EB-2016-0004

Exhibit S13

Municipalities of Kincardine, Arran-Elderslie and the Township of Huron-Kinloss ("South Bruce")

Interrogatory Responses

April 22, 2016

Attachment 3 – EFG - AMEC Report - April 15, 2013

FEASIBILITY STUDY
MUNICIPAL GAS DISTRIBUTION SYSTEM FOR THE MUNICIPALITIES OF KINCARDINE, ARRAN ELDERSLIE AND HURON KINLOSS

Submitted to:
Bruce Telecom
3145 Highway 21
Tiverton, Ontario
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Submitted by:

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April 2013

TB131008

April 15, 2013

TB131008

Mr. Steve Soychak, Chief Financial Officer
Bruce Telecom
PO Box 80
3145 Highway 21
Tiverton ON N0G 2T0

Dear Mr. Soychak:

Re: Feasibility Study for Natural Gas Distribution System

AMEC Environment & Infrastructure, a division of AMEC Americas Limited (AMEC) and Energy Fundamentals Group LLC (EFG), are pleased to provide this draft feasibility study for a proposed municipal gas distribution system for the municipalities of Kincardine, Arran Elderslie and Huron Kinloss. The report is in accordance with RFP #2013-01-13 and our proposal dated February 25, 2013.

We encourage any questions relating to this draft report and look forward to your feedback so that we can prepare a final report that is truly a product of an interactive process.

Yours truly,

DRAFT

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EXECUTIVE SUMMARY

Pursuant to the terms of the Agreement for Consulting Services dated February 25, 2013 between AMEC Environment & Infrastructure, a division of AMEC Americas and Bruce Telecom, we are pleased to provide the following report on the feasibility of developing a commercially viable natural gas transmission and distribution system to serve the municipalities of Kincardine, Arran Elderslie and Huron-Kinross inclusive of the communities of Chesley, Paisley, Tiverton, Kincardine, Point Clark, Inverhuron, Ripley and Lucknow, herein referred to as the "Project".

For purposes of this report, the Union Gas Limited (UGL) proposal, in its entirety, including all proposed transmission and distribution facilities to serve the specified residential, commercial and industrial loads projected by UGL will be referred to as **Plan "A",** or the base case.

With respect to the analysis and evaluation of Plan A, the work performed by AMEC and EFG, which is contained in this report, is comprised of the following aspects:

- Fatal Flaw Analysis; broad based assessment of the project from a stakeholder, oversight, design and overall feasibility standpoint to ascertain the existence of any major issues that could jeopardize successful completion of the project. This analysis does not include an assessment of commercial feasibility or opinion as to prospects for regulatory approval.

- Validation of current market information and development of a reasonable load forecast upon which Plan A and possible alternatives can be evaluated and compared.

- Assessment of the Plan A selected route and opinion as to suitability of routing and constructability.

- Confirmation of the suitability of the proposed Plan A facilities design in consideration of the initial load forecast and possible growth with first level cost verification (no third party bid solicitation) for reasonableness with respect to the selected route and associated transmission and distribution facilities.

- Identification/confirmation of the EA class and requirements, other permitting, regulatory and approvals required for certification and construction of the proposed pipeline.

- Proforma cost-of-service model based on traditional OEB ratemaking methodology.

- Landed cost of gas analysis using proforma cost of service to ascertain the relative competitiveness of Plan A.

In the course of performing its work, the study team determined that there may be a number of viable alternative approaches to developing and structuring supply and delivery facilities to achieve the end goal of delivering natural gas to the subject municipalities at potentially lower cost and lower relative risk. In this regard, this report presents an alternative to Plan A which we believe merits further analysis and consideration. At this stage, AMEC and EFG have only developed this alternative in sufficient detail to provide a reasonable basis for comparison to Plan A.

Evaluation of Project Base Case (Plan "A")

Union Gas Limited has proposed two separate high pressure transmission pipeline systems extending from its existing facilities (the "Owen Sound Line") at two separate take-off points to provide access to natural gas supply and delivery of gas to the eight target municipalities and 5 selected industrial loads including service to the Bruce Energy Centre. The total estimated installed capital cost of the transmission pipeline and distribution facilities totaled $97 million (2012 dollars). The split of estimated installed costs between transmission and distribution facilities is $59 million (61%) with respect to transmission pipeline and $38 million (39%) with respect to distribution facilities. Please refer to Figure 1 (attached to this Executive Summary for reference) of this report which illustrates the transmission and distribution facilities contemplated for Plan A. Please refer to Figures 4 and 5 from the report (attached to this Executive Summary), which illustrate facility schematics and transmission/distribution costs.

Fatal Flaw Analysis

As a general matter, based on the information provided by UGL, we identified no fatal flaws with respect to Plan A in terms of design and constructability. From a facilities design and routing perspective, based upon the mapping data provided with the study documentation, it appears that UGL has attempted to optimize the facilities design based upon their demand forecast. It also appears that UGL has configured the overall design of the proposed transmission and distribution facilities in a reasonable manner so as to accommodate the attachments and service to all projected loads recognizing peak hourly and seasonality of the loads while providing for a modest level of potential growth within the design.

With specific regard to facilities costing, UGL will have its own cost structures, overheads, and soft costs attributable to a project of this nature. Based upon the first level cost analysis and verification we have been able to complete with respect to the facilities Union has proposed for Plan A, we would suggest that the total estimated installed cost of facilities of $97 million for the combined transmission and distribution project is reasonable and within a tolerance band of 20%.

With respect to constructability, we identified no major issues or impediments for which the proper use of industry recognized construction methods and techniques along with necessary impact containment and mitigation measures could not be employed to successfully install the Plan A proposed facilities in accordance with applicable standards and codes.

Among other environmental considerations more fully outlined in Chapter 4 of this report, we would note that the proposed pipeline route traverses several water courses of which 23 would likely require horizontal directional drilling to install the pipeline facilities.

Natural Gas Load Forecast

For purposes of this study, we have reviewed UGL's estimates and conclude that estimates with regard to residential and commercial customers are reasonable. For large industrial load forecast, based on market intelligence we have gathered in the course of the study, we have adjusted the total forecast for this customer category to reflect current expectations. The proforma annual demand forecast we have developed is reflected as follows:

Residential	364,705 GJ's
Commercial	219,529 GJ's
Large Industrial	822,000 GJ's
Total	1,406,234 GJ's

By comparison, UGL's total demand forecast was 1,642,234 GJ's.

Table 1 in the report provides more details on this forecast.

Cost of Service

To evaluate Plan A in a manner consistent with current Ontario Energy Board rate making principles and policies and provide a basis to develop indicative landed cost analysis for Plan A, we have developed a comprehensive Cost of Service Model to determine the annual fixed and operating cost recovery requirements for the facilities being proposed. In summary, the 100% load factor resulting cost of service calculated on a unit basis is as follows:

Transmission	$4.107 per GJ
Distribution	$2.968 per GJ
Total Delivery Cost	$7.075 per GJ

By way of comparison, a residential customer currently served by Union Gas Limited in their franchise territory would pay a total approximately **$4.00** per GJ for transmission and distribution charges. These costs are inclusive of all property and income taxes.

Table 2 in the report provides more details on this forecast.

Landed Cost of Gas Analysis

As a point of reference and basis to assess the competitiveness of the Plan A versus current energy use and costs in the study area, we have prepared a landed cost analysis. Considering the load forecast prepared and the cost of service we have developed for the project, the average landed cost of gas is expected to be $13.025 per GJ including property and income taxes. By way of comparison, Union Gas Limited currently charges approximately $7.50 per GJ to its residential customers in Southwestern Ontario.

A more detailed account of this analysis is presented in Table 3 in the report.

Environmental & Regulatory Considerations

Natural Gas transmission, distribution and storage facilities in the province of Ontario fall under the jurisdiction of the Ontario Energy Board pursuant to the Ontario Energy Board Act (the "Act"). Specifically, Section 36 of the Act prescribes the following "No gas transmitter, gas distributor or storage company shall sell gas or charge for the transmission, distribution or storage of gas except in accordance with an order of the Board, which is not bound by the terms of any contract, 1998, c. 15, Sched. B, s. 36 (1)". This provision of the Act pertains to rates and tolls regulation.

Any entity seeking to construct and operate hydrocarbon transmission pipeline facilities in the province of Ontario must apply to the Ontario Energy Board (OEB) for authorization pursuant to Section 90(1) of the Ontario Energy Board Act, S.O. 1998 c.15 Sch B (the "Act").

For purposes of this report and our assessment, we have assumed that all facilities and the associated rates and charges for service will be subject to OEB approval.

OEB must be satisfied that an application is in the public interest before authorization will be granted for the development of any facilities. OEB generally considers a variety of factors before authorizing development including the need for the project, economic feasibility and environmental impacts. Environmental impacts include impacts on all components of the environment.

Applicants must prepare an "Environmental Report" as directed in the *"Ontario Energy Board Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Facilities in Ontario, 6th Edition, 2011".* A sequence of steps is required in the preparation of an Environmental Report. Once completed, the Environmental Report becomes a part of the applicant's file with OEB. The review of the Environmental Report is completed by the Ontario Pipeline Coordinating Committee (OPCC), which is made up of both provincial and municipal agencies, as well as other interested parties.

The following outlines the associated activities that will need to be completed as part of the Environmental Report:

- Route Selection and Constraints Mapping

- Consultation
- Environmental Study Report
- Pipeline construction, Operation and Maintenance
- Impact Management
- Phase I and Phase II Environmental Site Assessment

In this regard, the study team completed a preliminary environmental evaluation of the preliminary transmission/distribution route selected by Union Gas. That route is shown in Figure 1. The team's findings are summarized as follows:

Erosion Risks at Water Crossings

An erosion risk screening tool (ERST), developed by AMEC, was utilized to assess the risk of the proposed pipeline alignments.

The ERST identified 116 proposed pipeline alignments crossing watercourses, 70 of these along the Kincardine alignment and 46 along the Ripley alignment. The watercourses crossings were individually classified by stream order and ranked accordingly. Stream order value increases in magnitude as the size of the stream increases with additional stream confluence addition. The higher the stream order magnitude the higher the potential stream energy equals a higher potential risk for possible damaging stream flow regimes. The stream order analysis identified 7 fourth order or larger on the Kincardine alignment and 6 fourth order on the Ripley alignment. These include 1 with a stream order of seven, 1 of stream order five, and the remaining 11 with a stream order of four. The analysis also identified 12 crossings with a stream order of 3 which require additional analysis in the future.

Regardless of the ERST ranking, it is recommended that all of the 13 alignment crossings with a stream order of four order or larger requires additional analysis. This is recommended in order to determine proper design and construction across streams with potential energy brought on by this stream magnitude.

Natural Environment Existing Conditions

A review of secondary sources, including Ministry of Natural Resources' (MNR) Land Information Ontario (LIO) database, Google Maps and MNR Natural Heritage Information Centre (NHIC), was conducted to gather information on the following natural environment items occurring along the alignment of the proposed pipeline:

- Ontario Natural Areas;
- Species at Risk (SAR) and Rare Unlisted Species;
- General land cover; and,
- Watercourse crossings.

Ontario Natural Areas (Natural Areas) are specific geographical spaces which are recognized and dedicated to achieving the long-term conservation of nature with associated ecosystem services and cultural values. Natural Areas include areas such as Areas of Natural and Scientific Interest (ANSIs), Provincially Significant Wetlands (PSWs), Conservation Reserves, and Provincial Parks. The proposed pipeline alignment crosses two ANSIs, four PSWs, one Conservation Area and three Conservation Reserves. Routing and siting of pipelines in Natural Areas should be avoided if possible. Works within Natural Areas requires approvals from the MNR and local Conservation Authorities.

Species at Risk (SAR) are plant or animal species whose individuals or populations are considered Extirpated, Endangered, Threatened, or Special Concern. SAR and activities within their critical habitat are regulated by the federal Species at Risk Act, 2003 (SARA). Additionally, the Province of Ontario provides additional protection to SAR under the Endangered Species Act, 2007 (ESA). A review of MNR's NHIC online database, Fisheries and Ocean Canada (DFO) Distribution of Aquatic SAR mapping and Ontario Breeding Bird Atlas was performed to identify SAR's which are likely to occur along the proposed pipeline alignment. Professional experience based on the geographic location of the project and the adjacent land cover was also utilized to identify additional SAR likely to occur. Twelve SAR's were identified along the proposed alignments including Bobolink, Hungerford's Crawling Water Beetle, etc.

With respect to terrestrial ecosystems, land cover adjacent to the proposed pipeline alignments was determined based on Natural Resources Canada's (NRCan) land cover database (NRCan 2009). The land cover immediately adjacent to the alignments was primarily annual cropland (62.4%) and perennial cropland and pasture (28.9%). In addition to these land types, developed land (3.9%) and deciduous forest (3.6%) were the only other land covers which were adjacent to greater than 1% of the alignment length. Disruptions to farmlands by pipelines should be minimized and disruptions to prime farmland should be avoided if possible. As the proposed pipeline locations are directly adjacent to existing roadways the disturbance to agricultural lands should be minimal. Additionally, it is anticipated that should disturbance to farmlands occur it will be temporary and only last during pipeline installation.

With respect to aquatic ecosystems, although specific fish record information was not available for any of the other crossings at the time this document was issued, it is anticipated that the majority of the identified watercourses provide fish habitat. The Fisheries Act provides for the protection of fish and fish habitat. Under the Fisheries Act no one may carry out any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat (HADD) unless authorized by the DFO. In addition to the 116 identified watercourse crossings the pipeline likely also crosses drainage ditches or very small creeks which are not shown in the watercourse mapping. Watercourses which are not presented in the mapping can still provide fish habitat, thus work in these areas can result in a HADD and require DFO authorization.

Cultural Heritage Resources

Although there are only three registered archaeological sites in the immediate vicinity of the two proposed gasline routes, this may be more a consequence of a lack of previous research in the

area than an indication of relatively low site frequencies. A high level overview indicates that major portions of both the northern and southern pipeline routes have archaeological potential.

The highest archaeological potential along the northern route exists within the segments that correspond to: the drumlinized spillway immediately west of Dornoch and the sand plain at the western terminus near Lake Huron; 300 metres on either side of all watercourse crossings; and the grounds around each of the approximately 19 historic structures depicted in the 1880 historical atlas maps.

The highest archaeological potential along the southern route exists within the segments that correspond to: within the drumlin fields and on the kame moraine immediately west of Lower Wingham; 300 metres on either side of all watercourse crossings; and the grounds around each of the approximately 16 historic structures depicted in the 1880 historical atlas maps.

Several built heritage properties were identified in proximity to the proposed alignment (e.g., former schoolhouses, farm houses, churches, cemeteries, mills, etc). A more detailed assessment of these properties would be required for a formal OEB application.

Conclusion (Plan A)

In summary, it is the opinion of AMEC and EFG, based on the study and analysis conducted, Plan A is reasonable and feasible from a routing, design and cost perspective. We found no fatal flaws that would preclude the installation of the proposed facilities and we have concluded that the design configuration, as we have been able to ascertain it, would accommodate the forecasted loads with provision for modest future growth.

With specific regard to the potential loads associated with the Bruce Energy Centre, we believe the absence of Bruce Power as a forecasted load dedicated to the project is material. Although we have no direct, substantiated market data to quantify the extent of the load potential, we believe it to be of sufficient size to materially impact the overall feasibility of the project.

With respect to the reasonableness of UGL's proposed aid to construct with respect to the transmission and distribution facilities contemplated its Plan A proposal, we have not received sufficient information from Union to ascertain the reasonableness of the quantum. However, given the indicative landed economics we have developed with respect to Plan A as compared to UGL's current delivered cost of gas to a typical residential gas user in its franchise service territory, it is clear that some sizeable level of contribution in aid would be required for the project to proceed as a UGL lead build.

Finally, it is the opinion of AMEC and EFG that although Plan A appears to be technically feasible from a design, construction and installation perspective, and the associated cost appear to be within a reasonable range based on current industry standards and costs, it may not, in our view, represent the most practical or sensible approach to achieve gas service as UGL has proposed it. AMEC and EFG are of the opinion that even if 100% of the forecasted residential, commercial and industrial loads could be secured to underpin the project, the construction of transmission pipeline facilities as contemplated by Plan A, may not be practical or justified.

Consideration of Alternatives

The preferred approach with any major gas transmission and/or distribution facilities project is to develop and firm up market support and stage facilities in to meet that market demand as it firms up. In the context of this project, we believe there is merit in examining the larger loads and load centres to determine whether sufficient critical mass can be assembled to justify a staged build of a subset of the facilities to affect gas service to selected loads and communities.

We believe an alternative approach that could be feasible at lower overall capital cost resulting in lower risk and improved landed cost economics is possible. This alternative is outlined below as **Plan "B"**.

Plan B involves deferring consideration of building transmission pipeline facilities as part of the project at this time. This approach will remove approximately $60 million in facilities costs and $5.8 million per year in cost of service from the project and the associated risks inherent in the application, approval and construction phases of that undertaken.

In order to effectuate the delivery of natural gas to the town border stations that would otherwise receive gas from the transmission facilities contemplated in Plan A, this approach contemplates developing the necessary Compressed Natural Gas (CNG) deliver infrastructure to facilitate the delivery of natural to the distribution facilities. In effect, CNG becomes a virtual pipeline which can be systematically staged and incrementally expanded to meet the market.

For purposes of this study, we have made a preliminary determination that CNG is a technically viable option to service both industrial loads and distribution markets. As you are aware GFE has established a CNG delivery system for their Tiverton plant. We also believe, based on a high level investigation of the technology and indicative costs, CNG would be substantially less expensive from a capital cost standpoint and significantly more flexible in terms of deployment than the transmission pipeline contemplated in Plan A. It represents the access bridge to the market that would otherwise require pipeline facilities. Plan B requires more detailed study which we believe is warranted. With specific regard to the Southern Communities of Lucknow and Ripley, we have conducted preliminary discussions with a producer who operates approximately 55 kms of production gathering facilities in Huron County, south of the study area in relative close proximity to these two communities. The current facilities are also directly connected with Union Gas Limited at Wingham providing the ability to access gas from the Union system. Further study is required to ascertain the feasibility of serving these communities from the south however, it is a potential delivery option that should be pursued.

Recommendations and Next Steps

EFG and AMEC have concluded that the Union Gas Limited proposal, which we have characterized as Plan A, is not in our view the optimal design and approach to achieving access to natural gas service to the municipalities of Kincardine, Arran Elderslie and Huron-Kinross. EFG and AMEC believe that there are a number of alternative project designs and approaches which have the potential to accomplish gas service to the communities and industrial end-users at potentially lower cost and risk. We recommend that in order to make an informed decision on

whether to proceed with a natural gas project, the alternative approach we have described in the report, should be studied in greater detail with the goal of determining the optimal strategy and approach to be considered by the municipalities.

Next Steps

- *Develop the Business Case for Gas "Recommended Option"* – In order to place this undertaking in the proper perspective and provide the municipalities with sufficient information with respect to costs, risks and prospects for success to make an informed decision, a Detailed Business Case needs to be developed for what is determined to be the preferred project design and approach. As a point of reference, the Business Case should address the following key aspects:

    - Market
    - Facilities
    - Costs
    - Implementation Strategy, Phasing
    - Regulatory Requirements
    - Environmental Aspects
    - Project Execution & Critical Path
    - Risks/Returns
    - Financing

- *Market Commitment/Firm up Demand Forecast* – Beyond the verification of residential, commercial and industry load potential which we have already done, a decision to proceed with any project must be underpinned by securing market support and commitment. Although securing firm, binding commitments from residential and commercial customers in advance of gas service being available is difficult, if not impossible, we believe more work needs to be done with respect to market potential and demand. We need to more fully consider the impediments to customer conversion, conversion costs, how those costs get funded, and whether the fuel cost differential natural gas represents today and in the future will be sufficient economic incentive to capture and retain the load. A strategy may need to be developed to engender that commitment and perhaps incent conversion. With respect to the large industrial loads, it is customary in the gas industry to enter into precedent agreements (PA) with prospective customers which memorializes a commitment on the part of the end-user to commit their load to the yet to be constructed pipeline or distribution facilities if and when it is constructed. Price, contract tenor and minimum volume commitments typically form part of the PA. Revisiting Bruce Power in terms of interest will be an important step. As a general matter, the OEB certification process, particularly as it relates to Public Convenience and Necessity typically includes a demonstration of market support for the project.

As we indicated in the report, a phased approach to developing the project which considers risks and costs at logical milestone is most prudent. We believe determining whether there is a

commercially viable project that is acceptable to the municipalities with adequate market support, is acceptable in terms of risks and costs and can be financed is the next logical phase.

TABLE OF CONTENTS

Section **Page**

EXECUTIVE SUMMARY ..... **I**

1.0 INTRODUCTION **1**

1.1 Description and Purpose of the Proposed Pipeline 1
1.2 Study Team 1
1.3 Purpose and Organization of the Report 1
1.4 Objectives of the Feasibility Study 2
1.5 The Approval Process and Regulatory Requirements 4
1.6 Study Area 6
1.7 Data Sources and Mapping 6

2.0 FATAL FLAW ASSESSMENT **7**

3.0 PIPELINE ROUTE SELECTION PROCESS **8**

4.0 DESCRIPTION OF THE ENVIRONMENT **9**

4.1 Geomorphic Conditions Report Summary 9
4.2 Natural Environment Existing Conditions Report Summary 9
4.2.1 Ontario Natural Areas 10
4.2.2 Species at Risk 10
4.2.3 Terrestrial Ecosystems 11
4.2.4 Aquatic Ecosystems 12
4.3 High Level Evaluation of Risks: Cultural Heritage Resources 12
4.3.1 High Level Built Archaeological Risks: Summary 12
4.3.2 High Level Built Heritage Risks: Summary 13

5.0 FACILITIES COST / DESIGN VALIDATION- PIPELINE CONSTRUCTION, OPERATION AND MAINTENANCE **16**

5.1 Primary Conclusions Concerning Facility Design, Costs & Construction 16
5.2 Validation of Technical Pipeline & Distribution Design Conditions 17
5.3 Summary of Costs 17
5.4 Operation and Maintenance 17
5.5 Brief Discussion of Alternates and Impacts on Costs 18

6.0 MARKET / LOAD ASSUMPTIONS **19**

7.0 PROFORMA COST OF SERVICE AND LANDED COST OF GAS ECONOMICS **22**

8.0 CONCLUSIONS AND RECOMMENDATIONS **24**

9.0 CLOSURE **25**

LIST OF TABLES

Table 1: SAR Likely to Occur along Proposed Pipeline Alignments

Table 2: Proforma Demand Forecast

Table 3: Proforma Cost of Service

Table 4: Landed Cost of Gas Matrix

LIST OF FIGURES

Figure 1: Location Map for Bruce Telecom Pipeline

Figure 2: Study Development for the Preparation of an Environmental Report

Figure 3: Environment Report Review by OPCC

Figure 4: Facility Schematic- Owen Sound Communities

Figure 5: Facility Schematic- Hensall Communities

LIST OF APPENDICES

Appendix A- Geomorphic Conditions Report

Appendix B- Natural Environment Existing Conditions Report

Appendix C- High Level Evaluation of Risks: Cultural Heritage Resources

1.0 INTRODUCTION

1.1 Description and Purpose of the Proposed Pipeline

The Municipalities of Kincardine, Arran Elderslie and Huron Kinloss are located among the shores of Lake Huron and encompass the largest area in Southwestern Ontario that is not serviced with natural gas. The leadership and Councils of the Municipalities have endeavoured to evaluate the feasibility of providing natural gas service to the communities of Chesley, Paisley, Tiverton, Kincardine, Point Clarke, Inverhuron, Ripley and Lucknow. Bruce Telecom, a wholly owned entity of the Municipality of Kincardine, has been asked to perform the review and provide recommendations to the Municipalities.

1.2 Study Team

AMEC Environment & Infrastructure (AMEC) and Energy Fundamentals Group (EFG) were retained by Bruce Telecom to carry out this feasibility study. AMEC's study team consisted of technical and professional staff knowledgeable in natural, physical, land use and cultural heritage issues. EFG's team consisted of technical and operational professionals knowledgeable in: validating the cost and design of facilities; pipeline construction, operation and maintenance; validating markets and natural gas load requirements; and determining the proforma cost of service, indicative rates and landed economics.

1.3 Purpose and Organization of the Report

Companies planning to construct hydrocarbon transmission facilities on Ontario must apply to the Ontario Energy Board (OEB) for authorization pursuant to Section 90(1) of the *Ontario Energy Board Act, S.O. 1998 c.15 Sch B* (the "Act").

With respect to natural gas, OEB approves natural gas rates, issues gas marketer licenses, approves pipeline construction, approves designation of gas storage facilities, reviews applications for well drilling and provides recommendations to the Ministry of natural Resources (MNR). OEB also approves municipal franchise agreements and applications for certificates of public convenience and necessity for construction of works to supply natural gas.

Transmission pipelines and ancillary facilities require an application to OEB for leave to construct under Section 90(1) of the Act. Under Section 90(1), leave to construct must be obtained if the proposed hydrocarbon pipeline is more than 20 kilometres in length; is projected to cost more than the amount prescribed by the regulations (presently $2 million); and any part of the pipeline uses pipe that has a nominal size of 12 inches or more and has an operating pressure of 2,000 kilopascals or more.

Before proceeding with regulatory submissions and funding approvals an economic and environmental feasibility study is required to evaluate the development of a commercially viable natural gas distribution system within these municipalities. The findings of this study must be consistent with the requirements set out in *"Environmental Guidelines for the Location,*

Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario, 6th Edition" (OEB Environmental Guidelines) published by OEB.

To satisfy these requirements, EFG and AMEC have joined to provide their expertise with respect to routing and environmental matters that must be considered in the context of preparing a possible certificate application to OEB should the pipeline project proceed to that stage. Accordingly, this report is organized into the following chapters:

- Chapter 1 describes the proposed pipeline, introduces the study team, indicates the purpose and objectives, defines the regulatory requirements, and explains the methodology used to carry out the study;
- Chapter 2 describes the consultation that carried out during the study;
- Chapter 3 describes the proposed pipeline route as developed by Union Gas Limited (UGL);
- Chapter 4 describes the environmental features of the proposed pipeline corridor;
- Chapter 5 provides a commentary and opinion with respect to the appropriateness of facilities design and costs as proposed by UGL;
- Chapter 6 provides a proforma demand forecast based on UGL's projections with appropriate adjustments where applicable;
- Chapter 7 Proforma cost of service and landed cost of gas economics; and
- Chapter 8 sets out conclusions and recommendations.

1.4 Objectives of the Feasibility Study

The study team believes it is most prudent to approach the development and feasibility study of a project of this nature through a phased approach which includes practical and logical milestones that once accomplished, provide a basis to make an informed decision to commit additional resources and proceed further or halt the process. There are many aspects of a natural gas facilities project that must be advanced in tandem to ensure it can move through the regulatory approval process smoothly, without delay and ultimately achieve certification. It is the study teams experience that the intensity of the work and the cost associated with that work will increase over the project time line. In the same regard, if the project is managed prudently, project risks can be systematically reduced over time and at risk costs can be minimized. The study team have specific and direct experience managing natural gas pipeline facilities projects, performing the necessary tasks in the appropriate sequence while managing the various risks inherent in the project. The study team is uniquely qualified to assist Bruce Telecom in developing a prudent project plan, executing that plan while evaluating forward project risk at various points in time so that prudent resourcing decisions can be made.

The scope of work the study team was engaged to undertake largely conforms to the key aspects described in the RFP Scope of Services as follows:

- Validation of current market information
- Assessment of the selected route and opinion as to its viability.
- Conceptual facilities design and first level cost estimate (no third party bid solicitation) of selected route.
- Identification/confirmation of the EA class and requirements, other permitting, regulatory and approvals required for certification and construction of the proposed pipeline.
- Fatal Flaw Analysis; broad based assessment of the project from a stakeholder, oversight, design and overall feasibility standpoint to ascertain the existence of any major issues that could jeopardize successful completion of the project. Possible mitigation strategies will be considered for identified issues.
- Proforma cost-of-service and proposed rate design based on traditional ratemaking methodology.
- Landed cost of Gas Analysis using proforma rates developed.

This report provides a feasibility assessment of the project based on the work performed and makes recommendations to the Municipalities with regard to the project going forward. The report provides a summary of key findings, a “Fatal Flaw” analysis including various risks and opportunities identified and assumptions underpinning its analysis and results. The primary objective of the report is to provide Bruce Telecom with a sound basis upon which to determine whether there is a viable basis to proceed forward with the project to the next step. The next step will involve considerably more detailed work and time to prove up the commercial viability of the project to satisfy the OEB’s needs and necessity requirements and to assemble the technical details to prepare the project to make an EA and facilities filing with the OEB.

The determination of feasibility at this stage has been based, in part, on the information provided by Bruce Telecom which has already been developed as well as additional base line data collected and analysis conducted by the study team during the time allotted for the assignment. It has been assumed, for purposes of this assignment, that a primary facilities route has been designated and although this may not be the ultimate facilities configuration and optimal route, it represents the basis for our infield assessment and work. A formal “route alternatives study” along with public consultation is a requirement of the OEB regulatory process but beyond the scope of this assignment. This future work, along with a number of other detailed project activities, would be undertaken as part of the process to prepare a detailed Section 90(1) leave to construct application including an Environmental Report (ER) as prescribed in the OEB Environmental Guidelines.

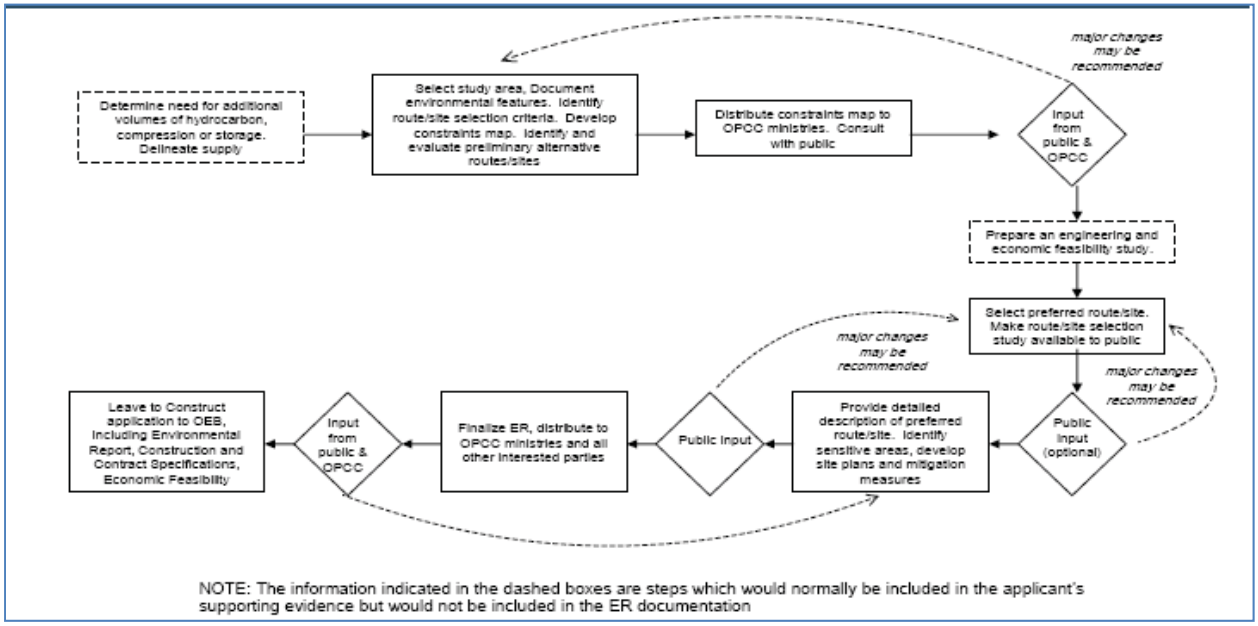
Given the limited time available to complete this work and Bruce Telecom’s desire to complete a preliminary economic and environmental assessment of project feasibility reasonably quickly, the study team is not in a position to provide a complete opinion with respect to the likelihood of regulatory certification by the OEB or certainty with respect to the commercial viability of the project.

1.5 The Approval Process and Regulatory Requirements

The Ontario Energy Board must be satisfied that an application is in the public interest before authorization will be granted for the development of any facilities. The Board generally considers a variety of factors before arrive at its decision on whether to authorize development. These factors include the need for the project, economic feasibility and environmental impacts. Environmental impacts include impacts on all components of the environment.

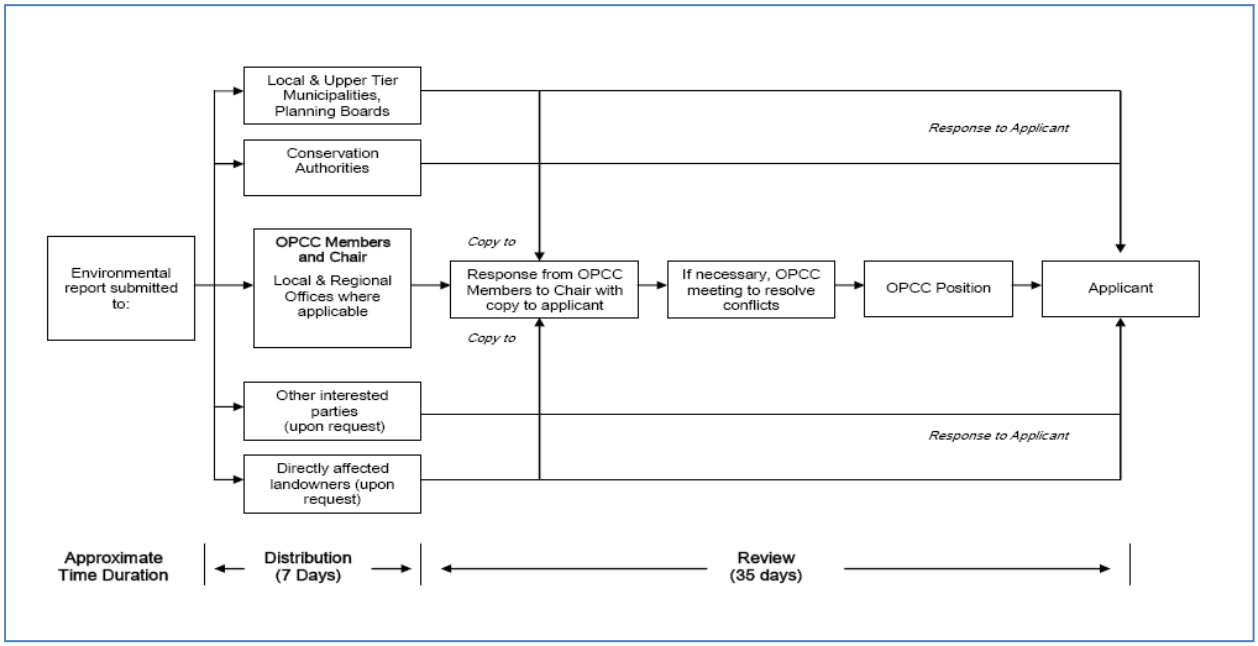
A sequence of steps is required in the preparation of an environmental report. Once completed, the environmental report becomes a part of the applicants file with the Ontario Energy Board. The review of the environmental report is completed by a committee, titled the Ontario Pipeline Coordinating Committee (OPCC), and made up of both provincial and municipal agencies, as well as other interested parties. It is chaired by a member of the Ontario Energy Board, with representation from the Technical Standards and Safety Authority, Ministry of Environment, Ministry of Agriculture, Food and Rural Affairs, Ministry of Tourism, Culture and Sport, Ministry of Municipal Affairs and Housing, Ministry of Natural Resources and Ministry of Transportation. The OPCC acts as a single contact for identifying any provincial concerns related to transmission and storage proposals and provides input into the routing and siting to review the environmental report. Figure 2 below details the study development for preparing an environmental report, while Figure 3 details the environmental report review by the OPCC.

Figure 1: Study Development for the Preparation of an Environmental Report



Source: Ontario Energy Board, Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario, 6th edition, 2011.

Figure 2: Environmental Report Review by the OPCC



Source: Ontario Energy Board, Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario, 6th edition, 2011.

Each applicant is expected to consult with OPCC on the constraints mapping and delineation of any alternatives. Once prepared, all this information is to be forwarded to the OPCC, as the OPCC will always review the completed environmental report. In some cases, the OPCC may wish to review draft documentation pertaining to any preferred routes or sites.

All constraints maps, the environmental report and post-construction monitoring reports should be submitted to the OPCC representative. Applicants should contact the OPCC chair or representative from each associated ministry or agency for the name and address of the local staff who will be reviewing all of the material. The applicant should also ensure that a cover letter accompanies the submitted documentation and directs that copies and responses be provided to the ministry OPCC chair and representative. Forty-two days shall be allowed for the environmental report review process.

During the OPCC review process, the environmental report should be submitted to both upper and lower tier municipalities, conservation authorities, and upon request to affected landowners, tenured persons, other affected parties and aboriginal persons. It is recommended that the forty-two day review period take place prior to application being made to the Ontario Energy Board, which allows for the review of the report, as well as resolution of concerns prior to the commencement of the hearing. The applicant must advise all affected parties in writing that those parties can provide comments on the environmental report. Copies of all letters received pertaining to the environmental report should be forwarded to the OPCC chair. Upon the completion of the review of the environmental report, the chair of the OPCC will advise the applicant in writing of any issues outstanding.

The applicant is expected to file all correspondence from OPCC as part of the application before the Ontario Energy Board. The environmental report is also to be filed as part of the pre-filed evidence with the application. Also with the application, the applicant shall provide a concise summary of the concerns raised by the OPCC members and other affected parties as addressed during the review period. This summary should address which concerns were addressed, whether any concerns remain and why they remain.

The following outlines the associated activities that will need to be completed as part of the Environmental Report:

- Route Selection and Constraints Mapping
- Consultation
- Environmental Study Report
- Pipeline construction, Operation and Maintenance
- Impact Management
- Phase I and Phase II Environmental Site Assessment

In this regard, the study team completed a preliminary environmental evaluation of the preliminary transmission/distribution route selected by UGL.

1.6 Study Area

The proposed route for the transmission pipeline and distribution systems within each community is shown in Figure 1.

The study area for the various environmental studies completed for this project is shown in the figures included with Appendix B. In general, a distance of 1 km either side of the proposed pipeline route was used to demarcate the limit of the study area.

1.7 Data Sources and Mapping

A number of shape files and aerial maps showing the pipeline route were provided by Bruce Telecom. These files were provided to Bruce Telecom by UGL earlier as part of their report to the Kincardine Group.

2.0 FATAL FLAW ASSESSMENT

Pursuant to the terms of the Agreement for Consulting Services dated February 25, 2013 between AMEC Environment & Infrastructure, a division of AMEC Americas and Bruce Telecom, we are pleased to provide the following report on the feasibility of developing a commercially viable natural gas transmission and distribution system to serve the municipalities of Kincardine, Arran Elderslie and Huron-Kinross inclusive of the communities of Chesley, Pasiley, Tiverton, Kincardine, Point Clark, Inverhuron, Ripley and Lucknow, herein referred to as the "Project".

The principle deliverable of the assignment in accordance with the engagement terms has been to evaluate the natural gas service proposal developed by UGL pursuant to a Memorandum of Understanding ("MOU") executed between the Municipality of Kincardine and UGL June 17, 2011. A summary of UGL's proposal is outlined in a Report to the municipalities dated March 2012. AMEC and EFG have reviewed a draft copy of that report which was found to be incomplete and as such, we have made a formal information request to UGL on March 7, 2013 to obtain all of the data and information with respect to the project, the details of are itemized in Schedule A of the MOU.

At the time of issuing this report, AMEC and EFG have not received any of the substantive information and assumptions underpinning the UGL report and have therefore prepared this report from first principles, relying on industry best practices and knowledge applied to the selected and limited information available to make our assessment.

For purposes of this report, the UGL proposal in its entirety including all proposed transmission and distribution facilities to serve the specified residential, commercial and industrial loads projected by UGL will be referred to as **Plan "A",** or the base case.

With respect to the analysis and evaluation of Plan A, the work performed by AMEC and EFG which is contained in this report is comprised of the following aspects:

- Validation of current market information and development of a reasonable load forecast upon which Plan A and possible alternatives can be evaluated and compared.

- Assessment of the Plan A selected route and opinion as to suitability of routing and constructability.

- Confirmation of the suitability of the proposed Plan A facilities design in consideration of the initial load forecast and possible growth with first level cost verification (no third party bid solicitation) for reasonableness with respect to the selected route and associated transmission and distribution facilities.

- Identification/confirmation of the EA class and requirements, other permitting, regulatory and approvals required for certification and construction of the proposed pipeline.

- Fatal Flaw Analysis; broad based assessment of the project from a stakeholder, oversight, design and overall feasibility standpoint to ascertain the existence of any major issues that could jeopardize successful completion of the project. This analysis does not include an assessment of commercial feasibility or opinion as to prospects for regulatory approval.

- Proforma cost-of-service model and proposed rate design based on traditional OEB ratemaking methodology.

- Landed cost of gas analysis using proforma cost of service developed to ascertain the relative competitiveness of Plan A and other possible alternatives.

In the course of performing its work, the study team determined that there may be a number of viable alternative approaches to developing and structuring supply and delivery facilities to achieve the end goal of delivering natural gas to the subject municipalities at potentially lower cost and lower relative risk. In this regard, this report presents these alternatives to Plan A which we believe merit further analysis and consideration. A complete study and analysis of these alternatives is beyond the scope of this engagement and report. At this stage, AMEC and EFG have only developed these alternatives in sufficient detail to provide a reasonable basis for comparison to Plan A.

In addition, based on the composition and geographic concentration of the potential loads to be served within the study area, any decision to proceed with the project, or subset of the project, should, in our view, consider a phased, or sequential approach targeting service to the largest load centres and customers in priority.

3.0 PIPELINE ROUTE SELECTION PROCESS

One of the key elements of the UGL detailed load analysis was to determine preliminary piping routes which align with customer attachments and associated loads. As stated in UGL's "Internal Report to the Kincardine Group", "Alliance Contractors, known to be Aecon and Linkline along with UGL personnel drove the Transmission and Distribution proposed running lines to provide budget labour pricing while considering ease and proficiency of construction" and "Pipeline design tactics include single road side distribution main construction, and pipeline routing to maximize customer attachment. The pipeline transmission and distribution routing used by UGL in their study is shown in Figure 1. As reflected in AMEC/EFG's proposal, our study team did not have access to all background information which supported the selection of the route proposed by UGL. AMEC/EFG have assumed, for the purposes of this assignment, that a primary facilities route has been designated and although this may not be the ultimate facilities configuration and optimal route, it represents the basis for our infield assessment and evaluation.

4.0 DESCRIPTION OF THE ENVIRONMENT

4.1 Geomorphic Conditions Report Summary

An erosion risk screening tool (ERST), developed by AMEC was utilized to assess the risk of EFG's proposed Kincardine and Ripley pipeline alignments. The ERST was applied to the proposed pipeline routing from a Level I feasibility only. This level of assessment provides the broadest evaluation possible in order to provide an initial indication of the risk of possible exposure due to erosion where the pipeline is proposed to cross watercourses. To provide this initial indication of pipeline exposure risk it was necessary to examine provincial and federal sources of data to ensure that the data used in the screening tool is readily available.

The ERST identified 116 proposed pipeline alignments crossing watercourses, 70 of these along the Kincardine alignment and 46 along the Ripley alignment. The watercourses crossings were individually classified by stream order and ranked accordingly. Stream order value increases in magnitude as the size of the stream increases with additional stream confluence addition. The higher the stream order magnitude the higher the potential stream energy equals a higher potential risk for possible damaging stream flow regimes. The stream order analysis identified 7 fourth order or larger on the Kincardine alignment and 6 fourth order on the Ripley alignment. These include 1 with a stream order of seven, 1 of stream order five, and the remaining 11 with a stream order of four. The analysis also identified 12 crossings with a stream order of 3 which require additional analysis in the future.

The stream order ranking was utilized to create a short-list of streams with higher potential stream energy that were then further analyzed for further erosion affecting factors. The resulting additional analysis suggested a moderate risk for 3 alignment crossings 1 each for Willow Creek, Vesta Creek on the Kincardine alignment 1 on Dickie Creek which is on the Ripley alignment. The analysis suggested that 2 alignment crossings had a high risk both on the Ripley alignment crossing the Stanley Drain and the McMurchy Award.

Regardless of the ERST ranking it is recommended that all of the 13 alignment crossings with a stream order of four order or larger requires additional analysis. This is recommended in order to determine proper design and construction across streams with potential energy brought on by this stream magnitude.

Please see Appendix A for the detailed geomorphic conditions report.

4.2 Natural Environment Existing Conditions Report Summary

This section details the existing conditions with respect to the natural environment along the alignment of the proposed pipeline based on a desktop review of available data and specific information requests to various government organizations. Further details on the following natural environment sections, as well as on general mitigation measures can be found in Appendix B.

A review of secondary sources, including Ministry of Natural Resources' (MNR) Land Information Ontario (LIO) database, Google Maps and MNR Natural Heritage Information

Centre (NHIC), was conducted to gather information on the following natural environment items occurring along the alignment of the proposed pipeline:

- Ontario Natural Areas;
- Species at Risk (SAR) and Rare Unlisted Species;
- General land cover; and
- Watercourse crossings.

Correspondence with Midhurst District MNR, Guelph District MNR, Maitland Valley Conservation Authority (MVCA) and Saugeen Valley Conservation Authority (SVCA) has been initiated to request additional information regarding the items listed above at the proposed pipeline locations however, a response was not available at the time of the release of this document.

4.2.1 Ontario Natural Areas

Ontario Natural Areas (Natural Areas) are specific geographical spaces which are recognized and dedicated to achieving the long-term conservation of nature with associated ecosystem services and cultural values. Natural Areas include areas such as Areas of Natural and Scientific Interest (ANSIs), Provincially Significant Wetlands (PSWs), Conservation Reserves, and Provincial Parks. The proposed pipeline alignment crosses two ANSIs, four PSWs, one Conservation Area and three Conservation Reserves. Routing and siting of pipelines in Natural Areas should be avoided if possible. Works within Natural Areas requires approvals from the MNR and local Conservation Authorities.

4.2.2 Species at Risk

Species at Risk (SAR) are plant or animal species whose individuals or populations are considered Extirpated, Endangered, Threatened, or Special Concern. SAR and activities within their critical habitat are regulated by the federal *Species at Risk Act*, 2003 (*SARA*). Additionally, the Province of Ontario provides additional protection to SAR under the *Endangered Species Act*, 2007 (*ESA*). The protection afforded by Ontario's *ESA* is generally greater than that afforded by *SARA*. The MNR should be contacted as part of the preparation of the Environmental Report in order to determine if any SAR are likely to be impacted by the project works. As a component of this feasibility study, the Midhurst District MNR and Guelph District MNR have been contacted to request additional information on SAR, however a response was not available at the time of the release of this document.

A review of MNR's NHIC online database, Fisheries and Ocean Canada (DFO) Distribution of Aquatic SAR mapping and Ontario Breeding Bird Atlas was performed to identify SAR which are likely to occur along the proposed pipeline alignment. Professional experience based on the geographic location of the project and the adjacent land cover was also utilized to identify additional SAR likely to occur. SAR which are likely to occur along the proposed pipeline alignments are listed in Table 1 below. Additional information on SAR, including habitat preferences can be found in Appendix B.

Table 1: SAR Likely to Occur Along Proposed Pipeline Alignments

Species Common Name (Latin Name)[1]	Federal Designation (*SARA*)[2]	Provincial Designation (*ESA*)[3]
Birds		
Barn Swallow (*Hirundo rustica*)	No Status	Schedule 3 - Threatened
Bobolink (*Dolichonyx oryzivorus*)	No Status	Schedule 3 - Threatened
Chimney Swift (*Chaetura pelagica*)	Schedule 1 - Threatened	Schedule 3 - Threatened
Common Nighthawk (*Chordeiles minor*)	Schedule 1 - Threatened	Schedule 4 - Special Concern
Eastern Meadowlark (*Sturnella magna*)	No Status	Schedule 3 - Threatened
Invertebrates / Insects		
Monarch (*Danaus plexippus*)	Schedule 1 – Special Concern	Schedule 4 – Special Concern
Hungerford's Crawling Water Beetle (*Brychius hungerfordi*)	No Status	Schedule 2 – Endangered
Rainbow Mussel (*Villosa iris*)	No Status	Schedule 3 – Threatened
Reptiles		
Eastern Ribbonsnake (*Thamnophis sauritus*)	Schedule 1 – Special Concern (Great Lakes population)	Schedule 4 - Special Concern
Milksnake (*Lampropeltis triangulum*)	Schedule 1 – Special Concern	Schedule 4 - Special Concern
Northern Map Turtle (*Graptemys geographica*)	Schedule 1 – Special Concern	Schedule 4 - Special Concern
Snapping Turtle (*Chelydra serpentina*)	Schedule 1 – Special Concern	Schedule 4 – Special Concern

4.2.3 Terrestrial Ecosystems

The proposed pipeline alignments are at the southwestern extent of the Great Lakes – St. Lawrence Ecozone (Mixedwood Plains ecozone) of Canada (Farrar 1995). Native tree species typically found in the landscape include Red Pine (*Pinus resinosa*), Eastern White Pine (*Pinus strobus*), Eastern Hemlock (*Betula alleghaniensis*), Yellow Birch (*Betula alleghaniensis*), maple species (*Acer sp.*), and oak species (*Quercus sp.*) (Farrar 1995).

Land cover adjacent to the proposed pipeline alignments was determined based on Natural Resources Canada's (NRCan) land cover database (NRCan 2009). The land cover immediately adjacent to the alignments was primarily annual cropland (62.4%) and perennial cropland and pasture (28.9%). In addition to these land types, developed land (3.9%) and deciduous forest (3.6%) were the only other land covers which were adjacent to greater than 1% of the alignment length.

Disruptions to farmlands by pipelines should be minimized and disruptions to prime farmland should be avoided if possible. As the proposed pipeline locations are directly adjacent to existing roadways the disturbance to agricultural lands should be minimal. Additionally, it is anticipated that should disturbance to farmlands occur it will be temporary and only last during pipeline installation.

4.2.4 Aquatic Ecosystems

The proposed pipeline alignments were overlaid on watercourse mapping to assess the locations of watercourse crossings. The alignments cross 116 identified watercourses, including 70 along the proposed Kincardine pipeline and 46 along the proposed Ripley pipeline. Watercourses were then classified by stream order to provide a rough estimate of aquatic impacts; larger stream orders represent larger streams and thus greater potential aquatic impacts from work in, or adjacent to, the watercourse. Of the 116 watercourse crossings, 65 were on first order streams, 26 on second order, 13 on third order, 10 on fourth order, 1 on fifth order, and 1 on a seventh order stream.

Although specific fish record information was not available for any of the other crossings at the time this document was issued, it is anticipated that the majority of the identified watercourses provide fish habitat. The *Fisheries Act* provides for the protection of fish and fish habitat. Under the *Fisheries Act* no one may carry out any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat (HADD) unless authorized by the DFO. In addition to the 116 identified watercourse crossings the pipeline likely also crosses drainage ditches or very small creeks which are not shown in the watercourse mapping. Watercourses which are not presented in the mapping can still provide fish habitat, thus work in these areas can result in a HADD and require DFO authorization.

Please see Appendix B for the detailed natural environment existing conditions report.

4.3 High Level Evaluation of Risks: Cultural Heritage Resources

4.3.1 High Level Built Archaeological Risks: Summary

In sum, although there are only three registered archaeological sites in the immediate vicinity of the two proposed gasline routes, this may be more a consequence of a lack of previous research in the area than an indication of relatively low site frequencies. A high level overview indicates that major portions of both the northern and southern pipeline routes have archaeological potential.

The highest archaeological potential along the northern route exists within the segments that correspond to: i) the drumlinized spillway immediately west of Dornoch and the sand plain at the western terminus near Lake Huron; ii) 300 metres on either side of all watercourse crossings (minimally estimated at 32); and iii) the grounds around each of the approximately 19 historic structures depicted in the 1880 historical atlas maps.

The highest archaeological potential along the southern route exists within the segments that correspond to: i) within the drumlin fields and on the kame moraine immediately west of Lower Wingham; ii) 300 metres on either side of all watercourse crossings (minimally estimated at 15); and iii) the grounds around each of the approximately 16 historic structures depicted in the 1880 historical atlas maps.

4.3.2 High Level Built Heritage[1] Risks: Summary

4.3.2.1 Northern Pipeline Study Area (Kincardine to Dornoch)

The stretch of proposed pipeline that runs from Kincardine north and east towards Dornoch spans several townships and counties, including Bruce County over the western portion of the pipeline and Grey County over the eastern portion. The pipeline travels from Kincardine north to Tiverton, east through Lovat to Chelsey and Scone, then further east through Kinghurst and terminating at Dornoch.

Municipality of Kincardine

Only the Municipality of Kincardine (which includes the Town of Kincardine and the Villages of Slade and Tiverton) maintains a Municipal Register of Cultural Heritage Properties of significance to the community, including properties designated under the *Ontario Heritage Act*. The other townships do not maintain any list or inventory of heritage properties. Therefore, there are no designated properties in these regions. The MTCS requires that any municipality with designated heritage properties must maintain these properties on a publicly accessible Register. The properties identified within the study area, according to the parameters set above include the following:

- One residential property (likely former farmhouse) located on the west side of Highway 21, just south of Concession 5, between Kincardine and Tiverton.
- A former schoolhouse located at 2354 Highway 21 between Kincardine and Tiverton is listed on the Municipal Register.
- Many properties within the Village of Tiverton have been identified, including at least five buildings located at or near the intersection of Main Street and King Street in close proximity to the right-of-way. These are not listed on the Register.
- The designated property located at 100 King Street (By-law #2006-007) is a log house and is one of the earliest structures in the Queen's Bush which pre-dates the founding of Tiverton by approximately 20 years.

Hamlet of Lovat

- Approximately three heritage properties have been identified in the vicinity of Lovat; however, their proximity to the right-of-way would need to be confirmed.

[1] Please note that cultural heritage landscapes were not addressed in this overview as a site visit would first be required.

- Approximately ten heritage properties along Concession Road 20, east of Lovat, have been identified, but it seems that they are not within close proximity to the right-of-way.

- A building which appears to be a former schoolhouse, just south of Paisley, as identified in the historic atlas is located on the south side of Concession Road 20.

- Approximately mid-way between Lovat and Chelsey, a church and cemetery are located very close to the right-of-way on the north side of Concession Road 20. Unmarked burials may be present beyond the currently identified limits of the cemetery.

- The historical atlas identifies the "A.D. McDonald Residence and Saw Mill", which should be further investigated.

Town of Chelsey/Scone

- Approximately four heritage properties have been identified in the Town of Chelsey and/or Scone, in close proximity to the intersection of Bruce Road 10 and 1 Avenue North.

- Several heritage properties are located east of Chelsey along Bruce Road 10, but none that appear to be within close proximity of the right-of-way.

- The Carding M. Saw Mill and approximately four to five other heritage buildings in the vicinity of the Mill appear to be located within close proximity to the right-of-way.

- Several other heritage properties have been identified along Grey Road 25 extending eastward from the Mill towards Kinghurst and Dornoch, to the terminus of the pipeline extension, but none in close proximity to the right-of-way.

4.3.2.2 Southern Pipeline Study Area (Ripley to Whitechurch)

The stretch of proposed pipeline located from south of the Town of Ripley to east of the Village of Whitechurch is primarily located within the Township of Huron-Kinloss. The Township does not maintain a Register or Inventory of Cultural Heritage Resources significant to the community. Furthermore, there are no designated cultural heritage resources within the Township according to staff who were contacted.

Town of Ripley

- The northernmost end of the pipeline is to be located just south of the Town of Ripley and may impact only a small number of potential heritage properties, depending on the exact location of the pipeline.

- The former Verdun Post office is identified in the 1880 historic atlas and may still be located at the southeast corner of Concession Road 4 and Bruce Road 7.

- Two residential properties approximately mid-way between Queen St. (Bruce Road 6) and Concession Road 4 could be impacted; however, they are set at least 10 metres back from the road right-of-way.

Lucknow

- There is no Google streetview information available for the stretch of pipeline running eastward from Bruce Road 7 to just east of Lucknow. However, the historical atlas for the area suggests there is potential for a historic structure in Clover Valley at the northeast corner of Concession Road 2 and Sideroad 10-S.

- The historical atlas and Google Maps also indicate several structures one concession north of Lucknow, in an area where Google Streetview data is also unavailable. These structures include a church on the north side of South Kinloss Avenue, north of the terminus of Havelock Street, and three additional structures (possibly farmhouses) east along South Kinloss Avenue to Torrence Street. The presence of any early church raises the possibility of an adjacent cemetery with marked and/or unmarked burials. The atlas does not indicate any significant structures along the balance of Torrence Street.

Whitechurch

- There are many heritage structures located along Bruce Road 86 from just east of Lucknow to east of the Village of Whitechurch, at the other terminus of the pipeline. There are approximately 15 properties within 10 metres of the road right-of-way, most of these are within the Village of Whitechurch itself and include a church, two or three commercial buildings. The balance are residential buildings. The presence of any early church raises the possibility of an adjacent cemetery with marked and/or unmarked burials.

Please see Appendix C for the detailed cultural heritage resources report.

5.0 FACILITIES COST / DESIGN VALIDATION- PIPELINE CONSTRUCTION, OPERATION AND MAINTENANCE

In this section we will address an independent review of the UGL Study. However, at the time of the preparation of this report, the detailed support data behind the UGL Study had not yet been made available.

Our independent review is therefore based upon our long term experience in the natural gas pipeline energy industry and knowledge of accepted and sound design and construction practices within both Canada and the United States.

Although addressed in detail in the next section, facility design and costs are solely dependent upon the markets to be served, as well as, the reservation of a certain amount of incremental capacity for future market growth. The assumption of future market growth plays an important role in the facility design with respect to optimizing the initial facility requirements that will provide the most cost effective expansion alternates (looping and or compression additions) for the future markets.

The review of the methodology used by UGL for determining market load profiles for all the classes of customers (Residential, Commercial and Industrial) in our opinion was done with proper and sound principles. This would also include the determination of peak hourly and annual loads. The projection of peak hourly load profiles (especially in temperature sensitive markets) and the associated required burner-tip delivery pressures are the primary assumptions used for sizing pipeline facilities. The market and load assumptions discussed in the next section were relied upon as a basis for validation of pipeline and distribution design of facilities and costs.

5.1 Primary Conclusions Concerning Facility Design, Costs & Construction

Our review of the UGL Study leads us to conclude that the Facility Design is appropriate for connecting and serving the market loads estimated for the Owen Sound and Hensall Communities and Industrial Customers.

With respect to costs, the UGL estimates fall within the $45,000 - $90,000 per inch km ($75,000 - $150,000 per inch mile) you would expect for high pressure transmission and distribution facilities in modest rural areas. Using UGL's specific cost figures for the Owen Sound Communities & Industrials, which includes a total of 79.59 km of 8" and 6" pipeline at a cost of $41,520,244, the resulting cost factor is approximately $65,000 per inch km ($110,000 per inch mile). Pending detailed design, permitting and contract bids, the UGL Study costs are within the expected range of costs.

A desktop review of the proposed pipeline routing does not appear to present any fatal flaw constructability issues. However, there may be some permitting and/or construction challenges identified once detailed design, routing and survey work has been completed. With proper front-end engineering, survey and design work, our experience is that it is rare that issues found during the permitting process would cause a collapse of the project.

5.2 Validation of Technical Pipeline & Distribution Design Conditions

Within the course of estimating facility requirements and costs, we also determined that the UGL Study used proper methods in identifying materials specifications. For transmission pipeline UGL appears to have specified Grade B, ERW pipe. For distribution facilities either high density or medium density poly pipeline appears to have been specified. The utilization of these materials falls within the range of cost estimates expected for the services contemplated.

5.3 Summary of Costs

Figure 4, "Facility Schematic – Owen Sound Communities & Industrials," and Figure 5, "Facility Schematic – Hensall Communities," illustrate the total potential project evaluated in the UGL Study.

Owen Sound Communities & Industrials		Distribution Cost	Transmission Cost
Communities			
Chesley		$ 3,256,873	
Paisley		$ 2,990,770	
Tiverton		$ 1,590,751	
Kincardine			
Pointe Clark			
Inverhuron		$ 25,799,970	$ 41,520,244
	Sub Total	$ 33,638,364	$ 41,520,244
	Total	$ 75,158,608	
Industrials			
Greenville Ethanol			
Bruce Power			
Ontario Power			
Ontario Power Nuke Waste Mgt			
Canadian Agra			
Paisley Brick and Tile		$ 1,046,416	
	Sub Total	$ 1,046,416	
	Total	$ 76,205,024	
Hensall Communities			
Ripley		$ 1,138,664	
Lucknow		$ 2,523,250	$ 17,350,450
	Sub Total	$ 3,661,914	$ 17,350,450
	Total	$ 21,012,364	
	Grand Total	**$ 97,217,388**	

5.4 Operation and Maintenance

The transmission and distribution facilities in the UGL Study represent typical facilities already operated and maintained by UGL. The costs to operate facilities by an existing Utility are

spread across their entire system and allocation percentages may be assigned based on classes of service. To the extent the facilities being addressed by this report are operated by a new entity (such as a municipal), full-time qualified personnel will be required to operate and maintain the facilities. Many small municipals contract out operating and maintenance services to a third-party rather than maintaining the overhead internally. The pro-forma cost of service contained in Section 7.0 of this report includes an order of magnitude provision for the operating and maintenance costs associated with both the pipeline and distribution facilities being proposed by UGL.

5.5 Brief Discussion of Alternates and Impacts on Costs

Pending receipt of additional detailed support materials from the UGL Study, we believe there may be additional alternates that could reduce the costs from those identified in the UGL Study. These alternates include utilizing local production in concert with extensions of existing production laterals and/or the use of larger diameter high density poly pipe. High Density Poly Pipe can be made available up to 16” in diameter with an operating pressure of 160 psig.

Discussion of several options will be done further in this report including the potential use of compressed natural gas delivered via trucks. There is also increasing activity utilizing LNG liquefaction and the delivery of LNG via trucks.

The above alternates are currently not included in the scope of work for study. To the extent it appears financial evaluations are positive, it is recommended that these additional alternates be looked at in more detail.

6.0 MARKET / LOAD ASSUMPTIONS

Table 2: Performa Demand Forecast

			Kincardine, Arran Elderslie, Huron Kinross			
			NATURAL GAS PROJECT			
			Proforma Demand Forecast			
			Summary			
	Northern Communities		(GJ's)	(m3)	(Mcf)	
		Residential	337,105	8,810,910	311,157	
		Commercial	172,143	4,499,302	158,898	
		Large Industrial	797,000	20,831,189	735,658	
	Total Northern		1,306,248	34,141,401	1,205,704	93%
	Southern Communities					
		Residential	27,600	721,382	25,476	
		Commercial	47,386	1,238,517	43,738	
		Large Industrial	25,000	653,425	23,076	
	Total Southern		99,986	2,613,325	92,290	7%
	Total Project					
		Residential	364,705	9,532,293	336,633	26%
		Commercial	219,529	5,737,819	202,636	16%
		Large Industrial	822,000	21,484,614	758,729	58%
	Total Project Load Forecast:		1,406,234	36,754,726	1,297,993	
	Assumptions:					
		1) Residential and C/ penetration rate = 80% of Likely to Convert				
		2) Large Industrial per UGL modified for known adjustments				
		3) Bruce Power excluded, Can Agra included				
		4) Res annual use per customer = 85 GJ's (2,265 m3) per year				
		5) Commercial Segmentation and Use per Customer				
		Small	85%	190	GJ's per year	
		Medium	15%	1080	GJ's per year	
		Large	5%	8125	GJ's per year	
		6) Total Forecast Capture Day 1				

For purposes of assessing the feasibility and economics associated with Plan A as well as the alternative approaches outlined in this report, we have developed a base case load forecast which has been constructed primarily from data supplied in the UGL Report. In instances where information has been obtained that necessitate an adjustment to the load estimate contained in the original study, we have made such adjustments to reflect the best possible estimate of potential natural gas demand given what is known today.

With respect to forecasted residential and smaller C/I customers, we have adopted UGL's projected attachments, rate of capture and expected use per customer. In our view, UGL's system-wide experience including regional specific experience with respect to the Owen Sound market suggest the approach to load forecasting is an acceptable and reasonable proxy with respect to this portion of the load forecast.

With respect to the 5 larger industrial loads considered in UGL's proposal, we note the following:

- Greenfield Ethanol ("GFE"), the largest of the industrial loads identified in UGL's demand forecast, has already established natural gas service to its Tiverton facility. Although GFE represents an important load to underpin the justification for the proposed facilities, it is our view that their willingness to commit their demand to support the project will be a function of the competitiveness of the landed cost of gas as delivered from the project versus their current economics. Nevertheless, we have included the GFE facility in our proforma demand forecast.

- Based upon independent conversations and anecdotal evidence, there appears to be considerable doubt with respect to the Can Agra load in terms of the prospect for any reasonable term commitment from that entity that could be relied upon to underpin the project. This is the second largest estimated load in the UGL forecast of large industrials. In the same regard as GFE, we have included the Can Agra load as projected by UGL in our proforma demand forecast.

- There appear to be other industrial loads not considered in the UGL large industrial load forecast and other loads included we believe have not been accurately forecast from a demand standpoint. For purposes of this assignment, we have not undertaken to identify all of these potential loads. We do know that Miller Paving in Scone, just east of Chesley has a potential natural gas load of 30,000 to 50,000 GJ's per year based on current production. That level of demand could increase with the introduction of material fuel cost savings, but not by a factor of 3 to 5 times. UGL has reflected this load at 139,000 GJ's per year; we have therefore adjusted that industrial demand downward. We also know that the Snobelen drying facility represents a potential load and is being pursued by North Cross Pipeline as a direct connected customer to their gathering system in Huron County near Lucknow. The potential load is unknown however, a 10 km, 6" lateral is being proposed to attach that load which would suggest meaningful demand; perhaps as much as 100,000 GJ's per year. This load has not been included in our proforma demand forecast.

- We also understand that the Chesley Hardwood facility has not been operational for some time. Although UGL has considered this load in its demand forecast (172,000

GJ's), a load comparable in size to the Can Agra load, we believe it is doubtful this load can be relied upon in the near term as underpinning for the project. We have removed that load from our proforma demand forecast.

- The largest potential load in the study area we believe is represented by Bruce Power and the related facilities in and around the Bruce Energy Centre. UGL has accounted for a small portion of that demand, (OPG and the Nuclear Waste facilities) in its industrial demand forecast; however those volumes are not material to the overall forecast. Based on informal discussions with UGL, we believe Bruce Power's total energy requirement (base-load and backup generation) represents a significant potential natural gas demand if it could be converted. If a decision is made to pursue the project, Bruce Power should be re-approached.

For purposes of this study, we have accepted the UGL large industrial forecast with adjustments based on market intelligence we have gathered in the course of the study.

7.0 PROFORMA COST OF SERVICE AND LANDED COST OF GAS ECONOMICS

To evaluate Plan A in a manner consistent with current Ontario Energy Board rate making principles and policies and provide a basis to develop indicative landed cost analysis for Plan A which can then be compared to possible alternatives, we have developed a comprehensive Cost of Service Model to determine the annual fixed and operating cost recovery requirements for the facilities being proposed. We have segmented the cost of service into two logical categories; transmission costs and distribution costs. We have further segmented transmission into the Northern and Southern Pipeline systems and segmented distribution to determine a cost of service for each community for illustrative purposes.

Table 3: Performa Cost of Service

Kincardine, Arran Elderslie, Huron Kinross
NATURAL GAS PROJECT
Proforma Cost of Service

	(000's)			
Transmission Pipeline Facilities	**Installed Cost**	**Annual Cost of Service**	**Annual Cost of Service** (tax exempt)	**UGL**
Northern Segment	$ 41,520	$ 4,100	$ 3,397	
Southern Segment	$ 17,350	$ 1,676	$ 1,423	
	$ 58,870	$ 5,776	$ 4,820	
Distribution Facilities				
Northern Communities	$ 34,685	$ 3,591	$ 2,938	
Southern Communities	$ 3,662	$ 582	$ 504	
	$ 38,347	$ 4,173	$ 3,442	
Total Project Cost	$ 97,217	$ 9,949	$ 8,262	
Annual Demand - Plan A Base Case GJ's		1,406,234	1,406,234	
Annual Cost of Transmission & Distribution - per GJ		$ 7.075	$ 5.876	$ 4.997
Transmission Cost		$ 4.107	$ 3.428	$ 1.095
Distribution Cost		$ 2.968	$ 2.448	$ 3.903
Total Delivery Cost per GJ		$ 7.075	$ 5.876	$ 4.997
Northern System 1306248 GJ's		$ 5.888	$ 4.850	
Southern System 99,986 GJ's		$ 22.583	$ 19.277	
1,406,234				

Assumptions:

1) See detailed Cost of Service Models by Segment

Table 4: Landed Cost of Gas Matrix

Kincardine, Arran Elderslie, Huron Kinross
NATURAL GAS PROJECT
Landed Cost of Gas Matrix
Summary

	Plan A $/GJ	Plan A $/GJ (tax exempt)	UGL M1 Res $/GJ
Transmission Charge -per Proforma C of S			
Distribution Charge - per Proforma C of S	$4.107	$3.428	$1.095
Costs applicable to New Facilities	$2.968	$2.448	$1.115
Fixed Monthly Charge	$7.075	$5.875	$2.209
UGL Cross System Transportation Charge	$0.000	$0.000	$2.788
Total Cost of Transportation & Distribution	$0.450	$0.450	$0.00
	$7.525	$6.325	$ 4.997
Cost of Gas - (UGL Eastern QRAM filing April 1st)			
	$5.500	$5.500	$2.297
TOTAL DELIVERED COST @ 100% LF			
	$ 13.025	$ 11.825	$ 7.294

Assumptions:

Total Delivered cost calculated on a 100% LF basis
UGL cross system toll est.

8.0 CONCLUSIONS AND RECOMMENDATIONS

9.0 CLOSURE

This report was prepared for the exclusive use of Bruce Telecom and is intended to evaluate the feasibility of developing a natural gas distribution system in the municipalities of Kincardine, Arran Elderslie and Huron Kinloss. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. Should additional parties require reliance on this report, written authorization from AMEC will be required. With respect to third parties, AMEC has no liability or responsibility for losses of any kind whatsoever, including direct or consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The investigation undertaken by AMEC with respect to this report and any conclusions or recommendations made in this report reflect AMEC's judgment based on information available at the time of preparation of this report. This report has been prepared for specific application to the proposed route of the pipeline as reported by Union Gas Limited. Unless otherwise stated, the findings cannot be extended to previous or future route conditions or portions of the proposed route which were unavailable for investigation. AMEC has used its professional judgment in analyzing this information and formulating these conclusions.

AMEC makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

Should you have any questions regarding this submittal or require further information, please feel free to contact the undersigned.

Yours truly,
AMEC Environment & Infrastructure
a Division of AMEC Americas Limited

Prepared by:

DRAFT

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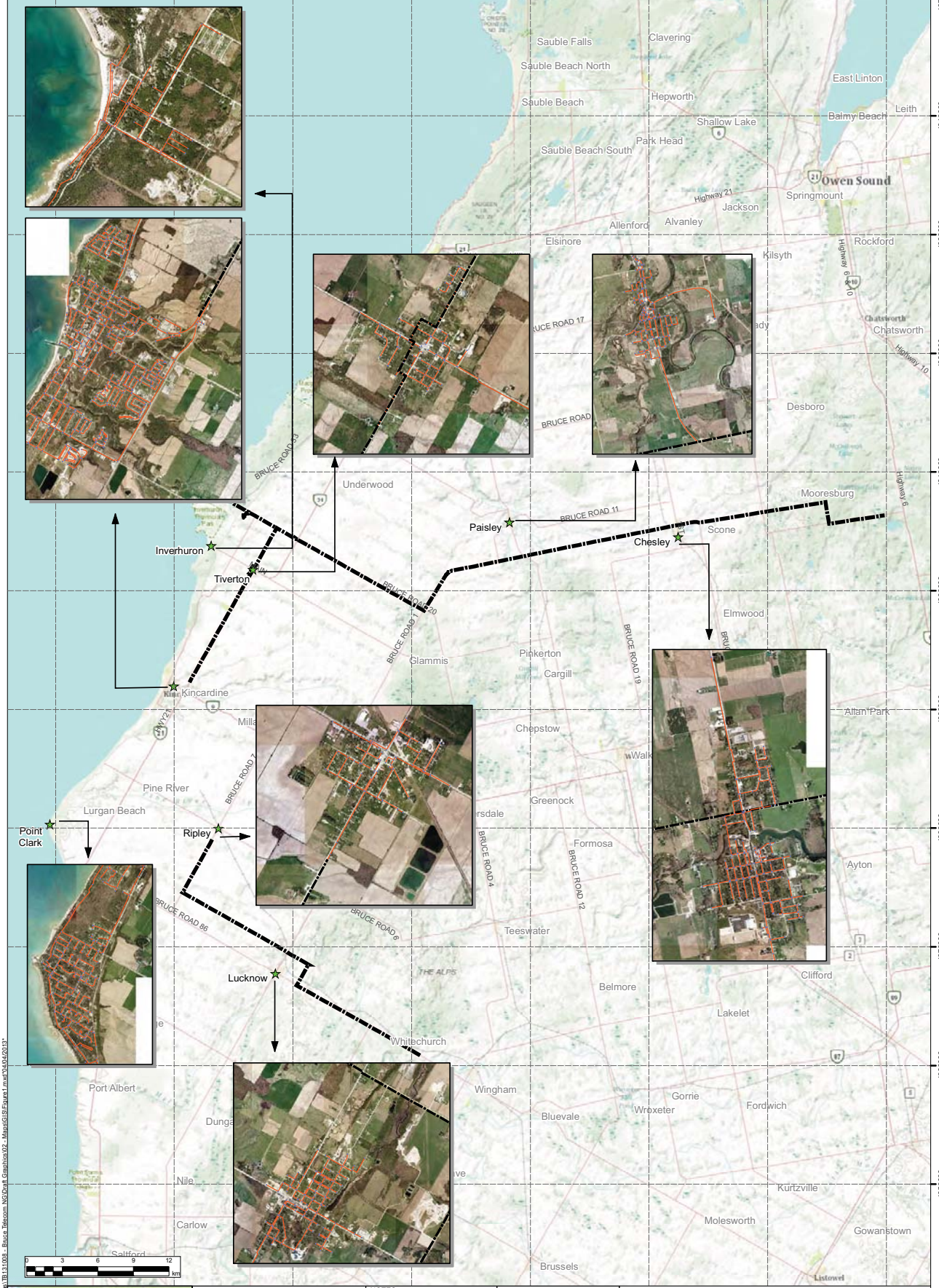
President & CEO, EFG



LEGEND

- Proposed Pipeline
- Distribution line

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC ENVIRONMENT & INFRASTRUCTURE REPORT No. ___ DATED ___.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: ESRI ; Union Gas

CLIENT: Bruce Telecom

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:300,000

N W E S

PROJECT TITLE: **Bruce Telecom NG**

Pipeline Location

PROJECT N°: TB131008

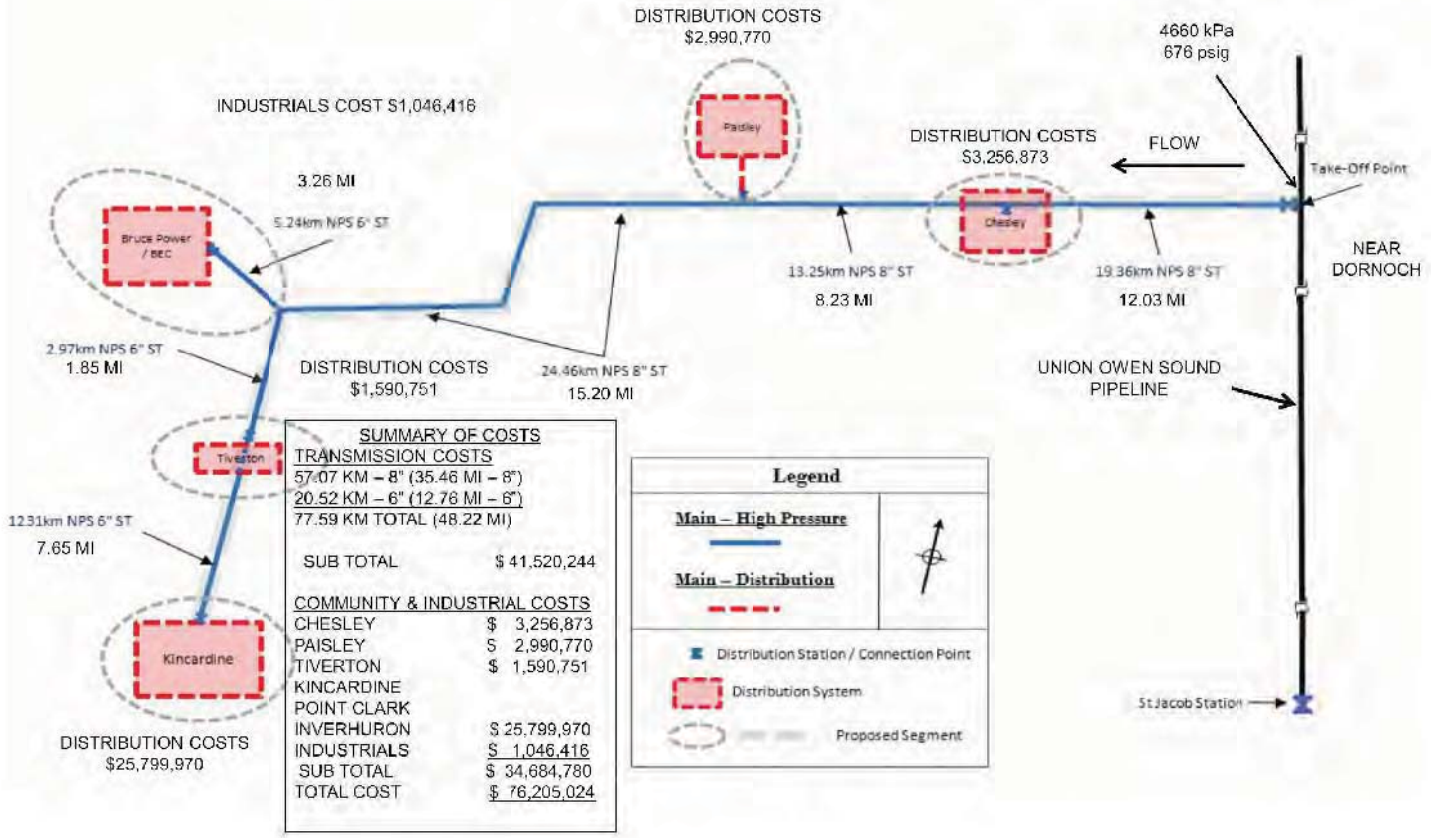
DATE: April, 2013

FIGURE: 1

AMEC Environment & Infrastructure
505 Woodward Ave., Hamilton, Ontario, L8H 6N6
tel: 905-312-0700 www.amec.com

Facility Schematic – Owen Sound Communities & Industrials

MODIFIED BY: THE BABIUK GROUP, Inc. (April 7, 2013)



SUMMARY OF COSTS	
TRANSMISSION COSTS	
57.07 KM – 8" (35.46 MI – 8")	
20.52 KM – 6" (12.76 MI – 6")	
77.59 KM TOTAL (48.22 MI)	
SUB TOTAL	$ 41,520,244
COMMUNITY & INDUSTRIAL COSTS	
CHESLEY	$ 3,256,873
PAISLEY	$ 2,990,770
TIVERTON	$ 1,590,751
KINCARDINE	
POINT CLARK	
INVERHURON	$ 25,799,970
INDUSTRIALS	$ 1,046,416
SUB TOTAL	$ 34,684,780
TOTAL COST	$ 76,205,024

Legend

- Main – High Pressure
- Main – Distribution
- Distribution Station / Connection Point
- Distribution System
- Proposed Segment

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC ENVIRONMENT & INFRASTRUCTURE REPORT No. ___ DATED ___.

CLIENT:	BRUCE TELECOM
PROJECT TITLE:	**Bruce Telecom NG**
Drawn By:	RL
Checked By:	DM
	Facility Schematic - Owen Sound Communities
Revision N°:	1
PROJECT N°:	TB131008
FIGURE:	4
Scale: N/A	
DATE:	09 Apr 2013

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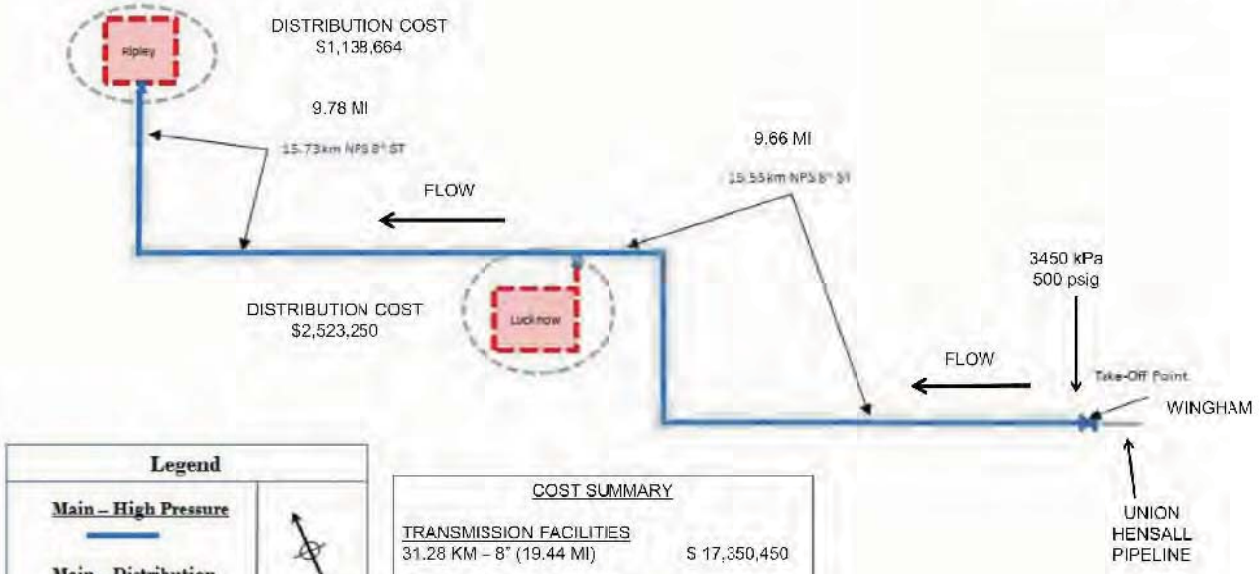
Facility Schematic – Hensall Communities

MODIFIED BY: THE BABIUK GROUP, Inc. (April 7, 2013)



Legend

- Main – High Pressure
- Main – Distribution
- Distribution Station / Connection Point
- Distribution System
- Proposed Segment

COST SUMMARY

TRANSMISSION FACILITIES	
31.28 KM – 8" (19.44 MI)	$ 17,350,450
DISTRIBUTION FACILITIES	
Community of Ripley	$ 1,138,664
Community of Lucknow	$ 2,523,250
	$ 3,661,914
TOTAL HENSALL COSTS	$ 21,012,364

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC ENVIRONMENT & INFRASTRUCTURE REPORT No. ___ DATED ___.

CLIENT: BRUCE TELECOM

PROJECT TITLE: **Bruce Telecom NG**

Drawn By: RL

Checked By: DM

Facility Schematic - Hensall Communities

Revision N°: 1

Scale: N/A

PROJECT N°: TB131008

DATE: 09 Apr 2013

FIGURE: 5

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APPENDIX A

GEOMORPHIC CONDITIONS REPORT

1.0 GEOMORPHIC CONDITIONS

1.1 Geomorphic Summary

An erosion risk screening tool (ERST), developed by AMEC, was utilized to assess the risk for pipeline cover erosion at the proposed watercourses associated with Bruce Telecom's proposed Kincardine and Ripley pipeline alignments. The ERST was applied to the proposed pipeline routing from a Level I feasibility only. This level of assessment presents the broadest evaluation possible in order to provide an initial indication of the risk of possible exposure due to erosion where the pipeline is proposed to cross watercourses. To provide this initial indication of pipeline exposure risk it was necessary to examine provincial and federal sources of data such as land use information, land cover information, and soils mapping to ensure that the data used in the screening tool is readily available.

AMEC identified 116 proposed pipeline watercourse crossings, 70 of these along the Kincardine alignment and 46 along the Ripley alignment. The watercourse crossings were individually classified by stream order and ranked accordingly. Stream order value increases in magnitude as the size of the stream increases with the addition of same order stream confluences. The higher the stream order magnitude the higher the potential stream energy resulting in a higher potential risk for possible damaging stream flow regimes. The stream order analysis identified 7 fourth order or larger on the Kincardine alignment and 6 fourth order on the Ripley alignment. These include 1 with a stream order of seven, 1 of stream order five, and the remaining 11 with a stream order of four. These crossings are illustrated in Appendix A-4: Aquatic Measurements. The analysis also identified 12 crossings with a stream order of 3 which require additional analysis in the future.

The stream order ranking was utilized to create a short-list of streams with higher potential stream energy and therefore erosion risk that were then further analysed for further erosion affecting factors. The resulting additional analysis suggested a moderate risk for 3 alignment crossings 1 each for Willow Creek, Vesta Creek on the Kincardine alignment, 1 on Dickie Creek which is on the Ripley aligment. The analysis suggested that 2 alignment crossings had a high risk both on the Ripley alignment crossing the Stanley Drain and the McMurchy Award.

Regardless of the ERST ranking it is recommended that all of the 13 alignment crossings with a stream order of four or larger requires additional analysis. This is recommended in order to determine appropriate crossing design and construction methods that will be required at these crossings.

1.2 Geomorphic Data Collection

Prior to collecting the secondary source data a preliminary list of factors affecting erosion and stream dynamics was created. This list was utilized to guide the search for secondary source data. Secondary source data which was consistently available for the majority of the watercourse crossings, and was found to correlate with a feasibility level for erosion risk was selected for further analysis. For Level I analysis the primary factor considered is stream order which provides a relative magnitude to each water crossing. The potential factors affecting erosion, and the data sources examined for each factor is outlined in Table A-1.

Table A-1: Preliminary Factors Affecting Erosion

Factor	Data Source	Factor Used in ERST
Soil Types (erodibility)	GIS data from Agriculture and Agri-Food Canada's Soil Landscapes of Canada version 3.2 Soil maps and reports from Agriculture and Agri-Food Canada's Legacy Soil Surveys	Yes
Confinement of River at Crossing	Current aerial imagery from Google Earth GIS data from Land Information Ontario	Yes
Land use	GIS polygons and data tables of land cover from Natural Resources Canada	Yes
Watershed size and stream order[1]	Canadian Digital Elevation Data from Natural Resources Canada	Yes
Channel and valley gradient[1]	GIS data from Land Information Ontario GIS data from Natural Resources Canada	No
Bankfull width	Current aerial imagery from Google Earth GIS data from Land Information Ontario GIS data from Natural Resources Canada	Yes
Floodplain Width	Current aerial imagery from Google Earth GIS data from Land Information Ontario	No
Channel Crossing Upstream & Downstream	Historic aerial imagery from National Archives of Canada	Yes
Bank Protection	Current aerial imagery from Google Earth GIS data from Land Information Ontario	Yes

1 Data required measurements or processing using ArcGIS to relate it to the assessment factor.

1.3 Geomorphic Processes and Pipeline Exposure

The ERST provides a classification of a watercourse's, susceptibility to experiencing erosion which may cause exposure of the buried pipeline. Developing an understanding of the processes which can lead to pipeline exposure is a crucial aspect of the development of the ERST. As water flows it exerts force on a stream's bed and banks, once this force becomes great enough the particles which make up the bed and banks will begin to erode. Pipeline crossings can be exposed as a result of either bed scour or bank erosion. Bed scour will expose the pipeline buried under the stream, while bank erosion exposes the pipeline in the adjacent floodplain. Additional information on geomorphic processes which may lead to pipeline exposure is presented in Appendix A-1.

1.4 Erosion Risk Screening Tool Development

The secondary source data which was available for the majority of the pipeline crossing locations was examined to determine what information it provided as well as how strongly this information correlated to erosion risk. From this examination, factors which predict erosion risk were extracted and ranked based on their level of correlation to erosion risk. The factor's correlation to erosion risk was given a correlation value from one to three, with one representing a low correlation, two representing a moderate correlation, and three representing a strong correlation. Additionally, each factor had its own scoring system developed to indicate the level of erosion risk. Factors were scored from one to three, with one representing a low risk, two

representing a moderate risk, and three representing a high risk. The factors utilized in the ERST as well as the correlation values they have been assigned are presented in various Table in the following section and Appendix A-2.

1.5 Erosion Risk Screening Tool

The secondary source data which was available for the majority of the pipeline crossing locations was examined to determine the level of information it provided as well as how strongly this information correlated to erosion risk. From this examination, factors which predict erosion risk were extracted and ranked based on their level of correlation to erosion risk. The factor's correlation to erosion risk was given a correlation value from one to three, with one representing a low correlation, two representing a moderate correlation, and three representing a strong correlation. This ranking was utilized to develop the final ERST.

The primary considerations at a Level I focus is primarily related to determination of stream order, land use, floodplain width, and proximity of channel crossing to upstream and downstream confinement and channel modification.

A summary of the factors to be assessed, as well as their correlation values and the related scoring system are outlined in Table A-2. Since the scoring system for each factor has a minimum score of one, the base score for a stream which has low risk from all factors is 9, or 33.3%. The scoring for risk classification is dividing into three rankings in the attempt to escalate each crossings relative ranking based on percent of the total points scored for erosion factors considered. The ERST classification breakdown is shown in Table A-3. Since this is a Level I assessment, weighted scoring was not considered. Weighted scoring is recommended for subsequent levels of feasibility assessment. The maximum score of 27 is the highest rating a crossing can attain. However, even a stream which has low risk from all factors could still experience rapid erosion events and by nature streams are continually transporting sediment due to erosion.

Table A-2: Erosion Risk Screening Tool Summary

Factor	Correlation Value	Minimum Score	Maximum Score
Soil Types - Erodibility	1	1	3
River Confinement	1	1	3
Channel Slope	1	1	3
Stream Order/Watershed Area	3	1	3
Land Use	3	1	3
Bankfull Width	1	1	3
Floodplain Width	3	1	3
Channel Crossing Upstream & Downstream	3	1	3
Bank Protection	3	1	3
Total	**19**	**9**	**27**

The score produced by the ERST was then utilized to classify the crossing's risk of experiencing rapid erosion events. The percentage risk of rapid erosion is based on the crossing's totaled score from the assessment is presented in Table A-3 below, and Table A-4 presents the watercourse assessment score and the resulting risk classification results for the 13 assessed watercourses. The driving factor that determined the risk classification for each individual crossing is presented in Table A-5.

Table A-3: Risk Classification from Screening Tool Results

Risk of Rapid Erosion Event	Score from Screening Tool	Score as Percentage
Low	Less than or equal to 16	Less than 63%
Moderate	Between 16 and 18	64% - 74%
High	Greater than or equal to 18	Greater than 75%

Table A-4: Risk Classification for Stream Order 4 and Larger Watercourse Crossings

Watercourse	Assessment Score (%)	Presence of Overriding Factor*	Risk Classification		
			Low	Moderate	High
K13	67	N/A		X	
K15	63	N/A	X		
K19	70	N/A		X	
K20	63	N/A	X		
K22	63	N/A	X		
K25	59	N/A	X		
K32	70	N/A		X	
R13	52	N/A	X		
R14	74	N/A		X	
R17	56	N/A	X		
R18	59	N/A	X		
R31	78	N/A			X
R40	78	N/A			X

*Level I study. Thus all crossings currently do not have any overriding factor attributed to level of data, results do not have any elevated risk resulting in classification increase of 1 level.

In total, thirteen crossings have an elevated risk based on having a stream order of four (4) or larger. Seven such stream orders exist for the Kincardine proposed route and six (6) are located along the proposed Ripley alignment. One additional crossing in Willow Creek had a stream order of 3, and should be further investigated at the next level. These watercrossings would have to be further investigated through site specific investigations as part of a more detailed feasibility assessment or during detailed design.

1.6 Assessment of Proposed Pipeline Crossings

The ERST was employed to screen all of the watercourse crossings with secondary analysis for potential elevated erosion risk. Secondary analysis requires desktop research on nine stream erosion factors that are listed in Table A-5. Of the 116 crossings analyzed, thirteen pipeline crossings were selected for secondary analysis based on stream orders greater than or equal to

four. One crossing had a stream order of three and the remaining stream crossings were identified with a stream order of two or less. For the purposes of the Level 1 feasibility assessment, the ERST review focussed on the watercourses with stream greater than 3 as it was assumed that these order 2 or less streams would be less likely to exhibit erosive forces capable of rapidly exposing a buried pipeline. This is assumed based on the stream order vs. discharge relationship in streams that often require streams with higher conveyance capacity have wider full bank flow and wider floodplains. The thirteen river crossings included for further assessment are located at various intersections with Willow Creek, Vesta Creek, Dickey Creek, Stanley Drain, and McMurchy Award Drain.

A standard form for data collection was developed to assist in recording the stream characteristics which were required as input for the ERST. Completed erosion risk assessment data collection sheets are provided in Appendix A-2. In Table A-10 the land cover percentages reflect the region of the project as a composition of mostly cropland and pasture. The land use risk factor was determined based on the fact that the percentage of annual cropland ranges from 25% to over 65% resulting in a mid ranking due to the potential erosion capability of fields not planted containing no root stability to prevent soil loss. Based on the data collected for the crossing, and the scoring system outlined in Section 1.6 of the development of the screening tool, each of the factors was scored for each of the crossings. The individual risk factor scores corresponding to each crossing are provided in Table A-5. Channel slope and floodplain width are not part of the scope for a Level I study. However, due to their importance they are considered and awarded a value of one, this requires additional effort in future assessment.

Stream characteristics for the thirteen stream crossings of Stream Order 4 or greater are illustrated in the figures contained in Appendix A-4: Aquatic Measurements.

Table A-5: Risk Factor Scores for Thirteen Crossings Stream Order > 4

Factor	(Wei Value Corre ghti	Willow Ck K13	Willow Ck K15	Willow Ck K19	Willow Ck K20	Willow Ck K22	Vesta Ck K25	Vesta Ck K32	DickieC k R13	DickieC k R14	DickieC k R17	DickieC k R18	Stanley Drain R31	Award Drain R40
Soil Types	**1**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
Confinement of River at X-ing	**1**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**1**	**3**	**1**	**3**	**3**	**3**
Channel Slope	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Stream Order & Watershed	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Land Use	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Bankfull Width	**1**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**2**		**2**	**1**

Floodplain Width	**3**	1	1	1	1	1	1	1	1	1	1	1	1	1
Channel Crossing Upstream & Downstream	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**2**	**3**	**4**
Bank Protection	**3**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**	**3**	**3**
Crossing's Weighted Score		**18**	**17**	**19**	**17**	**17**	**16**	**19**	**14**	**20**	**15**	**16**	**21**	**21**
Crossing's Score (%)		**67%**	**63%**	**70%**	**63%**	**63%**	**59%**	**70%**	**52%**	**74%**	**56%**	**59%**	**78%**	**78%**

Seven of the screened crossings were classified as having a Low risk; four crossings were classified as having a Moderate risk; and two of the screened crossings were classified as having a High risk. Crossings classified as Moderate risk and High risk should be further assessed during detailed design to validate the risk of potential pipeline exposure at these sites and to inform crossing design considerations. At a minimum further assessment would involve establishing precise steam bed slope and floodplain width and geomorphic condition for each crossing reach. The importance of further assessment is discussed in section 1.7. Advanced assessment of these sites should also include utilizing bed scour and bank erosion models to predict the effect of various flows on the stream within the reach containing each proposed pipeline crossing.

1.7 Recommendations for Future Erosion Risk Screening Tool Assessment

The need for additional assessment of a stream bed is usually created by the potential for channel adjustment (i.e. degradation caused by excessive erosion and scour or aggradation (deposition from erosion upstream) in response to changes resulting from human activities and extreme events. The next assessment level should consist of a variety of protocols resulting in a cumulative impact assessment that will assist in verifying the risk factors listed in Table 3-11. These protocols will include reconnaissance, measurement, and documentation of existing conditions and predicted future conditions that can be compared with historic conditions. Physical channel assessment consists of:

- Stream bed and bank soil characteristics.
- Channel stability: aggrading or degrading or stable, straightening, dredging, diking, armoring, cleaning, mass wasting events, upstream/downstream impoundments that effect sediment budget, streambank erosion in pipeline crossing site and reach, bend scour from changing flow patterns in nearby meander.
- Monumented cross-sections: If the pipeline alignment is approved and goes to the design level the major crossings identified should employ the use of permanently monumented cross-sections. This provides an elevation reference to depict channel changes. A resurvey of the crossing can then be done annually and changes properly identified and tracked. See Figure A-2 in the Appendix A-3 for example of cross-section survey measurement.

- Depth of Cover recommendation: Using the monumented cross-section and the various crossing specific geomorphic characteristics of the stream bed and stream bank can assist in a depth of cover recommendation for the pipeline. This should be determined for each crossing. Depth of cover determination is essential for encouraging as it results in a higher level of pipe protection from scour caused by runoff events that historically damage stream crossing pipelines.
- Landuse: land cover, infrastructure such as dams or floodplain fill, constraints on channel, livestock accessing stream site and reach causing erosive action, recreational vehicles or farm equipment accessing stream site and reach causing erosive action.
- Water Energy: measurements for stream depth, bankfull width, floodplain width, meander belt, and condition or channel confinement in order to document potential future channel changes.
- Organic material: inventory of large woody debris depositing within the reach that is currently dissipating stream energy, vegetation along banks determining present bank erosion and level of stability.

Erosion Risk factors scored in Table A-2 for each crossing require an additional weighted score based on the additional channel assessments previously recommended. There are specific cases where a full assessment of the crossing can trigger a crossing to be at high risk of experiencing a rapid erosion event. These conditions might include observation of rapid channel movement, rapid aggradation (deposition) or degradation, or known alteration of the channel. However, at the Level I study, the required site specific observation is not conducted. Level II study will prompt this further assessment.

The stream channel ground-truthing assessment can indicate the current stability of the stream by evaluating whether the stream is: a) aggrading (deposition), b) degrading (downcutting or incising), c) shifting in bed material size, d) changing rate of lateral movement through bank erosion (mass wasting), e) changing in morphological types through time.

Additional Desk top assessments shall consist of:

- Air photos
- GIS maps
- Satellite photos
- Historic records
- Stream Gauging (if available)
- Landslide and unstable slope data or surveys (if available
- Anecdotal information. Speak with local landowners as well as city, and local government engineers.

Other factors, such as channel gradient and floodplain factors are considered as important ERST ranking values, however, the assembly of the extensive data sets for these factors was

beyond the scope for Level I feasibility analysis. In recognition of their importance they are considered and provided a value of one but require additional effort in future assessment.

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APPENDIX A-1

GEOMORPHIC PROCESSES AND PIPE LINE EXPOSURE

STREAM FUNCTION OVERVIEW

Broadly speaking, the morphology of alluvial streams is a reflection of interactions among available energy, water, sediment, and structural elements. River and Land forms evolve from fluvial processes and tend toward self-stabilization due to mutual adjustments driven by the environment. Land erosion, river form and action are determined by physical laws that do not dictate merely one assessment nor solution to the reaction of the land form or channel to the changes imposed on them by seasonal climatic variations. As a result, the forms are assumed and the adjustments made will tend toward the most probable form.

The effects on channel form depends on the relative resistance of bed and bank material. The shape of the cross section of any of these studied river channels is a function of the flow, the quantity and character of the sediment in motion through the section, and the composition of the materials in the channel that make up the bed and banks of the channel.

The processes of deposition and scour can be expressed as a conservation law in which the rate of deposition or entrainment of suspended solids (grains) from the bed within the reach equals the rate of transport from upstream minus the rate of loss of sediment downstream. Thus, if more sediment is leaving a reach at the downstream end than entering it at the upstream end over a known period of time, then the rate of entrainment is negative, indicating scour is occurring.

Scour can occur as a result of a number of processes. The ERST attempts to screen for the likelihood of these processes occurring within a stream reach. Processes which lead to scour include bank slope failure, creation of, and migration of a headcut (nickpoint) within a reach, weathering of bank material, incipient motion of above average size sediment, and changes to stream gradient. It should also be noted that the process affecting the channel in which the crossing is a concern, may be located in a sub-tributary not being monitored. Anticipating which of these processes may be affecting a stream using secondary source data is difficult, and as such the ERST should be used in conjunction with field investigations and should not be the sole tool used for assessment of a pipeline crossing's susceptibility to erosion.

BED SCOUR

Pipeline crossings are buried under the stream beds, which makes them susceptible to bed scour and the resulting lowering of the stream bed. In a stable stream reach, bed-material is expected to move; however, the rate of bed-material entering the reach from upstream sources will be equal to that leaving the reach at the downstream end. Bed scour occurs when more bed-material leaves a reach than enters it. Bed scour may occur as a result of a decrease in upstream sediment supply, and/or an increase in stream power within immediate stream reach.

While the entrainment of upland soils from overland runoff is included in this definition, scour on river systems generally refers to the removal of material from the bed and banks of the river from streamflow. In a case like this, we will address the removal of material from the river banks

in section about Bank Erosion. Total scour on a river is composed of three components 1) general scour, 2) contraction scour, and 3) local scour. In general, the components are additive when addressing scour on the streambed.

Bed degradation over long reaches due to head cuts and changes in hydrology controls (such as dams, sediment discharge, or river geomorphology) is termed general scour. General scour often occurs during the passage of a flood, but is sometimes masked because sediments deposit to the original lines and grades on the falling stage of the hydrograph. General scour involves the removal of material from the bed and banks across all or most of the width of a channel. This type of scour may be natural or man-induced and requires geomorphic and sedimentation analyses to quantify.

The scour that results from the acceleration of the flow due to a contraction, such as a bridge, is called contraction scour. This type of scour also occurs in areas where revetments are placed such that they reduce the overall width of the stream segment. Contraction scour is generally limited to the length of the contraction, and perhaps a short distance up and downstream, whereas general scour tends to occur over longer reaches.

The scour that occurs at a pier, abutment, erosion control device, or other structure obstructing the flow is called local scour. These obstructions cause flow acceleration and create vortexes that remove the surrounding sediments. Generally, depths of local scour are much larger than general or contraction scour depths, often by a factor of ten. Local scour can affect the stability of structures such as riprap revetments and lead to failures if measures are not taken to address the scour.

Factors that affect local scour include:

- Width of the obstruction.
- Projection length of the obstruction into the flow.
- Length of the obstruction.
- Depth of flow.
- Velocity of the approach flow.
- Size of the bed material.
- Angle of the approach flow (angle of attack).
- Shape of the obstruction.
- Bed configuration.
- Ice formation or jams.
- Debris.

Analysis for scour in this report is limited to utilizing only desk top tools resulting in a scour assessment. The Level I analysis is limited to the characteristics identified in Table 0-1: Erosion Risk Screening Tool Summary as in this report.

Factor such as precipitation, climate, land uses change, and channel slope can have great impact on scour depth and loss in pipe cover due to their ability to alter peak flows. Overall, channel beds experience an increasing depth of activity over an increasing proportion of the bed as peak discharge is increased. Consequently, mean depths of scour increase with peak magnitude.

BANK EROSION

Pipelines also run below ground in the floodplain adjacent to streams. Bank erosion can potentially expose a pipeline within the floodplain even though the pipeline may be covered sufficiently in the center of the channel. An evaluation of pipeline failures during flooding of the San Jacinto River near Houston, Texas in October 1994, conducted by the NTSB, indicated that most pipeline failures during this flood occurred due to lateral erosion which resulted in the stream exposing the pipeline in the floodplain (NTSB 1994).

Bank erosion occurs when flowing water “plucks” a particle from a stream’s banks. Stream bank erosion is driven by two major characteristics: stream bank characteristics and hydraulic/ gravitational forces. By utilizing a variety of secondary source data a rough image of these characteristics within a stream reach can be pieced together.

ANTHROPOGENIC CONTROL

Anthropogenic affects, or those effects which result from human activity, are responsible for many of the changes in stream morphology. Human impacts on stream systems over the years have been numerous and diverse. Humans have straightened, dredged, dammed, diverted, and piped streams in efforts to increase “useable” land or reduce flooding. These alterations result in changes in the transport capacity of a stream, which in turn leads to the stream seeking a new equilibrium state through a combination of deposition and scour. Streams which have been recently affected by human impacts are likely to still be undergoing channel changes to find their new equilibrium. Additionally, streams which are currently at equilibrium can easily be disturbed by future human impacts which will result in changes in channel form in order to reestablish this equilibrium. Although this screening tool can account for some level of the anticipated anthropogenic affects, it cannot forecast the actual impacts humans will have on a watercourse.

APPENDIX A-2

MAJOR RIVER CROSSINGS EROSION RISK SCREENING DATA COLLECTION SHEETS

Table A-6: Crossing Stream Order

See Table B-6 in Appendix B

Table A-7: Crossing Drainage Area Stream Order > 4

Crossing Id	Area (km^2)
K13	225.49
K15	232.27
K19	235.19
K20	235.46
K22	24.30
K25	2512.76
K32	675.83
R13	15.17
R14	15.48
R17	39.34
R18	66.38
R31	45.24
R40	31.74

*K13, K15, K19, and K20 are located along the same watercourse, but the crossing locations are downstream of each other. As a result the area calaculated for these fours crossing in the above table contains overlap .

*R13 and R14 are located along the same watercourse, but the crossing locations are downstream of each other. As a result the area calaculated for these two crossing in the above table contains overlap .

Table A-8: Soil Types for Stream Order > 4 crossings

Crossing ID	Percent Sand	Percent Silt	Percent Clay	ERST
K32	24	54	22	**2**
K25	24	54	22	**2**
K22	24	54	22	**2**
K20	24	54	22	**2**
K19	35	47	18	**3**
K15	24	54	22	**2**
K13	35	47	18	**3**
R40	35	47	18	**3**
R31	35	47	18	**3**
R18	35	47	18	**3**
R17	35	47	18	**3**
R14	38	49	13	**3**
R13	35	47	18	**3**

Soil cohesion decreases with increased sand content; therefore, it appears reasonable that soils with higher sand contents were likely to erode at lower shear stresses.

Table A-9: Nearest Feature at Stream Order > 4 Crossings

Crossing	Downstream	Distance (m)	Over Crossing	Distance (m)	Upstream	Distance (m)
K13	Dam	2292	Bruce Road CR10	1	Grey Bruce Line	257
K15	Dam	1610	Concession Rd 2	0	Sideroad 25	440
K19	Crossing K20 / Concession Rd 20	618	Concession Rd 2	0	Unknown local Rd	1540
K20	Unknown local Rd	1511	Concession Rd 2	0	Crossing19 / Concession Rd 2	618
K22	Sideroad 5	770	Concession Rd 2	0	Unknown local Rd	526
K25	Goldie St	7037			Brant-Elderslie Rd	3275
K32	Bruce Road 1	3690	Concession Rd 2	0	Greenock Elderslie Rd	1660
R13	Torrence St	368	Bruce Rd 86	0	St Helens Line	2364
R14	Bruce Road 86	519	Torrence St	0	Bruce Road 86	368
R17	Old rail crossing convert to natural trail	1645	S Kinioss Ave	0	Grey Ox Ave	3036
R16	Old rail crossing convert to natural trail	664	S Kinioss Ave	0	Grey Ox Ave	2504
R31	Concession Road 2	1725	Bruce Road 7	0	Sideroad 10 S	2741
R40	Concession Road 6 E	716	Bruce Road 7	0	Sideroad 10 S	3745

Table A-10: Natural Confinement & Bank Protection at Stream Order > 4 Crossings

	Upstream		
Crossing Id	**Distance (km)**	**Description**	**ERST**
K32	n/a	Image too course to evaluate	**3**
K25	0.59	Appears to be fast moving water or sediment fall out	1
	1.05	Evidence of back pooling	1
	1.34	Erosion cutting bank, possible creation of island in the future	1
	1.41	Creation of pool on left side of watercourse	1
			1
			1
K22	0.12	Small island or land jetting out	1
	0.19	Narrowing of channel, unknown reason	**3**
	0.42	Small island in center of watercourse	1
	0.52	Road crosses watercourse	3
	0.53	Water pooling on upstream side of road	1
		(0 K<Narrowing,Widening<0.5K=3; 0.5 K >Narrowing<2K=2)	1
		(crossings <0.5 K up/down=3; 0.5 K >crossing<2K=2)	3
K20	0.24	Looks as though bank on outside of meander has eroded or collapsed	1
	0.62	Road crosses watercourse and is at crossing K19	**3**
			1
			1
			1
K19	0.38	Pooling of water on right bank, could be result of a small tributary	1
	0.76	Watercourse takes sharp right angled turn	1
	1.12	Watercourse takes sharp right angled turn, outside meander is bare soil	1
	1.63	Dam and road crossing resulting is large pooling of water upstream	**1**
K15	0.25	Narrowing of watercourse unknown reason	**3**
	0.44	Road crosses watercourse	2
	0.77	Island/side channel on right bank	1
K13	0.03	Long center island	1
	0.17	Evidence of back pooling	**2**
	0.27	Small tributary joins main watercourse	1
	0.56	Watercourse enters wetland area	1
	0.68	Watercourse loose defined shoreline	1
	2.52	Watercourse narrows at dam	**1**
R40	0.09	Shallow or bottoming out of watercourse	1
	0.52	Watercourse takes sharp right angled turn	1
	0.71	Road crosses watercourse	**2**
R31	0.03	Very narrow channel entering from culvert	**3**
	0.1	Widening of watercourse, unknown reason	3
	n/a	Nothing farther out could be determine to thick tree canopy in aerial imagery	
R18	0.87	Narrowing of channel, unknown reason	**2**
	0.91	small island/braiding of channel	1
R17	0.16	Small Tributary joins main watercourse	**1**
	0.23	Small Tributary joins main watercourse	1
	0.46	Multiple side channels, could be wetland	1
	0.87	Long center island	1
	0.97	Small island on outside of meander	1
	1.16	Small island on outside of meander	1
	1.21	Large center island	1
R14	n/a	Nothing could be determine to thick tree canopy in aerial imagery	**1**
R13	n/a	Nothing could be determine to thick tree canopy in aerial imagery	1

Downstream				
Distance (km)	Description	ERST	ERST AVG	Crossing Id
n/a	Image too course to evaluate	**3**	**3**	**K32**
0.46	Widening of watercourse scouring along bank	**2**	**1**	
0.62	Small Tributary joins main watercourse	1		
0.85	Appears to be fast moving water or sediment fall out	1		**K25**
0.94	Small Tributary joins main watercourse	1		
1.18	Small island on right side of watercourse	1		
1.58	Small island on left side of watercourse	1		
0.14	Evidence of cows/livestock using the watercourse	3	**2**	
0.17	Evidence of back pooling	1		
0.38	Shallow or bottoming out of watercourse	1		
0.43	Some sort of natural feature crossing watercourse, unable to provide more detail due to image quality	1		**K22**
0.52	Small Tributary joins main watercourse	1		
0.58-0.8	Shoreline is jagged and irregular	2		
0.8	Road crosses watercourse	**2**		
0.06	Bare bank, looks like access from farm fields	1	**1**	
0.43	Widening/pooling of water, unknown reason	1		
0.66	Evidence of back pooling	1		**K20**
0.89	Small island/sand bar on right bank	1		
1.06	Significant widening of watercourse, unknown reason	**2**		
0.38	Looks as though bank on outside of meander has eroded or collapsed	3	**1**	
0.62	Road crosses watercourse and is at crossing K20	**2**		**K19**
		1		
		1		
0.14	Narrowing of stream, unknown reason	**3**	**2**	
0.71	Watercourse starts to widen as a result of a Dam	2		**K15**
		1		
0.03	Dam	3	**2**	
0.25	Road/bridge crossing large waterbody created by the dam	**3**		
1	Large pooling of water, with downed trees/possibly flooded not related to dam/possible wetland area	1		**K13**
0.04	Narrowing of channel almost right after exiting culvert	3	**4**	
0.18	Widening of watercourse, unknown reason	1		
0.39	Bare soil on outside of meander	1		**R40**
0.42	Narrowing of wtaercourse, unknown reason	**3**		
0.46	Widening of watercourse, unknown reason	**3**		
n/a	Nothing could be determine to thick tree canopy in aerial imagery	3	**3**	
				R31
0.29	Drainage from agricultural fields joins main watercourse	**3**	**2**	
0.39	Small piece of land jutting out into the watercourse	1		**R18**
0.67	Possible transmission line or rail road crossing….hard to tell in aerial imagery	2		
0.74	Evidence of back pooling	2		
0.19	Large center island	1	**1**	
0.75	Large side channel	1		
1.16	Ponded area adjacent to farmer's field, looks artificial	**1**		**R17**
0.26	Side channel or artificial stream diversion	**3**	**2**	
0.34	Strange low lying area next to stream bank	1		**R14**
0.51	Road crosses watercourse	3		
n/a	Nothing farther out could be determine to thick tree canopy in aerial imagery			
n/a	Nothing could be determine to thick tree canopy in aerial imagery	1	**1**	**R13**

Table A-11: Landcover Calculation and Risk Factor

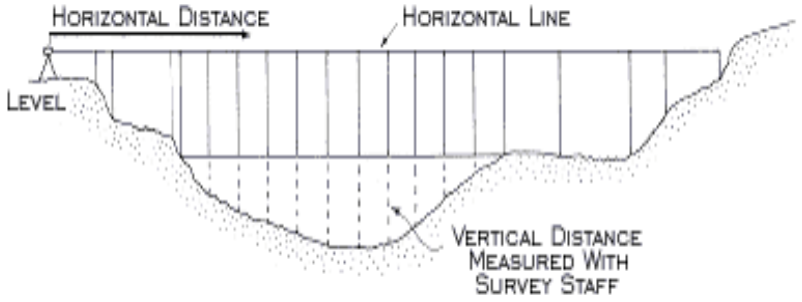
Landcover	Area (m^2)									
	K13		K15		K20/K19		K22		K25	
Water	22042	3%	0	0%	0	0%	0	0%	27193	3%
Non-Vegetated/Barren	0	0%	0	0%	0	0%	0	0%	0	0%
Developed	26524	3%	0	0%	0	0%	0	0%	0	0%
Wetland	14234	2%	21775	3%	27112	3%	0	0%	0	0%
Annual Cropland	198199	25%	511876	65%	513032	47%	358181	46%	262386	33%
Perennial Cropland and Pasture	517514	66%	251540	32%	507768	47%	427011	54%	495612	63%
Deciduous Forest	6678	1%	0	0%	32737	3%	0	0%	0	0%
Mixed Forest	0	0%	0	0%	0	0%	0	0%	0	0%
Total	785191	1	785191	1	1080650	1	785191	1	785191	1
Risk Factor		2		2		2		2		2

Landcover	Area (m^2)									
	K32		R13/R14		R17/R18		R31		R40	
Water	0	0%	0	0%	0	0%	0	0%	0	0%
Non-Vegetated/Barren	0	0%	51087	5%	18177	1%	0	0%	0	0%
Developed	0	0%	0	0%	0	0%	0	0%	0	0%
Wetland	51629	7%	0	0%	103529	8%	8358	1%	0	0%
Annual Cropland	188431	24%	711620	67%	618943	48%	504990	64%	276919	35%
Perennial Cropland and Pasture	321390	41%	186798	18%	261340	20%	174296	22%	485540	62%
Deciduous Forest	180161	23%	101968	10%	282276	22%	97548	12%	22732	3%
Mixed Forest	43581	6%	11667	1%	0	0%	0	0%	0	0%
Total	785191	1	1063140	1	1284265	1	785191	1	785191	1
Risk Factor		2		2		2		2		2

APPENDIX A-3

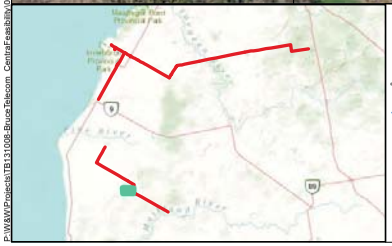
EXAMPLE OF CROSS-SECTION SURVEY

Figure A-2: Example of permanent channel cross-section survey



APPENDIX A-4

AQUATIC MEASUREMENTS



LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

- Non-Vegetated/Barren
- Water
- Developed
- Wetland
- Annual Cropland
- Perennial Cropland and Pasture
- Deciduous Forest
- Mixed Forest

Soil (Percent Sand, Percent Silt, Percent Clay)

16, 47, 37	38, 49, 13	13, 49, 38
22, 55, 23	46, 39, 15	24, 54, 22
25, 56, 19	47, 44, 9	31, 56, 13
35, 47, 18	61, 27, 12	35, 47, 18
35, 53, 12	68, 20, 12	59, 32, 9
36, 46, 18	11, 52, 37	

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC EARTH & ENVIRONMENTAL REPORT No. ___ DATED ___.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: NRCAN; MNR; Union Gas

CLIENT: Union Gas

PROJECT TITLE: **Bruce Telecom NG**

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:7,000

PROJECT N°: TB131008

DATE: April, 2013

FIGURE: 1

Aquatic Measurements

N W E S

AMEC Environment & Infrastructure
505 Woodward Ave., Hamilton, Ontario, L8H 6N6
tel: 905-312-0700 www.amec.com

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LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

- Non-Vegetated/Barren
- Water
- Developed
- Wetland
- Annual Cropland
- Perennial Cropland and Pasture
- Deciduous Forest
- Mixed Forest

Soil (Percent Sand, Percent Silt, Percent Clay)

16, 47, 37 | 38, 49, 13 | 13, 49, 38
22, 55, 23 | 46, 39, 15 | 24, 54, 22
25, 56, 19 | 47, 44, 9 | 31, 56, 13
35, 47, 18 | 61, 27, 12 | 35, 47, 18
35, 53, 12 | 68, 20, 12 | 59, 32, 9
36, 46, 18 | 11, 52, 37

NOTES:

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PROJECT TITLE: **Bruce Telecom NG**

Drawn By: RL | Checked By: DM
Revision: A | Projection: UTM Zone 17N

Aquatic Measurements

SCALE: 1:7,000

PROJECT N°: TB131008

FIGURE: 2

DATE: April, 2013

N W E S

AMEC Environment & Infrastructure
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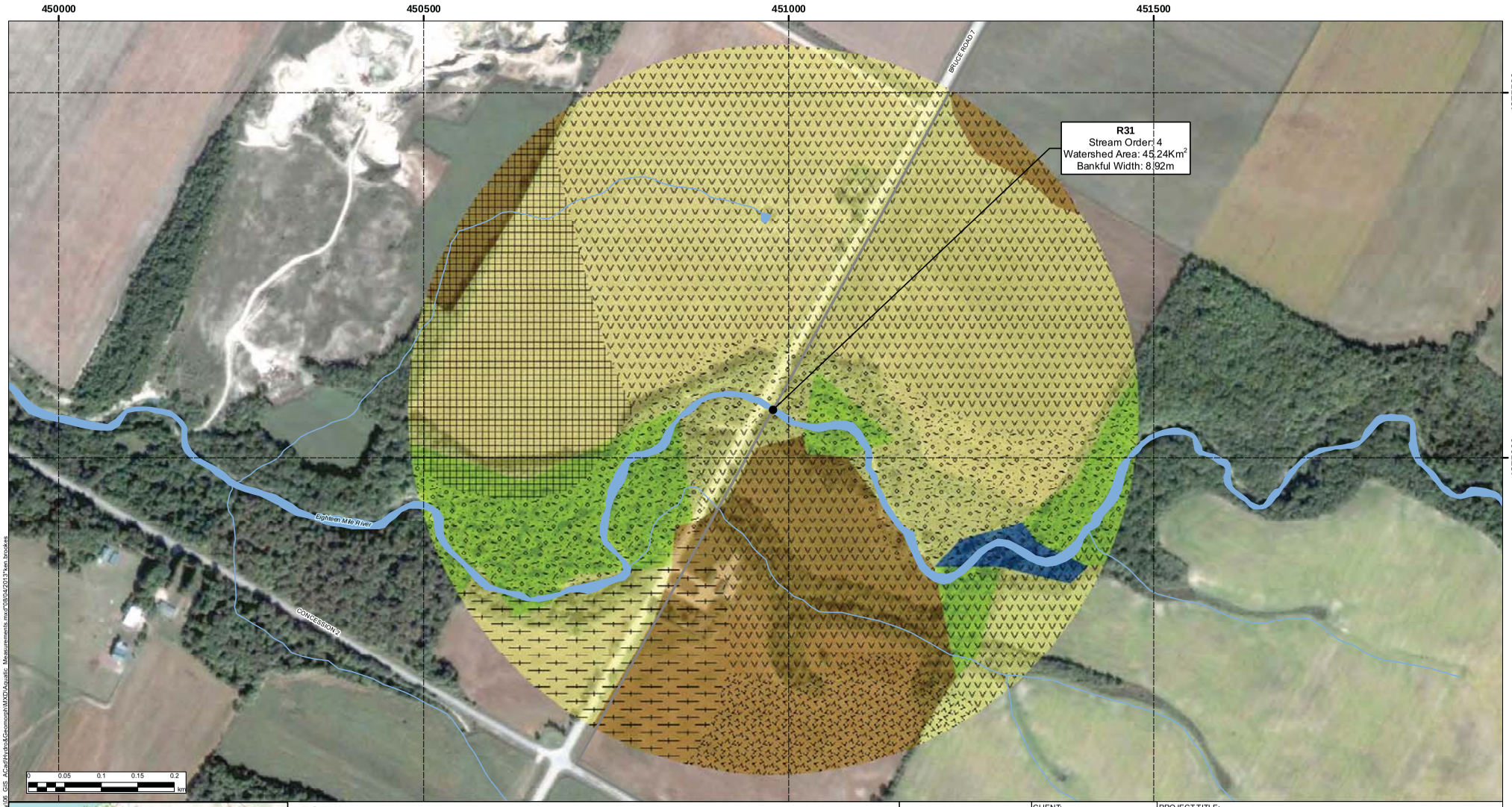

LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

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25, 56, 19	47, 44, 9	31, 56, 13
35, 47, 18	61, 27, 12	35, 47, 18
35, 53, 12	68, 20, 12	59, 32, 9
36, 46, 18	11, 52, 37	

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC EARTH & ENVIRONMENTAL REPORT No. ___ DATED ___.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: NRCAN; MNR; Union Gas

CLIENT: Union Gas

PROJECT TITLE: **Bruce Telecom NG**

Aquatic Measurements

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:5,000

PROJECT N°: TB131008

DATE: April, 2013

FIGURE: 3

N W E S

AMEC Environment & Infrastructure
505 Woodward Ave., Hamilton, Ontario, L8H 6N6
tel: 905-312-0700 www.amec.com

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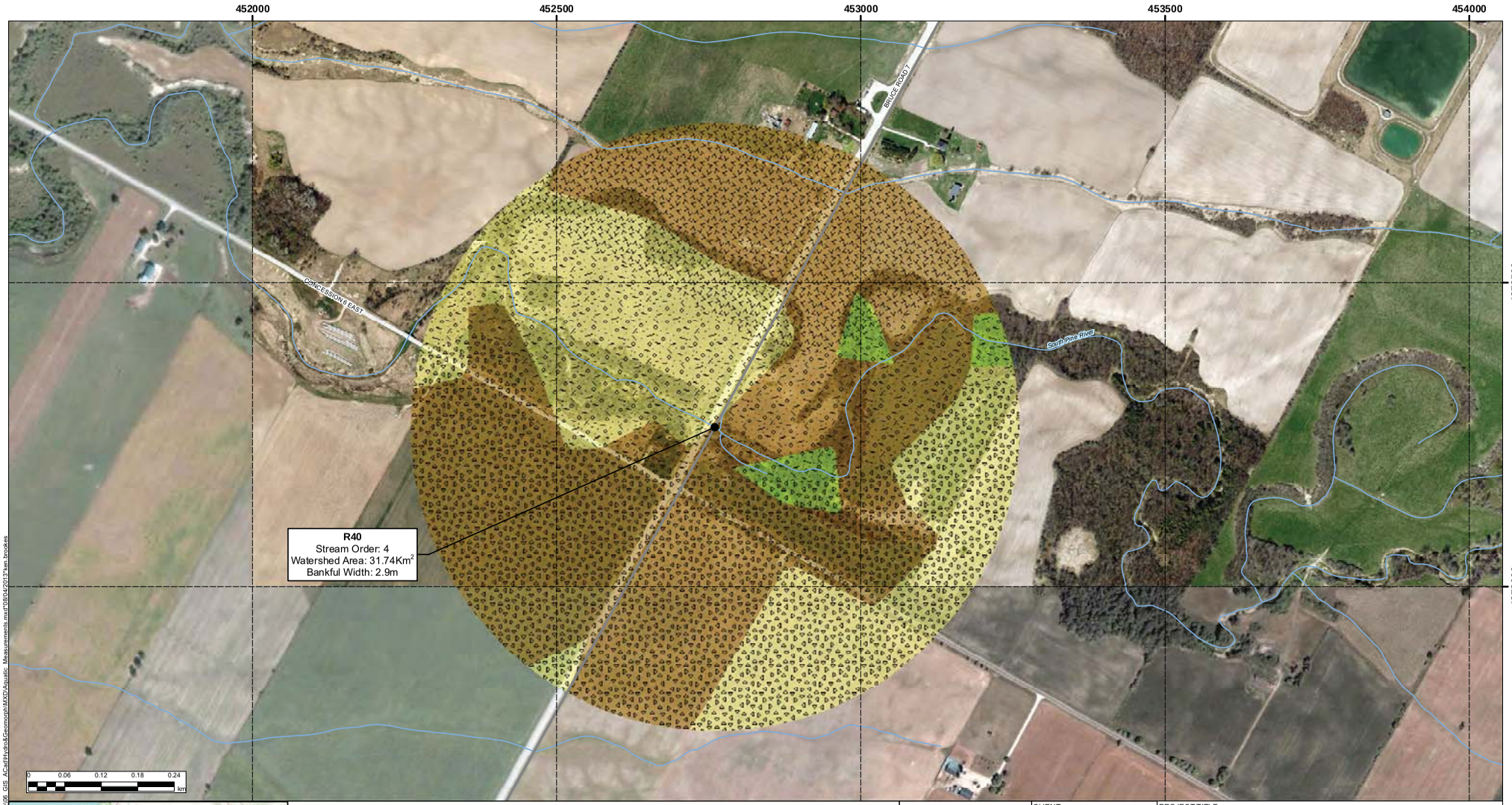

LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

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22, 55, 23	46, 39, 15	24, 54, 22
25, 56, 19	47, 44, 9	31, 56, 13
35, 47, 18	61, 27, 12	35, 47, 18
35, 53, 12	68, 20, 12	59, 32, 9
36, 46, 18	11, 52, 37	

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC EARTH & ENVIRONMENTAL REPORT No. ___ DATED ___.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: NRCAN; MNR; Union Gas

CLIENT: Union Gas

PROJECT TITLE: **Bruce Telecom NG**

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:6,000

Aquatic Measurements

PROJECT N°: TB131008

DATE: April, 2013

FIGURE: 4

N W E S

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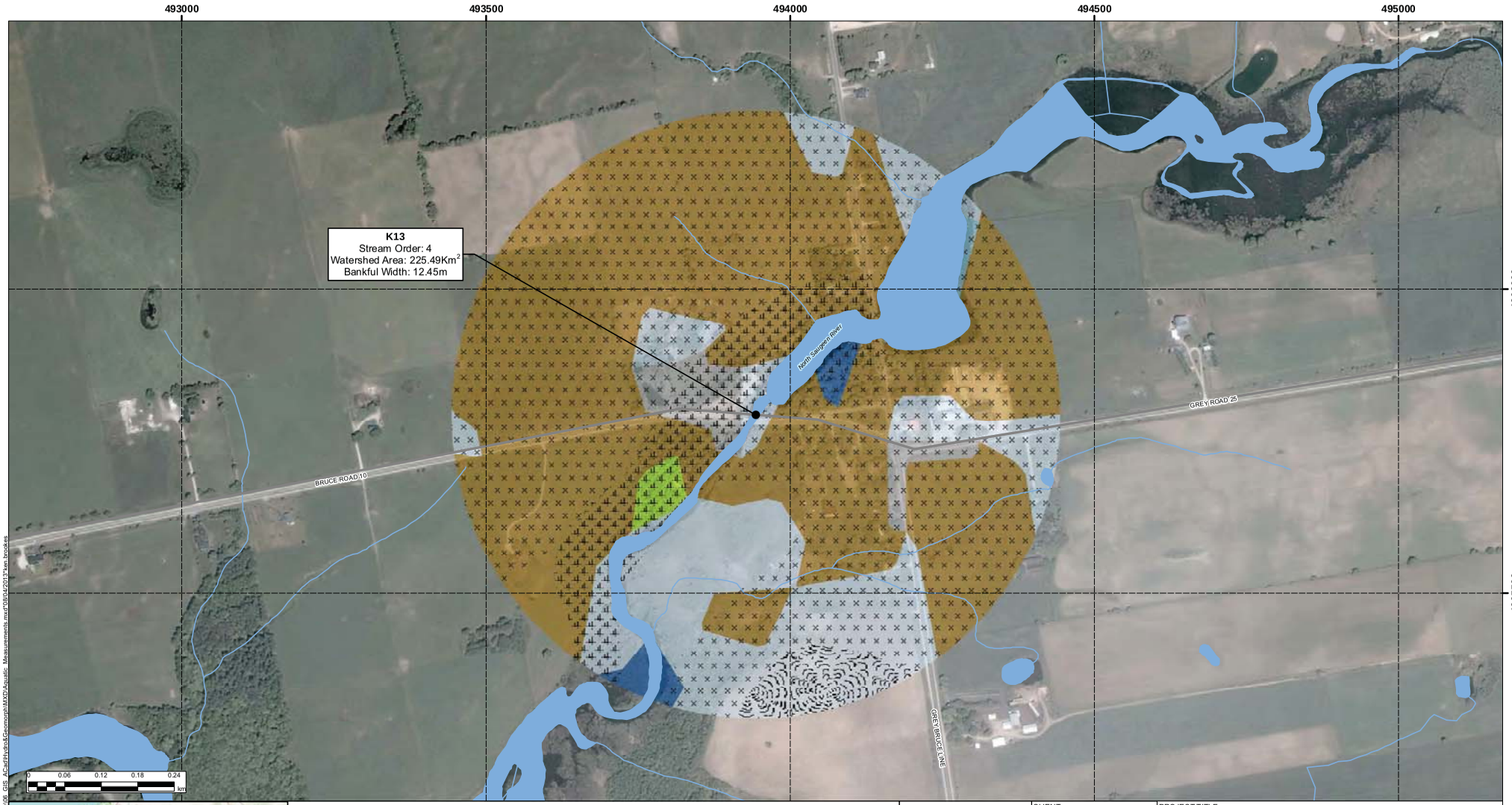

LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

- Non-Vegetated/Barren
- Water
- Developed
- Wetland
- Annual Cropland
- Perennial Cropland and Pasture
- Deciduous Forest
- Mixed Forest

Soil (Percent Sand, Percent Silt, Percent Clay)

16, 47, 37 | 38, 49, 13 | 13, 49, 38
22, 55, 23 | 46, 39, 15 | 24, 54, 22
25, 56, 19 | 47, 44, 9 | 31, 56, 13
35, 47, 18 | 61, 27, 12 | 35, 47, 18
35, 53, 12 | 68, 20, 12 | 59, 32, 9
36, 46, 18 | 11, 52, 37

NOTES:

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CLIENT: Union Gas

PROJECT TITLE: **Bruce Telecom NG**

Drawn By: RL | Checked By: DM
Revision: A | Projection: UTM Zone 17N
SCALE: 1:6,000

Aquatic Measurements

PROJECT N°: TB131008
DATE: April, 2013

FIGURE: 5

N W E S

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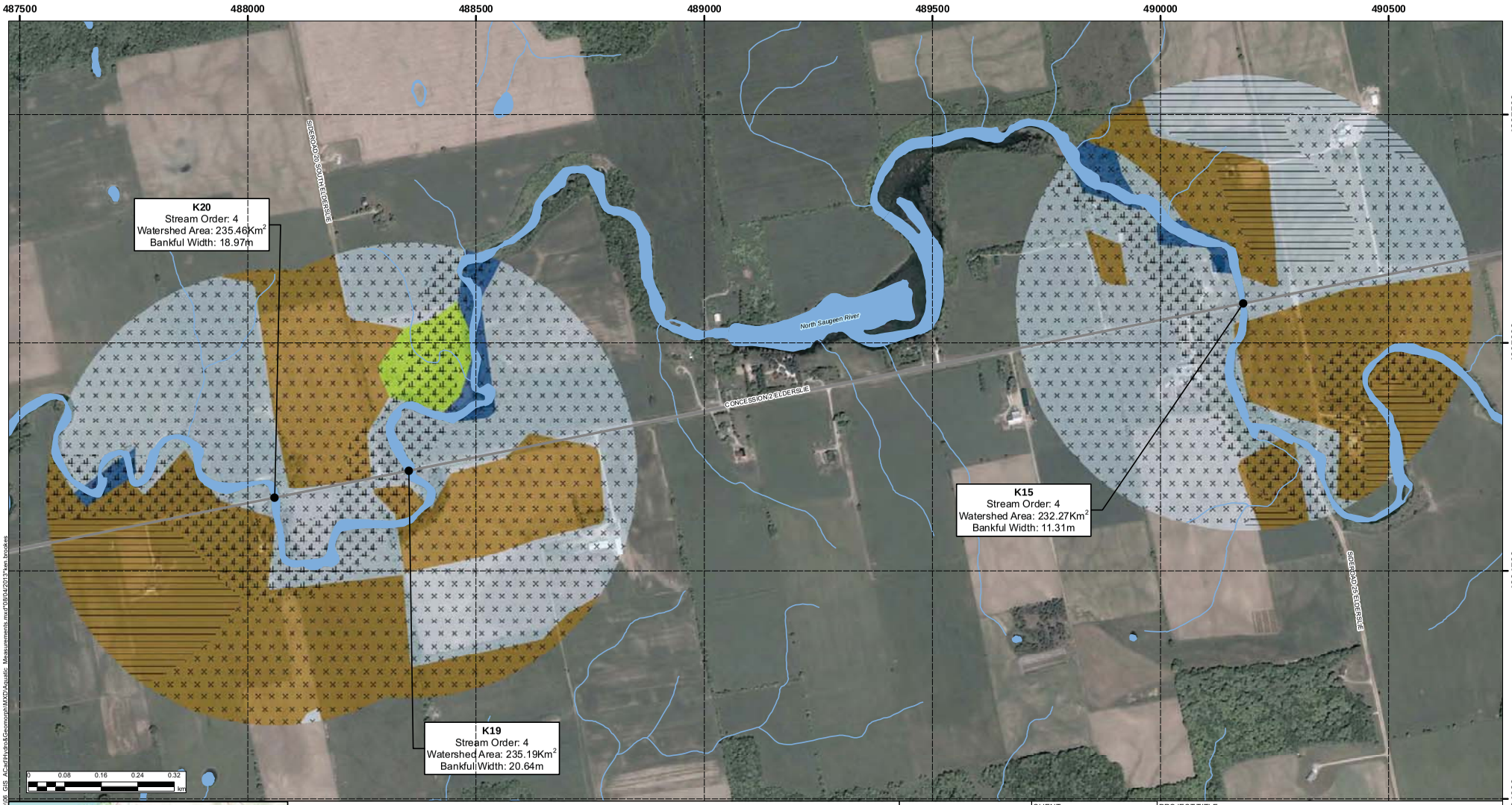

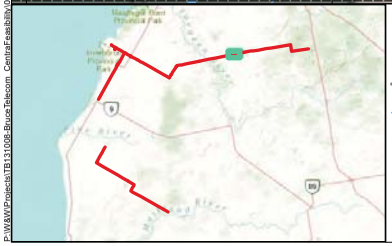

LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

- Non-Vegetated/Barren
- Water
- Developed
- Wetland
- Annual Cropland
- Perennial Cropland and Pasture
- Deciduous Forest
- Mixed Forest

Soil (Percent Sand, Percent Silt, Percent Clay)

16, 47, 37	38, 49, 13	13, 49, 38
22, 55, 23	46, 39, 15	24, 54, 22
25, 56, 19	47, 44, 9	31, 56, 13
35, 47, 18	61, 27, 12	35, 47, 18
35, 53, 12	68, 20, 12	59, 32, 9
36, 46, 18	11, 52, 37	

NOTES:

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SOURCE: NRCAN; MNR; Union Gas

CLIENT: Union Gas

PROJECT TITLE: **Bruce Telecom NG**

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:8,000

Aquatic Measurements

PROJECT N°: TB131008

FIGURE: 6

DATE: April, 2013

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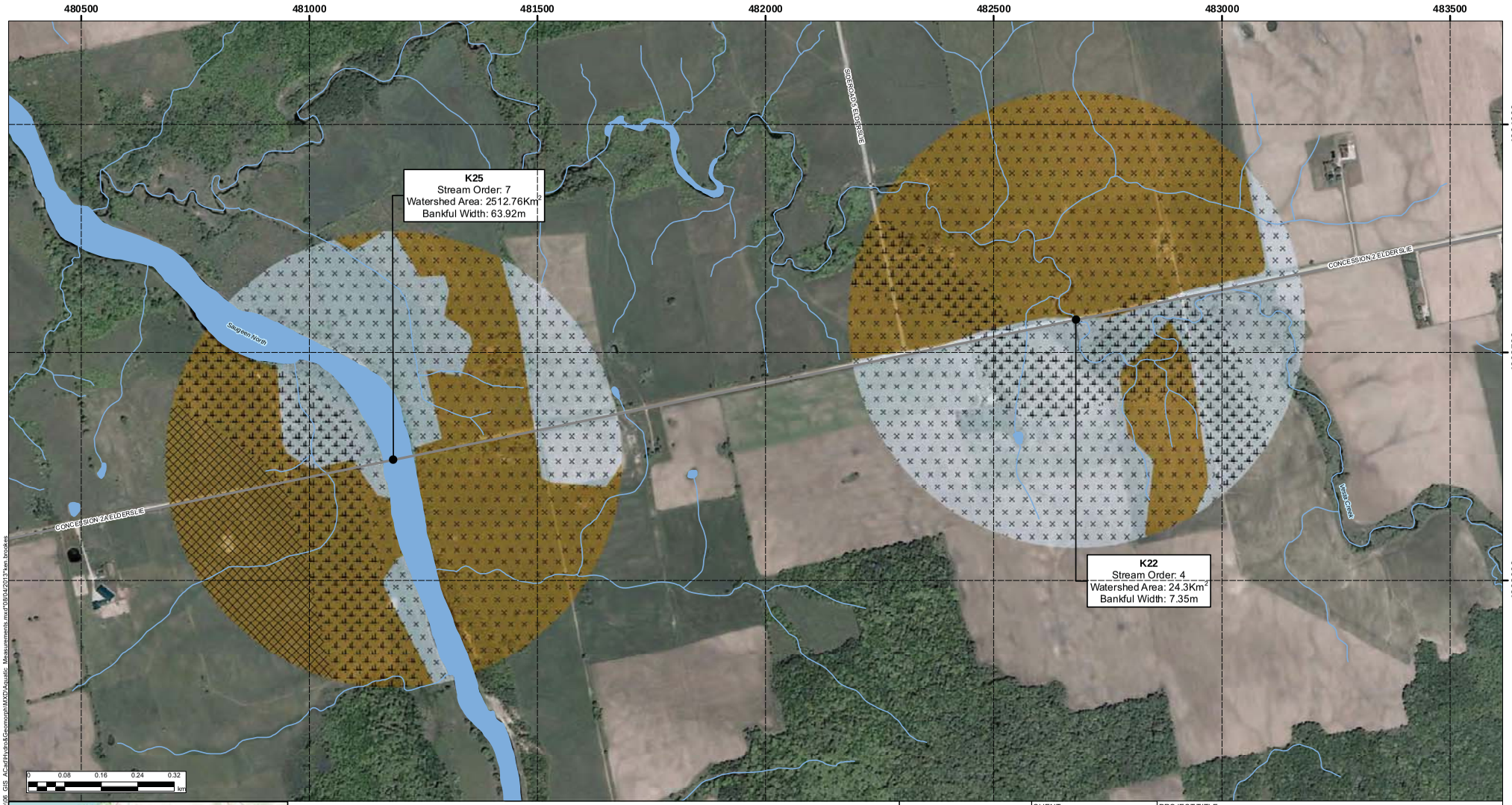

LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

- Non-Vegetated/Barren
- Water
- Developed
- Wetland
- Annual Cropland
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- Deciduous Forest
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16, 47, 37	38, 49, 13	13, 49, 38
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25, 56, 19	47, 44, 9	31, 56, 13
35, 47, 18	61, 27, 12	35, 47, 18
35, 53, 12	68, 20, 12	59, 32, 9
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NOTES:

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CLIENT: Union Gas

PROJECT TITLE: **Bruce Telecom NG**

Aquatic Measurements

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Revision: A | Projection: UTM Zone 17N

SCALE: 1:8,000

PROJECT N°: TB131008

DATE: April, 2013

FIGURE: 7

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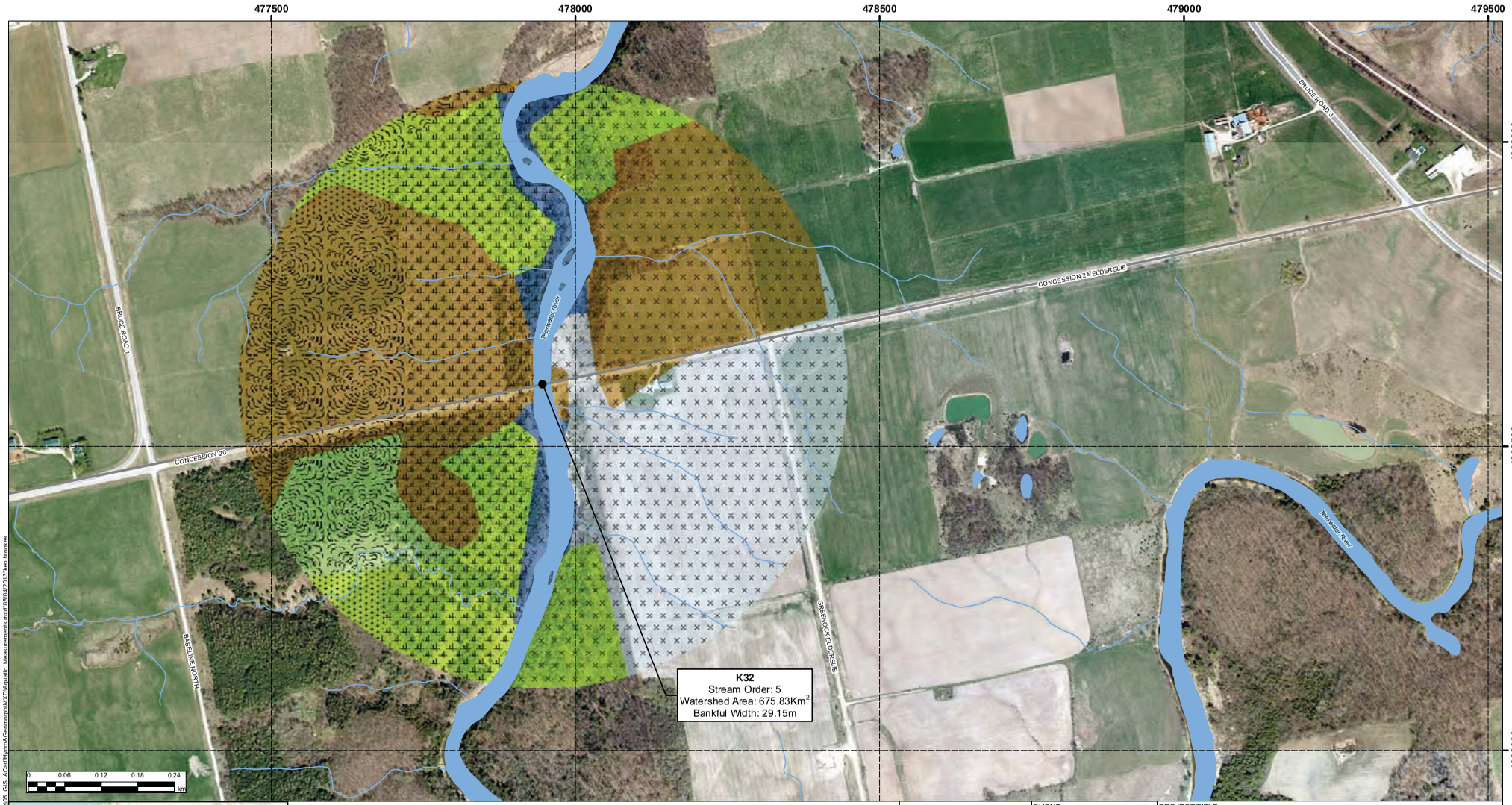

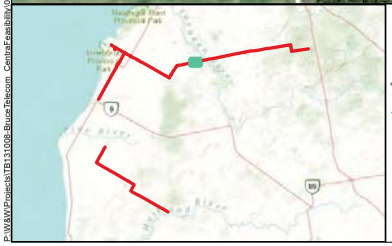

LEGEND

- Stream Crossing (Stream Order 4 and Greater)
- Pipeline
- Watercourse
- Waterbody

Landcover

- Non-Vegetated/Barren
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35, 53, 12	68, 20, 12	59, 32, 9
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CLIENT: Union Gas

PROJECT TITLE: **Bruce Telecom NG**

Aquatic Measurements

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:6,000

PROJECT N°: TB131008

DATE: April, 2013

FIGURE: 8

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APPENDIX B

NATURAL ENVIRONMENT EXISTING CONDITIONS REPORT

1.0 NATURAL ENVIRONMENT EXISTING CONDITIONS SUMMARY

The following sections detail the existing conditions with respect to the natural environment along the alignment of the proposed pipeline based on a desktop review of available data and specific information requests to various government organizations.

1.1 Ontario Natural Areas

Ontario Natural Areas (Natural Areas) are specific geographical spaces which are recognized and dedicated to achieving the long-term conservation of nature with associated ecosystem services and cultural values. Natural Areas include areas such as Areas of Natural and Scientific Interest (ANSIs), Provincially Significant Wetlands (PSWs), Conservation Reserves, and Provincial Parks. To determine the Natural Areas present within the vicinity of the proposed pipeline locations, a review of secondary sources was undertaken, including:

- Ministry of Natural Resources (MNR) Land Information Ontario (LIO) database. The database provides information on Provincially Significant Wetlands (PSW), Locally Significant Wetlands (LSW), Nature Reserves, and Provincial and National Parks;
- Google Maps. This online resource was used as an overview of the proposed pipeline locations to identify the presence of conservation reserves along the route; and
- MNR Natural Heritage Information Centre (NHIC) online database. The database provides information on Areas of Natural and Scientific Interest (ANSIs), Environmentally Sensitive Areas (ESAs) and Provincially Significant Wetlands (PSWs).

Correspondence with Midhurst District MNR, Guelph District MNR, Maitland Valley Conservation Authority (MVCA) and Saugeen Valley Conservation Authority (SVCA) has been initiated to request additional information regarding Natural Areas along the proposed pipeline locations however, a response was not available at the time of the release of this document.

Based on a review of Ontario's Natural Areas mapping (MNR 2013b) and Google mapping (Google Maps 2013) a number of Natural Areas were identified near and overlapping the proposed pipeline locations; these areas are identified and described in Table 1-1.

Additionally, a search of MNR's NHIC online database was performed to identify designated Natural Areas adjacent to the proposed pipeline location. To represent a reasonable zone of influence for any potential pipeline maintenance activities, all 1-km blocks covering the length of the proposed pipeline locations were selected and reviewed. Within this area (117 1-km blocks) three Natural Areas were found (MNR 2013a):

- Life Science ANSI - Kinghurst West;
- PSW Complex and Life Science ANSI - Glammis Bog; and
- PSW Complex - Mountain Creek Wetland.

Where available, a brief summary of the identified natural areas overlapping the proposed pipeline locations is provided following Table 1-1. Routing and siting of pipelines in Natural Areas should be avoided if possible. Works within Natural Areas requires approvals from the MNR and local Conservation Authorities. Appendix A contains figures which identify the locations of Natural Areas adjacent to the proposed pipeline locations.

Table 1-1 Ontario Natural Areas near the Proposed Pipeline Locations

Natural Area Classification	Number Within 1 km of Proposed Pipeline Locations	Number Overlapping Proposed Pipeline Locations	Description of Natural Area Classification
Areas of Natural and Scientific Interest	5 Glammis Bog Lothian-Lake Warren Shorelines Kinghurst Forest Kinghurst West Turnberry Swamp	2 Kinghurst West Lothian-Lake Warren Shorelines	ANSIs are areas of land and water that represent significant geological (earth science) and biological (life science) features. Earth science ANSIs include areas that contain examples of rock, fossil and landform features in Ontario. These features are the result of billions of years of geological processes and landscape evolution. Life science ANSIs are areas that contain examples of the many natural landscapes, communities, plants and animals found in the 14 natural regions of the province. MNR identifies ANSIs that are 'provincially significant' by surveying regions and evaluating sites to decide which have the highest value for conservation, scientific study and education.
Provincially Significant Wetlands	6 Anderson's Creek Complex/Andersons Creek Dickie's Creek Complex Glammis Bog Kinghurst Swamp Mountain Creek Wingham Complex	4 Anderson's Creek Complex/Andersons Creek Dickie's Creek Complex Kinghurst Swamp Mountain Creek	Wetlands are lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface. The presence of abundant water causes the formation of moist soils and favours the dominance of water tolerant plants. Values for wetland types are marsh, fen, swamp, bog, treed peatland, open water or unknown. Wetlands that meet certain criteria through the Ontario Wetland Evaluation System are designated as PSWs and are protected under the Provincial Policy Statement 2005, policy 2.1.

Natural Area Classification	Number Within 1 km of Proposed Pipeline Locations	Number Overlapping Proposed Pipeline Locations	Description of Natural Area Classification
Conservation Authority Areas or Conservation Reserves	4 McBeath Conservation Area Kinghurst Conservation Lands Saugeen Conservation Lands South Kinloss Tract	4 McBeath Conservation Area Kinghurst Conservation Lands Saugeen Conservation Lands South Kinloss Tract	The function of the Ontario Conservation Authorities includes protecting Ontarians and their property from flooding and erosion hazards. They protect natural areas and open space; restore and protect aquatic and natural habitats; and provide recreational and educational opportunities to local residents.

Source: LIO

Anderson's Creek Complex

Anderson's Creek Complex is a PSW complex made up of five individual wetlands, composed of two wetland types: swamp (90%) and marsh (10%). This area serves multiple ecological functions including: nesting sites and active feeding areas for colonial waterbirds, winter cover for wildlife with local significance for deer and waterfowl production, and regional significance for fish spawning and rearing (MNR 2013a). Snapping Turtles (*Chelydra serpentina*) are federally listed as species of special concern and have been observed within the Anderson's Creek Complex (MNR 2013a).

Glammis Bog

Glammis Bog is a PSW complex and Life Science ANSI. The PSW complex is made up of five individual wetlands, composed of three wetland types: swamp (60%), marsh (10%) and bog (30%). This area serves multiple ecological functions including: nesting sites for colonial waterbirds, winter cover for wildlife and providing local significance for deer. Great Blue Heron (*Ardea Herodias* fannini) are federally listed as species of special concern and have been observed within the Glammis Bog (MNR 2013a).

Kinghurst and Saugeen Conservation Lands

Saugeen Conservation governs a number of properties designated as Conservation Lands. These areas differ from typical Conservation Areas in that they have no/limited facilities are not generally designated as camping parks or day-use parks. These lands consist of significant forests and wetlands, reforested areas, management unites and properties which protect valuable headwater areas. The conservation goal is to preserve and manage the lands as natural parcels which contain representative features of Saugeen's unique landscape (Saugeen Conservation 2013).

Kinghurst Swamp

MNR's NHIC online database identifies Kinghurst Swamp as a non-provincially significant wetland complex made up of seven individual wetlands, composed of two wetland types: swamp (89.8%) and marsh (10.2%). This area serves multiple ecological functions including: locally significant waterfowl production areas, nesting sites and active feeding areas for colonial waterbirds, winter cover for wildlife including deer (locally significant cover), small mammals and birds.

Kinghurst West

Kinghurst West is a 550 ha Life Science ANSI extending from north of Louise Lake to west of Kinghurst. This candidate nature reserve contains diverse habitats including a kettle lake with floating fen and marsh border, a maple-birch upland forest on till moraine, scattered small kettles and an extensive lowland swamp. These features in combination with its size, high quality and headwater location, make this a high-ranking wetland/upland complex (MNR 2013a).

McBeath Conservation Area

McBeath Conservation Area is 55 ha area governed by Saugeen Conservation Authority and situated on the Saugeen River. This site is designed for canoeing enthusiasts and is accessible by water only with no public vehicle access (Saugeen Conservation 2013).

Mountain Creek Wetland

Mountain Creek Wetland is a PSW complex made up of three individual wetlands, composed of three wetland types: swamp (93.6%), marsh (6.1%) and bog (0.3%). This area serves multiple ecological functions including: nesting sites and active feeding areas for colonial waterbirds, winter cover for wildlife including Ruffed Grouse (*Bonasa umbellus*), deer, hare, small birds and mammals. Snapping Turtles (*Chelydra serpentina*) are federally listed as species of special concern and have been observed within the Mountain Creek Wetland (MNR 2013a).

1.2 Species at Risk

Species at Risk (SAR) are plant or animal species whose individuals or populations are considered Extirpated, Endangered, Threatened, or Special Concern. Federally, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is responsible for assessing and designating which wildlife species are in danger of disappearing from Canada. SAR and activities within their critical habitat are regulated by the federal *Species at Risk Act*, 2003 (*SARA*). Wildlife considered SAR have been listed under either Schedules 1, 2, or 3 of *SARA*. Schedule 1 species are species that have had their status reports reviewed by an official panel and are currently accepted with COSEWIC designation, granting them full protection by *SARA*. Schedule 2 species are species that must have their status reviewed within 30 days of being posted to the schedule and Schedule 3 species are species that must have their status reviewed within one year of being posted. On private land, these prohibitions apply only to listed aquatic species and migratory birds that are also listed in the *Migratory Birds Convention Act*, 1994 (*MBCA*). *SARA* operates to protect vulnerable species themselves, as well as the habitat that they depend on for survival and recovery.

The Province of Ontario has its own species assessment body, the Committee on the Status of Species at Risk in Ontario (COSSARO), which lists species under the *Endangered Species Act*, 2007 (*ESA*). The ESA provides designated species protection above and beyond that which is provided by federal legislation. The federal and provincial species lists are similar; however, the scope of assessment differs. If a species is listed under the ESA as an Extirpated, Endangered or Threatened, Section 9 of the Act prohibits killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, leasing, trading or offering to buy, sell, lease or trade a member of the species. Some of these prohibitions also apply to body parts of a member of the species, and to things derived from a member of the species. Similarly, if a species is listed on the *ESA* as an Endangered or Threatened, Section 10 of the Act prohibits damaging or destroying the habitat of the species. This prohibition also applies to an Extirpated species if the species is prescribed by the regulations. The regulations may specifically prescribe an area as the habitat of a species; but, if no habitat regulation is in force with respect to a species, "habitat" is defined to mean an area on which the species depends, directly or indirectly, to carry on its life processes. Species listed as Special Concern do not receive protection under this Act.

A review of MNR's NHIC online database revealed that there are twenty significant (rare) terrestrial and/or aquatic species found within the 117 one-km blocks covering the length of the proposed pipeline locations (MNR 2013a):

- 11 plant species;
- 2 fish species;
- 3 invertebrates/insect; and
- 4 reptiles.

Of these species, 8 are provincially designated SAR (five of which are also federally designated SAR) and 11 are provincially rare species (provincially ranked as SH – Possibly Extirpated (Historical), S1 - Critically Imperiled, S2 - Imperiled, or S3 – Vulnerable). The probability of these species occurring along the proposed pipeline locations is discussed in Table 1-2 and Table 1-3 respectively.

Additional searches for aquatic SAR included review of the Fisheries and Ocean Canada (DFO) Distribution of Aquatic SAR mapping, within the MVCA and SVCA watersheds, which includes distribution mapping for fish and mussel SAR. The DFO mapping provides a general indication of the potential habitat, but does not confirm presence or absence. DFO creates these maps to provide aid to agencies in determining whether development proposals should be referred to DFO as a result of the potential presence of SAR and the impacts of the development proposal activities on the SAR and their habitat.

The DFO mapping for the SVCA watershed indicates potential presence of three fish species as well as two mussel species (DFO 2013a; DFO 2013b). The DFO mapping for MVCA's watershed does not indicate potential presence of any fish or mussel SAR. Further correspondence has been sent to Aurora District MNR to inquire specifically about the findings of the DFO mapping however, a response was not available at the time of the release of this document.

Correspondence with Midhurst District MNR, Guelph District MNR, MVCA and SVCA has been initiated to request additional information regarding SAR along the proposed pipeline locations. However, a response was not available at the time of the release of this document.

Species which are listed in the *ESA* and/or *SARA* are presented in Table 1-2. These species are protected under these Acts as previously described. Species which are significant or rare are presented in Table 1-3. Species in Table 1-3 are of interest from a natural heritage perspective, but are not afforded protection under the *ESA* or *SARA*.

Table 1-2 Probability of Occurrence of SAR Identified by NHIC and/or DFO along the Proposed Pipeline Locations

Species Common Name (Latin Name)[1]	Federal Designation (*SARA*)[2]	Provincial Designation (*ESA*)[3]	Probability of Occurrence along the Proposed Pipeline Locations
Plants			
Eastern Prairie Fringed-orchid (*Platanthera leucophaea*)	Schedule 1 - Endangered	Schedule 2 – Endangered	**Low** – Historical record (1900). Requires moist prairies and bogs. Not likely to still be present with roadway right-of-way along the proposed pipeline alignment.
Hart's-tongue Fern (*Asplenium scolopendrium var. americanum*)	Schedule 1 – Special Concern	Schedule 4 - Special Concern	**Low** – Requires well shaded consistently moist sites located on or near dolomite deposits. Last recorded occurrence within study area in 1998. Necessary habitat not likely to occur within road right-of-way.
Fish			
Black Redhorse (*Moxostoma duquesnei*)	No Status	Schedule 3 – Threatened	**Low** - Prefers swifter flowing portions of medium to large streams containing pools and clear water with gravel, rock, or sand bottoms. The range of the species in Ontario is thought to be limited primarily due to siltation within streams.
American Eel (*Anguilla rostrata*)	No Status	Schedule 3 – Threatened	**Low** - Primarily benthic, using substrate and bottom debris as protection and cover. Spawn in the ocean and migrate to fresh water, Niagara Falls is the natural distribution limit in the Great Lakes.
Northern Brook Lamprey (*Ichthyomyzon fossor*)	Schedule 3 – Special Concern	Schedule 4 – Special Concern	**Low** - Prefers clear water streams, requires coarse gravel substrate and swift, unidirectional current for spawning.
Silver Lamprey (*Ichthyomyzon unicuspis*)	No Status	Schedule 3 – Special Concern	**Low** - Can live within streams or larger waterbodies such as large tributaries or lakes. Spawning occurs in shallow riffle areas in streams.
Invertebrates / Insects			
Hungerford's Crawling Water Beetle (*Brychius hungerfordi*)	No Status	Schedule 2 – Endangered	**Moderate** – Prefers small to medium size streams with moderate to fast flow, good aeration, cool temperatures, inorganic substrate, and alkaline water conditions. Often found downstream of culverts and dams. Known to occur in isolated populations in the Saugeen River.
Fawnsfoot Mussel (*Truncilla donaciformis*)	No Status	Schedule 2 – Endangered	**Low** - Typically found in lower portions of medium to large rivers at depths from 1 m to 5 m. Only known to occur in Muskrat Creek within project area.
Rainbow Mussel (*Villosa iris*)	No Status	Schedule 3 – Threatened	**Moderate** - Prefers shallow, well-oxygenated small to medium sized rivers. Known to occur within Ausable, Bayfield, Maitland, and Saugeen rivers.

Species Common Name (Latin Name)[1]	Federal Designation (*SARA*)[2]	Provincial Designation (*ESA*)[3]	Probability of Occurrence along the Proposed Pipeline Locations
Reptiles			
Eastern Ribbonsnake (*Thamnophis sauritus*)	Schedule 1 – Special Concern (Great Lakes population)	Schedule 4 - Special Concern	**Moderate** - Prefers edges of forested wetlands, lakes and streams. May use grassy road right-of-way for movement. Approximately 20% of alignment is near forested areas and numerous watercourse crossings exist.
Massasauga (*Sistrurus catenatus*)	No Status	Schedule 3 - Threatened	**Low** – Historical record (1964). Prefers habitat adjacent to river mouths with some rocks and long grasses. Pipeline alignment is likely too far south of the Bruce Peninsula for this species to be present.
Milksnake (*Lampropeltis triangulum*)	Schedule 1 – Special Concern	Schedule 4 - Special Concern	**Moderate** - Prefers forest clearings and edges and agricultural fields. May use grassy road right-of-way for movement. Substantial portions of the pipeline alignment are adjacent to agricultural fields.
Northern Map Turtle (*Graptemys geographica*)	Schedule 1 – Special Concern	Schedule 4 - Special Concern	**High** - Prefers slow moving, large rivers or reservoirs with pools and debris; require habitats with clean, deep water. Occasionally found in roadside ditches, may nest on road embankments.

Source: [1] MNR 2013a [2] EC 2013 [3] ESA 2007

Table 1-3 Significant/Rare Species Probability of Occurrence along the Proposed Pipeline Locations

Species Common Name (Latin Name)	Global G-Rank*	Ontario S-Rank*	Probability of Occurrence along the Proposed Pipeline Locations
Plants			
American Gromwell (*Lithospermum latifolium*)	G4	S3	**Low** – Historical record (1890). Prefers undisturbed high quality woodlots, shaded river banks and forested floodplains; and borders of forests.
Bluets (*Houstonia caerulea*)	G5	SH	**Low** – Grows among grasses in sparsely vegetated areas with sandy soil, usually moist open meadows. S-Rank indicates possibly extirpated and the last recorded occurrence within study area was 1970.
Eastern Green-violet (*Hybanthus concolor*)	G5	S2	**Low** – Historical record (1891). Prefers undisturbed high quality woodlots. Listed as occuring in mesic forests to swamps including floodplains.
Great Lakes Wild Rye (*Elymus lanceolatus ssp. psammophilus*)	G5T3	S3	**Moderate** – Prefers moist soil, tolerant of disturbance, occasionally found in right-of-ways. Primarily occurs along shores of Great Lakes in dunes and sandy shores. Last recorded occurrence within study area in 1989.
Low Nutrush (*Scleria verticillata*)	G5	S3	**Low** – Sandy or marly shores, interdunal flats, fens, and sedge meadows. Last recorded occurrence within study area in 1972.
Prairie Dropseed (*Sporobolus heterolepis*)	G5	S3	**Moderate** – Prefers dry to medium moisture, tolerates wide range of soil types. Typically associated with fens, moist to dry prairies and alvars. Last recorded occurrence within study area in 1996.
Ram's-head Lady's Slipper (*Cypripedium arietinum*)	G3	S3	**Low** – Requires bogs or cool moist woodlots. Prefers partial shade of conifers. Last recorded occurrence within study area in 1986.
Scarlet Beebalm (*Monarda didyma*)	G5	S3	**Low** – Historical record (1890). Prefers moist rich soils of forests, stream banks and floodplains.
Soft-hairy False Gromwell (*Onosmodium molle ssp. hispidissimum*)	G4G5T4	S2	**Low** – Historical record (1889). Prefers well drained upper slopes in open areas like old fields, pastures and grasslands.
Fish			
Golden Redhorse (*Moxostoma erythrurum*)	G5	S4	**Moderate** –Prefers slow moving streams with soft bottoms. Known to occur in tributaries to southern Lake Huron.
Invertebrates / Insects			
Clamp-tipped Emerald (*Somatochlora tenebrosa*)	G5	S2S3	**Low** – Breeding habitat is typically small forest streams. Forest margins are utilized for foraging. Last recorded occurrence within study area in 1986.
Harlequin Darner (*Gomphaeschna furcillata*)	G5	S3	**Low** – Breeding habitat is typically swamps and bogs. Forest margins are utilized for foraging.

***Global GRANK**

G1 Extremely rare
G2 Very rare
G3 Rare to Uncommon
G4 Common
G5 Very common
T# Rank applies to a subspecies or variety (# corresponds to GRANK)
G? Unranked or tentatively assigned rank (if placed after a ranking)

GNR Unranked
GNA Not Applicable

***Provincial SRANK**

S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
S? Not Ranked Yet: if follow a rank, Rank Uncertain
SNR Unranked
SNA Not Applicable

SU Unrankable (due to a lack of information)
S#B Breeding migrants (# corresponds to SRANK)
S#N Non-breeding migrants (# corresponds to SRANK)

As a final means of assessment of the presence of SAR along the proposed pipeline locations, a preliminary review of the land cover and associated habitats was performed. The fact that the proposed pipeline will run parallel to existing roadways was combined with surrounding land cover information and the geographic location of the project to develop a list of additional SAR which have a Moderate to High probability of occurrence along the proposed pipeline locations. These additional species are listed in Table 1-4. Mitigation measures to avoid disturbing or harming these species, as well as those mentioned above, are discussed in Section 1.5.

Table 1-4 SAR with Moderate Probability of Occurrence along the Proposed Pipeline Locations based on Land Cover and Habitat Availability

Species Common Name (Latin Name)[1]	Federal Designation (*SARA*)[2]	Provincial Designation (*ESA*)[3]	Description of Preferred Habitat
Birds			
Barn Swallow (*Hirundo rustica*)	No Status	Schedule 3 - Threatened	Prefer open habitats for foraging including grassy fields, pastures, agricultural crops and clear right-of-way areas. Barn Swallows are closely associated with human settlements and have shifted largely to nesting in and on artificial structures including garages, houses, bridges and road culverts.
Bobolink (*Dolichonyx oryzivorus*)	No Status	Schedule 3 - Threatened	Originally the Bobolink nested in tallgrass prairies of south-central Canada, however Bobolink has adapted to nesting in forage crops. This species also occurs in various grassland habitats such as wet prairie, graminoid peatlands, abandoned fields dominated by tall grasses, and remnants of uncultivated virgin prairie.
Chimney Swift (*Chaetura pelagica*)	Schedule 1 - Threatened	Schedule 3 - Threatened	Due to the land clearing associated with colonization, hollow trees became increasingly rare, which led Chimney Swifts to move into house chimneys. Today, the species is mainly associated with developed areas with chimneys which are used as nesting and resting sites, however, it is likely that a small portion of the population continues to use hollow trees.
Common Nighthawk (*Chordeiles minor*)	Schedule 1 - Threatened	Schedule 4 - Special Concern	The Common Nighthawk nests in a wide range of open, vegetation-free habitats, including dunes, beaches, recently cleared forests, grasslands, pastures, peat bogs, marshes, lakeshores, and river banks. This species also inhabits mixed and coniferous forests.
Eastern Meadowlark (*Sturnella magna*)	No Status	Schedule 3 - Threatened	As a ground nesting grassland specialist, the Eastern Meadowlark inhabits grassland habitats, native prairies and savannahs, as well as non-native pastures, hayfields, weedy meadows, herbaceous fencerows and airfields.

Species Common Name (Latin Name)[1]	Federal Designation (*SARA*)[2]	Provincial Designation (*ESA*)[3]	Description of Preferred Habitat
Invertebrates / Insects			
Monarch (*Danaus plexippus*)	Schedule 1 – Special Concern	Schedule 4 – Special Concern	Monarchs exist primarily wherever milkweed (*Asclepius spp.*) and wildflowers exist. This includes abandoned farmland, along roadsides, and other open spaces where these plants grow
Reptiles			
Snapping Turtle (*Chelydra serpentina*)	Schedule 1 – Special Concern	Schedule 4 – Special Concern	Preferred aquatic habitat of these turtles is characterized by soft, muddy bottoms, slow-moving shallow water and dense vegetation. Overwintering occurs in deep mud under continuously flowing water or in marsh areas. May utilize road shoulders of embankments as nesting sites.

1.3 Terrestrial Ecosystems

The proposed pipeline locations are at the southwestern extent of the Great Lakes – St. Lawrence Ecozone (Mixedwood Plains ecozone) of Canada (Farrar 1995). Native tree species typically found in the landscape include Red Pine (*Pinus resinosa*), Eastern White Pine (*Pinus strobus*), Eastern Hemlock (*Betula alleghaniensis*), Yellow Birch (*Betula alleghaniensis*), maple species (*Acer sp.*), and oak species (*Quercus sp.*) (Farrar 1995).

Based on Natural Resources Canada (NRCan) land cover database (NRCan 2009), 10 land cover types occur within one kilometer of the pipeline corridor as shown in Table 1-5. Activities within the ROW have the potential to impact the adjacent habitat or habitat use thus a one kilometer buffer was used to provide a quantification of potentially affected habitat. The land cover areas along the proposed pipeline locations and within the one kilometer buffer of the proposed pipeline locations are provided in Appendix B. It was found that some land cover data provided by NRCan was inconsistent with MNR land cover data (as reported in Section 1.1), specifically occurrences of wetland areas. The discrepancy is likely attributable to misidentification of wetland areas from aerial imagery. Based on professional experience, the NRCan estimate is more than likely an under-representation on the true wetland area within one kilometer of the pipeline alignment.

Table 1-5 Land Cover Along and Within 1 km of the Proposed Pipeline Locations

	Along the Proposed Pipeline Location		Within a 1 km Buffer of the Proposed Pipeline Location	
Land Cover Type	**Occurrences**	**Total Length (m)**	**Occurrences**	**Total Area (ha)**
Kincardine Pipeline				
Water	2	142.8	11	29.6
Non-Vegetated/Barren	1	22.6	14	21.6
Developed	12	4,284.3	25	212.7
Shrubland	0	0.0	1	8.7
Wetland	2	212.7	77	299.9
Annual Cropland	43	44,816.2	179	7,001.4
Perennial Cropland and Pasture	27	25,065.2	157	5,279.9
Coniferous Forest	0	0.0	37	111.5
Deciduous Forest	7	24,30.8	188	2,343.6
Mixed Forest	3	609.9	62	277.2

	Along the Proposed Pipeline Location		Within a 1 km Buffer of the Proposed Pipeline Location	
Ripley Pipeline				
Water	0	0.0	6	20.0
Non-Vegetated/Barren	0	0.0	4	16.5
Developed	0	0.0	2	30.3
Shrubland	0	0.0	23	39.0
Wetland	0	0.0	0	0.0
Annual Cropland	4	23,380.47	42	3,576.9
Perennial Cropland and Pasture	18	6,407.8	182	1,650.6
Coniferous Forest	0	0.0	6	14.1
Deciduous Forest	4	1,470.4	73	1,076.0
Mixed Forest	1	67.1	42	87.5

Source: NRCan 2009

As the proposed pipeline locations are immediately adjacent to existing roadways, disturbance to significant wildlife areas such as deer winter concentration areas (deer yards) should not be directly affected by project works. Any impacts will be indirect related to noise and disturbance related to temporary construction activities.

Moose (*Alces alces*) hold strong social, ecological, and economic importance in Ontario. Moose prefer areas with a mixture of young and mature forest. While the mature trees provide the necessary cover, young trees and shrubs are the primary food source for Moose (MNR 2013c). MNR mapping of moose range in Ontario was consulted and it was determined that their range does not extend into Bruce County thus the proposed pipeline will not impact any significant moose habitat features (MNR 2013c).

1.3.1 Agriculture

Disruptions to farmlands by pipelines should be minimized and disruptions to prime farmland should be avoided if possible. As the proposed pipeline locations are adjacent to existing roadways, disturbance to agricultural lands should be minimal. Additionally, it is anticipated that should disturbance to farmlands occur it will be temporary and only last during pipeline installation.

1.4 Aquatic Ecosystems

The proposed pipeline locations cross 116 identified watercourses, including 70 along the proposed Kincardine pipeline and 46 along the proposed Ripley pipeline;

Table 1-6 summarizes locations and characteristics of these watercourses. General watercourse mapping is provided in Appendix C.

Table 1-6 Watercourse Crossing Locations and Characteristics

Crossing ID	Watercourse Name	UTM Co-ordinates (NAD 83 Zone 17)		Stream Order
Kincardine Pipeline				
K01	N/A	509382.6	4906283	1
K02	N/A	509181.4	4906252	2
K03	N/A	505552.2	4905695	1
K04	N/A	505483.7	4905684	1
K05	N/A	505157.3	4905744	1
K06	N/A	503561.6	4907257	2
K07	N/A	502696.2	4907118	1
K08	N/A	502275.5	4907050	2
K09	N/A	500311.9	4906735	2
K10	N/A	497691.9	4906308	1
K11	N/A	496656.5	4906139	1
K12	N/A	496293.7	4906079	1
K13	N/A	493942.9	4905793	4
K14	N/A	493099.1	4905664	1
K15	N/A	490181.7	4905087	4
K16	N/A	489423.2	4904935	1
K17	N/A	489324.4	4904915	1
K18	N/A	488940.8	4904838	1
K19	N/A	488352.6	4904720	4
K20	N/A	488058.5	4904660	4
K21	N/A	483731.6	4903788	1
K22	Vesta Creek	482679.9	4903572	4
K23	N/A	482571.7	4903549	1
K24	N/A	481691.0	4903369	1
K25	N/A	481184.2	4903265	7
K26	N/A	481038.5	4903235	1
K27	N/A	480330.3	4903090	1
K28	N/A	480139.6	4903051	1
K29	N/A	479596.0	4902940	1
K30	N/A	478549.4	4902725	1
K31	N/A	478298.8	4902674	1
K32	N/A	477946.2	4902602	5
K33	N/A	476391.4	4902283	2
K34	N/A	476200.8	4902244	2
K35	N/A	474818.1	4901968	1
K36	N/A	474723.2	4901950	1
K37	N/A	474596.4	4901925	1
K38	Willow Creek	473102.3	4901540	2
K39	N/A	472796.0	4901159	1
K40	N/A	471281.8	4898702	2
K41	N/A	470213.4	4898777	2
K42	N/A	469630.0	4899108	1
K43	N/A	468462.9	4899758	1
K44	N/A	468072.6	4899976	1
K45	N/A	467380.0	4900364	2
K46	Willow Creek	467015.8	4900566	3
K47	Fourth Bruce Drain	464565.6	4901956	1
K48	N/A	462257.0	4903259	1
K49	N/A	461827.2	4903499	1
K50	N/A	461566.8	4903646	1
K51	N/A	461064.6	4903928	1
K52	N/A	459842.1	4904589	1
K53	N/A	458208.9	4904550	2
K54	N/A	457533.2	4903339	2

Crossing ID	Watercourse Name	UTM Co-ordinates (NAD 83 Zone 17)		Stream Order
K55	N/A	457290.2	4902904	1
K56	N/A	457135.5	4902627	1
K57	N/A	456899.4	4902203	1
K58	N/A	456469.2	4901703	1
K59	Tiverton Creek	456247.1	4901094	2
K60	Munro Municipal Drain	456080.5	4900797	1
K61	Andrews Creek	455696.0	4900113	2
K62	N/A	455369.6	4899532	2
K63	N/A	454932.2	4898755	1
K64	N/A	454781.6	4898488	2
K65	N/A	454642.7	4898243	1
K66	N/A	454536.7	4898055	2
K67	N/A	454265.0	4897575	2
K68	Rossell Drain	453543.5	4896298	1
K69	Canadian Municipal Drain	452378.3	4894238	1
K70	N/A	451879.1	4893357	2
Ripley Pipeline				
R01	Godkin Drain	470238.4	4861140	1
R02	Coulter - Grain Drain	469593.3	4861512	1
R03	Lott Drain	469091.7	4861800	1
R04	N/A	468957.2	4861878	1
R05	Dickies Creek	465214.0	4864010	3
R06	N/A	463458.9	4864992	1
R07	N/A	463355.5	4865050	2
R08	N/A	463356.8	4865049	2
R09	N/A	463000.1	4865250	2
R10	N/A	462653.8	4865444	3
R12	N/A	460921.5	4866410	3
R13	N/A	460359.1	4866725	4
R14	N/A	460445.9	4866993	4
R15	N/A	460739.0	4867507	1
R16	N/A	460817.0	4867644	1
R17	Dickies Creek	460210.3	4869136	3
R18	N/A	459754.6	4869395	4
R19	N/A	459412.8	4869617	3
R20	N/A	459251.3	4869711	3
R21	N/A	459214.5	4869732	3
R21	N/A	459214.5	4869732	3
R22	N/A	459221.5	4869728	3
R22	N/A	459221.5	4869728	3
R23	N/A	459001.3	4869856	2
R24	N/A	458418.3	4870195	1
R25	Stanley Drain	457445.8	4870751	1
R26	N/A	456604.0	4871233	2
R27	N/A	454462.4	4872452	1
R28	N/A	454240.1	4872577	3
R29	N/A	453058.1	4873247	1
R30	N/A	450903.4	4874931	2
R31	N/A	450978.2	4875065	4
R32	N/A	451520.7	4876042	1
R33	N/A	451710.2	4876383	1
R34	Boyd Creek	451875.0	4876677	3
R35	N/A	452076.9	4877038	1
R36	N/A	452261.2	4877368	1
R37	N/A	452462.9	4877729	1
R38	McMurchy Award Drain	452566.4	4877914	1
R39	McMurchy Award Drain	452546.5	4877878	1

Crossing ID	Watercourse Name	UTM Co-ordinates (NAD 83 Zone 17)		Stream Order
R40	N/A	452759.9	4878262	4
R41	N/A	452816.7	4878366	1
R42	N/A	452800.0	4878335	1
R44	N/A	452784.6	4878307	1
R45	N/A	452973.6	4878648	2
R46	N/A	453104.9	4878886	1

Source: Land Information Ontario
Notes: N/A = Not Available K# - along Kincardine Pipeline R# - along Ripley Pipeline

Fish and fish habitat information was requested from the Midhurst District MNR and Guelph District MNR however a response was not available at the time of the release of this document.

Although specific fish record information was not available for any of the other crossings it is anticipated that the majority of the identified watercourses provide fish habitat. The *Fisheries Act* provides for the protection of fish and fish habitat. Under the *Fisheries Act* no one may carry out any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat (HADD) unless authorized by the DFO. In addition to the 116 identified watercourse crossings the pipeline likely also crosses drainage ditches or very small creeks which are not shown in the watercourse mapping. Watercourses which are not presented in the mapping can still provide fish habitat, thus work in these areas can result in a HADD and require DFO authorization.

1.5 Mitigation

The following sub-sections identify general mitigation measures which may be implemented and items for consideration during further planning and project works. Project specific mitigation measures would be developed during the preparation of the Environmental Report and detail project design.

1.5.1 Vegetation

The proposed pipeline locations are adjacent to existing roadways primarily passing through areas of annual cropland and perennial cropland and pasture (Table 1-5). There are some forested areas that exist along the proposed pipeline locations which will be impacted by the proposed works. Disturbance to these areas should be minimized by reducing temporary work areas, limiting equipment storage areas and vehicle turning points where possible. Operational Provincial Standard Specification (OPSS) 801 (November 2010) identifies specification for the protection of trees which may be applied where appropriate. In the case that significant tree species are identified during any field investigations, it is suggested that an exclusion zone surrounding the area be delineated with appropriate fencing prior to construction works.

There are a number of wetland areas that will be disturbed along the proposed pipeline locations. Conservation Authorities (CA) have been empowered to regulate development and activities in or adjacent to watercourses and wetlands. The local CA and MNR should be consulted to ascertain the wetland boundaries and discuss mitigation strategies. However, the following mitigation measures are identified to limit impacts on the wetland complexes:

- Environmental protection fencing should be installed along the perimeter of the disturbance area to prevent works from extending into the wetland;
- Temporarily disturbed areas should be restored;
- Where applicable, disturbance widths are to be minimized by reducing temporary work areas, limiting equipment storage areas and vehicle turning points within the wetland area;
- Prior to the commencement of project works the wetland boundaries should be delineated in the field to aid in determining specific impacts and mitigation measures to be applied; and
- All reasonable preventative measures will be taken to control erosion at the source.

1.5.2 Terrestrial Wildlife

The *Migratory Birds Convention Act* (*MBCA*) makes it unlawful to pursue, hunt, take, capture, kill or sell birds listed therein ("migratory birds") (MBCA 1994). Compliance with the *MBCA* regulations and guidelines for vegetation clearing or demolition, as recommended by Environment Canada, needs to be considered during the project's construction and operation phases. In order to minimize the potential for incidental take of any nesting migratory birds, clearing of vegetation and any proposed work activities in migratory bird habitat should be undertaken outside of the active breeding season (mid-May to August 1 for Southern Ontario). If clearing (or other work is required during the nesting season), a nest survey should be conducted by a qualified avian biologist immediately (i.e. within 2 days) prior to commencement of the works to identify and locate active nests of species covered by the *MBCA*.

The Barn Swallow (*Hirundo rustica*) is provincially designated as Threatened and is therefore protected under the *ESA* which prohibits destroying critical or essential habitat for this species. Although Barn Swallow was not identified as occurring in the vicinity of the project, this species is closely associated with human settlements as it will nest in and on artificial structures, including bridges and road culverts which occur adjacent to the proposed pipeline locations.

Other urban tolerant bird species will also nest on buildings, bridges and other structures. Some of these species and their nests are protected under the *MBCA*. These structures should be inspected for nests by a qualified biologist prior to any construction activity commences. Other preventative measures may include physical obstructions, such as netting, to prevent the bird access to the structures prior to nesting season and/or undertaking works outside the spring and summer breeding bird window. Additionally, ground nesting bird species are susceptible to injury or inadvertent disturbance from construction activities. If vegetation clearing is kept outside the breeding bird season, effects to these species will be minimal.

Northern Map Turtle (*Graptemys geographica*) as well as Snapping Turtle (*Chelydra serpentina*) are provincially designated as Special Concern and are therefore not protected under the ESA; however, these species have been designated an Ontario S-Rank of S3 by MNR which identifies them as vulnerable in the Ontario due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making them vulnerable to extirpation. For this reason efforts should be made to prevent injury and disturbance to these

species. The probability of these turtles occurring along the proposed pipeline locations is high due to their habitat and nesting preferences, which include occasional nesting on road embankments. Field surveys should be conducted prior to project works to ensure the area is clear of these turtle species and their nests.

1.5.3 Aquatic Wildlife

During all project works measures should be taken to minimize disturbance to nearby watercourses and riparian areas. These measures include but are not limited to the following:

- Incorporation of appropriate timing constraints to ensure work avoids critical life stages of aquatic species;
- Minimization of the disturbance or removal of vegetation, maintaining maximum shading of watercourses, with the use of tree protection fencing where appropriate;
- Prompt stabilization and re-vegetation of all disturbed areas and/or treatment of the area with appropriate erosion protection materials;
- Storage and stabilization of any stockpiled materials away from watercourses;
- At areas of watercourse crossings, isolation of the work area to facilitate work in “the dry” and the capture and release (downstream) of any fish trapped within the isolated construction area while ensuring that dewatering and flow management measures do not interfere with fish passage; and
- Operation and storage of all materials and equipment in such a manner that prevents any deleterious substance from entering nearby watercourses.

1.5.4 Erosion and Sediment Control

Standard erosion and sediment control measures (e.g., silt fence, silt curtain, sedimentation basins, etc.) should be applied. These measures will be taken to prevent erosion or if erosion occurs, to prevent or reduce the release of sediment entering a watercourse and surrounding environment. All reasonable preventative measures should be taken to control erosion at the source. The control measures should be implemented prior to work and shall be maintained during construction and until disturbed areas have been effectively stabilized with permanent vegetation cover.

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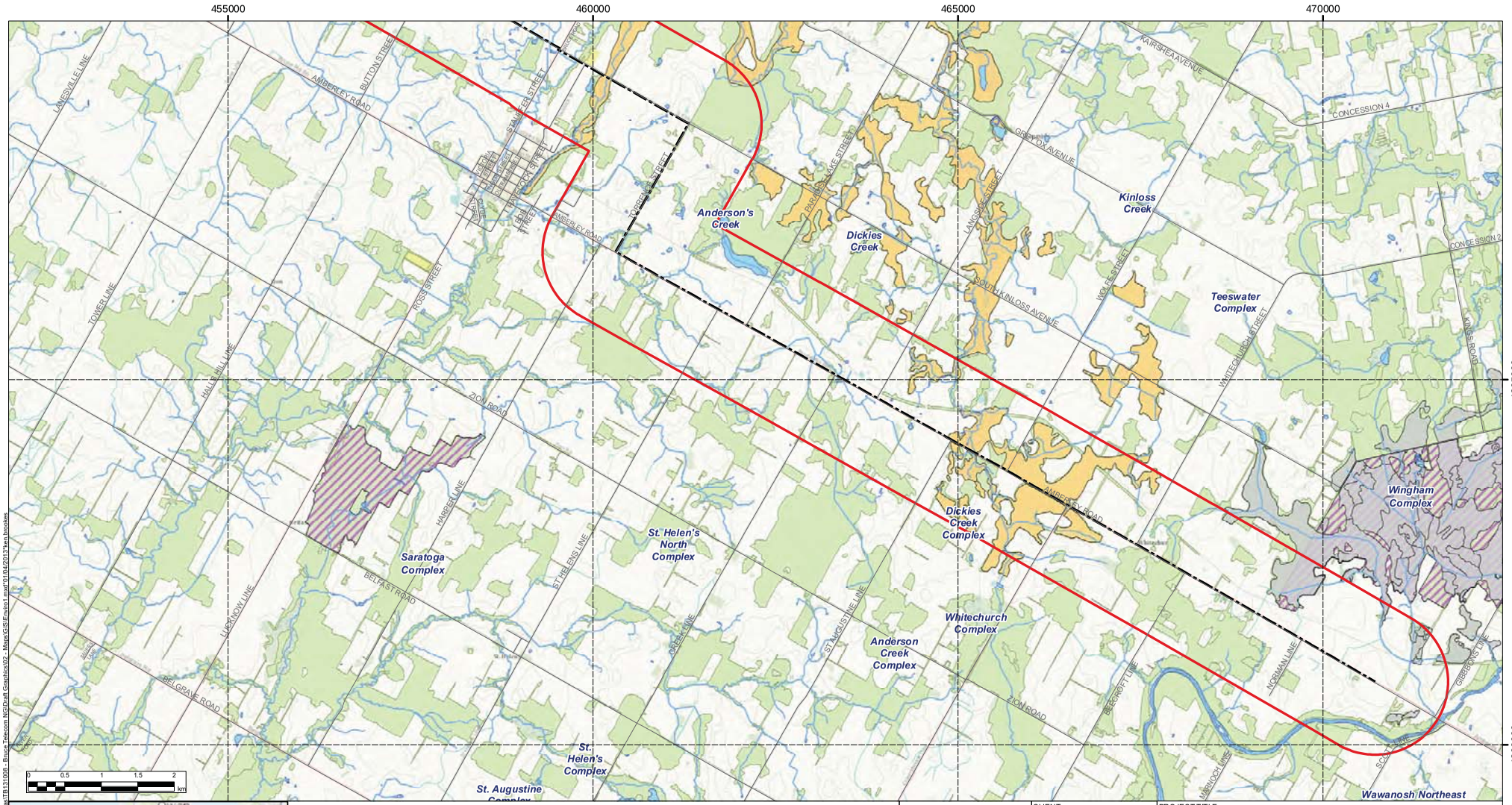
APPENDIX A

NATURAL AREAS FIGURES



LEGEND

- Proposed Pipeline Route
- 1km Buffer of Proposed Pipeline
- Watercourse
- Constructed Drain
- Waterbody
- Wooded Area

Provincially Significant Wetland

- Wingham Complex
- Mountain Creek
- Kinghurst Swamp
- Glammis Bog
- Dickies Creek/Dickie's Creek Complex

- Area of Natural and Scientific Interest (ANSI)

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC ENVIRONMENT & INFRASTRUCTURE REPORT No. ___ DATED ___.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: ESRI; MNR; Union Gas

CLIENT: Union Gas

PROJECT TITLE: Bruce Telecom NG

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:50,000

Ontario Natural Areas

PROJECT N°: TB131008

FIGURE: 1

DATE: April, 2013

AMEC Environment & Infrastructure
505 Woodward Ave., Hamilton, Ontario, L8H 6N6
tel: 905-312-0700 www.amec.com

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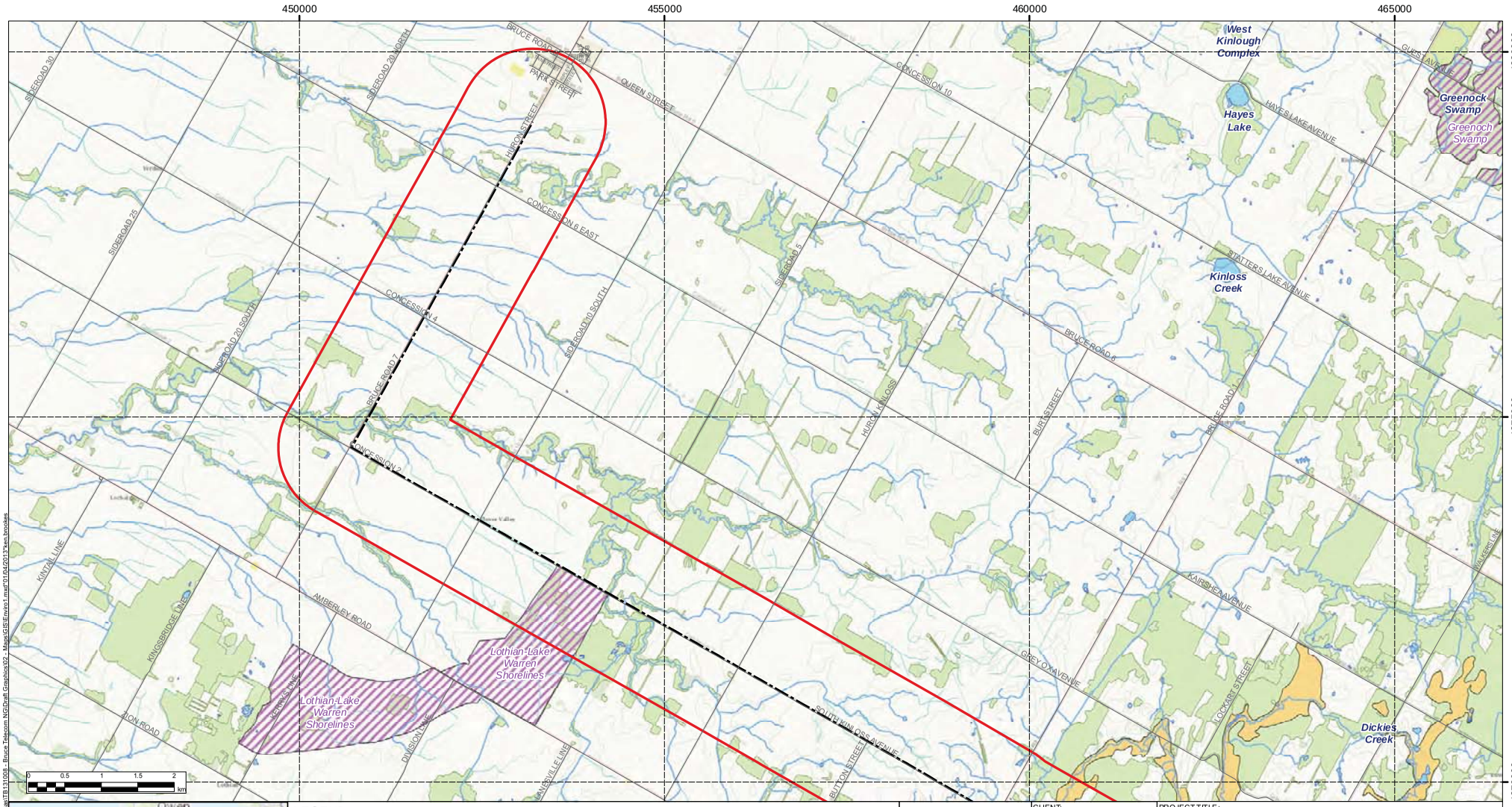

LEGEND

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SOURCE: ESRI; MNR; Union Gas

CLIENT: Union Gas

PROJECT TITLE: Bruce Telecom NG

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:50,000

Ontario Natural Areas

PROJECT N°: TB131008

FIGURE: 2

DATE: April, 2013

N W E S

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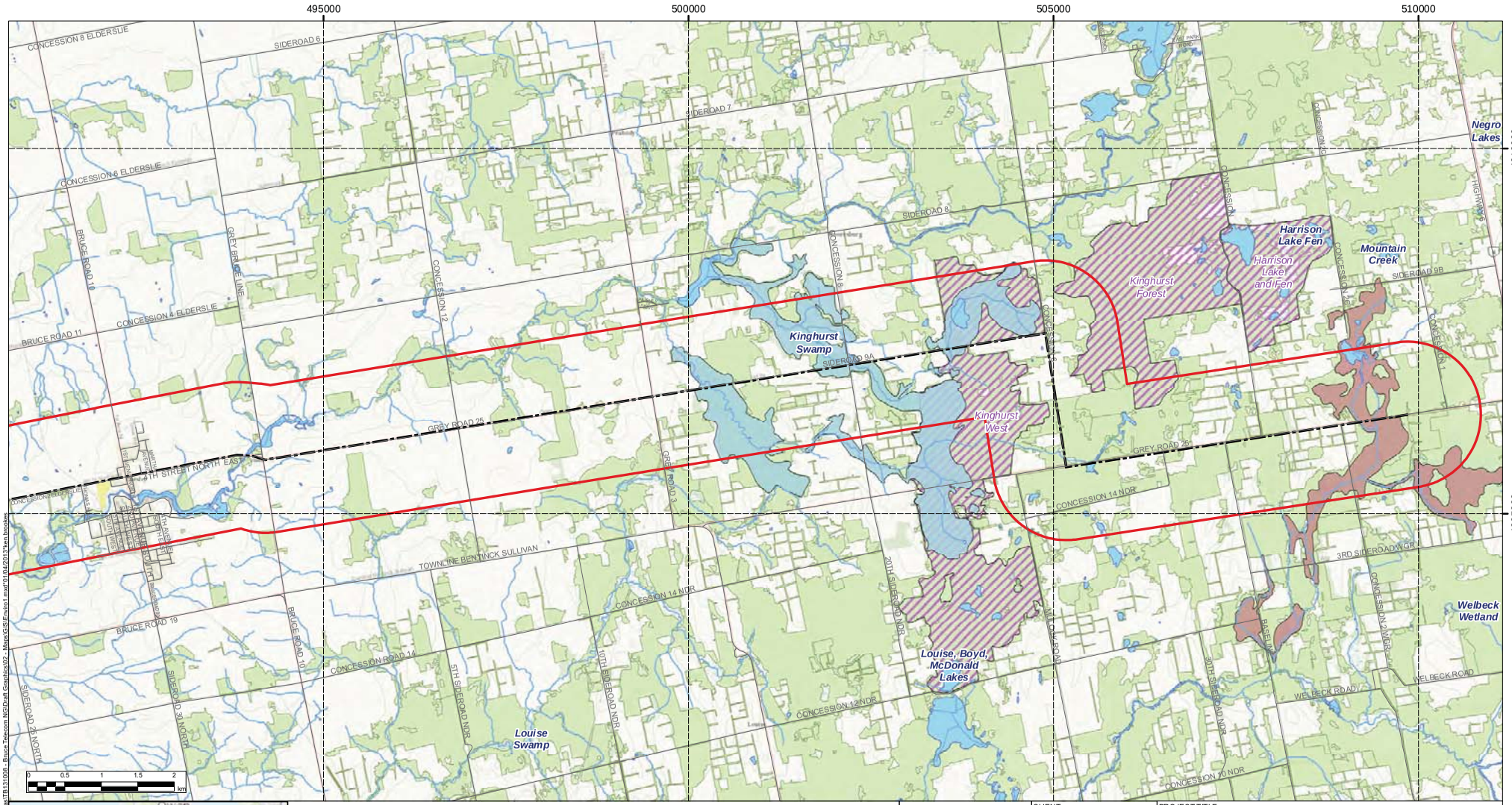

LEGEND

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- 1km Buffer of Proposed Pipeline
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CLIENT: Union Gas

PROJECT TITLE: Bruce Telecom NG

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Revision: A | Projection: UTM Zone 17N

SCALE: 1:50,000

Ontario Natural Areas

PROJECT N°: TB131008

FIGURE: 3

DATE: April, 2013

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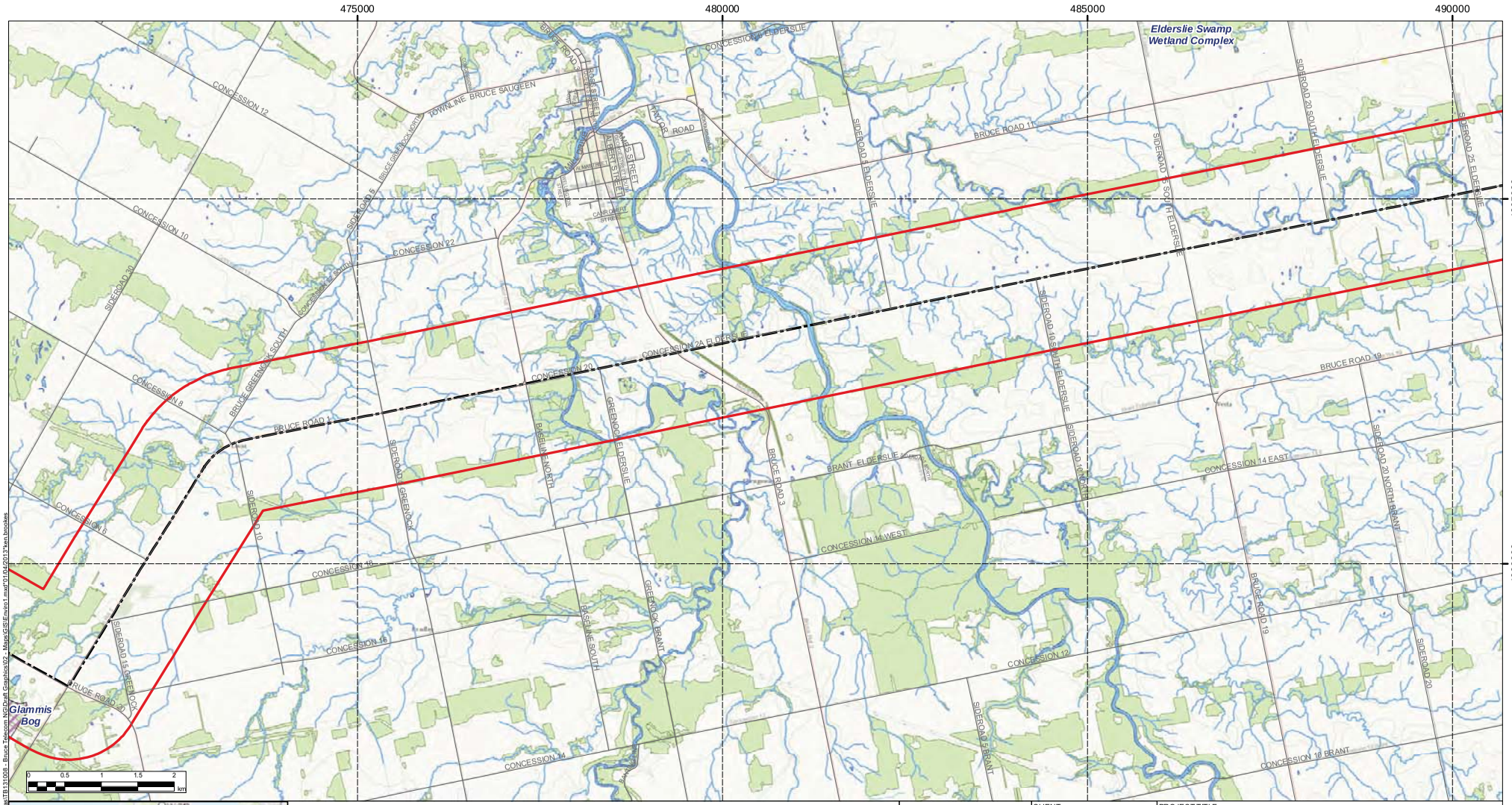

LEGEND

- Proposed Pipeline Route
- 1km Buffer of Proposed Pipeline
- Watercourse
- Constructed Drain
- Waterbody
- Wooded Area

Provincially Significant Wetland

- Wingham Complex
- Mountain Creek
- Kinghurst Swamp
- Glammis Bog
- Dickies Creek/Dickie's Creek Complex

- Area of Natural and Scientific Interest (ANSI)

NOTES:

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PROJECT N°: TB131008

FIGURE: 4

DATE: April, 2013

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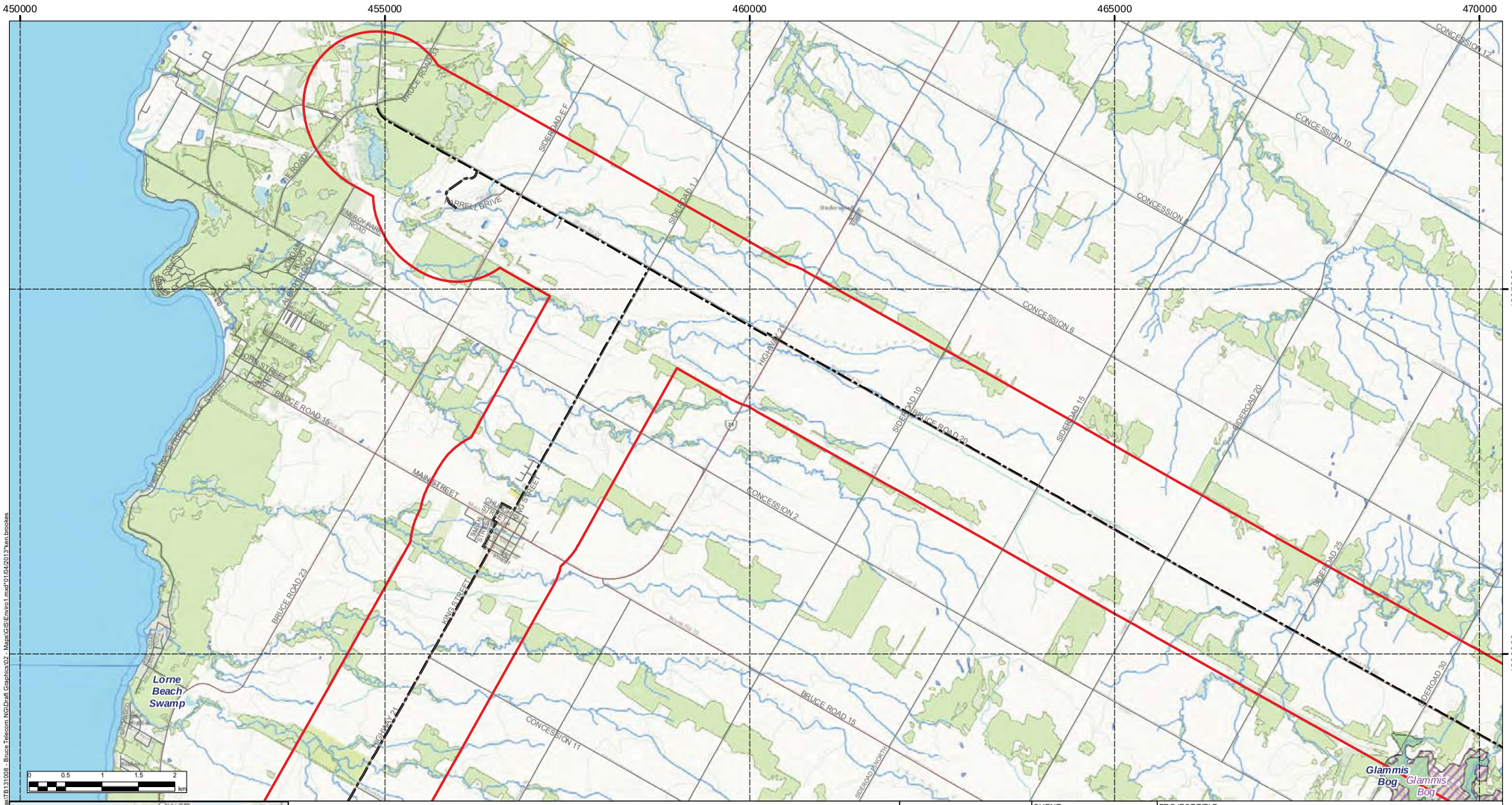

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Ontario Natural Areas

PROJECT N°: TB131008

FIGURE: 5

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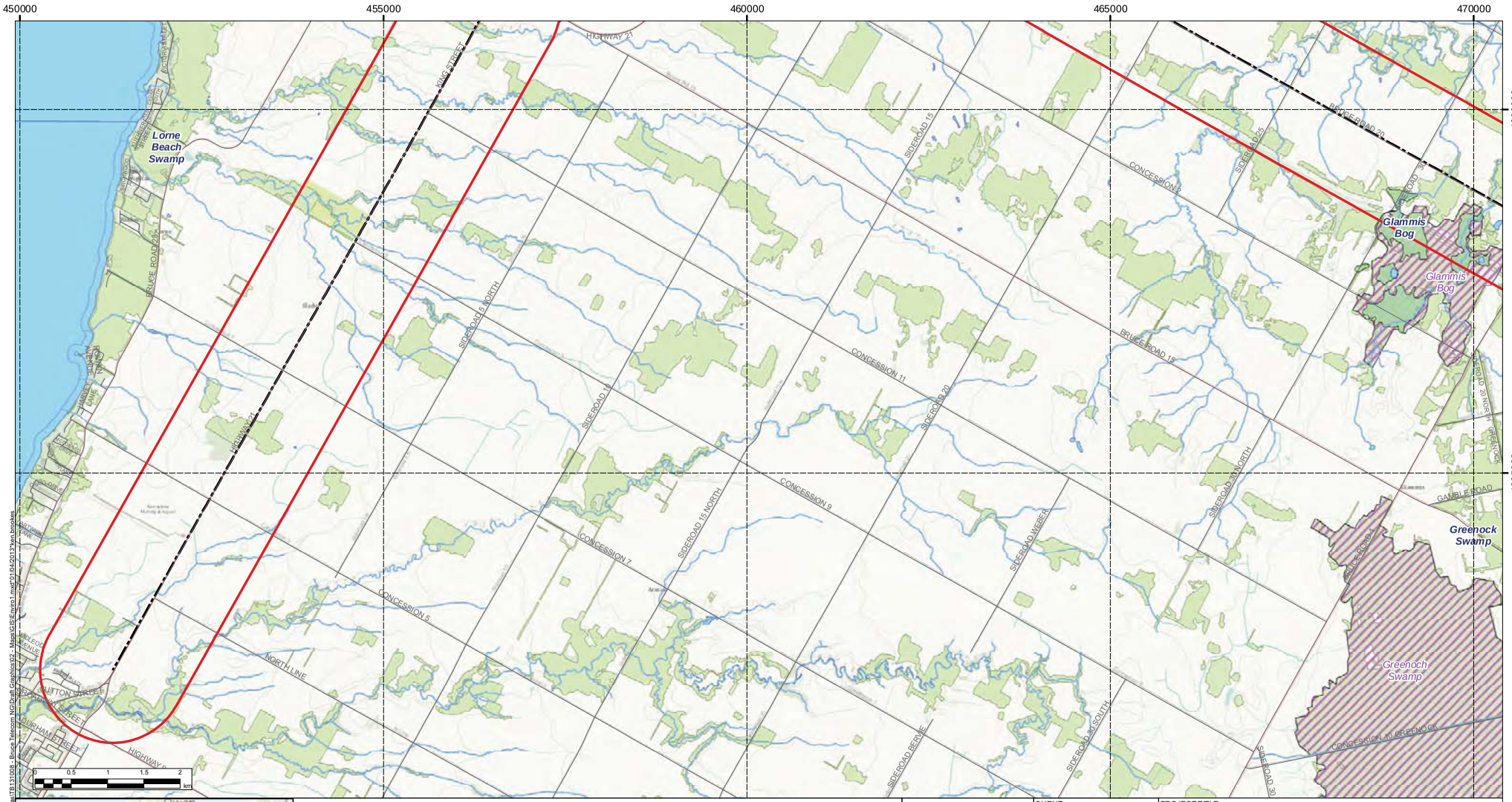

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- Waterbody
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Ontario Natural Areas

PROJECT N°: TB131008

FIGURE: 6

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APPENDIX B

LAND COVER FIGURES

LEGEND

- Proposed Pipeline Route
- 1 km buffer of Proposed Pipeline

Ontario Land Cover

Cover type

- Water
- Non-Vegetated/Barren
- Developped
- Shrubland
- Wetland
- Annual Cropland
- Perennial Cropland and Pasture
- Coniferous Forest
- Deciduous Forest
- Mixed Forest

NOTES:

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SOURCE: ESRI; MNR; Union Gas

CLIENT: Bruce Telecom

PROJECT TITLE: Bruce Telecom NG

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Land Use

PROJECT N°: TB131008

FIGURE: 1

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LEGEND

- Proposed Pipeline Route
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Ontario Land Cover

Cover type

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CLIENT: Bruce Telecom

PROJECT TITLE: Bruce Telecom NG

Drawn By: RL | Checked By: NH

Revision: A | Projection: UTM Zone 17N

SCALE: 1:50,000

Land Use

PROJECT N°: TB131008

FIGURE: 2

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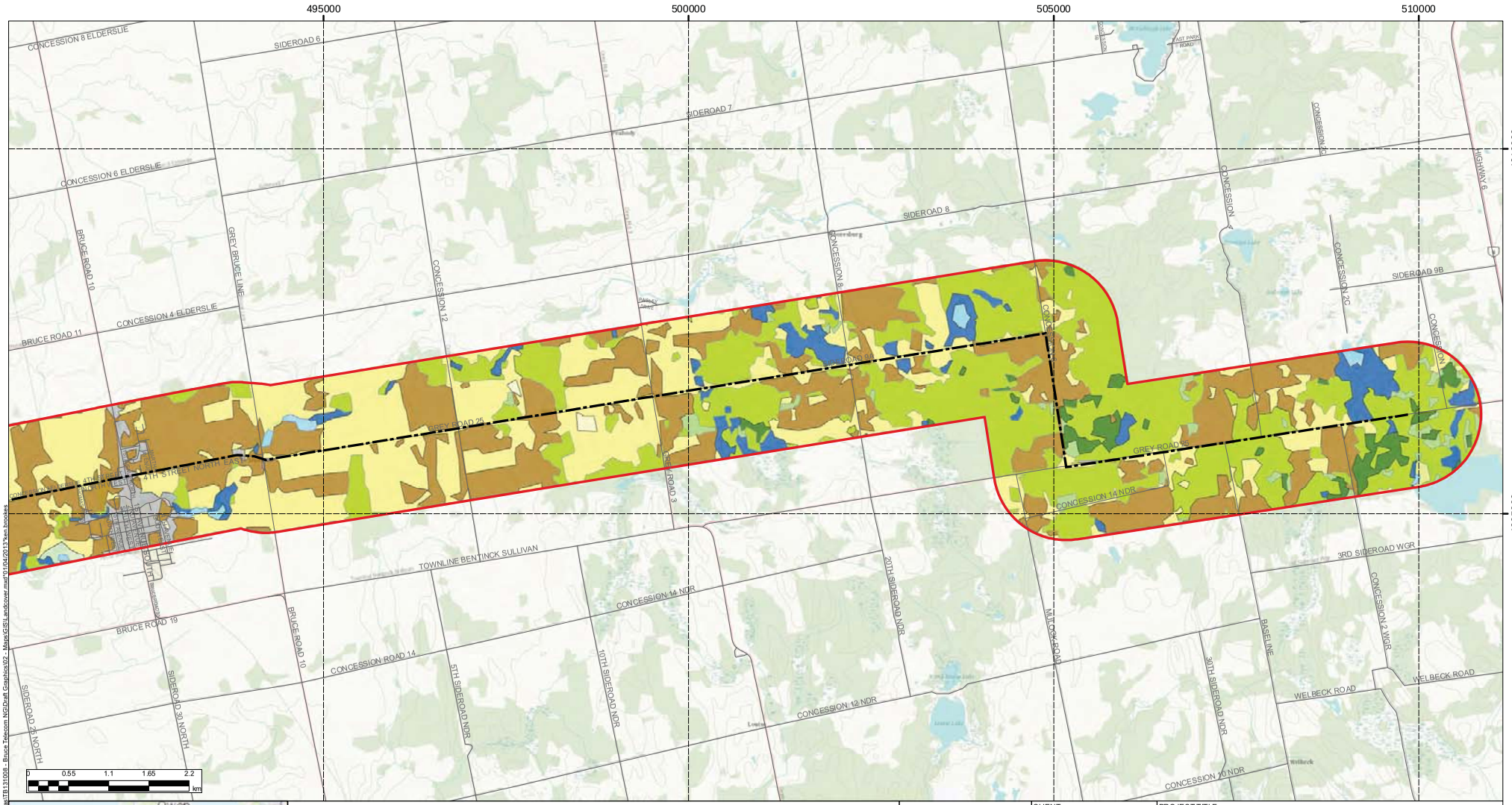

LEGEND

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- 1 km buffer of Proposed Pipeline

Ontario Land Cover

Cover type

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Revision: A | Projection: UTM Zone 17N

SCALE: 1:50,000

Land Use

PROJECT N°: TB131008

FIGURE: 3

DATE: April, 2013

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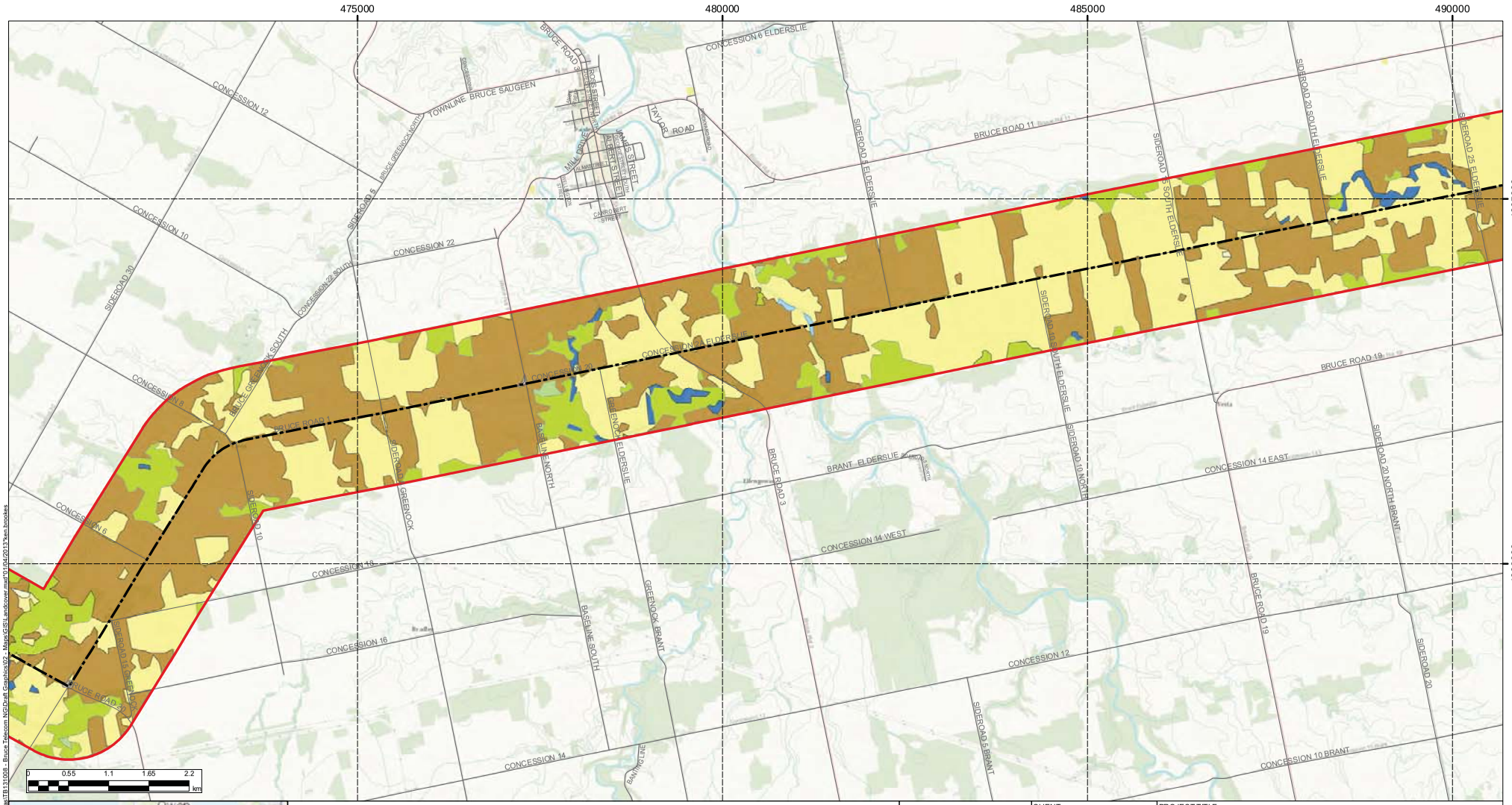

LEGEND

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Land Use

PROJECT N°: TB131008

FIGURE: 4

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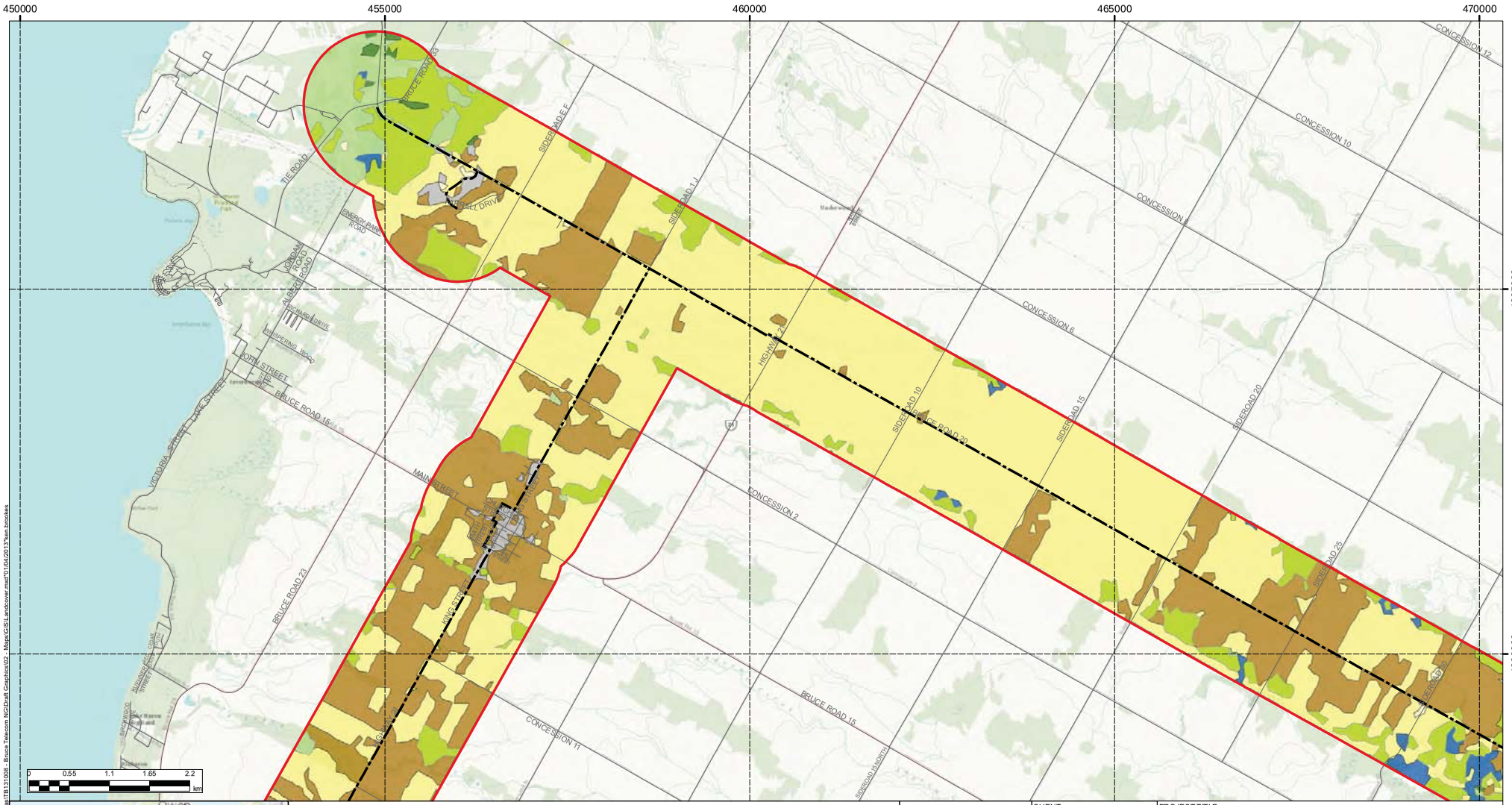

LEGEND

- Proposed Pipeline Route
- 1 km buffer of Proposed Pipeline

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CLIENT: Bruce Telecom

PROJECT TITLE: Bruce Telecom NG

Drawn By: RL | Checked By: NH

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Land Use

FIGURE: 5

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Land Use

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FIGURE: 6

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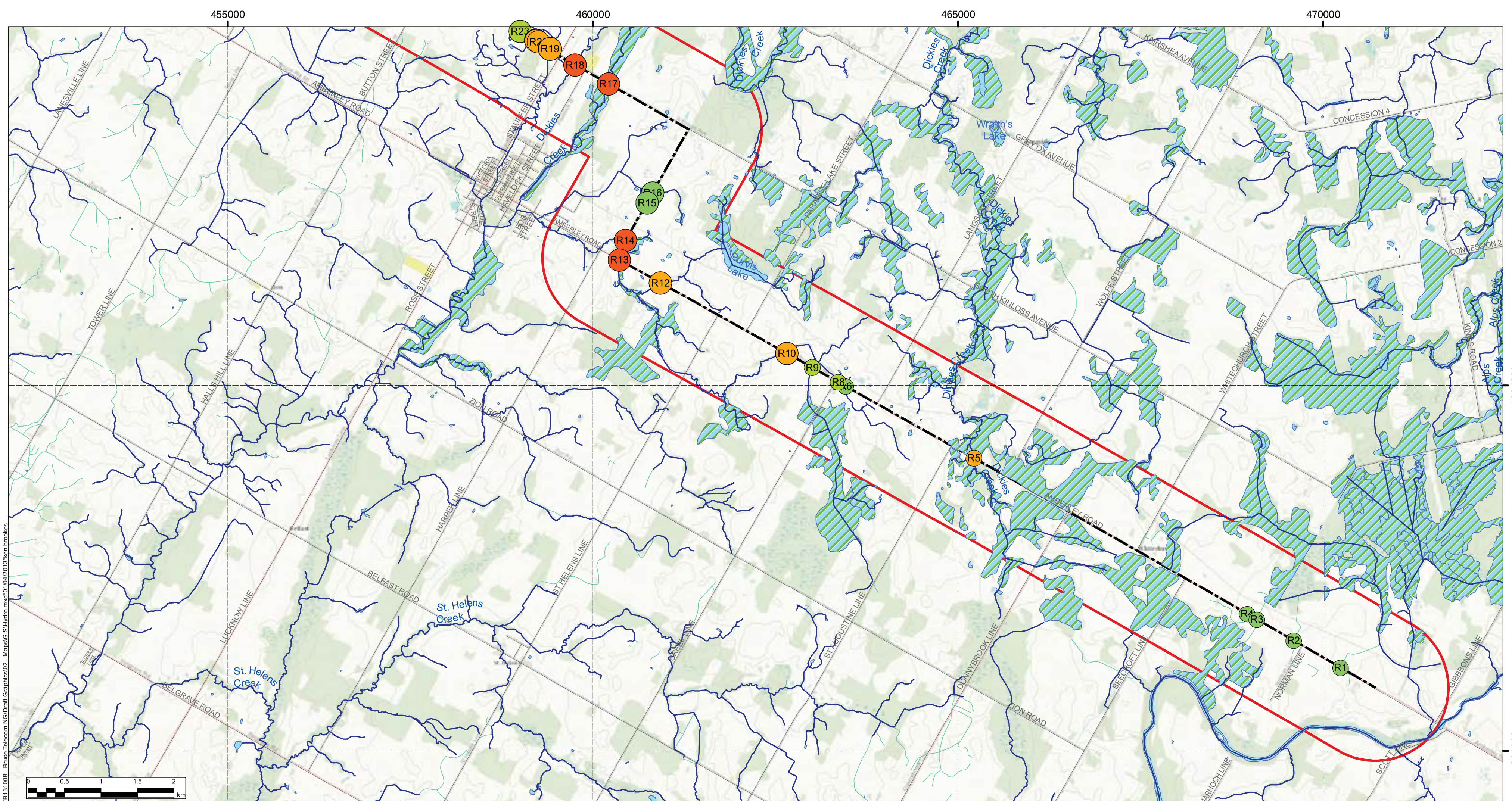
APPENDIX C

WATERCOURSE CROSSING FIGURES



LEGEND

- Proposed Pipeline Route
- 1km Buffer of Proposed Pipeline
- Watercourse
- Waterbody
- Constructed Drains
- Wetlands

Crossing by Stream Order

- SO 1
- SO 2
- SO 3
- SO 4
- SO 5
- SO 7

NOTES:
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CLIENT: Union Gas	PROJECT TITLE: Bruce Telecom NG
Drawn By: RL / Checked By: DM	Stream Crossings
Revision: A / Projection: UTM Zone 17N	
SCALE: 1:50,000	PROJECT N°: TB131008 / FIGURE: 1
	DATE: April, 2013

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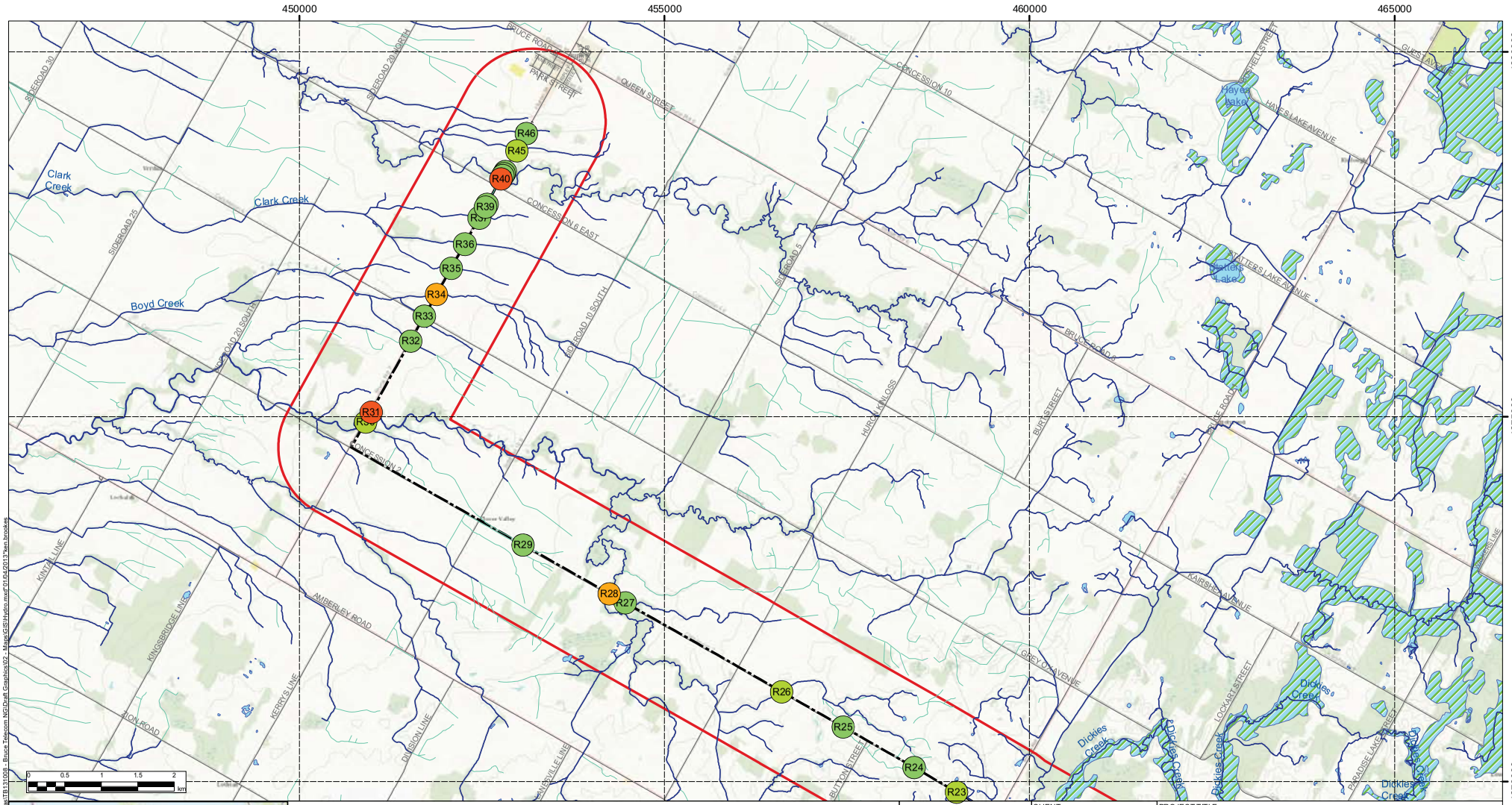

LEGEND

- Proposed Pipeline Route
- 1km Buffer of Proposed Pipeline
- Watercourse
- Waterbody
- Constructed Drains
- Wetlands

Crossing by Stream Order

- SO 1
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CLIENT: Union Gas

PROJECT TITLE: Bruce Telecom NG

Drawn By: RL | Checked By: DM

Revision: A | Projection: UTM Zone 17N

SCALE: 1:50,000

Stream Crossings

PROJECT N°: TB131008

FIGURE: 2

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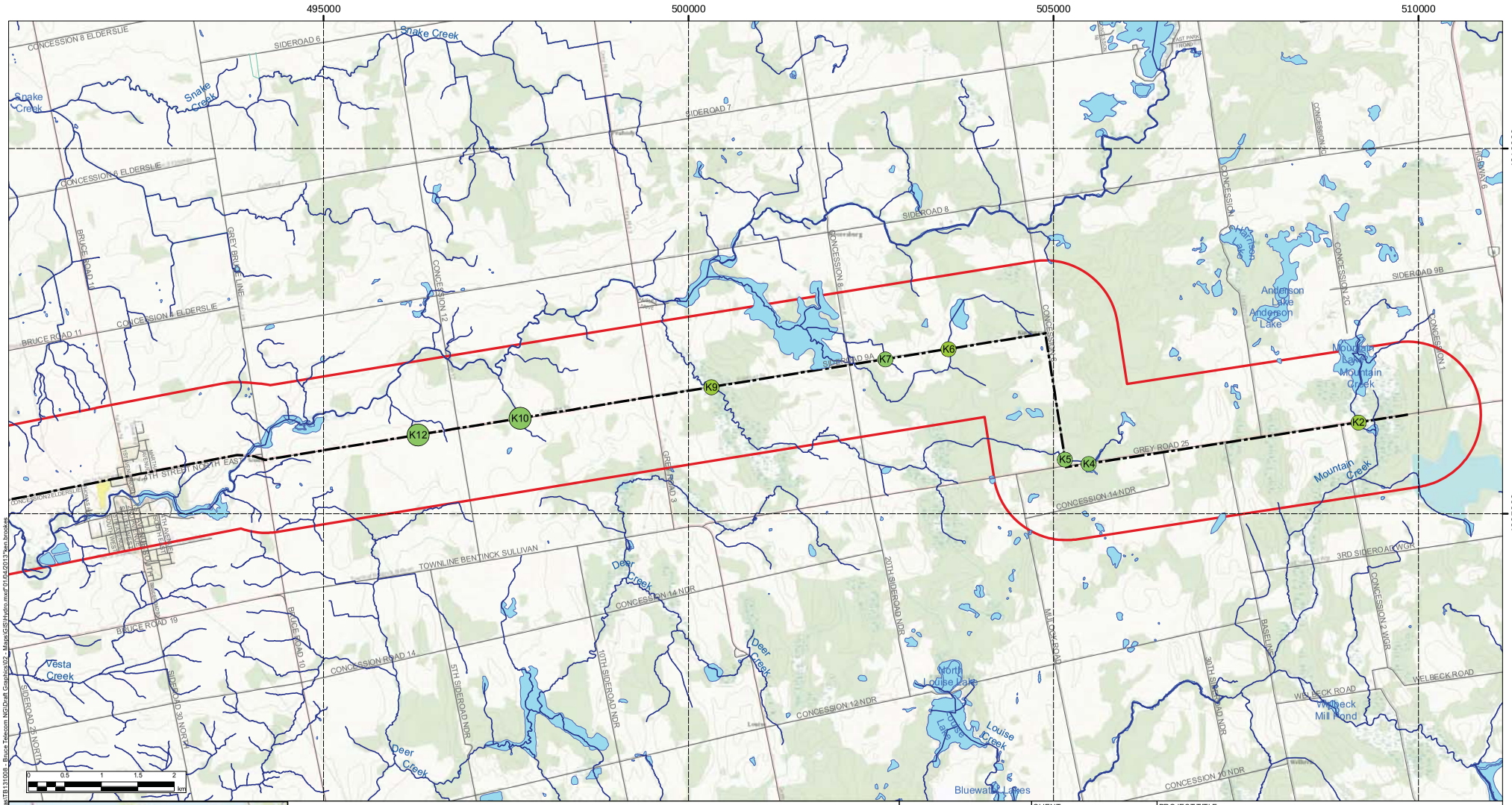

LEGEND

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- Watercourse
- Waterbody
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Stream Crossings

PROJECT N°: TB131008
DATE: April, 2013
FIGURE: 3

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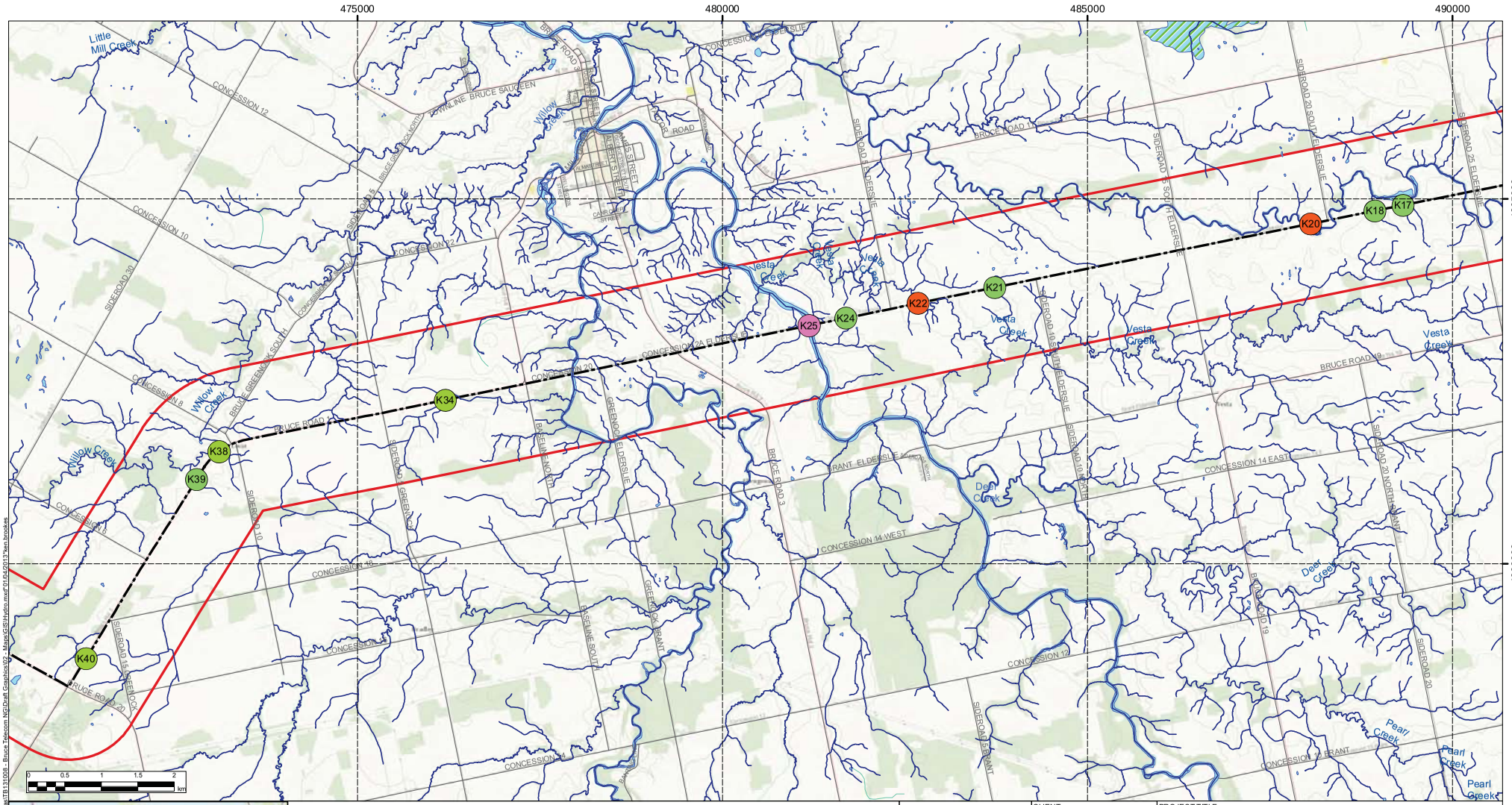

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Stream Crossings

Drawn By: RL | Checked By: DM
Revision: A | Projection: UTM Zone 17N
SCALE: 1:50,000

PROJECT N°: TB131008
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FIGURE: 4

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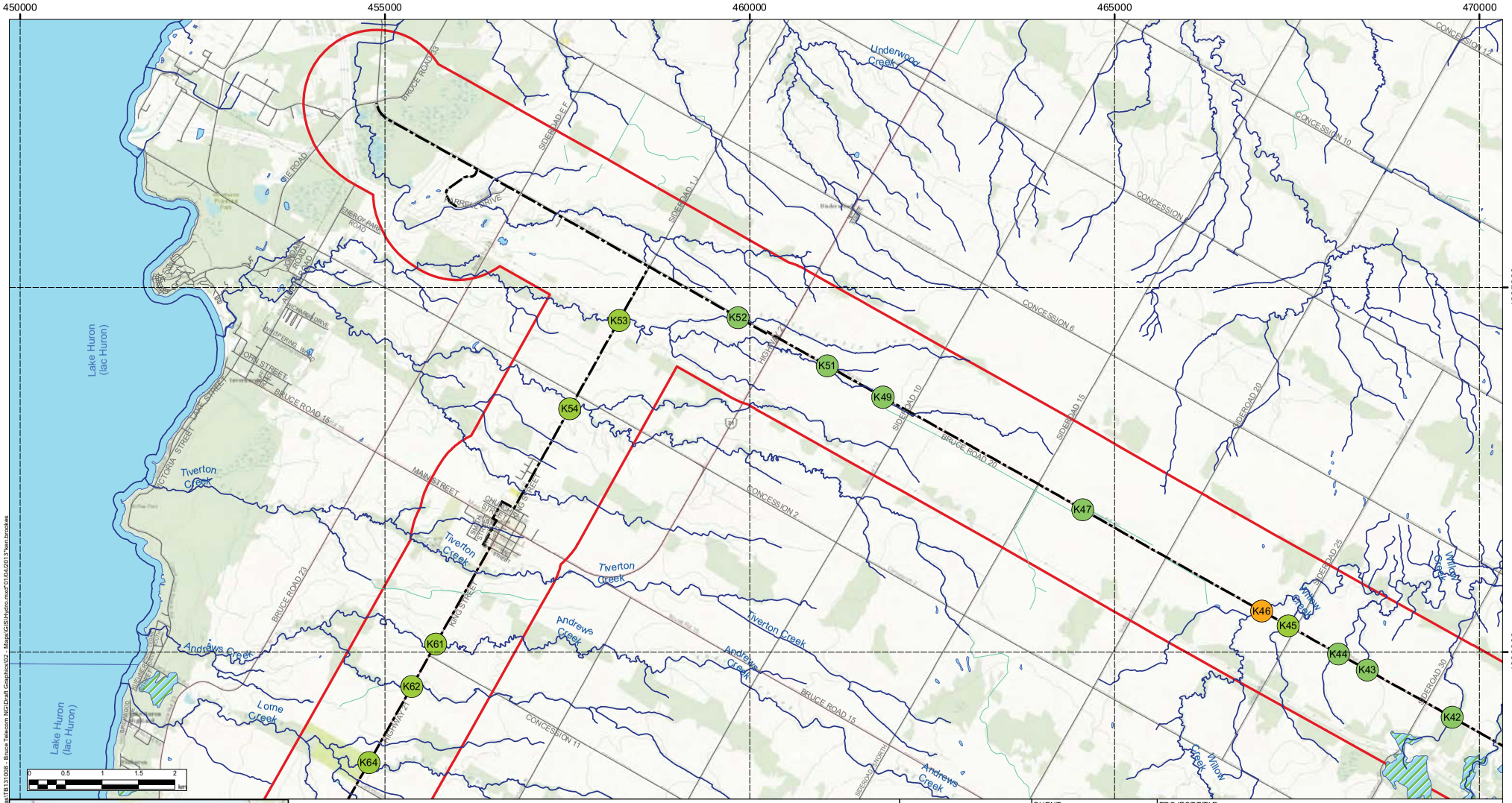

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- Waterbody
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Drawn By: RL | Checked By: DM

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PROJECT N°: TB131008

FIGURE: 5

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Stream Crossings

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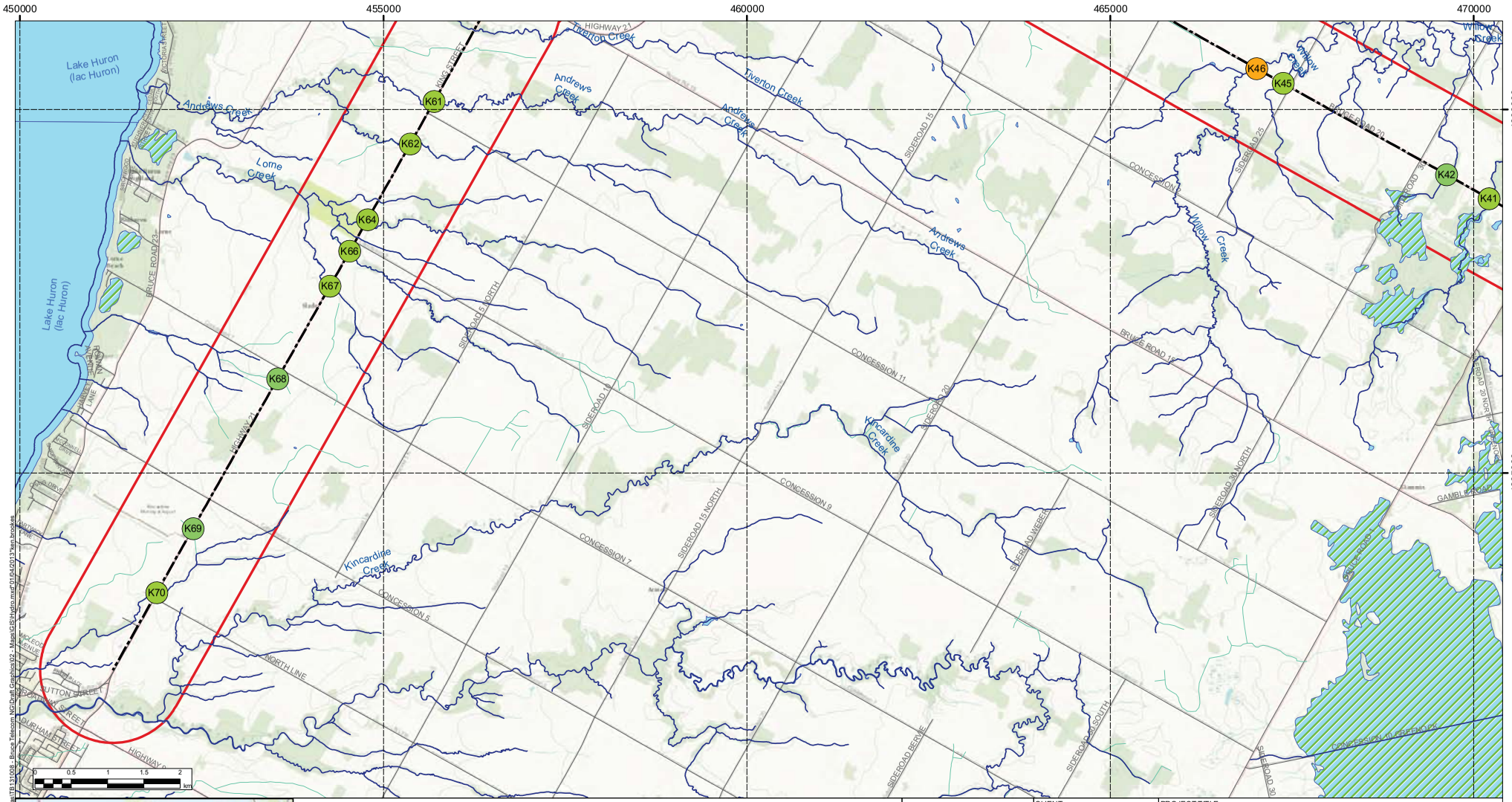

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- Wetlands

Crossing by Stream Order

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Revision: A | Projection: UTM Zone 17N

SCALE: 1:50,000

PROJECT N°: TB131008

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FIGURE: 6

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APPENDIX C

CULTURAL HERITAGE REPORT

HIGH LEVEL EVALUATION OF RISKS: CULTURAL HERITAGE RESOURCES

1.0 ARCHAEOLOGY

1.1 Background

In the Province of Ontario archaeological assessments are conducted in four stages: Stage 1 (background research and archaeological potential mapping) is largely a desktop exercise but may be supplemented by a property inspection; Stage 2 (property assessment) consists of field testing areas of archaeological potential by means of either shovel testing or pedestrian survey; Stage 3 (site-specific assessment) refers to the intensive testing of a known archaeological site in order to determine its cultural heritage value or interest; and Stage 4 (site mitigation) involves formulating and implementing avoidance and protection measures for an archaeological site with confirmed cultural heritage value or interest, or the comprehensive salvage excavation of such sites where they cannot be avoided and protected within the proposed development plan.

This section presents a high level overview of the archaeological potential of the two proposed natural gas pipeline alignments, but should not be considered a full Stage 1 assessment.

1.1.1 Determinants of Archaeological Potential

In general, the cumulative potential for both Euro-Canadian and Aboriginal archaeological sites is determined through the consideration of such factors as: the proximity of watercourses (e.g., creeks, streams, and rivers), water bodies (e.g., lakes, natural ponds, and wetlands), important early transportation routes (trails, passes, roads, railways, portage routes) and significant sources of raw materials; the frequency of previously registered archaeological sites in the vicinity; the presence of elevated topography or unusual landforms; and the presence of favourable soil conditions.

The single-most important of these factors for predictive modeling is proximity to water. Water, both potable and non-potable, not only allowed for the prolonged human use of an area but also facilitated the transportation of people and goods and served to focus animal and vegetable resources. According to the Ministry of Tourism, Culture and Sport's (MTCS) 2011 *Standards and Guidelines for Consultant Archaeologists*, lands within 300 metres of an extant or formerly mapped river or creek, or within 300 metres of the pre-development shoreline of Lake Huron, have potential for the presence of early Aboriginal and Euro-Canadian archaeological sites.

A Stage 1 assessment also looks at all available historic mapping to help determine historic Euro-Canadian archaeological potential. Although the majority of early Euro-Canadian settlement activity is likely to be captured by the basic proximity-to-water model cited above, early maps are also consulted to see where structures are depicted and which concession roads and railroads were in use at the time of the map's creation. Such transportation routes

frequently influenced where farmsteads, schools, churches, cemeteries and businesses would have been located.

1.1.2 Determinants of Low Archaeological Potential or Removed Potential

Archaeological potential is generally considered low or non-existent in areas that are perennially wet or that are sloping in excess of 20^0. Such areas may be exempted from the need for further (i.e., Stage 2) assessment, but only if the excessively sloping or permanently wet conditions are thoroughly documented in the field by a licensed archaeologist.

Similarly, areas that have been subjected to deep disturbance–for example through quarrying, grading or similar land altering activities–may also be exempted from the need for further assessment if the deep disturbance conditions are thoroughly documented in the field by a licensed archaeologist.

1.2 The Pipeline Routes

1.2.1 Physical Setting

The northern pipeline route, extending from Dornoch to Baie Du Dore, passes through four physiographic regions: the Horseshoe Moraines, the Saugeen Clay Plain, the Huron Slope and the Huron Fringe (Chapman and Putnam, 1984). A branching segment of this route, extending southward to Kincardine is located entirely within the Huron Slope region. The southern route, extending from just west of Wingham to Ripley, crosses the Horseshoe Moraines and the Huron Slope.

From east to west, the northern route passes through: the Horseshoe Moraines (including a drumlinized spillway, an undrumlinized till plain and a segment with shallow till and rock ridges); the Saugeen Clay Plain (consisting of generally level terrain with clay soils); the Huron Slope (comprised of a till plain); and a small section of the Huron Fringe (comprised of a level sand plain near Lake Huron). On the basis of elevated topography, unusual landforms and favourable soil conditions, the highest potential segments would be in the drumlinized spillway immediately west of Dorloch and in the sand plain at the western terminus near Lake Huron.

From east to west, the southern route passes through: the Horseshoe Moraines (consisting of drumlin fields and a kame moraine); and the Huron Slope (including a till moraine, a spillway, a till plain, a level sand plain and a bevelled till plain). On the basis of elevated topography, unusual landforms and favourable soil conditions, the highest potential segments would be in the drumlin fields and on the kame moraine immediately west of Lower Wingham.

The northern alignment crosses watercourses in at least 32 locations. Many of these crossings are by branches of the Saugeen River, the North River, Willow Creek, Spring Creek, Big Creek, Mill Creek and their various tributaries. Except for perennially low and wet areas, excessive

slope and areas where archaeological potential has been removed, a 300-metre buffer on either side of each of these crossings would be considered to have archaeological potential and to warrant further archaeological assessment.

The southern alignment crosses watercourses in at least 15 locations. Many of these crossings are by the Nine Mile River, Eighteen Mile River and the South Pine River and their various tributaries. Again, with the exception of perennially low and wet areas, excessive slope and areas where archaeological potential has been removed, a 300-metre buffer on either side of each of these crossings would be considered to have archaeological potential and to warrant further archaeological assessment.

1.2.2 Previously Registered Archaeological Sites in the Vicinity

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database ("OASD"), maintained by the MTCS. This database contains archaeological sites registered within the Borden System. In this system, each site is defined by a unique Borden Number, which is a geographic reference indicator, based on longitude and latitude. A Borden block is approximately 13 km east to west, and approximately 18.5 km north to south. Each Borden block is referenced by a four letter designator, and sites within a block are numbered sequentially as they are recorded.

A search of the OASD resulted in the identification of two registered archaeological sites within a radius of approximately one kilometre from the northern route and one archaeological site within a radius of approximately one kilometre from the southern route. Although there are only three registered archaeological sites in the immediate vicinity of the two proposed routes, this may be more a consequence of a lack of previous research in Bruce and Grey Counties than an indication of relatively low site frequencies.

The known site located near the northern route is situated approximately 800 metres southeast of the route's southern terminus. It is referred to as the Clements site (BbHj-37), but no information on cultural affiliation or site type was available from the OASD at the time this report was prepared. The known sites located near the southern route are referred to as Porters Location 3 (AlHi-1) and Porters Location 4 (AlHi-2). The former site, consisting of a single Daniels type projectile point (ca. A.D. 900–1650), was found approximately 120 meters southwest of the route. On the basis of a surface scatter of artifacts, the latter site was defined as a former Euro-Canadian farmstead dating to between ca. A.D. 1820 and 1890. It is located approximately 200 metres west of the route. These two sites are situated approximately one kilometre apart, in the portion of the proposed pipeline route immediately east of Lucknow.

1.2.3 Historical Land Use Summary and Historic Site Potential

The northern alignment crosses one historical township in Grey County (Sullivan) and four historical townships in Bruce County (Elderslie, Bruce, Greenock and Kincardine). A cursory examination of the historical atlas maps for these townships contained in H. Beldon & Co. (1880a, 1880b) indicates that the northern route passes by at least 19 structures that were extant in 1880. Except for perennially low and wet areas, excessive slope and areas where archaeological potential has been removed, the grounds immediately surrounding each of these structures would be considered to have archaeological potential warranting further archaeological assessment.

The southern alignment crosses two historical townships in Bruce County (Kinloss and Huron). A cursory examination of the historical atlas maps for these townships contained in H. Beldon & Co. (1880b) indicates that the southern route passes by at least 16 structures that were extant in 1880. Except for perennially low and wet areas, excessive slope and areas where archaeological potential has been removed, the grounds immediately surrounding each of these structures would be considered to have archaeological potential warranting further archaeological assessment.

1.3 Summary

In sum, although there are only three registered archaeological sites in the immediate vicinity of the two proposed gasline routes, this may be more a consequence of a lack of previous research in the area than an indication of relatively low site frequencies. A high level overview indicates that major portions of both the northern and southern pipeline routes have archaeological potential.

The highest archaeological potential along the northern route exists within the segments that correspond to: i) the drumlinized spillway immediately west of Dorloch and the sand plain at the western terminus near Lake Huron; ii) 300 metres on either side of all watercourse crossings (minimally estimated at 32); and iii) the grounds around each of the approximately 19 historic structures depicted in the 1880 historical atlas maps.

The highest archaeological potential along the southern route exists within the segments that correspond to: i) within the drumlin fields and on the kame moraine immediately west of Lower Wingham; ii) 300 metres on either side of all watercourse crossings (minimally estimated at 15); and iii) the grounds around each of the approximately 16 historic structures depicted in the 1880 historical atlas maps.

2.0 BUILT HERITAGE

2.1 Review of Potential Built Heritage Resources

The scope of work for AMEC's Built Heritage Team was to conduct a preliminary review of potential built heritage resources, particularly properties designated pursuant to the *Ontario Heritage Act*, which may be impacted by the proposed natural gas pipeline expansion project. The scope of study was limited to properties directly abutting the proposed pathway for the pipeline (generally within the right-of-way) and where there are built heritage resources (structures) located within approximately 10 metres of the right-of-way. The method of study included consulting historic atlases in order to determine where significant settlement features may have been built and may still exist, as well as a visual review of the Google Streetview function in Google Maps to identify built heritage structures along the study route. In addition, some internet sites were consulted to obtain information on each of the communities within the study area.

The MTCS provides criteria for determining cultural heritage value or interest. These criteria are classified in three primary categories, including: design/physical value, historical/associative value and contextual value. The Ministry requires that at least one criterion be met in order for a property to be considered to have cultural heritage value or interest. Although a comprehensive assessment of cultural heritage value of the built heritage resources within the study area is not possible without visiting each property and conducting the appropriate research, some preliminary information is able to be obtained by consulting those sources described above. By consulting the sources listed above, a very preliminary assessment of the three main categories of determining cultural heritage value can be developed.

The following is a list of properties that have been identified on a preliminary basis as having potential cultural heritage value or interest and are recommended to be reviewed in more detail prior to any work being undertaken that might impact these properties.

2.2 Northern Pipeline Study Area (Kincardine to Dornoch)

The stretch of proposed pipeline that runs from Kincardine north and east towards Dornoch spans several townships and counties, including Bruce County over the western portion of the pipeline and Grey County over the eastern portion. The pipeline travels from Kincardine north to Tiverton, east through Lovat to Chelsey and Scone, then further east through Kinghurst and terminating at Dornoch.

2.2.1 Municipality of Kincardine

Only the Municipality of Kincardine (which includes the Town of Kincardine and the Villages of Slade and Tiverton) maintains a Municipal Register of Cultural Heritage Properties of significance to the community, including properties designated under the *Ontario Heritage Act*.

The other townships do not maintain any list or inventory of heritage properties. Therefore, there are no designated properties in these regions. The MTCS requires that any municipality with designated heritage properties must maintain these properties on a publicly accessible Register. The properties identified within the study area, according to the parameters set above include the following:

- One residential property (likely former farmhouse) located on the west side of Highway 21, just south of Concession 5, between Kincardine and Tiverton.
- A former schoolhouse located at 2354 Highway 21 between Kincardine and Tiverton is listed on the Municipal Register.
- Many properties within the Village of Tiverton have been identified, including at least five buildings located at or near the intersection of Main Street and King Street in close proximity to the right-of-way. These are not listed on the Register.
- The designated property located at 100 King Street (By-law #2006-007) is a log house and is one of the earliest structures in the Queen's Bush which pre-dates the founding of Tiverton by approximately 20 years.

2.2.2 Hamlet of Lovat

- Approximately three heritage properties have been identified in the vicinity of Lovat; however, their proximity to the right-of-way would need to be confirmed.
- Approximately ten heritage properties along Concession Road 20, east of Lovat, have been identified, but it seems that they are not within close proximity to the right-of-way.
- A building which appears to be a former schoolhouse, just south of Paisley, as identified in the historic atlas is located on the south side of Concession Road 20.
- Approximately mid-way between Lovat and Chelsey, a church and cemetery are located very close to the right-of-way on the north side of Concession Road 20.
- The historical atlas identifies the "A.D. McDonald Residence and Saw Mill", which should be further investigated.

2.2.3 Town of Chelsey/Scone

- Approximately four heritage properties have been identified in the Town of Chelsey and/or Scone, in close proximity to the intersection of Bruce Road 10 and 1 Avenue North.

- Several heritage properties are located east of Chelsey along Bruce Road 10, but none that appear to be within close proximity of the right-of-way.

- The Carding M. Saw Mill and approximately four to five other heritage buildings in the vicinity of the Mill appear to be located within close proximity to the right-of-way.

- Several other heritage properties have been identified along Grey Road 25 extending eastward from the Mill towards Kinghurst and Dornoch, to the terminus of the pipeline extension, but none in close proximity to the right-of-way.

2.3 Southern Pipeline Study Area (Ripley to Whitechurch)

The stretch of proposed pipeline located from south of the Town of Ripley to east of the Village of Whitechurch is primarily located within the Township of Huron-Kinloss. The Township does not maintain a Register or Inventory of Cultural Heritage Resources significant to the community. Furthermore, there are no designated cultural heritage resources within the Township according to staff who were contacted.

2.3.1 Town of Ripley

- The northernmost end of the pipeline is to be located just south of the Town of Ripley and may impact only a small number of potential heritage properties, depending on the exact location of the pipeline.

- The former Verdun Post office is identified in the 1877 historic atlas and may still be located at the southeast corner of Concession Road 4 and Bruce Road 7.

- Two residential properties approximately mid-way between Queen St. (Bruce Road 6) and Concession Road 4 could be impacted; however, they are set at least 10 metres back from the road right-of-way.

2.3.2 Lucknow

- There is no Google streetview information available for the stretch of pipeline running eastward from Bruce Road 7 to just east of Lucknow. However, the historical atlas for the area suggests there is potential for a historic structure in Clover Valley at the northeast corner of Concession Road 2 and Sideroad 10-S.

- The historical atlas and Google Maps also indicate several structures one concession north of Lucknow, in an area where Google Streetview data is also unavailable. These structures include a church on the north side of South Kinloss Avenue, north of the terminus of Havelock Street, and three additional structures (possibly farmhouses) east along South

Kinloss Avenue to Torrence Street. The atlas does not indicate any significant structures along the balance of Torrence Street.

2.3.3 Whitechurch

- There are many heritage structures located along Bruce Road 86 from just east of Lucknow to east of the Village of Whitechurch, at the other terminus of the pipeline. There are approximately 15 properties within 10 metres of the road right-of-way, most of these are within the Village of Whitechurch itself and include a church, two or three commercial buildings. The balance are residential buildings.

Please note: The above information has been compiled on a preliminary basis from mapping data and does not represent a complete assessment of built heritage resources in the study area. Cultural heritage landscapes were not identified as part of the scope of this preliminary review.

3.0 REFERENCES

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1880a *Bruce Supplement in Illustrated Atlas of the Dominion of Canada.* Toronto: H. Belden & Co., 1880.

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