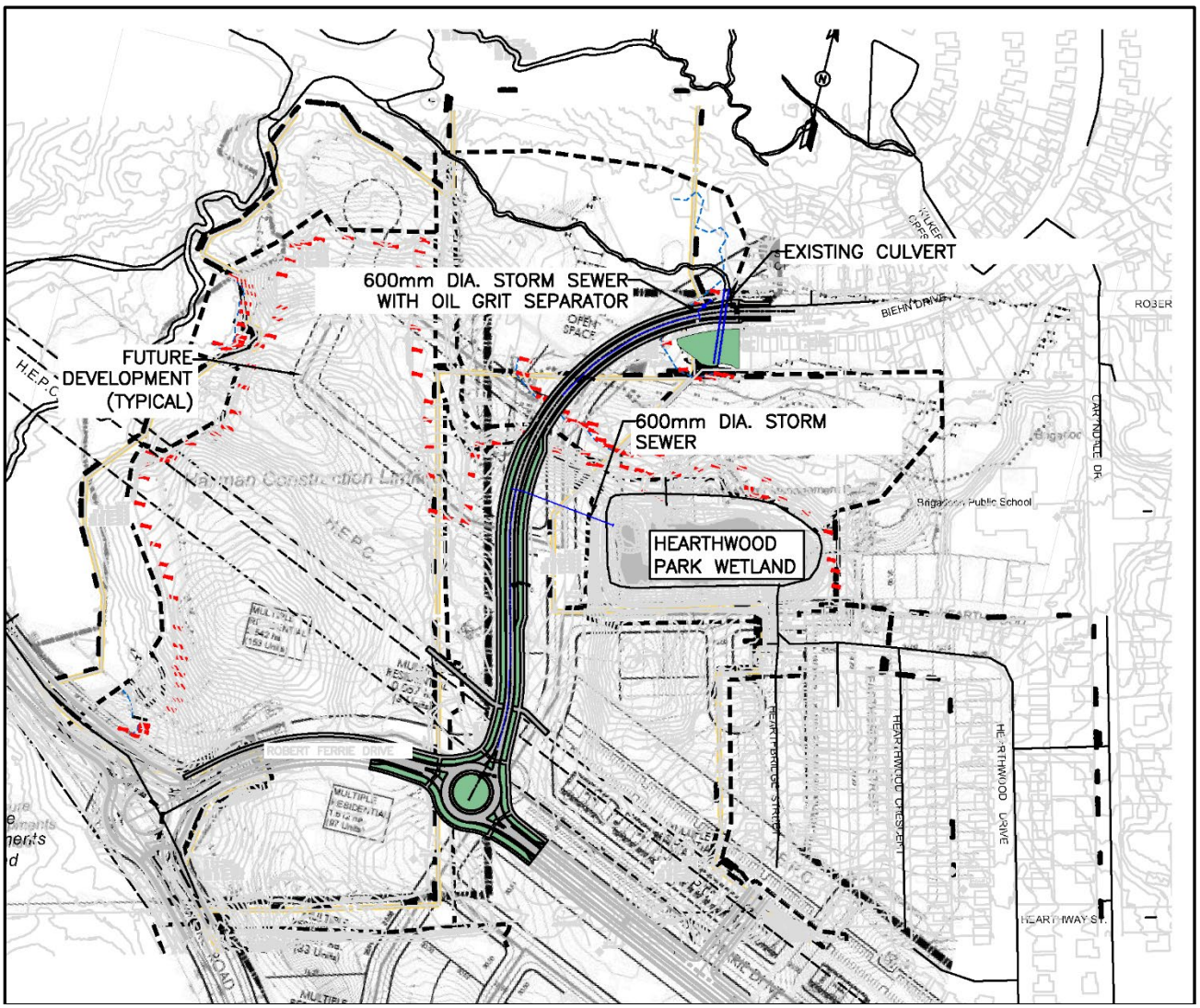


Figure 3 - Proposed Conditions

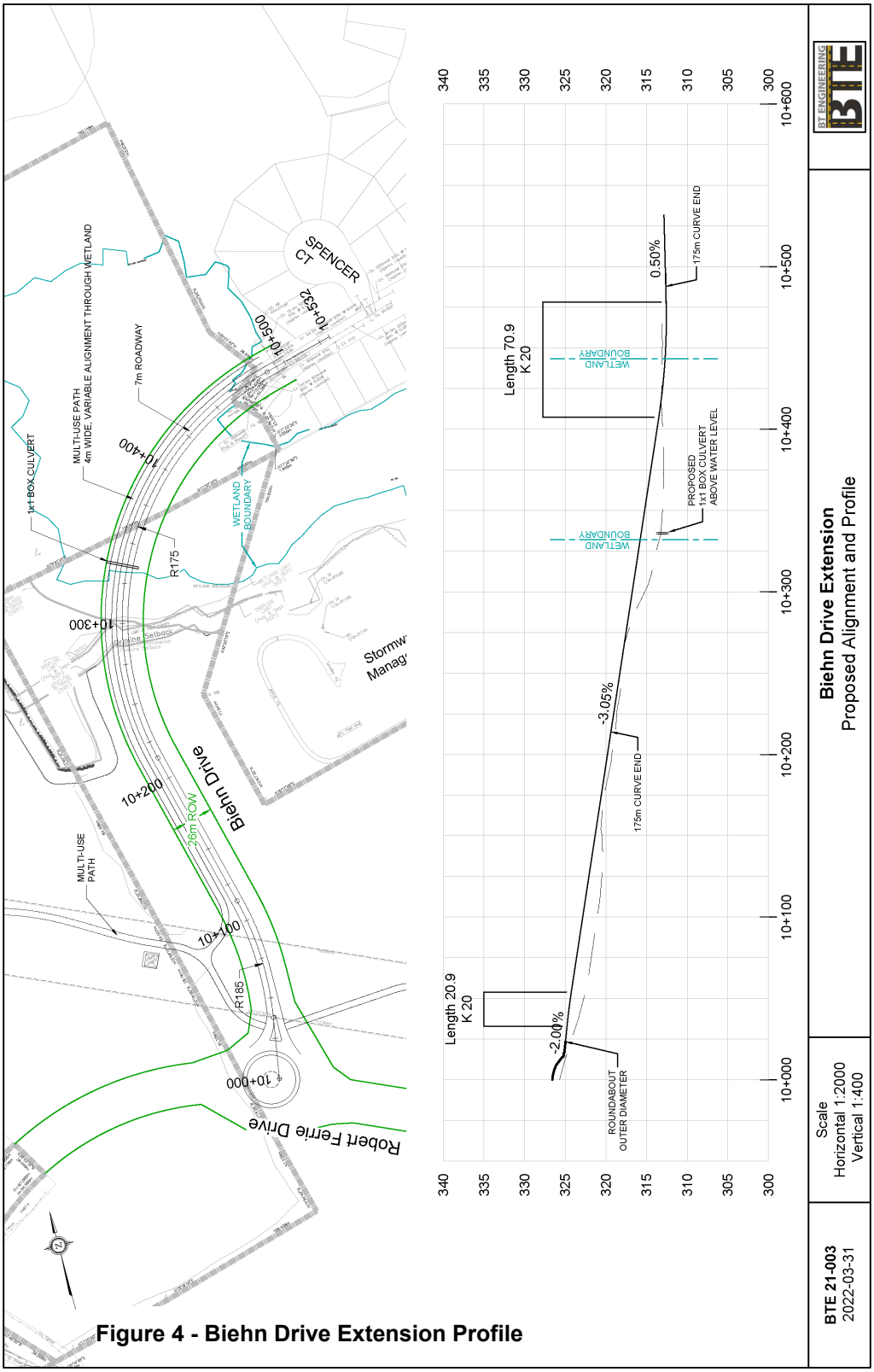


Figure 4 - Biehn Drive Extension Profile

Stormwater Management Measures

Station 10+000 to Station 10+300

The normal water level in the Hearthwood SWM wetland is 316.00 m. Therefore, it is proposed to provide a storm pipe to drain from the Biehn Drive extension to the pond. The proposed arrangement is shown on **Figure 5**. The peak flow for the 5-year storm is 210 l/s.

The 100-year storm peak flow is 392 l/s. It will be intercepted by providing inlets capable of conveying 200 l/s on each side of the road. Based on a road grade of 3.05%, double catch basins on each side of the road will be required to capture the 100-year storm flow into the proposed storm sewer.

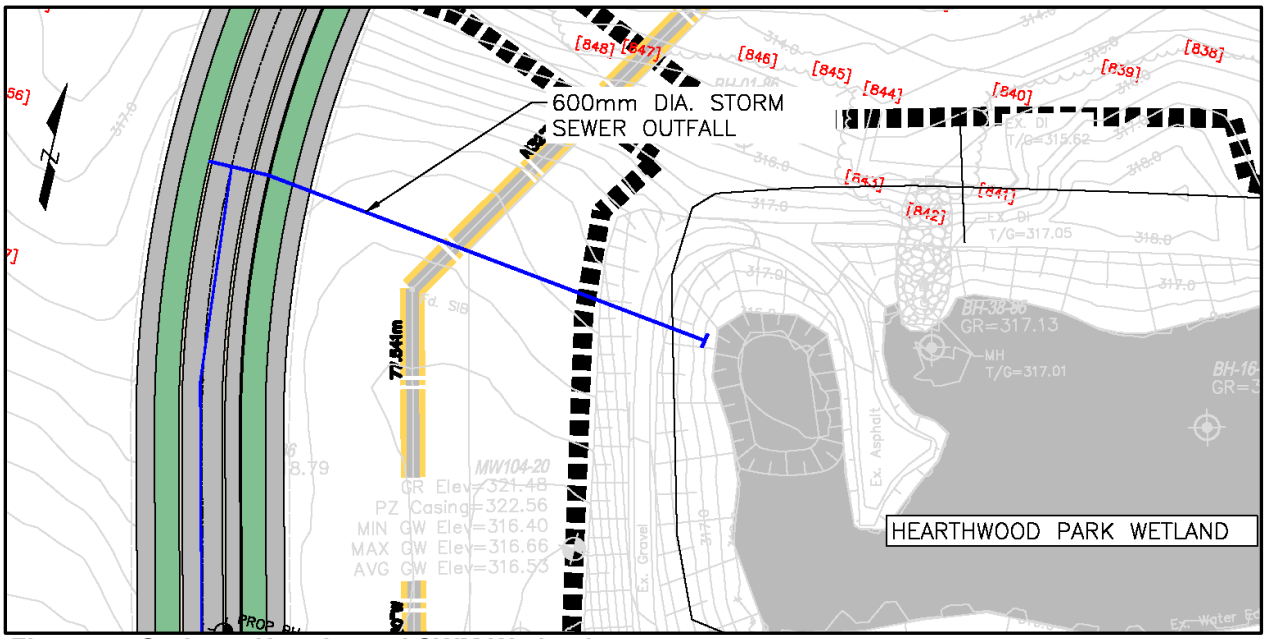


Figure 5 - Outlet to Hearthwood SWM Wetland

Station 10+300 to Station 10+532

The segment of road will require conveyance to the sag at Station 10+470±, where it will be discharged to the creek. There is no opportunity to provide stormwater quantity control for this road segment. However, it may be possible to reduce the effect of the pavement imperviousness by using permeable pavement in this segment. Stormwater quality control can be provided by discharging to the creek via an oil-grit separator. The proposed arrangement is shown in **Figure 6**.

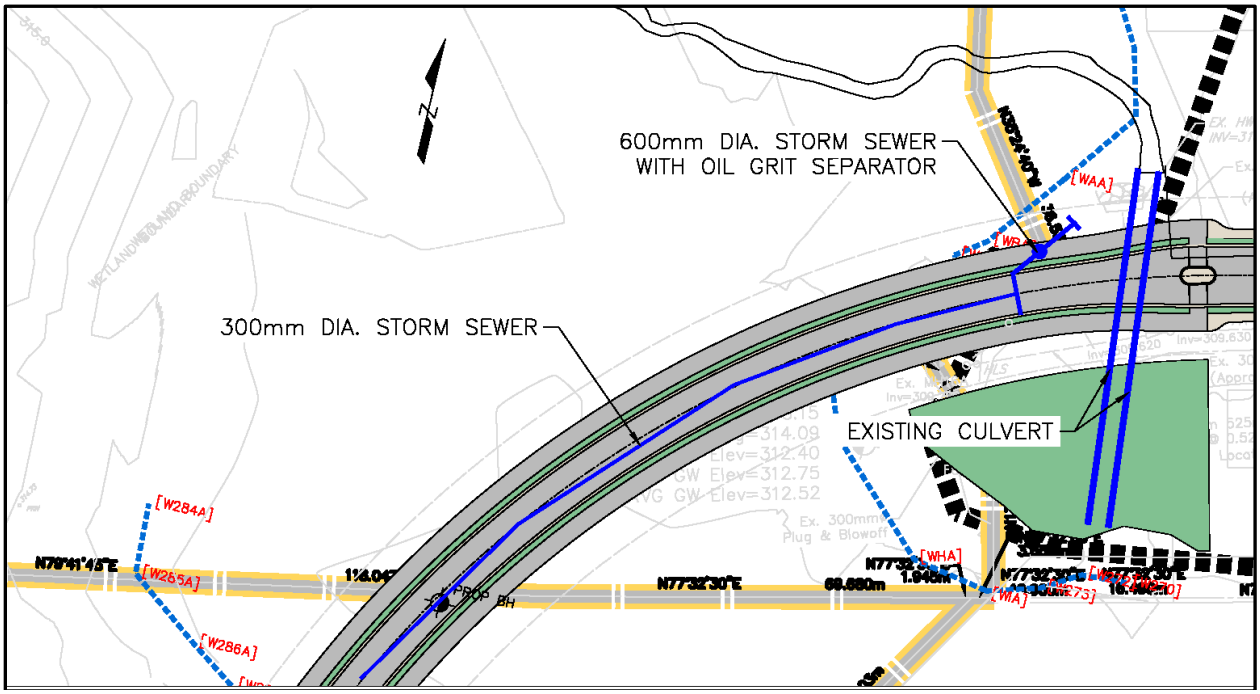


Figure 6 - Outlet to Creek

Conclusions and Recommendations

The following are the main conclusions of the Drainage and Stormwater Management study for the Biehn Drive Extension:

1. The existing Hearthwood Park SWM wetland can be used to provide stormwater quantity and quality control for the section of the Biehn Drive extension between Station 10+000 and Station 10+255. A storm sewer can be extended to direct the runoff up to the 100-year design storm flow to the SWM wetland.

2. From Station 10+255 to the connection to the existing Biehn Drive, the drainage from the proposed extension can be provided with stormwater quality by passing the flow through an oil-grit separator. However, it may be possible to provide additional storage and infiltration under the road.

It is recommended that the proposed drainage system be discussed with the City to obtain their agreement.

Prepared by

Leonardo Sanchez, P.Eng.

Sanchez Engineering Inc.

Appendix L

Council Resolution

BT ENGINEERING

Internal memo

Corporate Services Department

www.kitchener.ca

Date: March 9, 2023

To: E. Riek, Project Manager

From: M. Mills, Committee Administrator

cc: C. Reyes

Subject: Biehn Drive and Sanitary Trunk Sewer Extension Class Environmental Assessment (EA) - Environmental Study Report

This is to advise that City Council at its regular meeting held on Monday, February 27, 2023 passed the following resolution:

> “That the following motion be **deferred to the March 20, 2023 Council Meeting** to allow an opportunity to further review the scoring for alternative 4 outlined in the Environmental Assessment; the traffic demand needs for the community; alternative servicing and construction options; additional environmental impacts such as flooding and salt contamination; impacts on future development and housing supply; and, future construction of Robert Ferrie Drive:
>
> > "That the Biehn Drive and Trunk Sanitary Sewer Extension Class Environmental Assessment (EA) - Environmental Study Report (ESR), prepared by BT Engineering, dated January 18, 2023, be received; and, That the Biehn Drive and Trunk Sanitary Sewer Extension Environmental Study Report (ESR), be filed with the Ministry of the Environment Conservation and Parks (MECP) for the mandatory thirty (30) day review period as required by the Environmental Assessment (EA) Act, as outlined in Development Services Department report DSD-2022-188."

M. Mills

Summary/Conclusion of New Information Presented for March 20, 2023

by Bonnie Bender-Vargas

Re: Biehn Dr. Extension

Good Evening Mayor and Council Members.

Before I begin our conclusion, I would like to thank Councillors Chapman, Deneault, and Owodunni for joining us on the walking tour of our wetland and trails around the end of Biehn Dr., as well as Regional Councillor James and David Weber from the Green Party.

In summary, there is a solution that enables us to satisfy the needs of development with those of the environment and preserving our green space. The answer is simple: a combination of Alternatives 1 and 4 from the Environmental Study Report, where traffic is routed along Caryndale Drive and municipal services are installed using directional drilling – without the need for extending Biehn Drive through PSW-30.

This solution would:

- Safeguard the wetland, including its vegetation, streams and pond
- Protect wildlife such as the brook trout and other species, endangered or otherwise
- Prevent groundwater and drinking water contamination caused by salt runoff
- Maintain critical flood-prevention infrastructure and minimize insurance costs
- Respect the warnings and forecasts from the environmental experts … yes, we have a climate emergency. A lot has happened since the 30 years that this has been "on the books," and I would hope that elected officials execute plans based on the best, current data

The results of the "risk" solution, by extending Biehn Dr, seem to "split hairs" in that we really don't know what will happen to the wetland until it happens … then it's too late. But we do know for sure that:

- The wetland would absolutely and unavoidably, suffer damage from the construction of a trenched sewer and road extension
- Construction would be disruptive to wildlife during the process, and despite the proposed culvert, would almost certainly result in injuries and roadkill once traffic begins to flow.
- The brook trout would be affected, due to their well-known and data-backed sensitivity to salt runoff
- There is a huge concern of the impact of salt runoff on groundwater, which is a stated concern of the Region of Waterloo
- There is a real possibility of impact on the availability and cost of flood insurance in an already flood-prone area, should construction impact the wetland's ability to absorb storm water

Bulldoze and build, bulldoze and build. This is what some call progress.

I would define progress as working together with the City, its development interests, and local residents, to protect wetlands, in order to achieve the common goal: smart, and still profitable, development that maximizes preservation of green space for the benefit of all.

Trees filter air pollution and purify water. The more trees we remove, and wetlands we damage, the less filter we have. A CTV article from February 17, 2023, which was cross-posted to the front page of the Waterloo Region Record on February 27th, noted that Kitchener was ranked fourth out of the most polluted 16 Canadian cities, based on measurements of airborne fine particulate matter. This equates to each Kitchener resident inhaling 115 cigarettes per year, whether they want to or not. Paving wetlands results in irreversible damage for innumerable species of trees and wildlife, and, yes, including our own species.

Our presenters provided you with research from renowned experts to save the Wetland, including:

Dr. Nandita Basu, Professor Gail Krantzberg, and from the Government of Canada's heavily promoted video we watched earlier this evening. The Government's core thesis is that wetlands are a major line of defence in nature-based climate change solutions.

The City of Kitchener has been a leader and put itself on the map in so many ways, including the work with directional drilling on Dodge Drive. Let's continue that progress and not follow in the footsteps of Oakville, which is facing a class-action lawsuit from residents over water damage due to overzealous development. We can respect and be stewards of the Wetland, and yet continue to satisfy those who build and develop the infrastructure, roads, and buildings we need… just by looking at alternatives. There are always alternatives if we just work together and keep an open mind. Let's look at the using Caryndale Dr. as the traffic route to Robert Ferrie. Let's look at Directional Drilling.

As our mayor has stated in the past: "Build a better Kitchener together", "Work together with our citizens." With the many attendees joining us this evening, both in person and virtually, we, citizens of this City, ask that you be a leader when voting on this matter.

Thank You.

Thank you Mayor and council.

I am here to address the Biehn Dr. Extension project and speak to what us residents encounter having our houses in this wetland. It is my hope that with this information, you can make an informed decision that will not negatively impact the houses in the area.
We have lived in our house for 6 years and we learned quickly that our house and many others had water and flooding issues that dated back to the building of these houses. The first spring we were in the house, the basement flooded. We demo'ed the basement and left it for 2 years. In that time we had 3 additional floods. The constant presence of the water table against the concrete foundations causes regular cracks. Some homeowners have not been able to get insurance or have such high deductibles that it renders the insurance useless to protect them, such is my neighbours situation in which their deductible soared to $5000.
Every house in this area has sump pumps, usually 2 as back ups are needed. They regularly run even in the winter.

So what does this mean to you? And how can we as a city address these concerns?

Recently, a study from the University of Waterloo was published regarding the effects of climate change on the Canadian housing market. Its purpose was to inform home owners, mortgage lenders and municipalities. It examined whether catastrophic flooding affects house sold prices, days on market and number of listings. The 2 primary factors of climate change they noted was increased overall precipitation and loss of natural infrastructure (eg forests, grasslands and wetlands) which act as sponges. Among other detrimental effects to the market, the biggest and most notable finding was a 44.3% reduction in listings. As low level of listings is a significant factor in housing affordability, we should be mindful of that.

It gave 6 recommendations, one of which was directed specifically to governments. It was recommended to enforce guidelines and standards to retain and restore natural infrastructure to limit current and future flood risk. Many delegations have spoken on the harm that road construction will do to this area and was admitted by the consultants that this construction would likely raise the water table in the area. That's a concern not only for current residents but for the potential new ones. We don't want the city council to continue with the project after these many warnings from biologists, engineers, and residents alike. The implications of continuing this project in the suggested form with the full knowledge of how we and future homeowners will be negatively affected is arguably a big liability for council. There is currently a $1B class action suit by Oakville residents against the city and province claiming certain development made some homes into a flood plain that were previously not in one.
Should the water table rise and flood our homes are we prepared for the possibility of a class action law suit?
I urge you to consider the detrimental effects this project will have on us. There are many experts that agree with protecting wetlands: let's listen to them.

Biehn Drive Extension Presentation – Council Meeting March 20, 2023

Mayor and Council Members

My name is Kelli Kuzyk and I am a long-time resident of Brigadoon living on Caryndale Drive very close to Brigadoon School. A few weeks ago, I presented information regarding the changes and improvements I have personally seen in the local traffic flow in the Biehn and Caryndale Drive area.

Further to our presentations, concerns were raised by City Staff regarding better public transit and accessibility to the neighbourhood by emergency services — it is these two issues I will address tonight.

Brigadoon is a fully developed subdivision yet has always lacked good transit options since it was completed in 1989. Today, the closest bus stop for Brigadoon residents is on the corner of Biehn and Black Walnut Drives, about a 12 minute walk for many people in this area. We are aligned with the City that transit access should be expanded. Opportunities already exist to incorporate bus stops within Hearthwood Hills, a subdivision off of Caryndale Drive and to return the bus stop back onto Biehn Drive that was close to the intersection of Caryndale. Future opportunities also exist to put in new transit stops within the new development that is being planned with the goal of aligning all routes in the area, including those already present in the Doon South Community. We do believe with these improvements, we can link the various communities together and create a far better transit solution going forward.

(1st slide)

We also heard at the last Committee meeting concerns raised by the City about the inability of emergency services to fully access Biehn Drive south of Marl Meadow in the event of a road closure. I would like to refer you to the map on your screen with the streets outlined in pink. You will note that both Kilkerran and Robertson Crescents allow for ample access to Biehn Drive. Kilkerran connects with Biehn at two points, while Robertson Crescent enables a bypass of part of Biehn Drive using Caryndale. We believe that both these routes adequately meet the needs of emergency services to fully access Biehn Drive

appropriately without the need for the extension going through a wetland. Further, in the 35 years residents have lived in this area on Biehn Drive, we are not aware of any issue being reported where access was ever impeded.

(2nd slide)

In light of my remarks, we respectfully urge you to fully consider this new information presented tonight. Alternative 4 as shown on the map in purple will work well for the current and anticipated traffic flow connecting the various communities; the Alternative 1 route in yellow will address the need to put in the municipal services in conjunction with directional drilling but with no planned extension of Biehn Drive. We also shouldn't lose sight of the potential of enhancing the trail system in the new development to link to Brigadoon Woods without invasive measures. We know that the existence of lots of green space and trails is very attractive for potential homeowners.

Truly, this is a win-win solution for all parties, including the Developers and the wildlife in PSW-30, as well as Ward's Pond. It is the best solution for preserving our wetland and its habitat which is so precious to this area. It eliminates a great deal of liability and risk to the City should groundwater become contaminated, and should flooding and property damage ensue — damage that would no doubt result in lawsuits —AND it still allows for good traffic flow, new transit options, and adequate emergency services access.

Thank you for allowing our presence and voices to be seen and heard again. Thank you for keeping our environment at the forefront as you discuss and vote on this. Together we can implement a solution that is responsible, viable, but most importantly protects the wetlands that need protecting.

Tributaries and Confluences in the **Provincially Significant Wetlands** (PSW-30)

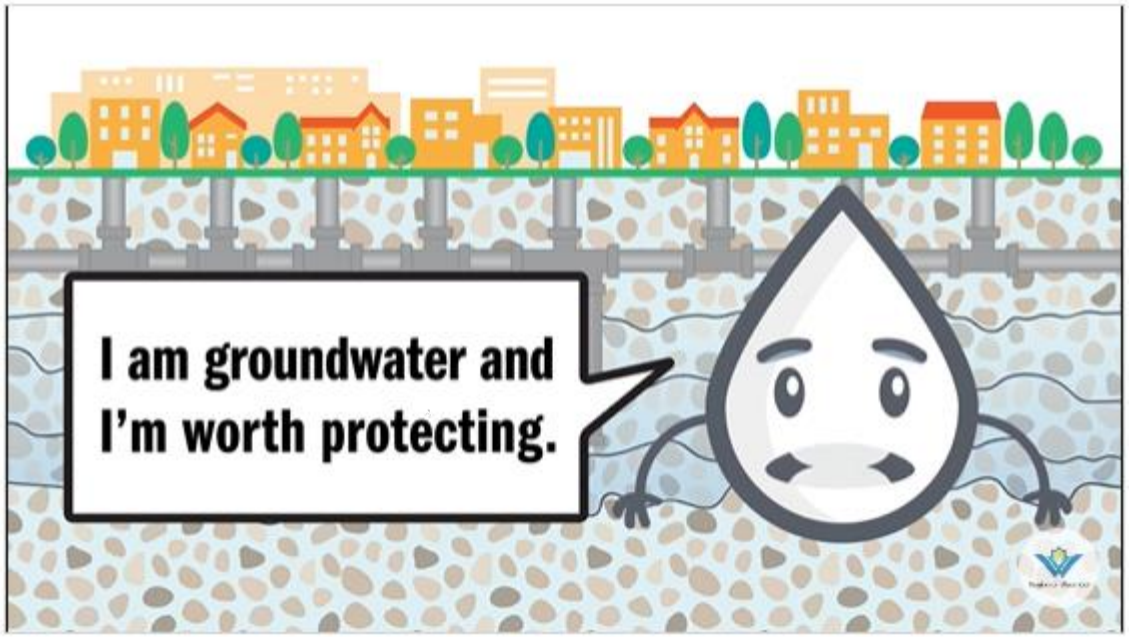
Protecting Natural Biodiversity in the PSW-30

In 2010, the City of Kitchener invested $2 million in the rehabilitation of Strasburg Creek and Wards Pond.

Project Success

Since its rehabilitation in the summer of 2010, Strasburg Creek has demonstrated significant improvements in aquatic environments within Strasburg Creek and Wards Pond.

Region of Waterloo Committed to Protecting Groundwater



Region of Waterloo website design

Region of Waterloo poster design

Wetland Discharge, Confluence, Tributary

Wetlands discharge water to the watershed.

Confluence: where two or more bodies of water meet, usually refers to the joining of tributaries.

Tributary: stream flowing into a larger river, pond, or lake

Dr. Nandita Basu, University of Waterloo
Professor & Canada Research Chair in Global Water Sustainability and Ecohydrology
Director, Collaborative Water Program
Civil and Environmental Engineering

Feb 6 2023, Podcast CBC Morning Edition KW

Small and Isolated Wetlands should be protected rather than paved over

> "They are so important because they catch the pollutant run-off from our farm fields, from our paved roads, and retain them, they hold onto them and that pollutant doesn't show up in our lakes, our rivers, our downstream water bodies. They are a big filter."

> "We found that if you have a small wetland that is in your neighbourhood or in your backyard, that actually can be twice as effective at retaining pollutants than the wetlands you can see near the lake."

> Once a wetland is gone, can it ever be brought back? ... "it takes hundreds of years"

> "Wetlands store carbon, and these functions take hundreds of years to develop."

> "When you see population increase, pollution increases. If you take away one in my neighbourhood and take away one your neighbourhood, over time the filtering ability of the landscape goes away so you get more pollutants in our beaches, in our lakes,... there's toxins in our drinking water from harmful algal blooms, and problem keeps increasing with the changing climate."

Dr. Nandita Basu, University of Waterloo
Professor & Canada Research Chair in Global Water Sustainability and Ecohydrology
Director, Collaborative Water Program
Civil and Environmental Engineering

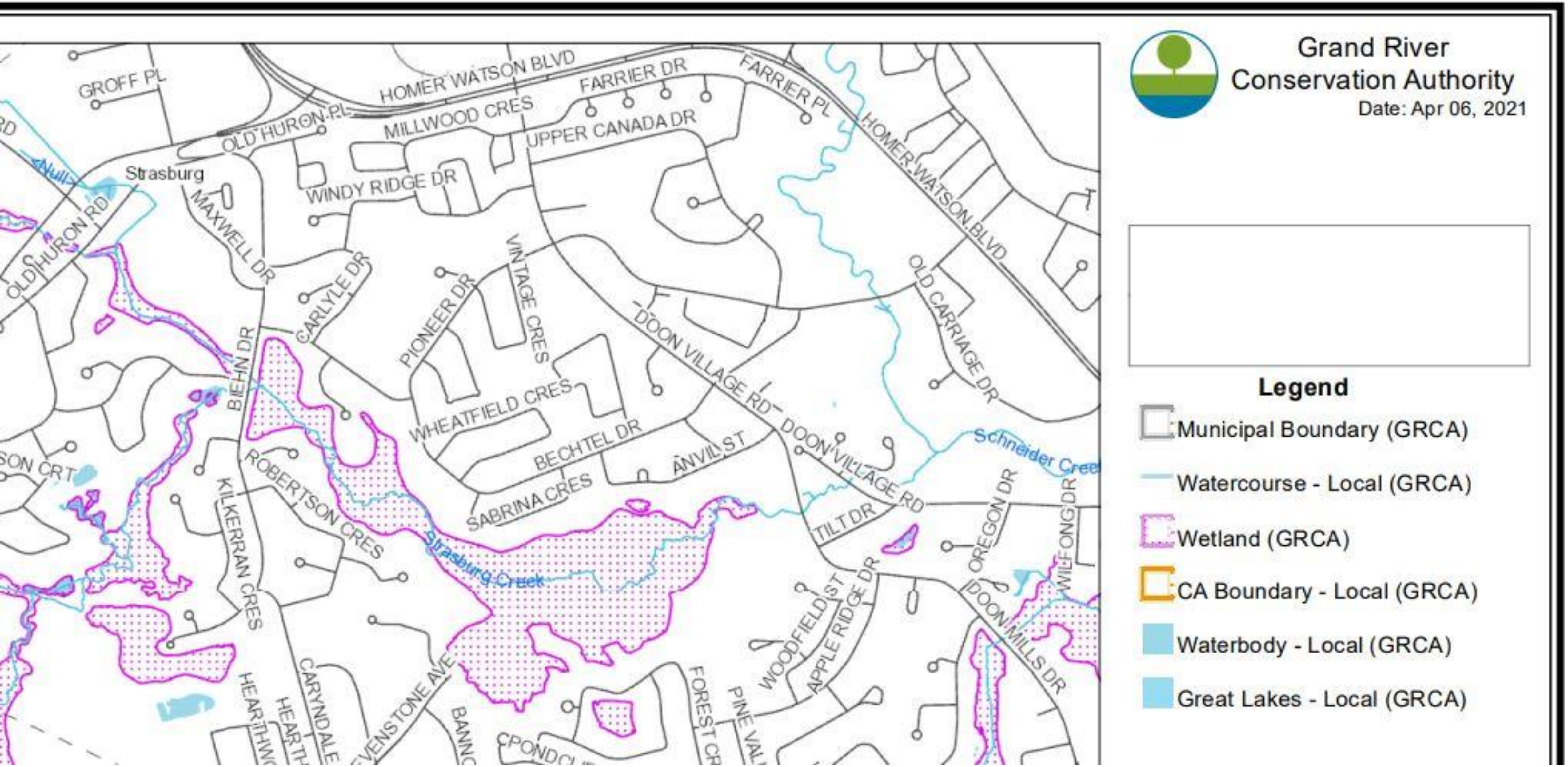
Feb 6 2023, Podcast CBC Morning Edition KW

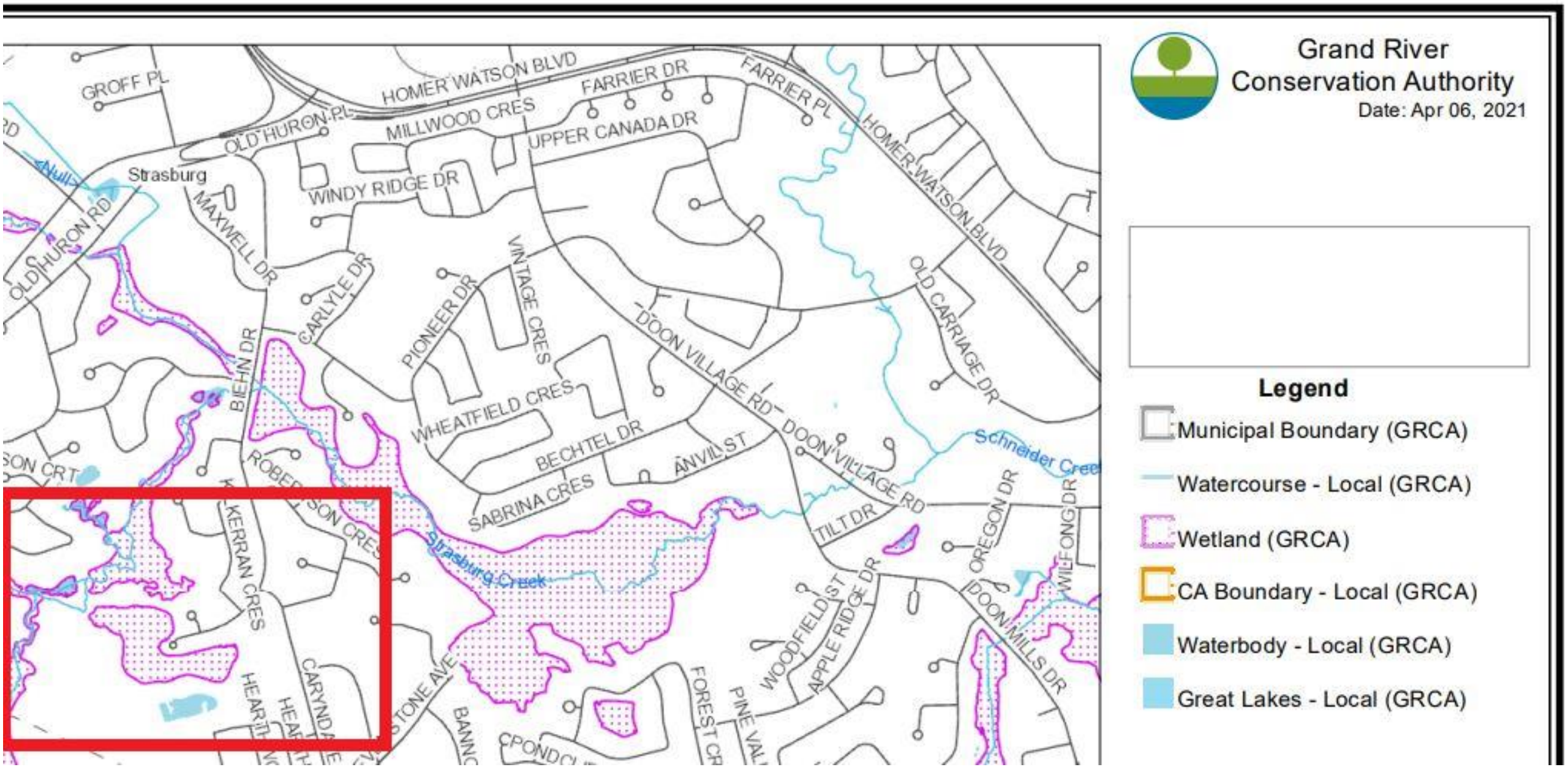
> “Sometimes they don't look the prettiest because they are cleaning your pollutants.”

Eric Hodgins, Manager Hydrogeology and Water Programs
Region of Waterloo

- "Our experience and observations is limited to the impacts to the Region's drinking water supply wells. With that being said, the additional road would require winter maintenance, and the application of salt both flows overland into stormwater basins and related wetlands as well as infiltrates into the groundwater. The degree to which it infiltrates or runs off at any location would be determined by the type of soils, grading, and construction profile of the road and could vary at different locations along a road length. The Region is not aware of these details for this road in part because there was no assessment of impact to source water conducted as part of the Environmental Assessment by the city."

Green=storm, blue=water


Grand River
Conservation Authority
Date: Apr 06, 2021
Legend
Municipal Boundary (GRCA)
Watercourse - Local (GRCA)
Wetland (GRCA)
CA Boundary - Local (GRCA)
Waterbody - Local (GRCA)
Great Lakes - Local (GRCA)
GROFF PL
HOMER WATSON BLVD
FARRIER DR
FARRIER PL
MILLWOOD CRES
UPPER CANADA DR
OLD HURON PL
Strasburg
WINDY RIDGE DR
MAXWELL DR
OLD HURON RD
CARLYLE DR
PIONEER DR
VINTAGE CRES
DOON VILLAGE RD
OLD CARRIAGE DR
BIEHN DR
WHEATFIELD CRES
BECHTEL DR
ANVIL ST
Schneider Cree
ROBERTSON CRES
KILKERRAN CRES
SABRINA CRES
TILT DR
OREGON DR
WILFONG DR
Strasburg Creek
WOODFIELD ST
APPLE RIDGE DR
DOON MILLS DR
CARYNDALE
FOREST CR
PINE VAL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SABRINA CRES
DOON VILLAGE RD
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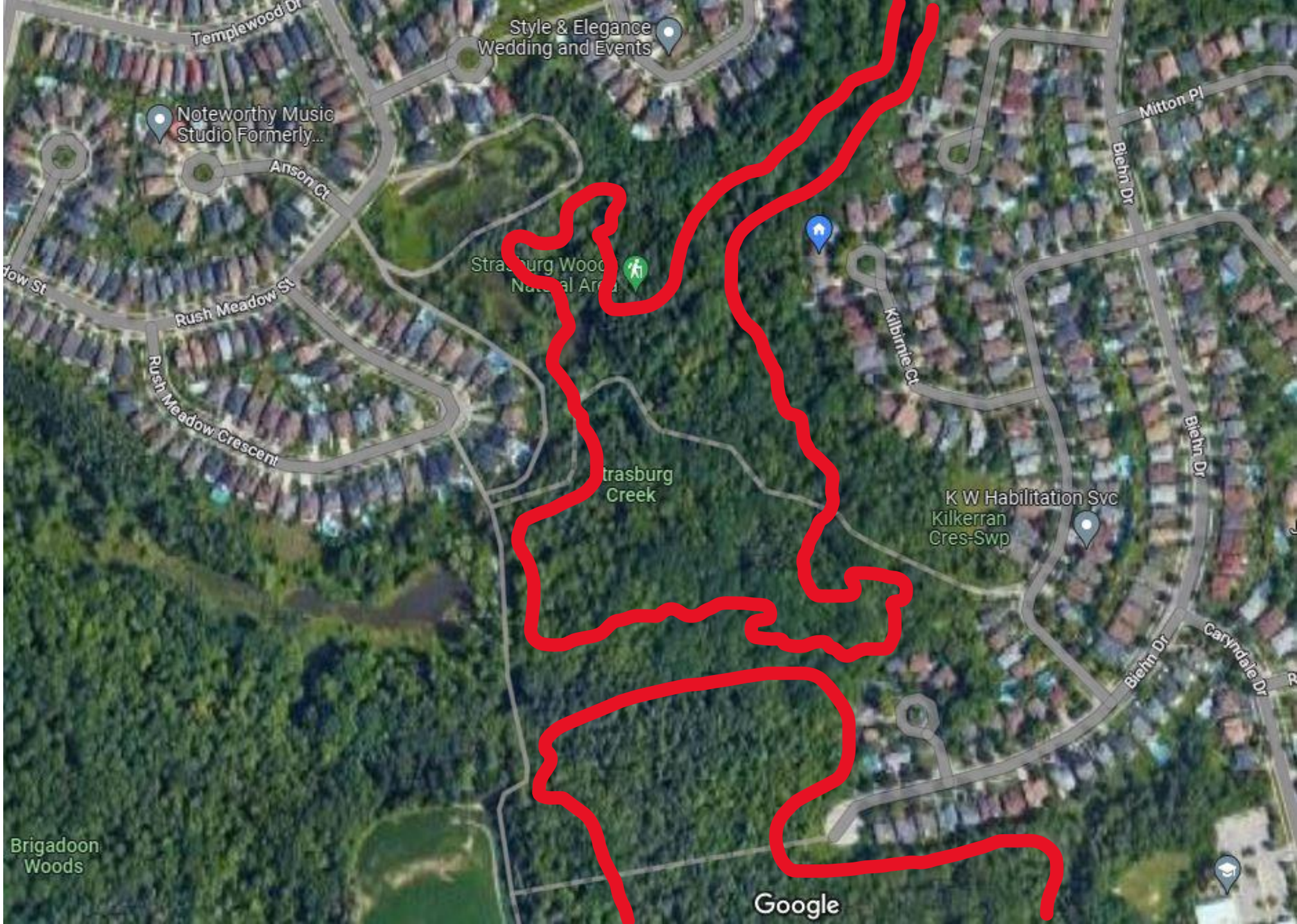
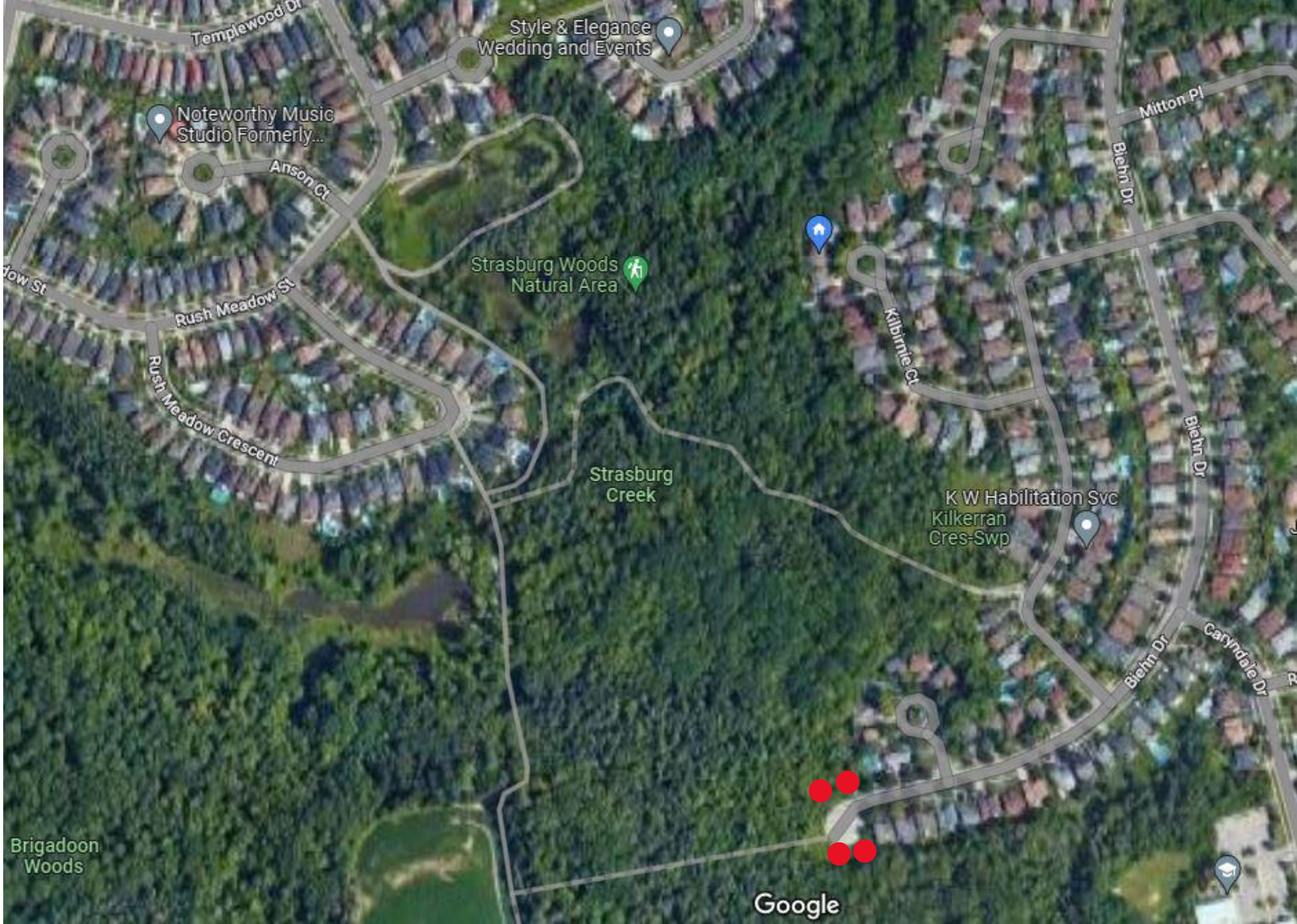
TILT DR
OREGON DR
WILFONG DR
Strasburg Creek
KERRAN CRES
WOODFIELD ST
APPLE RIDGE DR
DOON MILLS DR
STONE AVE
FOREST CR
PINE VAL

Aerial view of PSW-30 surrounding the end of Biehn Drive discharges into Strasburg Creek

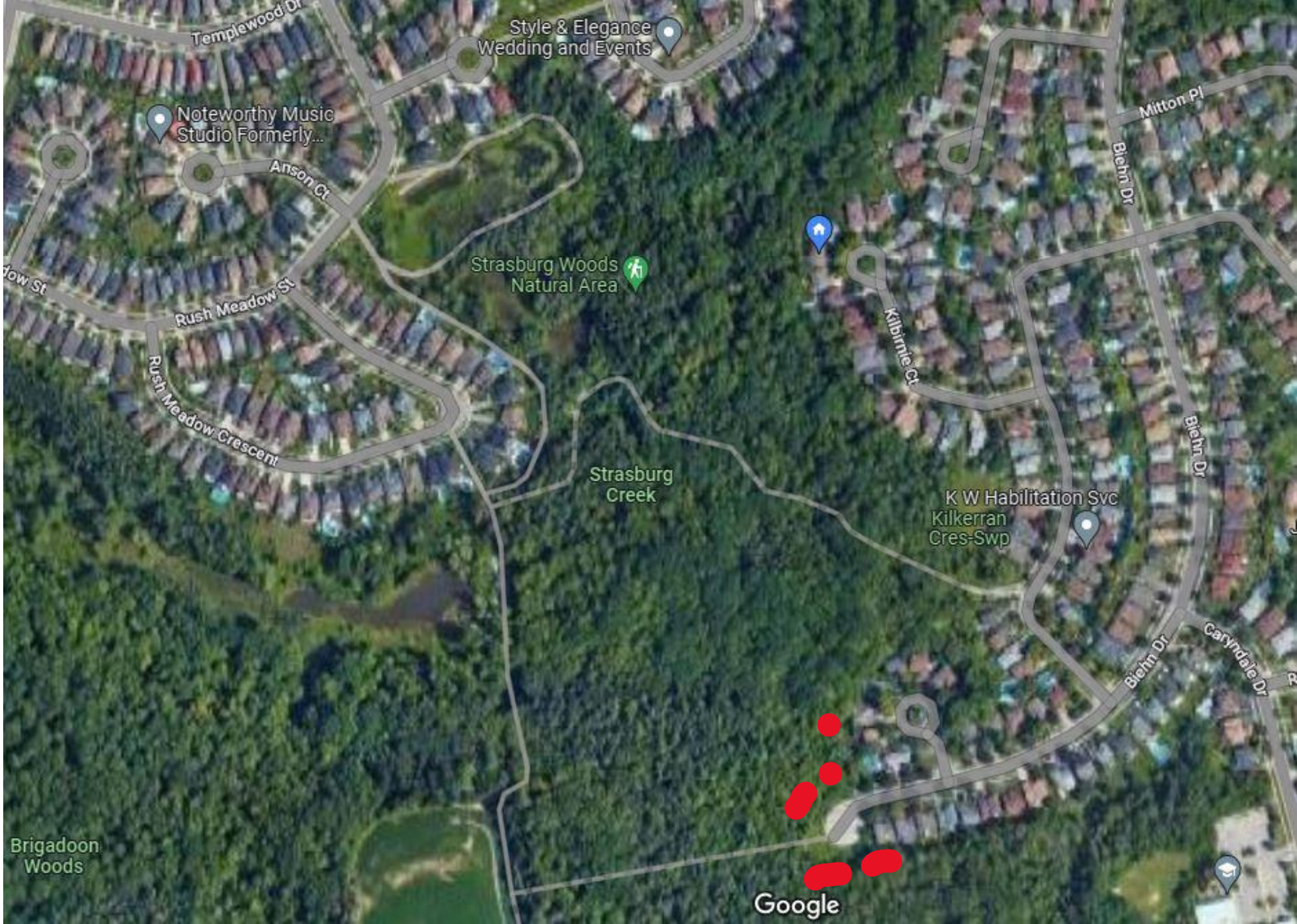


Stormwater enters the Strasburg Creek

- Salt contamination
- 6PPD-quinone (tires)
- Increased road temperatures

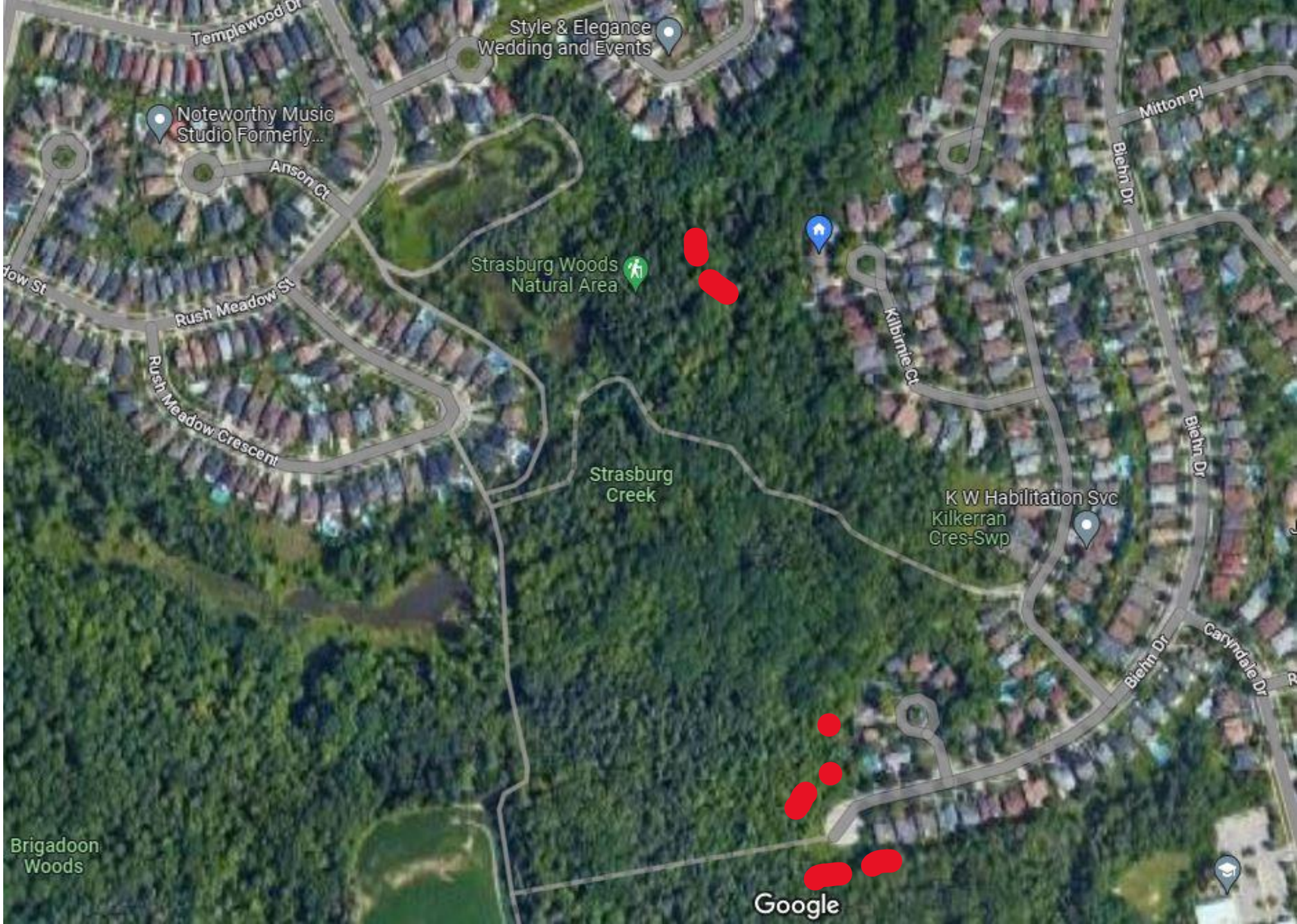


Multiple wetland discharge points enter the stream.



Discharge points add to stormwater run-off.

Multiple confluence points connecting together to feed into Strasburg creek.




Templewood Dr
Style & Elegance
Wedding and Events
Noteworthy Music
Studio Formerly...
Mitton Pl
Biehn Dr
Kilbirnie Ct
Biehn Dr
K W Habilitation Svc
Kilkerran
Cres-Swp
Biehn Dr
Carryndale Dr
Brigadoon
Woods
Google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Kilkerran Cres-Swp
Biehn Dr
Carryndale Dr
Brigadoon Woods
Google

Well at Kilkerren and Box Culvert Confluence

Strasburg Creek- Impacts of Development

Impact through:

- Salt run-off
- 6PPD-quinone (tires)
- Elevated street temperatures effect water temperature entering the stream confluence

Under scouring of tree roots results in loss of tree canopy and shade to maintain stream temperatures.

This community needs the Kitchener City Council to reconsider not disrupting the Provincial Significant Wetland 30 to protect the city's drinking water and the surrounding ecological habitats.

References

- Nandita Basu, PhD. : Podcast: *Small and Isolated Wetlands should be protected rather than paved over*
  > Professor & Canada Research Chair in Global Water Sustainability and Ecohydrology
  > Director, Collaborative Water Program
  > Civil and Environmental Engineering, University of Waterloo
  > Earth and Environmental Sciences, University of Waterloo
  > Canada Research Chair
- Eric Hodgins

  >Manager for Hydrogeology and Source Water at Region of Waterloo